#### Federal Environmental Assessment and Review Process



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Federal Environmental Assessment Review Office



Arctic Pilot Project (Northern Component)

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Report of the Environmental Assessment Panel

# PANEL REPORTS TO THE MINISTER OF THE ENVIRONMENT ON THE PANEL PROJECTS

- 1. Nuclear Power Station at Point Lepreau, New Brunswick. (May 1975)
- 2. Hydro Electric Power Project, Wreck Cove, Cape Breton Island, Nova Scotia. (August 1976)
- 3. Alaska Highway Gas Pipeline Project, Yukon Territory. (Interim report, August 1977)
- 4. Eldorado Uranium Refinery Proposal, Port Granby, Ontario. (May 1978)
- 5. Shakwak Highway Project, Yukon Territory British Columbia. (June 1978)
- 6. Eastern Arctic Offshore Drilling South Davis Strait Project. (November 1978)
- 7. Lancaster Sound Offshore Drilling Project. (February, 1979)
- 8. Eldorado Uranium Hexafluoride Refinery, Ontario. (February, 1979)
- 9. Roberts Bank Port Expansion, British Columbia. (March, 1979)
- 10. Alaska Highway Gas Pipeline, Yukon Hearings. (August, 1979)
- 11. Banff Highway Project. (October, 1979)
- 12. Boundary Bay Airport Reactivation. (November 1979)
- 13. Eldorado Uranium Refinery, R. M of Corman Park, Saskatchewan. (July 1980)

These documents are available from Federal Environmental Assessment Review Office 200 Sacré-Coeur Blvd., Hull, P.Q. Mailing address: Ottawa, Ontario KIA OH3

or

Federal Environmental Assessment Review Office 700-789 West Pender Street Vancouver, British Columbia V6H 1H2

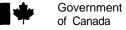


Arctic Pilot Project (Northern Component)

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Report of the Environmental Assessment Panel

OCTOBER 1980



Gouvernement du Canada

Environmental Assessment Review Examen des &valuations environnementales

Ottawa, Ontario K1A **OH3** 

₫ጋペ, ₫°C▷N▷ K1A OH3

The Honourable John Roberts, P.C., MP. Minister of the Environment Ottawa. Ontario K1A OH3

Dear Minister:

In accordance with the Federal Environmental Assessment and Review Process, the Arctic Pilot Project Environmental Assessment Panel has completed a review of the northern component of the proposal to ship liquified natural gas from the high Arctic to eastern Canada. We are pleased to submit this report for vour consideration.

The Panel's review has led to the conclusion that the project as presented is environmentally acceptable provided certain conditions are met.

Yours sincerely,

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NNS' D',

John S. **Klenavi c** 

Chai rman

Arctic Pilot Project

**Environmental Assessment Panel** 

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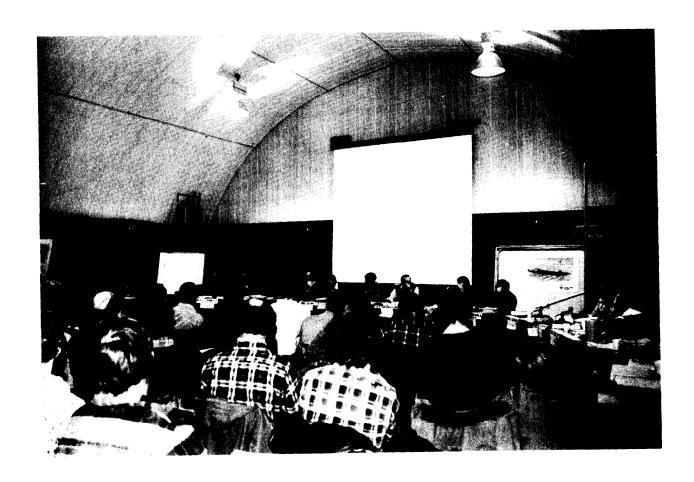
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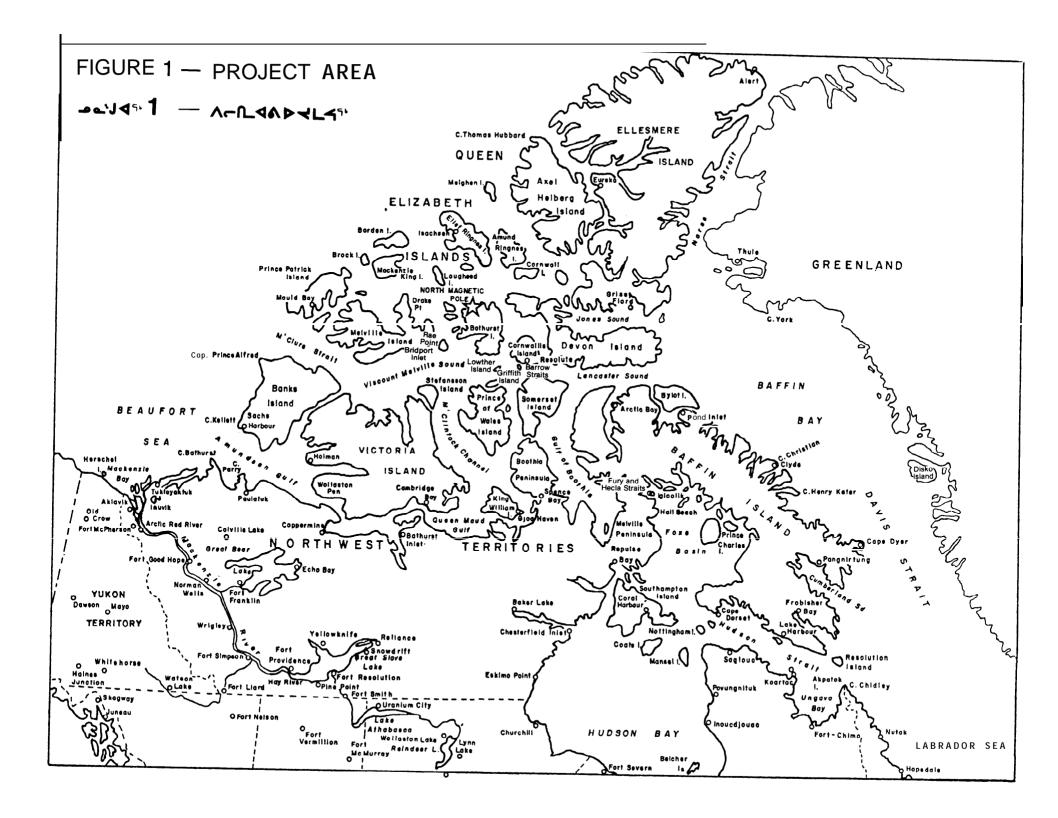
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### **EXECUTIVE SUMMARY**

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#### EXECUTIVE SUMMARY

The Arctic Pilot Project would involve the production and liquefaction of 6.4 mill ion cubic metres (225 million cubic feet) of natural gas per day from the Drake Point field on Melville-Island and its shipment to eastern Canadian markets in icebreaking tankers. The Environmental Assessment Panel has reviewed the northern component of the project which includes the facilities on Melville Island, and shipment of liquified natural gas by two icebreaking carriers through Parry Channel, and south through Baffin Bay and Davis Strait to the approaches to a southern Canadian terminal.

In January, 1979, an Environmental Statement was issued by the Arctic Pilot Project. This document along with a Socio-economic Statement and supplementary information requested by the Panel served as input to the review of the project.

The Panel solicited comments the Λn project from the public and from government agencies and in April, 1980, held public meetings in the communities of Arctic Bay, Pond Inlet, Grise Fiord and Resolute which arc located in the area of the proposed shipping route. Panel considered issues relating to the project rationale, long-term implications, development on Melville the the shipping aspects and the overall impact on the human environment. After carefully considering the information presented, the Panel reached a number of conclusions and has formulated recommendations are contained in this report.

The Panel's review has led to the conclusion that the project as presented is environmentally acceptable provided certain conditions are met.

#### **『マン・しゅう しょうしょ こうりょう アントル・**

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The Panel recognizes that this project would be a "pilot" project in the sense that it would pioneer year-round arctic transportation and develop in Canada a greater arctic expertise within industry It also recognizes that and government. year-round shipping of oil or gas on a much larger scale is being considered by others and that there is a paucity of information on potential impact in some areas in spite of the effort made by the Proponent in preparation for this review. The Panel believes that the relatively small-scale shipping proposal by the Arctic Pilot Project would permit further study and allow more accurate assessment of potential impacts and ways to minimize or determine more fully the effects of large scale shipping.

Parry Channel supports a biologically rich community of birds and mammals, many of which are considered to be of national and international i mortance. tional harvesting of natural resources by Inuit for home-use and income is still important in this region. It is essential, therefore, that ships be routed to avoid environmentally sensitive areas in Parry Channel and that advantage be taken of the pilot nature of this project to monitor and research the effects of yearround shipping in the Arctic. In the Panel's opinion, this can only be achi eved through the effective operation of a control authority by the Minister of Transport. authority would monitor ship movements and enforce good seamanship and appropriate environmental regulations such as those now in existence under the Arctic Waters Pollution Prevention Act.

Advantage should be taken of the long lead time required for the project to become operational to establish the control authority with a view to having an integrated routing system in place to deal with future ship traffic. To assist

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the control authority further, the Panel recommends that the Departments of Environment and Fisheries and Oceans establish an advisory committee which would recommend and approve studies necessary to allow biological information to be effectively integrated into the route selection process. Membership on this committee should include the Proponent, government and the territorial other federal departments. Wi thout further research on marine mammals. guided by the advice of Inuit and of government scientists and without a monitoring and control mechanism for the selection of the shipping routes, the Panel is unable to recommend that the project is environmentally acceptable.

The Panel has also recommended a number of specific conditions relating to the Drake Point facilities, Melville Island pipeline, Bridport Inlet facilities, shipping and the human environment as a result of its assessment of the Arctic Pilot Project.

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### CHAPTER 1

THE ENVIRONMENTAL ASSESSMENT REVIEW

### **५८** 1

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"Perception of the purpose of EARP hearings has been that they are of an overview nature to determine the attraction or drawbacks of a particular project. It has always seemed to me that the concerns over details of drilling procedures, permafrost stability, sumps, etc. are the responsibility of the regulatory branches of the federal government. And one assumes that projects will be conducted in accordance with the Acts and Regulations for their control."

Lindsay Franklin Panarctic Oils Ltd. "\L-C'\ \(\frac{1}{\sqrt{1}}\) \(\frac{1}{\sq

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"I would first, in all fairness, like to commend the proponent, Petro-Canada, for the responsible attitude they have demonstrated in attempting to deal with the environmental, social, and economic implications of this Project. As well, I think the EARP Panel has gained some civility, and some responsibility, and some seriousness for addressing these implications in the northern territories."

Peter Ittinuar. M P. Nunatsiaq ۱۵ مم<sup>ی</sup>م ، وداد عدم معدم در ا

#### CHAPTER 1 - The Environmental Assessment Review

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#### 1. 1 INTRODUCTION

This report to the Minister of the Environment, on the Arctic Pilot Project, has been prepared by an Environmental Assessment 'Panel, constituted under the federal Environmental Assessment and Review Process (EARP). This process was established by Cabinet, December 20, 1973, to ensure that:

- environmental effects are taken into account early in the planning of new federal projects, programs and activities;
- an environmental assessment is conducted for all projects which may have an adverse effect on the environment before commitments or irrevocable decisions are made, and those which may have significant adverse effects are referred to the Minister of the Environment for formal review, and
- the results of these assessments are used in planning, decision-making and implementation.

Federal projects are considered to be those initiated by federal departments and agencies, those for which federal funds are solicited, and those involving federal property. Federal departments and agencies are bound by the Cabinet **Proprietary Crown Corporations** Decision. and regulatory agencies, however, are rather invited than directed to participate in the Process.

Petro-Canada, a proprietary Crown Corporation, and the Department of Indian Affairs and Northern Development decided to refer the Arctic Pilot Project to the Federal Environmental Assessment Review Office for a public review after

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determining that the proposed project could have potentially significant environmental effects.

The referral was received in November, 1977, and a Panel was formed. The Panel's original mandate was to make recommendations on the environmental acceptability of the project to the Minister of the Environment. In late 1979, the Panel's mandate was expanded to include examination of the potential socio-economic implications of the project.

The scope of the Panel's review included the following components of the proposed Arctic Pilot Project:

- a) the gas wells, gas gathering and ancillary facilities associated with the Drake Point fields;
- b) a small diameter pipeline across Melville Island to Bridport Inlet;
- c) a liquified natural gas (LNG) plant at Bridport Inlet, and
- d) the shipment of LNG by icebreaking carriers through Parry Channel and south to the approaches to a southern Canadian terminal.

The present review has dealt with those components north of  $60^{\circ}$  N. A further review of the off-loading and regasification facilities at a southern Canadian terminal and the shipping route leading to it will be undertaken later by another Environmental Assessment Panel. At the time of this northern review, the location of the southern terminal and hence the shipping route to it had not been determined.

#### 1.2 PANEL COMPOSITION

The membership of the Environmental Assessment Panel is as follows:

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#### 1.2 $\Delta$ כר החר הי החר הי

Mr. John S. Klenavic
Panel Chairman
Federal Environmental Assessment
Review Office
Hull, Quebec.

Mr. David W.I. Marshall
Panel Vice-Chairman
Federal Environmental Assessment
Review Office
Hull, Quebec.

Mr. Malcolm O. Berry Atmospheric Environment Service Department of Environment Downsview, Ontario.

Mr. Don Bissett
Northern Pipelines Branch
Department of Indian Affairs and
Northern Development
Ottawa, Ontario.

Dr. Richard G.B. Brown Canadian Wildlife Service Department of Environment Dartmouth, Nova Scotia.

Mr. Robert W Hornal
Northern Affairs Program
Department of Indian Affairs and
Northern Development
Yellowknife, Northwest Territories.

Mr. Rod Morrison
Department of Economic
Development and Tourism
Government of the Northwest Territories
Yellowknife, Northwest Territories.

Brief biographies of Panel Mernbers may be found in Appendix I.

Mr. Bob Connelly, Federal Environmental Assessment Review Office, served as Executive Secretary to the Panel.

ר'⊂. ר>ני מפחרתפי שים נרפיי מפחרתאי שיםי כ" AD, מ"חמתארי.

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#### 1.3 REVIEW PROCEDURES

Review of the northern part of the began when an Environmental Statement was issued in January, 1979. After a review of the Environmental Statement by the Panel and government agencies, the Panel issued "Draft Guidelines for the Completion of the Environmental Assessment for the Arctic Pilot Project" in June, 1979. Comments on the draft guidelines were received from the public, the Proponent and government agencies and the "Final Guidelines" were issued in September, 1979. In response. the Arctic Pilot Project issued, in November, 1979, a supplement to its Environmental Statement. This supplement and a Socio-Economic Statement on the proposal were distributed to government agencies and the public in December, A document concerning the Drake Point gas gathering facilities entitled: "Environmental Overview Gas Production Component". was issued at the end of March. 1980. The documents submitted to the Panel by the Proponent as well as those issued by the Panel are listed in Appendix I I.

## 1.3.1 Public Information and Participation Programs

The Environmental Assessment and Review Process involves review and comment by the public, particularly those in the vicinity of the proposed project, as well as by various government agencies and other interested parties. information and participation programs were undertaken separately by Arctic Pilot Project personnel and by Panel supplied by the Environmental Assessment Review Office, on behalf of the Panel.

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#### 1.3.1.1 Arctic Pilot Project Program

The Proponent of the Arctic Pilot Project implemented a community liaison and consultation process beginning in 1977 with the communities of Arctic Bay, Grise Fiord, Pond Inlet and Resolute (figure 1). The purpose of the program was to advise these communities of the nature and potential effects of the Arctic Pilot Project and to establish a means of working with the northern people in the review of the project.

In May, 1977, a meeting was held with councillors from the Eastern Arctic, and of the Northwest Territories were briefed. Legislative Assembly Meetings were also held with the Inuit Tapirisat of Canada, the Baffin Region Inuit Association and the Baffin Regional Afterwards, a series of Council. were held with settlement meetings councils to explain the project, and the Proponent's social and economic policies and summaries of the environmental and socio-economic impact Regional meetings began in with participation of delegates from each settlement, to permit further discussion on the proposed project. In May, 1979, representatives from the settlements toured the Philips Petroleum Energy Plant at Kenai, Alaska to view the characteristics of liquified physi cal natural gas (LNG), and the operations involved in a gas liquefaction plant. associated wi th **Documents** environmental assessment review of the wi thi n project were ci rcul ated communities: summaries were translated into Inuktitut. A number of meetings have been held by Petro-Canada, on behalf of the Arctic Pilot Project, with Danish officials beginning in August, 1977. Proponent has reviewed a study prepared by Denmark on the implications of the project on Greenland and has agreed

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recently on joint environmental studies along the proposed shipping route.

It was the Proponent's intention that the consultation process outlined above would continue, if the project were to proceed, and that the mechanism that had been developed at the review stage would continue to be used to monitor project development and operation.

#### 1.3.1.2 The Panel Program

The Panel secretariat attempted to ensure that all persons and organizations having an interest in the project were informed of the review process, the time and location of public meetings, and of the opportunities to make their views known to the Panel.

On two occasions in 1979, Panel staff visited the communities of Arctic Bay, Grise Fiord, Pond Inlet and Resolute to meet with the Councils and members of the public to explain the nature of the review process. In addition, a presentation was made on the status of the review at the invitation of the Eaffin Regional Council, at its semi-annual meeting in Resolute in October, 1979. Officials of the government of Denmark were regularly briefed on the status of the review during the meetings associated with the Canada/Denmark Marine Environment Talks.

Information on the project was distributed to each community and to government agencies as well as to people on the project mailing list. This included: documents prepared by the Proponent associated with the Environmental Impact and information Statement. press releases, reviews prepared by government individuals, brochures agenci es and describing the review process, biographies of Panel members, and the agenda Colore

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and procedures for the public meetings. Most of this information was translated into Inuktitut.

#### 1.3.2 Public Meetings

Public meetings were conducted to permit the Panel to learn of concerns about the project and to allow interested persons to comment on the Environmental Impact Statement and the project.

