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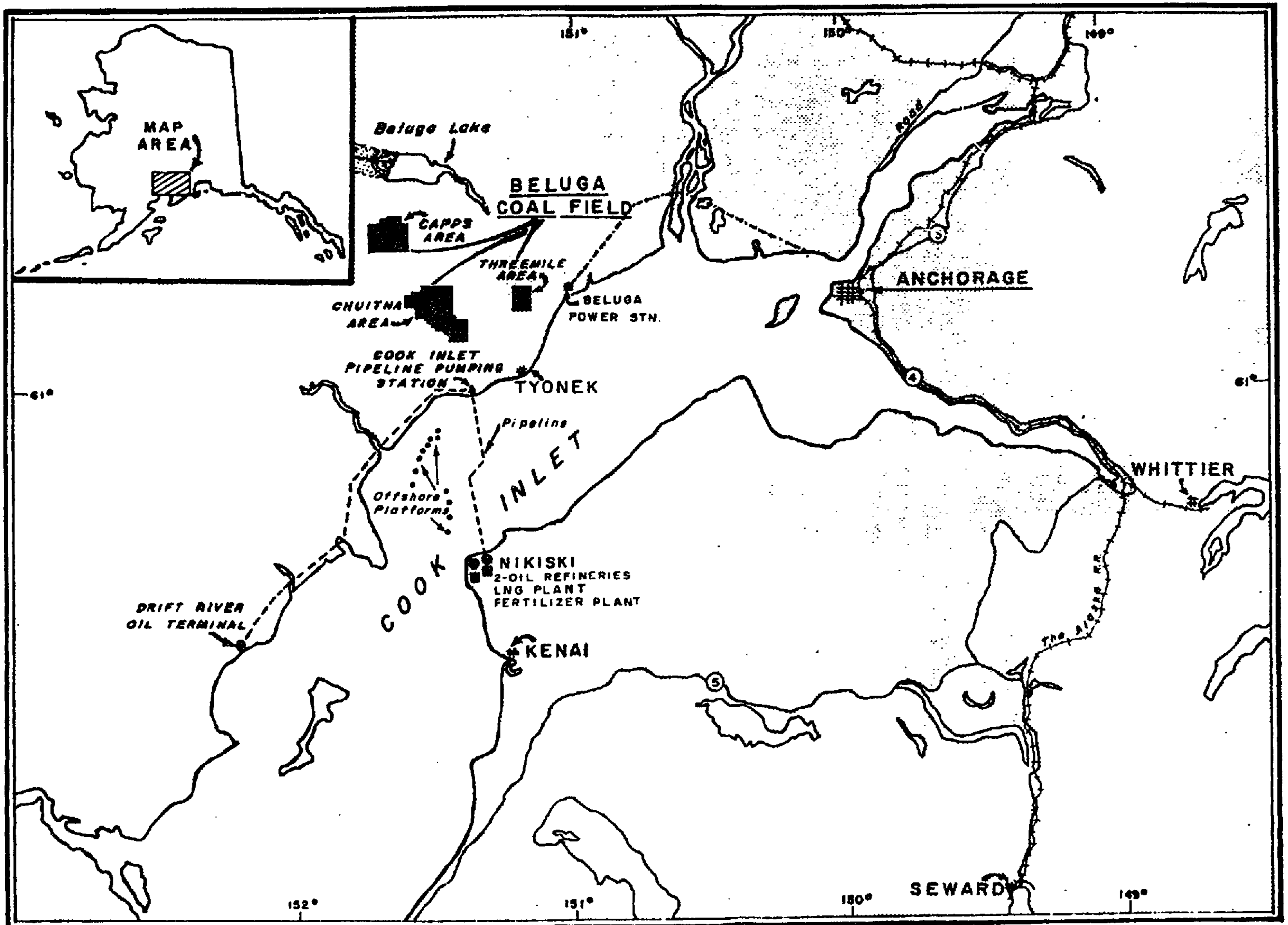
COAL TO METHANOL FEASIBILITY STUDY, BELUGA METHANOL PROJECT

Final Report. Executive Review

September 1981

Contract No. FG01-80RA50299

Cook Inlet Region, Inc.
Placer Amex, Inc.
San Francisco, California



LOCATION MAP

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BELUGA METHANOL PROJECT
COOK INLET REGION, INC.
AND
PLACER AMEX INC.

Mr. Stephen J. Michelsen
Contracting Officer
U.S. Department of Energy
Office of Procurement Operations
Forrestal Building
1000 Independence Avenue, S.W.
Washington, D.C. 20585

RE: The Beluga Methanol Project
DOE Grant DE-FG01-80RA-50299
Final Report

Dear Mr. Michelsen:

Cook Inlet Region, Inc. (CIRI) and Placer Amex Inc. (Placer) intend to develop a coal-to-methanol plant utilizing Winkler gasifiers and the ICI methanol synthesis process. The plant is to be constructed in the vicinity of substantial coal reserves in the Beluga district on the west side of Cook Inlet, approximately 60 miles from Anchorage, Alaska. These low-sulfur, high-volatile, sub-bituminous coal reserves will be used to produce fuel grade methanol at a rate of 54,000 barrels per day.

CIRI and Placer have completed a year-long analysis of the economic, environmental, and technical feasibility of this project. The results are summarized in succeeding sections. Detailed results are presented in separate volumes. However, the most significant findings can be abstracted as follows:

1. It is technically feasible to construct a 7,500 ton/day plant using commercially proven equipment and process technologies. The only departure from existing commercial applications incorporated in the design is the use of higher pressure (4-atmosphere) gasifiers. However, this modification is supported by extensive analysis, pilot operating tests, and commercial operation in a related technology.

2. The final design includes one 10-atmosphere coal gasifier test unit. If, prior to ordering components of the plant, tests performed with gasifiers at 10-atmosphere pressure verify anticipated results, a total of four (4) gasifiers for 10-atmosphere operation will be installed rather than eight (8) gasification trains. Net capital cost reduction is estimated at $100MM, and synthesis gas production cost is expected to be reduced as a result of improved efficiency. The use of gasifiers at 10 atmospheres could, thereby, reduce unit costs of the product by about $10/ton of methanol.

3. The baseline environmental study indicates that air, water, and ecological impacts can be kept within state and federal regulatory limits. Mine reclamation and other restoration activities will be aided by favorable seasonable growing conditions. The impact on the life-style of the Tyonek Native Village may be substantial. Phase Two of the project will include development of an area-wide plan to address these cultural concerns.

4. All basic resource inputs, including land, water, and coal, are available. CIRI and Placer jointly control more than 500 million tons of coal reserves. Sufficient land and water are available from CIRI and public lands. The availability of construction labor will depend upon the timing of major Alaskan development projects. However, many of the larger projects may be delayed indefinitely; and sufficiently skilled labor should be obtainable. The project design also incorporates modularization techniques to reduce onsite labor needs.

5. There appears to be more than sufficient markets for the planned methanol production. Several large, West Coast utilities have expressed strong interest in an assured supply of methanol. The use of methanol for motor vehicle fuel, either neat or as gasoline blend, is receiving strong interest, particularly in California. It is anticipated that by-product CO_2 will be sold locally for use in enhanced crude oil recovery. Marketability will be affected by federal and state fuel use and air quality regulations, as well as delivered price.

6. The total cost of the synthetic fuel complex, including the process plant, infrastructure, and employee facilities, and the two coal mines is estimated at $2.3 billion (1981).

7. The accompanying financial analysis shows a strong likelihood that the project will achieve positive cash flows. However, project returns resulting from the methanol prices used may not offer sufficient incentive to private investors due to the risks involved in a project of this magnitude.

8. The proposed product transportation system utilizing existing pipeline and tanker facilities is technically, economically, and environmentally acceptable.

Based upon the results of this feasibility study, CIRI and Placer have developed an overall work plan and schedule for the construction and operational phases of the Beluga Coal-to-Methanol Project. The object of the next phase is to advance the project to the point where a production decision can be made.

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Specific tasks to be accomplished during this phase include the preparation of an Environmental Impact Report, acquisition of major regulatory permits, preparation of a "definitive" cost estimate, development of an infrastructure plan, confirmation of marketability, and development of a financial plan.

Progress on these tasks and the overall objective will depend upon the results of discussions with additional equity investors, as well as with the U.S. Synthetic Fuels Corporation. A tangible commitment by the U.S. Synthetic Fuels Corporation in support of national energy goals will be necessary to make the project a reality.

Very truly yours,

COOK INLET REGION, INC.
AND PLACER AMEX INC.

Cole E. McFarland
Project Director

CEF/jn-1997Z

Attachment

cc: Mr. Robert L. Gall - w/attachment
U.S. Department of Energy
Morgantown Energy Technology Center
P.O. Box 880
Morgantown, West Virginia 26505

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EXECUTIVE REVIEW

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TECHNICAL VIABILITY

There are no major questions unanswered as to the technical viability of the Beluga Coal-to-Methanol Project.

The plant detailed in the Phase I study uses only commercially available technologies which have been fully demonstrated and proven. The major unit selections provide an integrated process plant with maximum reliability. The design incorporates multiple trains, the sparing of critical items, and the use of equipment within presently available size ranges. Particular attention has been given to optimal integration of all utilities and heat recovery systems and the control of environmental impacts in accordance with regulatory requirements. Adherence to these conditions results in an efficient configuration for the 7,500 tons per day, methanol producing complex.

The overall design concept is similar to those of well established coal-based chemical plants, differing only to the extent of incorporating demonstrated innovations and refinements which have since become available. There is but one departure from commercial technology -- a minor one, which raises the pressure of the Winkler gasifier about 2.5 atmospheres of pressure, absolute (ATA). The detail design minimizes risk while taking full advantage of the present state-of-the-art with respect to commercial operability, efficiency and safety.

Brief descriptions of the technologies, by major plant sections, are given below.

o <u>Coal Handling and Preparation</u>

All coal handling and preparation equipment is standard coal industry hardware. Final specification of crushing and drying equipment is deferred pending results of large-scale testing of Beluga coals. Presently available data has been used in a conservative manner to specify equipment for study purposes.

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o **Gasification**

The introduction to Volume II explains in detail the selection of fluid bed gasification using Winkler technology. In summary, for the Beluga project, this technology is judged the best choice for the following reasons:

- Excellent suitability to feedstock.
- Optimum raw gas for methanol production.
- Contaminants in effluent streams can be economically treated to environmentally acceptable levels with conventional technology.
- Best combination of capital, operating and maintenance economy.
- Longest history of successful commercial operation in the production of synthesis gas for chemicals.

The gasification system designed for the Beluga plant is a third generation Winkler system, incorporating the refinements of nearly 60 years of development. (Laboratory and pilot plant testing from 1922 to 1926, and commercial operating experience with continuing technical development and refinements since 1926.) A list of Winkler fluid bed gasification plants is given in Table 1.

o **10 Atmosphere Gasification**

One of the eight trains in the gasification section has been designed for 10-ATA operation, a further advancement of the Winkler system. Demonstration of the process and mechanical advantages of this unit will permit future plant expansion with a reduced number of gasification trains for a given volume of syngas production.

The components in the design of the 10-ATA train will also be capable of operation at 4-ATA.

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- **Latest Advances in Gasification Technology**

Vigorous research and development effort is yielding further improvements in coal conversion technologies. Many advanced pilot systems are showing promise. Members of the Beluga Project have been closely monitoring the progress of this R&D work, often with direct participation.

As the Beluga Project develops through detail design and procurement, certain demonstration plants of advanced designs could be brought into successful operation. Final gasification system selections could be influenced by the work in such pioneer units.

- **Methanol Production**

All process design and components in the methanol synthesis, distillation and purge gas reforming units are based on fully demonstrated technology. The ICI (Imperial Chemical Industries) low pressure process for methanol synthesis will be used. The basic ICI low-pressure catalyst has been in use since 1967.

A partial list of ICI low-pressure methanol plants now in operation or under construction is given in Table 2.

A single distillation column per train will be used. The steam reformer will be of a standard design and will contain 312 reformer tubes. Reformer furnaces with as many as 600 tubes have been designed and built.

- **Air Separation Plants**

Air separation units of the type and size selected for Beluga are identical with units now operating in the Sasol facility in South Africa. The individual modules are capable of producing 2500

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tons per day of 99.5% oxygen. A recent survey of large air separation plants, involving several hundred plant years of operation, indicates an average plant on-stream factor of 98%.

- Steam and Power Generation

The primary steam and power production facility for this plant will be a pulverized coal/char fired system with a steam turbine generation system. The utilization of char blended with raw coal has been demonstrated in Winkler facilities in Merseburg and Wesseling in Germany, Neyveli in India, and Kutahya in Turkey. The ratio of raw coal to char for the Beluga Project does not exceed the demonstrated successful combustion experience.

The possible application of fluidized bed combustion (FBC) will be explored prior to the final selection of boilers for this section. Proven FBC, if applicable to the Beluga complex, could offer significant thermal efficiency and economic advantages.

For flow sheet of process trains, see Coal-to-Methanol Plant section, Summary of the Phase I Feasibility Study.

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TABLE I
WINKLER COAL AND COKE FLUID BED GASIFICATION PLANTS

(As of September, 1981)

PLANT NUMBER	PLANT	PRODUCT	CAPACITY PER GASIFIER 1000 SCFH	NUMBER GASIFIERS	OPERATING DATES
1	BASF, Ludwigshaven, West Germany	Pilot Plant	75	1	1925–58
2	Leuna–Werke, Merseburg, East Germany	LBTU Fuel Gas & Synthesis Gas for MeOH and NH_3	3,730 2,240	5	1926–70
3	BRABAG, Bohlen, East Germany	Hydrogen	1,120	3	1938–Present
4	BRABAG, Magdeburg, East Germany	Hydrogen	1,230	3	1938–45
5	Yahagi, Japan	Ammonia	330	1	1937–60
6	Dai-Nihonyinzo-Hiryo, Japan	Ammonia	520	2	1937–59
7	Nippon Tar, Japan	Ammonia	520	2	1937–60
8	Toyo Koatsu, Japan	Ammonia	750	2	1938–69
9	Fushun, Mandschukuo, Japan	Syn. Gas for F.T.Fuel	750	4	1939–?
10	BRABAG, Zeitz, East Germany	Hydrogen	850	3	1941–Present
11	Treibstoffwerke, Brux (now Most), Czechoslovakia	Hydrogen	1,120 1,208	5 2	1943–72 1954–73
12	Salawad, USSR	Medium BTU Gas	860	7	?–Present
13	Baschkirien, USSR	Medium BTU Gas	860	4	?–Present
14	Dimitroffgrad, Bulgaria	Medium BTU Gas	860	4	1951–Present
15	Stara Zagora, Bulgaria	Medium BTU Gas	1,120	5	1962–Present
16	Fabrika Azotnih, Jendinjenja, Gorazde Yugoslavia	Ammonia	260	1	1952–Present
17	Calvo Sotelo I, Puertollano, Spain	Ammonia	350	1	1956–70
18	Calvo Sotelo II	Ammonia	350	1	1959–70
19	UKW, Wesseling I, West Germany	Synthesis Gas for MeOH and NH_3	630	1	1958–67
20	UKW, Wesseling II, West Germany	Synthesis Gas for MeOH and NH_3	630	1	1962–67
21	Azot Sanayii TAS, Kutahya, Turkey	Ammonia	450	2	1959–Present
22	Neyveli Lignite Corp. India	Ammonia	785	3	1965–79
22	Total (Including Pilot Plant)			63 Total (Including Pilot Plant)	
8	IN OPERATION AT PRESENT			29 IN OPERATION AT PRESENT	

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TABLE 2
PLANTS USING THE ICI LOW PRESSURE METHANOL PROCESS TECHNOLOGY

LICENSED PLANTS	LOCATION	CAPACITY STPD	ICI LICENSEE	STATUS/ START-UP
Taesung Lumber Company	Korea	165	Davy McKee	Onstream
Georgia Pacific Corpn.	USA	1200	Davy McKee	Onstream
Chang Chun Petrochemical	Taiwan	165	Davy McKee	Onstream
Monsanto Company	USA	1000	Chemico	Onstream
Nishi Nihon	Japan	1100	Kellogg	Onstream
Dor Chemicals	Middle East	165	Humphreys & Glasgow	Onstream
Elf Oil, Speyer	W. Germany	900	Humphreys & Glasgow	Onstream
Celanese Corporation	USA	2100	Davy McKee	Onstream (Expansion 1976)
Methanol Chemie Nederland	Holland	1100	Davy McKee	Onstream
PCUK (Ugine Kuhlmann)	France	660	Davy McKee	Onstream
Metanor SA	Brazil	200	Davy McKee	Onstream
Indiquimica, Algeciras	Spain	660	Davy McKee	Onstream
Taesung Methanol Company	Korea	1100	Davy McKee	Onstream
Rumanian Ministry	Rumania	660	Davy McKee	Onstream
China National Technical	China	330	Humphreys & Glasgow	Onstream
National Methanol Company	Libya	1100	Uhde	Onstream
Techmashimport, Gubaha	USSR	2750	Davy McKee	1982
Techmashimport	USSR	2750	Davy McKee	1982
SCT	Saudi Arabia	2300	Davy McKee	1983
Borden	USA	2000	Davy McKee	1980 (Revamp)
Almer Arzew	Algeria	330	Humphreys & Glasgow	Onstream
AE & CI Modderfontein	South Africa	60	Uhde	Onstream
Gujarat SFC	India	70	Linde	1982
MSK Kidinds	Yugoslavia	330	Technip	1983
CPDC	Taiwan	140	Lummus	1983
Ocelot	Canada	1340	Davy McKee	1983
ARCO Chemical	USA	2000	Davy McKee	1983
Air Products	USA	500	Davy McKee	1982 (Revamp)
Mobil R & D Corporation	New Zealand	4850	Davy McKee	1984
ICI PLANTS				
Billingham	England	300		Onstream
Billingham	England	1200		Onstream

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MANAGEMENT PLAN FOR PHASE II

The management plan is designed to provide an easy transition from Phase II studies to the actual procurement, construction and start-up of operations. The plan consists of these five principal parts:

1. Definition of Phase II Objectives
2. Management Structure
3. Detailed Work Plan for Phase II
4. Overall Timetable and Schedule for Execution of the Project
5. Completion of the Land Acquisition Plan

1.0 PHASE II OBJECTIVES

The overall objective is to develop all study and planning elements of the project to the level which will provide a sound basis for a "go-no go" decision, and to advance detail engineering to the point of permitting award of subcontracts and placement of orders for long lead time equipment and materials.

This will require completion of the following tasks:

1.1 Technical

Advance all design and engineering work to the degree necessary to determine project impacts for preparation of permit applications; confirm availability of all required resources; prepare appropriation type capital and operating cost estimates; and be in a position to place orders for "long-lead" subcontracts, equipment, and process-related items.

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1.2 Environmental

Complete environmental analyses in all areas, prepare all required Environmental Impact Statements, and apply for regulatory permits.

1.3 Marketing

Confirm the certainty of presently existing markets for methanol as a power generation fuel; review in depth the market potential for methanol as a motor vehicle fuel; determine market diversification in terms of geography and end use; and establish an optimum mix of price, stability and growth with appropriate attention to the national energy policy.

Develop penetration of the utility market to the point of obtaining preliminary commitments, subject if and where necessary to appropriate incentives that may be required in the early years of operation.

Investigate fully the sales potentials for by-product sulfur and carbon dioxide.

1.4 Financial

Find an equity partner or partners with ability to take full advantage of tax benefits and to supply such financial support as may be required to make the operation viable.

Prepare a final Financial Plan under which the "go-no go" decision may be made to proceed with the project. This plan will include the amount of support to be requested from the Synthetic Fuels Corporation.

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1.5 Infrastructure

Prepare a Beluga area development plan in conjunction with the Kenai Peninsula Borough and other area landowners to assure conformance with Coastal Zone Management policies and to avoid undesirable environmental, socioeconomic, and health and safety impacts.

1.6 Land Acquisition

Proceed with negotiations for the purchase and/or lease of lands required for the project. All agreements must be firm prior to the start of the final project phase.

1.7 Environmental Permits

All major permits required for construction must be obtained prior to start of Phase III.

2.0 MANAGEMENT STRUCTURE

Phase II and future phases of the Beluga Methanol Project will be under the direction of the Overall Project Director, who will report to the Project Directorate, which consists of representatives of the project partners. This group will provide the overall project objectives and guidelines to the Overall Project Director.

2.1 Organization

The project organization will utilize the basic strengths of CIRI/Placer, equity partner(s), Davy McKee, and the various consultants and participants in the Phase I study. The management organization is shown in the chart on Page 16. This basic organization for Phase II will be expanded below the Deputy Director level for work beyond Phase II.

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This organizational approach provides for management continuity in the subsequent phases of detail engineering, procurement, construction, and operation of the coal-to-methanol plant, including marketing and finance.

The responsibilities of the management team members are defined below.

2.2 Overall Project Director

The Overall Project Director, with the help of his immediate staff, will be completely responsible to the Project Directorate for organizing, directing, planning, and controlling the execution of Phase II work. His immediate staff will consist of:

- Project Director--Operations
- Project Director--Community Relations
- Project Director--Marketing and Finance
- Staff Consultants
- Deputy Project Director--Controls

2.2.1 Project Director--Operations

Will be responsible to the Overall Project Director for all engineering, procurement, and construction of the project. This role is typically filled by the project management contractor.

The Project Director--Operations will be fully responsible for organizing, directing, and managing the execution of the design, engineering, procurement, and construction of the project. He will administer and supervise all requirements of the agreement entered into for the work and will be the primary contact with the Overall Project Director on all matters. He will be fully responsible for the performance of the work in a timely and efficient manner within established schedules ana budgets and will control the assignment of manpower required for the project from the onset of the work. He will draw upon the most qualified specialists and expertise in the Davy McKee organization for the performance of all phases of the work.

2.2.1.1 Deputy Project Director--Engineering and Procurement

Will report to the Project Director--Operations and will be responsible for the performance of all process engineering and design engineering for the project. Further, he is directly responsible for the procurement activities of buying, expediting, inspection, and delivery to the module yard and construction site. It will be his duty to see that his areas of responsibility comply with project requirements and that engineering and procurement are carried out in an efficient manner, economically and on schedule.

He will direct and coordinate a team of Engineering Managers who will be assigned specific areas of responsiblity. During Phase II, this would include finalizing the mine and plant design basis, environmental and permitting work, and identify and be prepared to place orders upon commencement of the next phase for long-lead equipment and subcontract services.

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A Procurement Manager, reporting to the Deputy Director, will direct the activities of buyers, expeditors, inspection, and traffic personnel and will assemble equipment and materials from all areas to insure the best possible unit prices for the volume of equipment/materials required.

In Phase II, procurement activities will be directed at long-lead equipment and materials and provide support for the Appropriation Cost Estimate.

