

ALASKA LEGISLATURE SPECIAL COMMITTEE / SUBJECT FILES 8672

658 SCOMM21: ROYALTY OIL & GAS FILES 1977-78

When comparing the estimated capital costs presented by the Alcan and Maple Leaf proposals themselves, which Staff feels are neither realistic nor supportable, with those of Arctic Gas there is no doubt of the superiority of the Arctic Gas project.

As will be noted below under the environmental section (3) the Fairbanks Corridor Alternative would be environmentally preferable to all three of the applied for projects, even if such an alternative includes a pipeline from the Mackenzie Delta along the Dempster highway to the vicinity of Whitehorse (Richards Island lateral). It must be emphasized that this environmental preference is not for the low pressure, thin walled pipeline being proposed by the Alcan project. What is contemplated in this environmentally preferred system is a 48-inch and 42-inch diameter high pressure project similar to the Arctic Gas project re-aligned to the Fairbanks corridor. The testimony of Staff witness Kiely (Tr. 141/22,681, et seq.) discusses the probable economic consequences of such a project. The cost of a 48-inch diameter pipeline from Prudhoe Bay, through Fairbanks, along the Alcan Highway (including south of Fort Nelson) to Caroline and Empress, Alberta would be in the neighborhood of \$6.5 billion (Exhibit ST-31). The facilities currently proposed by Arctic Gas from Empress to Dwight, Illinois are estimated at \$1.3 billion (Exhibits AA-35 and 71). A Richards Island lateral with a capacity of 2.4 Bcf/d would cost approximately in excess of \$2 billion; thus, the total cost of the environmentally preferable alternative would be in the range of \$10 billion, more than 16% greater than the Arctic Gas project as proposed. In view of this, it is still Staff's position that such an alternative is not economically viable when compared with the Arctic Gas project.

Staff's position with respect to economics and unit cost can be summarized as follows:

(a) The Arctic Gas showing of capital and unit cost although slightly optimistic, appears to be reasonable. In particular, the argument of the Green Construction witnesses was, in the main, successfully rebutted. *

(b) The El Paso project is more susceptible to capital cost overruns because of the greater use of new and untried technology. The 12 percent increase envisioned by the Arctic Gas witnesses is reasonable, as is their inclusion within the cost of service of \$1.00 per MMBtu for fuel use. *

(c) The costs of both the Alcan and Maple Leaf projects must be considered when comparing with Arctic Gas. Alcan's construction schedule is unrealistic, and the supposed saving on escalated cost is indefensible.

(d) The Alcan and Maple Leaf projects are much costlier than the Arctic Gas project for both the U.S. and Canadian consumers. Not only are Alcan's projected unit costs higher, particularly in the west, but because of highly questionable capital cost estimates and inequitable and unsupported allocation methods, they are also highly suspect. *

(e) On comparison the Arctic Gas project will be the ~~cheapest~~ cheapest of the three, both on a capital and unit-cost basis.

(3) Environment

The Alaska Natural Gas Transportation Systems Environmental Impact Statements evaluating the proposals of Arctic Gas, El Paso Alaska, and Alcan represent the most exhaustive study undertaken by the FPC environmental Staff to date. Working in cooperation with Staff members of the U.S. Department of the Interior (DOI), the Commission Staff issued a three-volume DEIS in November 1975 which adopted the 16-volume DEIS prepared by DOI, a five-volume FEIS in April 1976 which adopted the 11-volume FEIS prepared by DOI, and a two-part Supplement to the FEIS in September 1976. This massive effort culminated with the presentation of more than 40 environmental Staff witnesses in the Administrative Hearings to support the findings of the FEIS.

The Staff's conclusions concerning the environmental impact of the Arctic Gas, El Paso Alaska, and Alcan proposals have been based on a recognition that if gas is to be transported from Prudhoe Bay to the lower 48 states, facilities will have to be constructed. In this context, the overall projects as proposed by Arctic Gas, El Paso, and Alcan are each considered environmentally acceptable, presuming that the mitigating measures proposed by the applicants and those that would be developed and required by Federal agencies would be implemented and successfully enforced. These mitigating measures would significantly reduce potential impact and hold environmental damage to a minimum.

Staff's environmental analysis concludes that there are undesirable aspects associated with each project. It is clear that if one of the three proposals is certificated and built, impact associated with scenic, recreational, and game sanctuaries would not be avoided. In particular, the Arctic Gas system traverses the Arctic National Wildlife Range and the El Paso system traverses the Chugach National Forest and Prince William Sound areas which are highly worthy of preservation. The Alcan project lacks the necessary expansion and flexibility required to transport additional volumes of gas to the lower 48 states, suggesting that additional pipeline looping would be needed in the future. Both El Paso Alaska and Alcan projects would require that the Maple Leaf Pipeline system be constructed in Canada if transportation of the Mackenzie Delta gas is to become available for future Canadian consumption. The El Paso project, the least environmentally desirable of the three proposals, requires pipeline and LNG facilities to be built in areas of high seismic risk and unique beauty. }

Staff believes that the Arctic Gas proposal, without the western leg, is environmentally preferable to the other two proposals, and it is preferable to any other route, including Staff's Fairbanks Corridor Alternative, if it included the Maple Leaf Pipeline system. However, the Fairbanks Corridor Alternative, suggested by the Commission Staff, with the Richard Island Lateral, remains environmentally superior to Arctic Gas, El Paso Alaska and Alcan if both proposed and non-proposed systems are considered (Tr. 23,772, 23,604-23,605; ST-52, p. 389; 23,613). This 48-inch diameter high-pressure system could provide the flexibility for expansion not available with the Alcan proposal, as well as environmental benefits not available with either Arctic Gas or El Paso Alaska. 27/ The above conclusions do not consider economic feasibility. These considerations are covered elsewhere in this brief. For an economic analysis of the Staff's Fairbanks Corridor proposal, see Section IV (2) above.

(4) Engineering

The particular terrain that is traversed by each of the proposed Alaskan natural gas transportation systems and their selected mode of operation determines the nature and extent of the engineering required for each project. Staff

27/ A description of this alternative appears on page A-7 of Exhibit ST-18 and Tr. 23,527-23,529.

believes that the alignment of the Arctic Gas project with its proposed design parameters is clearly superior to the other two projects. The Arctic Gas system has been designed against a background of extensive research and engineering planning. Its proposed alignment avoids areas of high seismic risk, mountainous terrain, and high soil liquefaction potential. In contrast, the El Paso system would employ sophisticated liquefied natural gas (LNG) technology to build terminals in areas of high seismic vulnerability. El Paso has not conducted the necessary base line studies to accumulate the geological information to adequately design its system and estimate costs. The El Paso pipeline passes through rugged mountainous terrain. The Alcan project also traverses high seismic and mountainous areas in Alaska and Canada, but not to the degree of El Paso. Alcan faces a soil liquefaction problem along a portion of its route in Alaska from Delta Junction to the Alaska-Yukon border. The Alcan pipeline system is based upon engineering principles and facility limitations which would necessitate further construction and looping once additional supplies of natural gas are found in northern Alaska. The Arctic Gas project is superior to the other two proposals in terms of fuel usage.

The Arctic Gas project is based upon a enormous engineering effort into every important area of design. Arctic Gas has pioneered research in many of these areas like frost heave and construction equipment. It has conducted seismic surveys, soil liquefaction studies, pipe stress tests, and the testing and design of new construction equipment. The design of its pipeline gives gas consumers the most efficient system in terms of net energy at least cost to the consumer. Its alignment avoids mountainous areas and high seismic zones. The Shallow Bay area of the Mackenzie Delta is the only geological area where liquefaction might occur; however, recent tests suggest that the soil liquefaction potential is low. The 1680 design is a consistent next step in the evolution of pipeline design.

The Alcan project crosses moderate seismic areas in Alaska 28/ where the liquefaction potential of soils is high and ground shaking and its secondary effects would be the main earthquake hazard. In the Canadian section of the proposed Alcan system, the pipeline would face a danger of fault rupture in the Shaskwak Valley where extensions of the Denali Fault are believed capable of magnitude 7 earthquakes. No studies have been performed and presented to this Commission, to support the finding that an adequate design for earthquake and soil liquefaction protection

28/ Livengood, Alaska to the Yukon, Alaska border.

has been made or that costs for such protection have been adequately estimated. The proposed Alcan pipeline would closely follow the operational Alyeska oil pipeline. Special provisions would have to be made to assure that the Alyeska VSMS or the oil pipeline would not be damaged by Alcan construction where the natural gas pipeline would cross or lie near the operational oil pipeline. It is possible to design suitable construction procedures; however, one mistake could damage the Alyeska pipeline, i.e. a single blasting shot going awry. The Alcan pipeline would also be less efficient than the Arctic Gas line in terms of fuel usage due to Alcan's lower wall thickness pipe, lower operating pressure, and longer route. Gas consumers would also lose valuable Btu's which will have to be stripped from the Prudhoe Bay gas stream in order to make the gas suitable for its transportation through the Alcan pipeline. ^{29/} Arctic Gas does not have this problem. The construction of the necessary gas conditioning plant in Prudhoe Bay and the necessary engineering and environmental studies for the Alcan pipeline make its proposed construction schedule impractical and unrealistic.

The El Paso system transporting gas through a rugged mountain area to a geologically dangerous Alaskan shoreline for further transportation to an earthquake region in California has the least desirable geotechnical alignment of the three proposed systems. El Paso's pipeline would cross the Denali Fault, traverse the Chugach mountains in Alaska where many faults may exist, and terminate at Point Gravina, another major earthquake region. El Paso has not conducted the necessary work to establish a proper seismic design for its terminal at Point Gravina, nor has it surveyed and studied the adjacent off-shore region. At Point Conception, California, the receiving terminal for El Paso Alaska LNG ships has likewise not been designed adequately to assure that it would withstand the maximum credible earthquake expected at such site. Again the baseline studies necessary for such design have not been done. The El Paso system is extremely fuel inefficient when compared to a pipeline, even with the most advanced LNG technology. In addition to using the gas for fuel, the LNG system uses electricity and fuel oil to operate the regasification facility and tankers. Over the life of the El Paso LNG project, on a conservative basis, it can be expected to consume as addition fuel

^{29/} Some of these Btu's extracted from the gas could be put into the Alyeska oil line; however, oil consumers would not necessarily be the gas consumers served by the Alcan project.

between 1/2 to one full years supply of delivered Prudhoe Bay gas. If the Arctic Gas's figures for fuel consumption are accepted, El Paso would deliver 6 percent less gas to market at a 2.25 Bcf/d of Alaskan input level, which over a 20-year period would equate to 1.2 years delivery of gas. ^{30/} The El Paso system requires a technology at its LNG vaporization and regasification terminals and ships which far surpasses presently operating LNG facilities.

(5) Gas Supply

All of the proposed systems are designed to transport gas from Prudhoe Bay to the lower 48 states. Prudhoe Bay contains the largest hydrocarbon reservoir on the North American Continent. Initial deliveries of gas from the North Slope of Alaska will approximate 2.0 to 2.5 Bcf/d in at least the initial years of production. Staff witness Wayne Thompson testified that a gas sales rate of 2.25 Bcf/d through year 1992, and thereafter a rate of 4.0 Bcf/d, could be achieved. All three of the proposed systems would be able to accommodate the initial volume. However, if additional volumes of gas should become available from nearby areas or Prudhoe Bay volumes reach a high level, Alcan and to a lesser extent El Paso are at a disadvantage to the Arctic Gas system, because of their capacity constraints and fuel usage.

The Kuparuk and Lisburne formations in the Prudhoe Bay area are possible future sources of additional supply. The Department of Interior estimates that reserve additions from these areas could reach 2.5 Tcf and 2.4 Tcf respectively. The most promising areas of potentially large gas reserves on the North Slope are the Arctic National Wildlife Range (ANWR) and the Beaufort Sea area. Potential reserve estimates in the ANWR are in excess of 14.5 Tcf and the potential reserves in the adjacent Beaufort and Chukchi sea provinces are estimated at 46.5 Tcf. If additional reserves are forthcoming from these areas, the Arctic Gas system would be the best system of the proposed three to transport such gas.

^{30/} With 26 trillion cubic feet of gas and with 6 percentage points difference in efficiency, 1.56 Tcf more gas would be delivered to market under Arctic's proposal assuming the same input volumes (See AA-127, p. 11, 16; Mitchell 168/27,653-27,657).

The Arctic Gas project would also benefit Canada through the transportation of gas from the Mackenzie Delta region of Canada. The transportation of Mackenzie Delta gas would further provide benefits to U.S. consumers by reducing the transportation costs associated with Prudhoe Bay gas. The shipment of Prudhoe Bay and Mackenzie Delta gas in one pipeline provides lower transportation costs for gas purchasers from both areas. It can be expected that approximately .7 Bcf/d of gas will be available from Mackenzie Delta in its early years of production. Canada has in recent years been allowing export permits to terminate. It is very doubtful, though, that Mackenzie Delta gas volumes will rise in the future to the level that exports of gas to the U.S. can be resumed at prior levels. Staff concludes, based upon NEB reports, that at best the connection of the Mackenzie Delta reserves will slow down or flatten out curtailment of Canadian exports of gas to the U.S. Rising Canadian domestic needs will absorb the Delta production in a relatively short period of time. The fact that Canada is now a net importer of oil may cause growing pressure upon its current surplus position in natural gas (Exhibit PG-126, page 140). *Handwritten: helpful*

(6) Financing

The primary determinant to successful financing is the economic viability of a project (Tr. 25,655; 18,565). The project must be able to generate operating revenues sufficient to meet its expenses, service its debt, and provide an adequate return for equity investment and at the same time market a product which the public can afford and will purchase. This assures that a capital market exists which can provide funds to the project. If two projects are equally attractive in terms of economic viability, the cost of financing itself becomes important.

As discussed earlier, Staff believes that the Arctic Gas project is vastly superior to the other two projects in terms of economic viability. It is able to deliver gas to the lower 48 states at a lesser cost than the El Paso and Alcan projects. Lending institutions are available in Canada, the United States and Euro-dollar areas which can provide capital funds to the project. The Canadian market, however, could be somewhat strained because of its proposed portion of the Arctic Gas capital. This could result in additional financing costs, although the funds would probably be available. 31/ The Alcan and Maple Leaf projects would strain it possibly even more.

31/ Over its construction period, Arctic Gas would account for a portion of new gross new corporate issues in Canada higher than normally taken by any one issuer (See Staff Financial Brief).

In terms of financial costs, the El Paso project is more attractive. The cost of capital for the Canadian portions of the Arctic Gas or Alcan projects will be higher whether the capital comes from Canada or U.S. markets. The El Paso project also has the benefit of Federal subsidies through the U.S. government guarantee under Title XI of the Merchant Marine Act of 1931, as amended (Giorle/Tr. 25,524-25,525).

(7) Tariff

Each of the three main applicants in this proceeding have filed pro forma tariffs designed to delineate the typical terms and conditions upon which gas transmission service would be rendered. The issues involved with tariff matters are common to all three applicants and would apply equally to all systems on an overall comparison basis except in the instance discussed below.

The one area where a tariff matter does have importance in an overall comparison between the applicants involves the proper allocation between U.S. and Canadian gas as it transits Canada in the same pipeline. Both Alcan and Arctic Gas have proposed a different manner to allocate costs between the U.S. and Canadian gas. Staff believes that the Arctic Gas procedure of utilizing the Mcf-mile method is a fair and equitable way of allocating costs. However, the proposed Alcan procedure is not fair and equitable to U.S. shippers. Alcan's method of cost allocation segregates its individual Canadian systems and assign costs to U.S. markets on an incremental basis. Alcan would freeze Alaskan gas costs at the initial looping stage of the AGT and Westcoast systems, which is the most expensive stage of any system's expansion. Later additions of other gas would get the benefit of lower costs. For this reason and others, as outlined in our cost allocation brief, Staff believes Alcan's Canadian allocation procedures are inequitable.