After consultation with the settlement Councils it was agreed that general meetings would be held in Resolute, the community closest to the planned development on Melville Island and to the proposed ship track. It was also agreed that community meetings would be held in the settlements of Arctic Bay, Grise Fiord, Pond Inlet and Resolute.

The purpose of the community meetings was to allow the Proponent to make a brief presentation on the Arctic Pilot Project, to respond to questions from the public, and to enable the Panel to further its understanding of the views of local residents to the project. Comuni tv meetings were held in the evenings as follows: on April 15 in Arctic Bay, April 17 in Pond Inlet, April 18 in Grise Fi ord, and on April 21, 1980. in Resolute. Consecutive interpretation in English and Inuktitut was provided. meetings were well attended and the Panel heard a wide range of concerns on the project.

To become more familiar with the project setting, the Panel, along with an Arctic Pilot Project representative, flew the proposed ship track from Resolute to Melville Island, the proposed pipeline route, and over Drake Point and Bridport Inlet. A similar trip was also arranged by Arctic Pilot Project personnel for a

#### 1.3.2. $\Delta_{\mathcal{O}}$ CLC 6NLNCDGYC

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number of the participants at the public meetings.

The general meetings were held in Resolute over a 6 day period from 29. April 23 to Si mul taneous interpretation was provided in English The Panel arranged for and Inuktitut. representatives from Arctic Bay. Pond Inlet and Grise Fiord to attend and participate in the general meetings in The Ministry for Greenland was Resolute. invited through External Affairs to send observers or participants to the public meetings. After consulting with the Greenlandic Home Rule Authorities, it advised the Panel that representatives from Denmark or Greenland would not be attending the meetings.

The first session was set aside for introductory statements by participants and for technical reviews undertaken by government agencies on the overall project. Specific sessions were allocated for more detailed discussion of the following: project scope, rationale and long-term implications; potential environmental impact of the Drake Point gas, gathering facilities, the Melville Island pipeline, the liquefaction plant and ancillary facilities at Bridport Inlet, and shipping component of socio-economic project: and the and communi tv impacts. The final dav included a session devoted to catching up outstanding matters followed by a closing session to receive concluding statements from participants.

The Panel arranged for various technical witnesses to be present and to take part in discussions devoted to the Melville Island pipeline, the facilities at Bridport Inlet and the shipping component of the project. The Proponent arranged for a number of consultants, who had participated in studies for the **Envi ronmental** Impact Statement, to be  $\Delta CD4$   $\Delta CD$ 

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present to explain their work and respond to questions. With the exception of the closing statements session, opportunities were provided following presentations for a question and answer period involving the Panel, Arctic Pilot Project personel, technical witnesses and the audience.

Government agencies participating in the the Department of review included: Mines and Resources; Department of Environment; Department of Fisheries and Oceans: Department of Indian Affairs and Northern Development; Department of Transport and the Government of the Northwest Territories. **Presentations** also made by the Member of **Parliament for Nunatsiaq**, Mr. Ittinuar, and by Mr. George Braden, the Minister of Economic Development Government of the Northwest Tourism Non-governmental organiz-Territories. the Baffin Regional ations included: Council (BRC), Baffin Region Inuit (BRIA), Association Canadi an Arctic Resources Committee (CARC), and the Inuit of Canada (ITC). Tapirisat Representatives from the communities of Arctic Bay. Grise Fiord, Pond Inlet and Resolute also made presentations. A written presentation was received from the Canadian Nature Federation. Tn individuals, other not representing any organization, presented their views on the project.

During the meetings in Resolute 69 oral presentations were made to the Panel and it received a number of written presentations, as well as technical reports and background information. A verbatim transcript was made. Persons appearing before the Panel and submissions made to it are listed in Appendices III and IV respectively.

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"We now have a window in time to test on a small scale, the transportation systems we will need to deliver these resources in the future."

Donald M. Wolcottl Arctic Pilot Project. " L\*a.ያ Lጋልኒራናናር የውንጓጎታንያ FPŁያ, CHłd ውጎጋልንLcልጎ ውሾራቲልጎ QLłeU ለጋዜጎታት ፖሬጎ ጋታት ውጋልትያቢላሙላችLC ሶንታትያ በተልት "

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"The project offers a rare opportunity to investigate a relatively pristine Arctic environment then disturb it in a controlled fashion and measure how its elements respond. Such information will be valuable in assessing the impacts of future northern developments and instituting useful mitigative measures."

Martin Barnett
Department of Indian Affairs and
Northern Development.

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PROJECT DESCRIPTION

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#### CHAPTER 2 - Project Description

#### 2. 1 INTRODUCTION

The Arctic Pilot Project would involve the production and liquefaction of 6.4 million cubic metres (225 million cubic feet) of natural gas per day from the Drake Point field on Melville Island and its shipment to eastern Canadian markets in icebreaking tankers. As a pilot project, it is designed to test the feasibility of delivering gas by ships on a year-round basis from the Arctic The project sponsors include: Petro-Canada Exploration Inc., Alberta Gas Trunk Line. Dome Petroleum TransCanada Pipelines Ltd., and Melville Ltd. production Shi ppi ng The gas facilities at Drake Point are the responsibility of Panarctic Oils Ltd.

The Proponent indicated that construction could commence in the fall of 1981 with completion in 1985. The project was expected to cost between \$1.5 to \$2 billion (1980) and to last 20 years. During the construction of the Melville pipeline and facilities at Bridport Inlet, the number of workers required would peak at approximately 550 persons. Construction of the gathering facilities at Drake Point would require a maximum of 250 workers. Approximately 40 to 45 workers would be regui red for the operation maintenance of the pipeline and Bridport Inlet facilities and a total complement of 168 persons (2 crews per ship) would be needed for the too ships. **Operation** of the Panarctic facilities at Drake Point would require 63 persons.

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#### 2. 2 F?EGIONAL SETTING

Construction activities related to the Arctic Pilot Project would take place on Melville Island, (figure 2) about 400 km west of Resolute, the nearest community. The only habitation on Melville Island is Rae Point (85 km N.E. of Bridport Inlet), a staging area for Panarctic's exploratory drilling program in the area. Rae Point does not have a permanent population.

The liquified natural gas (LNG) carriers would proceed eastward from Bridport Inlet through Parry Channel to Baffin Bay, then south along the west coast of Greenland. These icebreaking tankers would pass no closer than 32 km from Resolute (population 167), 128 km from Arctic Bay (population 403), 272 km from Grise Fiord (population 99), 144 km from Pond Inlet (population 649) and 45 km from the coast of Greenland.

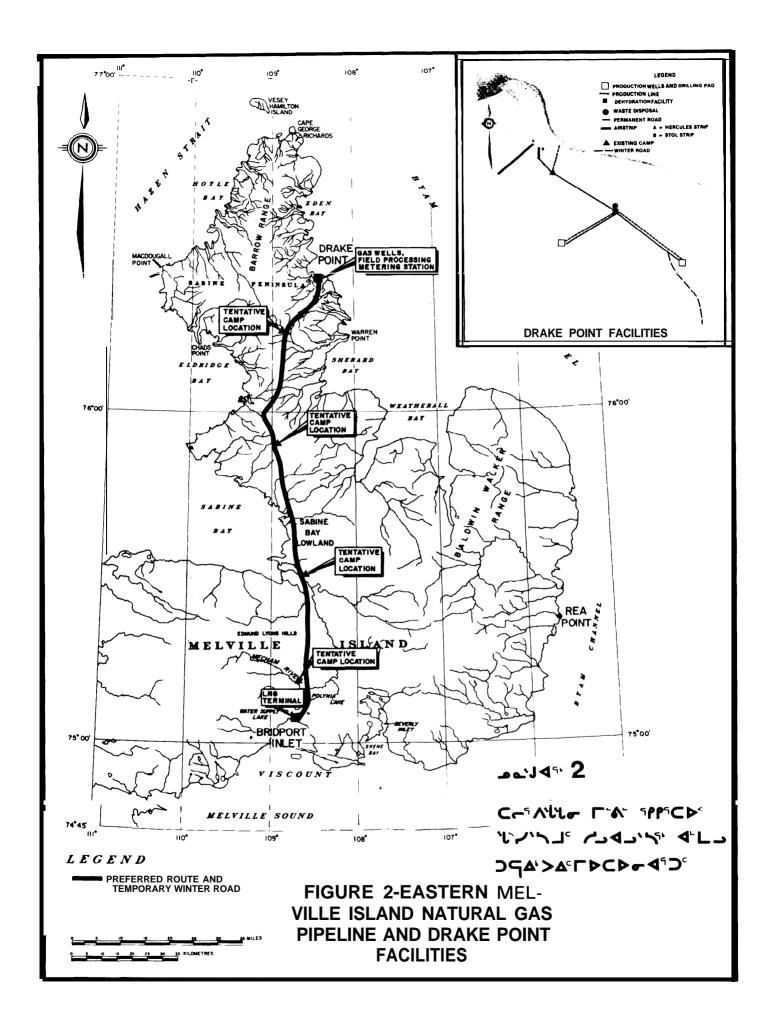
The community of Resolute located on Cornwallis Island was established in 1947 as a joint Canadian - American weather station. Inuit were not permanent residents on any of the islands of the Queen Elizabeth group at that time, al though there is evi dence of much earlier occupation. In 1953, Inuit families, primarily from Port Harrison, Quebec, were relocated to Resolute. Similarly, the community of Grise Fiord established in 1953 with Inuit families from Port Harrison and Pond The opening of trading posts by the Hudson's Bay Company at the present sites of Pond Inlet and Arctic Bay in 1903 and 1926 respectively, led to the subsequent establishment of communities settled by Inuit from northern Baffin Island.

#### 1 Population figures for 1978

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Although there have been significant changes in Inuit lifestyles since these communities were established, the traditional harvesting of natural resources for home-use and income is still important. Both direct income and imputed income from resources harvested for home consumption are significant to the economies of the region. Income from wage employment has become of major importance to Inuit in purchasing hunting equipment, imported foods and luxury items.

Traditional employers in the communities have been government agencies, co-operatives, settlement Councils and the Hudson's Bay Company. In recent years with increased industrial activity, Panarctic Oils Ltd., and Nanisivik Mines addi ti onal provi ded **employment** opportunities for those willing to work away from their homes. The new Arvik currently under construction on Little Cornwallis Island, is providing further opportunities for those wishing employment. In spite of these opportuniunemployment is high, and income levels are lower than the national average.

#### 2.3 PROJECT DESCRIPTION

### 2.3.1 <u>Drake Point Gas Gathering</u> Facilities

The Drake Point gas field is located on the Sabine Peninsula of Melville Island. It is operated by Panarctic Oils Ltd., which would supply gas to the Arctic Pilot Project.

Gas would be produced from two production clusters located on shore, each with 4 wells (figure 2). The wellheads would be on gravel pads; wells would be approximately 1 200 m deep. Drilling of

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the wells would take place in a single year from April to December. When the reserves were depleted, the production wells would be plugged and the wellheads removed.

The gas gathering system would involve 3 to 4 km of pipeline from the wellhead to a gas dehydration plant. Initially there would be no need for compressors to maintain operating pressure; after 10 years of operation compressors would be added. The plant, camp, waste disposal site and ancillary facilities would occupy 3 to 5 hectares. Approximately 10 km of permanent roads, occupying 10 hectares, would be constructed to provide all weather access to the wellhead clusters, strip, and the gas plant and camp areas. Construction would take place over a 3 year period.

#### 2.3.2 Melville Island Pipeline

The natural gas pipeline connecting the Drake Point field to Bridport Inlet, would consist of 160 km (100 miles) of 0.56 m (22 inch) diameter pipe. It would be buried in the permafrost at a minimum of 1 m below normal grade. A meter station would be located at Drake Point to measure the quantity and quality of the gas; the control facility would be located at Bridport Inlet. The gas would be chilled to ensure that the maximum temperature of the gas entering the pipe would not exceed -6" C.

The proposed route would traverse three distinct geographic regions: the Sverdrup Lowlands, the Parry Plateau and the Sabine Bay Lowlands. The very low mean annual air temperatures (mean July temperature is 0°C at Rae Point) sustain continuous permafrost soils throughout the island. The seasonal thaw is no more than 1 metre. The pipeline right-of-way

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#### 2.3.2. **Melville** Island, ۲ ماهداد کاد

would affect approximately 5 km<sup>2</sup> of land surface.

The Sverdrup Lowland region (Sabi ne Peninsula) is characterized by flat-lying sedimentary strata; soils are fine textured and derived from shale or sand-The Sabine Cay Lowland region is a low-lying plain with deposits of sands and silts covering sandstone bedrock. The terrain of the Parry Plateau is more characterized by low ridges and rugged, Soils are derived primarily valleys. from medium to coarse grained sandstone. While vegetation is not extensive, it is important to the wildlife found on Seven species of land Melville Island. nammals are known to inhabit Melville muskoxen, Peary caribou, arctic hare, collared lemming, arctic fox, wolf and ermine. Caribou and muskoxen are not hunted on Melville Island but populations have fluctuated significantly as a result of the harsh physical environment. species that occur regularly on Melville are typical of those the high Arctic throughout islands. Along the proposed pipeline route, the Bay Lowlands, in particular, Sabi ne provide important breeding habitat for loons, waterfowl (brant, king eider, and old squaw ducks) and shorebirds (red phalarope, white-rumped sandpiper, black - bellied plover).

The pipeline would cross a number of ephemeral streams. The only fish of significance on the island are char in some lakes near the route.

Construction of the pipeline would occur over two years in the periods from September 15 to November 1 and April 1 to May 15 when the active layer of soil is frozen but working conditions are tolerable. **Sverdrup** Lowland  $\neg \sigma \triangleleft \sigma$  (Sabine Dy GbLC, L' Gils Peninsula) DY GAGY 20 7DGY202. Sabine Bay Lowl and YDS SDL THS DOD'S DT YLOYOU DY 560 20. ΥΡ 560 ΥΓ, 20 DY 20. LPC C GROTE OF . NO PO ROJUS STO JUJUS DOLCE DE COS DESTOS VETEUDEL-L<sup>c</sup> Melville Island. 7, ▷L<sup>L</sup>LC ▷L≺<sup>c</sup> ペトドル・ファ Melville Island, 「. Dr L- $\Delta^{c}$ ,  $D^{b}D^{c}$ ,  $D^{b}C^{c}$ ,  $\Delta^{a}U\Delta^{c}$ ,  $D^{c}U^{b}U^{c}$ Island, 「 つゅつのゅ トレトレックリュー くっしょ v bading are blue Dai ale deboloar مرام عا طع مع مع معلم . ١٥ ١ حمد **Melville** Island, いちひゃちっこ ፈር ት የ ት ፡ ሀr -Coco dosopo ADYLYT Sabine Bav Lowland, rp 56 AD CLC OCA TYCDOC ر عم⊳۲ ، لا ۱۸ د د ما ۱۸ د کون کا ۱۸ د کون مرکم بهد کهد مرکم مرک د عمد ۱۳۵۵

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#### 2.3.3 Bridport Inlet Facilities

Bridport Inlet is a natural harbour on southern Melville Island, with a protective spit of land that provides an entrance channel 1 200 m wide. The Mecham River discharges into' the Inlet (figure 3).

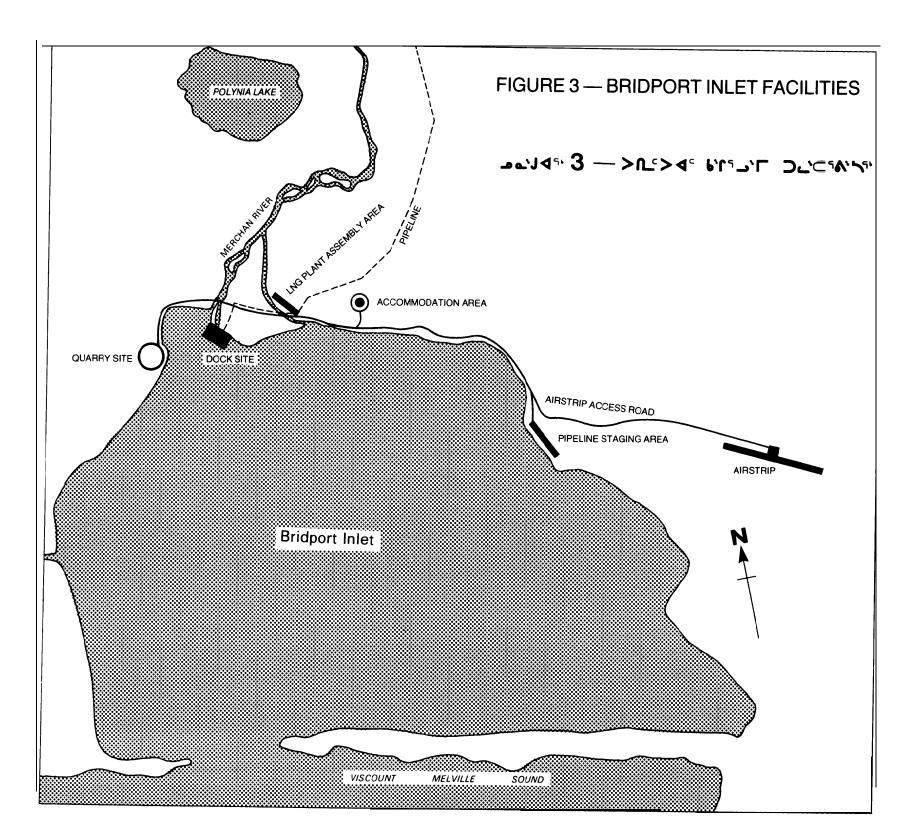
The proposed facilities at Bridport Inlet include a barge-mounted plant to liquify the natural gas, storage barges with a capacity of 200 000 cubic metres of LNG, a shipping terminal to receive and load the LNG carriers, an airstrip, workshop, warehouse and accommodation buildings, and a road network (figure 4).

