BUREAU D'AUDIENCES PUBLIQUES SUR L'ENVIRONNEMENT

REPORT ON AN INQUIRY

AND

PUBLIC HEARING

GROS CACOUNA LIQUEFIED NATURAL GAS TERMINAL

TRANSLATED BY: FEDERAL ENVIRONMENTAL ASSESSMENT REVIEW OFFICE

REPORT ON AN INQUIRY

AND

PUBLIC HEARING

VOLUME A

REPORT

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BUREAU D'AUDIENCES PUBLIQUES SUR L'ENVIRONNEMENT

Office of the President

Sainte-Foy, 23 March 1981

Mr. Marcel Léger
Minister of the Environment
Parliament Buildings
Quebec City, Quebec

Dear Sir:

In accordance with the mandate entrusted by you to the Office of public hearings on the environment on 29 October 1980, I am pleased to send you the Report of the Inquiry and Public Hearing into the Project to build a Liquefied Natural Gas Terminal at Gros Cacouna.

I would remind you that for the purpose of this mandate I formed a Commission consisting of Messrs. Georges G. Drapeau, John Klenavic, Luc Ouimet, Michel Yergeau and the undersigned. Messrs. Drapeau and Klenavic were designated by the federal Minister of the Environment and appointed by the Government of Quebec in accordance with the agreement in this regard between yourself and the Honourable John Roberts.

I trust that you will find the report satisfactory.

Michel P. Lamontagne
President

PROJECT TO BUILD
A LIQUEFIED NATURAL GAS TERMINAL
AT GROS CACOUNA

The Minister of the Environment gives notice that, pursuant to section 6(c) of the Environment Quality Act (Revised Statutes of Quebec, 1977, chapter Q-2) enacted by section 1 of chapter 64 of the 1978 statutes, he has entrusted to the Office of public hearings on the environment the mandate to conduct an inquiry and a public hearing into the project to build a liquefied natural gas terminal at Gros Cacouna, as formulated within the framework of the Arctic Pilot Project and as submitted to the Department of the Environment on 16 October 1980 by TransCanada PipeLines Ltd. with a view to obtaining a certificate of authorization pursuant to section 22 of the Environment Quality Act.

(signed)

Marcel Lēger
29 October 1980

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CHAPTER 1

INTRODUCTION

1.1 THE MANDATE

On 29 October 1980, the Minister of the Environment, Mr. Marcel Lēger, charged the Office of public hearings on the environment with the task of conducting an inquiry and holding a public hearing into the project to build a liquefied natural gas terminal on the island of Gros Cacouna. This project, formulated within the framework of the Arctic Pilot Project, was submitted to the Quebec Department of the Environment on 16 October 1980 jointly by TransCanada PipeLines and the Arctic Pilot Project with a view to obtaining a certificate of authorization in favour of TransCanada PipeLines pursuant to section 22 of the Environment Quality Act. The proponents were later informed that their application would fall under section 31 of the said Act.

1.2 THE COMMISSIONERS

In order to carry out this task in accordance with the Office's rules of procedure, Mr. Michel Lamontagne formed a Commission under his presidency comprising the Vice-President of the Office, Mr. Michel Yergeau, Mr. Luc Ouimet, Commissioner, and Messrs. John Klenavic and Georges Drapeau. Messrs. Klenavic and Drapeau were appointed by the Government of Quebec as additional members in accordance with paragraph 2 of section 6(b) of the Environment Quality Act.

Commissioners Klenavic and Drapeau were appointed on the recommendation of Mr. John Roberts, federal Minister of the Environment. In this connection, an agreement had been concluded on 28 November 1979 between the federal and Quebec Ministers of the Environment. This method of appointment was adopted to permit a joint approach to the evaluation of the possible environmental impact of the proposed liquefied natural gas terminal on Gros Cacouna Island. This report will thus be applicable

at both the provincial and federal levels and will avoid duplication of hearings on this question, which could also have been the subject of a hearing before the Federal Environmental Assessment Review Office.

1.3 INFORMATION

In every case submitted to it, the Office considers that it is responsible for ensuring that information is as complete and accessible as possible, taking into account the circumstances of each task assigned to it. It would be ridiculous to believe that the public could take an active part in the discussion during the course of a hearing unless it had been given the opportunity to acquire a good understanding of the subject before hand. This is in accordance with the principle that "the duty to submit is accompanied by the right to know".

With this in mind, the Office opened documentation and information centres in the municipal hall of St-Georges-de-Cacouna and in its permanent premises in Montreal and Quebec. Documentation relative to the application of TransCanada PipeLines and the Arctic Pilot Project, as well as other documents which could facilitate a better understanding of the project as formulated by the proponents, was available at these centres. Since access to these documents was often difficult, owning both to their volume and to their content, representatives of the Office of public hearings on the environment were assigned to each centre from Wednesday to Friday inclusive, following a schedule which enabled interested persons to obtain information outside normal working hours. The Federal Environmental Assessment Review Office offered its help and seconded personnel to the centres. The information centres were open from 13 November to 19 December 1980 and from 7 January until the end of the hearing.

1.4 THE HEARING

The hearing, in accordance with the Office's rules of procedure, was held in two separate parts. The first part was intended to permit the public and the Commission to become better acquainted with the case and to ask all the necessary questions in order to fully understand the project. The second part of the hearing was devoted exclusively to hearing briefs and opinions of individuals, groups and municipalities.

The first part of the hearing took place in the Rivière-du-Loup City Hall on 14 January 1981, and the second part on 17, 18 and 19 February 1981. During the second part, 18 briefs were submitted, of which 5 were from federal or provincial departments. Only one person made an oral presentation without having previously submitted a brief.

1.5 THE STRAIT OF CANSO (NOVA SCOTIA) CASE

With regard to the purpose of the hearing, several intervenors raised a question during the first evening which the Commission had to deal with at the beginning of the proceedings. It was in fact evident from the first session of the hearing that the question of an alternative site in Nova Scotia proposed by the proponents was a matter of major concern to the group interested in the development of the Rivière-du-Loup, Cacouna region, particularly after October 1980.

The Commission understands these concerns in view of all the questions left unanswered, particularly since the announcement of the federal government's intention to subsidize the construction of a gas pipeline to Nova Scotia. In the summary of the documents supporting their application of 16 October 1980, the proponents stated:

> If a timely decision is taken to construct a Maritime gas pipeline, the Melford Point location would be given equal consideration with Gros Cacouna by the Applicant. (Application, Vol 1, p. 5-1.)

Since that date, the federal authorities have expressed the firm intention of extending the gas pipeline to Nova Scotia, although approval has not yet been granted by the National Energy Board.

This condition, mentioned in mid-October 1980 by the proponents, has been met, according to them, as confirmed in a memorandum dated 27 January 1981 (document DD3). It is only a small step from this for the groups interested in promoting the Cacouna site to consider the Canso site a rival or threat. In this regard, Mr. Serge Bernier, speaking on behalf of the Jeune Chambre de Rivière-du-Loup (Junior Chamber of Rivière-du-Loup) stated at the 14 January 1981 session:

> Because it's always the same, we give all our information --- if we wish to promote our area, after all, we should also know what they have there: they will be able to find out what we have here, but we don't know what they have there. (Transcript of session of 14 January, p. 74.)

Obviously, the rules of the game must be clear in this regard. The Commission finds that too many broken promises and missed deadlines extending over several decades have resulted in spreading scepticism and even distrust in connection with any new project relating to Gros Cacouna. For many internenors who appeared at the hearing, too many ambiguities have been maintained for partisan or vote-getting purposes.

The Office of public hearings on the environment has not, however, received a mandate to discuss the Cacouna and Melford Point sites in order to decide which would be preferable. Its jurisdiction is limited to Quebec and the purpose of its mandate was - and is - solely to discuss the site proposed in the Rivière-du-Loup region with a view to assisting the Province of Quebec to exercise its jurisdiction in matters affecting the environment of its territory with full knowledge of the situation.

This report, then, deals only with the site proposed by the proponents for the construction of a liquefied natural gas terminal on the Island of Gros Cacouna, on the south shore of the St. Lawrence in the vicinity of Cacouna. There will be no further mention in this report of the alternative site at Melford Point. It is, however, important to remember that this question is ever present in this case and remains in the background of the problems affecting development of this region of Quebec.

1.6 THE CONCEPT OF ENVIRONMENT

We shall define from the outset the concept of environment as set forth by the authors of the Environment Quality Act (Revised Statutes of Quebec, ch. Q-2) and as understood by the Bureau. Given the diversity of the questions raised and the frequently differing local interests, the Office, as it has already mentioned in earlier reports, does not restrict the concept of environment to biophysical aspects only, but also includes social, economic and cultural concerns peculiar to the region involved. In this regard it should be remembered that paragraph 4 of section 1 of the Environment Quality Act defines the environment as being, amongst other things, "the ambient milieu with which living species have dynamic relations". Section 3(1)(i)(b) of the same Act provides for the determination of the parameters of environmental impact studies, taking into particular consideration the impact not only on the natural and the biophysical milieu but also on human communities, ecosystem balance, archeological and historical sites and cultural property. In addition, Division IV of the Act prohibits the emission, deposit, issuance or discharge of any contaminant of which:

> (---) the presence of which in the environment
> (---) is likely to affect the life, health, safety, welfare or comfort of human beings or to cause damage to or otherwise impair the quality of the soil, vegetation, wild-life or property. (Section 20, paragraph 22.)

The legislator has adopted a generous and all-encompassing concept of the environment as a milieu where people live and work and the Office, in the exercise of its functions, cannot restrict its field of study and inquiry to only physical considerations, excluding man and his activities from its concerns. If it were to do so, the public would not tolerate the fact that an organization such as the Office of public hearings on the environment existed solely to deal with problems affecting water quality, air and the flora and fauna, while no other organization existed to pay heed to the members of the human communities affected by projects.

The limited participation of the public and of local groups in the first part of the hearing, held on 14 January 1980, can be explained by this view of the environment as being restricted to biophysical elements.

Numerous testimonies confirm that participation increased vastly during the second part of the hearing, when the broader concept of the environment had been understood in the region. In this regard, we emphasize the preamble to the brief of the Rivière-du-Loup Chamber of Commerce, which reads:

> The Rivière-du-Loup Chamber of Commerce has already written to say that it did not intend to submit a brief. In effect, our understanding of the role of your organization being that you would hear those wishing to file objections or to make specific suggestions concerning the physical environment of a possible liquefied natural gas terminal at Cacouna, we did not consider our participation to be appropriate. (Brief no 17, p. 1.)

This also held true for the Chambre de commerce, d'industrie et de tourisme de la région du Grand-Portage (Grand-Portage region chamber of commerce, industry and tourism) which had decided not to submit a brief to the Office and which justified its change of attitude as follows:

> We were informed that your Commission would hear submissions only concerning the environment. Our absence was due to the fact that we consider our group as being primarily socio-economic. (Brief no 18, p 1.)

The Commission then proceeded to study not only the foreseeable impact of the project, as formulated by the proponents, on the natural environment of the island and the wetlands of Gros Cacouna, but also the advantages and consequences of such a project for the social and economic structure of the Kamouraska - Rivière-du-Loup - Témiscouata (KRT) region. This report presents the findings of the Commission and its analysis.

1.7 ORGANIZATION OF THE REPORT

The report first defines the project and establishes the problems associated with it. Then it describes the KRT region, with special emphasis on the site of the Island of Gros Cacouna and St-Georges-de-Cacouna with respect to both physical and socio-economic aspects. Next, the contents of the impact studies prepared by TransCanada PipeLines and the Arctic Pilot Project in support of their application are presented in summary form, with special emphasis on the methodology used. Fourthly, the report reviews briefly the chief concerns of the intervenors at the hearing. These various elements having been dealt with, it becomes easier to analyse the project with regard to both its acceptability and the mitigative measures which the Commission members feel are necessary. The report studies the acceptability of the project in terms of safety and the biophysical environment as well as of socio-economic and cultural factors. Finally, the last chapter reviews the main points raised at the hearing and incorporates the various elements of the analysis, in summary form, in order to arrive at a number of recommendations.

1.8 DEFINITIONS

It should be mentioned that, for the purposes of this report, the word 'proponents' or 'proponent' refers to the TransCanada PipeLines and the Arctic Pilot Project, and that LNG is the abbreviation normally used for "liquefied natural gas".

In addition, the volumes entitled:

> Application for a Certificate of Authorization to Construct an LNG Terminal at Gros Cacouna, Province of Quebec, Vols I-IV.

will be referred to as 'the application', including principally the impact study. Finally, the references to briefs submitted during the hearing apply to the full texts of the briefs listed in the appendix to this report.

CHAPTER 2

THE GROS CACOUNA LIQUEFIED NATURAL GAS TERMINAL PROJECT

TransCanada PipeLines proposes to construct an LNG terminal on Gros Cacouna Island as part of the Arctic Pilot Project. In order to put this proposal in proper perspective, it is appropriate to begin by briefly describing the Arctic Pilot Project as presented in the application and explained during the hearing.

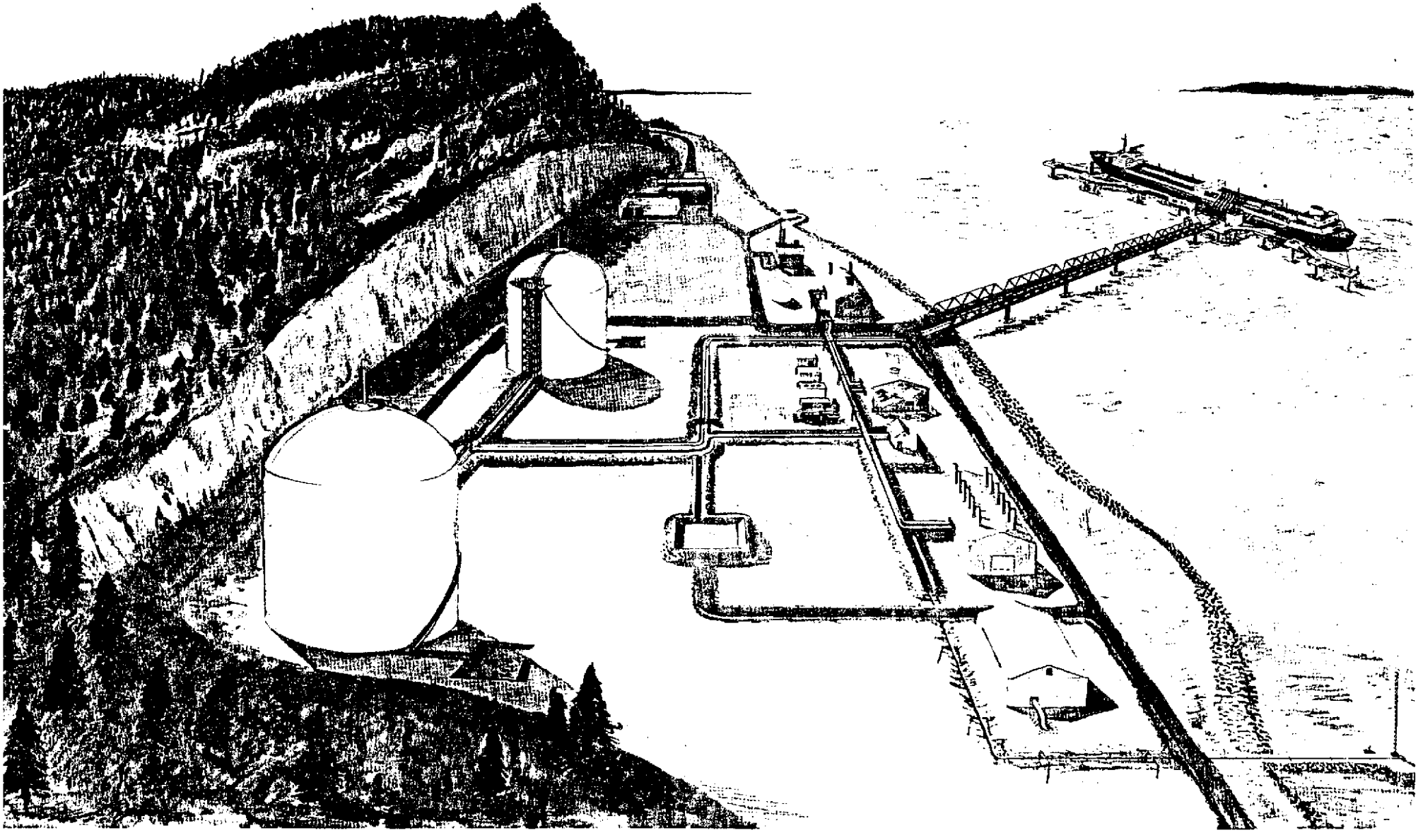
A consortium of companies, including Petro-Canada, is planning to develop a natural gas field on Melville Island in the Canadian Arctic and to ship the gas, in liquefied form, on board two ice-breaking carriers to the markets of Eastern Canada. The liquefied gas would be stored there and vaporized for distribution to consumers via a system of existing and planned pipelines.

The project is described as 'pilot' since it will initially test technology not yet applied in Canada, nor, in some respects, in the rest of the world. In fact, ice-breaking LNG carriers will be used for the first time, such vessels never having previously been built. It would also be the first Canadian experiment in the processing and transport of LNG on such a large scale and under such climatic conditions.

Finally, the project is a pilot project since only two LNG carriers will be used. The gas reserves in the Arctic are large enough that it is conceivable that a fleet of carriers would be used to ship the LNG south, or export it, if the pilot project were successful.

2.1 GAS EXTRACTION AND LIQUEFACTION

The Arctic Pilot Project can be divided into three components. First we have the northern component, involving gas extraction from the ground at Drake Point and transportation by pipeline over a distance of



A-3 FIGURE 1
ARTIST'S RENDERING OF THE LNG RECEIVING TERMINAL AT ORCO CACHUNA

160 km to Bridport Inlet on Melville Island, where a gas liquefaction plant and LNG storage tanks will be built. The liquefaction process involves cooling the gas to -160°C. Following liquefaction, the volume occupied is 1/600th of the gaseous volume; the liquefied gas would be stored at approximately atmospheric pressure. In the gaseous state the composition of the gas is 98% methane. The installations would be mounted on barges which would remain permanently at Bridport Inlet. From here the LNG would be loaded on to ice-breaking carriers and transported to a terminal in southeastern Canada.

2.2 LNG TRANSPORT

The second component of the project includes shipment to the Gulf by way of Parry Channel, Baffin Bay, the Labrador Sea and Belle-Isle Strait. From Belle-Isle Strait the LNG carriers will pass through the Gulf of St. Lawrence off the North shore of Anticosti Island (Jacques Cartier Strait) and sail upriver to the mouth of the Saguenay. They will then leave the main shipping channel and cross the river to Grós Cacouna Island. Except for the port approach the LNG carriers will use the one-way navigation channels which regulate marine traffic in the St. Lawrence estuary.

The vessels used will be specially built. They will be 370 m long with a beam of 43 m and a power rating of 180.000 HP (134.3 Mw). They will be able to carry 140.000m^3 of LNG and will be built as class 7 icebreakers capable of navigating in ice 2 metres thick. Each will carry 600 tons of diesel fuel in reserve, and will be able to operate with either gas or diesel fuel.

Each carrier will have six insulated membrane-type tanks for storing the LNG at a temperature of -160°C throughout the voyage. Part of the LNG will be vaporized and used as fuel for the vessel. In the event of an emergency - for example, if accelerated vaporisation occurred due to a break in the insulation - excess gas would be released into the

atmosphere via safety valves. Navigation equipment will include two radars, a gyro-compass, a satellite navigation system, a Loran C radio-navigation system, a Decca radio navigation system and a short-range position finder. Each crew would have 42 members and each carrier would make 15 round-trips per year, so that there would be a carrier alongside the terminal approximately every 12 days.

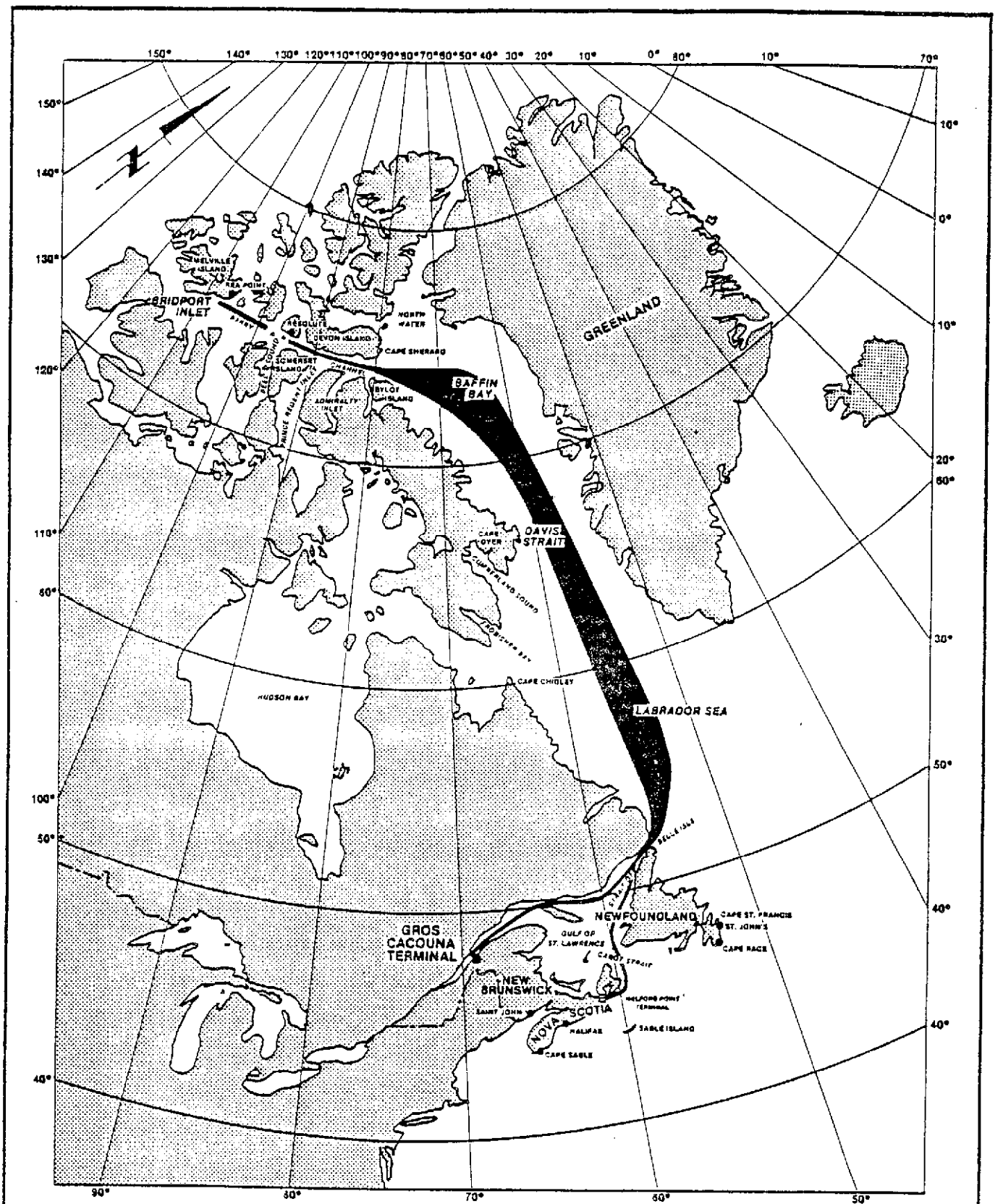
2.3 GROS CACOUNA LNG TERMINAL

The third component of the Arctic Pilot Project, the terminal, is the principal concern of the Commission's mandate. It involves a terminal where the LNG would be stored in liquid form, vaporized and distributed via a cross-over linking the terminal to the main pipeline system.