(8) Canadian Law and Treaty

Arctic states in its Canadian Reply Brief (p. 27) that Staff believes Canadian issues are "not real." This is inaccurate. The record evidence and legal argument of the parties have greatly reduced the number of conceivable unknowns which flow from the transit of U.S. gas across Canada. Moreover, these conceivable unknowns are not likely to affect the interests of the United States adversely, given the unprecedented trading relationship and history of cooperation between the two countries and the recent hydrocarbon treaty. The treaty is useful to the analysis not so much for its terms and conditions or for speculation about how protocols might be applied to a specific natural gas transportation system, but rather as evidence

that both governments are committed to carrying past cooperation into the future. Based in large measure on an evaluation of the persuasive record contribution of the State Department, 32/ Staff concludes that the Canadian law and treaty issue offers little if any guidance in a choice of an Alaskan Natural Gas Transportation System. The risks associated with the transit of United States gas across Canada are "real", but Staff believes they are modest and can be prudently incurred.

(9) Markets

The record in this proceeding contains considerable market and end-use information, but only with respect to those markets served by the respective potential shippers. However, reliability of this information is questionable. Since the major portion of the Prudhoe Bay reserves has not been contracted for, the identification and extent of specific markets to be served is merely speculative. Furthermore, in view of the time that will be required to complete any of the projects, we believe that these projected market studies may no longer be representative of the actual situation. The projected market requirements and anticipated supplies are too speculative to be utilized, particularly for comparative purposes. At the time such gas becomes available for curtailments, experienced during the interval coupled with a higher cost of gas, especially if deregulation becomes a fact, may result in a dramatic alteration in consumption patterns, not only for the participants but for the nation as a whole.

Although the future market requirements of individual pipelines may be speculative, it is apparent that the nation is presently experiencing a natural gas shortage 33/ and further, that future supply projections show a continued decline resulting in an even greater shortage. It is for this reason that Staff has recommended that, in spite of the absence of gas purchase contracts, a trunkline facility should be authorized at this time, but that such facilities be only those required to transport Alaskan gas to the lower 48 states and which would serve all regions of the country with a minimal amount of additional facilities (Lathom/Tr. 108/14,169-70).

32/ Exhibit EP-231, p. 173-188.

33/ "The Congress finds and declares that--(1) a natural gas shortage exists in the contiguous states of the United States; . . ." (Public Law 94-586).

Thus, the choice of an applicant does not revolve around which market its facilities will serve but rather which will best provide access to Prudhoe Bay gas for all markets. The trunkline of the Arctic Gas project best meets this criterion. It has been adequately demonstrated on the record that all regions of the country can be served either directly through the Northern Border facilities or by displacement. The proximity of the terminal point of the Northern Border Pipeline at Dwight, Illinois, to the center of the nation's major natural gas market area is graphically illustrated by Exhibit ST-46, and its relationship with the nationwide grid of existing pipeline facilities is evident when the proposed route is compared with Item by Reference ST-A.

V.

CONCLUSIONS AND RECOMMENDATIONS

The modified Arctic Gas project which economically connects the Mackenzie Delta reserves to existing facilities within Canada and the Prudhoe Bay reserves to existing facilities within the United States, is vastly superior to the El Paso Alaska project and the Alcan and Maple Leaf system. The evidence is overwhelming.

Staff supports the Arctic Gas project modified and improved by the elimination of the "western leg" lateral to California, which has been shown on this record to be high risk, uneconomic, unnecessary and environmentally unsound. ^{34/} The project supported by Staff is shown in Figure 1. Reference is made to Appendix B which is a check list of Staff proposed action on specific docketed applications in this case.

In Section IV(1)(c) we concluded, for the reasons stated therein, that the Maple Leaf project must be considered with the Alcan project. Having taken this position for our purposes in reaching a position we hasten to point out the obvious. It is possible that the Canadian Government will decide that it is in Canada's best interests to defer indefinitely into the future, consideration of any and all projects south along the Mackenzie River corridor, no matter what the economic consequences for Canada and the United States. We believe, however, that our responsibilities in this case are to develop a record based upon traditional economic, engineering, environmental and other factors and to take a position based upon these factors and these factors alone. Determinations as to what the United States Government should do in respect to authorizing an Alaskan gas project, if use of the Mackenzie Valley corridor is precluded, would depend upon the reason for the Canadian rejection of a Mackenzie Valley corridor and a Canadian decision on what was not precluded. Consultations between the two governments would be necessary, and should include the participation of each government's working level Staff who were intimately involved in the development of the decision-making process. Only in the case when no Alaska gas would be permitted to transit Canada

^{34/} Staff's position on the "western leg" or California lateral is fully covered in three specific briefs, which are listed in Appendix A... September 9, October 29 and November 19, 1976. The November 19th brief deals with Section 5(b)(1)(c) of Public Law 94-586 in respect to the "western leg".

is there a clear Staff choice of an alternative to the Arctic Gas project, without the need for more information. In this particular situation the El Paso Alaska project, in one of its variations, would be all that the United States could authorize.

Respectfully submitted,



Allan W. Anderson, Jr.
Commission Staff Counsel



Brian J. Heisler
Commission Staff Counsel

Washington, D.C.
December 7, 1976

APPENDIX A

Federal Power Commission Staff Briefs
Filed in El Paso Alaska
Company, et al. Docket No. CP75-96, et al.

<u>Issue Date</u>	<u>Title of Brief</u>
May 28, 1976	INITIAL TARIFF BRIEF OF COMMISSION STAFF
July 16, 1976	COMMISSION STAFF GENERAL CONDITIONS AND SCOPE OF PROCEEDINGS BRIEF (Supplement filed September 13, 1976)
September 8, 1976	+ COMMISSION STAFF BRIEF ON THE ISSUE OF SITING OF THE PROPOSED CALIFORNIA LNG GASIFICATION TERMINAL
September 13, 1976	BRIEF OF THE COMMISSION STAFF ON ARCTIC GAS PROJECT WESTERN LATERAL TO CALIFORNIA
September 13, 1976	BRIEF OF THE COMMISSION STAFF ON THE COOK INLET/CAPE STARICHKOF ALTERNATIVE
September 15, 1976	+ COMMISSION STAFF GAS SUPPLY BRIEF
October 4, 1976	REPLY BRIEF OF THE COMMISSION STAFF ON THE COOK INLET/CAPE STARICHKOF ALTERNATIVE
October 12, 1976	+ GAS SUPPLY REPLY BRIEF
October 29, 1976	REBUTTAL BRIEF OF THE COMMISSION STAFF ON ARCTIC GAS PROJECT WESTERN LATERAL TO CALIFORNIA
November 12, 1976	✓ INITIAL GEOTECHNICAL BRIEF OF THE COMMISSION STAFF
November 19, 1976	+ BRIEF OF THE COMMISSION STAFF ON SECTION 5(b)(1)(c) OF PL94-586
November 19, 1976	+ INITIAL ENVIRONMENTAL BRIEF OF THE COMMISSION STAFF
November 26, 1976	BRIEF OF THE COMMISSION STAFF ON NATIONAL SECURITY AND CANADIAN MATTERS

APPENDIX A

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Issue
Date

Title of Brief

November 26, 1976

+ INITIAL SOCIO-ECONOMIC BRIEF OF
THE COMMISSION STAFF

December 1, 1976

ANSWERING TARIFF BRIEF OF THE
COMMISSION STAFF

December 3, 1976

* GEOTECHNICAL REPLY BRIEF OF THE
COMMISSION STAFF

December 3, 1976

BRIEF OF THE COMMISSION STAFF ON
COST ALLOCATION ISSUE

Briefs to be Filed by Staff Prior to December 15, 1976:

' STAFF NET NATIONAL ECONOMIC BENEFITS
BRIEF

* STAFF FINANCING BRIEF

* STAFF WRAP-UP BRIEF

Reply briefs may be filed on socio-
economic and environmental issues.

APPENDIX B

CHECKLIST FOR REGULATORY ACTION ON STAFF'S ARCTIC GAS TRUNKLINE

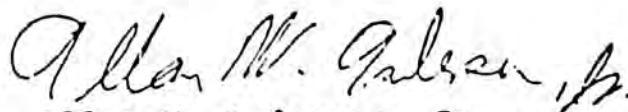
- (1) Grant applications of Alaskan Arctic Gas Pipeline Company in Docket Nos. CP74-239, CP74-240
- (2) Grant applications of Northern Border Pipeline Company in Docket Nos. CP74-290, CP74-291, with election filing for up to fully-powered case
- (3) Deny applications of Pacific Gas Transmission Company in Docket Nos. CP74-241, CP74-242
- (4) Permit withdrawal of Interstate Transmission Associates (Arctic) in Docket Nos. CP74-292, CP74-293
- (5) Hold in abeyance */ action on the application of Northwest Pipeline Corporation in Docket No. CP76-174, directing submission of description of facilities needed for "Rye Valley" displacement in conjunction with termination of NEB Lic. GL-4
- (6) Hold in abeyance */ the following pro forma Section 3 and 7(c) applications by shipper companies until perfected by submittal and Commission approval of gas purchase contracts: Columbia Gas Transmission, et al. CP75-257, Natural Gas of California (PGT) CP75-247, Pacific Interstate Transmission Company CP75-248, Northwest Alaska Company CP75-250, CP75-251 and Northwest Pipeline Company, Michigan Wisconsin Pipeline Company CP76-43, Natural Gas Pipeline Company of America CP76-49, Northern Natural Gas Company CP76-45
- (7) Deny stale Section 3 application of Pacific Gas Transmission Company in Docket No. CP71-182 for new import from Alberta.
- (8) Deny the following pro forma Section 7(c) applications rendered moot by eastern displacement: Columbia Gas Transmission Corporation CP76-48; Panhandle Eastern Pipeline Company CP76-54; Texas Eastern Pipeline Company CP76-54
- (9) Deny the following pro forma Section 7(c) application rendered moot by ITAA action Pacific Interstate Transmission Company CP75-249, CP75-251

*/ Authority for this is section 5(a)(1) of PL94-586 which provides that the Commission "may refuse to act on any application, amendment, thereto, or other requests for action under the Natural Gas Act".

CERTIFICATE OF SERVICE

I hereby certify that I have this day served the foregoing document upon each person designated on the official service list compiled by the Secretary in this proceeding in accordance with the requirements of Section 1.17 of the Rules of Practice and Procedure.

Dated at Washington, D. C., this 7th day of December, 1976.



Allan W. Anderson, Jr.
Commission Staff Counsel

Washington, D. C.
December 7, 1976

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JANUARY 1977

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ANALYSIS OF PROPOSED ALASKAN NATURAL GAS TRANSPORTATION SYSTEMS

Compiled by the ORGANIZATION FOR THE MANAGEMENT OF ALASKA'S RESOURCES, INC. (OMAR), Box 516, Anchorage, Alaska 99510

Three applications have been filed for the right to bring Alaska's 30 trillion cubic feet of natural gas south to U. S. consumers. One is an all-land route across Alaska through Canada to the midwest proposed by a consortium called Arctic Gas. Part of the gas would be delivered to Canada. Another is a land and water route from Alaska to California and into existing pipelines across the United States proposed by El Paso Alaska. The projects were initiated in 1969 and 1970 respectively. A third plan originated in March 1976 by Northwest Pipeline. It also is an all-land route which crosses Canada to the U. S.

TRANS-ALASKA/LNG PROJECT PROPOSED BY EL PASO ALASKA COMPANY

INTERNATIONAL CONCERNS

None. U.S. Defense Department says Alaska-LNG route permits full U.S. control and does not require reliance on a foreign government for defense in war and security in peace. Because total pipe mileage is only a fraction of trans-Canada mileage, protection would be greatly simplified. A former Royal Canadian Mounted Police official says defense of the Canadian segments would be "next to impossible."

BALANCE-OF-PAYMENTS IMPACT

Favorable to U. S. No adverse balance. All materials to be supplied by U.S. firms.

ENVIRONMENTAL IMPACT

Miles of new pipe for transmission of 2.4 bcf/d to U.S. 1,613

Line to follow 95% of Alyeska oil line (in or near a corridor that has been called "the most exhaustively studied in the world"). LNG carriers would sail from 2,500 square mile Prince William Sound through open waters to remote site on California coast. LNG is not classified a hazardous pollutant by either the Environmental Protection Agency or U.S. Coast Guard.

TRANS-CANADIAN PROJECT PROPOSED BY ARCTIC GAS CONSORTIUM

INTERNATIONAL CONCERNS

Major portion of line crosses a foreign country. Would be subject to control, management and regulation of a foreign government. Would also be legally required to pay Canadian provincial and federal government taxes. Faces opposition of Canadian nationalist groups, environmental organizations and Eskimo and Indian groups which claim ownership of the land the pipeline would traverse.

BALANCE-OF-PAYMENTS IMPACT

Unfavorable to U.S. Adverse balance of \$4.5 billion in taxes, \$4.8 billion in goods and services and \$11 billion in transportation charges, for a total deficit of over \$20 billion!

ENVIRONMENTAL IMPACT

Miles of new pipe for transmission of 2.25 bcf/d to U.S. 4,500

Traverses width of 8,900,000-acre refuge (Arctic National Wildlife Range, the largest wildlife refuge in America) and adjacent planned range in Canada.

TRANS-CANADIAN PROJECT PROPOSED BY NORTHWEST PIPELINE (ALCAN ROUTE)

INTERNATIONAL CONCERNS

Major portion of line crosses a foreign country where it would be subject to control, management and regulation by a foreign government. Line in Canada would pay billions in taxes to Canadian federal and provincial governments. Route through northern Canada also faces Indian land claims to the territory pipeline would traverse. By linking up with provincial gas pipelines, Alcan route runs risk of becoming political football in growing rivalry between provinces and Canadian federal government.

BALANCE-OF-PAYMENTS IMPACT

Unfavorable to U. S. Adverse balance of \$3.6 billion in taxes; other dollar amounts not available. (U.S. suffered highest ever balance-of-payments deficit November 1976 - \$906 million!)

ENVIRONMENTAL IMPACT

Miles of new pipe for transmission of 2.4 bcf/d to U.S. 5,400

Route follows 540 miles of Alyeska oil line, then generally along Alcan Highway into Yukon, overland in B.C. and Alberta where new sections of pipe would be built parallel to existing provincial pipelines.

Department of Interior estimates risk of delay in completion of Alaska-LNG project at HALF that of Arctic Gas project. With use of Alyeska's haul road and other construction facilities which required 1½ years to build, project has significant head start.

Approvals and permits required only by U. S. government agencies. President sends route decision to Congress by Fall 1977; Congress ratifies by joint resolution in 60 days or matter returns to President for new decision. Judicial action possible only on constitutional grounds.

Native claims now settled in Alaska after five years of extensive negotiations in the U. S. Congress. Settlement included 44 million acres of land.

Each construction segment (pipeline, LNG facilities and ships) can be conducted concurrently, thereby reducing adverse effect of strikes, material shortages, shipping delays, etc., on any construction phase.

Trans-Alaska proposal is based on use of existing and new gravel roads and year-round construction.

TAX BENEFITS TO UNITED STATES

\$12.8 billion to U. S. government entities over life of project.

EMPLOYMENT

Estimated total direct employment in U.S. at peak of construction: 22,500

Permanent work force in U. S. on project completion: 1,470

Total man-years of direct and induced employment in U. S. 749,000

CAPITAL COST

Total capital cost in 1975 dollars to bring 2.4 bcf to U. S. markets

-----\$6.5 billion-----

Subject to numerous delays such as (1) settlement of native land claims, (2) Berger Commission investigation, (3) opposition to crossing Wildlife Range by 15 environmental groups and (4) construction of haul roads, camps and other preliminary facilities before work can begin on pipeline.

Approvals and permits required by U.S. and Canadian agencies. Must compete before Canada's National Energy Board against popular Maple Leaf Project of Foothills Pipe Lines and Polar Gas proposal for Arctic Islands gas. NEB decision faces Canadian Cabinet review, implementing legislation by Parliament and possible judicial action.

Natives claiming 1.8 million square miles, almost half of Canada. One key government report recommended a 10-to-15-year delay after settlement of land claims before any pipeline is built.

Requires the construction of camps, haul roads and other preliminary facilities before construction of the pipeline may begin. Canada's historically higher strike rate could shut down entire project during any construction phase.