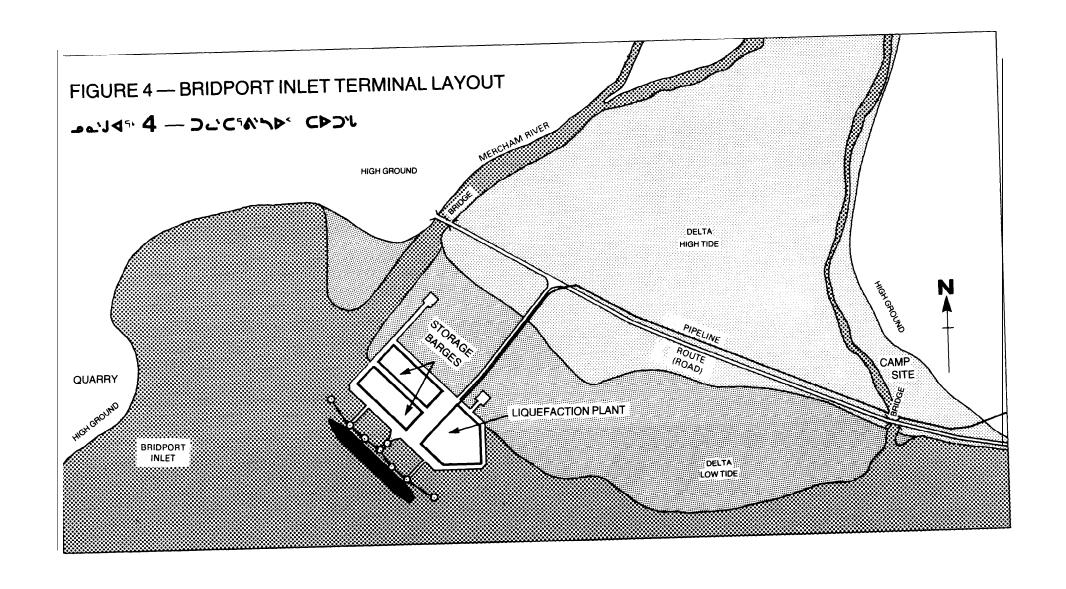
The plant would be designed to liquify 7.8 million cubic metres (275 million standard cubic feet) of gas per day. Both the plant and LNG storage facilities would be built in the south on barges and The gas would be towed to the site. liquified by 3 water-cooled, gas turbine drivers. The dock would be designed to have 8 cells, formed by driving sheet piping into the fine sands on the ocean floor and then filling the interior with To assist in berthing the crushed rock. vessels at the dock, warm water would be distributed below the ice to stop or slow down the ice growth. The water would be drawn from the Inlet and warmed by heat used in the gas cooling exchangers A quarry site process. has been identified approximately 1 km west of the A permanent airstrip would be constructed approximately 12.5 km by road the area. southeast of plant Approximately 16 km of roads would be required. Construction would take place over a 4-year period, with shutdown during the winter.

The principal wildlife resource in the Bridport Inlet area is the muskox. Approximately 100 muskoxen summered

#### 2.3.3 Bridport Inlet, にんいられ

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within 25 km of the mouth of the Mecham Waterfowl and fish in River in 1977. nearby lakes are present in small numbers in the Bridport Inlet area. It is could be expected that polar bears attracted to the area, especially during **Bridport Inlet sustains** construction. Ringed seals and few marine species. bearded seals are the only marine mammals knorrn to use the Inlet.

#### 

### 2.3.4 Shipping

The shipping component of this project would be unique. It would be the first attempt to operate on a year-round basis in the high Arctic and would be the first LNG transportation requiring the breakup of heavy ice during the course of normal operations.

The Arctic Pilot Project would involve the construction of 2 Arctic Class 7 icebreaking vessels. The ships would be 370 m long by 43 m wide, have an LNG cargo capacity of 140 000 cubic metres and would be designed with 180 000 shaft HP. LNG would be used as fuel, but 600 tonnes of diesel fuel plus various light hydrocarbon liquids in containers on deck would also be carried on board. Each vessel would make 15 round trips per year.

Each ship would have a 6 tank membrane containment system to carry the LNG. Navigation equipment would include: 2 radars, a gyro compass, a satellite navigation system. Loran C, Decca navigator and a short range position fixing system. In addition the use of Sonar is being considered. The ship's crew would consist of 42.

The shipping route would traverse Parry Channel, Baffin Bay and Davis Strait (figure 5). Ice conditions along the

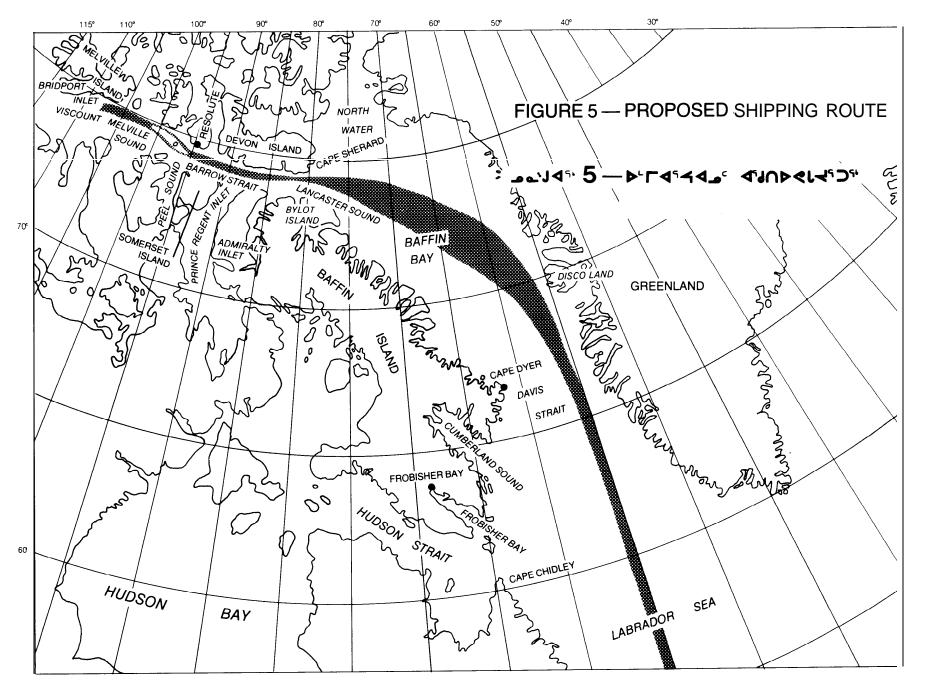
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route vary considerably, with respect to coverage by time of year, thickness and type. First year ice thickness can vary from 1.6 m in Davis Strait and Baffin Bay to 2.2 m in the Bridport Inlet area. In addition, the action of winds and surface currents upon the ice cover creates large numbers of pressure ridges. Within the ice pack in the Davis Strait area are many multi- year floes, thousands of and bergy bits; growlers are widespread and difficult to detect in the In the Melville Island area. ice pack. multi-year ice may also be found. ships traversing this route would attempt to take advantage of the ice cover patterns and seek to follow open leads and to avoid ridges or multi-year ice

The shipping route through Parry Channel (Lancaster Sound. Barrow Strait. and Viscount Melville Sound) is also a mi gratory route of significance for seabirds and marine mammals. Harp seals, beluga whales, narwhals bowhead whales enter Lancaster Sound when the fast-ice breaks up and migrate westward to areas in Parry Channel and el sewhere. The mari ne region of Lancaster Sound supports a biologically rich community of birds and nammals, many of which are considered to be of national international importance. bowhead whale is an endangered species.

Some 30 species of sea-associated birds and approximately 25 species of marine fish have been identified in Parry Channel. Major colonies of birds are concentrated on the shores of eastern Parry Channel in summer. The birds favour the longer season of open water in Lancaster Sound to that of the western portion; the majority migrate south in the winter.

With the exception of the ringed seal and polar bear, most marine mammals found in Parry Channel are migratory.

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Baffin Bay and Davis Strait support a more diverse marine flora and fauna than the Parry Channel region. Fish are a more important component of this marine ecosystem Water along the west coast of Greenland south of Disko Island is an important wintering area for marine mammals and seabirds. During the summer large colonies of breeding seabirds are found along the west coast of Greenland, at the entrances to Jones Sound Lancaster Sound and near the Baffin Island coast south of 66" N.

During late summer and fall, some species of marine mammals and seabirds are widely dispersed in and migrate through offshore waters. The mammals of the area are similar to those in Parry Channel but additional species of whales and seals are found off west Greenland. Many whales winter in and along the edge of the pack ice in Davis Strait and in western Greenland waters. These species follow leads and cracks that develop in the spring and migrate into northern Baffin Bay.

"We do not oppose development because wd know that such a viewpoint would be unrealistic and nobody would even listen to us. but we must emphasize our deep concern for our land, our animals and our people. We must have a say in the development that takes place here, and we must have some control over it, we must benefit from it both financially and otherwise, and we must protect ourselves and our way of life."

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دور ۱۲۰ در ۱۳۰



"I think that government is in the position also of being pushed to take up a very active role when these large projects do become implemented in the Canadian Arctic because of the very serious social and environmental concerns that would be entrained."

Dr. Andrew Macpherson
Department of Environment

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CHAPTER 3

ISSUES PILYCPY

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"...we will not accept the notion that a Pilot Project should proceed so that we can study its environmental impacts as part of a plan to expand the volume of hydro-carbon shipments from the Arctic. Our feeling is that the Northern environment is too precarious and too sensitive to be subjected to an environmental test of this nature. If the Arctic Pilot Project is to proceed, it must be scrutinized in a comprehensive manner. Mere commitments to monitor environmental impacts after-the-fact are not good enough."

Sinon Awa. Baffin Region Inuit Association

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"There is not much doubt that it can be done. Its environmental effects are, however, difficult to judge. Little use has been made of existing information to support scenarios of what might happen and their consequences. The result is that most of us at this hearing are not sufficiently briefed so that we are able to judge these consequences for ourselves."

Allen Milne. Technical Witness

ور اده مرد معمد که اکسان

"...we recognize that there are some significant knowledge gaps resulting from the fact that there is no precedent for year-round ice-breaking with such large ships in the Arctic. As a result we have taken the approach of identifying the major concerns, making a commitment to study these concerns as the project begins, and ensuring that design options exist if problems develop. The answers to some of the questions can only be obtained after year-round ice-breaking is in operation."

Menno Homan Arctic Pilot Project Δηςοφοριη ο ηςοσφοριη ο 1."

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CHAPTER 3 - Issues

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### 3.1 INTRODUCTION

This chapter presents an analysis of the issues which the Panel found to be significant during its review of the The Panel addresses, first of all, a number of general concerns dealing with the project rationale and the longterm implications. Issues related to specific aspects of the project addressed according to the project compo-These are categorized as the the Melville Drake Point facilities, Island pipeline, Bridport Inlet liquefaction plant and ancillary facilities, and In addition the Panel disshipping. cusses issues which relate to the project These are the human environas a whole. ment (socio-economic aspects) and long term research.

# 3. 2 PROJECT RATIONALE, NEED AND ALTERNATIVES

The Proponent has proposed this "pilot" project to prove the technical and economic feasibility of delivering natural gas from the Arctic Islands by ship on a year-round basis.

The advantages cited by the Proponent were outlined as follows:

- it would permit future enlargement of the Arctic Pilot Project if proven successful, and if unsuccessful could be discontinued and removed with minimal disturbance:
- the project would establish in Canada the necessary production and transportation technology to deliver gas from the Arctic Islands so that reserves

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could be brought into the Canadian market when required;

- since most of the project construction would occur elsewhere (ships, accommodation, storage and plant), the boom or bust pressures associated with development projects in the north would be minimized;
- the project would advance the technology necessary to deliver other Arctic resources without the major investment and dangers of a larger project or more environmentally hazardous cargoes;
- the project would provide an incentive (cash flow) for companies to continue exploration work in the Arctic Islands;
- the project would be compatible with the size of existing gas reserves and would also provide greater certainty about the recoverability of Arctic Islands' reserves; and
- the effectiveness of the project would enable a rational judgement to be made concerning the development of other gas fields further removed and the development of other resources from the high Arctic.

The rationale and need for the project were questioned by the Canadian Arctic Resources Committee (CARC). It argued that the project would be of dubious benefit to Canada from an energy standpoint since it would:

- high-grade (exploit the most accessible Arctic gas) the reserves on Melville Island:
- expose eastern Canadian consumers to a greater risk of supply interruption (caused by interruptions in shipping

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schedules) than they would be exposed to otherwise; and

- commit Canada to the long-term export of western Canadian gas (the proponent has proposed that a total of 12.8 million cubic metres of LNG would be exported from western Canada, that to be supplied by the project; 6.4 m<sup>3</sup> would be sold at million regular border price and 6.4 at the and increase arctic LNG price.) Canada's dependence on more expensive frontier gas.

The Panel notes these points but it is not in a position to review the Arctic Pilot Project in the context of domestic energy policies. It believes, however, that this subject will be examined thoroughly at the National Energy Board hearings on the Arctic Pilot Project.

also argued that a project It was involving a \$1.5 - \$2 billion expenditure and 20-year contractual commitments for gas could not be considered as a "pilot" venture: that it was likely to precipisimilar mari ne transportation development; and that it would be unlikely that the project would be abandoned if significant technical, economic or environmental problems were to arise. Proponent indicated that the project would be one-tenth the size of any other energy-related project planned in the Arctic, that other companies were also considering shipment of hydrocarbons from irrespective of the Arctic the Arctic, Pilot Project proposal, and that since the liquefaction plant would be bargemounted, the plant as well as the ships could be used elsewhere in the world. It was also pointed out that two ships were required as a minimum so that one could aid the other if needed (Canada does not have such an icebreaking capability) and that a "full scale" project could involve 30 ships.

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The Panel recognizes that this project would be a "pilot" project in the sense that it would pioneer year-round arctic transportation and develop in Canada a greater arctic expertise within industry and government. It also recognizes that year-round shipping of oil or gas on a larger scale is also being considered by others. This project. involving LNG shipment, woul d allow examination of year-round arctic shipping on a more modest scale. Any expansion of the number of ships, any major routing change, or a new proposal should require a further public review by government agenci es.

In its review of the Arctic Pilot Project, the Panel did not examine in detail alternate modes of transporting gas to southern Canada. The main alternative mentioned was the proposed Polar Gas pipeline. It was argued by some that the Arctic Pilot Project would replace a future Polar Gas line since both projects would utilize the Drake Point field. **Both the Proponent and** Panarctic Oils Ltd. disagreed. pointed out that the Arctic Pilot Project would utilize 40% of the proven reserves at Drake Point and this was not significant with respect to the volumes required to justify a pipeline. The Panel believes that the Arctic Pilot Project consortium should not be required to justify before an Environmental Assessment Panel its project in comparison with other possible competing projects. should be noted that the Polar Gas project has been referred to the Federal **Environmental Assessment Review Office** for a review by another Panel.) Arctic Pilot Project also indicated that it had considered other transportation means including air and submarines in the early stages of project conception but had discounted these alternatives as a result of projected high costs.

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Within the context of this review of the Arctic Pilot Project, alternate pipeline routes on Melville Island were discussed. The Panel's findings are presented elsewhere (sections 3.4.2). As an alternative to a pipeline, it was pointed out i cebreaki ng tankers coul d that directly to Drake Point to receive LNG. The Proponent indicated, however, this would require a Class 10 icebreaker rather than Class 7 and consequently was less attractive economically.

Alternate shipping routes and exploitation of alternate gas fields were also mentioned during the Panel review but not examined in detail by the Panel. Resources Committee Canadi an Arctic (CARC) suggested that it would be beneficial to exploit reserves in the Ellef Rignes Island area rather than Melville Island. Among other things, it noted that vessels from this area would pass through Jones Sound rather than Lancaster Sound. It was suggested that Melville Island gas need not be shipped through rather **Lancaster Sound**; that vi abl e alternatives existed via Jones Sound or through Fury and Hecla Straits, latter also avoiding a route on the west of Greenland. The Proponent advised that the route through Jones Sound would be longer and would require Arctic Class 10 icebreakers rather than Class 7 under the Arctic Waters Pollution Prevention Act. It also indicated that shipping through Fury and Hecla Straits is questionable since they were narrow and shallow, the currents are strong and considerable additional hydrographic work would be required to determine whether the ships could navigate safely through the area. The Panel notes that these alternate routes would pass through areas that are probably as environmentally sensitive as Lancaster Sound, and would not necessarily reduce Inuit concerns

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since other communities may be affected by these routes.

The Panel recognizes that there are a number of broader issues involved in exami ni ng the overall need for this These would include the possible impact on the ship-building industry in Canada, and the role of the project in the context of Canadian energy policy. The Panel believes that these issues, while beyond the mandate of an Environmental Assessment Panel, require careful consideration by the government which ultimately decide whether project should proceed.

### 3. 3 LONG-TERM IMPLICATIONS

### 3.3.1 Introduction

The Arctic Pilot Project is the first proposal to seek government approval for year-round shipping in the Arctic. The long-term implications of such an activity were of considerable interest to many.

### 3.3.2 Shipping

Many intervenors felt that the Arctic Pilot Project would be the first of many proposals involving shipping through the Northwest Passage<sup>2</sup> on a year-round basis. Credence was given to this concern by reports of large scale (30 to 50 ships) proposals to move oil, gas, and minerals to southern markets through the

2 The Northwest Passage refers to an east-west shipping route which would include, among others, Viscount Melville Sound, Barrow Strait and Lancaster Sound.

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Northwest Passage from Alaska and from Canada's western and high Arctic regions. Such proposals were projected to begin Operating by the mid-to late 1980's. Consequently, many felt that the Arctic Pilot Project should not be examined in isolation but that rapid increases in shipping, up to 1 000 annual transits by the year 2000, also had to be considered before the project could be viewed in a proper perspective. The Panel is aware that other proposals may follow this pioneering venture, particularly if it is successful. It is difficult to predict, however, how many ships might follow. The Panel recognizes that an individual proponent cannot be held responsible for future developments not under its control; rather the federal and territorial governments, in consultation with Inuit residents, and industry should be responsible for long-range planning and a determination of development priorities.

The Department of Indian Affairs and Northern Development and the Government of the Northwest Territories must assume leadership in such an endeavour and should move rapidly to demonstrate that planning for such development is in place.

The Panel is concerned about potential environmental effects of large scale, year-round shipping in the Arctic. It recognizes that it is technically feasible and knows that pressures to bring oil and gas to market may further encourage such developments. It also recognizes the paucity of information that exists on the potential impacts in spite of the efforts made by the Proponent in preparation for this review. There is an obvious need for further study. The Panel believes that the small-scale shipping proposal by the Arctic Pilot Project would permit study and allow more accurate assessment of potential impacts and ways to minimize or determine more fully the effects of large scale shipping.

