Federal Environmental Assessment and Review Process

25

Federal Environmental
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Beaufort Sea Hydrocarbon Production and Transportation

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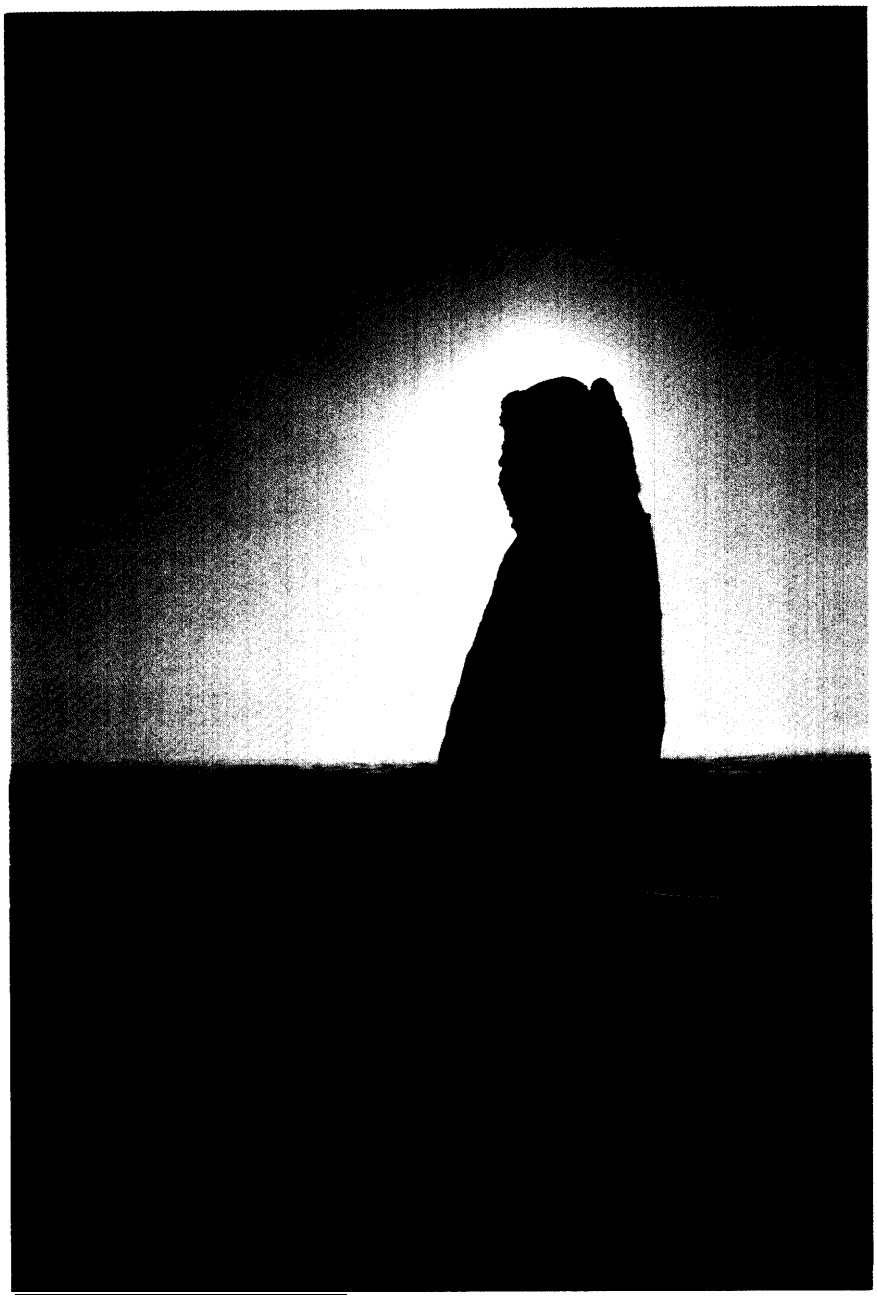

Beaufort Sea Hydrocarbon Production and Transportation Proposal

Report of
The Environmental
Assessment Panel

July, 1984

The Honourable Charles Caccia
Minister of the Environment
Ottawa, Ontario

and

The Honourable Doug Frith
Minister of Indian Affairs & Northern Development
Ottawa, Ontario

Dear Ministers:

In accordance with the Terms of Reference provided to the Beaufort Sea Environmental Assessment Panel, June 14, 1981, the Panel is pleased to submit for your consideration the Report of its review of the Beaufort Sea hydrocarbon production and transportation proposal.

The Panel Report focuses on the proposal submitted by Dome Petroleum Limited, Esso Resources Canada Limited, and Gulf Canada Resources Inc. on behalf of all acreage holders in the Canadian Beaufort Sea-Mackenzie Delta region for the purposes of the review process. The Proponents' proposal concentrated on off shore oil production and on both land and sea transportation. The Panel Report, therefore, includes only limited observations on gas production and transportation facilities.

Because of the preliminary nature of the proposal, the Panel directed its review, for the most part, toward the identification and assessment of major issues and concerns associated with the proposal. As a result, the Panel Report discusses potential effects, both positive and negative, upon the physical, biological and socio-economic environments and makes recommendations on how adverse effects should be controlled or avoided. In addition, the Panel Report includes comments on the capability of governments to control Beaufort Sea oil development and on the need for any subsequent public reviews.

As soon as the Panel Report Is released to the public, the Panel recommends that you institute a process which will assist northerners to be aware of and to understand its contents. That process is needed because of the importance of direct involvement of northerners, especially those in the potentially affected areas, in the planning for and implementation of Beaufort Sea oil production and transportation, should it be approved.

Finally, the Panel wishes to express its gratitude to all of the participants - community residents, special interest groups, individuals, Proponents and federal and territorial governments - for their substantial and most helpful contributions to the review process.

Yours sincerely,

John S. Tener

John S. Tener
Chairman
Beaufort Sea
Environmental Assessment Panel

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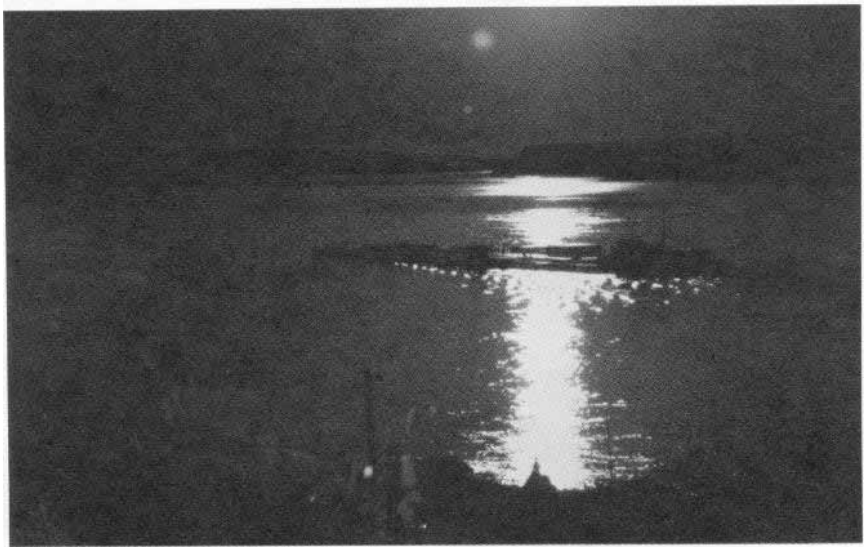

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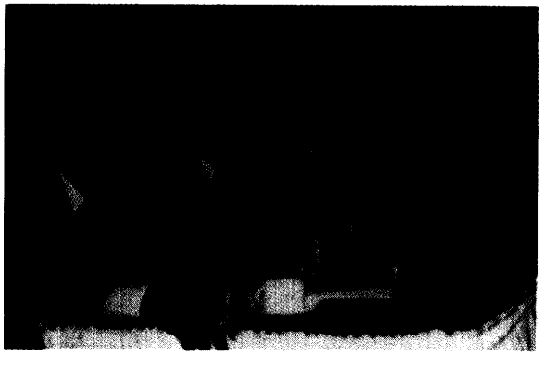
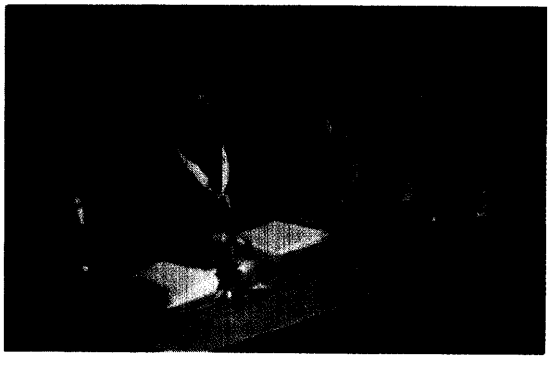




The Beaufort Sea Environmental Assessment Panel, after reviewing the Environmental Impact Statement (EIS) and associated documents on a proposal to produce and transport hydrocarbons from the Beaufort Sea-Mackenzie Delta region, after holding a comprehensive set of public sessions, and after assessing all the information presented to it, concludes that:

i) Beaufort Sea oil and gas production and transportation is environmentally and socio-economically acceptable if subjected to certain terms and conditions and carried out in a small-scale and phased manner;

ii) upon approval, oil production can commence within that region in a small-scale (about 15,000 m^3 oil/day) manner:

iii) a small-diameter (e.g. 400 mm) oil pipeline can be built through the Mackenzie Valley;

iv) oil tanker traffic through the Prince of Wales Strait and Parry Channel from the Beaufort Sea-Mackenzie Delta region should commence only after a government Research and Preparation Stage is completed, followed by the completion of an experimental Two Tanker Stage using Class 10 oil-carrying tankers and under specified conditions of use;

v) a gas pipeline can be built through the Mackenzie Valley only if the anticipated socio-economic impacts do not exceed those associated with oil production at a rate of about 15,000 m^3/day.

All of these conclusions are based upon the premises that appropriate research will have been completed, monitoring and surveillance mechanisms will be in place prior to project approval and mitigative measures will be applied.

Further hydrocarbon production is possible only if it is phased in and if the monitoring programs indicate to governments that the mitigative measures applied during the first phase have been successful.

Background

Over the past 20 years there have been significant sustained levels of exploratory activity for oil and gas both onshore and offshore in the Beaufort Sea-Mackenzie Delta region. As a result, sufficient reserves of hydrocarbons have been discovered to warrant consideration of production and transportation of oil and gas to southern markets.

In July of 1980, the Minister of Indian Affairs and Northern Development (DIAND) initiated a formal public review of oil and gas production and transportation in the Beaufort Sea, by asking the Minister of the Environment for a panel review under the Environmental Assessment and Review Process (EARP). Seven members were appointed to the Beaufort Sea Environmental Assessment Panel between January and May of 198 1.

On behalf of the over 40 companies holding exploration permits in the Beaufort Sea-Mackenzie Delta region, three companies, Dome Petroleum Limited, Esso Resources Canada Limited and Gulf Canada Resources Inc. (the Proponents), prepared and submitted to the Panel in November of 1982 a detailed Environmental Impact Statement for the production and transportation of oil and gas from the region. At the request of the Panel, the Proponents also submitted additional background and supplementary information in June 1983.

The Panel reviewed all these documents and subsequently received numerous submissions from the public and the Proponents at sessions held across the Northwest Territories, in Yukon, in Labrador, and in Calgary and Ottawa in southern Canada. These sessions began at Tuktoyaktuk on September 14, 1983, and ended at Ottawa on December 16, 1983. The public sessions consisted of Community Sessions, at which northern residents were invited to attend, and other, more formal, General Sessions, which were open to all participants.

On the basis of its evaluation of all the information received, the Panel has prepared this report for the Minister of the Environment.

The Proposal

Since 1965, some 150 exploratory wells have been drilled in the Beaufort Sea-Mackenzie Delta region. In 1972 the first artificial island was constructed in the Beaufort Sea and 23 others have been completed to date. In recent years islands have been built using steel and cement caissons, reducing dredging requirements and making year-round drilling more economical.

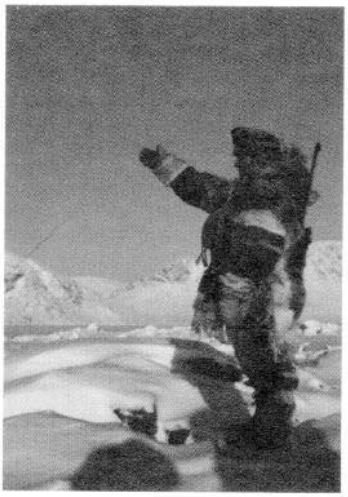
Drillships and associated support vessels also have been used since 1976, the latest of which is the *Kulluk*, a floating conical drilling unit. Innovative approaches to offshore drilling have been developed to expand the safe drilling periods throughout various depths of the icy waters of the Beaufort Sea.

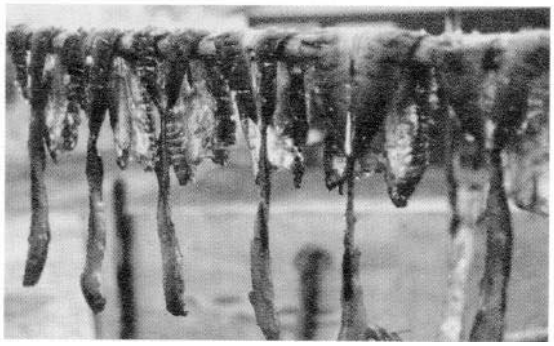
The oil and gas industry considers that the present recoverable reserves of oil (120 million cubic metres) and gas (290 billion cubic metres) found under the Beaufort Sea-Mackenzie Delta region warrant consideration for production and transportation, especially should significant, new reserves be discovered. Planning and engineering by the oil industry have focused on confirmation of commercial hydrocarbon reserves, and on the preliminary design of primary production and transportation systems. Oil could be transported to market by an overland pipeline along the Mackenzie Valley from Richards Island in the Mackenzie Delta to Edmonton, Alberta, or in icebreaking tankers travelling through the Parry Channel to eastern Canada, or both. If constructed, such production and transportation systems would require investments of tens of billions of dollars.

In addition to these transportation systems, offshore islands or other types of platforms would provide the foundations for drilling systems, production wells and associated processing facilities, while oil from onshore reservoirs could be produced by methods similar to those used in southern Canada.

The Proponents, in their submissions to the Panel, have described a range of options and scenarios for oil and gas production and transportation from the Beaufort Sea. These options ranged from oil production levels of about 15,000

Human Environment





m^3/day (about 100,000 bbls/day) to the "highest technically achievable" level of about 200,000 m^3/day (about 1,250,000 bbls/day). Recent exploration results suggest a likely production rate toward the lower end of this range. Associated with these production rates there could be a variety of options for production and transportation of oil and gas, for operational support systems and for variations of population growth associated with different options. Further, a variety of alternative programs for managing the effects of growth on the people of the North were discussed. It is apparent that the Proponents are prepared to make significant adjustments to accommodate the public interest.

The Assessment

For the purposes of its review, the Panel developed two objectives. These are that:

> northerners, developers and governments must ensure:
>
> -that northerners are able to manage the effects of changes and to derive long-term benefits from developments; and
>
> -that the degree of risk to renewable resources from oil and gas production and transportation activities will be acceptable to them.

The Panel has determined that in order to satisfy these objectives a "phased approach" to hydrocarbon production and transportation is needed. This approach will see a number of "small" projects following each other rather than one large-scale development project.

The potential benefits of oil and gas production and transportation would come from the substantial economic stimulus such activity could bring. Benefits could include the provision of employment for northerners, opportunities for northern business, and revenues to communities and territorial governments. These revenues would support improved education and training, social services, community infrastructure, and community and social development.

The Panel recognizes that, in some communities, oil and gas production could have adverse impacts on the northern way of life. For instance, the oil and gas industry might not bring all of the employment and business opportunities that individuals expect. The arrival of southern workers, increased income, new careers in industry and more extensive experiences and contacts with southern cultures could alter traditional lifestyles and values, and could affect community and family cohesion. Social services, community infrastructure and housing, and the management capabilities of local communities and other governments could be overwhelmed by large population increases. The Panel has concluded that with small-scale development, these changes and adverse effects can be managed; with large-scale development, they cannot be effectively managed.

Although northerners generally expressed support for Beaufort Sea oil and gas production and transportation, they recognized that development could bring problems. They welcomed the employment and business opportunities which could result. Many northern intervenors spoke in favour of some form of continued oil and gas development in the North, although the Dene Nation and the Baffin Region Inuit Association, in particular, called for a settlement of land claims prior to development.

Most northerners emphasized, however, that development would not be beneficial unless it were properly controlled and managed.

The earliest possible date for commercial shipments of oil from the Beaufort region would probably be 1988. The interval between now and then should allow government and the Proponents sufficient time to take steps to permit orderly, safe production and transportation of hydrocarbons in the North. During that time, however, government agencies must implement a management control system to include northern communities, and must establish effective, comprehensive programs to obtain baseline data on aspects of oil production and transportation relevant to potential Beaufort Sea region developments.

Shipping of oil and gas by Arctic Class 10 tankers or by pipeline up the Mackenzie Valley or by both means was proposed by the Proponents. The number of tankers and the diameter of a pipeline would be determined by the rate of production achieved in the Beaufort Sea-Mackenzie Delta region, the extent of anticipated adverse effects and the ability of northerners to deal with these effects.

Small-Diameter Pipelines

The Panel concludes that a small-diameter (e.g. 400 mm), buried pipeline would be the most acceptable alternative for transporting oil from the Beaufort Sea region because the drilling and production activities that support such a pipeline would provide benefits to the North and would have minimal negative impacts. There is also a wide consensus among federal and territorial government departments that a small-diameter pipeline could be built in an environmentally acceptable manner, given appropriate regulations, regulatory enforcement and monitoring procedures.

Tankers

Although the Panel prefers that the phased approach begin with a small-diameter pipeline, it is aware that certain factors may make a phased approach beginning with tanker transportation the favoured mode of oil transport. The Panel believes that oil-carrying tankers could be allowed initially on a demonstration scale (two tankers only), subject to a careful, step-by-step testing of the tankers and their operations.

Since the Proponents did not provide specific information on the effects of an Alaskan tanker route at the public sessions, this option was not addressed by the Panel.

Physical Environment

Large-Diameter Pipeline

Although the transportation of oil through a large-diameter pipeline (e.g. 1,000 mm) was presented as an option at the public sessions, there was little discussion of the environmental effects of such a pipeline by either the Proponents or intervenors. The Panel, in studying the potential adverse socio-economic effects of a large-diameter oil pipeline, concludes that those effects arising from the much larger population associated with that required to operate a production facility to fill such a pipeline (as contrasted to a small-diameter pipeline) would be much more severe. The Panel therefore concludes that, if a large-diameter oil pipeline is proposed in the near future, the detailed routing and potential socio-economic effects must be subject to a comprehensive public review process, unless the lessons learned from the construction of several small-diameter pipelines in the Mackenzie Valley have removed the concerns of the local communities, the Government of the Northwest Territories (GNWT) and the Government of Canada. In the event that a gas pipeline is proposed as the initial phase, it should be of such capacity that the adverse socio-economic impacts resulting from the production of gas and the operation of the line will not be greater than those arising from a 15,000 m^3/day oil production facility, unless a similar comprehensive public review is held.

Oil Spills

While the risks of an oil spill may appear small, the costs would be borne by local wildlife populations, some of which could be devastated, and by the people who depend upon them. In some situations a major oil spill cannot be cleaned up, given present technology.

The development of standards for oil-spill clean-up capabilities in all weather and seasonal conditions is recommended by the Panel as one aspect of preparation for future regulatory controls. These standards should be determined by the Minister of the Environment and the Government Leaders of the Northwest Territories and Yukon in consultation with the regulatory agencies and local people, and be revised as necessary from time to time.

Government Management and Regulatory Control

In order to facilitate phased Beaufort Sea oil and gas production and transportation, the Panel recommends that a Beaufort Sea Coordinator's Office be instituted, based in Inuvik, and headed by a senior federal public servant at the deputy minister level. The Panel supports the recent initiative of DIAND and the GNWT to establish a coordination office in Inuvik. This, however, should be regarded only as a first step. The establishment of an office with more seniority and responsibility is required to guide phased Beaufort Sea oil production and transportation effectively.

Firm government leadership expressed through explicit and sound development decisions must be given to facilitate orderly development, and to minimize negative environmental and socio-economic impacts in the region. While planning processes make the successful mitigation of adverse effects of industrial projects in the region more likely, a stable economic and development climate is a prerequisite to sound community development and to business or investment decisions.

The Coast Guard should issue instructions for the operation of vessels including those which recognize areas or times of environmental sensitivies. NORDREG, the Arctic Vessel Traffic Management System, should be made mandatory for all shipping in Canadian Arctic waters. A polar icebreaker of at least Arctic Class 8 specification should be constructed immediately. The Minister of Transport should appoint an independent port authority to control and manage all port and harbour developments in the Beaufort Sea region. The authority should have representation from local communities, aboriginal organizations and territorial governments. In order to prevent the proliferation of duplicate facilities, the construction and operation of only multi-user ports should be approved and kept at a minimum. In addition, a single government contingency plan for oil-spill clean-up in Arctic marine waters should be planned, administered and directed by the Canadian Coast Guard.

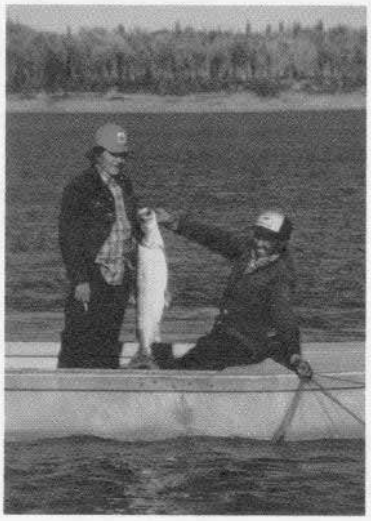
For coastal developments, no port or shore base should be permitted west of Kay Point, Yukon. Only one deep-draft port should be permitted on the Beaufort Sea coast, unless offshore production areas are so far apart that two such ports become necessary. It is generally expected that supply base facilities would be associated with a deep-water port, but it is also possible that alternative ports and supply bases will be proposed, particularly if the oil and gas reserves to be developed are in near-shore waters. The Panel has concluded that, although the environmental effects at sites east of Kay Point on the Yukon North Slope and sites east of the Mackenzie Delta can be made acceptable, it is also desirable that these facilities should be developed only on a common-user principle. Preferably, ports and supply bases should be limited to existing sites, or to one new site, if a deep-water port facility is eventually needed.

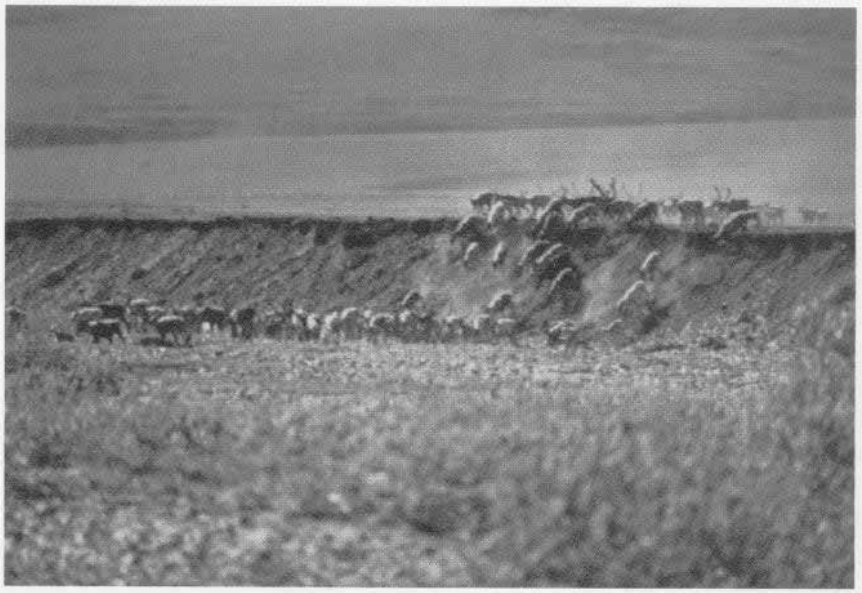
Research and Monitoring

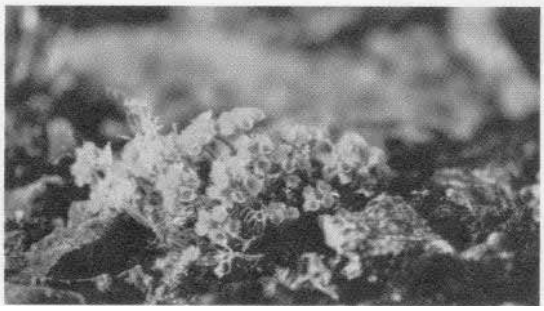
The Panel has concluded that research and monitoring activities of both the territorial and the federal governments require additional support, if Beaufort Sea-Mackenzie Delta region developments are to be managed effectively. Some information and research gaps are identified in this report such as the research required for the alternative of phased tanker transportation. Two primary needs for further research have been identified by the Panel. Long-term research into the basic physical and biological processes of the northern environment is needed by governments so that development impacts can be better assessed. The second primary research need is for baseline data upon which effective monitoring and mitigation programs can be developed.

Because of the importance of protecting the renewable resources of the North, of taking measures to minimize

Biological Environment







adverse social impacts on northerners, and of uncertainties about the effectiveness of some mitigative measures, comprehensive monitoring programs are required.

Community Consultation and Involvement

The Panel emphasizes the importance it attaches to local government involvement in decision making. For this involvement to be substantial, sufficient financial and human resources must soon be obtained by the territorial governments and provided to the local governments.

Local residents must have a major role in local studies, such as of resource harvesting, and communities, local hunters and trappers must have a strong role in renewable resource management, monitoring and enforcement.

The Panel has also recognized that northerners could have difficulties in obtaining compensation for small damage claims (up to $10,000), and outlines some basic objectives that should be part of a new compensation scheme.

The need to upgrade community infrastructure is a pressing requirement before, during, and after oil and gas production. Policies on education and training, public and private housing, energy sources for communities, and sources of sand and gravel need constant attention. These policies need to be integrated with the hiring practices of the Proponents and their contractors in order to better involve northerners. Unions must not present a barrier to employment for northerners. Conferences for northerners on regional or local business opportunities should be held, and purchasing processes extended, to encourage regional and local business development across the Northwest Territories and Yukon.

Funding

If the federal government decides that hydrocarbon production and transportation is to be encouraged in the North, the Panel believes that the federal government must accept the necessity of larger and timely expenditures by governments for social and environmental matters.

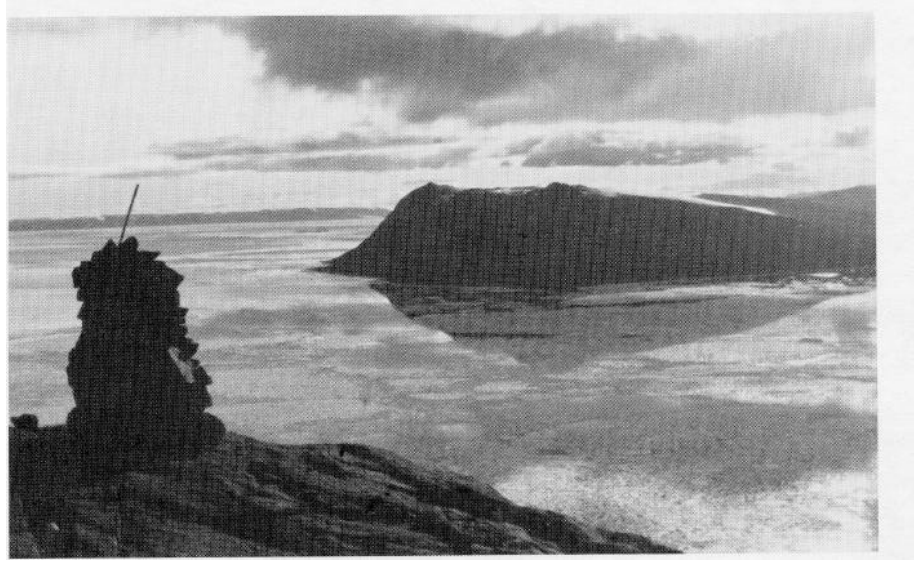
Conclusion

The Panel concludes that small-scale oil production and transportation is acceptable on environmental and socio-economic grounds, provided that:

- the Government of Canada, the Government of the Northwest Territories and the Government of Yukon put in place the Panel's recommended social and economic infrastructures and programs, prior to the commencement of construction of hydrocarbon production and transportation facilities, to minimize adverse social effects on, and to maximize lasting benefits to, northern people;
- northern residents have an effective voice in monitoring and managing problems that may come with changes to their way of life;
- the collective risks to northern residents from various project components be offset by increased benefits;
- the development of yet-to-be-proven approaches to producing and transporting oil be by phased development, with intensive research and careful monitoring;
- the standards for environmental protection and risk prevention be at least equal to the standards proposed by the Proponents in their EIS, in their other documents and in their statements at public sessions before the Panel;
- the commitments by the Proponents regarding socio-economic mitigative measures be met on a continuing and responsible basis;
- oil-spill response and clean-up capability be in place well in advance of oil production, and be capable of controlling spilled oil effectively;
- the Proponents share, where possible, facilities such as pipeline systems, shore bases and other required infrastructure;
- compensatory programs be in place to address real damages caused by the Proponents or others: and
- the Government of Canada, as the main approval authority, sufficiently develop its administrative, legislative, operational and research capability to ensure a full and effective review of proposed component projects, and to carry out the necessary licensing and regulation of their development and operation.

Part I

The Panel's Report



1 .O INTRODUCTION

The Beaufort Sea Environmental Assessment Panel was appointed in May of 1981 by the Minister of the Environment to identify the major positive and negative effects of hydrocarbon production and transportation from the Beaufort Sea-Mackenzie Delta region upon the human and natural environments in Canada's North, and to recommend ways and means of dealing with these effects.

A proposal for hydrocarbon production and transportation from the Beaufort Sea region was submitted to the Panel in June of 1981 by Dome Petroleum Limited, Esso Resources Canada Limited and Gulf Canada Resources Inc. (the Proponents) on behalf of all hydrocarbon leaseholders within the region.

Since that time the Panel has held many months of public meetings and has reviewed a series of documents prepared for it by the Proponents, the governments of the North, the federal government, native organizations, northern communities, public interest groups and individuals.

The Panel has also had the advantage of being able to consult studies and reviews on such subjects as the Mackenzie Valley Pipeline Inquiry, Beaufort Sea oil and gas exploration work, the Norman Wells Oil Expansion Project, the Arctic Pilot Project, Lancaster Sound Exploratory Drilling, the Alaska Highway Gas Pipeline and the Senate Committee Report on Northern Pipelines.

Early in the preparation of its report, the Panel developed and used two objectives as the philosophical basis for reaching its conclusions and recommendations. These objectives are that:

northerners, developers and governments must ensure:

-that northerners are able to manage the effects of changes and to derive long-term benefits from developments; and

-that the degree of risk to renewable resources from oil and gas production and transportation activities will be acceptable to them.

The Panel has determined, after reviewing the documents placed before it and listening to the discussions at the public sessions, that in order to satisfy these objectives a "phased approach" to hydrocarbon production and transportation is required. This approach would see a number of "small" projects follow each other rather than one large-scale development project. In the initial phase small refers to production and transportation of about 15,000 m^3 of oil/day (about 100,000 barrels/day).

Subject to recommendations and conclusions set out elsewhere in this report, a phased approach as envisioned by the Panel would see the following sequence of events.

1. Production facilities would be developed to achieve a rate of about 15,000 m^3 oil/day.
2. Transportation facilities would be developed either in the form of a small-diameter buried oil pipeline (eg. 400 mm), or in the form of two Arctic Class 10 oil tankers. (The latter is subject to a number of special provisions set out in Section 6.4.1.)
3. Production would be increased to the maximum capacity of the small-diameter pipeline.
4. A second oil pipeline or more tankers would be added.
5. A gas pipeline to transport gas associated with oil production might be added.
6. Further increases in production would lead to a larger-diameter oil pipeline or an increased number of tankers.

The reasoning which led the Panel to recommend a phased approach for oil production and transportation should be applied to any development proposals for non-associated natural gas.

"Northerners are anxious to participate and to share both the challenges, the risks and the benefits but they obviously must be partners The impacts are clearly going to be there, both good and bad They are inevitable but with due process, planning and management, they are manageable The Impacts, risks and problems will be reduced by allowing more time, more research and small scale protects The most difficult area, I have already mentioned is that of social change "

G N Faulkner, DIAND
Inuvik

These objectives and the concept of phased development are emphasized throughout the main body of this report. The report is divided into three parts. Part I begins with descriptions of the Panel's review process and the Proponents' proposal for production and transportation of hydrocarbons from the Beaufort Sea-Mackenzie Delta region. These descriptions are followed by a discussion of the risk of oil spills for different production and transportation components and the response procedures. The effects of the proposal on the human and natural environment are then described, and recommendations and conclusions are given as to the means of achieving the Panel's objectives. Two chapters describe the Panel's views on compensation and the Panel's specific recommendations to governments for necessary action. Part I of the report ends with summary statements concerning the Panel's conclusions and recommendations. The recommendations are grouped by topic and are numbered sequentially in Chapter 10. In the main body of the report the assigned number appears next to the recommendation.

As the Panel particularly wishes to acknowledge the work of the many northern communities in preparing evidence and speaking to the Panel, it has attempted in Part II of the report to summarize the concerns of each community as expressed at the Community Sessions.

In Part III the Panel has attempted to acknowledge all those who participated in its review and to provide additional information and background material to the reader.

2.0 THE REVIEW PROCESS

2.1 Introduction

In July, 1980, the Department of Indian Affairs and Northern Development (DIAND) initiated, under the Environmental Assessment and Review Process (EARP), a formal public review of a proposal to produce oil and gas from the Beaufort Sea area and transport it south to market by pipeline or tanker or both.' EARP is a process designed to review any proposed project in which there is federal government involvement, and from which there is a possibility of significant environmental and socio-economic effects.[2]

The Honourable John Roberts, Minister of the Environment, appointed seven members to the Beaufort Sea Environmental Assessment Panel between January and May of 198 1. (In the latter half of 1982, following the resignation from the Panel of two members, the Minister appointed two replacement members).

The Panel members are:

Dr. John S. Tener, Chairman, Ottawa, Ontario;
Mr. Titus S. Allooloo, Pond Inlet, Northwest Territories;
Mr. Douglas R. Craig, Carbon, Alberta;
Mr. Knute L. Hansen, Aklavik, Northwest Territories;
Mr. Allen R. Lueck, Whitehorse, Yukon;
Dr. J. Ross Mackay, Vancouver, British Columbia; and
Mr. Michael G. Stutter, Dawson, Yukon.

Their biographies are found in Appendix 6

2.2 Review Process Steps

An issues seminar was held in Calgary by the Federal Environmental Assessment Review Office (FEARO) on November 13, 1980, to identify preliminary environmental and socio-economic issues associated with the proposal.[3] The seminar was attended by a wide range of potential participants in the Panel's review process, including representatives from the oil and gas industry, the federal and territorial governments, northern communities, native groups and special interest groups. The issues identified at the seminar were useful in the development of the Draft Guidelines released by the Panel in June of 1981 to guide the Proponents in the preparation of an Environmental Impact Statement (EIS).

Although over 40 companies presently hold oil and gas leases in the Beaufort Sea-Mackenzie Delta area, the companies most active in the current exploration program in the Beaufort Sea area are Dome Petroleum Limited, Esso Resources Canada Limited and Gulf Canada Resources Inc. These three companies acted as the Proponents for the purposes of this public review.

Early in the review process, the Panel opened an office in Inuvik and hired a resident of Tuktoyaktuk, Mr. Roger Gruben, to coordinate Panel activities in the Western Arctic. Through the Inuvik office, many of the residents in the area became familiar with the review process. In November and December of 198 1, at public meetings held in Yukon and Northwest Territories communities and in Calgary, the Panel received comments and suggestions on its Draft Guidelines.

In February of 1982, the Panel issued Guidelines for Preparation of an Environmental Impact Statement. These Guidelines contained many changes from the original draft as a result of comments received at the public meetings. At approximately the same time, the Panel presented an Interim Report to the Minister of the Environment. The Report summarized the Panel's progress to date, outlined future plans, provided some preliminary thoughts on the review process, and suggested some amendments to the Terms of Reference.

Following the Minister of the Environment's review of the Interim Report, and after consultation with his colleague the Honourable John Munro, Minister of Indian Affairs and Northern Development, amendments were made to the Terms of Reference. A copy of the final Terms of Reference is attached as Appendix 8.

In November of 1982, the Panel received the Proponents' EIS. After a 90-day formal public review period, during which the advice and comments of 36 intervenors and the Technical Specialists (Section 2.11) were considered, the Panel decided that additional information was required and issued a Deficiency Statement through DIAND to the Proponents in March of 1983. The Proponents' response to the Deficiency Statement, the EIS Supplementary Information, was provided to the Panel on June 30, 1983.

In August of 1983, the Panel decided, after reviewing the EIS Supplementary Information and 20 interventions, that the Proponents' submissions provided sufficient information to proceed with the public sessions. A draft schedule and draft agendas were then issued for the sessions to be held in northern and southern communities to discuss and consider the environmental and socio-economic effects of the proposal. A Pre-Session Conference took place on September 13, 1983 in Yellowknife, NWT, to receive comments and to finalize the schedule and agendas for the public sessions. Those sessions were of two kinds. The Community Sessions involved only the residents of northern communities, their invited guests and representatives of the Proponents. The General Sessions were open to all participants and became the main forum in which technical and scientific matters were discussed.

The public sessions commenced on September 14 and were concluded on December 16, 1983, after which the Panel deliberated on all matters brought before it.

2.3 Terms of Reference

The Panel found formal Terms of Reference (Appendix 8) to be of substantial assistance both to itself and to review participants when considering matters such as land claims and revenue sharing. The Terms of Reference allowed the Panel some flexibility in dealing with issues that were borderline to its mandate.

In order to assist the review participants to understand the Panel's position with respect to contentious borderline issues, and to provide an insight into what the Panel was trying to achieve, the Panel released a statement in January, 1983 entitled "Where The Panel Is Going". This document provided background material for persons involved in the review process.

2.4 Operational Procedures

The Panel prepared a provisional document entitled "Operational Procedures" early in the review process (October, 1981) and gave the document wide distribution. The operational procedures outlined the general rules the Panel would follow during the course of the review, the use of Technical Specialists, the review of the draft EIS Guidelines, and the review of the EIS. Comment on the document was invited prior to its final acceptance. These procedures provided ground rules for participation in the public review process and thereby encouraged a fair and open process.

2.5 Public Review

The Panel commends the Government of Canada for requesting a full public review of a proposal of this magnitude at such an early stage in the planning process. The Panel heard a number of opposing views on the timing for such a review. Some participants felt that a review at this stage was premature, in that the Proponents did not have a specific project to present to the public and therefore could not answer specific questions and deal with specific environmental impacts. Some expressed the view that, in such reviews, proponents try to win approval for as wide a concept as possible, whereas intervenors try to limit options they oppose, or promote options they favour. Others felt that a review of this nature was extremely important, in that options for development had not been finalized by the Proponents. According to the latter viewpoint, by pointing out environmental and socio-economic considerations early in the planning process, decisions could be made and options exercised which would take into account the sensitivities of the biophysical and socio-economic environments. The Panel believes that the early initiation of the examination of the Proponents' proposal has given the federal government at least a three-year lead in the identification of a number of issues for which solutions are needed.

2.6 Environmental Impact Statement

The Proponents' Environmental Impact Statement, along with the 37 Support Documents and the EIS Supplementary Information, constitute one of the most complete environmental and socio-economic reviews written in Canada.

The EIS consists of approximately 2,000 pages and includes the following seven volumes:

Volume 1	Summary
Volume 2	Development Systems
Volume 3A	Beaufort Sea-Mackenzie Delta Setting
Volume 3B	Northwest Passage Setting
Volume 3C	Mackenzie Valley Setting
Volume 4	Biological and Physical Effects
Volume 5	Socio-Economic Effects
Volume 6	Accidental Spills
Volume 7	Research and Monitoring

In response to the Panel's EIS Guidelines, the development plans described in the EIS forecast a possible range of events to the year 2000. The EIS concentrated on the first five years of development, rather than long-term plans, because such plans are more susceptible to external factors such as government policy, community impacts and the results of monitoring programs. The EIS also includes the potential effects associated with high, medium and low rates of production. The Proponents' 37 EIS Support Documents provided relevant information in support of the EIS.

Following the Panel's examination of the EIS and the request for additional information in March of 1983, the Proponents submitted their EIS Supplementary Information, consisting of approximately 1,500 pages, in the form of the following seven documents:

Environmental and Technical Issues
Socio-Economic Issues
Zone Summary Beaufort Sea-Mackenzie Delta Region
Zone Summary Mackenzie Valley Region
Zone Summary Northwest Passage Region
Appendix I — Community Consultation/Information Review
Appendix II — Mitigative Measures and Action Plans

The Panel commends the Proponents for their intensive effort in the development of their documents. Indeed, the contents were so comprehensive that an index would have increased their value and thus would have made it much easier for intervenors to focus on topics of concern to them. The Panel suggests that an index be an integral part of future environmental impact statements.

2.7 Procedures for Public Sessions

The Panel was greatly aided in its work by the Panel Secretariat. The Panel and Secretariat, working in cooperation, developed a structured and comprehensive set of procedures for the public sessions. These were distributed to the public for comment. In retrospect, these procedures were important to the success of the public sessions.

The Pre-Session Conference held in Yellowknife in September of 1983, before any public sessions took place, provided all participants an opportunity to raise questions on the procedures the Panel intended to follow during the public sessions, and to point out their concerns with the Panel's proposed agenda. The Pre-Session Conference involved participants in the planning of the public sessions, and thus when the sessions began, people were better prepared to participate.

The Panel found Rule 29(2) of its Procedures for General Sessions particularly useful in making maximum use of the session time. Rule 29(2) requires that copies of presentations of scientific or technical fact or expert opinion, intended for the General Sessions, be filed with the Panel and distributed to other intervenors not less than one week before the scheduled presentation. When this rule was adhered to, other intervenors and the Panel had an advance opportunity to read the brief. Unfortunately, on many occasions, briefs were submitted so late that Panel members and others had little time to read them before the intervenor appeared. This was a disservice to the intervenor presenting the brief, as well as to the Panel particularly when the oral presentation of the brief was much shorter than the written presentation. Because of logistic problems and the intervenors' lack of familiarity with the process, the Panel implemented this rule with some flexibility. In future public reviews of this type, the Panel believes that participants should be required to follow the time rules for filing briefs or not be allowed to make a presentation. The Panel suggests that the minimum time for pre-filing of briefs should be increased from one week to at least two weeks.

2.8 Government Participation

Early in its review process, the Panel requested and received government position statements from relevant federal government departments and agencies, and from the territorial governments. These papers addressed the possible effects of proposed Beaufort Sea-Mackenzie Delta region oil and gas production and transportation on government programs, policies and activities, and the initiatives necessary to manage those effects. The information contained in these documents was useful to the Panel and the review participants, providing valuable background information, otherwise unavailable, on priorities and perspectives for future northern development.

The Panel's sessions on government management proved to be very useful. The Panel found it helpful to have government departments present information and have senior officials available to answer questions on current and future policies and programs. The information obtained was most helpful to the Panel during its deliberations. The one area where government departments and agencies could strengthen their efforts in public sessions would be in more actively raising concerns and issues, in addition to the presentation of written briefs. For instance, a summary statement on the issues of major concern, still outstanding following each session topic, would have given the Panel a better understanding of departmental positions. The Government of the Northwest Territories (GNWT) representatives, who actively intervened throughout the General Sessions, were an exception.

2.9 Intervenor Funding

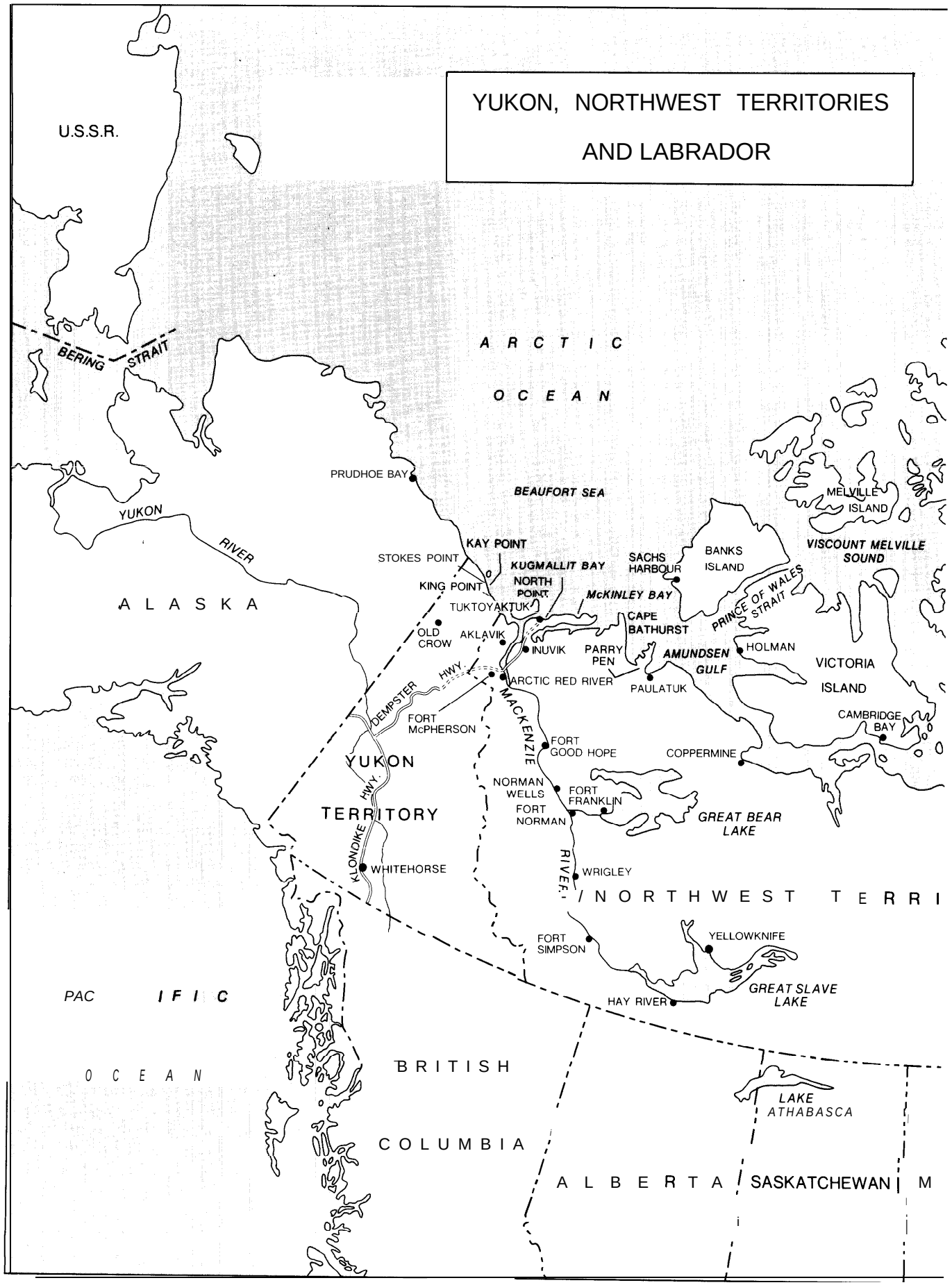
In 1981, the federal government established an intervenor funding program, on an experimental basis, to provide financial assistance to those wishing to present their views to the Panel. The funds were provided by the Department of Indian Affairs and Northern Development, and administered by a special committee that reported to the Executive Chairman of FEARO. Applications for funding were assessed by the committee, and approximately one million dollars was allocated during the course of the Panel's review (Appendix 9). Intervenor funding enabled many participants to prepare briefs and to travel to public sessions to present briefs. Although this program was independent of the Panel's review responsibilities, nevertheless the Panel concludes that the review process was materially assisted and that intervenor funding enhanced the quality and substance of interventions from northern residents whose interests would be most directly affected if the development were to go ahead.

1. **The Panel recommends that intervenor funding be made available for all future EARP reviews, and that funding be restricted to those participants who would be significantly affected by the proposal under review.**

The Panel believes that one way of doing this would be to ensure that the majority of the intervention funding committee be persons from the region being impacted.

2.10 Use of Technical Specialists

The Panel retained a number of Technical Specialists (Appendix 4), who were asked to provide impartial expert opinions and scientific facts on certain issues, and to raise other concerns which might be overlooked. The Technical Specialists were available to all review participants, including the Proponents. In some cases during the public sessions when an issue had reached an impasse, a Technical Specialist was asked to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RIVER
KAY POINT
STOKES POINT
KUGMALLIT BAY
NORTH POINT
KING POINT
McKINLEY BAY
SACHS HARBOUR
BANKS ISLAND
MELVILLE ISLAND
VISCOUNT MELVILLE SOUND
PRINCE OF WALES STRAIT
ALASKA
TUKTOYAKTUK
CAPE BATHURST
OLD CROW
AKLAVIK
INUVIK
PARRY PEN
AMUNDSEN GULF
HOLMAN
VICTORIA ISLAND
HWY.
ARCTIC RED RIVER
PAULATUK
DEMPSTER
MACKENZIE
FORT McPHERSON
FORT GOOD HOPE
COPPERMINE
CAMBRIDGE BAY
YUKON TERRITORY
NORMAN WELLS
FORT FRANKLIN
FORT NORMAN
GREAT BEAR LAKE
KLONDIKE HWY.
WHITEHORSE
RIVER
WRIGLEY
NORTHWEST TERRI
FORT SIMPSON
YELLOWKNIFE
GREAT SLAVE LAKE
HAY RIVER
PACIFIC
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BRITISH COLUMBIA
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ELLESMERE ISLAND
GRISE FIORD
CORNWALLIS ISLAND
JONES SOUND
DEVON IS.
RESOLUTE
BARROW STR.
LANCASTER SOUND
BAFFIN BAY
BYLOT ISLAND
POND INLET
CUNNINGHAM INLET
CRESWELL BAY
ARCTIC BAY
ADMIRALTY INLET
CLYDE RIVER
DAVIS STRAIT
BAFFIN ISLAND
BROUGHTON ISLAND
SPENCE BAY
IGLOOLIK
PANGNIRTUNG
HALL BEACH
CUMBERLAND SOUND
GJOA HAVEN
PELLY BAY
FOXE BASIN
FROBISHER BAY
LAKE HARBOUR
CAPE DORSET
CORAL HARBOUR
HUDSON STRAIT
LABRADOR SEA
TORIES
BAKER LAKE
RANKIN INLET
NAIN
MAKKOVIK
HOPEDALE
POSTVILLE
RIGOLET
FORT CHIMO
ESKIMO POINT
HUDSON BAY
LABRADOR
QUEBEC
MANITOBA
ONTARIO

chair an informal task force composed of intervenors and government and Proponent representatives to attempt to reach a consensus on that issue. This procedure worked well and the Panel suggests that future EARP panels continue to make use of Technical Specialists to help clarify and resolve contentious issues at the public sessions. In addition, the Panel concludes that future EARP panels should acquire Technical Specialists early in the review process, preferably at the time the EIS Guidelines are being prepared.

2.11 Public Sessions

The Panel believes that its practice of holding two different types of public sessions, community and general, was a success. The Panel held Community Sessions at 20 locations, involving 29 northern communities. The community residents and their invited guests were given extensive opportunities to express their views on the Proponents' proposal and to question the Proponents. Although a number of written presentations were made to the Panel at these sessions, most were made orally. Most of the presentations dealt with concerns that left no doubt as to what was important and why, such as wildlife being a link with the past, a present-day source of food and a security for the future. No academic discussion, no formal presentation by native organizations or by special interest groups, offered as compelling and vivid a picture of the goals and aspirations of native people as their own testimony.

Approximately 230 persons in the communities spoke to the Panel at the Community Sessions (Appendix 3). Many of those who spoke represented community councils, hunters and trappers associations and a variety of community organizations. The Community Sessions were well attended, and provided the Panel with much useful information and much cause for reflection.

Transcripts were made of all sessions and copies were sent to the communities shortly after the sessions. Although agendas were not prepared for the Community Sessions, the Panel believes that a flexible agenda may be useful for other panel reviews. In addition, the Panel believes that it may be useful to have more technical discussions at community sessions, but considers that this should be attempted only after consultation with community leaders. In summary, the Panel believes that community sessions, where appropriate, should be an integral part of public review processes.

The General Sessions were held at Resolute, Inuvik, Whitehorse, Yellowknife, Calgary and Ottawa, and were well attended (Appendix 2). The Panel endeavoured to promote a constructive and non-adversarial atmosphere throughout the public sessions. Most participants felt that this objective was achieved. An Inuvik resident, Tom Detlor, summed it up well:

> "We have found, Mr. Chairman, that conducting these hearings in a non-adversarial manner has fostered the growth of cooperation and consultation which was developing between the Town of Inuvik, industry and other levels of government."[4]

In addition, the Panel believes that the cooperation demonstrated by the two levels of government helped to achieve the success of the sessions.

2.12 Public File and Information Survey

The establishment of a Public File proved to be an effective aid in the review process. The File included an annotated index that enabled any review participant to locate all material either submitted to or distributed by the Panel. Copies of the Public File Index were located at Inuvik, Whitehorse, Yellowknife, Frobisher Bay, Vancouver, Calgary and Ottawa.

As part of the preparation for the review of the Beaufort Sea hydrocarbon production and transportation proposal, an information survey was initiated by the Beaufort Sea Environmental Assessment Panel Secretariat. The purpose of this survey was to identify kinds and sources of information which would be useful to the Panel, intervenors and Proponents, for the Panel's initial task of developing Guidelines for the Preparation of an Environmental Impact Statement, as well as for use throughout the process.

This survey resulted in a report entitled "Information Survey — Kinds and Sources — for the Environmental Assessment and Review Process: Beaufort Sea Hydrocarbon Production and Transportation Proposal" (October 1981). The first section of the report covered information sources in general and consisted of 60 Agency Information Sheets. Each information sheet identified a contact for that agency, as well as areas of expertise, current research projects, recent publications and information services relevant to the Beaufort Sea proposal. The second section of the report contained specific project information in the form of 162 Project information Sheets. Each sheet covered a current or recently completed project and provided the following information: project objectives, approach and progress, anticipated time frame, reports or publications, agencies and researchers involved and a contact for additional information. This report was widely circulated in

1981 and updated in May of 1982. This information would continue to be useful to those engaged in any site-specific work associated with this proposal or other northern projects.

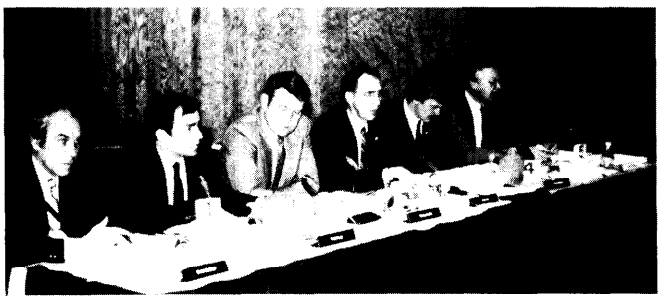
2. **The Panel recommends that the Department of Indian Affairs and Northern Development assume responsibility for the document entitled "Information Survey — Kinds and Sources — for the Environmental Assessment and Review Process: Beaufort Sea Hydrocarbon Production and Transportation Proposal" and have it updated annually.**

Researchers could also make use of the Arctic Science and Technology Information System (ASTIS), managed by the Arctic Institute of North America at the University of Calgary.

3.0 THE PROPOSAL

3.1 Introduction

This Chapter provides a brief description of the proposal presented to the Panel by the Proponents to produce and transport hydrocarbons from the Beaufort Sea-Mackenzie Delta region. For additional details, the reader is referred to Volume 2 of the Environmental Impact Statement. The effects of the various elements of the proposal on the North are described in Chapters 4, 5 and 6 of the Panel Report.



3.2 Background

The discovery of oil at Prudhoe Bay, Alaska in 1968 encouraged a number of oil companies to intensify exploration activities in the Beaufort Sea-Mackenzie Delta area of northern Canada.

Since 1965, approximately 150 exploratory wells have been drilled in the Beaufort Sea-Mackenzie Delta area. About 100 of these have been drilled on land. In 1972, Esso Resources Canada Limited began construction of artificial islands in the shallow waters (less than 20 metres deep) of the Beaufort Sea. Since then, the Proponents have constructed a total of 24 islands. The use of islands has allowed the companies to drill offshore year-round.

A refinement of the artificial island, the caisson-retained island, has reduced dredging requirements and thus made year-round drilling more economical. The caissons, fabricated from concrete or steel and placed on a man-made underwater berm, protect the drilling systems from ice, wind and wave forces.

Dome Petroleum Limited initiated a new caisson concept in 1982. The Single Steel Drilling Caisson (SSDC) is constructed from part of an oil supertanker and reinforced with steel and concrete. The vessel is ballasted and partially submerged onto a berm. The platform is then suitable for year-round drilling.

In deeper waters (from 20 to 60 metres) Dome Petroleum Limited has, since 1976, used drillships for drilling wells. Support vessels are used to break up ice floes that threaten the drillships, so that the drilling season has been extended to about 120 days a year. The latest addition to the Beaufort Sea exploratory drilling program is the Gulf Canada Resources Inc.'s *Kulluk*, a floating conical drilling unit, It has a reinforced conical hull which makes the unit capable of drilling in areas of moving ice, and hence extends the drilling season beyond that of a drill ship. Some 27 offshore wells have been completed from drillships since 1976.

3.3 Reserve Potential

The Geological Survey of Canada in its 1983 report gives an average expectation of 1.3 billion cubic metres (8.2 billion barrels) of recoverable oil and 1.86 trillion cubic metres (65.66 trillion cubic feet) of natural gas.[1]

To date, 120 million cubic metres of recoverable oil and 290 billion cubic metres of natural gas have been found.

The reserve potential for oil and gas was neither raised nor discussed at the General Sessions.

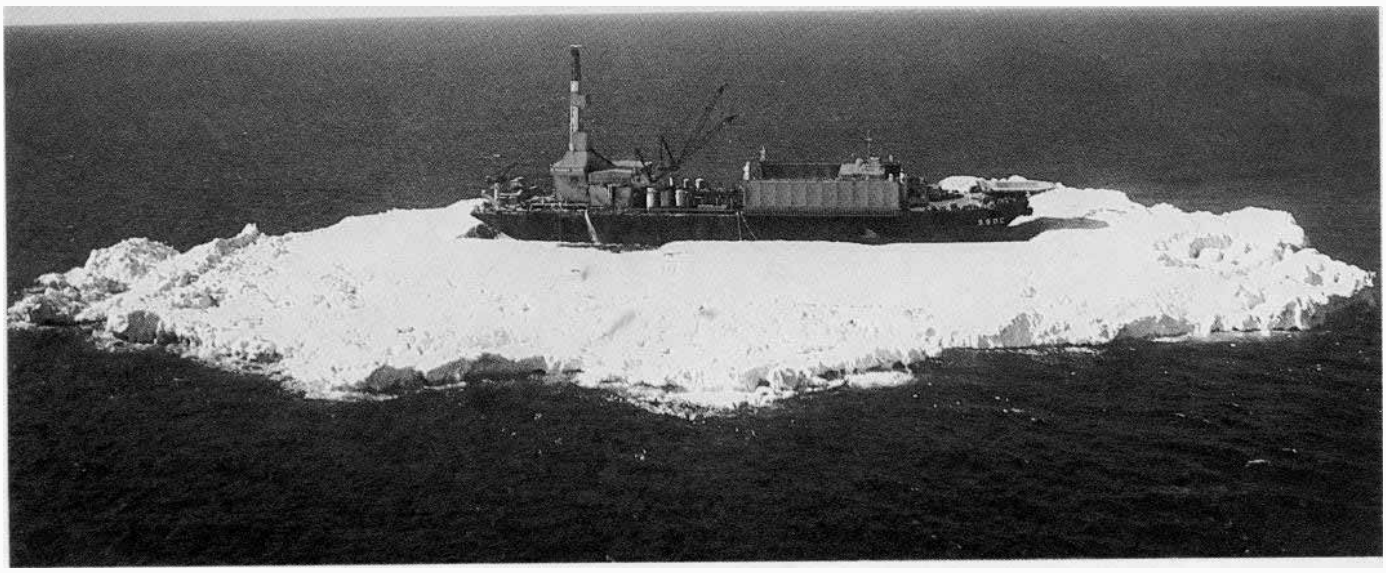
3.4 Plans for Production

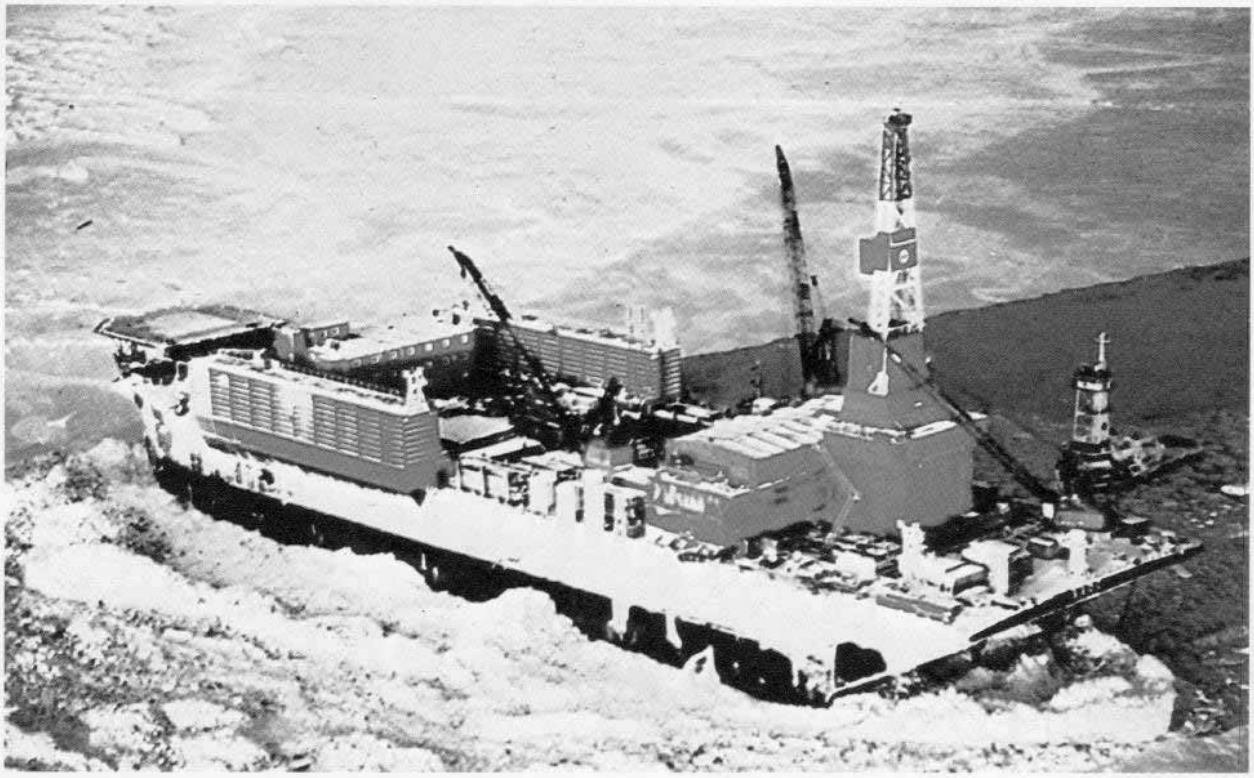
The Proponents contended that, with the present proven crude oil reserves and the potential for additional discoveries, planning should proceed for the production and transportation of these reserves. The Proponents expect most of the oil produced in the Beaufort Sea region to come from offshore reservoirs. Their present development plan consists of two main phases. The first phase would require confirmation of commercial quantities of recoverable oil and the construction of initial production and transportation facilities. The second phase would provide for further discoveries and long-term oil and gas production.