The terminal will comprise three main elements:

- The LNG transshipment area comprising a wharf for the carriers approximately 400 m from the shore and connected to the shore by a bridge. Pipes for the transfer of LNG and gas return to the vessel will be attached to this bridge.

- Two LNG Storage Tanks each having a capacity of 100.000m^3. The final decision as to the construction method to be used for these tanks has not yet been made; the application indicates, however, that the tanks would be made of double-wall prestressed concrete and have a diameter of 66.7 m and a height of 34.5 m. The inner and outer walls would be made of pre-cast concrete segments which would be post-tensioned after erection. A space of 1.1 m between the walls would be filled with insulation. The outer wall would be designed to withstand thermal shock and the hydro-dynamic and hydro-static forces involved in a rupture of the primary storage system. Retaining basins would be provided to totally contain a possible major leak, which the proponent estimates at 3.375 m^3.



S-1 FIGURE 1
CORRIDOR FOLLOWED BY
LNG CARRIERS

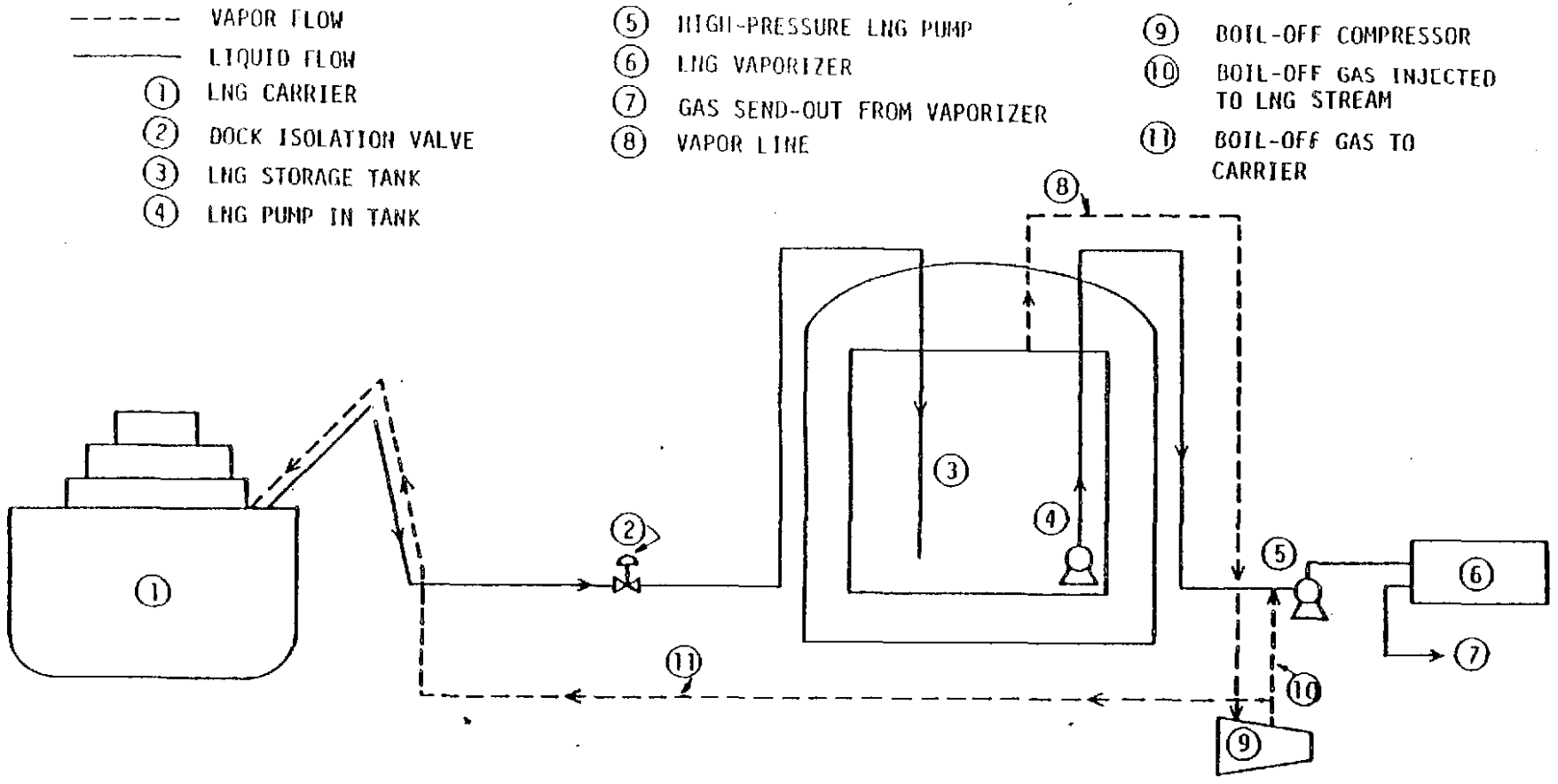
- LNG Vaporization System. The liquefied gas would be brought to the vaporizer by low - and high - pressure pumps. The vaporization system is designed to produce 6.37×10^6 m^3 of natural gas at 10°C per day on a continuous basis and uses six submerged vaporizers operating on gas.

The sketch on the following page, shows the method of transshipment and vaporization of the LNG. The gas is routed via pipeline to the main distribution system. The exact route of the pipeline has not yet been determined.

2.4 ENVIRONMENTAL ASSESSMENT OF THE NORTHERN COMPONENT OF THE PROJECT

Part of the Arctic Pilot Project has already been the subject of an environmental impact study. The exploitation of gas wells on Melville Island, pipeline transmission, liquefaction and transport of LNG on board carriers north of the 60° parallel are aspects of the project which have already been subjected to the federal environmental assessment and review process. The Commission formed by the Federal Environmental Assessment Review Office in November 1977 to examine the project had a mandate to formulate, for the Federal Minister of the Environment, recommendations dealing with the environmental acceptability and socio-economic implications of the aspects of the project mentioned above. In its report, published in October 1980, the Commission concluded that the project as presented was environmentally acceptable provided certain conditions were met. In this regard the two principal recommendations of the Commission are the following:

(----) the Minister of Transport should create a control authority responsible for monitoring, assisting and regulating ship movements and enforcing appropriate regulations in an environmentally sensitive area.



S-1 FIGURE 3
LNG FLOW AT THE LNG RECEIVING TERMINAL

> (---) the Department of the Environment and the Department of Fisheries and Oceans should form an advisory committee which would recommend and approve the studies needed to ensure that the necessary biological information be effectively integrated into the route selection procedures to be followed: the proponent, the Inuit, and other government agencies should also be represented on this Committee. (Report of the Environmental Assessment Panel, Arctic Pilot Project (Northern Component), Federal Environmental Assessment Review Office, Report #14 October 1980.)

2.5 THE ENERGY CONTEXT

The Cacouna LNG terminal project cannot be examined outside the context of government energy policies. Both levels of government recognize that oil occupies too large a place in our pattern of energy consumption, in view of the fact that reserves are steadily diminishing and security of supply is far from being assured. They have decided to promote the development of other sources of energy, such as natural gas, in order to ensure increased energy independence for the country.

The Quebec Government, as stated in its White Paper on Energy Policy, published in 1978, intends to promote increased reliance on natural gas as a means of satisfying Quebec's energy needs:

> In preparing our forecasts, we have adopted the hypothesis that natural gas could, depending on the conditions applied, satisfy between 6 and 12% of the energy needs of Quebec by 1990. (La Politique québécoise de l'énergie: assurer l'avenir.) (The Quebec energy policy: to protect the Future, 1978 p 62.)

The Quebec Department of Energy and Resources reiterated this point during its intervention in the first part of the hearing:

> In fact, in addition to generating potentially substantial economic benefits, this project lends support to the objective of increased penetration of natural gas into Quebec's energy balance. Although initially the pursuit of this objective depends on the availability of gas stocks from Alberta, the security of our supply would be greatly enhanced by the diversification of sources of supply which Quebec would achieve if it had regasification infrastructures on its territory (---). The connection of the LNG terminal to the gas supply system represents a further development in transport infrastructures which offers the opportunity to serve regions that would probably otherwise not be served. (Transcript of public hearing, Session of 19 January 1981, pp 89-90)

In its national energy program, made public in 1980, the Canadian Government also leans toward a reduction in the use of oil in favour of other less expensive fuels that are more readily available in Canada. Relying on arguments such as the fact that Canada is a net exporter of energy, the National Energy Program emphasizes the importance of reducing our oil consumption, for which we control neither the price nor the supply. The use of natural gas will be encouraged if financial incentives are provided for production and if the price of natural gas is more attractive to the consumer than the price of oil.

> Pricing policy for natural gas must meet two needs: provision of adequate incentive to production, and strong encouragement for consumers to use natural gas in preference to oil. (The National Energy Program, 1980, p 33.)

The conversion from oil to other fuels such as natural gas will also be encouraged by subsidizing consumers wishing to make such a conversion.

> The Government will seek agreement with the provinces for the implementation of a program of incentives to assist home owners and businesses to convert from oil. While details of the program may vary among provinces, the core program envisages grants to consumers to help cover their costs of conversions. (The National Energy Program, 1980, p 60.)

The federal government also intends to promote the development of the Canadian pipeline system to ensure the widest possible availability of natural gas.

CHAPTER 3

THE REGION

3.1 THE KAMOURASKA - RIVIERE-DU-LOUP - TEMISCOUATA REGION

At the hearing, the intervenors did not always refer to the same region. For example, some used the 01 region (Eastern Quebec) as a reference; this is a vast area stretching from La Pocatière to Gaspé which even includes the Magdalen Islands. Another reference region is designated by the initials KRT and is made up essentially of the counties of Kamouraska, Rivière-du-Loup and Témiscouata. On a still smaller scale, there is also the Rivière-du-Loup area; this comprises the area immediately surrounding Cacouna and encompasses the municipalities of Notre-Dame-du-Portage, Saint-Patrice, Rivière-du-Loup and the village and parish of Cacouna.

It is primarily the Rivière-du-Loup area that will be affected by the presence of the terminal, although during the construction period the recruitment of workers and the economic impact will probably spread throughout the KRT region.

The proponent has broken down the effects of the LNG terminal according to revenue and employment specifically for the KRT region; this data is given in the table on the following page. At the same time as the increase in employment that would be generated by the construction of the terminal and subsequently by its operation, it is interesting to examine the labour market and manpower situation in the KRT region. The per capita disposable income in the KRT region in 1977-78 was $3 439, or less than the Quebec average of $5 310 and the Rivière-du-Loup average of $5 210 (Dossier économique Rivière-du-Loup, Rivière-du-Loup economic review), Government of Quebec, Department of Industry and Commerce, 1978.)

IMPACT ON INCOME AND EMPLOYMENT: KRT REGION

		Direct Expenditures ($000, 1979)	Direct Employment (Man/Years)
Construction 1981-1985		45 460	715.75
LNG Carrier Operation	1 year	1 175	28
	20 years	23 500	560
LNG Terminal Operation	1 year	815	13
	20 years	16 300	260

(Application, Vol IV p. C-89,90)

LABOUR MARKET: KRT (1977-78)

Total Population	86 240
Active Population	34 355
Employed	28 575
Unemployed	5 780
Unemployment Rate	16.6%

(Rivière-du-Loup economic review, Government of Quebec, Department of Industry and Commerce, 1978.)

SECTORIAL DISTRIBUTION OF WORK FORCE
KRT REGION (1978)

Sector	Active Population	%
Primary		
Agriculture	4 466	13.0
Fishing and Forestry	2 405	7.0
Mining	550	1.6
Secondary		
Manufacturing	4 157	12.1
Construction	2 439	7.1
Tertiary		
Transport and Communications	2 508	7.3
Trade	3 916	11.4
Finance	687	2.0
Services	8 864	25.8
Public Administration	1 477	4.3
Not specified	2 886	8.4
TOTAL	34 355	100.0

(Application, Table 2 (C-3), Vol. IV, p. C-25.)

The preceding data reveal three important points: a high unemployment rate, an income level beneath the provincial average and a lower concentration of employment in the secondary sector than in other sectors. It must be borne in mind, however, that the major impact will occur during the construction phase and that it is only during this period of 3 to 4 years that the port would have a regional (KRT) influence on employment. Once the construction phase is finished the impact of the LNG port, owing to the small number of permanent jobs created, would be felt mainly in the Rivière-du-Loup area.

3.2 THE RIVIERE-DU-LOUP AREA

The Rivière-du-Loup area is defined by the Quebec Department of Industry and Commerce as comprising the municipalities of Notre-Dame-du-Portage, St-Patrice, Rivière-du-Loup and the village and parish of Cacouna. The population in these five municipalities totals 17 722.

The Rivière-du-Loup area is a crossroads and has been so since it was first used by the Amerindians and settlers as the 'grand portage' between Lake Témiscouata and the St-Jean river. Rivière-du-Loup is now a major junction for highway, railway, marine, and even air routes. It is in this area that highway 20 from Québec and Montréal meets highway 185 from the Maritime provinces and Maine. These roads also connect with highway 132 from the Gaspésie. It is much the same in the case of the railway. The national railway system connects the region on one side to Montréal and on the other side to the lower St. Lawrence region, the Matapédia Valley, New Brunswick and Nova Scotia. The transcontinental system connects the region to St. John (New Brunswick), Maine and the New England coast. In addition, the area is linked to the North Shore by a ferry service between Rivière-du-Loup and St-Siméon. The present harbour of Gros Cacouna is also an infrastructure that can give significant impetres to marine traffic in view of the distribution facilities offered by the railway system. Finally, the area is served by an airport with a 1825 m runway at Notre-Dame-du-Portage.

The Rivière-du-Loup area is well organized with regard to services and recreational facilities. Schools at the various levels of the educational system can be found in Rivière-du-Loup, including a Cégep. The development of infrastructures for educational purposes has made it possible to provide the area with sports facilities which could serve the entire population. Health services are also very well organized and there are 350 beds available at 2 hospitals which are served by more than 50 doctors.

3.2.1 AGRICULTURE

There are 85 farms within the area with 83 being classified as milk producers. Of these 25 are also potato producers. More than half of the region's area is classified as a "good to very good" agricultural land. The soil in the region is excellent for fodder crops and cereals, especially oats and barley, and vegetables such as potatoes, cabbage and celery. The farms of the region cover an area of 7425 hectares, of which 5130 are cultivated. Dairy production is the largest sector; in 1976 it accounted for revenues of $1 895 320, as compared with $238 221 for potato production (Rivière-du-Loup economic review, Department of Industry and Commerce, Government of Quebec, 1978).

3.2.2 FORESTRY

The forest is not an important resource in the immediate vicinity of Cacouna. However, it is important in the adjacent inland area and provides raw material for industries located in the Rivière-du-Loup area.

3.2.3 MINING

Peat is the chief product of the local mining industry. In 1977, there were 17 peat cutting operations within a 20 km radius of Cacouna, with

a total production of 137 000 metric tonnes. This production represented a volume of $4 500 000 and was half of the total Quebec peat production. There are also substantial deposits of gravel and sand in the Cacouna area as well as outcroppings of sandstone and slate which could be exploited.

During the second part of the hearing the caucus of Parti Québécois Members for Eastern Quebec drew the Commission's attention to the Parke underground reservoir.

This is a potential reservoir located 40 km south of Rivière-du-Loup. Information provided by SOQUIP (Société québécoise d'initiatives pétrolières) in a memorandum dated October 1980 indicates that the reservoir rocks are some 2000 m below the surface. The permeability of these rocks has been measured and SOQUIP reports that constructed pressure curves show that the limits of the reservoir were not reached at the time of the production test. SOQUIP has not been able to supply the Commission with details regarding the impermeability of the reservoir. If the reservoir is airtight and is large enough, it could be used for the storage of natural gas to meet peak demands or even, if the capacity permitted, to accumulate strategic reserves.

3.2.4 COMMERCIAL FISHING

Fishing is practised using mainly fixed gear which is especially effective due to the rhythm of the tides. The principal species fished in the Rivière-du-Loup area, including Ile Verte, are eel, herring, halibut and capelin. In 1980 the catch returned some $575 000 to local fisherman. Eel is by far the most profitable catch, having accounted for almost $460 000, as compared with herring, which is in second place, and for which the catch totalled slightly more than $54 000. (Source: BSQ and MAPA, 1980.)

3.2.5 INDUSTRY

Most industries in the region are located at Rivière-du-Loup. The most important are pulp and paper, textiles, metallurgy and food and beverages. The development of the industrial sector has followed an interesting pattern; in 1972, there were 23 manufacturing establishments employing 373 workers, while in 1976 there were 945 workers and 6 more enterprises. This substantial increase in industrial jobs (triple) results from major investments in the industrial sector on the order of $65 000 000 between 1973 and 1977. It should be noted that Rivière-du-Loup has had since 1975 an industrial park of 205 hectares located east of the town. (Source: MIC 1978.)

3.2.6 COMMERCE

Rivière-du-Loup is the commercial centre of the region; it has some 150 commercial establishments, and is thus able to support intensive development projects. The automobile sales sector is the most important in terms of business volume, expressed in dollars. This volume amounted to almost $13 000 000 in 1971, or close to half of the total business volume of approximately $29 000 000. The other leading sectors of commercial activity, on the order of $3 000 000 to $5 000 000, are food products, clothing and hardware. (Source: MIC 1978.)

3.2.7 TOURISM

The fact that Rivière-du-Loup is situated at a natural crossroads has made it an important tourist centre. Add to this the beauty of the countryside both along the shores of the St. Lawrence and inland, and it is easy to understand the presence of 33 hotels/motels and some 40 dining rooms and restaurants in Rivière-du-Loup. The 900 rooms available provide accommodation for an estimated 1500 tourists per day.

3.3 CACOUNA AND THE TERMINAL SITE

3.3.1 CACOUNA

The population of the two municipalities of the village and parish of Cacouna totals 1700. The village, which has 1080 inhabitants, is 3 km from the site of the LNG terminal.

Agriculture is the principal activity in Cacouna, where farmers are able to turn to account the excellent quality of the soil. There are also two commercial peat-cutting operations at Cacouna. Fishing is practised using fixed gear. Between the bend of the Rivière-du-Loup at the upstream extremity of Cacouna and the rivière des Vases at the downstream limit, 32 fishing licences were issued in 1980, 13 of them being for eel. Cacouna was, and still is, a popular vacation spot, as attested to by the villas strung out at the western end of the village, the most sumptuous being the Allen villa, which was left to the Capuchin Fathers.

3.3.2 THE SITE

The site selected by the applicant is located on the northeast face of the Island of Gros Cacouna and is backed by the highest part of the hill which forms the island. An area of 135 000 m^2 d will be developed at this location by excavating part of the hillside and using the excavated material to build a shelf extending some 50 m from the present shore line for a distance of about 600 m. The transshipment wharf will be located about 500 m from the shore at a depth of 15 m and will be able to accommodate vessels up to 375 m. The LNG terminal will be connected by road to existing port facilities at the western end of the island.

The Island of Gros Cacouna has been identified as a harbour development zone for many years. Despite the construction of jetties and dredging in 1968, it was not until 1979 that the first wharf was completed, permitting Gros Cacouna to be used as a regional port.

CHAPTER 4

METHODOLOGY OF THE IMPACT STUDY

Section III of the general regulations governing the assessment and review of environmental impacts describes the parameters that may be used in an impact study and stipulates, in paragraph (e) that "environmental impact studies must be scientifically designed and prepared". The purpose of this chapter is to describe and analyse the method used by the proponent. The content of the impact study was defined by the latter and approved by the Department of the Environment with some modifications.

4.1 SITE SELECTION METHOD

The methodology used by the proponent in choosing a site for the implementation of its project is governed by the following objective:

> The site ultimately chosen should conform, not only to stringent technical and security standards, but would be environmentally acceptable, and would entail maximum benefits of a socio-economic nature.
> (Application, Vol 2, p 4.)

In order to achieve this objective, the proponent has proceeded in stages since 1978. A brief description of each of these stages follows.

4.1.1 STAGE ONE:

DEFINITION OF PROJECT CHARACTERISTICS

The proponent first defined the main elements of its project and the equipment required. This data provided information on the technical requirements of the project. Then the proponent evaluated the effects

of the project, effects which it regarded as residual, assuming that the site were well chosen. Following this, and based on available data and preliminary consultation, the proponent selected eight possible sites in the middle estuary of the St. Lawrence River, six of these being on the south shore and two on the north shore. Although the study does not indicate the source of the data used in choosing the sites, the proponent informed the Commission at the hearing that it had used studies carried out or commissioned by various federal and provincial departments to identify sites suitable for the establishment of tanker super-ports in the St. Lawrence estuary. The proponent is of the opinion that certain conclusions of these studies, even though based on different selection criteria, could be applied to the LNG terminal project.

The chief considerations involved in the selection of these eight sites are: proximity and accessibility to the natural gas market, technical and economic feasibility of connection with the main gas pipeline system, navigational safety, general bathymetric considerations, current velocities, ice conditions, dredging requirements for terminal construction and operation and various prerequisites related to public safety. Preliminary discussions between the proponent and the responsible Quebec government authorities, a special study carried out by the National Harbours Board specifically for the project, consultation with St. Lawrence Seaway pilots and with a former Commander of the Canadian Coast Guard and an aerial survey of the middle estuary were all involved in selecting these eight sites. (Etude de l'île aux Lièvres comme site potentiel pour l'implantation d'un terminal méthanier, study of Ile-aux-Lièvres as a potential LNG terminal site), January 1981, André Marsan et Associés Inc., p 2.