2.2.1.2 <u>Deputy Project Director--Construction</u>

The Deputy Project Director--Construction, reporting to the Project Director--Operations, will be responsible for all construction-related tasks, including the module yard, transportation from the module yard to the site, and all site construction. He will manage and coordinate the individual Area Construction Managers and the team of specialists necessary to fulfill the construction requirements of the project.

Specialty areas include labor relations (module yard and Alaska), camp operation, construction subcontracts, module transportation, and operation of an Anchorage, Alaska, construction operations office.

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During Phase II, he will be involved in defining and scheduling all aspects of construction required for this project. This definition will be such that the accuracy of the Appropriation Cost Estimate is achieved. Further, he will fix the basis for the actual construction work by holding discussions with labor, fully establishing the module yard and site camp requirements, and be in a position to place long-lead critical subcontracts at the start of Phase III.

2.2.1.3 Deputy Project Director--Environmental

The Deputy Project Director--Environmental will be responsible for completing the environmental analysis of all project elements in order to apply for all regulatory permits and to submit an Environmental Impact Statement. An additional duty will be to develop and pursue all major permits which are required to start construction.

2.2.2 Project Director--Community Relations

The Project Director--Community Relations will report directly to the Overall Project Director and will be responsible for the key functions of all Alaskan public relations and land acquisitions. He will be heavily involved in the Beluga Area development plan along with Alaskan authorities. He and his staff will work closely in matters of permitting with the Deputy Project Director--Environmental. They will be located in Anchorage, but will

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maintain intimate contact will all other project groups. This intimate contact will provide local input to the project groups and assure completion of the Project Director--Community Relations' functions in a totally satisfactory manner.

2.2.3 Project Director--Marketing and Finance

The Project Director--Finance and Marketing will be responsible for planning and directing the implementation of the marketing plan and the financial plan. He will work very closely with the Overall Project Director and the Project Directorate to assure marketing and financial feasibility of the project.

2.2.3.1 Deputy Project Director--Marketing

The Deputy Project Director--Marketing will be responsible for marketing the product and by-products on a worldwide basis to the proper consumers at the most favorable pricing structure, as developed in conjunction with the financial advisors.

2.2.3.2 Deputy Project Director--Finance

The Deputy Project Director--Finance will be responsible for establishing budgets, maintaining a proper cash flow, preparing financial reports and projections, and all aspects of relationships with the financial community.

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2.3 Staff Consultants

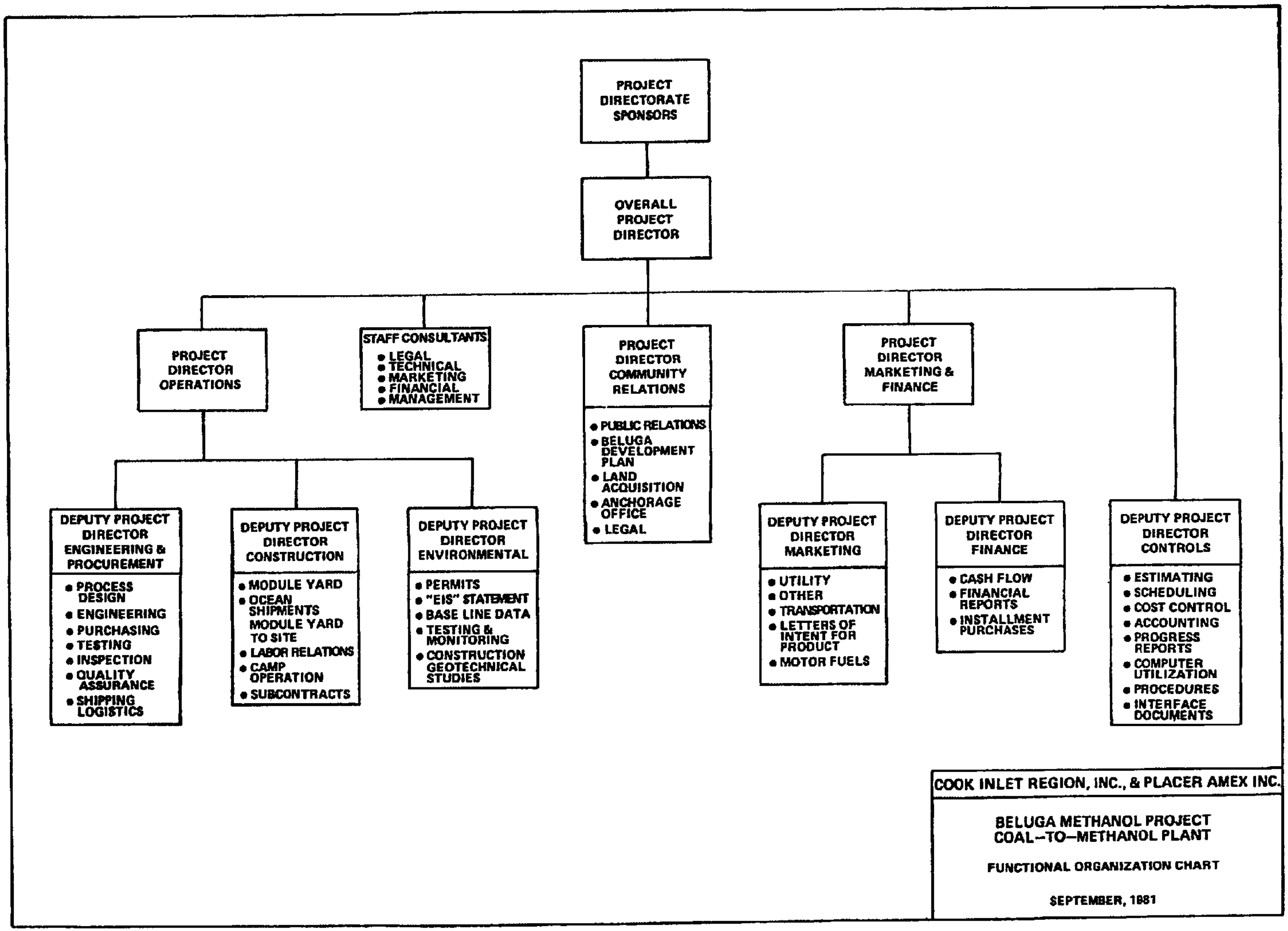
The Staff Consultants report to and provide the Overall Project Director with the specialized expertise required to meet the goals and objectives of the project with respect to managerial, technical, marketing, and financial matters. Their advisory roles are independent of the Project Directors, but they would assist the Project Directors as required for special tasks to aid the Overall Project Director. The advisory nature of their work allows for continuous updating of project goals and objectives without diluting the prime directives of the Project Directors.

2.4 Deputy Project Director--Controls

Reporting directly to the Overall Project Director, the Deputy Project Director--Controls will supervise and coordinate the estimating, cost control, scheduling, accounting, and reporting efforts required for the project. His initial responsibilities will include the development of detailed schedules and cost standards for the Phase II work. He will then monitor the actual progress and the cost against these standards, his prime objective being to identify problems early and report such to the Project Director. When problems are defined, he will work with the Project Director to implement corrective actions and will then follow up to assess the overall impact of the problem and correction action on project cost and schedule.

During Phase II, estimating activity will center around the development of an Appropriation Cost Estimate and trade-off studies required to finalize the design basis.

Cost Engineering and Scheduling will monitor the performance of Phase II work. Scheduling will develop detailed plans for the subsequent phases of the project, working with all appropriate participants.


PROJECT DIRECTORATE SPONSORS
OVERALL PROJECT DIRECTOR
PROJECT DIRECTOR OPERATIONS
STAFF CONSULTANTS
● LEGAL
● TECHNICAL
● MARKETING
● FINANCIAL
● MANAGEMENT
PROJECT DIRECTOR COMMUNITY RELATIONS
● PUBLIC RELATIONS
● BELUGA DEVELOPMENT PLAN
● LAND ACQUISITION
● ANCHORAGE OFFICE
● LEGAL
PROJECT DIRECTOR MARKETING & FINANCE
DEPUTY PROJECT DIRECTOR ENGINEERING & PROCUREMENT
● PROCESS DESIGN
● ENGINEERING
● PURCHASING
● TESTING
● INSPECTION
● QUALITY ASSURANCE
● SHIPPING LOGISTICS
DEPUTY PROJECT DIRECTOR CONSTRUCTION
● MODULE YARD
● OCEAN SHIPMENTS MODULE YARD TO SITE
● LABOR RELATIONS
● CAMP OPERATION
● SUBCONTRACTS
DEPUTY PROJECT DIRECTOR ENVIRONMENTAL
● PERMITS
● "EIS" STATEMENT
● BASE LINE DATA
● TESTING & MONITORING
● CONSTRUCTION GEOTECHNICAL STUDIES
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● OTHER
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● FINANCIAL REPORTS
● INSTALLMENT PURCHASES
DEPUTY PROJECT DIRECTOR CONTROLS
● ESTIMATING
● SCHEDULING
● COST CONTROL
● ACCOUNTING
● PROGRESS REPORTS
● COMPUTER UTILIZATION
● PROCEDURES
● INTERFACE DOCUMENTS
COOK INLET REGION, INC., & PLACER AMEX INC.
BELUGA METHANOL PROJECT
COAL—TO—METHANOL PLANT
FUNCTIONAL ORGANIZATION CHART
SEPTEMBER, 1981

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3.0 SUMMARY WORK PLAN FOR PHASE II

The work plan for Phase II is outlined in considerable detail by subject and project area in Appendix A of this Executive Review. The plan is summarized as follows:

3.1 Coal Mining

The Phase II work program will further confirm the technical and economic feasibility of mining coal from the Chuitna and/or Capps Area(s) of the Beluga coal field for use as raw material feedstock to the methanol plant. A secondary use will be as fuel for direct burning in onsite steam boilers producing process steam and electric power.

In-depth resource and hydrological drilling programs refined or supplemented by using test pit hydrological data will form the basis for detailed design and environmental provisions.

Considerable additional work will be done on the mining and reclamation plans and the coal haulage system.

All environmental monitoring and design considerations necessary for surface mining permits will be identified and resolved. Permits will be obtained prior to the start of Phase III.

Procurement will be sufficiently advanced to permit placement of orders for long-lead equipment and machinery early on in Phase III.

3.2 Geotechnical

Significant geotechnical investigations and structural designs will be required prior to final design. These include: detailed groundwater evaluations, a study of available construction materials, determination of till and rock

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characteristics, study of the seismicity and tidal wave potential of the site, study of the hydrology of the area, and a review of the past history of major landslides and earthquakes in the site area.

3.3 Railroad--Roadway--Dock

Phase II work will include additional field surveys, geotechnical terrain analyses, test drilling, surface hydrology studies, laboratory analyses, and establishment of foundation requirements. Environmental, health, safety, and socioeconomic requirements will be defined and included in all design bases.

Railroad equipment, operation, and maintenance will be reviewed in-depth with updated information. A firm of railroad specialists will participate in development of the final design requirements prior to start of engineering.

A marine architect and barge-tug operators will provide input necessary for the design and operational requirements of the barge dock. Field testing along the shoreline will be performed in the dock area.

3.4 Coal-to-Methanol Plant

Coal properties will be defined in further detail based on additional drilling, sample analysis, and tests early in Phase II. A final design basis will be established using updated coal properties, environmental and permitting requirements, a comprehensive water resource survey, and further investigations on utility sources such as electric power, oxygen and natural gas.

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The design of the plant from coal receiving through processing, methanol storage, and transport will be optimized. Engineering will progress sufficiently to allow award of subcontracts for engineering and procurement of long-delivery equipment and materials early in Phase III. Required early construction-related subcontracts (module yard, barge and transporters, etc.) will also be developed and evaluated to the point where placement of orders can proceed early in Phase III. Engineering subcontracts will consist of the dock, barge unloading area, railroad, bridges, oxygen plant, sulfur plant, acid gas removal system, buildings, and other major specialty civil and structural items.

3.5 Product Transportation

Shipping alternatives, including the use of the Cook Inlet Pipe Line facilities, will be further evaluated to determine if substantial costs savings are possible. Conceptual designs will be developed and comparative cost estimates prepared for a permanent off-shore tanker loading facility and shoreline berthing facilities. Shoreline berthing possibilities will be studied at several locations, including use of the construction, operation, and maintenance dock studied in Phase I. The shoreline berthing facilities noted will take into consideration the tide changes and mud flats.

3.6 Environmental

The environmental effort early in Phase II will encompass monitoring and data gathering required for permit application. Major approvals and construction permits will be pursued and obtained.

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The major areas of permitting include, but are not limited to, Prevention of Significant Deterioration (PSD), National Pollutant Discharge Elimination System (NPDES), Department of the Army Corps of Engineers, Office of Surface Mining, State Anadromous Fish Permits, and the Environmental Impact Statement.

3.7 Site Selection

The final site selection will be accomplished early in Phase II. At this point it appears that the primary factor in the site location will be the specific soils conditions. The more favorable climate and shorter period of snow cover favor the Cook Inlet site over the higher elevations at the mine areas. Broad areas within the preliminary site area (near Cook Inlet) have been found to have greater depths of organic overburden than anticipated, and relocation of the plant in a northwesterly direction would avoid these areas and reduce capital costs. Further engineering soils exploration will precede the final site selection decision.

3.8 Camp, Airstrip, Town, and Bus System

Site selection will be confirmed and finalized, based on detailed physical, land use and socioeconomic trends in the area. Campsite and town site size and cost will be adjusted according to the manpower and schedule needs of the project. The camp development subcontract package will be prepared, issued for inquiry, and awarded at the start of Phase III.

3.9 Appropriation Estimate

The Phase II plan will increase the level of estimating activity by placing emphasis on equipment and material costs, additional engineering development, construction planning,

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and refined cost evaluations of the barge-mounted plant modules. This will result in an Appropriation Estimate of higher accuracy and confidence than the Capital Cost Estimate submitted in Phase I.

3.10 Construction

During Phase II, a more detailed construction program will be developed, including assessment of the manpower split between site work and the modular shop.

A subcontract plan will be developed, the project craft manpower requirement will be compared with availability, and a plan for recruiting the necessary labor will be developed.

A project labor agreement will be drafted in conjunction with the various labor organizations.

3.11 Marketing

Work conducted prior to, and as part of, the work in Phase I has confirmed three principal West Coast markets for methanol (power generation, vehicle fuel, and the chemical industry). In Phase II, the following additional tasks will be pursued to insure the marketability of methanol:

1) Exploration of potential uses of methanol will be expanded to include industrial (as distinct from utility) power generation applications.

2) Although several West Coast utilities have expressed tentative interest, a more intense effort will be focused on four specific potential customers in the public utilities area.

3) Environmental concerns in market areas related to large-scale distribution and use will be identified and studied to insure marketability.

4) Specific methanol performance data and operating parameters will be established to ascertain the practicality of use.

5) The potential sale of carbon dioxide and nitrogen for enhanced oil recovery will be pursued.

A determination will be made of market diversification in terms of geography and end use that will provide the best mix of price, growth, and stability, with appropriate attention to national energy policy. Finally, the second phase study will include market development to the point where preliminary commitments can be negotiated.

3.12 Financial

A time profile of committed funds will be developed from the total capital requirement Appropriation Estimate. The treatment of assets under the Accelerated Cost Recovery System will also be quantified.

Financial advisors will develop the capitalization structure of the project to be patterned to the cash flow dynamics to provide suitable coverage of financial obligations. Investment tax incentives will be utilized to their fullest to benefit the capital structure.

The financial advisors will also draft the general terms of covenants required in the financing instruments. The receptiveness of the financial community will be assessed early in the course of this task.

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The extent of support required of, and agreed to by, the Synthetic Fuels Corporation will be identified from thc cash flow analyses. Their participation, along with equity sponsors from the private sector, will form the nucleus for financing the project.

4.0 OVERALL TIMETABLE AND SCHEDULE

4.1 Strategic Plan and Schedule

The bar chart schedule in this section displays the overall strategic plan and schedule for execution of the project. The plan will be implemented by sequentially developing more detailed plans and schedules at the tactical and operational levels. Tactical schedules (area, discipline, major work package) will be in Critical Path Method format. These schedules will provide effective time control at the project management level and provide milestones to guide planning, scheduling, and time control at the operational level. Various operational schedules will be prepared in the form of bar charts and work lists. These schedules, prepared by those responsible for execution of the work, are based upon parameters established by the tactical schedules and are used to plan and control day-to-day operations.

The first task at the start of Phase II will be the development of a Tactical Plan (CPM) followed by Operational schedules and control tools for all work relating to the Environmental Impact Statement, major permit work, financial plans, and cost estimates. Time control of this phase then begins with continuous monitoring and periodic updating of these plans and schedules.

The next major task will be a further review of the overall strategic plan and schedule. These activities will then be included, at the strategic level of detail, in the previously developed CPM schedule, which will then serve as the overall plan and schedule for the project until tactical level schedules can be developed for detail engineering, procurement, and construction.

As information becomes available (Process and Instrumentation Diagrams, Plot Plans, etc.) near the end of this phase, development of the tactical schedules for detail engineering, procurement, and construction will begin.

4.2 Project Timetable

Phase IIA:

The current project schedule projects the plant to be fully operational in 1988. This is based on the assumption that front-end work, in addition to that required for permits, will be performed during Phase IIA. One of the main areas in which work must be performed during the permitting process is the construction support period shown on the attached schedule.

The main critical path to achieving the construction support target is the regulatory permitting process and associated engineering, which culminates in the receipt of necessary permits by the First Quarter of 1984 prior to the start of construction. This is followed by completion of critical infrastructure construction work and the start of onsites construction in the spring of 1985. The key project decision point, critical subcontracts and equipment purchase order awards occur in the Third Quarter of 1983. This is after

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completion of the Appropriation Cost Estimate and financial plan, but before all major permits are obtained. There is a risk involved with this approach; therefore, purchase orders will be placed on a limited basis, with cancellation charges established at key milestones. These main critical items set the overall schedule for the project. Program support requires some overlapping of the various project phases. Specifically, the start of engineering to develop critical infrastructure subcontract packages must begin in the Third Quarter of 1982, which is prior to completion of the Appropriation Cost Estimate. Award of these subcontracts is required prior to receipt of major permits in early 1984.

Phase IIB:

The Phase IIB start of front-end and detailed engineering, along with procurement of major equipment, must also commence prior to permit receipt. This is required to support the construction of modules and the 28-month field construction program for onsite facilities.

Phase III:

Finally, Phase III, camp development, is also scheduled to start in the field before receipt of all major permits.

4.2.1 Phase I

Phase I, the feasibility study, was completed in October, 1981.

4.2.2 Phase IIA - Environmental Impact Statement

This phase begins after completion of Phase I and is defined as completion of the Environmental Impact Statement and major permit work. As shown in

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Table 3, Environmental Program, Phase IIA engineering for environmental work, permitting, and the financial plan, is scheduled for completion during the First Quarter of 1984. Following completion of the Appropriation Estimate in the First Quarter of 1983, a decision will be made on committing the remaining Phase IIA work dependent on the permitting progress and completion of the financial plan.

4.2.3 Phase IIA - Construction Support

In order to support plant start-up in the Third Quarter of 1987, some critical subcontracts and purchase orders must be awarded prior to the completion of Phase IIA.

The first critical milestone occurs during the Third Quarter of 1982, prior to completion of the Appropriation Estimate. At this time, the engineering necessary to develop the critical subcontract packages and evaluation of major equipment is scheduled to begin. The next critical milestones are the Fourth Quarter, 1983, and the First Quarter, 1984, award of the camp development, railroad, dock, site preparation, concrete (aggregate and batch plants), module yards, transportation, and buildings subcontracts. The schedule for this phase is based on the need to begin construction in the spring of 1984.

4.2.4 Phase IIB - Front-End Engineering

Although purchase orders will not be issued prior to the Third Quarter, 1983, front-end design must

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begin during the Fourth Quarter of 1982 in order to support the scheduled project completion. Detailed engineering and procurement (quotations and bid analysis) will commence three and six months later so that purchase orders for critical equipment can be awarded to support construction of modules. Based upon favorable permitting progress, purchase orders will be placed on a limited basis, with cancellation charges established. Detailed engineering is scheduled for 30 months, with procurement completing nine months later. The schedule for this phase is based on the critical requirements of the modular construction program.

4.2.5 Phase III

Phase III, construction, begins after receipt of permits and completion of infrastructure work in the spring of 1984. Construction of modules begins in the First Quarter of 1984, with completion in November, 1986, being a critical milestone. With completion of critical infrastructure work (railroad, dock, site preparation, and concrete batch and aggregate plants) by the spring of 1985, construction of onsite facilities can commence. Completion of these units will be sequenced based upon start-up requirements, with mechanical completion of the last unit scheduled for July 1, 1987. The overall project then culminates with a six-month start-up program scheduled for the final two quarters of 1987, resulting in a fully operational plant in January, 1988.