Project includes use of unreliable snow/ice road technique and winter construction on northern segments. Experience in Alaska has shown this to be technically impossible, resulting in project delays and cost overruns.

TAX BENEFITS TO UNITED STATES

\$2.2 billion to U. S. government entities over life of project.

EMPLOYMENT

Estimated total direct employment in U.S. at peak of construction: 10,000

Permanent work force in U. S. on project completion: 400

Total man-years of direct and induced employment in U. S. 245,000

CAPITAL COST

Total capital cost in 1975 dollars to bring 2.25 bcf to U. S. markets

-----\$8.6 billion-----

Subject to (1) and (2) of Arctic Gas project timing problems plus construction of preliminary facilities in Canada. Federal Power Commission and Canadian National Energy Board must consider applications. Other routes have been undergoing examination by FPC and NEB since 1975.

Approvals and permits required by U.S. and Canadian agencies. Must compete before National Energy Board against Arctic Gas, Foothills and Polar Gas (application expected to be filed this year for Arctic Islands gas). NEB decision faces Canadian Cabinet review, implementing legislation by Parliament and possible judicial action.

Faces unsettled native claims along pipeline route in Canada. Council of Yukon Indians wants majority control of company building line to protect native interests in addition to ownership of lands claimed.

Requires 18 months additional geotechnical, environmental and engineering studies after certification before construction could begin, giving this project longest completion schedule. Canadian strike situation applies.

Year-round construction possible on most segments of line. Use of existing gravel roads planned for part of Alaska construction.

TAX BENEFITS TO UNITED STATES

\$4.7 billion to U. S. government entities over life of project.

EMPLOYMENT

Estimated total direct employment in U.S. at peak of construction: 15,000

Permanent work force in U. S. on project completion: 600

Total man-years of direct and induced employment in U. S. 350,000

CAPITAL COST

Total capital cost in 1975 dollars to bring 2.4 bcf to U. S. markets

-----\$6.3 billion-----

OMAR is dedicated to the orderly development of Alaska's natural resources for the benefit of the entire United States of America. For additional information, contact OMAR at Box 516, Anchorage, Alaska 99510.

Why the second choice

NEWS 1-12-77

A.C. "Al" Swalling is chairman of the board of the Alaska Bank of Commerce and president of Swalling Construction.



By A.C. SWALLING

I appreciate being invited to express in this newspaper my views on a matter so vital to the economic health of Alaska, both near - term and for the future. I refer to the natural gas transportation system to bring North Slope natural gas to the South 48.

First, a bit of background. As chairman of the North Commission, established in 1967 by the Alaska Legislature, I was privileged to participate in the various studies carried on by that body. The members of the commission felt very strongly that the proposed oil line should be entirely under American control and so advocated.

THEY ALSO ADVANCED the concept that the natural gas pipeline should generally use the same corridor, terminating within Alaska at tidewater, with liquifaction facilities so sited that LNG could be "made available for transport by rail, truck, ship, or barge to remote villages and towns to bring total energy benefits of Alaska's resources within reach of all its citizens." Such a proposal would make possible the transportation of gas (surplus to Alaska's needs) to the Lower 48 by LNG carrier.

Some in the petroleum industry expressed opposition to a combination pipeline - LNG carrier system to transport North Slope natural gas to the southern markets. Arctic Gas is evidence of their opposition, but the commission persisted in its efforts to interest companies to analyze such a combination transport system.

Of all the companies approached only El Paso Natural Gas Co. evidenced interest. After many months of preliminary study, El Paso announced on Dec. 4, 1972, that they would file to develop and build such a system with a regasification facility on the West Coast and a tie in to the transcontinental pipelines, thereby making gas available to virtually any part of the Lower 48.

THE PROJECT was explained to Alaskans and overwhelmingly endorsed throughout the state. It was endorsed by the former and present governors, as well as the Eighth and Ninth Legislatures.

The filings of El Paso's Alaska project has been detailed and exhaustive. The statements, calculations, estimates, and computations of benefits to Alaska and the nation have withstood the cross examination by Arctic Gas and Alcan representatives as well as questions posed by the administrative law judge of the Federal Power Commission. Such is not the case of the Alcan's presentation whose interest in a competitive route did not surface until recently.

Too often lately we have heard certain media representatives and government officials suggest that because of the considerable momentum that Arctic Gas seems to have, Alaska may have to fall back and support the Alcan proposal as a "compromise" position in the natural gas pipeline controversy. Of course, this incredible idea presumes that the trans-Alaska route is doomed to failure, and Alaska must therefore settle for second best. Well, in my book, second best is a loser; and Alaska should not have to compromise on any issue involving its own interests or its natural resources. Furthermore, the project which will best benefit Alaska in this particular case also provides the greatest advantages to the nation as a whole.

THE TRANS-ALASKA project as sponsored by El Paso will provide many opportunities for Alaska that Alcan simply cannot meet. The comparable advantages and benefits are twice as great with the trans-Alaska route than with Alcan. For example, information available for each project shows that ad valorem and income taxes will be \$2.8 billion for trans-Alaska versus just \$1.3 billion for Alcan. The difference incidentally would be enough to build the Susitna Dam or pay for the capital move. Direct employment during the construction of the project will be 22,000 for Alaska and 15,000 for Alcan. Long-term employment after construction will be 600 for Alaska and 100 for Alcan.

By far the greatest advantage of the all-Alaskan route relates to its terminating at an ice-free tidewater site near Cordova. If Alaska is ever to have a chance to promote the construction of a petrochemical industry, it will be with the El Paso project. The natural gas and the even more valuable natural gas liquids (LPG's) must be delivered to a year-round shipping port to allow marine transportation of the product. Furthermore, Alaska is naturally at such a severe economic geographical disadvantage, that a difference of just a few cents per million - BTU in the cost of pipelining the feedstocks to the plant site, could make or break our ability to compete in a world petrochemical market.

is a loser

Some would neatly do away with this critical factor by suggesting that a lateral could be constructed from the Alcan pipeline to Prince William Sound. Let's look at this idea more closely. Assuming that both El Paso and Alcan will transport initial volumes from Prudhoe Bay of 2.4 billion cubic feet daily, the state's royalty share would amount to 12½ per cent, or 300 million cubic feet. El Paso's FPC application shows that its pipeline will be 810 miles long and have a yearly operating cost of \$503 million. This means that it will cost 51 cents per million BTU to transport gas from the North Slope to Cordova.

THE FPC EXHIBITS for the Alcan pipeline indicate that it will be 730 miles

long and have an annual operating cost of \$530 million, which translates to 62 cents per million BTU to the Yukon Border. But we must back up to Delta Junction, which would be the point of departure of the new lateral going to Cordova. The transportation cost to Delta Junction via the Alcan line (544 miles) would be 40 cents per million BTU. Then, the new lateral must be built — by someone — to haul the state's 300 million cubic feet of royalty gas southward. It would be 265 miles long and 24 inches in diameter, and would cost approximately \$234 million. With annual operating costs of \$49 million, the transportation cost between Delta Junction and Cordova would be another 40 cents.

This, the difference between the El Paso cost of service (51 cents) and the Alcan - new lateral cost of service (80 cents) would be 29 cents per million BTU. Delivering 300 million cubic feet of royalty gas each day, the annual savings which would result from the El Paso line for the potential petrochemical customer near Cordova, would amount to \$33.5 million. In the highly competitive world of the petrochemical industry, a saving of that magnitude would be a considerable incentive to locate in Alaska. We also hear the suggestion that a lateral could be built from the Alcan line to Haines. This arrangement would produce a transportation cost of \$1.27 per million BTU — considerably less attractive than even the lateral to Cordova.

...the problem of who would build either one of these laterals from the Alcan pipeline. Despite Alcan's representations, we have no real indication that that company would build them. Petrochemical companies are not in the pipeline business, so we shouldn't expect them to build the laterals. It might be possible to expect a new, private company to build them, but we have seen no sign of this happening yet. And finally, I suppose the state could get into the pipeline business, although I would suggest that we could make better use of our tax monies — the Permanent Fund included.

BECAUSE THE EL PASO pipeline, taking advantage of technological advances, will operate at a higher pressure than Alcan (1670 psi vs 1250 psi), it will be a more efficient system and would provide cheaper transportation to any point along its route. If 50 million cubic feet per day were delivered to Fairbanks, I am told that the transport cost would be 33 cents per million BTU for Alcan and 28 cents per million BTU for El Paso, providing approximately \$1 million in annual savings for the Fairbanks consumers with the all-Alaska pipeline. I understand that these figures do not include the cost of fuel, and if fuel costs were added, Alaskan natural gas customers would realize even greater savings with El Paso's project. Looking again at the FPC filings, we can see that within Alaska, Alcan requires 15 compressor stations consuming 80 million cubic feet of fuel each day, while El Paso needs just 10 stations consuming less than 45 million cubic feet of gas for fuel each day, thereby, effecting a very substantial saving of this valuable non-renewable resource.

The transportation advantage of the trans-Alaskan-LNG proposal extends beyond those communities along the pipeline itself. If for some reason communities in Southeast Alaska decide that they want North Slope natural gas, it could be delivered by barge in the form of LNG. Here once again, the economies of scale inherent in the El Paso project would result in a far lower transportation cost than Alcan could provide, by, in some cases, more than \$2 per million BTU.

It can be fairly stated that the trans-Alaskan route can offer Alaska everything that the Alcan route could, and more. Conversely, the Alcan route can show no advantage over El Paso, economically or otherwise.

UP TO THIS POINT I have only reflected on the benefits to Alaskans under the all-Alaska route. Let us add to those the national interests to be served through the balance of foreign payments, the construction of 11 LNG carriers in United States shipyards, the procurement of 1,500,000 tons of domestic pipe and fittings, as well as the manning of the carriers with American seamen.

...from the Commission of the North Commission, that the only logical transport system for natural gas from the North Slope to market, is one that is totally under the American flag.

Returning then to the original problem, we Alaskans simply cannot look upon Alcan as a "good second choice." It is in fact little better than Arctic Gas — which is no good at all for Alaska.

As the FPC staff position paper recently said, "Alcan is just a relocated Arctic Gas Project." Staff also strongly criticized Alcan's concept, costs and schedule as being unrealistic and undefensible. In other words, in my opinion, Alcan simply hasn't shown anyone that they know how to put together a major transportation project.

It should now be clear to all Alaskans that our real competition is Arctic Gas. And when we call Alcan a "good second choice," we are diluting our support for the trans-Alaska route. The end result will be that we'll get Arctic Gas approved — and we'll deserve it!

Fairbanks, Alaska
January 31, 1977

Representative Clark Gruening
Pouch V
Juneau, Alaska 99811

Dear Representative Gruening: Re: Proposed Gas Route Hearings

Mr. Michael E. DeMan of the Alaska Native Foundation has requested I bring materials received from Northwest Pipeline Corporation to your attention.

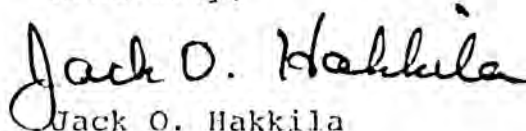
I have discussed the proposed Alcan route with Mr. Edward R. Hayes of the Northwest Pipeline Corporation at length both in conversations here in Fairbanks and on the phone. I have a record of my conversations with him as well as with others in his company and interested persons in the interior.

It is a matter of considerable importance that the natural gas from Alaska's North Slope be available to Alaskans for further processing into petrochemicals. The substance of the materials that I have reviewed leads to the prospects of establishing a permanent petrochemical industry in the interior of Alaska at the rate of a one-billion dollar plant a year for ten years following the construction of a gas pipeline. The establishment of a permanent petrochemical industry in Alaska's interior is not only worthy of consideration but I have concluded after considerable investigation that it is the most significant step in any industrialization which could be begun anywhere in Alaska. Ethylene, the basic feedstock of the petrochemical industry is in short supply, and we do have the ethylene available to us to begin an international-scale industry here. It is my considered opinion that if we allow our natural gas to leave the state without processing it into petrochemicals it will be a giant step backwards in the removal of colonial status for Alaska.

In reviewing the enclosed materials please understand that Northwest Pipeline Corporation has taken the position that while a world-scale petrochemical industry is feasible in interior Alaska, they are presenting this evidence for Alaskans to review in the hopes that we will see this as an opportunity and that we would want to do something about it. They are not interested in entering the petrochemical business.

I have other available information which I have drawn upon for a paper presented at the Alaska Science Conference last Summer and which I am pulling together for the University of Alaska-sponsored Town Meeting on Energy to be held here in Fairbanks in March. I would be glad to provide further testimony at your hearings if called upon.

Sincerely,


Jack O. Hakkila

Enc.: Earthquake Probabilities at L. N. G. Sites: Frank Alberti
and Associates

Alcan Pipeline Presentation: The Opportunity for Petrochemicals
and Hydrogen Refining in Alaska: Speech by Edward R. Hayes

cc: Michael E. DeMan



FRANK ALBERTI & ASSOCIATES

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October 28, 1976

Alaska Earthquake Probabilities at Gravina Point near Cordova, Starichka Site near Homer Alaska, and The Vicinity of Fairbanks, Alaska.

This report is a follow-up on a previous report which we entitled "Earthquake Probabilities at L.N.G. Plant Sites - South Central Alaska" and utilizes the same basic source material of probabilities studies interpolated by recent work performed by W. G. Milne et al. W. G. Milne's work show the Gravina Point area to have a ten year return period for 10% g accelerations at the Gravina Point site.

Interpolations of Milne's charts shows twenty year return periods for the Kenai Peninsula sites and the Fairbanks area. The probabilities are based on history and tectonic arguments and it is noteworthy that there has been a longer history of recording earthquakes in the Cordova and Homer, Alaska areas than there has been at Fairbanks.

It is also noteworthy that considerable uplift and subsidence at Cordova and Homer areas respectively occurred during the great earthquake of 1954. We have not encountered any records of vertical displacement at Fairbanks.

It is significant, we think, that the various investigators of the pipeline corridor agree insofar as establishing a lower design earthquake magnitude for Fairbanks ($M=7.5$) and (Valdez area) Gravina Point ($M=8.5$) as will be noted in the paper entitled "Ground Motion Values for Use in the Seismic Design of the Trans-Alaska Pipeline System" by Robert A. Page, David M. Boore, William B. Joyner, and Henry W. Coulter.

A considerable amount of damage occurred in the 1964 earthquake to Petrochemical facilities in the Cook Inlet and the Prince William Sound areas. Major losses occurred to the shore site facilities such as docks, tanks, plants, etc. and involved in many cases the earthquakes secondary effects of generating tidal waves. In this regard Fairbanks would not be affected.

Frank Alberti



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F. J. Becraft G. E. Foulke A. R. Por
M. E. Benefield E. R. Hayes J. H. Val
H. P. Diener R. W. Keener J. D. Wal

Earthquake Probabilities at L.N.G. Plant Sites - South Central Alaska

This is a resume of your requested study performed as you are aware by an engineer who has represented both insureds and insurers in the technical problems of earthquake insurability.

Alaska's earthquake loss history and high probability of frequent destructive seismic occurrences make it very difficult to insure earthquake coverage at the best sites and the most desirable construction classes in south central Alaska. The highly protected risk insurers who handle the high values such as in the Petrochemical, Allied Gas and Oil facilities, and more especially LNG plants judge each risk on its individual merits.

El Paso's final choice of sites namely the Gravina Point site near Cordova, Alaska and the Starichkaf site on the Kenai Peninsula near Homer, Alaska are respectively in the first and second worst earthquake sites in any Zone 3 earthquake location in any of the fifty states. The probability charts developed by A.E. Stevens and W.G. Milne show the Gravina Point area to have a one hundred year return period for earthquakes with 100% g peak accelerations ($M=8.5$), a fifty year return period for 50% g accelerations ($M=8.0$), and a thirty year return period for 20% g accelerations ($M=6.5$). In communications with Mr. Milne we were able to follow his method to obtain a ten year return period for 10% g accelerations ($M=5$ to 5.5). In contrast to this, for example, Milne et al shows for your Plymouth, Washington LNG site a one in one thousand year probability of a 10% g earthquake.