4.1.2 STAGE TWO:

DESCRIPTION OF SITES SELECTED

Each of the sites selected was described and analysed in terms of biological resources, land use and socio-economic considerations. This

second stage was completed taking into account only data available from publications and maps. Charts were prepared for each site showing the biophysical and socio-human components within a 5 km radius.

4.1.3 STAGE THREE:

CHOICE OF SELECTION CRITERIA

The proponent established criteria for four categories of factors in the form of minimal technical requirements for the construction and operation of the project or in the form of a set of characteristics necessary to ensure a high degree of compatibility with the socio-economic and biophysical environments affected. These factors are as follows: technical compatibility, ecological and land use compatibility, socio-economic desirability and safety. For further information on these criteria, the reader should refer to the table from the Application on the following page.

4.1.4 STAGE FOUR:

COMPARATIVE SITE EVALUATION METHODOLOGY

The method chosen was an adaptation of the Delphi hierarchy technique and the ordinal evaluation method proposed by Holmes and was elaborated by a multi-disciplinary team. The final working tool was a matrix combining quantitative and qualitative measurements which served to establish whether the sites met the project requirements as set forth in the selection criteria. To reduce the limitations of this methodology, the proponent used two site ranking matrices, one considering the compatibility of the options with the project and the other their vulnerability.

TABLE 2-1
SITE EVALUATION CRITERIA

ENVIRONMENTAL CRITERIA

- Biological Factors
  - Presence of or Proximity to Spawning Grounds
  - Presence of or Proximity to Nesting Areas
  - Presence of or Proximity to Bird Refuges
  - Diversity and Abundance of Benthos
  - Diversity and Abundance of Fish
  - Diversity and Abundance of Birds
  - Diversity of Intertidal and Coastal Habitat
  - Extent of Intertidal Flats
  - Shoreline Woodland Quality

- Land Use Factors
  - Presence of or Proximity to Housing (Permanent Houses or Cottages
  - Agricultural (Class A Agricultural Potential)
  - Presence of or Proximity to Recreational Facilities (Camping, etc.)
  - Cultural, Archeological or Historic Values
  - Fisheries
  - Potential of Shorelines for Recreation
  - Compatibility with Development Plans

SOCIO-ECONOMIC CRITERIA
- Project Compatibility with Regional Development Trends
- Site Access (Proximity of Highway, Railway, Dock or Port)
- Accommodation Capacity, within 10- and 25-km Radius of Site
- Access to Service Centres from Site
- Proximity and Availability of Manpower
- Anticipated Public Attitudes to Project

TECHNICAL CRITERIA

- Bathymetric Conditions
  - Distance to Adequate Water Depth (8 fathoms)
  - Dredging Depth Required (Port Construction and Maintenance)

- Navigation Conditions
  - Minimum Width of Approach Channe (2 x Ship Length)
  - Alignment of Approach Channel
  - Presence of Adequate Turning Bas (7 x Ship Length)
  - Presence of Adequate Anchoring A
  - Density of Maritime Traffic
  - Ice Conditions
  - Currents - Direction/Intensity
  - Ship Transit Time

- Physical Site Characteristics
  - Necessity for Length of Underwat Pipeline
  - Pipeline Length to Network Connection
  - Land Suitability for Pipe-lining
  - Land Access to Site
  - Topography of Site
  - Length of Cryogenic Line

PUBLIC SAFETY CRTERIA

- Population Densities
  - Densities of Population within a 2 km-radius
  - Density of Population within a 6 km-radius

- Other Conditions
  - Frequency of Calm Wind Periods
  - Distance of Settlements Located Downwind
  - topography (Presence or Absence Escarpment Affecting Atmospheric Dispersion

4.1.5 STAGE FIVE:

FINAL SELECTION

The final selection was made by means of an analysis of the results obtained with each matrix, taking into account the following four factors: biophysical environment, socio-economic aspects, technical considerations and public safety. In addition, the factors were weighted to establish their relative importance. Each site was rated according to 3 categories: preferable, acceptable and unacceptable, with only the last category implying severe limitations. In order for a site to be recommended it had to be at least acceptable, if not preferable, with respect to each of the four factors. With regard to the weighting of the factors, the proponent assigned a maximum value to technical aspects and safety, an intermediate value to biophysical aspects and a low value to socio-economic aspects.

The conclusion of this site selection study was that no one of the sites chosen for examination fully satisfied all the selection criteria. However, the Gros Cacouna and Cap-aux-Oies sites offered adequate conditions in many aspects and this justified the execution of engineering and safety studies.

4.1.6 STAGE SIX:

COMPARISON OF THE TWO SITES SELECTED

Four tools were used in choosing between these two sites: pre-engineering studies, visual analysis, public safety studies and finally, a number of public discussion meetings.

The pre-engineering studies were based on available data on winds, currents, ice, waves, seismic conditions and the loadbearing capacity of the ground. These studies made it possible to produce a design for each terminal and estimate costs. A comparison of the data reveals

that the two sites are on an equal footing with regard to technical and economic feasibility. The public safety studies made use of two types of data; namely, population density estimates and risk analyses. With regard to the latter, considering navigation conditions and climatic and topographic features, the proponent defined 3 types of possible accident, evaluated the risks associated with each type and compared them with other more commonly understood hazards. From these studies it was concluded that the site was very slightly preferable from the point of view of safety. The visual study was made by identification and mapping of the local panoramas. The two sites were compared with the help of twelve criteria reflecting the visual impact from different angles. It was concluded on this basis that Cap-aux Oies would be more significantly affected then Cacouna. Finally, in order to better appreciate public opinion, the proponent organized public discussion meetings, one at Rivière-du-Loup and another at Les Eboulements, to discuss the economic benefits and public safety. At Rivière-du-Loup the public reached favourably toward the project, while at Les Eboulements the meeting aroused considerable opposition.

The proponent decided in favour of Cacouna, not on the basis of a comparative analysis of the two site studies, but on the basis of the regulations concerning assistance for tourist development, adopted by the Quebec Government on 21 November 1979 (decree 3033-79) pursuant to section 37 of the Act respecting assistance for tourist development, which identified Charlevoix county as a priority area for tourist industry development. This decision rendered the Cap-aux-Oies site incompatible. Cacouna was selected, in spite of slightly higher risks with respect to public safety, but with the support of the public.

4.1.7 STAGE SEVEN:

ILE-AUX-LIEVRES

During the course of the hearing, the Commission asked why Ile-aux-Lièvres had not been considered a possible site. This island

is situated in the middle of the St. Lawrence river, facing Rivière-du-Loup, and appears to be preferable to Gros Cacouna Island from the point of view of safety. In a document entitled Study of Ile-aux-Lièvres as a potential site for the establishment of an LNG terminal, dated 6 February 1981, the proponent described the characteristics of the site using only available data and following the same methodology as in stage two for each of the other sites retained. A list of technical, environmental, socio-economic and public safety constraints was established for this site and it was concluded that from a safety standpoint, Ile-aux-Lièvres was a viable alternative to Gros Cacouna Island. However, with regard to other components of the study, namely, the technical, environmental and socio-economic aspects, the planned installations were incompatible with the site.

4.2 SITE STUDIES FOR GROS CACOUNA ISLAND

4.2.1 BIOPHYSICAL STUDIES

In evaluating the environmental impact of the project, the proponent identified those components of the project which would have repercussions on the biophysical environment of the Cacouna region. Subsequently, referring to an INRS oceanographic study completed in 1978 and entitled Etude de Gros Cacouna comme superport pour vrac solide au Québec (a study of Gros Cacouna as a solid bulk cargo superport), the proponent described the environmental features of Gros Cacouna Island: the climate, physical geography, geology, hydrography, the biological milieu, (flora and fauna), soil and water. A number of details concerning the regional environment were also furnished.

The proponent itself carried out several studies, one of them being aimed at defining the visual impact of the project. As mentioned in 4.1.6, this study was based on the identification and mapping of panoramas. A second study dealt with the spatial distribution of the different habitats of the tidal and coastal zone of the Cacouna region, with special emphasis on the salt marsh. Various vegetational areas

were identified, defined and described the bird-life of the area as at mid-July 1980 was observed and described, and updated our knowledge of bird and fish-life in the region was updated. The study was based on aerial photographs, a bibliographical review, field observations and vegetation sampling and examination by transect. The study of fish-life utilization of tidal and coastal habitats was not, however, based on field studies.

Bearing in mind the results of the studies detailed above, the proponent described the impact of the project during construction and operation of the terminal by comparing it, after quantification, with the criteria or standards prevailing in Quebec. Having identified the impact, the proponent prepared a list of studies necessary for a more accurate quantification. In addition, it developed measures designed to reduce the inevitable impact. Six studies were planned: speed and direction of currents, seismicity, sediment quality, identification of fish population by species and location of spawning grounds, identification of dumping sites for dredged material and emergency plans in the event of an oil spill. Some of these studies were in progress at the time the application was submitted.

4.2.2 SOCIO-ECONOMIC STUDIES

The proponent presented its study as a working tool rather than as an official document. It estimates that the project costs will change somewhat during the development.

The study identifies those aspects of the project which affect the economy of the Cacouna region and Quebec; the costs presented in this section are estimates. The study then goes on to describe the economic and social characteristics of the Cacouna region based on data for the period from 1973 to 1979. Policies with regard to maximization of socio-economic benefits and minimization of negative effects are defined. Finally, an evaluation of the economic impact and a cost/benefit analysis provide the basis for an evaluation of the social

and economic impact of the project on the Cacouna region and on Quebec. This analysis includes a list of non-quantifiable social and economic effects.

4.2.3 SAFETY STUDIES

To evaluate the possible risks of the project, the proponent adopted a methodological approach involving an analysis of system safety (Application, Vol 4, pp 8-9). This analysis included two fundamental interrelated elements: identification of the nature of the hazards and estimation of the frequency of accidents. The data on which these analyses were based were drawn from two sources, viz: past experience and failures of similar equipment. The answers sought concerned the extent of damage for anticipated accidents in 'worst-case' conditions. Finally, the risks to the public arising out of terminal activities were evaluated and compared with those of more common types of activity in order to provide more meaningful information.

The elements considered by the proponent in carrying out this study were as follows: LNG accident statistics, a detailed description of the safety aspects of LNG carriers, a detailed description of factors affecting navigational safety, an analysis of the risks of an accidental tanker cargo spill, a description of the terminal safety system and an analysis of the possibility of LNG leaks at the terminal. These tools served to identify the nature of the hazards associated with LNG and to estimate the frequency of accidents that may be expected.

Different models were used in calculating the risks faced by the public in the event of an accidental LNG spill at the terminal. They included one based on dispersion of vaporised LNG, another on the intensity of heat generated and finally, another on the burning of a gas cloud subsequent to an LNG leak. Several other types of accidents were also identified and the risks associated with each type calculate (wharf-side collision, harbour collision or grounding, tank damage,

multiple accident, collision or grounding at Les Escoumins or on the Shores along the navigation channel). A comparison of these risks with those of other types of accidents better known to the public (highway accidents, fire, lightning strikes ....) completed the analysis of risks for the public.

4.3 THE ANALYSIS

4.3.1 THE IMPACT STUDY AND THE QUEBEC DEPARTMENT OF THE ENVIRONMENT GUIDELINES

In February 1979, the Quebec Department of the Environment prepared guidelines for the evaluation of the environmental impacts of the establishment of an LNG terminal. The proponent submitted proposed specifications for carrying out this study to the Department at the end of February that same year. After examining these specifications, the Department concluded that they complied with departmental guidelines, but asked that the selection criteria be spelled out. A comparison between the impact study submitted by the proponent and the departmentally approved specifications reveals their conformity.

4.3.2 SITE SELECTION PROCEDURE

The criteria used to identify the eight potential sites are not defined in the impact study but are included in a document submitted by the proponent during the hearing (Study of Ile-aux-Lièvres as a potential site for the establishment of an LNG terminal). The Commission considers this information essential for an overall understanding of the proponent's general approach to the project. The selection criteria used in comparing the eight sites are well detailed and sufficient in number considering the many aspects of the project. In addition, the proponent has clearly stated which of the four categories of criteria were given the greatest weight in the site selection process. The weighting given to each category makes it considerably

easier to understand the procedure adopted. Finally, the matrix method developed for comparing the sites is a valid one.

None of the intervenors at the hearing questioned the choice of Gros Cacouna Island as the site for the establishment of the LNG terminal. Nevertheless, the Commission asked the proponent to evaluate the suitability of a ninth site, this being Ile-aux-Lièvres, opposite Rivière-du-Loup, with regard to the project requirements. The proponent complied reasonably quickly with the request and provided the Commission with a detailed study. The information in this study enabled the Commission to conclude that, despite some non-limiting reservations, the Island of Gros Cacouna remained an acceptable site, on technical, biophysical, socio-economic and safety grounds, for the implementation of the project as presented by the proponent.

4.3.3 SITE STUDIES, GROS CACOUNA ISLAND

The Commission finds that the proponent used mostly existing data for carrying out its studies, particularly in connection with the biophysical analysis. These data are occasionally inadequate for specific impact evaluations because they are often too general, sometimes outdated or quite simply incomplete. In addition, the Commission considers that the impact study is somewhat weak in terms of data integration. It attributes this weakness to the wide variety of data sources, which frequently causes the data to be not comparable.

During the hearings, a number of intervenors commented on the content of the studies and referred in particular to a colony of black gulls which use the cliffs of Gros Cacouna Island but which were not mentioned by the proponent. The absence of information concerning the impact of the project on seals on the ice floes of the Gulf of St. Lawrence was also noted. Information regarding the number and yield of fishing installations in the Cacouna region was found to be incomplete, and it was pointed out that too many unknowns existed with regard to

ice movement, current direction and velocities, seismic data, the nature and quality of surface and sub-surface fluvial sediments, the effects of dredging on herring spawning grounds and, finally, the future of cottages located on the northeast coast of the island.

The proponent took advantage of the many comments, made principally by federal and provincial departments, to gather additional information or simply to complete its impact study. Several studies relating to questions raised during the public sessions were provided by the proponent between the first and the second part of the hearing. These studies did not answer all the questions but did clarify several points. Complementary studies are to be carried out during the pre-construction stage.

Concerning the subject of socio-economic studies, the Commission questioned in particular the cost/benefit analysis contained in the impact study. No figures were provided for the expenses to be assumed by the community as a result of the installation of the project's infrastructure. This question is however, discussed at 6.3.1.2 of this report (Chap. 6).

The Commission also finds a complete absence of directives from the Department of the Environment on a program of environmental control and monitoring and, consequently, an absence of information from the proponent on this subject. The Commission's position is explained in 6.2.7 (Chap. 6).

Finally, the Commission concludes, in the light of the information furnished, that the complementary studies to be carried out are not such as to cast doubt on the choice of Gros Cacouna Island as the preferred site for the establishment of an LNG terminal. The proponent will be required, however, to submit the results of its studies and analyses to the government authorities as quickly as possible so that additional measures to reduce the impact of the project may be determined should this be necessary.

CHAPTER 5

PRINCIPAL CONCERNS OF INTERVENORS

Three main concerns emerged from the briefs presented to the Commission. The major concern involved socio-economic aspects; the effect of LNG on public safety came next, followed by the protection of the biophysical environment.

The various intervenors at the hearing can be divided into two main groups.

The first group comprises regional intervenors such as the Junior Chamber of Rivière-du-Loup, the Corporation de promotion industrielle de Rivière-du-Loup (industrial promotion corporation of Rivière-du-Loup), various other chambers of commerce, the parish and village of Cacouna, the caucus of Parti Québécois members for Eastern Quebec, the Conseil régional de développement de l'Est du Québec (regional development council for Eastern Quebec), the Conseil régional de l'environnement de l'Est du Québec (regional environment council for Eastern Quebec) and the Institut Maritime du Québec (Quebec marine institute).

The second group consists of government organizations intervening as experts.

Most of the regional intervenors were mainly concerned with socio-economic factors. The presentations made by the organizations concerned by these factors all echo the same theme, which can be summarized as follows: the region is experiencing a difficult economic situation in spite of a potential which only needs to be exploited. In this context, the construction of an LNG terminal appears to be a very promising solution, all the more so in that the negative environmental effects appear to be minimal. This concern is also reflected in the

presentations of two intervenors from outside the region, viz: Gaz Métropolitain and Gaz Inter-Cité.

The second group, comprising mainly government organizations, is chiefly concerned with the biophysical impact and public safety. They wish to be certain that the inventories and studies will be completed and that safety measures will be rigourously applied in order to minimize harmful repercussions on the surroundings.

5.1 REGIONAL INTERVENORS

The intervenors' views with regard to their region and their current situation are explained, along with other factors, in the following pages.

5.1.1 AN ACUTE UNEMPLOYMENT SITUATION

There is no doubt whatsoever that the intervenors from the KRT region see themselves as being in a very unfavourable situation, particularly with regard to employment, as has already been indicated by the Junior Chamber, of Rivière-du-Loup.

According to the intervenors, this unfavourable economic situation tends to create a vicious circle that is difficult to break. According to the Industrial promotion corporation, young people are aware of being part of a depressed area in so far as employment is concerned, and this is causing an outflow of skilled workers and a massive exodus of young people:

> Our young people have gone to offer their best and most productive years elsewhere for the last two generations -- some to the North Shore, some to James Bay, some to Ontario, some to forestry companies in Maine and hundreds of 18 to 30 year olds in Calgary and Edmonton and even on the oil drilling platforms of the North Sea and the

> Gulf of Mexico. (Brief of the Industrial promotion corporation, No. 3, p 3.)

The economic situation, which gives rise to unemployment, not only prompts young people to leave but also causes concern among the entire population.

Further, as the Cacouna Chamber of Commerce has mentioned, the local population lives in constant, deep frustration owing to a stagnant economic situation which there does not seem to be any hope of solving.

In the circumstances, the LNG terminal project would appear to be a significant solution to the socio-economic problems of the region.

> The population of our region has become ever more aware of its precarious situation and has grasped at various projects that would stimulate development. (Brief of the Caucus of Parti Québécois Members, p 8.)

5.1.2 A POTENTIAL TO BE EXPLOITED

Besides presenting the dark side of the region's economic picture, several intervenors before the Commission also described the region's potential, based on a favourable geographic situation, availability of human resources and an existing socio-economic infrastructure.

The chambers of commerce of Cacouna and Rivière-du-Loup, as well as the Junior Chamber of Rivière-du-Loup, believe that the geographic location of Gros Cacouna Island is a valuable asset with regard to the establishment of an LNG terminal.

According to these organizations, Cacouna is a crossroads for various forms of transport - railways, highways, seaway, deep-water harbour -

all of which contribute to make it a central point for Eastern Canada and the American Northeast as well as for the Quebec market.

The region's human resources are also a valuable asset. The Rivière-du-Loup Chamber of Commerce also emphasizes that the region is endowed with adequate teaching personnel and institutions.

On this point, the Industrial Promotion Corporation of the Rivière-du-Loup region provided the Commission with the principal findings of the study completed by the Rivière-du-Loup Junior Chamber during 1980, entitled Situation of Young Graduates in the Region. According to this study, 80% of young workers who completed their training in the region and are employed outside the region would be prepared to return if they were offered good jobs in their fields of specialization. The intervention of the Quebec marine institute should not be overlooked either; it has stated that it already has the necessary facilities for training all the LNG carrier personnel and numerous qualified teachers who are already aware of the specific training needs of LNG carrier personnel.

> (---) we believe that this possibility must be recognized as a very important resource of the area and that any decision regarding location of the LNG terminal not be
>
> made without this factor being taken into consideration. (Brief of the Quebec marine institute, p 1.)

Another major factor supporting the position of the regional organizations which favour the project is the existence of an adequate socio-economic infrastructure. The existence of the facilities necessary for the establishment of an LNG terminal such as industry, commerce, transport, miscellaneous services and, especially, the deep-water harbour of Gros Cacouna, was brought to the attention of the Commission by several intervenors.

> All that remains to be done is to put the finishing touches to the harbour and to construct warehouses. As far as infrastructures are concerned, they are already there or in the process of being completed. (Brief of the Municipal Corporation of the parish of St-Georges-de-Cacouna, p 4.)

We might add that the deep-water harbour is a source of great hope to the people of the Rivière-du-Loup region now that it has become a reality.

5.1.3 A SOLUTION TO ECONOMIC PROBLEMS

Various intervenors regard the project for the construction of an LNG terminal as a more or less definitive solution to the problems already mentioned in this report, viz: unemployment, the exodus of young people, the aging of the population, and the constant, deep frustration caused by economic stagnation. They believe that the project offers not only jobs and new investment opportunities but also a host of industrial possibilities, all with minimum impact on the environment.

For many, the project to build an LNG terminal is necessary because it will create an economic infrastructure in the Lower St. Lawrence region which will lead to the possible development of new industries. This project will create extremely beneficial economic spin-offs. Most of the regional intervenors made statements to this effect including the Junior Chamber of Rivière-du-Loup, which considers that this project alone should be capable of revolutionizing all prospects for the future.

It is for these reasons that the project appears to be vitally necessary for the region's economy. The basic investments for the construction and operation of the LNG terminal are seen as being very important, since they will create employment. According to certain intervenors, this highly technical project will have spin-off effects

on or attract other related industries, thus increasing the number of jobs in the area:

> In this way, in addition to creating employment, the said project, if authorized, will enable workers in the region to complete their training in the appropriate fields. (Brief of the Municipal Corporation of the village of St-Georges-de-Cacouna, p 5.)

> The development of the LNG terminal will have an indirect impact on job creation in the region and on the prosperity of several of our enterprises. (Brief of the Caucus of Parti Québécois Members for Eastern Quebec, p 5.)

The anticipated investments, according to the Junior Chamber, are definitely going to solve one of the region's major problems, viz, the exodus of young people:

> However, there is no doubt that these investments will be especially beneficial for the unemployed in the region and could also, to some extent, stop the outflow of young people who have been leaving the area for the last ten years or so in search of a future which they certainly could not find here. (Brief of the Junior Chamber of Rivière-du-Loup, p 12.)

The Cacouna Chamber of Commerce adds that the investments and the jobs are extremely important considerations that should not be overlooked in the final decision. The Junior Chamber, for its part, goes so far as to forecast the creation of 1000 jobs in the region during the three years that the construction of the two LNG carriers and a dry dock will take and 150 jobs per year per vessel for maintenance.

Another aspect which greatly interested the various intervenors at the public hearing was the spin-off effect of the LNG terminal on related

industries. According to them, the presence of an LNG terminal would unquestionably help promote the development of such industries, along with other factors.

Most of the organizations representing the socio-economic interests of the region stated more or less the same thing: that it is possible to envisage the establishment of related industries in the region. The Junior Chamber explains clearly what everyone hopes for:

> A host of industrial possibilities are offered to our region with the advent of the LNG terminal. (Brief of the Junior Chamber of Rivière-du-Loup, p 3.)