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TABLE 3

ENVIRONMENTAL PROGRAM

MONTH 1 IS OCTOBER 1981

Task			Month
1.	PSD Permit:		
	a.	Prepare monitoring plan and get agency approval	1 - 4
	b.	Required engineering design available	10
	c.	Monitoring period	5 -16
	d.	Finalize permit application	17
	e.	EPA review of application	18-19
	f.	Probable submittal of supplementary permit application information	19
	g.	Receive EPA determination of completeness	20
	h.	EPA process and issue permit	21-29
2.	NPDES Permit:		
	a.	Engineering data available	0
	b.	Prepare permit application	1
	c.	Submit permit application (plant and mine)	2
	d.	EPA determination that mine NSPS will require an EIS	3
	e.	Prepare DEIS and FEIS	4 -29
	f.	Environmental (fisheries and hydrology mainly) field studies necessary for (e)	4 -29
	g.	EPA issue NPDES permit with State certification	31
3.	Environmental Impact Statement, EIS: (See No. 2 NPDES)		4 -29

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4. Corps of Engineers 404 and Section 10 Permit:

a.	Engineering data available	0
b.	Submit permit application	2
c.	COE process and issue permit (the COE may choose to wait until after FEIS to issue permit)	3 - 8

5. State Anadromous Fish Permit:

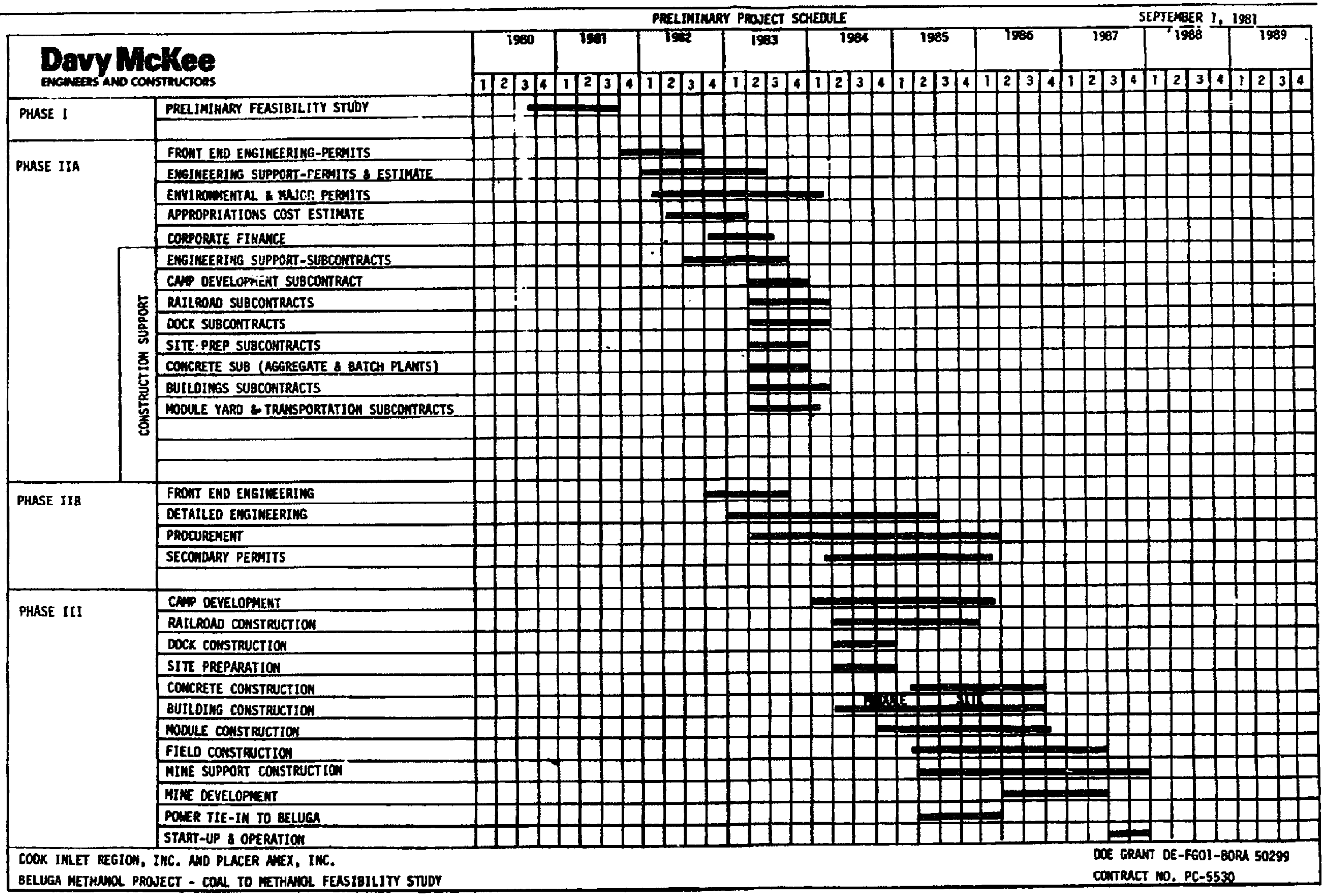
a.	Necessary additional fisheries field work (same effort as 2 (f) under NPDES)	4 -29
b.	Permit application (could be anywhere up to month 24)	24
c.	Permit issued	29

6. Surface Mining Permit:
(There is no state program at present)

a.	Necessary hydrology and soils field work	1 -24
b.	Prepare permit application	22-25
c.	Issue permit	29

Abbreviations

PSD - Prevention of Significant Deterioration
NPDES - National Pollutant Discharge Elimination System
EPA - Environmental Protection Agency
NSPS - New Source Performance Standard
EIS - Environmental Impact Statement
DEIS - Draft Environmental Impact Statement
FEIS - Final Environmental Impact Statement
COE - Corps of Engineers



PRELIMINARY PROJECT SCHEDULE
SEPTEMBER 1, 1981
Davy McKee
ENGINEERS AND CONSTRUCTORS
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1 2 3 4
PHASE I
PRELIMINARY FEASIBILITY STUDY
PHASE IIA
FRONT END ENGINEERING-PERMITS
ENGINEERING SUPPORT-PERMITS & ESTIMATE
ENVIRONMENTAL & MAJOR PERMITS
APPROPRIATIONS COST ESTIMATE
CORPORATE FINANCE
CONSTRUCTION SUPPORT
ENGINEERING SUPPORT-SUBCONTRACTS
CAMP DEVELOPMENT SUBCONTRACT
RAILROAD SUBCONTRACTS
DOCK SUBCONTRACTS
SITE-PREP SUBCONTRACTS
CONCRETE SUB (AGGREGATE & BATCH PLANTS)
BUILDINGS SUBCONTRACTS
MODULE YARD & TRANSPORTATION SUBCONTRACTS
PHASE IIB
FRONT END ENGINEERING
DETAILED ENGINEERING
PROCUREMENT
SECONDARY PERMITS
PHASE III
CAMP DEVELOPMENT
RAILROAD CONSTRUCTION
DOCK CONSTRUCTION
SITE PREPARATION
CONCRETE CONSTRUCTION
BUILDING CONSTRUCTION
MODULE
SITE
MODULE CONSTRUCTION
FIELD CONSTRUCTION
MINE SUPPORT CONSTRUCTION
MINE DEVELOPMENT
POWER TIE-IN TO BELUGA
START-UP & OPERATION
COOK INLET REGION, INC. AND PLACER AMEX, INC.
BELUGA METHANOL PROJECT - COAL TO METHANOL FEASIBILITY STUDY
DOE GRANT DE-FG01-80RA 50299
CONTRACT NO. PC-5530

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5.0 LAND ACQUISITION WORK PLAN

The pattern of land ownership in the project area is relatively simple and should pose no barrier to the assemblage of land parcels required for the transportation routes, staging areas, temporary construction facilities and operating facilities, such as the coal to methanol conversion plant complex, airfield and employee housing units.

With the exception of a few very small isolated parcels, land in the general project area is held in large blocks by only four owners, as noted below:

1. State of Alaska - 200,000 acres
2. Cook Inlet Region Inc. - 320,000 acres
3. Tyonek Village - 40,000 acres
4. Kenai Peninsula Borough - 6,000 acres

The total acreage to be acquired by the project, broken down by facility and current owner, is shown below with approximate owner areas.

Facility	Area (Acres)	Project Owners
Plant Use	1,000	CIRI (25%) Kenai Borough (50%) State of Alaska (25%)
Townsite	1,000	State of Alaska
Airstrip	150	State of Alaska
Railroad and Roadway	1,100	CIRI (20%) Kenai Borough (10%) State of Alaska (70%)
Barge Loading/Unloading	75	State of Alaska
Total	3,325	

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Approximately 450 acres will be acquired from CIRI, 250 for plant site and 200 for the railroad and service road. The remainder will be acquired from the public landowners. Land values in the area vary substantially, depending upon location and physical characteristics. CIRI has cited an approximate sale price of $3,000 per acre, or $1.41 million for the total CIRI land required. Alternatively, this land may be leased at a rate of $250 - $300 per acre per year.

The terms for the acquisition of State and Borough lands are generally unknown at this time. However, previous public land leases in similar situations usually specify lease rates corresponding to 2-6% of the market value per year. Data on land sales for comparable lands (generally inferior to CIRI lands) are very limited. However, discussions with a number of knowledgeable people indicate an approximate market value of $1,500 per acre. Using a 5% of market value figure, the total yearly cost of acquiring State and Borough lands will be approximately $214,000.

Placer Amex Inc. currently has an industrial land lease application before the State of Alaska. This application covers approximately 3,000 acres in the vicinity of the proposed plant site location. The State of Alaska has also stipulated a "floating" public easement across its lands, linking the Capps and Chuitna West mine sites with the plant and temporary dock sites. Owners of the lands remaining to be acquired have expressed interest in entering into negotiations for purchase or lease at the appropriate time.

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SUMMARY OF THE PHASE I FEASIBILITY STUDY

INTRODUCTION

Cook Inlet Region, Inc. (CIRI) and Placer Amex Inc. (PLACER) propose to develop a commercial scale coal-to-methanol operation located close to coal deposits in Kenai Peninsula Borough, Alaska, on the west side of Cook Inlet. The plan of the sponsors provides for participation in the venture by additional equity partners and financial assistance from the U.S. Synthetic Fuels Corporation.

The overall concept consists of the utilization of low-sulfur, high-volatile sub-bituminous coal from Alaska's Beluga coal field as feed for a process plant which will produce fuel grade methanol at the rate of 54,000 barrels per day, and distribution of the product to existing and potential markets on the U.S. West Coast.

The Beluga Area is estimated to contain over one billion tons of coal recoverable by surface mining methods. For the purposes of the feasibility study, two areas, containing approximately 500 million tons of recoverable, low-sulfur coal, have been planned for surface mining. These two deposits of sub-bituminous coal are located in the Beluga Area on State and CIRI coal lands held under lease by Placer Amex Inc. An extremely low average sulfur content of less than 0.2% and a location adjacent to deep coastal waters make the Beluga Area unique among known world coal deposits.

A total of 8.5 million tons of coal annually is proposed from two mines, each mine with sufficient reserves to produce 4.25 million tons per year for more than 30 years, the period covered by the current study.

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Both are surface mines. Capps would use shovels and trucks plus draglines to remove overburden. Chuitna West would use shovels and trucks, excavating in benches down to a maximum depth of about 600 feet.

Mining plans and estimates are based upon current geologic data plus assumptions regarding certain items, such as continuity of coal seams, slope stability, other geotechnical factors and governmental regulations. Additional data is required to support a more comprehensive study and for final mine design.

The process plant will be located on the west side of Cook Inlet at a point approximately 60 miles southwest of Anchorage and 25 miles southeast of the coal mines. An adequate volume of process and cooling water is available from subsurface and surface water supplies in the near vicinity, and the processing complex will be in close proximity to an existing oil pipeline and marine tanker transport system which, with planned terminal modifications and provisions for storage, can be used for loading and shipment of the methanol product to the markets.

The project encompasses development of the mines; construction of a railroad from mines to plant; a construction camp, town site, air strip, and related infrastructure; construction of the process plant proper; construction of a barge dock; and installation of all required processing and ancillary facilities, auxiliaries, and utilities.

The principal processes involved in the production of methanol from coal are coal gasification, syngas upgrading and methanol synthesis. For these processing stages, it is intended to use only commercially proven technology and equipment with demonstrated potential for further improvement in efficiency; namely, Winkler fluid-bed gasifiers, Allied Chemical's "Selexol" process for acid gas removal, Air Resource's "Lo-Cat" process for sulfur recovery, and the ICI low-pressure process for methanol synthesis. The selection of these processes

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and the guidelines established for design of the plant are aimed at maximizing the possibility for future increases in production capacity with minimum additional capital investment.

The methanol complex is planned to come onstream in late 1987 and to achieve its rated capacity in 1988.

This feasibility study, which constitutes Phase I of the project, has been carried out by CIRI/PLACER pursuant to the terms of Department of Energy Grant DE-FG01-80RA-50299. The objectives of the study are to resolve questions of plant design; establish estimates of capital costs, operating costs, and working capital requirements; survey fuel prices and markets; assess the marketability of the proposed methanol product; and confirm the economic viability of the project. These tasks are to be done at sufficient levels of accuracy to provide a basis for decision with respect to proceeding with the further phases of the project.

The work to be done is divided into nine principal tasks as detailed in the April 25, 1980, CIRI/PLACER proposal to the Department of Energy. These are listed under the heading "Task Cross Reference," which indicates those parts of this report in which each specification is fulfilled.

To provide the range of specialized expertise required to address the above tasks with authority, a study team was organized and responsibilities were assigned to the team members as follows:

MAIN PARTICIPANTS

CIRI/PLACER (Project Sponsor)	Overall responsibility for administration and coordination of the study; direct responsibility for all marketing and financial aspects.

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	Responsibility for the marketing and transportation, including pipeline studies from plant to ship loading terminal, marine transportation, and terminal handling.
DAVY McKEE CORPORATION (Principal Process & Project Engineer)	Management responsibility for studies of the mine, railroad, process plant onsites and offsites, pipeline and terminal modifications, townsite and airstrip; direct responsibility for conceptual design, engineering design, trade-off studies, and capital cost estimates for the railroad, process plant onsites and process plant offsites and environmental, health and safety, and socioeconomic assessments.
PAUL WEIR COMPANY (Mining Engineer)	Evaluate quality and quantity of coal resources; prepare capital and operating cost estimates for mining and reclamation; determine minesite facility requirements, mine power requirements, coal haulage, and ash disposal.
DOWL ENGINEERING/CCC/HOK (Environmental)	Preparation of the overall environmental and permitting plan for the project, including an environmental baseline monitoring program and an environmental assessment report.
CIRI/HOLMES AND NARVER (Engineers)	Provide conceptual design, engineering, trade-off studies, and capital cost estimates for the townsite, construction camp and airstrip.
BANKERS TRUST COMPANY (Financial Consultant)	Together with Lehman Brothers Kuhn Loeb, investigate possible financing sources for project execution. Develop relevant data and analyze the economic viability of the project. Prepare the financial plan.
LEHMAN BROTHERS KUHN LOEB (Financial Consultant)	In conjunction with Bankers Trust Company, investigate possible financing sources for project execution. Develop relevant data and analyze the economic viability of the project.

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CONSULTANTS

WILLIAM D. BAKER CO. (Estimating Specialist)	Review of mine facilities and capital cost estimates.
BOOZ, ALLEN, AND HAMILTON (Marketing Consultant)	Provide market research data, primarily for the potential use of methanol as motor vehicle fuels (blends and neat), and make projections of expected prices of fuels which are, or could be, competitive with methanol on the West Coast for electric power generation. The survey of West Coast utilities for potential use of methanol was principally performed by Placer Amex Inc.
COOK INLET PIPE LINE CO. (Operator Pipeline Co.)	Confirm the technical feasibility of and provide a tariff for utilizing the existing Cook Inlet Pipeline for transport of both crude oil and methanol, taking into account the conceptual engineering design, trade-off studies and modifications required to permit use of this pipeline and terminal for transporting, storing, and loading methanol.
DR. P. N. D'ELISCU (Environment)	Provide assistance as required by CIRI/Placer with respect to biological and environmental impacts of methanol handling, pipeline transportation, storage, and ship loading in Cook Inlet. This includes marine, freshwater, and terrestrial habitats.
R. A. FISK AND ASSOCIATES, LTD. (Railroad Consultant)	Analyses, evaluations, and reporting concerning routing and construction of the railroad. Provide installation and operating costs.
GREEN CONSTRUCTION COMPANY (Construction Consultant)	Collaboration with R. A. Fisk and Associates, Ltd., in providing data for estimating the cost of grading and constructing the selected railroad right-of-way.

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KLOHN-LEONOFF, LTD. (Geotechnical)	Provide consulting services as required in the area of mine and reclamation planning, particularly with respect to geotechnical criteria for the design of pit slopes, waste disposal piles, and drainage and sedimentation pond systems.
C. PRESTON LOCHER (Construction Consultant)	Consulting services as required concerning transport logistics and labor and construction methods in the Cook Inlet area.
D. A. SHOCK (Consultant)	Assist CIRI/Placer on methanol product quality specification, transport, and handling with respect to the pipeline.
DR. C. A. STOKES (Process and Marketing)	Provide technical services for the market study, primarily in the areas of motor vehicle fuels (applications, technical limitations, and potential quantities salable), chemical industry requirements, and price and economic verification.

The areas of responsibility for each of the above participants is indicated in the following tabulation of Tasks 1.00 through 9.00:

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TASK CROSS REFERENCE

Task	Title	Volume	Section	Participant
1.00	CONCEPTUAL DESIGN			
1.01	Mine	I	All Sections	Paul Weir
1.02	Railroad	III	Railroad	Davy McKee, Fisk, Green
1.03	Process Plant Onsites	II	All Sections	Davy McKee
1.04	Process Plant Offsites	II	All Sections	Davy McKee
1.05	Camp, Town, & Airstrip	III	Camp, Town, & Airstrip	CIRI/H&N
2.00	ENGINEERING DESIGN			
2.01	Mine	I	All Sections	Paul Weir
2.02	Railroad	III	Railroad	Davy McKee, Fisk, Green
2.03	Process Plant Onsites	II	Coal Preparation	Davy McKee
			Methanol Synthesis and Distillation	Davy McKee
			Emergency & Safety Systems	Davy McKee
			Buildings and Vehicles	Davy McKee
			Dust Collection	Davy McKee
2.04	Process Plant Offsites	II	Oxygen-Nitrogen-Air and Utilities	Davy McKee
			Wastewater Treatment	Davy McKee
			Storage Facilities	Davy McKee
2.05	Camp, Town, & Airstrip	III	Camp, Town, & Airstrip	CIRI/H&N
2.06	Overall Plant Layout	Executive Review	Summary of Study	Davy McKee
2.07	Pipeline Transport, Storage, Handling, and Ship Loading	III	Product Transportation	CIPL, D.A.Shock
3.00	TRADE-OFF STUDIES			
3.01	Mining Operation Alternate	V	Trade-Off Studies	Paul Weir
3.02	Shipping Coal Alternates	V	Trade-Off Studies	Davy McKee
3.03	Coal Drying Alternates	V	Trade-Off Studies	Davy McKee
3.04	Gasification Alternate with Various Qualities of Coal	V	Trade-Off Studies	Davy McKee
3.05	Construction Approach Alternates	V	Trade-Off Studies	Davy McKee
3.06	Product Shipping Alternates	V	Trade-Off Studies	Davy McKee
3.07	Ash Disposal Studies	V	Trade-Off Studies	Davy McKee

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Task	Title	Volume	Section	Participant
3.08	Natural Gas Alternate for Power Generation	V	Trade-Off Studies	Davy McKee
3.09	Comparison of Cooling Water Systems	V	Trade-Off Studies	Davy McKee
3.10	Hydrogen Sulfide Removal	V	Trade-Off Studies	Davy McKee
4.00	CAPITAL COST ESTIMATE			
4.01	Obtain Vendor Costs	(Included in 4.03)		
4.02	Obtain Subcontract Costs	(Included in 4.03)		
4.03	Prepare Individual Cost Estimates			
	a) Mine	I	Tables	Paul Weir
	b) Railroad	III	Railroad	Davy McKee, Fisk, Green
	c) Camp, Town, & Airstrip	III	Camp, Town, & Airstrip	CIRI/H&N
	d) Process Plant	V	Capital Cost	Davy McKee
4.04	Prepare Overall Capital Cost Estimate	V	Capital Cost	Davy McKee, CIRI/Placer, CIRI/H&N, W.D. Baker, C.P. Locher, Fisk, Green
5.00	MARKETING			
5.01	Evaluate Market Requirements	V	Marketing	C.A. Stokes; CIRI/Placer; Booz, Allen, & Hamilton
5.02	Develop Marketing Methods	V	Marketing	
6.00	SITE EVALUATION			
6.01	Site Data Collection	IV	Site Evaluation	CIRI/Placer, DOWL
6.02	Site Data Evaluation	IV	Site Evaluation	CIRI/Placer, DOWL, Klohn Leonoff
6.03	Applicable Construction Codes and Ordinances	IV	All Sections	DOWL
6.04	Plans for Acquiring Permits & Licenses	Executive Review	Work Plan for Phase II	CIRI/Placer, DOWL

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Task	Title	Volume	Section	Participant
7.00	ECONOMIC ANALYSIS			
7.01	Basic Definition	V	Financial	CIRI/Placer, Bankers Trust, Lehman Brothers Kuhn Loeb
7.02	Economic Analysis	V	Financial	
7.03	Financial Plan	V Executive Review	Financial Work Plan for Phase II	
8.00	ENVIRONMENTAL			
8.01	Environmental	IV	Baseline Data	DOWL
8.02	Socioeconomics	IV	Baseline Data	P.N.D'Eliscu
8.03	Site Evaluation	IV	Site Evaluation	CIRI/Placer, DOWL
8.04	Health	IV	Safety and Risk	DOWL
8.05	Safety	IV	Safety and Risk	DOWL
9.00	TECHNICAL SUPPORT PLANS			
9.01	Project Management Plan	Executive Review	Management Plan for Phase II	CIRI/Placer, Davy McKee
9.02	Project Manual	(Issued at start of Phase I; to be expanded for each additional phase.)		
9.03	Reports	(Quarterly reports issued during Phase I. Progress reports will be issued as required in future phases.)		

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COAL MINING

The total coal requirement for the project will be 8,500,000 tons per year. This includes the raw material input to the methanol plant (approximately 6,500,000 tons) plus tonnage to be used for generation of steam and electric power for the plant (approximately 2,000,000 tons).

The coal will be produced from two deposits of subbituminous coal, designated as the Capps Area and Chuitna West Area, which are located in the Beluga Coal Field on State of Alaska and CIRI lands which are held under lease by Placer Amex Inc.

The Capps and Chuitna West Mines each contain sufficient reserves to produce 4.25 million tons annually for more than 30 years, the period covered by this study. Together they contain 490,442,000 tons which is considered to be potentially recoverable. For the purposes of this study, portions of these reserves are not considered as minable.

At Chuitna West there are 163,111,000 tons considered to be minable, with a waste-to-recoverable-coal ratio of 7.1 BCY (bank cubic yards) per ton. Five minable seams occur at Chuitna West, of which "M" bed is the most prominent, containing over 50 percent of the total tonnage. Coal reserve estimates for the Chuitna Area were made with use of computer modeling methods.

The Capps Mine contains an estimated 223,527,000 recoverable tons of coal, with a waste-to-coal ratio of 6.9 BCY per ton. The minable tonnage at Capps is contained in two seams. The lower of the two (Waterfall Seam) accounts for more than 80 percent of the total reserve. Both the Waterfall and the overlying Capps seams contain clay partings that must be removed during mining. Manual modeling methods were used to prepare estimates of minable coal in the Capps Area, which were then checked by computer.

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Additional drilling in both areas is needed to raise the confidence level of the tonnage estimates and to extend the reserve area for Chuitna West. Additional exploratory data could expand the reserve tonnage as well as confirm presently estimated reserves.

Both mines will employ surface methods; no underground mining is proposed. Shovels and trucks plus draglines will remove overburden in the Capps Mine. In the Chuitna West Mine it is planned to use shovels and trucks, excavating in benches down to a maximum depth of about 600 feet. Wheeled scrapers will be used at both mines to remove topsoil and (at Capps) shallow overburden and partings. Overall stripping ratios are approximately the same at the two deposits; namely, 7 bank cubic yards (BCY) of overburden per recoverable short ton of coal.

Mining plans and estimates are based upon current geologic data plus assumptions regarding certain geotechnical factors and governmental regulations. In the early years of mining, Capps will produce up to 7.5 million tons annually, gradually reducing to 4.25 million tons in Year Five. During that period, Chuitna West would build up from 1.0 million tons in Year One to 4.25 million tons in Year Five.

