REPORT TO THE PRESIDENT

ON

ENVIRONMENTAL IMPACTS OF PROPOSED ALASKA GAS TRANSPORTATION CORRIDORS

BY THE

COUNCIL ON ENVIRONMENTAL QUALITY

JULY 1, 1977

EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL ON ENVIRONMENTAL QUALITY
722 JACKSON PLACE, N. W.
WASHINGTON, D. C. 20006

July 1, 1977

LETTER OF TRANSMITTAL

THE PRESIDENT:

Sir: The Council on Environmental Quality is pleased to submit its Report on the Environmental Impacts of Proposed Alaska Gas Transportation Corridors, in accordance with Section 6(d) of the Alaska Natural Gas Transportation Act of 1976.

Respectfully,

Charles Warren
Chairman

Gus Speth
Member

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Member Designate

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SUMMARY

Background

Since the discovery of large oil and natural gas reserves in the Prudhoe Bay fields in Alaska, several routes have been proposed to transport this gas to the lower 48 states.

° A North Slope/MacKenzie Valley corridor, sponsored by Alaskan Arctic Gas Company, would traverse Alaska's North Slope, cross into Canada at the MacKenzie River Delta, and run south along the river and thence into the Midwest; a western leg would transport gas to the western states.

° An Alaska LNG route proposed by the El Paso Alaska Company would follow the oil pipeline to a new terminal site on Prince William Sound where the gas would be liquefied and shipped by tanker to southern California.

° The Fairbanks Alternative corridor sponsored by the Alcan Pipeline Company would parallel the existing oil pipeline as far as Fairbanks and then follow the Alcan Highway through Canada. Some of the gas would be routed to the West Coast via a western leg, and most would go through Alberta and Saskatchewan to U.S. markets in the Midwest and the East.

All three corridors were analyzed in the environmental impact statement process of the Department of the Interior and the Federal Power Commission.

Recognizing an urgent national need for additional natural gas supplies, the Congress enacted the Alaska Natural Gas Transportation Act of 1976 to provide the means for a sound and expeditious decision by the President and the Congress on which, if any, transportation system should be built. To avoid the delays of possible litigation, the Act precludes judicial review of the environmental impact statements required by the National Environmental Policy Act (NEPA).

Under Section 6(d) of the Alaska Gas Act, the Council on Environmental Quality is directed to present to the President its views on the legal and factual sufficiency of the impact statements and on other environmental matters that we consider relevant. CEQ is also directed to provide members of the public with an opportunity to present oral and written data, views, and arguments on the impact statements. A total of four days of public hearings were

held in Anchorage and Washington, D.C., with written and oral testimony submitted by over 70 persons and organizations representing a wide spectrum of interests. These hearings were extremely informative and helpful to the Council in reaching its conclusions.

Views of the Council on Environmental Quality

Sufficiency of the Environmental Impact Statements

Because of the magnitude of the competing proposals and the abbreviated schedule for decisionmaking under the Alaska Gas Act, the decision at hand is to select a particular gas transportation route. It is the sufficiency of the environmental impact statements for this limited purpose that is considered here--not their sufficiency for determining precise alignments, facility locations, and other site-specific data.

After careful review of the impact statements and testimony submitted at our hearings, we have concluded that:

° Although they have shortcomings, the environmental impact statements are legally and factually sufficient under the National Environmental Policy Act for purposes of selecting the corridor and basic technology for a gas transportation system. Indeed, the NEPA process led directly to the development of the Fairbanks Alternative, the corridor that we believe to be environmentally preferable, as noted below.

° Although the impact statements provide the information necessary to select a corridor and the basic technology for a gas transportation system, they lack the data required for specific decisions concerning route alignments, project designs, mitigation measures, and facility siting. NEPA requires a continuous review of environmental factors and alternatives by agencies with authority over the approved gas transportation system. Environmental assessments, EIS supplements, or new impact statements may be required, depending upon the significance of impacts and the degree to which they have already been treated. Major design, engineering, or other site-specific decisions that follow the selection of a corridor and technology must be considered in one of these types of NEPA analyses.

Environmental Impacts of Alternative Corridors

The impact statements and other public documents provide

a wealth of information on the environmental impacts of each of the three corridors. Altogether, they permit a fair comparison of the significant environmental impacts that we believe are most relevant to the decision before the President and the Congress. We found that:

° The North Slope/MacKenzie Valley corridor is the most environmentally destructive of the three routes being considered. Intrusion into the wilderness stretching from the Canning River in Alaska to the MacKenzie Delta in Canada would be massively disruptive. We disagree strongly with the Federal Power Commission's conclusion that this corridor is environmentally acceptable.

This corridor would pass through parts of Alaska and Canada that are now hardly affected by industrial man's influence: Of its 195 miles in Alaska, 135 miles would cross the narrow coastal plain of the 8.9-million acre Arctic National Wildlife Range. Established to preserve unique wildlife, wilderness, and recreational values, the Range stands out as the last unspoiled area of its kind in the entire Northern Hemisphere.

The proposed North Slope/MacKenzie Valley pipeline would cut an east-west corridor across this unmarred landscape, requiring new port facilities, airstrips, helipads, gravel borrow areas and compressor stations as well. Although the land loss seems insubstantial when compared to the total Range, the harm likely to occur to wildlife and wilderness values there is vastly out of proportion to acreage figures.

The litany of measures proposed to protect the Range from pipeline construction is a testimony to scientific, technological, and management ingenuity. The applicant proposes to build that portion of the pipeline entirely in one winter, using only snow roads that vanish with the spring melt. We are skeptical about whether it could be done. The risks of failure are impressive and their consequences irremedial. Experience suggests that economic pressure to complete such a pipeline on schedule would not yield to the onset of spring and the wildlife that might stand in the way.

We must also note the widespread concern that such a gas line could invite an oil line and perhaps a permanent road, so as eventually to become a permanent

corridor. A gas line across the Arctic Range and Northern Yukon to the MacKenzie Delta would invite the exploration of oil and gas that may well exist within the Range or in the Beaufort Sea. The future of the Arctic Range must lie in the permanent dedication of this rich and unique area to wilderness. This is also the conclusion of the State of Alaska and every environmental organization appearing at our hearings.

The wilderness and wildlife values of the Range, along with the pipeline route, also extend into Canada, to the MacKenzie Delta. Natives there, who constitute the majority of the population in the Northern Arctic, have vigorously opposed any pipeline either across the North Slope or up the MacKenzie River, fearing its effects on their way of life and its interference with their land claims settlement. Canadian Justice Thomas Berger, who investigated the social and environmental impacts of this route for the Canadian government, recommended that to protect these people and the environment on which they depend, no pipeline be built across the North Slope.

- The Fairbanks Alternative corridor would largely follow existing transportation corridors, with no large-scale intrusion into wilderness areas or destruction of wilderness values. We find, in agreement with the Federal Power Commission, that it is the most environmentally acceptable of the three corridors.

But some of its environmental risks are still unknown. The preliminary state of the design effort suggests substantial uncertainty about fundamental concepts. Measures to deal with frost heave, thaw settlement, and summer construction, for example, are only roughly sketched. Still to be developed is site-specific information, such as stream crossings and additional workpad construction mileage.

On the other hand, it appears that the gas line could be safely constructed relatively near the oil pipeline across the existing workpad. The existing haul road along the oil pipeline would also be used, as would many of the existing campsites and other facilities. Further advantages can result from the availability of information on the geology, soils, stream characteristics, and wildlife, all of which

would aid in controlling impacts of the Fairbanks Alternative as far as Delta Junction, where it would depart from the oil pipeline.

Social and growth impacts of both the Fairbanks Alternative and the Alaska LNG route will obviously be greater in Alaska than those of the North Slope/ MacKenzie Valley corridor. Although no accurate measures of these impacts have been made, the Alyeska experience has prepared residents for what to expect. Many government, labor, and business interests as well as some Alaskan natives desire the growth effects of another pipeline project and believe its impacts can readily be absorbed.

A Canadian Inquiry headed by Dean K.M. Lysyk is now investigating the effects of the Fairbanks Alternative on the native claims settlement issue in the Southern Yukon. The report is intended to provide Canada with the social impact information needed to make a decision on this route.

- The Alaska LNG alternative presents risks to the environment, to public safety, and to system integrity not present with the overland corridors. Its significantly greater consumption of energy should also be viewed as an environmental cost, and it would have the greatest impact on Alaskan fisheries. It is possible that the Alaska LNG corridor and technology can be environmentally acceptable. At present, however, we are faced with significant uncertainties about thermal impacts, seismic design, ultimate suitability of the LNG plant sites proposed in Alaska and southern California, and the safety risks of LNG tanker traffic. This system would be environmentally acceptable only on condition that more specific analyses of alternative LNG facility sites and mitigation measures are conducted prior to any certification.

Because the Alaska LNG pipeline corridor makes the most extensive use of the existing oil pipeline corridor, its social, economic, and environmental impacts in Alaska would be similar to those of the Fairbanks Alternative. In its last 43 miles, however, the corridor would cross the Chugach National Forest, a roadless area of great scenic beauty, to Point

Gravina, where the gas would be liquefied, and from there transported by tankers to California, gasified, and sent to U.S. markets.

The most serious potential impacts of the LNG facility at Point Gravina are those associated with the seawater cooling system. According to the best evidence, the LNG plant as proposed would probably affect the marine ecology of Orca Bay substantially. Because the area is a valuable source of salmon and other commercial species, it could have profound effects on the local economy as well. But precise conclusions cannot be drawn because no substantial investigation of the Bay has been undertaken, and the water-related LNG plant systems remain undefined. Without this information it is impossible to determine whether the site at Point Gravina is environmentally acceptable or another is preferable. It seems likely, however, that an environmentally acceptable plant could be designed and constructed.

Similar problems arise with seismic design at the Gravina site. Earthquakes and resultant tsunamis present serious threats. The applicant asserts that a safe plant could be designed once Gravina conditions (e.g., the existence and depth of bedrock) are satisfactorily investigated. Although this assertion has not been successfully challenged, the necessary proof must await further site investigation and actual plant design.

From Point Gravina LNG tankers would leave for a California gasification site--Point Conception or Oxnard appear to be the current leading alternatives. Here complex land use, thermal discharge, and safety issues must still be resolved by the state and federal governments.

LNG tanker accidents can have major consequences. Tanker collisions or rammings and groundings could lead to vapor clouds, LNG pool fires, and accidents at the LNG facility--with possibly fatal effects. The analyses of LNG public safety risks on the record are inconclusive. Although it is not now possible to establish the level of public safety risk imposed by an LNG facility, it is possible to reduce substantially the consequences of events by remote location of facilities away from people.

> The Alaska LNG system is therefore unique, and it is difficult to analyze because of the inherent uncertainties posed. Mitigation of its environmental impacts and safety risks will be possible, but only at considerable, heretofore unestimated, expense.

We must note that the environmental damage inflicted by any of these transport systems will be significant. Thus we recommend that the need for Alaskan gas, the parts of the country that it would benefit, and the alternative energy supplies that they might receive now or at some later date be subject to the most careful scrutiny before a final decision is reached.

We have defined our environmental impact considerations as solely a function of corridor and technology, independent of the project sponsor. Although Alcan has proposed the least environmentally risky corridor--the Fairbanks Alternative--its proposal is the least well-developed of the three. And although we find the North Slope/MacKenzie Valley corridor unacceptable on environmental grounds, we note that Arctic Gas has provided environmental analyses of a depth and quality clearly superior to those of the other applicants.

Our conclusion that the Fairbanks Alternative corridor is the least environmentally damaging route assumes the strict application of environmental criteria in a full interdisciplinary review during the engineering design, construction scheduling, and route selection process. We also assume that the federal government will establish coherent stipulations, terms, and conditions and stringently enforce the environmental and public safety conditions in the field.

It will not suffice to rely on the project sponsor's "quality control" to protect the environment or to ensure compliance with government-imposed conditions. Effective enforcement will require a central federal authority and a new organizational structure to resolve interagency conflicts over jurisdiction and policy. In any case, we believe that the public would be well served by a citizen monitoring capability, staffed and federally supported to observe and report on pipeline construction, and well coordinated with the government monitoring structure.

Public Views Presented to the Council on Environmental Quality

Witnesses found the environmental impact statements in compliance with the National Environmental Policy Act, but several shortcomings were noted. Critics argued that the statements were too long and cumbersome and lacked explicit comparisons of the three corridors. Some also believed that the statements had omitted specific information or analyses, such as recent design and alignment changes in two of the proposals, long-range effects of pipeline construction, and comprehensive information on impacts in Canada.

The issues of greatest concern to witnesses included:

- Impacts on the Arctic National Wildlife Range
- Social and economic impacts in Alaska
- Impacts on Canada, especially on Canadian natives
- The net national economic costs and benefits of transporting Alaskan natural gas
- Regional distribution of Alaskan gas to the lower 48 states
- Implications for future resource development in the North
- Pipeline construction monitoring.

Other prominent issues were impacts on Alaska's fisheries and effects on coal gasification development.

Environmental groups testifying and the State of Alaska were unanimous in their opposition to the North Slope/MacKenzie Valley corridor; most environmental organizations strongly preferred the Fairbanks Alternative to the other corridors. Representatives of the State of Alaska and Alaskan business, labor, and local governments testifying favored the Alaska LNG route, believing it to hold the greatest social and economic benefits for the state. Many major Midwest, East Coast, and California gas distributors and transmission companies support the North Slope/MacKenzie Valley corridor. They believe the Arctic Gas proposal to be the most reliable and one that will ensure delivery of the greatest volumes of gas directly to markets.

PART I. VIEWS OF THE COUNCIL ON ENVIRONMENTAL QUALITY

Background

In 1968, a major discovery of oil and associated natural gas was made in Alaska's North Slope. Oil from this region has just begun to flow through the Alyeska pipeline on its way to the lower 48 states, but no decision has been made on the long-range plans for North Slope natural gas. According to the Federal Power Commission, the 200-square-mile Prudhoe Bay field contains an estimated 22.5 trillion cubic feet in proved natural gas reserves.