Engineers consider that 10% g as the threshold accelerations that are damaging to ordinary structures on firm soil. It must be considered that LNG containers and their allied plant equipment are not ordinary structures i.e. the N.F.P.A. National Fire Protection Association Standards 59A in relation to LNG plants require a degree of care in earthquake engineering equal to that of nuclear plants. The specific proposed site at Gravina Point according to the FPC report has a foundation described as poorly drained. Although foundation engineering can help this, such foundations often suffer more high intensities (damage) from a given magnitude (acceleration) than do structures on natural firm soil. The FPC report also states that the vertical uplift in the '64 Good Friday earthquake was 4.5 feet and in the horizontal displacement was some 30 feet. This does not meet the stated earthquake criteria of the Federal Power Commission which requires that it not be located on or adjacent to an active fault.

From an insurers viewpoint, at least, the proximity to a fault is considered adjacent when it involves gross changes in land elevations and strong ground shaking even though it may not involve surface faulting.

The Kenia Peninsula site apparently has according to the FPC report better foundation possibilities and somewhat less earthquake risk potential; however, it also involves a serious geological hazard where we witnessed at Homer gross subsidence of 4.5' to 5.7' in 1964. It would appear to be no better than the worst earthquake probability and severity zone in the lower 48 states.

Underwriters are aware that early catastrophic failures of liquified natural gas tanks were solved by metallurgists so that a high degree of reliability exists under normal working conditions when the cryogenic liquid

is stored and processed at -272° F. Added to the many uncertainties is the state of the art of cryogenic and earthquake engineering relative to LNG containers and plant appurtenances for resistance to great earthquakes of magnitude 8 or greater.

What we are saying is at the outset on the basis of what has been learned from the geologist, geophysist, and structural consultants reports that the general areas of the site require consideration of design earthquakes of the magnitude of 8 to 8.5 and further that these sites are in areas of distinct geological hazards. Underwriters would question in great depth the specifics of the geology of the sites and the ability of Cryogenic and earthquake engineers to persuasively show that LNG plant structures can be designed to safe limits for containing gas equivalents measuring in the billions of cubic feet involving liquid temperatures at -272° F that already have stretched technology to new limits. In other words the metallurgical problem as it relates to the stresses of great ground vibrations and ground displacements that exceed those found elsewhere in any of the other states appears to present a new problem to technology.

An insurers final review; however, would be based on not only the large area and site geology, the design earthquake magnitude, the distance from epicenter of earthquakes and fault lines, but also it would review the specific design input relative to ground structure interaction, allowable structural deformations, and the extent of deformation under simulated dynamic earthquake magnitude spectrums. Wind forces and direction because of gas dispersion or exposure is also an important factor.

Even if the FPC criteria regarding earthquakes were softened then at least three problem areas would be involved (A) The additional engineering and construction costs plus a feasibility consideration to accomplish completion of a facility that would comply with NEPA 59A particularly as it relates to seismic considerations. (B) The additional insurance costs throughout the life of the project providing the project, for the high values involved, would be insurable and (C) Last but not least the high human life exposure that could result from softening of the stated criteria resulting in basically improper siting of a major LNG plant and marine transfer facility.

At your request we interviewed the Industrial Risk Insurers relative to insurability of this type of risk in Alaska. The answer was quite discouraging to one seeking an earthquake insurance market in south central Alaska for plant locations where there are multimillion and even billion dollar concentrations of values. Currently the upper line limit is four million dollars for earthquake with a one million dollar deductible. Rates are significantly higher than in any of the other states. We are aware from other sources that a two and a half percent or two and a half dollar per hundred dollars of value rate is not uncommon for large industrial risks where there is an element of uncertainty relative to large earthquake forces or construction difficulties. There would; however, be a multiplier factor regardless of the rate for the higher hazard south central Alaska earthquake area. We are including with this study, references that were used in obtaining earthquake probabilities, geological information, and LNG construction requirements.

Frank Alberti
Frank Alberti, P.E.

"Locations that merited further consideration were subjected to additional studies to ascertain the extent to which each location complied with the requirements set forth in the criteria. These studies were concerned with a detailed evaluation of the physical conditions which exist in three major areas of each location: the area which would be utilized as the location of the plant, the area in which the marine terminal would be located and the bodies of water which would be utilized by the LNG carriers. A specific location was considered to be a viable site if it possessed characteristics equal or similar to those defined in the criteria, which are discussed in more detail in the subsequent sections." 1/

The staff is in agreement with the applicant that of the sites that were considered in Prince William Sound, the Gravina site is probably the most viable location on the basis of compliance with the technical requirements of the proposed project. The staff, however, disagrees with El Paso's premise that the Cape Starichkof site is not a viable alternative, since it, too, complies with the technical requirements of the project, and also has the advantage of exhibiting fewer environmental sensitivities and less potential for adverse environmental impacts than the Gravina site.

During the process of reviewing the information contained in the filings submitted by the applicant, the contract study prepared by the Oceanographic Institute of Washington, and numerous additional sources of information, the staff has become aware of the potential adversities that could be encountered in the Cook Inlet area, most notably the potential for the disruption of shipping or docking maneuvers through the interaction of winds and masses of sea ice. The Cape Starichkof site apparently lies outside the area of disruption.

Based on the historical record, the Gravina - Prince William Sound area appears to exhibit a higher susceptibility to large magnitude seismic events than does the Cape Starichkof - Cook Inlet area. As is indicated in Figure 89, a greater number of earthquakes ranging in magnitudes from 7 to 8 have occurred in the vicinity of Prince William Sound, than in the Cook Inlet area. During the 1964 earthquake, Gravina Peninsula was subjected to 4.5 feet of vertical displacement upward, and 30 feet of horizontal displacement. The Cape Starichkof area, located within the area of subsidence that resulted from the earthquake, was subjected to no more than 1 foot of subsidence.

1/ Trans-Alaskan Gas Pipeline Project, Site Selection Report.

ALCAN PIPELINE PRESENTATION

THE OPPORTUNITY FOR PETROCHEMICALS AND HYDROGEN REFINING IN ALASKA

Speech by Edward R. Hayes

Northwest Pipeline Corporation

Fairbanks, Alaska, November 5, 1976

I am very pleased to have the opportunity to address this meeting of Professional Engineers of Alaska and to discuss prospects for establishing a major petrochemical industry in Alaska. To be more accurate, I should say to expand Alaska's petrochemical industry, for Alaska already has one of the world's largest ammonia-urea complexes at Kenai.

As you know, most organic chemicals these days are manufactured either from crude oil fractions, natural gas, or natural gas liquids, and can therefore properly be considered as petrochemicals. In this presentation, however, I shall be referring principally to the high volume chemicals and derivatives that dominate the chemical industry, because this is where the prime opportunity for Alaska exists.

In addition, I shall also discuss what I consider to be a great potential for establishing hydrogen refining complexes in Alaska to upgrade Prudhoe Bay crude oil before it is shipped to the lower 48.

There can be no question that the volumes of raw materials that will be available in Prudhoe Bay natural gas will be far more than adequate to support economically sized petrochemical plants in Alaska. Let us for a moment review the quantities of the principal petrochemical feedstocks that will be present in the raw gas at Prudhoe Bay.

(SLIDE: EXHIBIT A)

As shown in Exhibit A, the oil companies at Prudhoe Bay will produce a raw gas containing close to 230,000 barrels per day of natural gas liquids based on a transportable volume of natural gas of 2.0 billion cubic feet

per day. By raw gas, I am referring to the gas that will be separated from the crude oil, as it is produced.

As you realize, the crude oil and natural gas at Prudhoe Bay are inter-mixed in the same reservoir with some of the gas actually dissolved in the crude oil and the remainder forming a gas cap. The volumes of natural gas liquids which I have shown in Exhibit A are based on a crude oil production rate of 1,600,000 barrels per day which appears to be close to the rate which will be approved by the State of Alaska.

The raw gas must be processed to remove most of the moisture and acid gases (CO_2 and H_2S). In addition, much of the butanes and pentanes plus components have to be removed in order to avoid condensation (or dew point) problems in the natural gas pipeline. No one knows for certain yet just what the final design of the raw gas processing unit will be. The oil companies have supplied an approximate analysis of the sales gas that would be supplied to the gas transmission company. However, it is quite possible and perhaps even likely, that the oil companies will ultimately design their processing system to remove most of the butanes and pentanes from the raw gas and blend these fractions with the crude oil; and concurrently, recover most of the lighter ethane and propane fractions for inclusion in the natural gas pipeline supply. Our calculations suggest that butanes and pentanes will have a much higher potential value in the crude oil than in the natural gas pipeline, perhaps as much as \$5 to \$6 per barrel higher.

Using the estimated gas analysis provided by the producers, we arrive at the volumes of natural gas liquids shown in Exhibit B. As you will

(SLIDE: EXHIBIT B)

note, Alaska's royalty share of ethane alone is sufficient to support a 500 million pound per year ethylene plant, based on an 80% yield factor. If propane is included, Alaska by itself has almost enough royalty feedstock

for a billion pound per year olefin facility. This would be comparable in size to the largest worldwide facilities now under construction. It is quite possible, however, when a petrochemical project is developed in Alaska, that one or more of the oil companies who control the remaining LPG fractions at Prudhoe would be an active participant and would assign a share of its LPG to the venture.

LPG supplies to petrochemical plants in the lower 48 will continue to decline in rough proportion to the predictable decline in natural gas production. Spokesmen for the petrochemical industry now flatly state that no new olefin plants based on LPG fractions will be constructed. All of the new plants, including several that are now under construction, will have to employ naphthas or gas oils as the feedstock. Olefin plants using the heavier feedstocks cost at least 50% more to construct than if ethane or propane were the raw material. Another disadvantage for plants using naphtha or gas oil is that a very broad spectrum of products is produced, ranging from methane and ethylene all the way to heavy fuel oil. While the yield of ethylene from ethane is around 80%, it is only 25-30% for naphtha. Any company desiring to produce ethylene today would be most fortunate to have a secure, economical long term domestic supply of ethane and propane such as should be available in Alaska in the near future.

Let us consider the range of petrochemical projects based on natural gas and natural gas liquids that could be established in Alaska. There are only two major petrochemical candidates that are manufactured from natural gas or methane: (1) ammonia and its derivatives, and (2) methanol and its derivatives. Both products are high volume commodities. By 1980, consumption of ammonia in the U.S. will reach 21,000,000 tons of which 75% will be consumed as fertilizer nitrogen and 25% will be used to produce industrial chemicals. Worldwide consumption by 1980 will be close to

100,000,000 tons.

Unfortunately, ammonia does not appear to be a very good prospect for Alaska for the foreseeable future. The major problem seems to be one of excessive production capacity combined with rather poor price prospects. As I have previously mentioned, Alaska already has the Union Oil facility at Kenai which is one of the largest ammonia-urea complexes in the world. It would not make much sense during a weak market to establish additional competition for an existing operation. Alaska's internal nitrogen fertilizer consumption is relatively small, around 1,200 tpy of equivalent ammonia. Looking well into the future, it is possible that the worldwide supply/demand picture may improve or that the demand for nitrogen fertilizer in Alaska will increase substantially. If so, ammonia could be considered as a "back-burner" possibility.

The situation for methanol is similar to ammonia. Without going into details at this time, I would also categorize methanol as a future possibility.

This brings us to the LPG fractions; ethane, propane and butane. I believe that the most experienced venture development specialists would identify the establishment of a major olefin producing complex as a prime commercial opportunity for Alaska. The principal olefins, ethylene and propylene, have become the major building blocks in manufacturing a wide range of synthetic resins and/or organic chemicals. Ethylene would be produced by steam cracking of ethane; and propylene by cracking propane. Natural gas would be used for fuel.

(SLIDE: EXHIBIT C)

Ethylene is the starting raw material for the two largest volume synthetic resins or plastics, as they are more commonly called, polyethylene and polyvinyl chloride. The latter is generally referred to as PVC. In

1976, approximately _____ tons of polyethylene and _____ tons of PVC were produced in the U.S. By 1980, these volumes are expected to reach _____ and _____ tpy, respectively. The worldwide growth rate for polyethylene is estimated at 10% annually. By 1986, 100 new high density polyethylene plants will be needed, along with an equal number of low density units.

The production of polyethylene in one or two satellite plants appears to be the best first choice for converting the ethylene into finished commercial products. One of the satellite plants could produce low density polyethylene which is used to produce pliable sheets and films and soft containers. The other satellite plant could convert ethylene into high density polyethylene which is extruded or molded into clear, hard bottles and shapes and is frequently used as an engineering type plastic. Initially, the production of PVC does not have quite as much allure because of the lack of an Alaskan source of chlorine. However, I certainly would not write PVC off as a future possibility.

In rough round numbers, a 500 million pound per year ethylene-polyethylene complex such as I have just described would require an investment of at least \$500 million; \$250 million for the ethylene plant and \$250 million for the satellite conversion plants. Such a complex would provide directly 300 to 400 high quality jobs including a high percentage of technical people - possibly as many as a hundred. It is possible that a larger billion pound per year ethylene plant might prove to be economically feasible.

A second phase expansion program might logically involve a cracking plant to produce propylene from propane. Additional ethylene would be produced as a co-product. Satellite plants would include a polypropylene plant and possibly an ethylene oxide-ethylene glycol unit. Also, co-polymers and polyethylene and polypropylene could be produced, further broadening the product

line. These facilities would probably cost an additional \$500 million in 1976 dollars.

To provide feedstock for the petrochemical complex, it would be necessary to construct large, sophisticated extraction plants to remove ethane and propane from the pipeline gas. As the result, propane would be readily available to the public, to industry and to agriculture in central Alaska and could be transported in the existing product pipeline to Haines. Universal availability of propane throughout Alaska would be helpful in improving living standards of the citizens.

Natural gas would be used as fuel in the ethane and propane cracking plants. We could conceivably be looking at an ultimate total investment of in the range of \$2.0 billion and a product volume approaching one million tons of product per year. Total direct employment would be close to 1,000 of which about 200 could be from the engineering or chemistry professions.

These products do not sell by the ton. Rather they sell by the pound - currently close to 30 cents per pound for the products which I have described. The value added in Alaska will be substantial as shown in Exhibit D. The

(SLIDE: EXHIBIT D)

present value of ethane and propane from Prudhoe Bay is approximately 17 cents per gallon or about \$79 per ton. Ethylene and propylene, the intermediate products, are worth about \$240 per ton. Polyethylene and polypropylene, the finished products sell for \$600 per ton and there is no reason that a portion of the polyethene and polypropylene could not be further upgraded in Alaska. For example, a polyethylene and polypropylene pipe manufacturing plant could be established that would serve Alaska and the Pacific Coast states; or a polyethylene calendering plant could be built to manufacture various grades of films and sheets.

If the Alcan Pipeline system is certificated, Alaska and its citizens will have the opportunity to develop the state's petrochemical potential.

There will no doubt be a reaction of skepticism from some interested parties who will respond that Alaska is too far from the markets to consider such an enterprise. I reply that if Alaska is not too far away to produce and transport its crude oil and natural gas then it is not too far removed to upgrade these products, and ship them to the markets in the lower 48.

The Province of Alberta was faced with a situation very similar to what you have here in Alaska. Most of its oil and natural gas were being transported out of the province. Just as with Alaska, there were several oil refineries, producing products for local needs, and several ammonia fertilizer plants. But, the really big petrochemical plants based on Alberta's raw materials were being constructed in Eastern Canada.

So the provincial government and Alberta Gas Trunk Line, Ltd., Alberta's largest gas transmission company, cooperated on an aggressive program to establish a major petrochemical industry within the province. Alberta has been successful in this effort. The province has built up a very large petrochemical network involving participation by several leading U.S. chemical concerns, as shown in Exhibit E. What Alberta has succeeded in

(SLIDE: EXHIBIT E)

doing, Alaska can likewise accomplish. I should also like to point out that Alberta Gas Trunk Line, Ltd. is one of the principals in the Alcan project. As you will note on the slide, the investment in these facilities exceeds one billion dollars. Alberta sets a figure of \$1.3 billion.