During the 30-year period the total estimated mine work force ranges from 700 employees at start-up to 1,174 in Year Five.

GEOTECHNICAL OVERVIEW

Klohn Leonoff, a Vancouver, Canada-based geotechnical firm with extensive experience in assessing hydrology and soils stability on large projects located around the world, was retained to provide consultation with respect to geotechnical aspects of the project. Their scope of work included the mine and waste disposal plan, railroad and access road construction, and process site selection. They were specifically requested to address the need to contain and minimize any sedimentation that might adversely affect the Chuitna River Salmon Fishery.

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The Klohn Leonoff study provides a general geotechnical overview of the project area and comments on the design work carried out to date. It also outlines the additional necessary work to bring the project to the final design stage. This additional geotechnical work is summarized in the Work Plan for Phase II.

Bedrock in the area is comprised of sedimentary rock of Tertiary age overlain by a discontinuous mantle of glacial till varying in thickness from 0 to 100 feet at an estimated average depth of 30 to 40 feet. The rock types are poorly indurated, essentially non-cemented, and considered to be weak.

A major fault strikes through the project area, separating the Chuitna and Capps pits. Upwards of 2,000 feet of throw is suggested on the fault, although subsequent erosion and glaciation have levelled the rock surface across the fault. In the Chuitna pit the bedrock is essentially level, but in the Capps pit it dips 6-12° to the north.

From the highlands area of the pits the landscape falls to the south over the Nikolai escarpment, which is a moderate-to-gentle, generally stable slope. To the north, the downcutting Chuitna River has resulted in generally unstable slopes along the entire river valley within the project area.

The area is one of strong seismicity, with numerous recent shocks of Magnitude 6 or greater on the Richter scale. Seismicity will be a topic for consideration in final design.

Pit slopes at the Chuitna Mine will encounter glacial till within the upper 100 feet, overlying soft sedimentary rocks. Final pit slopes, benches and intermediate slopes will need to be developed prior to final design.

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Drainage and pore pressure control of pervious aquifers may require vertical pump wells from benches. Drainage ditches around the edge of the pit and along the coal seam will control surface drainage.

It will be necessary to control the access of water into the waste dumps and restrict the development of pore pressures to acceptable levels. For surface waste dumps, it is recommended that compacted dikes of glacial till be constructed to confine the waste.

Relatively high groundwater tables are anticipated in the Chuitna pit. Drainage will be necessary to ensure slope stability.

Overburden materials in the Capps Pit and behavior of the pit slopes is similar to the conditions at Chuitna.

The control of surface and groundwater at the plant and town sites will be most important. The sites appear to be in areas of dense and stable foundation conditions. Construction design practices should avoid charging and trapping groundwater in the foundations.

Recent drilling in the barge dock area indicates that the foundation here consists of dense, granular material, probably glacial till, delta gravels, or tertiary bedrock. If it is, in fact, tertiary bedrock, the pier foundations should consist of high-capacity steel piles or equivalent. These piles should penetrate a reasonable depth, have low relative displacement, and have a high bearing capacity and resistance to uplift.

Present plans are to carry the ash by train to the West Chuitna pit area for disposal in the pit backfill. The ash, spread in layers, can have a deleterious effect on the seismic stability of the backfill. Therefore, the ash must be incorporated into the backfill so that continuous weak layers are not developed. An alternate solution would be to store the ash, in a slurry behind containment dikes, near the methanol plant. A suitable location may be north of the railroad loop. The environmental aspects of such a scheme would have to be considered.

COAL-TO-METHANOL PLANT

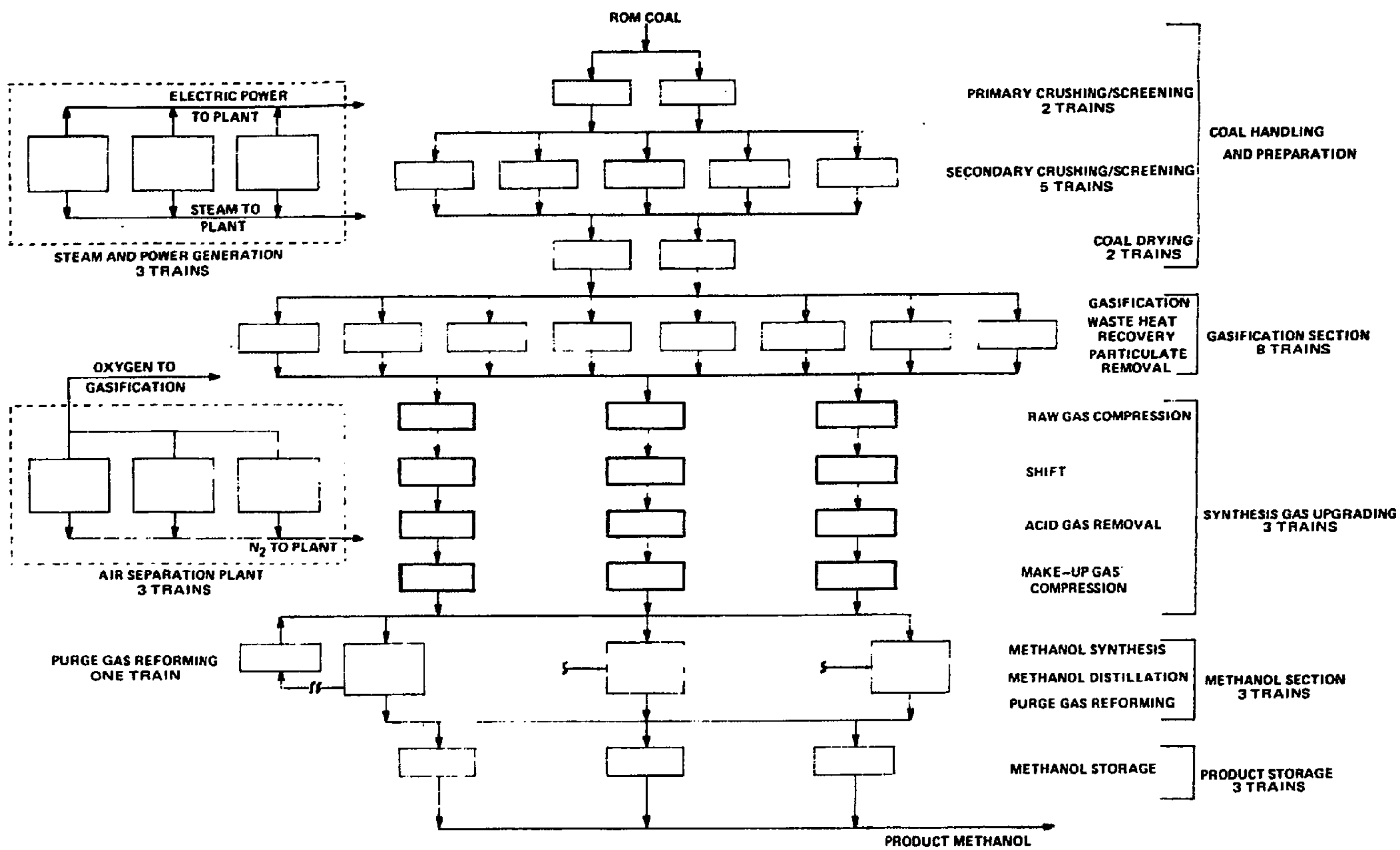
Overall Plant Description

The process plant is designed to be self-sufficient, importing coal feedstock and fuel coal, raw water, and small amounts of treatment chemicals. The product is 7,500 tons per day of fuel grade methanol, with the capability of producing chemical grade methanol. In the present design, carbon dioxide is vented to the atmosphere, and the only by-product recovered is a small amount of sulfur. The simplified block flow diagram (Figure 1-1) presents a graphic indication of the major processing steps and the number of operating units in each step.

The processing plant and major ancillary systems include the following sections:

- Coal Handling and Preparation
- Gasification
- Synthesis Gas Upgrading
- Methanol Synthesis, Distillation and Purge Gas Reforming
- Air Separation
- Steam and Power Generation

The plant being designed for self-sufficiency, all necessary ancillary systems are included.



PROCESSING TRAINS
FIGURE 1 - 1

Davy McKee ENGINEERS AND CONSTRUCTORS

PLACER AMEX INC.
COOK INLET REGION, INC.

FEASIBILITY STUDY
FOR
ALTERNATIVE FUELS PRODUCTION

PC–5530 9/7/81

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Designs for each of the major plant sections are briefly described as follows:

Coal Handling and Preparation

A blend of 70% Capps and 30% Chuitna coals, 6" x 0" run-of-mine is received by rail, unloaded, stacked, and stored in 15-day capacity storage piles.

The coal is retrieved from active storage and transferred to either the process plant or the utility boilers. Coal for the boilers is crushed to 1-1/2" x 0" in this area and transferred to the boiler area for final pulverizing.

Coal to be used in gasification is crushed to 3/8" x 0"; dried to 8% moisture; and sent to active, closed storage ready for transfer to the gasification section.

Gasification

The gasification section consists of the gasifiers, waste heat recovery systems, and particulate removal systems. There are eight fluid bed gasifiers operating at four (4) ATA and 2100°F. The coal is fed into the gasifiers by means of a lock hopper system. The coal feed rate is controlled by variable speed screw conveyors.

During gasification, the carbon in the coal reacts with oxygen and steam to form carbon oxides, methane, and hydrogen. The oxygen is supplied by three large-tonnage air separation plants which also supply nitrogen for process and utility use. The hot raw gas exits the top of the gasifiers. Larger residue solids are removed from the bottom of the gasifier, and finer particles exit with the gas. The ash exiting from the bottom is lock hoppered to atmospheric pressure and pneumatically conveyed to storage for eventual disposal to the mine.

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The hot gases leaving the top of the gasifier enter the waste heat recovery system (one unit for each gasifier train). These units use the heat in the gas to generate high pressure, superheated steam which is used throughout the plant. The solids entrained in the raw gas are a combustible char, approximately 30% carbon and 70% ash, which is used as fuel in the utility boilers. A portion of the char is collected at the bottom of the waste heat recovery unit, but the greater part is removed in a dry cyclone immediately following the waste heat recovery system. The dry char collected from the waste heat sections and cyclones is conveyed to the boiler for blending with raw coal for use as fuel.

Fine particles that may still be entrained in the gas are removed via a direct quench Venturi-type scrubber (one scrubber per gasifier train). The particle-laden water is sent to settling ponds where the particulate is concentrated and filtered. The water purge is sent to wastewater treatment for water recovery.

The raw gas, now cooled and clean of particulate, is delivered to the synthesis gas upgrading section for production of a gas suitable for methanol synthesis.

Synthesis Gas Upgrading

Four (4) major gas processing steps are included in the synthesis gas upgrading section:

- o Compression from 40 psia to 1390 psia (methanol loop pressure).
- o Adjustment of H_2 to CO ratio.
- o Removal of all sulfur compounds and other catalyst poisons.
- o Reduction of CO_2 content.

The synthesis gas preparation area consists of three (3) parallel trains.

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The first step in this section is raw gas compression which increases the pressure of the gas from 40 psia to 770 psia. Turbine-driven centrifugal, multi-body compressors are used.

From compression, the gas is saturated, preheated, and sent through a CO shift reactor, where the ratio of hydrogen to carbon monoxide is adjusted with sulfur-resistant catalyst to the required level for methanol synthesis. The reactor is a packed bed of catalyst.

From COS hydrolysis, the raw gas goes to the Selexol acid gas removal unit. The purpose of this unit is to remove the sulfur components in the gas and to adjust the CO_2 level in the gas to the required percentage for methanol synthesis. This process is selective in that it removes H_2S from the raw gas in the first absorber, and CO_2 removal is done with a second absorber. Since the solvent is recirculated, it must be continually regenerated by flashing. The absorbers are packed columns in which the gas streams are contacted with the liquid solvent. The purge gas stream leaving the H_2S flash system is sent to the sulfur recovery unit.

The gas leaving the CO_2 vent is 99%+ CO_2 and, hence, is simply vented. Since large amounts of CO_2 are released, consideration has been given to collection and possible sale for use in secondary recovery of crude oil. The synthesis gas leaving the Selexol unit contains only trace levels of H_2 and COS and has the proper ratios of CO, CO_2 and H_2 for methanol synthesis. Guard beds are provided for removal of any trace sulfur compounds and other catalyst poisons.

The final stage in this preparation area is make-up gas compression. The synthesis gas is compressed to the level required for methanol synthesis, which is 1390 psia. Turbine-driven, centrifugal type compressors are used.

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Methanol Synthesis Distillation and Purge Gas Reforming

The ICI low-pressure methanol process is used in this section of the plant. In order to produce 7,500 STPD of product methanol, three synthesis and distillation trains are required. Each train consists of one converter, one circulator, a distillation column and a set of heat recovery units. The circulator is a steam-driven, single-stage, centrifugal compressor.

The methanol converter is a pressure vessel of single-wall design constructed of low-alloy steel holding a single continuous bed of catalyst. Temperature control is achieved by injecting feed gas at appropriate levels directly into the bed, using specially developed distributors.

The converter exit gas is split for optimum heat recovery; one part heats the feed gas to the top of the converter, and the second heats the CO shift saturator water and reboils the distillation column. The streams are combined to heat all of the circulating gas and then cooled. The crude methanol is separated and let down from loop pressure to 60 psia.

The non-reactive components, mainly CH_4 and N_2, in the make-up gas are purged from the synthesis loop between the separator and the point of make-up gas addition. This purge gas and the flash gas from the letdown vessels are used as feed to a steam reformer. Seventy-five (75%) percent of this gas is used as process feedstock, and 25% is utilized as fuel for the reformer furnace. The reformed gas is recompressed and blended with the main synthesis gas stream.

A one-column-per-train distillation system is provided to produce the required product purity. The crude methanol from the letdown vessel flows to the preheater and then to the column. The reboiler heat is provided by part of the converter exit gas. The purpose of the

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distillation column is to remove water and the light ends from the crude methanol. The column overhead is completely condensed and returned to the column as reflux. Product methanol is withdrawn three trays below the reflux tray and is cooled prior to passing to the methanol product storage tank. The distillation column bottom, which is essentially water, is cooled and pumped to the wastewater treatment area.

Product storage facilities have also been provided in this section. Storage tanks for crude methanol and methanol product storage tanks are provided.

Major Support Facilities

- Air Separation

  This section produces all the oxygen required for gasification. The normal production is 7,500 STPD at 99.5% purity and 90 psia. Three (3) units are required for this capacity. Air and oxygen compressors are turbine-driven.

- Steam and Power Generation

  The remaining import coal not used in the gasification process is used in the boiler house for steam and power generation. Coal is blended with gasification char and is used as fuel for the three boilers to generate 1,200 psig steam. This steam is used both for process requirements and power generation from turbo-generators.

RAILROAD

The functions of the railroad are to haul coal from the mines to the plant; ash and sludge back to the Chuitna mine; and commodities between the dock, the plant, and the mines.

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The railroad system is a twenty-two mile long, single-track network with turnaround loops at the Capps Mine and the plant, a four-mile extension to the dock, sidings at the plant and the mines, two emergency passing sidings along the main route, and yard tracks at the plant.

The system includes facilities for loading and unloading coal, ash, and sludge; for servicing locomotives; and for locomotive and car repair. The rolling stock consists of eight 3,500 hp diesel electric locomotives, 138 coal cars, 39 ash cars, 46 sludge cars, 7 flat cars, 7 box cars, and 11 tank cars.

Two coal trains make three round trips each for five days a week. Each train has three 3,500 hp locomotives, 60 coal cars, 11 ash cars, and 12 sludge cars. Forty-two coal cars are loaded at Capps; and the remaining 18 coal cars are loaded at the Chuitna mine, where 11 empty ash cars and 12 empty sludge cars are attached. The train continues downhill from the Chuitna mine to the plant, where all sixty coal cars are unloaded.

On weekends, two trains make three trips each day hauling ash and sludge to the Chuitna Mine. These trains consist of two 3,500 hp locomotives, 11 ash cars and 12 sludge cars. Commodities are delivered by one train twice a week. This train consists of one 3,500 hp locomotive, 3 box cars, 3 flat cars and 5 tank cars.

R. A. Fisk & Associates Ltd., a Canadian consulting firm with considerable experience in sub-arctic railroad construction, was engaged to provide an independent estimate of construction and operating costs. Their conclusions were that the preliminary rail planning yielded reasonable results and that with minor adjustments the railroad alignment is acceptable.

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DOCK

A barge dock and slip with ramp and staging area is located at Granite Point on the west shore of Cook Inlet, about 3 miles from the methanol plant.

The slip will accommodate 400 ft by 100 ft barges. The maximum tide deviation is some 30 feet. All barge traffic in and out is at high tide, and barges are ballasted and beached for loading and unloading.

A single track extension of the railroad provides rail access between the dock, plant and all points along the main rail corridor. A 40-foot wide roadway parallel to the railroad provides for truck and module transporter traffic from dock to plant, town, camp and mines.

The dock facilities will handle all incoming and outgoing barge cargos of equipment, materials, fuels and supplies.

CAMP, AIRSTRIP, TOWN & BUS SYSTEM

The conceptual plan provides guidance for the initial consideration and eventual development of 1) a camp for 3,000 construction workers; 2) an airstrip capable of serving Lockheed Hercules aircraft; and 3) a permanent townsite for 2,600 to 4,200 persons (mine and plant workers and their families).

On reviewing available information regarding relevant socioeconomic factors, physical and land use characteristics, etc. of the project area, the following general conclusions have been drawn. Each of these is described more fully in Volume IV.

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CAMP DEVELOPMENT

The most appropriate method of camp development for support of the Beluga Methanol Project is believed to be the use of prefabricated and preinstalled modules which are readily available from local contractors and manufacturers in Alaska, as well as from larger camp manufacturers in the Gulf Region of the United States.

The development of a 3,000-man camp in the project area will cost approximately $25,120,700 (midpoint, 1981 dollars). This preliminary estimate includes costs associated with construction mobilization, facility erection and assembly, and utility development and installation.

Camp operation and maintenance costs will vary with the size of the camp. For example, a 50-man camp in the project area can be operated for approximately $70 per person per day; and for a 3,000-person camp, approximately $32 per person per day.

Preferably, the water source for the campsite would be the existing aquifer in the vicinity of the townsite utility complex; and the same supply could eventually be used for the permanent townsite. This approach, however, will be cost-effective only if the campsite is located within 1.5 miles of the permanent townsite.

AIRPORT DEVELOPMENT

One general transport aircraft, the Lockheed Hercules, has proven successful in the transport of construction materials and equipment, general cargo, and passengers to remote camps and communities in Alaska.

An airport capable of serving these aircraft under normal and crosswind conditions can be developed in the project area for approximately $6,078,000. This preliminary estimate assumes the use of construction equipment already mobilized for camp development, as well as the local availability of gravel.

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Given the limited quantity of potable water required, potable water and fire water supply at the airport can be delivered by truck on a weekly basis from the townsite water treatment and storage facility.

TOWNSITE DEVELOPMENT

The townsite is highly significant to the overall project in terms of its potential impact on employee morale and efficiency, work force continuity, and the general perception of the project by adjacent Cook Inlet Basin communities.

Given the preliminary assumptions regarding potential financial participation by the project and other investors, the estimated levels of financial responsibility for townsite development will be as follows.

Project	$ 18 million
Other Investors	85 million
Total	$103 million

Basic commercial, educational, and community service facilities will be centralized in the townsite in order to gain the advantages of reduced construction, operation and maintenance costs, and personal convenience to future town residents. These facilities, as well as some limited multiunit housing, will comprise the central core of the townsite, which will be financed and constructed incrementally by the project and other investors. Surrounding the central core of the townsite will be the development of single-family, townhouse, and multiunit residential neighborhoods. The neighborhoods will be developed and financed by private residential builders. Individual housing units will be marketed by a local real estate sales organization.

Circulation within the townsite will initially be accomplished primarily with use of small 20- and 45-passenger buses, as well as pedestrian and combination bicycle/cross-country ski trails throughout the town. The use of private automobiles may eventually be permitted.

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As in other rural Alaskan communities, school facilities will serve as community centers for community education, indoor and outdoor recreation, and social activities. Access to nearby recreational opportunities such as fishing, hiking, hunting, and camping will also be provided.

BUS SYSTEM

A fleet of 13 diesel-powered, 47-passenger buses will be provided to transport mine workers between the town and the mines via the roadway paralleling the railroad. The facilities will include terminals at the town and at each of the mines and a garage for bus storage.

The garage will be equipped for handling routine maintenance and minor repairs. Major repairs and scheduled maintenance services will be provided by the general maintenance shop at the methanol plant.

PRODUCT TRANSPORTATION & HANDLING

The Cook Inlet Pipe Line report (Section 6.0 in Volume III) finds that, with certain system modifications and product storage provisions, the existing CIPL crude oil pipeline can handle the transportation of both crude oil and methanol from Granite Point to ship loading facilities at the Drift River Terminal. The methanol plant will be located within about two miles from Granite Point, and the distance from Granite Point to Drift River Terminal is about 40 miles.

Pipeline Transportation and Shiploading

Methanol will be pumped from the product storage tanks at the plant to the CIPL facilities at Granite Point. The CIPL facilities currently have excess capacity, and the future throughput volume of crude oil to be handled by this system is projected to decrease (see Figure 1-2, Page 59). Thus, there is assurance, subject only to the discovery of

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large new oil fields in the area, that there will be capacity available in the CIPL pipeline and shiploading system to handle the entire production of the methanol plant over the life of the project.

The report prepared by the Cook Inlet Pipe Line Co. covers the engineering design requirements for transporting methanol through the CIPL system, additional storage at the Drift River Terminal if chemical grade methanol is produced, and loading of the methanol into tankers. Also included is a laboratory study performed for CIPL which discusses the equilibration and settling of methanol/Cook Inlet crude oil mixtures. The CIPL work establishes the feasibility of batching methanol with crude oil in the pipeline at a cost comparable to the present cost of transporting crude.

Mr. D'Arcy Shock was retained by CIRI/Placer as a consultant to work with CIPL on the laboratory portion of their work to ascertain the compatibility of crude oil and methanol in the pipeline. Mr. Shock has 35 years experience in research problems of this nature. As confirmed by him, the laboratory studies indicate that the methanol will not be contaminated by such substances as heavy metals, water, or sodium, nor will there be substantial loss of oil in methanol or vice versa in the proposed concept of pipeline operation.