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Even with continuing research prior to the start of shipping, the Panel recognizes that some biological impacts may not be adequately known until some years after the project has been operating. The intention of Petro-Canada, on behalf of the Arctic Pilot Project, to continue research and monitoring over the life of the project is an opportunity for government agencies and local residents, as well as industry, to determine trends, and solutions to much larger scale shipping activities that are projected to occur in the Northwest Passage. This would allow the Proponent and others to incorporate, in any expanded or new proposals, information on the assessment of biological impacts as well as data on physical impacts and on the engineering performance of the vessels.

### 3.3.3 Lancaster Sound Regional Study

The Lancaster Sound Regional Study was mentioned frequently during the review. This study was undertaken as a result of a recommendation by an earlier Environmental Assessment Panel. It will establish a comprehensive planning framework with the objective of formulating options for the use of Lancaster Sound. felt that this planning exercise should be expanded to encompass a larger area which would include Melville Island and that the Arctic Pilot Project should not be considered until the resource-use policy for Lancaster Sound had been deterni ned. It should be noted that the Lancaster Sound Regional Study is not intended to replace existing environmental soci o- economi c and reviews regulatory processes; rather it should assist decision-making on specific use proposals for the region in the future. The Panel's report will likely serve as an input to the Lancaster Sound Regional Study on one possible use of the Sound.

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Since its report deals with the environmental acceptability of the Arctic Pilot Project, the Panel does not believe that the planning framework need be in place before it can reach a conclusion on this project.

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### 3. 3. 4 International Implications

Concern was expressed by some intervenors on the potential impact of the project on Greenl and. In response to Greenlandic concerns, the Proponent has modified its proposed routing to avoid the environmentally sensitive Melville Bay and the Thule District coast. The ships would avoid sensitive coastal areas and stav approximately 45 km offshore Greenland. Danish/ Greenlandic representatives were invited (through the Department of External Affairs) to attend the public meetings in Resolute but advised they were not in a position to do so. The Panel therefore was unable to learn, on a first hand basis, of the concerns of Greenlanders. It is aware of concerns as to the potential effect on marine mammals and the traditional Greenlandic life-It is unable, however, to reach styles. a conclusion on the impact of the project in this area.

Danish/Greenlandic officials also indicated that they wished to continue discussions underway with Petro-Canada (on behalf of the Arctic Pilot Project), and Canadian government agencies to resolve any potential problems of the passage of the ships off the coast of Greenland. Agreement has apparently been reached with Danish. officials on further studies to be conducted jointly by the Arctic Pilot Project and the Danes along the proposed shipping route off the coast of Greenland.

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### 3.3.5 Approvals Process

The Arctic Pilot Project viewed a Panel recommendation of environmental acceptability as a means of obtaining environmental approval-in-principle. It pointed out that there would be National Energy Board hearings following the Panel and a number of regulatory Report. hurdles to overcome in order to proceed. Detailed information would be needed to obtain regulatory approvals. The Proponent, however, was unwilling to spend the funds needed for such information at this stage as it would be of little use if a form of approval-in-principle could not be obtained by the Panel Report and Ministerial endorsement.

There was concern that approval-inprinciple would be seen to prejudge the regulatory process. Regulators could adjust or control specific items (e.g. a land use permit for a borrow pit) but could not halt the project.

The Panel concludes that its review, with public and technical agency input, provides a mechanism for informed advice to Cabinet on environmental and social aspects and does not prejudice further reviews by government agencies.

### 3. 4 MELVILLE ISLAND

### 3.4.1 Drake Point Facilities

The gas production facilities would be operated by Panarctic Oils Ltd., rather than the Arctic Pilot Project consortium It was the Panel's view, nevertheless, that the Drake Point facilities should be considered as an integral part of the environmental assessment review of the Arctic Pilot Project. Accordingly, the

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### **3.4.1** $DS\Delta^b > \Delta^c \Gamma D C D \sigma d^c D^c$

scope of the review was identified by the Panel in its Guidelines for the Completion of the Environmental Assessment for the Arctic Pilot Project (September 1979) to include the gas wells, gas gathering and ancillary facilities associated with the Drake Point fields.

A document, entitled Environmental Over-Gas Production Component, shortly before the public recei ved The lateness of Panarctic's meetings. submission and the preliminary nature of the information provided made it difficult for the Panel and participants to assess this component of the project to the same degree as others. Discussion at the public meetings consequently was The Panel did receive further limited. submissions following the meetings. Those from the Departments of Environand Energy, Mines and Resources were of consi derable assistance in assessing the potential impact of the Drake Point facilities.

As a result of the limited discussion at the meetings and its review of the information provided by others, the Panel is able to make a number of observations. First of all, it noted that Bridport Inlet would be used as a storage site for equipment and materials for the construction of the Drake Point facilities. These would be transported along the winter road following the pipeline right-Rae Point was also identified as alternate staging area which if selected would require construction of a winter road to join the pipeline haul The Panel believes that construcroad. tion of roads should be minimized and recommends that Bridport Inlet be used as a staging site and that the pipeline right-of-way be used as a transportation corridor. Secondly, it noted a number of issues that were not fully addressed by Panarctic.

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### These are identified as follows:

- the thermal design of production wells, sumps, and waste disposal facilities;
- the thermal interaction of several wells drilled from the same pad;
- water supply;
- sources for borrow materials;
- location and conceptual design of roads and airstrips;
- permanent stream crossing structures, drainage control and erosion prevention mechanisms;
- general foundation stability;
- clean-up and reclamation programs;
- caribou and muskoxen movements in the area;
- the significance of the occurrence of ice fog; and
- air emissions and monitoring programs.

While there was a lack of specific information about the Drake Point facilities. it was clear to the Panel that there was nothing unusual or unique about the location itself. The proposed land-based activities would involve proven engineering technology. Panarctic has had considerable experience in Arctic drilling. In the Panel's view, the concerns identified above require further consideration. They can be resolved, however, during the design phases of the project with adequate consultation with the regulatory agencies to ensure that there are no significant environmental impacts.

This should occur before surface leases or land use permits are granted to the company for its facilities.

# 3.4.2 Pipeline Design, Construction and Operation

At the community meetings and the general meetings in Resolute, concerns were

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raised regarding the design, construction and operation of the pipeline on Melville Island. The discussion focused primarily on environmental problems that might arise in repairing a pipeline failure. In addition questions were raised on alternate routes and modes for the pipeline.

The major concern related to pipeline rupture was the possibility of failure during the summer; repair work could cause major damage to the terrain. The Proponent stated that the line would be designed so that breaks were highly unlikely. It would repair the pipeline in the summer by airlifting men and equipment to the break site with helicop-The repair procedure at the site woul d involve installing a temporary bypass line, within 36 hours of arrival under normal weather conditions. nent repairs would be completed in winter when the ground is re-frozen. In **addi** areas that experience significant settlement or erosion would be identified in the summer and repaired during winter. The Panel agrees that during summer only emergency repairs to the pipeline would be conducted with final measures undertaken when the ground is frozen.

There was concern that the Proponent had provided limited information on the design of the pipeline and consequently had underestimated the problems of laying a pipeline in continuous permafrost. In particular, there was a lack of information on thermal contraction cracking and disturbance of the thermal regime by the pipe which could lead to the possibility of slope movement (i.e. slow downhill creep of soil at the ground surface). Following the public meetings the Proponent provided an additional analysis of stress levels. The Proponent demonstrated that any stresses within the pipe result of ground tension or fracturing would be well within the

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allowable levels for steel pipe at the size proposed. It was also noted that there were certain situations, such as stress at pipe bends, or where thermal contraction cracks were at an angle rather than normal to the pipe, which required further analysis. The Proponent indicated that further studies would be carried out to investigate this phenomenon.

The Panel supports the Proponent's proposal to install instrumentation to monitor the pipeline and surrounding soil at a few locations where the potential for cracking is significant. An accurate engineering route survey of the pipeline route would be completed, supplemented by engineering field notes and the results of a geophysical survey of the pipeline route to identify regions of massive ice. In the light of the additional information provided and planned studies, the Panel concludes that effects of ground cracking on the pipe would not present an insoluble engineering problem even if severe stresses were to occur that could cause a failure of the they would do so during extreme cold and heavy ice conditions (winter and spring) when conditions are such that repair activities would cause disturbance to the environment.

The Proponent indicated that gas from the Drake Point production facility would enter the pipeline at -6" C rather than 0" C as originally proposed. temperature through most of the pipe would approximate the natural ground temperature in order to minimize melting of the permafrost. It was agreed, however, that there could be some effect on the active layer with resultant slope movement or soil erosion. The Panel accepts that only in exceptional situations would this activity constitute a threat to the pipe integrity. The Panel recommends. however. that surveillance

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should be undertaken by the Proponent during the construction and operation of the pipeline to detect and take remedial action to correct effects on the terrain.

There was considerable discussion on the route preferred by the Proponent and on two eastern alternatives for the pipeline. The Panel noted that the topography along the preferred route was much less severe and thus there was less chance for damage to the integrity of the pipeline. It would cross, however, vegetated areas of the Sabine Lowlands and Mecham meadows which are important for animals and birds. Approximately 0.15% of this area would be affected. Nevertheless the Panel believes that the Proponent was able to demonstrate the acceptability of its preferred route over other alternatives.

Some of the northern residents questioned the need for a buried pipeline. The Proponent indicated that an above ground pipeline, besides being more costly, would be more susceptible to damage and would pose a barrier to animals. The Panel agrees that a buried pipeline would be preferable.

There was concern that the pipeline might corrode as a result of induced currents caused by aurora borealis. This phenomenon has only recently been identified in connection with the Alyeska pipeline. The Proponent questioned whether this effect would create problems in its much shorter line but indicated that in the event that further study indicates that it might occur, insulating flanges could be installed on the pipe to eliminate the problem

A number of other design considerations (involving frost heave, stream crossings,

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borrow pits, water supply, waste disposal, erosion and landslide control) were raised by various intervenors. The Panel believes that these considerations should be an integral part of the final design of the pipeline to be reviewed and approved by appropriate regulatory agencies.

The Panel believes that the Proponent initially underestimated the potential problems associated with the construction and operation of a gas pipeline in continuous permafrost. This fact was highlighted by the lack of information on potential impacts contained in the Proponent's submissions to the Panel. er. in the Panel's view the Proponent is presently more aware of the substantial problems that may occur and consequently is prepared to proceed with its proposal with a great deal more caution. In addition, as this pipeline would be the first of its kind in Canada, the Panel recommends that government and industry together implement a program that will monitor and assess the effects of the construction and operation of the pipeline on the environment and the environment on the pipeline over the life of the project.

### 3.4.3 Bridport Inlet

Discussion of the design, construction and operation of facilities at Bridport Inlet focused on the stability of the terminal and LNG storage facilities, currents in Bridport Inlet, the effect of warm water discharge from the liquefaction plant and ballast water on the marine biota, air emissions from the liquefaction plant, bird/aircraft strikes at the proposed airstrip and protection of archeological sites.

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Opinion was expressed that the dock facilities would not be stable. With the proposed addition of warm water for ice there was concern that thawing of the permafrost would result and that the foundations might collapse. Proponent provided reasonable assurance during the public meetings that this would not occur. Subsequently further information was also provided which led the Panel to conclude that the thermal regimes of the water and seabed are being studied in a competent manner and that with proper engineering, it does not appear that any exceptional problems will ari se.

With respect to the natural gas storage facility adjacent to the dock, it was envisaged that the presence of LNG would lead to cooling and thus cause frost heave and thermal contraction effects. The Proponent indicated that the outer shell of the storage barges would be at ambient temperature, because the LNG tanks would be separated from the barge wall by insulation and a two-metre wide anbient layer. The Panel accepts that the foundations can be designed to ensure stability of the storage facilities. Panel recommends, however, that monitoring of the geothermal properties of the foundation subsoil be undertaken by the Proponent and reported to the responsible regulatory agency.

On the basis of information presented to the Panel by the Department of Fisheries and Oceans, the Panel concludes that the velocity of currents are sufficiently low so as not to hinder ship docking at the proposed terminal. With such minimal currents, the need for dredging was questioned. The Proponent indicated that it did not envisage a requirement for maintenance dredging but would do so in the event that sediments from the Mecham River did collect around the dock.

There was concern over the possible effect on the biota caused by the discharge of warm water to the Inlet and the introduction of exotic organisms in ballast water obtained from Davis Strait or areas further south. The mussel Mya pseudoarenaria is known to occur in Bridport Inlet. This is a common species in boreal waters, but its occurrence in a arctic environment is though not unique to Bridport Inlet. Because of this, the Panel does not consider this as a species warranting The Panel believes special protection. that any warm water exotic species which be introduced with discharged ballast water would not become established away from the thermal plume and, since the plume would be continually disrupted by the movements of shipping, might not become established at all. Cold-water exotics, taken on with ballast water in Baffin Bay, would have a better chance of survival but, if their establishment in this new environment is feasible, it should long ago have occurred naturally, since there is no geographi cal barrier between the two The Panel, nevertheless, supports the Proponent's proposal to monitor the biology of Bridport Inlet.

Discussion on potential air emissions centred on the emissions of oxides of nitrogen. There was concern that, under certain atmospheric conditions, nitrogen oxide concentrations might exceed the maximum desirable limit at ground level. The Proponent contended that concentrations would be an order of magnitude less than the maximum desirable limit. The Panel believes that nitrogen oxide levels would not be significant, however, it recommends that periodic monitoring be conducted.

The Panel supports the Proponent's intention to continue collecting weather data

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at Bridport Inlet as a means of refining weather forecasting in that area.

The western edge of the proposed airstrip would be located close to the Mecham River flats, an area occupied by brant immediately after the breeding season. Bird/aircraft strikes are a possibility at this time of year (July and August) but the Panel does not consider this to be a significant problem since the birds are moulting and thus flightless for part of the time and the flight path would cross only a small part of the available habitat.

There is one known historical site (Dealey Island) and five known archeological sites in the Bridport Inlet area which warrent protection. Likewise, any new ones revealed during the course of construction should be protected. The Panel suggests that the guidelines laid down by the National Museum should apply to all archeological sites. The Panel notes that the Proponent has agreed that any site disturbance would be strictly prohibited.

# 3.4.4 Impact on the Biological Environment on Melville Island

Intervenors were concerned about the effects of construction of the pipeline and the Bridport Inlet facilities on muskoxen and caribou particularly. In addition there was also concern as to the effects on the denning of polar bears near Bridport Inlet.

The Peary caribou population has declined by approximately 70% on the western Queen Elizabeth Islands in the last 20 years. This has apparently come about because a scarcity of winter food, following unusually heavy snow cover, has reduced numbers and inhibited breeding. Because of 

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this, the species as a whole has been given threatened status. However, the population south of Parry Channel has not been affected in this way.

Pipeline construction would be noisy and might disturb both the caribou and muskoxen in the vicinity. This activity would be confined to a strip no longer than 7 km at a time, with truck travel to and from borrow sites no further than 12 This activity would occur only during a six-week period in the spring and fall of 2 years. The Panel believes that the animals would be able to avoid comparatively small construction sites in the course of their movements to and from the eastern end of Melville Any effects of the disturbance to Peary caribou caused by pipeline construction would be small compared with major natural perturbation produced by climatic factors. The centre of muskoxen population appears to be on the southwest corner of Melville Island; consequently activity associated with the pipeline should affect a relatively small proportion of the Island's population. construction is completed, the buried pipeline would not present an obstacle to their movements. A small percentage 0.15%) muskox (approximately of meadowgrazing-habitat in the Mecham The Panel, Meadows would be destroyed. does not consider the minimal loss of grazing habitat to be significant and notes that a revegetation program could be undertaken by the Proponent if monitoring of the project's effects were to identify this need.

More generally, the Panel notes the concerns by Inuit and other intervenors that little is known about the distribution and movements of both muskoxen and caribou on Melville Island during the period of mid-winter darkness. They have been observed during the daylight periods in spring and fall when the proposed

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pipeline construction would take place. The Panel supports further studies at this period in order to determine possible disturbances during pipeline operation.

Activity at Bridport Inlet would be more long-lasting, i.e., up to 20 years or perhaps longer. The Proponent has not presented enough information on muskoxen movements along the coast for the Panel to be able to judge the extent of the disturbance which this might cause. Panel does not expect the impact to be significant, however. it stresses importance of monitoring the muskoxen movements at Bridport Inlet as well as muskoxen and cari bou populations in eastern Melville Island. In the long monitoring would be necessary to detect changes in population size and distribution; in the medium term to determine the paths of muskoxen movement past the Bridport Inlet facility and, in spring and fall, across the proposed pipeline right of way; and in the short term to allow construction traffic to be halted temporarily if it appears to be deterring these animals from crossing the pipeline and road networks.

The Panel believes that both during and after pipeline construction, the Proponent' s prohibition of hunting harassment of wildlife (specifically, muskoxen. caribou and moulting brant) should be strictly enforced. Parti cul ar care must be taken to minimize accidental disturbance, as well as prohibit deliberate harassment by helicopter and aircraft flights.

The Panel recommends that the Proponent prepare a document based on a literature review of the reactions of muskoxen and caribou to fixed-wing aircraft, helicopters and ground vehicles, to inform its personnel about ways of minimizing the disturbance which these cause.

