Docket No. CP80-

Exhibit Z-7
CENTER POINT JUSTIFICATION

Volume V

ALASKA SEGMENT

ALASKA NATURAL GAS TRANSPORTATION SYSTEM

Alaskan Northwest Natural Gas
Transportation Company

United States of America
Before the
Federal Energy Regulatory Commission

Docket No. CP80-

Exhibit Z-7
CENTER POINT JUSTIFICATION

Volume V

Application of
ALASKAN NORTHWEST NATURAL GAS TRANSPORTATION COMPANY

For a Final Certificate of Public Convenience and Necessity Pursuant to Section 7 (C) of the Natural Gas Act, as amended, and Section 9 of the Alaska Natural Gas Transportation Act of 1976 to construct and operate the Alaska Segment of the Alaska Natural Gas Transportation System.

July 1, 1980

EXHIBIT Z-7

CENTER POINT JUSTIFICATION

ALASKAN NORTHWEST NATURAL GAS TRANSPORTATION COMPANY

ALASKA SEGMENT OF THE
ALASKA NATURAL GAS TRANSPORTATION SYSTEM

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1.0 INTRODUCTION

On June 8, 1979, and September 6, 1979, FERC issued Order Nos. 31 and 31-B, respectively. These orders established the Incentive Rate of Return (IROR) mechanism.

The IROR mechanism was developed to provide an incentive for cost control during construction of the Alaska Natural Gas Transportation System (ANGTS). Under the IROR mechanism, project sponsors will earn either higher or lower rates of return depending upon their ability to control project costs. If actual costs are greater than estimated, sponsors will earn a lower rate of return on equity. If actual costs are below those estimated, sponsors will earn a higher rate of return on equity.

Because their actual cost performance is measured against estimated project costs submitted with this filing, the sponsors have carefully estimated these costs. In doing so, the sponsors recognize that the estimated cost is just one of many possible outcomes of project costs. These many potential project costs result from uncertainties in the cost estimate itself and uncertainties arising from potential cost impacts in the future. Consequently, the ultimate actual cost can be viewed as one of a distribution of potential project costs (see Figure Z-7-1).

As a result of these uncertainties, Applicant has prepared a detailed analysis of the total uncertainties in project costs and the resulting distribution of potential project costs.

The Certification Cost Estimate (CCE) includes a normal contingency of 12.0 percent. This contingency reflects normal uncertainties around a reasonable cost estimate. The normal uncertainties contained in this contingency include the following considerations: accuracy of material quantities, accuracy of material prices, human productivity assumptions, equipment reliability assumptions, engineering/design development status, normal schedule variance, and accuracy of bid specifications based on current project definition. The considerations exclude any potential design changes, scope changes, or uncertainties due to abnormal or unexpected events which would impact costs. These normal uncertainties will be reflected in actual project costs because execution contractors (ECs) bidding for fixed-price contracts will include this type of contingency in their bids.

1.0 INTRODUCTION (Continued)

These contingencies will partially compensate the ECs for the risk inherent in entering into a fixed-price contract for a major construction project in Alaska. Thus, this element of risk to the project sponsors belongs in the CCE as contingency.

Uncertainties resulting from abnormal events which impact project costs are included in the Center Point. In Order No. 31-B, the FERC stated the following relative to determination of the Center Point.

> "The Commission, in Order No. 31, gave the project sponsors two choices or options as to how the Center Point would be determined. The first option was to utilize a formula based upon a comparison of the Certification Cost and Schedule Estimate and the estimates in the President's Decision. In its Motion for Rehearing, Alaskan Northwest objects to this formula approach. Under the second option, the project sponsors could request a Center Point without reference to the formula as part of the Certification Cost and Schedule Estimate submission if a major change had occurred in the project, including likely overruns, that exceeded the estimates in the Decision.
>
> Alaskan Northwest's motion states that "...it now appears very clear that a reasonable cost estimate for the Alaska Segment of the project will exceed the March 1977 cost estimate by more than 30 percent." The Commission interprets this statement to mean that a major change in the Alaskan segment of the project has occurred since the President's Decision, and thus that Alaskan Northwest has rejected the option of setting the Center Point using a formula approach. Consequently, the Commission will not require that the formula approach be used for the Alaskan segment." [1]

The Applicant has opted to submit as part of its application for a final Certificate of Public Convenience and Necessity, an exhibit justifying the recommended Center Point. The justification is based upon the various abnormal or unexpected events that could increase costs from the Certification Cost and Schedule Estimate, and does not include any final design or change in scope events. This methodology is in accordance with FERC intentions in Order No. 31 that any allowances for

[1] Order No. 31-B p. 4.

1.0 INTRODUCTION (Continued)

unexpected events should be included in the value of the Center Point and not in the underlying Certification Cost Estimate.

> "Abnormal or unlikely events that could increase costs will be analyzed as part of the sponsors' submission concerning potential cost overruns from the Certification Estimate. The sponsors' analysis of the potential for cost increases from the Certification Estimate will then be used by the Commission in detemining the Center Point. If a convincing case is made that the potential for increases beyond the Certification Estimate is substantial, then a reasonable value for the Center Point may be substantially greater than one." [2]

A Center Point of 1.292 is justified by a thorough analysis of those abnormal events outside the control of project sponsors which could impact project costs (see Figure Z-7-1). The abnormal events considered by the sponsors were carefully screened to ensure (a) that each event could be quantified separately, (b) that no event could be considered a potential design or scope change (c) that no event was included as contingency. The Applicant is filing a list of potential design and scope change events that have not been included in the Center Point analysis. This list will also be submitted to the Office of the Federal Inspector (OFI). If these events occur, they will be subject to approval by the OFI.

The sponsors will also submit proposals in this filing for two other issues which affect the IROR mechanism, which are presently undefined. These two issues are: (a) the appropriate labor indices used for deflating actual project labor costs in the IROR procedure and (b) the treatment of third-party costs in the IROR procedure. Applicant will recommend in the instant exhibit the appropriate labor indices to be used for deflating actual project labor costs in the IROR mechanism. This recommendation is being made pursuant to Order No. 31-B wherein the FERC stated that:

> "In order to allow the sponsors more fully to develop detailed proposals for the labor cost portion of the composite index, within the general framework established in Order No. 31, and for the Commission to review these proposals, the Commission will reserve a final decision on the exact specifications of the labor component of

[2] Order No. 31 p. 54.

1.0 INTRODUCTION (Continued)

> the composite index until the sponsors have filed their Certification Cost and Schedule Estimates. With the filing of the Certification Estimates, the Commission expects the sponsors to specify in detail the quarterly or annual cost categories for labor and the measure of labor wage rates for each cost category that they propose. After reviewing the specific proposals submitted by the sponsors concerning labor cost indices, the Commission will approve or modify these proposals in conjunction with its consideration of the Certification Estimate." [3]

Finally, Applicant will recommend in the instant exhibit a procedure for dealing with third party monitoring and government-related costs. Such costs which are substantial and uncontrollable by the Applicant are, in the Applicant's view, not appropriately covered by the IROR mechanism.

[3] Order No. 31-B p. 30.

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2.0 CENTER POINT JUSTIFICATION

In addition to in-scope estimating uncertainties, Applicant faces risks arising from abnormal or unexpected events that could affect project costs. Under the IROR procedure, the risks posed by these abnormal events are to be quantified and used to justify a Center Point estimate. The Center Point is an important component of the IROR procedure. The Center Point compensates project sponsors and equity investors for the risk that project costs will increase due to events not subject to their control. By adopting this procedure, the FERC has recognized the risks inherent in a major construction project in Alaska. The Center Point is also a critical element in determining the ultimate return on equity received by the project sponsors. At the simplest level, if the ultimate cost performance ratio* equals the Center Point, the sponsors will earn the Center Rate of Return (17.5 percent). If the cost performance ratio is greater or less than the Center Point, the sponsors will earn a lower or higher rate of return, respectively.

Recognizing the importance of the Center Point to the project's profitability, Applicant has carefully evaluated the potential cost impact arising from abnormal or unexpected events. This evaluation resulted in a distribution of cost impacts from abnormal events having an expected value of 1.292, which is the Center Point Ratio.

Applicant's Center Point justification carefully follows the guidelines established in the President's Decision, Order 31 and Order 31-B. In accordance with Order 31-B, Applicant has decided to develop this justification rather than follow the formula approach to establishing a Center Point. As defined by FERC in Order 31-B:

> "The exhibit dealing with the Center Point should assess the likelihood of abnormal events that could increase costs which are not covered under the Change in Scope mechanism and the impact on costs that these events would have. This information will be used to set a Center Point that compensates for the possibiltiy of abnormal events increasing costs." [4]

*The cost performance ratio is the deflated actual capital cost divided by the projected capital cost.

[4] Order 31-B, p. 8.

2.0 CENTER POINT JUSTIFICATION (Continued)

Applicant has carefully limited the abnormal events considered to those not included in the change-in-scope mechanism and the design-change mechanism. As the project progresses, OFI will determine which design and scope changes are to be allowed. As part of this filing, Applicant is submitting lists of potential design and scope changes to OFI (see Tables 2-1, 2-2 and 2-3).

These conclusions will be discussed in more detail in the following section. Specifically, Applicant will discuss the risks that were included in the Center Point analysis.

2.1 RISKS INCLUDED IN THE CENTER POINT

Applicant determined the Center Point of 1.292 based on a probabilistic analysis of abnormal or unexpected events that could affect project costs. The results of this analysis indicate that such events could increase project costs from 1.125 to 3.483 billion dollars (see Figure Z-7-2). This range represents between a 14 and 44 percent increase in total project costs above the CCE plus contingency, and translates into a Center Point of 1.292. It is important to note that the Center Point is calculated by adding the average impact of abnormal events to total project costs (CCE plus contingency)*. Adjustments to total project costs will require adjustment to the Center Point to reflect the changes in the values that were used in its calculation.

To develop the cost impact of abnormal events, Applicant first defined more than 90 possible events, each of which was assigned to one of three categories established in Order 31-B: abnormal events, design changes, or scope changes (see Tables 2-1, 2-2, and 2-3).

