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Energy

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REVISED SRC-I PROJECT BASELINE

Volume 2

Work Performed Under Contract No. AC05-78OR03054

International Coal Refining Company
Allentown, Pennsylvania

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United States Department of Energy

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DOE/OR/03054-T14
(DE84015163)
Distribution Category UC-89

REVISED SRC-I PROJECT BASELINE

VOLUME 2

Prepared by

INTERNATIONAL COAL REFINING COMPANY
P.O. Box 2752
Allentown, Pennsylvania 18001

for the

UNITED STATES DEPARTMENT OF ENERGY
Office of Solvent-Refined Coal Products
under Contract DE-AC05-78-OR-03054

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SRC-I PROJECT BASELINE

PHASES I AND II

APPENDIX A

1.0 PROCESS DESIGN CRITERIA

The Process Design Criteria Specification forms the basis for process design for the 6,000-TPSD SRC-I Demonstration Plant. It sets forth: basic engineering data, e.g., type and size of plant, feedstocks, product specifications, and atmospheric emission and waste disposal limits; utility conditions; equipment design criteria and sparing philosophy; and estimating criteria for economic considerations.

Previously the formal ICRC Document No. 0001-01-002 has been submitted to DOE and revised, as necessary, to be consistent with the SRC-I Project Baseline. Revision 6, dated 19 March 1982, 51 pages, was forwarded to DOE on 19 March 1982.

During the Post Baseline period, Revision 7, dated 20 May 1983, 51 pages, was made to the document. It was forwarded to the DOE on 23 January 1984.

1.2.1 SRC PROCESS AREA

A. SRC PROCESS AREA DESIGN BASELINE

The SRC Process Area Design Baseline consists of six volumes. The first four were submitted to DOE on 9 September 1981. The fifth volume, summarizing the Category A Engineering Change Proposals (ECPs), was not submitted. The sixth volume, containing proprietary information on Kerr-McGee's Critical Solvent Deashing System, was forwarded to BRHG Synthetic Fuels, Inc. for custody, according to past instructions from DOE, and is available for perusal by authorized DOE representatives.

DOE formally accepted the Design Baseline under ICRC Release ECP 4-1001, at the Project Configuration Control Board meeting in Oak Ridge, Tennessee on 5 November 1981.

The documentation was revised by Catalytic, Inc. to incorporate the Category "B" and "C" and Post-Baseline Engineering Change Proposals. Volumes I through V of the Revised Design Baseline, dated 22 October 1982, are nonproprietary and they were issued to the DOE via Engineering Change Notice (ECN) 4-1 on 23 February 1983. Volume VI again contains proprietary information on Kerr-McGee Critical Solvent Deashing System; it was issued to Burns and Roe Synthetic Fuels, Inc. Subsequently, updated process descriptions, utility summaries, and errata sheets were issued to the DOE and Burns and Roe Synthetic Fuels, Inc. on nonproprietary Engineering Change Notices 4-2 and 4-3 on 24 May 1983.

B. CATEGORY "B" ENGINEERING CHANGE PROPOSALS

The following Engineering Change Proposals (ECPs) in the SRC Process Area were agreed upon and were adequately defined but, because of time constraints, were not included within the Original Design Baseline technical documentation. In the Post-Baseline period, these ECPs, except as noted, were included in the Revised Design Baseline documentation. Additional costs and savings (bracketed) are expressed in first quarter fiscal year 1982 dollars.

ECP No.	Description	Value
4-1002	Sour Gas Compressor Revisions For economic considerations and because of the good service records for reciprocating compressors in similar service, the Sour Gas Compressors were reduced in size from two 100 percent capacity units to two 50 percent capacity units. This ECP also covers the addition of a second suction drum and the deletion of one discharge drum. This ECP, which was estimated to save $1,657,000 in costs, was rejected by the PCCB.	
4-1003	Quench Mode as Plant Design Basis A novel quench process will be used to cool the SRC slurry after the Dissolver rather than indirect cooling through a system of heat exchangers in an effort to improve operations and the life of the pressure-letdown valves. Operation in the novel quench process will eliminate or reduce many process and mechanical unknowns with a slight decrease to the overall thermal efficiency.	(4,267,000)
4-1005	Modify Coal Slurry Heating and Pumping Design For capital cost reduction considerations, this modification allowed for the number of slurry heaters to be reduced from 6 to 4 units and for the number of slurry feed pumps to be reduced from 8 to 6. The outlet velocity of the coal slurry heater was increased from 12 feet per second, which was unduly conservative, to 18 feet per second, to yield satisfactory heat transfer.	(21,841,000)
4-1006	Modifications to Solidification Section The number of Solidifers in the Demonstration Plant will be reduced from 11 units to 10 units due to revised solidification design parameters. In normal operation, one-third only of the SRC is solidified; the remaining two-thirds are divided evenly and fed to the Delayed Coker and Expanded Bed Hydrocracker. It is not expected that the Delayed Coker and EBH will be out of operation simultaneously. Now, the Solidifiers are sized to handle the SRC vacuum bottoms when the SRC Area is operating at 50 percent of capacity, which amounts to approximately 83 percent of total capacity.	(5,968,000)

ECP No.	Description	Value
4-1009	Storage Tank Design Modifications The following storage tanks had design temperatures in excess of those allowed for API standard tanks: CSD Emergency Feed Drum, Molten SRC Vessel, Off-Spec Molten SRC Vessel and Molten SRC/TSL Storage Vessel. To overcome these problems, tank specifications were changed to comply with the ASME code. Temperature maintenance systems, agitators and internals will be changed, as necessary, with the new configuration.	(26,000)
4-1011	Boiler Blowdown Disposal Originally, it was planned to let-down the pressure to approximately 35 psig and pump the blowdown from steam generators within the Area to the BFW Treatment System. However, it was more cost-effective to flash the blowdown to 75 psig and recover the steam and send the condensate to the Cooling Water Return System.	330,000
4-1012	Design Changes for Start-Up/Shutdown A detailed review of start-up and shutown procedures was performed and aspects of start-up, shutdown, and optimization of the SRC Area were reviewed. Modifications were effected wherever start-up and shutdown activities had design effects on present equipment or piping systems. These modifications included the addition of recycle lines, and increases in pump capacities.	2,937,000
4-1014	Materials of Construction Modifications Recent pilot plant corrosion data collected from on-going test programs resulted in modifications being made to upgrade some of the materials of construction and corrosion allowances to increase the life expectancy of the equipment. The modifications incorporated some recommendations received from DOE.	2,763,000
4-1023	Modifications to KMAC Unloading Systems This ECP involved the conversion of the existing KMAC storage bin filter unit into a filter receiver with a capacity of one change bin. The filter receiver was then isolated from the bin by its airlock, thereby eliminating the possibility of fouling the bag filters.	86,000
4-1025	Light SRC Stripper Redesign The LSRC Stripper was redesigned to reduce the possibility of SRC carryover to the Stripper overhead system, and to reduce critical solvent losses in the LSRC product. A reboiler and feed cooler were added to the system.	528,000