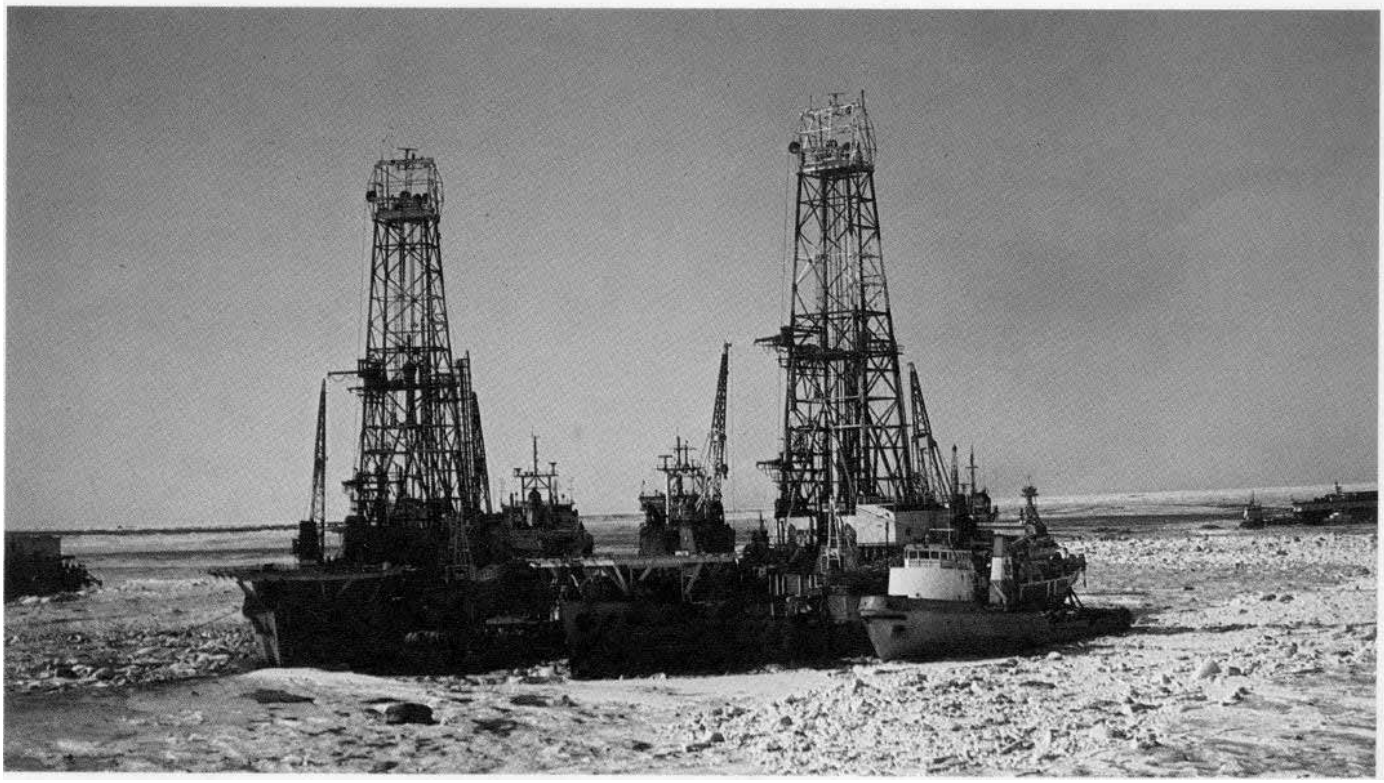
Oil would be transported to markets either through an overland pipeline, by icebreaking tankers, or by some combination of both. The Proponents estimated that their production and transportation proposals would involve an investment of tens of billions of dollars over a period of years.

3.5 Production Systems

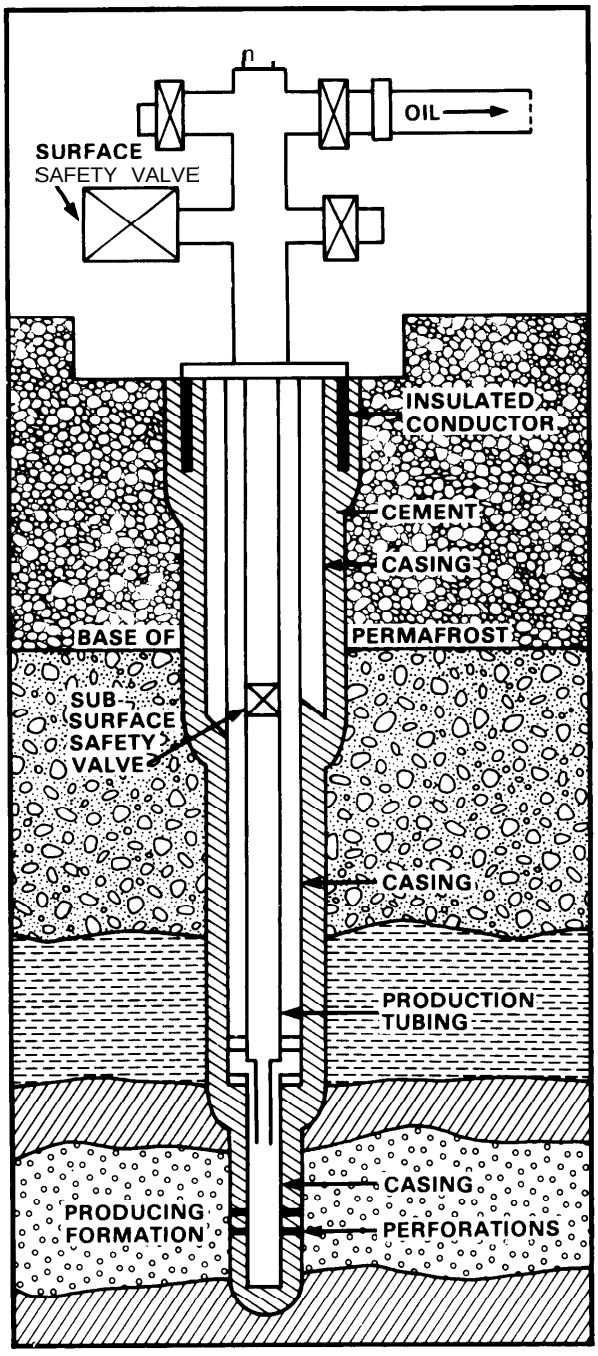
The production of hydrocarbons from beneath the Beaufort Sea would require the construction of permanent island platforms offshore. These platforms would serve as foundations for drilling systems, production wells, oil and gas processing facilities, storage tanks, utilities, pumping stations, electrical generators and other equipment, as well as accommodations for onsite workers. Concepts for design and construction of these platforms are evolving, based on the research and experience of the Proponents and the world-wide industry.







The layout of production wells on an island would vary, depending upon the characteristics of the subsurface reservoir. Up to 50 wells could be located on an island, and could be spaced as close as three metres apart. In other cases, wells could be completed with well heads on the sea floor.



Arctic wells require special precautions because of the presence of permafrost

The production drilling procedures and technologies to be used in the Beaufort Sea would not differ significantly from those used in other oil producing areas of the world, despite the cold Arctic environment and unique subsurface conditions. The regulations that currently govern drilling in northern areas are considered by the Proponents to be the most comprehensive and stringent of any drilling regulations in the world.

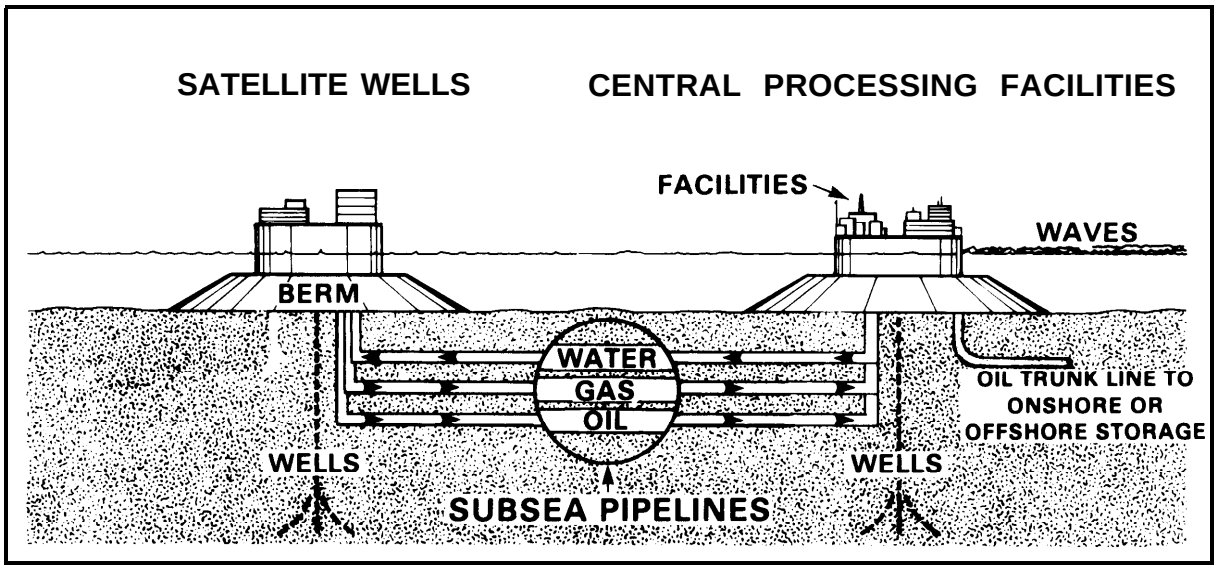
The drilling procedures would involve the use of rotary bits to cut through rock. Drilling fluid would be circulated in the hole to carry rock chips to the surface, to lubricate the bit and to control formation pressures. As the drilling proceeds, steel casings would be inserted in the hole and cemented in place. To avoid the thawing of permafrost, some well casings might be insulated or refrigerated. After the initial casing is cemented into place, a Blowout Preventer (BOP) stack would be fastened to the casing. The BOP would be located either on the surface of an island or in a "glory-hole" on the sea floor. Each BOP consists of a series of valves designed to seal the top Of the hole against formation pressures, whether or not there is drill pipe or tubing in the hole. The valves are operated by hydraulic pressure and would be activated (often automatically) if a catastrophic event occurred at the surface or in the hole. The BOP is designed with built-in redundancy to ensure that if one valve failed another could be used to control the well. The BOP would be tested regularly.

Once a well has been drilled to the intended depth, it must be completed so that oil and gas can be moved, under controlled conditions, from the subsurface reservoir to the surface. Well completions involve installation of production tubing and well head control equipment, perforating the well casing to permit oil and gas to flow into the well and, when required, the stimulation of a more rapid flow of oil into the well by physical or chemical means. When well completion operations are underway, drilling fluid would be maintained in the hole to offset formation pressure. The well head control equipment which replaces the BOP's during production operations consists of flow control valves, pressure gauges and chokes.

Once well completion operations were finished, production could begin. During production, subsurface safety valves would automatically be activated whenever well flows were uncontrolled. Should a catastrophic event occur at the surface, these valves, which are held open by hydraulic pressure, would automatically close. The Proponents, in answer to concerns raised by the Department of the Environment, indicated that, when tested, very few of these valves fail. When they do malfunction, 9 out of 10 close prematurely or fail to reopen, thus failing in a "safe" position.

Occasionally, during the life of a well, workover operations would be undertaken to improve productivity, to repair subsurface equipment, to remove sand from the well bore in order to enhance production or to apply other well stimulation techniques. During workover operations, drilling fluid would be circulated in the hole to control pressures.

Subsea pipelines would be used to connect all wells completed, either on satellite artificial islands or on the sea floor, with central processing facilities. Those pipelines would either bring the oil to a shore terminal to connect with overland pipe-



Subsea pipelines will move oilwell fluids from satellite islands to central processing Islands. Produced gas and water for injection may also be transmitted by subsea pipeline to injection wells. The produced oil or gas will then be pumped via subsea trunklines to tanker loading facilities, or alternatively to shore to a northern terminal of the overland pipeline

line systems or would connect the processing facilities with the tanker storage and loading terminals which might be situated either offshore or onshore.

Processing facilities would be required to treat produced well fluids before oil can be transported to southern markets. This processing would separate the gas that would both be associated with, and in part dissolved in, the oil in the source rock. After the pressure on the 'live' oil is reduced as it comes to the surface, the gas would be separated from the oil by density difference and the oil would then be stored in tanks to await shipment. If water were also produced with the oil, it too would be separated during this processing step. The facilities and technologies to prepare the oil for shipment to market are common throughout the industry and vary only in minor details related to the type of crude oil being produced.

For the tanker option, sizable oil storage capacities would be required either offshore or onshore in association with a tanker loading terminal. The Proponents estimated that approximately 410,000 m^3 (2,600,000 bbls) of storage capacity would be needed if two tankers were in use. This would be approximately 1.75 times the cargo capacity of the proposed Arctic tanker. One option to store oil would be a conventional, diked, tank farm arrangement on a man-made island. Alternatively, storage could be built into a production caisson or island platform. In either case, oil would be stored in several tanks for convenience and safety reasons. Other concepts were described by the Proponents in their EIS.

Two systems have been proposed for loading oil onto tankers. Tanker loading terminals could involve adaptation to the Arctic environment of the Single-Point Mooring Terminal commonly used around the world. Another proposal would be the development of a large island with a harbour for tanker loading.

For the pipeline transportation option, some storage would be required at the production island and onshore at the northern pipeline terminal. A conventional tank farm system would be used to store 12 to 24 hours of production flow. For a production scenario of about 15,000 m^3/day, this would require from about 8,000 m^3 to about 15,000 m^3 of storage.

The Proponents suggested that an early production and storage system would be an option they might wish to have available. One such system for use during the open-water season would involve a floating processing and storage facility, located on a barge and connected to a production island by a subsea pipeline or to a subsea well head by a flexible riser. The Proponents indicated such systems are in common use around the world. The barge would be moored to an anchor buoy and tankers would be loaded from the barge. Once permanent facilities are constructed, the system could be moved to the next new oilfield to be developed.

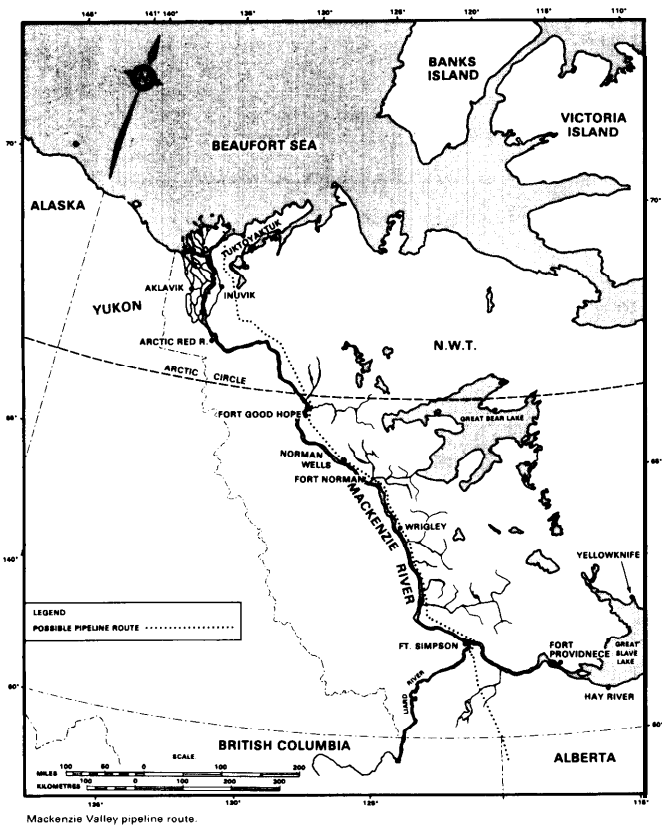
Onshore and nearshore reservoirs would be developed in a manner similar to that used in southern Canada. After reservoir delineation is complete, design, fabrication and installation of production facilities could begin. Oil-well fluids would be piped from well clusters to central processing facilities similar to those offshore. A complete onshore production system would be self-contained with its own power, water and waste treatment, disposal systems and accommodation facilities.

3.6. Transportation Systems

3.6.1 Pipelines

The Proponents' present development plans contain several alternative pipeline proposals, all using the Mackenzie Valley route from Richards Island in the MacKenzie Delta to Edmonton, Alberta for transporting oil from the Beaufort Sea. One alternative is a small-diameter pipeline that would carry low viscosity oil and would be buried in a manner similar to the Norman Wells oil pipeline currently under construction. Other alternatives would involve the use of a number of small-diameter buried lines, or a large-diameter line, extending from a site such as North Point on Richards Island to Edmonton. The pipeline would be approximately 2,250 kilometres (1,400 miles) long.

In the case of a small-diameter pipeline (e.g. 400 mm), oil would be chilled to a temperature just below 0°C before it is pumped into the line. The pipe would be buried throughout its length with a minimum of one metre of soil fill cover. When the pipeline is at maximum capacity, the pumping stations would be about 100 kilometres apart. Approximately one million cubic metres of gravel could be required for the small-diameter pipeline. Three winter seasons would be needed to construct the line with a peak workforce of about 1,850 persons.



Mackenzie Valley pipeline route.

Mackenzie Valley pipeline route

The large-diameter pipeline (e.g. 1,000 mm) would be designed and built using technology tested during the construction of the Trans Alaska Pipeline System. The pipeline would be constructed of high-strength, low-temperature steel. About one-third of the pipeline would be elevated aboveground on steel supports in areas where ice-rich permafrost is prevalent. The southern two-thirds would be buried with a cover depth of one meter. Where the pipeline crosses streams and rivers, the burial depth would be sufficient to avoid scouring by ice or water. In addition, a protective coating around the pipe would help to prevent exterior corrosion. It would take four years to build a large-diameter pipeline, with a peak workforce of about 13,000. Most activity would take place in the winter, when the ground is frozen, using snow pads to protect the surface.

The pipeline right-of-way would be up to 37 metres wide to accommodate trenching and backfilling. Where the pipeline is buried, the right-of-way would be restored to meet environmental requirements.

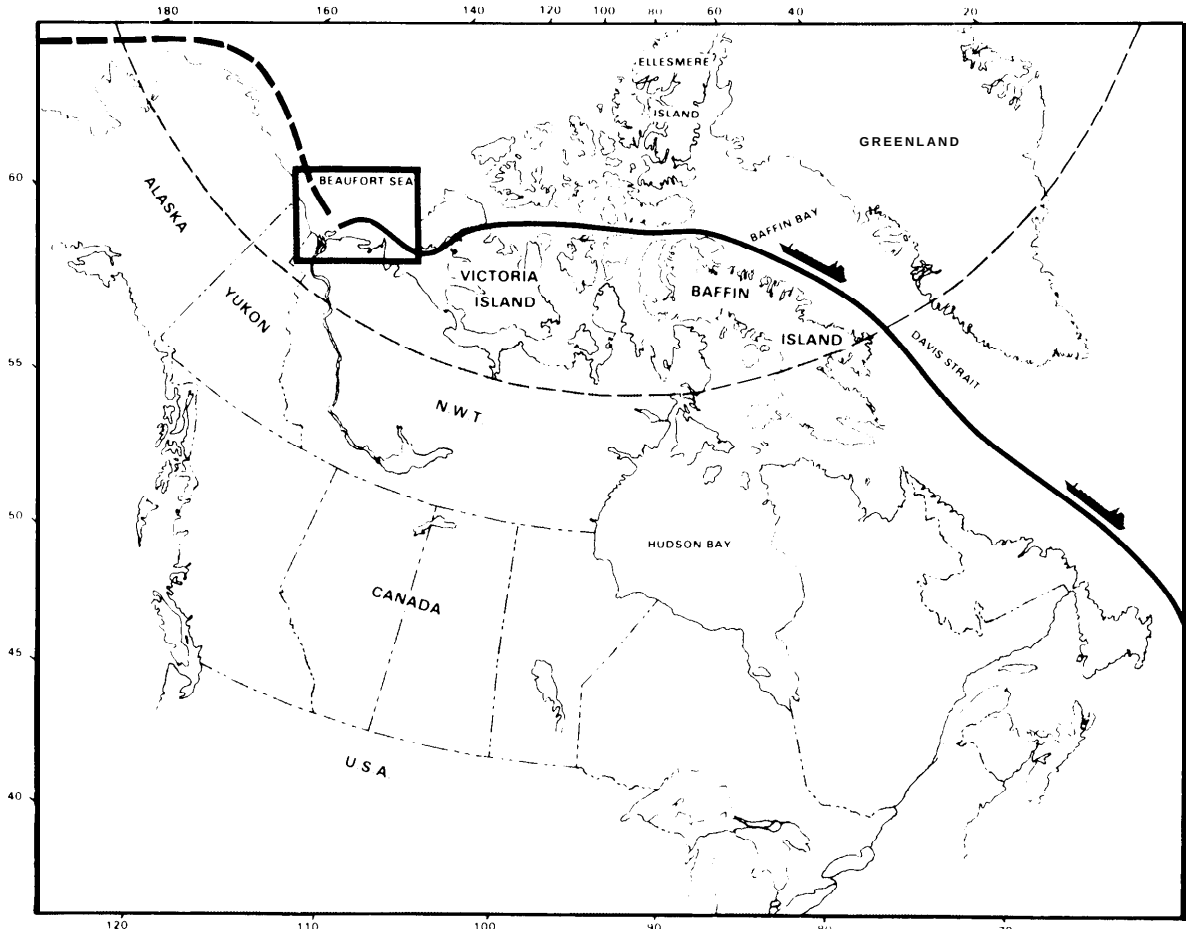
3.6.2 Tankers

The Proponents proposed the use of icebreaking Arctic tankers as one alternative for transporting oil from the Beaufort Sea to markets in the South.[2] These vessels would be designed to operate safely under Arctic conditions year-round, with a cargo capacity of 240,000 m^3 (1,500,000 bbls) contained in 16 cargo tanks. At least two tankers would be required to initiate operations. Thereafter, the size of the tanker fleet would increase, depending on the rate of discovery and production, and on the nature of the environmental impacts.

The Proponents described an eastern route through the Canadian Arctic Archipelago (Beaufort Sea, Prince of Wales Strait, Viscount Melville Sound, Barrow Strait, Lancaster Sound, Davis Strait) for their tankers. They did not provide an assessment of the effects of a western route passing north of Alaska, and so the Panel has not considered this routing option.

The Proponents' design for Arctic tankers would exceed the existing requirements for Arctic shipping. The design includes many safety features not found on conventional tankers. The Arctic tanker would be constructed with a double hull which would include a double bottom to reduce the danger of a spill in the event of an accident. The cargo tanks would be within the inner hull, so that no oil would be carried adjacent to the outer hull. These features would reduce, but not totally eliminate, the risk of an oil spill in a moving accident such as a collision or grounding.

Arctic tankers would be massively stronger than conventional tankers and approximately two to three times stronger than required by existing legislation. The Proponents stated that their Arctic tankers would be constructed to meet or exceed Class 10 standards under the Canadian Arctic Shipping Pollution Prevention Regulations (CASPPR), requiring the capability of making continuous progress at three knots in level ice of 10-foot thickness.



If Arctic tankers were used to carry oil from the Beaufort Sea they would likely travel through the Northwest Passage

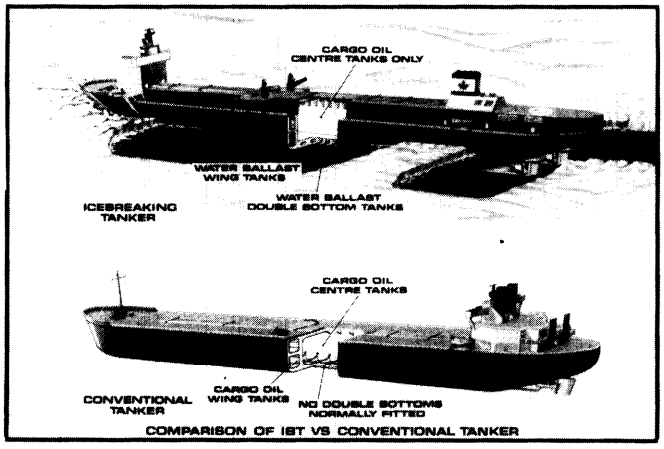
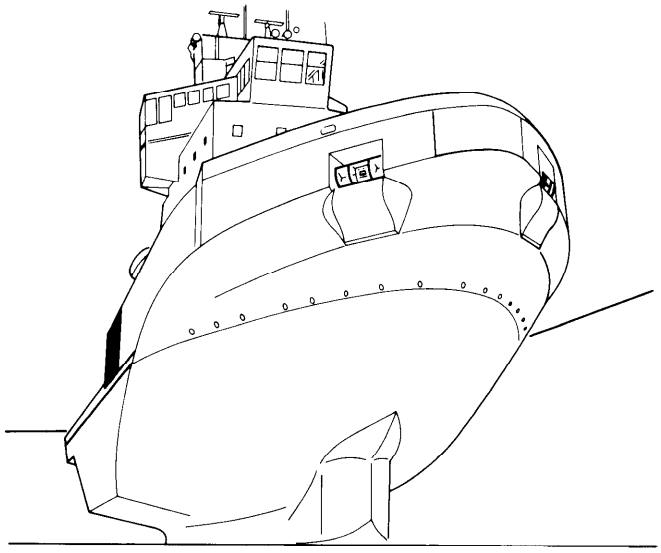
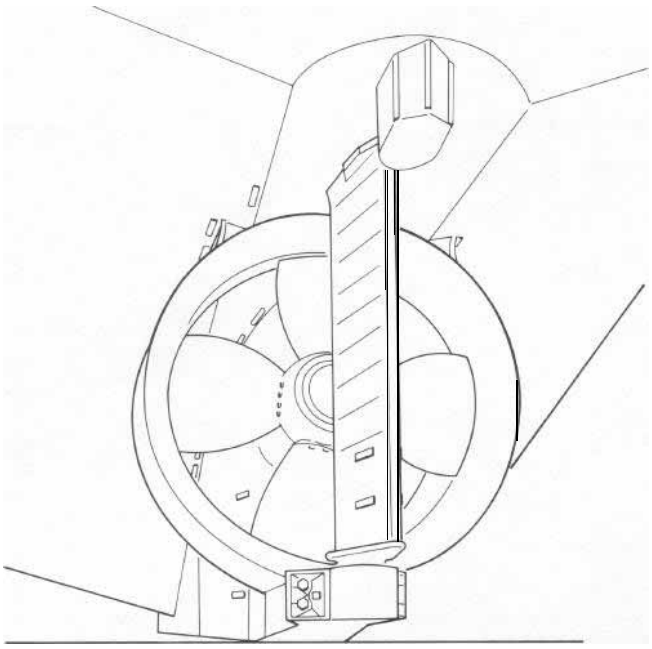


Illustration of special features proposed for Arctic tankers which are not found in conventional tankers These include a Class 10 icebreaking capability, separate oil and water ballast tanks and a double-bottomed hull to minimize the risk of oil spillage in the event of an accident



Spoon-shaped bow with ice knife and reamers



Propeller nozzles

The Proponents indicated that the Arctic tanker would be very manoeuvrable; special features would give it superior performance in turning and stopping compared to conventional tankers and an ability to perform well in Arctic conditions. These features would include increased shaft horsepower for propulsion (totalling 100,000 s.h.p.), twin power trains, increased astern thrust, twin rudders and twin controllable-pitch propellers with reversing capability. Problems of ice interaction with propellers would be partially overcome by the use of propeller nozzles and a special hull form.

Additional features designed to improve performance in ice include a spoon-shaped bow with ice knife and reamers, spray nozzles, bubbler systems, heeling systems and low-friction hull coatings. Many of these features have been tested on Dome Petroleum Limited's icebreaker Robert LeMeur.

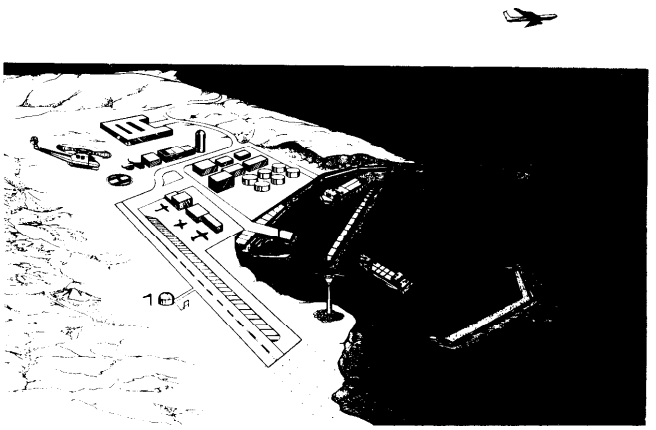
The Arctic tanker would have separate oil cargo and ballast tanks. In the event of damage to a cargo tank, the oil could be transferred to an undamaged ballast tank. The ship would also be equipped with dual inert gas systems which would be used to flood all open cargo spaces with inert gas to reduce the chance of explosion caused by ignition of volatiles in the ship's hold. The risk of explosion would be further reduced by the use of deep well pumps individually sited on the deck above each cargo tank, rather than the more common system of pumping to and from a single pumping station within the ship.

Dome's Icebreaker Robert LeMeur

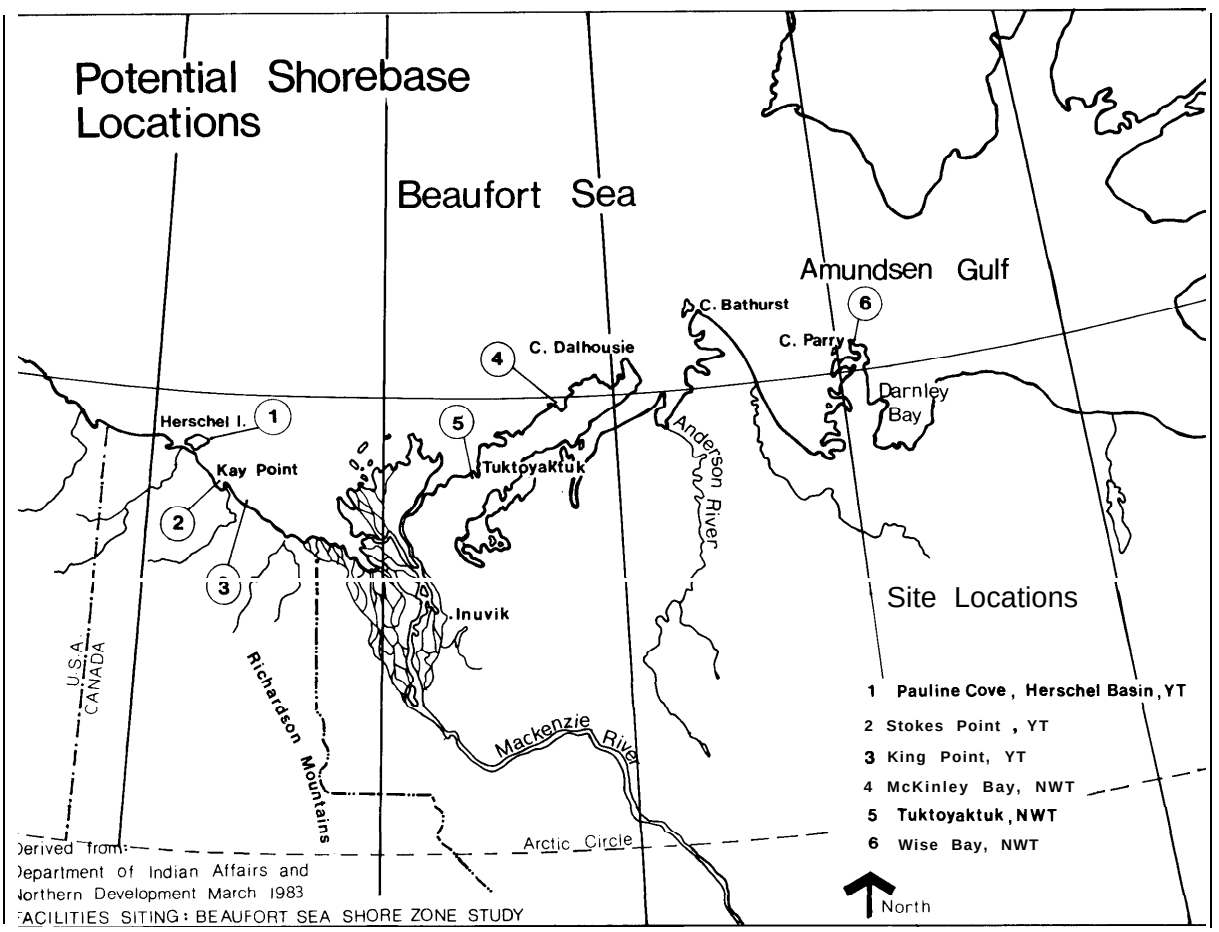
3.6.3 **Support Bases**

The Proponents' proposal identified support bases as an integral part of any oil and gas production and transportation project. These support bases would have warehouse facilities for consumables and construction materials needed to supply drilling, construction and production activities. They would act as transfer points for rotational personnel. If a support base is required on land for offshore operations it is called a shore base. In some cases a port may be associated with a shore base and would provide facilities for docking, mooring and repairing supply vessels, drillships and dredges. All support bases would also function as operation and administrative centres.

Dome currently has shore bases at McKinley Bay and Tuktoyaktuk, and Gulf plans to use a "floating shore base" concept on a temporary basis. The Proponents have indicated that these shore bases would not be satisfactory in the long term, since a deep-draft port would be required to support a production project. For production in the western Beaufort Sea area, the Proponents indicated that the only physically and economically viable locations for a deep-draft port that would meet these requirements would be either King Point or Stokes Point on the Yukon Coast. For production in the eastern Beaufort Sea area, sites east of McKinley Bay would be examined.



For production in the western Beaufort Sea area, the Proponents indicated that the only physically and economically viable locations for a deep-draft port would be either King Point or Stokes Point Shown here is an artist's rendering of a possible future King Point support base



4.0 OIL SPILLS AND RISK

4.1 Oil Spill Risk Assessment

4.1.1 Overview

The risk of a large oil spill was the major environmental concern expressed by many northern residents and intervenors. At the public sessions of the Panel, each community had its own particular concern. Communities in the Mackenzie Valley expressed concern about a rupture in a pipeline crossing of the Mackenzie River, the Great Bear River, and smaller rivers. Residents of the Beaufort Sea region spoke of spills into the Beaufort Sea. Communities along the proposed tanker route expressed fears about a potential tanker spill. Communities along the Labrador coast expressed the fear that an oil spill north of 60° North Latitude, the area covered by the present review, might be carried south onto the Labrador coast.

Because of these concerns and technical disagreements among experts about the degree of actual risk involved, the Proponents with their experts, the Department of the Environment (DOE) and a Technical Specialist held discussions on risk analysis in the summer and fall of 1983. These discussions, and the subsequent reports resulting from them, served to narrow the technical issues in risk analysis. They also provided a useful basis for discussion at the public sessions and assistance to the Panel in its deliberations and recommendations. Because of the importance the Panel attaches to oil spill risk assessment, a summary of this information is given in Appendix 11.

The purpose of oil spill risk assessment is to provide a numerical estimate of the risk of an oil spill associated with each component of any proposed production and transportation system. This numerical estimate provides an indication of the types of accidental spills which would be most likely to have potentially serious environmental effects. This, in turn, points to operations or geographic locations where special care should be taken to reduce the risk of a spill.

The assessment of oil spill risks for the Beaufort Sea proposal involved the use of representative historical data from other oil producing regions of the world. In many cases, these historical data were derived from data bases which included production and transportation facilities which differ in age, design, size and cause of accidents from those assumed for the Proponents' proposal. These data were modified to reflect the Arctic environment and the advanced types of engineering and technology the Proponents stated they would use. [1]

During the risk assessment studies, much of the discussion focused on methodological issues, such as the merits of various statistical techniques and data bases. Technical experts recognized the limitations of these methods but nonetheless concluded that they could be used to provide reasonable bounds for spill frequency and size. In interpreting the risk assessment studies, the Panel is well aware that judgement must be used in the interpretation of the analyses of oil spill risks.*

The Panel concludes that the analyses presented are valid only in describing risk within the range of possibilities assumed in this particular analysis and that, even then, other factors such as human error, enhanced awareness of risk and unforeseen circumstances could significantly alter the actual risk from the projected risk.

In addition, as a result of the conceptual nature of the Proponents' proposal, assumptions were made as to the location of production facilities. The Proponents, therefore, had to base their risk estimates on hypothetical scenarios. While the Panel accepts these scenarios as reasonable, changes in concept could alter somewhat the risk estimates presented by the Proponents.

In discussing the assessment of risk, it should be stressed that it is standard engineering practice to design facilities to take into consideration events with very low probabilities of occurrence. For instance, a facility would be designed to survive extreme events which might occur only once in a return period of many years. Longer return periods would normally be used where the failure of a structure could be catastrophic. Once the return period has been determined, engineers add a further allowance in their designs to address uncertainties which might exist in the quality of material, in allowances for the human factor and in the prediction of a range of environmental events. These design factors are incorporated into project design plans by the Proponents in order to reduce known and unknown risks to acceptable levels.

The Proponents' estimate of the risks of oil spills associated with various components of their proposal is given in *Table* No. 4.7. This table is based on a 100,000 bbls/day production level. The Panel has converted the volumes in Tables 4.1 *and* 4.2 to cubic metres and rounded the figures where appropriate. It should be noted that for purposes of this report the volume of about 100,000 bbls/day has been equated to about 15,000 m^3/day. Components 1, 2 and 3 relate to a production system based on a small-diameter pipeline. Components 1, 2 and 4 relate to a production system based on a two tanker system for transporting oil. The Proponents noted that, while the probabilities of an accident would increase at higher production levels, average spill sizes would not likely change significantly.

A summary of data concerning oil spill sizes for different components of oil production and transportation is given in *Table No. 4.2.* Columns (1) and (2) are estimates of the "maximum credible spill sizes" which experts believe are the largest spills that would have any credible probability of occurring during the first 20 years of Beaufort Sea production and transportation operations. It should be stressed that these spills have an extremely small probability of occurring based on the risk analyses presented to the Panel. Column (1) is based on a production level of about 15,900 m^3/day which is the approxi-

mate production level favoured by the Panel as a first phase of development. Column (2) suggests that, with a seven-fold increase in production levels to about 110,000 m^3/day, the spill sizes would increase only in the cases of subsea and overland pipelines. This increased spill size would apply if larger-diameter pipelines were constructed, but might not apply in the case of twinned pipelines, although the risk would then increase. Column (3) indicates the spill sizes for the largest oil spills recorded in any area of the world. These estimates were provided for purposes of comparison.

The estimates provided in *Table No.* 4.2 were presented in a report by Dr. Ray Lemberg, a Technical Specialist, at the request of the Panel. Dr. Lemberg consulted with the Proponents and their experts, as well as with the Department of the Environment and other Technical Specialists, to provide a summary of the major issues and disagreements remaining among those who had participated in preparing or advising on the preparation of the Proponents' report on Oil Spill Risk Assessment. Under the present state of knowledge about risk factors, the estimates given in Columns (1) and (2) were considered by those consulted by Dr. Lemberg to be reasonable estimates of the most extreme spill sizes which could be expected in the North as a result of the Proponents' proposals.

Table No. 4.1

Estimated Oil Spill Probabilities and Sizes for Various Components of the Proponents' Proposed Production and Transportation Systems Assuming a Production Level of about 15,900 m^3/day (100,000 bbls/day)

System Component	Annual Oil Spill Probability (Frequency)	Average Oil Spill Size
		(Cubic Metres)
1. Development Drilling		
Non-Blowouts	0.11	16
Blowouts	0.016	200
2. Production Operations		
Non-Blowouts	0.025	46
Blowouts	0.0033	3,500
3. Pipelines		
Su bsea	0.025	380
Overland	0.0094	220
Storage for Pipeline System	0.0005	2,200
4. Tankers		
Harbour	0.000138	5,300
Restricted Waters	0.000288	11,000
Open Sea	0.0000452	13,000
Storage for Tankers	0.028	2,200

Cubic metres may be converted to barrels through multiplying by 6.28

Source F G Bercha and Associates et al (Dome, Esso, Gulf) "Oil Spill Risk Assessment", Tables 5 2 and 5 7 (GEN-1)

4.1.2 **Production**

Production operations, as defined here, include development drilling and other phases of production. Development drilling includes drilling after exploration is complete and wells are being drilled to produce oil. Production operations include down-hole and well-head activities associated with movement

Table No. 4.2

Maximum Credible Spill Sizes Estimated for Various Components of the Proponents' Proposed Production and Transportation Systems

System Component	(1) Maximum Credible Spills at about 15,900 m^3/day Production Level	(2) Maximum Credible Spills at 110,000 m^3/day Production Level	(3) Maximum Recorded Oil Spill Sizes in World Data (for comparison)
	Cubic Metres	Cubic Metres	Cubic Metres
1. Development Drilling			
Non-Blowout	—	—	50
Blowout	330,000	330,000	490,000
2. Production Operations			
Non-Blowout	—		240
Blowout	*	*	24,000
3. Pipelines			
Su bsea	95	750	25,000
Overland	1,100	5,600	9,500
4. Tankers			
Collision, Ramming, Grounding	41,000	41,000	240,000
Structural Failure, Explosion, Fire	220,000	220,000	
5. Offshore Storage for Tankers	43,000	43,000	120,000

Cubic metres may be converted to barrels through multiplying by 6.28.

. World statistics do not differentiate very well between production and development blowouts Although 330,000 cubic metres was given as the maximum credible spill associated with development and production combined, the spill associated with production operations would be smaller.

Source. R. Lemberg. "Simplified Summary of Oil Spill Risk Assessments", November, 1983 (IN-40)

of fluids under controlled conditions from the subsurface reservoir to processing facilities, and well completion and maintenance activities.[3]

There are two categories of potential oil spills that might occur from development drilling and production systems: non-blowout related spills and blowouts. Non-blowout spills involve spills of fuel oils, oil-based drilling fluids used during development drilling or other small oil spills (less than 50 m^3). Most of these spills could be avoided by careful operating procedures.[4]

A blowout is caused by the partial or total loss of well control. Depending on the situation, control may be regained by use of existing well-control equipment, installation of special equipment, drilling a relief well or a combination of any of these measures.

Sometimes natural bridging of the well bore occurs during a blowout. This occurs when the well bore becomes clogged wholly or partially by debris. In this situation, the well production rate may be reduced or stopped, and the blowout may then be brought under control without other methods.

World statistics suggest that blowouts occurring during workovers accounted for most of the oil spilled in the production phase. Well workovers are described briefly in Section 3.5 and in the EIS.

Most blowouts are natural gas blowouts which do not result in an oil spill. Oil spills which do occur are usually small. However, there would be a very small but real chance of a large spill occurring as a result of a blowout during the production of oil from Beaufort Sea-Mackenzie Delta wells.[5]

4.1.3 Subsea Pipelines

Subsea pipelines would be needed to move oil from producing wells to processing facilities, and from processing facilities to an onshore pipeline terminal or offshore tanker loading terminal. Subsea systems are described in Section 3.5 of this report and in the EIS and associated documents.

Because of the advanced technology used for spill detection and pipeline shutdown, the Proponents indicated that the maximum spill size of a subsea pipeline would not be large. However, there have been large spills from subsea pipelines elsewhere, and subsea pipelines have accounted for much of the volume of oil spilled in offshore petroleum operations. Risk experts agreed that the probability of a subsea pipeline spill was as high or higher than for production operations, tankers, or storage, but the expected spill sizes were smaller.[6] There was no data base for buried subsea pipelines under Arctic conditions, so this risk had to be estimated from data obtained from other areas.

4.1.4 Overland Pipelines

The Proponents described in detail in their EIS and associated documents how overland pipelines could be used to transport oil to southern markets. The system would include the pipeline, storage and pumping stations. These systems are described in Section 3.6.1 and in the EIS.

The Proponents indicated that overland pipeline spills would be more frequent than spills associated with production operations, storage and tankers. The Proponents also said that the probability of a large spill would be much lower, and that the spill volume would be limited by pipeline size, spacing of control valves and well developed leak detection methods.

4.1.5 Offshore Storage for Tankers

If the tanker transportation system were used to transport oil to southern markets, storage and loading facilities would be required to serve the tankers. These facilities are described in Section 3.5 as well as in the EIS and associated documents.

The Proponents indicated that there would be a relatively high probability of small spills associated with oil storage and loading facilities for tankers. There would also be a small probability of a large spill.[7] Oil storage facilities would consist of several storage tanks, so that only a fraction of the stored oil would be subject to spillage at one time. Because storage facilities would be centralized and stationary, spill prevention measures, such as containment dikes, would be built into the design of the facility. Oil spill contingency plans could also be prepared for specific sites.

4.1.6 Tankers

Beaufort Sea oil might be carried to southern markets using Arctic tankers. These vessels have been described by the Proponents in the EIS and associated documents. They are also discussed in Sections 3.6.2 and 6.4 of this report.

The Proponents suggest that "tankers have similar risk characteristics to those of production and development drilling with slightly lower probabilities of a spill and slightly smaller maximum spill volumes."[8]

The Proponents, in estimating the risks of oil spills from tankers, adjusted world tanker statistics to reflect the more severe environmental conditions expected in the Arctic. They also adjusted data to allow for the safety features built into the proposed Arctic tanker. As noted in Section 3.6.2, the Proponents concluded that the Arctic tanker of their proposed design operating in the Arctic would be many times safer than a conventional tanker operating in southern waters.

The Proponents indicated that tanker accidents involving collisions with another vessel, ramming an iceberg or grounding would be unlikely to cause the loss of the whole ship. In these situations a loss of up to three cargo tanks out of 16 could occur. An accident involving the loss of an entire cargo (16 separate tanks) of an Arctic tanker would be quite unlikely, but could conceivably occur due to fire, explosion or structural failure. The Proponents stated that the risk of these events would be reduced significantly by the advanced design features of the Arctic tanker.[9] Technical Specialists in tanker design and navigation concurred with this statement.

4.1.7 Causes and Prevention of Accidents

The Proponents cited extensive research work which confirmed their conclusion that most accidental oil spills result

from human error. In production operations, these errors have included inattention to operations, inadequate maintenance, inadequate supervision, improper installation of equipment, improper work plans, improper work procedures and inadequate testing of equipment. They concluded that the mechanical equipment being used in production is reliable in design and function and that increasing sophistication would not necessarily decrease the frequency of accidents. They concluded that accident rates could be reduced primarily through preventative maintenance of equipment and better training and supervision of operators. [10]

For tanker accidents, the Proponents cited research indicating that 75 per cent involved human error, although in some cases mechanical failure did contribute to the accident. In some cases, extreme weather conditions such as high seas or fog have contributed to past tanker accidents. Very few tanker accidents have been due solely to human error. Human errors have included inadequate training, flouting of the law, breakdowns in communication or authority in vessel operation, honest mistakes, drug or alcohol-induced accidents, and errors in equipment design. The Proponents propose to control these error sources through careful recruiting, training and supervision, and failsafe design. [11]

Although many accidents are caused by errors during equipment operation, some errors may have originated years before the accident. For example, the Proponents indicated that most pipeline accidents are not due to operator error, but to faulty design, installation and maintenance.

The Proponents also noted that, for oil pipelines in environmentally sensitive areas, closer spacing of remotely controlled valves would reduce the volume of oil spilled.

The Panel agrees with the Proponents' conclusion that human error is the major factor in accidental oil spills. The Proponents described their proposed safety programs to reduce the human-error factor in accidents. Their safety record in Beaufort Sea operations to date has been excellent. The Panel urges the Proponents and government to continue to seek methods to reduce human error as the most direct means of avoiding a major oil spill.

4.1.8 Conclusions

The Panel concludes that the risk of an oil spill would not be appreciably higher for Beaufort Sea region oil production and transportation than for other parts of North America and abroad. In fact, with the technological advances that are being made, the risk may be lower. This conclusion applies to production in the Beaufort Sea region, transportation by pipeline in the Mackenzie Valley and transportation by tanker along the proposed tanker route. On the other hand, it should be stressed that although the statistical chance of having an oil spill may not be greater than elsewhere, the difficulties in applying oil spill countermeasures and the effects of an oil spill may indeed be greater in the Arctic.

Inasmuch as production and transportation is unlikely to take place before the late 1980's and the estimates of risk analysis have been based upon statistics collected prior to 1983, the conclusion of the Panel is that oil can be produced and transported from the Beaufort Sea as safely as from most other producing areas if the precautions stated in the EIS and in other information presented by the Proponents to the Panel are followed and stringent regulatory control is exercised.

The Panel also believes that safety features of oil production and transportation equipment will continue to be improved, but that the greatest contributing factor to risk, human error, must be addressed on a daily basis. The awareness of risk, the training and supervision in handling of equipment and the attitude of employees will determine whether most spills are likely to occur. For this reason, spill prevention must continue to be a central concern of the Proponents, their contractors and subcontractors, and government regulatory authorities.

The Panel further believes that because many companies could be involved in the Proponent's operations, the Government of Canada, for example, The Canada Oil and Gas Lands Administration (COGLA) and the Canadian Coast Guard (CCG), should be involved in surveillance and enforcement inspections to ensure that all operators, and their contractors and subcontractors, are able to implement spill avoidance measures effectively.

No system can be completely safe and it would be prudent to assume the worst case and thoroughly prepare for a major accidental oil spill. Such a spill would most likely occur in the Beaufort Sea production zone where facilities are concentrated. In this zone, it is imperative that the capability to implement effective countermeasures be maintained in constant readiness. If a pipeline system is approved to carry oil to market, great care must be given to design, installation and maintenance, and a contingency plan must be in place prior to production. For a tanker system, a reliable contingency plan must be prepared to address the logistic and environmental obstacles which must be overcome in responding to a spill in a remote and difficult environment.

4.2 Oil Spills

4.2.1 Introduction

The potential effects of an oil well blowout or tanker spill were raised as a major concern by many northerners throughout the public sessions. This was especially true for those who depend on renewable marine resource harvesting for food or income. The Inuit Tapirisat of Canada stated that equipment, personnel and time required to control and clean up a tanker spill at any point along the lengthy tanker route would be very different from what would be required for spills in the much smaller geographic area of the production zone.[12] Other northern residents expressed doubt about the Proponents' ability to detect and clean up spills that occurred under moving sea ice.[13] Indeed, under extreme conditions of weather or winter darkness, it may be impractical or too risky to human safety to mount any effective countermeasure efforts.

The Proponents stated in the EIS that accidental discharges from offshore production units and tankers, although potentially involving many tonnes of oil annually, represented a small

percentage of the total amount of oil entering the ocean from other sources. They agreed, however, that significant environmental effects could result from tanker spills or large oil well blowouts. As a result, they committed themselves to using the safest production and transportation systems available in order to ensure that the probability of spills is kept to the lowest possible level. [14]

The Proponents also discussed the potential biological and physical impacts of oil spills in Volume 4 of the EIS and, in fact, devoted all of Volume 6 to the fate, clean-up and effects of accidental spills of oil and hazardous materials. This information was augmented in the EIS Supplementary Information and provided useful source material for detailed discussions at the public sessions.

Although the Proponents have gained valuable experience operating in land and marine environments, they have limited experience and technological capability in containment and clean-up of oil in ice-covered waters. Since there have been no major oil spills in the Beaufort Sea to date, the only experience in clean-up measures has been gained through deliberate, experimental spills and a few small, accidental spills.

In the view of the Panel, it is important to recognize the existing limitations on capabilities to clean up spilled oil in the Arctic. These limitations arise from the inherent difficulty in getting to the oil and removing it from a marine environment where it may be on the water surface or associated with ice. The difficulties are further compounded by problems of remoteness, ice, lack of personnel and facilities and the harsh Arctic climate. Application of appropriate state-of-the-art technology, however, combined with effective regulatory control, research, employee training and constant enforcement of safety practices, will significantly reduce the total amount of oil which otherwise would be spilled. [15]

The Panel agrees with the Proponents and some intervenors that emphasis on the prevention of oil spills is by far the most effective environmental protection measure which could be implemented. The Panel encourages the regulatory agencies to develop standards that are sufficiently stringent to allow safe operations in Arctic conditions, and assumes that the Proponents will do everything in their power to meet, or exceed, these standards. If spills do occur, the Panel believes that every reasonable effort should be made to remove oil from the environment and to reduce oil contamination to the point where, after clean-up and natural degradation processes occur, there is no significant harmful residue.

4.2.2 **Types of Spills**

A listing of the types of oil spills which could occur as a result of Arctic oil production and transportation is detailed in the Oil Spill Risk Assessment Section (4.1). These include production well blowouts, subsea pipeline ruptures, overland pipeline ruptures, storage tank failures and tanker accidents. The most likely location for a large spill is in the offshore production zone, although spills could also occur along transportation corridors. Smaller, chronic spills could also occur from other sources. For the purposes of this section, discussions of oil spills have been grouped into three categories: offshore oil spills, spills on land and spills into rivers.

4.2.3 **Offshore Oil Spills**

Spills due to a tanker accident, a subsea pipeline rupture or an offshore oil well blowout were presented to the Panel as the major concern of intervenors. Intervenors pointed out the large volumes of oil that could be spilled from such sources and the difficulty, or even impossibility at certain times, of controlling and cleaning up large spills in either the production zone or along the proposed tanker route. They were also aware of the grave environmental consequences of such a spill. The Proponents presented a wide range of scenarios in their EIS concerning a number of different spill situations and explained in each case the countermeasures to be used.

4.2.3.1 **Behaviour of Spilled Oil**

The behaviour of spilled crude oil depends on its physical and chemical properties and the conditions under which it has been spilled. The crude oils presently being found in the Beaufort Sea region have, as expected, a range of properties, extending from the medium gravity Atkinson well to the somewhat lighter oil from the Issungnak well. [17] These oils vary in their tendencies to spread, evaporate, disperse and emulsify, and in the ease with which they may be skimmed, pumped and processed. These tendencies are also influenced by the prevailing temperature and the degree of oil weathering, both of which can vary greatly.

Spilled oil undergoes various weathering processes, which include the formation of water-in-oil emulsions or mousses, dispersion, evaporation, sedimentation, dissolution, oxidation and biodegradation. Oil which is neither recovered, chemically dispersed, nor burned would have to be left to weather naturally. The amounts of oil affected by these processes would depend on the circumstances of the spill and the time of year. In the winter months, for example, oil spilled beneath ice may become encapsulated in the ice and will not be likely to weather. As a result, the oil would be fresh and readily burnable when it is released during the spring break-up.

The natural process of dispersion, which mixes oil into the water column as small droplets, can be accelerated by using chemical dispersants. These chemicals are formulations of detergents and solvents which can be applied from boats or aircraft to oil slicks. No experience has yet been obtained in applying these chemicals in the Beaufort Sea, and their use is presently regarded as unproven. [18]

The Panel was informed that, in the past decade, there have been significant advances in the knowledge of the ultimate fate of spilled oil in the Arctic. The Proponents extensively documented the fate of oil spilled both over and under sea ice. The behaviour of oil in open water is well known, largely as a result of observations of spills in temperate waters. The behaviour of oil under continuous ice and in broken ice is far less predictable, since most information has come from small experimental spills.

In the case of a summer release of oil from a tanker in the vicinity of shorelines, as much as a third of the oil was predicted to evaporate from the sea. If clean-up or containment measures were unavailable, the remainder would either be left in the sea or would ground on shorelines.[19] Over time, much of the oil stranded on shorelines would be degraded or removed by erosion, but in places where wave energies and temperatures are low, as is common in the Arctic marine environment, this could take many years.

In order to minimize environmental damage under conditions which prohibit the immediate clean-up of the oil, it would be useful to be able to predict the movement of spilled oil until such time as conditions allow it to be dispersed or cleaned up. The ability to predict where oil will travel from a given spill site is important because it will allow preparations to be made to protect sensitive coastal areas, offshore habitats and marine species. (See Section 4.2.3.2)

Scientists have attempted to develop oil-spill trajectory models to forecast where spilled oil might travel in order to identify sensitive and vulnerable areas which should be given protection in the event of a spill. Unfortunately, the existing models are not sufficiently developed to permit reliable forecasts. In fact, the Proponents stated that their models did not include the shoreline currents, mean currents or tidal currents. They stated that their models are for general application, and that they were in the process of incorporating Beaufort Sea oceanographic data into these models.[20]

The detection and tracking of spilled oil in all sea states encountered in the Arctic was recognized by previous EARP Panels as a topic which requires attention.[21] The Department of Fisheries and Oceans stated that significant, undetected spillages could occur from subsea pipelines, especially during the dark season when the ocean is covered with ice. Once entrained into landfast or drifting ice, the oil may not be detectable for months, or until it surfaces in the spring through brine channels in the ice.

However, because oil production and transportation is not likely to commence for at least four years, considerable improvements in oil-spill trajectory models seem possible. Given this enhanced capability, the progress of a major spill could theoretically be tracked and countermeasures employed.

3 **The Panel recommends that the Proponents, the Department of the Environment and the Department of Fisheries and Oceans cooperate in a program to improve and validate oil-spill trajectory models that would be workable by the time production commences.**

Considerable discussion took place at some General and Community Sessions about whether oil spilled by a tanker in the Labrador Sea or in Davis Strait would reach the Labrador Coast. The Labrador Inuit Association stated that the winds and currents off the Labrador Coast are such that there is a chance that this may happen. The Proponents disagreed and mentioned that even if this were the case, the tanker would be so far out that it was unlikely that oil from a tanker spill would reach the shore. In addition, a Technical Specialist agreed with the Proponents that mean currents off Labrador would not likely transport oil slicks shoreward because the currents follow the depth contours. Nevertheless, the Panel concludes that it did not have sufficient information available to comment on this conflict of opinion. It will not be resolved until more comprehensive data on the winds and currents off the Labrador Coast are produced and made available to the public.

4.2.3.2 **Sensitivity Mapping**

Technical Specialists suggested that mapping of the times and places of unusual vulnerability of renewable resources to oil spills would facilitate protection of these areas in the event of an oil spill.[22] The Panel believes that such mapping is important in view of the present limited state-of-the-art in oil-spill trajectory modelling. Government and the Proponents should give high priority to identifying which sensitive renewable resources could be affected by spills at various times and locations in the production zone and along transportation routes.

The Proponents have carried out extensive shoreline habitat sensitivity mapping throughout the Beaufort Sea region. They stated that this work will be continued to include those sensitive areas located along the proposed tanker route. The objective of such mapping would be to identify highly vulnerable coastal regions, formulate detailed response plans for oil spills and devise the most appropriate clean-up methods.

Several intervenors raised concerns about the vulnerability of offshore habitats to oil spills. For example, seal pupping areas, marine mammal migration routes and polynyas are important non-shoreline habitat areas. The Panel believes that these areas should also be considered in sensitivity mapping.

4 **The Panel recommends that the Proponents complete sensitivity mapping of all areas potentially affected by oil spills in the production zone and along transportation routes before any transportation of oil takes place.**

4.2.3.3 **Oil-Spill Clean-up Techniques**

The Proponents stated that there is a wide spectrum of possibilities for clean-up and recovery of oil, depending on the location and volume of the spill. They have invested significant amounts of capital in buying and maintaining oil-spill clean-up equipment in the region. The Proponents have also invested heavily in technology development and research for oil-spill countermeasures in Arctic waters.

In spite of the advances made to date, it still would not be possible to clean up spilled oil in some cases. High waves, strong currents or certain types of ice could defeat even the best prepared and most conscientious operator.

The Proponents provided a review of the techniques and equipment presently available for oil-spill cleanup in the Arctic and estimated their probable success in different locations and weather conditions. They also tabled, in the EIS Supplementary Information and at the public sessions, further details on the practicality of oil-spill clean-up under adverse conditions.

The primary methods for clean-up of oil in waters are containment and physical removal. Transfer systems, water separators and disposal techniques have been developed and tested by the oil industry and government. Other techniques involve chemical dispersion and burning.

The Panel believes that for some months of the year, offshore spills which may occur in the region could not be contained or cleaned up due to climatic factors and limitations of existing technology. In these situations the Panel recognizes that the oil will be left to evaporate, disperse in the water column or spread over shorelines.[23]

The Proponents have pointed out that the costs of cleaning up spilled oil are so high (as much as several thousands of dollars per cubic meter) that a considerable emphasis will be placed on spill prevention through careful monitoring of equipment, procedures and personnel. The Proponents claim that under certain conditions, such as a spill under landfast ice, they could achieve a high clean-up efficiency by burning when the oil comes to the surface and can be ignited. The Panel has reservations about this level of efficiency because there has been no major oil spill under Arctic ice conditions, and thus no operational experience of clean-up effectiveness has been obtained.

For small spills, however, the Panel believes that in many cases effective measures to contain, disperse or clean up oil, once it is detected, are available to the Proponents.

The Panel recognizes, as do the Proponents, that it is essential that there be an oil-spill clean-up capability for all possible spill situations. The intent would be to ensure that oil recovery techniques would be capable of rapidly cleaning up oil to levels which would be safe for Arctic wildlife. The Panel believes that an oil-spill response capability must be established which can achieve a minimum standard expressed in terms of an oil recovery rate in cubic metres per day, and which can be mobilized and maintained within a specified time before getting help from other regions.

Arriving at any numerical values for oil-spill clean-up capabilities would require consideration of spill location, available technologies, costs, the volumes of oil produced or transported and prevailing environmental conditions. For example, a standard may make it necessary to have on hand sufficient equipment, dispersants and personnel in the Beaufort Sea region to contain, clean up and dispose of spilled oil at a specific rate.

The Panel believes that the evolution of standards for oil-spill clean-up capabilities for a number of weather and sea state conditions and locations would be of value both to the oil industry and to regulatory agencies. The standards would represent targets which would continuously take into account new clean-up technologies and oil production volumes.

5 **The Panel recommends that the Minister of the Environment and the Leaders of the Government of the Northwest Territories and the Government of Yukon jointly set minimum standards for oil-spill clean-up capability under various conditions and seasons of the year in the Beaufort Sea production zone and along transportation corridors recognizing that sensitive areas will require especially stringent standards.**

In defining such standards, the Minister of the Environment and the Leaders of the GNWT and the Government of Yukon (YTG) should consult with the Department of Fisheries and Oceans (DFO), DIAND, COGLA, the Department of Transport (DOT) and local community leaders. The numerical standards arrived at should be frequently re-examined and adjusted to take into account improvements in technology and changes in rates of offshore production and transportation of oil.

Contingency plans should include the definition of chain of command and lists of clean-up equipment, materials, chemicals, all trained personnel and other sources of assistance. The Proponents' equipment should be appropriate to the range of environmental conditions which can be expected to occur in the region.

Decisions to establish depots for clean-up equipment in remote areas should take into consideration sites which provide the best logistical access to the region, and should consider the importance of preserving coastal resources. Advance selection of any such sites should be part of an overall offshore contingency plan for the region.

6 **The Panel recommends that the Proponents' oil-spill contingency plans be formally reviewed and subject to approval by the appropriate government agencies before production drilling is allowed, and that regular test exercises be held to verify emergency response procedures and capabilities of the Proponents.**

The Panel further believes that the Government of Canada should ensure that government agencies are granted the necessary resources for fulfilling government's role in implementing contingency plans, including training and equipment. Government should have the capability to assist the industry where necessary in controlling a major spill.

Some intervenors expressed concern that oil spilled in the Beaufort Sea might be carried to Alaskan waters.[24] The Panel shares this concern and believes that every effort should be made by the Proponents and the Government of Canada to

establish liaison mechanisms with Alaskan oil companies and government agencies to arrange for mutually effective contingency plans.