For the Cacouna Chamber of Commerce, there is no doubt that the technologies related to the project will have even more favourable effects on economic development than the repercussions directly related to the project itself.

It should be noted that it was not only the regional organizations present at the hearing which recognized the effects of the project. Several intervenors, including Gaz Métropolitain Inc., spoke of the industrializing effects on related enterprises.

The majority of the briefs indicate that the project will certainly have spin-off effects, since it would make possible the advent of a number of enterprises which would use the cold generated by the vapourisation of LNG. The Cacouna Chamber of Commerce anticipates that entrepreneurs involved in energy production, commercial refrigeration and manufacturing processes using low temperatures would be interested in taking advantage of savings that could go as high as the tens of millions of dollars.

While acknowledging that it was difficult to evaluate these spin-off effects, the CRD suggested, amongst other possibilities, refrigerated warehouses, recycling plants and a methanol production plant. The

Caucus of Parti Québécois Members for Eastern Quebec, for its part, believes that the theory concerning spin-off effects is all the more realistic in that the deep-water harbour is a supplementary stimulant:

> The activity generated by the commercial deep-water wharf and the industries that will be attracted will act as additional stimuli for enterprises depending on the LNG complex. (Brief of the Caucus of Parti Québécois Members for Eastern Quebec, p 6.)

5.1.4 MINIMUM IMPACT ON THE BIOPHYSICAL ENVIRONMENT

Most of the intervenors were of the opinion that the biophysical environment would only be minimally affected. The CREEQ was the only regional organization to show concern and to suggest mitigative and compensatory measures.

The brief presented by the Caucus of Parti Québécois Members for Eastern Quebec confirms that there is no reason for alarm as far as the future of the environment is concerned. The brief of the Rivière-du-Loup Chamber of Commerce echoes more or less the same opinion. The CRD goes so far as to state that the project will have the indirect effect of creating a natural sanctuary, much to the joy of local ecology groups, by forming a buffer zone. In addition, the last intervenor, Mr. Michel Gauvin, concluded by saying that oil products are in any event much more dangerous and harmful to the environment.

Such an attitude rests on the confidence shown by the intervenors in environmental protection organizations and in the proponent's sense of responsibility.

For its part, the Junior Chamber of Rivière-du-Loup summarizes the Marsan et Associés study and concludes that the impact will be slight. It also indicates that a perusal of this document leaves the impression that the applicants gave careful consideration to environmental factors

in preparing the project, hence the confidence in the proponent's sense of responsibility. The proponent is perceived as being serious and thus as having taken every possible precaution to preserve the natural milieu in the vicinity of the project. The Rivière-du-Loup Chamber of Commerce concludes that, since the project is innovative, the investors have taken numerous precautions before becoming involved. Others consider that the government organizations have done their duty and have checked all aspects of the project that could affect the environment.

It is then possible, according to the Cacouna Chamber of Commerce, to reconcile development and environmental protection.

The intervention of the Regional environment council for Eastern Quebec qualifies the foregoing statements somewhat. It emphasizes the danger of natural gas and the attendant risks for those working at the site or in the vicinity as well as for the neighbouring population. Moreover, this organization considers it necessary to identify all the areas of life affected with a view to ensuring minimum negative impact during the construction phase. To this end, it believes that more detailed data is necessary and even that new data is required. CREEQ therefore asks that the requests for detailed information listed in its brief be satisfied before the Minister gives final authorization to the project. It also adds that the new data should be made public.

CREEQ has also formulated the following recommendations:

1. It is important that the dredging and blasting schedules take into account the peak population density periods of various wildlife species.
2. It is important that the environment inspector present at the site have powers beyond those of observer.
3. An agreement should be entered into to exclude the perimeter of Gros Cacouna harbour from the training area of the flying school, operated by the Aéro-Club de la Côte-Sud.

4. Agreement for construction of the terminal should be conditional on a pre-determined selection of future projects in the vicinity.
5. The system of project information and public relations should be open and maintained on an ongoing basis.
6. A mechanism for compensating fishermen should be provided for in the event that a significant loss of their catches occurs owing to construction work or an accident.
7. A plan should be drawn up for the protection of areas of high biological productivity.

(extract from CREEQ Brief)

5.1.5 LOW ACCIDENT RISK

The general impression drawn from the comments expressed on this subject by all the intervenors is that the risk of accidents related to the establishment of the LNG terminal are very low. The intervenors have confidence both in the proponent and in the government organizations that are involved.

On this point, the Junior Chamber adopts the conclusions of the study by Marsan and Associés:

> All risk of accident is limited to within the property, so that the public is not endangered (---). The probability of an accident is about the same as that of an individual being electrocuted in his basement. (Brief of the Junior Chamber of Rivière-du-Loup, p 5.)

There is also the statement made by Mr. Michel Gauvin at the evening hearing of 19 February 1981:

> (---) I'm beginning to realize that I've more chance of getting myself killed on the road than seeing something

> happen at the LNG complex. (Transcript of session of 19 February, p 45.)

In conclusion, as Mayor Michaud of the Parish of Cacouna has also said: "The people of Cacouna are not worried".

5.1.6 THE ENERGY MAP

Most of the briefs presented by the regional intervenors suggest that the LNG terminal at Cacouna will have beneficial effects with regard to energy, for Quebec as well as for the KRT region.

We might mention in this regard the intervention of the Regional development council for Eastern Quebec, which sees the KRT region making its mark on the "Energy Map".

> This strategic position would put Eastern Quebec at the centre of an energy strategy - a position it could not occupy based only on its own natural resources. (CRD Brief, p 15.)

Finally, it should be noted that certain statements of Gaz Inter-Cité and Gaz Métropolitain confirm this analysis. The former states in its brief that the project, thanks to increased security of supply, will offer residents greater flexibility in their choice of available energy sources and will contribute to the growth of the regional economy. For its part, Gaz Métropolitain speaks of the definite advantages for Quebec with regard to security of supply and economic impact.

5.1.7 AN ACCEPTED PROJECT

The project to establish an LNG terminal on Gros Cacouna Island is not contested; on the contrary, it has the support of all the groups who came to express their views at the hearing.

According to the Industrial promotion corporation of the Rivière-du-Loup region, the public has been informed and consulted. The terminal at Elba Island was visited, a mini-seminar was organized and the project was explained to the public by means of lectures, articles, TV interviews and radio programs. For its part, the Junior Chamber of Rivière-du-Loup carried out a survey which found that: 76% of the respondents were in favour of the establishment of an LNG terminal at Gros Cacouna. In addition, the Junior Chamber obtained the support of numerous other Quebec junior chambers which supported the choice of Cacouna as the most economic and most favourable site.

The various witnesses confirmed the acceptance of the project by the public and its wish to see the project approved by the authorities concerned and then executed. Further, the Chamber of Commerce of Grand Portage expressed the wish that the National Energy Board designate Gros Cacouna Island for the establishment of a gas carrier port.

Gaz Métropolitain believed that it was in the interest of the Quebec people for the decisions to lead to implementation of the project, while Gaz Inter-Cité outlined the advantages that would flow from the establishment of an LNG terminal at Cacouna. Finally, several intervenors claimed to represent public opinion:

> The people of the area, whether from the population in general, the business world, or the political world, wish to see the execution of this project at Gros Cacouna. (Brief of the Rivière-du-Loup Chamber of Commerce, p 1.)

> We can express the opinion that the majority of the residents of our municipality are in favour of the establishment of such a project in our immediate area. (Brief of the Corporation of the Village of Cacouna, p 1.)

It should be noted, however, that the Corporation of the Village of Cacouna has qualified its support as follows:

> It is to be noted, however, that the Municipality's support for the proponent, TransCanada PipeLines Ltd., is subject to the express condition that it fulfil this commitment as provided for in its application for authorization. (Brief of the Corporation of the Village of Cacouna, p 7.)

5.2 GOVERNMENT INTERVENORS

The government intervenors dealt with various aspects of the subject and we draw special attention to their concerns over protection of the environment and over safety.

5.2.1 INCOMPLETE INVENTORIES

The federal Department of the Environment believes that the proponent's impact study is adequately prepared. However, other departments consider certain information to be incomplete.

The federal Department of Energy, Mines and Resources indicates, in its brief, that the information given does not permit determination of the dangers arising from seismic movements. The Department of Fisheries and Oceans deplores the fact that the environmental impact study does not include information on the interaction between vessels and mammals, nor on the composition of dredged sediments. It also notes inconsistencies between the data on the physical environment contained in the study and the data used for design and operating procedures.

5.2.2 BIOPHYSICAL IMPACT

With regard to the subject of biophysical impact, the concerns of the federal departments of the Environment and Fisheries and Oceans are of particular note. Their concerns focus especially on the effects of dredging and LNG carrier operation. Although Fisheries and Oceans Canada does not believe that the proposed dredging of 70 000m^3

will significantly affect the various fish species such as eel, herring and capelin, it has nevertheless requested that the proponent carry out a sediment composition study. For its part, Environment Canada believes that the water quality should be affected only temporarily. Nonetheless, it maintains that additional dredging beyond that already planned - albeit minimal in quantity - will be necessary to permit navigation and docking of the vessels and it therefore requests that the work be evaluated and the quality of the materials adequately described.

The same holds true for the Quebec Department of Recreation, Fish and Game, which considers that the dredging will produce only local and temporary effects. The Quebec Department of Agriculture, Fisheries and Food, for its part, believes that the proponent, by taking appropriate measures, will be able to adequately resolve the problems directly related to maritime fisheries.

Regarding operation of the LNG carriers, the concern of the Department of Fisheries and Oceans focuses on the interaction between vessels and marine mammals, particularly with regard to concentrations of seals in the process of pupping.

Finally, the risks of spillage constitute a third area of concern. Although the Department of Fisheries and Oceans considers that the applicant has proposed acceptable emergency measures in the event of an oil spill, Environment Canada thinks that more or less major spills could occur during transshipment of diesel type fuel. It recommends that contingency plans for spills be developed in detail and adapted to the installations. As far as this federal department is concerned, final authorization should only be granted when these plans have been developed.

Finally it is noted that Environment Canada suggests:
Development plans should be elaborated to guarantee the conservation of certain ecologically important areas

which could be put at risk by future developments. (Report submitted by Environment Canada, p 8.)

The same department believes that the plans should take into consideration the fact that the number of people living or working in the high-risk zone should be kept to a minimum.

It goes on to say that it is important for the Commission to examine all necessary aspects in applying safety measures designed to minimize the risks associated with LNG.

As regards the tools presented to the Commission for evaluation of the risks involved in the transport of LNG, the Integrated Route Analysis mentioned by the Department of Fisheries and Oceans, and the Canadian Coast Guard TERMPOL evaluation procedure are noted.

Similarly, the Quebec interdepartmental committee on the Gros Cacouna terminal project states that the project is considered acceptable by all the departments consulted.

At most, some of the departments involved wish to obtain further information on the conditions governing terminal installation.

5.2.3 RISKS INHERENT IN LNG

There are public safety risks inherent in LNG. The Quebec Department of Energy and Resources considers that these risks could be minimized if steps were taken to ensure that the proponent respected the most recent construction standards. The same applies to the federal Department of Energy, Mines and Resources, which accepts the project provided that there are stable foundation materials and that sedimentary erosion is prevented with a view to ensuring increased safety in the event of earth tremors. Environment Canada contributes other information: the Department believes that vessel operating and

docking conditions will be very difficult because of wind and current speeds and ice movement and accumulation. It recommends:

> The use of this passive method (of ice control) rather than the method being considered by the applicant ... (which) would increase the risk of accident. (Brief submitted by Environment Canada, p 5.)

In addition, the federal Department considers that an emergency plan in case of an LNG spill should include:

- a regional plan for the very speedy (less than one hour) evacuation of the population;
- an automatic plan to provide the responsible authorities with an immediate definition of the evacuation area. This system must continuously integrate the available meteorological data, with the addition, (if possible) of the size of any potential spill. Such data should be used with the most conservative model possible. (Brief submitted by Environment Canada, p 8.)

CHAPTER 6

ANALYSIS

6.1 SAFETY

6.1.1 INTRODUCTION

Generally speaking, after analysis of all the interventions made during the public information period and the public hearing, the Commission considers that none of the arguments are of such a nature as to cast doubt on the validity of the LNG terminal project as presented by the proponent.

Considering that the Commission's role goes beyond an agreement in principle on the project and that several intervenors have raised questions relating to biophysical, social and economic considerations as well as submitted various recommendations before the Commission, we have analysed these subjects in order to extract specific recommendations from them. In the following pages we will deal with the acceptability of the project taking into account public safety, protection of the biophysical environment and repercussions on the socio-economic environment.

The Commission has attached special importance to questions of safety. Since LNG is a non-toxic but potentially dangerous substance, the risks to which the public and the biophysical environment would be exposed justify giving special attention to safety measures.

We will deal successively with these aspects: marine safety, safety of the installations and safety of terminal operations.

First, let us review several characteristics of liquefied natural gas in order to better understand the following pages. To be liquefied, natural gas must be cooled to -160°C. If kept at this temperature, the

gas remains in its liquid state. Liquefied natural gas is designated by the abbreviation LNG; one cubic foot of LNG weighs about 28 lbs., or about half the weight of water, with which it does not mix. LNG evaporates at room temperature, quickly increasing in volume to 600 times its liquid volume.

In the cold vapour state natural gas is heavier than air, so that in the event of a spill it would tend at first to remain at ground or sea level. As its temperature increases the gas would become lighter than air so that it would rise and disperse into the atmosphere.

In the gaseous state natural gas is not toxic, although it can cause asphyxiation due to lack of oxygen. It is flammable in the gaseous state in concentrations between 5% to 15% by volume. In the liquid state it is odorless and colourless and for all practical purposes looks like water. Owing to the very low temperature at which it is kept, LNG is liable to quickly fracture certain metals such as carbon steel.

History reveals that, except for a few unfortunate incidents, the best known of which is the Cleveland accident of 1944, LNG is reasonably safe, with a well-understood technology. The method of storing the gas in liquid form before it is revapourised in the transmission pipe system constitutes a cryogenic system.

Any failure of the cryogenic system resulting in an LNG leak will create two types of hazard. In the first place, the very low temperature of LNG will cause immediate freezing of anything or anyone exposed to liquefied gas; this danger is restricted to the immediate vicinity of the plant. Secondly, there is a fire hazard when the LNG vapourises due to an increase in temperature since, as we have just seen, air with a concentration of 5 to 15% of LNG vapour by volume is flammable. However, contrary to popular belief, the risks of explosion of a gas cloud appear to be minimal and all experiments in this regard show that LNG will only explode in a confined space.

Despite the assurances to the effect that the LNG industry is on the whole safe, that the number of accidents in the industry are very few, that the causes of these accidents are known, that the loss of human life is small and that damage to the environment has been minimal for the last 15 years, the subject should not be treated lightly. The small number of accidents does not mean that LNG is without danger; rather, it means that LNG is handled with care. In this respect, we need only look at the strict regulations adopted by several other countries with LNG terminals, such as the USA and France.

6.1.2 MARINE SAFETY

Each LNG carrier will carry a total of 140 000 m^3 of LNG in six separate insulated compartments. The construction of the carriers and the safety measures to be incorporated in them will be such that the worst foreseeable accident would be the complete rupture of a compartment, resulting in a spill of 28 000 m^3 of LNG. Such an accident might happen as the result of a collision or high speed grounding.

Taking into account current world practices, the Commission believes that it is reasonable to regard an instantaneous spill of 28 000 m^3 of LNG. Such an accident might happen as the result of a collision or high speed grounding.

Taking into account current world practices, the Commission believes that it is reasonable to regard an instantaneous spill of 28 000 m^3 LNG in water as the worst likely accident for the purposes of emergency planning. There are three methods of preventing marine accidents that might cause LNG spillage: the design and construction of the carriers, the training of crews and vessel movement control.

First, it is necessary to examine vessel design and construction. The proponent has stated that the carriers would be built in accordance

with established standards for this type of vessel, both at the national level by Transport Canada and at the international level by organizations such as IMCO and by shipyards specializing in LNG carrier construction.

The vessels will also be class 7 icebreakers, that is to say, they will be built to standards enabling them to move continuously in ice 2m thick without having to stop or reverse to free themselves from the ice.

The proponent has not submitted firm plans for these vessels to the Commission. Transport Canada, however, has mentioned in its presentation at the public hearing that the Canada Shipping Act gives it the responsibility of ensuring that all safety standards are complied with in the planning stage and during construction of vessels. Transport Canada has indicated that it is able to do this work and that its experts will examine the detailed plans of the vessels when these are available and inspect the vessels after construction to ensure that all safety standards have been met.

Although it is difficult to determine exactly how many LNG carriers are presently in service in the world, we can state that there are in excess of fifty. Some of these vessels, such as the METHANE PRINCESS and the METHANE PROGRESS, have carried LNG for more than 15 years without major accident or failure. Records of lost-service time required for maintenance or repair tend to show that LNG carriers are about average compared to all other classes of vessels. The same figures show, however, that recently-built LNG tankers spend more time under maintenance or repair than do tankers of earlier construction. These problems appear to be related to the much greater tonnage of the most recent generation of LNG carriers, which affects the cargo behaviour (increased sloshing of LNG) and to the much longer voyages which these vessels make (c.f. Transportation of Liquefied Natural Gas, Congress of the United States, Office of Technology Assessment, Sept 1977, p. 43). The proponent plans to use icebreaking carriers of

hitherto unequalled tonnage which cannot be compared with any carriers presently in service or under construction. The seatime for each voyage made by these vessels will be almost double the average for LNG carriers presently in service. It is evident that the proponent and the regulatory agencies must take these new factors into account during the design and construction of the vessels.

The second preventive measure involves the training of carrier crews. The competence of the ships' officers must meet certain international standards. The proponent has already indicated that it intends to hire highly qualified crews to serve on board the LNG carriers. The Quebec marine institute at Rimouski was mentioned by the proponent; it could be used for training and development of LNG carrier personnel. Since two crews are envisaged for each vessel, it will be possible for one crew to take development courses without adversely affecting voyage schedules. In response to a question on this subject, the Institute has indicated that it is ready to welcome Inuit in a training and development program for LNG carrier crews:

> It is within our mandate, in any case it is a public school that belongs to the Quebec education system and there is absolutely no obstacle to agreements of this type. (Transcript of public hearing, session of 17 February, pp 60-62.)

Transport Canada is responsible for ensuring that fully qualified officers and sailors are hired; the Commission can only emphasize the importance of crew training. Most marine accidents are due to human error and it is vital that LNG carrier crews be maintained at the highest possible level of competence. The Commission hopes that, in addition to ensuring that the crews thoroughly understand the operation of both the LNG carriers and the safety equipment provided, the proponent will provide for regular drills to check the condition of safety equipment and the crew's preparedness to deal with emergency

situations. In view of the rapidly changing knowledge in this field, the proponent should also ensure that crews be informed as quickly as possible of all new information concerning the behaviour of LNG and of gas clouds resulting from spills.

Another preventive measure involves vessel movement control, carried out in Canadian waters by the Canadian Coast Guard. This control is effected using navigation aids and systems of marine traffic management aimed at preventing collisions between LNG carriers and other vessels.

The LNG carriers will follow a clearly defined course in the St. Lawrence estuary. Transport Canada will decide if it is necessary to develop additional regulations for the LNG carriers and for other vessels or to have a pilot on board between Les Escoumins and Cacouna.

It has been mentioned that more than 11 000 vessels per year pass through the part of the St. Lawrence that will be used by the LNG carriers. The latter will add only another thirty sailings to this number.

One point, however, remains to be clarified, namely, the increase in traffic that would result from the construction of a solid bulk cargo port in the immediate vicinity of the LNG terminal. If such a project were to be carried out, Transport Canada would closely examine the measures necessary to ensure safety of the LNG carriers.

Stricter controls might be required but, taking into account the statements made by the responsible marine transport authorities, the Commission does not consider that the two activities would be incompatible. However, the Commission's present mandate is to report only on the LNG terminal project.

As far as this compatibility is concerned, Mr. Bertrand de Frondeville, a consulting specialist retained by the Quebec Department of Energy and Resources, stated during the hearing:

> As far as the freighters, which are of special interest here, are concerned, at Tobata and at Fos, i.e. in Japan and France, there are, quite close to the LNG terminals, some of the largest steel works in the world receiving ore freighters on a daily basis. (---) thus it seems that there is no problem of co-existence with the industries we have spoken about both with respect to themselves as well as the vessels and the mooring berths they use, provided that the infrastructures and the operating procedures are carefully studied by experts and examined by the public so that everyone knows his duty. (Transcript of Public Hearing, 18th February, pp. 114, 119 and 120.)

As far as foreseeable accidents are concerned, an instantaneous spill of 28 000 m^3 of LNG is the worst accident that appears likely to occur. Such a spill could only result from the rupture of one of the LNG carrier cargo tanks.

If a break were to occur in the upper part of the tank, the LNG would vapourise on contact with the air. It is possible that the vapour might catch fire and burn up near the vessel. Such a fire would be put out by the ship's fire detection and extinguisher system.

If, however, the tank rupture were the result of hull damage, the LNG would spread over the surface of the water. The liquid would vapourise on contact with the air and form a vapour cloud. From the many documents it has consulted on this subject, the Commission cannot but conclude that the behaviour of a natural gas cloud in the atmosphere does not appear to be well understood and is the subject of many differing hypotheses. These hypotheses are numerous in the case of spills over water rather than on land. Researchers differ constantly in opinion regarding cloud shape, size, movement and composition and the factors influencing such clouds. It is generally believed that the concentration of gas in a cloud is not homogenous. The concentration of gas would be light at the periphery, where air would be in the

highest proportion, but would increase considerably toward the centre. We have seen the conditions under which a mass of gas might ignite. One thing is certain - all observers agree that it would be impossible to extinguish a fire using any presently known fire-fighting techniques. Consequently, the only solution for reducing the risks of an LNG fire is to set up a rigourous prevention program. This applies also to the terminal operation itself.

The proponent states that under the worst weather conditions (that is to say, when atmospheric conditions are stable with light wind and relatively little turbulence, as commonly occurs during the evening) the vapour cloud, if not already on fire, could extend up to 8 km from the spill site before it were dispersed to the extent that it no longer constituted a fire hazard. Environment Canada states, however, that:

> Mathematical dispersion models such as those used by the applicant are of limited accuracy. Many validation studies have shown that a factor of two generally exists between the values predicted and those observed; in other words, the values observed can be double or half values calculated. For instance, a safety factor of two would extend the danger radius estimated by the applicant to Rivière-du-Loup. (Brief submitted by Environment Canada, p 7.)