ECP No.	Description	Value
4-1027	Product Oil Fractionation	9,159,000
	During Phase 0, ICRC anticipated that the liquid hydrocarbon products from the Demonstration Plant would be made as two cuts--a mixed fuel oil substitute for No. 2 fuel oil and raw naphtha for reformer feedstocks. However, product utilization activities during Phase I revealed that additional equipment and processing would be required to upgrade the cuts to marketable products. This ECP added a common Product Oil Fractionation Unit to fractionate the liquid hydrocarbons produced in the SRC Process, Delayed Coker and EBH Areas into naphtha, middle and heavy distillate fractions.	
4-1028	Operator Shelter and Field Laboratory	62,000
	A building was needed to provide area field personnel with toilet facilities, tool storage, a laboratory for simple tests to control the process and a sheltered place to prepare log sheets and other operating records.	
4-1031	Pumpressor (P-12724 A&B) Driver Modifications	1,093,000
	Changes to the overall steam balance resulted in insufficient 450-psig steam being available to drive the back-pressure turbine of the CSD Third-Stage Light-Phase Pumpressor. Substitution of condensing turbines reduced the steam demand by approximately 120,000 lb/hr. A trade-off study favored the installation of condensing turbine drives over variable-speed electric motors.	
	SRC Process Area Total	(15,144,000)

1.2.2. COKE AND LIQUID PRODUCTS AREA

A. COKER DESIGN BASELINE

The single volume Coker Design Baseline was submitted to DOE on 10 December 1981. It was formally accepted by the DOE under ICRC Release ECP 5-1001 at the Project Configuration Control Board meeting in Allentown, Pennsylvania on 17 December 1981.

The documentation was revised by the Lummus Company to incorporate the Category "B" and "C" and Post-Baseline Engineering Change Proposals. The Revised Design Baseline, dated September 1982, was issued to Burns and Roe Synthetic Fuels, Inc. via Engineering Change Notice (ECN) 5-1 on 3 November 1982. This document contains mostly proprietary information.

Subsequently, a process change which eliminated precooling of the Medium Gas Oil product before being sent to the SRC Process Area (Area 12) was incorporatec into Engineering Change Notice (ECN) 5-4. This ECN was issued to Burns and Roe Synthetic Fuels, Inc. on 20 June 1983 and included the revised documentation.

B. CALCINER DESIGN BASELINE

The Calciner Design Baseline, consisting of one volume, was submitted to DOE on 7 January 1982. It was formally accepted by DOE under ICRC Release ECP 5-1011 at the Project Configuration Control Board meeting in Oak Ridge, Tennessee on 26 January 1982.

The documentation was revised by the Lummus Company to incorporate the Category "B" and "C" and Post-Baseline Engineering Change Proposals. The Revised Design Baseline, dated September 1982 was issued to the DOE via Engineering Change Notice (ECN) 5-2 on 3 November 1982. This document is non-proprietary.

C. EXPANDED-BED HYDROCRACKER DESIGN BASELINE

The Expanded Bed Hydrocracker Baseline, consisting of two volumes, was submitted to DOE on 23 December 1981. It was formally accepted by the DOE under ICRC Release ECP 5-1012 at the Project Configuration Control Board meeting in Oak Ridge, Tennessee on 26 January 1982.

The documentation was revised by the Lummus Company to incorporate the Category "B" and "C" and Post-Baseline Engineering Change Proposals. The Revised Design Baseline, dated September 1982, was issued to Burns and Roe Synthetic Fuels, Inc. via proprietary Engineering Change Notice (ECN) 5-3 on 3 November 1982.

D. CATEGORY "B" ENGINEERING CHANGE PROPOSALS

The following Engineering Change Proposals in the Coke and Liquid Products Area were agreed upon and were adequately defined but, because of time constraints, were not included within the Original Design Baseline technical documentation. In the Post-Baseline period, these ECPs were included in the Revised Design Baseline documentation. Additional costs and savings (bracketed) are expressed in first quarter fiscal year 1982 dollars.

ECP No.	Description	Value
5-1004	Change Hot Condensate Subcooler to Pump Because of a change in the facility steam condensate return header system, the steam condensate subcooler was replaced by a pump which returns the condensate via a header at higher pressure to the Utility and Offsites Area.	12,000
5-1006	Eliminate Calciner Shift Bins In the interest of economy, the calciner shift bins were eliminated. The shift bins provided storage for the calcined coke product while it was being tested for quality. However, a simple resistivity test for calcined coke density requires no hold time and is the proposed method for testing the calcined product. There will also be a detailed analysis of samples of the green coke.	(333,000)
5-1007	J-Type Enclosures for Green Coke Conveyors 'J' type covers were added to the green coke conveyors to avoid moisture pick-up from rain which would increase greatly the fuel gas consumption in the calciner kiln. These covers replaced the completely enclosed galleries included in the Original Design Baseline to effect a capital cost reduction. Inasmuch as the green coke will be moist, containing up to 11 percent moisture, the concern no longer exists for the possible dispersion of potentially carcinogenic coke fines to the atmosphere.	(1,026,000)
5-1008	Reduction in Wet Gas Compresssor Size In the interest of economy, the capacities of the two Wet Gas Compressors were reduced from 100 to 60 percent.	(406,000)
5-1010	Operator Shelter and Smoke Area A building was needed to provide area field personnel with toilet facilities, tool storage, a laboratory for simple tests to control the process, and a sheltered place to prepare log sheets and other operating records.	62,000
	Coke and Liquid Products Area Total	(1,691,000)

1.3.1 CRYOGENIC SYSTEMS AREA

A. AIR SEPARATION UNIT DESIGN BASELINE

The ASU Design Baseline, consisting of one volume, was submitted to DOE on 16 December 1981. It was formally accepted by the DOE under ICRC Release ECP 3-1001 at the Project Configuration Control Board meeting in Oak Ridge, Tennessee on 18 February 1982.

There were no changes made to this Design Baseline during the Post-Baseline period.

B. CATEGORY "B" ENGINEERING CHANGE PROPOSALS

The following Engineering Change Proposal in the Cryogenic Systems Area was agreed upon and was adequately defined but, because of time constraints, was not included within the Original Design Baseline technical documentation. Additional costs are expressed in first quarter fiscal year 1982 dollars.

ECP No.	Description	Value
3-1003	Operator Shelter and Field Laboratory A building was needed to provide area field personnel with toilet facilities, tool storage, a laboratory for simple tests to control the process, and a sheltered place to prepare log sheets and other operating records.	62,000
	Cryogenic Systems Area Total	62,000

1.3.2 GAS SYSTEMS AREA

A. GAS SYSTEMS DESIGN BASELINE

The Gas Systems Design Baseline, consisting of ten volumes, was submitted to DOE on 3 December 1981. Volumes 6 through 10 were formally accepted by the DOE under ICRC Release ECP 6-1001 at the Project Configuration Control Board (PCCB) meeting in Allentown, Pennsylvania on 17 December 1981. The first five volumes were accepted at the PCCB meeting in Oak Ridge, Tennessee on 26 January 1982.

The documentation was revised by the Ralph M. Parsons Company to incorporate Category "B" and "C" and Post-Baseline Engineering Change Proposals. The revisions were covered by Engineering Change Notices (ECNs) 6-1 through 6-68, which were issued, as generated, from 12 August 1982 to 28 April 1983. The last transmitted nonproprietary transmittal, ECN-67, was made to DOE on 2 May 1983. The last proprietary transmittal, ECN-68, was made to Burns and Roe Synthetic Fuels, Inc. on 24 May 1983. Two additional ECNs, 6-69 and 6-70, were prepared to cover the material take-offs for the Gasification and Dust Preparation Units. Costs were then applied to these material take-offs by ICRC to arrive at the Revised Cost Baselines included herein.

B. HYDROGEN PURIFICATION UNIT DESIGN BASELINE

The HPU Design Baseline, consisting of one volume, was submitted to DOE on 23 December 1981. It was formally accepted by the DOE under ICRC Release ECP 3-1002 at the Project Configuration Control Board meeting in Oak Ridge, Tennessee on 18 February 1982.