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المعافلة المعالمة الم Dlb'L, ביים, חרשן מקשמ 20 ביים, סיול יל . די לאשכתאלי שפאחלי ארירר שאשטיאלי σο Dr Ly Γο Γος Δροβος σιρο σησιρο σησιρο CF4 C94 95, Uc. 2050 2010 47511 4011 401 חכסולינוכ כטרסיטיני פייטאי 4, 4744° 6, 64, 100° 42, 100° 6, 100° 6, 100° 6 1 - 11 Cil 401 a 5 - 11 C 4024 C CD 6C5 - 11 C DIF LAC ADCRCAGIC BYS OF ALLOCE DLT: LAC D'DAD COS NILLO TE NE PPS CD< ۵۵۵۵۵۵۹ ۵۵ ۵۲۲۱ع۱, ۵۵۶۲۹ ۵۱۵۹۶ ۵۵۹ ۵۲ رح لالا الهم المع المرفود مل لي مأرد من ا ۵۰ ۱۵۱ ۱۵۱ م حدی ۱۵۲ ۱۹۵۱ ۱۹۵۱ م Δ' L'L), havir st nCDJator DCPNCD لامون عاله رعن الله طربه در عن حال هيركرد طره 

The Panel notes that muskoxen and caribou populations will fluctuate as a result of natural causes, regardless of the Arctic Pilot Project. This could be overcome with the introduction by the Proponent and wildlife agencies of an enhancement program involving, for example, provision of winter feed or restocking programs. The advisability of such a program should be considered by federal and territorial Wildlife Services in the event that populations decrease further.

It is likely that up to 5 potential polar bear denning sites might be destroyed in building the Bridport Inlet facilities. Polar bear numbers are, however, not limited by the availability of denning sites - there are more sites than bears to use them - and so the population as a whole should not suffer. The principal danger to the species would be nuisance bears attracted to the Bridport Inlet and Drake Point sites by garbage and curiosity, and which might have to be shot out of consideration for human safety. To minimize this, garbage disposal regulations should be strictly enforced.

There was discussion as to whether the Mecham River is used by a population of anadromous char, whose movements would be interrupted by bridges and other construction across the river estuary at The evidence submitted Bridport Inlet. to the Panel indicates that no such population exists, and that the population of char found in Polynia Lake is land-locked. However. construction of crossings of the river by the Proponent should not block access by fish. A comparatively i nexpensi ve moni tori ng program might be undertaken by the Department of Fisheries and Oceans if it considers that there may be irregular runs of anadromous fish in the Mecham River that merit more detailed study.

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### 3.5 SHIPPING COMPONENT

### 3.5.1 Physical Environment

# 3.5.1.1 Effects of the Physical Environment on Ship Passage

In addition to the hazards common to all shi ps, the proposed yearocean-going operation of the vessels in northern waters would expose the LNG carriers to sea-ice conditions which could impede passage or cause the ships to founder. Icebergs or smaller pieces with which the ships i ce the presence of ice of sufficollide. cient strength to impede or prevent notion of the ship, and ice pressure against the ships' hulls. caused by wind-and current-induced ice motion, are major considerations in this regard.

To operate in these conditions, the Proponent desi gned has shi ps wi th propulsion systems of 180 000 shaft horsepower. more than 4 times the power of the Manhattan which traversed the Arctic in the winters of 1969 and 1970. work model **Extensive** analytical and testing were used in designing the hull to meet expected ice conditions. Navigation aids planned for the vessels would be considerably in excess of minimum under the Arctic Waters requi rements Pollution Prevention Act.

In assessing these factors the Panel considered that the integrity of the transportation system was of concern only to the extent that failure could have significant environmental or regi onal socio-economic implications. The Panel understood that ship design is being examined by the Department of Transport its interdepartmental through **TERMPOL** Coordinating Committee. Effects of

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"The ship is very wide and very big. It will be breaking a big distance of ice and it's going to be very wide. The hunters in Resolute are afraid about that. They will be polar bear hunting, seal hunting and caribou hunting so they will have to cross that area in order to go out hunting. They do not want to settle for white man's ways because that is not their way of life. Mr. Chairman, it also has to be understood that it should be studied more fully."

George Eckalook. Resolute

495 7878 495 7878



"There are always ships coming every year; they have not affected sea mammals all that much. But the LNG tankers will be travelling throughout the year. In the winter time the combination of the noise caused by the engines and the ice that the tanker will be breaking, will affect the sea mammals."

Simon Akpaleapik. Grise Fiord " CALHORAN KASA" KUNEN ANSIAL CLS; CALH ASCOBOANNI CN-KAC 'A KALAO PAJA PAJATA KAC 'A KALAO PAJATA KAC 'A KALAO PAJATA ALI KASAN ANDA BARA ALI KASAN ANDA BARA ALI KASAN ANDA BARA CIKU KASAN ANDA PAJATANO PC PA

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system failures are discussed elsewhere in this report.

In general, an adequate system for monitoring and prediction of ice, weather and weather-related elements such as state would be needed for vessel operations along the proposed routes. Onboard monitoring systems would partially fill this need, as would ice and weather information prepared by the Department of Environment for distribution on a routine The Panel noted, however, that basis. the latter information service is now available only during the traditional The Panel accepts the shipping season. Department of Environment's position that an increase in service would be needed to year-round accommodate the shi ppi ng planned by the Proponent.

Icebergs are common over much of the proposed route in Baffin Bay and Davis Strait, although frequencies of occurrence vary considerably from season to season and year to year. The result of a collision with a berg or a smaller piece of ice is difficult to define with precision but a significant possibility of serious damage to an LNG carrier exists. Growlers and multi-year ice floes pose a particular hazard, since these are very difficult to detect when visibility is poor.

The Proponent has put considerable effort into protection from this hazard, for in proposed ship design and example. operating procedures. In addition, the Proponent has a major program for development of sui table sea-ice sensing These aspects are subject to regulatory mechanisms and Codes of good practice. The Panel concludes, based on these considerations and the evidence from the Proponent and others, that the environmental hazards would be minimal.

Compressional stresses on the hull of the ship, caused by wind- and current-induced

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ice motion have also been studied in detail by the Proponent. There are limitations in assessing this factor precisely before operations, particularly since winter navigation has not been tried in the region of the proposed route. The Panel considers, however, that the effects would be limited to reducing vessel progress rather than causing major structural damage.

While compressional stresses can restrict ship passage, a more general constraint to ship penetration is the strength and thickness of both level ice and ice ri dges. The Panel has reservations about the adequacy of the data used by the Proponent to represent extreme conditions in ship-ice interaction modelling, primarily for the Parry Channel part of the Specifically it was felt that, because of the limited amount of measured ice-thickness data used in designs, ships might occasionally encounter ice offering greater resistance to penetration than Evidence indicated, howevanticipated. er, that the problem was, as with the case of ice pressure, essentially one of degree of impedement of ship progress, rather than major structural damage.

In summary, the Panel believes that under certain circumstances, ice conditions may lead to different rates of ship progress than predicted by the Proponent. While serious damage to the ship by ice was possible, this hazard would be reduced to a minimum with an adequate ice and weather information system

The Panel recommends that there be close cooperation between the Proponent and agencies providing ice and weather information (principally the Atmospheric Environment Service of Environment Canada) to ensure that an adequate weather and ice information system is developed for ship operations.

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# 3. 5. 1. 2 Changes in Ice Patterns Induced by Ship Transects

It was suggested that the LNG carriers penetrating the fast-ice edge primarily in the vicinity of Lancaster Sound near freeze-up or break-up, could cause breakup of the fast-ice on a scale sufficiently large to cause si gni fi cant changes in ice patterns. The Proponent presented evidence that this would not be the case because the effects of the ships would be insignificant in comparison with natural determinants of ice behaviour, such as wind, temperature and currents. The Panel concluded that while this was unlikely it was not impossible and that if the project were to proceed, careful monitoring to detect changes should be undertaken with a view to taking correcaction such as suspending or rerouting ship traffic for portions of the season if necessary. The Panel also concluded that the risk of altering the ice patterns would increase with increasing ship traffic through the area in spring and fall. The problem therefore, should be reassessed in the event substantial increases in traffic are planned above levels proposed for the project.

### 3. 5. 1. 3 Hydrographic Work

The Proponent agreed that a small amount addi ti onal hydrographic work was needed along the proposed route. tional charting could be completed well within the proposed construction schedule for the project and, therefore, was not considered to be a constraint to the project proceeding. The Canadian Hydrographic Service indicated it was prepared to undertake this. Cooperation between the Proponent and the Canadian Hydrographic Service would be required to complete this work.

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### 3.5.2 Operational Environment

# 3.5.2.1 Hazards Caused by Damage to Ships

Serious damage to the LNG carriers could result from a number of causes: accident equipment malfunctions aboard the vessels, collision with other ships or certain types of sea ice, or grounding. The past history of LNG carrier operations suggests that there is little risk of serious damage from onboard human error or equipment failure. The small amount of ship traffic over the northern part of the route, the sophisticated navigational aids to be used and the strength of the vessels' hulls makes major collison-caused damage unlikely. The hazard in this regard posed by sea ice is considered low (discussed in Section 3.5.1.1), as is that posed by grounding.

While the possibility of serious damage during operations is small, it cannot be di smi ssed. In case damage did occur, harm to the environment could result from either loss of LNG or fuel oil. Loss and combustion of LNG from 2 tanks, which is probably the worst case that could reaexpected, woul d sonably be produce intense heat. The effects of the fire are predicted to be limited to an area within an 11 km radius of the ship. range is based on predicted diffusion/ dilution rates as well as the fact that LNG is combustible only in 5 - 15% While the evidence mixtures with air. upon which this prediction is based is limited, the Panel believes it is acceptable for assessment of the part of the route being considered here. The Panel agrees that with the small probability of a major. LNG fire combined with the limited extent of its effects, the possibility of environmental damage is low.

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". ..somebody should be requested to do an in-depth study of how this kind of vessel traffic-management system would work, how we are going to maintain biologically important areas, given the level of shipping. I don't think there are simple answers here, but answers will have to be found."

Don Gamble Canadian Arctic Resources Committee

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"...the company policy is that it will provide guidance to its Masters which may require the ship to leave the preferred, or most favoured, route, and intrude into thicker ice conditions to avoid a sensitive area. Provided that does not present a hazard to the ship, the ship would be expected to take that detour."

Dawson Miller Arctic Pilot Project "... Chida 65 Cettal dotter

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The chances of damage to coastal communities was considered extremely remote provided the vessels are kept at least 11 km from them

Information was presented at the meetings that 600 tonnes of diesel fuel would normally be carried by the ships to comply with established regulations insurance requirements. Consequently, an oil spill would be possible. The Panel posed by oil recognizes the hazards spills into the sea, and the difficulty of containing or cleaning up these spills in ice-infested or rough waters. chances of environmental damage would be remote since the quantity of oil is small and it would be well protected inside the The Proponent, nevertheless. indicated its willingness to cooperate with the Environmental Protection Service and the Canadian Coast Guard in the development of an oil-spill contingency The Panel notes the concern of Inuit with respect to oil spills or shipping accidents and recommends that communities be kept informed on continrelative to plans activities perceived as having potential for adverse i mpact.

# 3.5.3 Impact on the Biological Environment

Many submissions at the public meetings indicated a strong concern with the shipping component of the project and resulting hazards to the wildlife of Parry Channel. Issues raised included the physical aspects of the passage of the LNG carriers through the ice, the effects of icebreaking on denning ringed seals in Parry Channel, and the passage of Inuit hunters and migrating Peary Caribou across Parry Channel.

There was concern that in spring whales might follow the carriers' tracks into

2470° 2640 20° LC 60L020° C&j% Çar Dr Lai Aar Di San In Ai Si CD8C22i اد که لی خرک و احدیر و بیک و آحکی پی د DYL40 NY50 01 L3 N3094860; 05 N3J ۹۶٬۴۵۲ که ۵۲۱۲۶۶مرط دره . C۵۱۵۱۰ DAPH' LC 46014CDUF' D" D' H45' J" d Af لكا د ١٥٥١، ١٠ عراد و ١٦٠ و١٠ عراد ١٥٥ רס, פן אירראס האלף ערון ארראס האלף ערי ע d' >9> LC d' Lo CAN>DNO YL' L' Aodo C5 Dob CLdois Dob Of Lo back 25 4500 「「「「 <pre ط ۵۲۶ کو ۲ مار ۲ مار ۲ مار کام کام ط کام ط ک کری ۱۹۷۸ و ۱۲۵ کری که ایا کری که ای کری کا کری Λοσφουσιατία στι Λυρονομία Napas of tala 2 14726 21 212 2128/2014C 2C 16 1918 ac "γσ" βοδςος ους βολΓαρκίς βουι ςας Α Denjash, Dac.

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Parry Channel from Baffin Bay and become trapped and drown when the tracks closed up. There was also considerable concern that the noise of icebreaking and also of the ships' engines would disturb the marine mammals which are found in winter and spring in the open-water lead which forms along the south coast of Devon Island, should the ships take the path of least resistance and follow this route. The same views were expressed for the area of open water which persists all winter along the West Greenland coast north to Disko Island and in Smith Sound and in northern Baffin Bay.

The Panel believes that the Proponent has dealt satisfactorily with only a few of The Arctic Pilot Project these issues. has shown that, unlike a natural lead, an icebreaker's track fills up very quickly with a dense rubble of ice. It seems unlikely that whales could be lured into this rubble by mistaking it for open Nevertheless, the Panel is not water. satisfied with the Proponents' contention that over most of the winter this rubble will re-freeze so quickly that it will not hinder the passage of Peary caribou across the Channel. This rubble could prevent a natural restocking of Melville Island by immigration. However, the Panel accepts that the general trend of Cari bou movement is east-west through the islands north and south of Channel. and that interchange between the caribou populations north and south of the Channel is rare. Hindrance of north-south movement is therefore unlikely to be serious in relation to maintaining the Peary Caribou population.

In the Panel's opinion, the effects of icebreaking on ringed seals have not been adequately dealt with. The Panel was told by many Inuit intervenors and also by the Department of Fisheries and Oceans that ringed seals are very important to the Inuit economy, and that they are also

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the principal food of polar bears, another important animal in this economy. Female ringed seals give birth in April and May, in dens in stable ice built in territories which have been taken up at freeze-up in the fall. Polar bears depend on the pups in these dens for much of their food in early spring.

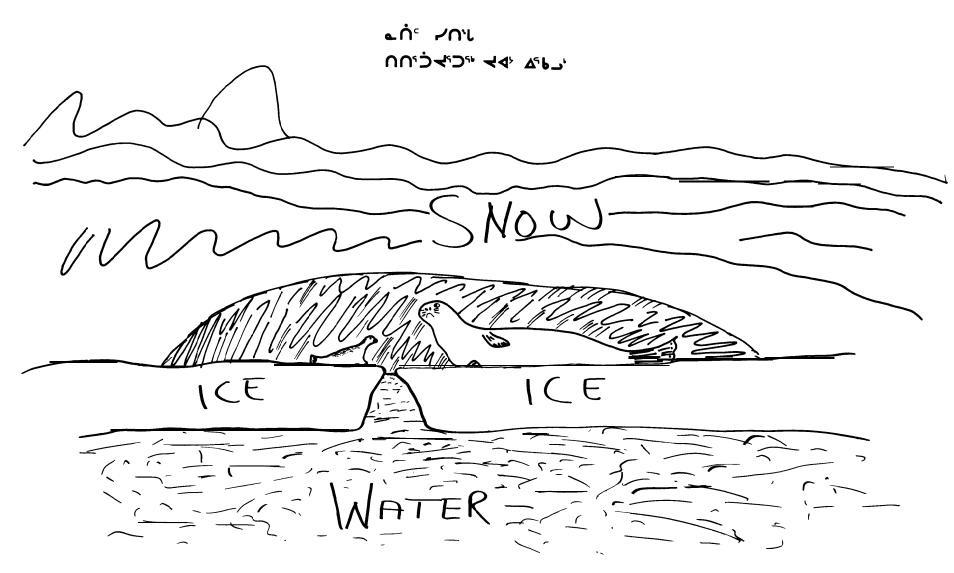
Inuit Hunters told the Panel that they feared that the passage of an LNG carrier through a denning area would kill significant numbers of seal pups, and that this would reduce the numbers of seals and bears in the inshore areas where they hunt these animals. The importance of seal and bear hunting to the economy of Inuit in Resolute is discussed in section 3.7.4.

These denning areas are spread fairly evenly on the fast-ice over most of Parry Their positions vary from year Channel. however, certain areas are important to Inuit hunters both because of the seals' abundance and because these easily reached from the are communities. For example, the area around Griffith and Lowther Islands is an important denning area close to the The preferred route Resolute community. for the LNG carriers, based mainly on minimum ice thickness, would pass through this area during the pupping season. The Proponent has argued that the ships' tracks are so narrow that the proposed 4 transits in April and May would result at worst in a loss of 1% of the pups of this very common seal. Nevertheless the size and recruitment rate of the ringed seal population is too poorly known for the Panel to judge whether this loss would lead to a significant reduction in the species' numbers. Moreover the calculation takes no account of the effects which the noise of the ships' passage may have on seals in the vicinity of the ships' tracks. The Panel was told that ringed seals are extremely sensitive to unfamiliar sounds and rapidly escape from

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ماله، ۱۵ کوم دلهه של אשת לשיר. בלבתילי שיי שאיישכיונ ۵۴ا۲ ۵۴۱، ۱۲۹۶، مد۵۵۵من CLa کا د کا کا د کی م کام کر ۱۵ کی د کام کر کام کر د کله ا ۸۲۱۱عه ۵ مار ۱۲ کبویری ۱۲ ۲۲ ۸۲۱۱ ۲۲ ۱ DC' CDZe'LC dijeZd'NDZe selhit' Dec. לי ש שרר אנה ספלה שותמי סי של ייףי CA D' 4171704L46 1170 04 15 2047A67 10 Nº 736299666, CLLD2956666 LC 2NDAGSCCS Nor. D' 2000 Nor OVER ON OF DE LOI 400 סישחרים כיני אבלים דנ אכרי לישטויף אררא ماطلام، به د ۱۹۲۵ من طد النام، د . د ۱۵۲۵ کور ۱۵۲۸ کور کارمهور ¿<1006 9077 80179252000 9709151 011 כבור סרליזשלי חחולקשלי ביור בחי סבי היה. Δr Γς-ρθι CDιν βργι CD δις Γγισι Δς Γιγ סבתייסי דיני דעי אלי פאירי כבסביקאי n ٥٠ ١٥٥ ١٥٥ منا١١٥ ١٥٠ . أد أن ٥١٥٥ ١٥٥ حه، ١٦ من ١٥ مه ١٥ مه ١٥ مه ١٠ م ΔΖΛ. CΔLΔ<- «ής ΨLΔ6ΡηΓίς LC Dr La 4a agule, choc.

## S≷₽L D≷N BY GEORGE ECKALOOK



them. This might mean that the seals would abandon their territories earlier in the year, if these lay close to the ships' tracks.