Since the discovery there have been three proposals to the federal government to transport the gas to the lower 48 states: The North Slope/MacKenzie Valley corridor, proposed by the Alaskan Arctic Gas Pipeline Company, would traverse Alaska's North Slope, cross into Canada at the MacKenzie River Delta, and run south along the river and thence into the Midwest; a western leg from Alberta would transport gas to the western states. The Alaska LNG system, sponsored by the El Paso Alaska Company, would follow the oil pipeline corridor to a new terminal site on Prince William Sound and then ship liquefied natural gas by tanker to southern California. Also paralleling the oil pipeline as far as Fairbanks, the Fairbanks Alternative corridor, proposed by the Alcan Pipeline Company, would then cross into Canada along the Alaska Highway with some gas routed to the west coast from Alberta via a western leg and most going through Alberta and Saskatchewan to U.S. markets in the Midwest and East. (For more detailed project descriptions and maps, see the Appendix.)

The Alaska Natural Gas Transportation Act of 1976 (Alaska Gas Act) reflects congressional concern that a sound and expeditious decision be made on which--if any--transportation system should be constructed. To avoid the delays of possible litigation, the Congress precluded judicial review of several aspects of federal decisionmaking, particularly a review of the sufficiency of the environmental impact statements (EISs) prepared on the proposed transportation systems.

At the same time, however, the Congress took steps to preserve the integrity of the EIS process and to ensure that the requirements of the National Environmental Policy Act were met before a decision under the Alaska Gas Act was finally reached. As a substitute for judicial review, it established special procedures for evaluating the

sufficiency of the environmental impact statements outside the context of courtroom proceedings.

The Alaska Gas Act requires the Council on Environmental Quality (CEQ) to hold public hearings on the environmental impact statements. The Council must then provide the President with a summary of the views expressed at the hearings, the Council's views on the "legal and factual sufficiency" of the impact statements, and views on other environmental matters that the Council considers relevant. The President, in turn, must find that the environmental impact statement on the transportation system that he selects complies fully with NEPA. Finally, the Congress must expressly verify the adequacy of this environmental impact statement in any resolution that it may adopt approving the President's selection of a natural gas transportation system.

This report responds to the CEQ directives in Section 6(d) of the Alaska Gas Act. In Part I we present our views on the adequacy of the environmental impact statements on the three pipeline systems prepared by the Department of the Interior and the Federal Power Commission. We also evaluate the significant environmental impacts of each of the three corridors that we believe are most relevant to the decision before the President and the Congress.

Part II is a summary of both written and oral data, views, and arguments submitted to the Council by members of the public and representatives of the three pipeline company applicants. Four days of public hearings were held in Anchorage and Washington, D.C. Before the record closed, the Council received testimony from over 70 persons and organizations; additional statements were received from more than a score of others in both the United States and Canada.

Sufficiency of the Environmental Impact Statements

The Statements

The National Environmental Policy Act requires all federal agencies to prepare and consider an environmental impact statement on each proposed major action significantly affecting the quality of the human environment. These documents serve as aids to decisionmakers and as "full disclosure" statements that facilitate public involvement in the national effort to protect and enhance the environment. In compliance with this requirement, environmental impact statements had already been prepared on the three proposed Alaska gas pipeline corridors when the Congress passed the Alaska Natural Gas Transportation Act of 1976.

The Department of the Interior issued the first EIS in final form in March 1976; its nine volumes total over 4,000 pages. The subject is the Arctic Gas Project's application for a right-of-way across federal lands on Alaska's North Slope. Both the Fairbanks Alternative and the Alaska LNG Route are alternatives to this proposal in that EIS.

The Federal Power Commission (FPC) issued a second statement on April 9, 1976. This six-volume, 1,500-page EIS analyzes the application of the El Paso Alaska Company for a certificate of public convenience and necessity for construction and operation of a gas transportation system following the Alaska LNG Route. The statement incorporates by reference substantial portions of the Department of the Interior's environmental impact statement on the North Slope/MacKenzie Valley Route.

A one-volume Supplement to the FPC statement was issued in September 1976. Its subject is an application by Alcan Pipeline Company for authorization to construct and operate a gas transportation system using the Fairbanks Alternative.

The Council's Approach

Members of our staff and others working under our direction began the Council review of the environmental impact statements by consulting briefs and other documents filed with the Department of the Interior and the Federal Power Commission and relevant reports and studies prepared by

other government agencies. Following this analysis, the Council made a preliminary identification of the significant environmental impacts of the proposed gas transportation system, such as:

- The environmental impacts associated with the new "chilled" pipeline technology and the impacts of pipeline construction

- The risks involved with the liquefaction, shipment, and regasification of natural gas as well as the impacts of an LNG facility on the fisheries of Prince William Sound

- The effects of each system on public land policies in Alaska, particularly on policies for the Arctic National Wildlife Range and the Chugach National Forest

- The growth-inducing effects of these proposals in Alaska, including their projected impacts on the demand for public services, their influence on patterns of land use, and their relationship to further development of mineral and timber resources

- The impacts of each system on Canadian citizens and their environment, including the social, economic, and cultural impacts on native communities

- The implications of each system for national and regional energy policies, including their effects, if any, on oil and gas development in other parts of Alaska, and on the availability of natural gas in the West, Midwest, and South

- The net national economic impacts of each proposal, including their effects on national employment and productivity.

These key issues shaped our analysis of the proposed transportation systems and formed the focus for our public hearings and our more detailed review of the environmental impact statements.

The second part of our task was to determine the legal significance, if any, of the analytical flaws that we discerned during our review. Based on the extensive new material submitted at our public hearings and on further staff analysis, we conducted this aspect of our analysis much as a court would, by applying statutory

standards to the facts before us and drawing legal conclusions regarding the impact statements' sufficiency.

Standards of Sufficiency

The basic standard of sufficiency used in our review is contained in Section 102(2)(C) of NEPA itself. We also relied on the Council's "Guidelines for the Preparation of Environmental Impact Statements" and leading judicial interpretations of the statute.

First, NEPA requires a thorough analysis of the significant impacts of major federal actions on the quality of the human environment. Accordingly, an EIS must fully evaluate a project's effects on local air and water quality, wildlife and fisheries, soils and vegetation, and aesthetics. In addition, the term "human environment" has been broadly interpreted to include the environment of other nations as well as our own and the social and economic fabric of human society as well as its natural surroundings. An environmental impact statement, therefore, must also consider the extra-territorial effects of proposed federal actions and their impacts on the society, culture, and economy of native peoples and others in the region.

Second, an EIS must assess all reasonable alternatives to a proposed action. Indeed, consideration of alternatives is the linchpin of environmental analysis because it frequently leads to discovery of less damaging ways to accomplish federal objectives.

Third, NEPA requires a full-scale search for measures to mitigate the environmental impacts of federal actions. Such measures may reduce these impacts to acceptable levels and make otherwise objectionable projects fit NEPA's environmental goals. Accordingly, impact statements must identify all feasible mitigation measures and explain how they will be implemented.

Fourth, the environmental impact statement was conceived in part as a way to involve the public in environmental decisionmaking. CEQ Guidelines require government agencies to circulate these documents widely among interested members of the public and citizen groups. In addition, agencies must consider the comments that they receive on their environmental analyses and must set forth their own views on the issues so raised.

Last, the sufficiency of any environmental impact statement is necessarily tied to the nature and scope of the federal action concerned. Here the federal action is selection of a gas transportation system. Because of the magnitude of the competing proposals and the abbreviated schedule for decisionmaking under the Alaska Gas Act, that decision essentially involves selection of a particular transportation technology and a particular transportation route. It is the sufficiency of the statements for this limited purpose that is considered here--not their sufficiency for determining precise alignments, facility locations, and other site-specific data.

Conclusions of the Council

The statements are sufficient for purposes of selecting the corridor and basic technology for a gas transportation system.

We have concluded that the environmental impact statements are legally and factually sufficient under NEPA and that they provide an adequate basis for selecting the corridor and the basic technology for an Alaska gas transportation system. The documents serve their essential purpose of providing responsible officials with the information that they need to make a reasoned choice among the competing proposals. In particular, the impact statements analyzed each of the significant impacts that we deemed crucial to adequate evaluation of the proposed transportation systems and discussed feasible mitigation measures for reducing environmental effects. The environmental impact statements were circulated to government agencies and subjected to public scrutiny as required by Council Guidelines, and we find that the Department of the Interior and the Federal Power Commission satisfactorily responded to comments received on their draft statements.

As the Federal Power Commission noted in its Recommendation to the President, these EISs are a rich source of environmental data. They have already led to substantial improvements in the routing and design of proposed gas transportation systems. Indeed, the Fairbanks Alternative was first discussed in the Department of the Interior's statement on the application of Arctic Gas for a right-of-way across federal lands. It was further analyzed and endorsed as an alternative route by the FPC staff in its subsequent EIS. The Alcan proposal and the FPC Supplement were direct outgrowths of this federal agency

analysis of reasonable alternatives. This development is a tribute to NEPA and illustrates the value of the environmental impact statement process to federal decisionmaking.

It bears emphasis, however, that these statements must be viewed as essentially akin to broad "program" documents which do not purport to analyze specific route alignments, project designs, or facility sitings, for example. The applicants themselves have not gone much beyond the concept of a buried, chilled, high-pressure gas pipeline in a "corridor" and, in the case of the Alaska-LNG proposal, the basic proposals for processing plants in Alaska and California and a fleet of LNG tankers. As a result, the EISs do not contain the site-specific and engineering design information that will be necessary to evaluate detailed plans for the actual on-the-ground construction of the approved transportation system.

Although we have concluded that the environmental impact statements do provide the information necessary to select a corridor and the basic technology for a gas transportation system, they lack the data required for specific decisions concerning route alignments, project designs, and facility sitings. These "downstream" decisions must be based upon more specific environmental data, as discussed on pages 18-19.

The statements are not perfect and their limitations should be recognized.

Although the environmental impact statements have contributed substantially to the refinement of alternative gas transportation proposals and in our judgment provide an adequate basis for selecting among them, they are far from perfect analyses or aids to government decisionmaking, and their limitations should be recognized.

To begin, the documents are much too long and poorly organized. In addition, they do not include several important modifications in the proposals which have been made since they were issued in final form. Finally, the environmental impact statements contain a relatively unsophisticated analysis of the socioeconomic impacts of the pipeline proposals, particularly in Canada with regard to impacts on native communities. In what follows, we discuss these problems and how they bear on the adequacy of the environmental impact statements.

1. Length and Organization

These environmental impact statements, like many others, are far too long, too repetitive, and in many respects too detailed to serve the decisionmaking needs of government officials responsible for selection of a transportation system. Rather than emphasizing the significant environmental issues deserving special analysis, the statements tend to consider all issues equally. Lacking is a succinct statement of the major environmental advantages and disadvantages of the systems proposed which could be quickly reviewed and comprehended by interested parties. Much of the crucial analysis is obscured by voluminous technical material and elaborate descriptions that are better suited to appendices or to backup material available to the public on request.

The usefulness of the EIS process was further complicated by the fact that the Federal Power Commission and the Department of the Interior proceeded independently and filed separate statements at different times. Although the two agencies did attempt to prepare a single statement, their efforts failed, largely because only one applicant applied for both FPC and Interior approval. Because the statements focus on different pipeline proposals, neither provides the integrated, comprehensive overview of alternatives which should ordinarily be found in a single EIS.

A shorter, more concise analysis and comparison of the corridors in a single impact statement would have been far more helpful to decisionmakers than the statements that were prepared. However, the record developed by the FPC, including its recent report to the President, this report, and other agency reports due to be released shortly, largely fulfill the need for new analysis and comparisons of the corridor proposals.

2. Subsequent Modifications

Following issuance of the EISs, Arctic Gas and Alcan modified their pipeline proposals. Arctic Gas abandoned its earlier frost heave and thaw settlement designs in favor of a Frost Heave Redesign which calls for heat tracing of the pipeline within frost-susceptible soils. Alcan dropped its plans for a 42-inch pipeline, substituting a 48-inch pipeline; the proposal also deviates from its original route by some 400 miles in British Columbia and Alberta. Neither modification has been analyzed in an environmental impact statement.

Both Arctic Gas and Alcan explained these modifications in formal submissions to the FPC and CEQ. From our analysis of these documents, we conclude that they must be considered only as modifications and not important changes in the basic nature and general route already proposed by each applicant. Given the fact that the proposals now pending are essentially elaborate conceptual studies, changes of this kind could appropriately have been anticipated when the EISs were prepared. Similar modifications are in fact to be expected as engineering design proceeds and responds to site-specific information. Under these circumstances and in light of the basic corridor and technology focuses of the EISs, we have concluded that the existing statements are legally sufficient.

3. Analysis of Socioeconomic Impacts

Although the environmental impact statements generally discuss existing data on socioeconomic impacts, the data are not well analyzed, particularly with respect to long-range impacts. Such shortcomings, however, reflect general problems with the state-of-the-art of socioeconomic impact analysis and its application to EISs.

For Canada the most significant social impact of two of the proposed pipelines may well be their effects on native communities and cultures. Both the Fairbanks Alternative and the North Slope/MacKenzie Valley Route would pass through or near many native Indian communities that have retained their traditional subsistence life styles and economies. The EISs recognize that these traditional native communities may be adversely affected by the construction and operation of a pipeline, but their analyses are weak. Neither statement moves much beyond a general identification of potential direct impacts, as opposed to analysis of the native culture, the value of maintaining it, and specific cultural threats posed by the several pipeline proposals.

In view of the difficulties faced by federal agencies in analyzing socioeconomic impacts, it is most fortunate that a Canadian study of the North Slope/MacKenzie Valley Corridor was recently released by the Berger Commission and that a study of the social effects of the Fairbanks Alternative in Canada is scheduled for completion in early August. In view of Canada's comprehensive look at the implications of these proposals for its own people, we see no need for further treatment of this subject in the environmental impact statement process.

4. Other Issues

During the Council's public hearings on the sufficiency of the environmental impact statements, several witnesses criticized them for failing to consider U.S. treaty obligations which could affect the proposed gas transportation systems. (See the Summary of Public Hearings, pages 38-54.) Such an analysis should be contained in the statements. Based on our review of relevant treaties, however, we have concluded that no major international commitments would be jeopardized by the proposed system and that the failure to examine this issue, although unfortunate, does not render the documents inadequate as a matter of law.

Several witnesses raised other issues for inclusion in the EIS analysis. (See pages 52-54.) And although it may have been useful to address some or all of these questions, in our judgment these issues are of doubtful significance for the environment, they are sufficiently covered in the statements, they call for speculation on the part of federal officials, or they are not relevant to the basic environmental decisions to be made now.