The most promising location for the initial petrochemical installations in Alaska would be in the broad valley of the Tanana River between Fairbanks and Delta Junction. The lack of direct access to the sea is not a critical disadvantage, assuming that reasonable rates could be obtained from the Alaska railroads. A petrochemical industry would provide high volume, steady movement for the Alaska railroad which would be a big benefit to

this vital transportation artery. The cost of transportation to the coast will be a small percentage of the selling price. Obviously, cooperation between the Alaskan railroad and the venture developers will be very important. The Haines product pipeline could be used for transportation of liquid petrochemicals, and if necessary a new product pipeline could be constructed to the Anchorage area.

Earlier this month a representative of El Paso Alaska outlined the potential for creating a petrochemical complex in Alaska similar to the one which I have just described, before the Fifth Alaska Plastic Seminar in Anchorage.

I applaud the El Paso Alaska representative for encouraging citizens of Alaska to think in terms of establishing a prosperous petrochemical industry in their state. However, I disagree with El Paso's stated premise that Gravina Point is the logical location for the complex. A tidewater location normally offers a logistical advantage, but not in this case. The reason is the high earthquake risks that exist in the Gravina Point area. During the 1964 Alaskan earthquake, the land at Gravina Point experienced a vertical uplift of 4.5 feet and a horizontal displacement of 30 feet. A petrochemical facility of the type I have described, with its complex system of absorption towers and fractionation towers, could not be constructed to withstand a tremor as strong as that of the great earthquake of 1964. As a result, the odds of obtaining adequate insurance coverage would be slim. According to an investigation made on behalf of Northwest Pipeline's Insurance Department; the combined, pooled capability of the entire worldwide insurance industry will not issue insurance for any chemical or petroleum facilities above a level of \$50 million per installation, at Gravina Point.

The incidence of earthquakes in the Fairbanks area is much less than for southern coastal areas. According to our consultant, the area around

Gravina Point has a ten year return period for earthquakes of 10% "G" acceleration as compared to a twenty year return for Fairbanks. Various investigators of the crude oil pipeline corridor established a lower design earthquake magnitude for Fairbanks, (M=7.5) versus (M=8.5) for Gravina Point. As you realize going from 7.5 on the Richter Scale to 8.5 means 10 times the magnitude of the seismic shock waves.

You can design a hotel to withstand an 8.5 scale earthquake, without collapsing, but there is no way to design and build a huge liquefaction plant or a giant petrochemical plant that could survive such a shock without tremendous damage and possibly catastrophic consequences. It does not appear possible to obtain adequate insurance coverage at Gravina Point and, without total insurance coverage, prospects of obtaining financing are poor. Exhibit F gives you a rough picture of the amplitude and incidence of earthquakes in Alaska.

(SLIDE: EXHIBIT F)

I am not suggesting that it will be easy to establish a petrochemical industry in Alaska. However, if the state and its concerned citizens are willing to expend the effort and cooperate with potential participants, I believe that successful, gratifying results can be achieved. Any one of the major oil producers at Prudhoe Bay would be first class operators. However, we must recognize that they would probably have to defer expansion of existing complexes in order to establish a new complex in Alaska. Other major oil companies as well as multi-national U.S., Japanese, and European chemical companies may be interested in joining an investor consortium just as Dow Chemical Diamond Shamrock have done in Alberta. The State of Alaska could also become an investor.

In addition to the prospects for establishing a petrochemical industry in central Alaska, the state has another equally strong and logical reason for insisting that the natural gas pipeline follows the route of the Alaska

crude oil pipeline to Fairbanks and Delta Junction. That is to supply natural gas for use in producing hydrogen which will be needed in the 1980's to upgrade Prudhoe Bay crude oil in Alaskan hydrogen refineries.

Crude oil will become so expensive by 1981 that it will become impractical to burn reduced crude in electrical generating plants. Instead, the reduced crude will be upgraded by a process called catalytic hydrocracking. By this technique, virtually the entire range of crude oil fractions can be converted into high value gasoline, diesel fuel, jet fuel, heater oil and petrochemical feedstock.

Having the petrochemical facilities and the hydrogen refineries in close proximity has substantial synergistic affects. The hydrocracking of reduced crude produces large volumes of benzene and other valuable aromatic chemicals which could be recovered and shipped through an existing product pipeline to Haines or by tank car to Anchorage for transshipment to other petrochemical centers in California. Or, these chemicals could be further upgraded in Alaska into such products as styrene and polystyrene. With the addition of butane cracking facilities, a synthetic rubber industry could be established near Fairbanks, Haines or Anchorage. Concurrently, by production hydrogen from the olefin cracking units could be recovered and utilized in the hydrogen refineries.

Much of California's crude oil supply in the 1980's will come from Prudhoe Bay at a time when California's natural gas deliveries are diminishing. Very little or no natural gas will probably be available in California for producing hydrogen for hydrocracking. The replacement gas will be LNG shipped in from Indonesia, South Alaska and possibly Australia, and SHG from coal. All of these sources are very expensive, much too costly for hydrogen production. SHG from oil may run as high as \$5 per million BTUs. Using naphtha at California refineries to produce hydrogen will also

be expensive and counterproductive. The oil companies will probably be much better off to have the crude oil upgraded in central Alaska where gas could be made available at reasonable cost.

In addition to converting low value reduced crude into high value products by hydrocracking, it might also prove desirable to upgrade the quality of the naphtha (gasoline) and gas oil (diesel fuel) fractions in Alaska by a process called hydrotreating or hydrofining. These processes to hydrocracking are similar except that the reaction conditions are less severe.

The installation of several hydrogen refineries could provide just as great a boost to the economy of central Alaska as petrochemicals. The new oil refinery now being constructed by the Earth Resources Corporation of Dallas, Texas at North Pole, Alaska represents an excellent initial refining step in central Alaska. The overall investment in hydrogen refining in central Alaska could easily exceed a billion dollars.

Environmentally, the petrochemical and hydrogen refining facilities which I have described are the pearls of industry. I would hesitate to use the term immaculate, but I can assure you that these plants are attractive and clean. Employment will be long-term and stable. This will appeal to native Alaskans. The capital investment per employee will be very high so no heavy burden would be placed on schools, hospitals, and other areas of the Fairbanks' infrastructure. Further, there is plenty of territory along the pipeline corridor between Fairbanks and Delta Junction to spread out these installations.

Alaska will lose these great opportunities if Prudhoe Bay gas is routed through the Mackenzie Delta via the Arctic Gas route. By diverting Prudhoe Bay gas from Alaska, Arctic Gas is depriving the state of the benefits associated with new stable industrial growth.

The El Paso project faces many hazards in the southern coastal area as well as strong, determined opposition from environmentalists and landowners in Southern California. In my judgment, Alcan presents the State of Alaska with the most options for developing a long range plan for future economic development. Alcan is the system that gives Alaska the most control over its royalty gas while keeping the door open to the many marvelous opportunities provided by petrochemicals and hydrogen refining.

THANK YOU!

EXHIBIT A

PETROCHEMICAL RAW MATERIAL IN PRUDHOE BAY RAW GAS
(BASED ON 1,600,000 B/D OF CRUDE OIL - 2.0 BCF/D OF SALES GAS)

LPG CONTENT OF RAW GAS

	(BARRELS/DAY)		(TONS/YEAR)	
	TOTAL LPG	ALASKA SHARE	TOTAL LPG	ALASKA SHARE
ETHANE (C-2)	108,000	14,000	2,450,000	307,000
PROPANE (C-3)	60,000	8,000	1,942,000	243,000
BUTANE (C-4's)	34,000	4,000	1,100,000	138,000
PENTANES+ (C-5's)	28,000	3,000	1,245,000	156,000
TOTAL	230,000	29,000	6,737,000	844,000

EXHIBIT B

PETROCHEMICAL RAW MATERIALS IN PRUDHOE BAY SALES GAS

(BASED ON 1,600,000 B/D OF CRUDE OIL - 2.0 BCF/D OF SALES GAS)

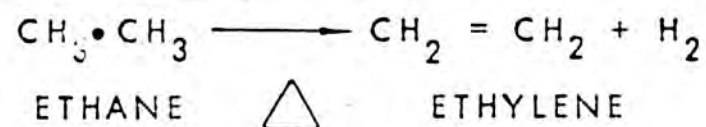
LPG CONTENT OF SALES GAS

	(BARRELS/DAY)		(TON/YEAR)	
	TOTAL LPG	ALASKA SHARE	TOTAL LPG	ALASKA SHARE
ETHANE (C-2's)	103,000	13,000	2,338,000	292,000
PROPANE (C-3's)	55,000	7,000	1,780,000	223,000
BUTANES (C-4's)	20,000	2,500	736,000	92,000
PENTANES+ (C-5's)	4,000	500	178,000	22,000
TOTAL	182,000	23,000	5,032,000	629,000

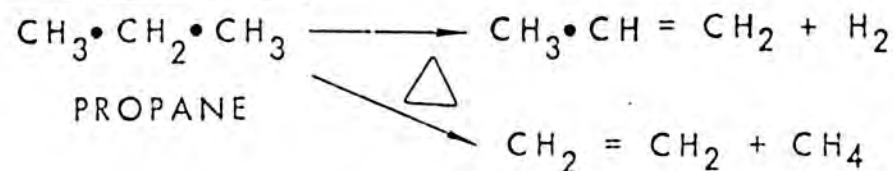
EXHIBIT C

PRODUCTION OF OLEFINS FROM LPG FRACTIONS

ETHANE TO ETHYLENE



PROPANE TO PROPYLENE



BUTANE TO BUTYLENE

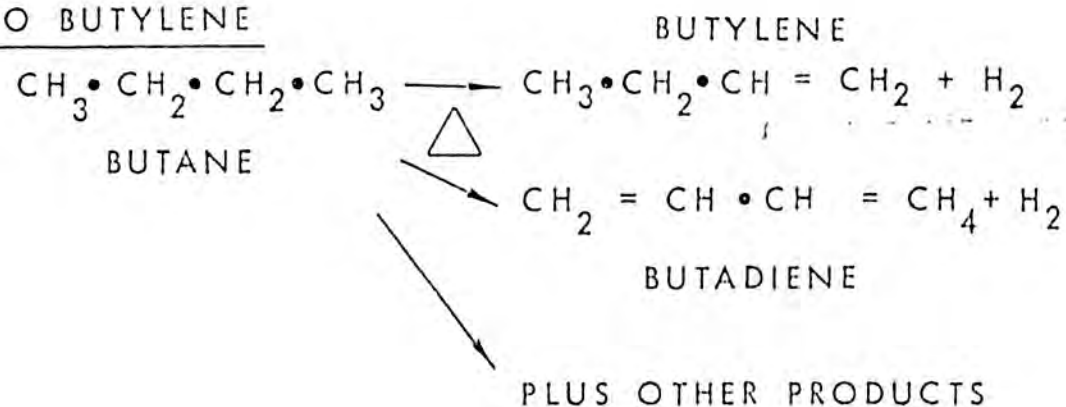


EXHIBIT D
ALASKA PETROCHEMICALS VALVE ADDED

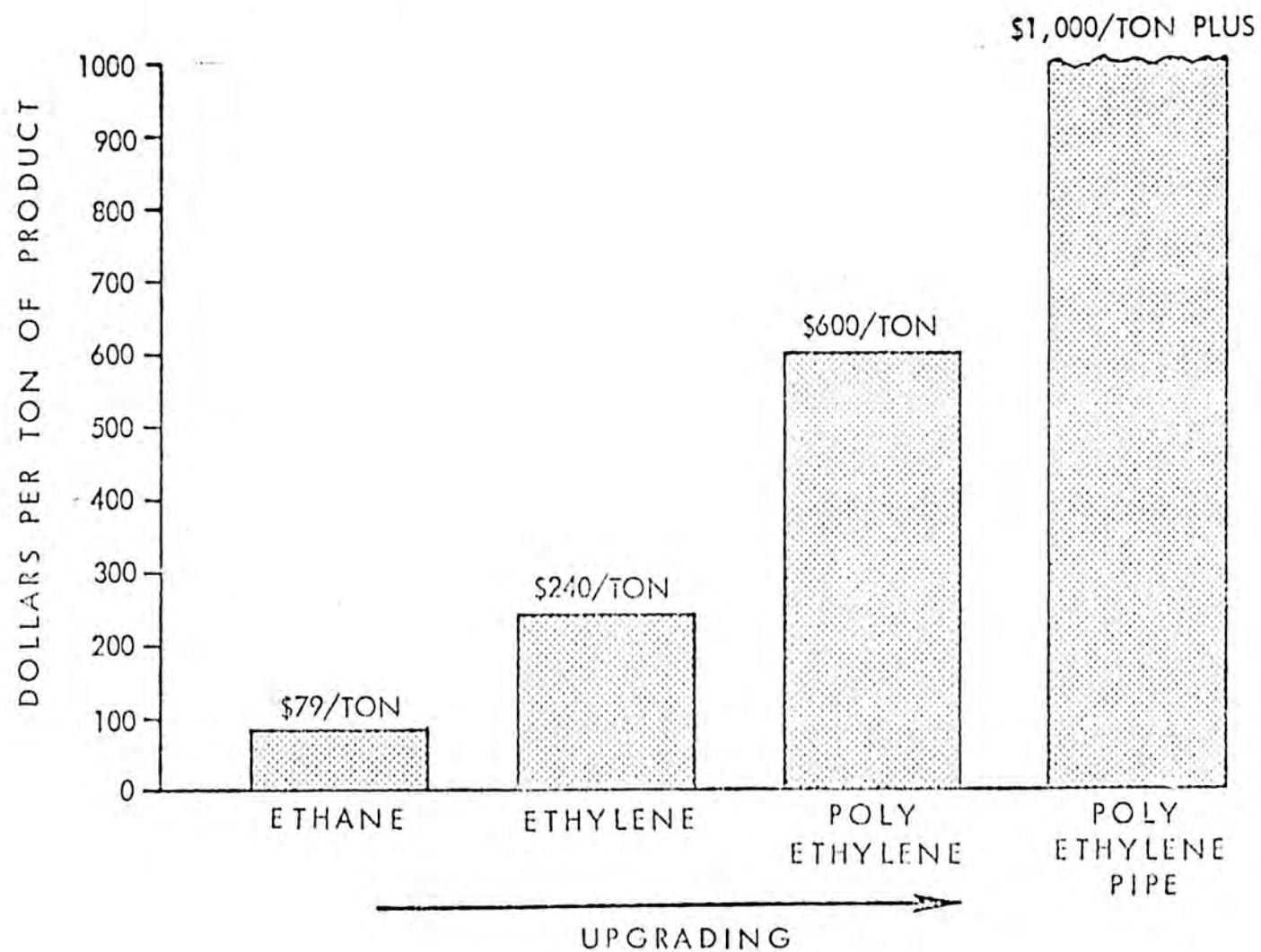


EXHIBIT E

ALBERTA PETROCHEMICAL RUNDOWN ON NEW PLANTS

NATURAL GAS BASED

- 3 WORLD SIZED AMMONIA PLANTS
- 2 WORLD SIZED UREA PLANTS
- 1 WORLD SIZED AMMONIUM NITRATE PLANT
- 3 WORLD SIZED METHANOL PLANTS
- 1 WORLD SIZED ACETIC ACID PLANT