The Panel heard evidence at the General Sessions on the involvement of northerners in oil-spill clean-up operations. Mr. D. MacWatt of Beaufort Environmental Support Services has trained and employed northerners for a number of years in controlling oil spills. He contended that this type of local expertise should be expanded to include other types of environmental protection services, such as sampling and monitoring programs.[25] The Panel believes that local knowledge and familiarity would assist in a successful oil-spill clean-up operation.

7 The Panel recommends that local people continue to be trained and employed through local businesses in the use of oil-spill clean-up procedures and equipment, and that these opportunities be extended to include other types of environmental protection programs.

4.2.3.4 Dispersants

The evidence presented to the Panel indicates that the effectiveness of the types of dispersant available for use on cold waters has not yet been proved.[26] The Proponents noted that research and development of dispersants is continuing and that an experimental research program evaluating the use of dispersants is currently near completion.[27] These efforts are useful in the development of criteria for the application of such chemicals to coastal and offshore environments.

While the use of dispersant chemicals would have to be considered on a case-by-case basis by the appropriate regulatory agencies, it is recognized that the availability of a proven, effective, low-toxicity chemical dispersant suitable for use on oil at temperatures at or below 5° C would significantly enhance the options for oil-spill countermeasures in the Beaufort Sea region. The Panel, therefore, suggests that research be continued into the development and testing of biologically safe chemical dispersants and equipment which will effectively disperse oil spilled into cold waters. Dispersants would represent one facet of an integrated oil-spill protection plan for the Arctic.

4.2.3.5 Biological Effects

Considerable discussion took place at the public sessions about whether or not marine mammals and sea birds would avoid oil or be affected by it. There was a general consensus that large concentrations of oil would affect many species in the immediate area of the spilled oil. For instance, whales occupy surface waters to breathe and feed, behaviour which would potentially expose them to spilled oil through direct contact, inhalation or ingestion. The Panel was advised by DFO that a lack of basic biological knowledge on the effects of the presence of oil on these important marine species represents a significant gap in present knowledge. There were also concerns raised about migratory sea birds and their habit of feeding on the sea during migratory flights. These concerns and others are discussed in the Offshore Biological Effects Section 6.7.

4.2.4 Spills On Land

The Proponents stated in the EIS that oil released onto land from a pipeline rupture or leak in the summer would probably penetrate a short depth into the ground. In winter months, the oil would penetrate the snow but would not enter the frozen soil. A technical expert familiar with the Trans Alaska Pipeline System stated that, except for a major spill at Atigun Pass, this pipeline has had only a few small leaks to date and these were detected quickly so that minimal damage occurred.[28] He further advised that although the Trans Alaska Pipeline System has a very sophisticated leak detection system based on an input/output balance, the system has not detected any of the leaks that have occurred. In all cases, the leaks were detected by visual observation by passers-by who were travelling on a road adjacent to the pipeline. It should be noted, however, that the Proponents do not plan to have a road adjacent to their proposed pipeline in the Mackenzie Valley so that visual detections of leaks will be less likely.

Techniques for periodic testing of the condition of the inner pipe wall throughout its length are available and should be used as part of any regular monitoring package. The Proponents propose to install equipment using mass-balance measures which would provide early warnings of leaks. These systems provide immediate spill warnings and small-leak detection of as little as 0.25 per cent of the flow rate.[29] In addition, right-of-way inspections (flying, walking) and third-party observations contribute to surveillance and monitoring for potential problem areas or detection of pipeline spills.

The Proponents suggested that clean-up efficiency for oil spills from overland pipelines would be up to 80 percent in summer and up to 90 percent in winter. The Panel concludes that with this clean-up potential and the low probabilities of an oil spill from a pipeline, the effects of a pipeline spill on land would be minimal, except for some disturbance to vegetation. This conclusion assumes that the Proponents would follow the procedures for pipeline construction, leak detection and oil-spill clean-up as outlined in the EIS and other information presented to the Panel.

The Panel recognizes the potential employment opportunities for northerners living in communities located close to certain segments of the pipeline. Jobs involving both spill detection procedures and spill clean-up activities should be discussed with the local communities by the Proponents.

4.2.5 Spills into Rivers

The effects of oil spills into rivers were also raised as a concern by intervenors. The history of buried oil pipelines crossing rivers indicates that few ruptures have occurred. If one did occur, the Proponents stated that the closing of shutoff valves on either side of the river would mean that the amount of oil spilled would likely be less than the amount in the pipe between the valves. They noted that the self-cleaning capacity of rivers due to natural dilution and the rate of flow would shorten the period of return to normal in comparison with that for lakes or some coastal marine spills. The Panel, however, believes that because of the currents, oil spilled into rivers

would be difficult to contain and that it would be virtually impossible to recover spilled oil from rivers during periods of ice cover and break-up. In addition, the long periods of darkness in the Arctic may compound the difficulties in reaching and instituting measures for containment and clean-up of the spilled oil. On the other hand, long daylight periods in the summer months would assist the implementation of clean-up measures. It is also possible that natural dilution might not occur under some conditions and concentrations of oil could serially affect habitats along the river.

> *"Mitigative measures are Included in the design process. First of all, all river crossings are usually made of thicker wall pipe and this results in a larger safety factor These river crossings are also burled deeper This avoids the scarring action* of the *hydraulics and it* a/so *avoids the erosion of the banks River crossings* are *Inspected more closely"*
>
> *M Arnett, ESSO*
> *Yellowknife*

The Proponents stated that there "are no data describing the sensitivities of common fish species in the Mackenzie River system to crude oil exposure. The available information on other species suggests that the sensitivity of eggs, juveniles and adults to light oil fractions is relatively high but may vary considerably among species."[30] The Panel believes that until more is known, important fish species must be assumed vulnerable and contingency planning conducted accordingly.

At most times, oil spilled into rivers would have few long-term effects. However, should there be sudden oil spills into streams and rivers, the high concentrations may have serious effects on fish, especially during spawning and migration periods. The Panel believes that the Proponents have been optimistic in their assessment of the consequences of oil spilled into rivers.

Dr. Fred Roots of DOE told the Panel that:

> "The Mackenzie River and some other streams discharging into the Beaufort Sea drain an area underlaid by petroleum-bearing geological formations, some of which, as at Norman Wells, come to the surface or give rise to oil seeps. Hydrocarbons are thus a natural component of Beaufort Sea hydrological systems and ecosystems. Some studies have indicated that Mackenzie River water, flowing through the delta, contains a considerably higher concentration of aromatic hydrocarbon compounds than average water of other river systems. The analyses suggest a considerable up-take of petroleum from natural sources. It is not at present known whether this hydrocarbon 'load' has been carried for centuries without environmental insult, whether the local ecosystem has made successful adaptation to it and thus may be possibly relatively tolerant of additional hydrocarbons, or whether the ecosystem has been stressed by the chronic toxic hydrocarbon dose so that it is now perhaps more sensitive to an increased dose."[31]

The Proponents recognized the existence of this natural hydrocarbon load.

The Panel believes that careful studies of river chemistry may give an indication of the amount and rate of natural up-take of petroleum and that studies in the area of the Mackenzie plume and adjacent Beaufort Sea may provide evidence of its dispersion and fate. This information could be useful in consideration of the potential environmental effects of oil spills in the Beaufort Sea and of oil spills into rivers flowing into it. The nature of the oil exposure conditions to which organisms are subjected by such low-level emissions of oil, and presumably the effects, are quite different from those which will occur in the vicinity of major spills.

4.2.6 **Continuing Oil Spill Research**

The Panel recognizes the extensive efforts of the Proponents and governments, especially the Department of the Environment, over the last decade in the area of oil-spill research in Arctic conditions and is aware that DOE's work is decreasing due to lack of effective government funding programs.

8 **The Panel recommends that the Government of Canada establish an effective funding mechanism immediately to ensure that the Department of the Environment, with the cooperation and participation of the Department of Fisheries and Oceans and the Department of Indian Affairs and Northern Development, continue research on oil-spill clean-up equipment and on the behaviour, detection and effects of oil spills in the Arctic marine, fresh water and terrestrial environments.**

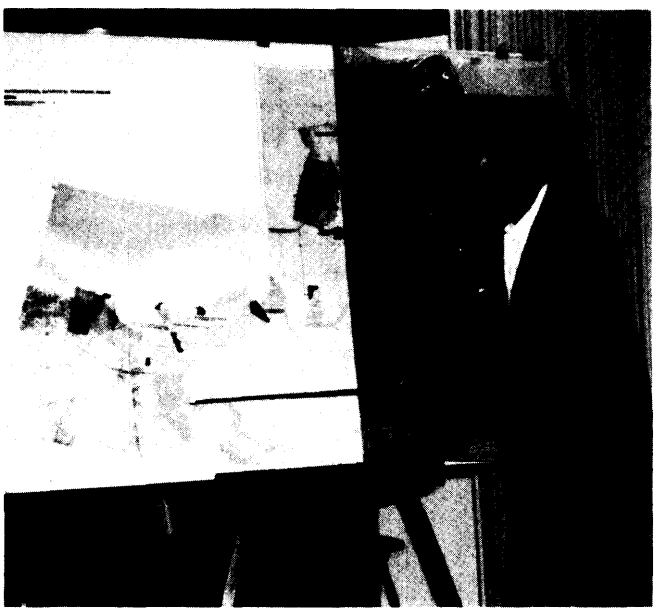
5.0 THE HUMAN ENVIRONMENT

5.1 Introduction

Only a portion of the northern population living north of 60° North Latitude will be directly affected by the Proponents' proposal if it proceeds. The effects will primarily occur in Inuvik and Tuktoyaktuk in the Beaufort Sea-Mackenzie Delta area, and in some of the communities in the Mackenzie Valley. Many people in Inuvik and Norman Wells are workers and business people directly dependent on the oil and gas industry for their livelihoods; they are looking forward to potential opportunities. The remaining communities are mostly native people and have mixed views about the project.

The North is in a state of transition. Northerners are not strangers to the effects, both good and bad, of change. In recent years, northerners have experienced changes in population growth, ways of life, modes of transportation, the means of communication, the northern economy and the forms of both governments. These changes have arisen from several different sources and not just from oil and gas development. Change is occurring now, and will continue to occur, regardless of the nature of future developments.

One of the most significant changes is the transition from a subsistence way of life to a cash economy. Northerners who have been accustomed to living off the land are now becoming more dependent on a cash income derived from a salary, from a business, or from government transfer payments. The cash income pays for the amenities — homes, travel, vehicles for hunting, television — which are already, or are quickly becoming, part of their everyday lives. Most northerners now have, through cash incomes, possessions which lack of money formerly put out of their reach. In some cases, the transition has been a difficult one, from which problems have arisen. The Panel was informed that many communities are aware of these problems and many are developing programs to deal with them. Some northerners have adapted well, prospering socially as well as economically. Others have not been so successful.



"Our point is simply that development can be seen, not as a social problem. but as an opportunity With proper planning, control, consultation and co-operation from all parties, development can be used to Improve social conditions in the north"

R Hoos, DOME
Inuvik

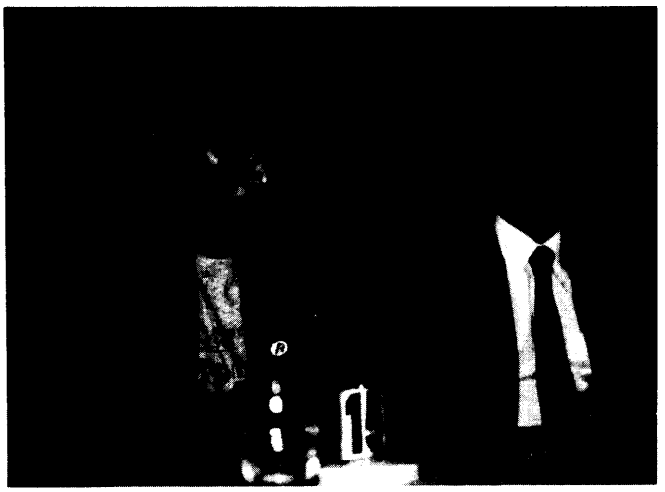
Beaufort Sea oil and gas production and transportation may cause adverse impacts for some communities in the project vicinity, but it also may provide significant new benefits to northerners. The communities to receive the greatest direct effects, good and bad, will be Inuvik and Tuktoyaktuk. Other communities such as Aklavik, Holman and Fort McPherson will receive fewer direct effects, as will the communities along the tanker route if tankers are allowed to proceed. All other communities will be affected indirectly through the economic multiplier effect.

Local communities and their residents are, in some cases, ill-equipped to deal with social change and social problems. The additional effects of oil production and transportation activities may compound their problems. The communities will be placed in the even more difficult position of reacting to problems rather than attempting to control them. Social problems and inadequacies in community services may be aggravated by differences in needs among the permanent and the incoming populations.

The arrival of southern workers, increased income, new careers in industry and more extensive experiences and contacts with southern cultures could alter traditional lifestyles and values and affect community and family cohesion. Social services, community infrastructure and housing, and the management capabilities of directly affected local communities and governments could be overwhelmed by large population increases which would come with large scale development.

Some other adverse effects that may occur are unwelcome population increases, shortages of goods and services, inflation, an increased crime rate and family dislocations, Attention is focused on these and other potential problems so that mitigating programs can be planned and be ready for implementation prior to production and transportation of oil and gas.

Some intervenors told the Panel that oil production and transportation may raise expectations of many kinds. For example, residents of some communities hoped for increased employment and greater benefits to all people living in the area, or feared that certain existing social problems such as alcoholism, family breakdown and the difficulties in the transition from traditional lifestyle to wage economy will become worse. The



"What we have consistently said for many years now is give us the machinery, include us in your whole machinery, not necessarily in the complex systems, but please Include us, give us a chance to deal with environmental effects or socio-economic effects, and when you do you will find that we could be very reasonable In fact, who knows, may be we would even welcome the oil companies with open arms, once we get these adversarial type things out of the way. "

T. Suluk, ITC
Resolute

Panel believes that oil production and transportation, by itself, will not solve the region's economic problems nor will it create massive social problems, For both economic and social reasons, it is important that sufficient time and information be available to the communities to carry out proper planning and to adjust to new conditions. Also, increased government help is required to assist communities to prepare for the future. Part of this preparation will be to help individuals understand what to expect in the future, where government and community responsibility and assistance ends and personal responsibility begins, and how to cope with changes now occurring or which may occur from the Proponents' proposal.

Since the linkages between development and social problems are mostly indirect and difficult to separate from other impacts, there is a need for a general program to identify and deal with the social problems as they exist, without attempting to define their exact causes. The goal is to alleviate, as much as possible, present and future socio- economic problems. Responsibility for baseline studies of existing conditions, and for any attempts to delineate future community needs, belongs properly to local and regional authorities. Local control and involvement in planning is one key to an eventual improvement of socio-economic conditions in the North.

The Panel believes that substantial benefits could accrue to northerners in the Beaufort Sea-Mackenzie Delta area in particular, if the development is managed by governments and the Proponents with the aim of benefitting northerners. Some of these benefits could include the provision of more employment for northerners, opportunities for northern business and tax revenues for communities and territorial governments. These new revenues could support improved education and training, social services, community infrastructure, and community and social development. There could also be an enhanced interaction between native northerners and others creating beneficial cross-cultural social interaction, and opportunities and motivation for travel and higher education.

Although northerners generally expressed support for Beaufort Sea-Mackenzie Delta area oil and gas production and transportation, they recognized that development could bring many problems. They welcomed the employment and business opportunities which could result. Many northern intervenors spoke in favour of some form of continued oil and gas development in the North, although the Dene Nation and the Baffin Region Inuit Association, among some others, called for a settlement of land claims prior to development. Most northerners emphasized that development should be controlled and managed to provide benefits to northerners and to avoid adverse effects.

As set out in the Introduction to the report, (Chapter 1.0) the Panel's principal socio-economic objective is that:

> northerners, developers and governments must ensure that northerners are able to manage the effects of changes and to derive long-term benefits from developments.

The Panel believes that this objective can best be achieved if the following action items receive constant attention both from governments and from the Proponents throughout the duration of any Beaufort Sea-Mackenzie Delta area oil and gas production and transportation project:

1. northerners must receive significant benefits, and adverse socio-economic impacts must be kept at a minimum;
2. the lifestyles and resource harvesting activities of northerners must not be disrupted in a manner unwanted by them; and
3. the territorial governments and appropriate communities must be direct participants in the activities which affect them.

The nature and scope of changes to the human environment resulting from commencing oil and gas production from the Beaufort Sea-Mackenzie Delta region will depend upon the type or scale of oil and gas production and transportation involved. Although the Proponents presented a number of development scenarios in their EIS and EIS Supplementary Information, it became apparent to the Panel that the Proponents were prepared to accept a small-scale, phased approach as an initial scenario.[1] In fact, the Proponents stated that very rapid rates of population growth would have the greatest potential for socio-economic disturbance to northern people. They further stated that a large population influx which would arise from a large-scale development would be the most difficult impact to mitigate, and would be impossible to mitigate if it occurred rapidly. The Panel heard little support for such development.

Most discussion of the socio-economic effects of increased populations was limited to the small-scale option. The Panel accepts the basic argument that the small-scale, phased

approach to development will be an effective way to avoid serious population increase problems, to allow time for northerners to prepare for opportunities and for change, and to enhance benefits.

The Panel concludes, for socio-economic reasons, that a small-scale, phased approach is acceptable because the resulting effects of changes are more manageable. With an initial, large-scale production and transportation mode, this is not possible.

Note: When addressing the human environment the Panel has concentrated its discussion on a phased, small-scale development alternative.

On the subject of northern benefits, the GNWT argued that, under existing tax allocation arrangements, it would receive more tax revenue from a pipeline system than from a marine transportation system. This revenue would help pay for social services needed and would move the GNWT closer to self-supporting status. Also, while there might be comparable numbers of long-term jobs under both modes of transportation, the Panel believes that the pipeline option would provide more opportunities for northern businesses and would create more employment opportunities for residents, including those presently gaining employment experience with the pipeline from Norman Wells to Zama. The Panel is convinced that more social and economic benefits could accrue to northerners if a pipeline, rather than tankers, were to move oil to the South.

This Chapter on the human environment describes some of the problems occurring in the North today and how they may be aggravated by further development such as the Beaufort Sea oil and gas production and transportation proposal. Following that description, there are more specific discussions of methods to manage the problems. No differentiation is made between problems that now exist and those which may occur from the implementation of the proposal. Regardless of the origin of the problems the Panel believes that governments must institute certain programs whether or not the proposal is approved. Other topics covered are the provision of community infrastructure and increased education and training programs in order that northerners will be better prepared to meet the changes that may come with development. General economic effects, northern employment programs and northern business opportunities are also described. The Chapter concludes with a discussion of socio-economic assessment methods and new initiatives in monitoring and research. A number of topics — such as alcoholism, family problems and crime — are discussed without conclusions or recommendations. These are general problems which require continuing attention, and which are unlikely to be completely solved.

5.2 Social Effects

5.2.1 **Introduction**

Many intervenors expressed concern about current social problems in northern communities: alcohol abuse, family problems, juvenile delinquency, rising crime rates, dependency on social assistance, and a recent high suicide rate among young people. These problems have developed from several different sources, not just from oil and gas activity. However, in the case of Tuktoyaktuk, they are aggravated by oil and gas activity. Several communities are attempting to develop programs to deal with these problems. Many intervenors stated that existing problems must be addressed in order to prepare communities and individuals adequately for the further changes which would occur with continuing oil and gas development.

Oil and gas production and transportation from the Beaufort Sea region would bring changes to the lives of northern people. These changes could be demographic, ethnic, economic, educational, occupational or socio-cultural. They could mean new opportunities and personal growth. Some northerners have reacted to the petroleum exploration phase with vigour and success. They have adapted well to change and prospered socially and economically as a result.

Most intervenors, however, stressed the potential for harm from oil and gas development. Although many harmful effects could be avoided by the phased growth approach recommended by the Panel, there will be changes which must be addressed.

5.2.2 **Community Development**

Shared lifestyles and traditions help to knit communities together; they provide the stability and energy for coping with change and taking advantage of opportunities. In native communities, in particular, traditional resource harvesting provides a basis for sharing which supports social solidarity and cohesiveness.

Community cohesion is important to the well-being of northern people. Stable and harmonious communities are better able to address and resolve their problems,

Community cohesion also enables northerners to adjust to changes which might occur with development. Intervenors expressed concern that the arrival of new residents in northern communities (particularly native communities) could erode social cohesion and lead to tension and divisiveness, unless efforts are made to assist existing and new residents to adjust. To adjust smoothly, communities must be able to integrate new members into the social environment. Community-organized programs to welcome new residents and involve them in social activities are important.

The Proponents noted that with the small-diameter pipeline scenario, community cohesion would be affected by population growth primarily in the communities of Inuvik and Tuktoyaktuk. The Proponents also stated that they would house their workers in existing communities only upon approval by the community councils. This would assist communities to avoid unwanted population increases. The Panel concurs with this approach and conclusion.

The Panel believes that governments should immediately give funding and other assistance to communities to organize community development programs. Although the Panel believes that these programs should be available to all northern com-

munities, priority should be given to communities which are now experiencing social problems, and which may be affected further by oil and gas developments. A positive approach to social development would enable community residents to take advantage of the opportunities which development could bring.

5.2.3 Northern Lifestyles and Traditions

Many northern residents expressed a strong desire to maintain their existing lifestyle, traditions and resource harvesting. They stated that benefits, such as jobs as a result of oil and gas production and transportation, would be desirable if their lifestyle were not disrupted. Many intervenors stressed the importance of traditional lifestyles and values to the well-being of communities. Some expressed concern that lifestyles and values could be weakened as a result of the influx of new residents, increases in income, adjustment to new careers and more extensive experiences and contacts with southern influences.

"Because we are small, tightly knit communities, these problems spread easily — like a chain reaction or contagion With all these things happening, we don't have a good feeling about ourselves sometimes Many people must learn again how to have respect for themselves Our culture is where we get our self respect Any solutions to our problems must be based on our culture For communities to be strong and adaptable to forces of change, cultural identity and community solidarity are of paramount importance Only then can the individual draw on the reserves of mutual support, stability, group strength, and familiar perspectives in coping with and capitalizing on opportunities of change and uncertainty The strengthening of native culture and traditions is, therefore, a foundation of any strategy for socio-economic mitigation''

M Teya
Fort McPherson

There was also support for further development of a wage economy in the North. The Sachs Harbour Hunters and Trappers Association stated that northern residents:

> "desire the same material comforts and intellectual stimulation as the rest of Canadian society. To reach these goals with a sense of dignity and self-esteem, we must be given the opportunities to develop the skills necessary to participate and compete as equals in our society."*

The Proponents have made many adaptations to industry operations to help individuals and communities maintain traditional lifestyles, including rotational work schedules, cross-cultural training, community consultation, research projects involving local people, country food purchases and other programs. Native organizations, communities and senior governments have also sponsored programs to strengthen local traditions and values. The Panel supports the intent of these initiatives and believes that northerners should have the option to maintain present lifestyles and traditions. Accordingly, the Panel concludes that the Proponents and governments should also consult regularly on ways to maintain and strengthen traditional lifestyles and values, in the context of employment, education and social programs.

5.2.4 **Alcohol Abuse**

Intervenors from communities indicated that alcohol abuse is frequent in many northern communities, They suggested that alcohol abuse is often a source of family breakdown, emotional stress, work problems and money management problems. The Proponents and intervenors provided information to the effect that most crime and illegal behaviour in northern communities are alcohol-related. Intervenors also suggested that juvenile delinquency is largely related to alcohol or alcohol-related family problems, such as family breakdown, child abuse and child neglect.[3]

The Proponents noted that alcohol abuse could be a problem for new arrivals who are adjusting to northern living as well as experiencing such stresses of a booming community as crowding, shortages, divisiveness and constant change. Larger communities, such as Inuvik and Norman Wells, have experienced problems associated with alcohol abuse in past boom periods.[4]

The Panel believes that, in many cases, alcohol is both the result and the cause of many social problems and concludes that communities must help develop methods to deal with their own problems.

Several communities have attempted to deal with existing alcohol abuse through prohibiting or rationing alcohol. Although these measures have been helpful in many cases, alcohol still reaches communities, often at greatly inflated prices, through 'bootlegging'. Communities stressed the need for more alcohol counselling and treatment programs to help individuals and families cope with alcohol problems. Several communities stressed the need for increased funding to establish community-based programs.

5.2.5 **Money Management**

Community spokesmen were concerned that community residents have often been unable to manage personal income. The Tuktoyaktuk Social Services Advisory Committee, for instance, stated that:

> "It appears that money management is a major problem in a Tuktoyaktuk family unit. Huge amounts of money are brought into these homes... yet this is totally gone before he/she returns to work."[5]

Similar concerns were expressed in other communities.[6]

The Proponents stated that, while sudden high earnings might be misused, this should not occur in communities which have had longer experience with wage employment. They referred to research showing that, in many instances, cash income has been heavily invested in resource harvesting equipment such as snowmobiles, canoes and outboard motors.

Although the Proponents expressed willingness to cooperate with the GNWT adult education programs in providing money-management courses to their employees, the Proponents and the GNWT agreed that this responsibility belongs to the GNWT. The GNWT noted that programs are in place to assist people to learn how to deal with industry and the effects of industry on their lifestyle. The Panel supports the direction of these programs, and believes that they should be further developed.

5.2.6 **Work Schedules**

Several community intervenors expressed concern about the effects work schedules may have on family life. These concerns related to the effects of rotational employment and long shifts, as experienced in the present exploration program. Work schedules have taken one or both parents away from home for 12-hour shifts, where locally employed as in Tuktoyaktuk, or for rotations of up to three weeks for other communities as in Coppermine. This has led to problems in family discipline and cohesion. It has also affected the education of children in traditional values.[7]

The Proponents noted that rotational schedules were developed to allow people time off to pursue their lifestyles. However, they recognized the problems with rotational employment and take the position that:

> "The downside of rotational work schedules is the extended periods of time away from home. This is characteristic of industry employment and individuals should be prepared to make some adjustment."[8]

Dr. Jack Ellis, a professor in environmental studies at York University, noted, however, that rotational or seasonal employment creates extended periods of leisure. These leisure periods could be socially constructive or destructive.[9]

Twelve-hour shifts were considered a problem in Tuktoyaktuk, where the supply bases are located, and where workers can go home after each shift. The Tuktoyaktuk Social Services Advisory Committee said that the absence from home of either or both parents due to rotational work schedules or 12-hour shifts, creates problems for families:

> " most of the Tuk women are employed by industry as kitchen helpers, housemaids and laundry cleaners on a 12-hour shift basis, leaving their husbands home to babysit. This appears to be causing hardships on their relationships and children. Most are too tired to tend to family matters but cannot quit because the pay is good or their husbands cannot or will not work. This causes role identity problems, stress, communication and family breakdowns, family disputes, misuse of alcohol, juvenile delinquencies, financial strains, etc."[10]

Mayor Steen of Tuktoyaktuk stated that children were not being looked after because of long shifts. In addition, men and women cannot be expected to have a social life after a long shift. He also stated that when men are taking care of the children while their wives are at work, the men do not have time to trap or fish.[11]

A representative of the Beaufort Sea Hunters and Trappers Association stated that post-employment' surveys have indicated that a number of employees have left employment because long work schedules caused them to forsake family obligations.[12] A representative of the Tuktoyaktuk Social Services Advisory Committee agreed that some employees "quit

their jobs because of the stress, because they can't cope with it in their homes." For those who are not working, "their family unit seems more together."[13]

The Proponents reported that, according to a survey of employees, employees preferred 12-hour shifts and would not want reduced pay from shorter shifts. The Proponents indicated willingness to be flexible toward shorter work schedules, depending on the nature of the job.[14]

Because concerns remain, particularly in Tuktoyaktuk and other Beaufort Sea region communities, the Panel believes the Proponents should continue to consult with employees and communities to review the effects of rotational work schedules and long shifts on community and family life, with a view to accommodating the employees and to mitigate undesirable effects.

5.2.7 Social Services

The effects of oil and gas development on the northern social environment cannot be considered without reference to existing social conditions. While the Panel's mandate was to consider the incremental effects which the Proponents' proposed oil production would bring, northern intervenors stressed the lack of staff and funding necessary to respond effectively to existing problems.[15]

The Honourable Richard Nerysoo of the GNWT told the Panel at Aklavik, early in the public sessions that:

> "I expect that in every hearing that you convene you will be meeting people who will tell you about the need for expanded government programs, and local community representatives will tell you about the Council's need to approve and expand municipal services to support Beaufort development. So I'm not afraid of being alone in identifying a need for funding. . We have not received any additional funds to ensure that whatever was occurring in Tuktoyaktuk, and in Inuvik could be dealt with on a more serious basis, and I think that the situation has to be resolved, and I think that if there is one recommendation that can be made it certainly can be that additional funding requirements, financial assistance, should be dealt with in a serious manner."[16]

Mr. Nerysoo was correct. Social service professionals and communities indicated that, unless effectively addressed, existing social problems could intensify as development proceeds. While additional funding should not be considered the only prerequisite for managing these effects, it certainly is essential. The Panel believes that funding must be provided early enough to get services into place in order to prevent social problems from deteriorating further. The Panel concludes that funding and staffing for social programs should be increased immediately to enable communities and social agencies to improve present social conditions to an acceptable standard.

Experience in other resource development regions has indicated that, as resource development has taken place, social programs have often been poorly funded and initiated too late to address the social stresses of regional growth at an early stage. The Panel also heard that funding has been diverted from other communities to address problems in impacted communities such as Tuktoyaktuk, Inuvik and Norman Wells. The Panel believes that funding must not be delayed, or taken from other areas where it is needed, in order to finance services necessary to help northerners prepare for and cope with growth.

9 The Panel recommends that arrangements be put in place by the federal and territorial governments, upon approval of oil and gas production and transportation, to enable social agencies and the communities to manage the socio-economic effects of growth.

The Panel considers it important to emphasize that spending more on social services to help residents cope with development can only be seen as a supplement to the important task of establishing northern residents as key participants in development. Northern residents must have an effective economic role which recognizes traditional values, and a voice in managing social problems arising from development to participate truly in the changing affairs of the region.

The Panel received many suggestions for programs to deal with existing and potential social problems. These included alcohol counselling and treatment programs, training in such life-skills as money management and programs to strengthen community leadership and management capabilities, to reduce social assistance dependency, to improve law enforcement and corrections, and to address the serious adjustment problems of northern youth. Only some of these programs have been touched on in this report. The Panel does not believe that it should attempt to describe in detail what social programs should be provided or what social problems should be given priority. Rather, because the issues vary from community to community, the Panel believes each community should be given considerable authority and funds to define and shape its own social programs.

5.3 Regional Population Growth Management

5.3.1 Introduction

Oil and gas production and transportation from the Beaufort Sea area will stimulate general economic activity and cause an increase in population. The influx of new workers and families will put new pressures on the northern communities in the area. While there will be benefits for participating northerners

> *"It is clearly very important not to underestimate the magnitude of what can occur, and since both the Alaskan and Scottish cases provide examples where employment and population effects were underpredicted by Industry studies in early stages, it is understandable that this tendency was likely considered by the present E.I.S. proponents. Yet it is, in my opinion, equally important not to overestimate these magnitudes, since this can lead not only to wasteful overallocation of social capital but also to undue and potentially cruel raising of socio-economic expectations — among natives and non-natives, potential employees and entrepreneurs alike, in this case."*
>
> *Dr J B Ellis, York University*
> *Inuvik*

in particular, there may be offsetting negative effects if the developments are not managed in a manner acceptable to the affected communities.

During the Panel review there was a general consensus that very rapid rates of population growth would produce the greatest socio-economic disturbance to northern society. The Panel heard little support for rapid, large-scale development. There were concerns, supported by substantial and convincing information submitted by the Proponents, communities, governments and others, that rapid, large-scale development could overwhelm the capabilities of northerners and northern communities directly affected by oil production and transportation. There may be difficulties in providing physical infrastructure and community services in communities experiencing population increases. There may be inadequate time to complete education and training programs for potential employees. Northern businesses may not be able to prepare adequately for industry-generated opportunities, and governments will need time to lay the groundwork for effective project regulation. Furthermore, the net long-term benefits which may accrue to northerners from small-scale, phased developments will not be similarily available from a single, large-scale development.

The Panel is therefore convinced that oil and gas production and transportation can be socially and environmentally acceptable and yield substantial benefits only if the rate of development is controlled.

10 The Panel recommends that, upon application, only small-scale, phased production and transportation of oil and gas resources from the Beaufort Sea region be authorited.

5.3.2 Potential Population Growth Rates

The population of the Beaufort Sea-Mackenzie Delta region is currently some 7,000, about half of whom are native people. The Proponents stated that population increases and resulting socio-economic effects would be centred primarily in Inuvik and Tuktoyaktuk. While a large proportion of the labour force would be rotated from southern homes to job sites, some permanent employees could be located in Inuvik or Tuktoyaktuk, depending on the preferences of those communities. The Proponents expect only limited growth to occur in other Beaufort Sea region and Mackenzie Valley communities. No population changes or increases in employment would occur in the Eastern Arctic.

Yukon could experience some economic growth from phased Beaufort Sea hydrocarbon production as a result of purchases from Yukon firms and employment of Yukon residents, but there would be minimal population effects. The economic effects would be experienced only gradually; as a result, negligible adverse socio-economic impacts would be expected. [17]

Table 5.1 provides a summary of the Proponents' estimate of the total population which could occur given present trends and the added effects of a small-diameter pipeline. Population estimates are also presented for the large-diameter pipeline for comparison. Although there are technical questions about the accuracy of forecasting methods,[18] these estimates provide a broad perspective on how population levels could be affected by the Proponents' proposal over the long term.

Given the small-diameter pipeline option, the estimated compounded annual growth rate for communities expressed as a percentage would be 3.5 for Inuvik, 4.6 for Tuktoyaktuk, 1.6 for Norman Wells and Fort Simpson and 1.1 for Hay River. The Panel is concerned about the growth estimates for Tuktoyaktuk given present social conditions and the lack of government assistance for extra social services needed because of impacts already experienced. The Panel also believes that such growth should be permitted only if present problems are managed, the population increase is approved by the Tuktoyaktuk Community and if the growth is well monitored.

While long-term population trends indicate a manageable rate of growth, construction cycles could cause rapid population fluctuations in some years. These fluctuations might have significant adverse socio-economic effects if they are not mode-

Table 5.1

Population Estimates for Selected Communities Assuming Present Trends, Small and Large-Diameter Pipelines during Production and Transportation.

		Present Trends (Natural Increase)	Small-diameter Pipeline	Large-diameter Pipeline
Inuvik	1985	3,330	3,735	3,743
	1990	3,565	4,695	12,785
	1995	3,800	5,329	18,666
	2000	4,035	5,546	26,146
Tuktoyaktuk	1985	857	992	984
	1990	964	1,341	1,351
	1995	1,071	1,581	1,789
	2000	1,177	1,681	2,317
Norman Wells	1985	439	439	439
	1990	461	513	518
	1995	482	535	697
	2000	504	557	719
Fort Simpson	1985	1,039	1,039	1,039
	1990	1,116	1,169	1,173
	1995	1,191	1,244	1,406
	2000	1,268	1,321	1,483
Hay River	1985	2,961	2,994	2,994
	1990	3,090	3,179	3,650
	1995	3,219	3,336	4,049
	2000	3,349	3,465	4,578

Source: Beaufort Sea-Mackenzie Delta Environmental Impact Statement Supplementary Information — Socio-economic Issues. June 30. 1983. Tables 3-17 to 3-21.

NOTE: These figures assume that construction of a small-diameter pipeline would begin in 1985 and the large-diameter pipeline construction would begin in 1990.

rated. Even for a development based on the small-diameter pipeline option, the Proponents estimated that the population of some communities could change by substantial amounts in a one-year period, especially during pipeline construction.[19] The Proponents stated that these short-term fluctuations could be moderated by rotational employment, temporary construction camps and other growth management measures described below. If these measures are implemented, the Panel concludes that the social and economic effects of the Proponents' proposal would be manageable.

It should also be noted that there will be peripheral population increases associated with the Proponents' development activity. Such peripheral increases must also be controlled.

5.3.3 Managing the Construction Phase Workforce

The labour requirements for the initial construction phase of development cannot be satisfied by the labour force in the communities adjacent to the work sites. A large temporary workforce is required to construct a pipeline and much of this demand can only be met by rotating labourers and tradesmen from other northern communities and from the South.

The Panel has heard strong representations from northern communities to the effect that they do not want to be overwhelmed by an influx of southern workers, nor do they wish to lose their young people to the larger communities when they seek employment outside the local areas.

A number of measures have been proposed which could limit the number of people moving to the North as a result of the proposal, and which could also allow northerners both to participate in oil and gas employment opportunities and to maintain their permanent residences in their home communities. These measures are discussed below.

5.3.3.1 Expanded Rotational Employment Systems

The Proponents now hire many northern workers from communities in the Beaufort Sea-Mackenzie Delta region and provide transportation to and from the job site allowing more time for the workers in their home communities. The extension of this rotational employment system and recruiting for Beaufort Sea jobs to other areas in the North would be the initial preferred method to limit the size of the southern construction-phase workforce.

The Panel commends the Proponents for hiring northern residents on a rotational basis, and concludes that the Proponents should widen the geographic limits, where economically feasible, for their northern recruiting for rotational employment. Residents closest to work sites should, however, be given first opportunity to apply for employment. The Proponents should also give preference in hiring to northern rotational workers over southerners, when possible.

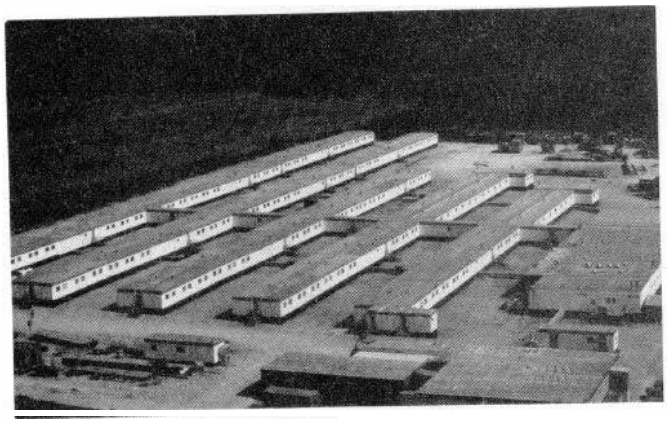
The Panel supports the continuation of rotational employment for southern workers as a method to reduce population impacts, provided that the Proponents' policy of employment priority for northern residents in the areas closest to the work-site is continued.

The Panel concludes that population growth should be encouraged in existing communities where such growth is approved by the community council and territorial government and where it can be managed effectively.

The Panel believes that the Proponents should consider establishing employment offices in Whitehorse and Yellowknife. Also, the Proponents should consider designating Whitehorse, Yellowknife and other major northern communities as points of origin for rotational employment provided such points of origin are approved by the appropriate community councils and territorial government. This would encourage workers presently living in the South to re-locate to these centres thereby strengthening the northern economy.

5.3.3.2 Temporary Construction Camps

The Proponents and other participants stated that access by construction workers to a community could have serious adverse impacts on community well-being. To mitigate these effects, the Proponents intend to accommodate construction workers in self-contained, temporary camps isolated from existing communities. This approach was strongly supported by intervenors. The companies would maintain strict discipline and prohibit alcohol, gambling, illegal drugs, hunting and, if the communities wish it, prohibit workers from visiting the communities.



11 The Panel recommends that:

camps be used for the temporary construction workforce;

these camps be located well away from communities, except where a community agrees to accept a camp; and

the Proponents and communities cooperate to determine rules governing employee access to local communities.

5.3.3.3 Managing Transient Job Seekers

Major resource developments attract many people in search of high-paying jobs. Transient job seekers could displace residents of the region from jobs both inside and outside a specific industry. The Proponents have recognized this possibility and intend to address it by hiring southern workers only at southern hiring halls. Northern workers would continue to be

recruited in the North using present practices. The Proponents also stated that they would continue to cooperate with government agencies, such as the Canada Employment and Immigration Commission (CEIC), in information campaigns to advise southern job seekers that only northern residents could be hired in the North. The Panel fully supports these initiatives.

12 The Panel recommends that the Proponents continue to develop public information campaigns in cooperation with government agencies to inform southern job seekers that northern employment can only be obtained through southern hiring halls.

It is likely that some persons will still come to the North seeking non-industry jobs or hoping to find work in the oil industry despite warnings that this work is not available. When these people remain unemployed, they sometimes become the responsibility of social service agencies. Additional funding is then required if these agencies are to assume the additional caseloads. There may also be increased pressure on existing housing and other facilities and services.

Potential problems with transient job seekers could be most severe for small communities. The presence of individuals with limited commitment to the community and an unsettled lifestyle could have adverse effects on these communities. The communities could manage this problem by:

monitoring in-migration of transients to enable communities and agencies to take appropriate action to control any problems which might arise; and

having in place and strictly enforcing "squatter" and "poaching" regulations where transients attempt to "camp out" near communities or in sensitive environmental areas.

5.3.4 Managing Long-Term Population Growth

5.3.4.1 Growth in Existing Communities

With the small-scale development alternatives there will be a small increase in the population of Tuktoyaktuk and Inuvik. The Panel has heard from the territorial governments that controlled growth would be welcomed.

The GNWT stated that it would support and encourage population growth in existing communities if certain conditions were met: the growth should be supported and approved by the community council; the GNWT and communities must have the financial resources to provide the necessary community infrastructure and social services to support the growth; the growth should be of a long-term nature which could provide a stable economic base, reducing the possibilities of boom-and-bust cycles; and, finally, the growth should be gradual and controlled, allowing the community sufficient time to prepare for and manage growth.

The Town of Inuvik stated that it would consider accepting a portion of the expected population increases associated with oil and gas production and transportation. Inuvik was created as a new town in the late 1950's and currently has a population of about 3,240 of which approximately 35 per cent are Inuit and Dene. The Mayor of Inuvik stated that the present infrastructure, with continuing improvements, would be capable of handling a total population of up to 7,500 persons.[20] The additional growth could benefit businesses and improve the tax base and community services.

The Government of Yukon advised that some northern centres, particularly Whitehorse, have unused capacity in existing residential, educational, transportation and industrial infrastructure, and could absorb increased population. These communities could be considered as bases for housing rotational employees.

The Government of Yukon told the Panel of the need for a permanent recruiting presence in Yukon, since Yukon residents want to participate in Beaufort Sea jobs.

5.3.4.2 New Communities

The option of accommodating population increases in either new communities or enclaves[21] was discussed by the Proponents in the EIS Supplementary Information and reviewed at public sessions. The Proponents stated that they would consider development of a new community if this was desired by the communities of the Beaufort Sea region.[22] However, the GNWT opposed the establishment of new communities.[23] The Panel concludes that new communities or enclaves would not be necessary given the small-scale production and transportation approach recommended in this report. If, however, at a later phase, new communities or enclaves become necessary, the Panel concludes that they should be established only if approved by the appropriate territorial government and nearby communities.

5.3.5 Project Abandonment

Although rapid growth is clearly undesirable, a decision against all development would also have immediate and severe socio-economic effects. With no prospects for production, petroleum companies would likely withdraw from the region, causing unemployment, business failures and problems of social adjustment for individuals and communities.

Several participants in the review were concerned about the potential socio-economic consequences if the oil and gas industry reduced or ceased production from the Beaufort Sea region soon after initiating production. Such a downturn could have long-term effects on communities, affecting those who would be making their living directly or indirectly from the oil and gas industry. The Government of the Northwest Territories advocated that governments and industry cooperate in planning for abandonment and find means to mitigate its effects.[24] The Panel supports this position.

Some intervenors were also concerned about final abandonment of the Beaufort Sea oil fields after oil reserves are depleted. The Panel believes that the phased approach would postpone the time when oil reserves are depleted. Further exploration would provide information on the total reserves which may exist in the Beaufort Sea region, and an indication of when these reserves might become depleted. Periodic review of the projected life of the fields would allow planning for eventual abandonment.

13 The Panel recommends that, before oil or gas production commmences, the Proponents develop contingency plans for abandonment satisfactory to governments, and that such plans be reviewed periodically.

5.4 Effects on Resource Harvesting

5.4.1 Introduction

The concerns expressed by native groups and communities had common themes: the importance of resource harvesting; the role of traditional lifestyles as a source of meaning, identity and community stability for northern people; and the potential for changes to present ways of life.

5.4.2 The Importance of Resource Harvesting

All participants agreed that hunting, trapping and fishing remain important to northern people. Besides providing food and cash income, people find that being out on the land fulfills important personal and community needs. This was stated succinctly by the Baffin Region Inuit Association:

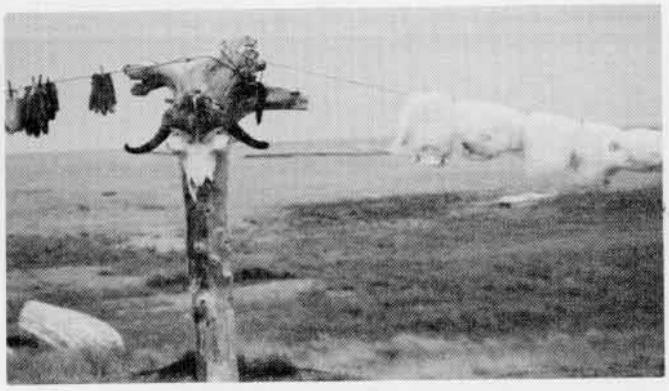
> "Firstly, and most obviously, Inuit hunt for food. In addition, animal products are used for clothes: mitts, parkas and kamiks. Secondly, the sale of certain animal products, ivory and skins, provides some cash income. I believe there is a third motivating factor more difficult to delineate, but no less important, because it is intangible. Inuit hunt because they are part of a hunting culture; it is their lifestyle."[25]

Similar statements were made by other intervenors, including the Dene Nation, the Labrador Inuit Association, the Beaufort Sea Hunters and Trappers Association and other groups.[26]

Despite the many changes which have occurred in the last century the harvest of wildlife and fish resources remains a source of subsistence and income for northern communities, and continues to provide social, nutritional and other benefits. There is evidence that "country" foods are still preferred over southern foods. In addition, the strong attraction of people to the land and to harvesting activities is still evident. People enjoy being on the land to pursue traditional activities. Native people assert that resource harvesting is still of paramount importance to the maintenance of their way of life and social ties in the community. The Panel believes that industrial development in the North must not adversely affect the environment or the freedom of northern natives to harvest wildlife resources.

5.4.3 Effects of Employment on Resource Harvesting

Information presented to the Panel confirmed that families engaged in resource harvesting generally have another outside source of income. This income is required for the purchase of equipment and supplies, such as snowmobiles, all-terrain vehicles, boats, outboard motors, gasoline, guns and ammunition and for equipment repairs. Alternative sources of income include the sale of handicrafts, government resource harvesting assistance, transfer payments (social assistance), small business income and wage employment. The Proponents noted that wage employment opportunities from increased oil and gas production and transportation would provide an additional source of income to supplement that obtained from resource harvesting.



In addition to cash income, resource harvesting requires time. For those involved in wage employment, there must be some trade-offs in the use of time for wage employment, for resource harvesting and for meeting family responsibilities. The Proponents stated that work schedules can be designed to enhance renewable resource harvesting activity by providing time off to pursue these activities at appropriate times each year.

Concerns were often expressed in communities about whether resource harvesting and other traditional skills will continue to be passed on to younger generations. The knowledge and skill required for resource harvesting, along with proper respect for and attitude toward the land and wildlife, is passed from older to younger generations through direct example and tutoring. The traditional ways of raising children reinforce this learning process through frequent involvement in resource harvesting. Further appreciation of these values comes from experience.

The Panel believes that the maintenance of resource harvesting skills is a responsibility of communities and individuals. Communities should ensure that young people are educated in traditional resource harvesting skills.

The Panel also recognizes that individuals in each community will have to decide whether wage employment in the oil and gas industry is compatible with their present lifestyle. While there was debate about the effects of wage employment on resource harvesting, the Panel has noted previously that there is considerable support among native people for further development of a mixed economy in the North, an economy which enables northern people to participate in wage employment while continuing their involvement in resource harvesting.

5.4.4 Pressures on Wildlife and Fish Resources

Because of the characteristics of fish and wildlife populations in the North, a small increase in hunting or other pressures may quickly deplete a species. Concerns were expressed by intervenors about the maintenance of fish and wildlife populations and the social effects of a decline in a desirable species. Although oil and gas developments may contribute to some reduction in number of fish and wildlife species, these effects are often overshadowed by other trends which have been occurring during the last century. With natural increases in human population and the change from camp life to settlement life, wildlife harvesting in some areas has been increasingly concentrated close to communities. Changes in technology such as the introduction of rifles, snowmobiles, outboard motors and all-terrain vehicles have also contributed to increased harvesting.

In addition to these influences, new residents of the North will want to participate in hunting, fishing and other outdoor activities. There is also potential for increased tourism, including sport fishing, hunting and other wildlife oriented activities which are actively promoted by the territorial governments. Commercial markets may also expand for country foods.

The Panel believes that fish and wildlife resources must be carefully managed if they are to be available for traditional uses. Territorial and federal resource management agencies have policies which give preference to traditional users. The Panel concurs with these policies while also recognizing the requirements of international agreements to conserve certain species.

54.5 Fish and Wildlife Management

Local hunter and trapper associations (HTA) expressed a desire for increased involvement in wildlife management. Governments and the Proponents have recognized the benefits of local participation and have involved local hunters and trappers in many studies, including resource harvesting studies, ship track crossing experiments and monitoring of the effects of artificial islands on marine mammal habitat.

Recent renewable resource harvesting studies have indicated the value of regionally based research programs. The Baffin Region Inuit Association resource harvesting study,[27] and similar studies in the Central Arctic, Keewatin and the Mackenzie Valley, have increased the understanding of the extent of resource harvesting activity, its importance economically and socially and the interrelationships between the wage economy and traditional activities.

The Panel believes that local residents should have a major role in the choice, design and administration of resource harvesting studies in order to ensure that local needs and concerns are addressed. The Panel further believes that funding of regionally-based data collection and monitoring studies of renewable resource harvesting which embrace both the environmental and socio-economic aspects should be continued by governments and the native organizations.

Despite their involvement in resource harvesting studies, local hunters and trappers expressed concern that decisions which affect their traditional livelihood could be made without their knowledge or active participation. They considered increased local control important to help avoid declines in socially important species and the imposition of restrictions on resource harvesting activities, including new or reduced quotas or area closures. The Panel believes that the best means for ensuring the protection of harvestable fish and wildlife resources is to put more of the responsibility for managing those resources into the hands of traditional users.

14 The Panel recommends that governments give to the communities and local hunters and trappers a stronger role in harvesting studies, in fish and wildlife resource planning and decision making, in monitoring and in enforcement.

5.5 Community Infrastructure and Housing

5.5.1 Introduction

Some northern communities will experience population growth if the Proponents' proposal results in hydrocarbon production and transportation. Most of this growth will occur in the Town of Inuvik although some limited growth could occur in Tuktoyaktuk and in other communities. Effective community planning is required to ensure orderly development of the physical infrastructure and housing necessary to accommodate growth.

5.5.2 Municipal Services and Infrastructure

Existing municipal services and infrastructure have already been strained in some communities such as Norman Wells and Tuktoyaktuk as a result of growth associated with past and current resource developments such as oil and gas exploration in the Beaufort Sea-Mackenzie Delta area and construction of the Norman Wells pipeline. These municipal services and infrastructure include roads, water supply, sewage disposal services, garbage dumps and so forth. The Government of the Northwest Territories has stated that it is attempting to assist

> *"A municipal government cannot justify expending significant public funds in developing an infrastructure for something that might happen, any more than any other level of government But what a municipality can do is plan and have as much of a detail plan as is possible to be ready for that eventuality But again, municipalities, I think, are going to be very cautious about going very far with anything unless there is some pretty firm assurance from senior government that — hey the ball game is on and get your act together"*
>
> *T Mason, Former Mayor Fort McMurray*

the most impacted communities such as Tuktoyaktuk, Norman Wells and Inuvik to upgrade their municipal services and infrastructure to minimum acceptable standards. To accomplish this, however, capital funding has been diverted from other communities where funding is also needed.[28]

The Proponents estimated in the EIS Supplementary Information that, for the development option based on a small-diameter pipeline, the Town of Inuvik could increase from its present population of 3,240 to about 4,695 by the year 1990 and to about 5,546 by the year 2000. (*Table* 5. I) As indicated previously, the Mayor of Inuvik stated that the present infrastructure, with continuing improvements, would be capable of handling a total population of up to 7,500 persons.[29] The Proponents presented information indicating that periodic upgrading and expansion of water and sewage systems, recreation facilities and schools would be required as Inuvik grew.[30] However, major capital improvements would not be required immediately to accommodate population growth associated with the small-scale development option.

The Panel believes that municipal services and infrastructure in communities potentially affected by oil and gas development should be upgraded to acceptable standards before development takes place and maintained at those standards during the oil and gas construction and production phases.

55.3 **Housing**

In general, the provision of adequate housing will be essential to mitigate some of the economic and social problems caused by oil and gas production and transportation. Crowded or substandard housing may increase social pressures. Disparities between the housing of industry or government workers and others in the community may be socially divisive. Housing shortages may drive up house prices and add to inflation. These effects can be a hardship on low-income groups.

Although increased demands for housing may be experienced in communities such as Tuktoyaktuk, Fort Simpson, Norman Wells and Hay River, major increases would be expected in Inuvik. The Town of Inuvik has designated a considerable amount of land in its community plan for residential development. Some of this land was serviced in the late 1970's in the expectation that the Mackenzie Valley natural gas pipeline would be built. The Town indicated that it is confident that it can handle the initial increases in population. To assist the Town of Inuvik in providing additional serviced land for development when needed, advance notice of the expected need for serviced lots should be provided in sufficient time for the construction of the necessary accommodation. To do so requires monitoring of population trends whether stimulated by industry or other forces. Adequate financing must also be provided from the federal and territorial governments to cover the costs of servicing and upgrading utilities and other costs.

The GNWT is promoting the establishment of a private housing market in larger communities.[31] This is unlikely to occur, however, until uncertainty about the future housing market is reduced. The GNWT advised that the Proponents could support the development of a private housing market by providing their employees with housing allowances. This would also encourage occupational and income mixes in Inuvik neighbourhoods In addition, accommodation of company employees in communities must be coordinated with the needs of other residents, so that housing shortages do not occur for lower income groups. The Panel supports these approaches.

55.4 **Local Energy Requirements**

The Proponents stated that "if topping plants proved economic, it might make sense to provide enough topping plant capacity to provide fuel to at least some of the Beaufort Sea Communities, as well as to the industry, a measure which could free transportation capacity on the Mackenzie River."[32] The Northern Canada Power Commission (NCPC) informed the Panel that local energy sources could reduce transportation and heating costs, and thereby provide early benefits to residents of the region.[33]

The Panel was told that there are several alternative local sources of energy which could be developed to supply regional markets, including natural gas and refined fuels from a local topping plant. The GNWT said that a small, shore-based or barge-mounted refinery or topping plant, for example, appears feasible if all sectors of the local market were supplied. However, the natural gas and topping plant concepts would not likely be viable if both were developed.[34]

Because the feasibility of providing energy resources for local use depends upon achieving an economic scale, the Panel believes that the communities, the federal and territorial governments, the Northern Canada Power Commission and the Proponents should cooperate in evaluating and developing energy sources to serve community, regional and industrial markets.

The Panel also believes that because of the remoteness of the Beaufort Sea region and because hydrocarbons are a non-renewable resource, energy sources developed for the local market should have long-term viability and a substantial reserve should be maintained to serve this market for the foreseeable future. This would be an important mitigative measure for reducing the impact of eventual abandonment.

5.5.5 **Sand and Gravel Resources**

An economic source of sand and gravel is an important requirement for community growth in the North. Communities require gravel for roads, landfill, airstrips, housing pads and other purposes. Construction of hydrocarbon production and transportation facilities such as artificial islands, shore bases, roads and pipelines also requires considerable amounts of sand and gravel. The GNWT stated that adequate sand and gravel resources appear to be available to meet future community, industry and government needs for the long term, but that studies are required to confirm this for certain communities such as Tuktoyaktuk and Inuvik.[35]

15 The Panel recommends that licensing authorities ensure that adequate supplies of sand and gravel are reserved to meet the long-term needs of northern communities.

5.6 Economic Effects

The current high price levels in the North are partly a result of remote location, limited competition and small market sizes. Seasonal interruptions of transportation at break-up and freeze-up periods also affect supplies and prices of goods in some areas. Short-term inflation and shortages have been commonplace in resource development communities due to lags in the improvement of transportation systems, delays in the provision of services such as housing and the lack of coordination between the developers and local businesses.

The increases in economic activity proposed for the Beaufort Sea region, and to a lesser extent for other regions, would increase demands for goods and services. An increased flow of goods into the region would be required to meet these demands and would put additional burdens on existing interregional supply systems such as barge services, airlines, and trucking. Provided that these carriers increase their capacity as necessary to meet additional demands, no major shortages or inflation should occur.[36]

The Proponents stated as a basic principle that they would avoid interfering with community supply systems and capacities. Where their purchases of local goods and services could create local shortages, the Proponents have stated that they will import goods themselves. Otherwise, they would be a large purchaser of locally supplied goods and services in the Beaufort region, in part to provide opportunities for northern businesses. Where the Proponents buy from the same suppliers as local retailers, the collective buying power of the Proponents and consumers could reduce unit transportation costs and inflation.[37] The Panel supports the Proponents in their pursuit of joint purchasing arrangements and in other efforts to minimize inflation and shortages during the construction stage. The Panel cautions that to date, it is unaware that any developer has found a method of building a major project in a remote area without creating temporary shortages and inflation. Norman Wells is a recent example of shortages, inflation and lack of housing.

In addition to the effects of higher demands for goods and services inflation could also be fuelled by high wage levels paid by the Proponents or government. These wages would be paid partly to compensate for the higher cost of northern living. However, because the Proponents would pay these wages, other businesses and employers would be pressured to match these levels for similar job categories. The added labour costs would be passed to consumers in higher prices.[38]

Inflation should not seriously affect the Proponents' or government employees who are receiving higher wages. However, some groups would be less able to bargain for higher incomes during inflationary periods but nevertheless would have to pay higher prices for goods and services. Inflation could be a hardship to persons on fixed incomes such as the elderly, single parent families, the disabled and the unemployed. Hunters and trappers, municipal employees and small business employees might also have difficulty obtaining higher wages. Inflation, therefore, would tend to impoverish these groups.[39]

The Panel believes that some inflation and shortages will accompany regional growth in the short term causing problems for some groups. In the long term, however, there should be improvement in the prices and availability of goods and services. The Panel urges that the GNWT and YTG monitor economic indicators to provide an early warning of inflation so that government and industry may act swiftly. This will provide a basis for adjusting the levels of assistance payments to keep pace with inflation.

5.7 Education and Training

5.7.1 Introduction

The Panel heard many views on the subject of education and training. Intervenors mentioned that basic education levels must be upgraded if individual aspirations to professional, managerial and readership positions are to be fulfilled.

> *"There are only so many people within those communities that have the expert/se and perhaps the motivation or the willingness to lead and too often, everybody is wanting them to take a leadership role and they have to make some choices and we have to respect those choices and therefore, at this point in time, in many of those communities the departmental staff are still trying to play a supportive role and to encourage a greater acceptance of responsibility in these areas ''*
>
> *B Dunbar, GNWT*
> *Inuvrk*

5.7.2 Education

Lack of education is generally recognized by many northerners as a major impediment to employment and career advancement. Entry to employment and achieving a satisfying industry career often depend upon the level of formal education of the job applicant. The Proponents have made exceptions in some cases, filling jobs with applicants who possess limited formal education, but noted that it is easier for a northerner to obtain employment and subsequent promotions if the applicant has at least completed Grade 10.

The Proponents mentioned in the EIS that the "economy and technology of the Beaufort Sea region are changing, and thus job-related educational requirements are rising." They pointed out that unless northerners strive to obtain higher education levels, they would be left behind and only unskilled or semi-skilled jobs would be available.

There is a disturbing tendency for a substantial proportion of young people in the North to leave schools prematurely, foreclosing their chances for a career. The cause has been attributed to a variety of factors, Some intervenors said that the necessity to leave the home community at an early age to pursue secondary schooling at a larger centre was a substantial disincentive. Others said that some youths leave school for high-paying jobs. The Proponents stated that for this reason they discourage hiring youths who drop out of school. Many intervenors stated that the lack of motivation for education results from the indefinite or unclear career paths presented to students, or from the lack of assurance that there was some likelihood of acquiring a job.

The Panel believes that communities and the GNWT should expand career counselling programs, as necessary, in order to help young people to choose their careers and to assist them to overcome problems they might experience during training programs.

Education opportunities should also be close to home. The GNWT and Canada Employment and Immigration Commission should explore the possibility of reinstating training allowances to be used for local adult education programs so that students and trainees would not be required to leave their communities to attend school.

Vocational education offers the most direct route for employment for many northerners. However, the Panel is also concerned about the future of native leadership in the North, especially if there is a major influx of southerners, unless more northerners pursue academic and professional training. The Panel noted that in some communities the more educated individuals have filled a number of leadership roles because of the shortage of persons qualified to carry out the duties associated with these positions. Higher education would be a starting point in many of the leadership careers in the North. The Panel encourages northern people to continue their education since every community needs educated people such as teachers, nurses, businessmen, mechanics and clerks whether or not the proposed development occurs. The Panel believes that higher levels of education for all northerners would assist them to manage the effects of changes that come with all types of development.

The Beaufort Sea development should create even more incentive for higher education and a demand for positions requiring higher education such as business managers, administrators, planners, engineers, social workers and others. For northerners to pursue such careers, they must take advantage of financial incentives for higher education, recognizing that some forms of specialized training can be obtained only in the South, It should be noted that adequate financial assistance for northerners is available today.

5.7.3 Training

The Panel received information from the Proponents and governments that significant vocational training opportunities are presently available to northerners. The Proponents have placed many northerners in on-the-job training programs. The Government of the NWT and the CEIC also sponsor apprenticeship and technical training programs. The Proponents and governments cooperate on many of these programs. However, some openings in industry and government training programs have remained vacant for lack of applicants.

The Proponents will not be the sole employers of northerners during the production phase. There will be employment by government, local business and renewable resource industries in such areas as environmental monitoring, consulting, secretarial work, park service work, business and fisheries. In addition, many of these types of jobs may be more compatible with traditional lifestyles than are those in the oil and gas industry. The training needs for these jobs should also be addressed.

The Panel believes that community residents would have more understanding and motivation to gain the education level needed to acquire a job of their choice if they were informed of government and industry employee selection criteria, trends in job opportunities and associated education requirements through government-sponsored workshops.

5.7.4 Facilities

The Panel heard several proposals from communities to establish community-based education and training facilities in the North.[40] The Beaufort Hunters and Trappers Association (representing several communities) argued for a training centre in the Beaufort Sea region. The Community of Tuktoyaktuk wanted to see a secondary school in the community as well as a vocational school to meet local needs. In the Eastern Arctic, the need for more advanced facilities was expressed in the communities of Pangnirtung, Pond Inlet and Arctic Bay. Such facilities would provide opportunities for individuals to pursue advanced education and technical training, without requiring them to leave their home communities or the North entirely, in order to advance their career potentials.

The Panel heard proposals to establish post-secondary, higher education facilities at Inuvik and in the Eastern Arctic. These institutions were seen as possible mitigative measures to the social effects of rapid regional development and as a means of providing young people and other persons with opportunities to improve their education. The institutions were also seen as a focus for cultural preservation as well as a centre to support northern research programs and to increase northern involvement in research. The Panel believes that these proposals for new institutions provide a possible base for unifying and supporting a regional strategy for upgrading the preparedness of northerners for northern development.