There were no changes made to this Design Baseline during the Post-Baseline period.

C. CATEGORY "B" ENGINEERING CHANGE PROPOSALS

The following Engineering Change Proposals (ECPs) in the Gas Systems Area were agreed upon and were adequately defined but, because of time constraints, were not included within the Original Design Baseline technical documentation. In the Post-Baseline period, these ECPs, except as noted, were included in the Revised Design Baseline documentation. Additional costs and savings (bracketed) are expressed in first quarter fiscal year 1982 dollars.

ECP No.	Description	Value
1-0011	Corrosion/Erosion Monitoring This ECP provided for a program to incorporate the ability to monitor the corrosion and erosion effects on the materials selected for use within the Gas Systems Area.	76,000
6-1002	Mixed Feed Gasification Heat & Material Balance This change proposal defined the costs of both the GKT and R. M. Parsons work associated with the preparation of a mixed-feed material balance for the three GKT-specified units in the Gas Systems Area.	34,000
6-1003	Selexol and DEA Spare Filters/Separators To decrease capital costs, the spare filters/separators in the DEA and Selexol Units were deleted.	(194,000)
6-1004	Gasifier Flare Operation This ECP covered the costs associated with the modification of the standard start-up procedures and flare operation for the gasification reactors so that the venting of unburned raw gas could be avoided. This change allowed flare stack burners to be continuously lit and raw gas to be monitored to assure that the oxygen content in the stack gases is less than one percent by volume.	48,000
6-1005	Nitrogen Purge System Revision The standard GKT nitrogen purge system design was based on a low-pressure nitrogen source. In order to take advantage of the higher pressure nitrogen gas purge available, it was recommended by GKT that its standard nitrogen purge system be modified to eliminate the four nitrogen seal pots per gasification train and to simplify controls and piping.	(522,000)

ECP No.	Description	Value
6-1006	Sulfur Storage This ECP added two 1,700 long ton storage tanks, winterized with steam heating coils and complete with steam-jacketed piping, emission controls, fire detection and protection, loading pumps and the associated one railcar loading station.	1,586,000
6-1008	Two 50% H_2 Compressors - Deletion of Third 50% Spare Compressor The Design Baseline has three (3) identical 50% hydrogen compression trains, two operating and one spare. This cost reduction ECP was to delete the spare hydrogen compressor and its associated equipment (coolers, knockout pots, and pulsation dampeners). Provisions were to be made in the present design for future addition of a spare compressor should plant operation find it to be a requirement. This ECP, which was estimated to save $3,042,000 in costs, was rejected by the PCCB.	
6-1009	LPG System and Storage Addition The LPG system shall be capable of storing 7,000 BBLS of LPG and vaporizing it on demand to the fuel gas networks when required to supplement the SRC.	4,690,000
6-1012	Segregated Wash Water System This ECP covered the costs associated with the revision of the flow scheme for the Gasifier Wash Water Treatment System to minimize the effects of high chloride concentrations and associated corrosion problems in the wash water on process equipment. In the revised flow scheme, process water was used for the Electrostatic Precipitator and for quenching the raw gas. This resulted in higher blowdown from the ash slurry pond but reduced the circulating chloride concentration and thus protected the equipment downstream of the quench chamber from chloride corrosion.	264,000
6-1013	Deletion of the Fourth Gasifier This ECP deleted all of the equipment, piping and structures related to the spare Gasifier which was the eastern-most gasifier train on the plot plan. Allowances for space in the plot plan, process and utility tie-ins and space for electrical hardware and instrumentation were made for the future addition of this fourth gasifier train.	(18,461,000)

ECP No.	Description	Value
6-1015	Two 67% Claus Plants To reduce capital costs, the Claus Sulfur Recovery Plants were reduced from two 100% units (one installed spare) to two 67% reaction trains, both of which will operate to handle the design gas flow. Front end equipment, which is shared between trains, was increased in size to handle the maximum operating case. The thermal oxidizer and stack remain at 100% of design capacity.	(2,436,000)
6-1016	Wash Water Treatment Pump Revision This change deleted the flush water pumps used to back flush the wash water coolers and modified the main wash water pumps from three 50 percent capacity units to four 50 percent capacity units. One of these wash water pumps will be used intermittently for the wash water cooler flushing service.	(41,000)
6-1024	Methanation Unit A Methanation Unit was used to process a portion of the makeup-hydrogen gas leaving the Selexol Unit. This gas was split into two streams: one stream was routed to the Hydrogen Compressors, while the other stream was routed to the Methanation Unit where the carbon oxides contained in the gas stream are converted to methane. The latter stream was finally routed to the Expanded Bed Hydrocracker and Naphtha Hydrotreater which require methanated hydrogen for proper operation since carbon monoxide adversely affects catalyst activity.	3,550,000
	Gas Systems Area Total	(11,406,000)

1.4.1 OUTSIDE BATTERY LIMITS FACILITY AREA

A. UTILITIES AND OFF-SITES DESIGN BASELINE

The Utilities and Off Sites (U&O) Design Baseline, consisting of three volumes, was submitted to the DOE on 3 November 1981. It was formally accepted by the DOE under ICRC Release ECP 7-1001 at the Project Configuration Control Board Meeting in Allentown, Pennsylvania on 17 December 1981.

The U&O Design and Cost Baselines have not kept pace with the changes and refinements in the designs of the various process areas. To contribute to a consistent overall plant design, Kellogg-Rust International will develop for ICRC a better defined process and cost package by 30 April 1984 for the U&O Area based on its Revised Design Basis Memorandum, which takes into account all Engineering Change Proposals and Post-Baseline design improvements and the steam/fuel optimization study.

The design update will be forwarded to DOE when it is completed.

B. CATEGORY "B" ENGINEERING CHANGE PROPOSALS

The following Engineering Change Proposals in the Outside Battery Limits Facilities Area were agreed upon and were adequately defined but, because of time constraints, were not included within the Original Design Baseline technical documentation. Additional costs are expressed in first quarter fiscal year 1982 dollars.

ECP No.	Description	Value
7-1002	Addition of Fourth Pulverizer Train A fourth Pulverizer of 85 TPH nominal capacity was added to insure adequate, proven pulverizing capacity to meet the required throughput of 250 TPH (dry basis). The feed coal may have a moisture content up to 14 percent.	6,576,000
7-1004	River Frontage Security Fence Security fencing was installed along the Green River. The addition of fence along the river was strongly recommended by the DOE during its review of the Design Baseline for the Outside Battery Limits Facilities Area.	52,500
7-1005	Flare System Spare Pumps To improve the reliability of the flare system, spare pumps were provided for the Quench Liquid Pump, the Liquid Recovery Pump, and the Flare Drum Pump. A warehouse spare was provided for the Knockout Pumps.	85,400
4-1031	Pumpressor (P-12724 A&B) Driver Modifications This value covers the impact on the Utilities and Off Sites Area by the SRC Area ECP 4-1031.	285,000
	Outside Battery Limits Facilities Area Total	6,998,900

1.4.2 CENTRAL CONTROL SYSTEMS AREA DESIGN BASELINE

The Central Control Systems Design Baseline, consisting of one volume, was submitted to DOE on 7 January 1982. It was formally accepted by DOE under ICRC Release ECP 9-1001 with the addition of one attachment at the Project Configuration Control Board meeting in Oak Ridge, Tennessee on 26 January 1982.