The proponent mentioned having considered the worst-case conditions in the calculations which showed a maximum danger zone of 8 km. Detailed comments on this matter were submitted after the hearing, to the effect that the radius of maximum danger, according to the various models, varies between 3.7 km and 5.8 km.

> In reality, unstable wind characteristics will cause a break-up of the cloud and vapor pockets could be blown further than the drift distances calculated on an average concentration basis. This is why the applicant has adopted an average concentration of 3.3% gas in air rather

> then the lower inflammability limit of 5% methane in air in estimating the extent of the danger zone. We consider that our method of calculation adequately compensates for the effect of variable wind characteristics on the drift distance of an inflammable cloud. (Detailed Comments of the Applicant on Annexes 3 and 4 of the questions and comments prepared by Environment Canada.)

Another factor which must be considered with regard to such accidents is the probability of their occurring. The proponent states that the probability of a major LNG spill from the carriers is 1.5 ± 10^{-5} (1.5 chances in 100 000). No one has questioned this probability. It may be deduced that there is an even smaller probability of a 28 000 m^3 spill spreading over 9 km or more.

The Commission considers that nothing useful would be achieved if an effort were made to determine exactly how far the cloud resulting from such a spill would travel. Considering the present situation with regard to the experiments tried and models used, it is in fact extremely difficult to forecast the extent of a vapour cloud with any degree of confidence.

The Commission realizes that the probability of a major spill is very small. In addition to the proponent's statistics, Mr. Bertrand de Frondeville mentioned the following during his presentation at the hearing:

> One can say that with the technology we now have following all these experiments - and it is a pity that we had to wait in some cases - the chances of accidents are minimal. (Transcript of public hearing, 18 February, p 116.)

The Commission concludes that the risks of major damage due to an LNG spill are acceptable according to the present criteria of Canadian

society. The Commission believes also that the risk of a spill does exist, albeit a small one. Consequently, in order to minimize the new risks involved in the shipment of LNG, the competent authorities should ensure that contingency plans are developed for those municipalities which would be most exposed along the carrier route. We shall discuss later what form these plans should take.

6.1.3 TERMINAL SAFETY

The Commission considers it reasonable that the LNG storage tanks have been designed in such a way that the roof will be the first to yield if the internal pressure becomes too high. In the event of such an occurrence, this design would permit the LNG to remain in the tank and vapourise gradually to escape upwards, thus reducing horizontal dispersion.

As for the technology to be used in constructing the tanks themselves, the Commission finds that the proponent has not yet arrived at a final decision, although for the time being, one can read on page A-18 of the application:

> LNG storage tanks considered in this design are of double-walled concrete construction (---). Tanks of this design are in LNG service in Barcelona and Philadelphia. Other tank designs will be investigated and evaluated as part of the design process.

Without intending to pass judgment on the European system known as PRELOAD, the Commission finds that this method does raise some serious doubts. In this connection, note should be made of the low fire resistance of the horizontal tension cables, the difficulty and danger of creating a vacuum inside the tanks, considering that the internal membrane is not secured to the ground, and the fact that the concrete skirt is not monolithic. The tank used by ENAGAZ S.A. of Barcelona is

built in this way and would seem to have problems both with regard to its impermeability as well as its reliability of operation.

In addition to the upper surface 'blow-out' design of the tanks, the Commission finds that other safety devices are provided for in the event of a leak resulting from a failure of the primary storage system: a concrete reservoir is to encircle the internal primary tank completely (although the reservations expressed in the previous paragraph should be borne in mind), the dikes surrounding all external piping and the impounding basins into which would be channelled any LNG spilled accidentally. These last two features appear to the Commission to be not only appropriate, but essential.

The terminal site itself could present an additional safety feature since it backs against the cliff, which would constitute a natural barrier to any liquid spill or vapour cloud directed shoreward.

On looking at the impact study and the sketches and drawings accompanying it, the Commission finds that the proponents have not felt it advisable to surround each tank with a retaining dike with a capacity at least equal to that of the tank. Yet most of the world's LNG tanks are surrounded by such containment dikes of gravel, reinforced earth etc. The proponent evidently considers that the external tank wall would serve as a containment dike in case of a leak in the inner wall. However, comparisons in this regard must be made with caution. Self-supporting, double-tank reservoirs in cold-resistant materials are not common. An example is provided at the MONTOIR terminal in Brittany, where the internal tank is a flexible steel membrane fixed to an external monolithic concrete structure. Elsewhere, at Cove Point, the self-supporting internal tank is made of 9% nickel steel but the external tank is not made of steel capable of resisting the very low temperature of LNG. In spite of this, and taking into account the Commission's reservations regarding the design and the technology chosen for these tanks by the proponents, it seems astonishing that nothing has been provided to contain a major leak of

LNG. This is all the more surprising since the terminal tanks referred to by the proponents are in fact surrounded by such dikes.

The government agencies showed some concern during their presentations with regard to the geotechnological aspects of wharf construction, the accumulation of sediment and the lack of seismic data.

> The information provided is not adequate to determine the hazards imposed on the project by seismic motion surficial geological conditions and littoral processes active at the terminal site.... The application does not provide sufficient information to evaluate the probability of future seismic events and the criteria appropriate for design of earthquake resistant facilities. The off-shore regime is not described in sufficient detail to evaluate the stability of the river bottom sediments under load or erosional conditions. --- the surficial geological conditions are not described in sufficient detail to assess the foundation conditions at the proposed construction site. (Brief of the Department of Energy, Mines and Resources, p 1.)

The proponent agreed at the hearings that more complete information was necessary and indicated that other studies would be made with a view to obtaining data that would enable a detailed wharf design to be prepared.

The company also indicated that it would carry out further geotechnological studies in preparation for the final plan. The Department accepted these replies and indicated that it was customary to establish detailed wharf plans once exact seismic data was available and that the final plan should be based on the most recent and most complete seismic data available.

The Commission is of the opinion that the additional geotechnological and seismic studies should be submitted to the federal Department of Energy, Mines and Resources for consideration. This new data would be used in drawing up a final plan for the structure of the wharf.

6.1.4 TERMINAL OPERATIONS

The terminal operations can be divided into two parts: first, the wharfside work involving docking and casting off of LNG carriers and cargo transfer, and secondly, the LNG storage and vapourisation operations on land.

The carriers will be especially vulnerable as they approach or leave the wharf, since they will be moving at reduced speed with a consequent decrease in maneuverability. They will be almost entirely controlled by tugs at the times and may also be subject to varying conditions of currents, ice and wind ranging from very favourable to very dangerous. Environment Canada stated at the hearing:

> Observation of the velocity of currents, ice movements, and accumulation, and/or wind velocity in the Gros Cacouna area leads us to believe that, at certain times during the winter, docking and operating conditions will be very difficult. (Report submitted by Environment Canada, p 5.)

The proponent plans to minimize the ice problem either by using tugs to push the ice away from the wharf continuously or by building permanent structures to control ice movement. At first glance it seems that the use of passive structures might be more effective and less dangerous. Environment Canada in fact recommends:

> (---) the use of this passive method rather than the method being considered by the applicant, namely the constant use of a tug boat to tow ice out into open

> wabers: in our view this would increase the risk of accident. (Report submitted by Environment Canada, p 5.)

The Commission considers that the recommendation of Environment Canada is appropriate, since the use of tugs for the above purpose would, among other things, increase the number of vessel movements in the vicinity of the docked tanker. Considering that the present studies appear somewhat superficial, the Commission recommends that the proponents pursue their studies to determine the best method of ice control.

As far as dangers due to winds and currents are concerned, the proponent indicates that docking of the LNG carriers will not be allowed when wind speeds exceed 80 km/hr. Further, if wind speeds exceed 50 km/hr while a carrier is alongside, emergency measures would be put into effect including possibly stopping transshipment operations and, if the wind speed reached 80 km/hr, casting off the carrier. Considering the available information, the Commission believes this last maneuver may be necessary. However, it would be essential to ensure that emergency cast-off procedures can be effected at any time, considering that it is difficult to foresee when wind speeds will exceed 80 km/hr.

To facilitate this maneuver, the use of tugs would be essential. In this connection, Mr. de Frondeville said:

> Secondly, provided that the tugs are there again, with perhaps two or three tugs of sufficient power depending on weather conditions - we are talking of large tugs of 4500 HP - there is no problem for an emergency sailing. But the tugs must be there. (Transcript of public hearing, 18 February, p 119.)

Consequently, the Commission considers that the proponent should make sure that there are enough tugs alongside to handle an emergency cast-off whenever an LNG carrier is docked. The Commission notes that the proponent has provided for an emergency shut-down of transshipment operations whenever weather conditions might require this.

The Commission does not believe that the transfer of LNG presents any special safety problems except under the violent wind conditions mentioned above. Under such conditions, transfer of the cargo would be stopped as quickly as possible. The Commission wishes to point out that the following two requirements are essential for ensuring an immediate stoppage of operations: the presence of someone on the site throughout the transshipment period capable of making this decision and an efficient communication system between the carrier and the transshipment control centre.

The second part of the terminal operations consists in storing and vapourising the LNG. The worst accidents that could happen during these operations are:

- failure of a large LNG pipe.

- major leak in the internal tank.

According to the proponents, the largest spill that could occur in the event of a main line break would be 3 375 m^3 of LNG. Only a violent collision with a ground vehicle or aircraft would be capable of causing such a break.

The proponent considers that a major leak in the primary storage tanks would not result in an LNG spill since the exterior wall would prevent the liquid from spreading to the outside. However, the tank roof would probably collapse and a gas cloud would be produced. The dangers of such a cloud have already been mentioned. The proponent indicates three possible causes of tank failure: the falling of an aircraft or

other object on the tank, an earthquake or excessive internal pressure. To these three the Commission would be tempted to add the possibility of a terrorist attack, which would appear to be more likely than the fall of an aircraft.

The Regional environment council for Eastern Quebec has drawn the Commission's attention to the fact that the Island of Gros Cacouna is inside the training area used by the flying School of the Aéroclub de la Côte sud (Rivière-du-Loup). The Commission believes that this significantly increases the risk of tank damage due to a falling aircraft. Transport Canada should prohibit any training or recreational flying above and in the vicinity of the terminal.

The complete failure of a reservoir (internal primary tank and outer wall) is not considered by the proponent to be a likely occurrence. However, the Commission cannot agree with this view, given the fact that neither the plans and drawings for the tanks nor the technology chosen by the proponents have been submitted.

The proponents deal with public safety in their application (Application, Vol. 4, pp # B-163 et seq.) and include probability statistics for the types of accidents described above in the appendices (appendices 1 and 10). The proponents have provided for certain safety equipment to minimize the effects of possible accidents.

> All outdoor runs of piping will be enclosed within diked or curbed channels. If any LNG is spilled it will be directed to impounding basins located at a safe distance from other terminal facilities. The surface-to-volume ratio of impounding basins will be kept small to limit the rate of vapour generation. Channels leading to impounding basins will be designed to minimize the surface area that comes in contact with the flowing liquid, thus minimizing the rate of heat transfer to the LNG and the consequent rate of vapour evolution.

(Application, Vol. 4, p. B-126.)

The gas detection and firefighting systems should be adequate.

> Gas detectors are useful for the detection of small spills and gas leaks. They will be installed at the unloading dock, in all process buildings and in the air-intake ducts of all other terminal buildings. (Application, Vol. 4, p. B-127.)
>
> The following fire and vapour control systems will be incorporated into the terminal:
>
> 1. Fire water.
> 2. High expansion foam.
> 3. Dry chemical.
> 4. Inert gas.
>
> (Application, Vol. 4, p. B-130.)

These will comply with Canadian and international standards as well as with applicable insurance company standards.

The proponents have provided for a contingency plan for the site itself and personnel trained to respond to any emergency situation. The restricted danger zone, which would extend 528 m from the tanks, would provide increased protection in case of accident. Although most of this zone would be TransCanada PipeLines property, the proponents should purchase cottages, prohibit permanent residences and control the movement of people in the area.

Besides the information supplied by the proponents on the safety of the facilities, the Commission has taken into consideration the views of government organizations such as the Quebec Department of Energy and Resources in determining the acceptability of the facilities from the

safety standpoint. This Department stated during the first part of the hearing:

> We are now able to indicate to the Office of public hearings on the environment that the proposed facilities will meet or even exceed the most rigourous design and construction standards existing in North America today.
>
> The Department has also concluded that several aspects of the project exceeded the limits imposed by standards. With the help of its consultants and on the basis of accumulated knowledge of various aspects of LNG facilities, the Department has been able to estimate the effects of the establishment of an LNG terminal at Gros Cacouna on public safety.
> (Transcript of hearing, 14 February, p. 94.)

On the strength of these views, based on the analyses of internationally recognized experts, the Commission is of the opinion that the facilities proposed by the proponents will be safe.

The Commission wishes, however, to make two additional comments. The first concerns the importance of a well-planned and efficient maintenance and parts replacement system. This is the most important safety measure that should be taken inside the plant. The observations of the Commission lead it to believe that it is a mistake to attempt to classify all possible incidents or failures inside the terminal and to develop appropriate response measures. The classification would be so cumbersome and would be so rarely used that in the event of an incident the reaction time would be longer than if the classification had never been made. All of which does not mean that certain measures should not be taken, far from it. But the best way of avoiding failures is still to draw up an equipment inspection program and a schedule for the replacement of parts before the end of their normal service life. Experience shows that well-established programs of this type have been

effective in avoiding major accidents at other terminals. In this connection, the government authorities would be advised to ensure that the proponents carry out inspections of their facilities at regular intervals and that they replace parts as necessary.

The second remark which seems to be essential concerns the contingency plans needed to minimize the consequences of accidents at the terminal. These plans are obviously aimed at reducing the possible risks imposed on the neighbouring population and should be established in cooperation with local and government authorities. Such plans should also apply to Quebec municipalities along the route of the LNG carriers. Amongst other things, a list should be made of the persons in authority to be contacted in case of accident, indicating the sequence in which they should be contacted depending on the nature of the incident. Finally, the public should be fully informed with regard to the existence and content of these plans.

Certain questions were raised concerning the compatibility of terminal activities with the solid bulk cargo port planned for construction in the vicinity. The proximity of the LNG terminal would pose a slightly increased risk for workers at the solid bulk cargo port, but this risk would be within acceptable limits for industrial activities. The contingency plans should, however, take into account the presence of workers at the solid bulk cargo port.

6.1.5 CONCLUSION

By way of conclusion to this section on safety, we believe that the LNG terminal can be built and can operate in full safety within acceptable accident probability limits.

It should be remembered, however, that LNG is potentially dangerous and that the behaviour of a vapour cloud is likely to be unpredictable. The rather positive results obtained with respect to the safety of LNG terminals should not way us to the point that we minimize the risks.

The Commission is of the opinion that very strict safety measures should be imposed by the proponents and enforced throughout the lifespan of the terminal. Government agencies such as Transport Canada (marine operations), the Quebec Department of Energy and Resources, the Quebec Civil Protection and the municipal authorities involved should strive to ensure compliance with the safety measures with a view to minimizing the consequences of a possible major LNG spill, both on water and at the terminal itself.

6.2 THE BIOPHYSICAL ENVIRONMENT

The intervenors at the hearing raised several questions relating to protection of the biophysical environment, particularly with respect to dredging, water quality, aquatic wildlife, marsh habitats and marine mammals. The possible visual impact of the proposed facilities on the local population and on visitors was also a matter of concern. For the purposes of this analysis, these matters are dealt with by taking into account the effects of terminal construction and operation on the quality of the environment.

6.2.1 DREDGING

In the document entitled "Replies to Questions and Comments of the Department of the Environment - 5 December 1980" the proponent explains that dredging will only be necessary at Gros Cacouna Island during construction of the wharf. According to these experts, no dredging will be required for navigation or docking purposes, since the water at the proposed wharf site is sufficiently deep (12-16m).

It is also important to note that, according to the proponents, no maintenance dredging is foreseen, at least in the short term. The intertidal zone would thus not be affected by dredging.

According to the application, it will be necessary to dredge about 70 000 m^3 of silt and sand from an area of 8 750 m^2. This

dredging would only need to be carried out at the site planned for construction of supports for stone-filled caissons, 25 m square, whose main purpose would be to support the wharf columns. The present silt and sand substratum will be replaced by gravel. The 70 000 m^3 of material to be removed would not appear to be significant in comparison with other dredging operations carried out in this region.

In 1965 and 1966, 760 000 m^3 were dredged for the breakwater foundation at the port of Gros Cacouna. In 1967 and 1968, 2 410 000 m^3 were dredged inside this port. This operation was repeated in 1978-79 with the removal of 942 000 m^3 of spoil. Finally, 363 000 m^3 were dredged outside the harbour in 1967-68.

At the Rivière-du-Loup harbour, between 1970 and 1980, 28 900 m^3 to 65 705 m^3 were dredged annually in connection with port maintenance. These data are presented in greater detail in the table based on information supplied by the federal Department of Public Works, (letter filed with the Commission by Public Works Canada on 29/30 January 1981).

Even if the extent of dredging appears at first glance to be insignificant, we agree that these operations should be preceded by a sediment analysis to determine in particular the composition of the sediments and the concentration of any dangerous or toxic substances.

A detailed knowledge of sediment composition, together with an assessment of current velocities and directions in the area dredged will make it possible to determine the density and configuration of the dispersed sediment tail-stream likely to result from dredging operations. A knowledge of the concentrations of dangerous or toxic materials is extremely important to determine if these operations will result in suspensions exceeding acceptable limits and consequently resulting in the contamination of river waters and biological substrata. It is assumed that the proponents will provide the competent authorities with the data they have collected in order to

obtain a special dredging permit guaranteeing the safety of the operations.

With regard to the type of dredger to be used, the previously mentioned document containing answers to the questions of the Department of the Environment discusses the choice of either a grab-bucket dredger or a hydraulic-suction dredger. The Commission considers that the proponents' choice and their arguments in favour of the advantages of a grab-bucket dredger are logical; however, depending on the characteristics of the sediments, this decision will have to be taken after analysis of all the documents filed. The dumping of the dredged sediment is considered from two angles, depending on whether the sediment is contaminated or not. Contaminated sediment would have to be dumped in confined areas so that there would be no contact with the aquatic environment. The proponent suggests using the same fill area as for the construction of the Gros Cacouna port. This proposal should be adopted, since it would seem preferable to make use of an already disturbed area rather than to compromise virgin territory.

The proponent proposes two sites for non-contaminated sediment, namely, one 7.8 km upstream from the Island of Gros Cacouna (long. 69° 34', lat. 47° 32'30", depth 13m), and another 26 km from the island off St. Siméon between the North Shore and Ile-aux-Lièvres (long. 69° 52'10", lat. 47° 50'15", depth 40m).

A preliminary analysis shows that the first location, i.e. the one upstream from Gros Cacouna, appears to be the most suitable, since it would combine at one location the dredged materials from the LNG terminal construction and those from the maintenance of the port at Rivière-du-Loup.

Finally, the proponents suggest as another possibility the creation of new aquatic ecosystems using non-contaminated dredgings. Such a proposal was made by the Study Committee on the St. Lawrence River in its report in 1978. The Committee proposed, for example, that certain

dredgings be used to increase the intertidal wetlands and to create artificial islets. Using such an approach, the proponents would help minimize the effects of dredging in the St. Lawrence by adopting sound solutions and improving the quality of the ecological environment.

Later in this analysis we will deal with the program of environmental control and monitoring to which the creation of artificial habitats would be subject.

As part of its analysis, the Commission examined the possibility of dredging after the terminal had become operational. According to the proponents, the planning for the proposed harbour development is based on the principle of minimizing effects on the marine environment. Accordingly, the terminal would be built on pillars and the wharf would be located at a depth which would preclude the need for dredging.

In the document filed on 5 December 1980 in reply to the questions of the Quebec Department of the Environment, the proponents state:

> (---) dredging at Gros Cacouna will only be necessary during construction of the wharf. No dredging will be required for navigation or docking of the vessels since the river is deep enough at the wharf site. It should be noted that no short-term maintenance dredging has been provided for. The intertidal zone will not be affected by dredging operations.

Finally, during the second part of the public hearing, Mr. David Russell summarized the proponents' position regarding the need for maintenance dredging:

> Our concept is that we will be building in depth where we don't have to dredge which is what we said previously and we still believe that to be true. So, I have a problem in saying that we are going to extend the wharf where we

> are going to dredge because it is our belief that we will be doing neither, because with the vessel operating in the manner in which we expect it to operate in, the depth of water as we now understand it, is sufficient. (Transcript of hearing, 19 February, pp. 9 and 10.)

We can therefore conclude that, according to the proponents, there will not be any maintenance dredging.

6.2.2 WATER QUALITY

The principal factors contributing to the alteration of water quality during construction will be the dispersion of dredged materials, the installation of the pillars, land fill designed to create the necessary spaces for land facilities and the discharge of waste water. During the operating phase, the factors affecting water quality will be waste water from terminal operations, accidental oil spills and changes in the coastline due to land fill activities required for the installation of terminal infrastructures.

The main problem caused by dredging activities, as already identified, is the possible alteration of water quality. Data currently available and submitted by the proponents does not appear to indicate that dredging would cause any major problems with respect to water quality in the terminal area. However, the proponents have committed themselves to taking sediment samples at the dredging site and carrying out analyses in order to determine whether the spoil might release toxic materials into the marine environment.

The development of the area needed for the establishment of the terminal on the coast will involve dumping some 400 000 m^3 of fill taken from the adjacent cliffs. The effect of this operation on water quality will depend on the composition of the sediments being handled. The proponents indicate that the fill will consist of blocks large enough to resist the erosive action of the waves and ice. In the

circumstances, one can assume that there will not be any significant quantity of material fine enough to be transported by waves and currents and thus affect water quality.

The problem of waste water discharge from construction activities was dealt with by the proponents in response to a question from Environment Canada. In their reply, the proponents reaffirmed that all possible steps would be taken to avoid pollution of both the marine and the terrestrial environment. TransCanada PipeLines cited its experience in this field, mentioning that standards were laid down in a document entitled Environmental Protection Practice Handbook. In addition, they assured the Commission that contractors would be required to specify the means they intended to use to recover polluting substances related to their activities. The proponents indicated in their project description that, during the operating phase, waste water would undergo secondary treatment by means of a rotating-disc biological contacter to ensure that terminal effluents meet government requirements. The biologically-treated effluent would be discharged near the wharf at a rate of approximately 2.5 m^3/Hr. In addition, they assured us that water from the vapourizers containing carbonates would be neutralized before discharge at a rate of 3 m^3/Hr. Finally, a drainage system would be installed to recover water contaminated by hydrocarbon in order to extract all oil.

Considering that the terminal operations will not systematically produce pollutants and that the proponent is committed to ensuring that all effluents discharged to the environment will comply with government standards at all times, the Commission considers that the discharge of waste water will not pose problems as regards the quality of the environment.