Education and training programs could be improved by regionally-based facilities which could provide extension courses in communities. Such institutions should be tailored to local needs and should provide both technical and academic train-

ing. These institutions should consider the possibility of becoming formally associated with a southern university or college.

16 The Panel recommends that the feasibility of establishing post-secondary, higher educational facilities at Inuvik and in the Eastern Arctic be explored thoroughly and immediately by governments and community representatives, and that the results be published and distributed in the communities for discussion purposes and for subsequent government and community action.

Although education and training programs and facilities are expensive, the Panel believes that cost alone should not be the determinant in evaluating these programs. At the same time, the Panel recognizes that the responsibility for completing education and training programs belongs to individuals.

It should be recognized that those students who go to southern Canada for additional education gain useful experience to take back to their communities and the students also have the opportunity to learn about other cultures. This could assist them to manage potential changes in their communities as a result of future developments.

In summary, the Panel believes that improved education and training are essential to ensure that northerners are able to take advantage of career opportunities. Education and training opportunities are available for those who seek industrial careers. The Panel believes that governments should give all possible support to preparing northerners for roles in Beaufort Sea oil and gas development.

5.8 Employment

5.8.1 Northern Involvement

Many participants in the review stressed the need for northern involvement in the employment opportunities provided by Beaufort Sea oil and gas production and transportation.[41] The Proponents repeatedly stressed in their EIS and at public sessions that it would be their objective to involve northerners by emphasizing long-term employment, as well as by providing short-term jobs. Throughout the public sessions, the Panel heard considerable debate over the definition of a northerner. For the purposes of this report, the Panel defines a northerner as an individual who has resided north of 60° North Latitude for at least the past year.[42] The Proponents stated that northerners are presently given first priority for northern jobs.

> **"When the** *Dew Line started a lot of the native people in the Delta were employed by the Dew Line, and after the Dew Line was finished, after they got all their buildings up, and everything like that, bringing all their equipments in, and the native peoples didn't get any jobs. They were all sent back home and there was trained people coming from the south to operate the machines that they brought."*
>
> *G Edwards*
> *Aklavik*

The Panel has already discussed in Section 5.1 the benefits which increased employment could have for northerners. Employment provides a direct opportunity for northerners to share in the economic benefits of development. Employment would help to improve northern standards of living and the self-sufficiency and independence of individuals and families. However, the Panel cautions that northerners should not consider the oil and gas industry as the primary source of jobs in the North. While this oil and gas proposal should be viewed as an important industrial development and will help establish a stable economy, it will create jobs and opportunities for a relatively small number of residents.

The Proponents stated that most of the job opportunities from Beaufort Sea oil and gas production would be located in the Beaufort Sea region. At the present time, approximately 450 workers are employed from that region. The Proponents estimate that $1,700 per capita was received by Beaufort Sea region residents in 1982 from oil industry wages. The Proponents also estimate that Beaufort Sea region residents received $5,100 per capita in direct, indirect and induced income.

The Proponents indicated that increased employment would be expected in the production phase. For the construction of production facilities for the small-diameter pipeline scenario, the Proponents estimated that on-site personnel would peak at 1,200 and that 250 employees would be required for later operations-related activity. The Proponents forecast that continuing exploration activity would require an increase in manpower from the current 1,500 workers to 2,000, with exploration activity remaining constant at that level through the year 2000.

Most of the needed workers would be rotational employees from the South, although the Beaufort Sea proposal would provide employment opportunities to northerners in the active labour force, assuming minimal skill levels. Some skilled labour shortages could occur in certain job categories, unless workers are brought in from the South.

The Proponents indicated that construction of a small-diameter pipeline, with production facilities discussed above, would require a peak workforce of 1,850 temporary construction workers in the Mackenzie Valley. These jobs would last for only three winter construction seasons. Approximately 60 permanent employees would be needed for long-term pipeline operation and maintenance. While the Proponents noted that many Mackenzie Valley residents could qualify for jobs during construction, union membership and seniority requirements could pose obstacles. The Proponents also indicated that many of the pipeline construction jobs would be filled by highly skilled workers from the South. Given suitable training and experience many of the 60 longer-term jobs could be filled by northerners.[43]

Jobs such as clearing of rights-of-way, operation of heavy equipment and general labour could be filled by northerners, although certain other jobs would have to be filled by workers with specialized skills. The Panel believes that northerners, if properly trained, could fill those jobs, especially if additional pipelines were to be constructed in the North. For example, northerners are now gaining skills by working on the Norman

Wells Expansion Project and by being involved in joint ventures with southern firms.

Many northern adults lack the education required to compete for industry jobs. Many men and women over 30 have not had extensive formal schooling.[44] For them, the requirement for a paper diploma is a significant barrier to employment. In many cases, these individuals have had many years of responsible work experience in a trade. The Panel believes that this barrier should be addressed by the GNWT and the Proponents. Potential solutions include: expansion of current adult education programs to upgrade education levels, giving credit in admission requirements to training and employment programs for informal experience, review of hiring qualifications for mature applicants in order to waive formal education requirements where possible and designing jobs to accommodate mature individuals without formal education. The Proponents and government have made efforts in these areas but the Panel believes that more is required.

Residents of the Eastern Arctic would have only limited employment opportunities as a result of the Proponents' proposal. In the EIS, the Proponents stated that the use of tankers to transport oil would not provide many jobs. At Resolute, the Proponents reiterated this view and said that only local people with considerable training could acquire a job on a tanker. They also stated in the EIS that some onshore jobs, such as jobs related to traffic control, reconnaissance, monitoring and research may become available if tankers are used to transport oil. Despite the difficulties that may be involved, the Panel encourages the Proponents to provide job opportunities for Eastern Arctic residents in the Beaufort Sea operation by considering ways to assist them with transportation costs from their communities to the job sites.

5.8.2 **Cross-Cultural Training**

The Panel heard concerns that interactions between native and non-native employees have at times been strained or awkward resulting from lack of understanding of cultural differences. The Panel believes that this is often a major reason for native northerners not staying with jobs. The Proponents have recognized this situation and have incorporated cross-cultural training into their orientation programs. The Panel supports this initiative and believes that such programs should become a requirement for all oil industry workers, native and non-native, who intend to work in the Beaufort Sea region. The design and administration of these programs should be carefully developed and monitored for effectiveness. The Panel believes that the Proponents should include in the selection criteria for new employees an evaluation of an employee's ability and willingness to work harmoniously in a culturally diverse work place.

The Panel realizes that northerners are often called upon to make significant adjustments to their lifestyles to meet the requirements of an industrial career. Information was presented by BRIA that in the case of the Nanisivik Mine, available industrial jobs were not filled by local residents.[45] This was attributed to conflicts between traditional lifestyles and working conditions in the more highly regimented industrial work place. The Panel believes that cross-cultural orientation programs would sometimes be useful to assist employees to adjust to the industrial work environment without employees losing their association with their traditional way of life. If these programs are not available, it may be difficult to reach northern hiring objectives. Accordingly, such orientation programs should be part of cross-cultural training programs.

Cross-cultural orientation should be made available to business and government employees as well as in industry. Cross-cultural orientation would be accomplished better through a local education centre or community college.

17 The Panel recommends that the communities, governments and Proponents work together to integrate cross-cultural orientation with existing training programs.

18 The Panel recommends that the Proponents and the Government of the Northwest Territories establish cross-cultural orientation programs that are developed and delivered by northerners who are thoroughly familiar with native and non-native cultures and with experience in the industry's oil fields.

5.8.3 **Job Motivation and Progression**

The Panel heard concerns from communities and government that northerners, particularly natives, have tended to become bottle-necked in entry level positions. The opportunity for advancement to better jobs is very important to the motivation and eventual success of an employee.

The Panel believes that the Proponents and governments should continue to explore and implement various strategies to increase job progression rates for northerners. To establish careers for northerners, northern residents should be given preference for training programs and for jobs which lead to permanent careers with the potential for advancement.

The GNWT and CEIC stated that the Proponents have made commendable advances in the hiring of northerners. The implementation of the Proponents' northern hiring preference policy is a means of achieving the federal and territorial objective of maximizing employment and career opportunities for northerners. The Panel supports this general policy but urges the Proponents to ensure that their contractors and subcontractors implement the same policy.

The Proponents have emphasized the hiring of northerners, adapted work schedules to accommodate traditional life styles and provided extensive training opportunities. The Panel believes that northerners need significant career opportunities and visible career progression potential as opposed to simply having a job as a source of income. The Proponents, governments and the communities must work together to develop effective career progression programs.

58.4 **Labour Force Estimation**

At Inuvik and Whitehorse, territorial government representatives emphasized the importance of forecasting and monitoring of labour force demand as an input to effective planning for the participation of northerners. A clear understanding of skill

levels and entry requirements for future jobs goes a long way in developing adult education and training programs. Information on the number and timing of jobs available in various job categories would permit matching of people with jobs.

The Panel is aware that governments and the Proponents, in the recent past, have compiled separate lists of potential employees and their skills on a community basis. The Panel encourages the gathering of such information but believes that the governments and the Proponents should work jointly with the communities in compiling such information. In addition, the Panel believes that the Proponents should continue to provide lists of jobs as they become available.

With regard to Eastern Arctic residents, the Panel supports the BRIA recommendation that, following any approval of year-round shipping, the Proponents should provide to communities an estimate of the numbers and types of jobs, skill requirements and the availability of training programs.

The Panel is also aware of the difficulty that the disadvantaged and handicapped people in the North encounter in entering the workforce, and encourages the Proponents and governments to ensure that these persons have effective access to suitable jobs.

5.8.5 **Recruitment Programs**

Community residents suggested that employment officers, when based in communities, have enhanced the recruitment of community residents. Not all communities, however, have recruitment officers. Some community spokesmen requested that employment and liaison officers be stationed in communities on a full time basis.[46] These officers could perform a variety of functions. They could provide information on jobs available in industry and could assist local residents to find employment. They could help develop better community awareness of industry operations and they could provide information to local businesses on the local purchasing requirements of industry. They could improve communications and understanding between the companies and the communities. The Panel urges the Proponents and governments to establish joint employment liaison offices in those communities with a sufficient labour force to warrant such a position. The establishment of these offices should be a cooperative venture among the companies, with costs shared by government and industry.

5.8.6 **Union Practices**

Concern was expressed to the Panel by native organizations, communities, the Government of the Northwest Territories and others about potential restrictions on access to employment for northerners due to union practices. Many of the trades required for Beaufort Sea developments would involve workers who are members of large southern or international trade unions. These unions have restricted memberships and seek to limit employment on job sites to unionized workers. Northern residents fear that these unions could refuse them membership and deny them access to jobs. Recent experience with the Norman Wells project was given as an example of how union requirements, seniority and resulting company policies have been barriers to employment for local residents. Union restrictions could tend to counteract northern hiring policies. Elsewhere in this report, the Panel concludes that more jobs should be filled by northerners and that developing a northern expertise in pipeline construction (possibly through joint ventures) could increase the job opportunities available to northerners. Union cooperation in support of these initiatives should be encouraged. Unions must not present a barrier to employment for northerners.

The GNWT is considering labour legislation to address restrictive union practices and has encouraged unions to be more accessible to northern workers. The GNWT stated that because of the Northwest Territories Act and the Canada Labour Code, the enactment of labour legislation in the Northwest Territories would require further negotiations with the Government of Canada. The GNWT pointed out, however, that if labour legislation were enacted in the Northwest Territories, its major thrust would be to increase access to oil and gas industry employment opportunities for NWT residents. The Panel recognizes the importance of this issue and urges the GNWT and the Government of Canada to resolve the problem quickly. Hopefully, union cooperation or, if necessary, legislation can address this problem and ensure northerners better employment opportunities.

The Panel appreciates the complexity of this issue and concludes that the GNWT and the Government of Canada should use the time available before Beaufort Sea oil and gas production and transportation proceeds, to work with unions, the Proponents and northern communities to devise ways to solve the union problem and to develop appropriate legislation as required.

19 The Panel recommends that the Government of Canada and the Government of the Northwest Territories establish an agreement, after consultation with labour unions, that includes legislation, if necessary, to ensure that unions are neither a barrier to employment for northerners nor to the development of northern businesses.

5.8.7 **Employee Health and Safety**

Intervenors expressed concern about the adequacy of employee health and safety programs. The GNWT stated that inspections by COGLA of offshore platforms and facilities with respect to worker safety were inadequate. These inspections should include occupational health and safety, fire safety, boiler and pressure vessels and electrical safety.[47] COGLA and the Province of Nova Scotia have worked out an agreement to enable provincial inspectors to inspect offshore rigs, but COGLA has not developed a similar arrangement with the GNWT. The GNWT indicated it did not consider COGLA inspection services adequate to cover the responsibility for employee health and safety. While the Proponents stated that they have qualified health and safety personnel involved in ensuring worker safety, the GNWT contended that it should have the capability to conduct its own inspections.[48]

The Proponents stated that their safety record for the Norman Wells project has been better than the industry average. They

suggested that while there may be a jurisdictional problem over who is responsible for worker health and safety, there is no reason to believe that worker safety is being jeopardized since worker safety is a priority with the Proponents.[49]

The Panel believes it vital that responsibility for safety inspections be clarified immediately. To illustrate the problem, information was presented indicating that the safety record in the North Sea offshore production area has been poor with the sinking of a hotel platform and many day-to-day accidents. This was attributed, in part, to a divided jurisdiction over worker safety and to the failure to assign responsibilities prior to the commencement of production.[50]

20 The Panel recommends that the Government of Canada and the Government of the Northwest Territories establish an agreement designating responsibility for regular inspection of the Proponents' facilities with respect to occupational health and safety.

5.9 Northern Business Opportunities

The northern business community expressed strong support for oil and gas production and transportation in the Beaufort Sea region. Businessmen suggested that regional economic development resulting from this proposal could stimulate economic activity, encourage formation of new businesses and provide business opportunities for existing firms and native development organizations.

The Panel is aware that, at present, many northern businesses have difficulty in competing with southern firms for contracts. The Panel was informed that this is mainly due to greater overhead resulting from higher operating and transportation costs, smaller markets, smaller skilled labour forces and long winter periods without work. In spite of this, the Panel recognizes that the Proponents have given contracts to northern businesses providing them with more work and thus making them more competitive. The Panel commends the Proponents and believes that more support of this type would give northern businesses a better chance to become established. In addition, the Inuvik Chamber of Commerce spoke positively of past association with the Proponents and expressed confidence concerning the role northern businessmen could play in future development projects.

The Panel is also aware of the support that has been given by governments to northern businesses and encourages continuation of these programs. The GNWT has provided ongoing advice to businessmen during start-up and operation of a business. Advice has been provided on incorporation, evaluation of business opportunities, business planning, financing, day-to-day operations and other aspects of running a business. Through action plans negotiated with industry, the GNWT has cooperated with industry in planning for business development. Further assistance has been given by federal programs such as those of the Federal Business Development Bank.

The Panel was informed that northern businesses have several options for obtaining capital to finance their business ventures. There are the conventional financing mechanisms of financial institutions as well as special loan programs provided by governments. Government loan programs, however, have been useful but have often reacted too slowly to enable businessmen to take advantage of opportunities. Industry and government have assisted small business by packaging contracts in smaller sizes. Joint ventures between northern firms and industry or with southern firms have improved the opportunities for small businesses to compete.

In general, new businesses have limited equity capital to invest. Many business opportunities require large outlays in the form of bonding. The short track record of many northern entrepreneurs has been a constraint for bonding companies.

21 The Panel recommends that the Government of the Northwest Territories provide more effective assistance to local businesses for bonding purposes.

The Panel believes that existing and prospective businesses need a forum for discussing government and industry programs oriented to small business. The Panel believes that an annual Regional Business Opportunities Conference, or a similar event, could provide valuable assistance to businesses in identifying opportunities, understanding tendering and other company procedures, and locating financial sources. Workshops could also be held during the conference to enable businesses to upgrade or refresh their knowledge or skills. The Panel believes that such a conference would also provide feedback to the Proponents and government so that services to and by businesses could be improved.

The Panel believes that reliable information is a prerequisite to sound business planning and investment. A stable economy in the Beaufort Sea region could be encouraged by prompt and firm government decisions and policy.

The Panel is also aware of the involvement of native organizations, such as the Inuvialuit Development Corporation, in northern business ventures. The Panel recognizes the importance of such initiatives to northerners and supports expansion of their involvement in future business interests.

The Panel also recognizes the desire of Yukon businesses for greater participation in an expanding Beaufort Sea economy. In order to enhance Yukon business participation, the Panel suggests that when feasible, the Proponents open purchasing offices in Yukon. Participation in the Beaufort Sea economy would strengthen and diversify a Yukon economy which has been deeply affected by the recent recession.

5.10 Socio-Economic Impact Assessment

5.10.1 Introduction

The purpose of the Panel's socio-economic impact assessment was to evaluate the effects of industrial development on the social, cultural and economic conditions in the North. The Proponents' EIS provided substantial detail about the existing socio-economic conditions in the North but was found incomplete by the Panel in that there was limited discussion of the potential effects of changes introduced by development. The EIS Supplementary Information included a more comprehen-

sive discussion of the potential effects and this formed the basis for productive public discussions during the General Sessions.

Additional information presented during the sessions by the Proponents and intervenors included research studies, professional judgements, case studies from other areas and discussions of previous experiences of industry, government and communities.

5.10.2 Assessment Methodology

Socio-economic impact assessment usually includes a description of the population and economic changes brought about by development. This requires an integration of information from many different subject areas. The data often vary in precision and accuracy. If there is general agreement about the estimated changes, then these are followed by an analysis of the possible social effects of the changes and their significance to the individuals, communities and governments.

Baseline socio-economic information presented in the EIS and associated documents did not provide an adequate base for socio-economic impact assessment and monitoring in the opinion of Technical Specialists and intervenors. However, other specialists noted that much baseline information is available, although not found in a single, accessible location. They also suggested that, with cooperation among senior governments, community leaders, social agencies and the Proponents, an adequate data base could be quickly assembled to support an effective monitoring program. Government of the Northwest Territories' presentations included proposals to rationalize and expand the baseline data collection procedures.[51]

Many intervenors commented on the difficulties of forecasting the population and economic changes caused by oil and gas developments. The Beaufort Sea Planning Model, which the Proponents used to forecast economic, employment and demographic influence, was criticized for unrealistic assumptions relating to rates of production and the multipliers for economic benefits. Estimates about the size and distribution of new population growth were difficult to make, given the uncertainties in the locations and scale of various oil and gas production facilities and in the modes of transportation. In all cases the forecasts were hypothetical because of the uncertainties in oil and gas reserves and markets.

The Panel, in the EIS Guidelines, the EIS Deficiency Statement and during the public sessions, encouraged discussion of the potential effects of proposal-induced population changes. The social effects of different types of community growth management policies were addressed in the EIS Supplementary Information and were the focus of discussion during the General Sessions. These discussions ranged from relatively straightforward issues about planning community needs for physical infrastructure, to more complex issues such as the social effects of changes in resource harvesting opportunities or the effects of changes in the ethnic composition of communities.

Although there were often a number of different opinions among the intervenors addressing socio-economic issues, one common theme emerged. While intervenors differed on what specific effects might occur, and often about the social processes causing these effects, they were in agreement that the proposed development could hasten some changes already occurring in the social, economic and cultural patterns of the North and that future assessments should focus on techniques to manage that change effectively.

The Panel believes that the GNWT is approaching the level of preparedness which will be necessary for undertaking appropriate, ongoing impact assessment programs. When more specific project details and more reliable forecasts of changes become available, then more effective impact management and planning will be possible. The Panel believes, however, that improved assessment methods are required and should be developed for specific application in the North. The GNWT has applied for NOGAP funding for new assessments which directly involve communities and community organizations. The Panel supports this GNWT initiative.

510.3 Monitoring

The purpose of socio-economic monitoring is to provide information about changes in socio-economic conditions and to improve the management of development impacts. Information obtained from this monitoring can be used to document effects of development and to devise methods to address adverse effects. The success of these methods can then be evaluated through subsequent monitoring activities.

The information presented to the Panel by the Proponents, governments and intervenors provides valuable assistance in the selection of initial issues and trends which could be the focus of a monitoring program. Some important issues mentioned earlier in this report are housing demand, employment trends, training, social conditions and economic trends. The GNWT has provided preliminary details of the monitoring projects they would like to undertake following a review of community needs.[52] Those who use monitoring reports for making decisions such as the Proponents, communities and governments should be involved in the definition of monitoring priorities. This will ensure that these priorities will reflect the collective needs of social agencies and communities, and that communities and agencies will share ownership and accept the validity of the results.

The need to begin, as soon as possible, several monitoring programs coupled with supporting research was emphasized

by the GNWT and other review participants, even though the baseline information is often incomplete or unbalanced. It is particularly important to proceed with the monitoring of actual socio-economic conditions since there appears to be considerable uncertainty about the changes which might occur as a result of the proposal. The Panel concludes that it should be possible for the relevant GNWT and federal agencies to design cooperatively an effective and focused monitoring program without delay.

510.4 Community Participation

Experience has shown that the more responsibility and control a community exercises in solving its problems, the more successful the community will likely be in solving them. Because of the varying social issues and conditions among the communities, community direction of social programs helps to ensure that these programs are sensitive to the unique social and cultural needs of each community.

It is the policy of the GNWT that social programs should be community-based. The GNWT has encouraged community councils and advisory groups to take a larger role in the planning and management of social programs and has recruited and trained individuals from communities as social workers. However, the GNWT has encountered some hesitancy on the part of local community leaders toward accepting additional program functions.[53] This hesitancy is understandable, considering the heavy workloads carried by community leaders and the resources currently available to them.

The GNWT is attempting to strengthen local governments to prepare them better for managing current social, economic and community problems. The Panel commends the GNWT's efforts to strengthen local government processes and local control over the planning and conduct of local services. If this is to be effective, the communities must be given the necessary legislative, human and financial resources. The Panel believes this is essential in order to give communities added experience and the confidence to deal with future problems.

510.5 Research

The Proponents and numerous intervenors suggested the need for social research to assist in planning social programs and in mitigating problems arising from development. The Panel, however, believes that this research should not be allowed to intrude on the lives of northerners, as has happened many times in the past. If social research is to be conducted in communities, it should be oriented to the needs expressed by the communities themselves, and not necessarily to what government, industry or academics might consider useful. The Panel believes that communities should provide the basic direction and ground-rules for the conduct of this research. Mr. Thomas Sulluk, representing the Inuit Tapirisat of Canada, suggested that northerners feel like advisors in their own land, although they have the knowledge of the land and people which outside consultants, who advise the Proponents and governments, cannot have.

In addition, communities should be given the financial support and assistance necessary to conduct their own research. Advisors should be available, through the territorial governments, for communities to call upon when the communities feel that such technical assistance would be useful. The Government of the Northwest Territories, in its NOGAP submission, identified several socio-economic research priorities in addition to requests for impact funding for various communities.[54] Also identified was a significant lack of adequate baseline information. This is disturbing to the Panel since exploration activities are already having significant effects on local communities and the GNWT. The Panel believes that, at present, there is sufficient understanding of some of the basic problems that the GNWT need not wait for comprehensive analyses to be finished. Oil and gas developments are occurring now so community-based problem solving must also begin now.

> "Community governments, faced with the prospects of rapid growth, now find themselves dealing with issues never before experienced by Council or their staff. Without technical, political and legal capabilities to negotiate with industry and senior levels of government, communities are often overwhelmed by the many issues confronting them and they lose control over the events that are happening in the community..."[55]

6.0 THE NATURAL ENVIRONMENT

6.1 Introduction

In its consideration of the implications to the natural environment should the oil and gas of the Beaufort Sea-Mackenzie Delta region be produced and transported to southern markets, the Panel is aware of certain fundamental characteristics of that environment.

Temperature, for example, is one of the primary factors which have profound effects on the nature of the physical and biological environments of the Arctic. Temperature has a large role in creating the Arctic climate and the water and ice regimes (ice cover, spring break-up and fall freeze-up) and in the formation of permafrost and the biological productivity of soils and the sea. It has an equally important influence upon the kinds of plants and animals living in the Arctic and upon how they live.

"A reduction in the pace of development would probably be the single most Important mitigative measure that could be applied to lower the potent/al for a serious environmental impact from a large hydro-carbon production project in the Arctic "

Dr A MacPherson, DOE
Inuvik

The combined effects of a rigorous climate and cold, impoverished soils, along with other factors, have resulted in fewer kinds of plants and lower annual plant production as food for plant eating animals than are found in southern Canada. Such results in turn have been largely responsible for the existence of fewer kinds of animals and the variations in their productivity and survival.

In the sea, cold water, ice cover and long periods of winter darkness, as well as other factors appear to have resulted in lower total annual biological productivity of marine organisms than in southern waters.

Because of these constraints on the productivity of terrestrial and marine species of great importance to northern people, the Panel believes that it is essential for extra care to be taken to assure that those species are protected and managed in the best possible way.

Therefore, the Panel has developed the following objective:

> northerners, developers and governments must ensure that the degree of risk to renewable resources from oil and gas production and transportation activities will be acceptable to them.

The Panel believes that this objective must be achieved in order to protect the renewable resource base in the North. As mentioned earlier in this report, the Panel has concluded that the socio-economic benefits can be maximized, and adverse effects minimized, through a phased small-scale development approach. The Panel believes that it will be easier to manage the renewable resources through this same phased small-scale approach than through a development requiring a larger human population increase. For example, data bases can be refined, and monitoring and mitigation programs can be put in place in order to avoid or correct adverse effects on the renewable resources as developments proceed.

To help assess how the physical and biological environment could affect or be affected by the proposal, components of the proposal to produce and transport oil and gas are each assessed. The first section in this Chapter begins with a description of some possible problems relating to the northern environment. The following section discusses the effects on the environment of the various production and transportation systems. The effects of operational and accidental impacts on the onshore and offshore biological communities are also described. The Chapter concludes with a discussion of the monitoring, mitigation and research programs necessary for successful control of negative impacts on the natural environment.

6.2 The Effects of the Environment on the Proposal

6.2.1 The Changing Climate

According to estimates by the Proponents and government, it seems unlikely that production facilities would be in place before the late 1980's. Both groups agree that, once production commences, it is likely to continue for several decades.

The Panel was presented with evidence by the Proponents and by the Department of the Environment that there have been long-term temperature changes observed in the past and predicted for the future. [1]

It is known from studies of temperature profiles in permafrost that the Alaskan Arctic Coast has experienced a warming of about 1.8°C during the last century. A somewhat similar warming trend also occurred in the Mackenzie Valley. Some long-term projections suggest that a warming trend, from a global increase in carbon dioxide, would be greater in the polar regions than in temperate regions. The environmental changes that might follow are difficult to forecast, particularly if a warming trend were also accompanied by a change in winter precipitation. Should a warming trend take place, the likely effect on permafrost would be to increase the thickness of the active layer and to cause thaw settlement and slumping in ice-rich areas. These events might result in maintenance and stability problems in some permafrost areas.

On the other hand, if there is no appreciable warming trend from an increase in carbon dioxide, predictions are that, at least in the Eastern Arctic, there might be a drop in mean annual temperature of between 0.5 and 1.0°C between 1980 and the year 2010. This cooling trend, if it occurred, would affect ice conditions along the tanker route.

The possibility of climatic change was recognized in the Norman Wells Environmental Assessment Report with a recommendation that a thermal analysis should cover the possibility of climatic change over the life of the project. The Panel appreciates the fact that climatic change, and the consequences of climatic change, would occur so slowly that mitigative and remedial action can be taken. The Panel remains concerned, however, that the potential effects of changes in the long-term ground temperature may not be fully recognized by the Proponents. The Panel concludes that the possibility of climatic change during the life of the project should be considered in the design and construction of a pipeline and other fixed facilities in permafrost areas.

6.2.2 **Artificial Islands**

The forces resulting from moving ice would be the most important design consideration for construction of artificial islands in the Beaufort Sea. The Beaufort Sea differs from most other areas where hydrocarbons are produced because of the presence of ice for most of the year. Accordingly, any proposed offshore production systems must be designed to withstand the ice forces present or possible in the Beaufort Sea. These forces include those of impact of first-year ice as well as multi-year ice features. While there are no icebergs of the Greenland type in the Beaufort Sea, there is a remote possibility of a large ice island (tabular iceberg) appearing in the deeper offshore waters. These ice islands break off the ice shelves of northern Ellesmere Island and generally move slowly southwest with the Beaufort Gyre.

The Canadian petroleum industry has been conducting extensive research on ice forces and island-building technology for over a decade. The Proponents have also gained practical knowledge and experience from their observations of ice behaviour around the artificial islands built for exploratory drilling. The Proponents stated that they have resolved problems related to the design of islands to withstand ice forces, such as the multi-year ice in deeper waters, ice pile-up and ride-up problems, and the intrusion of an ice island. They contended that future research will confirm and refine earlier studies and lead to further design improvements.[2]

Regarding the subject of ice forces, Dr. L. Gold of the National Research Council stated that one of the difficulties of operating in the Beaufort Sea would be to identify accurately the magnitude and frequency of the extreme ice events that structures would have to withstand.[3] The same viewpoint was also expressed by DFO in relation to oceanographic factors such as wave conditions and storm surges.[4] The Panel is in agreement that continued research combined with a long-term data base is required for a better understanding of extreme events relevant to the design of offshore facilities.

According to the Proponents, some of the geotechnical problems that may be encountered in the Beaufort Sea include the stability of foundation materials, the possibility of thawing of subsea permafrost around well casings causing subsidence of foundation material, and the potential for liquefaction of sand-filled islands during earthquakes.

The Panel notes that there would normally be an early warning of major environmental forces, such as the intrusion of an ice island, which could affect the integrity of an island platform. Should there be evidence of the progressive failure of any island or facility, contingency plans could be implemented to close down-hole valves in the producing wells and to remove all stored oil from the island, or to burn any oil remaining before it would get into the water. The Proponents indicated that oil stored for tanker transport could be removed within approximately 30 days, subject to tanker availability, while the oil stored for pipeline transport could be removed within a day. The Panel encourages the Proponents, in consultation with government, to continue to refine their predictive capability so as to ensure that there is sufficient advance notice to allow for the safe removal of stored oil from any production or storage facility in the Beaufort Sea.

The Panel recognizes that improvements are constantly being made to the designs of artificial islands and that further advances will occur as understanding increases. Given the substantial experience available to the Proponents from exploration drilling in the Beaufort Sea, the Panel is satisfied that production islands can be designed, built and safely operated.

6.2.3 **Subsea Pipelines**

The transportation of crude oil by subsea pipelines in the Beaufort Sea would involve problems not previously encoun-

tered in offshore production areas such as the North Sea and the Gulf of Mexico, where extensive winter ice cover and subsea permafrost do not exist.[5] Three of the principal problems associated with subsea pipelines in the Beaufort Sea would be the possibility of sea-bottom scouring by pressure ridge keels, thaw subsidence of ice-bonded permafrost beneath warm buried pipelines and repair of buried pipelines under winter conditions. The Proponents have recognized these problems and are conducting studies to develop design criteria to address them.

When ice scouring occurs, keels of drifting ice ridges drag along the sea bottom to deform, displace and scour the seabed sediments. Subsea pipelines must be placed in trenches deep enough to keep them undamaged by this scouring during the service life of the pipeline. The frequency of ice scouring at a specified site is difficult to determine. The data are also limited on ice keel depth distributions and on the relationships among scouring frequency, sedimentation that obliterates scours, and water depth. Furthermore, wide differences in the depth of trenching required for a subsea pipeline have been estimated for the Alaskan and Canadian Beaufort Sea, and even within the Canadian Beaufort Sea itself, as a result of the use of different analytical approaches.[6] Thus the prediction of trench depth is an evolving process that will require progressive refinement to reflect the findings of planned future research by industry and government.

A second Arctic problem relating to the burial of warm subsea pipelines would be potential thaw settlement, especially differential settlement, from the thermal disturbance of ice-bonded permafrost. This thermal disturbance of the permafrost might also increase the potential for seismic or wave-induced liquefaction of non ice-bonded sediments. The Proponents stated that they intend to address these concerns by avoiding problem areas in their final route selection, which involves detailed examination of foundation conditions.[7] Excellent progress has been made through cooperative studies by the Proponents and the federal government in the mapping of subsea permafrost, but data are difficult to analyze because of factors such as the sediment discharge of Mackenzie River waters into the Beaufort Sea, coastal retreat, and the submergence of permafrost terrain due to sea level changes within the past ten thousand years.

A third Arctic problem relating to the burial of warm subsea pipelines would involve subsea pipeline repair in winter beneath an ice cover. The problem was addressed in the EIS and a supporting document.

49 The Panel recommends that the Canada Oil and Gas Lands Administration have the Proponents' proposed under-ice repair methods for subsea pipelines tested under field conditions prior to operation of the pipelines.

The Panel concludes that offshore production and transportation facilities could be designed, built and operated with minimal environmental risk. This conclusion is based upon the past record of the Proponents in building offshore facilities and contingent upon proper regulations in the design, testing, construction and operation of future facilities.

6.3 Production Systems

6.3.1 Common Wastes, and Hazardous and Toxic Materials

6.3.1.1 Introduction

The Panel was informed that the types of waste resulting from production of oil in the Beaufort Sea region would vary and would require complex strategies for handling and disposal over the producing life of the oilfields. These materials constitute environmental and human safety hazards to varying degrees. The Panel recognizes the responsibility of DIAND, COGLA, DFO, DOE, and the GNWT to monitor, regulate and enforce standards for waste disposal and containment. As a general comment, the Panel believes that the firm application of regulatory controls will adequately protect environmental resources from any significant long-term impacts from oilfield production, and notes that there are various government-industry working groups currently assessing specific issues related to this topic.

The Proponents stated in the EIS that discharge of sewage, heated cooling waters, drilling fluids, BOP fluids, ballast and formation waters would have local effects on water quality. Offshore discharges, however, would be confined to areas around drilling platforms and vessels or would be subject to rapid dilution in the sea. The dilution factor, in addition to the use of oil-water separators and other treatment facilities, led them to conclude that the effects of most discharges on water quality would not be of significant regional concern.

Technical Specialists and intervenors expressed concern about the potential effects of hydrocarbon accumulations in the Beaufort Sea from the release of formation water, minor spills and other sources.[8]

Many oil fractions, from natural and man-made sources, are subject to chemical and biological degradation in the sea. Trace metals, on the other hand, could eventually enter food chains, although such material disposed onto the seabed in the plume of the Mackenzie River would probably be buried in sediments. The Proponents noted that at other locations the material could be transported outside the area where it was released but, in most cases, this material would probably remain within a few hundred metres of the well sites.

6.3.1.2 Discharge of Formation Water

Formation water, also called production water, is water that is sometimes associated with the crude oil in the reservoir. The Proponents informed the Panel that, where practical and feasible, formation water from offshore fields would be reinjected into the reservoir. They noted that, because injection wells are normally drilled two to three years after production begins, there could be a period when formation waters would not be reinjected and oil-water separators would be used to reduce oil concentrations prior to discharge of formation waters into the sea. They said that the most significant concern with respect to the discharge of formation water would be their trace metal and oil contents. They indicated that at about

15,000 m^3 per day rate of production less than 32 m^3 of this oil would be released per year.[9] However, even at high rates of production, they noted that the amounts of trace metals released would represent a small percentage of the natural amounts carried into the Beaufort Sea by the Mackenzie River. According to DFO, the annual industrial input of hydrocarbons would take about a decade to equal natural inputs by the Mackenzie River into the Beaufort Sea.[10]

The Panel recognizes the validity of these statements but believes that, as a general principle, wastes should not be disposed of into the Beaufort Sea.

26 The Panel recommends that the discharge of formation waters containing hydrocarbons and trace metals to the Beaufort Sea be avoided. Formation waters containing these substances must be reinjected to the reservoir at the earliest date feasible. Until that date, any discharge of formation waters must meet government environmental standards.

6.3.1.3 Disposal of Drilling Wastes

Drilling fluids or "muds" are usually water-based and contain a number of chemicals necessary to the drilling process. As drilling proceeds, rock cuttings are separated from the drilling fluid and discharged into the sea. From time to time, drilling fluids must also be disposed of and these are normally discharged into the sea. This discharge usually has minor, localized effects, including burying of a small area of benthic habitat, minor degradation of water quality near the drilling site and possible accumulation of trace metals. Government regulatory authorities have regulations in place to control the discharge of drilling fluids and rock cuttings. The Proponents cited a joint industry and government study which concluded that disposal of drilling fluids in Arctic waters has not had detrimental effects to date.[11]

Oil-based drilling fluids are sometimes required for specific drilling situations. Although the Proponents noted that oil-based fluids have not been found necessary for Beaufort Sea exploration drilling to date, they have stated that these fluids might be required for production drilling in special cases. The Panel was told by DIAND that COGLA, in cooperation with DFO, DOE and DIAND, is preparing guidelines for the use of oil-based drilling fluids on Canada Lands.[12] The Panel has some reservations about the use of oil-based fluids and concludes that, if such fluids were to be used, procedures must be adopted to avoid the disposal of those fluids into the Beaufort Sea.

6.3.1.4 Hazardous and Toxic Chemicals

The Proponents described several types of chemical substances which would be required for well development and production operations. Some of these substances could be considered toxic or hazardous if released to the environment. The Proponents noted that the handling and transportation of these substances is regulated under federal legislation by the Department of Transport. They are also regulated under territorial ordinances.

Intervenors suggested that proper management of hazardous and toxic chemicals requires both an effective management strategy to avoid spills and a contingency plan to respond to spills or other accidents.

An integrated hazardous materials management strategy for the Mackenzie River Valley and Beaufort Sea, where there are overlapping jurisdictions, would help to minimize the possibility of spills and contamination on land, in the Mackenzie River system and in the Beaufort Sea. In this context, DOE recommended to the Panel that comprehensive procedures be established for the handling, transport, storage, use and disposal of hazardous and toxic materials.[13]

Contingency plans are required for response to various categories of hazardous and toxic chemical spills. The Proponents stated that they would have contingency plans, equipment and personnel to deal safely with any spillage of such materials.[14] Prior to production, these plans should be reviewed and be subject to approval by appropriate government agencies, and the role of various government agencies clarified so that responses could be made expeditiously to prevent loss of life or damage to the environment.

The Panel recommends that prior to production and transportation of hydrocarbons from the Beaufort Sea region:

27 an integrated regional hazardous and toxic chemical management strategy be prepared by the Department of Indian Affairs and Northern Development in consultation with the Department of the Environment, the Department of Fisheries and Oceans, the territorial governments and the Proponents for the handling, transport, storage, use and disposal of hazardous and toxic substances; and

28 the Proponents' contingency plans for responding to spills and other accidents involving hazardous or toxic chemicals be subjected to regulatory review and approval.

6.3.1.5 Fluids for Pressure Testing

The Panel is aware that pressure testing is required at the time of construction of all pipelines, both subsea and onshore. Water is usually used for this testing, but a freezing-point depressant (methanol) and biocides may also be added. The Panel concludes that any fluids used for pressure testing of pipelines must be treated to water quality standards assigned by the appropriate regulatory agencies before discharge.

6.3.1.6 Ballast and Bilge Water

Vessels may require water for ballasting during journeys to and from the Arctic. The Panel believes that regulations for monitoring and enforcement of all ballast water standards should be reviewed, updated and put in place as soon as possible. The Panel concludes that any ballast or bilge waters discharged into Arctic waters must first be treated to water quality standards assigned by the appropriate regulatory agencies.

6.3.1.7 Monitoring the Fate of Pollutants

A carefully designed monitoring program to assess the movement of potential contaminants in the Beaufort Sea could pro-

vide an early warning of problems which may emerge during the production phase.

The Panel concurs with Dr. D. Mackay, a Technical Specialist, that

> "... a primary public expectation is that if Beaufort Sea hydrocarbon development proceeds, the Government of Canada will take vigorous and thoughtful action to assure a careful stewardship of this region and ensure that there is no accumulation of unacceptable hydrocarbon contamination. [15]

The Panel concludes that such a program should be carried out by DFO and DOE, the agencies with the technical expertise.

29 The Panel recommends that the Department of Fisheries and Oceans and the Department of the Environment design a program to determine the fate of hydrocarbons, trace metals and hazardous substances in the Beaufort Sea originating from industry activities.

6.3.2 Ocean Dredging

The construction of artificial islands and the trenching for subsea pipelines will result in extensive dredging in offshore areas of the Beaufort Sea. The Proponents have constructed many artificial islands from dredged materials for exploratory purposes. This experience has demonstrated their island-building capability and increased their technological expertise in Arctic conditions.

The Proponents stated in their EIS that a maximum of 50 to 70 km^2 of seafloor could be directly disturbed during the period considered (1982-2000) if dredging was limited to 10 metre deep excavations. It is expected that some dredging will occur to depths of 20 metres below the seafloor, which would result in less total area being disturbed.

At the General Sessions, the Proponents stated that they now plan less dredging than is indicated in the EIS. They noted that advances in technology for island-building are occurring rapidly, and since the EIS was written, the use of caisson retained islands and the SSDC (Single Steel Drilling Caisson) has dramatically reduced dredging requirements. In addition, the small-scale and phased developments recommended by the Panel would require less initial dredging than would the larger scale production scenarios of the EIS.

The information on reduced dredging requirements by the Proponents and the small-scale phased approach recommended by the Panel indicates that the dredging offshore would affect only a small fraction (far less than 1 per cent) of the Beaufort Sea environment.

The concerns expressed by several intervenors focussed on the disturbances to fish and benthic ecosystems which would result from dredging activities. Perhaps of greater biological consequence, but of limited areal extent, would be dredging in localized habitats close to shore. This dredging would be required for shallow-water island construction, for the excavation of shore approaches for subsea pipelines and for mooring basins or docks at shorebase sites. The Proponents recognized that nearshore dredging should be scheduled to avoid times critical to fish. The Panel, however, was advised by DFO that there is a lack of knowledge of the distribution and occurrence of fish in some parts of the nearshore and offshore Beaufort Sea environment. The Department of Fisheries and Oceans raised concerns regarding possible disruption of fish habitat and general impacts to the benthic ecosystem from significant dredging.

The Panel concludes that DFO should continue to be involved closely in the setting of criteria for the timing and placement of dredging activities and should establish research and monitoring programs which can assess the extent of any long-term impacts of dredging on critical biological resources in the Beaufort Sea region. These resources should be defined well in advance of any dredging activities.

The Panel received no evidence of any major impacts from dredging activities to date. The Panel concludes from the evidence of the Proponents and the intervenors that with DFO's continuing involvement as described above, the fish habitat which may be disturbed by dredging will be localized and within acceptable limits. Further, the Panel agrees with the Proponents that the effects of dredging generally will be localized and will have minor impacts on benthic ecosystems.

6.3.3 Stabilization of Landfast Ice

Landfast ice is defined as ice which is anchored to the shoreline and extends offshore in a largely stationary sheet, stabilized by ice keels grounded on the bottom. In the Beaufort Sea, landfast ice extends offshore to about the 20 metre depth contour. Factors controlling the growth and break-up of landfast ice are poorly understood with the result that the effects of artificial islands on the ice regime are difficult to predict.

Residents of Tuktoyaktuk and other Beaufort Sea communities expressed concern at various stages of the review, that artificial islands might anchor and stabilize landfast ice and, by delaying break-up, for example, may impede the movement of beluga whales into Kugmallit Bay at the end of June or early July.

In view of these concerns, the Panel requested additional information about the stabilization of landfast ice from the Proponents to supplement that contained in the EIS. This additional information was further supplemented by the Proponents, by the Department of the Environment, and by intervenors at Resolute, Tuktoyaktuk and Inuvik. [16]

The studies by the Proponents and the Department of the Environment, using observations for the 1973- 1983 period, indicated that the artificial islands built to date cannot be shown to have had any detectable effect on the formation, growth or break-up of the landfast ice in the Richards Island and Kugmallit Bay area. The evidence suggests that spacings between islands of five to ten kilometres may not present any significant influence on ice patterns. No research has yet been undertaken on closer spacings. The islands create rubble piles around them. The persistence of rubble piles, which affect travel across the ice, would be expected to continue for many

years if the islands were not removed to a depth well below sea level after being abandoned.

Assessing the effect of artificial islands on landfast ice is complicated by the natural variability of the landfast ice regime. There is insufficient scientific and local evidence to separate the natural variability of landfast ice conditions from those that may be attributed to the presence of artificial islands. In the opinion of the Panel, unless the natural growth and break-up of landfast ice is better understood in the Beaufort Sea area, the role of artificial islands on the stabilization of landfast ice will continue to be controversial and difficult to assess.

The Panel notes that the Proponents gave a commitment to continue to monitor the effects of artificial islands on landfast ice.

30 The Panel recommends that further research be carried out by the Proponents, the Department of the Environment and the Department of Fisheries and Oceans to determine the influence of artificial islands on the growth and break-up of landfast ice.

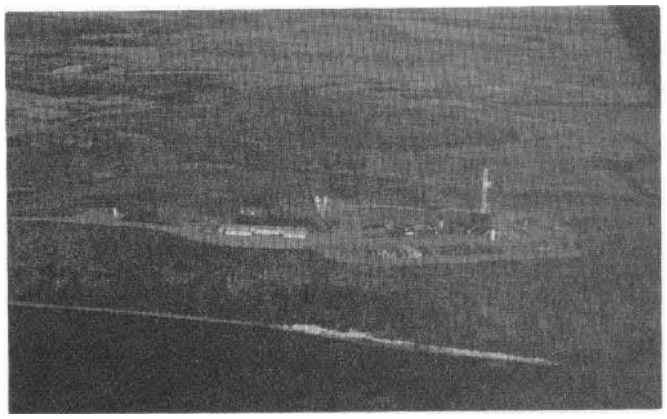
The Panel concludes that, if research proves ice break-up in Kugmallit Bay is being delayed due to the Proponents' activities to the detriment of resident hunting activities, the Proponents, if requested by the resident hunters, should take appropriate mitigative action such as using an icebreaker to help accelerate break-up.

6.3.4 Onshore Production Facilities

The location of onshore production facilities will be determined in large part by the sites of major oil discoveries. Aspects of production facilities have been outlined in the EIS including gas and water separation equipment, processing facilities, storage tanks and sumps, all of which are conventional in the oil industry world-wide and can be constructed in an environmentally acceptable manner. In addition, the Proponents have had considerable drilling experience on land since 1965 in the Mackenzie Delta region, and regulatory processes have proven adequate to prevent serious environmental problems. Site reclamations over the last decade have also been successful.

It is also apparent to the Panel that the initial choice of a site for production facilities is one of the greatest determinants of the magnitude and nature of potential environmental impacts. Therefore, a review of siting proposals by government environmental agencies remains particularly important. The Panel concludes this is best undertaken by the existing regulatory authorities using existing review processes, or those processes which develop as part of the new northern land use planning initiatives.

The Panel concludes that onshore production facilities can be constructed in an environmentally acceptable manner provided that appropriate regulatory requirements are met and effective surveillance and monitoring are undertaken.



The Panel concludes that onshore production facilities can be constructed in an environmentally acceptable manner provided that appropriate regulatory requirements are met and effective surveillance and monitoring are undertaken.

6.4 Arctic Tankers

6.4.1 Overview

The potential effect of year-round tanker traffic on the biological and physical environment of Canadian Arctic waters was the most frequently raised concern during public sessions in communities located along the proposed tanker route. Although the Proponents and Technical Specialists told the Panel that the Arctic tankers would, if constructed and operated as proposed (see Section 3.6.2), be the safest oil tankers in the world, intervenors questioned whether the design and performance claims of the Proponents could be proven. Many intervenors were also concerned about the effects of icebreaking on ice regimes, human travel and safety, and wildlife. In addition, they expressed concern about the effects of vessel sound on marine mammals.

The Panel has stated its preference for a small-diameter buried pipeline as a first step in a phased approach to the transportation of oil from the Beaufort Sea. At the same time, the Panel recognizes that tankers would receive serious consideration by the Proponents and governments, particularly if oil is discovered at deep-water locations. The Panel believes that not enough is known at this time to fully assess the potential effects of year-round tanker traffic, nor does it appear that there is sufficient government preparation to support this traffic. On the other hand, there is adequate time, should the Proponents and governments act quickly and effectively, to resolve these difficulties prior to the need for year-round transportation of oil by tanker, particularly if the first phase of production involves a small-diameter pipeline.

In order to resolve these difficulties, the Panel describes an evaluation process that, in its opinion, must be carried out by the Government of Canada before year-round Arctic tanker transportation of oil is approved. The evaluation consists of two stages:

A. The Research and Preparation Stage; and

B. The Two Tanker Stage.

A. Research and Preparation Stage

The Research and Preparation Stage would begin immediately. The **Research Stage** would focus on baseline information on the distribution and normal behaviour of wildlife that would be affected by tanker traffic, the hearing sensitivity and communication processes of marine mammals, and the natural variations in ice regimes. The **Preparation Stage** would focus on government support systems, namely communications, hydrographic charts, weather, ice and hazard detection systems, and government and industry oil-spill contingency plans. These two components are described in more detail later in this section. In addition, government would continue its review of current shipping regulations, ship design requirements and support systems to ensure that these are adequate to address the risks involved in the transport of oil.

During the Research and Preparation Stage, the Proponents could design, build and test the Arctic tanker (as described in Section 3.6.2).

The Panel is aware that the proposed Arctic tanker would be required to pass a number of Coast Guard inspections and sea trials to ensure that the vessel was designed, constructed and equipped to comply with all conditions necessary for its intended service. In addition to the preceding, the Panel is also predicating the acceptance of the Arctic tanker on the high design and performance objectives given by the Proponents. The vessel would also be evaluated by ship classification societies to obtain marine insurance ratings. Because the Proponents propose to exceed existing standards involved in these tests, the Panel is aware that further inspections and sea trials are necessary to verify the Proponents' claims for the performance of these vessels. These sea trials should be conducted with a non-polluting cargo and be held in an area other than along the proposed tanker route in order not to disturb the collection of baseline data. For example, the tanker could travel to an area consisting of ice-covered waters that would be remote from the proposed tanker route. The Government of Canada should ensure that these inspections and sea trials are carried out and that the results of these inspections will outline the specific **conditions for use** under which the Arctic tanker may operate. These conditions for use could be altered, depending upon the performance of the tanker over a number of years of operation.

2. **Two Tanker Stage**

Some effects of tanker traffic cannot be completely determined until the ships actually enter northern waters. To undertake such tests, safety requires two vessels so that one may relieve the other in the event of difficulties. The Two Tanker Stage would begin after the relevant baseline studies were assessed, and government support systems and oil-spill contingency plans were in place. After two tankers had undergone the necessary sea trials and inspection processes called for in the Research and Preparation Stage, the Two Tanker Stage would involve two tankers transporting oil along the tanker route. A comprehensive monitoring program would be initiated to evaluate the effects of the Two Tanker Stage on the distribution and behaviour of wildlife and on ice regimes. If the research and monitoring programs indicate significant adverse environmental effects, the regulatory agencies should order the conditions for use to be changed.

Following the Two Tanker Stage, the duration of which would depend upon the research and monitoring program, the Government of Canada would decide whether tankers would be allowed, the conditions for use and the number of tankers. The conditions for use might necessitate steps such as rerouting of ships, altering schedules to avoid critical times or areas of biological activity, changes to ship speed or ultimately cessation of tanker traffic. The Proponents should be prepared, as a condition of approval, to comply with all conditions for use.

The actual construction of the tankers could start at any time, provided that the Proponents are aware that there is a chance that they may end up using their tankers elsewhere in the world, if adverse environmental impacts are identified and proven to be unacceptable as a result of continued use in the Arctic.

As a result of information presented by the Proponents, intervenors and technical experts, the Panel concludes that the features described by the Proponents could ensure the safe transport of oil by tanker, subject to verification of the ability of the Arctic tanker to meet the performance objectives as stated in the EIS and associated documents.

6.4.2 Navigation

The Proponents acknowledged that for an Arctic tanker operating year-round through the Northwest Passage, accurate information on its position at all times is vital to safe operation. To this end the proposed Arctic tankers would be equipped with a variety of navigation systems including conventional as well as the latest electronic and satellite systems for navigation. These systems would be used for position-finding as well as for ice and hazard detection. Advanced communication systems would be used to obtain information on weather, sea ice and oceanographic conditions that have been gathered by conventional weather stations, airborne and shipborne radar, and satellites. Several research programs are presently in progress to refine and improve current navigation systems and to advance the state-of-the-art in Arctic navigation.

The Proponents stated that existing shore-based aids to navigation are inadequate for year-round Arctic tanker shipping. However, the Canadian Coast Guard stated that aids to navigation could be placed along the tanker route, as necessary, and that such steps are already in the planning stage. A new navigation satellite system, the NAVSTAR satellite, currently under development in the United States, might also be available to permit vessels in Arctic waters to determine their position continuously to within 100 metres. This system could be important in areas where radio positioning systems were not available along the proposed tanker route. The Panel believes that the Department of Transport must establish all necessary aids to navigation before any approved oil tanker traffic proceeds.

The Department of Fisheries and Oceans indicated that further work is needed to bring present hydrographic charting of the

proposed tanker route up to Canadian standards for shipping. They stated that completion of this charting could require five to ten years at an accelerated pace.[17] The Panel believes that completion of the charts for any proposed route must be a precondition of approval for any Arctic oil tanker traffic.

The Panel recommends that before transportation of oil by any tanker is permitted:

33 necessary navigation and communication systems, and weather, ice and hazard detection systems be operational; and

34 hydrographic charting for the proposed tanker route be completed.

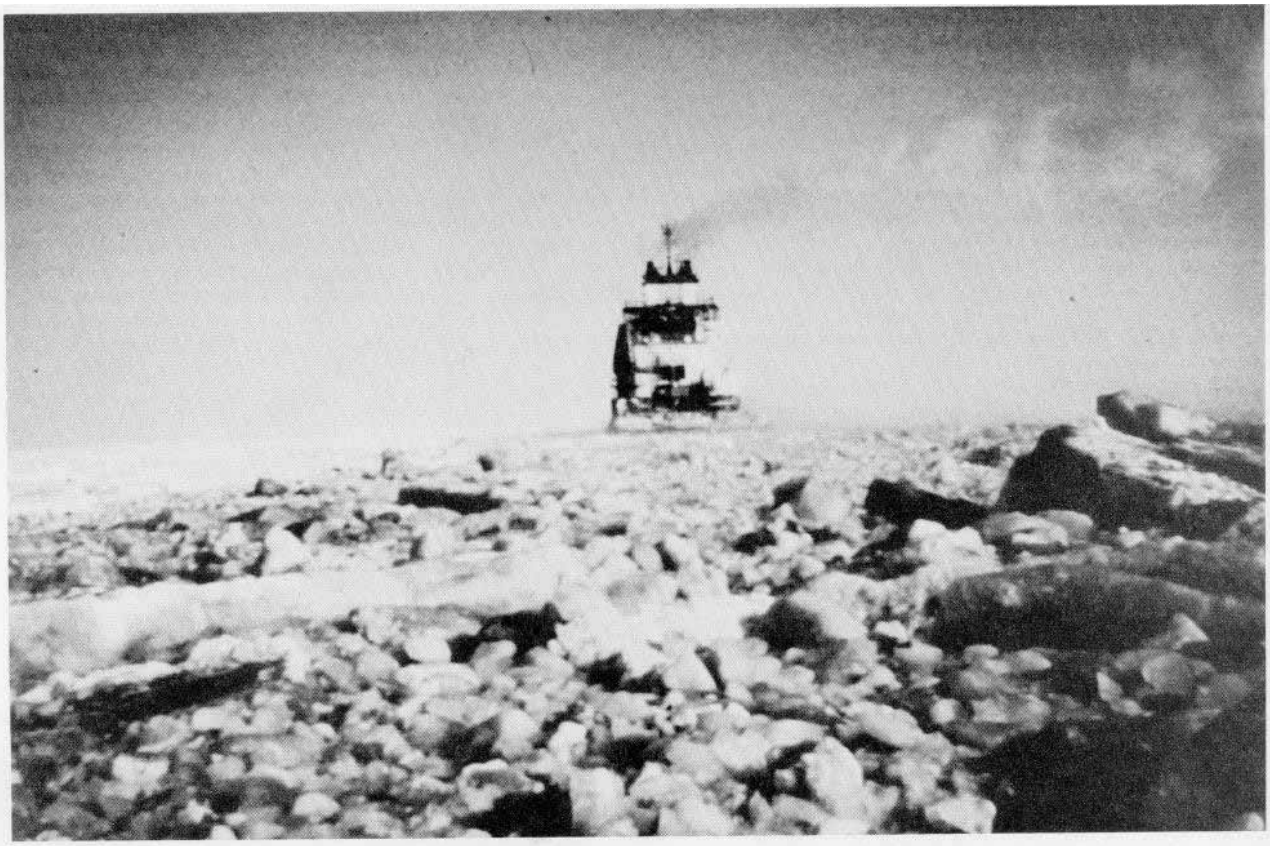
6.4.3 Effects of Icebreaking

The Panel is aware that the use of coastal waters cannot and should not be restricted to a particular user group. But where, as in the Arctic, coastal communities depend to a great extent upon the harvesting of marine mammals and fish for their livelihood, it is necessary to consider carefully the environmental effects of the proposed shipping activities.

Assessment of the effects of icebreaking is complicated by the natural variations in physical and biological environments along the proposed tanker route. There are substantial year-to-year variations in the nature and extent of the ice cover. Seal and other wildlife populations are known to vary significantly in numbers and distribution from year-to-year, due in part to changing ice patterns. The social significance of these wildlife species makes it important to understand the variations as thoroughly as possible.

6.4.3.1 Effects of Icebreaking on Break-up and Freeze-up

Several intervenors expressed concerns that the year-round transit of ships through Arctic waters would alter local ice regimes along the proposed tanker route and change the timing of spring break-up and fall freeze-up. It was suggested that this could affect the distribution of wildlife and the opportunity for winter travel and hunting.



Several intervenors expressed concerns that the year-round transit of ships through Arctic waters would alter local ice regimes along the proposed tanker route and change the timing of spring break-up and fall freeze-up.

In the Eastern Arctic, concerns were expressed that icebreaking would delay the formation of the ice in Lancaster Sound in the fall and cause changes in timing of spring break-up of the ice cover in Lancaster Sound and Barrow Strait. There was speculation that the stabilized ice edge could form further to the west and that many areas of Lancaster Sound could become inaccessible to hunters as a result. Statements were also made that changes in the position of the ice cover could change the patterns of biological productivity throughout Lancaster Sound. [18]

In the Western Arctic there were reservations expressed about the Proponents' understanding of the effects of continual icebreaking in Prince of Wales Strait and Amundsen Gulf and the possible changes to the ice regimes and timing of break-up and freeze-up. It was suggested that these changes could alter the distribution of wildlife.

There was considerable technical discussion at public sessions on the effects of icebreaking on ice regimes. The Proponents contended that ship traffic would not significantly affect ice conditions such as freeze-up and break-up. They suggested that if there were effects, these would be masked by the natural variations in the ice cover. The Proponents presented information in the EIS and the EIS Supplementary Information that described the year-to-year natural variation in ice patterns in the Beaufort Sea and Parry Channel. [19]

The Baffin Region Inuit Association argued that it surely could not be denied that, at some level of shipping, there may be significant effects on distribution of landfast ice. They noted that the icebreaker John *A. MacDonald* and the *M.V. Arctic* were observed to create cracks in the ice cover perpendicular at some locations to the direction of the ships' movements. They suggested that as a result of these cracks, ice floes could break off prematurely into Lancaster Sound, under certain air temperature, current and wind conditions. [20]

The concern was also expressed that with frequent ship passages Lancaster Sound might not freeze up or there would be larger areas of open water than presently occur. It was indicated that hunters understand the natural conditions, but when ships are in the vicinity, the behaviour of ice is not so easy to predict and therefore the risk to hunters increases.*'

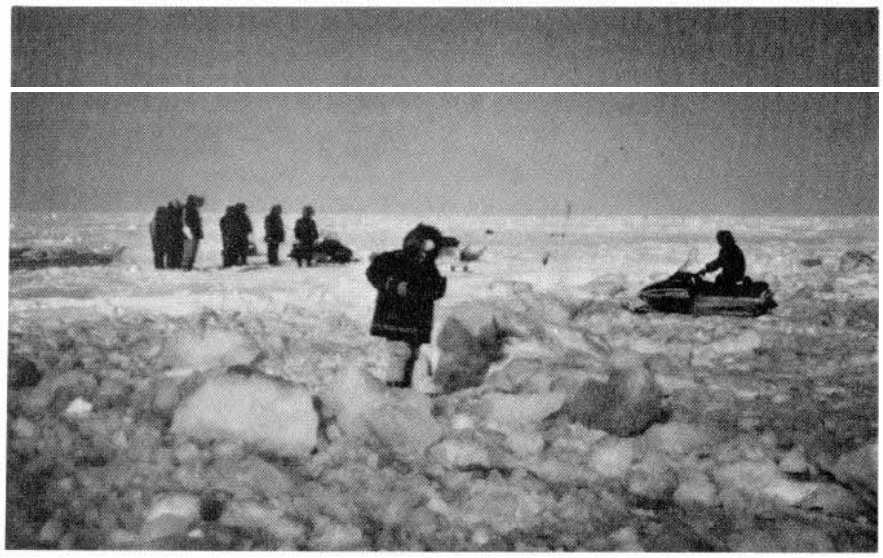
While the Proponents were convinced that enough is known to predict ice effects, Dr. P. Greisman, a Technical Specialist in physical oceanography, concluded that the effects of ship traffic on break-up and the stability of floe edges are still not understood. A few ship transits might not appreciably weaken the ice cover and cause break-up but numerous passages might destabilize ice regimes. He concluded that the amount of traffic at which icebreaking would become a problem has not been established.

The Department of Fisheries and Oceans also expressed the opinion that the level of understanding of the physics responsible for ice distribution was not adequate for the Proponents to conclude that vessel tracks would not affect break-up or freeze-up. The Department recommended a research program be implemented prior to significant increases in icebreaking activity [21] The Panel concludes that further basic research and long-term monitoring are required to determine what effects, if any, icebreaking activities could have on ice regimes.

31 The Panel recommends that the effects of icebreaking on ice regimes be further studied by the Proponents and the Government of Canada and that these studies include field research and monitoring during the Two Tanker Stage.

6.4.3.2 Effects of Icebreaking on Human Travel and Safety

Many northern residents expressed concern that the tracks of icebreaking tankers might be a hazard or inconvenience to



Experienced hunters and research scientists worked together during the icebreaker track research program.

hunters because of delays in freezing, because of the presence of rubble from repeated ship passages and because hunters might be unaware of the presence of a track in bad weather conditions. Although the Proponents provided evidence from experiments in landfast ice at McKinley Bay using the icebreaker M.V. *Kigoriak* to show the safe delay times after which hunters could, in winter, cross a track soon after it is made, the extrapolation to conditions in other areas such as Parry Channel was questioned. There is evidence that a ship's track will freeze rapidly in winter, usually within one or two hours where there is little current. In June, depending upon the site and weather conditions, refreezing may be very slow or may not occur at all.

The concern for human safety was different from area to area depending upon human activity and use. People were concerned about areas near settlements, hunting areas and inter-island travel routes. One area of concern was Prince of Wales Strait, but the Proponents stated that in some years there are no crossings.[23] Another area of concern was Barrow Strait, since many hunters cross between Resolute and Prince of Wales Island and Somerset Island from March to June.[24] The issue involved not only the crossing of ship's tracks, but also the potential for premature break-up, interruptions to hunting and the potential ecological effects of tankers traversing Barrow Strait year-round.

Some intervenors requested that a means be devised to advise winter travellers of the approach of tankers or the existence of open ship tracks. The Proponents agreed to make all reasonable attempts to notify people of the approach of ships and to consult with communities to develop mutually acceptable procedures. Those procedures should be applied during periods of intense human activity within the proposed shipping routes.