There were no changes made to this Design Baseline during the Post-Baseline period.

1.5.4 PRODUCT UTILIZATION

A. CATEGORY "B" ENGINEERING CHANGE PROPOSALS

The following Engineering Change Proposals in the Product Utilization Area was agreed upon and was adequately defined but, because of time constraints, was not included within the Original Design Baseline technical documentation. Additional costs are expressed in first quarter fiscal year 1982 dollars.

ECP No.	Description	Value
1-1002	Product User Retrofit (Conversion) Costs	1,000,000
	This ECP covered the ICRC Project Management costs for the conversion of three oil-fired utility boilers and one industrial oil-fired furnace for SRC solid combustion demonstration programs. Also included were the modifications to a utility boiler for consumption of off-spec SRC solids. These conversions were necessary to demonstrate the feasibility of directly substituting SRC for petroleum. The Phase III costs for these conversions are $45,100,000.	
	Product Utilization Area Total	1,000,000

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APPENDIX B

Except for Item 1.0, Work Breakdown Structure (WBS) and Dictionary, the supporting information referred to in Appendix B is not part of the Baseline because it is not under Configuration Control. Appendix B lists documents that were previously submitted to DOE and have been compiled here for reference.

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SUPPORTING INFORMATION

1.0 WORK BREAKDOWN STRUCTURE (WBS) AND DICTIONARY

The Project Work Breakdown Structure (PWBS) divides the total project into its component plant areas and related support facilities and services. The latest updated PWBS (Drawing Number 00-10-90001D Revision 5 dated 29 January 1982) was included in the PWBS and Dictionary document (Revision 0 dated 15 February 1982) forwarded to the DOE on 23 March 1982.

There were no changes made to this document during the Post-Baseline period.

2.0 ASSUMPTIONS

Assumptions applicable to the development of this Revised Project Baseline are as follows:

a. The Revised Design Baseline is based on the best available definition as of 1 September 1983.

b. The Area Contractor's procurement and support of the Construction Manager/Constructor (CM/C) procurements shall be as set forth in ICRC Master Project Procedure MPP 5-1, Revision 1, so that the Area Contractor can complete his detailed engineering in a timely fashion.

c. The original project schedule, and hence the schedule included herein, was based on:
   - Procurement activities leading to vendor selections will begin 15 June 1982.
   - Procurement will occur in a timely fashion without undue delays. Based on experience to date, this implies that only highly valued ($5 MM and up) purchase orders will be submitted to DOE for consent, and consent actions will take no longer than 30 calendar days.
   - DOE will review and comment on First and Second Milestone Review Packages only, and in accordance with the Project Schedule.
   - The EIS Record of Decision for 15 October 1982 will be maintained. Additional environmental requirements could add to the overall project cost and schedule.
   - The federal condemnation proceedings, if required, will take no longer than the commercial land acquisition to permit rezoning to occur to allow the move on site by 15 April 1983.

   In the event that the SRC-I Project is restarted, a new schedule must be developed for conditions then existing and with allowances made for restart and mobilization efforts.

d. Phase I Engineering costs represent the detailed estimates of the Area Contractors and CM/C for the defined work.

e. Phase I costs include vendor engineering.

f. The Area Contractors estimated Phase II equipment costs including the costs for items of equipment to be purchased by the CM/C in the final analysis. Quantities of bulk materials were estimated by the Area Contractors for their respective Areas, but the quantities were priced by the CM/C.

g. Field labor productivity for construction crafts is adjusted to a 1.38 multiplier over the Gulf Coast basis. The construction estimate is based on work being done on a 40-hour work week basis. The work will be performed on a subcontract or direct hire basis so as to minimize the cost and duration.

h. Spare parts are included at a total budget of 5% of total materials and equipment costs.

i. All costs are on a first-quarter fiscal year (FY) 1982 basis.

j. Escalation for the Original Project Baseline was estimated in accordance with the following schedule (as directed by DOE):

Start Date - First Quarter FY 82 (15 November 1981)

Escalation Rates

FY 82	10%
FY 83	10%
FY 84	9%
FY 85	9%
FY 86 and Beyond Years	8%

No allowance was made for escalation in the Revised Cost Baseline.

k. No fee is included for Air Products and Chemicals, Inc., Rust Engineering Company, Catalytic, Inc., or ICRC costs.

l. U.S. Highway 60 will be improved in time to provide better access to the site to accommodate the buildup in the number of construction personnel on the site.

m. Funding for the execution of the project will be released in sufficient quantitiy and time so as not to impede the Project Schedule.

3.0 DESIGN BASIS MEMORANDA

The following memoranda define the design basis for the total Demonstration Plant as well as for the Product, Support Processes and Outside Battery Limits Facilities and Central Control System. They are formal ICRC documents that have been submitted to DOE previously and have been revised, as necessary, to be consistent with the Project Baseline.

a. SUMMARY DESIGN BASIS MEMORANDUM (WBS 1.0)

ICRC Document No. 0001-01-008, Revision 3, dated 19 March 1982, 30 pages, was originally forwarded to DOE on 23 March 1982.

Conforming Revision 4, dated 23 January 1984, 30 pages, was made to the document for compliance with the Revised Design Baseline; it was forwarded to DOE on 30 January 1984.

b. SRC PROCESS AREA DESIGN BASIS MEMORANDUM (WBS 1.2.1)

ICRC Document No. 0001-01-001, Revision 4, dated 1 December 1981, 38 pages, completed with Proprietary Appendix A, Revision 4, dated 17 December 1981, 11 pages; Appendix B, Revision 4, dated 1 December 1981, 9 pages; and Appendix C, Revision 4, dated 1 December 1981, 5 pages, was forwarded to DOE on 5 January 1982. This document defines the work to be performed by Catalytic, Inc. of Philadelphia, PA.

Conforming Revisions 5 and 6, 50 pages, were made to the Design Basis Memorandum to incorporate all design changes which were made and included in the Revised Design Baseline. The revised document was forwarded to DOE on 23 January 1984.

c. DELAYED COKER/CALCINER AREA DESIGN BASIS MEMORANDUM (WBS 1.2.2.1)

ICRC Document No. 0001-01-005, Revision 4, dated 19 March 1982, 27 pages, was forwarded to DOE on 7 April 1982. This document defines work to be executed by The Lummus Company of Bloomfield, NJ.

Conforming Revisions 4, 5, and 6, 27 pages, were made to the Design Basis Memorandum to incorporate all design changes which were made and included in the Revised Design Baseline. The latest revised copy was forwarded to DOE on 30 January 1984.

d. EXPANDED-BED HYDROCRACKER AREA DESIGN BASIS MEMORANDUM (WBS 1.2.2.2)

ICRC Document No. 0001-01-006, Revision 4, dated 19 March 1982, 25 pages, was forwarded to DOE on 1 April 1982. This document defines work to be executed by The Lummus Company of Bloomfield, NJ.

Conforming Revisions 4 and 5, 25 pages, were made to the Design Basis Memorandum to incorporate all design changes which were made and included in the Revised Design Baseline. The revised document was forwarded to DOE on 23 January 1984.

e. CRYOGENIC SYSTEMS DESIGN BASIS MEMORANDUM (WBS 1.3.1)

ICRC Document No. 0001-01-004, Revision 3, dated 30 June 1981, 29 pages, was forwarded to DOE on 20 July 1981. This document defines work to be executed by Air Products and Chemicals, Inc. of Allentown, PA.