*The following two formulas can be used to calculate the Center Point:

$$\text{Center Point} = 1.0 + \frac{\text{Expected Value of Abnormal Events}}{\text{CCE}}$$

$$\text{Center Point} = \frac{\text{Expected Value of Abnormal Events + CCE}}{\text{CCE}}$$

2.1 RISKS INCLUDED IN THE CENTER POINT (Continued)

As required by Order 31-B, design changes were defined as:

> "Changes in quantities or types of materials, labor and services and changes in project development or construction schedule and construction techniques, resulting from changes in design or schedule (including changes in the time necessary to obtain the required government approvals and permits) between the time the Certification Cost and Schedule Estimate was prepared and the approval of the Final Design." [5]

Changes in scope were defined as changes occurring after final design approval and falling into one of the following five categories:

- Declared or undeclared war.
- Any emergency or major disaster declared by the President, or one which would have been declared had it occurred in the United States.
- Design changes required by changes in Federal or state laws and regulations.
- Major changes in routing or capacity ordered by Federal or state governments.
- Delay in issuance of government permit or certificate which is not the fault of project sponsors and causes significant cost increases. [6]

As a result of this analysis, 36 abnormal events were defined as those events which could increase costs but are not covered under the change-in-design or change-in-scope mechanisms. Section 4.0 contains a summary of each abnormal event selected for this analysis and Section 5.0 contains a short description of each potential design and scope change.

After the 36 abnormal events were classified, experts from Applicant's operator (NWA), the Project Management Contractor (PMC), and selected outside sources defined the probability of occurrence of each event classified as abnormal, the range of cost impacts, and the impacts on schedule. For some events (e.g., pipeline mode changes during construction due to field conditions), the probability of occurrence was 100 percent, while for others the probability of occurrence

[5] Order 31-B, p. 72.
[6] Order 31-B, p. 75.

2.1 RISKS INCLUDED IN THE CENTER POINT (Continued)

was small. The probabilities were defined by reaching consensus among the experts interviewed for each event.

The same experts also evaluated the range of potential cost impacts if the event did occur. First, the assumptions in the engineering estimate which related to the event were reviewed. Then values were established to represent the incremental costs of each event. Three values were established for each cost: the minimum value, the most likely value and the maximum value. The minimum value is defined as that cost which has a 10 percent probability that the actual cost would be below this minimum value. The most likely value is defined as a modal value, i.e., the cost that has the highest probability of occurring. The maximum value is defined as that cost which has a 10 percent probability that the actual cost would be greater than this maximum value.

In developing cost ranges, great care was exercised to ensure that there was no double-counting between cost impacts arising from the abnormal event and other elements, i.e., the engineering estimate, contingency, design and scope changes, or other abnormal events. In addition, the impacts of schedule delays were quantified as costs. In essence, schedule delays will be overcome by compressing the duration of delayed activities so they are completed on time. This is a logical assumption, since it is more cost effective to complete on schedule than to delay completion.

The cost ranges and probabilities for the 36 events were then used to determine the impact of abnormal events on project costs. A computer simulation was employed to determine the range, distribution and expected value of costs resulting from abnormal events. The resulting distribution was then tested for its sensitivity to key abnormal events. Those with large cost impacts were then subjected to further scrutiny.

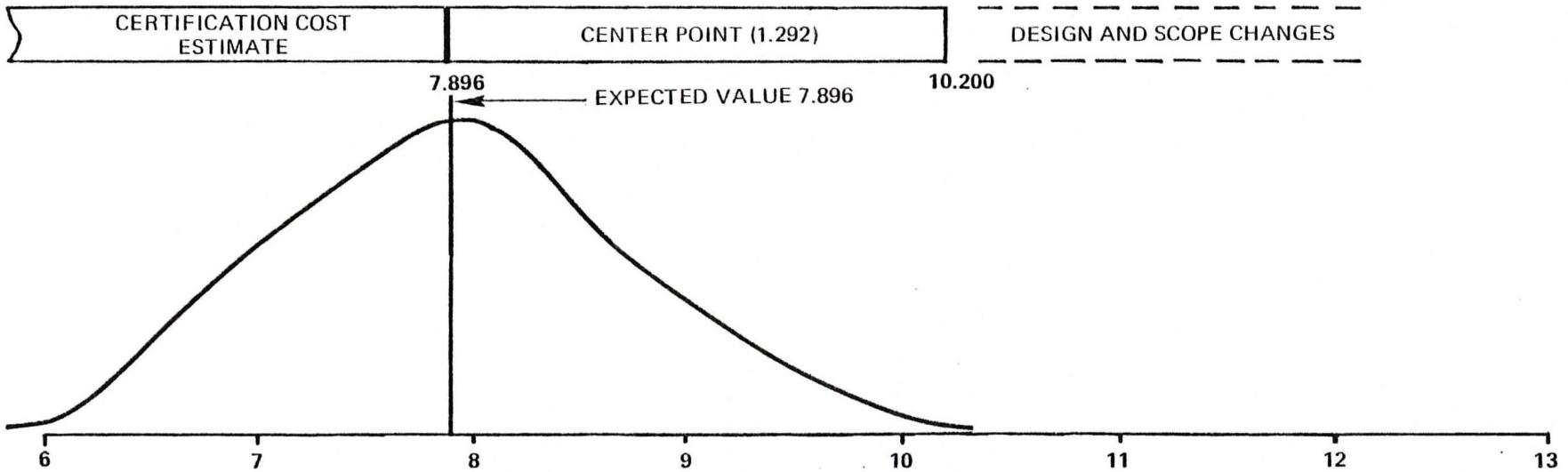
The range, distribution, and expected value of the cost impacts from abnormal events was developed through a computer simulation. This simulation consisted of 1000 random samplings of each event. The samplings resulted in a range of aggregate cost impacts from $1.125 to $3.483 billion and an expected value of $2.304 billion. This rather broad range results from the nature of the risks presented by the events. One specific event, for example, changes in foreign exchange rates, could reduce project costs by as much as $165 million or increase them by as much as $265 million.

2.1 RISKS INCLUDED IN THE CENTER POINT (Continued)

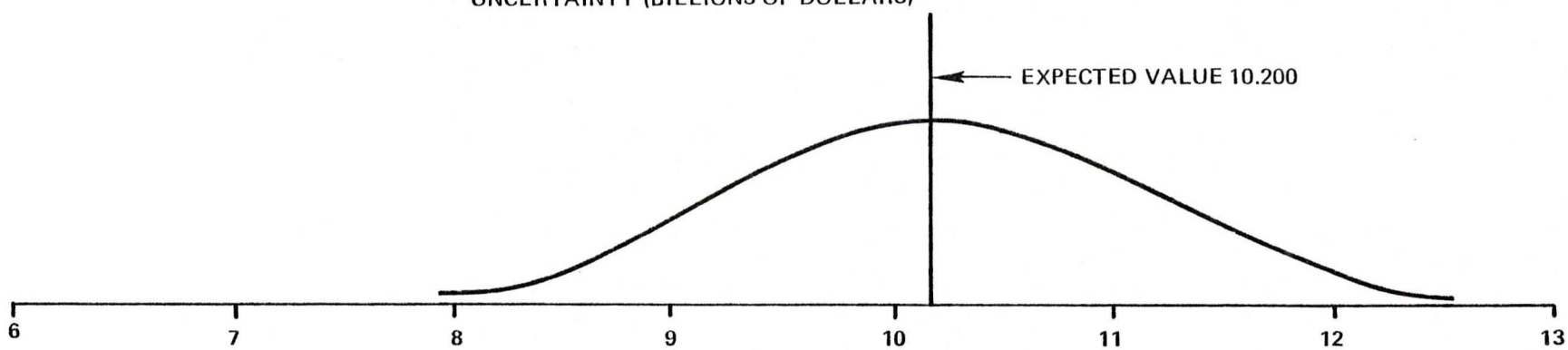
Most events show only the possibility that project costs will increase, not decrease. This tendency results from the fact that most abnormal events change the assumptions in the engineering estimate and require additional resources to overcome their impacts.

The Applicant has used the expected value (weighted average) to define a Center Point of 1.292 and is sharing the risk of potential cost overruns equally with the consumer. Figure Z-7-2 demonstrates that there is a 50 percent probability that cost impacts from abnormal events could exceed the expected value. Even with a Center Point of 1.292, Applicant still faces significant risk. In other words, Applicant is assuming a risk neutral posture.

RELATIONSHIP OF CERTIFICATION COST ESTIMATE AND CENTER POINT



DISTRIBUTION OF PROJECT COSTS RESULTING FROM IN-SCOPE ESTIMATING UNCERTAINTY (BILLIONS OF DOLLARS)



DISTRIBUTION OF PROJECT COSTS RESULTING FROM IN-SCOPE ESTIMATING UNCERTAINTY AND THE IMPACT OF ABNORMAL EVENTS (BILLIONS OF DOLLARS)

FIGURE Z-7-1

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CUMULATIVE DISTRIBUTION OF THE IMPACT OF
ABNORMAL EVENTS ON PROJECT COSTS