The most serious possible cause of accidental water contamination would be an oil spill. A maximum of 1000 m^3 of diesel fuel will be pumped on board the LNG carriers each time they dock at the terminal. Recovery of oil products spilled on water is always considered a

difficult task and one that is rarely effective. Prevention remains the best approach to avoiding oil spills. During the second part of the hearing, the Regional environment council for Eastern Quebec made the Commission aware of their concerns with regard to the possible repercussions of this type of accident.

In order to give greater weight to this preventive approach, it is appropriate to examine the chances of recovering oil spilled accidentally at the terminal: this is almost nil if ice conditions exist, especially at Gros Cacouna. Oil spread over the ice would almost be invariably inaccessible, firstly because the ice would be too thick to permit the movement of floating equipment, and secondly because it would not be strong enough to support the weight of cleaning crews and their equipment. Icebreakers cannot be used either, since they would only break up and disperse the ice and the oil along with it. In other words, then for a hundred or so days a year, when the temperature is below the freezing point, there is no hope of success with these emergency measures. Further, in open waters, the deployment of booms and skimmers and other means of recovery must be considered in the light of the circumstances specific to the Gros Cacouna terminal, taking into account the following constraints:

1. The terminal will be built on pillars so as not to affect current and tide flows, but in case of a spill these pillars will make recovery of the oil more difficult.

2. The efficiency of booms diminishes as wave heights and current velocities increase: has an adequate assessment of the efficiency of recovery operations been made for conditions under which current velocities would exceed 1 knot, with wave heights of 60 cm-conditions likely to be encountered frequently at the proposed terminals. It should also be added that such conditions promote the spreading and mixing of oil.

3. Even under ideal conditions, it would be necessary to evaluate the recovery rate taking into account, amongst other things, evaporation and dissolution of the light hydrocarbon fractions which are in relatively large proportion in the case of diesel fuel.

In summary, the Commission considers that those responsible for the emergency measures to be taken in connection with the accidental spillage of hydrocarbons, on both the government's and the proponent's side, should apply their main efforts to the development of preventive measures aimed at minimizing the risk of such spills and, at the same time, protecting the waters of the St. Lawrence estuary.

Considering that these spills are due to human error or equipment failure and that they are more likely to occur during transshipment, it should be possible, as already mentioned, to provide for means of containment. As an example, the bridge or wharf where the transshipment of hydrocarbons will be carried out should be sloped inward so that any spilled liquid could be recovered in a sump at the centre of the wharf rather than spreading over the sea. It would also be possible to recover any liquid that might escape from piping or hoses connecting the vessel to the wharf by using sufficiently large troughs.

But, most important of all, the Commission believes that the proponents should make a special effort in training personnel in these matters and in supervising operations.

It was mentioned at the very beginning of this section that the shoreline will be altered owing to land fill operations during the construction of the terminal and that these operations might result in some problems of water quality. In the analysis, however, and taking into account the irregularity of the coastline in the vicinity of the terminal, the Commission considers that the work necessary for the

development of the terminal site should not cause major changes that might affect the coastal environment adversely.

Since they will be built on pillars, the wharf and the bridge would not have any appreciable impact on waves or currents. Some erosion might be observed around the pillars. However, since the latter are to be sunk in gravel beds, this material is presumably too coarse to be transported by the currents.

6.2.3 VISUAL IMPACT

Based on an analysis of the information on visual impact supplied by the proponents, it would appear that during construction the impact would be similar to that of a large construction site with movement of trucks and heavy equipment, cranes, scaffolding and stocks of materials. Apart from the truck movements, the construction site would be screened by the Island of Gros Cacouna. The visual impact would therefore be minimal.

Once built, the terminal will have two large LNG storage tanks 42 m high and 67 m in diameter. These tanks will back against the rock face of the island, on its northwest slope. The tanks will therefore be lower than the highest points of the island and will be nestled in the excavated area of the hillside.

For all practical purposes, the LNG terminal will not be in sight of the population. It will only be visible from the road along the Rivière-des-Vases and from the west part of Notre-Dame-des-Sept-Douleurs on Ile Verte, in both cases at a distance of some 5 km from the site. The tanks will be lower than the horizon line formed by Gros Cacouna Island. If appropriate colours are chosen, as suggested by the proponents, the terminal would be almost unnoticeable.

6.2.4 AQUATIC WILDLIFE

As for the analysis of the possible impact of terminal construction and operation on the aquatic wildlife, the Commission has studied at some length the presence of commercial fish species in the waters of the Cacouna region.

According to information supplied by the proponents, the ichthyofauna of the region includes the following commercial species: eel, capelin, smelt, tomcod, herring, black sturgeon and shad. However, the proponents state:

> (---) of the above species, herring is the most abundant. Herring are pelagic, planktonivorous fish that swim up the estuary into brackish water, often travelling in large schools. (Application, Vol. 4, p. D-36.)

Although we have very little information on the species in the immediate area of the site chosen for the terminal, we can agree that they would be present in more or less large numbers depending on the types of habitat found along the shores. The sand-bank marsh areas downstream from Gros Cacouna Island, between Ile Verte and the South Shore of the St. Lawrence, constitute a most favourable ecological area for aquatic wildlife.

The proponent stated, in response to a question from the Quebec Department of the Environment concerning the possibility of disturbing certain biological sites during construction of the terminal, that measures will be adopted to take account of these biological phenomena.

Despite this, with the exception of the dumping site chosen for the dredging spoil, one cannot really - in the light of the information supplied - reach any conclusions regarding the specific effects that the terminal construction and operation might have on commercial fishing in the area.

For this reason, the Commission carried out a summary assessment of the location of these fisheries and their activities in order to be certain that they will not suffer any major damage.

The analysis shows that between the wharf at Rivière-du-Loup and Rivière-des-Vases, 32 fishing licences were issued by the Quebec Government, distributed as follows:

- From Rivière-du-Loup wharf to l'Anse-au-Persil	6 licences
- From l'Anse-au-Persil to St. Georges-de-Cacouna wharf	8 licences
- Vicinity of Gros Cacouna jetty	5 licences
- North Shore of Gros Cacouna Island	1 licence
- From Gros Cacouna Island to the mouth of Rivière-des-Vases	5 licences
- South Shore of Ile Verte	7 licences

For further information on this subject, refer to the fishing licence location map (1980) on the next page.

The Commission would like to add, however, that the above information is based only on data relating to fishing licences issued by the Quebec government. The Commission does not know whether these licences are exploited, that is, whether licensed fishermen have in fact installed fixed gear at the above locations.

According to the information obtained by the Commission from various sources, regional fishing quotas would appear to be excellent for eel, herring and capelin.

It is not our intention to examine in detail the profitability of commercial fishing in this region, but rather to emphasize its importance in the light of the possible construction of the LNG terminal. One of the conclusions in the brief submitted by the

Regional environment council for Eastern Quebec is that additional information might be required in this regard:

> The protection of commercial species, with more information on the effect of the work on commercially valuable fish populations in the region, especially eel, herring, smelt and capelin. (CREEQ brief, p. 4.)

The analysis of fishing licence locations suggests that particular attention should be paid to the ten fisheries situated near the St. Georges-De-Cacouna wharf, the one at Gros Cacouna Island and the four others about 2 km downstream from the terminal site on the South Shore of the St. Lawrence.

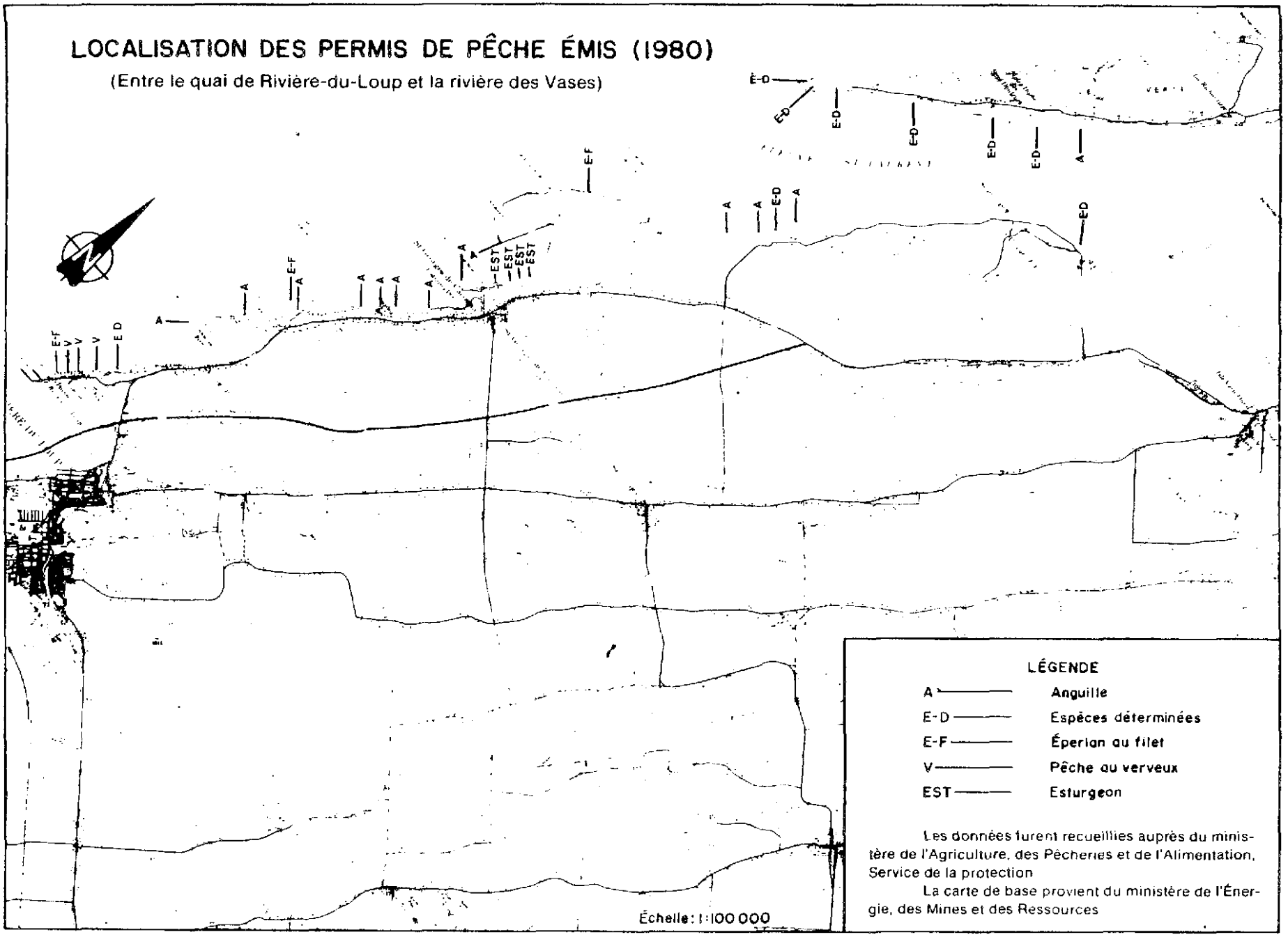
The fishery on the north shore of Gros Cacouna Island is less then 1 km from the terminal site and would be displaced by the terminal. The two most conceivable occurrences which might affect installations immediately above and below the site are an accidental oil spill and the dredging of 70 000 m^3 of loose deposits and gravel which is necessary for construction of the concrete supports for the access bridge.

As far as accidental oil spills are concerned, we can envisage only preventive measures for rendering them unlikely; however, if a spill were to occur, then the proponents, if they were at fault and if there were damage to others, would have to correct the situation and compensate the victims if necessary. The proponent undertook to do this at the public hearing:

> I think my response to that would be the same as it has been on another occasion similar to this and that if we, as Trans Canada were at Fault in any way in causing damage to others then naturally we'd compensate those that suffered some disadvantage like that. (David Russell, Transcript of hearing, 18 February, p. 75.)

LOCALISATION DES PERMIS DE PÊCHE ÉMIS (1980)

(Entre le quai de Rivière-du-Loup et la rivière des Vases)



Location of fishing licences issued (1980) (Between Rivière-du-Loup wharf and Rivière des Vases)

Legend:

A	Eel
E-D	Determined Species
E-F	Smelt (netted)
V	Hoop Net Fishing
EST	Sturgeon

Data furnished by the Department of Agriculture, Fisheries and Food, Protectiion Division.

On an original map from the Department of Energy, Mines and Resources

Scale: 1:100,000

On the other hand, the planned dredging is a one-time event that will not be repeated after construction. The Commission was informed that a dredging impact study, including a sediment dispersion model, would be completed by the spring of 1981. According to the proponents, this study should confirm that the temporary effects of the dredging will be limited to a radius of about thirty metres from the site.

It would thus be very important that this dispersion model provide information which would enable precautions to be taken to avoid reducing the catch. One possible measure is the establishment of a work schedule which takes into account the biological cycle of the most commonly fished species (eel, capelin, smelt, herring, etc.).

However, the proponents conclude that the terminal construction and operation activities will not have a significant effect on commercial fishing:

> We do not believe that there will be any impact on fishing since, as Mr. Roy emphasized, there is a fishery quite close to the present harbour and the catch appears to be very good. (Transcript of hearing, 18 February, p. 74.)

6.2.5 MARSH HABITATS

In its presentation, the federal Department of the Environment emphasized that there were ecologically important marshlands in the vicinity of and downstream from Gros Cacouna Island. The Department would like to see measures taken to ensure the protection of these areas, especially between Ile Verte and the South Shore of the St. Lawrence River.

> (---) Moreover, management schemes must be designed to further, the development of improvement schemes will guarantee the conservation of certain areas of significant

> ecological important value that areas which could be put in threatened peril. In order to ensure the long-range protection of these sensitive sites that are considered sensitive we recommend that these planning agencies develop an ecological zoning plan fo the region. (Report submitted by Environment Canada, p. 9.)

In connection with this subject, the Commission contacted the water environment branch of the Quebec Department of the Environment to obtain full information regarding the ownership of the intertidal zones identified between Gros Cacouna Island and Rivière-des-Vases. According to their interpretation, the seigniorial concessions in this area, a zone bounded by the high-tide line, belonged to the Quebec Government. For a clear picture of the area, the reader may refer to the map showing the position of the three seigniories, Le Parc, Lachenais and Villeray.

In the opinion of the director of the water environment branch, the reference to wetlands in the concessions does not imply, ipso facto, the granting of that area of the river banks between the low and the high-water lines.

For its part, the Department of Recreation, Fish and Game formed a working group for the protection of marsh habitats some months ago. The main tasks of the group are to analyse habitat conservation needs, study the various ways of providing for their protection, make recommendations to the decision-making authorities and initiate a program of action. The working group has already identified the area previously mentioned and agreed on its ecological importance.

The Commission believes that these wetlands are not very likely to be affected by the normal operations of the LNG terminal. But, where dredging is concerned, there is some reason to believe that a temporary increase in turbidity of the water and some change in the transport and

sedimentation phenomenon might occur in the marsh areas below Gros Cacouna Island.

These dredging operations will therefore have to be planned for periods of low biological production to minimize this impact.

The Commission is also very much aware of the repercussions that the LNG terminal might have on land use in this region. The intertidal zones between the Island of Gros Cacouna and the federal reserve further to the east form extremely important habitats, from the point of view of both area and quality, for biological production and for the maintenance of water quality, as pointed out in Environment Canada's report.

Further, these same areas could be attractive to the shipping trade and industries related to the terminal and the liquefication plant.

Without appropriate planning, this region could be adversely affected by developments which would deprive the St. Lawrence River of an environment generating major biological resources. The Commission emphasizes, not so much through excessive caution as through concern over preventive measures, that the government authorities should devote all the attention necessary to this situation, and that legal or administrative means be provided to ensure this protection in the near future.

If the interpretation of the water environment branch of the Quebec Department of the Environment is confirmed by the legal branch of the Department, this territory is owned by the government, a situation which would greatly facilitate the introduction of protective measures.

6.2.6 MARINE MAMMALS

At the hearing, several intervenors emphasized the possible effects that the LNG carriers might have on certain marine mammals in the Estuary and the Gulf of St. Lawrence. These effects would be felt mainly by the migrant populations of Greenland seals and several thousand hooded seals.

The conclusions of the federal Department of Fisheries and Oceans are that these populations would only be slightly affected, if at all, by the passage of the vessels. However, the route to be taken should be more clearly defined in order that the possible harmful effects on these populations during migration and the March pupping season may be taken into account. The proponents have in fact committed themselves to considering these factors in determining the route to be used by their vessels.

6.2.7 ENVIRONMENTAL CONTROL AND MONITORING

By environmental control, the Commission means the implementation of all mitigative and safety measures provided for at the time of construction of the LNG terminal and during its operation which are aimed at minimizing the effects on the environment. Environmental monitoring includes environmental studies and evaluations done on a short and medium-term basis with a view to confirming various predicted effects or to review certain operations to minimize their effects or ensure increased safety.

In the Commission's opinion, this program must be considered an integral part of the impact review and assessment process. We would go as far as to say that it is a guarantee of the process and that it ensures monitoring of the work and compliance with the requirements stipulated at the time of issue of the permit. Environmental control will enable the plans and specifications to be adapted to specific situations so that the safety and protection of the environment can be taken into account. Considering that impact forecasts may in certain cases be under or over-estimated, environmental monitoring will help

provide precise answers based on the collection of well-structured scientific information.

The responsibility for environmental control and monitoring must be exercised at three levels: the proponent, government authorities and local authorities and organizations.

The first stage, that is development of the program, falls to the proponent, guided by directives from government authorities. It is at this stage that the activities and responsibilities of each party will be determined.

The second stage is the launching and the follow-up of the control program during the construction period. Here it will be necessary to provide for various precise, flexible and efficient mechanisms so that prompt, well defined intervention will be possible. Those responsible should be fully competent to intervene as required and should have all the necessary authority.

The third stage, the implementation of the environmental monitoring program, consists in evaluating the medium and long-term effects. It should, however, provide replies to unanswered questions and fears and thereby contribute to reducing deficiencies in the operation of the terminal. The evaluation must also provide those responsible with a basic knowledge of environmental production, since they will no doubt have to make various decisions related indirectly to the terminal facilities.

6.2.8 LIAISON COMMITTEE

The formation of a liaison committee was suggested several times during the public hearing. This committee would be charged with establishing a permanent relationship between the proponents, government authorities, local authorities and the population in general. The exact functions of the committee were not defined during the hearing,

but there was a general feeling that the committee should be especially concerned with informing the public about the project and that it should participate in the development of emergency measures, be involved in specific urgent decisions related to adapting the project to local conditions during the construction phase, participate in the development and launching of an environmental control and monitoring program, and ensure compliance with regional hiring policies proposed by the proponents. All of this would make it at least a better prepared organization for planning the establishment of the terminal in the Cacouna region and making it much more acceptable to the public, and more in line with the public's wishes.

Consequently, the Commission considers that it is the proponents' responsibility to initiate such a committee and to ensure that all organizations concerned with the environmental aspects of the project, including socio-economic aspects, are represented. The various government parties concerned with the project should also be represented on the committee.

6.3 THE SOCIAL AND ECONOMIC ENVIRONMENT

6.3.1 GENERAL CONSIDERATIONS

In the study on the acceptability of the LNG terminal project at Gros Cacouna, the regional intervenors attached considerable importance to social and economic factors. Several were tempted to underevaluate other aspects of the question such as safety, the biophysical impact and the repercussions on the quality of life, in order to give greater weight to the economic benefits and spin-off. By way of example, it is interesting to note the following two statements: (the underlining is added by the Commission).

> (---) they hope that the proponents (---) will take steps to minimize as much as possible the few negative aspects that could result from implementation of the said project.

> (---) it appears that the anticipated benefits will greatly outweigh the few foreseeable negative effects which, incidentally, could be expected to decrease in the future. (Brief of the Corporation of the Village of Cacouna, p. 2.)

There are obviously good reasons for this attitude, as we will have occasion to show throughout this chapter.

In the following pages, the Commission will analyse its findings regarding the positive and negative effects that the project might produce. This analysis deals with economic and social questions related to the project, from the pre-construction period to the operating stage. These socio-economic effects obviously vary according to the stages of the project.

6.3.1.1 THE ECONOMIC CONTEXT

In carrying out this analysis, the Commission has endeavoured to situate the various components of the project as much in the perspective of the KRT region as in the context of the Rivière-du-Loup/Cacouna/St. Patrice agglomeration. The Commission has examined mainly the briefs filed during the second part of the hearing, the proponent's application and the proponent's replies to the questions of the federal and provincial departments of the environment. The Commission has also considered the information available for the Rivière-du-Loup region in a report on the economy prepared by the Quebec Department of Industry and Commerce.

The various social and economic arguments raised in favour of the project have been dealt with individually, albeit in different ways, by almost all the intervenors. There was a great deal of emphasis on the high unemployment rate in the region, the departure of young people for Montreal and Quebec City or the latter's need to seek their living on the North Shore. Also emphasized was the desire of the local people to

take their future into their own hands, to look after their economic development themselves, and to create centres of interest which would encourage the active population to stay in the region and conditions which would promote growth and creativity in the area of investments.

In this regard, the Commission notes, amongst other things, the remarkable efforts and impressive results of the actions taken in the co-operative sector. However, despite the fact that the population itself has taken control and despite the existence of major natural resources, the intervenors at the hearing found that these efforts were still not enough. They want to attract more large investments, especially in the high-technology field. Well-organized groups that have not spared any effort in seeking the industrial development of the region have impressed upon us the importance of developing activity in the secondary sector, which appears deficient when compared with the tertiary sector. It is in this context then - a context wherein the regional population hopes to see investments made by both government and private industry - that the Gros Cacouna terminal project is being proposed and that public hearings were held.

The Commission has already emphasized in the introduction, but repeats here for the purposes of its analysis, that the Gros Cacouna Island LNG terminal project is the latest in a long list of projects which have in turn provided fodder for political, social and journalistic activities over the last twenty years both in the immediate region and throughout Quebec. Besides Mayor Michaud of the municipality of the parish of St. Georges-de-Cacouna, many others consider that, with regard to the 'superport' or deep-water harbour of Gros Cacouna Island, or the solid bulkcargo transshipment port, many promises were made, many investments were announced amid a fanfare of publicity, and many hopes were raised with regard to economic spin-off, only to result finally in disappointment and defeatism over the meagre results achieved to date.

Although this context has weighed in favour of public acceptance of the project, despite the unquestionable risks associated with this type of

infrastructure, the project itself has given rise to numerous rumours. Judging from the newspapers and from the statements of certain intervenors, the Commission has found that the project has sometimes been greatly exaggerated, albeit through no fault of the proponents. By way of example, the Commissioners have seen the project represented as an investment of 1½ billion dollars and even, in one case, of more then 2 billion dollars, neither of which bears any relation to reality.