COOK INLET PIPE LINE COMPANY
THROUGHPUT VOLUMES

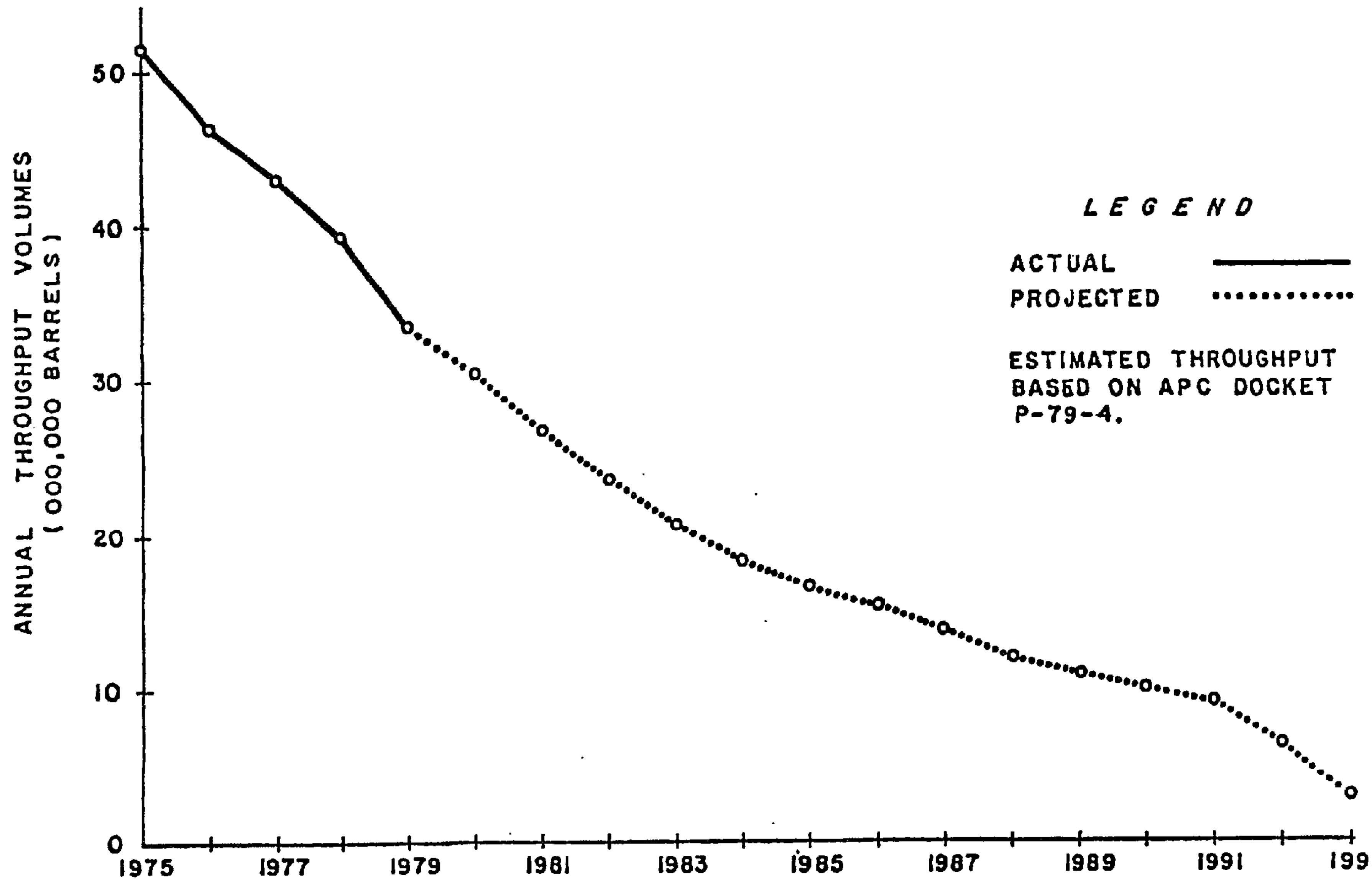

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FIGURE 1-2

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Marine Transportation

Methanol will be loaded aboard tankers at the existing all-year marine terminal at Drift River. As methanol is routinely transported in ships and barges, no innovative technology or equipment is required.

The economies and flexibility of marine transport enhance the shoreside location of the Beluga Project with important advantages in serving markets. The major population and industrial centers in each of the Pacific Coast States of California, Oregon, Washington, Hawaii and Alaska can all be served by ocean-going vessels, with many of the ports being able to berth the largest vessels that could be accommodated at the Drift River loading terminal, approximately 70,000 DWT.

Terminalling

At marine terminals in the market areas, methanol will be stored in fixed or floating roof tanks according to well established practice. In general, these tanks will be owned by customers or by established bulk terminal operators. In many cases, tanks will be converted from fuel oil service. Especially with floating roof tanks, vapor emissions will not be significant because the vapor pressure of methanol is relatively low (e.g., lower than for gasoline). With large, fixed-roof tanks, it is already established practice to vent the air space to atmosphere or, in sensitive air quality areas, to use catalytic fume combustors on the emitted vapors.

Local Transportation to Ultimate User

From the terminal to such users as utilities, transport will be by existing pipeline systems to tanks at their generating plants. In the case of smaller isolated power units, methanol will be trucked from terminal to plant as is now done in the chemical methanol industry.

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Safety Aspects

The safe handling of methanol has long been established by industry. Customers will be instructed in handling of methanol following existing practices. A typical industry safety manual, included in Volume III, describes proper handling of methanol with reference to possible fire, explosion, and health hazards.

ENVIRONMENTAL

The objectives in this study were to define the major Environmental, Health, Safety and Socioeconomic (EHS&S) issues relevant to development of the Beluga Coal-to-Methanol Project.

In performance of the study, the following five-step procedure was followed:

1. Review of all existing data and published environmental and socioeconomic information relative to the project area.

2. Supplement the published information with the findings of recent and ongoing state and federal land resource projects.

3. Identify specific areas where the environmental data base is insufficient to make meaningful appraisals of the environmental effects and permit requirements of this project. Following this identification, develop, plan and conduct specific field investigations in the highest priority areas.

4. Review the total project design and consider its effect on each major EHS&S attribute.

5. Summarize the conclusions and make preliminary findings regarding permit requirements and environmental factors (data gaps) pertinent to the next stage of planning and development and general environmental acceptability of the project.

Briefing meetings were conducted with the various agencies at both the state and federal levels. Representatives of the U.S. Army Corps of Engineers, Alaska Department of Fish and Game, Federal Fish and Wildlife Service, Environmental Protection Agency and Department of Energy visited the project site to review the general project concept and observe the environmental field activities.

The intention of this study is to present the findings in a systematic format compatible with the National Environmental Policy Act outline for an Environmental Impact Statement, that can be utilized efficiently in preparing an EIS, which would be the next major step in the orderly progression of project permitting.

The field program was initiated in the fall of 1980. Under the general environmental program, preliminary work was undertaken to perform reconnaissance surveys of aquatic habitats and determine the presence or absence of fish in the numerous streams in the area; perform reconnaissance surveys of big game distribution; and a reconnaissance survey of the intertidal habitat near the proposed dock location. Other tasks included, but were not limited to, vegetation mapping, wetlands determination, and socioeconomics.

The hydrology and geotechnical programs included drilling two test water wells and an observation well; drilling six test holes; digging thirty-two test pits; and collection of six grab samples from existing road cuts.

The principal environmental issues were grouped into four categories which are discussed in general in the remainder of this summary.

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The Beluga area, although not one of the major salmon fisheries in Alaska, has three principal drainage systems containing relatively productive fish habitats. A key environmental issue concerns the fish populations in each of these three areas; primarily, the Chuitna River system due to its immediate proximity to the Chuitna mine area. Any water discharges to this river system or development activities near it would involve particularly close scrutiny by the Alaska Departments of Fish and Game and Environmental Conservation. Several permits are required to get approval for development activities near a fishery.

The methanol plant process and cooling concept requires water of approximately 15,000 gpm. Present freshwater surface sources have been ruled out as insufficient, and desalination of Cook Inlet water to fill the freshwater requirement is unfeasible due to extraordinary power requirements. This study confirmed that deep groundwater is available in limited quantities, far short of anticipated needs. An infiltration gallery system in the lower reaches of Nikolai Creek appears to be the most viable alternative for large volumes of freshwater.

Although wetland areas constitute major portions of the general Beluga area, the plant site avoids standing bodies of water and appears relatively dry. There is a fairly high water table, and the plant site supports types of vegetation representative of a wetland; for this reason, a portion of the plant site may be considered a wetland. A preliminary determination by the Corps of Engineers, however, indicates that plant development in this area may not require a permit.

The potential sedimentation from mining activities and runoff during the construction and operation phases of the plant remain an issue relative to fisheries. The Environmental Protection Agency requires an Environmental Impact Statement for these areas. New Source Performance Standards exist for a point wastewater (drainage) discharge from a coal mine, and these discharges would require a National Pollution Discharge Elimination System (NPDES) Permit under the Clean Water Act.

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Due primarily to likely cultural changes and the changes in the present subsistence level life-style, the neighboring Village of Tyonek generally does not welcome the inevitable growth that would accompany the proposed development in the Beluga area. Special consideration must be given to reducing potential socioeconomic conflicts with village residents.

The primary air pollutant emitted from the mining operation would be suspended particulates, and from the plant operation it would be the products of combustion. The Beluga area is considered virtually pristine, being relatively unaffected by industrial activities. Because this project would constitute an introduction of air emissions into a clean air shed, there would be air quality impacts. However, preliminary computer modeling indicates emissions will be within the limits of the air quality regulations under the Clean Air Act.

In conclusion, based on the present level of environmental knowledge of the project area, and with prudent construction and operation practices, all required permits should be obtainable. The information gathered in the field, previous assessments of the issues in the Beluga area and the occasional involvement and comments of state and federal agency personnel during the environmental studies revealed no single environmental or permit issue which could preclude proceeding with this project.

SITE SELECTION

The coal reserves available to the project as feedstock are in a 450 square mile area, bounded on the north by the Beluga River, on the south by Nikolai Creek, on the west by Capps Glacier, and on the east by the shore of Cook Inlet. Eliminating those tracts and stretches of land that are clearly unavailable or unsuitable, the area remaining for selection of the plant site is reduced to about 150 square miles.

The procedure followed from this point on was to narrow the alternatives from which to make a preliminary site selection as part of this Phase I Feasibility Study. The final site selection will be made in Phase II.

The alternatives in the preliminary site selection were to place the plant at or near the feedstock source (the mines); or convenient to product transportation (a tidewater plant with a dock on Cook Inlet); or in a location remote from the feedstock, but closer to markets. With these considerations in mind, four possible areas were reviewed:

1. The Vicinity of Granite Point on Cook Inlet

   This is an approximately ten square mile area on the shoreline between Granite Point and the mouth of Nikolai Creek. Outstanding advantages here are proximity to an existing 20-inch pipeline which can transport methanol product to a tanker terminal at Drift River, and proximity to the shore, which would facilitate unloading and movement of large prefabricated modules, other construction equipment and materials, and operating and maintenance supply shipments. The principle disadvantage here is the need for a mine-to-plant coal transportation system.

2. Capps Mine

   The advantage of being near the feedstock source and also near the first coal to be mined, is outweighed by many disadvantages (e.g., difficulty of transporting modules, need for a product pipeline to Cook Inlet, and higher elevation with more severe winter weather) and, therefore, was ruled out of consideration.

3. Chuitna Mine

   At approximately 15 miles from the shore of Cook Inlet, the advantages are nearness to feedstock; coal to be supplied from Capps

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Field would be transported downgrade, instead of uphill as from Chuitna to Capps; and a shorter pipeline than would be required from Capps. This option is retained for further study in Phase II.

4. Remote Location

To complete the examination of alternatives, the possibility of an area away from Beluga or even outside of Alaska was briefly considered and then dismissed as unfeasible.

The two most likely alternatives, Granite Point and Chuitna, were then compared using evaluation criteria relevant to both. The comparison favored Granite Point, and that area is designated in this review as the base case for the Phase I Feasibility Study.

MARKETING

The logical market area for methanol from the Beluga Project is comprised of the population and industrial centers of the Pacific Coast states. Anticipated markets for this methanol extend from Puget Sound, Washington, to Los Angeles and Long Beach, as well as Hawaii. Potential receivers are concentrated in areas that have, or are close to, harbors, enabling these users to benefit from the economies and flexibility of having fuel delivered by marine transport.

The market for methanol as fuel for electric power generation already exists. The utilities' need for clean fuels like methanol is such that the entire projected Beluga plant production could be consumed in currently operating generating plants in California, Oregon, and Hawaii, where costly, low-sulfur petroleum fuels are mandated. The only concerns of the utilities are those of assured supply and competitive price; i.e., a price that does not substantially exceed that of such premium petroleum products as distillate fuels during the life of the fuel contract.

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In contrast, methanol as a motor vehicle fuel is already roughly competitive in price with the existing fuel, namely, gasoline. Methanol can be used in additives or blends with gasoline or in pure form. The potential demand arising from these uses is enormous, but has thus far been limited because vehicles capable of utililzing neat (pure) methanol are not yet mass-produced and because, until recently, methanol blends were severely limited by EPA regulations. Whereas utilities could contractually be committed to long-term, take-or-pay purchases, motor vehicle fuel distributors would not be as amenable to such contracts which are necessary to finance a large synthetic fuels venture.

Although methanol cannot yet be commercially used in diesel engines, its use in place of gasoline in spark ignition engines and in place of distillate fuels in combustion turbine power generation will release "middle distillates" for other uses. This product displacement mechanism can thereby make available more of the jet and diesel fuels which are of greatest concern to the Department of Defense.

Electric Utility Market

A single 1,000 Mw plant, operating at a heat rate of 10,000 Btu/Kwh and a 60% load factor, would consume the entire production of the Beluga plant. Existing generating units of five utilities, Southern California Edison Company, Los Angeles Department of Water and Power, Portland General Electric Company, Puget Sound Power and Light Company, and Hawaiian Electric Company, could already provide a market sufficient to take more than the total Beluga plant production. For reasons of air quality, premium-priced, low sulfur petroleum fuels or, when available, natural gas, have been mandated for plants of these utilities--evidence that clean fuels which are clean-burning are important.

Commercial-scale tests using methanol have been successfully conducted by utilities in both combustion and steam turbine units. Except for

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substitution of burners and provision for the additional storage capacity required for methanol, there are no major technological nor regulatory impediments, whether in plants built for and using other fuels or in new plants.

Emissions from methanol-fueled units will not have any particulates or sulfur-containing gases, and tests in commercial units have confirmed that nitrogen oxide emissions are even lower than when the units are gas-fired. Air quality regulations already imposed in California, Oregon, and Hawaii favor the use of methanol over other fuels. As a result, methanol could enable large, existing generating facilities, currently severely limited by air quality regulations to one-half or less of their rated capacities, to be fully utilized.

Motor Vehicle Fuel Market

There are large potential markets for methanol in motor vehicle fuels as gasoline blends, as a replacement for gasoline, as a component of chemical additives which are themselves blended with gasoline, and as feedstock for "synthetic" gasoline.

Unleaded gasoline blends of 6-8% methanol show octane enhancement and efficiency benefits, and it can be conservatively concluded that mileage per gallon of blend in recently made automobiles is at least equal to that for unleaded gasoline alone. The market for methanol in unleaded gasoline blends has been severely restricted by the EPA, although the basis of the regulation does not pertain to products of combustion. Industry has challenged these regulations, the result being a recently granted waiver (October, 1981) to permit fuel suppliers to use up to 12% methanol in gasoline blends. With an 8% blend of methanol in gasoline, 25% of the five-state market would require 3,000 tons of methanol per plant operating day; and the price would be approximately that for gasoline on a volume basis.

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For neat methanol, no technical limitations exist; and availability of this fuel would promote use of high-compression, lean-burning engines, superior to those now designed for gasoline. However, large-scale production of automobiles suitably equipped to utilize neat methanol has not started and will be required to provide economies in manufacture necessary to develop the enormous market potential.

Methyl tertiary butyl ether (MTBE) and other additives are used as volume extenders and octane enhancers for gasoline. About 0.37 ton of methanol is required for each ton of MTBE. The EPA has approved amounts of MTBE up to 7% in blends, as well as the use of certain other methanol-containing additives; and approvals of higher concentrations and additives are expected. MTBE production potential on the West Coast is equivalent to about 500 tons of methanol per day.

Chemical Markets

The Beluga plant could also produce chemical grade methanol for the West Coast chemical industry, primarily for manufacture of formaldehyde. It is expected that from 1,000 to 1,500 tons/day of Beluga methanol could be sold to chemical markets at prices higher than those obtainable on the basis of fuel value. Because of freight and tariff advantages, Beluga chemical grade methanol could have a lower delivered price on the West Coast than Canadian imports. Moreover, methanol that is currently being produced is derived from natural gas and, therefore, will sustain price increases as natural gas becomes deregulated in the coming years. Beluga methanol will have the advantage of not being tied to the rising price of deregulated natural gas. The list price of chemical grade methanol delivered on the West Coast is already about $0.90/gallon, about $14/million Btu. Much of the West Coast market could be obtained as a result of the savings of considerable transport costs from the U.S. Gulf Coast.

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Carbon Dioxide and Nitrogen Markets

About 172 million cubic feet per day of carbon dioxide will be a by-product of the Beluga plant. It is expected that the entire quantity of this gas can be sold to petroleum producers in the area for use in "enhanced oil recovery," enabling the production of oil which would otherwise remain in the ground. The four oil fields in Upper Cook Inlet are within fifteen miles of the plant; and, thus, the nearby Beluga source of high-purity carbon dioxide is an attractive commercial opportunity. A price of $1.00 per thousand cubic feet is believed to be conservative for high-purity gas close to a location where it would be used; this would amount to revenues of $58,000,000 per year (equivalent to about $23.00 of carbon dioxide per ton of methanol produced), available at little or no added cost to the plant.

In addition, a much larger quantity of nitrogen will be available for sale as a by-product of the oxygen plant. Although a small portion of the nitrogen produced will be consumed in the methanol plant operaton, up to about 700 million cubic feet per day will be available for such use as pressurization in adjacent oil fields to improve recovery of petroleum.

CAPITAL COST

The total Project Cost Estimate is shown in Table 3.

The values shown were independently generated by Davy McKee, Paul Weir Company, CIRI Holmes & Narver (H & N), and R. A. Fisk & Associates. The following descriptions outline the responsibilities of each party.

- Davy McKee - responsible for generating (i.e., directly or thru subcontractors) all costs directly related to the onsite process units, onsite support facilities, and infrastructure.

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CIRI H & N and R. A. Fisk & Associates provided cost data for the infrastructure and railroad, respectively, which are incorporated in the Davy McKee estimate.

o Paul Weir Co. - responsible for generating all costs directly related to mine support facilities and initial operating equipment costs for both mine operations (i.e., CAPPS and CHUITNA) including mine development costs.

The costs generated by Davy McKee were developed with use of a variety of techniques, some of which are as follows:

o Material take-offs were performed to establish equipment and material quantities, which, in turn, were priced using vendor quotations and in-house sources.

o Labor costs were generated by applying to the quantities Davy McKee Base 1.0 labor man-hour units with appropriate productivity multipliers, in order to establish total man-hours. These man-hours, both direct-hire and subcontract, were priced using wage rates developed for this project.

o Semi-rigorous material take-offs were performed to establish material quantities, which, in turn, were priced using in-house sources.

o Material costs and associated labor man-hours were factored using historical relationships from a variety of similar projects, for those areas where limited engineering information was available. The labor man-hours were then adjusted using appropriate productivity multipliers and priced using wage rates developed for this project.

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- o Independent analyses were performed in order to evaluate what work would be done in the module yard and at-site.

- o Davy McKee personnel visited the principal module yards, naval architects, and maritime transporting companies in the Seattle, Washington, area and obtained first-hand information on construction techniques, labor rates, productivity and barge costs.

- o Alaskan factors and working conditions were provided by Mr. Preston Locher, who acted as a consultant to Placer Amex Inc. The input provided by Mr. Locher included data on manpower availability, productivity, labor rates and construction techniques suitable for the selected site.

- o An independent review of Davy McKee's estimate was conducted by Mr. W. D. Baker, acting as a consultant to Placer Amex Inc. Major categories of work were analyzed by Mr. Baker, including man-hour units and productivity, and deemed acceptable.

A complete delineation of the manner in which Davy McKee generated costs for all areas will be found in Volume V under the tab titled "CAPITAL COST."

A complete delineation of the Paul Weir estimate will be found in Volume I.

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TABLE 3

OVERALL PROJECT CAPITAL COST

	August 1981 Price Levels (M-$)
Davy McKee Estimate -	
Process and Support Facilities, Infrastructure, Field Indirects, Services, etc.	$1,956,216 (a)
Paul Weir Estimate -	
Premining Costs	20,467 (b)
Mine Support Facilities	195,732 (b)
Mine Equipment	78,066 (b,c)
Contingency	29,427 (b)
Sub-Total, Mines	323,692
Escalation:	
Process Plant	847,180 (a)
Mines	200,495
Sub-Total, Escalation	1,047,675
TOTAL PROJECT COST	$3,327,583

(a) Davy McKee calculated values as shown in Table 4.
(b) Paul Weir calculated values as shown in Volume I.
(c) Does not include continuing capital requirements after 1987.

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TABLE 4

DETAIL OF DAVY McKEE COST ESTIMATE

	8/13/81 Cost Estimate (M-$)
ONSITE PROCESS	
Coal Receiving, Storage and Reclaiming	45,233
Coal Preparation	22,772
Coal Dryer	61,286
Process Coal Conveying	11,437
Gasification, Waste Heat Recovery & Particulate Removal	89,873
Gas. Char & Coal Dryer Part. Removal, Settling & Filt.	24,527
Raw Gas & Make-up Gas Compression	96,885
Raw Gas Shift & Acid Removal	103,047
Sulfur Recovery Plant	15,396
Methanol Synthesis & Distillation	139,782
Reforming	48,770
Air Separation Plant	116,651
Nitrogen Plant	4,139
Dry Char & Ask System	14,777
Subtotal	794,575
ONSITE SUPPORT FACILITIES	
Chemical Storage	2,242
Fuel Storage	768
Product Storage	23,450
Cooling Water System	64,215
Raw Water System	4,201
Boiler Feed Water	8,387
Wastewater System	25,535
Fire Water System	8,133
Steam & Power Generation	204,898
Electrical Distribution	19,933
Interconnecting Pipeway, Utility Distribution, Relief & Flare Systems	50,590
General, Buildings, & Major Maintenance Equipment	121,474(a)
Subtotal	535,726
INFRASTRUCTURE	
Railroad & Access Road	127,679
Dock Facilities	23,742
Townsite	17,479(b)
Airstrip	6,087
Pipeline	5,310
Powerline	- (c)
Subtotal	180,297
Overtime Premium	49,250
Subtotal Direct Costs	1,559,848

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TABLE 4 (Cont.)