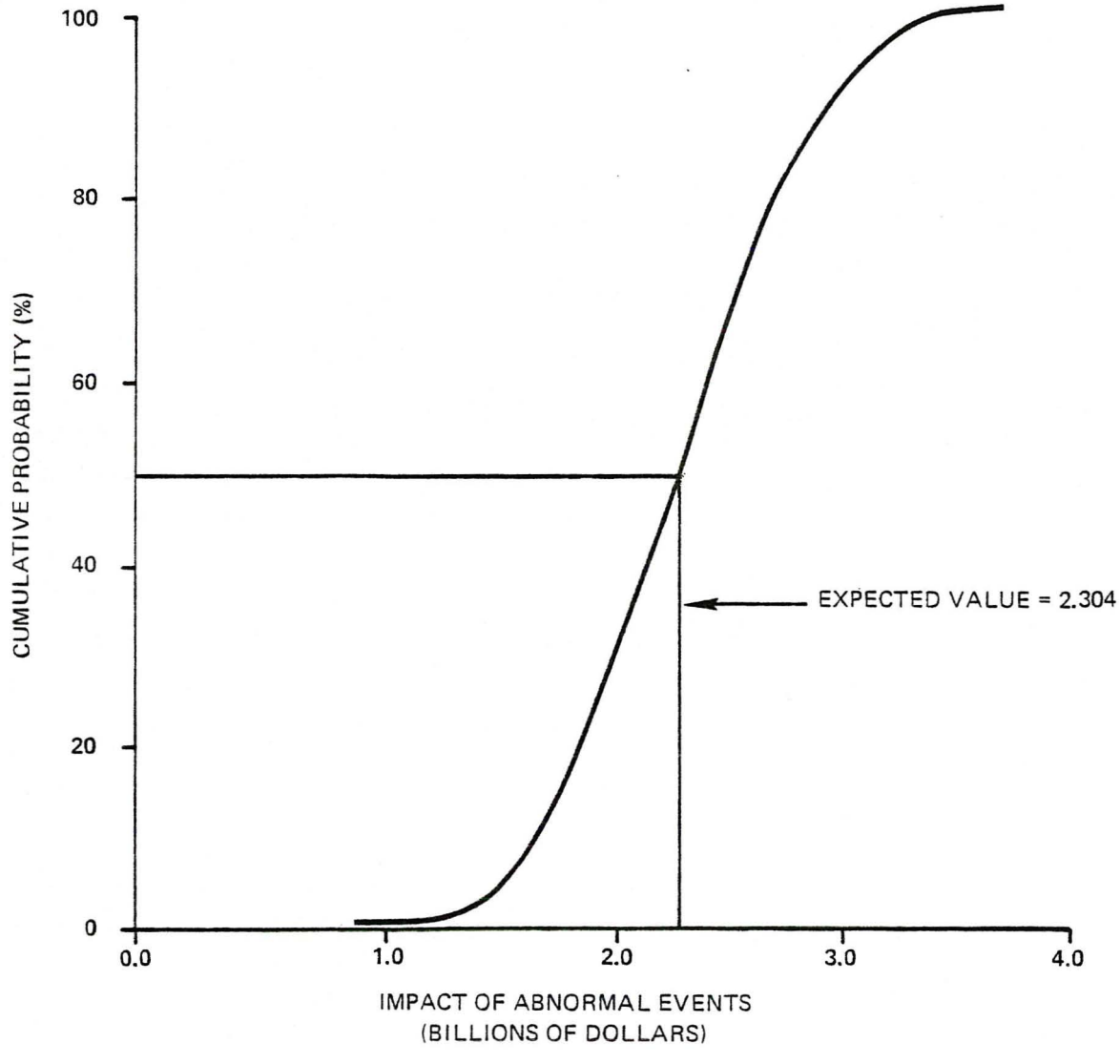

FIGURE Z-7-2

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TABLE 2-1

POTENTIAL EXOGENOUS EVENTS WHICH IMPACT PROJECT COSTS DUE TO ABNORMAL EVENTS

Terms and Interpretations of Environmental and Construction Stipulations
Delays Resulting from Third Party Interests
Changes in Federal Inspector Personnel
Changes in Federal Administration
Changes in State Administration
Pipeline Mode Changes During Construction Due to Field Conditions
Station Geotechnical Conditions Encountered After Final Design
Determination of Proximity of Aggregate After Final Design
Impact of Weather on Construction
Cultural and Paleontological Resources
Unanticipated Biological Resources
Terms and Conditions of Project Labor Agreement (PLA)
Strikes and Slowdowns
EC Quality Assurance and Control Problems
Vendor Quality Assurance and Quality Control Problems
EC Bankruptcy
Vendor Failure to Perform
Premium Transportation Charges
Domestic Markets for Construction Materials
World Markets for Transportation Services
Domestic Markets for Construction Equipment
Domestic Markets for Qualified Contractors
Domestic Markets for Craft Labor/Foremen
Lender Actions
Capital Market Conditions
Foreign Exchange Rates
Competition for Alaskan Road Use
Natural Disasters Not defined within IROR as Scope Changes
Accidents to TAPS
Transportation Accidents
Sabotage, Vandalism and Theft
Property Damage and Personal Injury Liability
Changes in Insurance Rates
Disruption of Primary Mode of Transportation
Repair of Insulation and Coating Applied at Double Jointing Facility
Unknown Impacts on Project Costs which cannot be Established

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TABLE 2-2

POTENTIAL EXOGENOUS EVENTS WHICH IMPACT PROJECT COSTS DUE TO DESIGN CHANGES

Pipeline Construction from Snowpad
Aboveground Pipeline Construction
Workpad Insulation and Width Requirements
Pipeline Mode Design
Pipeline Mode Type Used for Given Geotechnical Conditions
Waste Heat Recovery Systems in Compressor Stations
Changes in Phased Design Approach
Terms and Interpretations of Environmental and Construction Stipulations
Intra-Alaskan Connections
Station Noise and Pollution Control
Changes in Camp and Office Building Codes
Designation of Environmentally Sensitive Areas
Changes in Pipeline Operating Parameters
Changes in Assumptions Regarding Availability of Natural Gas for Line Displacement and Packing
Designs of River, Road and TAPS Crossings
Designs of Critical Areas (E.G., Atigun Pass)
Changes in Pipeline Route
Construction Timing Requirements
Crack Arrestor Requirements
Compressor Station Relocation
Pipe Insulation Requirements
Camp Relocation
Government Mandated Changes in Procurement Practices
Change in Ad Valorem Tax Terms
Change in Payroll Tax Terms
Change in Sales, Use and Other Tax Terms
Government Subsidy of Tanacross and Northway Airfields
Tariffs and Duties
Change in IROR Terms
Alaskan Road Use Terms and Conditions
Government Monitoring Procedures and Requirements
MBE and EEO Requirements
Alaska Hire Requirements
Pipeline Mode Changes During Final Design Due to Field Program Data
Station Geotechnical Conditions Determined During Final Design
Determination of Proximity of Aggregate During Final Design
Cultural Resources Determined in Field
Condition of Purchased Temporary Facilities
Unanticipated Biological Field Conditions
TAPS ROW Mitigative Measures

TABLE 2-2 (Continued)

Delay in Obtaining Unencumbered Certificate
Delay in Obtaining State ROW
Delay in Obtaining Federal ROW
Delay in Resolving Haines ROW
Delay in Obtaining Airfield Permits
Delay in Obtaining Field Program Permits
Delay in Obtaining Camp Construction Permits
Delay in Obtaining Communications Permits
Delay in Obtaining Material Site Permits
Delay in Obtaining Double Jointing Facility Permits
Delay in Obtaining Compressor Station Air Quality Permits

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TABLE 2-3

POTENTIAL EXOGENOUS EVENTS WHICH IMPACT PROJECT COSTS DUE TO SCOPE CHANGES

Pipeline Construction from Snowpad
Aboveground Pipeline Construction
Workpad Insulation and Width Requirements
Pipeline Mode Design
Pipeline Mode Type Used for Given Geotechnical Conditions
Waste Heat Recovery Systems in Compressor Stations
Terms and Interpretations of Environmental and Construction Stipulations
Intra-Alaskan Connections
Station Noise and Pollution Control
Changes in Camp and Office Building Codes
Designation of Environmentally Sensitive Areas
Changes in Pipeline Operating Parameters
Designs of River, Road and TAPS Crossings
Designs of Critical Areas (E.G., Atigun Pass)
Changes in Pipeline Route
Construction Timing Requirements
Compressor Station Relocation
Pipe Insulation Requirements
Change in Ad Valorem Tax Terms
Change in Payroll Tax Terms
Change in Sales, Use and Other Tax Terms
Government Subsidy of Tanacross and Northway Airfields
Tariffs and Duties
Change in IROR Terms
Alaskan Road Use Terms and Conditions
Government Monitoring Procedures and Requirements
MBE and EEO Requirements
Alaska Hire Requirements
TAPS ROW Mitigative Measures
Acts of War
Emergencies or Major Disasters
Delay in Obtaining River Crossing Permits
Delay in Obtaining Pipeline Construction Permits
Delay In Obtaining Material Site Permits
Delay in Obtaining Station Construction Permits
Delay in Obtaining Site Specific NTPs from OFI and SPCO
Delay in Obtaining Operating Permits

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3.0 OTHER IROR ISSUES

In addition to the uncertainties associated with the CCE and abnormal or unexpected events, Applicant has identified two other issues that affect the IROR procedure:

- The appropriate labor costs indices to use to deflate actual project labor costs.
- The treatment of third-party monitoring and other government costs within the IROR procedure.

Applicant's position on each of these issues is discussed below.

3.1 LABOR INDICES USED IN IROR MECHANISM

In Order 31, the FERC stated that the actual capital cost (the sum of direct construction costs actually incurred in constructing the pipeline) should be adjusted to eliminate the effect of general inflation prior to calculating the cost performance ratio and the IROR. [7] For this purpose, the FERC provided an inflation adjustment mechanism to deflate direct construction costs (excluding interest during construction) to base-year prices for comparison with the CCE. The inflation index used in the inflation adjustment mechanism has the following characteristics:

- The adjustment is accomplished using a composite index of construction costs indices.
- The composite index is a weighted average of 42 indices currently available from the government or other recognized sources.
- Each of the 42 indices measures the price index for a specific category of construction costs.
- The weighted average varies from quarter to quarter and is based on the proportion of the specific category of costs in the total costs for the project as estimated in the CCE.

[7] Order No. 31, p. 111.

3.1 LABOR INDICES USED IN IROR MECHANISM (Continued)

- The weights used for any construction occurring after the end of the estimated construction period will be those used in the last year of the construction in the estimated schedule.