32 The Panel recommends that, in order to assess the effects of icebreaking on human travel and safety:

a) the Government of Canada and the Proponents, in consultation with the communities in the affected areas, gather information on the frequency and extent of human activity on the ice in relevant locations along the proposed tanker route;

b) in areas of concern, the Government of Canada and the Proponents carry out experiments to evaluate the potential hazard created by vessel tracks; and

c) the Proponents, in areas where ship track crossing may be a potential problem, establish with local communities an effective notification system about the approach of ship traffic.

6.4.3.3 Effects of Icebreaking on Wildlife

Several communities expressed concerns about the effects of icebreaking on wildlife. These concerns included the potential for icebreaking to change or disrupt animal life and habitat, or to cause seals and their predators to abandon their current habitat in the vicinity of vessel traffic. Intervenors were also concerned about the possibility that seal dens could be flooded by passing ships. Research on these concerns is complicated by the lack of information about where seals build their, dens. The Panel addresses these concerns in Section 6.7.3.

6.4.4 Effects of Vessel Sound

The effects on marine mammals of underwater sound produced by ships were discussed by many participants in this and previous public reviews.

The Panel received information on three aspects of the underwater sound issue: the modelling and measurements of the magnitudes of sound produced by ships, the modelling and measurement of the propagation of sound from the ships to the marine mammals over a range of distances from the ships, and the hearing sensitivities of marine mammals and the effects of vessel sound on them.

The Proponents presented information which had been gathered in modelling and sound propagation studies for various types of vessels, particularly with respect to propeller sound.[25] On the basis of the preceding information, it is apparent that predictions of vessel sound, particularly propeller sound, would be reasonably accurate. Sound produced from a ship while breaking ice would be more difficult to predict, but this could be measured directly to provide a reasonable understanding of the sound magnitudes at the source. Evidence shows that the sound of breaking ice would not be significantly different from natural ice noises. Peak sound production may occur when reversing under full power during icebreaking operations in heavy ice.[26]

The Panel received and reviewed much of the testimony which had been tabled during the Arctic Pilot Project (APP) review.[27] Although the APP involved a vessel different from the proposed oil tankers, in subsequent discussions many of the same problems were identified for the Beaufort Sea proposal. Independent experts testified that the limited data on the physiological and behavioural responses of marine mammals meant that little could be said about potential effects of underwater sound without a great deal of further research. This opinion was repeated at several points during public sessions.[28]

The effects of vessel sound on marine mammals are addressed in detail in Section 6.7.9. Recommendations for specific research are also outlined, and this research should be initiated before tankers are allowed to operate in the Arctic.

6.4.5 Marine Support and Regulation

Although safe navigation of Arctic tankers would be the responsibility of the Proponents, the Government of Canada has the responsibility to ensure that all shipping in the Arctic is properly supported and regulated. Support activities would include provision of navigation and weather information, emergency response, and search and rescue services. Regulatory activities would include the monitoring and control of vessel traffic and ship routes, preclearance of vessels for Arctic operations and the protection of the Arctic environment.

6.4.6 Implications for Arctic Shipping

Vessel traffic is likely to increase in the Arctic waters as hydrocarbons and other minerals are shipped south and fuel and other supplies needed by resource developers and by communities are brought to the North. Vessels presently in use do not meet the standards for Arctic tankers proposed by the Proponents. These standards substantially exceed the requirements of present regulations governing shipping in the Canadian Arctic. This poses a real dilemma for the Panel. The Panel would prefer that the Proponents' standards apply to all ships throughout the Arctic carrying oil but recognizes this would interfere with existing services supplying fuel to northern communities and installations in the summer. Because of the presence of icebergs and periodic adverse atmospheric conditions in summer, the Panel believes that this season could be hazardous for vessels. Accordingly, the Government of Canada should examine regulations applying to summer shipping to ensure that these regulations provide for safe summer shipping operations.

Substantial volumes of oil may be carried south from other hydrocarbon developments by large vessels operating under ice conditions similar to the proposed Beaufort Sea-Parry Channel route. The Panel believes that such vessels must meet design and operating standards similar to those of the Proponents.

6.4.7 Conclusion

The Panel believes that the Arctic tanker, if built and operated as proposed by the Proponents, could be safely operated in Arctic waters. The potential environmental effects of tanker traffic, the concerns about possible tanker operations, the data deficiencies and the need for further baseline research about marine mammals lead the Panel to the conclusion that tanker transportation of oil should be subject to a comprehensive evaluation before obtaining final approval. Two tankers would be used for testing purposes, with final approval given for phased increases in tanker traffic if initial indications suggest that it could be shown that long-term adverse environmental effects would remain within acceptable limits.

Many of the potential environmental effects cannot be examined theoretically, and monitoring programs must be used to gather relevant information. The Panel believes some of these studies could be undertaken with a Class 8 icebreaker under consideration by the Government of Canada, rather than with the proposed Class 10 tankers. Tests of tanker performance, on the other hand, can only be accomplished using the proposed Arctic tankers.

The option to refuse final approval of Arctic tanker transportation of oil on environmental grounds must be retained if renewable resources are to be protected.

Some of the research studies should be designed to continue throughout the Two Tanker Stage and into a long-term monitoring program which should be established with respect to all ship traffic along the proposed tanker route.

As demands for Arctic resources increase, there will be more proposals for Arctic shipping. The time for developing the knowledge necessary for managing this shipping is now. The Panel believes that much can be learned from the two-stage evaluation process it has recommended. Information from this evaluation will be valuable in improving the future design and performance of Arctic vessels, developing policies and regulations for Arctic shipping and evaluating the number and types of ships which would be allowed to transit Arctic waters.

22 **The Panel recommends that the Government of Canada approve the use of oil tankers to transport Beaufort Sea oil only if:**

a comprehensive government Research and Preparation Stage is completed by governments and industry; and

a Two Tanker Stage using Class 10 oil-carrying tankers demonstrates that environmental and socio-economic effects are within acceptable limits.

6.5 Pipelines

6.5.1 Introduction

The transportation of oil by pipeline from Richards Island in the Mackenzie Delta to Edmonton, Alberta was an important subject of the Panel's review. All pipeline options (see Section 3.6.1) were open for discussion, but most participants concentrated attention on small-diameter buried lines. As the public sessions progressed, there was less and less discussion of the large-diameter pipeline option. There was a general consensus that the magnitude of environmental and socio-economic impacts was somewhat proportional to the rate and scale of industrial development (see Chapter 5 for socio-economic considerations). On the basis of this consensus and the supporting documentation the Panel has concluded that small-scale, phased production and transportation is the preferred option. This approach would minimize the negative consequences of oil and gas production and transportation activities and should enhance lasting economic benefits to northerners over the long term.

In the mid 1970's the overland pipeline transportation mode for a gas pipeline was discussed in detail at the hearings of the Mackenzie Valley Pipeline Inquiry. The conclusion of Justice Berger was:

> "that it is feasible, from an environmental point of view, to build a pipeline and to establish an energy corridor along the Mackenzie Valley, running south from the Mackenzie Delta to the Alberta border. Unlike the Northern Yukon, no major wildlife populations would be threatened and no wilderness areas would be violated. I believe that we can devise terms and conditions that will allow a pipeline to be built and an energy corridor established along the Mackenzie Valley without significant losses to the populations of birds, fur bearers, large mammals and fish."[29]

The Panel also had information available to it on the completed Trans Alaska Pipeline System, the proposed Alaska Highway Gas Pipeline, the Norman Wells Oil Expansion Project and the Polar Gas Project.

6.5.2 Gas Pipelines

Little information was provided to the Panel concerning gas production and transportation facilities. The Panel, however, believes that with the exception of some environmental problems identified in the Mackenzie Valley Pipeline Report and in other reports, such as the effects of frost heave on pipelines, the construction and operation of a gas production and transportation project in the Beaufort Sea-Mackenzie Valley region appears to be environmentally acceptable if environmental terms and conditions, yet-to-be-defined, are specified and enforced. Based upon the existing information available for the design and construction of pipelines in continuous and discontinuous permafrost, the Panel is satisfied that enough information is known to develop effective terms and conditions to ensure that a gas pipeline could be constructed and operated in an environmentally acceptable manner.

The Panel believes as well, that such a gas project could be socially acceptable provided that impacts resulting from population increases are of a small-scale nature.

In the Panel's view, production and transportation of gas separate from that associated with oil production, could precede the production of oil provided that the population required to produce the gas and operate the line will not be greater than that required for a 15,000 m^3/day oil production facility.

6.53 Small-Diameter Oil Pipeline Qption

In 1981 an EARP Panel concluded that a small-diameter, buried oil pipeline from Norman Wells, NWT to Zama, Alberta was environmentally acceptable under certain conditions.[30] The pipeline is now under construction.

Welding together two sections of pipe.

There was also a wide consensus among federal and territorial government departments making presentations to the Beaufort Sea Environmental Assessment Panel that a small-diameter buried oil pipeline could be built through the Mackenzie Valley in an environmentally acceptable manner given appropriate regulations, regulatory enforcement and monitoring procedures.[31] Technical experts reached the same conclusion.[32] Intervenor groups also contended that small-diameter alternatives provided the most environmentally acceptable development option, given certain conditions.

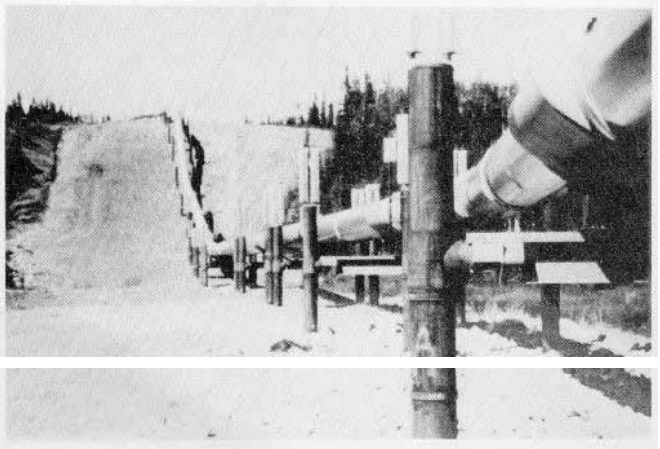
Opposition to any pipeline development was expressed by the Dene Nation and by a few individuals within communities, who urged that no development proceed until there has been a settlement of outstanding land claims.

In view of the near consensus on the environmental evidence and the Panel's own assessment of this evidence, the Panel concludes that a small-diameter buried oil pipeline (e.g. 400 mm) and the related production facilities can be constructed and operated in an environmentally safe and acceptable manner. In the future, if increased transportation capacity were desirable, the pipeline could be looped and pumping stations could be added. Such an approach minimizes the subsequent socio-economic effects, provides more economic benefits for northerners and allows incremental increases which spread any additional impacts over a longer period of time. Furthermore, a phased, small-scale development permits a continuing assessment of both environmental and socio-economic effects with the result that better mitigative measures could be adopted for future phases of the project.

23 The Panel recommends that, upon application, the transport of oil from the Beaufort Sea-Mackenzie Delta region through the Mackenzie Valley only be authorized to begin through a single, small-diameter buried pipeline.

6.5.4 Large-Diameter Oil Pipeline Option

Although a large-diameter oil pipeline (e.g. 1,000 mm) was presented as an option in the EIS, there was little discussion of such a pipeline by either the Proponents or intervenors at the Panel public sessions, A large-diameter oil pipeline, if constructed, would be mainly in an elevated mode in the North and in a buried mode in the South, similar to the Trans Alaska Pipeline System. Inasmuch as the Alaskan large-diameter



The elevated sections of the Alyeska Pipeline can expand and contract by virtue of sliding mounts that support the line. In permafrost regions, as illustrated here, the vertical support members are cryoanchors-the twin metal cylinders atop the support that contain gaseous ammonia which by a process of continual condensation and evaporation draws heat from the frozen ground, thereby ensuring the stability of the ground and the pipeline.

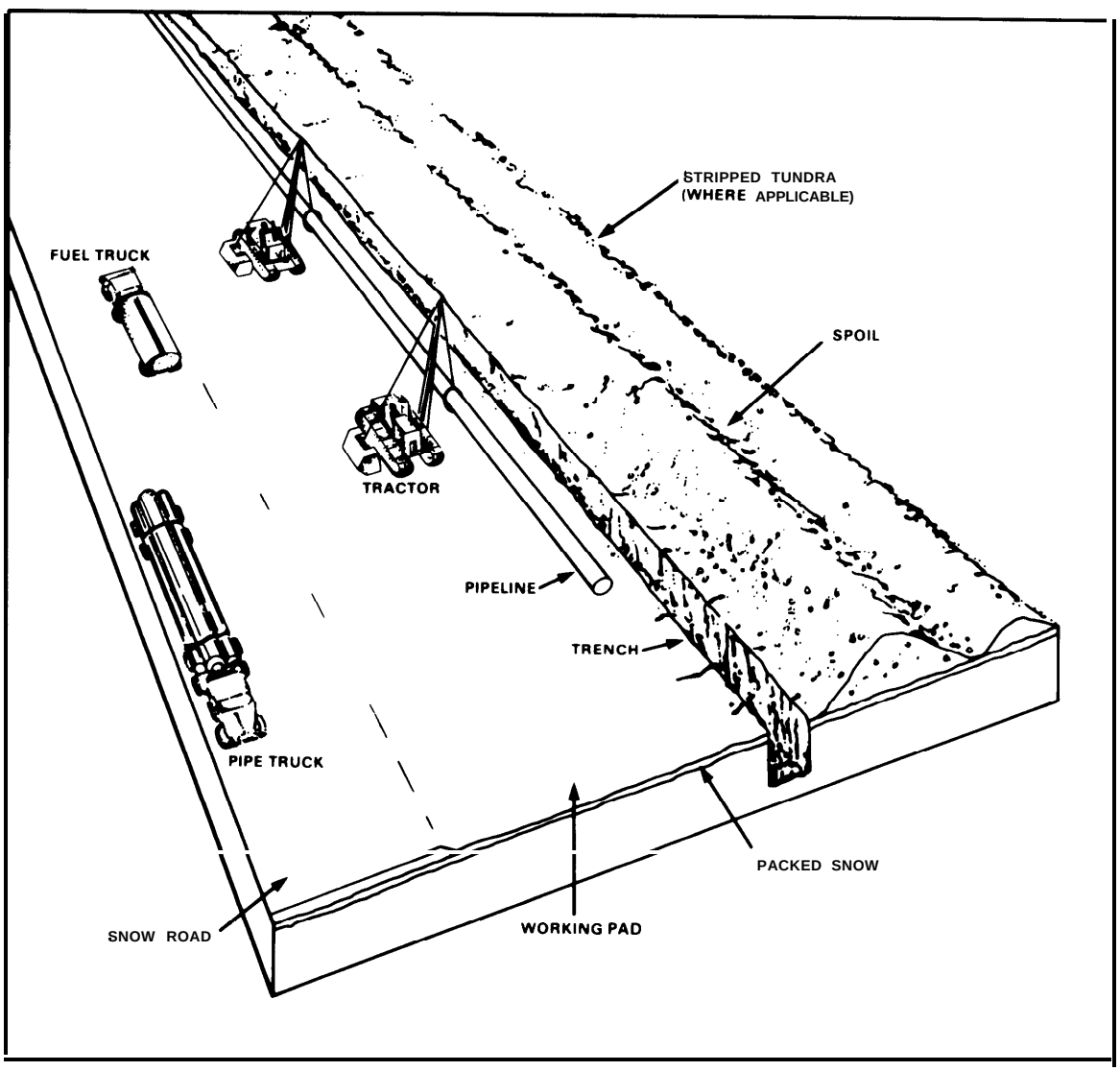
pipeline has already been constructed in continuous and discontinuous permafrost environments, and has been operating successfully in recent years with few problems, there appears to be no fundamental reason why a similar pipeline could not be constructed in an environmentally safe manner in the Mackenzie Valley. However, the socio-economic effects of such a pipeline appear to be unacceptable, and since no comprehensive public review has been carried out to address that concern the Panel concludes that, if a large-diameter pipeline is proposed in the future, the potential socio-economic effects must be subject to a comprehensive public review. If other pipeline projects have been completed through the Mackenzie Valley as part of the phased development concept, then a review with the Mackenzie Valley communities carried out by the government agencies involved may be sufficient. If, however, a large-diameter oil pipeline is the initial mode of transporting oil through the Mackenzie Valley from the Beaufort Sea-Mackenzie Delta region, a more formal public review process is required.

24 **The Panel recommends that a comprehensive public review on socio-economic grounds for a future large-diameter oil pipeline (e.g. 1000 mm) be undertaken if it is the initial mode for transporting oil through the Mackenzie Valley.**

NOTE: all further comments about pipelines in this chapter refer to a small-diameter, buried oil pipeline, unless otherwise stated.

6.55 Construction Phase Effects

With the experience gained during construction of the Norman Wells to Zama small-diameter oil pipeline, few new problems should be encountered in constructing a similar pipeline that



Buried pipelines in Permafrost regions would be built using snow roads for temporary access and snow work pads to minimize disturbance of the natural terrain

begins on the Beaufort Sea coast. Available technology and construction techniques in combination with informed right-of-way routing choices are expected to be adequate to avoid serious geotechnical problems.

The Proponents intend to use snow roads and other winter construction techniques, thereby eliminating the need for year-round road access in order to minimize environmental damage and terrain disturbance in the northern permafrost areas. In some areas with limited snowfall, however, snow-making may be required and the protection techniques may be less effective. Careful monitoring must be carried out to ensure that the winter construction techniques fulfill the planned mitigation functions.

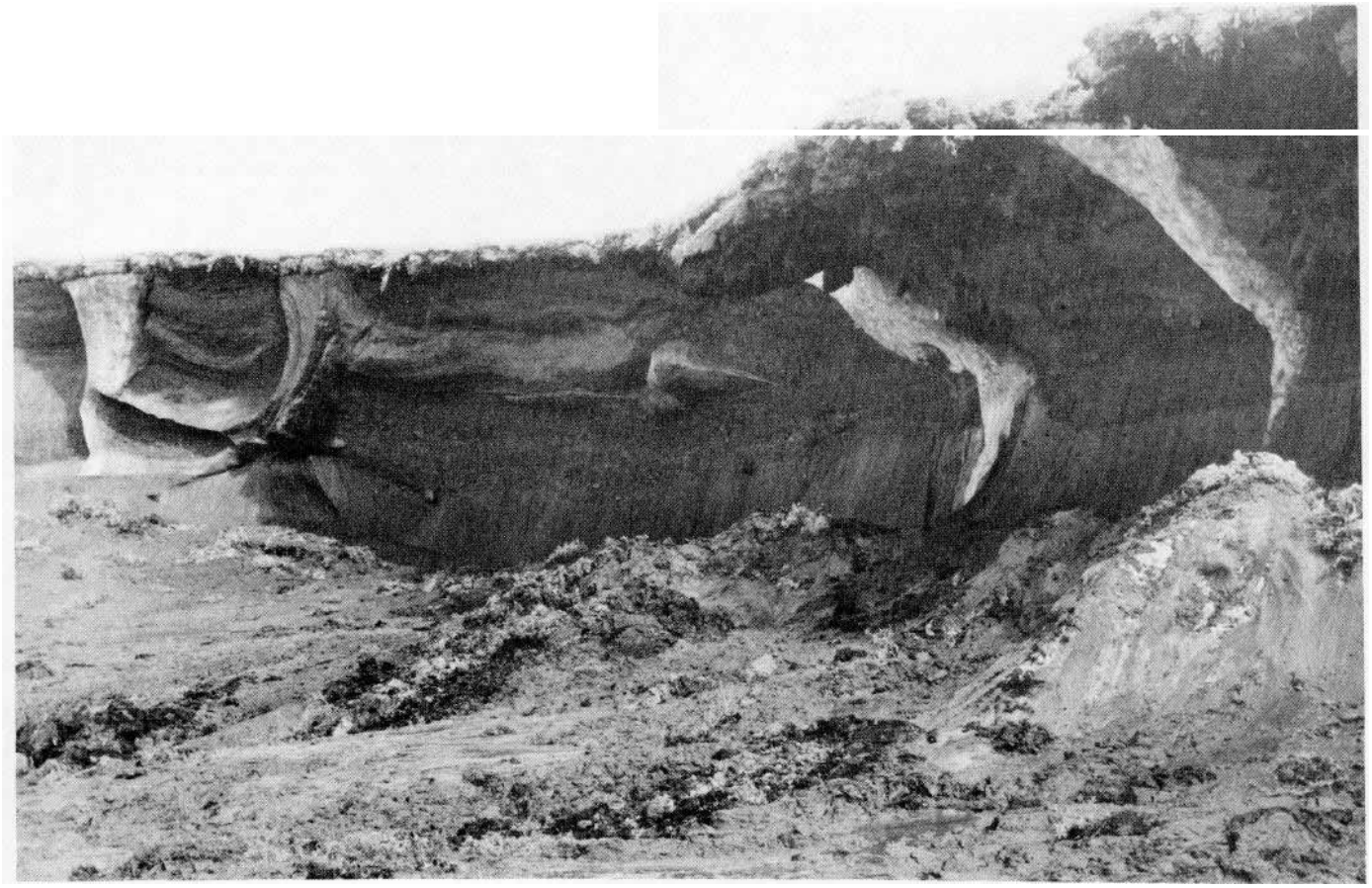
The potential problems of buried pipeline crossings of streams and rivers, particularly at Great Bear River near Fort Norman, N.W.T. and the Mackenzie River upstream from Fort Simpson, N.W.T., were raised by a number of intervenors. The Panel recognizes there must be proper regulatory control and full consultation among Department of Fisheries and Oceans, the Proponents, and local communities about the location of river crossings and the avoidance of important aquatic habitats, and about construction scheduling to avoid important fish migration periods. The Panel is satisfied that pipeline river crossings can be completed with minimal negative effect.

Each community in the immediate vicinity should be given the option of having an observer present at industry expense during the pipeline construction phase at river and major stream crossings, such as on the Mackenzie River or Great Bear River. Such a community involvement program will help alleviate local concerns about the integrity of buried pipelines beneath rivers.

The Panel concludes that the environmental effects of overall pipeline construction will be minimal if mitigative measures are implemented.

6.5.6 Operations Phase Effects

The Proponents presented considerable information about their plans for safe operation of an oil pipeline in the Mackenzie Valley. Most of their data relate to the design characteristics and safety features which are used to reduce the risk of oil spills.[33]



Four ice wedges exposed in a natural slump at Garry Island, N. W. T. The ice wedge at the left is 4m wide at the top.

It is apparent from the Panel review and comments by various participants that most of the significant environmental effects could be kept at an acceptable level. The Panel believes, however, that the Proponents are overly optimistic in their statements concerning the capabilities of pipeline leak-detection methods and that more attention should be given to direct visual observation techniques. The addition of intermediate mass balance metering stations at places such as Norman Wells, N.W.T., and Zama, Alberta would also improve the capability of the leak-detection system, especially necessary during winter months.

Maintenance of a pipeline in the absence of a summer road was an issue raised by several intervenors. In northern areas where ice wedges are numerous, particularly north of Inuvik, and where the upper part of permafrost is ice-rich, technical evidence suggested that the Proponents have likely underestimated the maintenance problems for the first few years after construction.[34] Local, unanticipated problems of stream erosion, channeling beneath the pipeline, thermal erosion, differential thaw settlement, and slope failure may occur. There is no evidence to suggest that pipeline integrity would be threatened, except by an extreme event, but rather that summer maintenance in the absence of a road may be significantly more difficult than the Proponents state.

The Panel concludes that the Proponents should develop and design contingency maintenance plans prior to the initiation of pipeline construction to avoid summer maintenance problems similar to those that occurred in Alaska. These plans would be especially important since the Proponents have stated that there would not be any summer roads.

Pump stations and storage facilities along the right-of-way and the access routes to these facilities would have more site-intensive environmental effects than the pipeline right-of-way proper, but these could be reduced by proper initial site selection, waste management practices (air and water), sound abatement equipment and limitations on the activities of operations personnel. The Panel concludes that decisions on the number and location of pump stations are the responsibility of the Proponents and the regulatory authorities, but that site selection should reflect the views of local residents and the GNWT.

Direct effects on wildlife, due to the hunter access provided by a pipeline right-of-way, were discussed at length during the public sessions and in written presentations. According to most intervenors, a pipeline right-of-way in the forested areas, without a maintenance road, would have little effect on access during the summer months but during the winter months a right-of-way would improve access and potentially affect wildlife harvesting. Therefore, the Panel concludes that wildlife management and other control methods along the right-of-way should be determined by the responsible agencies, prior to the initiation of construction, and in consultation with local communities and Hunters and Trappers Associations.

Decisions relating to revegetation should be flexible and left to the regulatory authorities, This suggestion is made because of experience in revegetation studies in Alaska, the Mackenzie Valley and elsewhere. The Panel believes that revegetation, by whatever means, to minimize adverse disturbance is desirable, but it is not necessary for cosmetic purposes at sites where natural vegetation will become established in due time. Revegetation and reclamation practices along pipeline rights-of-way were not an issue during the Panel review.

6.5.7 Corridors

Selection of an energy transportation corridor and a pipeline right-of-way within the corridor were subjects of concern to many participants in the Panel review. It was generally agreed that it was advisable to select one corridor for this project anticipating that it would accommodate other future developments, but there was controversy over an appropriate configuration of rights-of-way within the corridor. Potential problems mentioned by participants at the public sessions included: effects on wildlife; geotechnical and biophysical concerns which vary the need to have either wide or narrow separation between facilities such as two buried pipelines; the advisability of having dissimiliar utilities such as pipelines and power lines use a common or adjacent right-of-way; and maintenance problems and liabilities when different corporate ownerships are involved. The communities in the Mackenzie Valley, in general, were opposed to the development of multiple rights-of-way and proliferation of facilities.

The Panel concurs with DIAND and the GNWT that one general utility corridor, which would include the initial pipeline right-of-way, is the appropriate development alternative for the Mackenzie Valley at this time. Potential expansion of the pipeline system and the need for other rights-of-way for other linear facilities within the corridor, however, necessitate that consideration be given to the long-term implications of corridor development.

The Panel encourages DIAND and the GNWT to define one energy transportation corridor in order to assist with the delineation of future rights-of-way. As a general principle, the Panel believes that there should be a single corridor.

6.5.8 Rights-of-Way

The adoption of common-carrier principles will initially limit unnecessary proliferation of rights-of-way for oil and gas transportation. Single lines can be looped or pumps can be added if there is a need for expansion. The issue of whether future facilities should be confined to single or adjacent rights-of-way cannot be prejudged at present, but it is the Panel's opinion that, where multiple rights-of-way are necessary, they should be developed within a single corridor, where practical. The boundaries of such a corridor and the precise location of rights-of-way within the corridor should be determined in consultation with local communities. Recognizing that initial right-of-way selection tends to predetermine the location of an energy corridor the Panel concludes that the route selection for an initial small-diameter pipeline should be undertaken in a manner which balances the present Proponents' interests with those of local communities and future potential users. Such a selection should be subject to public discussion and preferably within the DIAND and GNWT land use planning process.

6.6 Support Facilities

6.6.1 **Ports and Supply Bases**

At present the Proponents have ports and supply bases at Tuktoyaktuk and McKinley Bay and have used staging areas at locations such as Pauline Cove, Tuft Point, Wise Bay, and Summers Harbour along the coast. The Proponents consider a deep-water port eventually will be necessary to support production facilities and believe that none of the sites now in use may be suitable. There is a small possibility that a deep-water port will not be needed at all.[35] The Proponents expressed a wish to keep all options open until the most likely production sites are determined with greater certainty.[36]

Stokes Point and King Point on the Yukon Coast, and Wise Bay and Summers Harbour on Parry Peninsula, have been identified as potential deep-draft harbour facility sites, both by industry and in the Department of Indian Affairs and Northern Development Facilities Siting Study.[37] The Proponents stated that, because of physical restrictions, Tuktoyaktuk and McKinley Bay are not suitable sites for deep-draft facilities. The Proponents consider that the final site should be determined on the basis of the locations of the hydrocarbon reserves.

The Proponents' consideration of a deep-draft port at Stokes Point and/or King Point on the Yukon North Slope evoked extensive comments from public intervenors, the Government of Yukon and the federal government (Department of the Environment, Department of Fisheries and Oceans, Department of Indian Affairs and Northern Development). Intervenors' concerns about the Proponents' proposal included questions about the need for a deep-draft port, the acceptability of the site-selection process, the direct impacts of the shore facilities and the indirect or associated impacts caused by any related infrastructure such as roads. Opposition to development on the North Slope commenced with the Berger Inquiry and has been centered mainly upon the potential impacts on the Porcupine Caribou herd and the effects that development could have on the establishment of a national park in the western portion of the North Slope.

The Panel heard sufficient evidence, given the present state of knowledge, to recommend against any deep-water port west of Kay Point because of potential impacts on the Porcupine Caribou herd, especially in the calving period, and of potential adverse impacts to fish and marine mammals. Representation by the Department of the Environment concerning park proposals and park evaluation studies provided documentation of natural values, possible boundaries and proposed management guidelines. Parks Canada officials stated that developments within or close to the proposed park are incompatible with its wilderness themes. They also stated that they were prepared to undertake a public boundary review process to examine the proposed boundaries in detail.[38]

The Panel agrees with the intervenors that the environmental conditions for a port facility at King Point are less restrictive than for Stokes Point. Evidence from caribou experts indicates that controlled development at King Point is unlikely to have adverse consequences on the Porcupine Caribou herd.[39] Questions were raised about whether a causeway at King Point would restrict nearshore movement of fish. The Panel considers this to be a problem requiring research and proper design.

It is generally expected that a deep-water port would be associated with a supply base for pipeline terminals and related equipment facilities, but it would also be possible that alternative ports and supply bases might be proposed, particularly if the oil and gas reserves to be developed were in nearshore waters. The Panel concludes that although the environmental effects at sites east of Kay Point on the Yukon North Slope and sites east of the Mackenzie Delta can be made acceptable it is also desirable that these facilities should only be developed on a common-user principle. Preferably, port and supply bases should be limited to existing sites or to one new site if a deep-water port facility were eventually needed.

6.6.2 **Supply Operations**

The supply operations required to support the Beaufort Sea oil and gas production and transportation proposal include increased marine traffic in the Beaufort Sea, increased river traffic along the Mackenzie River, increased road traffic over the Dempster Highway and increased air operations to and from various facilities. The Proponents supported the existing regulatory controls on air and marine traffic, stating that these were adequate to limit any negative environmental effects, particularly given the commitment to special mitigation measures in the EIS.

With respect to air traffic, the Proponents committed themselves to avoiding low overflights of important waterfowl nesting habitats and other sensitive areas such as caribou calving grounds. Such measures would be government monitored to ensure that they were effective and if necessary, regulations could be modified. Department of Transport currently regulates air traffic in consultation with the Canadian Wildlife Service (CWS). The Panel considers this arrangement adequate at the present time.

Congestion of traffic on the Mackenzie River system is not yet a problem but it may become so in the future. Some form of river traffic management system may be required to help avoid dangerous congestion at critical points along the river and to allow for efficient use of the Mackenzie River system for freight. The Proponents have committed themselves to ensuring that basic community supplies are delivered as a first priority for barge traffic on the Mackenzie River. If production occurs and the development of a local topping plant follows, this could reduce the volume of petroleum products currently shipped down the Mackenzie River, again delaying the need to expand the present river capacity.

Marine supply traffic to and from offshore Beaufort Sea operations is currently strictly regulated by the Canadian Coast Guard for both human and environmental safety. This regulatory framework was considered adequate by most participants but there were important concerns raised by the residents of Tuktoyaktuk on the impacts of ship traffic on whales and on

the livelihood of the Inuvialuit hunters. Solutions to this potential problem were only discussed in very general terms.

The Panel concludes that the existing government regulatory processes and support services for air traffic, barge traffic and marine supply traffic are capable of ensuring satisfactory performance. It is important to stress, however, that this conclusion is predicated on the assumption that a government-approved environmental monitoring program will be in place prior to the onset of expanded developments.

6.6.3 Quarries

The Proponents consider that Mt. Sedgewick, to the southwest of King Point, would make an excellent source of rock if linked to King Point by road. The expert opinion on caribou is that heavy traffic on a road to Mt. Sedgewick would have little or no environmental effects during the winter, but such traffic could have serious adverse effects during periods of spring and summer caribou movements.[40]

Parks Canada expressed the wish to incorporate Mt. Sedgewick within the proposed national park boundaries as this site is integral to the wilderness values of the area. There is a possibility that other potential rock types and sources would be available such as Mt. Fitton and they should be investigated. The need for rock for offshore drilling and production structures may not be as great as originally expected because of changing technologies for these facilities.

The Panel believes it would be unfortunate to build a road to Mt. Sedgewick from King Point if the need for rock can be met by another source or if an alternative method of island-building reduces that need. For these reasons, the Panel concludes that a quarry at Mt. Sedgewick should not be developed until all these aspects are completely investigated.

6.6.4 Roads

Another controversial aspect of the King Point proposal is the road linking King Point to the Dempster Highway. Intervenors and caribou experts were virtually unanimous in agreeing that the physical presence of a road might not be seriously disruptive to caribou, but that the access for hunters created by the road could have serious adverse effects. For this reason the Panel believes there should be no construction of a road linking King Point with the Dempster Highway unless access can be strictly controlled.

Activities during the caribou movement periods should be stopped or controlled under conditions acceptable to the Porcupine Caribou Management Board. This Board, consisting of territorial governments and native representatives should develop regulations for control of traffic and other human access.

6.6.5 Conclusion

The Panel believes that, by limiting the spread and proliferation of facilities in the Beaufort Sea region, environmental impacts can be kept within acceptable limits. Therefore, the Panel concludes that all onshore infrastructures related to offshore and onshore hydrocarbon production should be based on common-carrier, common-processor and common-user principles.

The Panel recommends that:

25 **no port or supply base be permitted west of Kay Point;**

50 **only one deep-draft port be permitted on the Beaufort Sea coast unless offshore production areas are so far apart that two separate deep-draft ports become necessary;**

51 **each deep-draft port proposal be subject to a formal public review process, preferably the regional land use planning process;**

52 **development of a quarry at Mt. Sedgewick not be permitted pending a further public review (preferably through the regional land use planning process) of the need for such rock and alternative sources of rock such as Mt. Fitton; and**

53 **if there is a proven necessity for use of a quarry at Mt. Sedgewick, the Porcupine Caribou Management Board regulate access to the quarry.**

6.7 Offshore Biological Effects

6.7.1 Introduction

Offshore wildlife species form an important part of the northern renewable resource economy. Major effects on these species, such as those from large oil spills, have been discussed and the long-term impacts evaluated. The Panel also heard views on the possible incremental, cumulative effects upon principal marine species of production and transportation of oil and gas from the Beaufort Sea. Those effects, although subtle, could exert long-term impacts on animal populations and thus would be more difficult to evaluate. Predictions are limited by the data available and it was in this respect that the Proponents' EIS and EIS Supplementary Information provided a valuable compilation and interpretation of the existing data base.

The Proponents stated that their normal, offshore operations would generally result in negligible-to-minor impacts upon offshore species and that, where long-term effects might be felt, they would be localized and not of regional significance.

Intervenors spoke to the Panel of the value to local people of animal species, such as ringed seal, whales, polar bears and marine birds, and of the need to conserve these resources for future generations.

The Department of Fisheries and Oceans advised the Panel that the monetary value of the marine fisheries in the Arctic, including fish and marine mammals, is not high when compared with the marine fisheries of the east and west coasts of Canada. However, DFO cautioned that:

> "in cultural terms and with respect to meeting the subsistence needs of the Indian and Inuit populations their importance is clearly very great. Loss of, or significant reduction in, these stocks would cause great distress apart from the biological implications of such a catastrophe."[41]

The Panel agrees with this evaluation. The Department of Fisheries and Oceans also stated that the species of greatest economic significance to the region, the ringed seal, lake whitefish and Arctic char, are the species most likely to be exposed to effects from major oil spills or regional developments. The Department of Fisheries and Oceans estimated that at present the stocks of these animals appear to be withstanding current levels of exploitation although certain Arctic char stocks, particularly those in the vicinity of settlements, are in a "depressed state".[42]

The Department of Fisheries and Oceans pointed out the key areas of importance to Arctic marine ecosystems are:

> "the under-surface of the ice particularly in the spring (April-May-June) before break-up when activity of the under-ice biota is greatest; the ice-edges that form in spring during breakup and are frequently the site of great biological activity involving Arctic cod, marine mammals and sea birds, and the inshore sub-tidal zone about which relatively little is known".[43]

The Department of Fisheries and Oceans identified the geographic areas of concern with respect to the continued well-being of certain marine mammal populations as the following locations: Cumberland Sound (beluga, bowhead); Cunningham Inlet (beluga); Lancaster Sound (bowhead, beluga, narwhal, walrus, seal); Jones Sound (walrus); Creswell Bay (narwhal, beluga); Amundsen Gulf (bowhead, beluga); and the Mackenzie Delta and southern Beaufort Sea (bowhead, beluga and whitefish).

These regional populations are of special ecological significance and precautions will have to be taken to ensure their conservation and protection.

These general concerns were augmented by detailed discussions of several important species.

6.7.2 Polar Bears

The production and transportation of oil and gas has the potential for adverse effects on polar bears. The results of research on and monitoring of the species were discussed at length at the public sessions by the federal and territorial governments.[44] The Proponents concluded in the EIS that there would be minor impacts from normal activities over a 20-year period on the regional polar bear population. Polar bears are a species of cultural and economic value throughout much of the Northwest Territories and Yukon and are harvested annually under controlled community quotas. They are also protected under national and international agreements.

Polar bears are inherently curious and are known to congregate around human facilities or activities, particularly where a potential source of food exists. The Government of the Northwest Territories' biologists are concerned that mortality resulting from bear/human conflicts may cause the Beaufort Sea population of polar bears to decline. The Government of the Northwest Territories' Wildlife Service, in cooperation with the Proponents, is developing means of detecting and deterring bears from installations. This type of research should be encouraged as part of an overall, regional bear management strategy.

The Panel encourages the Proponents to improve consultation with the GNWT Wildlife Service and local Hunters and Trappers Associations regarding the location and design of camp facilities in order to minimize bear/human conflicts.

Detecting possible impacts on polar bears in the offshore zone requires a long-term commitment to research and monitoring in order to separate natural population changes from man-induced changes. To accomplish this, the GNWT recommended that previous research programs be resumed and expanded to include research on factors such as ice conditions and ringed seal population levels. These factors must be investigated to permit a better understanding of the variables responsible for changes in bear populations.

35 **The Panel recommends that the Government of Canada provide adequate funding to the Government of the Northwest Territories to resume an effective monitoring program on polar bears of the Beaufort Sea and Parry Channel regions to enhance management and protection of this species.**

6.7.3 Seals

The ringed seal is the most abundant and widespread marine mammal in the Canadian Arctic offshore region. Other species of seal (eg. bearded seals) are also found throughout the Beaufort Sea and along the proposed tanker route. The wide distribution of seals could expose them to impacts of varying degrees from shore bases, offshore drilling operations, vessel traffic, subsea pipeline oil spills and so forth. The wide regional distribution of seals would also serve to reduce the significance of any localized major impacts.

Most of the coastal communities in the Canadian Arctic harvest seals. They are used for food and clothing and the pelts also provide a source of income. Ringed seal populations are subject to considerable fluctuations, apparently as a result of changes in the abundance of food. Impacts which occurred at times when stocks were low, as during the 1974-1977 period in the Beaufort Sea region, could conceivably reduce their regional abundance.

The Panel believes that a major oil spill could seriously disrupt local populations of seals, particularly if the oil accumulated below sea ice and blocked the animals' access to dens or breathing holes. Even in the worst cases, significant impacts to local populations would probably be offset by the resilience and wide distribution of the species. More subtle, chronic impacts on food sources resulting from such occurrences could also continue to impact seal populations. It is not possible, however, to reach definitive conclusions on the potential long-term impacts on these species.

Other disruptions, such as those resulting from the use of workboats, tankers and icebreakers could pose a threat to seals during the ice season in the corridors used by such vessels. Concern was expressed that ship traffic could cause seals to abandon the area of the ship track and move to differ-

ent areas, along with polar bears which prey on them.[45] The Proponents noted this possibility in the EIS, suggesting that frequent disturbance of the ice and noise from the ships could cause significant effects on the seal populations close to the ship corridor. They also stated that there is some evidence for the contrary view that seals are attracted to ship tracks because they can more easily establish breathing holes in the track rubble. These seals would be further disturbed during subsequent ship passages.

The alternative approach of requiring ships to use new tracks for each passage would avoid this problem but would cause more initial habitat disturbance; it is impossible at this point to assess which impact would be the greater. On a regional basis, the Proponents concluded the potential effects upon seals of icebreaking could range from minor to moderate, depending to some extent on the geographical distribution of seals. They proposed to reuse the same track as a mitigative measure to avoid displacing a larger number of seals. It is clear that their conclusion is tentative and that research and monitoring programs will be required to determine the most effective form of mitigation.

The community of Arctic Bay and the Baffin Region Inuit Association (BRIA) expressed concern that the passage of Arctic tankers could result in waves being transmitted beneath the ice for long distances causing flooding of seal dens during the pupping season. Newborn ringed seal pups are very susceptible to death from exposure during the pupping season if wetted in the first two weeks of life.

In response to these concerns, the Proponents stated that they have not observed flooding of seal dens and that this flooding would not occur during the ice cover in late March and early April when seals pup.[46]

The Proponents, government agencies, and northern residents disagreed on the location of seal dens but they agreed that further research was necessary to map seal pupping areas.[47] Inuvialuit hunters from Sachs Harbour and Holman argued that ringed and bearded seals were distributed throughout the Prince of Wales Strait.[48] The Baffin Region Inuit Association provided similar information for Barrow Strait concluding that

> "more recent research has found ringed seal lairs concentrated in the offshore areas of the Strait, away from most bays and shorelines, and thus in the path of the proposed tankers."[49]

The Baffin Region Inuit Association also stated that a large ringed seal population, important to Pond Inlet and Clyde River hunters, inhabits and breeds in the offshore pack ice in Baffin Bay.[50]

The Panel concludes that there is not a sufficient understanding of the location of seal dens to determine the potential effects of ship traffic. If this information becomes available, it may be possible to alter the routing of ships and avoid concentrations of seals or adopt other mitigative measures. Further research is therefore required to identify the distribution of seal dens along the proposed tanker routes.

36 **The Panel recommends that the Department of Fisheries and Oceans conduct the research programs necessary to:**

a) identify distribution of seals along the proposed tanker route; and

b) determine the effects of icebreaking on seal behaviour and mortality, including the loss of pups due to flooding of dens.

6.7.4 Whales and Walrus

Bowhead whales, beluga whales and narwhal were the three whale species of concern to the participants in the Panel review. As sources of food and in the case of narwhal, ivory, they are valued components of the renewable resource economy.

> *"We are reviewing the narwhal population estimates in this area, making an attempt to refine them to the point that we can establish quotas which genuinely reflect what can be taken from the population. If the population went down severely for any reason, I think we would get together with the people concerned and talk about it, and try to establish a quota that reflected what the population was."*
>
> *J.T. Strong, DFO*
> *Resolute*

The Panel heard concerns from a wide variety of scientific and community sources about the environmental effects of oil spills, vessel traffic, sound and icebreaking activities on these species. It was frequently suggested that there were so few data on these subjects that definite forecasts of impacts were difficult.

Bowhead, while officially an endangered species and closed to harvesting in Canadian waters, is subjected to a regulated hunt by Alaskan Inupiat. The Department of Fisheries and Oceans noted that, in spite of a long-term moratorium on indiscriminate harvesting, the best data indicate that bowhead stocks are still low compared with their numbers before the commercial whaling era in the Western Arctic from 1860 — 1900.[51] A similar situation also prevails in the Eastern Arctic,

The Proponents indicated they felt that industrial developments would have negligible effects on bowhead whales with the possibility of minor regional impacts due to industrial noise.

Although programs of research have been initiated to define the seasonality and distributions of this species, there are still significant gaps in the knowledge about the biology and ecology of the bowhead. During the public sessions the Panel was not provided with biological data sufficient to make detailed recommendations on protection of the bowhead.

Potential impacts upon this species include the effects of increased vessel traffic throughout the Beaufort Sea region and along the proposed tanker route. The long-term effects of underwater noise on bowhead are not known. Similarly, the effects of a large release of oil are not understood. Mitigative measures to protect this species need to be designed and put in place in conjunction with any final approvals for production and transportation. Industrial activities should, in particular, be timed to avoid critical periods. Because of the international movements of the bowhead it is important to arrange an international approach to research about the species.

37 The Panel recommends that the Government of Canada explore the possibility of an international research program on the biology, distribution and ecology of the bowhead whale.

Beluga (white whales) occur in distinct populations throughout the Arctic and they make annual migrations up through Baffin Bay and Lancaster Sound in the Eastern Arctic and in the west from the Bering Sea through the Chukchi Sea-Beaufort Sea region to the southeastern Beaufort Sea and the Amundsen Gulf. The Proponents suggested that industrial development impacts on beluga would be neglible with a possibility of minor impacts from industrial sound. The Department of Fisheries and Oceans informed the Panel that the view, held until quite recently, that beluga enter warm estuarine waters to calve, has now been modified. Many animals have been seen to enter these waters with young already present.[52] Beluga are likely to be most vulnerable then because of the presence of very young animals in a confined habitat.

The effects of tanker traffic on ice-edges and ice-leads as they may affect beluga populations and their movements, should be studied in greater detail in order to develop procedures which will minimize adverse impacts. The effects of underwater noise should also be studied. The Proponents have been monitoring beluga populations in the Beaufort Sea since 1972. This should be continued and complemented with studies by government agencies such as DFO.

Since DFO has the clear legislative mandate for research on and protection of marine mammals in the Arctic, this agency should expand its research programs for these species in both the eastern and western Arctic region.

38 The Panel recommends that the Department of Fisheries and Oceans undertake research programs on beluga whales to develop effective monitoring and mitigation programs.

Narwhal are found in the Arctic waters off eastern Canada in Davis Strait, Baffin Bay and Lancaster Sound. Narwhal are usually associated with pack ice and are known to calve in the deep waters off northern Baffin Island.

Because there is insufficient knowledge of narwhal biology and behaviour it is difficult to estimate the effects upon narwhal of underwater sound and major pollution incidents such as large oil spills from tankers. The Department of Fisheries and Oceans concluded that it is most important to avoid oil contamination in the area frequented by narwhal during the open-water period.[53] Concerns were also expressed by local people that open leads caused by marine traffic could trap narwhal and other species of whales if leads refreeze or close.

The Proponents stated that narwhal would not follow a ship because no open water would be left in the tanker track and the noise of the vessel would discourage them from following. The Panel believes that there is insufficient information to rule out the possibility that whales could follow ships and be trapped. It therefore concludes that the effects of icebreaking on whales should be monitored. The Panel commends the initiative of DIAND in funding research regarding the response of narwhal to shipping in Admiralty Inlet, but recognizes that such research is the responsibility of DFO.

39 The Panel recommends that the Department of Fisheries and Oceans conduct research to define better both narwhal distribution patterns and the potential impacts of tanker traffic upon the species.

The results of the above research should be integrated into the design of mitigative measures and future monitoring programs.

Walrus, hunted for subsistence purposes and ivory, have also suffered a great historic reduction in range as a result of indiscriminate hunting. The Department of Fisheries and Oceans concluded that this species is considered to have little capacity to live in association with modern man unless it is adequately protected.[54] Walrus are a species which might be impacted by tanker traffic, but since no specific data were presented to the Panel, it cannot draw conclusions. The Panel does conclude, however, that continuing research on walrus will aid in the understanding of the potential impacts of oil spills and vessel traffic.

6.7.5 Fish

Many anadromous and marine fish species, such as Arctic char, provide an important renewable resource harvest to Arctic communities. Some, such as Arctic cod, provide an important link in the Arctic food chain for many wildlife species.

Fish are susceptible to both direct and indirect disruption. Impacts which occur at particularly sensitive times during the year, such as during spawning runs or migratory movements, can have significant effects on local fish populations. These impacts if repeated year by year or in many different areas could result in cumulative reductions in populations.

The Department of Fisheries and Oceans informed the Panel that before the effects of any disturbance on fish can be assessed it is essential to have broadly-based knowledge of the system likely to be affected.[55] Such knowledge of Arctic fish is not yet available and logistic difficulties make the required ecological data difficult to obtain. For instance, Arctic cod, although not directly harvested, is the fish species of greatest significance in the Arctic marine food chain. Local disruptions to such populations could cause considerable local impacts upon birds, seals and other animals that depend upon Arctic cod for food.

40 The Panel recommends that the Department of Fisheries and Oceans, as part of an Arctic coastal and estuarine fisheries research and management program, identify and study fish habitats within the Beaufort Sea coastal area, and fish species which could be sensitive to oil and gas production and transportation to develop effective monitoring and mitigation programs.

6.7.6 Marine Birds

The lack of information on the seasonal distribution and ecology of many species of marine birds and concerns about the direct consequences of major oil spills on migratory spe-

cies were the two major issues raised at the public sessions relating to effects on marine birds.

The Proponents concluded that all impacts from development would have neglible-to-minor consequences for regional bird populations although site specific effects could be greater. The CWS told the Panel that:

> "significant portions of the area's breeding populations gather in small areas of open water, particularly during the spring migration in most years, and throughout the breeding season in heavy ice years, where spilled oil is likely to collect. Any bird contaminated by oil in such conditions will most likely die. In addition, survival of some populations could be further jeopardized by changes in food availability caused by disruption or contamination of feeding areas associated with stable ice edges. Further, there is no evidence to suggest that available oil-spill countermeasures can mitigate these adverse effects."[56]

The Panel is concerned with the paucity of baseline data on marine birds in the Beaufort Sea and along the proposed tanker route and believes that more information is needed.

The Arctic environment represents the last undeveloped area within the range of habitats available to many migratory marine birds. Because many of these species are under stress in other parts of their range, these species may suffer adverse consequences from cumulative or synergistic environmental impacts. Although not quantifiable, the impacts caused by oil and gas development must be viewed as potentially more significant than they would be in a simple, site-specific impact assessment.

41 **The Panel recommends that the Canadian Wildlife Service of the Department of the Environment expand the existing commitments to research on the most important Arctic marine and terrestrial bird species likely to be affected by the proposed development so that adequate baseline data are available for monitoring and mitigation programs.**

6.7.7 Benthic, Planktonic and Epontic Marine Organisms

The Proponents presented extensive data in their EIS on benthic flora, planktonic communities and epontic biota and fauna.

They stated that oil spills and chronic discharge of pollutants could have significant deleterious effects on localized populations of these organisms. The duration and severity of acute lethal and chronic sub-lethal impacts on these localized communities, and the time of recovery of affected habitats, would depend on the amount, duration and toxicity of contaminants.

The Department of Fisheries and Oceans stated that, in the case of a massive release of oil, there could be significant effects on the sub-tidal flora and fauna and the under-ice biota. As these are probably the two most productive systems in the Arctic marine environment, DFO feels that more basic research would be of value to help define long-term impacts.[57]

While localized impacts may be significant to some biological communities, especially species which are relatively immobile, the Panel concurs with the Proponents' view that while disturbances and wastes from the normal development of offshore hydrocarbon resources may cause localized impacts, they would probably not significantly impact the widely distributed regional communities of epontic and planktonic species. That conclusion was supported by information presented to the Panel in briefs from DFO.

The Panel concludes that basic, ecological research into planktonic, benthic and epontic species should be carried out as a component of the recommended coastal fisheries research program (see Section 6.7.5). In addition, more research should be carried out to define the physiological, toxicological and ecological effects of oil upon these marine species and upon species at higher trophic levels.

6.7.8 Polynyas

Polynyas, areas of open water surrounded by ice, are critically important to the survival of marine birds and mammals. Recurring polynyas are relatively localized, occurring in the Beaufort Sea at Cape Bathurst, along the proposed tanker route in Lancaster Sound between Devon and Bylot Islands and further south in Cumberland Sound and in Frobisher Bay. These recurring polynyas and shoreleads are of predictable location and are among those Arctic areas in which open water is found quite consistently in winter and early spring.

Polynyas and their associated lead systems appear to play a critical role in the survival of many important populations of marine mammals and birds in the Canadian Arctic. The Cape Bathurst polynya in Amundsen Gulf, through which the proposed tankers would travel, serves as an overwintering area for subadult ringed seals and bearded seals; as an important feeding site for their predator, the polar bear; and as spring feeding and staging areas for migrating beluga and sea ducks. The Eastern Lancaster Sound polynya, which is part of the North Water and also on the tanker route, is equally important to beluga in the autumn, to seabirds in the spring and autumn and to seal and polar bear populations in the spring. During summer months the area is a major feeding area for bowhead and narwhal, as well as for substantial numbers of seabirds.

Because of the great ecological significance of polynyas to the existence of important marine mammal and seabird populations along the proposed tanker route, the Panel concludes that additional information on the subject is required.

42 **The Panel recommends that ship passage through polynyas be conducted in a manner that will minimize impacts on marine mammal and bird populations, and that further studies be conducted of the Cape Bathurst and Eastern Lancaster Sound poiynyas to help define the best procedures to minimize impacts from ship traffic and from oil spills.**

6.7.9 Effects of Vessel Sound

Residents of communities who hunt marine mammals in the Beaufort Sea and along the proposed tanker route stated that vessel sound could cause marine mammals to move away, making hunting difficult or impossible. Other major participants stressed existing information deficiencies with respect to the impacts of vessel sound upon marine mammal hearing.

The Proponents stated that simple models of sound propagation from source to receiver have been devised which allow researchers to forecast the sound exposure of an animal, although for Arctic environments the models are still not precise. The exposure of a seal, at a certain distance from a moving source, such as a tanker, to a certain frequency and magnitude of sound for a period of time can be determined with reasonable precision if the physical characteristics of the water, the ocean bottom and the depth are known. Total sound exposure of the marine mammals can be derived for various scenarios once the number of ships, the number of passages and the sound magnitudes at the ship source are known.

Information about various marine mammals' sensitivity to a range of frequencies of sound at various magnitudes is relatively sparse as is the understanding of acute pain thresholds and sub-acute physiological and behavioural responses to noise. Nor is there an adequate understanding of marine mammal communication and of echo-location processes and the potential impacts of increased background sound masking these phenomena.

Although some studies have been initiated by DIAND, direct experimental evidence from sound monitoring studies and documentation of related Arctic marine mammal response is quite limited and does not allow definitive conclusions.

Direct observations by the Proponents suggest that present disturbance by vessels in the Beaufort Sea does not cause whales to abandon important habitat areas but their local distribution may change if the disturbance is particularly intense. Contrary results have been reported from other areas.[58] Concern remains that problems such as chronic stress could eventually result in ecologically significant changes in population size or distribution. No conclusions are yet possible on this issue.

Much of the direct experimental evidence involves sound measurements which combine ship noise, ambient noise and marine mammal sounds so that it is often difficult to differentiate the relative magnitudes of each source. This difficulty, along with those inherent in undertaking controlled field experiments on sea mammal behaviour, suggest that progress in determining actual impacts on mammals will be slow. Therefore, to improve the understanding of these issues, a Two Tanker demonstration project is recommended to allow direct experimentation and observation.

The Panel is encouraged by support from the Government of Canada, the governments of Denmark and the United States, various industry and academic groups and the World Wildlife Fund for collaborative studies on underwater sound in Baffin Bay, Lancaster Sound and the Beaufort Sea.

44 **The Panel recommends that the Department of Fisheries and Oceans:**

continue and expand the research activities necessary to understand the potential impacts of vessel traffic upon Arctic marine mammals by;

a) identifying the characteristics of sounds propagated by icebreaking tankers to be used to carry Beaufort Sea oil to southern markets to confirm present predictions about the nature of those sounds,

b) obtaining baseline data on ambient sound before tanker traffic occurs,

c) determining propagation paths and energy losses of sound from tankers for representative marine coastal habitats;

45 gather baseline data on sea mammal distributions, movements, numbers and migrations prior to tanker traffic;

46 undertake research on the behavioural response of marine mammals to the sounds produced by icebreaking ships in Arctic waters;

47 undertake research on the extent to which vocal communication and echo-location used by marine mammals are masked or otherwise interfered with by ship-produced sounds and the effects of such interference upon the mammals; and

46 undertake research on the extent of any acute and sub-acute physiological responses resulting from ship-produced sound.

6.7.10 Conclusion

Industrial development in Canada's North should be carried out in such a way as to recognize the importance to local inhabitants of the sustained productivity of the region's renewable marine resources.

Existing information on population and behavioural ecology of major Arctic marine species in representative or critical areas is inadequate. This prevents careful analyses of undisturbed environments and of impact assessment, and hinders the development of effective mitigative measures.

In many areas of concern, the environment is already being affected by human activities, so that the opportunity to obtain "biological baseline data" is fast slipping away. The Department of the Environment concluded that although less is known about the regional population dynamics of fish or invertebrates than for other life forms, the most useful immediate advances in environmental impact assessment will likely come from better knowledge of mammal populations. The Panel concurs.

In conjunction with the recommended research programs, the Panel has also endorsed several monitoring programs, both to assist in the collection of baseline data prior to development and to consider the impacts once development proceeds. These programs are further developed in Section 6.9.3.

The Panel concludes that offshore development can be carried out in an acceptable manner if it is approached with caution and in a phased manner as recommended elsewhere in this Report, so that monitoring information will have timely applications to mitigative measures.

6.8 Onshore Biological Effects

6.8.1 Introduction

Throughout the North, during all phases of the review, the Panel received comments by intervenors about the effects of development on a variety of terrestrial animal species. The information ranged from site-specific detailed concerns to broad general concerns about the cumulative and synergistic consequences of development. A common theme expressed was that the renewable resource economy of Yukon and the Northwest Territories is a viable and important component of the future of these regions and that the productivity of the animal species that form the basis of that economy must be a continuing principal focus of government policy.

In their EIS and in the EIS Supplementary Information, the Proponents discussed mitigative measures and their effectiveness, monitoring program proposals, residual and cumulative effects and the social significance of changes to wildlife populations The conclusions reached in these documents remained controversial for some review participants and led to substantial discussion during the public sessions.

In general the Panel believes that much has been learned about wildlife during the last decade. The efforts of the CWS, the Proponents and the GNWT Department of Renewable Resources have been helpful with respect to this review and much useful information about species and habitats has been collected.

6.8.2 Caribou

The discussion of caribou focused on the Porcupine herd. The Panel heard evidence about caribou biology and behaviour and about wildlife management problems. Control and management of human activities emerged as a common concern.

There was also discussion about the Bluenose Caribou herd and other ungulates which may be affected by the Beaufort Sea developments but with the exception of overhunting, the impacts were generally considered minor.

> *". the effects of a complex of exploration and development sites, the accompanying air and ground access routes, and the collection and delivery systems for industrial products, have both cumulative and synergistic effects on caribou. "*
>
> *Dr. A. M. Martell*
> *Whitehorse*

In the Proponents' EIS Supplementary Information they concluded that, with the exception of increased hunter access year after year, none of the potential impacts was considered cumulative neither by repetition nor by being added together. Synergistic effects could potentially result from combinations of the effects of deflection of migrating animals by roads and overhunting due to increased hunter access. The Proponents also emphasized in the EIS Supplementary Information that the data base was adequate for the general purposes of the present assessment but was clearly inadequate for more precise forecasting of impacts. They questioned the value of more detailed analyses at this stage.

In spite of these statements there was still substantial disagreement by intervenors with the Proponents' forecasts about cumulative effects on caribou which were predicated on the assumption of completely effective mitigation. The Government of the Northwest Territories and CWS experts felt that further research would lead to a better understanding of caribou population dynamics and hence to a better ability to forecast the general population changes which may be induced by developments.

In practical terms the divergence of views about effects on caribou resulted in differences of opinion about the kind of conservative management policies or mitigation procedures which will work best. As a result, it has become apparent that more data and more field experience are required to develop effective mitigative measures.

The Panel concludes that both the impact assessment and the development of management activities cannot be more precise or effective until more information is available on the Porcupine Caribou herd and other herds. Until such information is available, however, it will be necessary for appropriate monitoring to be undertaken and for conservative mitigative measures to be assumed as part of any industrial developments that may have negative effects on caribou.

Research subjects for the Porcupine herd proposed by DOE included summer range ecology, the significance of insect relief habitat, the interrelationship of linear developments and caribou behaviour, and the behaviour and range of bulls during the calving season. Although there was much discussion of the experience of other researchers in different areas most people believed it important to obtain more direct information specific to the Yukon North Slope environment.

43 The Panel recommends that the Government of Canada provide full financial support to the Canadian Wildlife Service of the Department of the Environment and the Department of Renewable Resources of the Government of Yukon to undertake the following to allow the design of effective mitigation and monitoring programs:

- **a) specific research related to the reaction of caribou to vehicle traffic and to overflight by jet aircraft;**
- **b) specific research on the Yukon North Slope caribou range ecology, particularly summer ecology, including the importance of insect relief habitat; and**
- **c) computer simulation modelling of caribou population dynamics.**

6.8.3 Fish

Industrial development in the Beaufort Sea region potentially affects a wide variety of both freshwater and marine fish and their habitat, although there are not likely to be severe impacts because of the Proponents' proposed mitigative measures. The Proponents and intervenors made specific comments on various data deficiencies with respect to habitat problems in areas such as the North Yukon coast. These deficiencies included migration/construction timing, protection of spawning and rearing habitat, protection of anadromous species, and insufficient knowledge about the basic productivity of resident species in lakes and rivers.

Resident and anadromous species were identified as concerns both in terms of maintaining a supply for human consumption and as an integral part of the food chain for higher trophic levels, particularly marine birds and mammals. With the exception of the effects of oil spills into lakes, streams and rivers and domestic fishing pressures, it was generally agreed that the potential effects of development on spawning and rearing habitat could be minimal. Unfortunately the distribution of these habitats is not well known. Impacts are therefore difficult to predict. The Panel believes that DFO should expand the data inventory in areas designated for imminent development.

Site specific environmental designs were not reviewed by the Panel but it is widely known that river-crossing techniques for pipelines, granular material extraction activities, toxic and chemical waste disposal and other activities which potentially affect fish are mature technologies which will have minor impact, assuming proper regulatory control and enforcement.

The importance of the fishery to the renewable resource economy both directly and indirectly is a primary reason for the concerns of northerners about development impacts on fish. The Panel also considers that the provision of fishing opportunities to groups traditionally involved in the fishery is as important as simply having a supply of fish for food. These subjects are further discussed in Section 5.4. Subsistence, recreational and commercial fishing interests should be protected and regulated in accordance with the biological productivity of lakes, streams and rivers.

6.8.4 **Birds**

Several types of potential impacts from the proposed development on migratory birds, waterfowl, and other resident species were discussed by intervenors and the Proponents.[59] With the exception of specific impacts such as oiling of shore birds, effects of loud sound on nesting and staging areas, and effects on rare raptor species, most of the commentary related to the need to protect the prime habitats important to these species. Most of these sensitive areas have already been identified by various government agencies and the Panel agrees that these areas should be avoided if possible; if not, special mitigative measures must be used in combination with monitoring programs and contingency plans to reduce the impacts to a negligible level. The Panel is aware that CWS and the territorial governments will undertake detailed site specific analyses for these contingency plans, as part of the mitigation package attached to each phase of the development.

The major effects of industrial noise on birds in the Beaufort Sea area will, with few_ exceptions, be experienced by migratory bird species that spend about four months in the Arctic and the remaining eight months in southern Canada, the United States, Mexico, or elsewhere.[60] Given the pressures on certain species in the South, Arctic habitats may be critical to the long-term viability of those species. The control of noise may be as much a part of environmental conservation in these habitats as the maintenance of water quality, terrestrial habitats and food sources.