NEPA requires a continuous review of environmental factors and alternatives by agencies with authority over the approved gas transportation system.

The three pipeline proposals must be considered as project concepts rather than specific site alignments and project designs, as previously noted. The applicants have yet to formulate and seek approval for the detailed construction and operation of their proposed transportation systems.

Even assuming that a proposal is approved under the Alaska Gas Act, there are many decisions to be made before a pipeline is to be built. In addition to detailed planning by the applicants themselves, the federal government must formulate terms and conditions for federal certification of the pipeline (unless waived under the Alaska Gas Act), it must issue permits as now prescribed by law, and it must approve specific pipeline alignments and rights of way, location and design of compressor stations, and, for the Alaska-LNG Route, location and design of processing facilities.

Many decisions have important environmental implications. NEPA requires that agencies make these decisions after a thorough interdisciplinary analysis of all reasonable

alternatives and their environmental impacts. Section 102(2)(E) requires continuous consideration of reasonable alternatives at the site-specific stage of design planning and implementation. In addition, CEQ Guidelines state that further formal analysis, perhaps in the form of a supplement, is required when a broad program statement does not adequately assess the significant environmental impacts of major individual actions implementing a large-scale construction project.

In short, following a Presidential and Congressional decision on a pipeline corridor, federal agencies may not bypass further environmental analysis of the authorized system simply because broad program statements have been prepared and found sufficient under NEPA. Rather, they must weigh important environmental concerns at all subsequent stages of decisionmaking to ensure that the Nation's environmental policy receives as much attention on the ground in Alaska as it does while federal planning is underway in Washington. Environmental assessments, EIS supplements, or new impact statements may be required, depending upon the significance of impacts and the degree to which they have already been treated. Any major design, engineering, or other site-specific decision that follows the selection of a corridor and technology must be considered in one of these types of NEPA analyses.

Environmental Impacts of Alternative Corridors

Perhaps no energy development project has received more environmental analysis than the three proposed for bringing North Slope natural gas to the conterminous United States. Two huge environmental impact statements, several years of FPC hearings, and numerous other federal and state studies have addressed and analyzed nearly every conceivable effect of these corridors on the human environment. Testimony presented to the Council at public hearings and our onsite investigation of the three pipeline routes in Alaska further supplement the information available to us. Altogether these facts permit a fair comparison of the three corridors and their relative environmental effects.

From the extensive record before the Federal Power Commission, it recommended to the President that all three pipeline corridors are environmentally acceptable.[1/] We do not agree. Pipeline construction and operation along the North Slope/MacKenzie Valley Corridor would cause irreparable damage to the wilderness and wildlife of the Arctic National Wildlife Range and the Northern Yukon. The need to protect this unique ecosystem and other considerations discussed subsequently have led us to the conclusion that this corridor is unacceptable from an environmental point of view.

In contrast, the Fairbanks Alternative lacks these major impacts, and we find it environmentally preferable to the other corridors. The Alaska LNG system uses a technology with uncertain risks and low energy efficiency and ranks between the other two corridors on environmental grounds. It should be approved only on condition that more specific analyses of alternative LNG facility sites and mitigation measures are conducted prior to any certification.

In drawing these conclusions, we do not pretend expertise on other factors that could argue more favorably for the North Slope/MacKenzie Valley or Alaska LNG corridors. But we believe it incorrect to conclude that all three corridors are environmentally acceptable. The basis for these conclusions is presented below.

We must emphasize here that our conclusions are predicated on the assumption of a compelling need for gas from Alaska. From one perspective, the most obvious environmental choice is to build no Alaska gas transportation system whatsoever. Alaska and Northern Canada

possess unspoiled beauty, and their wilderness, wildlife, and traditional native cultures cannot be lightly regarded. It would be misleading to conclude that because damage has already been done by the oil pipeline and earlier projects, no more would occur from construction of a new pipeline along these existing corridors.

Whether Alaska and the United States as a whole will benefit from exploitation of the state's gas reserves is a question that too few have cared to consider. The Joint Federal-State Land Use Planning Commission for Alaska contends that Alaska's economy can do without the gas pipeline.[27] But an even more compelling question is whether the United States should convert Alaska into an energy province. One witness, an Anchorage resident, posed what seems to be a central issue: "This is the last chance for Americans to civilize a great region without disrupting its ecology and without falling victim to the technological juggernaut as it does so. . . . It's either our last chance or America's final orgy."[37]

We cannot urge too strongly that the need for Alaskan gas, the parts of the country that it would benefit, and the alternative energy supplies that they might receive now or at some later date be subject to the most careful scrutiny before a final decision is reached on any gas transportation system from Alaska's North Slope.

North Slope/MacKenzie Valley Route (Arctic Gas)

The proposed North Slope/MacKenzie Valley Route would pass through parts of Alaska and Canada that are now hardly affected by industrial man's influence: Of the 195 miles of this corridor in Alaska, 135 miles would cross the narrow coastal plain of the 8.9-million acre Arctic National Wildlife Range.

Established in 1960 by Public Order 2214 to "preserve unique wildlife, wilderness, and recreational values," the Range is described by Alaska's Commissioner for Natural Resources as the "crown jewel" of the National Wildlife Refuge System. Again and again witnesses at our hearings emphasized that the Range stands out as the last unspoiled area of its kind in the entire Northern Hemisphere.

Its ecological value cannot be overstated. It has been aptly described by the Interior Department as:

> the only remaining largely undisturbed continuum of arctic ecosystems and vegetation types from the Arctic Ocean to the interior of Alaska. It is the only place in the United States where it is still possible to conduct long-term investigations into the natural history of arctic plant and animal communities in protected portions of the Arctic Coastal Plain, Arctic Foothills, Brooks Mountain Range, and the Porcupine plateau. Nowhere else in the Alaskan Arctic are these physiographic provinces compressed into such a short distance.[47]

The Range is most notably the principal habitat of the 115,000 Porcupine caribou, the largest and the least disturbed and most stable North American caribou herd. Other species supported by the Range include polar bear, barren-ground grizzly, recently reintroduced musk oxen, Dall sheep, wolverine, and vast numbers of migratory birds.

The proposed North Slope/MacKenzie Valley pipeline would cut an east-west corridor across this unmarred landscape. Pipeline construction would require new port facilities on the Beaufort Sea, at Camden Bay and Demarcation Bay. Along with the five 2,400-foot gravel airstrips, six helipads, nine gravel borrow areas, connecting haul roads, three compressor stations, and the pipeline trench itself, these facilities would require some 3,200 acres of the Range's coastal plain.

Compared to the total Range, the acreage lost seems insubstantial. But its direct and induced effects would be considerable. The harm likely to occur to wildlife and wilderness values of the Arctic Range is vastly out of proportion to acreage figures. The pipeline would pass directly through the traditional calving ground and postcalving gathering area of the caribou herd. The Interior Department and caribou researchers[57] have indicated that the caribou present there during these periods, especially cows with calves, would be extremely sensitive to minor disturbances, so that over the years the pipeline facilities, their noises, odors, and sight and the aerial and ground-level maintenance activities could vastly reduce the size and strength of the Porcupine herd.

And with these effects would come other drastic changes to the ecosystem of the Range. Polar bears den around Camden Bay, but construction activities would make this area unusable, with possible long-term net losses of this rare species in the Range. The Interior Department has concluded that these impacts cannot be mitigated because of the secretive and sensitive nature of denning polar bear. Similarly, Interior expects the project to reduce populations of fish, musk ox, moose, arctic fox, wolves, and grizzly bear. Swans, ducks, and geese would also be lost despite plans to locate the pipeline south of major bird nesting areas. It is well to remember that all these effects would occur in a Range set aside to preserve wildlife.

If there were no significant effects on wildlife, there would be other losses to count. The Range stands out as one of the last great wilderness regions in the world. In the early 1970's the Interior Department drafted a report concluding that the Range met Congressional standards for inclusion in the National Wilderness Preservation System.[6/] It still does. But its present value will be lost if a pipeline and the periodic intrusion of people and machines violate its boundaries.

The litany of measures proposed to protect the Range from pipeline construction work is a testimony to scientific, technological, and management ingenuity. The applicant proposes to build that portion of the pipeline entirely in one winter, using only snow roads that would vanish with the spring melt. Nearly 200 miles of these snow roads would be built in an area as arid as a desert. Quantities of equipment would be imported by barge during the six ice-free weeks of summer. New and as yet untested techniques for welding, backfilling, and trench digging would be pioneered in darkness and in windchill factors as low as -100°F. Yet by spring thaw, all the crossed streams must again be suitable for fish, and all equipment must be removed before the snow roads disappear.

We are skeptical about whether it could be done. The risks of failure are impressive and their consequences irremedial. Too much depends on avoiding a season or two of late freezes and early thaws that would curtail snow road construction plans. An expert who supervised construction of the TAPS line on the North Slope laughed at the idea: "We were commissioned in October of 1976 to prepare a 4.2 mile snow workpad. . . . We did everything we could think of to get snow to build that 4.2

miles. Yet it took 31 days." And what of the "myriad units of equipment?" he asked. "Do they miraculously disappear with the spring thaw? At the present time, there are over 2,000 pieces of construction equipment north of the Yukon on the TAPS project. The demobilization of these units will take several months of intense effort using good gravel roads and stable bridges."[7]

Experience suggests that economic pressures to complete such a pipeline on schedule would not yield to the onset of spring and the calving caribou and other wildlife that might stand in the way. It is all very well to develop stringent environmental terms and conditions and elaborate plans for their enforcement. But we cannot overlook the warning of Anchorage witness John Hakala--once a permit is issued, construction will proceed according to the dictates of economic pressure and the hostile Arctic environment. "Under cover of winter's darkness and weather conditions, who will be the wiser?" he asked. "That is, until spring melt has occurred and the damage becomes visible." Even with the best of intentions, the shortcuts and human errors of such complex endeavors are likely to cause serious environmental disruption to the Range.

Only recently, by letter to the Council, Arctic Gas described several new construction and route changes for the Arctic Range that it believes would be feasible and environmentally satisfactory.[8] The changed wharf sites, fewer compressor stations in the Range, a pipeline somewhat farther north and farther from the center of caribou calving grounds, and fewer airports would indeed be an improvement. No doubt there are other design changes still possible that would mitigate specific problems. But the vast impact on the Arctic Range ecosystem, although shifted from one species or area to another, would still remain.

In weighing the environmental problems unique to the North Slope/MacKenzie Valley Route, we must note the widespread concern that such a gas line could invite an oil line and perhaps a permanent road, so as eventually to become a permanent corridor.[9] It has happened before in Alaska.

Such corridors tend to grow, and they will do so whether in the Arctic Range or elsewhere. Canadian Justice Berger applied this lesson when he sought to forecast the implications of the proposed North Slope/MacKenzie Valley Route through Canada. It was not simply a gas

line but an energy corridor that he envisaged, whether bringing oil and gas from the Arctic Range or bringing it from the offshore Beaufort Sea.

We know that such a corridor across the North Slope is not contemplated by the Arctic Gas Group. But present intentions do not suffice. There can be no guarantees. A gas line across the Arctic Range and Northern Yukon to the MacKenzie Delta would invite the exploration of the oil and gas that may well exist within the Range or in the Beaufort Sea. And is it really likely that after successful exploration, oil and gas will not be developed? We doubt it and we doubt that the present values of the region can then withstand another round of mitigation efforts. Even a legal or administrative ban on development in the Range after the gas line is built (as has been suggested by the State of Wisconsin) holds little comfort; the destruction of a unique wilderness area for a single relatively short-lived project would then simply become even more difficult to justify.

In short, we believe that the fate of the Arctic National Wildlife Range is at stake. In the words of Alaska Attorney General Avrum Gross: "If we open the Range to the pipeline, the Range is gone--it's that simple. . . . Once that first pipeline goes in, we have said goodbye to the Arctic National Wildlife Range."

The wilderness and wildlife values of the Range, along with the pipeline route, also extend into Canada, to the MacKenzie Delta. The importance of the Northern Yukon as a wildlife habitat is at least as great as that of the Range. The migratory bird nesting area for major North American flyways lies along the pipeline path in the Northern Yukon. Even with restricted aircraft flights, the pipeline's effects on snow geese nesting and gathering might well be significant and long lasting.

From the record before us, it has not been possible to judge the extent to which the mitigation measures proposed in Canada for this pipeline route will protect either these migratory birds or Beluga whales and their calves which thrive in the relatively warm waters flowing north to the MacKenzie Delta. We recognize, however, that the serious proposals for a Canadian equivalent of a protected Arctic Range, whether a wilderness park or an ecological preserve, would be precluded by this pipeline route. Given the fact that there are other pipeline alternatives, such a corridor decision would be unnecessarily destructive.

Among the serious impacts of the North Slope/MacKenzie Valley Corridor that are most difficult to measure are those on the native peoples of Canada. Although both Interior and FPC address social impacts, they have been most extensively treated in the Report of the Berger Commission to the Canadian government.[10] They were also raised by native groups testifying before CEQ.

Testimony before us raised concerns about the effects of a pipeline corridor on the natives living in the Northern Yukon Territory. They have experienced relatively little non-native influence and still lead a largely subsistence existence. Justice Berger has recommended that, to protect these people and the environment on which they depend, no pipeline be built across the North Slope.

In this region and along the MacKenzie River in the Northwest Territories, pipeline effects relate to the demands of the Yukon Indians and the Dene, Inuit, and Meti for equitable aboriginal land claims settlement. These natives, who constitute the vast majority of the population in the Northern Arctic, have vigorously opposed any pipeline either across the North Slope or up the MacKenzie River, fearing both its direct effects on their way of life and its interference with their land claims settlement.

On balance, the North Slope corridor poses a grave threat to the integrity of the Arctic National Wildlife Range. For similar reasons, Justice Berger stated that "there should be no pipeline across the Northern Yukon" because "it would entail irreparable environmental losses of national and international importance." We have judged that this route, from an environmental perspective, is unacceptable. The future of the Range must lie in the permanent dedication of this rich and unique area to wilderness.

Fairbanks Alternative (Alcan)

Unlike the North Slope/MacKenzie Valley Corridor, the Fairbanks Alternative would make extensive use of existing pipeline and transportation routes. For some 539 miles to Delta Junction, Alaska, it would parallel the trans-Alaska oil pipeline route. Then it would travel some 730 miles into the Southern Yukon along the Alaska Highway and the now-abandoned Haines pipeline, which was constructed in the 1950's between Fairbanks and Haines. Farther south, in Alberta, much of the construction would also parallel existing pipeline rights-of-way.