The result in the first case might be a significant decline in seal population. In the second case the adult seals would not be killed, but they might be driven away to areas less accessible to the hunters from Inuit communities. versely, there was also some indication that ringed seals adapt to regular disturbances. Those located below the Resolute airport flyway are not excited by aircraft noise. Ringed seals inhabit harbours in more southerly areas that are visited by ships on a regular basis.

There was considerable discussion on the ship's routing through Parry Channel. A number of participants expressed the opinion that confining the ships to a narrow corridor during the winter period would minimize the impact on the seals. **Proponent** has agreed that computer-generated ship track optimal, must take into account biological factors such as the presence of seals, as well as ease of navigation. A study is currently underway to integrate biological factors into the route selection process. Panel notes that there is at present no of locating, nanner let alone counting ringed seal dens, and so no method of adding this information in real time to the other criteria used to plot preferred ship tracks. Nevertheless, in the Panel's view, the development of an optimum route to minimize the effects to the marine environment is essential to the operation of this project. requiring involve a procedure continued integration of environmental and other data and may result in different routes depending on the season of the The Panel believes that optimum routes can be found but that there is a need to have in place an appropriate

D6LAD20cD6 L6 D1 L06 406 aD j6C556 or <>PU 20 20 P C 2 AMULGAS CISS OF LAS 445 DADJRCS UPLS PPPYNJ der nnsastice and ob. Do das داک کا کاروارودک عال کری CDUک بالاخرو. PUCITAILE LAS APPOUR VOITE LAS CA اعد کا احلا طحه . اوک حلاء الحکم الحکم الحد הי לוי רי ליהי מאטנאסים, או פאסי כאגים لاحلاما. فدن أن ٢٥٠٨ دره أمه كم לאנ פעטקי, ג-ף יפטאי, עפטפערכ פער מעכי غام، CD م دو به غود مراد ۷۵ حربه، ۱۵ هرد، کرد کار الارور برد ، چاد کے دیہ کی دیہ کے اور کے کی اور الاد ہے دی۔ ان کی دیا۔ ان کی الاد کی اور الاد الاد کی اور ا JUNILY CYG. CALAbadinal, ici no AHLIPIL, ASPI COLFIFIL ASINIPOLFI DI LAI DUTAL CVCTAL TO CUDILDCD4% DIFFCUIP ۵۰ ۱۱ که ۱۲ که denenos is delia diviso bodis corealid نه ۱۹۵۲ که طلع که فرد که نالاناک موره همر חי סטחר וף כבי סטי בי סלי בי סלי בי ٩٢ حاله . فد ١٥٠ ٥ ١٨ ١٨ > ٩ ١٩ الزاد ١٥ م ראי של אלוי בילי כדובי שנשלי פראס בר שביסי Pads הראסבחי העק JOS LIC LODER CALACISTIC.

"I would say, as far as the influence of the physical environment goes, whatever the 30 passages, and even if it's a double number of passages back and forth through the area, may amount to in influence on the physical environment, that is going to be negligible compared with what nature does anyhow."

Fritz Mueller. Zurich, Switzerland

אר רסשי את אמיאני.



"According to our understanding, and our way of life, it would be better if these ships took the same route time after time."

Alan Maktar Pond Inlet "Leta J OPPOLANA, a'LA APPON APPON NO CH d a DECT ROA APPON NO CAL'L JA AN ALD SET!"

de" L'ICH FANLCHIEDS

centre or authority to ensure that this is done.

The effect of underwater noise on marine mammals has not been adequately ad-It appears that beluga whales in the Saguenay and Churchill rivers have been able to habituate to the noise of ships' engines. Harp seals, in the short term at least, are known to avoid artificial, underwater sounds and the old whalers often commented on the sensitivity of bowhead whales to the sounds of Several Inuit described ships' engines. how belugas and narwhals avoid the sounds Some outboard motors. speakers expressed the opinion that the fleeing of the bowheads, belugas and narwhals may have been because these animals associated engine noises with hunting, rather than a dislike of engine noise as such.

Nonetheless, whales are known to have a complex acoustic system of communication which could be jammed by extraneous noise. This could drive them from a preferred habitat, such as the open lead along the south coast of Devon Island. But without further information it is impossible to say whether ship tracks should be located away from such areas, and how far away. During the meetings the point was frequently made that the carriers should be routed along a narrow track in the thicker ice in the centre of the Channel.

The principal risk to birds would be to murre colonies at Prince Leopold Island, Cape Hay and along the west Greenland coast, where these birds are locally concentrated on the water close to the colonies, and to a lesser extent to concentrations of feeding birds along the coasts and at the ice edge. In late summer, the Greenland coast north of Disco Island is used as a moulting area by common and king eiders feeding in northern Baffin Bay and much of the

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Canadian high Arctic. In an LNG accident the birds in such concentrations might suffer significant mortality from freezing if the LNG did not catch fire and from burning if it did. The Panel believes that the carrier route would be too far offshore for an accident to such concentrations, flocks of birds feeding at the ice edge would still be vulnerable. In addition, engine noise and the unnecessary sounding of the ship's siren could disturb breeding seabirds, especially murres. er, the ships should be too far offshore from the colonies for this to be a serious factor.

In spite of these concerns, the Panel believes that major impacts can be miti-Advantage can be taken of the 5-year lead time before the carriers come into operation to carry out an experimental investigation of the effects of underwater noise and icebreaking noise on whales and seals and to establish seal nunbers and distributions in Channel, as a baseline for assessing the effects of the tankers' passage. In addition, as noted by Inuit, information was lacking during the dark season, both in terms of potential physical straints to the project and environmental The Proponent has indicated its intention to study sea mammals in the dark season. **Inuit hunters must take** part at every stage, from the design of the study programs to the collection of data in the field.

The Panel agrees with the Proponent that advantage should be taken of existing icebreaker operations, such as those being carried out by the Canadian Coast Guard and Dome Petroleum, to determine the fate of the ship's track through the ice under various temperature regimes.

The Panel believes that information from these studies will permit examination of

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בי חי סי אדרי בכ של של סירנדף ביקנ שף ארט של פיל על הראף ביקנ של ארני אף ארט של מילני היאף ארט של מילני היאף ארט של היילי היאף ארט של היילי הייל היילי הייל היילי היילי היילי היילי היילי היילי היילי היילי הייל היילי היילי הייל היילי הייל הייל הייל הייל הייל הייל היילי הייל ה

the long-term effects of the passage of the LNG carriers on marine mammals in Parry Channel and planning of short-term changes of route to minimize the disturbance to these mammals.

Finally, the Panel wondered whether it would be practicable to route the LNG carriers so that they consistently travel through suboptimal ice conditions in order to avoid environmentally sensitive The Panel does not doubt that the Arctic Pilot Project shipping superintendent will give such instructions to his and that the captains will with good faith on both accept them But the captains' professional training will make them aim for the fastest and most efficient passage and the Panel was advised that an icebreaker captain will seek the easiest way through A captain is, moreover, the sole judge of the best action to take for the safety of his ship.

The Panel accepts the Proponent's statement that it will instruct its captains to take all reasonable precautions to the environment but it is uncertain how effective these instructions will be, given the present level of knowledge of the biological systems in Davis Strait, **Baffin Bay and Parry** The Panel notes that the choice Channel. of a route will inevitably be a compromise between environmental considerations and standard maritime and icebreaking practice and that given the slightest doubt the latter will have the advantage. Panel, therefore, considers it essential that there be a centralized source of information and control to permit ships to navigate safely in the Northwest Passage on a year-round basis, wi th full regard to envi ronmental matters.

Environmental issues in the Arctic fall within the jurisdiction of the Depart-

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ويكود ع- ا، بدد ا ۵ مكلد ك لا في له كه علا ل ic allusta at uple it her at he upaat De طلاماته بعد مان طر ۵۲ دور برطن عبره . فرن من 1740 Dr Lai Aar Dr Lai Aa-Uydai Jac tda د L د L د L و ۱۲۵ ه ۱۲۷ ۱۲۵ و ۱۲۷ ۱۲۵ DL LQ, 4000 كالحربة باحره كارك برعره في ۵،۲، ۵ ۹۹۶۷،۹۲۵ ۱۰ ۱۹۹۹ ۱۹۹۹ ۱۹۹۹ σίντις στι ποιτίς Δαστι από στι σε CALQ dbg dydr drlair Lnd gr dylb D טי אפן האטטקי סינ סר בפנ אפעיינ<sup>י</sup> פוראיף א حد ۱۹۵۲ ال ۱۲۵ میال ای مه محد میده، چنالک ک Πις Υθημις Τος Ασφ σικής, CΔΓΩΓς ,Δοροποίες το τις Ασφ σικής, CΔΓΩΓς , 

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denos risitues opos es or Lei cordis le Nilitais de docs es des si de ments of Transport, Fisheries and Oceans, Environment, Indian Affairs and Northern Development as well as the Government of the Northwest Territories. Each of these agencies appears to have powers that, if exercised, could restrict passage of ships through the Northwest Passage.

The Department of Transport is the government agency responsible regulating shipping. The Panel recom mends, therefore, that the Minister of Transport establish a control authority to monitor, assist, and regulate ship movements in the Arctic, particularly the Northwest Passage, on behalf of the government of Canada. At present there is a voluntary monitoring system in called NORDREG which might operation serve as a starting point for this control authority. The operations centre most logically be located at Resolute, where it would be near potential problem areas, and accessible to Inuit to provide shipping information and receive their comments. Such a control authority would also enforce good seamanship and appropriate envi ronmental regulations.

To assist it further, the Departments of **Environment** and **Fisheries** and **Oceans** should establish an advisory committee which would recommend and approve studies necessary to allow biological information to be effectively integrated into the route selection process. Membership on this committee should include the Proponent, Inuit, the territorial government and other federal departments. Moreover, government departments should evaluate their regulatory mechanisms to make them applicable for year-round shipping in the Arctic.

These recommendations are fundamental to the Panel's endorsement of the Arctic Pilot Project. Without further research on marine mammals guided by the advice of

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local people and government scientists and without a monitoring and control mechanism for the selection of the shipping routes, the Panel is unable to recommend that it is environmentally acceptable.

The Panel believes that the authority would not require a large government infrastructure in the short term. The Panel does believe, however, that with the lead time required for ship and pipeline construction the government can be anticipatory to this matter rather than reactive to it after shipping starts. The responsibilities of this authority should be reviewed periodically and strengthened if necessary.

The government may wish to consider a cost recovery mechanism for its studies and administrative costs. This could be applied over a number of years to the ships using Parry Channel.

#### 3. 6 HUMAN ENVIRONMENT

#### 3.6.1 Introduction

This section considers the potential socio-economic impact that the project would have in the Arctic. The Panel notes first of all that the Socioeconomic Statement of the application and filings to be lacking in subsequent analysis or impact forecasting. Proponent has used data of limited accuracy and which was outdated in many In the absence of adequate instances. socio-economic material the Panel has been forced to use other sources in attempts to estimate the likely impacts The community meetings of the project. and technical meetings have indicated a

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number of substantial concerns about the project and northern development in general. These are outlined in the following sections.

#### 3. 6. 2 Land Claims

A number of Inuit and others indicated at the community meetings and Resolute general meetings that the project should not proceed before a land claims settlement. Inuit felt that a land claims settlement would provide them with some control over northern development so they could maintain their lifestyles and culture which are closely identified with wildlife and hunting.

Inuit Tapirisat of Canada also stated that development should not commence until land claims are settled. It was not, in general, against development,. but was concerned that implementation of the Arctic Pilot Project, might preempt a resolution of issues such as property rights and political developments which are presently under negotiation. The Baffin Region Inuit Association (BRIA) similarily took the position that land claims should be settled prior to any major resource development.

The Proponent indicated that it was prepared to honour any agreement on land claims. It further pointed out that the project might be of use to land claims negotiators since it would be capable of providing information on the value of a northern non-renewable resource.

The Panel recognizes the high priority and increasing urgency Inuit give to a land claims settlement in the face of development proposals such as the Arctic Pilot Project.

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#### 3.6.3 Inuit Involvement in **Development**

Inuit expressed a desire to be active partners with government and industry in northern development. It was not clear, however, what such Inuit involvement might constitute in terms of the project.

The Panel recommends that the Proponent clarify its intent and conditions for Inuit involvement in the project so these may be considered by government in consultation with Inuit before any regulatory approvals.

#### 3.6.4 Wildlife and Huntina

The major concern of Inuit at the community meetings focused on wildlife resources and the potential impacts of developments such as the Arctic Pilot Project. Particular concerns centred around ship routings and ships' tracks in ice with potential disruption of marine mammal migrations and intrusions on prime seal habitat, including seal pupping areas. Inuit in the region are substantially dependant on hunting, trapping and fishing as sources of food and income.

The Proponent has provided the following information to the Panel on renewable resource harvesting in the Lancaster Sound region. During the 1978-79 season, hunting and trapping generated an estimated \$219,108 cash income for 218 Inuit trappers, while 276 Inuit General Hunting Licence holders harvested edible wild meats having an imputed total value of \$1,059,800 (the numbers relating to trapper and General Hunting Licence holders indicate a large number of the 276 General Hunting Licence holders both hunted and trapped). Available data suggests imputed meat values may have

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"If Lancaster Sound would be used as a shipping route all year round it is difficult to say what effects it will have on the sea nammals. If something should happen to the animals or they move it would be hard for the Inuit to live."

Peter Aglak. Pond Inlet لد *۱۳۵۰ د* ، ۲۵



"...the NWT is not opposed to northern development. It is, though, interested in northern development which facilitates maximum advantage to the northern society. We recognize the advantages to the southern society and consequently the advantage to the whole of Canada, however, we must insist, as a northern body, that exploitation of northern resources benefit foremost the people of Northern Canada."

David Gilday. Government of the Northwest Territories

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been underestimated by the Proponent. Clearly hunting and trapping are major economic activities for Inuit.

A number of Inuit at the Arctic Bay, Pond Inlet and Grise Fiord meetings indicated that a central routing of ships through Lancaster Sound would avoid sensitive 'resource pool" areas (areas not actively hunted but recognized as biologically important), such as southeastern Devon Island, and would minimize impacts at fast-ice edges along the south side of Lancaster Sound.

Further west, Resolute Inuit expressed concerns about seal pupping areas between Cornwallis Island and Somerset Island, particularily the Griffith and Lowther Islands area. This area is of primary importance to Resolute Inuit for both spring seal and polar bear hunting on the sea ice.

The Proponent's statistics indicate the importance of seal and polar bear hunting to Resolute Inuit. **During the 1975-76** and 1976-77 seasons there were 39 and 45 General Hunting Licences issued respectively to Resolute residents. In the 1975-76 and **1976-77 seasons**, polar bear hides accounted for 70% and 25% of the respectively; comprised 10% and 15% in the same period. In addition, seal constituted 20% (1 953 kg) of the estimated average annual edible meat harvest for the period 1970-71 to 1976-77.

The Baffin Region Inuit Association (BRIA) study on resource harvesting was mentioned. The Panel suggests that it be adapted as necessary to become a long term project impact monitoring mechanism through recording changes in hunter harvests on a locational basis. This, of course, would be subject to the interests and concerns of BRIA. Such data would be of value not only for possible compensatory purposes but as one of a series of

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indicators on animal population trends within the project sphere of influence. In the Panel's view, the Proponent should provide financial assistance to the BRIA study.

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#### 3. 6. 5 Access to Resource Areas

The Resolute Inuit expressed major concern about potential problems of access across Barrow Strait ice, to Somerset and Prince of Wales Islands, posed by ships' during important tracks. winter spring caribou hunting periods. tics collected by the Government of the **Territories** indicate Northwest Resolute Inuit harvested 120 caribou during the 1978-79 season. General discussions relative to ship refreezing rates which are speculative did not appear to overcome Inuit con-While the Panel notes intention of the Proponent to study impacts with Dome Petroleum's Icebreaker Kigoriak, the Panel feels the magnitude of this problem will only become apparent on initiation of the project in the specific region using LNG vessels. charters based on real need may provide an ultimate if not entirely satisfactory solution in the event ships' tracks do prove to be a hindrance to hunters.

The Panel felt it was unlikely that the if properly designed and operproject, would seriously ated. disrupt native hunting, however, that possibility could not be completely dismissed. The Panel accepts that, in principle, certain kinds of disruption would warrant compensation by the Proponent. The Panel was unable to determine how compensation might be allocated. It also recognizes that this

3.6.6 Compensation

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is not simply a question of cash for disruptions. Many Inuit indicated they would not accept such a system if it meant a major change to their hunting way of life.

The Panel believes that the onus in establishing a satisfactory compensation mechanism lies with the Department of Indian Affairs and Northern Development and the Government of the Northwest The need for compensation Territories. policies should be and strategies addressed in order to meet any possible loss of livelihood experienced by Inuit hunters and trappers relative to the project and other Proponent's anv northern development project. Acceptance of a general government compensation policy by industry should be a condition attached to any regulatory approvals. Such a policy must be determined by consulting with Inuit potentially affected by northern development projects.

#### 3. 6. 7 Employment

The Panel believes that the employment policies and proposed employment strategies of the Proponent are adequate for initial planning of employment opportunities for Inuit and other northern resisubject to recommendations of the Government conditions Northwest Territories and appropriate federal departments and agencies. Panel deplores the late filing on April 28, 1980, of critical employment information material which precluded Inuit input on this important aspect of the project at the community meetings, and may have affected the input of other parties at the Resolute general meetings.

While the Panel commends the Proponent on the establishment of an Employment Program Work Group with the Government of the Northwest Territories and the PYGCP' LC 4bP' 45+50° CALACP5+  $n_J$  CF'  $n_J$  CF'  $n_J$  CALACP5+  $n_J$  CALACP

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Canadian Employment and Immigration Commission in Yellowknife, the Panel believes the Proponent should not wait to implement its employment strategies until the final design stage of the project. Decisions should be made in consultation with government and the Inuit on the number of Inuit to be employed and trained once the project receives approval to proceed.