The Panel is aware of past cooperation among the Proponents and government agencies in monitoring the effects of aircraft on migratory birds and other wildlife in areas considered sensitive to such disturbances. The evidence presented to the Panel, including site-specific studies such as those at the Taglu drill site on the edge of the Kendall Island Bird Sanctuary, suggests that with proper planning, disturbances of migratory birds by aircraft may be kept to an acceptable level.[61] The Panel urges CWS to continue the review and monitoring of migratory bird populations required as a result of the proposed developments.

6.8.5 **Habitat Inventory**

Examples of the habitat inventory and mapping programs of the GNWT and the CWS [62] suggest that the understanding of the use of seasonally sensitive areas by a variety of other species of terrestrial animals is increasing. While these programs are not complete it is now possible for these agencies to respond to industrial development proposals. Some general understanding of the significance of habitat disturbance which might be involved in development can now be provided, particularly with respect to migratory bird habitat in the Mackenzie Valley, raptors and raptor habitat, polar bears and some other carnivores and caribou. Such habitat inventories, as well as many specific behavioural studies, now allow substantive comments to be made on the nature and viability of mitigation proposals put forward by the Proponents.

While the Panel notes that there are various ecological and land use maps for most of the Mackenzie Valley in existence and that there has been considerable northern input to the preparation of these maps, the Panel concludes that continued updating, and refinement and designation of various "special areas" require immediate attention by governments.

It is apparent from the statements of the GNWT that its Department of Renewable Resources in conjunction with the CWS has extensive plans for new and continuing research on individual species and habitats, both for planning wildlife management and for providing a better basis for resource harvesting research programs underway in the NWT. The Northern Oil and Gas Action Program (NOGAP) has been recently established. The Panel views this as a positive step for facilitating better mitigation and improving monitoring programs. Specific research needs relating to specific developments are also being funded under the auspices of the Environmental Studies Revolving Fund (ESRF) and this too represents a positive approach.

The Panel concludes that existing wildlife habitat inventory programs should be further supported by the relevant government agencies. The Proponents should recognize sensitive and important habitats identified by CWS, DFO, GNWT and YTG as areas which require either avoidance or special mitigative measures. These habitats should be a fundamental part of the DIAND land use planning program.

6.9 Environmental Impact Assessment

6.9.1 Introduction

Environmental Impact Assessment (EIA) processes and procedures in Canada have been evolving and changing for a decade and will continue to do so. Different approaches have developed within various jurisdictions and scientific disciplines and the basic concepts are as well known and shared as the basic problems, Lack of information about basic components or processes of natural environments and a lack of standards or criteria to judge the significance of potential impacts are two very common issues in environmental impact assessment. The EIA practitioners continue to work toward solutions to these problems, The Minister of the Environment, acting on a Federal Environmental Assessment Review Office initiative, recently approved the establishment of the Canadian Environmental Assessment Research Council (CEARC) which will promote and facilitate EIA research efforts. Even with these advances, however, no EIA process can be applied without modification to all types of development.

The specific methods used by the Proponents, intervenors and others to assess the potential environmental impacts of the Beaufort Sea proposal have their limitations but the EIS documentation provided a good overview of the problems which may be caused by oil and gas production and transportation. The prediction and assessment of impacts is made difficult by data deficiences for many animal species, a lack of methods of assessing potential cumulative and synergistic effects of development, logistic problems for data gathering in Arctic environments, the conceptual nature of the development proposals and the subjective nature of the understanding of the level and significance of impacts.

The Panel recognized these difficulties during its initial review of the Beaufort Sea EIS but still shared the concern of several review participants that the assessment methodology for the biophysical environment was not well developed in the documentation. Accordingly, in the Panel's EIS Deficiency Statement, a further analysis was requested. Rather than calling for a total revision, however, the Panel asked the Proponents to concentrate on caribou, ringed seals and narwhal and to discuss explicitly the potential cumulative effects of development upon these species. This provided representative illustrations of the methods and difficulties involved in the assessment procedure. These illustrations would then form the basis for discussion during the Public Sessions. The Proponents undertook this task but the results demonstrated that the techniques available for this type of analysis need further development.

The Proponents' EIS and EIS Supplementary Information nevertheless provide a good review of data deficiences. This review serves as a valuable aid to help assign priorities for future research and monitoring activities. The assessment of the biophysical effects of development, however, cannot be considered to be complete. The EIS represents a significant achievement but it must be seen as a starting point rather than a definitive final statement.

6.9.2 Assessment Methodology

The matrix approach used in the Proponents' EIS is a simple yet effective way to summarize most of the perceived environmental consequences of development. It serves to identify broad areas of concern but the Panel recognizes that many conclusions are based on professional judgement, which in turn is often based on experience from other geographic areas. Within the constantly evolving context of environmental impact assessment processes it would be very difficult to specify a more effective method for this conceptual level of review.

Nevertheless, the methodology was criticized by several review participants on the basis of inaccuracies, inconsistencies[63] and lack of specificity and comprehensiveness[64]. The broad definition of impact categories (major, moderate, minor, neglible) was criticized as imprecise and often misapplied. The matrix technique has also been criticized as inadequate to represent concern about cumulative and synergistic effects. Many of these criticisms, however, are generic problems in environmental impact assessment. In fact, of the intervenors who criticized the methodolgy of the EIS, few presented a practical alternative approach to assist the Panel in its deliberations.

Many intervenors were concerned about the Proponents' optimistic reliance upon completely effective mitigative measures. The Panel believes that a conservative approach to environmental design by the Proponents should ensure that effective mitigation measures are incorporated into the implementation of site-specific projects.

In light of the difficulties with the nature of impact assessment and the concerns about the effectiveness of mitigative measures it is essential that effective and timely environmental research and monitoring programs be established. The following sections outline the basic components of a research and monitoring program.

6.9.3 Environmental Monitoring

The Panel accepts, as a broad general definition of environmental monitoring, that of Beanlands and Duinker.

> "The term monitoring refers to repetitive measurement of specific ecological phenomena to document change primarily for the purposes of (i) testing impact hypotheses and predictions and (ii) testing mitigative measures."[65]

This monitoring definition is intended to exclude the surveillance and inspection activities undertaken by regulatory agencies. Surveillance activities are designed to ensure that resource developers are in compliance with the terms and conditions of their project approvals (see Section 8.12).

During the General Sessions much of the discussion and criticism by intervenors of specific aspects of the Proponents' environmental impact assessment concluded with a request for extensive monitoring of the effects of development.

The Panel concludes that, lacking data, the most effective way to determine and assess the effects is to allow developments

in a phased manner, with extensive monitoring. To do this for every potentially affected species for the entire project, however, would be cost-prohibitive and to some degree unproductive in light of documented experiences from other areas which suggest minimal effects from some aspects of the project. An efficient approach to the design of a monitoring program such as that taken by DIAND-sponsored Beaufort Environmental Monitoring Project is needed.

6.9.3.1 The Beaufort Environmental Monitoring Project[66]

The purpose of the Beaufort Environmental Monitoring Project (BEMP) was to design a practical and efficient monitoring program which could effectively gather information about the environmental impacts of oil and gas developments. An interdisciplinary group of scientists attempted to build a mathematical simulation model of the Beaufort Sea ecosystem, knowing in advance that there were insufficient data to complete a version that would work. In their attempt, they tried to identify the critical data gaps and to understand better those parts of the environment which are most sensitive to man-induced changes.

The list of basic research needs which emerged from the BEMP was then examined on the basis of more pragmatic criteria, cost-effectiveness of research, significance of the species in socio-economic terms and basic scientific research capability. These needs then were modified into hypotheses about the effects of development which could be examined as part of a continuing monitoring and research program during development.

The Panel commends DIAND on the positive initiative it undertook in sponsoring the BEMP. Interdisciplinary, interagency programs such as this are an innovative approach to natural resource management. The Panel concludes that the results of the BEMP experiment should be assessed, and if found satisfactory, the approach should be used as the basis for part of the monitoring program for the Beaufort Sea oil and gas developments.

6.9.3.2 Scope of Monitoring Programs

The approach used in the BEMP does not prejudge the elements of the biophysical environment which would become priorities for monitoring but allows an interdisciplinary analysis of feasible and cost-effective studies. As a result, the program would include a range of monitoring options related to various aspects of oil and gas production and transportation in the Beaufort Sea region such as the analyses of new facilities in new locations and additional analyses of important species. Thus the scope of each regional monitoring program may vary to accommodate regional needs. This scope may change through time as new data accumulates and research priorities develop. Clearly there is a need for central coordination of these studies.

6.9.3.3 Future Coordination of Monitoring

The Panel proposes that coordination of monitoring projects be undertaken by the Beaufort Sea Coordinator's Office (BCO). It is not intended that responsibility for the actual monitoring be part of the BCO responsibilities. Rather the BCO will keep an account of the status of proposed, initiated and completed projects and will provide a referral service for the results of the monitoring.

> *"Experiences from both Shetland and Orkney have shown very clearly that the local level, where it's got the right information, and where it's got the right powers, is quite capable of dealing both with other levels of government and with the oil companies to a reasonably successful degree."*
>
> *Dr R Butler*
> *University of Western Ontario*
> *Inuvik*

No matter how well designed in theory, the monitoring program will require proper coordination so that information can be collected and used in an efficient manner. The BCO could play an important role in ensuring that monitoring proposals are implemented, are adequately funded, and receive the interagency cooperation needed to achieve the minimization of social and environmental impacts and the maximization of benefits.

The BCO, as envisaged, would have a role in the coordination of the monitoring studies and would also provide the focus for community information programs and involvement in these studies. Although not providing any funding directly, the BCO would be a primary source of information for those agencies which presently allocate funds for research. Coordinating the efforts of a multitude of government agencies to avoid future duplication of effort should be the primary focus of activity.

6.9.3.4 Monitoring and Mitigation Research

Another objective of the monitoring program, however structured or managed, should be a program of research related to the effectiveness of various mitigative measures. Ultimately there may be more than one way to solve an anticipated environmental problem. The effectiveness of alternative measures should be evaluated and compared to understand the reasons for successes and failures. The Panel concludes that the monitoring program should include a program of research designed to evaluate the effectiveness of different mitigative measures.

54 **The Panel recommends that the Beaufort Sea Coordinator's Office coordinate the monitoring and research projects associated with the production and transportation of Beaufort Sea-Mackenzie Delta oil and gas.**

6.9.3.5 Criteria and Standards for Monitoring

The Panel heard extensive comment on the need to assess the significance of environmental effects, and particularly about the lack of standards upon which to base a definition of significance. In theory any development will have environmental effects but these effects may not be significant. Without criteria and standards to help define "significance", it is very difficult to decide how closely to monitor projects or to know when extraordinary mitigative measures should be used if an actual effect is adverse and diverges markedly from an expected effect. Without such criteria for design guidance, it is

difficult for the Proponents to include mitigative measures in the initial project design.

55 **The Panel recommends that, for the purpose of implementing an effective monitoring program, the Beaufort Sea Coordinator's Office coordinate the establishment of suitable criteria and standards to be developed by the Government of the Northwest Territories, the Government of Yukon and relevant federal government departments.**

6.9.4 Research

When a proposal for a new large-scale development in Canada is subjected to an environmental review, the ensuing recommendations are likely to be based mainly upon knowledge and opinion derived from past research and the personal opinions of many individuals. With respect to the North, past EARP panels and the present Panel, were faced with many contentious issues that cannot be resolved given the existing state of research. Fortunately, there has been a great increase in site-specific and applied research in the Beaufort Sea-Mackenzie Delta region since the early 1960's; unfortunately, there has been no such increase in basic research. Consequently, a variety of important environmental concerns associated with a project of the magnitude of the Beaufort Sea-Mackenzie Delta region oil and gas proposal must remain unanswered until further basic research is completed.

The Panel has been informed that government funding for basic research has been reduced significantly in real terms in Canada in the past decade. Basic research, whether in government or supported by government in the private sector, appears increasingly dependent upon project-specific financing. Therefore, short-term applied research tends to dominate over long-term basic research whose results, in the short term, may be intangible. During the General Sessions, for example, the most helpful advice given to the Panel on contentious environmental issues frequently came from scientists, from inside or outside of government, who carried out long-term basic research in the North.

One of the further consequences of the decade-long reduction in Arctic research has been a movement of scientists from government to industry. During the General Sessions, the Panel at times realized more expertise now exists within the industrial sector than in government in a number of important areas of government responsibility. This makes it difficult for the responsible government departments to make judgements about scientific and technical evidence submitted to various regulatory bodies.

In spite of the very large areas of land and sea in the Arctic, the importance to northern people of a sustained renewable resource economy and the significance to Canadian sovereignty of an adequate knowledge of the Arctic, Canada does not have integrated, focused policy or programs for Arctic research. The lack of policy is regrettable and has led to a fragmented approach to the design and application of efficient research programs.

The Panel believes that the ultimate responsibility for basic research in the North rests with government, and that government must ensure a balance between applied and basic research so that development in the North is not adversely affected by a lack of basic research into the biophysical environment.

The Panel believes that the Government of Canada must be assured that the necessary research has been completed if it is to make informed decisions as development projects are promoted. The basic research programs should be viewed as the cost of doing business. The only alternative policy would be for government to discourage all development.

The Panel appreciates the fact that government funding for research is not unrestricted and that priorities must be established for northern research. Accordingly, some research priorities that the Panel believes are environmentally important for the long-term development of the North have been identified. The identification of the research priorities has come from many sources: some from unresolved questions raised by communities and intervenors and some from government departments, both federal and territorial, with legislative responsibility in the North. Other priorities are based upon the judgement of the Panel as to what research is required in order to ensure that production and transportation of oil and gas proceeds in an environmentally acceptable manner.

The list of specific research projects is by no means complete and the Panel recognizes that many important projects have been omitted. In the Panel's opinion, if long-term basic research is not carried out into the recommended research topics, governments, regulatory authorities, monitoring agencies and others will be required to make important decisions on many environmental concerns without complete or adequate knowledge.

6.9.5 Specific Research Projects

6.9.5.1 Oceanographic and Related Research

The Panel concludes that there is a need for a better understanding of the physical and biological processes in Arctic environments in general and the Beaufort Sea in particular. A new major multidisciplinary oceanographic program incorporating existing research programs would be a desirable basis for research studies but the Panel recognizes the practical difficulties in providing adequate funding for this work. It is important, therefore, that the most efficient and productive avenues of research associated with the Proponents' projects be identified rather than that a general endorsement be given to investigation of all basic physical and biological processes. The Panel endorses the following research initiatives:

- the dynamics of the wind-driven pack ice-ocean system including: studies of the processes which determine ice movement with an aim to predicting ice concentration, motion and deformation from oceanographic and meteorological data; basic research on ocean/ice/atmosphere heat flux; the thermodynamics of ice pack break-up and freeze-up processes; the physics of landfast ice formations, stabilization of landfast ice by artificial islands and destabilization by ship traffic; and wave and storm surge forecasting techniques;

- research into seabed geological processes and hazards including: sediment dynamics, seabed ice scour, subsea permafrost, and seabed deformation and displacement (the distribution of faulting, slumping and slope instability); and
- marine chemistry research including further investigations of naturally occurring hydrocarbons and the dispersion, biodegradation and weathering of oil.

6.9.5.2 Effects of Oil on Marine and Terrestrial Arctic Species

The effects of oil spills on Arctic animal life were reviewed in the EIS in an overview fashion by the Proponents and various government departments have provided specific comments on the need for specific research projects. The Panel endorses the following research priorities:

- basic research on the fate of spilled oil in the Beaufort Sea, and
- basic research on the impacts of spilled oil on relevant Arctic micro and macro fauna.

6.9.5.3 Marine Mammals and Marine Mammal Habitat Research

The available information about the biology and ecology of marine mammals is somewhat deficient for an in-depth impact assessment of industrial development. In some cases, little data are available for species upon which the potential impacts may be severe. Researchers attempting to obtain information about these species face logistic difficulties when undertaking experimental programs.

Comments by DOE, DFO, DIAND, GNWT and the communities have contributed to the Panel's understanding of the following basic research needs:

- bowhead whale life-history research including studies of the effects of industrial activities on bowhead behaviour and distribution,
- beluga whale research with specific focus on distribution and the effects of vessel sound on behaviour, and
- research on the effects of icebreaking and vessel noise on narwhal movements and distribution.

6.9.5.4 Fish and Fish Habitat Research

Arctic fish species and habitats, although recognized to be important to the food chain for higher trophic levels, have not received the research emphasis required for effective management for sustained yields. If a better understanding of the indirect impacts of industrial developments on various marine mammals and various predators such as polar bears is to be achieved, more information will be required about fish and fish habitats. Of equal importance is the subsistence value of Arctic fish species to northern people.

The Panel has identified the following research need:

- research, as part of an Arctic coastal and estuarian fisheries research and management program, to identify and study fish habitats and fish species which could be sensitive to oil and gas production and transportation.

6.9.5.5 Birds and Bird Habitat Research

Many terrestrial and marine bird species, and in particular the migratory species, have been relatively well researched and the potential impacts of various phases of industrial development are reasonably well known. The distribution of these species is not fully known, however, and not all nesting and rearing sites have been mapped. During certain life-cycle phases, these species are relatively sedentary and the impacts of oil spills, for example, can have catastrophic site-specific impacts. For these reasons and in recognition of our international commitments to preserve and manage these species, the Panel supports continuation of the inventory and monitoring work of the GNWT and CWS. The Panel has made recommendations on the inventory programs in Section 6.8.5. While important, these inventory programs do not represent new research initiatives.

6.9.5.6 Terrestrial Mammals and Terrestrial Mammal Habitat Research

Caribou received much attention during the Panel review and the research needs for the biology and ecology of the species were well described. Other ungulate species received some attention but there was only passing mention of various predator species and fur-bearers of economic importance. The nature of the harvesting studies of these species received more attention than the species themselves. The Panel recognizes the concern of intervenors, the CWS, YTG and GNWT, that these species should receive greater attention, particularly with respect to habitat management and the potential importance of special habitat areas. Recommended research to provide sufficient information for the implementation of effective management, mitigation and monitoring programs includes:

- specific research related to the reaction of caribou to vehicle traffic and to overflight by jet aircraft,
- specific research into Yukon North Slope caribou range ecology, particularly summer ecology including the importance of insect relief habitat, and
- computer simulation modelling of caribou population dynamics.

6.9.5.7 Integrated and Multidisciplinary Programs

Although most of the requests received by the Panel for new and continuing research initiatives concentrate upon single species or upon the impacts of a single industrial activity, several review participants and the Panel recognized the need for integrated research programs.

The Department of the Environment emphasized the need for a better understanding of the Arctic estuaries which may be affected by development. The Mackenzie Delta is the major focus of interest but biologically productive habitat for marine species and related terrestrial species is also found at the outlets of other river systems. The ecology of these environments is not yet well documented and further multidisciplinary research is needed.

The Panel was informed about the work of Parks Canada, CWS, GNWT and the special DIAND Northern Conservation Task Force, each of which is undertaking research and inventory studies to define better the extent of lands which should be conserved. These initiatives include the mapping of important habitats and studies attempting to devise new statutory and policy mechanisms for the protection of these lands.

The Panel supports research on:

- the biological and physical processes in estuarine environments,
- the biological and physical characteristics of polynyas, and
- the ecology of coastal lakes and streams, particularly on the Tuktoyaktuk Peninsula.

7.0 COMPENSATION

Compensation was a major topic of discussion at the Community and General Sessions and was addressed at length by the Proponents in the EIS Supplementary Information. At the Community Sessions, the Panel heard northerners and residents of the Labrador coastal communities express concern that loss of wildlife harvesting would lead to loss of lifestyle and that this should be compensated for in some manner. Others indicated that no amount of compensation could pay for loss of lifestyle.

> *"Once our wildlife don't exist any more, money can not turn them back to life. Money can not change or compensate for the wildlife."*
>
> *J. Kooneeliusie*
> *Broughton Island*

> *"We want development, we need development but at our pace, to meet our goals. We are not willing to risk our environment that has supported the Inuit culture and the lifestyle to become heavy equipment operators. We want more than that for our children."*
>
> *G Williams*
> *Arctic Bay*

> *"It is essential that we have a method of paying compensation for any ill effects that will arise from oil production. Compensalron will have to be established prior to start-up, as well as the identification of what events will be considered for compensation. It is not satisfactory to have the proponents Indicate that compensation may be paid. We want to know when, how and how much will be paid for specific incidents."*
>
> *G Williams*
> *Arctic Bay*

The Panel considers it to be of substantial importance to resolve the long-standing issue of whether loss of wildlife harvesting opportunity, because of activities of others, is compensable. There is a potential for major losses in the renewable resource industry and considerable change in lifestyle for northerners as a result of the implementation of the proposed development. A review of the positions put forward by the various participants is set out below.

In the EIS Supplementary Information, the Proponents advocated a single, direct method for most claimants to present their case and receive timely results. They recommended that claims arising from major oil spills in marine waters should be dealt with separately, through the present legislation (the *Arctic Waters Pollution Prevention Act)* which is comprehensive and provides sufficient protection. Also, the Proponents said that they would be prepared, in instances where loss had occurred but there was no legal method of collecting, to examine on a moral basis a fair way to compensate the claimant. The Proponents presented a comprehensive brief on the present law and on what they felt would be a fair method of compensating wildlife harvesters in the future. Their brief pointed out that it was the function of the various governments to prepare the necessary legislation and framework to allow for the provision of compensation.

The Government of the Northwest Territories presented a Renewable Resource Compensation Directive, the main point of which is that a developer would prepare a compensation plan for submission to the government along with the final project proposal.[1] Where any claim for loss due to development cannot be attributed to any one developer, then all developers in that area would be required jointly to share reimbursement costs. A Compensation Board would be appointed by the GNWT Minister of Renewable Resources. The brief, in effect, set out the framework in which the GNWT felt that a compensation program could be instituted.

The Department of Indian Affairs and Northern Development presented a six point brief which described the following *draft* position on compensation:

"1. Compensation will be a term and condition of government-industry agreements for approved projects. DIAND will ensure that compensation is addressed and necessary provisions established in conjunction with approvals on a project-specific basis using common principles outlined below.

2. Responsibility for providing compensation rests with developers whose activities give rise to the need for compensation.

3. Compensation claims will be dealt with through direct claimant-developer negotiations, wherever practical, with government providing assistance as requested.

4. Responsibility for establishing and initiating a claim rests with the claimant.

5. Compensation claims should be treated in a timely and equitable manner.

6. DIAND will continue to work with the GNWT, industry, other federal departments and hunters and trappers to develop appropriate compensation programs."*

The principles underlying the DIAND position were:

> "The Department places its emphasis on the prevention of adverse effects of northern development on renewable resource harvesting rather than on mitigation or amelioration after damage occurs.
>
> The Department has no legal liability, as a result of issuing approvals for projects, to provide compensation resulting from project effects on renewable resources and harvesters.
>
> Compensation should be considered for equipment loss or damage and loss or reduction of commercial and subsistence harvests caused by direct reductions to wildlife populations, deflections of wildlife away from regular hunting areas and/or loss of access to hunting areas. Compensation cannot reasonably be considered for loss of lifestyle or cultural change since these transcend specific projects and are in some measure compensated for through regional and northern benefits.
>
> Compensation claims should be assessed on the basis of historical harvest levels and hunter effort, with substantiation being provided by local HTA's and wildlife officers, and compensation calculated using a prescribed formula. DIAND will continue to support wildlife harvesting data collection projects, such as the BRIA study, to provide sufficient historical harvest

> data for use in documenting and assessing reductions to wildlife harvests. This includes an onus on hunters, trappers and fishermen to keep records of their harvests.
>
> An arbitration process should be established to deal with unresolved claims. In the event that direct negotiations and arbitration prove unsuccessful, the claimant would then have recourse through the courts to sue as the final means to resolve claims.
>
> A reduced burden of proof should be applied to the establishment of compensation claims by claimants. In the case of unattributable claims, a clear indication of reduced harvest success per unit effort should be sufficient grounds for establishing a claim: the need to demonstrate a causal relationship should not necessarily be a requirement.
>
> A process should be established to deal with compensation claims that can not be attributed to a specific project. DIAND supports the establishment of temporary compensation boards to adjudicate unattributable claims for compensation and to designate the compensation level and responsibility for payment of these claims. Accordingly, through government-industry agreements, industry will be required to accept responsibility for unattributable losses.''[3]

The Department of Indian Affairs and Northern Development in response to questions raised by the Panel also provided its opinion on the problems associated with the legislation for compensation claims by renewable resource harvesters particularly with the Arctic Waters Pollution Prevention *Act* and the Oil and *Gas Production and Conservation Act.* They pointed out seven problems which require attention. They are:

> ''1. the legislation deals with specific cause and effect relationships resulting from specific types of development and, accordingly, does not comprehensively address the full range of development impacts under one statute;
>
> 2. the legislation establishes the courts as the main vehicle for settling disputes over claims, resulting in lengthy and expensive court battles and delays in claimants receiving compensation;
>
> 3. the *Oil and Gas Production and Conservation Act* does include loss of opportunity, however, the legislation does not expand in detail on the traditional common law limitations applied by the courts concerning what damages are considered compensable;
>
> 4. the legislation and regulations do not outline a specific process for the implementation of the compensation provisions;
>
> 5. the legislation does not deal with the cumulative effects of development, only with project specific effects;
>
> 6. primacy needs to be established between the *Arctic Waters Pollution Prevention Act* and the *Oil and Gas Production and Conservation Act;* and,
>
> 7. limits to liability and third party loss provisions need to be reviewed in terms of their appropriateness and adequacy in compensating for a major oil spill.''[4]

The Dene also presented a strong and thoughtful brief which was very helpful but which, in part, went beyond the Terms of Reference of the Panel in that it dealt with compensation as it applied to native land claims. The Panel is aware that compensation for lands taken from the native people is the basis for all land claims negotiations and settlements in Canada. The Panel also heard that native people have been frustrated over the years. Governments and non-natives have taken lands previously used by the natives and have encroached upon hunting, trapping and fishing areas. In most instances, this has occurred without compensation. Complaints to government concerning individual damage claims to date have been diverted to the land claims negotiating table where they remain unresolved.[5]

The Terms of Reference of the Panel do not allow it to address the issue of native land claims since they are being negotiated by the Government of Canada in a different forum. Nevertheless, compensation for all northerners who may incur losses due to the proposed development is within the Panel's Terms of Reference and must be addressed.

The Panel believes that the Proponents, DIAND and the GNWT have shown, through their briefs and presentations to the Panel, a will and the necessary good relationship to develop a compensation package acceptable to northerners.

Compensation for lands taken or interfered with so as to affect hunting, trapping and fishing without reimbursement is the basis of all land claims negotiations and settlements. The native people do not consider relevant the matter of who is exploiting the land and interfering in a detrimental way with their activity.

Often in the past, government, and to a lesser extent private enterprise, have caused damage or difficulties to renewable resource harvesting in the region. The Beaufort Sea hydrocarbon production and transportation proposal is a major project by private enterprise with government encouragement. Not only will industry increase development activities, and hence the potential for damage or loss to local people, but government activities such as road and airport construction will create possibilities of loss.

Private individuals and secondary industries will also contribute to this process. To restrict compensation for loss to activities of the Proponents alone will resolve only a portion of the total problem that may arise in the region. The Panel concludes that a compensation process must be set up to include all loss or injury without regard to who caused it. Compensation, of course, should be available to all northerners, not just those of native ancestry.

Compensation terms set out in other agreements may restrict certain individuals from participating and may allow others to opt out of any general compensation program in return for other benefits. For example, a settlement of native land claims may provide a payment for certain losses and thereby restrict the participants from making a specific claim under the compensation package. Others may sign a joint venture agreement with industry in order to participate in a particular development and in return forego their right for compensation.

Intervenors assumed that only developers would have to pay compensation for loss or injury. It is the position of the Panel that once a compensation board is appointed it must be completely independent in order to hear claims against any party

causing loss or injury, including the government which has appointed it. The Panel refers to a "compensation board" as a board with powers yet to be defined.

The present legislation bearing on Arctic oil production and transportation, the Arctic Waters Pollution Prevention Act and the Oil and Gas Production *and Conservation Act,* sets out a framework in which compensation is to be paid. In the event of a major oil spill or other catastrophic pollution, it is the view of the Panel that the compensation board must have the power to pay interim compensation. The board should be able to provide immediate relief to the claimants on a day-to-day basis until such time as the full extent of the damages can be ascertained through the procedures in the above Acts and final compensation paid. This could be achieved by establishing a "no fault" fund or a similar arrangement. If there is a catastrophic event, northerners may not have the expertise or the knowledge of how to proceed under the foregoing Acts. However, they should be familiar with the board's activities and the board in turn will be able to assess quickly the real and timely needs of the claimants and to provide them with interim payments almost immediately. No doubt some legislative changes will be required in order to delegate the necessary authority to the board. The Panel considers a rapid response capability to be a crucial point.

The Panel understands that there are many difficulties involved in assembling a compensation package which will accomplish the objectives of DIAND, the GNWT and the Proponents. Legal constraints arising from separate jurisdictions for marine mammals and fish and terrestrial animals, the setting up of another legal process to adjudicate claims outside of the present system, the difficulty of developing a lesser standard of proof or of reversing the onus of proof and the difficulty in enforcing binding decisions in the face of the Charter of Rights have all been considered.

Nevertheless, the Panel believes a comprehensive compensation package for all northerners is essential. The Panel believes many small losses and damages occurring in the NWT and Yukon today are not compensated for because there is no suitable body to which the claimant can apply for relief. The present legal process is prohibitive for resolving this sort of problem since most losses and damages are small ranging from a few hundred dollars to about $10,000. The legal costs, the time involved and the risk of being unable to prove the losses or damages to the standard required, rules out this avenue of relief.

A separate compensation board with the power and jurisdiction to make quick and binding decisions would set up an entirely new and separate judicial system. The decisions of the compensation board would be appealable to a court of appeal. If the board were allowed to make decisions without the standard of proof required in a court of law, its decisions would be suspect on appeal. Therefore, the objective of having a quick system to settle claims for damages would not be achieved because a court of appeal could dismiss the case.

A compensation board without legislated powers was considered. The board would take funds provided to it in advance by the Government of Canada, the NWT and Yukon territorial governments, and developers under the terms of their compensation agreement with the governments and would use them to pay claims presented. An informal, non-judicial hearing with the claimant and the defendant would establish the facts as they are known and then a decision could be rendered. If a loss was established to the satisfaction of the board, an award would be given. The Panel is advised this would be legally impossible because the board would be paying out money. Any government funds paid out must be paid only through a legislated process based on accepted legal standards. As well, the defendants would have a right to appeal under the Charter of Rights.

The dilemma which appears to be facing the Panel and the parties attempting to establish a reasonable, simple method of small claims compensation is that the present system coupled with government rules imposes a complex web that cannot be overcome easily. The Panel is also aware that there are informal methods of agreeing on compensation in other parts of Canada. They can be appealed through the legal system. This implies that a solution is possible. The Panel describes objectives that the Government of Canada, GNWT and YTG along with the Proponents should strive to accomplish. How these objectives are accomplished is a matter for the parties to resolve. The objectives should, however, be achieved as soon as possible.

The Panel believes that the following objectives should be incorporated in a compensation plan:

- There should be a "compensation board" established by each of the territorial governments to adjudicate claims within their separate jurisdictions. Each board should deal only with small damages or claims up to about $10,000. These boards should have as much power as possible to settle compensation claims, but should have at least the power to make recommendations.
- Any northerner alleging a loss of income or damages resulting from the activities of others should have the right to present a claim for compensation to an independent, readily accessible "compensation board".
- The Government of Canada and the territorial governments should develop the conditions under which a permittee or licencee will be required to pay compensation with the necessary terms to allow a third-party claimant to take action for loss or damages.
- A developer wishing to carry on activities in either territory should be required to present a compensation plan satisfactory to the government of the territory in which it wishes to operate prior to being provided with the permit or licence applied for.
- The Government of Canada, GNWT, YTG and the Proponents should develop, for the guidance of the "compensation board", a schedule of payments for the kind of small claims anticipated along with guidelines, and a schedule of per-diem and expense allowances for successful claimants.
- In the event the developer (private or public) and claimant do not settle the claim privately and the "compensation board" recommendation is not satisfactory, the claimant should be provided with legal aid services under the present territorial legal aid systems as may be required to take the claim to civil court.

- The federal and territorial governments should develop legislation describing the policy and terms for compensation.

- The Government of Canada should amend the *Arctic Waters Pollution Prevention Act* and the Oil and Gas Production and *Conservation Act* as required to assure that compensation will be available in a timely manner to those experiencing loss or damage resulting from activities covered under these Acts. These amendments should include a provision for legal aid to claimants and interim payments if the claimants depended upon a resource for livelihood and this resource is no longer available.

56 **The Panel recommends that the Government of Canada, the Government of the Northwest Territories and the Government of Yukon develop and implement a comprehensive compensation plan for the North encompassing the objectives set out by the Beaufort Sea Environmental Assessment Panel before production and transportation of Beaufort Sea oil and gas proceeds.**

8.0 GOVERNMENT MANAGEMENT

8.1 Overview

The Panel's Terms of Reference included the examination of the governments' capability to control Beaufort Sea oil and gas developments. To complete this examination the Panel requested and received from federal departments and the territorial governments position statements which described the impacts of Beaufort Sea hydrocarbon production and transportation on their policies and programs, and their plans for coping with these impacts. The statements were widely distributed prior to the Public Sessions. The Panel, at the General Sessions, listened to suggestions by the Proponents, intervenors and government representatives as to how governments could best manage their responsibilities in the development and operation of Beaufort Sea hydrocarbon production and transportation.

> *"Government policy must be clear, timely, consistent, and most importantly, Integrated, so that industry can get on with its job for planning for the development of Beaufort oil, and by so doing, assisting government in achieving its objectives."*
>
> *D. Motyka, Gulf*
> *Whitehorse*

The Proponents, in addressing the subject of government management, sought a clear statement of policy from the governments, and little in the way of regulatory change. The territorial governments sought a mechanism to obtain funds and personnel in a timely manner so as to fulfill better their legislative mandates. The federal departments sought direction concerning policy, timing and methods for coordination. They too emphasized the need for adequate and timely commitments of funds and personnel. The communities sought adequate and timely funding to prepare themselves for development. Native groups sought a role for themselves in the management of the project and of the renewable resources upon which they depend. Individuals sought assurances that their aspirations would be respected by developers and governments alike.

> *"A comprehensive monitoring framework should be developed by government and industry in advance of development and should include residents of the development area"*
>
> *J. Donihee*
> *Yellowknife*

The Panel heard several intervenors describe the initiatives being applied by government and industry to the Norman Wells expansion project. The Panel assumes that the lessons learned from this experience will be employed in the management of Beaufort Sea hydrocarbon production and transportation projects.

> *"Unlike, the glowing pictures which some people will try to paint about this project (Norman Wells), it has not necessarily proceeded in a way which was promised, nor which is acceptable to the Dene. Neither is there a great deal of confidence that it has been a positive experience, nor that the land and resources within Denendeh have been adequately protected"*
>
> *Ms. L. McLachlan*
> *General Council to the Dene Nation*
> *Yellowknife*

In the Norman Wells project there was one area of particular concern to the Panel. It was told that, after the regulatory hearings had been completed, the Government of Canada ordered a two-year delay so that many groups could better prepare themselves for the effects of the development. This preparatory work was frustrated in the case of the Government of the Northwest Territories by the delay in obtaining funds from the federal government to proceed. Particularly frustrating to all parties was the fact that there was substantial agreement as to what had to be done, and even how to do it; but promised funds were not provided in a timely fashion.

> *"We believe that small projects will allow for slower expansion, and thus more effective implementation of government services, and programs, but with the proviso that the financial assistance is made available to n fact government, in particular the Government of the Northwest Territories, so that we can develop the necessary programs, and the long-term requirements for the communities as the development occurs, or prior to the development taking place."*
>
> *R. Nerysoo*
> *A kla vik*

61 **The Panel recommends that the senior governments cooperate in designing funding mechanisms for the regulatory surveillance for any Beaufort Sea-Mackenzie Delta project which will avoid such problems as those Identified by the Norman Wells experience.**

The Panel, after consideration of all of the evidence presented, concludes that the governments, both federal and territorial, should have in place the mechanisms that with some regulatory adjustments and the provision of adequate financial and human resources for research, monitoring and social support systems will allow phased development to proceed.

57 The Panel recommends that the federal and territorial governments ensure that their respective departments and agencies prepare effective policies and programs now for managing Beaufort Sea-Mackenzie Delta hydrocarbon production and transportion with a goal of strengthening local management roles.

The Panel expands on this recommendation by suggesting that the governments' task of preparation should include:

- locating government management structures for Beaufort Sea hydrocarbon development in the Beaufort Sea-Mackenzie Delta region;
- improving and strengthening coordination mechanisms;
- providing a mechanism for rapid and adequate funding of social and capital programs;
- making improvements to shipping regulations and legislation;
- establishing a Beaufort Sea Port Authority;
- developing an expanded capability for Arctic research and monitoring;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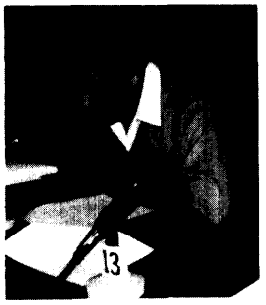
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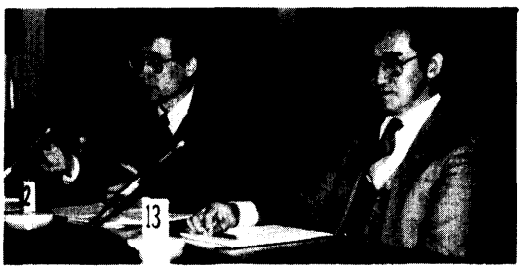
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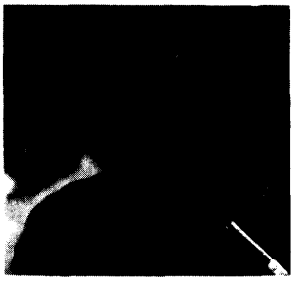

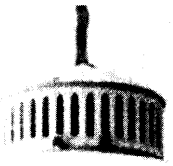


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- designing standards for environmental and socio-economic monitoring;
- establishing an effective surveillance and enforcement capability;
- supporting archaeological research and management;
- ensuring adequate expertise is available to evaluate the Proponents' technical proposals;
- developing a public review procedure to examine the environmental and socio-economic effects of tankers travelling through the Labrador Sea south of 60° North Latitude; and
- developing a system for placing in the public record the actions taken as a result of the Beaufort Sea Environmental Assessment Panel Report.

8.2 Local Control

The Panel found that government structures in northern Canada, given the population base involved, are extremely complex; federal, territorial, regional, local and native interests all have to be considered. From the information offered by local residents and politicians at the Community Sessions it was clear to the Panel that such complexity often confuses local residents. Often this confusion has led to frustration and dissatisfaction, particularly with those government agencies not present in the community.

> *"We should not under rate the ability of the Communities and their councillors to meet the development challenge."*
>
> *J. McEachern, GNWT Inuvik*

It was also clear that there is considerable frustration in northern governments and among northerners with the present powers of the federal government which, through DIAND, controls land, resources and the pace of political development north of 60° North Latitude. The Panel was informed that northerners are particularly frustrated by their inability to reach the federal decision makers and with the apparent lack of accountability to the local people of these decision makers.

The Panel believes that this frustration may be at the root of many of the socio-economic problems from which northern communities suffer. The introduction of additional stress through hydrocarbon production and transportation activities will, as has been discussed elsewhere in this report, only increase the problems these communities face. If, however, this underlying frustration can be removed, then the socio-economic consequences of hydrocarbon production and transportation will be reduced.

The Panel is aware of the work and recommendations of the "Drury Commission" on the devolution of governing powers from the Government of Canada to the Government of the Northwest Territories. It is also aware of the present discussions between the two levels of government about that subject and that some control has already been delegated. The Panel was informed about the Shetland islands County Council experience where the method used by the central government of the United Kingdom to delegate its authority while retaining a veto in the national interest and providing experts as required, appears to be working well and could be considered as a model. The Panel is convinced that early resolution of this matter is in the best interests of northern people.

58 **The Panel recommends that the federal and territorial governments negotiate as soon as possible the further transfer of administrative control to the Territories.**

8.3 Project Coordination

Throughout the public sessions on government management the Proponents, the Government of the Northwest Territories and DIAND advocated some form of project coordination at the local level. Some intervenors described problems with past attempts at coordination, many of which resulted from the creation, too late, of a coordinating mechanism. The Panel is pleased to note that the creation of a Mackenzie Delta Beaufort Sea Coordinating Office was announced jointly by DIAND and the GNWT in Inuvik on December 10, 1983 and that both the Minister of DIAND and the Minister of Energy in the Government of the Northwest Territories mentioned the importance of this office in their remarks to the Panel on December 16, 1983. The Panel is concerned, however, that the role of the Beaufort Sea Coordinator as described by the Ministers, while perhaps adequate for the present, needs to be expanded and strengthened as plans for production and transportation become more precise.

59 **The Panel recommends that the role of the Beaufort Sea Coordinator's Office be expanded to make it the coordinating office not only among the community-based Development impact Zone Group and governments, but also among industry and governments.**

The Panel believes that:

- this office should be the principal coordinating mechanism for Beaufort Sea-Mackenzie Delta hydrocarbon production and transportation projects;
- the office should remain in Inuvik;
- as the coordinator should have direct access to the deputy ministers of the federal and territorial government departments, as well as to industry and community groups, in order to expedite the solution of emerging problems, the coordinator should have the rank of a federal deputy minister, and be appointed by the Privy Council after consultation with the territorial governments;
- the coordinator should have the roles of facilitator, ombudsman and advisor but should not have regulatory responsibilities;
- the timing of this appointment should allow the coordinator time to implement effective monitoring mechanisms but, in any event, should be not later than the date of the approval of the first hydrocarbon production or transportation project in the Beaufort Sea-Mackenzie Delta area;
- the coordinator's office should include staff seconded to the coordinator from other federal and territorial departments as a means of improving communications and understanding between the coordinating office and the regulators: and
- the coordinator, in addition to responding to the concerns of the DIZ Group, should chair a management committee whose

role would be to identify potential interjurisdictional disputes and resolve them before they develop. The committee would include senior on-site representatives of industry, the Regional Director of the Inuvik Region of the GNWT, the senior officials of DIAND, DFO, DOT, and DOE who reside in the North, community administrators from Tuktoyaktuk, Inuvik, and Aklavik, and, when matters relating to Yukon are discussed, a senior official of the Yukon Government.

8.4 Planning

During the course of the public review many intervenors pressed for the establishment of a land use planning process and the establishment of a regional land use plan in the Beaufort Sea region prior to hydrocarbon production. The Proponents have stated that such a plan would provide a better framework for their planning purposes but, in their view would not be absolutely necessary.

The Panel heard from DIAND, the GNWT and the YTG, among others, that general agreement is near among parties on how the planning process will proceed. One draft of such an agreement was tabled at the Whitehorse General Session. The Panel would view the establishment of a planning process acceptable to the federal, territorial and local governments and native organizations as a major step forward.

There remain, however, many steps to be taken before the completion of a "plan" for the Beaufort Sea region. These include:

- the identification of a joint Yukon and Northwest Territories government planning mechanism for the Beaufort Sea coast;
- the identification of a planning process for Arctic offshore areas;
- the integration of the regional land use planning process with the Committee for Original Peoples' Entitlement (COPE) Final Agreement and the Council of Yukon Indians (CYI) Agreement-in-Principle;
- the creation of the proposed planning commissions and their associated advisory committees as well as technical support staff and other resources; and
- the identification of the specific federal and territorial policies which apply to this region.

These problems will not be easy to resolve and it is unlikely that approved regional land use plans will soon emerge.

While the job of any regulator or planner is much simplified if basic principles for an area have been accepted in a formal plan, it is possible to proceed with development without such a plan as long as governments consult among local people, industry and themselves and react positively and quickly to the suggestions made by those consulted. The Panel believes that, with the creation of the Mackenzie Delta-Beaufort Sea Development Impact Zone Group and the Coordinator's office, this process is possible.

The Panel recommends that:

62 **all parties proceed to establish a regional land use planning process and to complete land use plans for the Beaufort Sea-Mackenzie Delta region as soon as possible; and**

63 **if no regional land use plan is in place, a process, preferably the regional land use planning process, be used to ensure local public involvement in the site selection for major facilities.**

8.5 Government Offshore Contingency Plans

The Panel heard, and examined, considerable evidence regarding the existing government institutional apparatus for oil-spill contingency plans in Arctic seas.

As matters now stand, it is the Panel's understanding that, depending upon the location and type of oil spill which may occur, as many as 15 government and regulatory agencies could become involved; they would work with a number of oil companies, their contractors, local peoples and other personnel. In addition the Governments of the United States and Denmark may be involved. The international implications of a major spill demand that clear lines of authority, accountability and responsibility be defined before offshore oil production and transportation are permitted. The Panel believes that existing arrangements are too complex. It is important that simple, direct and effective measures for contingencies be in place in advance of offshore oil production.

The Panel recommends that:

64 **a single authority, the Canadian Coast Guard, be empowered to administer, plan and direct a government contingency plan for any oil spill in Arctic marine waters whether it originates from production platforms, pipelines, artificial islands, any form of shipping or from a source on shore that contaminates marine waters;**

65 **the Canadian Coast Guard have a consultation mechanism with all government agencies responsible for marine environmental management and protection throughout the region; and**

66 **the Arctic Seas Contingency Plan for oil-spill containment and clean-up take into consideration the necessity for cooperation between international agencies.**

8.6 Vessel Traffic Management

The Panel was told that there are problems in the overall control and monitoring of ship vessel traffic through the Canadian Arctic.

Transport Canada holds the legal mandate and responsibility for ensuring shipping safety in Canadian waters. If a vessel is disabled or sinking in Arctic waters, or has encountered some other emergency, government's responsibility must be absolute and its actions must be swift and unencumbered by jurisdictional or communications problems.

At the General Sessions the issue of the emergency response capabilities of the Government of Canada in the Canadian

Arctic was raised, as was the issue of the lack of control over daily shipping operations both in the Beaufort Sea and along the proposed Arctic shipping route. The Panel was advised that the Canadian Coast Guard was establishing a Control Authority for Arctic Seas but that the system now in place (NORDREG) is not mandatory. The Canadian Coast Guard has suggested that amendments be made to the Regulations under the *Arctic Waters Pollution Prevention Act* (AWPPA) so that environmental concerns can be addressed by Pollution Prevention Officers in directing ship traffic within Arctic zones. The Government of Canada is in the process of inviting "funded bids" for a Class 8 icebreaker to support Arctic shipping and research but has not yet committed itself to construction.

The Panel concludes that the Government of Canada must have clear regulatory authority over environmental aspects of Arctic shipping. It also believes that the Government of Canada should be capable of responding to incidents in Arctic seas in a timely fashion with adequate equipment.

The Panel recommends that:

67 the Canadian Coast Guard be empowered, through amendments or additions to existing Acts and Regulations, to direct shipping away from, or issue instructions for the safe operation of vessels within, specific areas, at times or locations of environmental sensitivity;

68 the present vessel traffic management system, NORDREG, be made mandatory for all vessels which enter Canadian Arctic waters. The management system must be extended now to the Beaufort Sea region so that the Canadian Coast Guard and all others concerned can become familiar with the system before Arctic tankers enter these waters; and

69 the Government of Canada immediately commence the construction of an icebreaker that would meet at least Arctic Class 8 specifications.

In the designation of operating conditions for Arctic ship traffic, the Coast Guard should consult with the appropriate government departments and local residents to identify environmentally sensitive regions and to set up monitoring standards for those regions. In cases where deficiencies of data are identified, the regulatory authorities should set out shipping directives which err on the side of caution, until such deficiencies are addressed through appropriate programs of research.

8.7 Port Authorities

Port facilities (see Section 6.6.1) have been, and will continue to be, of great interest to industry and local people within the Beaufort Sea area.

The Panel believes that it is possible to resolve many of the concerns about ports at the local level if a mechanism is designed which will give some control over port developments to local representatives.

The Panel recommends that:

70 the Minister of Transport establish a single port authority to control and manage all port and harbour developments on the Beaufort Sea coast;

71 the port authority include northern residents selected from nominations made by local communities, native organizations and the territorial governments; and

72 multi-user ports be encouraged so that the proliferation of facilities is minimited.

8.8 Funding

The policy of the Government of Canada for the North envisions development proceeding with the full participation of northerners and in an environmentally acceptable fashion. To encourage development, large sums of public moneys have gone to the petroleum industry in the form of exploration incentives. Some moneys have also been spent on accelerated research programs such as the Eastern Arctic Marine Environmental Study, the Beaufort Sea Project and for social development such as the Norman Wells training program, but these are insufficient to meet present requirements. If the federal government decides that hydrocarbon production and transportation is to be encouraged in the North, the Panel believes that the federal government must accept the necessity of larger expenditures by governments for social and environmental matters. For instance, the federal government has committed itself to northern hydrocarbon exploration. It should therefore recognize and accept that it must provide adequate funds in advance for social programs, infrastructure development, research and monitoring, and other relevant activities so as to be prepared for development projects.

73 The Panel recommends that, for each recommendation made in the Panel Report, the appropriate funding agency provide adequate and timely funds for its implementation.

8.9 Revenue Sharing

A number of intervenors including the Government of the Northwest Territories recommended some form of resource revenue sharing between the federal government and the territorial governments. This would provide a means of providing funds to pay for capital and operating costs for community infrastructure developments needed prior to development activities and a means of reducing territorial dependence on federal funds. The Panel believes that an increased share in resource revenues for northerners would enhance northern benefits and local autonomy, and would serve to make development more acceptable. Collective risks to the renewable resource base of northern residents must be offset by significantly increased local, northern benefits. The establishment of a Northern Heritage Fund has been suggested by the Senate Committee on Northern Pipelines; the Panel supports the creation of such a fund as an interim measure. This would allow negotiations on revenue sharing to proceed concurrently with any part of the development proposal.

8.10 Government Research Effort

The Panel heard evidence on the status of the present government research effort. Much excellent work has been done and is being done and new programs are being planned.

The Northern Oil and Gas Action Program (NOGAP) of DIAND and the Environmental Studies Revolving Fund (ESRF) of COGLA are examples given to the Panel of new government initiatives to support Arctic Research.

The Northern Oil and Gas Action Program is designed to answer certain specific questions relating to phased Beaufort Sea development and is to operate over seven years. The program was designed with the help of several of the territorial and federal departments and has the potential to do much to resolve their specific concerns about hydrocarbon production. Secure funding for NOGAP had not been obtained, as of the completion of this report.

The Environmental Studies Revolving Fund uses industry funds to conduct applied research, the better to prepare government to make decisions concerning petroleum development in the Canada Lands. The Panel heard criticisms from intervenors concerning slowness in implementing any research, the detrimental effect this has had upon research carried out by consultants, apparently high governmental administrative costs and complicated application procedures. Fund managers recognized some of these problems and were working to overcome them. In the opinion of the Panel these administrative problems can be solved but this fund will not likely be successful in replacing the vigorous research by industry that preceded its introduction.

The government is to be commended for these new incentives but the Panel cannot ignore the remarks in Ottawa of Dr. Fred Roots:

> "... our scientific capacity with respect to the North is frankly not in good shape. Rising costs, and perhaps even more important, the need to devote scarce resources to urgent problems for immediate decisions have meant that the carefully planned long-term research projects of the Department of the Environment and of other agencies have been seriously curtailed".

The Panel has commented in Section 6.9.4 on the need to conduct basic research as well as mission-oriented research in the Arctic regions. This need must be satisfied by government resources.

60 **The Panel recommends that the Government of Canada make a commitment to a fifteen-year program of accelerated Arctic research that includes the following elements:**

- **a) a federal policy for Arctic research which provides a national focus for short and long-term Arctic research and provides a mechanism for funding this research;**
- **b) a commitment to encourage research in the North by northerners;**
- **c) increased support for basic research during this period for federal agencies such as the Arctic Biological Research Station, the Canadian Wildlife Service, the Ocean Sciences and Surveys Directorate, the Polar Continental Shelf Project, and other centres of Arctic expertise;**
- **d) a program designed to strengthen university centres for Arctic research;**
- **e) a special tax write-off for the cost of industry-sponsored research in the Arctic that is made public within two years of the completion of field work; and**
- **f) funding for NOGAP.**

The Panel has identified in Chapters 5 and 6 a number of research issues within the domain of government which it believes require attention now if knowledgeable government management decisions are to be made concerning specific development projects. The list is not complete but it does reflect the Panel's judgement and the collective views of many agencies and individuals appearing before the Panel.

8.11 Monitoring

Many references to monitoring have been made in previous sections of this report. They serve to emphasize the importance the Panel places on the ability to monitor and to react. The final responsibility for such programs rests with government.

The Panel commends the new monitoring initiatives at Norman Wells and in the Beaufort Sea. A start has been made. The Panel encourages DIAND, in conjunction with other federal departments and the appropriate territorial government departments, to expand these initiatives to include all the Mackenzie Valley, the Beaufort Sea Region and the Parry Channel within the next three years. The background data and data from other research should be used in setting standards for establishing effective monitoring programs for Beaufort Sea oil and gas production and transportation which can give advance warnings of possible problems.

74 **The Panel recommends that the federal government provide funds now for the development of both social and environmental monitoring systems for the Beaufort Sea region.**

The Panel encourages public dissemination and discussion of industry and government objectives for the monitoring programs to be undertaken and the proposed standards against which changes will be measured so that all northerners can have confidence in the monitoring process and understand what it can and cannot do.

The Panel also urges regulators to watch for and to avoid the establishment of unreasonable regulatory guidelines. To this end, the Panel supports the review of environmental regulations now being undertaken by DIAND in co-operation with the territorial governments and other federal departments.

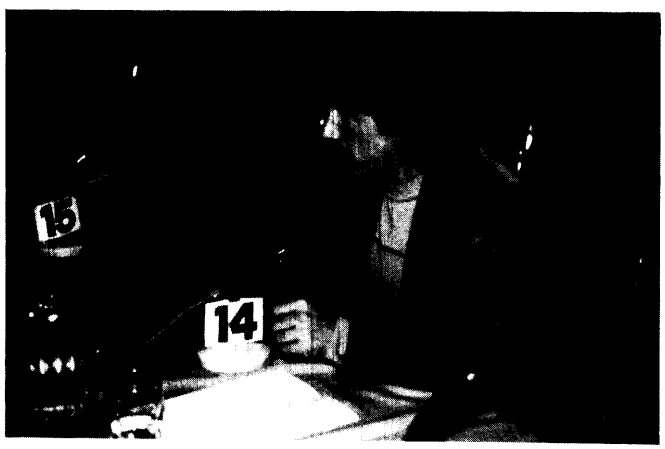
8.12 Surveillance

Once a particular project has received the required approvals, the governments should implement an effective inspection, surveillance and enforcement program that is and is seen to be fair and thorough. Participation in surveillance was requested by native groups and communities. Surveillance responsibilities now rest with various government departments and the Panel is concerned that gaps or unnecessary duplication of surveillance may occur.

75 The Panel recommends that the government departments with surveillance and enforcement responsibilities form a surveillance working group that would include representatives from northerners, both native and non-native. This group should work through the Beaufort Sea Coordinator's Off ice.

8.13 Archaeological Resources

The archaeological resources of the Arctic regions of Canada are of cultural significance to all Canadians, but particularly to northerners. These resources are relatively undisturbed and well preserved. Because they remain largely exposed at the surface, they may be easily damaged or removed and their archaeological value lost. Investigative work and analyses by the Archaeological Survey of Canada of the National Museum of Man (NMM) and the territorial agencies are far from complete.



If oil production and transportation proceed in the Beaufort Sea region, along the proposed tanker route and in the Mackenzie Valley, disturbances to archaeological resources will be more likely because of the general increase in human activity. The Proponents have recognized this problem and propose remedial action. A number of intervenors expressed concern about the need to protect archaeological resources that may otherwise be destroyed or damaged by development.

The Panel is encouraged by the recent agreement among the three agencies (YTG, GNWT, NMM) upon the basic points of an integrated archaeological research and management approach which could serve as a basis for the establishment of a Beaufort Sea Archaeological Program. It is also important in such a management program that an operational referral process be developed to alert the appropriate authorities in the event that previously unidentified archaeological sites are discovered during development activity.

The Archaeological Survey of Canada of the National Museum of Man has proposed a comprehensive research and management program for northern archaeological issues.

76 The Panel recommends that a Beaufort Sea Coastal Archaeological Program be established with the National Museum of Man as the lead agency. The participants in the Program should include the Beaufort Sea-Mackenzie Delta communities, the Proponents and the agencies responsible for archaeological heritage matters at the territorial and federal levels.

To minimize the loss of valuable archaeological information, steps should be taken to ensure that resource developers are fully informed of the measures they should take. To help achieve this the Panel concludes that the territorial archaeological agencies should play the lead role in the archaeological permit issuance system and that regional land use planning and environmental assessment processes should include input from the Archaeological Survey of Canada.

The Panel strongly supports the involvement of local community members and native organizations in the investigation and preservation of their own heritage.

77 The Panel recommends that the Government of Canada provide additional financial assistance to develop further the local education, interpretation and training components of the heritage preservation programs of both Yukon and the Northwest Territories.

8.14 Technical Review Capability

Intervenors at the public sessions often were doubtful that government departments had available to them expertise as good as or better than that available to the Proponents. This was felt to be particularly significant if the Proponents were proposing the use of new techniques or technologies be used.

78 The Panel recommends that the responsible government agencies, through contract if necessary, acquire expertise of the highest calibre, where it is not now present, to evaluate designs, construction techniques and operating procedures proposed by the Proponents and new to these agencies.

8.15 Anticipated and Unanticipated Developments

Throughout the General Sessions discussion took place on a number of current and proposed northern resource development projects such as the Norman Wells Plant Expansion, Polar Gas, Lancaster Sound Exploratory Drilling and the Arctic Islands Exploration activity by Panarctic. The Panel is also aware that other as yet undefined developments may become economically possible as a result of Beaufort Sea oil and gas production and transportation. Both the anticipated and unanticipated developments have the potential of additional impacts on northern people and the northern environment. The Inuit Tapirisat of Canada, for example, informed the Panel in Resolute of its concerns about the impacts that could arise if the Proponents' maximum use of tankers occurred as well as the potential impacts from additional shipping, including international traffic. The Panel concurs with the Inuit Tapirisat of Canada and recognizes that the Proponents' projects could act as a catalyst for a number of additional northern resource development projects. For this reason, much more comprehensive regional planning and sound growth management policies will be required by governments.

79 The Panel recommends that the Department of Indian Affairs and Northern Development, in consultation with the territorial governments, prepare for the increased development of northern energy resources which may result from approval of a Beaufort Sea transportation project to ensure that the rate and pace of growth of these developments is consistent with a small-scale, phased approach for each region of activity.

8.16 Further Public Reviews

The Panel was directed in its Terms of Reference to examine the need for subsequent public review of any aspects of Beaufort Sea hydrocarbon developments and, where appropriate, has responded in this report.

A public review of the effects of tanker traffic south of 60° North Latitude was requested by the Labrador Inuit Association and by the Government of Newfoundland. That review was not within the mandate of the present Panel. The Labrador Inuit Association established through questioning of federal government witnesses in Ottawa that it is not possible under the current Environmental Assessment and Review Process to refer this matter to an Environmental Assessment Panel because the jurisdiction to approve marine transportation projects in the Labrador Sea is unclear. A complete review of the Proponents' proposal will not have occurred until, among other things, the matter of tanker traffic off the coast of Labrador is dealt with.

80 The Panel recommends that the Minister of the Environment either:

a) appoint with the Government of Newfoundland an independent review body to conduct a public review on the environmental and socio-economic effects of tanker traffic in the Labrador Sea; or

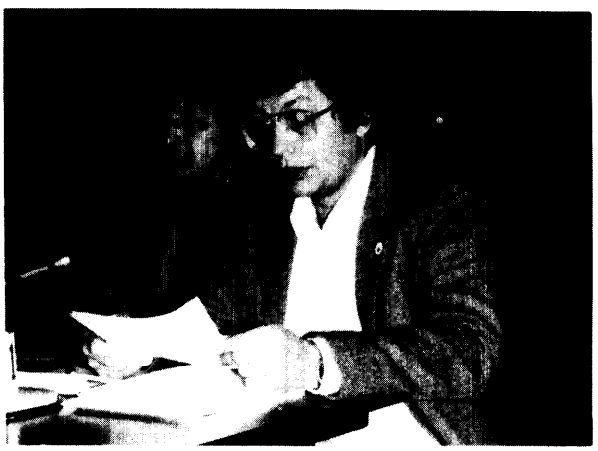
b) sponsor a review of this issue at a conference called for that purpose to be held in Newfoundland. Recommendations made at the conference should be published and the Department of the Environment should attempt follow-up action where appropriate.

Elsewhere in this report the Panel examined the need for other public reviews. The Panel concluded that some form of public review would be required for large-diameter oil pipeline projects (Section 6.5.4), for any form of Yukon North Slope port development (Section 6.6.1) and for the development of and access to a quarry site at Mt. Sedgewick (Section 6.6.3).

8.17 Aboriginal Claims

Much of the uncertainty in the North can be traced to unresolved aboriginal claims. The Panel heard some intervenors suggest that Beaufort Sea production not take place until the claims now under negotiation have been settled. The Proponents urged settlement of the claims and indicated that they are prepared to accept the terms of the negotiated settlements and to work within new legal structures. The native communities look to the claims as a means of gaining some control over development activities in the North. The Panel is sympathetic to their goals and is aware that both sides are working diligently to settle these matters. The Panel concludes

that the early resolution of land claims will assist native northerners in directly participating in those activities which relate to their environmental and socio-economic concerns.



81 The Panel recommends that the Government of Canada, the territorial governments and the native groups strive to resolve the outstanding aboriginal claims as soon as possible.

8.18 International Considerations

The Panel is aware that residents of Greenland and Alaska have concerns regarding the effects of oil tanker movements respectively east or west. Although no interventions were made at the public sessions by either Alaskan or Greenlandic representatives, the Panel received written statements from Alaskans and Greenlanders on specific concerns and oral comments at the Nain Community Session from a Greenland resident. Because some residents of Alaska and Greenland could be affected by tanker traffic, the Panel believes these concerns should be addressed.

82 The Panel recommends that the Beaufort Sea Environmental Assessment Panel Report report be made available by the Department of External Affairs to the Government of the United States, the Government of the State of Alaska, the North Slope Borough of Alaska, the Government of Denmark and the Home Rule Government of Greenland.

8.19 What Comes Next

The Panel was impressed with and most appreciative of the interest shown by the many individuals and groups who participated and took time to contribute to the Panel's review. Many intervenors expressed an interest in being able to follow the Government's actions after the Panel Report is made public.

83 The Panel recommends that the initiator of this review, the Department of Indian Affairs and Northern Development, publish a yearly report describing the progress that has been made in addressing the recommendations of the Panel or the reasons why the recommendations were not accepted.

9.0 CONCLUSIONS

The Panel concludes that small-scale oil production and transportation is acceptable on environmental and socio-economic grounds, provided that:

- the Government of Canada, the Government of the Northwest Territories and the Government of Yukon put in place the Panel's recommended social and economic infrastructures and programs, prior to the commencement of construction of hydrocarbon production and transportation facilities, to minimize adverse social effects on, and to maximize lasting benefits to, northern people;
- northern residents have an effective voice in monitoring and managing problems that may come with changes to their way of life;
- the collective risks to northern residents from various project components be offset by increased benefits;
- the development of yet-to-be-proven approaches to producing and transporting oil be by phased development, with intensive research and careful monitoring;
- the standards for environmental protection and risk prevention be at least equal to the standards proposed by the Proponents in their EIS, in their other documents and in their statements at public sessions before the Panel;
- the commitments' by the Proponents regarding socio-economic mitigative measures be met on a continuing and responsible basis;
- oil-spill response and clean-up capability be in place well in advance of oil production, and be capable of controlling spilled oil effectively;
- the Proponents share, where possible, facilities such as pipeline systems, shore bases and other required infrastructure;
- compensatory programs be in place to address real damages caused by the Proponents or others; and
- the Government of Canada, as the main approval authority, sufficiently develop its administrative, legislative, and research operational capability to ensure a full and effective review of proposed component projects, and to carry out the necessary licensing and regulation of their development and operation.