FIELD INDIRECT COSTS

At-Site F.I.C. & O/H	109,758
Module Yard F.I.C.	29,006
Labor Camp & Subsistence	90,152
Subtotal Field Indirects	228,916
Barges	- (d)
Professional Services	144,121
Environmental Impact	- (e)
Royalties & Commissions	9,755
Start-Up Costs	- (f)
Catalysts	- (g)
Spare Parts	- (h)
Insurances	13,576
Taxes	- (i)
Total Current Day Cost	1,956,216
Escalation	847,180
Contingency	-
TOTAL PLANT COST	2,803,396

EXCLUSIONS:

Land Cost
Future escalation beyond the 2nd Quarter of 1987
Interest during Construction
Coal Mine Development Costs & Coal Loading
Equipment Costs (included in Paul Weir estimate)
Operating and Maintenance Costs for Start-up

Financing Costs
Sales Tax (none required)
Contingency
Cost of equipment, materials, and associated labor at the Drift River terminal is not included in this estimate, but is covered by the CIPL pipeline tariff

NOTES

(a) Values include barges, spare parts, and vendor supervision.
(b) Includes CIRI/Placer portion of townsite, only.
(c) Included with "Electrical Distribution" in the amount of $5,600M.
(d) Included in the Direct Costs in the amount of $30,304M.
(e) Included with Professional Services.
(f) Estimated man-hours are included with Professional Services.
(g) Included in the Direct Costs in the amount of $19,831M.
(h) Included in the Direct Costs in the amount of $10,318M.
(i) No state sales tax is included, assuming possession takes place in Alaska.

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FINANCIAL

The financial analysis consists of six cases. These cases present the financial impact of varying assumptions for both the project entity and the investors. The major assumptions which form the basis of the analysis are as follows:

1. Projections for the price of methanol

2. Projections for the economic environment and the potential for significant price escalation

3. Assumptions concerning the capitalization structure of the Project

Case 1

The selling price for the project's methanol production is based on 110% of the current selling price of No. 2 distillate fuel. This relationship of methanol to distillate is adjusted so that the dollar value of higher Btu distillate and lower Btu methanol is equivalent. 100% of the methanol produced by Beluga is sold at this price.

In this case, price, as well as other revenues and costs associated with the project, is held constant in 1981 dollar terms. Moreover, all the financing for the capital spending for Beluga is assumed to come from investors; the financing plan does not include an intentional raising of long-term debt in the capital markets.

Combining this set of conditions with the production schedule and capital cost estimates provided by the engineers to the project, provides the means to develop the project's income statement, balance sheet, cash flow statement, and partnership returns. The revenues for Case 1 total approximately $9.2 billion, and total net profit is approximately $487 million over the life of the project. The after-tax rate of return to the investor is approximately 4.9%. These calcula-

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tions are shown in Table 1A on page 80. For more detail, see Volume V, Financial Appendix A.

Case 2

The National Energy Policy Plan (NEPP), published by the Department of Energy, forecasts that energy prices will undergo "real-growth" in price for 20 years through the Year 2000 (see Appendix H in Volume V, Financial). This second case replaces the constant base price of $161.63 per ton and instead substitutes a price structure that reflects NEPP's projected real growth. Using this pricing schedule, the total revenues increased from $9.2 billion (Case 1 total revenues) to approximately $15.2 billion. Total net profit before tax equals approximately $6.3 billion, and the after-tax internal rate of return becomes 11.5%. The calculations for Case 2 are shown in Table 1A on page 80. For more detail, see Volume V, Financial Appendix B.

Case 3

While continuing to utilize the real growth in price as forecasted by NEPP to determine the price for methanol, an additional assumption is incorporated into the third case. As in all cases, the construction period for the project is assumed to begin in 1982 and to last for more than five (5) years. Partial revenue production is expected to begin in 1987, with full revenue production starting the following year. In light of the long lead time between the beginning of construction and the commencement of full production, an escalation factor is used to calculate the associated revenues and costs for case 3. Under this assumption, total net revenues over the life of the project equal approximately $19.6 billion, total net losses are $20.1 billion, and the after-tax rate of return is 12.0%. Due to the escalation of costs as well as the revenues, total net capital investment increases from $1.7 billion to $2.4 billion. See Table 1A on page 80. For more detail, see Volume V, Financial Appendix C.

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Case 4

As indicated in Volume V, Section 2, Marketing, methanol can be used as an additive or a blend with gasoline. Management believes that the emergence of a motor fuel market for methanol is a reasonable potential alternative. Consequently, the fourth case examines the sales of 50% of the project's methanol to this market. The price for the methanol that is sold to the motor fuel market is calculated as 90% of the gasoline price as derived from the NEPP report. Escalation of costs and revenues are also included. Based on these assumptions, the following financial results are obtained for Case 4. Total revenues are approximately $26.5 billion, net losses are $3.4 billion, and the after-tax rate of return is 7.8%. Selling to the motor fuel market reduces the losses significantly from $20.1 billion in the preceding case to $3.4 billion. However, since the investor derives tax benefits from the losses continually sustained by the project, the net after-tax cash returns for the case using 100% sales to utilities appear to be better than that for this case. Consequently, the after-tax rate of return for this fourth case is lower than that for the third case; 7.8% as opposed to 12.0%. Calculations for this case are shown in Table 1A on page 80. For more detail, see Volume V, Financial Appendix D.

Case 5

One major change in the assumptions takes place in this case. Instead of 100% of the financing being provided by investors, 25% of the capital requirements are financed by a long-term debt issue. The proportion of sales to utililties and to the motor fuel market remains the same, as well as the escalation of the resulting revenues and costs. The effect of leverage leads to total net revenues equalling approximately $26.5 million, total net losses equalling approximately $7.2 billion, and net after-tax rate of return equalling approximately 10.8%. The calculations are in Table 1B on page 81. For more detail, see Volume V, Financial Appendix E.

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Case 6

The level of debt is increased for the sixth case to equal 75% of the capital requirements. Although the investor always receives positive cash returns, the level of debt grows to such a large amount to make the project inoperable. By the year 2007, borrowings necessary to cover interest expense and long-term debt repayment are over $40 billion. As a consequence, the investors would not receive the positive returns as indicated in Table 1B on page 81. For more detail, see Volume V, Financial Appendix F.

Volume V, Financial, provides the detail background, while this summary provides only an overview. In addition, all the other elements that constitute the assumptions used for the financial calculations are presented in Volume V, Financial.

Finally, the potential involvement of the government in the project is considered; and various alternative means by which such an involvement can be accomplished are explained in Volume V, Financial.

Table 1A
Selected Financial Statistics

($ millions)

Selected Life of Project Statistics	Base Case (Appendix A)	NEPP Forecast for Distillate #2 (Appendix B)	NEPP Forecast for Distillate #2 with Escalation (Appendix C)	50% of Sales to Motor Fuel with Escalation (Appendix D)
Total Revenues	$9,265	$15,184	$19,626	$26,488
Total Net Profit	487	6,293	(20,120)	(3,414)
Total Cash Distribution*	2,654	8,364	0	2,471
Long-Term Borrowing**				
Amount Peak Borrowing	34	-	17,093	60
Year Peak Borrowing	1987	-	2007	1987
Latest Year Borrowing Outstanding	1988	-	2007	1988
Partnership Returns***				
Total Net Investment(1982-1987)****	1,704	1,705	2,444	2,444
Total After Tax Cash Return (1988-2007)	2,680	4,983.63	11,615	5,447
After Tax Internal Rate of Return	4.94%	11.54%	12.03%	7.8%

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* Designated as Dividends Common in financial statements.

** In the financial statements Long Term Borrowing (as opposed to LTD) indicate the financing of cash shortfalls.

*** Rounded.

**** Total Net Investment equals Equity Investment Minus the positive tax benefits derived from ITC, Depletion and Losses taken the same year of the equity investment.

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TABLE 1B

SELECTED LEVERAGE CASE FINANCIAL STATISTICS

($ millions)	50% Sales to Motor Fuel with Escalation	
	F.D. = 75% Equity = 25%	F.D. = 25% Equity = 75%
Selected Life of Project Statistics		
Total Revenues	$26,488	$26,488
Total Net Profit Before Taxes	(49,877)	(7,241)
First Year Report Net Profit Before Taxes	N/A	1,993
Total Cash Distribution*	0	255
Long-Term Borrowing**		
Amount Peak Borrowing	49,297	5,352
Year Peak Borrowing	2,007	2,007
Latest Borrowing Outstanding	2,007	2,007
Partnership Returns***		
Total Net Investment (through 1987)	0	1,506
Total After Tax Cash Return (1988-2007)	26,774	5,081
After Tax Internal Rate of Return	N/A	10.79%

* Designated as Dividends Common in the financial statements.
** In the financial statements Long Term Borrowing (as opposed to LTD) indicate the financing of cash shortfalls.
*** Rounded.

CONSTRUCTION

Construction in a remote area can be very expensive, especially if large numbers of craftsmen are required; therefore, offsite modular construction will be maximized.

Modular construction consists of building sections of the plant in the Lower 48, loading them on barges, and shipping them to Beluga where they will be installed on prepared foundations.

Modularization will transfer labor from the field site to modular shops, where there is manpower available and improved working conditions, which will provide an improved schedule along with cost savings.

The effect of the modular construction approach on the construction camp will be to reduce the construction work force from approximately 4,000 to approximately 3,000 workers. Please note that these numbers are based on our information as of mid-1981. When the Phase II effort commences, a detailed assessment of the manpower split between site work and the modular shop will be determined.

The main input from the construction group during the feasibility study was the input on labor rates, productivity and project site conditions.

C. Preston Locher was hired as an Alaskan construction consultant to develop the labor considerations for the State of Alaska and the Pacific Northwest. He concluded that the next 5-10 years will be a boom period in Alaska and the modular shops of the Pacific Northwest, and there may be a shortage of skilled labor in these areas.

TRADE-OFF STUDIES

As part of the work required to be done in Phase I, various systems, methods of operation, technical processes, and processing facilities

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were examined with respect to their cost, efficiency and suitability for the Beluga Project. In those areas where alternate choices were available, technical and economic comparisons were studied to arrive at the selections which have been incorporated in the plant for the purposes of the study.

Task 3.01 -- Mining Operation Alternates

Stripping Alternates

The use of large bucket wheel excavators for major overburden stripping at both mine sites was considered during the mining study. While the majority of the material to be removed appears to be suitable for this excavation method, there is some degree of uncertainty on some of the harder material. For the purposes of this study, the more conservative truck-shovel excavation method was chosen. However, any future study should include geotechnical work for the purposes of determining bucket-wheel excavator suitability.

Conveyor transport of waste and coal was also considered during the course of the study. Since the size of material to be transported is one of the major limits in conveyor transportability, insufficient information was available to determine the suitability of this method. Actual excavation tests will be required in future studies in order to determine average material breakage size. However, potential cost savings from conveyor transport are sufficient to justify the investigation of in-pit, portable waste crushers as a method of obtaining conveyor maximum size limitations.

Task 3.02 -- Coal Shipping Alternates

The need in this area is for means of transporting coal from the Capps and Chuitna mines over distances of up to 23 miles to the methanol

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plant, and returning ash and sludge to the Chuitna mine area for disposal. Three general methods are available for handling material volumes of the magnitudes involved; namely, a system of slurry pipelines, a conveyor system, or a railroad system.

Of these methods, the slurry pipeline carrying coal in water was ruled out after brief consideration of the problems and costs of dewatering, ash disposal, and the varying particle size requirements of plant processing and power generating units.

The remaining alternatives, conveyor and railroad, present a number of possible equipment arrangements and combinations, each of which was studied and evaluated.

On the basis of comparative costs, it was concluded that a railroad system using diesel electric locomotives is the best choice among the alternatives examined.

Task 3.03 -- Coal Drying Alternates

The Winkler gasification process requires that the moisture content of prepared coal feed to the gasifier section does not exceed a maximum of 8% by weight. The Beluga coals received at the plant have an average moisture content of 23.9%. Thermal drying is required to remove the excess 15.9 wt. percent of moisture during coal feed preparation.

A brief investigation of the various commercial drying processes narrowed the choice to fluid bed or flash type dryers. Further investigation of these two types, for drying the high inherent moisture Beluga coals, led to the choice of two fluid bed dryers for this service.

No drying tests have been performed on these coals for this Phase I study. While past coal industry experience indicates that the fluid bed type is the most reasonable choice, testing will be essential in the next phase to evaluate the process and economic advantages of fluid bed drying.

Task 3.04 -- Gasification with Various Qualities of Coals

The characteristics of coal feedstock which affect plant processes are:

1. Reactivity
2. Ash content and its melting behavior
3. Sulfur content
4. Nitrogen content
5. Volatile matter and fixed carbon

A study was made to show how these characteristics affect the gasification process.

Task 3.05 -- Construction Approach Alternates

In view of the remote location and the construction environment of the Beluga plant site area, maximum modularization with fabrication of modules in the Seattle/Tacoma area has been selected as a means to improve project cost and schedule. The Beluga plant site lacks support facilities for labor, but is accessible by water, making it conducive to modular type construction.

Modularization will transfer the labor requirement from the field site to shops using assembly line methods, thereby, reducing labor costs, improving working conditions, and permitting parallel fabrication and improved schedules.

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Modularization is most effective for sites in non-industrial areas with good water access and where a large percentage of labor must be imported and camp-supported. A greater advantage accrues where site weather conditions hamper construction. These conditions are present at the Beluga plant site.

An overall schedule reduction is attained since not only complete pre-assembly is used, but also pre-testing and pre-commissioning in the fabrication yard will insure a shorter start-up time period.

Task 3.06 -- Product Shipping Alternate Study

In view of the existing facilities of Cook Inlet Pipe Line Company (CIPL), primary emphasis was placed on utilizing this transportation system for delivering methanol from the plant to storage and ship loading installations located at Drift River on Lower Cook Inlet.

CIPL has the capacity to transport the methanol product in its pipeline which passes close to the proposed plant and which extends about 42 miles to a tank storage area and ship loading terminal at Drift River. The feasibility of using this transport system for methanol has been confirmed.

Due to time and budget limitations it was not possible to compare use of the pipeline with a new dock. This will be done in Phase II.

Task 3.07 -- Ash Disposal Study

In this study, alternatives were evaluated for the disposal of the large quantities of ash and char generated and/or collected within the plant process area.

The disposal method chosen must accommodate 6.36 acre-feet per day of solid material based upon the 10,253 cubic yards of char/ash generated per day. Because of the remote location of the char/ash source, transportation of this large quantity of char/ash would also have to prove environmentally feasible. Disposal should also demonstrate minimal environmental impact, thereby, reducing regulatory and permitting activity.

Based upon the above restrictions, it was concluded that the Mine Reclamation Plan provides an environmentally acceptable disposal scheme, while being economically feasible. Therefore, primary consideration has been given to the Mine Reclamation Plan.

The alternatives considered were (1) Mine Reclamation, (2) Landfill, (3) Commercial Use/Sale.

Task 3.08 -- Natural Gas Alternate for Power Generation

This study was conducted to reduce capital costs of the project by the substitution of natural gas for coal energy in the power production section of the plant. A system designed to burn all of the char produced by the process and use natural gas for the remainder of the fuel input to the power production facility has been prepared. This option will include two nominal 70-Mw, gas turbine generator sets with supplementary fired heat recovery boilers and two char boilers with supplemental natural gas firing to insure complete char combustion.

A cost savings is realized as a result of the lower capital investment required for natural gas turbines as compared to steam turbine boiler combinations. Additional capital costs savings are realized through the elimination of the coal feeding portion of the Base Case power plant, as well as reductions in size of the ash handling system. Operating costs will be reduced due to substantial decreases in the pumping of cooling water required for condensing turbines which are not part of the alternate case, as well as reduction in operating and maintenance manpower. However, these operating savings are reduced by

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the incremental cost of natural gas over coal. In summary, the gas turbine alternate becomes the economical choice for the project, if natural gas can be procured at a delivered price of $2.60 per million Btu's.

Task 3.09 -- Comparison of Cooling Water Systems

This study covers the possible use of various alternative cooling water systems. Such considerations as cooling towers, seawater, air fins, or combinations of the above were developed to determine which alternative would be the most economical. Congahbuna Lake was also studied for possible use as a natural cooling pond.

An all-cooling-tower system has been selected because it requires the least capital investment. The cooling water system will be reviewed and re-evaluated during Phase II using updated data which will be available at that time.

Task 3.10 -- H_2S Removal Before or After CO Shift and Optimum CO Shift Pressure Level

This trade-off study was conducted to obtain the optimum pressure level for upgrading H_2/CO ratio (CO-Shift) and to select the sequence of units for the acid gas removal operation. The pressure studies were conducted at 250, 750, and 950 psig levels, with both selective and non-selective acid gas removal systems using Selexol and Rectisol units. In all cases, both operating and capital cost requirements were considered for the process blocks starting from the raw gas compression to the acid gas removal units.

This detailed analysis resulted in the conclusion to proceed with the following process sequence for this study report:

1. Raw gas compression to 750 psig

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2. CO shift and COS hydrolysis

3. Selective H_2S removal for sulfur recovery followed by controlled CO_2 removal by the Selexol System so as to achieve the required methanol synthesis gas composition.

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APPENDIX A

DETAILED WORK PLAN FOR PHASE II

APPENDIX A

DETAILED WORK PLAN FOR PHASE II

1.0 COAL MINES

Essentially, the work in this area will be to confirm the technical and economic feasibility of mining coal from the Chuitna and/or Capps deposits in the Beluga coal field as raw material feedstock to the methanol plant. A secondary use (possibly for such lower quality coal as may be produced) will be as fuel for direct burning in onsite boilers to produce process steam and electric power.

Considerable emphasis will be placed on the mine plans, reclamation plans, and coal handling systems. An extensive resource and hydrological field drilling program will form the basis of a detailed mine and reclamation plan. The plan will then be refined with results of pit tests for accurate assessment of slope stability, soil characteristics, and other soil and hydrological parameters. Detailed aerial photography, interpretive mapping, soil and hydrologic samples, and the results of other field programs will be used for detailed design and for environmental assessments.

All environmental monitoring and design considerations necessary for surface mining permits will be identified and resolved. Permit applications will be submitted, pursued and obtained to allow start of Phase III on schedule. Mine Planning and Engineering will develop specifications, identify and evaluate all "long-lead" equipment and machinery

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requiring early purchase to permit start of mining activities, and assure start-up of the plant in the 3rd Quarter of 1987.

Further study will be pursued of conveyor transport in the mine areas as an alternative to trucking spoil and coal.

Mine aquifers will be defined; and mine waste pumping, treatment, and discharge will be reviewed in detail. Ongoing fishery and surface hydrology studies will be considered in water discharge plans.

Results of the drilling program will be used to review the possibility of mining the deposit by advancing up dip or on the strike.

The alternative of tracked backhoes working on coal in lieu of front-end loaders for coal loading will be studied.

Additional studies will be conducted on the use of bucket wheel excavators as a primary excavation method.

Mine support facilities will be refined and optimized as updated data and plans are developed.

2.0 GEOTECHNICAL WORK

Additional geotechnical information will be required prior to the start of final design. The main subjects to be investigated are:

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2.1 Detailed groundwater evaluation including installation of piezometers to determine groundwater conditions, and pump wells to determine permeability of mass rock and aquifers, for both Capps and Chuitna Pits.

2.2 Study of locally available construction materials, particularly of glacial till for foundations and containment dykes, and of granular material for road surfacing and concrete aggregate.

2.3 Determination of till and rock characteristics for shear strength in the design of pit slopes, waste dumps, and all other temporary and permanent slopes.

2.4 Study of the seismicity and tidal wave potential of the site and determination of appropriate design methods and parameters for geotechnical structures and foundations.

2.5 Study of the hydrology of the area and determination of design approaches and parameters to ensure water handling arrangements are compatible with project, state, and federal guidelines. This work will include flood diversion, erosion control, and sedimentation management.

2.6 Determine geotechnical design requirements for dumps, pit slopes, roads and railbeds, bridges, dock, townsite, plantsite, coal dumps, coal ash disposal, water diversions and sedimentation ponds.

2.7 Study the development and behavior of major landslides in the area to assess their significance relative to stability of coal pit walls, railroad and roadway cuts and fill areas, etc., particularly with respect to seismicity.

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3.0 RAILROAD, ROADWAY AND DOCK

Conceptual design of the railroad, dock, and access roadway has been based on current data such as existing topographic maps, preliminary railroad studies, limited data on barge and dock requirements, as well as preliminary geotechnical, surface hydrology, and environmental, health, safety, and socioeconomic requirements.

Work in Phase II, including completion of current surveys and investigations, will form the basis for the start of detailed design for the dock, railroad and roadway facilities.

3.1 RAILROAD AND ROADWAY

The design of railroad and roadway alignments, bridge structures and drainage structures will be refined in accordance with the data obtained from the following additional work:

A geotechnical terrain analysis will be conducted to identify types of materials to be excavated in cuts, foundation conditions for fills, sources of borrow, potential areas of instability, etc.

Confirmation of terrain analysis by field observation, test drilling and laboratory analysis.

Gravel pits will be located and evaluated as to quantity; and samples will be tested to determine acceptability for use as fill, subgrade, concrete aggregate, etc.

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Railroad and roadway alignments will be run in the field, quantities will be recalculated based on field rather than map measurements, and adjustments made to achieve the most economical design and/or to avoid probelem areas. Interceptor and offtake ditches will be designed.

Expected runoff in drainage channels will be studied in order to size and locate drainage structures.

Detailed drilling will be done at each bridge site to determine the most economical bridge design for each site.

A detailed analysis will be made to determine if the high first costs of electric locomotives can be offset by operating efficiencies. Once the type of locomotives is determined, the operational plan for the railroad will be finalized. Use of conveyors will also be reviewed for use in place of certain sections of the railroad.

Railroad track design will be reviewed, and subballast and ballast will be analyzed. The types of ties and fastenings will be investigated based on performance records under similar conditions.

Railroad rolling stock sizing, train make-up, and schedules will be optimized. Also, the possible use of a passenger train for plant-to-mine transportation of personnel will be reviewed.

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Equipment maintenance requirements will be re-evaluated as to centralization and/or work which can best be transported to Anchorage for repair.

Railroad and roadway bridge and culvert drawings, subcontract specifications and equipment specifications will be prepared and issued for bids. Equipment and subcontract bids will be analyzed, conditioned and brought to the point where purchase orders and subcontracts can be awarded in Phase III.

3.2 DOCK

The dock design requirements will be finalized on the basis of data developed in the following additional work:

Towed sea-going barge sizing, plant module unit, and other barge cargo unloading requirements will be established employing the services of a Marine Architect.

A subcontract package for overland transporter, including module setting on prepared foundations and barge and tug services, will be prepared; bids analyzed; and an optimum barge, tug, and transporter operating plan will be developed. This work will be coordinated with the dock design outlined above. The subcontract bids will be processed to the point where a subcontract can be let in Phase III.

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The tug and barge approach and dock area will be surveyed and geotechnical investigations conducted to establish the optimum location for the barge dock. Maintenance of the approach channel and barge basin will be considered in this review.