Although the precise direct impacts of a new gas pipeline along these existing corridors will depend on site-specific designs and engineering, we agree with the Federal Power Commission that the Fairbanks Alternative promises the least environmental impact. The applicant for this route states that the gas line could safely be constructed about 80 feet from the oil pipeline across the existing workpad, which would have to be widened from 15 to 40 feet. Evidence submitted by the State of Alaska indicates that blasting can be safe even at a distance of 40 feet from the oil pipeline.[11] Testimony given by the President of Alaska International Construction Company, an Alyeska contractor, corroborated this finding.

The existing haul road along the oil pipeline would also be used, as would many of the existing camp sites and facilities and gravel supply sites. Further advantages can result from the availability of Alyeska's vast information on the geology, soils, stream characteristics, and wildlife, all of which could aid in controlling impacts of the Fairbanks Alternative as far as Delta Junction.

Unlike the other two corridors, the Fairbanks Alternative passes through no de facto wilderness areas in Alaska. In Canada, however, the corridor passes inside the fringe of the Kluane National Park for 13-1/2 miles, although for 11 miles the corridor would parallel or use the existing Haines product pipeline right-of-way. Intrusion would also occur for a distance of 90 miles inside the borders of the Kluane Game Sanctuary--an area subject to mineral development where hunting is prohibited. Farther south and west the corridor would cross two provincial parks.

There is no evidence that the pipeline will affect either the Arctic or Porcupine herd although the pipeline may interact with the central Arctic caribou herd, as does the Alyeska oil line. Possible impacts on peregrine falcon nesting areas near the Alyeska line are also expected to be minimal. In weighing the three alternatives, the Alaska Chapter of the American Fisheries Society concluded that the Fairbanks Alternative would be least damaging to Alaska's fishery resources.[12]

On the other hand, social and growth impacts of both the Fairbanks Alternative and the Alaska LNG Route will obviously be greater in Alaska than those of the North

Slope/MacKenzie Valley Corridor. Although no accurate measures of these impacts have been made, the Alyeska experience has prepared residents for what to expect. Alyeska's impacts on Fairbanks--housing shortages, wage discrepancies, population and crime increases, inflation, and changes in life style--have been carefully monitored and appear to be well understood.[13] Many government, labor, and business interests as well as some Alaskan natives desire the growth effects of another pipeline project and believe its impacts can readily be absorbed.[14]

A special concern made known to the Council at its hearings is the potential impact of the Fairbanks Alternative on native peoples in the Southern Yukon and on their aspirations. Some of these impacts were described briefly by the Interior Department and the Federal Power Commission in their impact statements. The FPC, in particular, reported that the Fairbanks Alternative would have adverse consequences for Indians in the Yukon and in British Columbia due to the rapid influx of new workers, increased alcohol abuse and crime, and rapid inflation. The Council for Yukon Indians elaborated its concerns at the CEQ hearing, stating its opposition to any gas pipeline construction along this corridor until native institutions and economic bases have been developed and native land claims equitably settled and implemented, all of which may take from seven to ten years.

The effects of the Fairbanks Alternative on the native claims settlement issue in the Southern Yukon are now being studied by a Canadian Inquiry headed by Dean K.M. Lysyk, whose report is due to the Canadian government by August 1, 1977. In concert with the Berger Commission report, it is intended to provide Canada with the social impact information needed to make a pipeline route decision.

It is clear, however, that there are striking differences between the likely impacts on natives of the Fairbanks Alternative and the North Slope/MacKenzie Valley pipeline. In the MacKenzie Valley and Northern Yukon, the vast majority of the people are natives living in scattered villages. They are more dependent on the traditional subsistence economy of hunting, trapping, and fishing than the people farther south. In the Southern Yukon, natives constitute a much smaller portion of the population. Most of these live in Whitehorse, the Yukon capital, or in villages along the Alaska Highway or other roads. The highways have already brought these people into frequent contact with non-native culture and development patterns in a way

that the natives of Old Crow, in the Northern Yukon, have not yet experienced. The World War II Canol Road and product pipeline project from Norman Wells to the Alaska Highway, the Haines pipeline project, and the Whitehorse-to-Skagway railroad have each added to the pressures impinging on traditional native life in the Southern Yukon. Natives there have also shared their changing environment with a majority of non-natives, many of whom are third and fourth generation residents.15/

Even so, the Council for Yukon Indians believes that the cumulative effects of development will be severe. Justice Berger's report stated, with respect to the North Slope/MacKenzie Valley corridor and native claims there that "if the pipeline is built before a settlement is achieved, the communities that are already struggling with the negative effects of industrial development will be further demoralized. To the extent that . . . the sense of being made irrelevant to your own land is a principal cause of social pathology, the native people will suffer its effects in ever greater measure." The Lysyk Inquiry is intended to examine these questions as they relate to the Southern Yukon.

It is important to note that the Fairbanks Alternative, like the Alaska LNG system, would not allow access to MacKenzie Delta reserves in Canada. A proposal is now pending before the Canadian government to attach these gas supplies either to existing Canadian pipeline systems (the "Maple Leaf" project) or to the Fairbanks Alternative corridor pipeline (the "Dempster Highway corridor"). Both are sponsored by the Foothills Company, a subsidiary of the Canadian partners in the Alcan project.

The fate of these proposals depends wholly on whether Canada decides to develop its MacKenzie Delta gas reserves and to incur the consequent social and environmental impacts. Whatever the Canadian decision may be, our environmental conclusion remains unchanged: We should preserve the Arctic Range from the damage and disruption of a pipeline corridor across from Prudhoe Bay.

Alaska LNG Route (El Paso)

With the exception of the last 43 miles, this pipeline

corridor would follow the entire Alyeska oil line through Alaska. The social, economic, and environmental impacts of this, the most extensive, use of the existing oil corridor would therefore be similar to those of the Fairbanks Alternative. In the last 43 miles, however, the corridor would cross the Chugach National Forest to Point Gravina, where the gas would be liquefied, transported by tankers to California, gasified, and sent to markets. A number of unique environmental impacts result primarily from the new territory traversed and from the gas conversion process.

One prominent concern is that pipeline construction would damage valuable commercial and sport fisheries on rivers in southern Alaska. In the Copper River drainage area alone, commercial fishermen harvest over 1 million salmon each year. Because the pipeline would be located near fish spawning areas, serious threats are posed by possible fuel oil spills, gravel mining operations, sedimentation, and wastes from construction activities.

As the corridor continues south to Prince William Sound, it crosses the Chugach National Forest, a roadless area of great scenic beauty. Although not unique like the Arctic Range, the Chugach has wilderness characteristics that the corridor would destroy. We do note that Point Gravina and other portions of the National Forest adjacent to it may well forfeit their protected status in any event once the Chugach natives' claims are settled and these lands become private.

The proposed liquefaction plant at Point Gravina itself would occupy an area now inhabited by black-tailed deer and by the Northern bald eagle, whose nests can be found on and around the industrial site. Should the site be developed, protection of the nests is unlikely to succeed in the long run.

The most serious potential impacts of the Point Gravina facility are those associated with the seawater cooling system. The once-through system now contemplated would return cooling water to Orca Bay 21°F warmer than ambient temperatures. The quantity of heat discharged to the Bay under these conditions is roughly the same as that from a 1,000-megawatt electric generating plant.

Marine life is also threatened by chemical biocides, such as chlorine, that are added to the cooling water. The applicant admits that all organisms that pass through the system would be killed. These would include fish eggs,

larvae and the plankton that form the base of the ocean food chain. Moreover, salmon fingerlings and other commercial species could be killed by impingment on the trash racks and traveling screens.

These effects have alarmed fishing interests in Prince William Sound and have sparked opposition to the LNG facility.[16] In response, El Paso and state government spokesmen testifying before CEQ noted the potential value of the waste heat in developing an aquaculture industry in the Sound. Information on aquaculture there is scant, however, and the success of such a venture is questionable.[17]

El Paso is willing to use other cooling systems if required to do so; dry or wet cooling towers are possible alternatives. Each has its disadvantages. Dry cooling towers are large, relatively unattractive, and noisy. Wet cooling towers can cause fog and icing problems and can release biocides and impurities with the vapor. Both systems are costly and energy intensive, but no cost analysis has been undertaken.

An LNG facility on Prince William Sound must also reckon with the still unknown risks of earthquakes, tsunamis, and seiches. The proposed site lies in an active seismic zone, and there may be an active fault just two miles offshore. Seismic information must be improved considerably before it can be determined whether the facility should be sited at Point Gravina or at Cape Starichkof in the Cook Inlet area, where one LNG facility already exists.

How much a Point Gravina LNG facility would induce industrial growth in the area is still speculative. Discussion of a new petrochemical center there appears not to be firmly based at present,[18] but it is a prospect that many interests in Alaska strongly favor. As OCS development continues, the possibility for drastic changes to the Prince William Sound area will be increased if the Point Gravina site is built.

From Point Gravina LNG tankers would leave for a California gasification site--Point Conception and Oxnard appear to be current leading alternatives. Here complex land use, thermal discharge, and safety issues must still be resolved by the state and federal governments. Earthquake risks exist at both sites. The release of 300,000 gallons of cooled water per minute

(12°F below ambient temperatures) may be more easily harnessed and usefully employed at Oxnard. However, adequate exclusion zones to lessen the threat to public safety can be provided at Point Conception. This site is presently rural and scenic, so that its use would impose substantial aesthetic impacts. Here too, the seas are considerably rougher than off Oxnard, raising potential marine safety problems.

LNG tanker accidents can have major consequences. Tanker collisions or rammings and groundings could lead to vapor clouds, LNG pool fires, and accidents at the LNG facility--with possibly fatal effects. The analyses of LNG public safety risks on the record are inconclusive. The Department of Transportation summed up the problem in a recent Notice of Proposed Rulemaking as follows:

> The Materials Transportation Board believes . . . that improved effort . . . is desirable to determine whether any proposed LNG safety standards are reasonable and economically practicable. The bases for this view are that no generally accepted risk assessment procedure presently exists, probability estimates have not been developed for accidental events at a facility, and convincing arguments have not been presented to show that the probability of major accidents is negligible.[19]

Although it is not now possible to establish the level of public safety risk imposed by an LNG facility, it is possible to reduce substantially the consequences of events by remote location of facilities away from people. This approach is essentially the one proposed by El Paso with its Point Gravina and Point Conception sites.

The Alaska LNG system is therefore unique, and it is difficult to analyze because of the inherent uncertainties posed. Mitigation of its environmental impacts and safety risks will be possible, but only at considerable, heretofore unestimated, expense. Moreover, its advantageous use of the Alyeska corridor is diminished by the efficiency penalties imposed by LNG technology. Whereas both overland pipeline systems would consume,

according to the FPC, just over 6 per cent of the natural gas received, the LNG system would consume nearly 11 per cent. In short, the LNG system would use 73 per cent more energy than the overland pipelines. This loss of natural gas should be viewed as an environmental and economic cost because the energy lost will have to be replaced by some other and perhaps less desirable fuel to be produced elsewhere--with yet another set of environmental impacts.

Conclusions

The North Slope/MacKenzie Valley corridor is the most environmentally destructive of the three routes being considered. The intrusion into the wilderness stretching from the Canning River in Alaska to the MacKenzie Delta in Canada would be massively disruptive.

Loss of wilderness does not stand alone as an argument against the North Slope/MacKenzie Valley corridor. Our concerns extend to the problems facing construction in an environment of unparalleled hostility and fragility, to subsequent gas and oil development in the Range that would be encouraged by the pipeline, and to the effects on the native peoples of the North who oppose this corridor. Because of these factors, we believe, contrary to the FPC, that the environmental impacts of this route are unacceptable.

The Alaska LNG system presents different risks. Its conversion plants and marine transport scheme carry with them unique environmental impacts, the significance of which is largely unknown at this stage. According to the best evidence, the LNG plant as proposed at Point Gravina by El Paso would probably impact the marine ecology of Orca Bay substantially. Because the area is a valuable source of salmon and other commercial species, it could have profound effects on the local economy as well. But precise conclusions cannot be drawn because no substantial investigation of the Bay has been undertaken and the water-related LNG plant systems remain undefined. Without this information it is impossible to determine whether the site at Point Gravina is environmentally acceptable or another is preferable. It seems likely, however, that an environmentally acceptable plant could be designed and constructed.

Similar problems arise with seismic design at the Gravina site. Earthquakes and resultant tsunamis present serious threats. The applicant asserts that a safe plant could

be designed once Gravina conditions (e.g., the existence and depth of bedrock) are satisfactorily investigated. Although this assertion has not been successfully challenged, the necessary proof must await further site investigation and actual plant design.

The Alaska LNG alternative presents risks to the environment, to public safety, and to system integrity not present with the overland corridors. Its significantly greater consumption of energy should also be viewed as an environmental cost. It is possible that the Alaska LNG corridor and technology can be environmentally acceptable. At present, however, we are faced with significant uncertainties about thermal impacts, seismic design, ultimate suitability of LNG plant sites proposed in Alaska and California, and the safety risks of LNG tanker traffic. Although site-specific information is also lacking on the Fairbanks Alternative, our ignorance about that route is much less important than the unknown site-specific impacts of the Alaska LNG system.

The Fairbanks Alternative corridor is 250 miles longer than the North Slope/MacKenzie Valley route and so involves that much more environmental damage. Its impacts are largely restricted to existing transportation corridors, however, and involve no large-scale intrusion into wilderness areas or destruction of wilderness values. We believe that this is the environmentally preferable route.

But some of its environmental risks are still unknown. The preliminary state of the design effort suggests substantial uncertainty about fundamental concepts. Measures to deal with frost heave, thaw settlement, and summer construction, for example, are only roughly sketched. Still to be developed is site-specific information, such as stream crossings and additional workpad construction mileage. On the other hand, access to existing largely all-weather highways can contribute substantially to mitigation of environmental impacts. Government review of the engineering design and construction schedule will be critical if this access is to be used to advantage.