NATURAL GAS LIQUIDS BASED

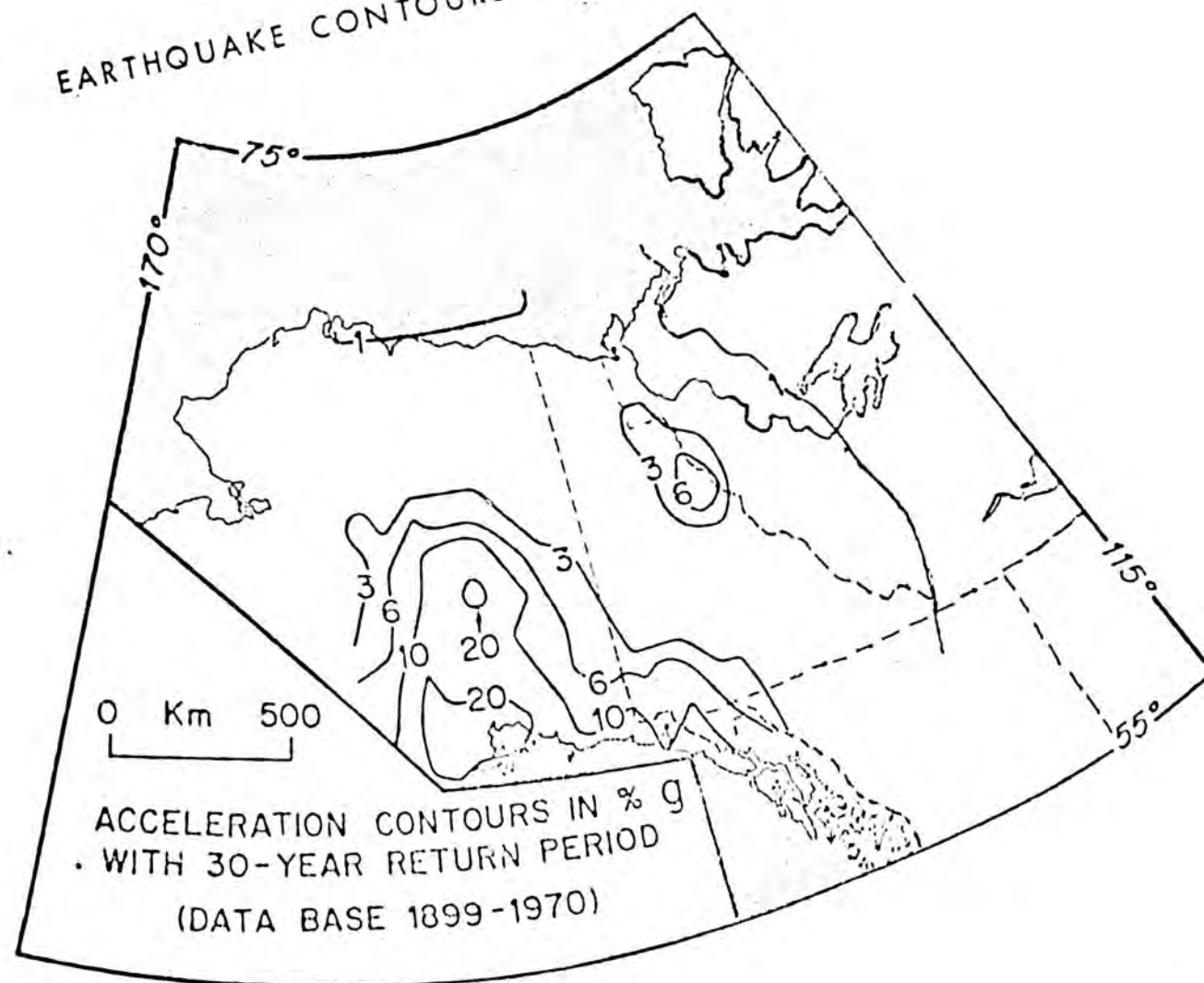
- 1 WORLD SIZED ETHYLENE PLANT
- 1 ETHYLENE OXIDE - ETHYLENE GLYCOL PLANT
- 1 VINYL CHLORIDE PLANT

CONDENSATE BASED (PENTANES PLUS)

- 1 BENZENE - GASOLINE PLANT

VALVE - WELL OVER \$1 BILLION

EXHIBIT F
EARTHQUAKE CONTOURS FOR ALASKA



CRUDE OIL AND NATURAL GAS ARE THE MOST IMPORTANT RAW MATERIALS
IN
THE MANUFACTURE OF BASIC ORGANIC CHEMICALS

FIELD GAS

UREA

METHANOL

NGLE

VINYL CHLORIDE

ETHYLENE DICHLORIDE

ETHYLENE OXIDE

ETHYLENE GLYCOL

VINYL ACETATE

HD POLYETHYLENE

LD POLYETHYLENE

POLYPROPYLENE

ACRYLONITRILE

NAPHTHAL
CRUDE OIL
COAL

ETHYL BENZENE

BENZENE

O-XYLENE

M-XYLENE

P-XYLENE

TETRAETHYLENE

SCOMM

#21:28

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL POWER COMMISSION

In the Matter of)
El Paso Alaska Company, et al:) Docket Nos. CP75-96, et al:

.....
WRAP-UP BRIEF OF THE ALCAN PROJECT
.....

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December 16, 1976

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL POWER COMMISSION

In the Matter of)
) Docket Nos. CP75-96, et al.
El Paso Alaska Company, et al.)

WRAP-UP BRIEF OF THE ALCAN^{1/} PROJECT

With the passage of the Alaska Natural Gas Transportation Act of 1976 (Act), Pub. L. 94-586, 90 Stat. 2903 (October 22, 1976), Congress recognized that the selection of an Alaskan natural gas transmission system is one of the most important energy decisions facing this country during this century. Thus, instead of relying upon the traditional procedures embodied in the Natural Gas Act, 15 U.S.C. §§717, et seq., Congress established a special procedure which will permit the final decision to be made only after substantial input from all levels of government. The decisional process begins, of course, with the initial decision of the Presiding Judge.

Given the spirit of the Act, Alcan submits that, regardless of the proposal ultimately preferred by this agency, it is incumbent upon the Presiding Judge and the

^{1/} For the purposes of this brief, Alcan Pipeline Company, Northwest Pipeline Corporation, Foothills Pipe Lines (Yukon), Ltd., Westcoast Transmission Limited, The Alberta Gas Trunk Line Limited and The Alberta Gas Trunk Line (Canada) will be collectively referred to as "Alcan."

Commission to weigh the evidence and provide an objective and balanced evaluation of the comparative merits and disadvantages of all three competing projects. Such an evaluation, in contrast with the biased presentation in Staff's position brief, will provide the groundwork for meaningful participation in the decisional process by other Federal agencies, the President and the Congress.

The vast record in this proceeding contains a plethora of detailed information on such issues as engineering, economics, environmental impact, tariffs, financing, and gas supply. This evidence has been adequately catalogued in prior briefs on specific subjects, and, therefore, will not be reiterated in this brief. Instead, this final submission by Alcan will address the broad issues which led to the formation of the Alcan Pipeline Project, and which, in our judgment, should control the selection of a system to transport desperately needed Alaskan gas to U.S. consumers for the foreseeable future. These issues are:

1. Whether an overland system should be selected instead of a combined land-water system.
2. If an overland system is selected, which route should be chosen in light of environmental, economic, and Canadian considerations.

Pipeline design is important, of course, but this issue should not dictate the selection of a system. In the last analysis,

the design of the project selected will be optimized on the basis of specific information developed regarding deliverability from Alaska, market distribution, and technological feasibility.

I. Overland System vs. Combined Land-Sea System

Virtually all parties who have addressed this issue (except, of course, El Paso Alaska, the State of Alaska and two purchasers of Alaska royalty gas whose support is compelled by their gas purchase contracts) have concluded that a totally overland system is far superior to a combined land and water transportation system in terms of ease of construction, reliance on existing technology, reliability of cost estimates, safety, and reliability of service once operations commence. Alcan believes that, in light of the history of the natural gas transmission industry over the past 40 years or so, there can be no doubt that reliance upon proven pipeline technology in a project of this magnitude is far preferable to reliance on relatively new LNG technology. This is especially so when consideration is given to the fact that the El Paso proposal is beyond the current technological limits of even this relatively new industry.

Fear of Canadian interference is the primary reason for El Paso's "all-American" project. In Alcan's view, there is no foundation whatsoever for this fear. Once the Canadian government has approved a trans-Canada system,

Alaskan gas undoubtedly will be transported to the United States without interference by the Federal or provincial governments of Canada.

The key, however, is to secure Canadian approval of an overland route in the first place. To accomplish this, the Canadian government must be provided with an alternative which protects Canadian interests as well as United States interests. The Alcan Pipeline Project is such an alternative.

II. Selection of the Optimal and Realistic Overland Route

Alcan's Canadian co-sponsors have testified that, in their judgment, Canada will be willing to permit a transit pipeline to cross its territory, provided Canadian needs and interests are respected. In addition to meeting Canadian needs and interests, the overland route selected should maximize environmental advantages, logistical advantages, and economic advantages, including benefits to the State of Alaska.

A. Environmental and Economic Considerations

With the exception of a short segment between Fort Nelson, British Columbia and Zama, Alberta, the entire Alcan route follows existing transportation corridors. From an environmental standpoint, the use of these existing corridors will mean that the overwhelming majority of Alcan's construction will occur in areas which have already been

environmentally impacted. This approach stands in sharp contrast to the Arctic Gas Project which will require new intrusions into pristine wilderness areas.

The location of Alcan's proposed route along established corridors, in the vicinity of all-weather roads, also gives it clear logistical and economic advantages over Arctic Gas. It is simpler to place and move men and equipment along Alcan's route than along Arctic Gas' route. Invariably, then, there must be a higher degree of confidence in Alcan's proposed construction schedule than in Arctic Gas'. The economic advantages of Alcan's proposed construction schedule and its greater reliability in adhering to that schedule are discussed in the briefs on economic matters filed by Alcan. Indeed, the advantages of Alcan's route and its maximum use of existing technology will enable it to complete its system and bring Prudhoe Bay gas to the lower 48 states some two years sooner than either of the other applicants. Even the Commission Staff has acknowledged that Alcan could bring Prudhoe Bay gas to the lower 48 states a year earlier than the other applicants.

Maintenance is also an important consideration. The availability of all-weather work roads and other facilities along existing transportation corridors means that Alcan will be able to engage in year-round maintenance and repair operations with very little, if any, environmental

and economic impact. In contrast, Arctic Gas' ability to conduct maintenance and repair operations on its North Slope and Cross-Delta segment, without significant environmental and economic impact, is severely limited.

Not the least of the economic benefits of the Alcan Project are those to the State of Alaska. Although Alaska has expressed its preference for the El Paso Project, which completely traverses the state, it has characterized Alcan as a sound second choice in its position brief. The reasons are evident. By going southward to a point beyond Fairbanks before turning southeastward toward the Alaska-Yukon border, the Alcan system will enable Alaska to transport its royalty gas from Prudhoe Bay to the heartland of Alaska. The benefits which the Alcan Project would bring to Alaska are summarized in Alcan's briefs on socio-economic issues.

Apart from the foregoing environmental and economic issues concerning the routing of an Alaska gas transportation system, another major routing question in this proceeding is: Should the Arctic National Wildlife Range (and of course the similar North Slope land immediately adjacent to the Range in Canada) be sacrificed in order to bring Alaska gas to the lower 48 states? In Alcan's view, this issue overshadows the numerous other environmental matters which have been addressed in the course of this hearing. Every major environmental

organization in the United States has expressed adamant opposition to efforts to construct a pipeline across the Wildlife Range. This is not to say that these other issues are not important, but in distilling key issues, the impact on the Range clearly emerges as dominant. If the only choice open to the decision makers were to authorize a pipeline across the Range, as proposed by Arctic Gas, or not bring North Slope gas to the lower 48 states, a difficult question would indeed be posed in light of this country's urgent need for additional natural gas supplies, on the one hand, and its strong commitment to preserve environmental, wildlife, wilderness and recreational values, on the other hand. Fortunately, that stark decision need not be made, since there is another reasonable alternative overland proposal available: the Alcan Project. Again, if the entire picture is viewed dispassionately, there is simply no need to ruin the Arctic National Wildlife Range in order to bring Prudhoe Bay gas to the lower 48 states.

Even if this nation should eventually decide to seek hydrocarbon reserves which might potentially underlie the Range, the construction now of a gas pipeline through the Range will in no way benefit that development. If significant hydrocarbon deposits are discovered underlying the Range, they are likely to be oil reserves with solution and associated gas, similar to the deposits in Prudhoe Bay. Thus, in any event, a new oil line would necessarily connect

the hypothetical discoveries with the existing oil/gas separation and conditioning facilities at Prudhoe Bay to permit the oil to be transported south in the Alyeska oil pipeline. Therefore, any argument that the proposed Arctic Gas routing would advantageously connect such potential reserves with transportation facilities ignores the realities of the situation. ^{2/}

B. Utilization of Existing Systems

One of the great strengths of the Alcan system design is its maximum utilization of existing systems in Canada. Just as the Commission Staff discovers economic and other benefits from maximizing the use of existing facilities in the lower 48 states, so too does Alcan find such benefits from maximizing the use of existing facilities in Canada. The environmental benefits are obvious, and the economic benefits are also evident when one compares the cost of building entirely new facilities with the cost of partial looping of an existing line, combined with joint utilization of various facilities and personnel.

Of particular significance in this case is the undisputed fact that AGTL and Westcoast, which will not only expand

^{2/} To utilize Arctic Gas' routing for transportation of the gas from such reserves, either new oil/gas separation and conditioning facilities must be constructed in the Range or such gas will somehow have to be transported to Prudhoe Bay.

their own existing facilities to accommodate the Alcan project, but, along with Foothills, will build the new line segments in Canada, know more about constructing and operating pipelines in the far north than any other pipeline operators in North America. They have actually done it, and not merely theorized about it in laboratories and offices. Consequently, an overland project utilizing these unique talents is most likely to yield major benefits to U.S. shippers and consumers.

C. Canadian Considerations

Since Canada must approve any transit pipeline which would transport Alaska gas across its territory, Canadian needs and interests must be considered in the decisional process looking toward the selection of a totally overland route. When Arctic Gas filed its application in 1974, its sponsors believed that their project would ideally accommodate the needs and interests of both the United States and Canada. However, subsequent events have made it increasingly clear that Canada may not need or want a pipeline running through the MacKenzie Valley to connect MacKenzie Delta reserves in a time frame which will reasonably accommodate the need and desire of the United States to bring badly needed Prudhoe Bay gas to the lower 48 states. The record in this proceeding now shows that, in the recent past, natural gas consumption in Canada is growing at a considerably lower rate than previously anticipated, while gas supplies

from traditional sources, particularly in Alberta, have been increasing. Thus, Canada's need for Delta volumes now appears much less urgent in the near term than it did when the Arctic Gas application was filed.

More importantly, however, it now appears, on the basis of extensive hearings conducted by the Berger Inquiry, that extremely difficult socio-economic and political problems exist in the MacKenzie Valley, in the form of native land claims and the desire of the native peoples to secure adequate political rights. Indeed, the staff of the Berger Inquiry has tentatively recommended that no pipeline be built through the MacKenzie Valley until 10 to 15 years after the native claims in that area have been resolved. While Canadian action on the Berger staff recommendation cannot be predicted, it would be foolhardy for the United States to select an Alaska natural gas transportation system that is clearly vulnerable to long delays and massive cost overruns on account of problems known to exist and which cannot be resolved by decision makers in this country. These thorny problems are endemic to the Arctic Gas proposal, but not the Alcan proposal. As Alcan's Canadian sponsors have testified, the Alcan project provides a means of assuring the U.S. of overland access to its Alaskan reserves at the earliest possible date, while leaving Canada the flexibility to connect the Delta reserves at such time as required by her national interest.

Some parties -- most conspicuously, the Commission

Staff -- have maintained that the Alcan Project and the Maple Leaf Project, which is designed to bring MacKenzie Delta gas to Canadian markets, must be treated as a single project for purposes of environmental and economic comparison with the Arctic Gas Project.^{3/} Of the many allegations made by Alcan's opponents, this is perhaps the most absurd. The record in this case clearly demonstrates that the Alcan and Maple Leaf projects, while complementary, are entirely separate and distinct. Unlike Arctic Gas, the Alcan project's timing and cost are not de pendent upon the construction^{4/} of a pipeline to connect Mackenzie Delta reserves.

Arctic surmises, without any support in the record, that approval of its proposal will have a beneficial impact on the level of Canadian gas exports to the United States. This

^{3/} Strangely, the Staff does not deem it proper to combine the Maple Leaf Project with the El Paso Alaska Project for comparative purposes. The illogic of Staff's position is striking. Alcan and El Paso both deal only with Alaska gas, and either project could be authorized regardless of actions taken with respect to Mackenzie Delta gas.