In accordance with the Commission's invitation in Order 31-B [8], Applicant proposes that the proper labor cost index component to the composite index for the inflation adjustment mechanism should be that index or indices which are explicitly defined in the terms and conditions of the Project Labor Agreement. This approach would be in lieu of the predetermined labor indices now contained in Order No. 31-B, p. 28. The adoption of a labor index or set of indices by Applicant prior to negotiating actual wage rates and escalation clauses in the terms and conditions of the Project Labor Agreement will severely limit Applicant's ability to reduce costs. Such predetermined indices will establish an artificial floor for wage rate discussions and thus constrain Applicant's negotiating position. This will undoubtedly result in higher project labor costs than if the labor indices were not predetermined. Consequently, the proper labor cost index component to the composite index for the inflation adjustment mechanism, should be that index or indices which are explicitly defined in the terms and conditions of the Project Labor Agreement.

Using the labor cost indices from the Project Labor Agreement will not reduce Applicant's incentive to control costs. Craft labor represents such a significant share of total project costs (approximately 20 percent), that Applicant has every incentive to control costs in order to arrange effective and timely financing.

3.2 TREATMENT OF THIRD-PARTY MONITORING AND OTHER GOVERNMENT COSTS IN THE IROR MECHANISM

Under the terms of the Mineral Leasing Act (Section 28) and Alaska Statutes 38.35, Applicant is obligated to reimburse federal and state agencies for oversight expenditures. In preparing the CCE, Applicant requested and received an estimate of reimbursable costs that would be incurred by various federal and state agencies. Applicant has not analyzed the validity of the cost submissions of such agencies. For filing purposes, these costs have been included in the CCE. However, Applicant proposes that the CCE be adjusted

[8] Order 31, p. 116 and Order 31-B, p. 28.

3.2 TREATMENT OF THIRD-PARTY MONITORING AND OTHER GOVERNMENT COSTS IN THE IROR MECHANISM (Continued)

for third-party monitoring and other government-related costs to equal such costs in the actual capital costs for determination of the cost performance ratio.

Since the projected capital costs for third-party monitoring were developed by governmental agencies, Applicant should not be required to accept a cost performance ratio based in part on cost estimates not prepared under its supervision and control. Examples of the costs included are a $50,000,000 Community Impact Contingency Fund, training expenses to upgrade the skills of local welders, and $22,000,000 for costs which include the construction of a jail facility and the expansion of a hospital wing.

Government-related costs will escalate as a result of inflation, as well as from real increases due to increasing demands for socioeconomic assistance, etc. The real cost increases are not within the direct control of Applicant. Applicant would face tremendous cost risks if these and other uncontrollable government-related costs were imposed on the project at a later date and not allowed as a design or scope change.

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4.0 SUMMARY OF ABNORMAL EVENTS

This section provides a listing and description of 36 abnormal events which could occur during the construction of the project. Each of these events was evaluated in terms of assumptions made in the engineering estimate, the probability of occurrence of each on this project, and the anticipated maximum, minimum and most likely cost and schedule impacts which would result.

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EVENT #1: TERMS AND INTERPRETATIONS OF ENVIRONMENTAL AND CONSTRUCTION STIPULATIONS

Probability of Occurrence: 100%
Range of Cost Impacts
Minimum: $--5 MM
Most Likely: $130 MM
Maximum: $200 MM

ENGINEERING ESTIMATE ASSUMPTIONS

General stipulations have been promulgated. A very specific interpretive guide to the stipulations will be attached to the grant of ROW and those interpretations will be identical to assumptions in the base estimate. Notices to Proceed (NTPs) and regulatory permits will not be significantly delayed due to interpretation of stipulations. (Permit applications will be scheduled to provide expected receipt of permits 6 months prior to mobilization for the associated activity.)

PROBABILITY

There is a 100 percent probability of some differences in interpretation of stipulations among NWA/PMC, the government and contractors.

COST RANGE

Costs affected will be for engineering and field activities related to NTPs and regulatory permits, i.e., about $800 million in engineering and $2.7 billion in field activities. Half the cost impact would be treated as design or scope changes; the remainder falls within abnormal events. These events will not be associated with delays in receiving permits, but with what must be done in the field. Accordingly, the cost effects are: 1) a minimum of minus $5 MM, 2) most likely, less than plus $130 MM, and 3) a maximum of less than plus $200 MM.

DELAY RANGE AND MILESTONE IMPACT

Cost effect is implicit in cost range.

EVENT #2: DELAYS RESULTING FROM THIRD PARTY INTERESTS

Probability of Occurrence:	50%
Range of Cost Impacts	
Minimum:	0
Most Likely:	$490 MM
Maximum:	$660 MM

ENGINEERING ESTIMATE ASSUMPTIONS

The estimate assumes that there will be no delays resulting from third party interests.

PROBABILITY

Due to the scope and location of the project, the potential exists for delays caused by third parties, e.g. environmental groups, private landowners, native corporations, etc. These delays will be beyond the control of government and NWA personnel and can result in significant costs to the project. Experts estimate that there is a 50 percent probability that delays will occur as a result of third parties operating outside the control of NWA and government personnel.

RANGE OF VALUES

It is likely that a six-month delay could occur. If this occurs, the sponsors will still incur costs of some craft labor and salaried personnel. It is more cost effective to maintain good personnel during a delay than to conduct massive layoffs. If this occurred during civil construction, the cost impact would be $490 MM. The worst impact would be a year's delay during peak construction. This would result in increased costs of $660 MM.

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EVENT #3 CHANGES IN FEDERAL INSPECTOR PERSONNEL

Probability of Occurrence: -
Range of Cost Impacts
Minimum: -
Most Likely: -
Maximum: -

ASSUMPTIONS

Applicant assumes that changes in key members of the Federal Inspector's staff will not deter the Office of the Federal Inspector from expeditious treatment of the project. In the event that changes in staff do affect the project, Applicant anticipates such effects would normally be encompassed by the IROR design-and-scope-change mechanism.

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EVENT #4: CHANGES IN FEDERAL ADMINISTRATION

Probability of Occurrence: -
Range of Cost Impacts
Minimum: -
Most Likely: -
Maximum: -

ASSUMPTIONS

Applicant assumes that, in the event there are changes in Federal Administration over the course of the project, these changes will not change the Administration's general support and desire to expedite the project. In the event that changes in Administration do affect the project, Applicant anticipates such effects would normally be encompassed by the IROR design-and-scope-change mechanism.

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EVENT #5: CHANGES IN STATE ADMINISTRATION

Probability of Occurrence: -
Range of Cost Impacts
Minimum: -
Most Likely: -
Maximum: -

ASSUMPTIONS

Applicant assumes that, in the event there are changes in the State of Alaska Administration over the course of the project, these changes will not affect the State Administration's general support and desire to expedite the project. In the event that changes in the State Administration do affect the project, Applicant anticipates such effects would normally be encompassed by the IROR design-and-scope-change mechanism.

EVENT #6: PIPELINE MODE CHANGES DURING CONSTRUCTION DUE TO FIELD CONDITIONS

Probability of Occurrence:	100%
Range of Cost Impacts	
Minimum:	0
Most Likely:	$ 75 MM
Maximum:	$210 MM

ENGINEERING ESTIMATE ASSUMPTIONS

Field Programs are assumed to be comprehensive so there will be little designing during construction.

PROBABILITY

There is a 100 percent probability that there will be surprises due to field conditions along the 743 miles of the route.

RANGE OF VALUES

Contractors will not be likely to stop work to reduce costs, because delays would negate potential savings. Costs due to changes in mode will result from delays due to crews waiting for new designs for the specific area, as well as approval to resume construction. The minimum value assumes that mode changes are encountered which create a net impact of zero costs. The most likely value assumes that mode changes will be required which will increase pipeline EC costs by 5 percent. The maximum value assumes a 13 percent increase in pipeline EC costs. Cost increases result from increased depth, increased use of insulated mode, and increased level of geotechnical information available when construction begins.

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EVENT #7: STATION GEOTECHNICAL CONDITIONS ENCOUNTERED AFTER FINAL DESIGN

Probability of Occurrence: 100%
Range of Cost Impacts
Minimum: 0
Most Likely: $4 MM
Maximum: $8 MM

ENGINEERING ESTIMATE ASSUMPTIONS

Geotechnical conditions will vary dramatically from site to site. Geotechnical conditions will be well understood prior to completion of final design as a result of future, thorough field/drilling programs. These changes will be incorporated into final designs and allowed by OFI as design changes.

PROBABILITY

There is a 100 percent probability that actual conditions will vary from projected.

COST RANGE

Costs would be impacted only for site preparation, piling, excavation and concrete (i.e., no impact on station design standardization). Possible cost impacts on these activities are: minimum 0%; most likely +7.5%; maximum +15%. Total cost in the engineering estimate for site preparation, etc., is about $55 MM. Therefore, the cost range is calculated as: minimum $0, most likely $+4 MM, maximum $+8 MM.

DELAY RANGE AND MILESTONE IMPACT

Cost effect is implicit in cost range.

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EVENT #8: DETERMINATION OF PROXIMITY OF AGGREGATE AFTER FINAL DESIGN

Probability of Occurrence: 100%
Range of Cost Impact
Minimum: (See below)
Most Likely:
Maximum:

VALUES

Pipeline Section	Minimum	Most Likely	Maximum
1	$ 6.9 MM	$ 6.9 MM	$ 7.6 MM
2	$ 7.3 MM	$ 7.3 MM	$ 8.7 MM
3	$ 9.0 MM	$12.6 MM	$13.5 MM
4	$12.4 MM	$13.9 MM	$23.0 MM
5	$ 8.9 MM	$12.4 MM	$13.3 MM
6	$ 7.7 MM	$13.0 MM	$13.9 MM

ENGINEERING ESTIMATE ASSUMPTIONS

The estimate assumes the project uses optimally located material sites with adequate aggregate reserves. Sites have been chosen on the basis of accessibility, haul distance, environmental stipulations and prior use.

PROBABILITY DETERMINATION

Because all sites are optimally located, there is a 100 percent probability that haul distances and costs will be increased.

COST RANGE

Experts estimated there is a 10 percent unreliability in quantities contained in aggregate sites. The increased costs due to material unreliability is 10 percent, resulting from increased hauling costs. By hauling from nonoptimal sites, changes in terrain will increase the haul costs above those resulting from the 10 percent unreliability. These values were created by multiplying 10 percent plus the terrain factor times aggregate costs. Terrain factors ranged from no cost impact in pipeline Section 1 to 200 percent in pipeline Section 4. Costs will not decrease because sites are optimally located, and excess material in one site will not reduce the cost in supplying neighboring sites.