No changes were made to this document during the Post-Baseline period.

f. GAS SYSTEMS AREA DESIGN BASIS MEMORANDUM (WBS 1.3.2)

ICRC Document No. 0001-01-003, Revision 2, dated 25 February 1981, 68 pages, was forwarded to DOE on 25 February 1981. This document defines work to be executed by The Ralph M. Parsons Company of Pasadena, CA.

A conforming Revision 3, 70 pages, was made to the Design Basis Memorandum on 10 August 1983, to incorporate all design changes which were made and included in the Revised Design Baseline. The revised document was forwarded to DOE on 23 January 1984.

g. OUTSIDE BATTERY LIMITS FACILITY DESIGN BASIS MEMORANDUM (WBS 1.4.1)

ICRC Document No. 001-01-0007, Revision 2, dated 15 October 1981, 179 pages, was forwarded to DOE on 12 November 1981. This document defines work to be performed by The Rust Engineering Company of Birmingham, AL.

Conforming Revisions 3 and 4 were made to the Design Basis Memorandum to reflect all design changes which were made and incorporated into the Revised Design Baselines of the Area Contractors of the process areas. Additionally, the DBM was divided into two sections for the zero discharge mode for wastewater handling: Section A, 120 pages, covering Area 16 - Utility Systems and Area 11 - Raw Material and Product Handling and Storage Systems and, Section B, 103 pages, covering Area 17 - Off Sites.

Copies of the revised documents were sent to DOE on 29 July 1983.

h. CENTRAL CONTROL SYSTEMS DESIGN BASIS MEMORANDUM (WBS 1.4.2)

ICRC Document No. 001-01-0009, Revision 0, dated 30 September 1981, 79 pages, was forwarded to DOE on 5 October 1981. This document defines work to be performed by Johnson Controls, Inc. of Philadelphia, PA.

No changes were made to this document during the Post-Baseline period.

4.0 PROJECT MANAGEMENT PLAN

ICRC has prepared a comprehensive plan for the accomplishment of the project, entitled the Project Management Plan (PMP). The current edition of the plan, Revision 2, dated November 1981, was forwarded to the DOE on 23 March 1982.

The plan describes (1) the proposed organization, including subcontractors' organizations, for accomplishing the work; (2) the personnel to fill key project positions, including subcontractor personnel and their qualifications; (3) the proposed plan for interface management, including but not limited to interfaces between ICRC, the government and subcontractors; (4) ICRC's management tools and techniques ensure timely, efficient accomplishment of the work within the budget and schedule; (5) the Work Breakdown Structure (WBS); (6) the Project Schedule; (7) the Project Estimate; (8) reporting procedures; (9) document management and control; (10) manpower management and control; (11) ICRC's system for managing costs and schedules and for achieving project objectives, including the ability to objectively measure the performance of these elements on an integrated basis; (12) insurance plans; and (13) facility utilization.

The PMP will be updated and revised as detailed information is developed and becomes available. ICRC will implement the procedures and systems defined in the PMP.

ICRC has also developed and will implement the following plans which will supplement the PMP.

a. CONFIGURATION MANAGEMENT PLAN (CMP)

The Configuration Management Plan (CMP) was developed to exercise configuration control, i.e., control of technical, cost, and schedule changes, for the SRC-I Project. Draft No. 5 of the CMP, dated 16 February 1981, was forwarded to DOE for comments on 19 February 1981. By October 1981, DOE adopted its final SRC-I Configuration Management Plan.

ICRC is exercising configuration management in accordance with both plans. In any instance of conflict between the plans, ICRC has deferred to the DOE plan until the ICRC plan can be revised. The plan will be revised prior to the full implementation by DOE of configuration control on the project.

The significant differences between the plans are: the revised ICRC plan will include the Design, Schedule, and Cost Baseline hierarchy (this hierarchy is being practiced now), and the revised ICRC plan will conform to the ECP approval authority limits as specified in the DOE plan, paragraph 2.4. These and other insignificant differences will also be corrected in the revised ICRC plan if and when the project to construct the Demonstration Plant is reactivated.

b. PROJECT BASELINING PLAN

The Project Baselining Plan addresses the responsibilities and timetables for developing the Original Design, Cost, and Schedule Baselines for the Demonstration Plant. The plan, dated 29 June 1981, was forwarded to DOE for approval on 29 June 1981. No changes were made to the plan during the Post-Baseline period.

c. COST AND SCHEDULE CONTROL SYSTEMS CRITERIA IMPLEMENTATION AND SURVEILLANCE PLAN

The C/SCSC Implementation and Surveillance Plan, Revision 0, dated 27 November 1980, defines the methods and procedures to be used by ICRC to implement the C/SCSC, identified in DOE Order 2250.1 dated 25 September 1979, and to evaluate the adequacy of operating the management control system. This plan was forwarded to DOE for approval on 18 September 1981. It has not been changed.

d. SAFETY PROGRAM PLAN

The purpose of the Safety Program Plan is to identify potential hazards to employees or the general public that may be associated with designing and operating the Demonstration Plant and to identify the systems, equipment, or procedures that may be necessary to minimize the risks involved.

The 30 November 1981 Revision of the Safety Program Plan was forwarded to DOE on 18 March 1982. No changes have been made to this plan.

e. ENVIRONMENTAL PLAN FOR CONSTRUCTION

The objective of the Environmental Plan for Construction is to present measures that will be taken to mitigate harm that may occur to the environment during construction. The plan, dated 19 October 1981, was forwarded to the DOE for comments on 26 October 1981.

The plan covers erosion and sedimentation control, disposal and handling of construction wastes, air pollutants, construction noise, and removal and storage of topsoil. It is intended that the contents will be expanded by the CM/C, if and when the project is reactivated.

f. INTERFACE MANAGEMENT IMPLEMENTATION PLAN

The Interface Management Implementation Plan prescribes how orderly and efficient identification and exchange of information between SRC-I cost accounts will be established and maintained. It assigns specific interface plan development, maintenance, and audit responsibilities.

The original issue of the plan was forwarded to the DOE on 18 March 1982. It has not been modified to date.

g. TECHNOLOGY TRANSFER PLAN

The Technology Transfer Plan is designed to transfer information about the SRC-I process, its end use, and its end products to appropriate audiences who are interested in the development of synthetic fuels.

The first version of the plan was transmitted to the DOE in Volume Task V of the deliverables of Phase 0. The current version was transmitted to DOE on 18 March 1982.

h. QUALITY ASSURANCE PLAN

The Quality Assurance (QA) Manual defines the ICRC organization and responsibilities for implementing the QA program to ensure that design, engineering, procurement and construction of the Demonstration Plant are provided at the required level of quality.

Revision 2 of the ICRC QA Manual was forwarded to DOE for review and approval on 5 February 1981. There have been no subsequent revisions.

i. BY-PRODUCT DISPOSITION PLAN

This report presents a comprehensive discussion on each potentially marketable by-product that the Demonstration Plant will produce: LPG, sulfur, and mineral aggregate. The Plan discusses projected by-product market demand, market development efforts conducted to date, future marketing efforts, and designated milestones for obtaining sales agreements for the disposition of these by-products.

Revision 1 of this plan was forwarded to DOE on 23 March 1982; it is still the current issue.

j. DOCUMENT CONTROL PLAN

The objective of the Document Control Plan is to establish a uniform procedure for the controlled receipt, transmittal, and distribution of documents within ICRC and the transmittal and distribution of documents to its Area Contractors, the DOE, and any other outside parties.

The system also establishes document control requirements to be satisfied by the Area Contractors. The requirements cover the use of standard sizes and formats for drawings and specifications, drawing indices, document numbering systems, microfilming procedures, and vendor data control.