^{4/} Alcan has responded at greater length to the Staff's arguments in its Reply Brief to Positions of Other Parties, filed December 16, 1976. As noted in other briefs filed by the Alcan Project, Alcan can very easily eliminate the proposed exchange arrangement involving Delta gas and, through the addition of minor compression facilities, transport the entire amount of Prudhoe Bay gas directly to the AGTL System in Alberta. (See Alcan's initial brief on economic matters, pp. 16-17; Tr. 39,157.) Alcan is ready and willing to commit to do so, thereby removing even the remote suggestion that there may be a connection between the Alcan Project and the Maple Leaf Project.

specious contention is discussed in Alcan's reply brief on Canadian issues, as well as its reply brief to the position briefs of other parties. In light of the foregoing discussion, it is evident that Mackenzie reserves will be developed only when Canada finds it in its best interest to do so. When that time arrives, the Maple Leaf project stands ready to bring such reserves to appropriate markets in an expeditious manner.

In sum, Alcan affords the only logical choice of an overland route from Prudhoe Bay to the lower 48 states, since it, unlike Arctic Gas, affords recognition to Canadian interests. Not only does Alcan offer Canada the opportunity to accommodate its neighbor by approving a transit pipeline through Canadian territory, but it permits Canada to do so without losing its flexibility with respect to the development of Mackenzie Delta reserves. Moreover, only Alcan recognizes Canada's interest in having its existing pipeline facilities (AGTL and Westcoast) utilized in conjunction with a transit pipeline.

III. Technological Matters

As noted, Alcan believes that the most crucial judgments which the Commission, the President and Congress must make are (1) which is the preferable transportation mode, and (2) which overland route should be selected. On the basis of the facts and circumstances as they exist today and will con-

tinue to exist in the foreseeable future, the Alcan route is the only reasonable choice available to the decision makers.

Very serious issues on system design have been raised in this proceeding. While these issues are secondary and should not control the selection of a route, they must be resolved ultimately. Alcan believes that the Commission, in preparing its recommendation to the President, can lay the foundation for ultimate resolution of the design issues. This part of the brief will consider some key technological questions and suggest how the Alcan project will meet them.

At the outset, Alcan believes that the final engineering design and construction techniques that should necessarily be utilized on whichever project is selected cannot be determined in an adversary proceeding such as this one. Modifications and refinements are to be expected throughout construction, particularly in a project where new technology and techniques are required. Likewise, permit stipulations by government agencies having jurisdiction will greatly influence final design, prior to and during construction. This has been amply demonstrated during the Alyeska project. Certain designs in that project still have not been approved by jurisdictional agencies, yet the job is nearly complete. Even the concept of a totally chilled, buried gas pipeline, which has been central to each of the three proposals, may be modified as detailed design proceeds. It has been shown in these

proceedings that not all potential geotechnical problems have been solved to date, even after massive investment of time and money. In short, design issues cannot be of pivotal decisional significance in this proceeding.

The key issue in the area of pipeline design is the size of the line which will best accommodate the gas supply likely to be available from Alaska. When the Arctic Gas Project was initially presented in 1974, its sponsors were faced with the problem of designing a line which would not merely be optimally sized to meet the requirements for transportation of Alaska gas, but which would also accommodate the volumes expected to be available from the Mackenzie Delta. Throughout the hearings, Arctic Gas has steadfastly maintained that it expects 2.25 Bcf/d from Prudhoe Bay and, after a few years of buildup, 2.25 Bcf/d from the Mackenzie Delta. Accordingly, its pipeline is designed for a maximum of 4.5 Bcf/d. As discussed at length in Alcan's initial and reply briefs on gas supply issues, it now appears that the maximum volume likely to be available from Prudhoe Bay is 2.0 Bcf/d, and, indeed, the State of Alaska, which will control the amount of gas which will be made available through its approval of the field operating plan, has indicated that no more than 2.0 Bcf/d is the likely volume which will be made available for transportation to the lower 48 states. If Mackenzie Delta volumes are developed as projected by Arctic

Gas (to the level of 2.25 Bcf/d), the Arctic Gas system will have an expansibility capability without looping of 12.5%. Any expansion of the Arctic Gas system to accommodate additional Alaska gas beyond 2.25 Bcf/d will require looping of Arctic Gas' main line through Canada from Tununuk Junction south. Of course, if Mackenzie Delta volumes do not reach the 2.25 Bcf/d level, Arctic Gas will have additional flexibility to expand its Alaska gas deliveries, should additional supplies from Alaska ever become available, beyond 2.25 Bcf/d without looping. At the very least, however, this would require additional compressor stations on the Prudhoe Bay lateral, thereby assuring further destruction of the Arctic National Wildlife Range and its unique wildlife, wilderness, and recreational values.

The Alcan Project, on the other hand, is optimally sized to handle the volumes which are likely to be available from Alaska throughout the life of the project.^{5/} Thus, at its design volumes of 2.4 Bcf/d, the Alcan system has expansion capability, without the addition of any facilities, of 20% above the anticipated maximum daily volume of 2.0 Bcf. And Alcan has demonstrated that its system can be expanded

^{5/} This subject is discussed at length in Alcan's initial and reply briefs on gas supply issues. See also Rebuttal Brief on Environmental Matters of the Alcan Project, pp. 6-8, which was filed on December 9, 1976.

without looping to an average daily volume of 2.9 Bcf (3.1 Bcf on a peak day) -- an expansion capability of 45 percent above the expected maximum of 2.0 Bcf/d. Of course, the Alcan system, like the Arctic Gas system, can be further expanded through incremental looping or a combination of looping and compression.^{6/}

Alcan acknowledges that its use of a 42" line at 1250 psig operating pressure and its use of lower pressure existing pipelines will result in greater fuel consumption than would the use of a 48" express line operating at 1680 psig. Alcan is certainly sensitive to this issue in this time of energy shortage. However, there is a real trade-off involved in resolving the fuel consumption issue, namely, fuel economy versus system reliability. Alcan believes that the greater the degree of new, untried technology involved in a proposal of this magnitude, the less reliable will be the estimated construction costs, scheduling projections and service after operations commence.

One important question is whether this project, which must be constructed in one of the most hostile environments in the world, is the proper occasion to experiment with

^{6/} The sponsors of the Alcan Project are ready, willing, and able to expand the system to accommodate additional Alaska volumes which may become available. See, e.g., Blair, Tr. 41,787, 41,797; Phillips, Tr. 42,158-59.

technology not yet tried and tested in actual pipeline operations. Both of the overland applicants, Alcan and Arctic Gas, must inevitably propose some new technology, namely construction of a chilled gas pipeline in permafrost areas. Indeed, both applicants propose higher pressure pipelines than are currently in operation anywhere else in North America. But here the similarity ends. In terms of pipeline pressure, Alcan would go to 1250 psig, 25% beyond the highest pressure line now in operation in North America, while Arctic Gas would leap 68% beyond current technology to 1680 psig. In addition, Arctic Gas has opted for 48-inch pipe, again larger than any gas pipeline in operation in North America. Should billions of dollars be gambled upon Arctic Gas' ability to make a successful giant leap forward in pipeline technology, or should the more modest, but nonetheless real, technological advances proposed by Alcan be accepted? Alcan submits that the same logic which should lead the decision makers to prefer a totally overland system to a combined land and water transportation system should lead them to prefer a system which, although technologically innovative in certain respects, is sufficiently close to existing technology to assure construction on schedule and within estimated costs, and which will prove to be a safe and reliable service over the life of the project. This is especially so in view of the fact that United States gas consumers and taxpayers may be called upon to pay for the system "in all events."

Following the selection of a route, the governments of Canada and the United States will be required to reach an agreement, perhaps after further investigation, on a pipeline design which will protect the interests of both countries. Alcan's sponsors are willing to abide by such a decision and build the system that is determined to be appropriate under the circumstances, provided that it meets applicable safety codes.

V. Conclusion

As noted above, there can be no doubt that, in scope, size, and level of uncertainty regarding key issues remaining after the close of the record,^{1/} this is no ordinary certificate case to be resolved by the Commission under its standard decisional criterion. Under these circumstances, Alcan submits that the Presiding Administrative Law Judge and the Commission will best serve the President and Congress by not proposing a typical certificate of public convenience and necessity, but rather by providing a decision which identifies the U.S. and Canadian interests involved in the selection of an applicant.

^{1/} For example, there are still no executed contracts for the sale of Prudhoe Bay gas to shippers; there is no definitive evidence concerning the handling of the construction and cost of the huge gas processing facility which must be constructed at Prudhoe Bay; and there is as yet no fixed wellhead price for the Prudhoe Bay gas.

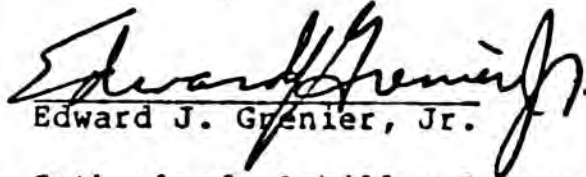
In this connection, the Presiding Judge and the Commission can provide a service to the President and Congress which the Staff proved unwilling to perform. Staff insists on approval of the Arctic Gas project without an even-handed balancing of the alternatives. This obvious attempt to push Canada to the project which Staff has non-objectively selected is not what Congress requested. Further, this approach could cause substantial delay in the event that Canada should reject a proposal for which the U.S. has provided no alternative.

Alcan urges the Commission (and the Presiding Judge in his initial decision) to focus upon the key decisional factors discussed in this brief. Although the typical issues raised in comparative certificate proceedings, such as comparative cost of service, must be addressed, such issues should be given secondary weight in the decisional process.

Alcan respectfully submits that, in view of the foregoing, the record itself, and numerous other briefs filed by Alcan in this proceeding, the Presiding Administrative Law Judge and the Commission should recommend selection of

the Alcan Project, after going through the review and ranking process recommended herein.

Respectfully submitted,


Edward J. Grenier, Jr.

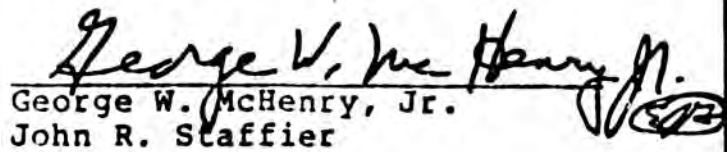
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Alcan Has New Plan

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ANCHORAGE (AP) — American and Canadian sponsors of the Alcan Pipeline Project for transport of Prudhoe Bay natural gas by an alternative express pipeline system will be filed with Canada's National Energy Board by the end of this month.

John G. McMillian, chairman of sponsor Northwest Pipeline Corp. and its subsidiary Alcan Pipeline Co., says the alternative proposal calls for construction of a 48-inch-diameter pipeline.

The firm's earlier proposal was based on use of 42-inch pipe. It was sharply criticized by Administrative Law Judge Nahum Litt, the Federal Power Commission hearings judge, as being inadequate.

Litt endorsed an alternate proposal offered by Arctic Gas for a route through the Arctic National Wildlife Refuge and south through Canada.

He called a route proposed by El Paso Natural Gas Co. a "viable option." That route would parallel the trans-Alaska oil pipeline to Gravina Point, where gas liquification plants would prepare it for tanker shipment south.

The FPC record is currently closed, and the panel is preparing to make its recommendation to the President by May 1. The President will then select a line. Congress is to make a final decision on the route by the end of this year.

Alcan's Alaska representative, Morris Thompson, said today a decision on the alternative route as it relates to the FPC has not yet been made.

McMillian says Alcan's larger pipe can carry about 3.4 billion

cubic feet of gas per day through Alaska and western Canada for delivery near Kingsgate, B.C., and Munchy, Sask., both near the U.S.-Canadian border.

McMillian says the express line option "will provide for greater expansion flexibility than Alcan's initial proposal, if it is determined that such expansibility will best suit the long-term needs of the U.S.

"This larger system proposed for our route is very similar to the so-called 'Fairbanks Alternative' proposal that was recommended by staffs at the Federal Power Commission and the Department of Interior," he said.

"Since we believe that the selection of the route is the key decision, we are prepared to alter our proposed facilities in any responsible manner that will meet U.S. objectives and also be acceptable to Canada."

The pipeline would still parallel the trans-Alaska oil pipeline to a point south of Fairbanks, and then swing east to follow the route of the Alaska Highway. However, the route would then shift to divide at Caroline, Alta. Originally, a branch was to head south through British Columbia to Washington state for West Coast deliveries.

Under the revised proposal, a 42-inch pipeline would carry about 70 per cent of the gas to Munchy and into the proposed Northern Border Pipeline for redelivery to the U.S. Midwest and East. The remaining 30 per cent would be transported through 36-inch pipeline along existing corridors to Kingsgate for redelivery to western U.S. markets.

**THE ALCAN
PIPELINE PROJECT
A REALISTIC
SOLUTION TO THE
TRANSPORTATION
OF ALASKAN
GAS**



Facts about Alcan

The Alcan Pipeline Project is one of three systems currently being considered by the Federal Power Commission for the transportation of Alaskan gas reserves to markets in the lower U.S.

The Alcan Pipeline Route will parallel the Alyeska oil pipeline for 539 miles to Delta Junction, at which point it will proceed along the Haines utility corridor and the Alcan (Alaska) Highway to Fort Nelson, British Columbia and Zama Lake, Alberta. Existing Canadian pipelines will carry the Alaskan gas for redelivery to U.S. transmission companies at three points along the U.S./Canadian border.

New Pipeline: 1,806 new pipeline miles — 731 in Alaska and 1,073 in Canada.

Diameter: 1,499 miles of 42-inch pipe and 307 miles of 36-inch pipe.

Capacity: 2.4 billion cubic feet per day (expandable to 3.1 billion) within three years of operation. Initial capacity of 1.2 billion cubic feet per day.

Cost Estimate: In 1975 dollars, the Alaskan portion of the Alcan Project will cost \$2.3 billion, and the Canadian portion will cost \$2.4 billion. Alcan's total costs, including additional facilities in the lower 48 states, are \$6.3 billion.

Comparative Costs are \$10.4 billion for Arctic Gas and \$6.6 billion for El Paso.

Canadian Associates: Alberta Gas Trunk Line Company Limited and its subsidiary, Alberta Gas Trunk Line (Canada) Limited; Westcoast Transmission Company Limited; and Foothills Pipe Lines Ltd.

Alcan's Advantages:

- Lowest total investment for transporting Prudhoe Bay gas.
- Lowest delivery costs.
- Earliest delivery date.
- Provides stable economic growth base for the Alaskan interior.
- Least environmental impact.
- Year-round access to all facilities.
- Can be built independent of Canadian decision to develop its frontier gas reserves.



What is the Alcan Pipeline Project?

The Alcan Pipeline Project is the proposal of the Alcan Pipeline Company, a wholly-owned subsidiary of Northwest Pipeline Corporation, headquartered in Salt Lake City, Utah. Northwest Pipeline owns and operates a 4,400-mile pipeline system extending from the San Juan Basin in New Mexico and Colorado to the Canadian border, serving natural gas customers in seven western states. The company supplies all of the natural gas consumed in Idaho, Oregon and Washington and part of the gas used in Nevada, Wyoming, Utah and Colorado. Northwest Pipeline has assets of more than \$500 million.

On July 9, 1976, the Alcan Pipeline Company filed a request with the Federal Power Commission seeking authorization to construct a 731-mile pipeline in Alaska, utilizing the Fairbanks Corridor / Alcan Highway Route. This pipeline will be part of a proposed new pipeline system to transport natural gas from the Prudhoe Bay on Alaska's North Slope to markets in the lower 48 states.

The planned pipeline would follow established utility and highway corridors in Alaska and Canada and would utilize existing Canadian pipeline systems to deliver the gas to the United States border. This conforms to the Mineral Leasing Act which calls for joint use of rights-of-way to prevent unnecessary scarring of public lands.

Four Canadian Companies — Westcoast Transmission Company Limited; The Alberta Gas Trunk Line Company Limited and its subsidiary, Alberta Gas Trunk Line (Canada) Limited; and Foothills Pipe Lines Ltd. — have entered into an agreement with Alcan and Northwest Pipeline to transport the Prudhoe Bay gas through Canada to the U.S. border and have filed the necessary applications for Canadian regulatory approvals.