We have defined our environmental impact considerations as solely a function of corridor and technology matters, independent of the project sponsor. Thus, although Alcan has proposed what we believe to be the least environmentally risky corridor--the Fairbanks Alternative--its proposal is the least well-developed of the three. In El Paso's case, the absence of a complete

record assumes more importance because of the potential for environmental damage at Point Gravina and Point Conception or Oxnard. Environmental impacts of this proposal cannot be assessed accurately without additional design and data, particularly with respect to the seawater cooling system and seismic information at Point Gravina.

Although we have concluded that its North Slope/MacKenzie Valley corridor was unacceptable on environmental grounds, we also note that Arctic Gas has provided environmental analyses of a depth and quality clearly superior to those of the other applicants. Moreover, Arctic's performance of its obligations to examine alternatives helpful to the preparation of the Interior Department's EIS led to the analyses which establish the Fairbanks Alternative as the environmentally preferable route.

Our conclusion that the Fairbanks Alternative corridor is the least environmentally damaging route assumes strict application of environmental criteria in a full interdisciplinary review during the engineering design, construction scheduling, and route selection process.

Perhaps more critically, we assume that the federal government will stringently enforce the environmental and public safety conditions in the field. It will not suffice to rely on the project sponsor's "quality control" to protect the environment or to ensure compliance with government-imposed conditions. Effective enforcement may require a central federal authority and a new organizational structure to resolve interagency conflicts over jurisdiction and policy. But whatever the federal oversight and enforcement structure, we believe that the public would be well served by a citizen monitoring capability, staffed and federally supported to observe and report on pipeline construction compliance with government standards. Such citizen participation should, however, be carefully coordinated with the government monitoring structure so that the successful applicant will have, in Arctic Gas' words, "a single voice" to which to respond.

FOOTNOTES

1. Federal Power Commission, Recommendation to the President: Alaska Natural Gas Transportation Systems, May 1, 1977.

2. Statement by Walter Parker, State Co-Chairman, Joint Federal-State Land Use Planning Commission for Alaska, May 23, 1977, Washington, D.C.

3. Statement by Charles Konigsberg, May 17, 1977, Anchorage.

4. U.S. Department of the Interior, Alaska Natural Gas Transportation System, Final Environmental Impact Statement, Alaska Volume (Washington, D.C.: U.S. Government Printing Office, March 1976).

5. Statement by Dan Roby, Federation of Western Outdoor Clubs, May 16, 1977, Anchorage.

6. Arctic National Wildlife Range Wilderness Study Report, Preliminary Draft, March 1972.

7. Statement by Lon McDermott, President, Alaska International Construction Co., May 17, 1977, Anchorage.

8. Letter to Charles Warren, Chairman, from William Brackett, Chairman, Arctic Gas, June 17, 1977.

9. Statements by representatives of the State of Alaska, the Sierra Club, The Wilderness Society, Friends of the Earth, the National Audubon Society, and the National Wildlife Refuge Association, among others.

10. Northern Frontier Northern Homeland: The Report of the MacKenzie Valley Pipeline Inquiry (Ottawa, Ontario: Minister of Supply and Services Canada, 1977).

11. L.L. Oriard, Woodward-Lundgren and Associates, A Guide To Evaluate Damage Potential to Pipelines from Nearby Construction Blasting, Oakland, Calif., undated.

12. Statement by Norval Netsch, President, Alaska Chapter of the American Fisheries Society, May 16, 1977, Anchorage.

13. Statement by Sue Fison, Director, Impact Information Center, Fairbanks North Star Borough, May 17, 1977, Anchorage.

14. Statements by representatives of the Organization for the Management of Alaska's Resources, Teamsters Union Local 959, City of Valdez, Cordova Chamber of Commerce, Chugach Natives, Inc., and Eyak Corporation, May 16-17, 23, 1977, Anchorage and Washington, D.C.

15. Statement by J.K. McKinnon, Minister of Local Government, Yukon Legislative Assembly, June 6, 1977.

16. United Fishermen of Alaska, Resolution on Natural Gas Pipeline Route, March 3, 1977, submitted in support of statement by Jack Van Hyning, Fisheries Consultant, May 17, 1977, Anchorage.

17. Statements by Seward Mayor Richard Neve, Professor of Marine Sciences at the University of Alaska, May 16, 1977, and Jack Van Hyning, May 17, 1977, Anchorage.

18. Statement by Avrum Gross, Attorney General, State of Alaska, May 16, 1977, Anchorage.

19. 42 Fed. Reg. 20776 ff., April 21, 1977.

PART II. PUBLIC VIEWS PRESENTED TO THE COUNCIL ON ENVIRONMENTAL QUALITY

Public participation in the environmental decisionmaking process, a clear objective of the National Environmental Policy Act, is given special attention in the Alaska Gas Act. Section 6(d) directs the Council on Environmental Quality to provide the public an opportunity to present written and oral data, views, and arguments on the environmental impact statements prepared for the proposed Alaskan gas transport systems.

In response to its mandate, the Council conducted four days of public hearings in mid-May 1977. Recognizing that the choice of a transport corridor will profoundly affect Alaska, we held hearings in Anchorage on May 16-17 to obtain firsthand the views of Alaskan citizens. In addition, testimony was heard in Washington, D.C., on May 23-24. For individuals unable to appear, the hearing record was officially open until May 27.

More than 70 persons and organizations submitted written and oral testimony, with a score more sending in other written comments. Witnesses included individual citizens and representatives of labor, industry, environmental organizations, Alaskan and Canadian native groups, state and local government, and the three pipeline applicants. (Witnesses are listed on page 55.)

Although some testimony specifically addressed the adequacy of the EISs, it was apparent that public concern extended to decisions and recommendations made by the Federal Power Commission and the Berger Commission inquiry in Canada as well. For the most part concerns centered on roughly a handful of issues:

- Impacts on the Arctic National Wildlife Range
- Social and economic impacts in Alaska
- Impacts on Canada, particularly on the natives
- Net national economic costs and benefits of transporting Alaskan natural gas
- Regional distribution of Alaskan gas to the lower 48 states
- Implications for future resource development in the North
- Pipeline construction monitoring.

These and other major issues raised by witnesses as well as comments on the environmental impact statements are summarized below.

Major Issues and Concerns

Impacts on the Arctic National Wildlife Range

For nearly all environmental groups testifying, the single most important issue was the maintenance of the integrity and wilderness character of the Arctic National Wildlife Range. For this reason, they, the State of Alaska, and other Alaskan citizens adamantly oppose the Arctic Gas route's crossing of the Range.

Construction of a pipeline through the Range would violate its basic purposes, witnesses contended. According to Dave Spencer, Alaska Representative of the National Wildlife Refuge Association and former supervisor of national wildlife refuges in Alaska for the U.S. Fish and Wildlife Service, the Congress directed that the primary use of wildlife refuges is for "the welfare of wildlife and its natural habitat." Spencer also pointed out that Public Land Order 2214, establishing the Range, states its purpose as "preserving unique wildlife, wilderness and recreational values."

Citing the Interior EIS and other sources, witnesses claimed that the Arctic Route would seriously affect the size and health of fish and wildlife populations native to the Range, among them the Porcupine caribou herd whose traditional calving grounds would be traversed by the Arctic line; the tundra grizzly, Arctic wolf and wolverine; the northernmost herd of Dall sheep; a discrete population of polar bear whose pregnant females use inland winter denning sites; and snow geese which use portions of the Range as traditional fall staging areas.

Witnesses were also concerned about irremediable damage to sensitive permafrost soils as a result of pipeline construction and maintenance.

At the heart of many of these arguments is a basic skepticism about the ability of Arctic Gas to adhere successfully to its proposed winter construction schedule. Although Arctic contends that it can and will complete construction in the Range during winter months (when most wildlife is off the Range and snow roads can allegedly be built), a number of people familiar with the construction of the trans-Alaska oil pipeline challenged the feasibility of Arctic's proposal.

Charles Champion, the Alaska Pipeline Coordinator, and construction contractors on the oil pipeline all argued

that weather conditions and water availability on the North Slope during the winter months would prevent completion in the single season contemplated by Arctic. Further, witnesses asserted, the lack of yearround access may seriously hamper postconstruction testing, cleanup, and maintenance. If Arctic enters the Range only in winter months as it promises, these activities would take place over several years, thereby prolonging disturbance to the Range. Other witnesses considered it more likely that the combined pressures of mounting project costs, demand for delivery in the lower 48 states, and emergency repair requirements would force Arctic to enter the Range during thaw periods when wildlife is present and the tundra is most vulnerable to permanent damage.

During questioning, environmentalists repeatedly emphasized the singularity of the Range, claiming that it is the only unspoiled Arctic ecosystem in the world. The Chugach National Forest, they said, although unquestionably beautiful, is nevertheless characteristic of wilderness areas in the state. Testimony presented by the Chugach Native Corporation also indicated its selection of Point Gravina and other portions of the Chugach National Forest under the Native Claims Settlement Act. Once these claims are settled, these portions would lose their National Forest status.

For a number of witnesses, the most serious aspect of pipeline construction across the Range is the precedent set for future hydrocarbon and mineral development. They claimed that establishing a new corridor would inevitably lead to pressures for development, thereby destroying forever the wilderness values of the Range. In the words of Alaska Attorney General Avrum Gross, "If we open the Range to the pipeline, the Range is gone--it's that simple. . . . Once that first pipeline goes in, we have said goodbye to the Arctic National Wildlife Range."

Testifying for Friends of the Earth in Alaska, Jim Kowalsky cited as untrue the assertion in the FPC's Recommendation to the President that the Department of the Interior and the State of Alaska have full authority to limit further activity on the Range. So far as Friends of the Earth had been able to determine, Kowalsky said, such authority does not exist.

We asked representatives of the three applicants whether they would support federal actions prohibiting any future hydrocarbon development on the Range. Alcan's position was that existing law, including the Mineral Leasing Act,

the National Wildlife Refuge Administration Act, and Public Land Order 2214, precludes development as incompatible with the protection of unique wildlife, wilderness, and recreational values.

El Paso took no position, noting that if the Congress formally designates the Range as wilderness under the Wilderness Act, hydrocarbon exploration and development would be foreclosed and that if wilderness status is not accorded, such activity can take place with less environmental impact if oil and gas lines in the fields are directed west to Prudhoe Bay.

Arctic Gas considered it "presumptuous to take any position at this time." Its system does not rely upon gas from the Range; nor will the system "by any lawful test of causation" lead to oil or gas development there. Further, Arctic Gas believes it premature for any government body to allow or foreclose oil and gas development on the Range at this time. That decision should be made when concrete proposals are presented.

The State of Wisconsin reiterated the point that its support of the Arctic Gas system is conditioned upon restrictions on future oil and gas exploration in the Range. Another condition is some form of compensation to future generations for the loss of wilderness--through acquisition of either additional wilderness area or additional acreage to the Arctic National Wildlife Range.

Social and Economic Impacts in Alaska

For a number of Alaskans, including representatives of state and local governments, the prospect of additional revenues and employment to be gained by an all-Alaska route is a compelling argument for the El Paso system. Attorney General Gross reported that in studying the relative economic benefits of the Alcan and El Paso proposals, the state found that the El Paso proposal provided far greater in-state investments than Alcan.

Walter Parker, State Co-Chairman of the Joint Federal-State Land Use Planning Commission for Alaska, disputed the state's conclusions. The Commission argued that net fiscal benefits to the state from pipeline construction would be marginal at best--perhaps negative. And in the long run, individual well-being, as measured by per capita personal income, would not significantly increase as a result of gas line construction, and it might even decrease under the El Paso proposal. Although the econ-

omy of the state would be affected by any of three proposals, the state is not dependent upon any for its economic viability, Parker said.

The entire question of future industrial development resulting from a pipeline was an issue that a number of witnesses felt had been overlooked in the EISs. The state believes that ready access to its royalty gas, which the El Paso system would provide, carries with it the possibility of long-range economic benefits, presumably in the form of new industry. In questioning, however, state representatives revealed that despite ready availability of fuel, the possibility of future petrochemical development at Gravina Point appeared somewhat "dimmed" at present because of other overriding cost considerations.

Testimony nevertheless revealed that some communities anticipate and welcome new or continued growth associated with pipeline construction. They include the majority of Fairbanks residents, natives represented by Doyon Ltd. with land claims falling within Alcan's proposed route, and the Chugach natives who have selected Point Gravina and some other parts of the Chugach National Forest involved in El Paso's proposal. Speakers for the City of Valdez and the Cordova Chamber of Commerce argued in favor of the El Paso system, contending along with several other witnesses that communities situated along the TAPS corridor are already able to absorb future demand for housing and public services and, further, that these communities can provide an experienced labor pool for future pipeline construction.

In contrast to this unqualified enthusiasm was a concern for localities' ability to plan for orderly growth. The Fairbanks Town and Village Association, a regional planning and development corporation, feared that communities will be unable to undertake necessary planning and construction efforts without some federal "front end" financial assistance. They found the environmental impact statements deficient on this point.

In its comments on the FPC draft EIS, the Association had asked that the successful applicant be required to establish a loan and grant fund for the use of state, regional, and local governments in planning and construction of public facilities necessary to support pipeline construction and operation. Although the FPC believes that Alaskans ought to fund such activities with their own revenues, the Association's Executive Director said that

local government will not have the money in time.

Impacts on Canada

The socioeconomic and environmental impacts of pipeline construction through Canada were subjects that a number of witnesses believed had not received adequate consideration. Impacts on the culture and life styles of native groups were particularly important issues that had been overlooked in U.S. proceedings. Witnesses urged that the findings of Canadian Justice Thomas Berger's MacKenzie Valley Pipeline Inquiry be seriously reviewed by U.S. decisionmakers, perhaps as a formal supplement to the EISs. However, comparable information on impacts in the Southern Yukon, i.e., associated with the Alcan Route, has not yet been published.

Representatives of the Council of Yukon Indians and of the Indian Brotherhood of the Northwest Territorities (the Dene) described their concern about development and its effects on their efforts to achieve an equitable land claims settlement. Both groups feared that in the absence of strong native institutions and economic bases, non-native industrial development would threaten the traditional culture and way of life of their peoples. Although Alcan argued that its route would traverse a part of the Yukon primarily populated by non-natives and already developed to some extent, the Council for Yukon Indians was concerned about cumulative impacts of large-scale development on its people in the South. Both the Yukon Indians and the Dene, supported by church groups in Canada and the Friends in the United States, have called for a moratorium on resource development until their land claims have been settled and implemented. The Dene in the Northwest Territorities estimated the time required at a minimum of 20 years; the Yukon Indians feel that they will need from 7 to 10 years.