The Document Control Plan is embodied in two ICRC Master Project Procedures. They are MPP 2-2, Revision 1, ICRC Document Control and MPP 2-3, Revision 1, Contractor Document Control.

The Master Project Procedures forwarded to DOE on 10 June 1981 are still current.

k. PROCUREMENT MANUAL

The Procurement Manual establishes the scope, policies, and guidelines to be followed in procurement transactions and defines the responsibilities and approval levels associated with this function. The policies have been developed to conform with requirements established by the federal government and the DOE Procurement Regulations for the design, construction, and operation of the SRC-I Demonstration Plant.

The Procurement Manual was forwarded to DOE for approval on 25 November 1980. The manual was updated seven times; the latest update occurred 7 June 1982.

l. GENERAL ENGINEERING SPECIFICATIONS

The General Engineering Specifications define a set of uniform, minimum, acceptable technical requirements for equipment, services, and materials to be used in the SRC-I Demonstration Plant. The requirements cover design criteria, fabrication, installation, inspection, and testing. The Specifications were not revised.

The General Engineering Specifications are contained in six volumes. Copies of them were forwarded to the DOE on 5 June 1981 and updated as additions and revisions become available. No revisions to the specifications were made during the Post-Baseline period.

m. SOCIOECONOMIC IMPACT ASSESSMENT

The Socioeconomic Impact Assessment Report provides a thorough analysis of the baseline conditions and probable effects on local public entities and selected services in the area of impact resulting from the proposed Demonstration Plant at Newman, Kentucky. The study analyzes the labor availability, relocation of the labor supply, and the effects of the immigration of labor on social services and public entities in the study area.

The report, prepared by Dames & Moore, was forwarded to DOE on 24 June 1981. No changes to the report were made during the Post-Baseline period.

n. ICRC POSITION DESCRIPTIONS VOLUME

The ICRC Position Descriptions Volume sets forth the ICRC organization structure, complete with the position descriptions for all professional personnel. The position descriptions include the following information: position title, name of the incumbent, position to which the position in question reports, position description, and principal responsibilities.

Revision 4 of the ICRC Position Descriptions Volume was forwarded to DOE on 17 August 1981. No revisions to the descriptions were made during the Post-Baseline period.

o. MANAGEMENT SYSTEMS PROCEDURES

Management Systems Procedures explain ICRC's Cost/Schedule Control System, define by detailed procedures how the policies of that system and associated requirements of the ICRC Configuration Management Plan are to be implemented, and demonstrate that the management control system complies with DOE Order 2250.1, DOE Cost and Schedule Control System Criteria for Performance Measurement. The procedures supplement the extensive ICRC personnel training program.

Revision 2 of these Management Systems Procedures dated August 1981, was forwarded to DOE on 16 December 1981. No changes have been made since then.

5.0 RESEARCH AND DEVELOPMENT PLAN

The Research and Development (R&D) Plan justifies the need for programs developed to support the Demonstration Plant. More specifically, it identifies technology gaps and proposes specific R&D programs to ensure the technical viability and environmental acceptability of the Demonstration Plant, presents management information required to implement laboratory and pilot plant programs, seeks DOE approval for the technical emphasis and direction of R&D programs, and establishes the R&D budgets required to implement the plan.

The R&D Plan was forwarded to the DOE for approval on 16 December 1981.

An updated Process R&D Plan covering the Post-Baseline Period was transmitted to DOE on 22 December 1982 in two sections - Subcontract R&D Plan and Internal R&D Plan.

6.0 MANPOWER PLANS

The Original Baseline Phase I, II, and III Manpower Plans which follow indicated the time-phased manpower of the Area Contractors, the CM/C, and ICRC, as of March 1982, based on their estimates minus prior expenditures, and used the engineering, procurement, construction, and operation baseline schedules indicated in the Executive Summary and applicable subsections. Manpower Plans for Category B and C Engineering Change Proposals were included in the original document. The information was presented on a monthly basis for 1982, and annually thereafter.

The Phase I Manpower Plans indicated the number of personnel estimated to be required at reporting levels four and five of the WBS. This had been determined by totalling the applicable estimates for each Area Contractor, the CM/C, and ICRC. Similarly, the Phase II Manpower Plans had been developed at the reporting level of the WBS for ICRC. These were segregated into two categories: craft manhours, direct and indirect, and project management and support.

There was no justification to prepare new manpower plans for Phases I, II, and III during the Post-Baseline period.

SRC-I

ORIGINAL BASELINE

MANPOWER SUMMARY

Manhours Expressed in Thousands

WBS Element	Phase I	Phase II	Total
1.1	-	184.5	184.5
1.2.1	1,060.0	4,555.6	5,615.6
1.2.2	523.4	1,594.6	2,117.4
1.3.1	235.6	602.3	837.9
1.3.2	1,114.9	4,685.1	5,800.0
1.4.1	1,364.5	9,328.5	10,693.0
1.4.2	44.9	15.8	60.7
1.5.1	1,109.9	5,565.1	6,675.0
1.5.2	561.6	789.5	1,351.1
1.5.3	173.2	267.8	441.0
1.5.4	106.0	106.0	212.6
1.5.5	121.4	79.3	200.7
1.6.2	-	1,167.2	1,167.2
1.6.4	-	505.4	505.4
Total	6,415.4	29,446.7	35,862.1

March, 1982

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U. S. DEPARTMENT OF ENERGY
BASELINE

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Phase I

1. Contract Identification
Demonstration of the Solvent Refined Coal Process

2. Contract Number
DE-AC05-78OR03054

3. Contractor (name, address)
International Coal Refining Company
P. O. Box 2752
Allentown, PA 18001

OVERALL SUMMARY - MANPOWER

4. Contract Start Date
10 July 1978

5. Contract Completion Date

6. Identification Number	7. Reporting Category (e.g., contract line item or work breakdown structure element)			10. Planned Current Fiscal Year FY82																
		FY80	FY81	O	N	D	J	F	M	A	M	J	J	A	S	Total FY82	FY83	FY84	FY85	Total
1.2.1	SRC	130.7	204.5	12.2	12.1	13.9	14.8	16.0	16.7	18.5	19.2	20.6	22.8	23.7	25.7	216.2	257.4	234.3	16.9	1060.0
1.2.2	Coke & Liquid Products	36.3	82.9	8.5	7.5	8.1	7.0	7.1	8.7	9.5	11.0	17.6	18.8	20.9	24.6	149.3	165.3	89.6	-	523.4
1.3.1	Cryogenics	13.0	26.5	2.1	2.2	3.5	2.3	2.3	2.4	2.9	3.4	3.4	3.6	4.2	3.9	36.2	95.5	64.4	-	235.6
1.3.2	Gas Systems	60.6	139.3	16.8	23.7	33.7	40.7	45.2	46.2	47.8	48.3	47.8	48.6	50.5	50.5	500.4	306.6	107.2	.8	1114.9
1.4.1	Utilities & Offsites *	143.5	148.6	15.0	22.7	32.0	30.4	33.1	39.0	41.4	43.4	42.1	39.3	39.6	40.2	418.2	525.2	129.0	-	1364.5
1.4.2	Central Control System	-	15.1	1.1	.4	.4	.5	.5	.7	.8	.8	.8	1.0	1.1	1.2	9.3	14.5	6.0	-	44.9
1.5.1	Project Management	102.9	119.2	17.3	12.5	15.8	13.2	14.2	14.7	17.4	20.4	21.2	28.1	26.1	25.6	226.5	535.1	126.2	-	1109.9
1.5.2	Administration & Planning	92.5	125.6	15.1	10.7	13.9	11.3	11.8	12.5	14.3	11.4	12.1	13.9	12.2	11.4	150.6	130.1	61.2	1.6	561.6
1.5.3	Technical Support	11.3	71.7	4.9	3.4	4.6	3.8	4.0	4.0	4.6	3.7	3.9	4.7	4.0	3.9	49.5	28.7	12.0	-	173.2
1.5.4	Product Utilization	24.7	23.5	1.6	1.2	1.7	1.4	1.6	1.5	1.7	1.3	1.4	1.7	1.5	1.4	18.0	18.8	18.8	2.2	106.0
1.5.5	E.P.L.A. Support	34.4	38.0	1.9	1.5	1.8	1.4	1.5	1.5	1.7	1.5	1.5	1.8	1.6	1.5	19.2	17.6	12.2	-	121.4
	Total	649.9	994.9	96.5	97.9	129.4	126.8	137.3	147.9	160.6	165.0	172.4	184.3	185.4	189.9	1793.4	2094.8	860.9	21.5	6415.4