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EVENT #9: IMPACT OF WEATHER ON CONSTRUCTION

Probability of Occurrence:	100%
Range of Cost Impacts	
Minimum:	$-10 MM
Most Likely:	$ 90 MM
Maximum:	$180 MM

ENGINEERING ESTIMATE ASSUMPTIONS

The estimate assumes some loss of productivity due to arctic weather. It is assumed that the estimate reflects construction in an average weather year like 1976 (a year of peak TAPS construction).

PROBABILITY

There is a 100 percent probability that weather will impact the project.

RANGE OF VALUES

At a minimum, project costs may decrease as a result of favorable weather. A most likely case assumes that there will be some weather delays. One estimate of the $90 MM most likely value assumes a total of 30 days delay in construction at a cost of $3 MM per day of delay during peak construction activity. The maximum value assumes approximately 60 days of delay resulting from weather during peak construction. By adding crews to make up for delays, the project will finish on time.

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EVENT #10: CULTURAL AND PALEONTOLOGICAL RESOURCES

Probability of Occurrence: 5%
Range of Cost Impacts
Minimum: 0
Most Likely: $3 MM
Maximum: $6 MM

ENGINEERING ESTIMATE ASSUMPTIONS

Extensive field programs will be undertaken including walking the ROW, access road, etc., to identify any possible cultural and paleontological resources. The estimate has no allowance for unexpected identification of resources during construction.

PROBABILITY

The 5 percent probability of unexpected resources being discovered is due to the thoroughness of the preconstruction field survey. However, there is some chance of resources being identified during ditching, material site development, or during breaking of ground.

COST RANGE

If cultural, or more likely, paleontological remains are found, e.g., in frozen sites during ditching, then the project organization will fulfill all legal requirements by reporting the occurrence and determining the extent and nature of the resource. A maximum case is that this would occur once, resulting in a one-mile reroute valued at $6 MM. There is no chance of a cost decrease since any discovery will delay construction. Therefore, a most likely case is a reroute of 1/2 mile costing about $3 MM.

DELAY RANGE AND MILESTONE IMPACT

Costs of any delay are implicit in the cost range.

EVENT #11: UNANTICIPATED BIOLOGICAL RESOURCES

Probability of Occurrence: 100%
Range of Cost Impacts

Minimum:	0
Most Likely:	$20 MM
Maximum:	$60 MM

ENGINEERING ESTIMATE ASSUMPTIONS

The estimate assumes that seasonal restraints (shown in the March Charts), will reflect known biological resources. Of particular concern are peregrine falcons and fisheries. No allowance is made for unanticipated biological resources once construction activities start.

PROBABILITY

There is a 100 percent probability that there will be an incident of unanticipated biological resources.

COST RANGE

Discovery of a peregrine hatchery could result in a reroute. Unanticipated fish stream activity could result in a significant break in cadence. As a maximum case, there may be 18 occurrences of unanticipated biological conditions or about 3 per pipeline section over the 3-year construction period. As a maximum, we assume 6 one-mile reroutes due to peregrine hatcheries and 12 breaks in cadence due to fisheries. Each reroute has a cost of about $6 MM. Each break in cadence is assigned a cost of $2 MM for a total maximum cost of $60 MM. The most likely case if $20 MM (2 reroutes and 4 breaks in cadence) and there is no chance of a cost decrease.

DELAY RANGE AND MILESTONE IMPACT

Costs associated with delays are implicit in the cost range.

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EVENT #12: TERMS AND CONDITIONS OF PROJECT LABOR AGREEMENT (PLA)

Probability of Occurrence: 100%
Range of Cost Impacts
Minimum: $-15 MM
Most Likely: $115 MM
Maximum: $265 MM

ENGINEERING ESTIMATE ASSUMPTIONS

The estimate is consistent with terms and conditions of existing labor agreements in Alaska (i.e., the SOHIO Motor Pool Labor Agreement) which includes a no-strike clause. The estimate includes about 50 million craft hours at about $30 per hour, for a total of $1.5 billion. The estimate assumes no delays in negotiating the PLA.

PROBABILITY

There is a 100 percent probability of some differences, though they may be minor.

COST RANGE

Encompasses all terms and conditions of the PLA, as negotiated compensation and noncompensation terms have a direct bearing on each. The values were estimated by averaging the estimates of experts. Estimates were:

1) Minimum, 0% change; most likely, +10%; maximum, +20%.
2) Minimum, -1%; most likely, +5%; maximum, +15%.

Therefore, the average is:

1) Minimum, -1%; most likely, +7.5%; maximum, +17.5%.

The cost range is therefore:

- Minimum, $-15 MM
- Most Likely, $115 MM
- Maximum, $265 MM

If the EC contracts were cost plus, then the most likely, and the maximum values would be substantially higher.

DELAY RANGE AND MILESTONE IMPACT

Cost effect is implicit in cost range. (No delays in negotiating the PLA.)

EVENT #13: STRIKES AND SLOWDOWNS

Probability of Occurrence:	100%
Range of Cost Impacts	
Minimum:	0
Most Likely:	$30 MM
Maximum:	$75 MM

ENGINEERING ESTIMATE ASSUMPTIONS

No strikes, slowdowns, or wobbles. With fixed price contracts, ECs will assume the risk of labor dissention and administer the labor agreement.

PROBABILITY

There is a 100 percent probability of some intentional reduction in productivity on the part of labor as a result of dissatisfactions.

COST RANGE

The above range in costs assumes that there are no strikes and that ECs are effective in administering the labor agreement. However, costs may still increase if slowdowns occur. Therefore, minimum cost change of 0%, most likely of +2% ($+30 MM), maximum of not more than +5% ($+75 MM). If project sponsors are forced to enter into cost-plus contracts with ECs, slowdowns and wobbles could result in significantly higher cost increases.

DELAY RANGE AND MILESTONE IMPACT

Cost effect is implicit in cost range.

EVENT #14: EC QUALITY ASSURANCE AND QUALITY CONTROL PROBLEMS

Probability of Occurrence: 100%
Range of Cost Impacts
Minimum: 0
Most Likely: $ 50 MM
Maximum: $100 MM

ENGINEERING ESTIMATE ASSUMPTIONS

The estimate assumes a very aggressive quality control and assurance program which increases potential for rework. It also assumes that the plans presented adequately assess quality control and quality assurance requirements.

DETERMINATION OF PROBABILITY

There is a 100 percent probability that quality control or assurance problems will occur during the project.

DETERMINATION OF VALUES

The minimum value is zero. Many problems can be routinely resolved without the need for additional expenditures. It is unlikely that costs could be less than estimated because it is a conservative estimate.

The most likely value assumes that inexperienced craft labor will increase the inspection and rework required. This in turn requires the addition of more inspectors. The rework forces a reaction, resulting in increased overall inspection to prevent problems from occurring in other areas.

The maximum value assumes that a large quality problem occurs which causes remedial action and a significant increase in the number of inspectors required. All the remedial work and problems are assumed to have occurred despite the efforts of NWA, the PMC, ECs, and government inspectors.

DELAY RANGE

Delays are included in the cost range.

EVENT #15: VENDOR QUALITY ASSURANCE AND QUALITY CONTROL PROBLEMS

Probability of Occurrence:	100%
Range of Cost Impacts	
Minimum:	0
Most Likely:	$10 MM
Maximum	$30 MM

ENGINEERING ESTIMATE ASSUMPTIONS

Vendor contracts for permanent materials and consumables are valued at about $1 billion. Both the PMC and ECs will procure some of these items. Both the vendors and contractors will have QA/QC responsibilities as will NWA on certain key items. The estimate has no allowance for QA/QC problems with goods secured from these vendors.

PROBABILITY

There is a 100 percent probability that there will be some QA/QC problems with items supplied by vendors.

COST RANGE

Experience on other major projects indicates that problems with the quality of goods supplied by vendors can result in cost increases to the project sponsors of up to 3 percent of the value of the associated items or $30 MM. There is no possibility of cost decreases associated with vendor QA/QC and the most likely cost increase is expected to be $10 MM or 1 percent of the value of vendor supplied materials.

DELAY RANGE AND MILESTONE IMPACT

Cost effects of delays are implicit in cost range.

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EVENT #16: EXECUTION CONTRACTOR (EC) BANKRUPTCY

Probability of Occurrence:	50%
Range of Cost Impacts	
Minimum:	$10 MM
Most Likely:	$30 MM
Maximum:	$50 MM

ENGINEERING ESTIMATE ASSUMPTIONS

No EC will face bankruptcy.

PROBABILITY DETERMINATION

There are a limited number of contractors who are capable of undertaking this type of project or parts thereof. Some examples are: Morrison-Knudsen, Reading & Bates, Sedco, Williams International, Bechtel, Guy F. Atkinson, Peter Kiewit, Green, Perrini, and Majestic-Wiley. The impact of unit-price contracting on these companies is especially severe, and the magnitude of this project will test these firms' financial capacity. It is estimated that there is a 50 percent probability of bankruptcy for one contractor.

COST RANGE

The range was determined by estimating the amount of payables that would be outstanding for each EC when cashflow problems occurred. It is assumed that NWA, in the case of bankruptcy, will pay off the amounts due, and the PMC will begin managing construction directly. It is also assumed that the PMC will be monitoring each EC so a bankruptcy will not be a surprise and they will be prepared to assume control.

DELAY RANGE

There is no delay because the PMC will step in immediately and manage construction.

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EVENT #17: VENDOR FAILURE TO PERFORM

Probability of Occurrence:	100%
Range of Cost Impacts	
Minimum:	0
Most Likely:	$ 40 MM
Maximum:	$100 MM

ENGINEERING ESTIMATE ASSUMPTION

Vendor contracts for permanent materials and consumables are valued at about $1 billion. The estimate provides no allowance for vendor failure to perform according to contract terms.

PROBABILITY

On a project of this magnitude, there is a 100 percent probability that some vendors will miss deadlines or not produce items to specification.