10.0 LIST OF RECOMMENDATIONS

It should be noted that the Panel has nine **principal** recommendations; two in the Human Environment Section, four in the Natural Environment Section and three in the Government Management Section.

10.1 The Process

The Environmental Assessment and Review Process is constantly evolving. As a result of the Panel's experience in the Beaufort Sea Environmental Assessment Panel Review process it recommends that:

1. **intervenor funding be made available for ail future EARP reviews, and that funding be restricted to those participants who would be significantly affected by the proposal under review:**

2. **the Department of Indian Affairs and Northern Development assume responsibility for the document entitled "information Survey — Kinds and Sources — for the Environmental Assessment and Review Process: Beaufort Sea Hydrocarbon Production and Transportation Proposal" and have it updated annually.**

10.2 Oil Spills and Risk

The Panel has made a number of recommendations on the subject of oil spills, and the importance of preventing them and being fully prepared in the event that one occurs. The Panel recommends that:

3. **the Proponents, the Department of the Environment and the Department of Fisheries and Oceans co-operate in a program to improve and validate oil-spill trajectory models that would be workable by the time production commences;**

4. **the Proponents complete sensitivity mapping of ail areas potentially affected by oil spills in the production zone and along transportation routes before any transportation of oil takes place;**

5. **the Minister of the Environment and the Leaders of the Government of the Northwest Territories and the Government of Yukon jointly set minimum standards for oil-spill clean-up capability under various conditions and seasons of the year in the Beaufort Sea production zone and along any subsequent transportation corridors recognizing that sensitive areas will require especially stringent standards;**

6. **the Proponents' oil-spill contingency plans be formally reviewed and subject to approval by the appropriate government agencies before production drilling is allowed, and that regular test exercises be held to verify emergency response procedures and capabilities of the Proponents;**

7. **local people continue to be trained and employed through local businesses in the use of oil-spill clean-up procedures and equipment, and that these opportunities be extended to include other types of environmental protection programs;**

8. **the Government of Canada establish an effective funding mechanism immediately to ensure that the Department of the Environment, with the cooperation and participation of the Department of Fisheries and Oceans and the Department of Indian Affairs and Northern Development, continue research on oil-spill clean-up equipment and on the behaviour, detection and effects of oil spills in the Arctic marine, fresh water and terrestrial environments.**

10.3 The Human Environment

The **principal** recommendations in the Human Environment Section are that:

9. **arrangements be put in place by the federal and territorial governments, upon approval of oil and gas production and transportation, to enable social agencies and the communities to manage the socio-economic effects of growth;**

10. **upon application, only small-scale, phased production and transportation of oil and gas resources from the Beaufort Sea region be authorired.**

The Panel has made several other recommendations relating to the human environment. The Panel recommends that:

11. **camps be used for the temporary construction workforce. These camps must be located well away from communities, except where a community agrees to accept a camp. The Proponents and communities must co-operate to determine rules governing employee access to local communities;**

12. **the Proponents continue to develop public information campaigns in cooperation with government agencies to inform southern job seekers that northern employment can only be obtained through southern hiring hails;**

13. **before oil or gas production commences, the Proponents develop contingency plans for abandonment satisfactory to governments, and that such plans be reviewed periodically;**

14. **governments give to the communities and local hunters and trappers a stronger role in harvesting studies, in fish and wildlife resource planning and decision making, in monitoring and in enforcement;**

15. **licensing authorities ensure that adequate supplies of sand and gravel are reserved to meet the long-term needs of northern communities;**

16. **the feasibility of establishing post-secondary, higher educational facilities at inuvik and in the Eastern Arctic be explored thoroughly and immediateiy by governments and community representatives, and that the results be published and distributed in the communities for discussion purposes and for subsequent government and community action;**

17. **the communities, governments and Proponents work together to integrate cross-cultural orientation with existing training programs;**

16. **the Proponents and the Government of the Northwest Territories establish cross-cultural orientation programs that are developed and delivered by northerners who are thoroughly familiar with native and non-native cultures and with experience in the industry's oil fields;**

19. the Government of Canada and the Government of the Northwest Territories establish an agreement, after consultation with labour unions, that includes legislation, if necessary, to ensure that unions are neither a barrier to employment for northerners nor to the development of northern businesses;

20. the Government of Canada and the Government of the Northwest Territories establish an agreement designating responsibility for regular inspection of the Proponents' facilities with respect to occupational health and safety;

21. the Government of the Northwest Territories provide more effective assistance to local businesses for bonding purposes.

10.4 The Natural Environment

The Panel has made four principal recommendations in the Natural Environment Section. The Panel recommends that:

22. the Government of Canada approve the use of oil tankers to transport Beaufort Sea oil only if:

    a) a comprehensive government Research and Preparation Stage is completed by governments and industry, and

    b) a Two Tanker Stage using Class 10 oil-carrying tankers demonstrates that environmental and socio-economic effects are within acceptable limits;

23. upon application, the transport of oil from the Beaufort Sea-Mackenzie Delta region through the Mackenzie Valley only be authorized to begin through a single, small-diameter buried pipeline;

24. a comprehensive public review on socio-economic grounds for a future large diameter oil pipeline (e.g. 1000 mm) be undertaken if it is the initial mode for transporting oil through the Mackenzie Valley;

25. no port or supply base be permitted west of Kay Point.

With respect to pollutants entering the marine environment. the Panel recommends that:

26. the discharge of formation waters containing hydrocarbons and trace metals to the Beaufort Sea be avoided. Formation waters containing these substances must be reinjected to the reservoir at the earliest date feasible. Until that date, any discharge of formation waters must meet government environmental standards;

27. an integrated regional hazardous and toxic chemical management strategy be prepared by the Department of Indian Affairs and Northern Development in consultation with the Department of the Environment, the Department of Fisheries and Oceans, the territorial governments and the Proponents for the handling, transport, storage, use and disposal of hazardous and toxic substances;

20. the Proponents' contingency plans for responding to spills and other accidents involving hazardous or toxic chemicals be subjected to regulatory review and approval;

29. the Department of Fisheries and Oceans and the Department of the Environment design a program to determine the fate of hydrocarbons, trace metals and hazardous substances in the Beaufort Sea originating from industry activities.

With respect to ice and icebreaking, the Panel recommends that:

30. further research be carried out by the Proponents, the Department of the Environment and the Department of Fisheries and Oceans to determine the influence of artificial islands on the growth and break-up of landfast Ice;

31. the effects of icebreaking on ice regimes be further studied by the Proponents and the Government of Canada and that these studies include field research and monitoring during the Two Tanker Stage;

32. in order to assess the effects of icebreaking on human travel and safety

    a) the Government of Canada and the Proponents, in consultation with the communities in the affected areas, gather information on the frequency and extent of human activity on the ice in relevant locations along the proposed tanker route;

    b) in areas of concern, the Government of Canada and the Proponents carry out experiments to evaluate the potential hazard created by vessel tracks;

    c) the Proponents, in areas where ship track crossing may be a potential problem, establish with local communities an effective notification system about the approach of ship traffic;

33. necessary navigation and communication systems, and weather, ice and hazard detection systems be operational before transportation of oil by any tanker is permitted;

34. hydrographic charting for the proposed tanker route be completed before transportation of oil by any tanker is permitted.

On the matter of wildlife, birds and fish, the Panel recommends that:

35. the Government of Canada provide adequate funding to the Government of the Northwest Territories to resume an effective monitoring program on polar bears of the Beaufort Sea and Parry Channel regions to enhance management and protection of this species;

36. the Department of Fisheries and Oceans conduct the research programs necessary to:

    a) identify distribution of seals along the proposed tanker route; and

    b) determine the effects of icebreaking on seal behaviour and mortality, including the loss of pups due to flooding of dens;

37. the Government of Canada explore the possibility of an international research program on the biology, distribution and ecology of the bowhead whale;

38. the Department of Fisheries and Oceans undertake research programs on beluga whales to develop effective monitoring and mitigation programs;

39. the Department of Fisheries and Oceans conduct research to define better both narwhal distribution patterns and the potential impacts of tanker traffic upon the species;

40. the Department of Fisheries and Oceans, as part of an Arctic coastal and estuarian fisheries research and management program, identify and study fish habitats within the Beaufort Sea coastal area, and fish species which could be sensitive to oil and gas production and transportation to develop effective monitoring and mitigation programs;

41. the Canadian Wildlife Service of the Department of the Environment expand the existing commitments to research on the most important Arctic marine and terrestrial bird species likely to be affected by the proposed development so that adequate baseline data are available for monitoring and mitigation programs;

42. ship passage through polynyas be conducted in a manner that will minimize impacts on marine mammal and bird populations, and that further studies be conducted of the Cape Bathurst and Eastern Lancaster Sound polynyas to help define the best procedures to minimize impacts from ship traffic and from oil spills;

43. the Government of Canada provide full financial support to the Canadian Wildlife Service of the Department of the Environment and the Department of Renewable Resources of the Government of Yukon to undertake the following to allow the design of effective mitigation and monitoring programs:

    a) specific research related to the reaction of caribou to vehicle traffic and to overflight by jet aircraft;

    b) specific research on the Yukon North Slope caribou range ecology, particularly summer ecology, including the importance of insect relief habitat; and

    c) computer simulation modelling of caribou population dynamics.

The Panel has made a series of recommendations on the subject of research related to vessel sound. The Panel recommends that:

44. The Department of Fisheries and Oceans continue and expand the research activities necessary to understand the potential impacts of vessel traffic upon Arctic marine mammals by;

    a) identifying the characteristics of sounds propagated by icebreaking tankers to be used to carry Beaufort Sea oil to southern markets to confirm present predictions about the nature of those sounds,

    b) obtaining baseline data on ambient sound before tanker traffic occurs, and

    c) determining propagation paths and energy losses of sound from tankers for representative marine coastal habitats;

45. the Department of Fisheries and Oceans gather baseline data on sea mammals distribution, movements, numbers and migrations prior to tanker traffic;

46. the Department of Fisheries and Oceans undertake research on the behavioural response of marine mammals to the sounds produced by icebreaking ships in Arctic waters;

47. the Department of Fisheries and Oceans undertake research on the extent to which vocal communication and echo-location used by marine mammals are masked or otherwise Interfered with by ship-produced sounds and the effects of such Interference on the mammals;

48. the Department of Fisheries and Oceans undertake research on the extent of any acute and sub-acute physiological responses resulting from ship-produced sound.

The Panel on a variety of other matters, further recommends that:

49. the Canada Oil and Gas Lands Administration have the Proponents' proposed under-ice repair methods for subsea pipelines tested under field conditions prior to operation of the pipelines;

50. only one deep-draft port be permitted on the Beaufort Sea coast unless offshore production areas are so far apart that two separate deep-draft ports become necessary;

51. each deep-draft port proposal be subject to a formal public review process, preferably the regional land use planning process;

52. development of a quarry at Mt. Sedgewick not be permitted pending a further public review (preferably through the regional land use planning process) of the need for such rock and alternative sources of rock such as Mt. Fitton;

53. if there is a proven necessity for use of a quarry at Mt. Sedgewick, the Porcupine Caribou Management Board regulate access to the quarry;

54. the Beaufort Sea Coordinator's Office coordinate the monitoring and research projects associated with the production and transportation of Beaufort Sea-Mackenzie Delta oil and gas;

55. for the purpose of implementing an effective monitoring program, the Beaufort Sea Coordinator's Office coordinate the establishment of suitable criteria and standards to be developed by the Government of the Northwest Terrltories, the Government of Yukon and relevant federal government departments;

10.5 Compensation

The Panel has made only one recommendation concerning compensation but this may well prove to be one of the most difficult recommendations to implement. The Panel recommends that:

56. the Government of Canada, the Government of the Northwest Territories and the Government of Yukon develop and implement a comprehensive compensation plan for the North encompassing the objectives set out by the Beaufort Sea Environmental Assessment Panel before production and transportation of Beaufort Sea oil and gas proceeds.

10.6 Government Management

The principal recommendations made by the Panel on the subject of goverment management are that:

57. the federal and territorial governments ensure that their respective departments and agencies prepare effective policies and programs now for managing Beaufort Sea-Mackenzie Delta hydrocarbon production and transportation with a goal of strengthening local management roles;

58. the federal and territorial governments negotiate as soon as possible the further transfer of administrative control to the Territories;

59. the role of the Beaufort Sea Coordinator's office be expanded to make it the coordinating office not only among the community-based Development Impact Zone Group and governments, but also among industry and governments.

With regard to government research, the Panel recommends that:

60. the Government of Canada make a commitment to a fifteen-year program of accelerated Arctic research that includes the following elements:

    a) a federal policy for Arctic research which provides a national focus for short and long-term Arctic research and provides a mechanism for funding this research;

    b) a commitment to encourage research in the North by northerners;

    c) increased support for basic research during this period for federal agencies such as the Arctic Biological Research Station, the Canadian Wildlife Service, the Ocean Sciences and Surveys Directorate, the Polar Continental Shelf Project, and other centres of Arctic expertise;

    d) a program designed to strengthen university centres for Arctic research;

    e) a special tax write-off for the cost of industry-sponsored research in the Arctic that is made public within two years of the completion of field work; and

    f) funding for NOGAP.

The Panel on a variety of other matters, further recommends that:

61. the senior governments cooperate in designing funding mechanisms for the regulatory surveillance for any Beaufort Sea-Mackenzie Delta project which will avoid such problems as those identified by the Norman Wells experience;

62. all parties proceed to establish a regional land use planning process and to complete land use plans for the Beaufort Sea-Mackenzie Delta region as soon as possible;

63. if no regional land use plan is in place, a process, preferably the regional land use process, be used to ensure local public involvement in the site selection for major facilities;

64. a single authority, the Canadian Coast Guard, be empowered to administer, plan and direct a government contingency plan for any oil spill in Arctic marine waters whether it originates from production platforms, pipelines, artificial islands, any form of shipping or from a source on shore that contaminates marine waters;

65. the Canadian Coast Guard have a consultation mechanism with all government agencies responsible for marine environmental management and protection throughout the region;

66. the Arctic Seas Contingency Plan for oil-spill containment and clean-up take into consideration the necessity for cooperation between international agencies;

67. the Canadian Coast Guard be empowered, through amendments or additions to existing Acts and Regulations, to direct shipping away from, or issue instructions for the safe operation of vessels within, specific areas, at times or locations of environmental sensitivity;

68. the present vessel traffic management system, NORDREG, be made mandatory for all vessels which enter Canadian Arctic Waters. The management system must be extended now to the Beaufort Sea region so that the Canadian Coast Guard and all others concerned can become familiar with the system before Arctic tankers enter these waters;

69. the Government of Canada immediately commence the construction of an icebreaker that would meet at least Arctic Class 8 specifications;

70. the Minister of Transport establish a single port authority to control and manage all port and harbour developments on the Beaufort Sea coast;

71. the port authority include northern residents selected from nominations made by local communities, native organizations and the territorial governments;

72. multi-user ports be encouraged so that the proliferation of facilities is minimized;

73. for each recommendation made in the Panel Report, the appropriate funding agency provide adequate and timely funds for its implementation;

74. the federal government provide funds now for the development of both social and environmental monitoring systems for the Beaufort Sea region;

75. the government departments with surveillance and enforcement responsibilities form a surveillance working group that would include representatives from northerners, both native and non-native. This group should work through the Beaufort Sea Coordinator's Office;

76. a Beaufort Sea Coastal Archaeological Program be established with the National Museum of Man as the lead agency. The participants in the Program should include the Beaufort Sea-Mackenzie Delta communities, the Proponents and the agencies responsible for archaeological heritage matters at the territorial and federal levels;

77. the Government of Canada provide additional financial assistance to develop further the local education, interpretation and training components of the heritage preservation programs of both Yukon and the Northwest Territories;

78. the responsible government agencies, through contract if necessary, acquire expertise of the highest calibre, where it is not now present, to evaluate designs, construction techniques and operating procedures proposed by the Proponents and new to these agencies;

79. the Department of Indian Affairs and Northern Development, in consultation with the territorial governments, prepare the increased development of northern energy resources which may result from approval of a Beaufort Sea

transportation project to ensure that the rate and pace of growth of these developments is consistent with a small-scale, phased approach for each region of activity;

80. the Minister of the Environment either:

a) appoint with the Government of Newfoundland an independent review body to conduct a public review on the environmental and socio-economic effects of tanker traffic in the Labrador Sea; or

b) sponsor a review of this issue at a conference called for that purpose to be held in Newfoundland. Recommendations made at the conference should be published and the Department of the Environment should attempt follow-up action where appropriate;

81. the Government of Canada, the territorial governments and the native groups strive to resolve the outstanding aboriginal claims as soon as possible;

82. the Beaufort Sea Environmental Assessment Panel Report be made available by the Department of External Affairs to the Government of the United States, the Government of the State of Alaska, the North Slope Borough of Alaska, the Government of Denmark and the Home Rule Government of Greenland;

83. the initiator of this review, the Department of Indian Affairs and Northern Development, publish a yearly report describing the progress that has been made in addressing the recommendations of the Panel or the reasons why the recommendations were not accepted.

The Beaufort Sea Environmental Assessment Panel

John S. Tener
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FOOTNOTES

Persons interested in obtaining copies of the referenced documents are referred to the bibliography (Appendix 1).

SECTION 2.0 THE REVIEW PROCESS

1. Dome Petroleum Limited, Esso Resources Canada Limited and Gulf Canada Resources Inc. Hydrocarbon Development in the Beaufort Sea-Mackenzie Delta Region, June, 1981.
2. Federal Environmental Assessment Review Office, Revised Guide to the Federal Environmental Assessment and Review Process, May, 1979.
3. Seminar, Federal Environmental Assessment Review Office, Beaufort Sea/Mackenzie Delta Development Plan. J.S. Klenavic, Chairman. Calgary, Alberta. Nov. **13, 1980, 93p.** (manuscript)
4. Ottawa General Session, December 16, 1983, Vol. 2, p. 78.

CHAPTER 3.0 THE PROPOSAL

1. Procter, R. M., G. C. Taylor, and S. A. Wade, Oil and Gas Resources of Canada 1983, Geological Survey of Canada, Paper 83-31, 1984, 59 **pp.**
2. RB-14.

CHAPTER 4.0 OIL SPILLS AND RISK

1. GEN-1, p. 8.
2. Lemberg, IN-40; BRIA, RB-4 and Resolute General Session, October 17, 1983, A.M., pp. 57-58; ITC, RB-2 and Resolute General Session, October 17, 1983, P.M., pp. 86-93; DOE, R-6; DFO, I- 19; Hainsworth, IN-58.
3. GEN-1, pp. 8-13.
4. GEN-1, pp. 9, 12. 23, 24.
5. GEN-1. pp. iv, 10, 13, Tables 5.1.1 and 5.0; EIS, Vol. 6, p. 2.13.
6. IN-40: Table 2, Sec. 2.2.
7. GEN- 1, p. iv.
8. Ibid.
9. GEN- 1; IN-40; RB- 14.
10. EIS, Vol. 6, Sec. 2.3.1.2.
11. RB-14; EIS, Vol. 6, Sec. 2.2.
12. I-18.
13. R. Goose, Sachs Harbour Community Session.
14. IN-50; EIS, Vol. 6, Sec. 2.2 and 2.3; GEN-1.
15. EIS, Vol. 6, Sec. 2.2 and 2.3.
16. Ibid.
17. EIS, Vol. 6, Sec. 3.2.
18. R-5; EIS, Vol. 6, Sec. 5.2.1.6.
19. IN-43.
20. Inuvik General Session, November 14, 1983, Vol. I, pp. 12- 15.
21. Report of the Environmental Assessment Panel, Lancaster Sound Drilling, Sec. 3.5.
22. D. Mackay, Critique of EIS, 1982.
23. See IN-43.
24. IN-26, Greisman, Inuvik General Session, November 14, 1983, Vol. 1, pp. 27-35.
25. IN- 16; MacWatt, Inuvik General Sesion, November 14, 1983, Vol. 2, pp. 1-12 and Hill, p. 30.
26. D. Mackay, R-5.
27. EIS, Vol. 6, p. 5.18; GEN-12.
28. Yellowknife General Session, December 6, 1983, Vol. 2, esp. pp. 54-60.
29. EIS, Vol. 6, Ch. 7.
30. EIS, Vol. 6, p. 7.5.
31. GEN-67, p. 23.

CHAPTER 5.0 THE HUMAN ENVIRONMENT

1 EIS-SI, Socio-Economic Issues, Sec. 6, p. 2; Inuvik General Session, November 19, 1983, Vol. 1, pp. 32-33, 44-47.

2 Sachs Harbour Community Session, p. 39.

3 EIS-SI, Socio-Economic Issues, Sec. 2, p. 33; IN-24; IN-59.

4 EIS-SI, Socio-Economic Issues, Sec. 4.

5 IN-59.

6 Holman Community Session, p. 69; Aklavik Community Session, p. 77; Inuvik Community Session, pp. 93-94; Coppermine Community Session, p. 15.

7 Holman Community Session, p. 69; Inuvik Community Session, p. 61.

8 IN-69.

9 Inuvik General Session, November 19, 1983, Vol. 2, pp. 60-63 and November 23, 1983, Vol. 2, pp. 48-45.

10 IN-59.

11 Inuvik General Session, November 19, 1983, Vol. 2, pp. 44-48.

12 Tuktoyaktuk Community Session, p. 36.

13 Inuvik General Session, November 19, 1983, Vol. 2.

14 Ibid.

15 Tuktoyaktuk Social Services Advisory Committee, Inuvik General Session, November 19, 1983, Vol. 2, and IN-59; Mackenzie Delta Dene Regional Council, I-23; GNWT. Inuvik General Session, November 22, 1983, Vol. 1, and IN-60; Rev. K. Schneider, Inuvik Community Session, p. 48.

16 Aklavik Community Session, pp. 37, 39.

17. EIS, Vol. 5, Sec. 10.
18. Ellis, IN-65; Hainsworth, IN-58; H. C. Davis and G. B. Hainsworth, "A Critical Appraisal of the Economic Aspects of the Proposed Beaufort Sea Development," 1983.
19. EIS-SI, Socio-Economic Issues, Table 3-13.
20. IN-19.
21. For purposes of this report, an enclave is defined as a new community established in isolation from existing communities. The Proponents suggest an industrial enclave such as the Dead Horse-Prudhoe Bay enclave in Alaska would be a cost-effective approach to housing employees, if other ways are unsatisfactory. (EIS-SI, Socio-Economic Issues, Sec. 4.1.4).
22. EIS-SI, Socio-Economic Issues, Sec. 4, p. 146.
23. IN-37.
24. IN-26; IN-37.
25. IN-10.
26. I-7; I-23; I-24; RB-3; Holman Community Session, p. 47.
27. Resolute Bay Hunters and Trappers Association and Arctic Pilot Project, Resource Harvesting Activity, Resolute Bay, 198 1 (CS-20).
28. IN-37.
29. IN-19.
30 EIS-SI, Socio-Economic Issues, Sec. 4, pp. 35-57.
31. IN-37, p. 34.
32. EIS, Vol. 5, p. 8.11.
33 NCPC, WH-1, p. 9.
34 YK-15.
35 IN-37.
36. Hainsworth, IN-58; EIS, Vol. 5, Sec. 8.5.1.
37. Wiswell, Rozen, Inuvik General Session, Nov. 23, Vol. 1; Broom, Inuvik General Session, November 21, Vol. 2.
38. Chief J. Charlie, Fort McPherson Community Session, p. 39; Social Services Advisory Committee of Tuktoyaktuk, IN-59; EIS, Vol. 5, Sec. 8.5.1.
39 Hainsworth, IN-58; Mair, R-8; EIS, Vol. 5, Sec. 8.5.1.
40 Tuktoyaktuk Community Session, pp. 60-61; Resolute General Session, November 21, 1983, Vol. 1; IN-52.
41 G. Njootli, I-10; Fort Norman, I-21; BRIA, RB-4; GNWT, IN-26.
42. See IN-37, p. 63.
43. Arnett, Yellowknife General Session, December 7, 1983, Vol 2; EIS, Vol. 5, pp. 11.14, xxvi.
44. Inuvik General Session, November 23, 1983, Vol. 1, pp. 17-21.
45. Resolute General Session, October 20, 1983, Vol. 2, pp. 60-70.
46. Tuktoyaktuk Community Session, p. 38; Coppermine Community Session, pp. 3 I-32.
47. GEN-34.
48. Yellowknife General Session, December 8, 1983, Vol. 1, pp. 5-18.
49. Ibid.
50. Inuvik General Session, November 21, 1983, Vol. 3, pp. 26-31.
51. GNWT, YK-17.
52. Ibid.
53. GNWT, IN-26.
54. GNWT, YK-17.
55. GNWT, IN-37.

CHAPTER 6.0 THE NATURAL ENVIRONMENT

1. EIS, Vol. 3A, Sec. 1.1.4.5; DOE, WH-34.
2. K. Croasdale, Inuvik General Session, October 10, 1983, Vol. 1, pp. 3-12 and Vol. 2, pp. 23-25, 113-I 18; October 18, 1983, Vol. 2, pp. 18-82; IN-82; EIS, Vol. 2, Sec. 4.3.5; Vol. 7, p. 3.2 and Sec. 6.2.
3. Inuvik General Session, October 18, 1983, Vol. 3, pp. 34-35.
4. Ottawa General Session, December 15, 1983, Vol. 2, p. 108.
5. Walker, D.B.L., D.W. Hayley, and A.C. Palmer, The Influence of Subsea Permafrost on Offshore. Pipeline Design, Permafrost Fourth International Conference, Proceedings, July 17-22, 1983, Washington, D.C., National Academy Press, 1983, pp. 1338-1343.
6. Wadhams, P., The Prediction of Extreme Keel Depths from Sea Ice Profiles, Cold Regions Science and Technology, 1983, Vol. 6, pp. 257-266; Understanding the Arctic Sea Floor for Engineering Purposes, Marine Board, Commission on Engineering and Technical Systems, National Research Council, Washington, D.C., 1982.
7. D. McKeehan, Inuvik General Session, October 10, 1983, Vol. 2, pp. 111-112.
8. DFO, Inuvik General Session, October 12, 1983, Vol. 1, pp. 73-81; E. Tull, Ibid., pp. 30-36; D. Mackay, OT-1; T. Parsons, Marine Biological Impacts, 1983.
9. IN-40.
10. Inuvik General Session, November 12, 1983, Vol. 1, p. 28.
11. Inuvik General Session, October 17, 1983, Vol. 1, p. 33; APOA, DIAND, DOE, and DFO, Report on Offshore Oil and Gas Drilling Fluid Disposal in the Canadian North, 1982.
12. Inuvik General Session, October 17, 1983, Vol. 1, p. 28.
13. OT-24.
14. EIS, Vol. 6, Ch. 9.
15. OT-1, p. 7.
16. GEN-5 1, IN-36, WH-35.
17. DFO, OT-2, p. 19; DFO, Government Position Paper, p. 14; Transport Canada, Government Position Paper, p. 52.
18. Resolute General Session, October 19, 1983, Vol. 2, pp. I-5; Arctic Bay, I-16, p. 6; Inuvik General Session, November 18, 1983, Vol. 2, p. 40; EIS, Vol. 4, p. 4.3.
19. EIS, Vol. 4, Section 4.1.2; Danielewicz, Inuvik General Session, November 18, 1983, Vol. 2; EIS, Vol. 3A, Section 1.1.3 and Vol. 3B, Section 1.1; EIS Supplementary Information, Environmental and Technical Issues, Discussion Papers No. 2 and 3.
20. RB-4.

21. Resolute General Session, October 19, 1983, Vol. 2, pp. 1-5.
22. RB-7, p. 4; Inuvik General Session, November 18, 1983, Vol. 2, pp. 31-33.
23. Holman Community Session, pp. 64-65.
24. RB-4.
25. RB-20.
26. EIS, Vol. 4, p. 4.11; GEN-49; OT-23; RB-20.
27. RB-23, 24, 25, 26, and 27.
28. RB-2, 4, 7, 9, 12, 16, 19, 20, 22; IN-53, 66; OT-3; GEN-3, 44, 49.
29. The Report of the Mackenzie Valley Pipeline Inquiry, Vol. 1, pp. xvi-xvii.
30. Report of the Environmental Assessment Panel, Norman Wells Oilfield Development and Pipeline Project, January, 1981.
31. GNWT Final Argument, GEN-34; DFO, OT-2; DOE, IN-17.
32. M.C. Metz, Yellowknife General Session, December 5, 1983, Vol. 2, pp. 6-18; M.W. Smith, Letter to Beaufort Sea Panel Executive Secretary, January 24, 1983.
33. Y K-30, Chapters 17-20.
34. M.C. Metz, GEN-29.
35. Inuvik General Session, November 15, 1983, Vol. 1, p. 9 and Vol. 2, p. 24.
36. Ottawa General Session, December 14, 1983, Vol. 1, p. 47.
37. Interdepartmental Environmental Review Committee, DIAND, Facilities Siting: Beaufort Sea Shore Zone Study, March 16, 1983.
38. Whitehorse General Session, December 1, 1983, Vol. 2, p. 81.
39. WH-9; WH-19; Whitehorse General Session, December 1, 1983, Vol. 2, pp. 28-29.
40. WH-19.
41. GEN-52.
42. Ibid.
43. Ibid.
44. See IN-9, 10, 11, 12, 34; WH-9, 11, 19.
45. BRIA, RB-4, pp. 4-7; A. Elias, Holman Community Session, pp. 57-58.
46. R. Hoos, Resolute General Session, October 19, 1983, Vol. 2, pp. 17-26; EIS, Vol. 4, p. 4.7.
47. R. Hoos, and P. Esau, Sachs Harbour Community Session, p. 14; A. Elias, Holman Community Session, pp. 56-57; BRIA, R-10; DFO, RB-7; DOE, R-6.
48. R. Kuneyuna, Holman Community Session, p. 17; P. Esau, Sachs Harbour Community Session, p. 22.
49. BRIA, Letter, October 26, 1983.
50. BRIA, RB-4, pp. 4-7.
51. GEN-52.
52. Ibid.
53. Ibid.
54. Ibid.
55. Ibid.
56. RB-29.
57. GEN-52.
58. RB-19, p. 56.
59. For example, see WH-19, IN-34, IN-35, and RB-29.
60. IN-34.
61. For example, see Inuvik General Session, November 15, 1983, Vol. 2, pp. 48-52.
62. YK-2; YK-3.
63. IN-6.
64. DOE, I-12, Vol. 1.
65. G.E. Beanlands and P.N. Duinker, An Ecological Framework for Environmental Impact Assessment in Canada, Dalhousie University, 1983.
66. OT-33.

CHAPTER 7.0 COMPENSATION

1. IN-41, 42.
2. OT-16.
3. Ibid.
4. OT-16, p. 5.
5. YK-20.

CHAPTER 9.0 CONCLUSIONS

1. EIS, Vol. 5, Sections 9.0, 10.1.4, 11.1.4, 12.3.3; EIS Supplementary Information, Socio-Economic Issues, Section 6; See also EIS Supplementary Information App. II Mitigative Measures and Action Plans; and public session statement of Proponents.

Part II

Community Summaries

From September to November, 1983, the Panel visited 20 northern communities and heard many views and concerns from the residents of 29 different communities. This section summarizes many of these views on a community-by-community basis,

"The Government of the Northwest Territories given the funds, could ensure that the benefits of Beaufort development would be more widely distributed and longer lasting Our citizens could be better trained, our communrtres could have better services, our government could have increased responsibilities I expect that in every hearing that you convene you will be meeting people who will tell you about the need for expanded government programs, and local community representatives will tell you about the Council's need to approve and expand municipal services to support Beaufort development"

R Nerysoo, GNWT
Aklavik

"In the midst of all this concern about decision making, my colleagues and I want to emphasrze that we support the Beaufort Development During your visits to the Western Arctic communrtres, you will likely meet people which you already have employed by the companres or people who have business contracts with the oil companies I believe that you will discover the kind of excitement about the future, the possibilities for local involvement, that will make you enthusiastic about Beaufort development. "

R Nerysoo, GNWT
Aklavik

"My brggest concern is budgeting, learning how to make your pay cheque go from one pay day to the next pay day but at the same time putting some away in the bank to make it last the family through hard times, through Christmas time, spring time, spring break and down to when he gets back to his work in spring time."

E. Bernhardt, GNWT
Coppermrne

" fobs do look attractive to many people living in this area, but after the oil and gas industry, there will be an even higher impact of unemployed people And, my feeling is that I would like to see the environment, the animals protected under controlled development "

C *Hoogak*
Sachs Harbour

"While we are very protective of our livelihood and culture that does not imply that we are totally anti-development The Inuvaluit desire to be an active participant within government and industrial developments in our geographical areas"

R. Goose
Beaufort Hunters & Trappers Association
Tuktoyaktuk

"We do have quite a number of people that graduate from high school every year, and they don't know — they just don't seem to fit in anywhere. Maybe that's the wrong term to use, but there should be some place for them to go, and if this industry is going to develop the way it should, many of the people should be absorbed into this workforce. "

M Carrol
Akalvik

'As far as development in the Beaufort is concerned, I think it is something that's going to benefit the communrtres and local residents and also *northern businesses, but in the case that the oil companres should pull out of the Beaufort due to lack of results or you know, oil in the Beaufort or gas, what happens to the people in businesses that become dependent on development of the Beaufort as a source of income?"*

R. Kuneyuna
Holman

"You're looking at exporting oil in ten years So if the oil industry and the Government can get together and start helping us to train the people — in ten years we will be ready for your development Hopefully, by then we will have a land claim settlement, we'd had sold our land to the Government — they'll sell it to you — we'd be prepared for it — we'd share it with all Canadians — someone has got to take the initiative for them to get together to help us. "

E Firth
Fort McPherson

"Our main point is that the people of Tuktoyaktuk be able to retain their culture and their means of livelihood from the land and also, when possible, be given the opportunity to take advantage of various jobs that are made available through development. We ask that the oil companres, their associated contractors and the governments show proper respect for the land and its people. "

E. Dillon
Tuktoyaktuk

Beaufort Sea-Mackenzie Delta Communities

AKLAVIK, N.W.T.

September 15, 1983

In Aklavik the Panel listened to concerns about training, alcohol problems, government programs and employment. Frustration was expressed about training programs which lead nowhere and are often inadequate to get graduates jobs beyond a menial level. People would like to see more opportunity for northern businesses and for participation in project activities at a more senior management level. It was felt that cross-cultural orientation programs for southern workers and supervisors would help them in understanding the northern lifestyle and culture.

The Mayor of Aklavik, Mr. George Edwards, suggested that there would be little employment for natives after the construction phase of major projects. He also expressed concern about shore base development at Stokes Point which might drive the caribou away.

Mr. Freddy Greenland asked what had happened to the recommendations of the Berger Report, especially the recommendation for park status for the Yukon North Slope. He emphasized the sensitivity of the area and supported the concept of no development on the North Slope. Other concerns which he mentioned related to future employment possibilities, social problems, the high suicide rate at Tuktoyaktuk and Fort McPherson, and the low attention that governments give to community concerns.

The Honourable Richard Nerysoo, MLA for Mackenzie Delta, explained that the GNWT supports a phased approach to Beaufort development using the pipeline transportation mode. The GNWT does not support an exploration base at Stokes Point. Funding requirements and financial assistance must be seriously considered. He also discussed establishment of the Beaufort Sea Development Impact Zone and explained his government's policy for the funding of training and higher education for native northerners and other northerners.

Other concerns expressed at the meeting included the long-term effect of the Proponents' proposal on peoples' lives, alcoholism and the need for professional counsellors, money management counselling, and the Proponents' different definitions of a northerner.

"So, what I'm trying to say here tonight that's at the fop of my mind is what are we going to accomplish by this hearing, who's going to listen to it, and who's gorng to follow out the recommendations?''

Chief F Greenland
Aklavik

COPPERMINE, N.W.T.

September 19, 1983

The Hunters and Trappers Association (HTA) of Coppermine voiced support for the presentation by the Sachs Harbour and Holman Hunters and Trappers Association regarding oil spills and tankers in Prince of Wales Strait. Residents generally supported the pipeline alternative over icebreaking tankers. Problems of migrating animals encountering possible oil spills was another issue addressed.

Mr. Ernie Bernhardt, of the Department of Social Services of the GNWT, pointed out the difficulty in accepting progress while at the same time retaining a traditional way of life. He suggested three areas which may assist the community in the adjustment: general and supportive counselling at the community level and on the job; budgeting or assistance in money management; and the employment of an expeditor, not just in terms of logistics, but as a liaison/information person at the community level.

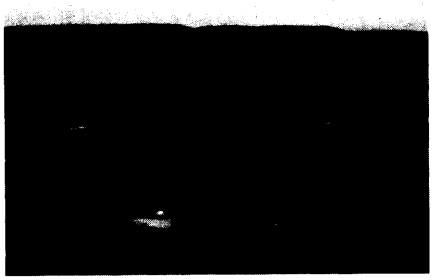
Other questions were raised about the size of the Tuktoyaktuk training centre (Tuk Tech), how candidates are selected, and plans for expansion. It was pointed out that northerners would prefer to train in a northern community rather than to go south.

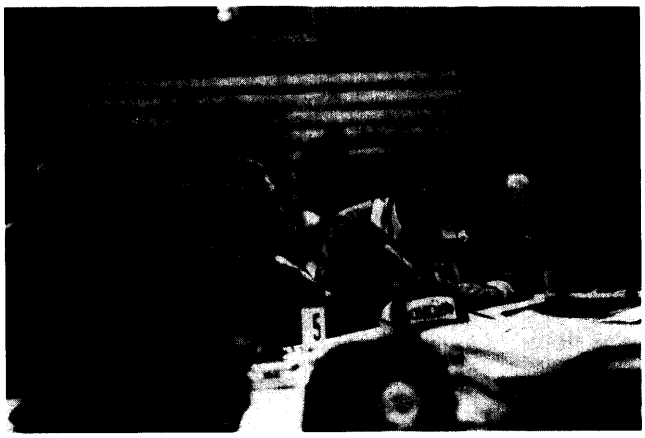
FORT MCPHERSON AND ARCTIC RED RIVER, N.W.T.

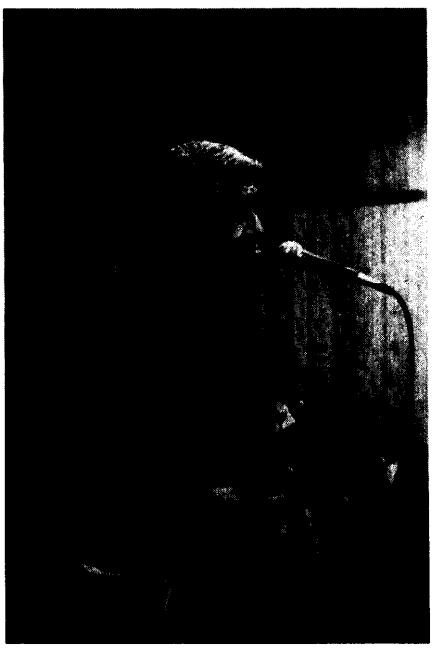
September 21, 1983

The primary issue for residents attending this Community Session was the importance of the Mackenzie River and Delta to the food supply and traditional lifestyle of the communities. Examples were cited of environmental damage created by previous oil company activities. Concern about the caribou and damage to their calving grounds was expressed as were plans for development at Stokes Point. It was noted that there is considerable concern for the land, as evidenced by the number of people at the meeting even though the trapping season had started.

It was stated that goods and services will remain expensive as long as the oil companies pay high wages. Changes which have occurred from development have not helped the people. Mr. Ernest Firth stated, "They studied the environment, the waters, the land — they haven't taken a serious look at the people that live around this area." The opinion was that, while development should go ahead, the people should also be listened to and be prepared for development. Cross-cultural training would help native people and southerners understand each other, and training in money management would help people deal with a wage economy. There have been some







economic advantages to Fort McPherson resulting from development, but also some serious social and economic problems.

Mr. Robert Simpson presented an overview of the concerns of the Mackenzie Delta Dene Regional Council. Concerns highlighted were: funding, the Panel's mandate, the impact of the project on lifestyle and land claims, planned development and control, land use planning, economic and social problems, and research.

HOLMAN, N.W.T.

September 17, 1983

Most of the concerns and comments heard at the Holman meeting were about icebreaking tankers and the impacts they would have on wildlife and harvesting activities. Mr. Roy Kuneyuna pointed out that ringed and bearded seals, found throughout Prince of Wales Strait, are vulnerable in the spring to any disturbance, contrary to the view of the Proponents. He recommended no ship traffic anywhere through the Northwest Passage in spring when there is the potential for disruption in areas where young seals are born.

Residents questioned the Proponents about possible oil spills, cleanup capability, percentage of recovery, response capability and timing, and accident probability. They also emphasized the need for onboard oil-spill equipment aboard the tanker. They also suggested that the answers given by the Proponents seemed more speculation than fact.

A further presentation emphasized wildlife resources, critical areas and concerns of the people of Holman for protection of the land, sea and animals. Concerns focused on disruptions and changes to animal life such as migration, ship tracks as barriers to travel over the ice and waste problems created by ships.

Other concerns included importance of sport hunting to the local economy, compensation for hunters and trappers, loss of employment as the project is abandoned, separation of family members for extended periods during employment, money management, and training.

INUVIK, N.W.T.

November 22, 1983

The Panel heard a wide range of opinions and concerns expressed about development in the Beaufort Sea region ranging from strong support of the project to caution about the social and environmental problems that are often associated with mega-projects.

Concern about impacts on the Town of Inuvik ranged from increased social problems to the loss of recreational facilities because of housing requirements. Current youth problems of suicides and delinquency, a recognition that there are insufficient professional resource people to deal with stress-related problems, especially in the mental health and family life areas, and an appeal for handicapped facilities and equal opportunities for industry-related employment were raised before the Panel.

The Panel was informed that while industry cannot be blamed for all the social ills of the North, native people have paid a high price in terms of social impact wherever industrial activity has been in the North. The plight of residents of the west-end of Inuvik especially was brought to the Panel's attention. It was suggested that large scale natural resource projects in peripheral regions invaribly leave the indigenous inhabitants worse off than before. A need for northern people to be involved in and part of any boom situation was raised by the Native Women's Association of NWT.

A number of suggestions to help residents with socio-economic impacts were presented. These were counselling of individuals in financial and money management, lifeskills training, native counsellors for employees and families, health workers, transient centres and cross-cultural workshops for government and industry.

Special requirements of education in the North were raised with the Panel. It must be a system that accommodates the needs of a limited industrial economy with those of a hunting and fishing economy. Industry and governments should be encouraged to set up cooperative educational programs.

Some concerns were raised about training opportunities, compensation for native hunters, and the hiring of southerners with northern addresses.

Some criticism of the Panel review process was heard from the Inuvik Chamber of Commerce. It was suggested that the review process duplicated the work of other agencies, that there were inequities in intervenor funding and that delays for development resulted from the review process. Mr. A. Pluim stated that "you have to live and work here in order to understand what really is taking place. Those of us who have lived and worked here are not being listened to."

A number of residents said that development should proceed as quickly as possible so that benefits such as much needed services for recreation and other community activities could be built. The bottom line was that the town be given ample opportunity to plan properly for increased oil and gas activity.

OLD CROW, Y.T.

November 11, 1983

The first community speaker was Chief Johnny Abel who stated that the Yukon North Slope, particularly Stokes Point with its abundant wildlife, should not be tampered with. This was a recurring concern which cited the importance of the Porcupine Caribou to the culture and way of life for the Loucheux Band at Old Crow. Residents supported the recent government decision not to allow development of the North Slope — at least until land claims were settled. The idea of a wilderness park was encouraged for protection of the animals. Game is a main source of food for the people of Old Crow.

Questions were raised about the need for ports on the North Slope and which locations are preferred. It was recognized that development would mean roads which would bring tourists and others. The people felt that this would be devastating to the environment. The importance of monitoring, mitigation and a formula for compensation was stressed. Mr. W. Thomas related his experiences with industry and the concerns he has about Beaufort Sea development. It was also stated that "what we expect to happen and what actually happens are sometimes two different things. No one is sure what exactly will happen to the Caribou herd." The Panel was asked to listen to what the people are saying. They should have a say in what is going to happen in their lives. Only after land claims are settled, and management boards are set up, could development be controlled by the people of the North.

Concern was expressed about how people are affected spiritually, mentally and physically by the impacts of development. In the final presentation, Mr. G. Njootli said that, although some residents expressed an interest in obtaining potential employment with industry, this concern was secondary to the well-being of the animals the community was dependent upon for food. Mr. Njootli called for no development until land claims are settled, and there is some form of protection for the North Slope.

PAULATUK, N.W.T.

September 20, 1983

Gilbert Ruben presented, on behalf of the settlement of Paulatuk, a submission to the Panel based upon a field worker survey on the effects of Beaufort Sea development. The three principal concerns related to damage to the environment, availability of local training and opportunities for people to continue to live off the land. In summary, the questionnaire determined that development would be beneficial, provided environmental and socio-economic issues were adequately addressed.

Other environmental concerns were heard on potential oil spills and their impact on wildlife and the impacts of land and air traffic on migratory birds. The Panel also heard Mr. Edward Ruben tell of his personal experiences with the Proponents' ship track experiments at McKinley Bay.

Residents outlined social concerns about money management, housing, training, the cost of living, the COPE (land claims) Agreement-in-Principle and the impact of the abandonment phase of the project on employment.

SACHS HARBOUR, N.W.T.

September 16, 1983

The residents of Sachs Harbour expressed concern primarily about the impacts of underwater sound, icebreaking tankers and air traffic on hunting activities and wildlife.

Questions about the effects of noise from icebreaking tankers and aircraft on bearded and ringed seals and whales and resulting effects on polar bears and arctic foxes were raised. There was concern about seal pupping areas in or near Prince of Wales Strait, oil spills, prolonged spring break-up, the ability to use the Strait for hunting and transportation to and from Victoria Island and compensation for lost hunting opportunities.

Employment opportunities and advancement within industry, skill development and training, and economic benefits for northerners were the subjects of questions from community residents. Other topics raised were the possibility of a compensation board to review claims and determine awards for loss of commercial or traditional subsistence, adequate community consultation before decisions are made, the loss to the community of local employees seeking higher wages with industry, and recognition of Inuvialuit experience and expertise in many areas where the Proponents have employed southern consultants.

TUKTOYAKTUK, N.W.T.

September 14, 1983

The Tuktoyaktuk Community Session began with a presentation by the Beaufort Hunters and Trappers Association which expressed concerns related to the importance of the environ-

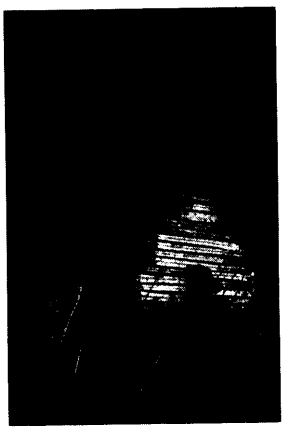
ment to their subsistence and way of life. Specific concerns mentioned included the potential impacts of tankers on bearded and ringed seals, the effects of underwater noise on sea mammals, the possible abandonment of seal pups by adult seals and the disruption of hunting patterns resulting from development activities. The group presented suggestions for a harbour authority for the Tuktoyaktuk Harbour, for cross-cultural orientation for southerners, for ways to improve work motivation, for the need for community infrastructure and for measuring the changing social values in the Beaufort communities.

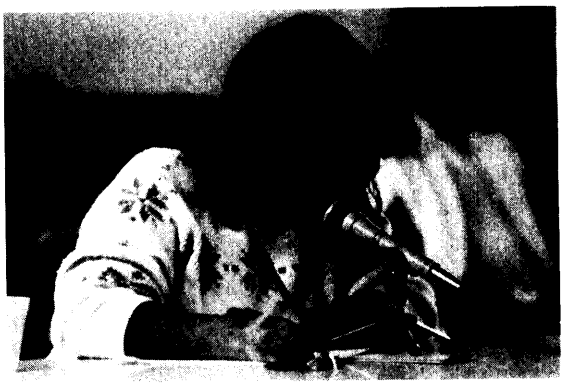
The Hamlet Council also supported the idea of a harbour authority with local representation to control and monitor ship traffic and harbour development and expansion.

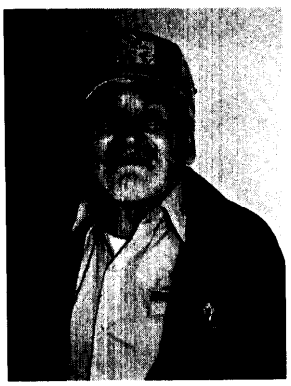
The local Tuktoyaktuk Hunters and Trappers Association and the Hamlet Council commented on problems caused by the airport which is experiencing increased traffic. Concern was voiced that the airport blocks access to important hunting areas, that air traffic has impacts on wildlife and that increased airport activity results in increasing dust and noise.

Environmental concerns included requests for further research on the effects of noise on marine mammals, on the effects of abandoned artificial islands, on the impact of artificial islands in prolonging ice break-up, and requests for additional oil-spill experiments under real-life conditions. This latter subject was further discussed at the Inuvik General Session by Tuktoyaktuk Mayor Vince Steen.

Social issues included a local petroleum industry training centre proposal; on-going, long-term training and employment of Inuvialuit to raise skill levels; union concerns; northern contracting opportunities; special impact funding; abandonment; compensation for loss or damage to subsistence income from the land; the loss of traditional skills and culture; and the need for a land claims settlement. The Social Services Advisory Committee of Tuktoyaktuk brought further concerns to the Panel's attention in Inuvik. The problem areas identified were alcohol and drug problems, juvenile delinquency, spouse and child abuse and the need for improved social service facilities in Tuktoyaktuk.







Mackenzie Valley Communities

FORT FRANKLIN, N.W.T

September 23, 1983

Several references were made to the Berger Inquiry where Dene submissions stressed land claims settlement before development. Without a settlement, "our land is getting smaller and smaller", as land is leased without consultation and resources are exported without benefit to the native people. The importance of the land and animals to the people was noted on several occasions. "We love our land . . . because we make a living on it . .."

Frustration was expressed by the three Chiefs from Fort Franklin, Fort Good Hope and Fort Norman, and others in attendance, over the number of meetings where concerns have been presented again and again but nothing has happened. Native people have concluded that they "have to be part of it" to get any benefit. Residents requested the Panel to take into consideration the desire to get something in return for what is being taken out of their land. The people stated their preference to settle their land claim before considering development, People would be supportive of the Proponents' proposal if they and their children could benefit from the proposal.

Better communication with the communities and information distribution were stressed. People wanted to know how the project fits into the land use planning framework, Water Board hearings and wildlife management schemes.

A monitoring agency was suggested to look at people's problems related to discrimination, training, compensation, small business and native business opportunities, and the high cost of living. It was suggested that the Panel make use of experience gained from the Norman Wells Project.

Other local concerns related to alcohol abuse in construction camps, in communities, and on the job, and to the possibility of damming the Great Bear River to provide electricity for pipeline pumping stations.

FORT GOOD HOPE, N.W.T.

September 27, 1983

At the Fort Good Hope Community Session, residents related their experiences with the Norman Wells Expansion Project and their concerns about the current proposal. Many of the concerns and issues were similar to those presented to the Berger Inquiry. Some positions have not changed.

The Panel heard about the importance of traditional activities such as trapping, hunting and fishing — "... land is our money; we trap on it and we live on it." It was suggested that an interim agreement on protection of lands and resources should be implemented prior to land claims settlement. Questions of royalty payments and compensation for loss must also be considered.

Some frustration was expressed about governments' slow implementation of the recommendations of the Norman Wells Panel and the repetitiveness of hearings without recognition of many of the local concerns. "We have said many things in the past and more than likely it ends up on a shelf somewhere in Ottawa collecting dust. The government has before it recommendations from previous enquiries which are not being implemented but which could turn negative impacts into positive ones."

Other concerns heard in the community related to training and native employment. Even after having taken training courses, and with some experience, people are having difficulty finding a job with industry.

Ms. D. Delancy, on behalf of the Fort Good Hope Band Council, made the point that governments should not leave it to the Proponents to come up with their own compensation policy. Government must ensure that an agreed-upon policy is in place before regulatory approval of any project. She also made the point that the regulatory process is backwards — all the approvals were given before a contingency plan was prepared, or the EARP Panel recommendations on the Norman Wells Expansion Project satisfactorily dealt with.

FORT NORMAN, N.W.T.

September 28, 1983

Many Fort Norman residents expressed a close relationship with the land and spoke of the importance of wildlife to them. Trapping is a part of their life and they want to maintain it. They brought to the Panel's attention the traditional activities of hunting, trapping and living off the land, and the need for protection of wildlife, as well as the issue of compensation for damages. Concerns about the timing of the Norman Wells pipeline crossing of Great Bear River, blasting, water quality and access to the construction camp at Great Bear River were also raised.

The experiences of many with the Norman Wells Expansion Project were related. Of concern were the issues of communications, union employment, northern contracting, training, the cost of living and alcohol. Information distribution and the timeliness of community consultation about jobs and contract opportunities were cited as problems. Bonding, the ability of small community contractors to compete with large southern firms, and a lack of training opportunities were identified as barriers to northern participation in the Norman Wells Expansion Project. Unions are a concept foreign to many native peo-

"We hope the Panel will be aware at this time and when they are listening to me now, I hope they will take into consrderatron all that I have sard now, and that also when they *do write up their renews, they would certainly do their best to try and help us, so that we do get something out of this* development that's *taking* place. ''

G. Kodakin
Chref
Fort Franklin

"We want a better life tomorrow, that's why we are here, because we're concerned. He says we know, we have experienced our previous lives rrght *up til* now what krnd of *life we had, and we want a better living and* a *better living for our children too.''*

P. Wright
Chief
Fort Norman

'Slowly, there IS diminishing of our land claims through oil leases, pipeline routes, mineral leases. highways, parks, municipalities, et cetera as these are things that the Federal Government will not negotiate with us. ''

J. Antoine
Chref
Fort Simpson

"I've heard from some people that we could be faced with pipeline developments for the next 20 years that there could be pipeline building for the next 20 years, all over the place. And when I think about that that's when I begin to think that I don't quite have enough information to make, you know, an intelligent response to this Panel ''

J T'Seleie
Fort Good Hope

"So far the Federal Government has Introduced into Parliament that Bill C48 empowering them to do as they wish with the land and how it should be explored and how it should be exploited. And they have done nothing to make our rights clear to us, but they have given themselves the rrght to do as they wish with the land''

E Grandlambe
Fort Good Hope

"So. In summary, we think a compensation policy can't be based on individual property rights; it has to be based on recognrtron of a *collective right of people to harvest their resources. And the government can't leave it up to the proponents* to *come up with their own compensation policy It's the government's responsibility to make sure that's agreed upon before they would give any regulatory go-ahead ''*

D. Delancy
Fort Good Hope

"Because over all the years of *all* the meetrngs *taking place, and of all the concerns that we have presented, nothing has ever really happened, we have never gotten anything out of all the development* takrng p/ace *in* the *north ''*

G Kodakin
Chief
Fort Franklin

"It really *hurts when you attend these hearmgs. They prom/se us all the lobs that are available to the northerners, and then you get on the phone to apply for a lob, or you* send an *application in* and they tell you you're not *qualified for it. You know, that really hurts a person. ''*

A. Yallee
Fort Norman

"We know that this kind of development, extracting nonrenewable resource and ship it out south, can't go forever. There will be a day when thrs kind of thing has got to stop, there will be no more left some day, and the scar on this country will be here, and us Aboriginal people, this IS where we stay and we want to stay and we would suffer from it''

G Blondin
Fort Franklin

pie. A need was expressed for more information on unions, such as what a union is, the qualifications needed to join a union and why unionized contractors are used.

Chief Paul Wright spoke of the importance of communication and about his disillusionment with major development. He said through the translator, "... he's wearied, he doesn't expect anything from it, and says it's pretty hard for my people because it seems like they're not going to participate in it and they wouldn't get anything from it." The Dene and oil companies must come to mutual agreement so everyone can benefit from development. He said "... if we listen to one another . . . it will be a better future for us . .." "... if we don't listen to one another, . . . there will be more problems . .."

FORT SIMPSON/WRIGLEY, N.W.T.

September 29, 1983

Chief Jim Antoine was the first speaker at the Fort Simpson Community Session. His presentation made reference to the Berger Inquiry and clearly indicated that the position and feelings of the community about land claims had not changed. The feeling is that land claims are being jeopardized by development, since leased or alienated lands cannot be part of a land claim; yet land is still being leased with no Dene input. Royalties should be paid on resources taken from the ground of the native people to ensure programs are established to meet their needs.

The recommendations of the Norman Wells Panel were referred to the Beaufort Sea Panel for consideration. People objected to the fact that a second pipeline is being considered before the effects of the first are realized. Several people expressed concern about the pipeline crossing of the Mackenzie River upstream from Fort Simpson and about the fact that a major part of the Norman Wells line would be built in the coming winter season, without a monitoring agency in place.

Fort Simpson Mayor J. Villeneuve pointed out that Fort Simpson is still burdened by a municipal services and infrastructure which were expanded in anticipation of an earlier pipeline that never materialized. No special impact funding or assistance has been provided.

> *"I might say at this time that the problems that we are experiencing in Fort Simpson with respect to providing services, et cetera, are a carryover of the pipeline that never was, which is the Mackenzie Valley Pipeline. So we haven't solved those problems yet and we are now pracbcally in the middle of one pipeline and the Panel here is considering the next one after the one that is presently going through "*
>
> *Mayor J.Villeneuve*
> *Fort Simpson*

Housing shortages, the high cost of living, alcohol problems, unemployment and poor social and economic conditions among the native community were noted. Dissatisfaction with employment, training and contract opportunities was expressed, as was skepticism about project studies carried out and the motives of government and industry.

NORMAN WELLS, N.W.T.

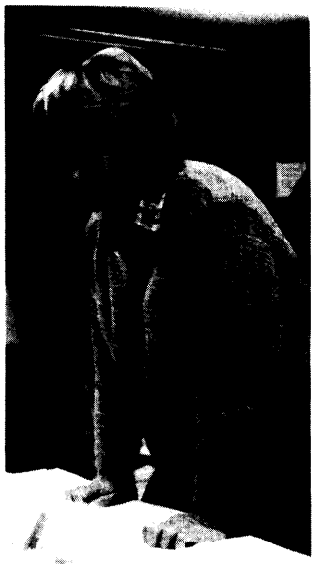
September 26 1983

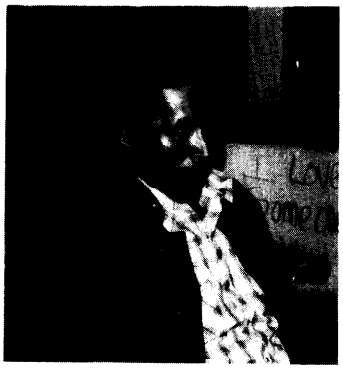
The focus of the Norman Wells Community Session was on the Norman Wells Expansion Project and impacts related to it. Project impacts on the community infrastructure included soaring operating and maintenance costs and general administration expenses, inadequate water delivery service, lack of recreation facilities, housing shortages, lack of residential planning, and the loss of autonomy for the Hamlet.

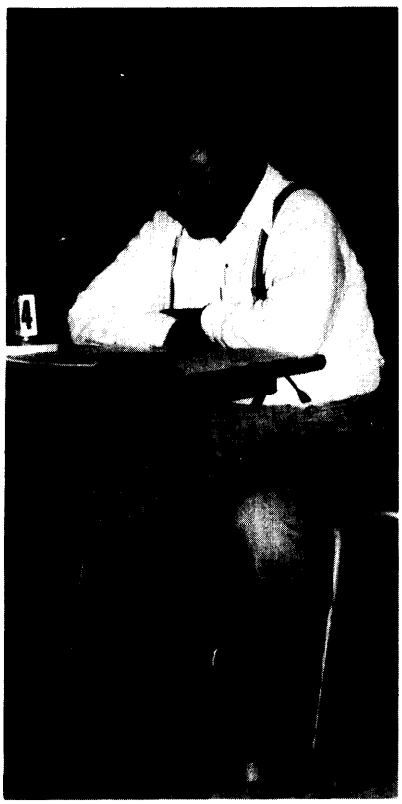
Unionized jobs, definition of a northerner in terms of NWT residency requirements, lack of community cohesiveness because of rotational schedules, the timing of work training programs and lack of government assistance were issues raised by others.

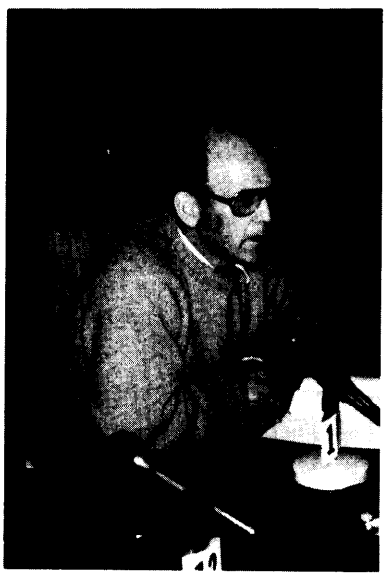
One of the biggest disappointments associated with the Norman Wells Expansion Project was the inadequacy of impact funding and the failure to establish a Development Impact Zone group. While many "do not disagree with resource development . . . we do not wish to become a victim of circumstance." Further to this issue it was recommended that governments and proponents of mega-projects in the North should establish special capital expenditure funding for resource towns and agencies before future projects are implemented. Governments were inadequately prepared for the Norman Wells Expansion Project.

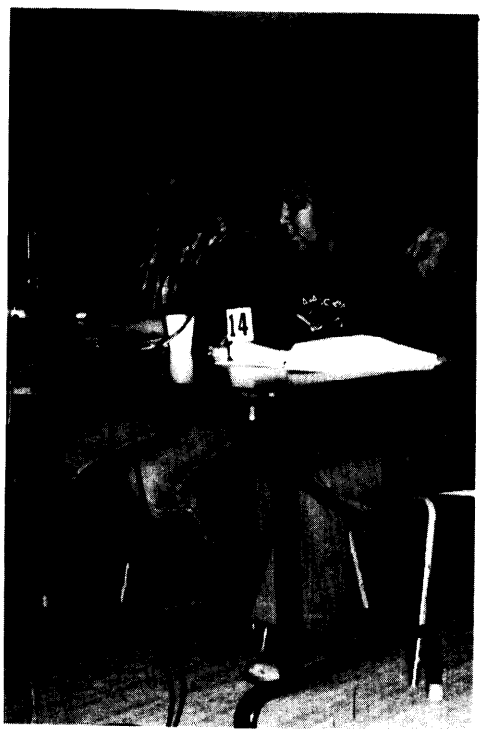
The Metis Association had concerns about wildlife and the lack of protection from transient hunters, the lack of communication between companies and native organizations, the lack of statistics on native employment, housing that is inaccessible to northerners while southern workers are taken care of, and the inability of northern contractors to compete with large southern companies. Other concerns related to environmental issues such as oil-spill response capability at critical times in terms of weather and ice, construction impact on the land and the effect of winter road access to wildlife.











Eastern Arctic and Labrador Communities

ARCTIC BAY, N.W.T.

October 14, 1983

The meeting began with a presentation by the Development Review Committee of Arctic Bay and the Hamlet Council. Mr. G. Williams pointed out that information collected to date by government scientists and industry has only been collected during the summer months. Seldom have people collected environmental data in fall or winter. The question was asked about how assumptions or accurate predictions can be made when data for the full year are not available. Examples of some of the unknowns included cod spawning areas and the distribution of wildlife species.