15. Remarks * Includes total manhours for Rust Engineering Services. See supplemental plan for detail by WBS.

Manhours Expressed in Thousands

17. Cost Plan Date
March, 1982

18. Signature of Contractor's Project Manager and Date

19. Signature of Contractor's Authorized Financial Representative and Date

20. Signature of Government Technical Representative and Date

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U. S. DEPARTMENT OF ENERGY
BASELINE

Phase I

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1 Contract Identification
Demonstration of the Solvent Refined Coal Process

2. Contract Number
DE-AC05-78OR03054

3 Contractor (name, address)
International Coal Refining Company
P. O. Box 2752
Allentown, PA 18001

SRC AREA MANPOWER

4. Contract Start Date
10 July 1978

5 Contract Completion Date

6 Identification Number	7. Reporting Category (e.g., contract line item or work breakdown structure element)			10 Planned Current Fiscal Year FY82																
		FY80	FY81	O	N	D	J	F	M	A	M	J	J	A	S	Total FY82	FY83	FY84	FY85	Total
1.2.1.1	Area Engineering Integration	10.2	34.4	.6	.9	1.1	1.5	1.6	1.4	1.7	1.9	2.0	2.1	2.2	2.5	19.5	41.6	63.2	4.5	173.4
1.2.1.2	Slurry Preparation & Pumping	3.6	9.1	.1	.1	.2	.2	.4	.5	.6	.8	1.1	1.6	2.1	2.6	10.3	21.4	20.5	3.8	68.7
1.2.1.3	Slurry Heater	.9	2.5	.2	.2	.3	.5	.6	.8	.9	.9	1.1	1.3	1.5	1.8	10.1	15.1	11.2	.4	40.2
1.2.1.4	H_2 Recovery & Dissolver	3.2	7.1	.2	.3	.4	.5	.6	.9	1.6	1.8	2.1	2.4	2.1	2.1	15.0	19.1	13.1	-	57.5
1.2.1.5	Solvent Recovery	1.7	5.2	.6	.6	.7	.7	.8	.8	1.0	1.0	1.2	1.3	1.5	1.8	12.0	13.0	11.4	2.7	46.0
1.2.1.6	Vacuum Column	1.0	3.3	.4	.4	.4	.4	.5	.5	.5	.5	.5	.6	.6	.7	6.0	13.5	12.2	-	36.0
1.2.1.7	Critical Solvent Deashing	3.2	7.9	.7	.8	.8	1.0	1.1	1.2	1.4	1.5	1.4	1.7	1.7	2.0	15.3	41.0	18.0	-	85.4
1.2.1.8	Solidification	.9	4.2	.3	.3	.3	.5	.7	.7	.7	.8	.5	.5	.7	.7	6.7	10.9	14.0	-	36.7
1.2.1.9	Engineering Tech. Support																			
	Catalytic	12.8	12.7	.6	.6	.8	.8	1.0	1.0	1.2	1.2	1.3	1.3	1.3	1.3	12.4	11.8	1.3	-	51.0
	ICRC	57.3	53.5	2.6	2.4	2.6	2.7	2.7	2.7	2.6	2.5	2.5	2.6	2.5	2.5	30.9	-	-	-	141.7
	Subtotal 1.2.1.9	70.1	66.2	3.2	3.0	3.4	3.5	3.7	3.7	3.8	3.7	3.8	3.9	3.8	3.8	43.3	11.8	1.3	-	192.7
1.2.1.0	Area Management																			
	Catalytic	22.0	48.0	4.0	4.1	4.4	4.4	4.4	4.5	4.5	4.5	4.7	5.0	5.4	5.6	55.5	57.1	64.7	5.5	252.8
	SWEC	-	-	-	-	-	-	-	-	-	.2	.5	.5	.5	.5	2.2	6.7	.2	-	9.1
	ICRC	13.9	16.6	1.9	1.4	1.9	1.6	1.6	1.7	1.8	1.6	1.7	1.9	1.6	1.6	20.3	6.2	4.5	-	61.5
	Subtotal 1.2.1.0	35.9	64.6	5.9	5.5	6.3	6.0	6.0	6.2	6.3	6.3	6.9	7.4	7.5	7.7	78.0	70.0	69.4	5.5	323.4
	Total Manhours 1.2.1	130.7	204.5	12.2	12.1	13.9	14.8	16.0	16.7	18.5	19.2	20.6	22.8	23.7	25.7	216.2	257.4	234.2	16.9	1060.0

15. Remarks Rust Engineering Service manhours applicable to SRC Area detailed on supplemental manpower plan.

Manhours Expressed in Thousands

17 Cost Plan Date
March, 1982

18. Signature of Contractor's Project Manager and Date

19. Signature of Contractor's Authorized Financial Representative and Date

20. Signature of Government Technical Representative and Date

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(1-78)

U. S. DEPARTMENT OF ENERGY
BASELINE

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Phase I

1. Contract Identification
Demonstration of the Solvent Refined Coal Process

2. Contract Number
DE-AC05-78OR03054

3. Contractor (name, address)
International Coal Refining Company
P. O. Box 2752
Allentown, PA 18001

COKE & LIQUID PRODUCTS MANPOWER

4. Contract Start Date
10 July 1978

5. Contract Completion Date

6. Identification Number	7. Reporting Category (e.g., contract line item or work breakdown structure element)	FY80	FY81	10. Planned Current Fiscal Year FY82 O	N	D	J	F	M	A	M	J	J	A	S	Total FY82	FY83	FY84	FY85	Total
1.2.2.1	Coker/Calciner	9.9	25.2	1.7	1.3	1.3	1.2	1.2	1.7	2.5	3.3	6.0	7.0	7.8	10.6	45.6	51.9	6.9	-	139.5
1.2.2.2	EBH	6.6	14.0	2.0	1.9	1.8	1.3	1.4	1.9	2.0	2.8	4.7	4.4	4.8	5.5	34.5	55.3	44.3	-	154.7
1.2.2.3	Area Management																			
	Lummus	15.5	26.6	2.3	2.0	2.5	2.0	2.0	2.6	2.4	2.5	4.1	4.6	5.4	5.7	38.1	47.9	32.6	-	160.7
	SWEC	-	-	-	-	-	-	-	-	-	-	.3	.3	.4	.4	1.4	4.1	1.4	-	6.9
	ICRC	4.3	12.3	1.5	1.3	1.5	1.4	1.4	1.4	1.5	1.3	1.4	1.4	1.4	1.3	16.8	6.1	4.4	-	43.9
	Total 1.2.2.3	19.8	38.9	3.8	3.3	4.0	3.4	3.4	4.0	3.9	3.8	5.8	6.3	7.2	7.4	56.3	58.1	38.4	-	211.5
1.2.2.4	Engineering Tech. Support	-	4.8	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	12.9	-	-	-	17.7
	Total Manhours 1.2.2	36.3	82.9	8.5	7.5	8.1	7.0	7.1	8.7	9.5	11.0	17.6	18.8	20.9	24.6	149.3	165.3	89.6	-	523.4