Given the socio-political context sketched above, we have felt it extremely important to provide the public with an optimistic but at the same time accurate picture of the project's economic aspects and to measure the real impact of the project while avoiding unreasonable expectations with regard to its contribution to the development. This has the effect of breaking with the past situation so vehemently decried by the intervenors. The Commission was surprised to find that the intervenors at the hearing tried to provide, at one and the same time, highly positive and highly negative descriptions of the region's economic situation. As we saw earlier, they emphasized the high rate of unemployment, the aging of the population and the depressing effect of a weak economy, on the other hand, they emphasized the dynamism of the economic agents, the value of available infrastructures, the excellence of the highway and railway systems and the industrial potential which is only waiting to be exploited. If one relies on the statistics presented by the intervenors, especially the Industrial promotion corporation of Rivière-du-Loup, one finds that the economic situation varies according to whether one is dealing with the town of Rivière-du-Loup, the Rivière-du-Loup area or the KRT region. The data shows that the town compares favourably with the general average for Quebec as regards income, average age and various other indices. The situation is less favourable for the Rivière-du-Loup area, while statistics for the KRT region reveal more obvious economic difficulties. As for the municipalities of the village and parish of Cacouna, economic activity, including agriculture, is satisfactory and incomes are comparable with those in Rivière-du-Loup. Questioned on

the subject, Mayor Michaud confirmed this impression. When one examines the figures for unemployed university graduates, one finds that most of those affected are teaching and social science graduates. This being the case, the Commission cannot see how development of a secondary industry might solve the unemployment problem.

Finally, it should be noted that the economic impact associated directly or indirectly with the terminal construction project should be felt mainly in the Rivière-du-Loup/Cacouna/St. Patrice agglomeration. Obviously, the population there is counting on this project, on the establishment of a solid bulkcargo port and on related industries, in the hope that all these projects together will generate sufficient economic activity to meet the needs of the KRT region as a whole.

6.3.1.2 COST/BENEFIT ANALYSIS: A FEW COMMENTS

The proponents have chosen to include in their impact study a cost/benefit analysis of the project. The Commission can only agree with this approach and mention that in many countries, such an analysis is the basic method used for evaluating public investment projects.

The advantage of this type of analysis for large-scale projects of the type proposed by the public and parapublic sectors is that it makes it possible to determine if the project, in terms of alternatives, will produce all the desired results. It appears to be increasingly necessary to consider, at the same time as the direct, indirect and induced economic effects of any given project, the economic costs imposed directly or indirectly on the community. In this way, it is possible to obtain a truer picture of the project's impact. For example, if we take the case of the routing of a highway, one can understand that the Department of Transport would favour the least expensive route; however, it is necessary to check whether the route might impose a much greater economic cost on the community than the benefit the Department of Transport might derive. This exercise must take into account not only all the direct and indirect benefits of the

project, but also the costs to the community and the restraints that may be imposed on other activities.

It was in this perspective that the proponents wished to carry out a cost/benefit analysis of their project, as indicated in section 5.10 of the impact study, on pages C-100 et seq of Vol. 4.

Examination of the results shows that the analysis describes in detail the direct, indirect and induced benefits derived from the expenditures incurred for terminal construction and operation and the taxes paid to the community. The study also refers to a number of spin-off activities which are unfortunately difficult to determine at the local level considering the little information that is available for the agglomeration.

As regards the costs to be assumed by the community, the study underestimates them, considers that they would be virtually negligible, or even ignores them outright. The proponents thus conclude that these costs would not be their responsibility or that if there were costs, they would assume these directly unless the taxes covered them.

These costs do exist, however. For example, there was the construction of an aqueduct to serve the deep-water harbour and island of Gros Cacouna. The construction of the terminal would require additional services connected with road maintenance, civil security and supervision of the work, to cite only a few examples. It will also be necessary to adopt a zoning plan so that land use will be compatible with industrial development projects around the island. The cost of this plan will obviously have to be borne by the municipalities, which will have to retain consultants to draw up the plan, ensure liaison with the various levels of authority and ensure compliance with the plan.

Other examples of costs: the presence of the terminal means that attention will have to be paid to its compatibility with a solid

bulkcargo port; otherwise, there would be a risk of increases in safety problems and possibly in insurance rates for the various operations. Further, according to the attorney for the parish of St. Georges-de-Cacouna, it is necessary to consider expropriation of existing cottages on the northeast side of the island. A project such as this one will, in the opinion of the proponents themselves, require development and landuse control within a certain radius of the terminal. In particular, the proponents suggest controlling the density of residential buildings near the boundaries of the restricted zone, with the obvious goal of reducing the risks associated with the operation of a major LNG storage depot. This means that the municipalities will have to adopt a lower residential density rate than would otherwise be the case and therefore suffer a proportional loss of revenue.

With regard to safety, by the admission of the proponents themselves, consideration should be given to the formulation of an integrated plan providing for emergency measures and even an evacuation plan for Cacouna and Rivière-du-Loup.

During the terminal construction phase, there may be temporary effects on the fishing installations in the neighbourhood of the island as well as on sports activities in the bay of Cacouna. It should also be noted that some inconveniences that are difficult to evaluate financially will be caused by truck movements, noise, dust, and all the normal inconveniences connected with construction projects of this size.

Obviously, one can always conclude that all these costs will be assumed by the proponent, by the government (as was the case with the subsidization agreed to by the Quebec Government for construction of the aqueduct mentioned earlier) or by the community itself to attract such a project. But in every case, we feel it is necessary to identify, evaluate and calculate all the costs and benefits that a project represents for a community.

> Such an approach goes beyond a simple study of the technical and financial feasibility of the undertaking and requires a study on a much wider scale. Guide to cost benefit analyses, Treasury Board Secretariat, March 1976.

It is highly probable, in the case we are concerned with, that the perception, the convictions and the will of the local authorities and interested groups would not have changed if they had been provided with more complete information on project costs. The Commission finds, however, that the exercise of preparing a genuine cost/benefit study of the project was not completed, the subject having been glossed over rather than analysed in depth.

Yet it appears essential to the Commission that the local authorities and everyone involved become completely and objectively aware of the short and medium-term financial implications, whether direct, indirect or induced, of the project proposed by the proponents. In this way, the local authorities would be able to calculate the financial and non-financial costs, examine them in relation to the anticipated benefits and subsequently impose with greater accuracy the taxation rate required to spread the burden equitably between the proponents and the community.

On the other hand, the Commission also notes the proponents' undertaking to act as good citizens by assuming their share of the property taxes which will eventually be imposed on them, and by offering to help local and regional authorities find solutions to particular problems which might be caused by the implementation of their project, such as accommodation, health and recreation services, civil security, sewage treatment, etc. It is obvious that such an attitude, provided it is followed through, makes the project and its risks more acceptable.

6.3.2 EFFECTS ON THE SOCIO-ECONOMIC ENVIRONMENT DURING THE TERMINAL CONSTRUCTION PHASE

Everyone expects the maximum economic benefits for the region to occur during the construction phase, mainly because the project will require many workers during the four years it will take to complete. This is obviously not a question of permanent employment but of temporary jobs with a fluctuating demand reaching a maximum of 470 jobs depending on the stage of construction.

Obviously, considering the relatively small population of the Rivière-du-Loup/Cacouna agglomeration, one cannot ignore the many benefits accruing from the arrival of a large group of workers hired at one site. The effects would be felt in accommodation, retail trade, materials supply, sports activities and the consumption of services as diverse as the cinema, health services, restaurants and laundries. Adding to this list the additional taxes that the local authorities will be able to collect, the animation generated by the arrival of skilled manpower and the stimulating effect that this new enterprise will have on the regional economy, the Commission concludes that, temporary as it may be, this resurgence of activity will have beneficial effects at the local level for a longer period than the construction phase itself.

To ensure improved co-ordination between the various groups involved, we have discussed at 6.2.8 the advisability of forming a liaison committee to link, on the one hand, the local authorities and groups interested in social and economic development or environmental protection and, on the other hand, the proponents. The Commission notes that such a proposal seems to have the endorsement of all the interested parties and concludes that such a committee should be organized as soon as the necessary construction authorizations have been obtained. In this regard, the municipality of the village of Cacouna emphasizes that one of the first tasks of the liaison committee should be to ensure that maximum efforts are made to hire workers in

the Rivière-du-Loup/Cacouna/St. Patrice agglomeration and the KRT region on a priority basis.

The Commission also notes the statement of the proponents, and considers it an undertaking on their part, to the effect that they would adopt the policy of purchasing the materials and equipment needed for the construction of the terminal and the wharf in the region, insofar as possible.

Similarly, maximum use would be made of the accommodation facilities near the work site. The Commission notes, however, that this accommodation should not be obtained at the expense of the sizable tourist industry of Rivière-du-Loup/Cacouna during the period from June-September. It might be advisable in this case to insist on maximum use of rooms for rent in private homes. We feel it would be rash to build new accommodation facilities for a temporary demand of this nature, considering that these new facilities might later compete with established facilities.

It is also necessary to consider the social impact that will necessarily be borne by the residents of the village and parish of St. Georges-de-Cacouna, who will come into daily contact with several hundred people not only from outside the Rivière-du-Loup/Cacouna/St. Patrice agglomeration, but also from outside the KRT region. It should be kept in mind that the new technology represented by an LNG terminal will make its presence felt not only during the operating phase but also - and perhaps even more so - during the construction phase, thus requiring workers and engineers who may not presently be available in the region, or even in the province. All this will result in considerable activity and animation, but it is impossible to say whether relations between the workers from outside and the present residents will be positive or negative. The Commission finds, to say the least, that this is a question that should also be a priority concern of the liaison committee.

As regards the problems which might arise in connection with recreational, health and police services, the Commission feels that the Rivière-du-Loup agglomeration has adequate services and is already large and well-structured enough to be able to absorb the additional activities without difficulty. This would be all the more true if the proponents were to establish certain infirmary services, maintain supervision over work site security and the behaviour of the workers, and offer any additional accommodation and recreational services that might be necessary.

6.3.3 EFFECTS ON THE SOCIO-ECONOMIC ENVIRONMENT: OPERATING PHASE

Many intervenors strongly emphasized the major benefits that would accrue from the operation of the terminal. We must point out, however, that many of these anticipated benefits stem from enthusiasm and optimism, and are not necessarily founded on studies or on an adequately documented file.

6.3.3.1 BENEFITS: REGIONAL AND PROVINCIAL

First, let us look quickly at the benefits the terminal would offer both to the Rivière-du-Loup/Cacouna/St. Patrice agglomeration and to the whole of Quebec.

It is obvious to the Commission that the establishment of an infrastructure like the LNG terminal in the St. Lawrence estuary offers definite benefits both for the region and for Quebec as a whole. In fact, as the creator of a number of direct jobs in a region where unemployment is endemic, an infrastructure of this type will also necessarily involve the use of complementary services which will create further jobs.

As the first LNG storage centre of this type and size in Canada, the terminal would undoubtedly draw the attention of many observers from industrialized countries to Rivière-du-Loup and Cacouna and confer upon

the area a prestige associated with the presence of a high-technology industry. It must not be forgotten that the method of supplying the terminal using ice-breaking LNG carriers would be not only a Canadian first, but also an international first, and would be sure to be of interest to Western Europe, which is well aware that a large part of current natural gas reserves are located in the Arctic. As a comparison, one might say that Cacouna would find itself in a somewhat similar situation to the little town of St-Laurent-des-Eaux in the Loire region, which was the site of one of the first French nuclear power plants.

In addition, the jobs created by the operation of the terminal would not only offer the additional advantage of opening the way for a new technology but would also enable some of the region's workers to acquire experience in handling LNG.

It is at the provincial level, however, that one realizes even more fully how valuable the completion of this project would be. In this connection, the Commission concurs in the opinion of Mr. Denis l'Homme, who stated on behalf of the Quebec Department of Energy and Resources that:

> (---) this project will promote the objective of increased reliance on natural gas in Quebec's energy consumption pattern (---) the security of our supplies would be
>
> strengthened considerably by the diversification of supply sources which would result from the existence of regasification infrastructures in Quebec. (Transcript of hearing, 14 January, p. 89.)

Moreover, one cannot ignore the fact that the planned installations would offer the considerable advantage of changing Quebec's position at the end of the supply line. The presence of the terminal would put

Quebec at the head of the system and would offer increased flexibility of supply and management of demand.

Finally, as Gaz Métropolitain so appropriately pointed out in its brief, the eventual connection of the terminal to the gas distribution system would unquestionably make it possible to supply gas to Eastern Quebec, a service that probably would not otherwise be initiated for many years.

The Commission also finds that the project as formulated is in line with the perspective adopted in the Quebec Government's white paper on energy, published in June 1978, which advocates the use of an LNG port located in Quebec to ensure an outlet for natural gas from the Arctic.

Nor can the Commission allow to go unmentioned the many studies carried out by the working group established by the Department of Energy and Resources, which conclude that it is possible to construct an LNG terminal at Gros Cacouna Island whose operation would be safe. These studies were carried out by employees of the Quebec government, with the help of independent experts.

Finally, the Commission must take into account the main conclusion of the brief filed by the Department of Energy and Resources as co-ordinator of an interdepartmental committee on the project, which reads as follows:

> (---) interdepartmental consultations have revealed that the LNG terminal project for Gros Cacouna as presented by the proponent is considered acceptable by all the departments consulted. (Brief of the interdepartmental committee, p. 14.)

6.3.3.2 EFFECTS ON EMPLOYMENT AND THE ATTRACTION OF INDUSTRY

Effects on employment: three arguments were frequently advanced by the intervenors at the hearing in order to justify implementation of the

project, namely, job creation, the advent of the cryogenic industry and the attraction of industry in general.

With regard to the creation of jobs, it is necessary to keep things in proportion and remember that the proponent expects to hire only 226 workers for the terminal and transshipment operations and for the two LNG carriers. The Commission finds that several intervenors exaggerated somewhat in evaluating the possible benefits of the project in the area of job creation.

With respect to indirect jobs, despite the many questions asked it is impossible to come up with a figure, given that the services to be provided at Gros Cacouna Island and at the LNG terminal have not been identified, apart from maintenance services for the access road to the terminal and cleaning services.

With respect to permanent direct jobs, the Commission finds that the proponent has stated, at page C-70 of Vol. IV of its impact study, that:

> The permanent site personnel consists of 19 people, at least 8 of whom will be hired locally.

On the other hand, André Marsan, at page 49 of the Transcript of the hearing for 14 January 1981, corrects these figures and says that the terminal operations will provide 13 man/years of work in the KRT region, out of a total of 26 permanent jobs open to Quebec workers. One can therefore conclude that the operation of the terminal will provide work for 13 people from the KRT region and another 13 from Quebec but outside the KRT region. The Commission is surprised at the small number of permanent jobs created by the operation of the terminal, considering the large quantities of LNG that will eventually be stored. In comparison, the terminal at Fos-sur-Mer, with a storage

capacity of 240 000 m^3, employs 63 full-time workers. The new terminal at Montoir in Brittany, with a capacity similar to that of the present project, but with a wharf capable of accommodating two ships at the same time, presently employs 75 people and plans to increase the number to about 100. The terminal at Cove Point, Maryland, with a capacity of 180 000 m^3, employs 100 people, while the terminal at Elba Island in Georgia employs 71. Since nothing in the documentation indicates that a new method of operation will be adopted, the Commission does not understand how it will be possible to operate the proposed facilities with so few employees. Gaz de France, for example, had provided for a staff of 40 at Fos-sur-Mer but found in 1975 that it needed to increase this number to 63 because it was impossible to carry out all the operations with such a small staff.

As for the operation of the LNG carriers, there would appear to be 182 permanent positions, with another 18 positions for shore-based support services. Of the above 182 positions, the proponents estimate that 35 would be available to Quebec workers (page C-73, Vol. 4 of the impact study), although this figure might be higher depending on supply and demand at the time the vessels are put into service and on the qualifications of the Quebecers who will have just joined the marine labour force. It is expected, however, that the 18 shore-based support positions will be available to Quebec workers.

Of the 53 man/years involved in LNG carrier operations forecast for Quebec, Mr. Marsan has stated, at page 49 of the transcript of the hearing of 14 January 1981, that "operation of the LNG carriers will offer about 28 man/years of employment to the region".

DISTRIBUTION OF JOBS

	LNG CARRIERS	TERMINAL
KRT Region	28	13
Quebec (including KRT region)	53	26
Outside Quebec	147	0

The Commission thus finds that according to the information currently available, the LNG terminal project at Gros Cacouna Island should provide 41 permanent positions for workers of the Kamouraska/Rivière-du-Loup/Témiscouata region, out of a total of 79 jobs available to Quebec workers.

One should also note the small number of jobs open to Quebec workers in the area of LNG carrier operation. It is advisable for agreements to be concluded with the Quebec marine institute at Rimouski so that specialized marine workers can be trained in Quebec to fill a larger number of the 200 jobs quickly.

It is understandable that a region which has seen so many of its residents in the most productive age groups go to work on the North Shore, in James Bay, the USA, Western Canada and even the Gulf of Mexico, will welcome with enthusiasm any project capable of creating permanent jobs. The Commission agrees with the opinion of the Industrial promotion corporation of Rivière-du-Loup that unemployment is the most disastrous circumstance, from the point of view of the social environment, that can effect a regional society.

The Commission only fears that excessive enthusiasm may mask the reality of the project and the benefits that can reasonably be expected by substituting benefits never claimed by the proponents. In this connection, the Commission cannot share the opinion of the Junior Chamber of Rivière-du-Loup, which writes:

> This project, with an overall cost of 217 million dollars, could single-handedly revolutionize all our region's prospects and settle definitively the chronic problem of unemployment and lack of growth in the regional economy. (Brief of the Junior Chamber of Rivière-du-Loup, p. 11.)

The Industrial promotion corporation says much the same thing on page 29 of its brief in stating that the project constitutes a unique opportunity to significantly improve an environment weakened by the economic stagnation of the last 25 years.

Like many intervenors at the hearing, the Commission agrees that the socio-economic impact of the project is the true prize at stake. The members of the Commission do not understand, however, how the present project alone can produce the vast repercussions attributed to it.

As for the Caucus of Parti Québécois members for Eastern Quebec, it states on page 5 of its brief that the construction of the LNG terminal will have a very positive impact on the Rivière-du-Loup region in terms of job creation. However, this positive impact depends on one condition, namely the concentration of several hundred new workers in the area. Again, nothing on record, either in the applicants' impact study or the various briefs filed with the office, allows us to state that such an ideal might be realized in the near future.

The Cryogenic Industry

Several intervenors have rightly emphasized that the operation of the terminal cannot in itself be the answer to the region's unemployment problem. The solution might lie in the establishment nearby of a number of satellite plants using low-temperature processes or seeking to locate close to a reliable source of natural gas.

During the hearing, many references were made to the cryogenic industry.

The Junior Chamber of Rivière-du-Loup stated in this connection:

> A host of other industrial investment projects could be attached to the establishment of a superport. There is talk in particular of canning factories and refrigerated

> warehouses which could operate at reduced costs due to the cold produced by LNG (---). There has also been talk of a cryogenic research centre as well as a whole group of cryogenic plants. (Brief of the Junior Chamber of Rivière-du-Loup, p. 3.)

The Caucus of Parti Québécois members for Eastern Quebec said:

> One can foresee the establishment in the Gros Cacouna region of various satellite undertakings which would use the cold produced by the storage of LNG. (Brief of the Caucus of Parti Québécois Members of Eastern Quebec, p. 6.)

In addition, the brief of the Cacouna Chamber of Commerce reads as follows:

> Entrepreneurs involved in energy production, commercial refrigeration and manufacturing processes using low temperatures are certainly going to be interested in taking advantage of the savings, which could run into the tens of millions of dollars in operating costs. The economic spin-off from such undertakings may be ten times the spin-off from the project itself. In the opinion of our local Chamber, this is the main argument influencing our position and our representations. (Brief of the Cacouna Chamber of Commerce, p. 7.)

Considering these definite views it must also be said that the municipality of St. Georges-de-Cacouna writes:

> It is also conceivable that the existence of an LNG terminal at Gros Cacouna would lead to the establishment of related industries in the region. (Brief of the Municipality of the Village of St. Georges-de-Cacouna,

p. 6.)

Similarly, it is worth quoting the Regional development council for Eastern Quebec:

> However, in this field it is difficult to make firm forecasts and many rumoured projects will never be realized. We should mention, however, certain suggestions which are not at all farfetched, such as refrigerated warehouses (---) recycling plants (---) a methanol production plant (---). (Brief of the Regional development council for Eastern Quebec, p. 13.)

For their part, the proponents cite three types of potential industrial spin-off from LNG technology, viz. energy production, commercial refrigeration and commercial manufacturing processes using LNG as a source of cold.

The applicants are, however, careful to point out at page C-98 of Vol. IV of their impact sutdy that the discussion of the subject is highly speculative.

According to information available to the Commission, only the third type of spin-off, the manufacture of liquid oxygen and nitrogen presently exists commercially rather than experimentally. This process is currently used at the regasification terminals at Fos-sur-Mer in the South of France and at Negishi in Tokyo Bay, Japan.

This statement is confirmed by the testimony of Mr. Bertrand De Frondeville, who stated that:

> The two projects which are, or rather the two systems of transporting LNG which, to my knowledge, use low temperatures industrially, are, as far as the liquid air industry is concerned, involved in the production

> of liquid oxygen and nitrogen; one of these is at Tokyo and the other is at Fos-sur-Mer, near Marseille, in France. The Japanese also use the cold from revapourisation in several of their installations, especially at Tokyo, to improve the efficiency of nearby thermal power stations, to which they also supply gas. (Transcript of hearing, 18 January, pp. 109 et seq.)

Although technologically the use of the cold produced by an LNG plant seems to be recoverable for other industrial purposes, the Commission must say that very few experiments or projects have reached the commercial production stage anywhere in the world.

The establishment of a cryogenic industry is an assumption which must be considered. The most appropriate approach, however, would seem to be that of the Regional development council for Eastern Quebec, which has stated that many rumoured projects will never be realized. In the Commission's view, all the arguments which base job creation prospects on the low-temperature industry should be treated with caution.

Attraction Effects

With respect to the attraction effects that the terminal might have on other industries and the possibility that they might locate near the terminal to be sure of a stable supply of natural gas, the Commission finds that no such project has yet been officially announced, notwithstanding the declaration of the Industrial promotion corporation to the effect that a plant would be interested in locating in the Cacouna region provided it could be guaranteed a supply of 7×10^6 ft^3 of natural gas.