COST RANGE

Vendor failure to perform can cause 1) substantial delays or disruptions in the field, 2) additional requirements to other manufacturers' on an expedited basis, 3) and field failure of equipment that could not be tested at the factory due to schedule compression. Experience on other major projects indicates that such problems can result in a 10 percent increase in the cost of materials and consumables or about $100 MM. No decrease in the base estimate is possible and the most likely occurrence is about 4 percent increase or $40 MM.

DELAY RANGE AND MILESTONE IMPACT

Cost effects of delays are implicit in the cost range.

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EVENT #18: PREMIUM TRANSPORTATION CHARGES

Probability of Occurrence: 100%
Range of Cost Impacts

Minimum:	$ 2 MM
Most Likely:	$20 MM
Maximum:	$40 MM

ENGINEERING ESTIMATE ASSUMPTION

The estimate contains a small allowance for premium transportation costs to expedite transportation in key situations.

PROBABILITY

There is a 100 percent probability that actual costs will exceed the funds provided for premium transportation costs in the estimate.

COST RANGE

The principal reasons for premium transportation costs are: vendor failures to meet schedule, material or equipment failure in the field, and vandalism. At a maximum, premium transportation will affect less than 10 percent of transportation shipments for an increment above the base estimate of $40 MM. It is most likely that incremental charges will be $20 MM. The minimum increase may be $2 MM.

DELAY RANGE AND MILESTONE IMPACT

None. Premium transportation is used in instances where other events increase the potential for costly delays.

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EVENT #19: DOMESTIC MARKETS FOR CONSTRUCTION MATERIALS

Probability of Occurrence:	100%
Range of Cost Impacts	
Minimum:	0
Most Likely:	$ 50 MM
Maximum:	$200 MM

ENGINEERING ESTIMATE ASSUMPTION

The estimate assumes that the domestic markets prevailing today for construction materials will prevail at the time construction materials are procured. Currently, the market for construction supplies is rather slack. (Vendor contracts for consumables and permanent materials are valued at about $1 billion.)

PROBABILITY

There is a 100 percent probability for changes in the world markets.

COST RANGE

Many major construction projects are being contemplated worldwide for the same period as the ANGTS. A sharp increase in construction activity in this period may occur, placing strains on suppliers of construction materials, resulting in sharp price increases, shifts to more expensive sources, or delays, all with substantial cost effects. Experience on other major projects indicates that costs of vendor-supplied materials may increase by about 20 percent when activity in construction markets increases dramatically. Twenty percent of the vendor-supplied materials on this project is equivalent to about $200 MM. It is most likely, however, that expected increases in construction activity will result in overall price increases for materials and consumables of five percent, or $50 MM. There is no significant probability of a cost decrease below the base estimate.

DELAY RANGE AND MILESTONE IMPACT

Costs associated with delays are implicit in the cost range.

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EVENT #20: WORLD MARKETS FOR TRANSPORTATION SERVICES

Probability of Occurrence:	100%
Range of Cost Impacts	
Minimum:	0
Most Likely:	$ 30 MM
Maximum:	$100 MM

ENGINEERING ESTIMATE ASSUMPTION

Total transportation costs for the project are valued at about $450 MM based on existing market conditions. The estimate has no allowance for possible changes in market conditions. Market conditions are currently relatively slack.

PROBABILITY

There is a 100 percent probability of some changes in market conditions.

COST RANGE

Maximum of $100 MM based on approximately 25 percent increase in mainline pipe shipping costs in the event of tight market conditions for most transportation modes. Most likely case is about a 7% increase in costs or $30 MM. There is no significant probability of a cost decrease, as current shipping rates reflect relative inactivity in the shipping markets.

DELAY RANGE AND MILESTONE IMPACT

Costs associated with possible delays (e.g. securing deep draft ships and barges) are implicit in the cost range.

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EVENT #21: DOMESTIC MARKETS FOR CONSTRUCTION EQUIPMENT

Probability of Occurrence: 100%
Range of Cost Impacts

Minimum:	0
Most Likely:	$20 MM
Maximum:	$80 MM

ENGINEERING ESTIMATE ASSUMPTION

Construction equipment costs are valued at about $400 MM. The estimate assumes current market conditions prevailing at the time of construction.

PROBABILITY

There is a 100 percent probability of changes in market conditions.

COST RANGE

Construction markets are currently fairly slack, but many major construction projects are being contemplated worldwide for the same period as the ANGTS. A sharp increase in construction activity can lead to sharp price increases for construction equipment, shifts to less effective substitute equipment, and delays in securing necessary equipment. Experience on other major projects indicates that the construction equipment costs on a project of this nature may increase by as much as 20 percent, due to increases in global or regional construction activity or $80 MM. It is most likely, however, that expected market conditions will result in a 5 percent increase or $20 MM. There is no significant possibility of a price decrease.

DELAY RANGE AND MILESTONE IMPACT

Costs associated with delays are implicit in the cost range.

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EVENT #22: DOMESTIC MARKETS FOR QUALIFIED CONTRACTORS

Probability of Occurrence:	100%
Range of Cost Impacts	
Minimum:	0
Most Likely:	$45 MM
Maximum:	$75 MM

ENGINEERING ESTIMATE ASSUMPTION

The estimate assumes that contractors will be readily available to bid for and work on this project.

PROBABILITY

There is a 100 percent probability that domestic markets for contractors will change.

COST RANGE

There are a limited number of experienced contractors capable of executing this project. They are limited due to the size of the project, which requires significant managerial and financial strength. If the market for these contractors becomes tighter, i.e., if there is an increase in projects competing for their services, they will be more expensive. Furthermore, some contractors may require up-front financing in order to line up the necessary equipment, etc., for their effort. There is a 10 percent probability that world markets will not change enough to impact project costs. It is most likely that world market conditions will create a $45 MM increase in the fees charged by all contractors on the project. At a maximum, market conditions could increase costs by $75 million. There will be no delays resulting from this event.

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EVENT #23: DOMESTIC MARKETS FOR CRAFT LABOR/FOREMEN

Probability of Occurrence: 100%
Range of Cost Impacts
Minimum: 0
Most Likely: $100 MM
Maximum: $225 MM

ENGINEERING ESTIMATE ASSUMPTION

Craft labor costs are estimated to be about $1.5 billion reflecting 50 MM manhours at about $30 per hour.

PROBABILITY

There is a 100 percent probability of changes in market conditions.

COST RANGE

This cost range calculation explicitly excludes possible effects of factors considered in "Terms and Conditions of the Project Labor Agreement." Sharp increases in construction activity on the North Slope and elsewhere could make it more difficult and costly to find skilled craftsmen and labor. The unavailability of skilled labor, such as welders, during periods of high construction activity can have a major effect on productivity, the need for rework, and such intangibles as worker morale. As a maximum, shortages of skilled labor could increase craft labor costs by up to 15 percent or $225 MM. Given expectations about competing construction activity, it is most likely that costs will only increase by about 7 percent or $100 MM. There is no significant chance of reduced costs because the estimate assumes skilled labor available in adequate numbers.

DELAY RANGE AND MILESTONE IMPACT

Costs of any delays are implicit in the cost range estimates.

EVENT #24: LENDER ACTIONS

Probability of Occurrence:	See below
Range of Cost Impacts	
Minimum:	$ 46 MM
Most Likely:	$115 MM
Maximum:	$230 MM

ENGINEERING ESTIMATE ASSUMPTION

Lenders will be periodically updated on project progress, but will not intervene in any way, e.g., by restricting drawdown of debt below requirements.

PROBABILITY

There will always be a judgment factor in the release of funds. There is a 5 percent probability of significant lender action. If lender actions occur, then there is a 5 percent possibility that project completion will be delayed.

COST RANGE

If lender action is taken without an effect on project completion, we assume it will occur just prior to, or at the beginning of the first major construction season and that the range of cost impacts will be: minimum, +2%; most likely, +5%; maximum, +10% of the total costs for that construction season (i.e., about $2.3 billion). Therefore, the range of cost impacts will be a minimum of $46 MM, most likely $115 MM, and a maximum of $230 MM.

DELAY RANGE AND MILESTONE IMPACT

If there is no delay in project completion, then the cost impact of delays are implicit in the calculation of the cost range. However, if project completion delay occurs, then we assume the lender action occurs at the beginning of the third (final) construction season and results in the following distribution of possible delays: minimum-12 weeks, most likely-19 weeks, maximum-26 weeks. In this case, the cost impacts should be calculated as a rate/ function of time.

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EVENT #25: CAPITAL MARKET CONDITIONS

Probability of Occurrence:	See below
Range of Cost Impacts	
Minimum:	$ 37 MM
Most Likely:	$185 MM
Maximum:	$370 MM

ENGINEERING ESTIMATE ASSUMPTION

Assumes stable capital market conditions prevail throughout the project.

PROBABILITY

There is a 10 percent probability of a substantial major change in capital market conditions during the project. If these changes occur, then there will be a 5 percent probability of project completion delay.

COST RANGE

If capital market conditions change significantly without an effect on project completion, we assume that the range of cost impacts will be: minimum +.5%, most likely +2.5%, and maximum +5% of total project costs. Therefore, the project range of cost impacts is: minimum $37 MM, most likely $185 MM, and maximum $370 MM.

DELAY RANGE AND MILESTONE IMPACT

If there is no delay in project completion, then the cost impact of any delays in specific activities are implicit in the calculation of the "cost range." However, if project completion delay occurs, then we assume the market changes occur at the beginning of the third (final) construction season and result in the following distribution of possible delays: 10%-26 weeks, most likely-39 weeks, maximum-52 weeks. In this case, the cost impact should be calculated as a rate/function of time.

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EVENT #26: FOREIGN EXCHANGE RATE

Probability of Occurrence:	100%
Range of Cost Impacts	
Minimum:	$-175 MM
Most Likely:	$ +25 MM
Maximum:	$+265 MM

ENGINEERING ESTIMATE ASSUMPTION

No change from existing exchange rates. Prices from alternative suppliers of key equipment/materials were averaged to arrive at a unit price.