4.0 COAL-TO-METHANOL PLANT

Process and utility flow sheets, major equipment duty, facility and equipment layouts, electrical single-lines and motor lists have been prepared based on data available during the Phase I study.

Work in Phase II will include the use of detailed information on Beluga coal properties, site surveys, geotechnical data, in-depth construction planning, and environmental and permitting requirements.

Data obtained from the following will form the basis for the detailed design of the methanol process plant:

4.1 Review, re-evaluate and select the best possible plant site location.

4.2 Sizing, location and number of coal handling and crushing units and drying facilities will be finalized in view of large-scale coal sample analyses and tests.

4.3 Number and size of gasifier trains will be reviewed based on more extensive coal sample analysis and testing.

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4.4 Study the permissibility and economics of in-plant use of natural gas, including use for power generation.

4.5 Review space requirements, operational requirements, and functional and construction components for all buildings.

4.6 All utility and communication systems will be reviewed based on updated project criteria, including: water supply, treatment, and distribution; wastewater collection, treatment, and disposal; fire protection; internal telephone communication system; UHF radio systems; etc.

4.7 Update dust collection system flow sheets.

4.8 Update motor lists with HP estimates based on final selected equipment quotations.

4.9 Study the options of purchased power and oxygen versus onsite production.

4.10 Optimize power generator sizing, substation configuration, transmission line voltages, motor horsepower voltage split, 15-KV cable routing method, etc.

4.11 Geotechnical investigations will be conducted to obtain additional data including: test pits, laboratory tests, pile load tests (if required), etc.

4.12 Resolve water sources; in addition, water pump tests will be conducted to better define groundwater characteristics.

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4.13 During Phase II the following items will be completed to the point where subcontracts for engineering and procurement of long-delivery equipment/materials can be pursued early in Phase III:

- o Site preparation and grading drawings
- o Underground sewers and firewater system drawings
- o Product storage and pumping drawings
- o Insulation, refractory,and fireproofing specifications
- o Piping specifications
- o Piping line index
- o Control and instrument drawings
- o Control panel layout drawings
- o Instrument lists
- o HVAC flow sheets for buildings
- o Obtain soils data and establish overall civil design criteria
- o In-plant road drawings
- o In-plant pipe racks
- o Preliminary design of major foundations
- o Preliminary design of major structures
- o Preliminary design of modular bases
- o Layout model of plant facilities
- o Subcontract drawings and specifications
- o Equipment and subcontract bid analysis
- o Electrical hazard classification, grounding plan
- o System and subsystem single-lines
- o Lighting plans will be started
- o Communication plans will be started
- o Control room layout
- o Logic diagrams will be started
- o Electrical schematics will be started

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5.0 PRODUCT SHIPPING ALTERNATIVES

5.1 Background

The feasibility study investigated the use of the existing Cook Inlet Pipe Line system for the transport, storage, and shiploading of the methanol product. This system comprises such important components as the 20-inch diameter pipeline which extends from Granite Point adjacent to the plant to Drift River; storage tanks at the Drift River terminal on Cook Inlet; and the offshore ship loading platform at Drift River.

Laboratory studies confirmed the capability of this system to transport both methanol and crude oil between Granite Point and the Drift River loading terminal. The compatibility of batching crude oil and methanol through the pipeline was established, and an engineering/design evaluation developed technical information on modifying the system to enable both liquids to be handled.

A cost analysis, conducted concurrently with the engineering study by the pipeline owners and operators, has indicated that even with quantities of methanol equivalent to those of crude oil being pumped through the pipeline, the estimated tariff for methanol would be about the same, or possibly greater, per unit of volume, as that now paid by the shippers (producers) of the crude. In other words, the larger volumes transported would not greatly affect the pipeline tariff despite the larger throughput, which theoretically should amortize the pipeline company's costs for modifying the system.

5.2 Possible Alternatives

A review of possible shipping alternatives to use of the Cook Inlet Pipe Line system will ascertain whether such other alternatives could provide significant economic savings in comparison with the substantial accumulated cost of pipeline tariffs over the plant's anticipated operating life.

5.2.1 A conceptual design study will be performed in sufficient detail to produce a construction cost estimate for a tanker-loading facility at one or more selected dock locations close to the methanol plant site. A permanent off-shore mooring and liquid-loading terminal will be investigated, as will up to three shoreline berthing facilities. Possible dock locations for shoreside loading terminals include:

1. Extension of existing dock at Tyonek
2. New dock approximately 3,000 feet west of Tyonek
3. New dock at Granite Point

The conceptual design study of the shipping facility will focus on use of the dock for shiploading of methanol. Secondly, the study will consider use of the shiploading facility for receiving supplies and equipment for the plant and mine operation and the townsite.

5.2.2 Since the export of coal as a dry bulk commodity from the Beluga coal field to foreign markets is also being actively pursued, an investigation is currently being made for a dock or pier in the Granite Point - North Foreland area, close to the proposed methanol plant.

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The construction of a marine port equipped for shipping dry bulk cargoes could enable liquids as well as coal to be loaded at this site on ocean-going vessels. Such a port would, accordingly, provide a substitute to the existing pipeline and shiploading terminal at Drift River. Lower direct transportation costs for the methanol could be expected, and amortization of the pier cost could be shared by the methanol and coal which would both be shipped from the same marine terminal.

6.0 ENVIRONMENTAL

The Environmental Work Plan under Phase II of the Beluga Methanol Project will focus on obtaining the major regulatory approvals; i.e., the Prevention of Significant Deterioration (PSD), National Pollutant Discharge Elimination System (NPDES), Department of the Army Corps of Engineers (Sections 404 and 10), Office of Surface Mining (OSM), and State Anadromous Fish Permits, as well as the Environmental Impact Statement (EIS) and the Environmental Protection Agency (EPA).

The PSD permit is necessary to prevent significant deterioration of air quality in areas cleaner than required by the National Ambient Air Quality Standards (NAAQS); i.e., the Beluga-Tyonek area, and to fulfill the requirements of the Federal Clean Air Act.

The first step in securing the PSD permit is to get agency approval of a prepared air monitoring program. Once the monitoring period is complete and all required engineering design data is available, the permit application can be

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finalized and submitted to the EPA. Notification of whether or not the application is complete will be given by the EPA within 30 days of receipt. Final determination is statutorily required within one year of receipt of a completed application. There is a 30-day public comment period, and the opportunity for a public hearing must be provided.

On receiving the PSD permit, construction must start within a reasonable period of time (typically within 18 months of approval) and stay on a continuous construction schedule. Normally, long delays will invalidate the permit.

The NPDES permit is required in order to curb water pollution by monitoring and controlling the discharge of waste, e.g., the disposal of process waters, mine drainage, sanitary sewage, leachate from coal pile storage, on-site surface drainage, etc.

Once the engineering data is available; e.g., flows, sources of pollution and treatment technologies, the permit application is prepared and submitted to the EPA (at least 180 days prior to commencing the discharge).

There is a 30-day review by the State of Alaska for certification, which may include a public hearing if it is detemined to be in the public interest.

Finally, the EPA will issue the NPDES permit state certification.

The EIS is generally required in order to insure that environmental information is available to public officials and citizens before decisions are made and before activities begin.

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Actually, an Environmental Impact Assessment (EIA) is first prepared, drawn largely on the data and results obtained from environmental field studies (e.g., fisheries and hydrology).

The lead agency, likely the EPA, will then determine if the environmetal impact is significant or controversial. If not, no further action on the part of the applicant is required; if so, the applicant must prepare a Draft Environmental Impact Statement (DEIS). The DEIS is reviewed by federal and state agencies and commented upon by the public. If the review and comments are favorable, the Final Environmental Impact Statement (FEIS) is issued.

The Department of the Army Corps of Engineers' permits are required pursuant to Section 404 of the Federal Water Pollution Control Act Amendment of 1972 and Section 10 of the Rivers and Harbors Act of 1899 because of the possibility that the proposed project will discharge dredged or fill material into waters of the United States and/or affect the course, location, condition or capacity of such waters.

After the engineering data is available, the permit applications can be submitted to the Army Corps of Engineers. Although the permits can usually be issued within 90 days after receipt of a completed application, the Corps may choose to wait until after the FEIS is reviewed before issuing the permits.

A state program for the OSM permit has not been established for Alaska. Therefore, it is expected that the permit application will conform to federal requirements as dictated by the Office of Surface Mining Reclamation and Enforcement, Department of the Interior. The permit application can be prepared once the following types of field work data are assembled: (1) geology description; (2) groundwater information; (3) surface water information; (4) alternate water supply information; (5) climatological information; (6) vegetation information; (7) fish and wildlife resources information; (8) soil resources information; (9) land-use information; and (10) cross-sections, maps, and plans. It can be assumed that the OSM permit will not be issued until after the publication of the FEIS.

The State Anadromous Fish Protection permit is required if the proposed activity will affect the natural flow or bed of a specified anadromous river, lake, or stream, or use equipment in such waters of Alaska. Fisheries field work data is necessary in order to prepare the permit, which is issued on an annual basis.

The majority of the schedule work plan for Phase II will be comprised of securing the above major permits. This effort is significant due to the great amount of monitoring and data gathering that is required for the completion of the permit applications. The remainder of the Phase II Environmental Work Scope will be devoted to obtaining all other necessary, minor permits and approvals.

7.0 SITE SELECTION

The final stage of site selection involves adjusting the preliminary site location to make it most compatible with the actual conditions and constraints identified in the feasibility study. This final site selection step will be accomplished under Phase II of project development. At this point,

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it appears that the primary factor that will influence some adjustment of the site location will be specific soils conditions. Broad areas within the preliminary site area have been found to have greater depths of organic overburden than originally anticipated. Indications are that some relocation of the plant site in a northwesterly direction would avoid some deep overburden and reduce capital costs through reduced site preparation work. Further soils exploration will precede the final site selection decision.

Considerations to be taken into account during Phase II for the plant site located at Granite Point will be:

(1) A distinct advantage of this location would be realized in the transportation of the finished product due to close proximity to the existing 20-inch diameter Cook Inlet pipeline, which currently transports crude oil to a tanker terminal at Drift River, approximately 40 miles to the south. Production of oil from fields served by the pipeline is continuing to diminish, providing certainty of pipeline availability.

(2) A plant near the shore would ease the movement of large prefabricated plant modules, allowing more flexibility in planning and construction. It would also reduce operating and maintenance commodity transport cost when the plant is operable.

(3) Other positive factors include a more favorable climate and shorter period of snow cover than at the higher elevations of the mine areas.

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(4) Selection of this location would avoid the natural hazards associated with being near the shoreline at seal level, but also would remove the option of being able to barge large, prefabricated plant units into place. However, it would still be possible to receive and install large, prefabricated interplant modules using a coordinated barge and surface transportation network.

(5) Portions of this candidate site area are considered wetlands by definition; however, it is believed that these wetland areas fall under the jurisdiction of the Corps of Engineers' nationwide permit authority, a classification which avoids complications that may be associated with obtaining permits for a tidewater location.

(6) Environmental and geotechnical constraints all appear reasonable for this location, and indications are that necessary permits could be granted.

8.0 CAMP, AIRSTRIP, TOWN AND BUS SYSTEM

Selected available information on physical and land use, as well as relevant socioeconomic trends for the Cook Inlet Region, have been used in Phase I conceptual plans. The following will be finalized in Phase II:

1. Site selections will be finalized for the camp, townsite and airstrip following a detailed study of area site characteristics.

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2. Relevant socioeconomic trends of the surrounding Cook Inlet Region will be reviewed in-depth and considered in the selection of the final locations for the camp, townsite and airstrip.

3. Appropriate agencies concerned with general design criteria for the airport, utility systems and educational facilities will be contacted. Appropriate criteria will be incorporated in final plans for these facilities.

4. When the estimate and schedule for the total project are finalized, the campsite and townsite size and cost will be adjusted to suit manpower and schedule needs.

5. Financial backers and developers will be found for appropriate portions of the townsite.

6. Prepare and issue the construction camp subcontract packages for inquiry, evaluate bids, and be ready to award at the time funding becomes available.

7. The number of buses will be fixed according to manpower requirements.

9.0 APPROPRIATION ESTIMATE

9.1 Introduction

The estimating activity to date has resulted in an estimate of the Total Plant Cost for the proposed coal-to-methanol facility.

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The Phase II plan is to increase the level of estimating activity by placing emphasis on equipment and material costs, additional engineering development, construction planning and refined cost evaluations of the barge-mounted plant modules. This will result in an Appropriation Estimate of higher accuracy and confidence than the Phase I Capital Cost Estimate.

9.2 Basis of Estimate

The proposed Appropriation Estimate will be based on the following data:

- o Process, Utility and Instrumentation Diagrams
- o Equipment List
- o Equipment Data Sheets
- o Catalyst & Chemical Summary
- o Utility Summaries & Layouts
- o Facility Layouts
- o Equipment Layouts
- o Equipment Specifications
- o Equipment Inquiries
- o Equipment Weights

- o Soils Analysis
- o Site Development Plans
- o Building Layouts
- o Railroad Layouts

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- o Module Studies, Layouts & Typical Structural Designs
- o Motor Lists
- o Electrical Single-Line Diagrams
- o Electrical Equipment Specifications
- o Instrument Specifications
- o Control Room and Panel Layouts
- o Professional Services Man-Hour Estimate
- o Detailed Schedules
- o Shipping Costs & Schedules from West Coast to Plant Site
- o Construction Plans
- o Field Indirect Cost Estimate

9.3 Estimate Staffing

At the outset of the estimating effort, a Cost Supervisor and Project Estimator will be assigned to this project for the duration of all estimating activities. It will be their responsibility to insure consistency in the estimating approach for all participants' estimating disciplines, including method of material take-off, pricing technique, quality control and accuracy. To insure this consistency, the Project Estimator will prepare a detailed work plan and schedule.

9.4 Estimates By Others

For certain proprietary process systems, installed cost estimates will be provided by the selected technology licensor. For infrastructure elements, such as the railroad, airstrip, offsite pipelines, etc., the cost estimate will be provided by the consultant engaged for that element.

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9.5 Major Equipment

Approximately 80% of the major equipment dollar value, including electrical equipment, will be priced from vendor quotations, following a review for technical and commercial acceptance. Equipment pricing will also include weights, shipping costs to the module fabrication yard, and overseas crating and shipping costs, if shipped direct to the site. The balance of the equipment will be priced from telephone quotations or in-house data from recent similar equipment purchases. Developmental allowances will be added to major equipment costs to cover increases due to normal design changes and purchase order extras based on previous experience.

9.6 Bulk Materials

Detail quantity tabulations will be prepared for all major elements in the project. These include material take-offs for piping, electrical equipment, instrument devices, civil and structural components. Bulks: i.e., electrical, instrumentation, fireproofing, insulation and painting quantities will be factored using relationships established from similar projects. Material costs will be generated from established in-house Davy McKee information, supplemented by sample pricing on major items such as concrete, pipe and structural steel in the West Coast and/or Anchorage, Alaska, markets. Resolution and surplus factors will be added to the "neat" material take-offs to approximate final design quantities. Proratable material and labor will be added to cover items, not estimated in detail, but as percentages of measurable material and labor. Proratables cover labor items such as unloading, shake-out, hauling, scaffolding, welder qualification, hydrotesting and flushing.

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9.7 Subcontract and Direct Field Labor

The construction plan will define the extent of participation by subcontract versus direct-hired field labor. Labor man-hours will be established by applying Davy McKee Base 1.0 man-hour units to the take-off quantities. Man-hours will then be adjusted by applying productivity factors for either the plant site area or the West Coast, depending on whether the specific work is to be performed at the site or in the module production plant. Field man-hours, for the plant site and West Coast work, will then be priced utilizing established local wage rates and fringe benefits. Subcontract wage rates will be adjusted based on historical experience to reflect the subcontractor's indirect costs, overheads and fees.

9.8 Productivity Evaluation

Productivity is evaluated on the basis of information developed from four (4) sources. The first source is based upon industry surveys. This includes the result of surveys provided to Davy McKee by major companies with whom Davy McKee participates in continuously monitoring labor conditions.

The second source is the result of labor surveys prepared by Davy McKee's Construction Services Group. These contacts with area business and labor leaders provide current productivity information.

The third source is from subcontractor surveys. Subcontractor quotations on a unit-price basis are compared to Davy McKee's standard man-hour units to develop productivity factors based on subcontractors' anticipated conditions.

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The fourth source is a productivity factor analysis. This method employs a subjective analysis of the effect of conditions in the specific area of the project on productivity. Such factors as weather, labor availability, distances from storage areas to work areas, hazardous activities, and others are evaluated.

9.9 Field Indirect Cost

Based on detailed plans for construction staffing and sequencing, and a specific breakdown of subcontract versus direct-hire participation, the Construction and Estimating Departments will prepare a detailed estimate of Field Indirect Costs for both module fabrication and plant sites, and will include the following:

- Construction Supervision
- Field Office Labor
- Auxiliary Field Labor
- Temporary Construction
- Construction Equipment
- Small Tools
- Consumables
- Field Office Expenses

Additional areas which will require special attention in the Field Indirect Cost estimate include the construction labor camp, temporary roads and docks, and temporary utility systems.

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9.11 Professional Services

A definitive estimate of Professional Services man-hours required to complete detailed design of the plant will be prepared by the specific engineering disciplines and assembled by Engineering Management. Other home office estimate man-hours, such as, print services, scheduling, clerical, procurement, construction management, cost engineering, accounting, computer services, etc., will be prepared by the respective department heads. Man-hours will be priced from current composite discipline rate schedules.

9.12 Insurance and Taxes

For the final Definitive Cost Estimate, a detailed analysis of insurance and tax requirements will be made using rates obtained by the Davy McKee Insurance and Tax Departments working with the client's experts and State of Alaska officials.

9.13 Escalation

All cost estimates will be subjected to an Escalation Analysis in order to identify and cover anticipated increases in cost through the project duration. The Escalation Analysis will be prepared using Davy McKee's computerized escalation systems (MPET and MEC) and will establish minimum and probable escalation figures.

9.14 Accuracy and Contingency

Three (3) different methods of analyzing project risk will be employed to develop a contingency recommendation. The first

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Risk Analysis will be performed using Davy McKee's Contingency Checklist. This tool provides consideration for plant cost increases resulting from such elements of risk as productivity deterioration, second bidder risk and schedule stretchout. The following four steps are involved:

- o Determine the Components subject to Risk
- o Identify the Risk Elements
- o Evaluate the Risk Level for each Element
- o Calculate the resultant total Risk by component and in total at three levels: Minimum, Probable, and Maximum.

The Davy McKee Accuracy Calculation (MAC) computer program will be employed as the second assessment of Project Risk. Quantity and pricing techniques employed to prepare each estimate will be analyzed, and the potential plant cost variance will be calculated. Line item variances established by the MAC program will be used to establish a preliminary contingency.

Davy McKee Reconciled Estimate Contingency Accuracy Probability (RECAP) provides the third tool used to aid in evaluating estimated investment risk and exposure. Preliminary Contingencies recommended after the above analyses will be plotted on a composite "Cost/Probability" graph, and the probability of overrunning the "Target" Estimate before and after the inclusion of the recommended Contingency will be shown.

9.15 Trade-Off Studies

The Estimating Department, working with the engineering disciplines, will develop trade-off studies, as required for such subjects as alternate materials handling schemes and docking facilities.

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10.0 CONSTRUCTION

Total project construction plans and schedules will be developed and finalized to permit start of module yard and site activities early in Phase III. This activity is critical in that engineering and procurement must be geared to meet the requirements of the project in an orderly and efficient manner. Temporary field facilities, major lifts, execution plans, man-power loading and subcontract work packages will be developed.

Construction labor considerations are also a very important part of the overall plant costs; therefore, during Phase II, a detailed assessment of the manpower split between site work and the modular shop work will be determined.

As part of the Phase II effort, the total subcontract plan will be developed and selected critical infrastructure, site development, railroad, dock, concrete, buildings and module yard subcontracts will be inquiried and evaluated for award early in Phase III.

Availability of local subcontractors will be explored and evaluated for possible utilization on specialized units of work such as refractories, electrical, instrumentation, communications, insulation, painting, etc. Based on this evaluation, the direct-hire versus subcontract work split will be determined. Utilizing data provided by other project participants, plans for gravel pits, concrete aggregate plants, concrete batching facilities, etc., will be developed.

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The project craft manpower will be reviewed against availability and a plan for obtaining the necessary labor developed. Construction camp plans will be finalized.

Project labor contract discussions will commence with appropriate labor organizations in order to firm up the project labor agreement. Items covered will include: nature of project, major facilities and equipment, manpower requirements, hiring and timekeeping requirements, work rules, accident prevention, security and methods of operation.

Safety requirements will be developed including: need for state and local safety permits; plans for ambulance services, first aid, hospital, physicians, police protection and fire protection. Record-keeping requirements by federal, state and local agencies will be determined.

11.0 MARKETING

11.1 General

Work conducted prior to, and as part of, the work program under the DOE grant has strongly confirmed three principal West Coast markets for methanol (power generation, vehicle fuel, and chemical industry). However, this work has led to a number of additional tasks being suggested to insure early marketability of methanol: (1) Potential uses of methanol should be expanded to include such transportation fuel markets at MTBE production, fuel cell applications which may be developed by the mid-1980's, and industrial (as distinct from utility) power applications; (2) Although all West Coast utilities have expressed tentative interest, four, specifi-

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cally, should be the focus of a more complete, immediate effort to establish Beluga methanol in their fuel supply mix; (3) Environmental concerns in market areas related to the potential large-scale distribution and use of methanol should be identified and studied to insure marketability is not unduly restricted; and (4) Specific methanol performance data and operating parameters should be established to ascertain the practicality of methanol use if marketability and early financial feasibility are to be established.

A determination will be made of market diversification in terms of geography and end use that will provide the best mix of price, growth, and stability, with appropriate attention to the national energy policy. Further, the Second Phase study will include market development to the point where preliminary commitments are obtained for purchase, subject, if and where necessary, to appropriate incentives that may be required in early years of production. To achieve this stage at an early date, the following marketing tasks are to be performed to assure technical and commercial acceptability:

11.2 Fuel for Power Generation

In a potential major market area, Southern California, assessments will be made of possible constraints which could impede prompt, large-scale use of methanol as a fuel for electric generation. The proposers will work with recognized authorities in both atmospheric emissions and effects of alcohols upon terrestial and aquatic habitats. Effects of such emissions or possible accidental spills which result from handling, transport, or use of methanol will be reported; and the means to avoid or mitigate any adverse results will be presented. Compliance with federal and state regulations and those of the South Coast Air Quality Management District (California) will be assessed in detail.

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The investigation will have particular value because this district probably has the most stringent regulations in the nation, the area is a major potential methanol market, and substitution of methanol for currently used fuels should at least reduce ambient concentrations of the following: SO_2, NO_x, and particulates.