When asked for advice to the United States in view of their own concerns, Daniel Johnson, Chairman of the Council for Yukon Indians, suggested that we approve the El Paso system. Georges Erasmus, President of the Indian Brotherhood of the Northwest Territorities, urged instead that we reexamine the need for Alaskan gas and consider more seriously the alternative of not building <u>any</u> pipeline at this time.

The Yukon Government, however, holds a different opinion on the desirability of a pipeline through the Territory. According to a statement submitted for the record by

J.P. McKinnon, Minister of Local Government, the Government believes that a pipeline project need not be considered a negative factor in the development of the Yukon "as long as appropriate safeguards are maintained." Because it is seen as having fewer social and environmental impacts and greater long-term economic benefits to the Yukon, the Alcan Highway route is preferred over a MacKenzie Valley corridor. McKinnon points out that, unlike the Northwest Territorities, the Yukon has a long history of development and a well-established economic infrastructure. Natives comprise only about one-fifth of the population, and about one-half of these are already engaged in a wage economy.

Many of the concerns about impacts of construction on the Arctic National Wildlife Range extended to impacts on wilderness and wildlife in the Northern Yukon and the MacKenzie Valley. For these same reasons, then, the Alcan Route was found environmentally superior because it would run through an existing corridor.

Nevertheless, several important points about environmental impacts of the Alcan Route through Canada were raised in testimony submitted by El Paso and Arctic Gas. Both applications pointed out that the FPC environmental impact statement did not mention the fact that the proposed Alcan alignment through northern British Columbia would run through the Kluane Game and Ecological Reserve, which is protected by Canadian law; the alignment would affect an important winter range of Dall sheep as well as other important wildlife habitats.

The FPC was also criticized for failing to take into account the environmental impacts of constructing the Maple Leaf project or the Dempster Highway corridor to transmit MacKenzie Delta gas if the El Paso or Alcan Routes were approved. The FPC claimed that it was unnecessary to do so because the decision to construct either of these two alternatives would be made entirely by Canada. However, Arctic Gas noted that a pipeline through the Dempster Highway corridor may exacerbate impacts on the Porcupine caribou herd, whose spring and fall migration routes and winter range are traversed by the highway.

Net National Economic Costs and Benefits

The net national economic benefits (NNEB) analysis prepared by the Department of the Interior and the Federal Power Commission using cost figures submitted by the

applicants led these agencies to conclude that economic benefits to the United States would outweigh project costs in all three cases. As one might expect, the applicants argued that their projects would produce the greatest net benefits; a few others, including the Organization for the Management of Alaska's Resources and Teamsters Local 959 in Alaska, supported El Paso's contention that its project would provide highest U.S. employment and revenue levels. A few witnesses, however, challenged the government's conclusions and raised serious questions about the economic viability of any Alaskan gas transport system.

Dr. Arlon R. Tussing, formerly chief economist for the U.S. Senate Committee on Interior and Insular Affairs, claimed that although the method of analysis used to calculate the NNEB was adequate, the applicants' projected costs were unrealistically low. All proposed systems are vulnerable to considerable risks of cost overruns, Tussing said, on the order of those experienced by other major custom-engineered construction projects in North America over the last two decades. Jerry McCutcheon, a witness at the Anchorage hearings, added that a Library of Congress study found most of these overruns to run from 200 to 300 percent.

In view of a likely transportation project cost of about $20 billion or more, Tussing advanced the possibility that Alaskan gas could reach its final markets at a price of $6 to $7 per thousand cubic feet, more than twice the present price of imported oil in terms of heating value. McCutcheon questioned whether there would be any demand for Alaskan gas even at $2.80 per thousand cubic feet.

In Tussing's view, although all three projects are subject to large overruns, the Arctic proposal holds the greatest risk because it crosses large areas of wilderness with no existing infrastructure and no construction history. He considers the Alcan project the low-risk alternative because it is an overland pipeline system which, to a great extent, would go through areas which have already experienced major construction.

An important indicator of economic viability is a project's ability to attract sufficient financing from private lenders, according to Sidney Wolf of the Environmental Policy Center. And yet the FPC has had to recommend several forms of incentives to private lenders because the high project risks have thus far discouraged

capital commitments. Through these measures, then--rolled-in pricing, guaranteed rates of return to lenders, and direct consumer guarantees of debt charges--gas consumers will be paying for Alaskan gas even if it would prove otherwise unmarketable, an event which Wolf, like Tussing, believes highly likely.

Aside from precedents set for future large-scale development projects, Wolf claimed that capital may be diverted from investment in deep well gas development of known and highly probable reserves in the lower 48 states that could produce more gas with less environmental disruption. Arctic Gas claims that this situation is highly unlikely because all new sources of gas are attractive for investors.

Although questioning whether it is even possible, Wolf contended that the most sensible approach to attracting private investment is to eliminate or reduce project risks, perhaps by transporting Alaskan gas in the least expensive way. He agreed with Tussing that the Alcan system would be the least costly because it is least likely to experience cost overruns. He also believes that the costs of both the Alcan and Arctic proposals can be further reduced by eliminating the proposed Northern Border pipeline segment and instead expanding the existing Trans-Canada and Great Lakes pipeline systems.

Regional Distribution of Alaskan Gas to the Lower 48 States

Several witnesses briefly stated their support of an overland pipeline system delivering gas directly to needy markets. This point was considerably expanded in testimony submitted by gas transmission and distribution companies from the Midwest, East Coast, and California. Central to their arguments was the need for uninterrupted supplies of natural gas in order to forestall air quality impacts of conversion to dirtier fuels. These companies, the State of Wisconsin, and business groups in the Midwest and California believe that for several reasons the Arctic Gas system is most likely to assure continued supply.

First, the Arctic Gas system is designed to deliver the most gas. Because it would tap MacKenzie Delta reserves, the Arctic system would reduce the risk of export curtailment by ensuring that Canadians' domestic gas demands will be met.

With regard to regional access to the gas, witnesses from Wisconsin and California made clear their preference for direct delivery. In the view of Wisconsin Public Service Commission Chairman Charles Cicchetti, the Midwest will not accept the El Paso proposal and its plans to deliver gas to the Midwest by displacement because of risks of service interruption. If a tanker accident or an earthquake were to disrupt delivery, Cicchetti said, Midwest companies are unsure whether gas diverted from California would still go to the Midwest or would be sent back to California.

Pacific Interstate Transmission Company and California gas distributors also voiced displeasure with the FPC Commissioners' recommendation that a decision to construct a western leg of an overland system be deferred. Substituting a displacement scheme, they believe, would raise the cost of transportation to the West and make it impossible for western markets to pay gas producers the same price paid by other consumers. Although El Paso's system would deliver gas directly to California, companies there favor an overland system as more reliable.

Another concern is the timing of initial deliveries. The State of Wisconsin believes that the El Paso system will require the most time before initial deliveries. In addition to a lengthy construction time, decisions on gasification facility sites in California are likely to be delayed considerably. Wisconsin also believes that delivery under Alcan's proposal will be delayed because of the need for much additional research.

On the other hand, Tenneco, Inc., claimed that its decision to support the El Paso proposal as a condition of its sales contract for Alaskan state royalty gas was based on its conclusion that the El Paso system can deliver gas to the lower 48 states two years earlier than either of its two competitors. Like Wisconsin's concerns about delays in LNG facility siting decisions in California, Tenneco's concerns are that major unresolved Canadian issues may prevent timely construction of the proposed trans-Canada systems.

Implications for Resource Development in the North

In the view of several witnesses, the focus on alternative gas transportation proposals ignores a basic and important question: What are the implications of developing Alaskan gas for future resource development in Alaska and northern Canada? Several witnesses at the

CEQ hearings expressed the belief that the relationship of natural gas production to land use and other resource development had been overlooked in the environmental impact statements and the FPC decision--in the words of Charles Konigsberg of Anchorage, "If you concentrate on only the gas line now, then that obscures for you what is in my view the real meaning or significance of what has taken place here in Alaska. . . . We're not just talking about a gas pipeline, just as we were not, in '68, '69, and '70, talking about an oil pipeline."

Acceleration of Beaufort Sea OCS development, for example, is a particular concern of Alaska's North Slope Borough. As explained by Borough Mayor Eben Hopson, the Inupiat community on the North Slope and in Canada depends on the Beaufort Sea as a major food source. Mayor Hopson fears that a pipeline across the Slope (the Arctic Gas route) would tempt industry to "overextend" itself in Beaufort Sea OCS development, an event that he views as the most serious environmental threat posed by the Arctic Gas route. Mayor Hopson believes that this indirect impact was not sufficiently examined in the EISs; in fact, he is skeptical that any single project EIS can adequately assess potential impacts in the Arctic.

Other witnesses criticized the EISs for failing to look at natural gas development in the context of overall energy resource development in Alaska, particularly petroleum. Testimony submitted by the Joint Federal-State Land Use Planning Commission for Alaska pointed out that thus far there do not appear to be any major gas provinces in Alaska--known oil and gas reserves are primarily developed for oil. The Commission concluded, therefore, that it would be a "grave error" to develop long-range plans for Alaskan gas which are not totally related to oil production in Alaska.

In examining the relationship between Prudhoe Bay oil and gas production, the State of Alaska and the FPC concluded that gas sales would impose very little cost in oil recovery. Anchorage businessman Jerry McCutcheon sharply disputed this conclusion, asserting that extraction of gas would reduce ultimate oil recovery by 1.4 to 2.4 billion barrels; such a sacrifice is unwarranted when the highest oil recovery levels can be reached simply by postponing gas extraction for 15 to 20 years.

The questionable effects of extracting gas at this time, along with the magnitude of associated economic, social, and environmental costs, led McCutcheon and others to con-

clude that the Nation's interest may be best served by delaying construction of a pipeline.

Pipeline Construction Monitoring

Alaskans and others familiar with the construction of the trans-Alaska oil pipeline expressed their concerns that the mistakes of the past not be repeated in future pipeline projects: Adherence to environmental standards should be made a part of the terms and conditions imposed upon the applicant, and an effective monitoring and surveillance program must be instituted to ensure compliance with these stipulations.

Although the terms and conditions imposed upon Alyeska were considered well-drawn, witnesses claimed that an ineffective environmental quality control program produced an unnecessarily high level of environmental impacts during construction. The Joint Fish and Wildlife Advisory Team, a group of biologists from the Alaska Department of Fish and Game and the U.S. Fish and Wildlife Service who served as advisors to state and federal surveillance efforts, recorded 691 violations of environmental stipulations between June 1974 and October 1976. According to Allen Carson, state coordinator of the Team, most of them would not have occurred had the contractor created an adequate quality control program. In the absence of such a program, Carson explained, government monitors become quality control inspectors by default, a role for which they were neither organized nor properly trained.

The state urged, therefore, that the government require the builders of a gas pipeline to have an effective quality assurance/quality control program before granting right-of-way leases.

Several environmental organizations in Alaska also asked that any gas pipeline surveillance effort include provisions for citizen participation: "Public projects must be conducted in the public eye," said Dee Frankfourth of the Alaska Center for the Environment. Attempts to obtain information on the oil pipeline proved frustrating, she and other environmentalists claimed, and were further thwarted by lack of funding. They suggested that important features of a citizen monitoring program include non-industry funding, access to government meetings, and on-the-ground access to pipeline construction areas.

When asked their views, all three applicants endorsed some form of citizen monitoring, with Alcan suggesting that efforts be financed by the federal government. Each was careful, however, to emphasize that final decisions should rest with an authorized government entity. To paraphrase the Arctic Gas Chairman, the applicant must have a "single voice" to which to respond. El Paso added that the authorized official should be responsible for selecting citizen groups and determining how they would participate in the monitoring.

Other Issues

Impacts on Alaska's Fisheries

According to Jack Van Hyning, a marine biologist and fisheries consultant in the Northwest, fish is Alaska's most important natural resource in terms of its commercial, recreational, and subsistence food values. In 1974, fisherman earned approximately $100 million from their catch. In his view, the portion of El Paso's route from Delta Junction to Point Gravina would have the greatest impact on fisheries resources in the state, going through some of its most valuable fish-producing waters. The effects of thermal discharge from an LNG plant on fish and other marine life in Orca Bay and the effects of tanker traffic on commercial and sport fishing in Prince William Sound would also be profound.

Other fisheries experts stated that the heated effluent could be productively used to support a major aquaculture project. Wallace Noerenberg, member of a state planning team working on salmon rehabilitation and enhancement in Prince William Sound, claimed that ponding the heated water could produce significant quantities of chinook and coho salmon. Seward Mayor Richard Neve, Professor of Marine Science at the University of Alaska, acknowledged, however that despite many attempts only a few successful mariculture (aquaculture at sea) projects are presently in operation. Dr. Van Hyning also stressed that mariculture is still in its infant stages, with many engineering and biological problems unsolved, and it should not be considered a realistic measure to mitigate the effects of thermal effluents.

Effects on Coal Gasification Development

Because one of the proposed pipeline segments in the lower 48 states would pass through extensive coal reserves in the northern Great Plains, witnesses were asked to

comment on effects of a nearby gas pipeline on coal gasification development.

The Michigan Wisconsin Pipe Line Company, a member of the Arctic Gas project, does not contemplate using this pipeline segment for a coal gasification project sponsored by them and other midwestern companies (now pending before the FPC). The Company stated, however, that "these facilities will probably be found to provide the most economical method of transporting coal gas [and] if approved and constructed in a timely manner . . . could be the logical vehicle for transporting coal gas for Michigan Wisconsin and others."

Other witnesses noted, however, that water availability will be the significant determinant in the future of coal gasification in that region, with proximity of a transportation system only secondary.

Alternatives to the Three Proposals

Several alternatives were suggested:

° To the Northern Border Pipeline Route: Because it is a brandnew pipeline crossing through the environmentally sensitive potholes region of North Dakota, several environmental organizations suggested existing trans-Canada pipelines or the Red River corridor instead.

° To the Arctic Route: The Alaska Conservation Society suggested more careful investigation of a beach route across the North Slope.