Inuit at community meetings and Resolute meetings expressed mixed views about rotational employment<sup>3</sup> and its tive socio-economic advantages and disad-The project is so remote, and wildlife so scarce on Melville Island that the Panel thinks it unlikely Inuit would wish to be in permanent residence at the Drake Point and Bridport sites. The Panel feels the project offers a new opportunity to assess rotational employment in the Arctic and is satisfied the Proponent will endeavour to meet Inuit scheduling. preferences on rotational Inasmuch as this is a new project, it is recommended that appropriate Inuit organization(s) receive funding from the Proponent, the Government of the Northwest Territories and the Department of Indian Affairs and Northern Development to research and monitor positive and negative impacts of Inuit rotational employment, including related community impacts and the overall effects on Inuit cultural preferences and lifestyles.

In its supplementary material of April 23, 1980, the Proponent confirmed its intention to extend its employment recruiting area to communities and areas

3 Rotational employment is a practice commonly followed in northern projects whereby workers from northern communities are flown to the project, work for a specific period, then flown to their home communities for a break and replaced by other workers from the communities for a similar work period.

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beyond the Parry Channel region, for example, at Coppermine and Yellowknife.

The Panel believes that the Proponent's recruiting, employment and transportation strategies as contained in its supplementary material filed April 28, 1980, will forestall potential large movement of Inuit to Resolute to seek jobs on the project. Such a move could adversely affect the community and its hunting areas.

The Panel notes the Proponent has not attempted to assess the socio-economic impacts of this decision. The Panel reconnends that the **Proponent** immediate action to extend its information and consultation programs to the expanded recruiting area and further recommends that the Government of the **Northwest Territories and the Proponent** assess the socio-economic impacts of this decision.

In spite of the Proponent's statements at the Resolute meetings, the Panel continues to be concerned that its employment policies and projected employment strategies may not be applied at Panarctic's Drake Point facility. Although Panarctic indicated it would follow these policies and strategies, the Panel recommends appropriate government agencies ensure this is done.

The Panel believes that if there are no serious environmental impacts affecting hunting, trapping and fishing, direct community impacts, other than those associated with rotational employment, would be minimal. Arctic Bay, Pond Inlet and Grise Fiord are located well away from the project.

At Resolute, the Inuit have opportunities for controlling social impacts, due to the location of the community some dis¿cinc D' Apri LC D' rasent of Ababy cn Not fir, ai y Dabe fir it i cania" Not fir, ai y Dabe for the discount 28, 1980, Cannod Le aire incoues of Asi of borad is Ababy of pond of the Coll cala in Not of not roll of L aconio al Lo aire aire ar not cono.

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tance from the airport and associated transient facilities.

#### 3.6.8 Bridport Inlet as a Growth Centre

The Panel recognizes Bridport Inlet has for growth because of inpotential hydrocarbon devel opment creasing shipping in the Northwest potential The Panel recommends that the Passage. Department of Indian Affairs and Northern Development and the Government of the Northwest Territories assess economic growth potentials in the high western Arctic and consider reserving space at Bridport Inlet to meet potential needs government infrastructure services, and potential community development over the long term Should this potential be realized, then there should be a requirement on the part of the Proponent to participate in the costs with such development at associ ated Bridport Inlet if the project does lead to a need for schools and permanent housing.

#### 3.6.9 Small Business Opportunities

The Panel believes the Proponent should make a concerted effort to provide oppor**business** tuni ti es for entrepreneurs resident in the Northwest Territories. It should work with the Government of the Northwest Territories to identify availsupplies and services in Territories and then invite bids from resident firms or individuals to fulfill its construction and operational needs. In the immediate area of the project (high Arctic) the Panel recommends that community Councils and Inuit entrepreneurs be given priority consideration in small business development. The Panel further recommends the Proponent be

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# 3. 6. 10 Rising Energy Costs in Lancaster Sound Communities

Inuit at the community meetings expressed concern about the increasing costs of energy in their communities and queried whether the Arctic Pilot Project would supply energy to the communities. The Proponent indicated that it was examining liquid hydrocarbon sources on Melville Island, unrelated to its own project, as a possible energy source for the communities. The Panel believes this may be a proposal leading to unrealistic expectations on the part of communities.

The Government of the Northwest Territories also pointed out that the sale of gas by Panarctic to the Arctic Pilot Project could be considered as a potential source of income for the Government of the Northwest Territories as royalties from this non-renewable resource.

#### 3.6.11 Community Consultation Programs

The Panel commends the Proponent on its efforts to familiarize the communities with its project over the long term Despite these efforts, it is clear from the community meetings that the consultation program has not been totally effective. Efforts should be made to provide more complete information to the communities and to seek out community comments. The Panel recommends that the Proponent establish a regional information office

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and resident information officer fluent in Inuktitut to meet continual requirements for successful consultation, cooperative planning and implementation of a project such as the Arctic Pilot Project.

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# 3. 6. 12 Long Term Socio-Economic Impact Studies

# Inuit and Inuit organizations at the technical meetings indicated a need for long term socio-economic impact studies. They thought such studies should be carried out with Inuit expertise. The Panel acknowledges increasing Inuit concerns about socio-economic impacts and recommends that the Proponent and government cooperate in funding at appropriate levels to enable Inuit to plan and carry out socio-economic studies related to the project.

#### 3. 7 LONG-TERM RESEARCH

Throughout the meetings at Resolute, it became evident that a great deal of knowledge of the physical, biological and human environment in the Arctic was still needed to predict adequately possible impacts of energy development proposals. This was acknowledged by the Proponent and commitments to undertake further studies were made. In addition, two federal government departments (Environment and Fisheries and Oceans) currently envi ronmental involved in research indicated that they were attempting to extend their involvement in northern environmental work.

While the Panel concludes that a greater use of possible impact scenarios in the Environmental Impact Statement and within the Arctic Pilot Project presentation would have been helpful, it believes it

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has acquired sufficient information to make conclusions and recommendations on the environmental acceptability of this proposed development. However, neither the Panel, nor any one else, can attempt to predict, specifically, long-term developmental impacts to the North as a result of year-round shipping in the Arctic, based upon existing environmental information.

The Lancaster Sound Environmental Assessment Panel referred to this problem and recommended government science programs in the North be expanded in the areas where development is proposed. If the Arctic Pilot Project proceeds within the period being considered, its key element, transportation, may become a stimulant to substantial northern development.

The Panel concludes that the time was never more appropriate and conducive for all federal government agencies concerned (such as Environment; Energy, Mines and Resources: Fisheries and Oceans; Indian **Affairs** and Northern Development: National Research Council and Transport) and the Government of the Northwest Territories to concentrate its resources to carry out northern research in areas i mmi nent devel opment. The Panel recommends that a long-term research program with participation from industry, and territorial governments, universities and research organizations should be established and implemented so that studies related to imminent development schemes would be given priority.

The Panel recognizes that Inuit have knowledge of the local biological and physical environments and suggests that they actively participate in any research program One method of doing this may be for both government and industry to train and employ Inuit as research observers and technicians. Opportunities for Inuit as research observers and technicians may

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be more attractive than construction work for example. This would not only provide an opportunity to utilize their knowledge of the Arctic but also should provide economic benefits through employment. An indication of the Proponent's intent in this regard should be made prior to regulatory approvals.

The Panel concludes that unless a serious effort is put forward by all concerned to significantly increase environmental research in the North, the Arctic Pilot Project cannot be considered as a true "pilot" project and thus a major opportunity to truly assess the short and long term effects of full-scale development in the North will be lost.

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"I am suggesting now that the Arctic Pilot Project could go a great deal further in this respect and could make a commitment to developing means for Inuit to participate not only in the gathering of data but in its analysis and in the consequent formulation of decisions over the progress of the project as it affects the environment and their way of life."

Peter Poole. Inuit Tapirisat of Canada

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". . . the efforts to date to set up monitoring machinery, socio-economic monitoring machinery are very commendable but they need an underpinning and ten years down the line one should be able to tell what has happened to a community like Pond Inlet, or whatever, because of projects like the Arctic Pilot Project, not only because of the Arctic Pilot Project but because of development,..."

Ed Weick
Department of Indian Affairs
and Northern Development

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CHAPTER 4

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CONCLUSIONS AND RECOMMENDATIONS

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#### **CHAPTER 4 - Conclusions and Recorrrnendations**

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#### 4. 1 OVERALL CONCLUSION

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The Environmental Assessment Panel has reviewed the northern component of the Arctic Pilot Project and has found the project to be environmentally acceptable subject to certain conditions. The Panel believes that it is essential that ships be routed to avoid environmentally sensitive areas in Parry Channel and that advantage be taken of the "pilot" nature of this project to monitor and research the effects of year-round shipping in the The Panel concludes that this can be only be achieved through the formation of a control authority to monitor ship movements, and enforce good seamanship and appropriate environmental regu-Without further research on marine mammals, guided by the advice of Inuit, and of government scientists, and without a monitoring and control mechanism for the selection of the shipping routes, the Panel is unable to recommend that the project is environmentally acceptable.

**4.2 RATIONALE** FOR CONCLUSIONS **AND** RECOMMENDATIONS

#### 4.2.1 Introduction

In this section, the Panel outlines its conclusions. the rati onal e for the and recommends a number of conclusions, The Panel considers the conditions. project rationale. long-term implications. development on the Melville Island, the shipping aspects, the overall impact on the human environment and long term research.

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#### 4.2.2 <u>Project Rationale and Long-term</u> Implications

#### Conclusion:

The Arctic Pilot Project would allow examination on a modest scale, of year-round shipment of natural gas from the Arctic.

#### Reason:

1. The project would be a "pilot" project in the sense that it would pioneer year-round arctic transportation and develop in Canada a greater arctic expertise within industry and government.

#### 4.2.3 Melville Island

#### 4.2.3.1 Drake Point Facilities

#### Conclusion:

While there was a lack of specific information on the Drake Point facilities, the Panel concludes that there is nothing unique about the location of the proposal and that there will not be any negative environmental impacts that cannot be satisfactorily mitigated.

#### Recommended Condition:

1. Concerns identified as requiring further consideration with respect to the Drake Point facilities should be resolved to the satisfaction of regulatory agencies before surface leases or land use permits are granted to the company for its facilities.

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#### 4. 2. 3. 2 Pipeline

#### Conclusion:

The proposed pipeline can be constructed and operated in an environmentally acceptable manner.

#### **Reasons:**

- The pipeline can be designed and installed to minimize structural failures principally caused by ground cracking.
- The pipeline might have some effect on the active layer with resultant slope movement or soil erosion; it is unlikely that this would affect the pipeline integrity.
- 3. The Proponent demonstrated the acceptability of its preferred pipeline route over other alternate routes on Melville Island.
- 4. The adverse effects of pipeline construction and operation on the Peary caribou and the muskoxen would be minimal.
- 5. The Proponent demonstrated satisfactorily the merits of a buried pipeline as compared with an above-ground pipeline.
- 6. There are a number of 'design considerations with respect to the pipeline that need further consideration; these can be resolved during the design phases of the project by adequate consultation with the regulatory agencies.

#### Recommended Conditions:

1. During the summer months, only emergency repairs to the

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pipeline should be conducted; other remedial measures should be undertaken when the ground is frozen.

2. Surveillance of the pipeline should be undertaken during construction and operation to detect and take remedial action to correct effects on the terrain.

3. Instrumentation should be installed at selected locations to monitor the pipeline and surrounding soil where the potential for ground cracking is minimal.

and industry Government should implement a program to moni tor and assess effects of the construction and operation of the pipeline on the environment and the environment on the pipeline life of over the project.

5. Concerns with respect to the pipeline relating to frost heave, stream crossings, borrow pits, water supply, waste disposal and erosion and landslide control should be resolved to the satisfaction of regulatory agencies.

- 6. Prohibition of hunting and harassment of wildlife should be strictly enforced; personnel should be informed about ways of minimizing the disturbance caused by fixed-wing aircraft, helicopters and ground vehicles in particular.
- 7. Further monitoring by the Proponent of the muskoxen and caribou population on eastern Melville Island is necessary.
- 8. The Proponent and federal and territorial wildlife services

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- should consider the advisability of programs which would enhance the muskoxen and caribou populations of eastern Melville Island.
- 9. Archeological sites known and revealed during construction activity on Melville Island should be protected; appropriate guidelines laid down by the National Museum should be applied.

#### 4.2.3.3 Bridport Inlet Facilities

#### Conclusion:

With sound engineering design and construction, the shipping terminal at Bridport Inlet can be constructed and operated in an environmentally acceptable manner.

#### **Reasons:**

- 1. The natural harbour at Bridport Inlet and low velocity water currents should facilitate ship docking at the proposed terminal; strong winds should not be a serious constraint to the movement of the vessels in Bridport Inlet.
- 2. The introduction of warm water from the liquefaction plant and ballast water from ships in Bridport Inlet should not have a significant effect on the natural biota of the harbour.
- 3. With proper engineering, it does not appear that the addition of warm water to Bridport Inlet for ice control purposes would affect the stability of the dock facilities.

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- 4. The foundations can be designed to ensure stability of the storage facilities.
- Air emissions from the liquefaction plant would not likely be significant.
- 6. The hazard of bird/aircraft strikes at the proposed Bridport Inlet airport is unlikely to be severe.
- 7. The effects to polar bear caused by the destruction of possible denning sites in Bridport Inlet would not be significant.
- 8. The potential effects of the Mecham River construction activity associated with the Bridport Inlet facilities on anadromous char could not be determined but are unlikely to be serious.

#### Recommended Conditions:

- 1. Monitoring of the geothermal properties of the foundation subsoil should be undertaken by the Proponent and reported to the responsible regulatory agency.
- 2. Weather information should be collected regularly and periodic measurements of ground-level concentrations of nitrogen oxides should be conducted.
- 3. Monitoring of the biology of Bridport Inlet, as per the Proponent's proposal, should be undertaken.
- 4. Garbage disposal regulations at Bridport Inlet should be strictly enforced so as to minimize the attraction of the facility to polar bears.
- 5. River crossings in the Bridport Inlet area should be designed so as to permit fish to migrate upstream, further

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studies of the anadronous char population should be undertaken by the Department of Fisheries and Oceans, at its discretion.

6. The historical and archaeological sites in the Bridport Inlet area warrant protection and principles established by the National Museum should be followed to ensure this occurs.

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#### 4.2.4 Shipping

#### Conclusion:

The Panel is able to endorse, subject to certain conditions, limited shipping on a year-round basis as proposed by the Arctic Pilot Project.

#### Reasons:

- 1. With the navigational aids planned for the vessels, the potential environmental hazards resulting from ship collision with icebergs, bergy bits or growlers would be minimal.
- 2. Effects of wind- and currentinduced ice motion would be primilarily limited to reducing vessel progress rather than causing major structural damage.
- 3. The likelihood of environmental damage, caused by oil or the loss of liquified natural gas either as a spill or through combustion, would be remote.
- 4. The interchange between caribou populations is primarily east-west through the islands north and south of Parry Channel and therefore, the

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- ship's track would be unlikely to have a serious effect on caribou.
- 5. The ships track in ice was projected to fill quickly with a dense rubble of ice; whales would be unlikely to be lured into this rubble by mistaking it for open water.
- 6. The proposed route would be far enough offshore to have a serious effect on the seabird population in the event of an accident.
- 7. Engine noise and the sound of the ships' siren could disturb breeding seabirds, especially murres, however, the ships should be too far offshore for this to have a significant effect.

#### Recommended Conditions:

In recommending conditions under which the project could proceed in an environmentally acceptable manner, the Panel notes certain reservations. These are:

- 1. It is likely that at certain times of the year the ships track will not refreeze quickly and consequently will hinder passage of Inuit hunters and Peary caribou across Parry Channel;
- the ships may have adverse effects on ringed seals in Parry Channel during passages in April and May in particular but possibly also from November onwards when the denning territories are set up; this may have a subsequent impact on polar bears which hunt seals and on the Resolute Inuit hunti ng which is largely dependent on seals and polar bears;

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- 3. the effect of ships' noise caused by the engines and by icebreaking on marine mammals is not well understood; and
- 4. there is a risk that shipinduced changes in ice patterns could occur; this risk of altering ice patterns would increase with increasing ship traffic from other projects.

It is due to these concerns that the Panel stresses the importance of the proposed control authority, the advisory committee and long-term research program proposed by the Proponent.

The advisory committee to be established by the Departments of Environment and Fisheries and Oceans would recommend and approve studies necessary to allow biological information to be effectively integrated into the route selection Membership on the committee process. would include the Proponent, Inuit and government agencies. A control authority should be established by the Minister of Transport to monitor, assist and regulate ship movements in the Arctic and to enforce appropriate regulations such as those now in existence under the Arctic **Prevention** Waters Pollution guidelines created by the committee recommended above. To assist the recom mended authority, government departments should evaluate their regulatory mechanisms to make for them applicable year-round shipping in the Arctic.

With this in mind, the Panel outlines the following conditions:

1. There should be close cooperation between the Proponent and agencies (principally the Atmospheric Environment Service) providing ice and weather information to ensure an adequate weather and ice

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information system is developed for ship operations.

- 2. Additional assessment is required on the characteristics of the tracks, during critical periods of ice cover, which would be left by the carriers, and the implications of these tracks to travel by Inuit and to wild-life.
- 3. Monitoring of the effects of ships transit on regional ice patterns, primarily in the Lancaster Sound area, should occur, with a view to taking corrective action such as suspending or rerouting ship traffic for portions of the season if necessary.
- 4. Cooperation between the Proponent and the appropriate government agencies is required in order to complete the hydrographic information required along the proposed shipping route.
- 5. The selection of ship routing should involve the integration of physical factors and biological factors so as to minimize adverse impacts on wildlife.
- 6. Advantage should be taken of the 5-year lead time between approval and project operation to establish seal numbers and distributions in Parry Channel, as a baseline for assessing the effects of the tanker's passage.
- 7. Before the Proponent establishes route parameters, experimental investigation should be conducted of the effects of underwater noise and icebreaking noise on whales and seals.

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- shoul d be Information dark duri ng the gathered both in terms of season potential physi cal constraints to the project and environmental impacts: study should involve the Proponent, agencies and government Inuit.
- The Proponent and government agencies should cooperate in the development of contingency plans and should keep communities informed about contingency plans relating to shipping accidents or pipe**b**reaks whi ch line havi ng maior perceive as potential for adverse environmental impacts.