Assistance will be provided by the Southern California Edison Company, which has tested methanol as fuel in both commercial-size combustion turbine and steam turbine units. The utility will provide data, where available, on air quality and emissions associated with these tests. Information to be sought from manufacturers of generating equipment will include costs of converting boiler equipment to burn methanol, thermal efficiencies (heat rates), and possible load limitations. Commercial assessment of a methanol-fueled, combined cycle plant will be ascertainable from this information. This is important to projected West Coast applications for both utility and industrial use.

Applicability of methanol will be investigated for commercial development of fuel cells that may be expected within the next 5-6 years. Attention will be directed to those modular power units which are scheduled for near-term demonstration in commercial situations.

11.3 Transportation Fuels

It is increasingly clear that methanol has its best chance to be competitive without subsidy in the transportation fuel market.

The study will investigate markets for methanol in the manufacture of MTBE (a methanol-based gasoline additive) on the West Coast. This market was not pursued earlier due to lack of i-butene supplies from ethylene plants in this area. It has now been found that butenes from catalytic cracking streams of refineries can be used with methanol to produce MTBE.

A major western railroad interested in fuel sources for locomotives, has recently inquired about the status of Beluga methanol. This railroad is resuming research and development work at a U.S. research institute, with the goal of achieving a methanol fuel appropriate for powering diesel locomotives. It is understood that such work is also underway overseas, and marketing activities will include monitoring of progress in this field. The development of this application would be of significance to Beluga mine operating costs inasmuch as methanol could be an attractively priced fuel for locomotive operation.

Developments occurring in commercialization of fuel-cell-powered motor vehicles will be monitored. As methanol has been considered to be the optimum fuel for this application, projections will be made of this potential market.

11.4 Carbon Dioxide Sales

Because of the demonstrated interest in use of by-product CO_2 for enhanced oil recovery by the petroleum producers in Upper Cook Inlet Fields, more specific assessment of interest will be obtained, such as quantities of CO_2 potentially usable by the individual operators. The quantity of CO_2 that may be required for a unit of incremental oil to be

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produced will be estimated in order that an approximate measure of value can be determined. Some determination of CO_2 pipeline logistics will be attempted, and current sales prices for CO_2 in other areas will be obtained in order to arrive at the potential revenues attainable.

11.5 Chemical Industry

It is necessary to work with the principal suppliers of methanol to the Pacific Northwest and West Coast and, in some cases, methanol users, to establish whether take-or-pay contacts can be arranged. Although there is no question of interest, there is a need to convince such customers to count on a certain amount of Beluga methanol in their advanced planning.

11.6 Other Activities to be Pursued

Possible constraints, including regulatory controls, to large-scale use of methanol in the projected marketing area will be identified and analyzed. These include:

o Atmospheric Emissions
The means to minimize during transfer operations and in methanol storage will be determined. Special attention will be given to interpollutant emission offset policy for volatile organic compounds, as use of methanol produces no SO_2 or particulates and lower NO_x emissions than conventional fuels. Also to be considered is assessment of emissions during the arrival and departure of methanol carrier vessels, as well as in cargo discharge.

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- State and federal impediments to use of methanol as blends and as neat fuel in the transportation section will be evaluated.

- Assessment of Possible Spills
  Complementing the work performed in the Cook Inlet area which assessed the potential impact on biotic systems from an accidental spill of methanol from the pipeline and shiploading system, a determination will be made of the risks, if any, involved in the discharge of methanol cargoes from vessels and in its transport and handling to the ultimate receivers.

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APPENDIX "B"

VOLUME IV

ENVIRONMENTAL, HEALTH, SAFETY AND SOCIOECONOMIC ASSESSMENTS

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TASK CROSS REFERENCE

The organization of this report does not follow the sequence of Tasks 1.00 through 9.00 in the Statement of Work and Study Schedule stipulated in the CIRI/Placer Proposal of 25 April, 1980. It has been found more convenient and orderly to arrange the subject matter as now presented in Volumes I through V.

To enable those concerned to review the study findings with respect to the associated assigned tasks, the following cross referenced tabulation is provided.

TASK CROSS REFERENCE

Task	Title	Volume	Section	Participant
1.00	CONCEPTUAL DESIGN			
1.01	Mine	I	All Sections	Paul Weir
1.02	Railroad	III	Railroad	Davy McKee, Fisk, Green
1.03	Process Plant Onsites	II	All Sections	Davy McKee
1.04	Process Plant Offsites	II	All Sections	Davy McKee
1.05	Camp, Town, & Airstrip	III	Camp, Town, & Airstrip	CIRI/H&N
2.0	ENGINEERING DESIGN			
2.01	Mine	I	All Sections	Paul Weir
2.02	Railroad	III	Railroad	Davy McKee, Fisk, Green
2.03	Process Plant Onsites	II	Coal Preparation	Davy McKee
			Methanol Synthesis and Distillation	Davy McKee
			Emergency & Safety Systems	Davy McKee
			Buildings and Vehicles	Davy McKee
			Dust Collection	Davy McKee
2.04	Process Plant Offsites	II	Oxygen-Nitrogen-Air and Utilities	Davy McKee
			Wastewater Treatment	Davy McKee
			Storage Facilities	Davy McKee
2.05	Camp, Town, & Airstrip	III	Camp, Town, & Airstrip	CIRI/H&N

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Task	Title	Volume	Section	Participant
2.06	Overall Plant Layout	Executive Review	Summary of Study	Davy McKee
2.07	Pipeline Transport, Storage, Handling, and Ship Loading	III	Product Transportation	CIPL, D.A. Shock
3.00	TRADE-OFF STUDIES			
3.01	Mining Operation Alternate	V	Trade-Off Studies	Paul Weir
3.02	Shipping Coal Alternates	V	Trade-Off Studies	Davy McKee
3.03	Coal Drying Alternates	V	Trade-Off Studies	Davy McKee
3.04	Gasification Alternate with Various Qualities of Coal	V	Trade-Off Studies	Davy McKee
3.05	Construction Approach Alternates	V	Trade-Off Studies	Davy McKee
3.06	Product Shipping Alternates	V	Trade-Off Studies	Davy McKee
3.07	Ash Disposal Studies	V	Trade-Off Studies	Davy McKee
3.08	Natural Gas Alternate for Power Generation	V	Trade-Off Studies	Davy McKee
3.09	Comparison of Cooling Water Systems	V	Trade-Off Studies	Davy McKee
3.10	Hydrogen Sulfide Removal	V	Trade-Off Studies	Davy McKee
4.00	CAPITAL COST ESTIMATE			
4.01	Obtain Vendor Costs	(Included in 4.03)		
4.02	Obtain Subcontract Costs	(Included in 4.03)		
4.03	Prepare Individual Cost Estimates			
	a) Mine	I	Tables	Paul Weir
	b) Railroad	III	Railroad	Davy McKee, Fisk, Green
	c) Camp, Town, & Airstrip	III	Camp, Town, & Airstrip	CIRI/H&N
	d) Process Plant	V	Capital Cost	Davy McKee
4.04	Prepare Overall Capital Cost Estimate	V	Capital Cost	Davy McKee, CIRI/PLACER, CIRI/H&N, W.D. Baker, C.P. Locher, Fisk, Green
5.00	MARKETING			
5.01	Evaluate Market Requirements	V	Marketing	C.A. Stokes; CIRI/Placer; Booz, Allen, & Hamilton
5.02	Develop Marketing Methods	V	Marketing	
6.00	SITE EVALUATION			
6.01	Site Data Collection	IV	Site Evaluation	CIRI/Placer, DOWL

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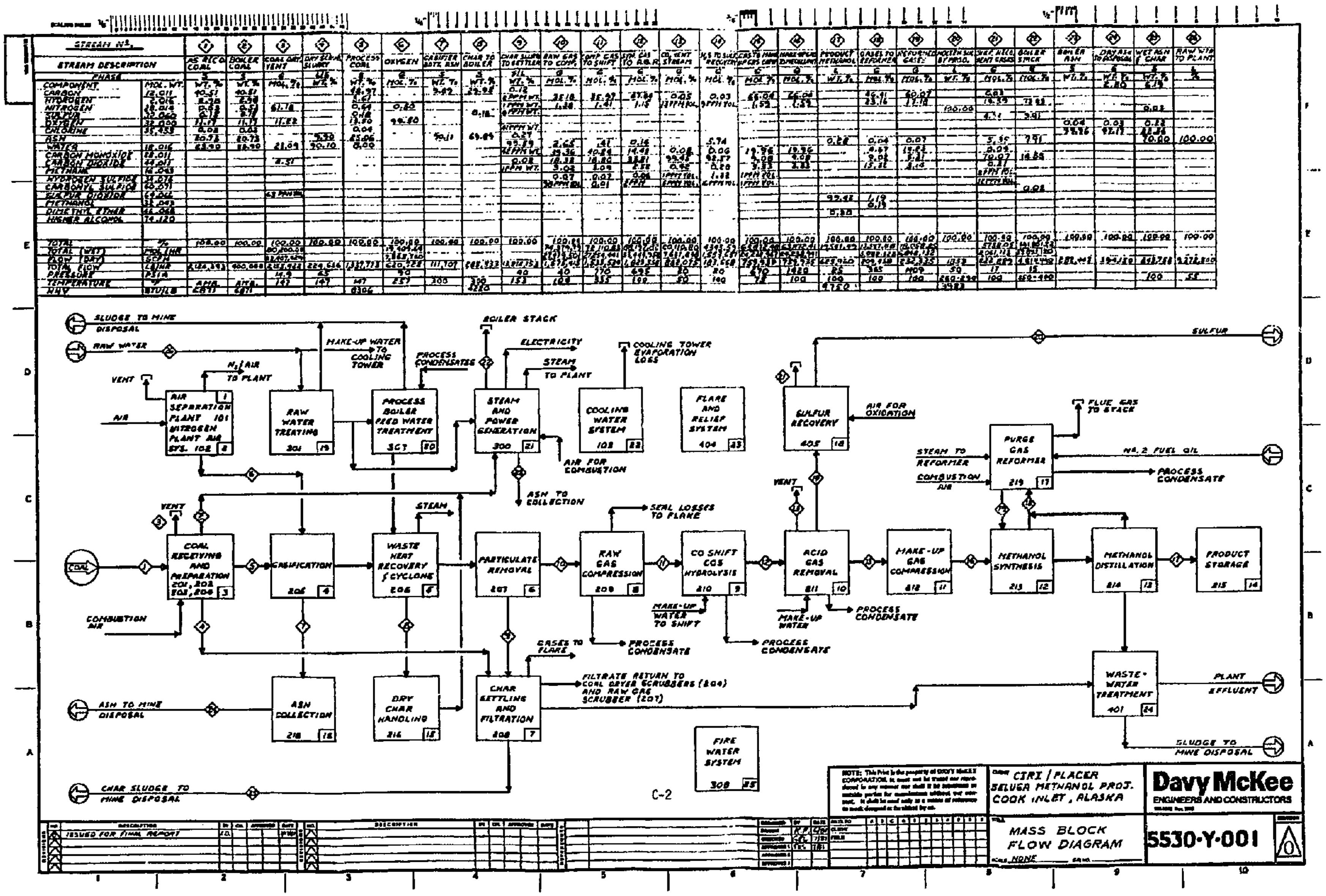
Task	Title	Volume	Section	Participant
6.02	Site Data Evaluation	IV	Site Evaluation	CIRI/Placer, DOWL, Klohn Leonoff
6.03	Applicable Construction Codes and Ordinances	IV	All Sections	DOWL
6.04	Plans for Acquiring Permits & Licenses	Executive Review	Work Plan for Phase II	CIRI/Placer, DOWL
7.00	ECONOMIC ANALYSIS			
7.01	Basic Definition	V	Financial	CIRI/Placer, Bankers Trust,
7.02	Economic Analysis	V	Financial	Lehman Bros.
7.03	Financial Plan	V	Financial	Kuhn Loeb
		Executive Review	Work Plan for Phase II	
8.00	ENVIRONMENTAL			
8.01	Environmental	IV	Baseline Data	DOWL
8.02	Socioeconomics	IV	Baseline Data	P.N.D'Eliscu
8.03	Site Evaluation	IV	Site Evaluation	CIRI/Placer, DOWL
8.04	Health	IV	Safety and Risk	DOWL
8.05	Safety	IV	Safety and Risk	DOWL
9.00	TECHNICAL SUPPORT PLANS			
9.01	Project Management Plan	Executive Review	Management Plan for Phase II	CIRI/Placer, Davy McKee
9.02	Project Manual (Issued at start of Phase I; to be expanded for each additional phase.)			
9.03	Reports (Quarterly reports issued during Phase I. Progress reports will be issued as required in future phase.)			

APPENDIX C

DRAWINGS

	Title	Drawing Number
1.	Overall Plant Area Plan	5530-001-P-001
2.	Mass Block Flow Diagram	5530-Y-001
3.	Utility Block Flow Diagram	5530-Y-002



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CIRI / PLACER
SELUGA METHANOL PROJ.
COOK INLET, ALASKA

Davy McKee
ENGINEERS AND CONSTRUCTORS

MASS BLOCK FLOW DIAGRAM

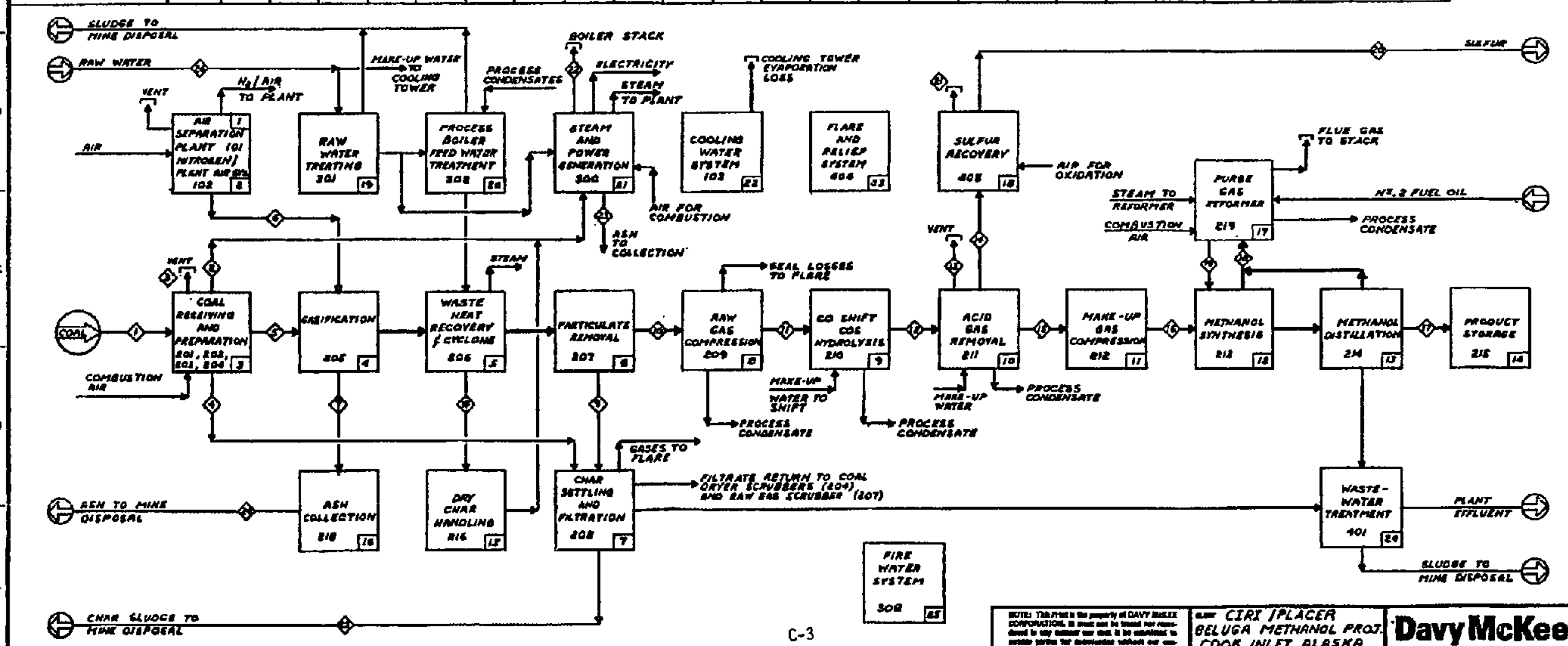
SCALE NONE

5530-Y-001

PLANT UTILITY TABLE

UTILITY CODE		1	2	3	4	5	6	7	8	9	10	11	12
AREA		101	102	201, 202, 203, 204	205	206	207	208	209	210	211	212	213
COOLING WATER	GPM	80,060	850		920	300		62,310	88,980		16,370	12,370	7300
ELECTRICITY	KW												
CONSUMED		82	8710	14,890	1910		155	2480	100	590	32,195	200	1345
GENERATED													
STEAM USED	LB/HR												
1515 PSIA, 900°F													
1270 PSIA, 950°F		810,868											
870 PSIA, 840°F									929,779			184,320	117,000
115 PSIA, SAT.					535,006						57,820		
STEAM GENERATED	LB/HR												
1515 PSIA, 900°F													
1270 PSIA, 950°F													
870 PSIA, 860°F						1,822,512							
115 PSIA, SAT.						5927							
BFW REQUIRED	LB/HR					1,846,962				690,353			
AIR FOR COMBUSTION	SCFH			23,908,780									
NITROGEN	SCFH			27,000	447,911								
FUEL REQUIREMENTS													
NATURAL GAS	SCFM												
NO. 2 FUEL OIL	GAL/DAY												

UTILITY CODE		13	14	15	16	17	18	19	20	21	22	23	24	25
AREA		214	215	216	218	219	405	301	302	300	103	404	401	309
COOLING WATER	GPM	962				10,528	780			59,167	329,867			
ELECTRICITY	KW													
CONSUMED		2995	4980	185	875	845	1510	580	2850	15,000	15,220		1089	410
GENERATED										165,000				
STEAM USED	LB/HR													
1515 PSIA, 900°F						228,113								
1270 PSIA, 950°F														
870 PSIA, 840°F														
115 PSIA, SAT.		64,314				492	155,583 (INCLUDES TOTAL PLANT STEAM TRACING)	114,350	38,411					
STEAM GENERATED	LB/HR													
1515 PSIA, 900°F						286,700								
1270 PSIA, 950°F										810,665				
870 PSIA, 860°F														
115 PSIA, SAT.										969,487				
BFW REQUIRED	LB/HR					864,000				1,767,500				
AIR FOR COMBUSTION	SCFH					3,180,724				50,155,022				
NITROGEN	SCFH				912,000									
FUEL REQUIREMENTS														
NATURAL GAS	SCFM											1000		
NO. 2 FUEL OIL	GAL/DAY					138								



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CIRI / PLACER
BELUGA METHANOL PROJ.
COOK INLET, ALASKA

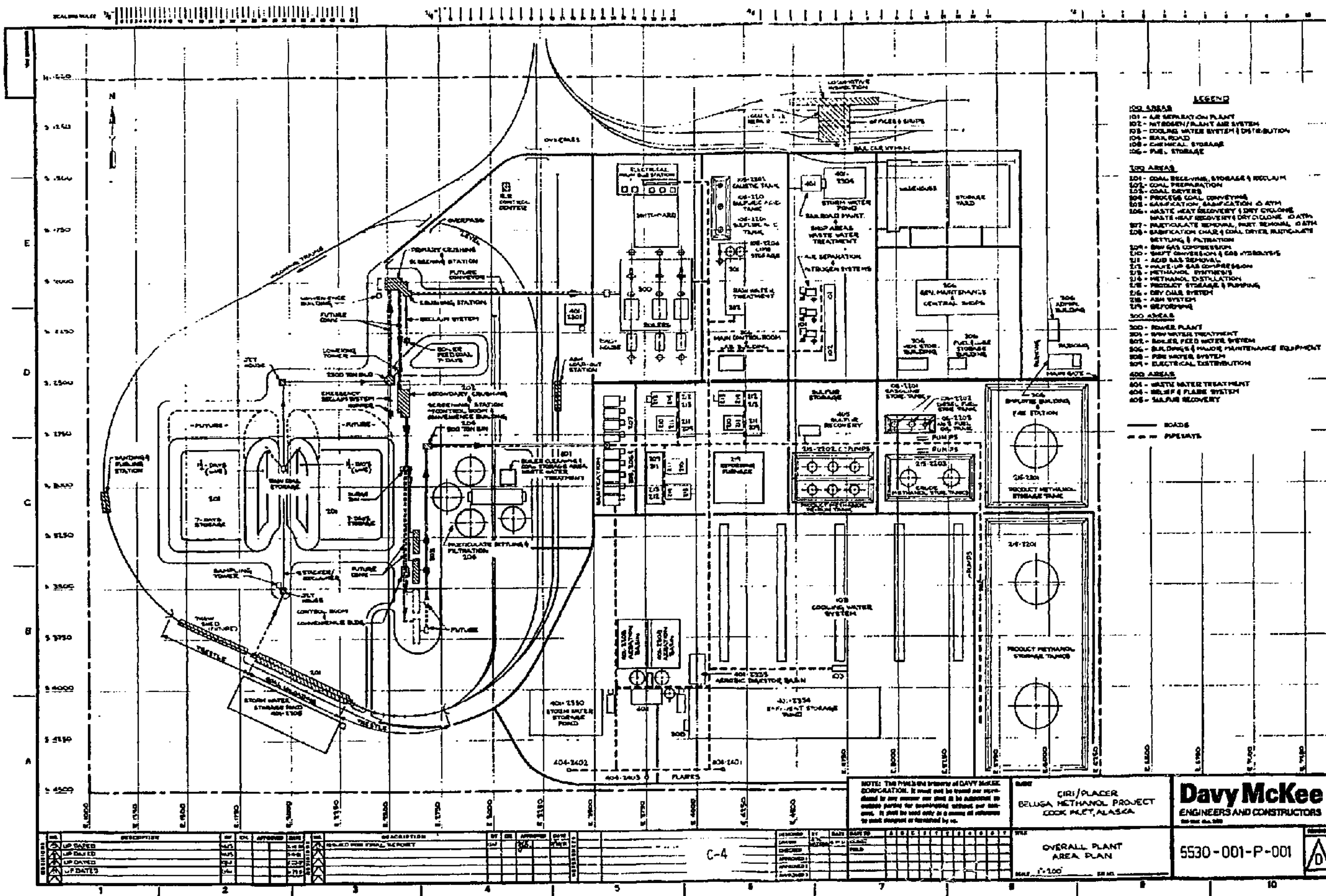
UTILITY BLOCK FLOW DIAGRAM

SCALE NONE

Davy McKee
ENGINEERS AND CONSTRUCTORS

5530-Y-002

ISSUED FOR FINAL REPORT



*U.S. GOVERNMENT PRINTING OFFICE: 1981 740-145-2728