° To new pipeline construction: Sullivan Marsden, Jr., Professor of Petroleum Engineering at Stanford University, introduced a proposal into the hearing record that was originally considered in the Interior Department's EIS: that onsite conversion of Prudhoe Bay gas into methanol or other liquid petrochemicals could obviate the need for a separate gas pipeline. Questioning whether the trans-Alaska oil pipeline will ever be fully used at design capacity, Marsden suggested that these liquid petrochemicals could be shipped through the oil pipeline either in product batches or in solution with crude oil. He urged that with lower capital costs and fewer environmental impacts than new gas pipeline construction, this proposal be thoroughly evaluated along with those supported by gas pipeline companies and utilities.

Adequacy of the Environmental Impact Statements

Witnesses familiar with the environmental impact statements prepared for the Alaska gas transport system proposals believed them to meet the requirements of the National Environmental Policy Act. Nevertheless, we heard repeated criticism of the EISs as decisionmaking documents, with charges directed against both their format and scope.

EIS Format

The preparation of separate impact statements for each proposal resulted in a voluminous array of information which witnesses found confusing, cumbersome, and of little use in formulating decisions. Instead of merely listing impacts associated with each route, they said, the statements should have provided explicit side-by-side comparisons of all alternatives, with some evaluation of the relative importance of impacts.

One most important feature missing from the impact statements, according to Barbara Graham, counsel to The Wilderness Society, the Sierra Club, the National Audubon Society, and the Alaska Conservation Society (the Conservation Intervenors) is an adequate analysis of the various risks attendant to these projects. Only with a thorough evaluation of economic, environmental, and project completion risks can the environmental impact statements provide the base for a decision. Testimony submitted by Alcan tended to support her contention; they call for a supplement to the impact statements consisting of assessments of comparative environmental risks in terms of both likelihood of occurrence and magnitude of potential harm.

Information Believed Lacking

Although not disputing the adequacy of the impact statements under NEPA, witnesses stated that certain information necessary for a full understanding of the likely consequences of project approval was missing. The most oft-repeated criticism in this regard was that the EISs had not given sufficient attention to impacts in Canada. As noted earlier, witnesses were particularly concerned that impacts on native life styles and culture be taken into account and asked that Justice Berger's report be seriously considered by U.S. decisionmakers. A full assessment of socioeconomic and environmental impacts of the Alcan route in Canada is still missing, witnesses claimed.

Beyond these more general comments, several specific omissions were cited:

1. The Arctic Gas and Alcan proposals analyzed in the EISs differ significantly from those presently proposed.

El Paso's testimony pointed out that the Arctic Gas proposal now calls for heat tracing of certain pipeline segments, which would entail installation of electric generating stations at 13 locations in Canada, about 400 miles of overhead powerlines, and over 150 miles of buried electrical powerlines in the MacKenzie Delta. El Paso also noted that since preparation of the EIS supplement on the 42-inch Alcan pipeline proposal, Alcan has proposed a 48-inch pipeline and a revised alignment through portions of Canada. The presently proposed alignment, according to El Paso, would place the Alcan pipeline more than 5 miles away from existing corridors for 36 miles in the Yukon, for over 300 miles in British Columbia, and for another 150 to 200 miles in Alberta and Saskatchewan.

2. The Interior EIS failed to treat the impact of the Arctic Gas route on U.S. commitments in international treaties.

According to the National Wildlife Refuge Association, no mention was made of the following international agreements to which the United States is a party:

- The Migratory Bird Treaty with Canada, Mexico, and Japan protecting the snow goose population, which uses the Arctic Wildlife Range for a feeding and staging area

- The 1973 Agreement on the Conservation of Polar Bears with Canada, Denmark, Norway, and the USSR protecting "the ecosystems of which polar bears are a part, with special attention to habitat components such as denning and feeding sites and migration patterns"

- The 1942 Convention of Nature Protection and Wildlife Protection in the Western Hemisphere

- The 1972 Agreement on Cooperation in the Field of Environmental Protection between the United States and the USSR dealing with the preservation of natural reserves

- The unratified 1976 convention between the United States and the USSR concerning the Conservation of Migratory Birds and their Environment.

3. The National Audubon Society cited the absence of discussion of impacts associated with pipeline maintenance and pipeline disposition after the gas stops flowing.

4. Mayor Eben Hopson claimed that although some Borough employees may have been interviewed, no effort was made to involve the North Slope Borough in the planning or execution of the EISs.

5. Chugach Natives, Inc., and Eyak Corporation pointed out that the FPC impact statement made no mention of the fact that under the Alaska Native Claims Settlement Act their members have selected the Point Gravina LNG site and adjacent portions of the Chugach National Forest affected by the El Paso Route.

TESTIMONY SUBMITTED ON ENVIRONMENTAL
IMPACTS OF ALASKA GAS TRANSPORTATION CORRIDORS
Anchorage, Alaska, May 16-17, 1977
Washington, D.C. May 23-24, 1977

Appearing Before the Council

Alaska Center for the Environment - Dee Franfourth and Peg Tileston
Alaska Conservation Society - Ruth Schmidt
Alaska International Construction Co. - Lon McDermott, President
Alaska, State of - Allan Carson, Department of Fish and Game; Charles Champion, State Pipeline Coordinator; Avrum Gross, Attorney General; William C. McConkey, Department of Commerce and Economic Development; and Ernst Mueller, Department of Environmental Conservation
American Fisheries Society, Alaska Chapter - Norval Netsch, President
Anchorage Audubon Society - Robert Shipley
California Gas Distribution Group (Pacific Gas and Electric Co., San Diego Gas and Electric Co., Southern California Gas Co., and Pacific Interstate Transmission Co.) - John A. Sproul, Senior Vice-President, Pacific Gas and Electric Co.
Chugach Natives, Inc., and Eyak Corporation - Joe P. Josephson, Counsel, and Cecil Barnes, President
Cordova Chamber of Commerce - Doug Bechtel
Council of Yukon Indians - Daniel Johnson, Chairman
Doyon, Ltd. - Emil Notti, Senior Vice-President
Charles Edwardsen, Board Member, Arctic Slope Regional Corp.
Environmental Policy Center - Sidney Wolf, Oil and Gas Consultant
Fairbanks Environmental Center - George Matz, Executive Director
Fairbanks North Star Borough - Sue Fison, Director, Impact Information Center
Fairbanks Town and Village Association for Development, Inc. - Jerry Smetzer, Executive Director
Federation of Western Outdoor Clubs - Dan Roby
Friends Committee on National Legislation - Stephen McNeil
Friends of the Earth - Jim Kowalsky, Alaska Representative, and Pamela Rich, Alaska Coordinator
Barbara Graham, Counsel to The Wilderness Society, Sierra Club, National Audubon Society, and the Alaska Conservation Society
John Hakala, Soldotna, Alaska
Eben Hopson, Mayor of North Slope Borough (represented by Billy Keakok)
Indian Brotherhood of the Northwest Territories - Georges Erasmus, President
Joint Federal-State Land Use Planning Commission for Alaska - Walter Parker, State Co-Chairman

Charles Konigsberg, Anchorage, Alaska
Jerry McCutcheon, Anchorage, Alaska
National Audubon Society - Stephen T. Young
National Wildlife Federation - Louis S. Clapper, Director of Conservation, and Dr. Raymond Johnson, Consultant
National Wildlife Refuge Association - Dave Spencer, Alaska Representative
Richard Neve, Mayor of Seward and Professor of Marine Sciences, Institute of Marine Science, University of Alaska
Wallace Noerenberg, Fisheries Consultant, Alaska
Organization for the Management of Alaska's Resources (OMAR) - Beverly Isenson, Executive Committee Member; Lee Fisher, Executive Committee Member; and Homer Burrell
Robert C. Penney, Anchorage, Alaska
Project North - Hugh McCullum, Project Coordinator, and G. Russell Hatton, Staff Representative, Anglican Church of Canada
Robert Retherford, Anchorage, Alaska
Sierra Club - Brock Evans and Jack Hession, Alaska Representative
Ted Stevens, U.S. Senate
Leslie E. "Red" Swanson, House of Representatives, Alaska State Legislature
Teamsters Union Local 959 - Robert W. Johnson
Tenneco, Inc. - Dr. Casey E. Westell Jr., Director, Industrial Ecology
The Wilderness Society - William Cunningham and Peter Scholes, Alaska Regional Representative
Trustees for Alaska - Clifton Eames
Arlon R. Tussing, Adjunct Professor of Economics, University of Alaska
Valdez, City of - William Morrice, Port Director
Jack Van Hyning, Fisheries Consultant, Fairbanks, Alaska
Wildlife Society, Alaska Chapter - James Bartonek
Wisconsin, State of - Dr. Charles J. Cicchetti, Chairman, Public Service Commission

Alaskan Arctic Gas Pipeline Company - William W. Brackett, Chairman; Daniel Collins, Counsel; Dr. F.W.S. Banfield, Professor of Biology, Brock University; Dr. Randall Gossen, Canadian Arctic Gas Pipeline Ltd; and Daniel Gibson, General Counsel, Pacific Gas Transmission Co.
Alcan Pipeline Company - Stewart Udall, Counsel, and David Watkiss, Counsel
El Paso Alaska Company - Dr. John M. Craig, Director of Environmental Affairs; Luino Dell'Osso, Jr., Project Manager; Dr. Howard Reiquam, Senior Environmental Scientist; William Wise, Principal Counsel; and J. Alan Galbraith, Counsel

Written Testimony

Associated General Contractors, Alaska Chapter
Mrs. Dixie M. Baade, Petersburg, Alaska
Columbia Gas System Service Corporation
Defenders of the Outdoor Heritage, Salt Lake City
Gerald Hood, Temsters Union Local 959
Laborers International Union of North America, AFL-CIO
Maritime Trades Department, AFL-CIO
Sullivan S. Marsden, Jr., Professor of Petroleum Engineering, Stanford University
Michigan Wisconsin Pipe Line Company
Natural Gas Pipeline Company of America
Urban C. Nelson, Juneau, Alaska
Robert B. Olshansky, Anchorage, Alaska
Panhandle Eastern Pipe Line Company
Southern Natural Gas Company
Texas Eastern Transmission Corp. and Transwestern Pipeline Company
Yukon Territorial Government

Other Written Comments

Benicia (California) City Council
California Chamber of Commerce
California Council for Environmental and Economic Balance
Canada-U.S. Environmental Council
Citizens Gas, Indianapolis
Calvin Dahn, St. Paul, Minnesota
Edward W. Farmer, Sweeny, Texas
Foster City (California) Chamber of Commerce
Greater Minneapolis Chamber of Commerce
Greater Ukiah (California) Chamber of Commerce
Indiana Gas Association, Inc.
Indiana State Chamber of Commerce
David Kippen, Anchorage, Alaska
National Fuel Gas Distribution Corp., Buffalo, N.Y.
Verne B. Nelson, Minneapolis, Minnesota
Northern Natural Gas Company
San Leandro (California) Chamber of Commerce
South Dakota, State of
South San Francisco Chamber of Commerce
Tennesseans for Better Transportation
Tracy (California) Ditrict Chamber of Commerce
Beverly Ward, Anchorage, Alaska
G.H. Wilson, Albuquerque, New Mexico
Mrs. Opal Wilson, Albuquerque, New Mexico

APPENDIX. APPLICANTS FOR THE PROJECT[1/]

1. Alaskan Arctic Gas Pipeline Company

The first applicant to the FPC for a certificate of convenience and necessity to transport Alaskan natural gas was a consortium of American and Canadian natural gas pipeline companies, Alaskan Arctic Gas Pipeline Company (Arctic) which filed with the Commission on March 21, 1974.[2/] Arctic Gas proposes a wholly overland route. The pipeline would traverse the north coast of Alaska and the Yukon Territory, to the MacKenzie Delta, then head southeasterly along the MacKenzie River into Alberta, to Caroline Junction. There it would divide into an "eastern" and "western" leg. The eastern leg would continue to Monchy, Saskatchewan; there it would connect with the proposed Northern Border system which would carry the gas to Dwight, Illinois, with intermittent take-off points. The western leg would enter the United States at Kingsgate, B.C., and continue to Antioch, California; the United States portion of this segment would be constructed by Pacific Gas Transmission Company and the Pacific Gas and Electric Company. Arctic's pipeline is also designed to transport Canadian MacKenzie Delta gas and future Beaufort Sea gas to Canadian markets. (See Exhibit I-1.)

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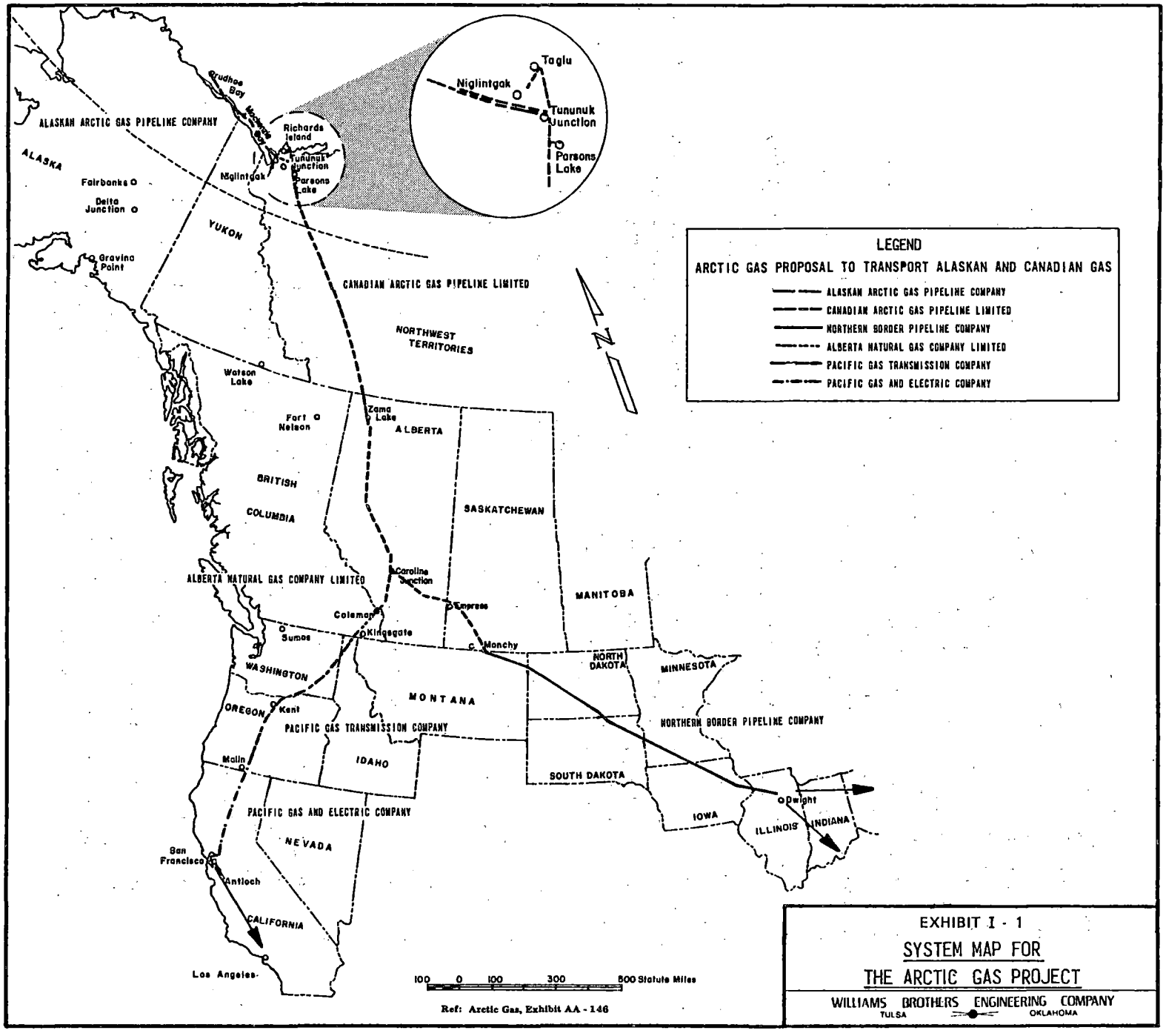
1 Excerpted from Federal Power Commission, Recommendation to the President: Alaska Natural Gas Transportation Systems, May 1, 1977.