# 4.2.5 Human Environment

# Conclusion:

The Panel concludes that any adverse socio-economic impacts can be prevented or mitigated by careful management of the "pilot" project and attention to Inuit concerns by both the Proponent and government.

The Panel has noted the Inuit priority on a land claims settlement and a participatory role in northern development projects. Although di rect soci o- economi c impacts on the communities will be minimal due to the remoteness of the project, indirect impacts may result from rotational employment. **Reservations have** already been expressed by the Panel in section 4.2.4 (Shipping) as to potential effects on sea mammals in Parry Channel, particularly ringed seals, and impacts on Resolute Inuit hunting activities.

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#### Reasons:

- 1. The proposed facilities on Melville Island are remote from Inuit communities.
- 2. The project would offer an opportunity for Inuit to become participants in northern development subject to agreements between government, Inuit and the Proponent.
- 3. The project would provide employment opportunities to Inuit. Employment on a rotational basis according to Inuit preferences would minimize direct impacts on communities.
- 4. The project would be unlikely to affect current population distribution and consequently should not affect existing community services.
- 5. The project would offer a potential revenue base for regional development in the high Arctic.
- The Proponent's biological research programs woul d provide additional information on wildlife resources, particularly sea namals. important to Inuit hunters and trappers and to Inuit lifestyles. Such information would provide a basis for the development of an innovative wildlife management program for the high Arctic.

#### **Recommended Conditions:**

1. The Proponent should clarify its intent and conditions for Inuit involvement in the project so these may be considered by government in consultation with Inuit

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before any regulatory approvals are granted for the

project.

- 2. Should the track not refreeze satisfactorily at seasons important to the Inuit hunting economy, so that Inuit are prevented from crossing Parry Channel, the Proponent, in consultation with Inuit, should develop and provide alternative means of crossing unfrozen ship tracks.
- Subject to the interest of Baffin Region Inuit the (BRIA), Association Proponent shoul d provi de funding to the BRIA resource harvesting study. Such a study carried out as a long term project would provide a monitoring mechanism to record hunter harvests and any changes occuring within the project sphere of influ-Such information combined with environmental research findings may provide a basis for measuring project impacts.
- The Department of Indian Affairs and Northern Development and the Government of the Northwest **Territories** after consultation should. wi th Inuit. establish a compensation mechanism to meet any loss of livelihood experienced by Inuit as a result of the project or costs attributable to adjustments in hunting patterns induced by the project. Acceptance of a general compensation government policy by industry should be a condition attached to any regulatory approvals.

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- Once a decision is taken to proceed with the project, the Proponent should immediately undertake to implement its empl oyment strategies in consultation with government; as the Inuit are unlikely to seek permanent residence at Bridport Inlet due to its remoteness and scarcity of wildlife, rotational employment will provide an alternate means for Inuit to benefit from the project.
- 6. The Proponent, the Government of the Northwest Territories and the Department of Indian Affairs and Northern Development should fund the appropriate Inuit organization(s) to research and monitor the impacts of Inuit rotational employment, including related community impacts and the overall effects on Inuit sociocultural preferences and lifestyles.
- The Proponent should extend its information and consultation programs to the expanded recruiting area; the Government of the Northwest Territories and the **Proponent** socioshoul d the assess impact of this economi c decision.
- 8. Appropriate government agencies should ensure that Panarctic Oils Ltd. will also follow the Proponent's policies and strategies with respect to employment.
- 9. The Department of Indian Affairs and Northern Development and the government of the Northwest Territories should assess the economic growth potential in the high western Arctic and consider reserving space at Bridport

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Inlet to meet potential needs for government infrastructure and services, and potential community development over the long term Should this potential be realized, then there should be a requirement on the part of the Proponent to participate in the costs associated with such development at Bridport Inlet if the project does lead to a need for schools and permanent housing.

- 10. The Proponent should encourage small business opportunities through a policy of giving preference to northern entrepreneurs.
- 11. A regional information office should be established at Resolute by the Proponent and staffed by a resident officer fluent in Inuktitut.
- 12. Research funding should be provided by the Proponent and governments throughout the lifespan of the project to enable Inuit to plan and carry out various socioeconomic studies.

# 4.2.6 Long-Term Research

#### Conclusion:

A long-term research program on the physical, biological and human environment should be established and impleparticipation mented wi th from industry, federal and territorial governments, universities, research organizations and by Inuit so studies related to that imminent development schemes would receive priority.

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# Reasons:

- 1. A great deal of environmental knowledge of the Arctic is still needed to predict adequately possible impacts of energy development proposals.
- 2. Without a long-term research program, the Arctic Pilot Project cannot be considered as a true "pilot" project and as an opportunity to assess the short- and long term effects of year-round shipping in the Arctic.

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# ARCTIC PILOT PROJECT **ENVIRONMENTAL ASSESSMENT PANEL**

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John S. Klenavic Chairman

Davi**t W.I. Marshall** Vice-Chairman



# **4-4-7**



APPENDIX I - BIOGRAPHY OF PANEL MEMBERS

## **CHAIRMAN**

JOHN S. KLENAVIC, Federal Environmental Assessment Review Office, Hull, Quebec.

Mr. Klenavic was born in St. Catherines, Ontario and attended schools in Ontario, British Columbia and Manitoba. He graduated from the Royal Military College, Kingston, and Queen's University with a degree in Chemical Engineering (B.Sc.).

He served in the Canadian and British Armies from 1960 to 1968 and subsequently worked as an industrial engineer and quality control chemist in the food processing industry in Toronto. In 1973 he was appointed Acting Director of the Environmental Emergency Branch, Environmental Protection Service of the Federal Department of the Environment. This Branch is concerned with the prevention of, and response to, spills of pollutants into the environment.

Mr. Klenavic was appointed to his present position of Associate Executive Chairman, Federal Environmental Assessment Review Office in mid-1977 and is currently chairman of ten Environmental Assessment Panels.

Mr. Klenavic is a member of the Association of Professional Engineers of Ontario.

# VICE- CHAIRMAN

D. W.I. MARSHALL, Federal Environmental Assessment Review Office, Hull, Québec.

Mr. Marshall was born in Ottawa and graduated from Queen's University at Kingston with a degree in Chemical Engineering (B.Sc.).

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After performing two years of water quality work on the international section of the St. Lawrence River, he joined the Ontario regional office of the Environmental Protection Service upon its formation in 1972. Mr. Marshall was actively involved in the development of this regional operation and concentrated his efforts in the areas of pollution control and environmental impact assessment.

In April 1978, Mr. Marshall joined the Federal Environmental Assessment Review Office and in addition to being responsible for the administration of five Environnental Assessment Panels, he assumed the duties of Chairman of the Lancaster Sound Environmental Panel. In 1979. Mr. Marshall returned to the Environmental Protection Service as Chief, Environmental Impact Assessment and Design Division and was responsible for the management of a national program designed to examine the environmental effects of proposed developments having broad environmental implications. devel opments These i ncl uded activities associ ated wi th offshore drilling, mining, pipelines, harbours and transportation.

In January 1980, Mr. Marshall returned to the Federal Environmental Assessment Review Office as Director, Pacific Region.

MALCOLM 0. BERRY Atmospheric Environment Service, Department of Environment, Downsview, Ontario.

After completing his B.Sc. in Mathematics and Physics in 1963, and a one-year course in Meteorology, Mr. Berry worked for what is now the Atmospheric Environment Service of the Federal Government as a weather forecaster, in various parts of Canada. While working in this capacity

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at the Arctic Weather Center in Ednonton, he was granted a two-year leave to complete his M.Sc. at the University of Alberta.

In 1973, he transferred to the Arctic Meteorology Section of the Atmospheric As head Environment Service in Toronto. of that section until 1978, involved in weather-related aspects of a wide variety of northern activities such as the Beaufort Sea Project and the Mackenzie Valley Pipeline. In mid-1978, he was appointed to his present position as Chief, Applications and Impact Division of the Atmospheric Envi ronment Service, with responsibility for the analysis and interpretation of climatic information for agriculture, renewable energy and a variety of other applications.

DON BISSETT, Northern Pipelines Branch, Department of Indian Affairs and Northern Development, Ottawa.

Don Bissett graduated from the Mr. University of Western Ontario with a B.A. and MA. and completed a year of post graduate studies at the University of Alberta in the field of economic geogra-He has taught elementary school in remote areas and was a sessional univer-He has been sity lecturer on the north. Northern Servi ce Officer in Keewatin, the eastern arctic and on the He has carried out socioeconomic research in the eastern and western arctic, the Mackenzie Valley and is the author of a number of reports. provi ded Bissett admi ni strati ve support and liaison to the Berger and Lysyk Inquiries on northern pipeline has been Departmental proposals and co-ordinator under the research Environmental/Social Program Northern He is currently Chief of the Pipelines. Division, Northern Public Review Pipelines.

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RICHARD G. B. BROWN, Canadian Wildlife Service, Department of Environment, Dartmouth, Nova Scotia.

Dick Brown was born and educated in England. He graduated from Oxford University in 1957 with a B. A. in Zoology, then specialised in Animal Behaviour and took his D. Phil. at Oxford in 1962. From 1960-1962 he advised the U. K. Ministry of Defence on the dispersal of birds from military airfields, and from 1962-1965 did post-doctoral research at Oxford on the behaviour and ecology of gulls. He came to Canada in 1965 as a research associate at the Department of Psychology, Dalhousie University.

He joined the Canadian Wildlife Service in 1967 and from then until 1971 was engaged in research on bird damage to fruit crops in southern Ontario.

He started to organise the Canadian Wildlife Service seabird research programme in 1969, and since 1971 has been engaged on this full-time, based at the Bedford Institute of Oceanography, Dartmouth, Nova Scotia. His particular interest is the distribution and ecology of seabirds while they are at sea. He has had considerable experience in environmental assessment work involving seabirds and other animals in the eastern Arctic and in Atlantic Canada.

Dr. Brown has done ornithological fieldwork in Lapland (1957-1959) and Alaska (1960), and has taken part in Bedford Institute research cruises in the northern Baffin Bay/Lancaster Sound area (1970, 1974, 1976, 1977), in Hudson Strait (1975), and off Labrador and Atlantic Canada; he also took part in foreign-going Canadian oceanographic cruises to South America (1970,1977), the West Indies (1975), and West Africa (1976).

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ROBERT W HORNAL, Northern Affairs Program, Department of Indian Affairs and Northern Development, Yellowknife, N. W.T.

Mr. Hornal graduated in Honours Geology from Queen's University, Kingston in 1961 and spent two years doing post graduate work in geophysics at Harvard University. In 1963 he joined the Gravity Division of the Earth Physics Branch, Department of Energy, Mines and Resources where he spent seven years conducting geophysical surveys in Northern Canada and interpreting the results in a series of publications.

He joined the Department of Indian Affairs and Northern Development in 1970 as Resident Geologist in Yellowknife. Since that time Mr. Hornal has served in several capacities within the Department and is now Director of the N.W.T. Region for the Northern Affairs Program

As Director for the Northern Affairs Program, he administers legislation controlling mineral exploration, oil and gas drilling and environmental legislation concerning water, forests and lands in the Northwest Territories.

ROD MORRISON, Regional Operations, Government of the Northwest Territories, Yellowknife, N. W.T.

Mr. Morrison studied Economics and Commerce at Simon Fraser University and upon graduation in 1969 moved to Yellowknife, N. WT. After undertaking a variety of Morri son assignments in the north, Mr. was appointed Executive Assistant to the Commissioner of the Northwest Territo-Mr. Morrison worked in this capacity for close to four years and was involved in all activities actively associated wi th the Commissioner's office.

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Following this position, Mr. Morrison moved to Inuvik where he assumed the duties of Assistant Regional Director for the Territorial Government. From Inuvik, he moved to Rankin Inlet to assume the position of Regional Director for the Keewatin. Two and a half years later, Mr. Morrison returned to Yellowknife as the Director of the Department of Personnel.

After a year in the human resource field, Mr. Morrison became Director of Regional Operations for the Territorial Government. In May, 1980, Rod Morrison was appointed to his present position of Deputy-Minister, Department of Economic Development and Tourism His responsibilities include the overall direction, policy development, administration and co-ordination of all departmental programs whose primary objective is to develop a northern economy in a manner compatible with northern lifestyles and aspirations.

406 16 U.S. J. 40046 DPD5 Cp gag  $\Delta^{\omega}$ 60 $\Delta$ 5'  $\Delta^{\omega}$ 60',  $\Delta$ فحدک اح لوم ۵، هو ۵۲ ۱۸ د د د د عالا 40 مع عالا الله أه عالم 1 عال و ۱۶۵ مع oocultoc iste gill. LΔΓ, n-50c0; >5 لُم عاد ۵ مه او علی المرد و مول عداد عداد عداد المرد و المرد ۸۴ و حراد طرد ۱۳۵ ک کود جن کار المی کود کرد الموناد ๔ฃ๙๛๒๎ฃ๎c วหั่่ ๛ opb. Ac' nab ५' กษั้ง  $\Delta L^{\bullet} \circ \Delta^{<} >^{c} \wedge C^{c}$  nab  $\Delta^{c} \subset CLAC \quad L^{-b} \Rightarrow C^{c}$ dopo dos ro codoleiso Λes no All Ac' nab Yr do' od' C'l' JOPP'C DPDS CS DTDS DELO LELTENGE.

## APPENDIX I I - REVIEW DOCUMENTS

- A. Documents submitted by the Arctic Pilot Project to the Environmental Assessment Panel.
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- 2. Environmental Statement Melville Island Components January, 1979.
- 3. Environmental Statement Shipping Component January, 1979.
- 4. Environmental Atlas January, 1979.
- 5. Environmental Statement -Supplementary Information - November 30, 1979.
- Environmental Overview Gas Production Component - March, 1980.
- 7. Socio-Economic Statement North of 60" Latitude November, 1978.
- Geotechnical Evaluation Report (Volumes 1-2), Prepared by EBA Engineering.
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- 10. Conceptual Design for Bridport Inlet Harbour Facilities (Volumes 1-2), Prepared by Fenco.
- 11. Bathymetry and Geotechnical Surveys for Proposed LNG Dock Facilities, Bridport Inlet, Melville Island, N.WT., Prepared by Geocon.
- 12. Seismic Parameters for Designing the Proposed LNG Facilities Bridport Inlet, Prepared by Geocon.

- 13. Study of Influence of Shipping on Break-Up and Freeze-Up in Lancaster Sound. Appendix A, Prepared by Arctec.
- 14. Preliminary Risk Analysis LNG Carrier System A. P. P., Prepared by Arctec.
- 15. Final Reports of Preliminary
  Contingency Plans LNG Carrier
  System A. P. P., Prepared by Arctec.
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- 18. An Analysis of the Air Environment of Bridport Inlet, Prepared by Western Research.
- 19. Comparisons of Wind and Temperature Data Collected on Melville Island at Bridport Inlet, Beverly Inlet and Rea Point Over the Period of July 15, 1977 to May 31, 1978, Prepared by Western Research.
- 20. Capacity Plan.
- 21. Steel Qualities.
- 22. LNG Safety Analysis for the A. P. P., April 1978, Prepared by R & D Associates.
- 23. Track Bridging, Prepared by Arctec Canada Limited.
- 24. Observations of Marine Marrrnal and Sea Bird Interaction with Icebreaking Activities in the High Arctic, Prepared by C. Hatfield Consultants.
- 25. Ice Management within Bridport Inlet Executive Summry Report, Prepared by Acres Consulting Services.

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- 28. Survey of the Marine Environment of Bridport Inlet, Melville Island, Prepared by LGL Limited.
- 29. Active Layer Detachment Slides on King Christian Island and The Sabine Lowland in the High Arctic, Prepared by Hamilton and Bliss.
- 30. An Oceanographic Study of the Bridport Inlet, Melville Island, N. W.T. (Part II and III), Prepared by Frozen Sea Research Group.
- 31. Studies of Terrestrial Mammals on Eastern Melville Island, Prepared by LGL Limited.
- 32. Helium Tritium Analysis, Bridport Inlet, Melville Island, N. W T., Prepared by Zafer Top.
- 33. Pipe Burial Test Section Construction and Monitoring May to September, 1979, Prepared by EBA Engineering Consultants.
- 34. Archeological Site Survey...of
  Bridport Inlet and the Proposed
  Interior Pipeline Corridor, Melville
  Island, N.W.T., Prepared by Dr. Peter
  Schledermann.
- 35. Landscape Survey, Eastern Melville Island 1978 Unpublished Report, Prepared by R. M. Hardy and Associates Limited.

- 36. Number and Distribution of Birds on Eastern Melville Island, July-August, 1977 Unpublished Report, Prepared by LGL Limited.
- 37. Number and Distribution of Marine Mannals Along the Coasts on Eastern Melville Island, July August, 1977 Unpublished Report, Prepared by LGL Limited.
- 38. Studies on Ice Management a Summary Report - December, 1979, Prepared by Acres Consulting Limited.
- B. Documents issued by the Environmental Assessment Panel.
- 1. Draft Guidelines for the Completion of the Environmental Assessment issued by the Environmental Assessment Panel and Submissions on the Petro-Canada Environmental Statement, (June 1979).
- 2. Comments presented to the Environmental Assessment Panel on the Draft Guidelines for the Completion of the Environmental Assessment for the Arctic Pilot Project, (September 1979).
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- 4. A Compendium of Briefs presented to the Arctic Pilot Project Environmental Assessment Panel, 28 March, 1980.
- 5. Transcripts of the Proceedings of the Federal Environmental Assessment Review Panel in the matter of the Arctic Pilot Project at Resolute, Northwest Territories (Volumes 1-13), April, 1980.

APPENDIX III - APPEARANCES BEFORE THE PANEL

Robin Abercrombie Arctic Pilot Project

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Simon Akpaleapik Grise Fiord

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Titus Allooloo Pond Inlet

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Patrick Anderson Arctic Pilot Project

James Arvaluk Frobisher Bay

Simon Awa

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Martin Barnett
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John Bennett Bennett Environmental Consultants Ltd.

Prof. William Bowes Technical Witness

Douglas Bowie Arctic Pilot Project

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Dr. Rolph Davis LGL Limited

Robert Dick Arctic Pilot Project

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Dr. Peter J. Williams Technical Witness

Donald M Wolcott Arctic Pilot Project

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