The LNG terminal itself is a storage and vapourisation infrastructure connected to the natural gas transmission system. The transmission system under federal jurisdiction is not involved with the distribution

of natural gas, which comes under the jurisdiction of the provincial Régie du gaz et de l'électricité. The transmission system must be understood in relation to the distribution system, whose basic function is to bring the gas from the transmission system to the consumer. Needless to say, the two go hand in hand apart from the fact that the terminal is necessarily linked with the construction of a gas pipeline to which the various components of the distribution system will be connected.

The supply of natural gas to future plants in the Cacouna industrial park will require the installation of a distribution infrastructure; at present, no application for any such installation has been made to the Régie du gaz et de l'électricité.

The Commission does not believe that the industrial benefits of natural gas are to be found at this level. Gaz Métropolitain described these benefits clearly when it wrote:

> The company also wishes to emphasize the fact that such an LNG terminal (---) by its strategic position near important markets and by its industrializing effect on related enterprises will produce major economic benefits for Quebec in the short, medium and long term, while ensuring increased diversification in energy supplies for many years to come. (Brief of Gaz Métropolitain, p. 2.)

The Commission believes that the location close to markets and distribution infrastructures would have the effect of keeping the cost of natural gas at a reasonable level, thus protecting its competitiveness in relation to other forms of energy. The Commission cannot conclude that an industry might locate at Cacouna because it would cost less to purchase its gas supply near the storage depot. In fact, it can be expected that, a uniform pricing policy throughout the distribution system, like the existing one, would enable all consumers

located along the system to enjoy the benefits of natural gas without having to worry about their distance from the storage depot.

What might motivate industry to locate at the Cacouna industrial park is the fact that the present project submitted by the proponents forms part of a program for the improvement of the Rivière-du-Loup/Cacouna region, which already boasts a deep-water harbour capable of taking giant ore-carriers and other solid bulk cargo vessels. If one adds to this project, already partly finished, the fact that Rivière-du-Loup and Cacouna are at the junction of an impressive transport infrastructure; that they have access to sufficient electrical energy for industrial purposes and an available labour supply; that a regional development plan being carried out jointly by the village and parish of St. Georges-de-Cacouna will provide a large area for industrial development, one can understand that industry might be drawn to the site. This interest is all the more understandable if one adds to these benefits an additional factor; namely, the LNG terminal, which would facilitate - and even accelerate - the distribution of natural gas in Eastern Quebec.

CHAPTER 7

CONCLUSIONS

7.1 GENERAL

7.1.1 The Commission considers the project to build a liquefied natural gas terminal on the north shore of Gros Cacouna Island within the boundaries of the municipality of Saint-Georges-de-Cacouna parish, as a whole and as submitted, to be acceptable biophysically, socially, economically and in terms of safety.

7.1.2 None of the representations made by the intervenors and none of the Commission's findings are such as to cast doubt on the pertinence of the project, bring the terminal design into question or jeopardize its construction.

7.1.3 The Commission feels, however, that after obtaining government authorization but before formulating detailed plans and specifications, the proponents should supply further data concerning dredging, soil quality, wildlife resources, local seismicity, ice control, the technology chosen for tank construction, the environmental control and monitoring program and the contingency plan.

7.1.4 Since many projects previously announced for Cacouna have subsequently been abandoned, the Commission feels it is important, should this project be cancelled, that such a decision be announced as quickly and as unequivocally as if a decision had been made to build the terminal.

7.1.5 The proponents should establish, in cooperation with local and government authorities, a liaison committee whose primary duties would be to inform the population on the project and its schedule, to develop and see to the application of mitigative and emergency measures during

the construction and operation of the terminal and to ensure that the local hiring policies advanced by the proponents are followed.

7.2 BIOPHYSICAL ASPECTS

7.2.1 In general, having reviewed the contents of the application and having analysed all of the submissions from the intervenors at the public hearing, the Commission concludes that there is no major impact on the biophysical environment of such a nature as to prevent the issuance of a certificate of authorization by the government.

7.2.2 As for the impact on water quality, there is no technical reason to conclude that the terminal construction and operation activities will significantly affect water quality in the Cacouna region, provided that the mitigative measures proposed by the proponents are taken.

7.2.3 The planned dredging of 70 000 m^3 of material during the construction of the terminal wharf should be carried out in accordance with a program submitted and accepted by the Quebec Department of the Environment, after a more detailed analysis of the nature of this material has been supplied in support of the application.

7.2.4 During construction of the terminal, every effort should be made to dump dredged material at sites already in use for the maintenance dredging of Rivière-du-Loup harbour, so long as the sediments analysed by the proponents are not contaminated and unless the Quebec Department of the Environment determines a more suitable dump site with a view to enhancing certain natural habitats.

7.2.5 Should the analysed dredging spoil be contaminated, the Commission feels that it should be dumped in a confined environment so as to avoid the resuspension of any substances toxic to the environment.

7.2.6 Concerning the possibility of an accidental spill of petroleum products, the Commission feels that efforts should be concentrated primarily on the adoption of preventive measures, the training of personnel and recovery at the source, considering the difficulties encountered in on-water recovery operations during a large part of the year.

7.2.7 Notwithstanding the previous paragraph, should such an accidental spill occur on water, it would be advisable to supply the regional authorities of the Department of the Environment, as well as any other government authority requesting it, with an emergency procedure which takes into account the ecological zones represented by the marshlands near the terminal.

7.2.8 Whereas the liquefied natural gas terminal project can lead indirectly to encroachments on marshlands situated between Ile Verte and the South Shore of the St. Lawrence River, the Commission feels that immediate measures should be taken to protect these sensitive ecological areas.

7.2.9 The Commission feels that these marshlands constitute a significant part of the wildlife habitats in the St. Lawrence estuary and that any use other than wildlife management should be prohibited.

7.2.10 To this end, the Commission recommends that the analysis of the steps taken to provide such protection be assigned to the working group on the protection of priority habitats in Quebec, under the responsibility of the Department of Recreation, Fish and Game.

7.2.11 Concerning the ownership of these marshlands, the Commission suggests that the Department of the Environment determine the title and ownership thereof, by means of a legal opinion, in order to provide the above-mentioned working group with essential information for the execution of its mandate.

7.2.12 The Commission feels that certain commercial fishing facilities upstream or downstream from the terminal may be temporarily affected during the construction of the terminal. Consequently, it is recommended that environmental monitoring be carried out to limit such damage and provide for fair compensation, if necessary.

7.2.13 The federal Department of Fisheries and Oceans should obtain from the proponents any information necessary for establishing preventive measures designed to avoid any significant alteration in the activity of marine mammals which frequent these waters at a vital point in their reproductive cycle.

7.2.14 It is imperative that an environmental control and monitoring program be submitted for approval to the Quebec Department of the Environment.

7.3 SAFETY ASPECTS

7.3.1 Subject to the provision of fuller details concerning construction techniques and operating methods, the Commission feels that the liquefied natural gas terminal can be built and can operate safely within acceptable accident risk limits.

7.3.2 The government agencies responsible for public safety should ensure that the proponents establish and maintain all safety measures aimed at minimizing the risk of a major liquefied natural gas spill in the course of terminal operations.

7.3.3 The Commission suggests that the Quebec marine institute, located in Rimouski, be involved in the training and development of the staff working on the liquefied natural gas carriers.

7.3.4 Since it is imperative that liquefied natural gas carrier crewmen have a thorough and up-to-date knowledge of the operation of such vessels and of the safety equipment located on board, the

proponents should provide for regular drills to verify the condition of safety equipment and the crew's readiness to meet emergency situations.

7.3.5 The Commission feels that the marine activities of a solid bulk cargo port and those of the liquefied natural gas terminal can be co-ordinated and rendered compatible.

7.3.6 The likelihood of a major liquefied natural gas spill is low and the risks are acceptable, considering the criteria currently used by Canadian society. However, the responsible authorities should ensure, in cooperation with local authorities, that contingency plan is developed and implemented for the most exposed municipalities, including those situated along the St. Lawrence within Quebec's boundaries.

7.3.7 The Commission feels that the proponents, prior to establishing detailed plans for the liquefied natural gas terminal, must conduct certain additional studies on the geotechnical aspects and seismicity of the Cacouna region, to be submitted to the Quebec Department of Energy and Resources and the federal Department of Energy, Mines and Resources.

7.3.8 The proponents should develop a regular and exhaustive facilities inspection program to determine the aging and wear of equipment parts, and to ensure timely replacement.

7.3.9 The studies on the movements and formation of ice in the vicinity of the terminal must be completed.

7.3.10 Given the danger thresholds established by the proponents, the Commission feels it is necessary for docked carriers to be attended at all times by a sufficient number of tugs to allow emergency manoeuvering throughout the cargo transfer period.

7.3.11 The Commission feels that the proponents must decide quickly on the construction technology to be used for the LNG tanks in order that they may supply government authorities with complete information on this subject.

7.3.12 Regardless of the technology chosen for tank construction, the Commission is surprised to find that each tank is not encircled by an impounding basin with a capacity at least equal to that of the tank.

7.4 SOCIAL AND ECONOMIC ASPECTS

7.4.1 In the light of the findings submitted to it, the Commission feels that completion of the liquefied natural gas terminal project is desirable from the economic and social standpoints for the Rivière-du-Loup/Cacouna/Saint-Patrice agglomeration and for the Kamouraska/Rivière-du-Loup/Témiscouata region as a whole.

7.4.2 The Commission feels it is reasonable to build the terminal near Rivière-du-Loup, since this centre already has well-organized health, recreation and security services, thus avoiding the need to have small municipalities such as Cacouna (village and parish) bear all the costs related to a project of this size.

7.4.3 The Commission feels that the Cacouna terminal project would provide assured benefits to Quebec as a whole in that it would ensure a degree of diversification in energy supply, facilitate more rapid distribution of natural gas in Eastern Quebec and provide Quebec with direct access to natural gas reserves in the Arctic.

7.4.4 The Commission is of the opinion that, although its impact on employment and the economy will not be as significant as some people claim, the terminal project will give renewed hope to the population of the KRT region.

7.4.5 As a corollary, the Commission feels that any decision to abandon the project could lead to significant disbandments among the most committed groups and organizations.

7.4.6 Given the number of permanent jobs related to the operation the terminal, the Commission feels that the project will have a positive, though limited, effect on employment in the Rivière-du-Loup/Cacouna/Saint-Patrice agglomeration but that it will not solve the unemployment problem once and for all, as some would have us believe.

7.4.7 The Commission finds it difficult to understand how only 35 of the 182 permanent positions related to LNG tanker operations are open to Quebec workers and concludes that the offers made by the Quebec marine institute at Rimouski should be acted upon immediately in order to increase appreciably the number of jobs open to the Quebec population.

7.4.8 The Commission feels that, because the number of firms currently using the refrigeration capabilities of LNG terminals for industrial purposes is so small, it cannot be concluded that the construction of the terminal will, in the short term, lead to the development on Gros Cacouna Island of an industry specializing in refrigeration processing and use.

7.4.9 The Commission would have preferred to have the proponents conduct a more thorough cost-benefit analysis, so that the costs relating to the project could be calculated with as much precision as the benefits.

SIGNED BY

Michel P. Lamontagne

SIGNED BY

Michel Yergeau

SIGNED BY

John Klenavic

SIGNED BY

Luc Ouimet

SIGNED BY

Georges Drapeau

Sainte-Foy, March 20, 1981

LIST OF INTERVENORS WHO FILED BRIEFS OR EXPRESSED OPINIONS

1. La Jeune chambre de Rivière-du-Loup (junior chamber of Rivière-du-Loup).

2. Institut maritime du Québec (Quebec marine institute).

3. La Corporation de promotion industrielle de la région de Rivière-du-Loup (industrial promotion corporation for the Rivière-du-Loup region).

4. La Chambre de commerce de Cacouna (Cacouna chamber of commerce).

5. La Corporation municipale de la paroisse de Saint-Georges-de-Cacouna (municipal corporation of the parish of Saint-Georges-de-Cacouna).

6. Gaz Métropolitain Inc.

7. Le Conseil régional de développement de l'Est du Québec (regional development council for Eastern Quebec).

8. Le Conseil régional de l'environnement de l'Est du Québec (regional environment council for Eastern Quebec).

9. Gaz Inter-Cité Inc.

10. Caucus of Parti Québécois members for Eastern Quebec in the National Assembly.

11. Le comité interministériel du Québec (Quebec interdepartmental committee).

12. Energy, Mines and Resources Canada.

13. Environment Canada.

14. Fisheries and Oceans Canada.

15. Canadian Coast Guard.

16. La Corporation municipale du village de Saint-Georges-de-Cacouna (municipal corporation of the village of Saint-Georges-de-Cacouna).

17. La Chambre de commerce de Rivière-du-Loup (Rivière-du-Loup chamber of commerce).

18. La Chambre de commerce du Grand Portage (Grand Portage chamber of commerce).

19. Mr. Michel Gauvin.

LIST OF DOCUMENTS FILED

A -BY THE PROPONENTS

1. Curriculum vitae of TransCanada PipeLines and Petro-Canada representatives present at the public hearing.

2. Replies to questions and comments raised on 5 December 1980 by the Department of the Environment, 14 January 1981.

3. Applicant's reply to Mr. Michel Yergeau's question re a possible contradiction between Vol. I of the Application and the comments made by Mr. J. Archambault during the first part of the hearing, 27 January 1981.

4. Corrections to the text "Replies to Questions and Comments raised on 5 December 1980 by the Department of the Environment".

5. Replies to questions and comments submitted to the applicant by Environment Canada (Quebec Region), 6 February 1981.

6. Replies to questions raised by federal authorities at a meeting held in Quebec City on 30 January 1981.

7. Study of the black gulls of Gros Cacouna Island, 6 February 1981.

8. Replies to questions raised on 28 January 1981 by the Quebec Department of the Environment, environmental assessment branch, impact study analysis section, 6 February 1981.

9. Replies to questions and comments submitted to the applicant by the federal Department of Fisheries and Oceans (Quebec Region).

10. Answers to comments received from the federal Department of Energy, Mines and Resources, 6 February 1981.

11. Study of Ile aux Lièvres as a potential site for the establishment of an LNG terminal, 6 February 1981.

12. LNG Receiving Terminal Seismic Risk and Local Faults, Gros Cacouna, Quebec, Toronto, August 1980.

13. Applicant's replies to questions and comments raised by the Quebec Department of Municipal Affairs, 17 February 1981.

14. Corrections to the transcript of the first part of the hearing, 14 January 1981, submitted by the applicant, 18 February 1981.

15. Applicant's detailed comments on appendices 3 and 4 of the questions and comments prepared by Environment Canada, 19 February 1981.

16. Final comments of Mr. Don Wolcott at the session of 19 February 1981.

17. Replies to questions from Transport Canada (Coast Guard), Arctic Pilot Project, 3 February 1981.

B -BY GOVERNMENT ORGANIZATIONS

18. Report presented to the Office of public hearings on the environment concerning the Gros Cacouna LNG terminal project by the Department of Energy and Resources, conventional energy branch, 14 January 1981.

19. TERMPOL procedure and assessment methodology with covering letter of 22 December 1980 signed by A.L. Collier of the Canadian Coast Guard.

20. Technical comments on the application for a certificate of authorization to construct an LNG terminal at Gros Cacouna, Environment Canada (Quebec Region), 22 December 1980.

21. Assessment of the environmental repercussions of the LNG regasification terminal on the Island of Gros Cacouna, Energy, Mines and Resources Canada, 8 January 1981.

22. Technical review of the environmental impact study re construction of an LNG terminal at Gros Cacouna, Department of Fisheries and Oceans, January 1981.

23. Analysis of replies to questions and comments of sections B and C raised by the Department of the Environment on 5 December 1980, Quebec Department of the Environment, impact study analysis section, February 1981.

24. Preliminary report: site preselection, location study for an LNG Terminal in Quebec, Department of Energy and Resources, energy branch, gas and petroleum division, March 1979.

25. Emergency Evacuation Plan prepared by the applicant and the Department of Energy and Resources.

26. Memorandum on property law, St. Lawrence River, Gros Cacouna and Ile Verte area, Mr. Gilles R. Plante to Mr. Michel Lamontagne, 11 March 1981.

27. Memorandum from the Senior Assistant Deputy Minister of the Environment to the Acting Regional Director, Mr. Patrice Dionne, 25 September 1980.

28. Letter to Mr. Georges Drapeau from Mr. Jules Demers, federal Department of Public Works, re dredging carried out by private industry in Rivière-du-Loup harbour since 1970, 29 January 1981.

29. Letter to Mr. Georges Drapeau from Mr. V. Robichaud, federal Department of Public Works re dredging work carried out at Gros Cacouna harbour since 1965, 30 January 1981.

30. Topographic map of habitats favourable to migratory birds in marine environments, Ile Verte estuary of the St. Lawrence, maps Nos 45A and 45B, Environment Canada 1620 000.

C -BY OTHER ORGANIZATIONS

31. Notes for an address by the Honourable Marc Lalonde, Minister of Energy, Mines and Resources, Rivière-du-Loup, Wednesday, 17 December 1980, Jeune Chambre de Rivière-du-Loup, 17 February 1981.

32. Information Brochure, Gros Cacouna, mais c'est chez-nous, une page oubliée, Conseil régional de l'environnement de l'Est du Québec, 18 February 1981.

33. List of Cacouna commercial fisheries: Names, addresses and telephone numbers, Conseil régional de l'environnement de l'Est du Québec, 19 February 1981.

34. Survey of various aspects of municipal life at Rivière-du-Loup, June 1980, Jeune chambre de rivière-du-Loup Inc., 20 February 1981.

35. Rivière-du-Loup weather conditions, 1979 and historical data, Corporation de promotion industrielle de Rivière-du-Loup, 23 February 1981.

36. Extract from the interim report to the interdepartmental harbour subcommittee (solid bulk freight), Winds at Gros Cacouna, 6 April 1976, pages 76 to 91, Corporation de promotion industrielle de Rivière-du-Loup, 23 February 1981.

37. SOQUIP, draft: Parke underground reservoir, Jules Boucher, Member for Rivière-du-Loup, 20 February 1981.

38. Letter to the Office of public hearings on the environment from Mr. Yvan Roy, President, Conseil regional de l'environnement de l'Est du Québec, re commercial fisheries in the region, 16 March 1981.

LIST OF REFERENCE DOCUMENTS

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   Marsan, André. Evaluation of the environmental repercussions of the establishment of an LNG terminal and port, 21 February 1979.

2. TransCanada PipeLines and Arctic Pilot Project, Application for a Certificate of Authorization for the Construction of an LNG Terminal at Gros Cacouna, Province of Québec.

   Vol 1 Application and Summary, 86 p.
   Vol 2 Site Selection Study (Phase 1), 216 p.
   Vol 3 Site Selection Study (Phase 2) and additional studies 233 p.
   Vol 4 Public Interest, 583 p.

3. Petro-Canada and The Alberta Gas Trunk Line Company, The Arctic Pilot Project, January 1979.

   Vol 1 Application for Permit to National Energy Board, 16 p.
   Vol 2 Markets and Gas Supplies, 103 p.
   Vol 3 Installations, 111 p.
   Vol 4 Finance, 57 p.
   Vol 5 Public Interest, 153 p.

4. The Arctic Pilot Project, Summary of environmental statement, January 1979, 54 p.

5. Arctic Pilot Project, Environmental Statement Melville Island Components, January 1979, 175 p.

6. Arctic Pilot Project, Environmental Statement: Shipping Component, 261 p.

7. Arctic Pilot Project, Environmental Overview Gas Production Component, 233 p.

8. Arctic Pilot Project, Environmental Statement, supplementary information, November 1979, 260 p.

9. Melville Shipping Ltd. Arctic Petro-Carriers Project, Shipment of Liquefied Natural Gas from Melville Island to the Eastern Seaboard, System Performance, September 1977, 248 p.

10. Canada, Environmental Assessment Review, Arctic Pilot Project Draft Guidelines for the Completion of the Environmental Assessment Issued by the Environmental Assessment Panel and Submission on the Petro-Canada Environmental Statement, (January 1979), June 1979.

11. Canada, Environmental Assessment Review, 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, 25 p.

12. Canada, Environmental Assessment Review, Guidelines for the Completion of the Environmental Assessment for the Arctic Pilot Project, September 1979, 13 p.

13. Canada, Environmental Assessment Review, A Compendium of Briefs presented to the Arctic Pilot Project Environmental Assessment Panel, 222 p.

14. Canada, Federal Environmental Assessment Review Office, Arctic Pilot Project (Northern Part), Report of the Environmental Assessment Commission, Oct. 1980, 67 p.

15. Quebec, Office of public hearings on the environment, Bibliographical references on liquefied natural gas, August 1980.

16. Various articles extracted from the list of bibliographical references.

17. Articles from GASTECH 79, LNG-LPG Conference, Houston, Texas, November 1979.

18. Papers presented at the APP LNG Safety Seminar, Ottawa, 12 February 1980, 61 p.

19. Havens, Jerry A., Predictability of LNG Vapor Dispersion from Catastrophic Spills onto Water: An Assessment, prepared for the Office of Merchant Marine Safety, United States Coast Guard, April 1977, 210 p.

20. Havens, Jerry A., A Description and Assessment of the sigmet LNG Vapor Dispersion Model prepared for U.S. Department of Transportation, United States Coast Guard, Office of Merchant Marine Safety, Final Report, February 1979, 193 p.

21. U.S. Coast Guard Department of Transportation, LNG-LPG Vessel Management Plan and Emergency Plan, August 1979, 56 p.

22. U.S. Coast Guard Department of Transportation, Liquefied Natural Gas and Liquefied Petroleum-Gas, Views and Practices, policy and Safety, March 1980, 38 p.

23. Quebec, Energy Branch, Assurer l'avenir, la politique québécoise de l'énergie, 1978, 90 p.

24. Canada, Energy, Mines and Resources, The National Energy Program, 1980, 115 p.

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29. Canadian Standards Association, Liquefied Natural Gas (LNG) Production, Storage and Handling, CSA Standard Z 276 M 1978, 71 p.

30. Standard for the Production, Storage and Handling of Liquefied Natural Gas (LNG), NFPA 59A, 1979, 82 p.

31. Canada, Transport Canada, Coast Guard, Ship Safety Branch, TERMPOL Code LNG/LPG Supplement, October 1979, 51 p.

32. The National Research Council, Panel of Liquefied Natural Gas Safety Evaluation - Safety Aspects of Liquefied Natural Gas in the Marine Environment, Final Report, June 1980, 343 p.

NOTE: AVAILABILITY OF DOCUMENTS AND TRANSCRIPTS

All the documents and briefs submitted at the hearing and most of the reference documents listed in the Appendix are available from the

Office of public hearings on the environment, at Quebec City and Montreal.

The tape-recording of the hearing and the transcript of all testimonies are also available on request.