PROBABILITY

There is a 100 percent probability that exchange rates will vary.

COST RANGE

Exchange rates were examined relative to the US dollar for 1972 to 1979, for the 4 countries that may provide substantial inputs to the project, i.e., Japan, Canada, Germany, and Italy. The distribution of costs was calculated as:

- Minimum - equals the maximum decline over three years for any country (-27% for Italy).
- Most likely - equals average of the maximum declines and maximum increases in exchange rates over any three year period for every country (+4%).
- Maximum - equals the maximum increase over three years for any country (+43% for Germany).

DELAY RANGE AND MILESTONE IMPACT

None.

EVENT #27: COMPETITION FOR ALASKAN ROAD USE

Probability of Occurrence:	100%
Range of Cost Impacts	
Minimum:	0
Most Likely:	$25 MM
Maximum:	$50 MM

ENGINEERING ESTIMATE ASSUMPTION

No delays due to competition for use of Alaskan Haul Road.

PROBABILITY

There is virtually a 100 percent probability of some delays.

COST RANGE

Cost range only considers increased costs due to idle transportation equipment waiting to access the haul route, and breaks in cadence in the field. (Therefore, no premiums for alternatively expedited transportation are included in these numbers.) Experience on TAPS indicates that constrained access to the haul road could result in cost increases of as much as $50 MM, but the most likely case is $25 MM with no significant probability of cost decreases as no delays are currently assumed.

DELAY RANGE AND MILESTONE IMPACT

Costs associated with delays are implicit in cost range estimates.

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EVENT #28: NATURAL DISASTERS NOT DEFINED WITHIN IROR AS SCOPE CHANGES

Probability of Occurrence:	100%
Range of Cost Impacts	
Minimum:	0
Most Likely:	$ 20 MM
Maximum:	$250 MM

ENGINEERING ESTIMATE ASSUMPTIONS

No natural disasters. Contemplated insurance coverage, while providing first dollar coverage for property damage, would not fully offset damages from a natural disaster, e.g., flood, earthquake, fire or explosion.

PROBABILITY

There is a 100 percent probability of some natural disaster occurring along the pipeline ROW during the 3-year construction period.

COST RANGE

About $5.7 billion of value is added to the project between the start of the project and completion. As a maximum, there may be several significant natural disasters that do not qualify as a national disaster. Assuming each occurrence resulted in significant rework and perhaps even delays in completion, then costs could amount to $250 million, or less than 5 percent of the total value added during construction. However, it is most likely that costs of natural disasters will be substantially below 1 percent of value added, e.g., resulting in 3 miles of rework at $6.5 MM per mile or about $20 MM. There is no chance of a reduction in costs associated with this event.

DELAY RANGE AND MILESTONE IMPACTS

A natural disaster could result in substantial delays; the costs of such delays are implicit in the cost ranges above.

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EVENT #29: ACCIDENT TO TAPS

Probability of Occurrence:	100%
Range of Cost Impacts	
Minimum:	0
Most Likely:	$ 10 MM
Maximum:	$100 MM

ENGINEERING ESTIMATE ASSUMPTIONS

The estimate includes funds to construct a gravel berm between TAPS and NWA construction activities where the lines are in close proximity. NWA's insurance coverage is limited to $1 MM for each occurrence and $10 MM total coverage. World insurance market capacity is presently designed to cover $100 MM of a major accident to TAPS, absent any mutual limitation agreement that will be negotiated with TAPS in the future.

PROBABILITY

There is a 100 percent probability that some occurrence will happen that will impact cost.

DETERMINATION OF VALUES

The risk of an accident to TAPS arises from the potential of runaway equipment to hit Vertical Support Members (VSMs) (per Alyeska and NWA field programs experience). There are three potential causes of runaway equipment. In order of importance these are: lack of experienced operators, loss of traction on ice, and mechanical malfunction. In addition, accidents are more likely to occur in hilly terrain (in pipeline Sections 2 and 3) and during the shoulder months. Accidents and the resulting delays are most likely to occur during stringing and bending operations.

The values were assessed by estimating the delays associated with accidents, the cost of environmental cleanups, and repairs to TAPS. For the best case, it was assumed that no accidents would occur. For the most likely case, it was assumed that ten minor accidents would occur resulting in minor environmental cleanup, with one day's delay for each accident and repair to TAPS. At a maximum, it was assumed that there was a significant oil spill, that TAPS required substantial local repairs, and that work was stopped in that area for a month.

EVENT #30: TRANSPORTATION ACCIDENT

Probability of Occurrence:	100%
Range of Cost Impacts	
Minimum:	0
Most Likely:	$ 1 MM
Maximum:	$50 MM

ENGINEERING ESTIMATE ASSUMPTIONS

No accidents are associated with the $450 MM estimated for transportation. Cost of materials being transported and the freight charges are insured at 110 percent of value. Spare parts/materials ordering policy will mitigate possible near-term impacts of supply interruption.

PROBABILITY

There is a 100 percent probability that some accidents will occur.

COST RANGE

While the loss of material will be zero because of insurance for freight/material value plus minimization of consequential damage through spare parts/materials policy, delays caused by accidents could impact project costs. Most likely, there will be a minimal ($1 MM) impact created by delays. However, the ripple effects of a longer delay such as men and equipment waiting for key resources could create as much as a $50 MM cost impact.

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EVENT #31: SABOTAGE, VANDALISM AND THEFT

Probability of Occurrence:	100%
Range of Cost Impacts	
Minimum:	0
Most Likely:	$ 50 MM
Maximum:	$220 MM

ENGINEERING ESTIMATE ASSUMPTIONS

No allowance for sabotage, vandalism and theft. Consequential damages not insured.

PROBABILITY

Sabotage, vandalism and theft can have a significant effect on project costs. It can result in rework, reordering, loss of productivity, and sizable delays, or breaks in cadence. About $5.7 billion of value is added to the project during construction. Experts on other major construction projects estimate that vandalism, sabotage and theft could affect project costs after insurance by as much as $220 MM or about 4 percent of the value added during construction. Even with careful security measures, it is most likely that these occurrences will increase costs to the project sponsors by $50 MM. There is no chance of cost decreases.

DELAY RANGE AND MILESTONE IMPACTS

Costs of delays are implicit in cost range estimates.

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EVENT #32: PROPERTY DAMAGE AND PERSONAL INJURY LIABILITY

Probability of Occurrence: 100%
Range of Cost Impacts

Minimum:	0
Most Likely:	0
Maximum:	0

ENGINEERING ESTIMATE ASSUMPTIONS

Insurance will cover costs associated with any event causing third party property damage, or personal injury to others, except all liability associated with damage to the TAPS oil line. This event is discussed in accidents to TAPS.

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EVENT #33: CHANGES IN INSURANCE RATES

Probability of Occurrence: 100%
Range of Cost Impacts
Minimum: See Values Below
Most Likely:
Maximum:

ENGINEERING ESTIMATE ASSUMPTIONS

At current rates, $110 MM is indicated for insurance premiums which is for owners' and contractors' financial protection. In addition, there is approximately $160 MM of workers' compensation insurance premiums in the labor costs. Therefore, total "insurance" costs in the estimate are approximately $270 MM. Of the $110 MM of insurance that is not for workers' compensation, about $45 MM is liability insurance and about $65 MM is property insurance.

PROBABILITY

There is a 100 percent probability that rates will differ from those assumed in the engineering estimate.

COST RANGE

Insurance rates are highly volatile and tend to move upward more quickly than downward. For example, insurance rates are sensitive to: 1) rate of return on short-term money instruments, 2) stock market values, 3) underwriting-to-surplus ratios, and 4) losses experienced by the insurance industry. Insurance rates are presently considered low. Possible cost ranges for various types of insurance differ as follows:

Type of Insurance	Minimum	Most Likely	Maximum
Liability			
% Change	-15%	100%	300%
$MM Change	-6.8	65	135
Property			
% Change	-15%	30%	100%
$MM Change	-10	13.5	65
Workers' Comp.			
% Change	-15%	30%	100%
$MM Change	-24	48	160

(Values for the three types of insurance should be treated as independent distributions.)

EVENT #33: CHANGES IN INSURANCE RATES (Continued)

DELAY RANGE AND MILESTONE IMPACT

None.

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EVENT #34: DISRUPTION OF PRIMARY COMPONENTS OF TRANSPORTATION SYSTEM

Probability of Occurrence:	75%
Range of Cost Impacts	
Minimum:	$ 5 MM
Most Likely:	$ 20 MM
Maximum:	$300 MM

ENGINEERING ESTIMATE ASSUMPTIONS

The estimate includes $550 MM for transportation services. These services include primary transportation system components in Alaska like the government-owned railroad to Fairbanks, port facilities at Whittier, Seward and Valdez, the Yukon and other bridges, etc.

PROBABILITY

There is a 75 percent probability that there will be some disruption in the transportation system in Alaska.

COST RANGE

Any disruption of the primary components in the transportation system would force the project to use alternate modes of transportation at incremental costs, e.g., including extra road use and maintenance costs. Pipe and various materials must be delivered to Valdez, then trucked. In addition, impacts of these disruptions could cause schedule delays which affect the costs of mobilization and demobilization required to accommodate these schedule changes. In the event of a disruption due to the loss of a key element of the transportation system during peak construction, use of alternate modes could cause a delay valued, as a maximum, at $300 MM. The most likely occurrence is less than a 10 day delay in delivery of materials with a resulting cost of $20 MM. There is no chance of cost reductions.

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EVENT #35: REPAIR OF INSULATION AND COATING APPLIED AT DOUBLE-JOINTING FACILITY

Probability of Occurrence: 100%
Range of Cost Impacts
Minimum: $-2.2 MM
Most Likely: $13.8 MM
Maximum: $32.4 MM

ENGINEERING ESTIMATE ASSUMPTIONS

The estimate assumes it is possible to bend insulated pipe in the field.

PROBABILITY

There is a 100 percent probability of some damage occurring.