Discussions and concerns involved icebreaking tankers, oil spills, ship track crossing, changes to the ice regime, noise, tanker routing and impacts on wildlife. Noise concerns centered on possible frightening of the animals and the possibility of interfering with the ability of seals to echo-locate, particularly during the dark period. Dangers were expressed about icebreaking activities which could prevent hunters from using Lancaster Sound safely, increased seal pup mortality in birth dens, and increased multi-year ice in Admiralty Inlet which would interfere with hunting and fishing activities. The possibility was raised of alternative ship routing in order to avoid some of the problems.

Oil spills were seen as one of the greatest threats to the environment. The questionable effectiveness of dispersants, ignitors and clean-up of oil in moving ice or a sea state greater than one and a half metres were raised as concerns. The local people's dependence on wildlife for consumption was raised in terms of compensation for adverse effects. Residents stressed that wildlife losses in terms of food, clothing and culture cannot be compensated. "We must stress to you again that the environment has been and still is today the base that Inuit culture and economy has been built on and maintained."

A number of requests were made to slow down development so Inuit can prepare to participate. Few benefits are perceived for Inuit in terms of jobs and "it is impossible to have full participation due to a lack of education." It was suggested that the concerns and recommendations of Inuit are being ignored. The settlement of land claims and other political developments should take priority.

Other issues brought to the Panel's attention were training of tanker officers and crew, employment of non-Canadians, preference for a pipeline rather than tankers, more studies in areas of social concern, Inuit participation on any committee dealing with tanker operations and the psychological impacts of a loss of lifestyle. "The oil companies have really got to convince us that they can carry out this responsibility."

FROBISHER BAY, N.W.T

October 23, 1983

Environmental issues discussed at the Frobisher Bay Community Session were mainly related to wildlife concerns. Questions were asked about disturbances of narwhal and beluga along the shipping route. Another concern related to polar bear research and how Inuit hunters might contribute.

A question was raised about the validity and quality of research being carried out since it was being conducted by the same companies that want to drill.

There was some discussion about education and training which would allow Inuit to participate in development. It was suggested that education should come before development. The Proponents' reactions to the question of land claims and job training were also sought.

The meeting concluded with a discussion by BRIA representatives of the potential for Inuit people to participate in Arctic environmental studies. The Proponents were asked whether or not they had tried or intended to try, to access systematically the body of environmental knowledge which the Inuit people inherently possess.

NAIN, LABRADOR

October 27, 1983

The Nain Community Session was attended by representatives of the Labrador communities of Makkovik, Hopedale, Postville and Rigolet. Each community made a presentation to the Panel, and in general each was opposed to tankers travelling through the Labrador Sea.

Specific tanker concerns related to the testing of the ships, oil spills, seaworthiness in freezing spray, contingency and clean-up plans, and the impact of noise and traffic on wildlife. The success of clean-up techniques in the Labrador Sea was questioned where high winds, waves, currents and tides could impair their effectiveness.

> "What *I'm trying to* **get** at *is* that *this oil, if it were spilled up in the Davis Strait area between Labrador* and *Greeland, and moved down to the front, off the* coast, *then there's the possibility that it would stabilize right where the Harp Seals pup And when the Harp Seals* are *pupping, that's when the warmer weather starts to set in. And I think the thing we have to think about is it's possible that where the largest concentration of Harp Seals are, that's possible where the largest concentration of your spill could be.* "
>
> *Mayor W. Andersen*
> *Nain*

The lack of winter weather observations and sea conditions for offshore Labrador was emphasized. Even satellite imagery is not reliable because of the persistence of cloud and fog in the winter months.

It was stated that coastal residents rely almost entirely on the resources of the Labrador Sea. An oil spill could jeopardize the livelihood of fishermen and seal hunters on the northern Labrador coast. Concern was expressed about oil mixed with drifting pack ice being released into the water column as the ice melts at a time sensitive for hatching cod eggs.

A communication gap is perceived between the Labrador people, government and industry. The Labrador Inuit Association pointed to the lack of credibility of governments with the Labrador people in terms of environmental protection for the ocean and coastline. They requested that the Government of Canada take action to include the area south of 60° N Latitude in the review process and to ensure that environmental regulations are legislated. It was stated that, "Arctic waters do not stop north of 60° . . . nor would the tankers."

Socio-economic issues centered on concern for sea mammals and the fisheries that might potentially be affected by the project and the direct impact such effects would have on the traditional way of life and culture of the northern coast. Compensation for losses resulting from the project was questioned since there is a heavy reliance on the resources of the sea to supplement the high cost of southern foods.

PANGNIRTUNG, BROUGHTON ISLAND AND CLYDE RIVER, N.W.T.

October 22, 1983

The Pangnirtung Community Session was attended by residents from Broughton Island and Clyde River. The Panel listened to concerns about ship traffic in Davis Strait, such as the possible impacts this may have upon wildlife, the effects of underwater noise and oil spills. The importance of wildlife such as narwhal, seals, and polar bear to the Inuit culture and lifestyle of the people of east Baffin was stressed, as money could not bring back a way of life or compensate for the loss of wildlife.

Contingency plans and response capability under adverse conditions of weather, waves, on-shore currents and ice were questioned. The Panel heard from residents that at times immediate response to an accident would be impossible, as demonstrated by personal accounts of the difficulty in searching for lost individuals.

Residents suggested more community and Inuit involvement in research studies and monitoring. Local credibility of monitoring results could be improved by Inuit participation on ships.

Questions were raised about the social issues of employment and training opportunities which would allow for Eastern Arctic Inuit participation in development activities. Apparent barriers to employment and training were discussed such as education levels, language ability, distance and transportation problems, and the degree to which Beaufort area jobs are advertised in the Eastern Arctic.

It was also suggested that ships returning empty from the South may be able to bring in goods or equipment which would be expensive by air or would have to wait until sea lift.

"The reason why we would like the proponents to hold on is so that *the Inuit would have benefit because we know if they are going* ahead, *the higher skilled jobs would go just to southerners. ''*

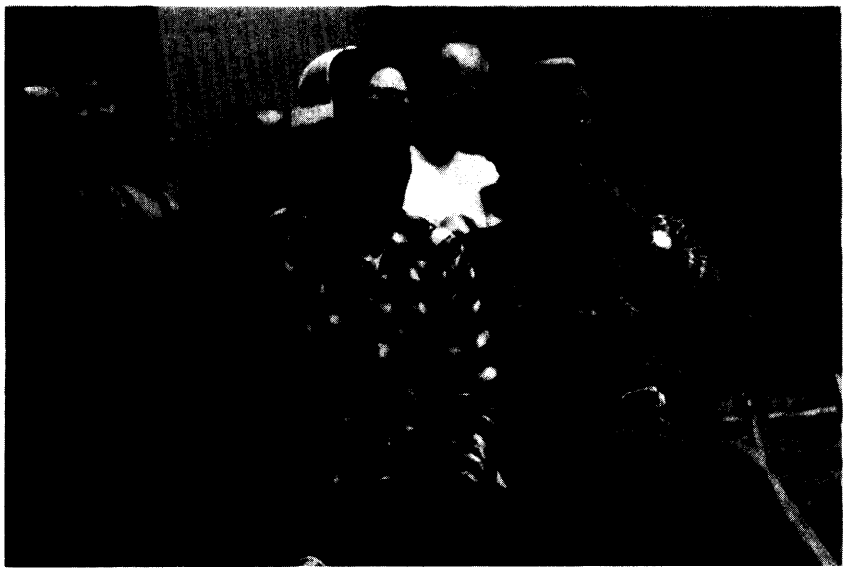
L Ukalianuk, BRIA

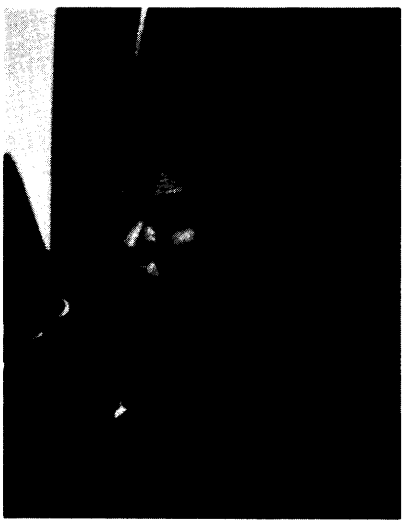
"The proposed tanker route through the Labrador Sea *seems to be a one-sided program We, the people have everything to lose and nothing to gain.''*

S. Edmunds
Postville

''But we have not changed our tune since 1979 Our tune has been that "no development until we are ready '' No development until land claims are settled or no development until adequate cleaning material is found for oil spilling ''

E Erkloo
Pond Inlet



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POND INLET, N.W.T.

October 13, 1983

Concerns raised at the Pond Inlet Community Session ranged from educational matters and employment opportunities to the risks and impacts of tanker traffic through Lancaster Sound. Sam Omik put the issue in perspective when he said, "Don't take the non-renewable resources from our land until our people can play a meaningful role in these developments." Other remarks suggested, "No development until we are ready; no development until land claims are settled or no development until oil spills can be cleaned up."

Concern was expressed that the Proponents did not understand the environmental effects of its activities, nor did it understand the cultural and subsistence importance of wildlife. "If there is a big change in our land we would be very sad . ..'', "wildlife has a great deal to do with our lives." Compensation could not cover a lost lifestyle or culture.

Some residents stated that in governments' preoccupation with resource development they tend to forget about people development. The need for better education standards and facilities in the North was stressed. Schooling is substandard and children should neither have to leave home to go to high school, where they are compelled to live in residence away from their families, nor should they have to leave the North for a technical school or university. "If education is not going to improve, I would rather not see the oil being transported through the sea."

More specific concerns were raised about the relocation of marine mammals, difficulties with crossing of ship tracks, underwater noise effects and oil spills. The Proponents were questioned about the risk of oil spills, clean-up capability and experience, and the impact on birds, beluga, narwhal and seals. Also raised were the issues of the manoeuvrability of the ships in relation to seal dens and the possibility of hunters being set adrift because of cracks formed from ship traffic, Monitoring of impacts from ship operations was also suggested.

Socio-economic concerns expressed were on the benefits to the people of the North from further shipping development, the speed of development, employment opportunities, the definition of northerners, barriers to employment such as unions, low education and transportation problems. It was stated that it is difficult to look favourably on a development if job opportunities are unlikely and there are no benefits.

"An Inuk would be sickly if he did not eat *country foods Even though we can buy food from the stores, we must still* hunt *for our most important food that is the animals from the land and sea and even though we can buy clothing from the stores, our best and warmest clothes must be made from the animals that we hunt. ''*

''I am trying to make you understand that the environment plays a very important role in our lives. If Industry destroys our environment, they will destroy our people along wrth it. ''

J. Nutarq
Pond Inlet

RESOLUTE / GRISE FIORD, N.W.T.

October 18, 1983

The Resolute Community Session was attended also by representatives from Grise Fiord. Most of the concerns raised at the meeting focused on oil tanker traffic and the impact of ships on wildlife and hunting activities.

Resolute Mayor George Eckalook pointed out that the Beaufort Sea proposal was different from the Arctic Pilot Project and consequently more serious in terms of impact. He raised questions on oil spills and the difficulty of cleaning up oil in cold water. He also questioned the credibility of the Proponents' oil spill experiments, which were taken in ideal spring and summer conditions.

The inevitability of an oil spill during the life of the project was mentioned and the lack of guarantees that accidents or oil spills would not have an impact on the wildlife. The importance of wildlife to Inuit people for food and clothing was demonstrated.

''As you might well know, we do not grow our food in this area. But, however, we have plenty of wildlife like seals, narwhals and fish. It seems to us that you could even say that the sea is our farm whereby it provides us with food. Where in the southern sectors of Canada, you plant food on the land. Where we *in the North have used the sea for our livelihood as well* as *consumption. ''*

W. Audla
Resolute

It was stated the people did not want to see ships in the winter because they use the ice for transportation to their hunting grounds. Concerns were raised about the re-freezing of ship tracks, rough ice and the danger, if it were covered with drifting snow, that a ship track would not re-freeze right away. Also of concern were the impacts of tankers on birth dens of seals, and on narwhal which may follow a re-freezing ship track. Solutions to the danger of people camped or crossing the ice of Barrow Strait at night were also addressed.

Questions concerning employment on the tankers, education as a barrier to employment and compensation for wildlife losses were raised. It was stated that while the Proponents discuss all the good things their proposal has to offer, there is not much said about the negative impacts. People from the Arctic have a lot to offer people from the South in the way of experience when they come North to work.

"And also, if the ice track, if the ships' track have been covered immediately by drifting snow, I know this by an experience as a child, when I know for a fact that if open water is covered with snow immediately, there is a danger that it won't be freeze-up right away. ''

G. Ageeagok
Grise Fiord

Part III Appendices

APPENDIX 1

DOCUMENTS RECEIVED BY THE BEAUFORT SEA ENVIRONMENTAL ASSESSMENT PANEL

The Terms of Reference issued to the Beaufort Sea Environmental Assessment Panel included a requirement that "all documents submitted to and correspondence with the Panel are available to the public." In response to that requirement the Beaufort Sea Environmental Assessment Panel established a Public File of material received by the Panel. This file was maintained throughout the review process at the Beaufort Sea Panel Office in Inuvik and at the Federal Environmental Assessment Review Offices in Vancouver and Ottawa. An annotated "Index to the Public File" was established and maintained with the Public File. Copies of this Index were located at the Department of the Executive, Government of the Northwest Territories in Yellowknife; at the Yukon Archives in Whitehorse; at the DIAND office in Frobisher Bay; and later at the Arctic Institute of North America in Calgary. The Public File Index was available for use at all public meetings of the Panel. In July 1983, prior to the public sessions, a listing of all reports and publications included as part of the Panel Public File was distributed to all intervenors. All documents were made available on a limited loan basis throughout the process.

A complete bibliography of reports, publications and interventions from the Public File has been compiled as a separate document and is available upon request from the FEAR0 offices in Ottawa and Vancouver.

The transcripts and the transcripts of the Community and General Sessions are also available for consultation at the FEAR0 offices in Ottawa and Vancouver.

An annotated index to these transcripts and the written interventions has been prepared as a working document and is also available on request at the same offices.

Enquiries should be addressed to:

Federal Environmental Assessment Review Office
700 — 789 West Pender Street
Vancouver, B.C.
V6C 1H2

or

Federal Environmental Assessment Review Office
13th Floor, Fontaine Building
200 Sacred Heart Blvd.
Hull, Quebec
K1A OH3

APPENDIX 2

PARTICIPANTS AT GENERAL SESSIONS

PARTICIPANTS, ORGANIZATION/AFFILIATION

AGEEAGOK, Gamalie, Grise Fiord
ALLEN, Bertha,NWT Native Women's Association
ALLISON, Lorraine, GNWT
AMAGOALIK, Simeone, BRIA
ANDERSEN, William, Mayor of Nain
ANDRE, James, Beaufort Mackenzie Delta DIZ Group
ARNETT, Mike, Esso
ARNOLD, Chuck, GNWT
AUDLALUK, Larry, Grise Fiord
BARNABY, George, Dene Nation
BARNETT, Martin, DIAND
BARRETT, David, Canadian Coast Guard
BARRY, Tom, DOE
BAUER, Gary, Whitehorse Chamber of Commerce
BAYLY, John, Dene Nation
BEAKHUST, Grahame, Beaufort Sea Alliance
BEANLANDS, Gordon, Technical Specialist
BEAUBIER, Hiram, DIAND
BENSEN, Mel, Esso
BERCHA, Frank, Proponents' Advisor
BERTULLI, Margaret, Northern Heritage Society
BEZAIRE, George, Esso
BILLINGSLEY, Doug, Canadian Reindeer Ltd.
BLASCO, Steve, EMR
BOBBIT, Judith, Labrador Inuit Association
BONN, Warren, Technical Specialist
BOURQUE, Jim, GNWT
BOYD, Forbes, DFO
BRICEL, Robin, GNWT
BRICKMAN, Barry, DIAND

BROOKS, David, Beaufort Sea Alliance
BROOM, Noel, Dome
BROWN, Neil, Proponents' Advisor
BRYCE, Peter, Gulf
BURNET, Peter, Beaufort Sea Alliance
BUTLER, Richard, Resource Person
CALDWELL, Ed, Esso
CAMPBELL, Neil, DFO
CARLEY, Michael, University of British Columbia
CARR, Brian, GNWT
CATTANACH, Rory, Dome
CHAMBERLIN, Ted, Beaufort Sea Alliance
CHANIN, Al, Gulf
CHURCHER, Archie, Dome
CINQ-MARS, Jacques, National Museum of Man
CLARKE, Allan, DFO
COHEN, Philip, DOE
COOLICAN, Murray, Inuit Tapirisat of Canada
CORNFORD, Alan, DFO
COTTERILL, Ewan, Dome
CROASDALE, Ken, Proponents' Advisor
CROMBIE, Margaret, DIAND
CROZIER, Horace, CEIC
CULLEN, Andrew, DIAND
DANIELEWICZ, Ben, Dome
DAVIDSON, Don, DOT
DAVIS, Rolph, Proponents' Advisor
de MARCH, Larry, DFO
DETLOR, Tom, Town of Inuvik
DEVITT, Paul, GNWT
DICKENS, David, Proponents' Advisor
DILLON, Lucy, Tuktoyaktuk Social Services Advisory Committee
DIRSCHL, Herman, DIAND
DONALDSON, Judith, BRIA
DONIHEE, John, GNWT
DONNELLY, Paul, GNWT
DUNBAR, Blair, GNWT
DUNLOP, Will, DIAND
DUVAL, Wayne, Proponents' Advisor
EDMUNDS, Sharon, Labrador Inuit Association
ELIAS, Albert, MacKenzie Delta DIZ Group
ELLIS, Jack, York University
ENNIS, Gordon, DFO
ERASMUS, George, Dene Nation
ERICKSON, Diane, Technical Specialist
EWING, Gerry, DFO
FAULKNER, Neil, DIAND
FAUMAN, Peter, YTG
FELIX, Emanuel, Tuktoyaktuk
FERBEY, John, YTG
FERRIS, Peter, DIAND
FERRIS, Ronald, Anglican Bishop
FLETT, Susan, GNWT
FORBES, Don, EMR
FOSTER, Mel, Northern Canada Power Commission
FRASER, Ivan, GNWT
FREDERKING, Bob, National Research Council
FRIEDENBERG, Brent, Beaufort Sea Alliance
GANSKE, Joe, DIAND
GIBSON, Robert, Beaufort Sea Alliance
GILMOUR, Jeff, GNWT
GOLD, Lorne, National Research Council
GOODMAN, Ron, Esso
GRAF, Ron, GNWT
GREENLAND, Fred, Chief Aklavik Band
GREISMAN, Paul, Technical Specialist
GREY, Paul, GNWT
GRINSTEAD, John, Canadian Coast Guard
GUIMONT, François, DIAND
GUNN, Anne, GNWT
GUTHRIE, Jim, Beaudril
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HALEY, Don, Proponents' Advisor
HAMBRIDGE, Mark, YTG
HARKER, Don, Beaufort Sea Support Base Ltd.
HARPER, Kenn, Proponents' Advisor
HARRISON, Garth, Dome
HAYES, Ted,
HILL, Dick, Inuvik Chamber of Commerce
HOBART, Charles, Proponents' Advisor
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HODGSON, Dick, DOT
HOEFS, Manfred, YTG
HOOS, Rick, Dome
HORN, Lee, GNWT
HORNE, Murray, Beaudril
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HURST, Rick, DIAND
INGLIS, Julian, DIAND
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JAKIMCHUK, Ron, Proponents' Advisor
JOHNSON, Lionel, DFO
JONES, Gordon, Arctic Petroleum Operators Association
JOSEPHSON, Rick, DFO
KADLOO, David, Arctic Bay
KADLOO, Levi, Arctic Bay
KAKFWI, Stephen, Dene Nation
KALYNIUK, Gerry, Esso
KAPTY, Al, Trans North Air
KENNEDY, Gay, GNWT
KIVISILD, Hans, Proponents' Advisor
KLASSEN, Bill, YTG
KLENAVIC, John, DIAND
KNOX, Bill, Beau-Tuk Marine Services
KNOX, John, Beau-Tuk Marine Services
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KOROL, Andre, Whitehorse Chamber of Commerce
KRETZ, Ralph,
LANGTRY, Ted, DIAND
LATOUR, Paul, GNWT
LAWLER, Herb, DFO
LAWRENCE, Michael, DFO
LEE, Jim, Esso
LEMBERG, Ray, Technical Specialist
LEWIS, Glen, Esso
LOKEN, Olav, DIAND
MACKAY, Don, Technical Specialist
MACPHERSON, Andrew, DOE
MAGEAU, Camille, DIAND

MANSFIELD, Arthur, DFO
MAR, John, DIAND
MARKHAM, Bill, DOE
MARR, Ian, Canadian Coast Guard
MARTELL, Art, DOE
MASON, Ted, Resource Person
MAURO, Jennifer, Mackenzie Delta Dene Regional Council
MCALLISTER, Sean, Father, Catholic Church
MCCART, Peter, Proponents' Advisor
MCCORMICK, Kevin, DOE
MCCOURT, Ken, Proponents' Advisor
MACEACHERN, Joe, GNWT
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MCGEE, Charles, GNWT
MCGEE, Robert, National Museum of Man
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MILNE, Glen, Beaufort Sea Alliance
MONAGHAN, Hugh, GNWT
MOODY, Paul, GNWT
MOORE, Brett, DOE
MOORE, Michael, GNWT
MORRISON, Bob, Gulf
MORISON, Murray, DIAND
MOSHENKO, Robert, DFO
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MURPHY, Harry, YTG
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NICHOLLS, Brian, DFO
NICOLAAS, Nick, Canarctic Ventures
NIDER, Sheldon, GNWT
NUNGAQ, Levi, Resolute
NUTARAQ, Jesse, Pond Inlet
O'CONNOR, Michael, Proponents' Advisor
O'NEIL, Dan, GNWT
OKPIK, Abe, Dome
OMIK, Sam, Pond Inlet Development Committee
PARKES, Michael, DIAND
PARSONS, Tim, Technical Specialist
PATENAUDE, Gilles, DIAND
PEARCE, Bill, Interprovincial Pipeline (NW) Ltd.
PEARSON, Art, Whitehorse Chamber of Commerce
PEARSON, The Honourable Chris, Leader of the Government of Yukon
PEDDIE, Erwin, Proponents' Advisor
PEDDIE, Wayne, Proponents' Advisor
PERRY, Dale, YTG
PESSAH, Ed, Dome
PICK, Archie, International Pipeline (NW) Ltd.
PILKINGTON, Roger, Gulf
PISTRUZAK, Bill, Dome
PLUIM, Al, Pluim Contractors Ltd.
PORTER, Selby, Bow Valley Resource Services Ltd.
PULLEN, Tom, Technical Specialist
REDSHAW, Arthur, DIAND
REES, William, University of British Columbia
REID, Dave, Proponents' Advisor
RENNIE, Frances, DOE
RICHARDSON, Nigel, Technical Specialist
ROBERTSON, Jim, Mayor of Inuvik
ROBINS, G. L., DFO
ROOTS, Fred, DOE
ROTHSCHILD, Henri, EMR
ROWELL, Judy, LIA-ITC
ROZON, Gordon, Proponents' Advisor
RUBY, Pat, Proponents' Advisor
RUEL, Maurice, COGLA
RUSSEL, Don, YTG
RUSSELL-LEBLOND, Nancy, Beaufort Sea Alliance
SANGSTER, Hugh, Interprovincial Pipeline (NW) Ltd.
SAVOIE, Donat, DIAND
SAVOIE, Parry, DIAND
SCHILDER, Vladimir, DIAND
SCOTLAND, Bill, Northern Pipeline Agency
SCULLION, John, DIAND
SERGY, Gary, DOE
SHEEHY, Greg, Canadian Nature Federation
SIMMS, Tom, Gulf
SIMON, Willie, Mackenzie Delta Dene Regional Council
SIMPSON, Bob, Mackenzie Delta Dene Regional Council
SINCLAIR, Duncan, YTG
SLUSARCHUK, Bill, Proponents' Advisor
SMILEY, Brian, DFO
SMITH, Barney, YTG
SMITH, Jim, Northern Canada Power Commission
SMITH, Tom, DFO
SPEDDING, Geoff, Esso
STAPLES, Lindsay, Beaufort Sea Alliance
STEEN, Vince, Mayor of Tuktoyaktuk
STEIN, Jeff, DFO
STENHOUSE, Gordon, GNWT
STEPHENSON, Carol, Canadian Coast Guard
STERLING, Robert, DIAND
STONE, David, DIAND
STRICHARUK, Jack, Dome
STRONG, Tom, DFO
STUCKLEY, Janusez, Proponents' Advisor
SULUK, Thomas, Inuit Tapirisat of Canada
SWITZER, Bruce, DOE
TAGAK, Andrew, Hunters & Trappers Association of Resolute
TASCHEREAU, Maurice, COGLA
TAYLOR, Ken, Polar Gas

TERHUNE, Jack, Technical Specialist
TEYA, Mary, Mackenzie Delta Dene Regional Council
THOMAS, David, Proponents' Advisor
THOMAS, Maurice, COGLA
TILDEN, David, DOE
TODD, Murray, Dome
TULL, Eric, Beaufort Sea Alliance
UKALIANUK, Lucien, BRIA
USHER, Peter, Beaufort Sea Alliance
VANDERKOOY, Nick, Dome
VERNON, Gary, DFO
WADDELL, Bruce, DIAND
WALLACE Ron, Inuit Tapirisat of Canada
WALSH, Valda, Technical Specialist
WARD, John, Dome
WATSON, Dennis, DIAND
WEINSTEIN, Pat, Proponents' Advisor
WEISBECK, Don, GNWT
WILLIAMS, Glen, Arctic Bay
WILSON, Brian, DOE
WISWELL, Andrew, Gulf
WOLFE, Ed,
WYKES, Colin, DOE
YATES, Barry, Northern Pipeline Agency
ZARIWNY, Al, GNWT
ZOLTAI, Steve, DOE

APPENDIX 3

PARTICIPANTS AT COMMUNITY SESSIONS

TUKTOYAKTUK, September 14, 1983

ALLEN, Roger
BEZAIRE, George
CARPENTER, Ada
COCKNEY, Kennedy Jr.
DILLON, Eddie
FELIX, Emanual
GOOSE, Roy
GRUBEN, Roger
HOOS, Rick
KIKOAK, Edward
KIKOAK, Lena
KIKOAK, Roy
LYONS, Mary
POKIAK, Calvin
WHITE, Agnes
WISWELL, Andrew
WOLKIE, Fred

AKLAVIK, September 15, 1983

BEZAIRE, George
CARROL, Martin
DIXON, Geoffrey
EDWARDS, George
FURLONG, Charles
GARDLUND, Sarah Ann
GREENLAND, Freddie
HOOS, Rick
KARNES, Rose Marie
MORRISON, Bob
NERYSOO, The Honourable Richard
OKPIK, Abe
SITTICHINLI, Jim Edward
SITTICHINLI, Lazarus
WISWELL, Andrew

SACHS HARBOUR, September 16, 1983

BEZAIRE, George
CARPENTER, Andy
CHURCHER, Archie
ESAU, Shirley
ESAU, Peter
GOOSE, Roy
HOAGAK, Charles
HOOS, Rick
KUPTANA, William
OKPIK, Abe
SIDNEY, Floyd
WHITE, Agnes

HOLMAN, September 17, 1983

ALEEKUK, Issaac
BEZAIRE, George
CHURCHER, Archie
ELIAS, Albert
HOOS, Rick
KATAOYAK, Simon
KUNEYUNA, Roy
KUPTANA, Robert
OKPIK, Abe
ROSE, John
SIMMS, Allen

COPPERMINE, September 19, 1983

ALGIAK, Alec
BERNHARDT, Ernie
BEZAIRE, George
GUTHRIE, Jim
HAVIOYAK, Donald

HOOS, Rick
KARNES, Rose Marie
PIGALAK, Tommy
WISWELL, Andrew

PAULATUK, September 20, 1983

BEZAIRE, George
HOOS, Rick
RUBEN, Edward
RUBEN, Garrett
RUBEN, Gilbert
THRASHER, Tom
WHITE, Agnes

FORT MCPHERSON, September 21, 1983

ANDRE, Hyacynth
BEZAIRE, George
CHARLIE, Johnny
FIRTH, Ernest
HOOS, Rick
KOE, Charles
MACDONALD, William
NORBERT, Nap
SIMPSON, Bob
SNOWSHOE, Charlie
WISWELL, Andrew

FORT FRANKLIN, September 23, 1983

BARNABY, Charlie
BATON, Paul
BEZAIRE, George
BLONDIN, George
HOOS, Rick
KODAKIN, George
T'SELEIE, John
WIDOW, Fred
WRIGHT, Paul
YALLEE. Alvin

NORMAN WELLS, September 26, 1983

ARNETT, Mike
BJORNSON, Kathy
BYRNE, William
CALDWELL, Ed
DANIELSON, Liz
DOOLITTLE, Violet
HARBURN, Norm
LINTON, Phyllis
MYERS, Rick
SCHMITKE, Warren
STEVENS, Sandra
WISWELL, Andrew

FORT GOOD HOPE, September 27, 1983

ARNETT, Mike
BARNABY, Charlie
BENSON, Mel
BEZAIRE, George
CALDWELL, Ed
DELANCY, Debbie
GRANDJAMBE, Edward
HOOS, Rick
JACKSON, Lucy
KOCHON, Charlie
MCLAUGHLAN, Letha
POPE, Frank
SHAE, Dolphus
T'SELEIE, Frank
T'SELEIE, John
WISWELL, Andrew

FORT NORMAN, September 28, 1983

ANDREW, Fred
ARNETT, Mike
BENSON, Mel
BLONDIN, John
CLEMENT, Robert
ERHARDT, Phil
HALEY, Susan
MENACHO, Victor
MENDO, Maurice
NEYELLE, Jonas
WIDOW, Fred
WISWELL, Andrew
WRIGHT, Paul
YAKELEYA, Elizabeth
YALLEE. Alvin

FORT SIMPSON, September 29, 1983

ANTOINE, Don
ANTOINE, Jim
ARNETT, Mike
CALDWELL, Ed
LAFFERTY, William
MCARDY, John
MENICOCHE, Betty
MENICOCHE, Kevin
PEARCE, Bill
RODH, Mrs.
SAKE, William
VILLENEUVE, Jim
WISWELL, Andrew

POND INLET, October 13, 1983

ALLOOLOO, Margaret
ATADJUAT, Joanasee
AWA, Appia
CATTANACH, Rory
CHURCHER, Archie

ERKLOO, Elijah
HOOS, Rick
IDLOUT, Paul
JAMES, Bob
KALYNIUK, Gerry
KILLIKTEE, Nigeoo
KOMANGAPIK, Dorothee
KOONARK, Stephan
KOONOO, Joseph
MCDERMOTT, Noel
NASHAK, James
NUTARAK, Jobie
NUTARAK, Jemiama
NUTARAK, Jesse
OMIK, Sam
PANIPAKOCHO, Elijah
QITSUALAK, Rebecca
SANGOYA, Paniloo
UKALIANUK, Lucien
WISWELL, Andrew

ARCTIC BAY, October 14, 1983

AOLA, Lasaloosie
ARNATSIAQ, Peter
CHURCHER, Archie
HOOS, Rick
INURAQ, Charlie
IPEELEE, Attagutak
KADLOO, Levi
KADLOO, David
KADLOO, Levi
LEVI, Leah
MCIVER, Jim
NAQITAQVIK, Olayuq
PEARCE, Frank
QAMANIRQ, Peter
SHAPPA, Kik
UYUKULUK, Moses
WILLIAMS, Glen
WISWELL, Andrew

RESOLUTE, October 18, 1983

AKEEAGOK, Gamalie
AMAGOALIK, Simeone
AUDALUK, Larry
AUDLA, Walter
CATTANACH, Rory
ECKALOOK, George
GREYELL, Bob
HOOS, Rick
NUNGAQ, Levi
NUNGAQ, Philip
NUTARAJUK, Immooshie
PUDLUK, Ludy
WISWELL, Andrew

PANGNIRTUNG, October 22, 1983

ARNAQUQ, Davidee
AUDLAKIAK, Steve
CURRIE, Jim
FISHER, Maurice
HOOS, Rick
IKARIALUK
KOONEELIUSIE, Jaco
KOMOARTOK, Norman
LUISEE, Jaco
MARSHALL, Paul
METUK, IOLA
OSLER, Steven
PUDLOO, Koonark
WISWELL, Andrew

FROBISHER BAY, October 24, 1983

ALLOOLOO, Margaret
BRADETTE, Denis
DONALDSON, Judith
GUENETTE Christine
HOOS, Rick
MCNEIL, Ian
NASHUK, Rita
NESBITT, Tom
OKPIK, Abe
WISWELL. Andrew

NAIN, October 26, 27, 1983

ANDERSEN, August
ANDERSON, William
BOBBIT, Judith
BROOMFIELD, Henry
EDMUNDS, Randy
EDMUNDS, Sharon
EDMUNDS, Silpa
EGEDE, Ivalo
ETTULAK, Julius
HOOS, Rick
HUNTER, Renatus
IGLIORTE, Philip
JOSHUA, John
LEO, Able
MAGGO, Paulus
MURPHY, Reuben
OBED, Paul
OKKAUTSIAK, Tom
PALLISER, Bob
PENNY, Danny
ROWELL, Judy
SAIMAT, Julius
SILLET, Gerry
STARR, T.
UVLORIAK, Tom
WARREN, Garfield
WILLIAMS, Frances
WISWELL, Andrew

OLD CROW, November **11, 1983**

ABEL, Charlie
ABEL, Johnny
ABEL, Rosalie
BEZAIRE, George
BRUCE, Robert
BRUCE, Robert Jr.
CARLICK, Wayne
CHARLIE, Alfred
CHARLIE, Ben
CHARLIE, Carl
CHARLIE, Effie
CHARLIE, Lazarus
DRAGGERMAN, Cathy
FROST, Alice
FROST, Steven
HOOS, Rick
KASSI, Mary
KAY, Elizabeth
KENDI, Randall
LINKLATER, Effy
LINKLATER, Irwin
MITCHELL, Katherine
NETRO, Hanna
NETRO, Lorraine
NJOOTLI, Grafton
NJOOTLI, Stanley
PETER, Abraham
PETER, Mary
SAX, Don
TETLECHI, Randy
THOMAS, Willie
WISWELL. Andrew

INUVIK, November 22, 1983

ALLEN, Bertha
BEAUDREAU, Vicki
BILLINGSLEY, Doug
BURLINGAME, Stamatia
CARDINAL, Elaine
COADY, Bill
CURRIE, Doreen
CURTIS, Peggy
HEINE, Dr.
HICKS, Jack
HILL, Cynthia
HILL, Dick
HOOS, Rick
HUSKEY, Susie
KISOUN, Delma
LEE, Jim
LOUIS, Ed
MCEACHERN, John
PLUIM, Al
SCHNEIDER, Ken
WARK, Lee
WEIR, Bob
WESTAWAY, Peter
ZUBKO, Tom

APPENDIX 4

TECHNICAL SPECIALISTS

During the Panel's review process, the Panel engaged a number of specialists to provide advice on technical issues to the Panel and to all other review participants on request. The Technical Specialists' reports to the Panel and participation at the General Sessions formed a valuable contribution to the process. The following list acknowledges those who served as Technical Specialists and gives their areas of speciality

Dr. Gordon Beanlands	-Assessment Methodology
Mr. Warren Bonn	-Tankers
Dr. Craig Davis	-Economics
Ms. Diane Erickson	-Socio-economics
Dr. Paul Greisman	-Arctic Oceanography
Dr. Geoffrey Hainsworth	-Economics
Dr. Ray Lemberg	-Risk Analysis
Dr. Donald Mackay	—Oil Spills
Mr. Winston Mair	-Renewable Resources
Mr. Nigel Richardson	-Regional Planning
Dr. Timothy Parsons	-Marine Biology
Capt. Thomas Pullen	-Arctic Shipping
Mr. Andrew Roman	-Operational Procedures
Dr. Michael Smith	-Northern Pipelines
Dr. John Terhune	-Underwater Noise
Ms. Valda Walsh	-Socio-economics

The Panel is indebted to the following resource persons who provided valuable background information during the General Sessions on related projects which have been completed elsewhere in the world.

Dr. Richard Butler and Dr. Gordon Nelson	-Shetland Islands Experience
Mr. Ted Mason	-Fort MacMurry Experience
Dr. Michael Metz	—Trans Alaska Pipeline Experience

APPENDIX 5

ACKNOWLEDGEMENTS

The Panel wishes to extend its thanks to all those who helped the Panel become better informed. Those individuals include, in particular, all the participants at the public sessions as well as those who wrote briefs for the Panel's use.

The cooperation of the Proponents and their staff is gratefully acknowledged. Many members of the group worked long hours on behalf of the process. This effort was appreciated by the Panel.

The Panel received the support and cooperation of the Department of Indian Affairs and Northern Development, which initiated the review, as well as other federal departments which contributed to this review. The work of the territorial governments was particularly appreciated.

Communities give unstintingly of their knowledge and hospitality. The Panel was welcomed in each of the communities it visited and learned much from these visits.

The Panel wishes to extend special thanks to its Executive Secretary, David Marshall, and his staff, for their contributions to the work of the Panel.

Panel Support Staff

Executive Secretary
David Marshall

Secretariat Members
Paul Scott, Robert Greyell, Elsie MacDonald, Larry Wolfe, Stephan Fuller, Robert Hornal, Ron Wallace,

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Gwen Saund, Diana Wetzel, Roberta Lauer, Theresa Salway, Evelynne Major, Charlotte Peters, Patricia Benoit.

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Wayne Bryant, Environmental Protection Service, Stephan Fuller, Robert Greyell, Native Press.

The Panel extends its thanks to Canadian Government Printing Office for its outstanding help.

APPENDIX 6

PANEL BIOGRAPHIES

DR. JOHN S. TENER (CHAIRMAN). Dr. Tener is a retired senior federal public servant living in Ottawa, Ontario. Dr. Tener was associated with Arctic wildlife research and management for 25 years.

MR. TITUS S. ALLOOLOO. Mr. Allooloo is a former mayor of the Hamlet of Pond Inlet, where he was born and raised. He is a former member of the Baffin Regional Council and is knowledgeable about Eastern Arctic issues and concerns.

MR. DOUGLAS R. CRAIG. Mr. Craig is a professional engineer who was Vice Chairman of the Alberta Energy Resources Conservation Board from 1971 until his retirement in 1977. Previously, he held a number of positions with that agency's predecessor, The Alberta Oil and Gas Conservation Board. His home is in Carbon, Alberta.

MR. KNUTE L. HANSEN. Mr. Hansen is the former mayor of the Hamlet of Aklavik of the Northwest Territories, where he was born and raised. Mr. Hansen has been employed as a northern employment manager for Imperial Oil and as a field worker and negotiator for the Committee for Original Peoples Entitlement. He is currently secretary-manager of the Hamlet of Aklavik.

MR. ALLEN R. LUECK. Mr. Lueck is a practising lawyer who assisted in the formation of the Yukon Native Brotherhood and the Council for Yukon Indians, acting as the Council's legal advisor from 1969 to 1977. Involved in mining exploration and development in Yukon, Mr. Lueck formerly lived in Whitehorse and since October, 1983 has resided in Richmond, B.C.

DR. J. ROSS MACKAY. Dr. Mackay is widely known and respected for his studies of permafrost and post-glacial history of the Western Arctic coast. A professor emeritus of geography at the University of British Columbia, he has spent some 30 seasons conducting research in the Western Arctic. Dr. Mackay lives in Vancouver, B.C.

MR. MICHAEL G. STUTTER. Mr. Stutter is a former member of the Yukon Water Board, and is engaged in gold mining in the Dawson City area. From 196 1 to 197 1 he operated a river barge service into Old Crow. He was a member of the Yukon Territorial Council from 1970 to 1974. Mr. Stutter makes his home in Whitehorse, Yukon.

The Panel wishes to extend its thanks to Fred Carmichael and Lucas Ivvalu for their work as Panel Members during the initial stage of the Panel's review.

APPENDIX 7

DEFINITIONS

Active Layer	The top layer of ground above the permafrost table that thaws each summer and refreezes each fall.
Anadromous	Fish that return from the ocean to fresh water to reproduce (spawn), e.g., salmon.
Benthos	Plants or animals that live on or in the bottom of the sea, a lake or stream.
Corrective Mitigation	Refers to measures introduced to reduce an impact after it has started to occur.
Cumulative Effects	Refer to the combined effects of development components and associated activities occurring either simultaneously or sequentially.
Endangered (Species)	Any indigenous species of fauna or flora whose existence in Canada is threatened with immediate extinction through all or a significant portion of its range.
Epontic	The under surface of the ice.
Food Web (Chain)	A diagramatic presentation of a natural community, which indicates what each member eats. At the bottom of the web are plants and bacteria, and large carnivores are at the top of the web.
Glory Hole	A pit in the seafloor at the bottom of which is the well head. The depth of the pit is such that the blowout preventer stack does not reach the level of the normal sea floor.
Gyre	A slow circular flow of ocean currents.
Icebreaker, CLASS 8	An icebreaker capable of sustaining a speed of 3 knots through ice 8 feet thick.
Ice Wedge	A massive, generally wedge-shaped body with its apex pointing downward, composed of foliated or layered, vertically-oriented ice.
Impact, Local	Exists when any physical or chemical changes (or alterations in vegetation patterns) are only expected to be detectable within one km of proposed facilities or linear transportation corridors.
Impact, Long-Term	Exists when a change is likely to persist for more than ten years from the onset of the disturbance.
Impact, Major	Exists when a regional population or species may be affected to a sufficient degree to cause a decline in abundance and/or a change in distribution, beyond which natural recruitment (reproduction and immigration from unaffected areas) would not likely return that regional population or species, or any population or species dependent upon it, to its former level within several generations.
Impact, Medium-Term	Exists when a change is likely to persist for five to ten years from the onset of the disturbance.
Impact, Minor	Exists when a specific group of individuals of a population in a localized area and over a short time (one generation) may be affected, but other trophic levels are not likely to be affected in a manner which is considered regionally significant, or the integrity of the population itself is not significantly affected.
Impact, Moderate	Exists when a portion of a regional population may be affected to a sufficient degree to result in a change in abundance or distribution over more than one generation of that portion of the population or any population dependent upon it, but which is unlikely to affect the integrity of any regional population as a whole.

Impact, Negligible	Exists when the degree of the anticipated or actual biological effects are less than minor.
Impact, Regional	Exists when physical or chemical changes (or alterations in vegetation patterns) are expected to be detectable beyond one km or proposed facilities or linear transportation corridors.
Impact, Short-Term	Exists when a change is likely to persist for less than five years from the onset of the disturbance.
Permafrost	The thermal condition of earth materials such as soil and rock, when their temperature remains below 0°C continuously for at least two consecutive winters and the intervening summer.
Permafrost, Continuous	Permafrost occurring everywhere beneath the exposed ground surface throughout a geographic region except where there have been disturbances to the growth of permafrost.
Permafrost, Discontinuous	Permafrost occurring in some areas beneath the ground surface throughout a geographic region where other areas are free of permafrost.
Plankton	Microscopic plants and animals that live floating or suspended in the water column.
Spawn	The roe (eggs) and milt (sperm) from fish; or the act of depositing these products during periods of fish reproduction.
Synergistic (Effects)	Occur when the total effect of the mixture of several development components or activities is greater than the sum of their individual expected effects.
Topping Plant	A small refinery to process the light hydrocarbons producing gasoline, diesel fuel, or other products from crude oil.
Trophic (Levels)	Related to feeding; refers to the position of an animal in the food web.
Well Workover	The action of repairing or enhancing an oil or gas well by re-entering the well with a drill.

APPENDIX 8

TERMS OF REFERENCE — June, 1981 (as amended August, 1983)

Introduction

In July 1980, the Minister of Indian Affairs and Northern Development, the Honourable John Munro, referred the development proposal of hydrocarbon production from the Beaufort Sea area to the Honourable John Roberts, Minister of the Environment, for a formal review under the Environmental Assessment and Review Process (EARP). The referral letter stated that environmental and socio-economic considerations were to be included in the Panel's review and that adequate public consultation should take place in the development of the Guidelines for the preparation of the Environmental Impact Statement (EIS). The three proponents of the development proposal under review are Dome Petroleum Limited, Esso Resources Canada Limited and Gulf Canada Resources Incorporated.

Purpose

The purpose of this document is to delineate the responsibilities of the Environmental Assessment Panel, the review process it should follow and the expectations that the federal government has for this specific review. The Panel should notify the Minister of the Environment of any major recommendations for revisions or refinements that it may consider necessary to make during the course of the review.

Mandate of the Panel

The mandate of the Panel is to identify major development effects, both positive and negative, upon the physical, biological and human environments and recommend ways and means of dealing with them. As part of this mandate, the Panel should review and assess all relevant information associated with the physical, biological and socio-economic considerations of the proposal. The Panel should be prepared to address possible community changes such as effects on existing life-style and conditions.

Scope of the Review

The Panel review is to include all related activities north of 60° of the proponents' proposal associated with or resulting from the commercial production and shipment of hydrocarbon resources from the Beaufort Sea area. This includes possible onshore and offshore oil and gas production facilities in the Canadian Beaufort Sea area and subsequent transportation of oil and gas to southern markets by icebreaking tankers or pipeline(s) or by both means. The Panel shall consider only those exploration activities that would occur concurrently with production and that would add to the total activity in a presented production area.

The proposal under review is still at the preliminary design stage. The level of detail of information required by the Panel should be directed towards the identification and assessment of the major issues and concerns associated with the proposal. Although detailed design information may not be required by the Panel for all stages of the review, it may ask for preliminary design information on production concepts or on premises upon which design is based. This information should describe and justify any statement involving concept viability or risk analysis of possible structural damage or failure. Specific engineering information may also be required to examine the extent to which technology is new or proven. Furthermore, a certain amount of design detail may be necessary for the evaluation of potential environmental risks.

The review process is structured to allow for the identification and evaluation of the major issues and concerns associated with the proposal. A comprehensive review at this stage is expected to assist all agencies involved in the review, currently or in the future, to properly and responsibly deal with the conclusions and recommendations of the Panel.

The Panel, in its review, should take into consideration previous and possible future northern activities which are relevant to this specific proposal. For example, the Panel should be aware of the Lancaster Sound Green Paper exercise and previous EARP reviews such as the Arctic Pilot Project, and Norman Wells Pipeline. Furthermore, the capacity of Governments to control Beaufort Sea oil and gas developments should be considered by the Panel. In addition, the need for any subsequent public review of any aspects of these developments should be included.

International Implications

The Panel does not have the mandate to hold public meetings or assess environmental impacts outside of Canada. Nonetheless, it should be prepared to receive interventions from Greenland and Alaska and to include their views in its final report. The Panel is to work directly with the Federal Environmental Assessment Review Office (FEARO) and the Department of External Affairs when making any arrangements for contacts and communications with other countries in matters dealing with information exchange.

Panel Review Process

The main components of the Panel review process are as follows:

1. Panel formation.
2. Environmental Impact Statement Guidelines in draft form issued by the Panel to the public, proponents, and government agencies for review.
3. Panel Terms of Reference and Panel operational procedures made public.
4. Public review of draft EIS Guidelines including public meetings.
5. EIS Guidelines completed by Panel and issued to the proponents through the initiator, the Department of Indian Affairs and Northern Development (DIAND).
6. Interim progress report published by the Panel.
7. EIS completed by proponents and submitted to the initiator and forwarded to the Panel for review.
8. EIS distributed by the Panel to the public and government agencies.
9. Public and government agency review of the EIS and submission of written comments to the Panel.
10. Based upon public and government agency review of the EIS and by the Panel itself, the Panel may identify deficiencies in the EIS and ask proponents for more information. If the EIS is deemed adequate, this step will be bypassed. If not, proponents will be required to submit additional information to address identified deficiencies.
11. Public meetings held by the Panel to review the environmental and socio-economic implications of the proposal.
12. Panel prepares its report in final and submits it to the Minister of the Environment.

The following provides more detail of some of these stages and other important elements of the process.

i) Environmental Impact Statement Guidelines developed by the Panel

The Panel should undertake to issue Guidelines for the preparation of the EIS. The Panel should seek public input on draft EIS Guidelines which should include public meetings and written comments. The Panel will consider alterations to the draft Guidelines taking account of the response received and then issue a final set of EIS Guidelines to the proponents through the initiator. The Panel may publish an amendment to the Guidelines if new information becomes available.

ii) Environmental Impact Statement prepared by the Proponents

The EIS is a document to be prepared by the proponents (Dome Petroleum Limited, Esso Resources Canada Limited and Gulf Canada Resources Incorporated) that is designed to outline the proponents' proposal in detail, describe the existing environmental and socio-economic settings and provide an analysis of potential effects and possible mitigation and compensation measures. A summary in non-technical terms should also be provided by the proponents. When the EIS is received by the Panel, it should be forwarded immediately to government review agencies, as well as special interest groups and individuals who have indicated interest in the proposal. A minimum period of 60 days will then be allowed for review and comments by all concerned to be forwarded to the Panel. On the basis of the comments received from the public and government agencies, the Panel should decide if it has enough information to proceed with public meetings, or, if necessary, to issue a deficiency list to the proponents to obtain further information.

One factor in making the judgement is the degree to which the Guidelines have been followed. It must be understood that the Panel is reviewing a proposal and its potential effects and that the EIS is one of many sources of information to assist the Panel with its review. If the EIS has diverged from the Guidelines or is lacking something requested by the Guidelines, the proponents should be able to explain in the EIS why a particular Guideline was not followed so that the Panel can make a judgement about how important the missing information is, once it has seen the complete EIS. If the Panel decides to issue an EIS Deficiency Statement, it will be necessary for the proponents to prepare an acceptable response before the public meetings.

iii) Additional Information

During the course of the review process, the Panel may feel it necessary to request, or it may receive, information in addition to the EIS in order to assist it with the review. This additional information could include statements from specific government agencies that are actively involved in the review process (e.g. Environment Canada, Fisheries and Oceans Canada, Department of Indian Affairs and Northern Development, Department of Energy, Mines an Resources, Transport Canada, Government of the Northwest Territories, Government of Yukon, etc.) and could give some indication of how this proposal may affect or be affected by existing and planned departmental programs and responsibilities. Also, government agencies should be prepared to provide a statement of respective existing policies and programs relevant to the public review of the proposal.

iv) Public Meetings

The Panel should hold both community and general public meetings in order to allow full public discussion on the Guidelines. The community meetings should be strictly informal sessions between the community residents and the Panel, while the general meetings should be more structured and open to all participants in the review process. These public meetings will also allow an opportunity for the public to comment on the Panel Terms of Reference and Panel Operational Procedures. Public meetings, both community and general, will also be held by the Panel after receipt from the proponents of an acceptable EIS. This second set of public meetings will provide a forum for discussion of the proposal in total and its envi-

ronmental and socio-economic implications. The main focus for this set of public meetings will be the proponents' EIS. However, all other relevant documentation, including submissions from federal departments, territorial governments, and the public, will also be discussed.

v) Interim Progress Report to the Minister

Following the public meetings on the draft EIS Guidelines, the Panel should publish an up-to-date work progress report and describe its plans for future activities.

vi) Panel Operational Procedures

The Panel shall develop a comprehensive outline of its specific process procedures governing the conduct of its review. These operational procedures will be based on FEARO's general procedural guidelines and made public.

vii) Panel Report to the Minister

The Panel shall complete its review in a thorough but expeditious manner with its final report submitted to the Minister of the Environment no later than six months after completion of the last public meeting.

Panel Relationships

The Panel reports directly to the Minister of the Environment and is responsible for both the public review process and the preparation of the Panel Report. The Panel Chairman will submit the Panel Report to the Minister of the Environment upon its completion.

The Panel relationships are detailed below:

i) Federal Environmental Assessment Review Office (FEARO)

The Panel is independent from the operations of FEARO in conducting its review. FEARO shall provide general procedural guidelines, staff for the secretariat, administrative services, and a budget, and will act as the contact point for international liaison. The Panel should prepare a budget and submit it to FEARO for approval.

ii) The Panel Secretariat

The Secretariat to the Panel is responsible for providing the administrative services associated with the Panel's review under the direction of the Panel Chairman and the Panel members. Except for public meetings, the Secretariat is the main point of contact for communication between the Panel and all participants, with particular responsibility for public information and participation.

iii) Proponents

The Panel shall limit its direct contact with the proponents to correspondence and the possibility of a visit to operational sites to gain a clear understanding of the proponents' proposal. The proponents' primary contact with the Panel is the Secretariat.

iv) Initiator

The Panel shall limit its direct contact with the initiating department, DIAND, to correspondence and briefing sessions to develop a good understanding of federal government policies and programs dealing with northern resource development. DIAND's primary contact with the Panel is the Secretariat.

v) Public

All documents submitted to and correspondence with the Panel are available to the public. Except for public meetings, the public's primary contact with the Panel is the Secretariat.

APPENDIX 9

INTERVENOR FUNDING PROGRAM

Group	81/82	82/83	83/84	Total
Arctic Bay	$ 2,000	$ 6,000	—	$ 8,000
Town of Inuvik	28,000	60,000	—	88,000
Tuktoyaktuk	4,000	12,000	—	16,000
Beaufort Sea Advisory Committee	20,000	20,000	—	40,000
Beaufort Sea Research Coalition	134,000	—	—	134,000
Beaufort Sea Alliance	—	100,000	55,000	155,000
Metis Association	36,000	70,000	—	106,000
Dene Nation	59,000	50,000	26,912	135,912
Inuit Tapirisat of Canada	23,000	75,000	2,981	100,981
Council for Yukon Indians	6,500	10,000	—	16,500
Inuvik Chamber of Commerce	—	7,500	—	7,500
Pond Inlet	1,000	10,000	—	11,000
Old Crow Band Council	1,500	6,000	—	7,500
Canadian Reindeer (1978) Ltd.	—	7,500	—	7,500
Hamlet of Aklavik (on behalf of Beaufort Sea-Mackenzie Delta communities)	—	30,000	—	30,000
Baffin Region Inuit Association	—	40,000	9,094	49,094
Fort Norman Band and Settlement	—	2,500	—	2,500
Fort McPherson Settlement Council	—	8,000	—	8,000
National and Provincial Parks Association	—	1,500	—	1,500
Fort Good Hope Dene Community	—	6,000	—	6,000
Paulatuk Settlement Council	—	2,500	—	2,500
Labrador Inuit Association	—	20,000	5,774	25,774
Holman Settlement Council	—	7,000	—	7,000
Hamlet of Norman Wells	—	7,000	—	7,000
Town Council of Nain	—	—	7,000	7,000
Sachs Harbour Hunters and Trappers	—	5,000	—	5,000
Makkovik	—	—	2,500	2,500
Postville	—	—	2,500	2,500
Hopedale	—	—	2,500	2,500
Rigolet	—	—	2,500	2,500
Fort Simpson Dene Band	—	6,930	—	6,930
Beaufort Hunters and Trappers	—	—	2,500	2,500
TOTAL:	$315,000	$570,430	$119,261	$1,004,691

APPENDIX 10

ABBREVIATIONS

APOA	Arctic Petroleum Operators Association
APP	Arctic Pilot Project
App.	Appendix
ASTIS	Arctic Science and Technology Information System
AWPPA	Arctic Waters Pollution Prevention Act
bbls	Barrels
B.C.	British Columbia
BCO	Beaufort Coordinator's Office
BEMP	Beaufort Environmental Monitoring Project
BOP	Blowout Preventer(s)
BRIA	Baffin Region Inuit Association
C	Celsius
CASPPR	Canadian Arctic Shipping Pollution Prevention Regulations
CEARC	Canadian Environmental Assessment Research Council
CEIC	Canada Employment and Immigration Commission
ch.	Chapter
COGLA	Canada Oil and Gas Lands Administration
COPE	Committee for Original Peoples' Entitlement
CS	Submission filed at Community Sessions
CWS	Canadian Wildlife Service
CYI	Council for Yukon Indians
DFO	Department of Fisheries and Oceans
DIAND	Department of Indian Affairs and Northern Development
DIZ	Development Impact Zone
DOE	Department of the Environment
DOT	Department of Transport
e.g.	For example
EARP	Environmental Assessment and Review Process
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EIS-SI	Environmental Impact Statement — Supplementary Information
ESRF	Environmental Studies Revolving Fund
FEARO	Federal Environmental Assessment Review Office
GEN	Submission filed with Panel, but not associated with public sessions.
GNWT	Government of the Northwest Territories
HTA	Hunters and Trappers Association
I	Submission filed by participant after reviewing Proponents' EIS
IN	Submission filed at Inuvik General Session
ITC	Inuit Tapirisat of Canada
km^2	Square kilometres
LIA	Labrador Inuit Association
LNG	Liquefied natural gas
m^3	Cubic metres
m	Metre
MLA	Member Legislative Assembly
mm	Millimetres
NAVSTAR	Navigation and Communications Satellite
NCPC	Northern Canada Power Commission
NMM	National Museum of Man
No.	Number
NOGAP	Northern Oil and Gas Action Program
NORDREG	Arctic Vessel Traffic Management System
N.W.T.	Northwest Territories
OT	Submission filed at Ottawa General Session
p.	Page
pp.	Pages
R	Submission filed by intervenor after reviewing Proponents' response to Panel's Deficiency Statement.
RB	Submission filed at Resolute General Session
Sec.	Section
SIA	Socio-economic Impact Assessment
Tuk Tech	Tuktoyaktuk Training Centre
Vol.	Volume
WH	Submission filed at Whitehorse General Session
YK	Submission filed at Yellowknife General Session
YTG	Yukon Territorial Government

APPENDIX 11

BACKGROUND STUDIES ON OIL SPILL RISK ASSESSMENT

This appendix presents an overview of the documents submitted to the Beaufort Sea Environmental Assessment Panel concerning oil spill risk assessment. It also outlines the process through which risk assessments were developed.

i) Dome Petroleum has been studying icebreaking tankers (LNG and oil) for several years. The Arctic Pilot Project hearings heard extensive evidence. Some of the transcripts were tabled by Inuit Tapirisat of Canada at the Resolute General Session. (RB-22 to RB-27)

ii) In 1981, Dome commissioned the following report, now listed as Support Document No. 21:

F. G. Bercha and Associates Limited, "Final Report — Arctic Tanker Risk Analysis", April, 1981. 101 pp.

iii) In November, 1982 the Proponents submitted their EIS which included a section relevant to oil spill risk assessment:

Dome, Esso, Gulf, "Chapter 2: Occurrence and Prevention of Oil Spills", in Volume 6: Accidental Spills, EIS, November, 1982. 14 pp.

iv) The risk assessment information in the EIS was reviewed by Technical Specialist Dr. Ray Lemberg and by Dr. Phil Cohen, a statistician from the Department of the Environment, who produced the following critiques:

Dr. Ray Lemberg, Lemberg Consultants (Canada) Inc., "A Critical Risk Analysis Evaluation of the Environmental Impact Assessment: Beaufort Sea Hydrocarbon Production Proposal", January, 1983. 85 pp.

Dr. Phil Cohen, DOE, "Review and Recommendations for Risk Analysis of Beaufort Sea Oil Transportation", December, 1982, in "Environment Canada's Technical Review of the Beaufort Sea Environmental Impact Statement, Volume II, Appendix ii", February, 1983. (I-12) 24 pp.

Other comments were received from other intervenors and Technical Specialists during the deficiency review.

v) The Panel issued a Deficiency Statement requesting more information on the probabilities and potential volumes of various oil spills:

Beaufort Sea Environmental Assessment Panel, "A Statement of Deficiencies on the Environmental Impact Statement for Hydrocarbon Development in the Beaufort Sea-Mackenzie Delta Region", March, 1983. 31 pp.

vi) FENCO Consultants Limited produced the following report for the Department of the Environment:

FENCO Consultants Limited, "A Safety and Reliability Analysis of Arctic Petroleum Production and Transportation Systems", DOE-Environmental Protection Service, Ottawa, March, 1983. 66 pp. appendices.

vii) A rebuttal of the Lemberg and Cohen critiques was prepared by F. G. Bercha and Associates Limited for the Proponents. See (iv):

F. G. Bercha and Associates Limited, "A Discussion Paper on the Critiques and Interventions Tabled on the Dome, Gulf, and Esso Beaufort Sea-Mackenzie Delta EIS", for Canmar, June, 1983. 40 pp.

viii) The Proponents completed their response to the Panel's Deficiency Statement in June, 1983:

Dome, Esso, Gulf, "Oil Spills", in "Environmental and Technical Issues Beaufort Sea — Mackenzie Delta Environmental Impact Statement Supplementary Information", June 1, 1983. 41 pp.

ix) During June, July and August, 1983 four meetings were held between the Proponents and their consultants (F. G. Bercha and Associates and FENCO Consultants), the Department of the Environment (Mr. Brett Moore, Dr. Phil Cohen), and Dr. Ray Lemberg. Mr. Larry Wolfe of the Panel Secretariat attended the meetings as a monitor. The participants agreed on a general approach to studying risk and presenting risk analyses. However, the responsibility for the report remained solely with the Proponents and their consultants.

F.G. Bercha and Associates Limited and FENCO Consultants Limited in conjunction with Dome, Esso, and Gulf, "Oil Spill Risk Assessment — Final Report", September, 1983. (GEN-1) 118 pp.

The Proponents submitted a correction to this report as follows:

A. C. Churcher, "Clarification of Development Drilling Oil Spill Risks with and without the Ixtoc Exploration Blowout", November 2, 1983. (IN-38) 3 pp.

x) Drs. Lemberg and Cohen had reservations about the GEN-1 report and outlined these reservations in their reports to the Panel:

Dr. Ray Lemberg, Lemberg Consultants (Canada) Inc., "Comments on 'Oil Spill Risk Assessment' Dated September, 1983 by the Proponents", received October 12, 1983. (RB-11) General Sessions and resubmitted October 28, 1983. A correction was also made on November 2, 1983. The amended and corrected edition was received as IN-31. 28 pp.

Dr. Phil Cohen, (DOE), "Analysis of Proponents' Estimate of the Chance of Oil Spills Resulting from Oil Production in the Beaufort Sea, Part 1 — Tanker Transportation", October 8, 1983. (RB-6) 31 pp.

Dr. Phil Cohen, (DOE), "Analysis of Proponents' Estimate of the Chance of Oil Spills Resulting from Oil Production in the Beaufort Sea, Part 2 — Pipeline vs Tanker Transportation", 34 pp. November 1, 1983. (IN-25) (This document was amended November 20, 1983 on the basis of information received at the Inuvik General Session and resubmitted as WH-30). Dr. Cohen also presented a written copy of his oral statement at Inuvik (IN-45). 2 pp.

xi) Discussions at the General Sessions are recorded primarily in the following transcripts:

RESOLUTE 17-2/48-101
INUVIK 10-3/20-70
INUVIK 12-1/1-9, 27-36, 67-85
INUVIK 12-2/1-16

xii) The Panel, on the basis of testimony heard on November 10, 1983, during the General Sessions at Inuvik, requested Dr. Ray Lemberg (Technical Specialist) and Mr. Larry Wolfe (Panel Secretariat) to convene a meeting of the Proponents and their consultants; Dr. Phil Cohen of the Department of the Environment; and Technical Specialists, Mr. Warren Bonn and Dr. Mike Smith to produce a simplified summary of agreements and remaining disagreements concerning risk assessment. Consultations were held on November 11 and a report tabled November 12 at the Inuvik General Session:

Dr. Ray Lemberg, "Simplified Summary of Oil Spill Risk Assessment", November 12, 1983. (IN-40) 11 pp.
ed1390;-1