2 As finally constituted, this group includes principal applicants Canadian Arctic Company Ltd. and Alberta Natural Gas Company Ltd. (applicants before the National Energy Board of Canada), Alaskan Arctic, Northern Border Pipeline Company (a partnership of six United States natural gas transmission companies), Pacific Gas Transmission Company, and Pacific Gas and Electric Company. The original group also included the principal producers.


Taglu
Niglintgak
Tununuk Junction
Parsons Lake
Prudhoe Bay
Richards Island
ALASKAN ARCTIC GAS PIPELINE COMPANY
ALASKA
Fairbanks
Delta Junction
YUKON
Gravina Point
CANADIAN ARCTIC GAS PIPELINE LIMITED
NORTHWEST TERRITORIES
Watson Lake
Fort Nelson
Zama Lake
ALBERTA
BRITISH COLUMBIA
SASKATCHEWAN
ALBERTA NATURAL GAS COMPANY LIMITED
Caroline Junction
Empress
MANITOBA
Coleman
Kingsgate
Sumas
Monchy
NORTH DAKOTA
MINNESOTA
WASHINGTON
MONTANA
OREGON
Kent
PACIFIC GAS TRANSMISSION COMPANY
NORTHERN BORDER PIPELINE COMPANY
Malin
IDAHO
SOUTH DAKOTA
Dwight
IOWA
ILLINOIS
INDIANA
PACIFIC GAS AND ELECTRIC COMPANY
NEVADA
San Francisco
Antioch
CALIFORNIA
Los Angeles
LEGEND
ARCTIC GAS PROPOSAL TO TRANSPORT ALASKAN AND CANADIAN GAS
ALASKAN ARCTIC GAS PIPELINE COMPANY
CANADIAN ARCTIC GAS PIPELINE LIMITED
NORTHERN BORDER PIPELINE COMPANY
ALBERTA NATURAL GAS COMPANY LIMITED
PACIFIC GAS TRANSMISSION COMPANY
PACIFIC GAS AND ELECTRIC COMPANY
100 0 100 300 500 Statute Miles
Ref: Arctic Gas, Exhibit AA - 146
EXHIBIT I - 1
SYSTEM MAP FOR
THE ARCTIC GAS PROJECT
WILLIAMS BROTHERS ENGINEERING COMPANY
TULSA
OKLAHOMA

2. El Paso Company

On September 24, 1974, El Paso Alaska Company (El Paso) filed an application for a second transportation system.[3] El Paso would transport only Alaskan gas by a pipeline which would generally follow the route of the Alyeska oil pipeline to a point north of Valdez and then to a warm water port at Gravina Point on Prince William Sound, Alaska. The natural gas would be liquefied and a fleet of liquefied natural gas (LNG) tankers would transport it to a California terminal and regasification plant. After regasification, the gas would be transported by pipeline and by displacement to natural gas consumers throughout the United States.[4] (See Exhibit I-2.)

3. Alcan Pipeline Company and Northwest Pipeline Company

On July 9, 1976, Alcan Pipeline Company and Northwest Pipeline Company (Alcan) filed a third application for a certificate, covering a route across Alaska following the Alyeska pipeline route to Fairbanks, Alaska, then along the Alcan Highway to the Alaska-Yukon border.[5] The route goes through Canada along the Yukon-British Columbia border, then south using in part existing Canadian gas pipelines in British Columbia and Alberta, and then to the U.S. border, connecting to the west with Northwest Pipeline near Sumas, Washington, and PGT at Kingsgate, British Columbia. Gas would move east through

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3 Other companies involved are Western LNG Company and El Paso Natural Gas Company.

4 Displacement is a method of distribution whereby natural gas may be supplied from a closer point in exchange for gas elsewhere. Such procedures avoid the transportation costs of physically transferring gas between markets.

5 The companies directly involved are Alcan Pipeline Company (Alaska), Foothills Pipelines (Yukon) Ltd., Westcoast Transmission Company Ltd., Alberta Gas Trunk Line (Canada) Ltd. and, by adoption, Northern Border Pipeline Company, Pacific Gas Transmission Company, and Pacific Gas and Electric Company.

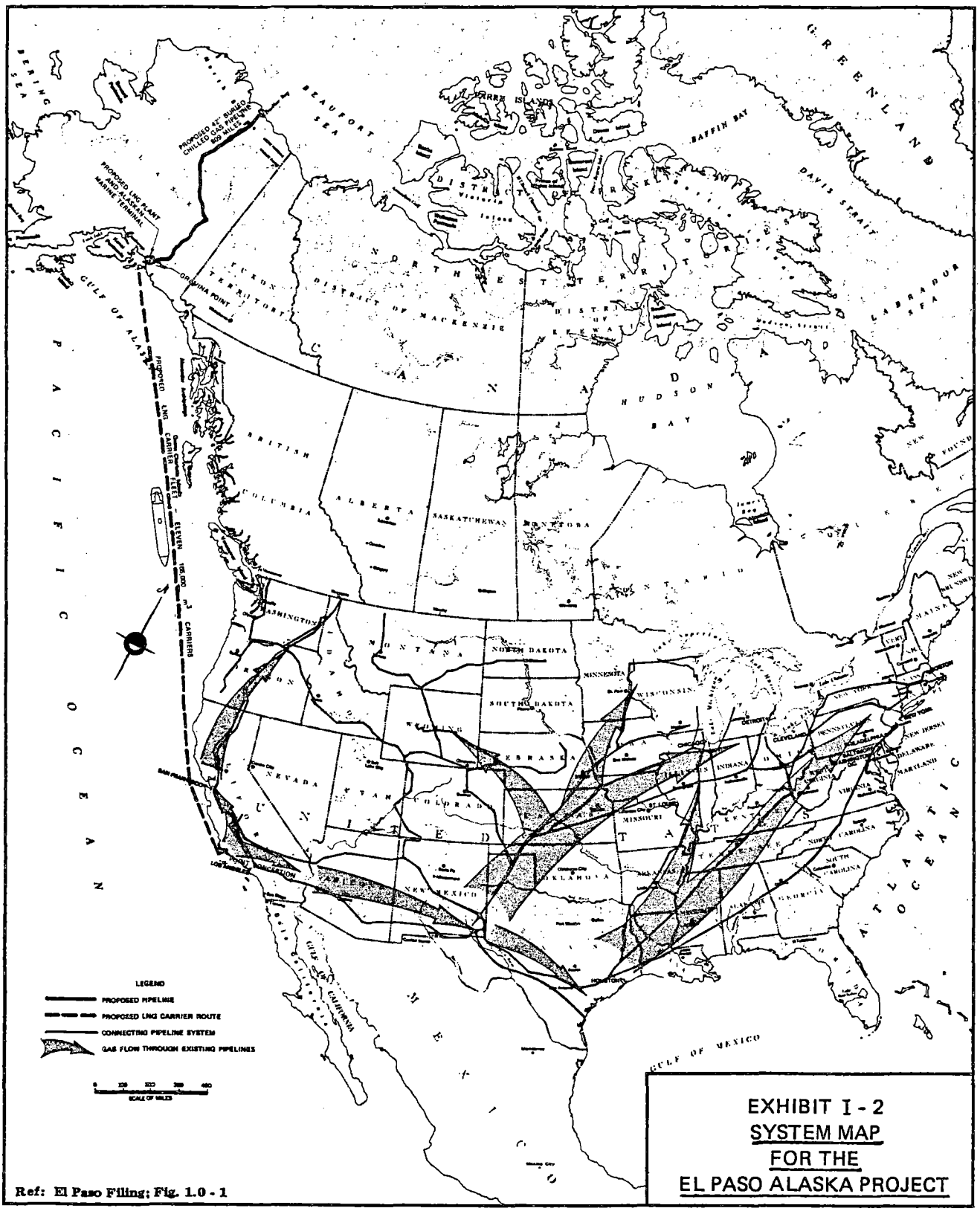

EXHIBIT I - 2
SYSTEM MAP
FOR THE
EL PASO ALASKA PROJECT

Ref: El Paso Filing; Fig. 1.0 - 1

new facilities to Monchy, Saskatchewan. This application assumes that Northern Border, an applicant in the Arctic Gas project, would receive the gas at Monchy and distribute it to the Midwest and East.

On March 8, 1977, Alcan filed an alternate proposal which follows essentially the same route as the original proposal[6] but consists of an all new pipeline with no commingled Canadian gas. The proposed route south of Caroline Junction, Alberta, is essentially the same as that proposed by Arctic. (See Exhibit I-3.) In oral argument before the Commission in early April, Alcan stated that the alternate proposal is to be regarded as their primary proposal.

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6 New routing is provided for about 500 miles in British Columbia and Alberta.

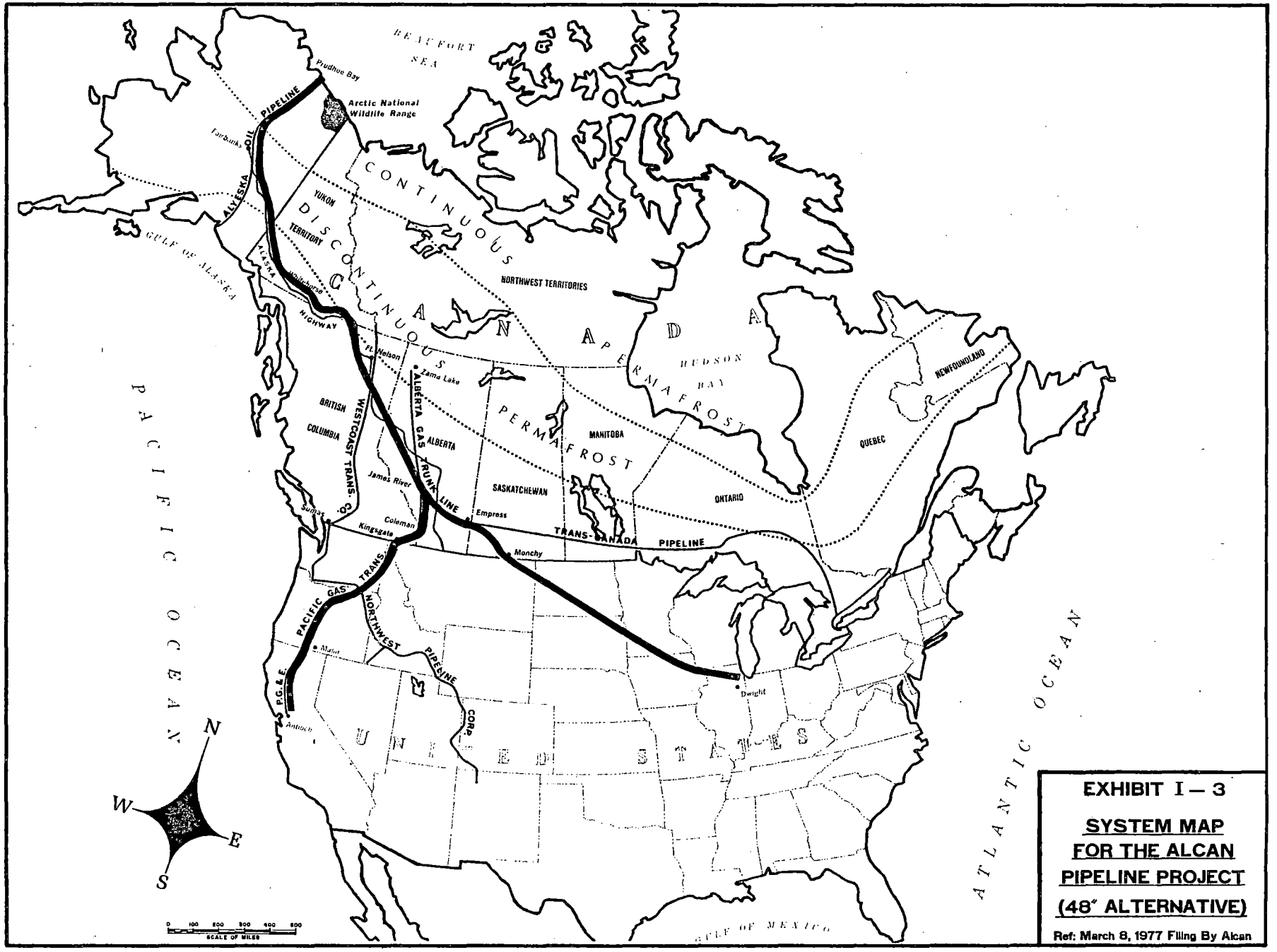

EXHIBIT I – 3

SYSTEM MAP FOR THE ALCAN PIPELINE PROJECT (48" ALTERNATIVE)

Ref: March 8, 1977 Filing By Alcan