RANGE OF VALUES

Damage is most likely to occur during the bending of pipe at the site. This will require additional crews and materials above those currently estimated. Experts interviewed stated that in the minimum case, costs would decrease by 5% or $-2.2 MM. A most likely case is that cost will increase by $13.8 MM or 32%. A maximum case is that costs will increase by 75%.

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EVENT #36: UNKNOWN IMPACTS ON PROJECT COSTS WHICH CANNOT BE ESTABLISHED

Probability of Occurrence: 100%
Range of Cost Impacts

Minimum:	0
Most Likely:	6.25% of Certification Cost Estimate
Maximum:	12.5% of Certification Cost Estimate

All project costs or potential project costs which can be identified have been included in one of 5 places in the CCSE. These are: the engineering estimate, contingency, abnormal events, and design changes or scope changes. However, not all potential project costs could have been captured in these categories. Other potential project costs can occur from events which are not identifiable at the present time. These events are called unknown-unknowns or unk-unks for short.

Unk-unks are events which cannot logically be estimated or anticipated. As the project progresses, events occur which in hindsight are understandable, but which could not have been logically anticipated or planned for. An example of an unk-unks is the John Hancock Building in Boston, Massachusetts. The building was designed and completed before anyone realized that unusual physical properties existed which caused its windows to fall out repeatedly. Note that this unk-unks required additional expenditure and created delays but did not stop the project completely.

Due to their very nature, it is impossible to have a good estimate of unk-unks. Still, reasonable estimates based on past project experience could be at least 25% of the cost estimate at this stage of a project. However, most experience is based on cost-plus projects without the IROR mechanism and therefore with less incentive to attempt to anticipate future events. To be conservative, we will assume that our extra effort to anticipate "abnormal" events has cut the unk-unks in half, i.e., 12.5%. Furthermore, we will consider 12.5% the extreme of a range for unk-unks with a midrange value of 6.25%. This final estimate is considerably lower than average past experience no matter how it is viewed.

EVENT #36: UNKNOWN IMPACTS ON PROJECT COSTS WHICH CANNOT BE ESTABLISHED (Continued)

The concept of unk-unks arose within the Department of Defense when major procurement cost overruns were post-audited. They are discussed in an analysis of the risk and uncertainties of the project prepared by the Institute for Defense Analyses for FERC. [9]

[9] On the Treatment of Risk and Uncertainty in Determining Change in Scope Allowability and Center Point Establishment in the Alaska Gas Pipeline IROR Mechanism; James D. McCullough (Institute for Defense Analyses Paper P-1413), March, 1979.

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Hearing Exhibit No.

5.0 POTENTIAL DESIGN AND SCOPE CHANGES AND THEIR DESCRIPTIONS

NWA has identified a number of potential design and scope changes which may occur during planning, permitting and construction of the project. The use of the term design refers to changes that occur subsequent to the Certification Cost Estimate but prior to final design approval. The term scope refers to changes that occur after final design approval as defined in Order 31-B.

The following list details potential changes which have been identified to date. The list cannot be considered comprehensive nor in any way limiting. Rather the potential changes should be considered representative of the types of changes that could occur for which the applicant would expect design or scope change approval. Each potential design change is designated by D, and a scope change by S, respectively.

1. Pipeline Construction from Snowpad - Pipeline construction is required using a snow or ice workpad instead of a conventional gravel workpad. If a snowpad is required, construction would take place in the winter months rather than the currently planned shoulder and summer month construction season (D,S).

2. Above-Ground Pipeline Construction - Portions of the line require above-ground construction techniques instead of the currently planned buried mode. This would require the use of pile bents, sleepers, or berm-type support for the above ground mode (D,S).

3. Workpad Insulation and Width Requirements - Workpad is required to be further insulated and widened (D,S).

4. Pipeline Mode Design - Changes are required in the design of specific modes (D,S).

5. Pipeline Mode Type Used for Given Geotechnical Conditions - Changes in mode type required for geologic or soil conditions, e.g., requiring a more conservative mode type for permafrost areas (D,S).

6. Waste Heat Recovery Systems in Compressor Stations - Waste heat recovery systems for main gas turbine compressor units are required in compressor stations (D,S).

5.0 POTENTIAL DESIGN AND SCOPE CHANGES AND THEIR DESCRIPTIONS (Continued)

7. Terms and Interpretations of Environmental and Construction Stipulations - The terms of environmental and construction stipulations are different from those in the estimate and their interpretations change during construction. These include sources for water, restoration and revegetation requirements, etc. (D,S).

8. Intra-Alaskan Connections - The State may take its royalty in kind and/or require connections other than the TAPS which are included in the estimate to supply Alaskan communities and industry with natural gas (D,S).

9. Station Noise and Pollution Control Standards - Different requirements for noise and pollution control equipment than currently estimated for the compressor stations (D,S).

10. Changes in Camp and Office Building Codes - Local and State governments change building codes for camps and pipeline office buildings (D,S).

11. Designation of Environmentally Sensitive Areas - Salmon spawning areas, caribou migration routes and other animal or plant environmental situations may lead to schedule and/or routing changes (D,S).

12. Changes in Pipeline Operating Parameters - The State of Alaska may renew their request for a pipeline which would operate at pressures sufficient to carry more liquids. In addition, other changes could be required, e.g., the pipeline is required to increase/decrease capacity (D,S).

13. Changes in Assumptions Regarding Availability of Natural Gas for Line Displacement and Packing - Canadian gas is not available for packing the Alaska Segment (D).

14. Designs of River, Road and TAPS Crossings - Crossings are required to have a different design than was estimated to mitigate impact on roads, rivers or streams and TAPS (D,S).

15. Designs of Critical Areas (e.g., Atigun Pass) - Different designs are required in critical construction areas (D,S).

5.0 POTENTIAL DESIGN AND SCOPE CHANGES AND THEIR DESCRIPTIONS (Continued)

16. Changes in Pipeline Route - Pipeline routing is changed due to biological, archaeological, TAPS proximity and other considerations (D,S).

17. Construction Timing Requirements - Change in construction schedule to increase winter and shoulder month activities in order to reduce environmental impact (D,S).

18. Crack Arrestor Requirements - Crack arrestors may be required by the government to reduce the impact and dangers of rupture during pipeline operation (D).

19. Compressor Station Relocation - Compressor station location is determined inappropriate thereby requiring change in station camp location (D,S).

20. Pipe Insulation Requirements - Change in amount of insulated pipe required to mitigate impacts in perma-frost zones (D,S).

21. Camp Relocation - Camps are moved to mitigate environmental impacts (D).

22. Change in Ad Valorem Tax Terms - Changes in ad valorem taxes applied to the project (D,S).

23. Changes in Payroll Taxes - Changes in payroll taxes applied to the project (D,S).

24. Change in Sales, Use and Other Tax Terms - Changes in taxes applied by local jurisdictions to the project (D,S).

25. Government Subsidy of Tanacross and Northway Airfields - The govenment changes the value of its subsidy to improve the two airfields (D,S).

26. Tariffs and Duties - The federal government could change the duties charged on imported pipe and other materials. This could include the impact of trigger pricing or a cost equalization tariff on imported goods (D,S).

27. Changes in IROR Terms - The stipulations or interpretations of the IROR terms could change during the life of the project (D,S).

5.0 POTENTIAL DESIGN AND SCOPE CHANGES AND THEIR DESCRIPTIONS (Continued)

28. Alaska Road Use Terms and Conditions - The State of Alaska may impose new truck load limits and/or require funding for state highway maintenance (D,S).

29. Government Monitoring Procedures and Requirements - Changes in government procedures and requirements which are not within the control of project sponsors (D,S).

30. MBE and EEO Requirements - Changes in the current assumptions regarding MBE and EEO stipulations which impact the project (D,S).

31. Alaska Hire Requirements - Requirements to fill a percentage of the jobs available on the project with Alaskan residents (D,S).

32. Buy American - The government requires NWA to purchase mainline pipe and other materials from domestic suppliers (D).

33. Pipeline Mode Changes During Final Design Due to Field Program Data - Field programs generated additional data which result in mode changes in specific areas (D).

34. Station Geotechnical Conditions Determined During Final Design - Station foundations must be adjusted to local conditons as determined by field programs (D).

35. Determination of Proximity of Aggregate During Final Design - Results of field programs may result in changing aggregate site locations or increasing haul distances in areas where preliminary sites were determined to be insufficient (D).

36. Cultural Resources Determined in the Field - Archaeological sites encountered by field programs require rerouting to avoid adverse impacts (D).

37. Condition of Purchased Temporary Facilities - Pipeline camps and other purchased facilities may require extensive refurbishment due to degradation since 1978 (D).

38. Unanticipated Biological Field Conditions - Field programs may encounter unanticipated biological conditions requiring mitigative measures or rerouting (D).

5.0 POTENTIAL DESIGN AND SCOPE CHANGES AND THEIR DESCRIPTIONS (Continued)

39. TAPS ROW Mitigative Measures - Additional mitigative measures may be required to protect the integrity of the TAPS oil line (D,S).

40. Acts of War - As defined in the change-in-scope mechanism in Order 31-B (S).

41. Emergencies or Major Disasters - As defined in the change-in-scope mechanism in Order 31-B (S).

42. Delay in Obtaining Unencumbered Certificate (D).

43. Delay in Obtaining State Right-of-Way (D).

44. Delay in Obtaining Federal Right-of-Way (D).

45. Delay in Resolving Haines Right-of-Way (D).

46. Delay in Obtaining Airfield Permits (D).

47. Delay in Obtaining Field Program Permits (D).

48. Delay in Obtaining Camp Construction Permits (D).

49. Delay in Obtaining Communications Permits (D).

50. Delay in Obtaining Compressor Station Air Quality Permits (D).

51. Delay in Obtaining Material Site Permits (D,S).

52. Delay in Obtaining Double Jointing Facility Permits (D).

53. Delay in Obtaining River Crossing Permits (S).

54. Delay in Obtaining Pipeline Construction Permits (S).

55. Delay in Obtaining Station Construction Permits (S).

56. Delay in Obtaining Other Site-Specific NTPs from OFI and SPCO (S).

57. Delay in Obtaining Operating Permits (S).

58. Change in phased design approach (D).