Alcan Pipeline's project will be designed to transport all of the Prudhoe Bay gas, up to approximately 2.4 billion cubic feet per day, through a 42-inch diameter pipeline. The pipeline will follow the Alyeska oil pipeline for ap-



BRITISH
COLUMBIA

ALBERTA



Northwest Pipeline Corporation owns and operates a 4,400 mile pipeline system serving natural gas customers in seven western states.

proximately 539 miles to Delta Junction, south of Fairbanks, where it would then parallel the Alcan (Alaska) Highway to the Yukon border.

At the Alaskan/Yukon border gas would be delivered to a new pipeline to be constructed by a Canadian company, Foothills Pipe Lines Ltd., which would continue the transportation of gas through a 42-inch pipeline along the Alcan Highway to the Yukon-British Columbia border and then by Westcoast Transmission Company Limited to Fort Nelson, British Columbia.

At Fort Nelson, a portion of the gas would be diverted into the expanded existing system of Westcoast for ultimate delivery to the United States at an interconnecting point on the border near Sumas, Washington, where the gas will be received by the Northwest Pipeline system for delivery to western markets.



The Alcan Project will provide for direct pipeline delivery of Alaskan gas to markets in the lower 48 states.

The remainder of the gas would be transported from Fort Nelson to Zama Lake, Alberta through a new pipeline for delivery at Zama Lake to Alberta Gas Trunk Line Company Limited. Alberta Gas Trunk Line would then transport the gas through its expanded existing system for delivery to Empress, Alberta, and to Coleman, Alberta where the existing Alberta Natural Gas Company line would carry the gas to Kingsgate, British Columbia for delivery to the Pacific Gas Transmission system, which would transport the gas to California.

From Empress, Alberta, Foothills would construct a new pipeline to Monchy, Saskatchewan and from there, gas destined for the Midwest and Eastern regions of the United States could be delivered through the Northern Border Pipeline, presently pending before the FPC.

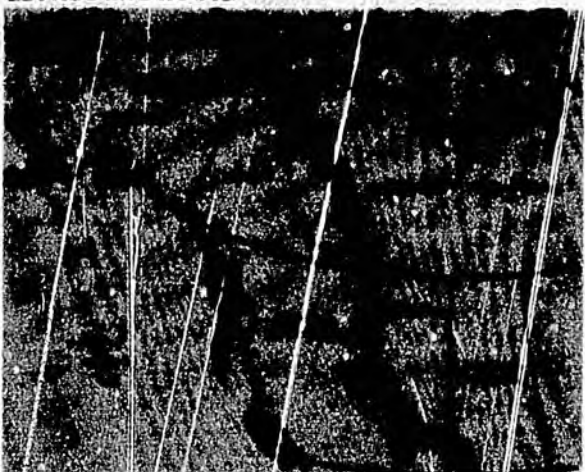
What are the Alternative Proposals?

The El Paso Natural Gas Co. proposes to construct a trans-Alaska pipeline that would roughly follow the Alyeska oil pipeline. Under El Paso's proposal, gas would be liquefied in Alaska and transported as LNG to southern California where the gas would be delivered from the West Coast to the rest of the U.S. by a displacement mechanism which has not yet been defined.

The proposal of the Arctic Gas Group is an all-land route that would begin in Prudhoe Bay, cut straight across the virgin wilderness areas including the Arctic National Wildlife Range, to Canada's Mackenzie Delta, then south to the U.S.-Canadian border, where proposed companion lines would carry the gas to the eastern and western U.S.



EL PASO LNG ROUTE



TRANS-CANADA ROUTE OF ARCTIC GAS

Economic Advantages of Alcan

The total cost of the Alcan Project, including facilities for transporting the gas within the lower 48 states, is \$6.3 billion in 1975 dollars. This compares with \$10.4 billion for the Arctic Gas proposal and \$6.6 billion for the El Paso proposal.

The lowest total cost is a major advantage. The Alcan Project will almost certainly be easier to finance. Capital, like natural gas, is a resource that is limited but very necessary.

This lower total cost makes Alcan transportation costs lower. Figures filed with the Federal Power Commission show that Alcan will be able to transport Alaskan gas to the U.S. at a lower cost than either of the competing projects. We estimate the transportation cost of our service to markets in the lower U.S. to be \$1.35 per million BTU, compared to \$1.59 per million BTU for Arctic Gas, 24-cents higher than Alcan. El Paso's transportation costs, on a comparable basis, are expected to be \$1.69 per million BTU, 34-cents higher than Alcan.

There are many reasons for Alcan's lower total cost and lower transportation cost figures. One is that Alcan is following existing highway and utility corridors all the way. Additionally, use of the existing oil pipeline construction work pad, communications system, airfields and all-weather roads will allow work to begin immediately with a minimum of preliminary construction.

Transporting equipment and supplies to the construction site is a major logistical problem. Without existing roads, the problem is multiplied many times.

New Construction Pad

Arctic Gas proposes construction of snow roads and would have to bring much equipment in by air. Under the Arctic Gas plan, pipeline construction would take place from snow roads during the short winter construction periods.

However the northern reaches of Canada and the area along Alaska's North Slope are semi-arid regions, with precipitation measuring

only about 10 inches per year and occurring mostly in summer.

Therefore, annual snowfall would be insufficient for the construction of snow roads and the manufacture of artificial snow would be required. However, Arctic Gas has no prototype machine to produce the snow necessary for the roads.

Even if it were possible, most experts doubt that the snow roads would prevent damage to the highly sensitive arctic soil. They also doubt that there's enough water to make the snow to construct the roads and even if the water can be found, utilizing it in this fashion would almost certainly damage fish populations irrevocably. Use of ocean water is clearly impossible because the high salt content would create permanent damage to the arctic soil and wildlife. In short, Arctic Gas is relying on a totally unproven concept.

El Paso's prime route generally follows the Alyeska oil line but would require construction of a new work pad. El Paso has filed an alternative route which would utilize 79 per cent of the Alyeska work pad, but still proposes its prime route which would lead to much duplicated work and increased environmental impact.

When the Alcan route departs from the

Cost of the Alcan Pipeline Project is \$4.1 billion less than that of Arctic Gas and \$300 million below El Paso's project.





Alcan delivery cost per million BTU, an all-important cost to the consumer, is the lowest.

route of the oil line near Delta Junction and continues southeast following the Haines pipeline corridor and the Alcan Highway, the highway itself will provide access to all construction areas and will enable Northwest to get supplies and equipment to the work site more quickly and with less expense.

We believe that utilizing facilities presently available is an important way to keep costs down.

Another area in which we adhere to this philosophy is in the utilization of existing Canadian pipelines. Our Alcan route would tie in to West-coast Transmission Company facilities at Ft. Nelson, British Columbia and to Alberta Gas Trunk Line facilities near Zama Lake, Alberta. These Canadian lines have excess capacity at present and can be "looped" to handle more of the Alaskan gas as it comes on stream.

Unlike Arctic Gas, we see little reason for an entirely new pipeline in areas where existing pipelines can do the job. This is another reason why Northwest can deliver the gas two years sooner than Arctic Gas or El Paso.

Time Means Money

Those two years mean money. If men and equipment are on the job two years longer, it simply stands to reason that costs will be substantially higher, not only because of the amount of time but because of inflated unit costs of labor and equipment.

Constructing the Alcan route as quickly as possible is another way we plan to hold costs down.

Our Canadian associates in the Alcan Project have North America's greatest experience in gas pipeline construction through permafrost. This experience will enable them to hold costs down and complete construction on schedule.

We also chose the 42-inch pipeline because it is the most economical method of transporting a daily volume of from 2.0 to 2.5 billion cubic feet of gas, as projected by Prudhoe Bay producers. Total recoverable reserves in the field are estimated at 26 trillion cubic feet, but Prudhoe Bay is essentially an oil field — not a gas field — and gas production above certain levels may cause an irreplaceable loss of oil in the gas cap. The State of Alaska has the responsibility of deciding how much oil and gas will be produced from the field, and one of the considerations is to adopt a plan which prevents undue loss of oil. For this reason it will be some time before the Prudhoe Bay field produces large volumes of gas. Our system is the only one with flexibility to handle small gas production rates and build up to the volumes which are realistically expected to be produced from the Prudhoe Bay field.

Half for Canada

Arctic Gas is proposing a 48-inch pipeline to carry up to 4.5 billion cubic feet daily. One-half of this capacity is dedicated to Canadian use for transportation of Mackenzie Delta reserves, destined exclusively for Canadian markets. Therefore, Arctic Gas is transporting only 2.25 billion cubic feet daily for U.S. markets. This compares with 2.4 billion cubic feet per day for the Alcan Project. We estimate that the Alcan line is adequate to carry all of the gas production which may be realistically expected from the Prudhoe Bay oil field.

Although Northwest's proposal does not need Canadian gas to operate profitably, it should be pointed out that the Alcan Project is compatible with Canadian plans to develop Mackenzie Delta gas at a later date.

It is definitely in the U.S. national interest to develop Alaskan North Slope reserves quickly and to transport them to energy-hungry U.S. markets. But is it in Canadian interests to develop Mackenzie Delta reserves immediately? This is a question that only Canada can answer.

Some facts are known. The Arctic Gas proposal would force development of Mackenzie Delta gas in the early 1980's. However because of increasing prices and a corresponding reduction in demand — in conjunction with increasing supplies in British Columbia and Alberta — it may not be in Canada's national interest to develop the Mackenzie Delta reserves at this time.

Northwest's proposal gives Canada the option of developing these reserves at a time when they will be most needed to meet the country's long-term requirements. The Canadians have made quite a point of wanting to reserve Canadian gas for domestic use and it is highly unlikely that additional imports from Canada to the U.S. are forthcoming. The Alcan Project can be approved to deliver Prudhoe Bay gas independent of Canada's policy for developing frontier gas.

Environmental Advantages of the Alcan Plan

The pipeline route chosen by Alcan and Northwest has been widely acclaimed as environmentally superior to the other two alternatives. The Federal Power Commission environmental staff and the Department of Interior both favor the Alcan Highway route. This route also has won the support of the Sierra Club, Friends of the Earth, National Audubon Society, Wilderness Society and others, and some of their comments have been included in this brochure.

The reasons for their objections to the Arctic Gas proposal are primarily that it would gouge a pipeline corridor directly across the coastal plain of the Arctic National Wildlife Range, the only large, pristine arctic wilderness area and the largest of our national wildlife refuges.

Environmental and safety objections have prompted their opposition to the El Paso proposal. El Paso is proposing a complex system,

*Caribou calving grounds
in the Arctic National Wildlife Range.*





Alcan would affect no undisturbed wilderness areas.

of gas liquefaction, transportation and regasification in environmentally sensitive areas on a scale never before attempted and not yet proven.

Which brings up another point. These ingredients: new technology, sensitive environments and a large scale relative to previous projects are the major ingredients for mammoth-sized cost overruns. Dr. Arlon Tussing, former chief economist of the Senate Interior Committee and a professor at the University of Alaska, has said that he would not be surprised to see the cost of either the El Paso or Arctic Gas projects exceed \$20 billion.

The Alcan Project, however, has all of the ingredients for realistic costs and the lowest probability for cost overruns. Alcan proposes conventional technology — a 42-inch diameter line at normal pipeline pressures and only traverses environments where construction experience exists.

Environmentalists prefer route of the Alcan Pipeline Project

“

“(The Wilderness Society) is most pleased to see the filing by Northwest Pipeline Company — at the Federal Power Commission — to construct a transportation system along the existing TAPS Corridor and the Alcan Highway to connect with existing distribution systems in Canada. This route appears to us to be the most environmentally sound.”

—Brec Cooke, The Wilderness Society

"The Fairbanks-Alcan corridor appears to be the most environmentally acceptable alternative because it uses a developed transportation corridor which will not degrade the wilderness character of the Arctic National Wildlife Range and obviates the inherent long-term risks of an All-Alaska, LNG system."

—Pamela Rich, Friends of the Earth

"A less elaborate system (than that proposed by either Arctic Gas or El Paso Alaska Company) would certainly benefit the consumer, and a proposal which utilizes existing corridors would have far fewer adverse environmental effects, lower operating and maintenance costs, and less chance of cost overruns than either of those proposed."

—Barbara Heller, Environmental Policy Center

"... there is increasing evidence that the Alcan Highway routing may be the most environmentally preferable of all the alternatives now before us."

—Brock Evans, The Sierra Club



Sheenjek River Valley of the Arctic National Wildlife Range.

"We believe that the Fairbanks highway alternative deserves further analysis and review so that it can be compared with the other two proposed routes. If your (the Senate Commerce Committee's) purpose is to assure more direct delivery of natural gas to the Midwest or Northeast, the Fairbanks route would do it."

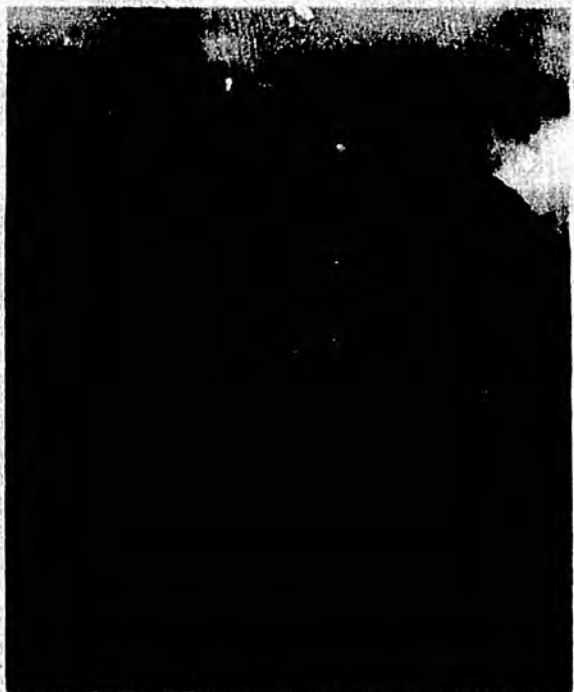
—Cynthia E. Wilson, The National Audubon Society

"... the Center favors construction of the gas pipeline in a utility corridor that is already in use with the provision that the pipeline should utilize to the maximum extent facilities that are already built, including highways, construction pad, access roads, material sites, camps, etc."

—Peter Scholes, Alaska Center For The Environment

"The staff concludes that ... the Fairbanks Alternative ... is the most environmentally acceptable system to transport Prudhoe Bay gas to the lower 48 states."

—Environmental Staff, The Federal Power Commission





"The Fairbanks Route, because it follows the Alyeska Oil Pipeline and other transportation routes through Alaska and Canada, would avoid some of the impacts associated with the Applicant's (Arctic Gas) proposal, the Offshore, Coastal, Interior, and Cross Delta Routes."

—The Department of Interior

"The Fairbanks-Alcan route may be the least environmentally damaging . . . while, at the same time, be economically comparable to the two other basic proposals."

—Thomas L. Kimball, National Wildlife Federation

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Alcan will utilize the Alyaska work pad.

Other Objections Cited

There have been other objections to the El Paso proposal. El Paso has proposed an LNG liquefaction plant site in an active earthquake zone at Prince William Sound in Alaska. In contrast the Alcan route follows a relatively placid zone north of the most active earthquake areas.

No less eminent a scientist than Dr. Edward Teller of the University of California called for a re-examination of the LNG safety issue. LNG tankers of the size proposed by El Paso have never before been built.

El Paso has proposed an LNG terminal at Point Conception, California, but faces considerable opposition. The Friends of The Earth organization recently reaffirmed its opposition to El Paso's proposed LNG plant sitings at either the undisturbed beach area of Point Conception or the alternative Los Angeles Harbor, which already is overly congested.

Also in order to site its LNG regasification plant at Point Conception, El Paso must receive approval from a number of California state regulatory agencies.

Uses Less Gas

Few doubt that Alcan will use less gas for transportation than El Paso. Not only does El Paso use gas for transportation but also for liquefaction operations. The pipeline system is also more reliable. Bad weather and rough seas could easily delay shipping, and under the El Paso plan the gas would stop moving.