15. Remarks

Manhours Expressed in Thousands

17. Cost Plan Date
March, 1982

18. Signature of Contractor's Project Manager and Date

19. Signature of Contractor's Authorized Financial Representative and Date

20. Signature of Government Technical Representative and Date

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U. S. DEPARTMENT OF ENERGY
BASELINE

Phase I

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1. Contract Identification
Demonstration of the Solvent Refined Coal Process

2. Contract Number
DE-AC05-78OR03054

3. Contractor (name, address)
International Coal Refining Company
P. O. Pox 2752
Allentown, PA 18001

CRYOGENICS MANPOWER

4. Contract Start Date
10 July 1978

5. Contract Completion Date

6. Identification Number	7. Reporting Category (e.g., contract line item or work breakdown structure element)			10. Planned Current Fiscal Year FY82																
		FY80	FY81	O	N	D	J	F	M	A	M	J	J	A	S	Total FY82	FY83	FY84	FY85	Total
1.3.1.1	Air Separation Unit	1.0	1.4	-	.1	1.3	.1	.1	.1	.2	.4	.2	.2	1.1	.6	4.4	54.4	36.4	-	97.6
1.3.1.3	Area Management																			
	APCI	8.9	20.8	1.3	1.4	1.5	1.5	1.5	1.6	1.8	2.2	2.4	2.5	2.3	2.5	22.5	38.3	26.0	-	116.5
	SWEC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	ICRC	3.1	4.3	.8	.7	.7	.7	.7	.7	.9	.8	.8	.9	.8	.8	9.3	2.8	2.0	-	21.5
	Subtotal 1.3.1.3	12.0	25.1	2.1	2.1	2.2	2.2	2.2	2.3	2.7	3.0	3.2	3.4	3.1	3.3	31.8	41.1	28.0	-	138.0
	Total Manhours 1.3.1	13.0	26.5	2.1	2.2	3.5	2.3	2.3	2.4	2.9	3.4	3.4	3.6	4.2	3.9	36.2	95.5	64.4	-	235.6

15. Remarks

Manhours Expressed in Thousands

17. Cost Plan Date
March, 1982

18. Signature of Contractor's Project Manager and Date

19. Signature of Contractor's Authorized Financial Representative and Date

20. Signature of Government Technical Representative and Date

DOE Form CR 533P
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U. S. DEPARTMENT OF ENERGY
BASELINE

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Phase I

1. Contract Identification
Demonstration of the Solvent Refined Coal Process

2. Contract Number
DE-AC05-78OR03054

3. Contractor (name, address)
International Coal Refining Company
P. O. Box 2752
Allentown, PA 18001

GAS SYSTEMS MANPOWER

4. Contract Start Date
10 July 1978

5. Contract Completion Date

6. Identification Number	7. Reporting Category (e.g., contract line item or work breakdown structure element)			10. Planned Current Fiscal Year FY82																
		FY80	FY81	O	N	D	J	F	M	A	M	J	J	A	S	Total FY82	FY83	FY84	FY85	Total
1.3.2.1	Gasification	1.9	29.7	4.2	6.2	3.7	11.4	12.6	12.7	13.2	13.4	12.4	13.0	13.0	13.2	134.0	82.9	28.4	-	276.9
1.3.2.2	Gas Treating																			
	Parsons	1.2	30.7	3.6	5.4	7.2	9.5	10.6	11.1	11.4	11.8	11.4	11.3	11.3	11.2	115.8	62.5	20.7	-	230.9
	HPU-APCI	.9	2.2	.4	.3	2.0	.5	.1	.1	.1	.3	.7	1.0	2.9	3.2	11.6	35.2	8.1	-	58.0
	Subtotal 1.3.2.2	2.1	32.9	4.0	5.7	9.2	10.0	10.7	11.2	11.5	12.1	12.1	12.3	14.2	14.4	127.4	97.7	28.8	-	288.9
1.3.2.4	Sulfur Recovery	.2	4.7	1.2	1.9	2.7	3.4	3.9	3.9	4.1	4.1	4.1	4.0	4.0	4.0	41.3	22.2	7.4	-	75.8
1.3.2.5	Area Management																			
	Parsons	43.6	50.7	5.2	7.9	10.9	13.9	15.9	16.3	16.8	17.3	16.8	16.7	16.7	16.4	170.8	90.5	36.9	.8	393.3
	SWEC	-	-	-	-	-	-	-	-	-	-	.3	.3	.4	.4	1.4	5.2	.5	-	7.1
	ICRC	12.8	21.3	2.2	2.0	2.2	2.0	2.1	2.1	2.2	2.0	2.1	2.3	2.2	2.1	25.5	8.1	5.2	-	72.9
	Subtotal 1.3.2.5	56.4	72.0	7.4	9.9	13.1	15.9	18.0	18.4	19.0	19.3	19.2	19.3	19.3	18.9	197.7	103.8	42.6	.8	473.3
	Total Manhours 1.3.2	60.6	139.3	16.8	23.7	33.7	40.7	45.2	46.2	47.8	48.9	47.8	48.6	50.5	50.5	500.4	306.6	107.2	.8	1114.9

15. Remarks Rust Engineering Service manhours applicable to Gas Systems Area detailed on supplemental manpower plan.

Manhours Expressed
in Thousands

17. Cost Plan Date
March, 1982

18. Signature of Contractor's Project Manager and Date

19. Signature of Contractor's Authorized Financial Representative and Date

20. Signature of Government Technical Representative and Date

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U. S. DEPARTMENT OF ENERGY
BASELINE

Phase I

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1. Contract Identification
Demonstration of the Solvent Refined Coal Process

2. Contract Number
DE-AC05-780R03054

3. Contractor (name, address)
International Coal Refining Company
P. O. Box 2752
Allentown, PA 18001

UTILITIES & OFFSITES MANPOWER

4. Contract Start Date
10 July 1978

5. Contract Completion Date

6. Identification Number	7. Reporting Category (e.g., contract line item or work breakdown structure element)			10. Planned Current Fiscal Year FY82																
		FY80	FY81	O	N	D	J	F	M	A	M	J	J	A	S	Total FY82	FY83	FY84	F^Y85	Total
1.4.1.1	Utility Services	1.1	6.2	1.0	3.0	4.3	2.0	2.8	4.6	6.2	7.1	8.7	8.0	8.0	8.6	64.3	104.2	32.5	-	208.3
1.4.1.2	Offsites	10.2	16.4	3.5	4.9	6.7	7.4	9.6	11.3	11.3	13.1	12.1	9.8	10.1	7.5	107.3	96.3	8.0	-	238.2
1.4.1.3	Raw Material, Product Handling & Storage	.2	5.3	.4	4.6	5.7	7.1	6.3	8.2	7.1	8.0	5.8	5.8	6.0	8.5	73.5	108.6	1.8	-	189.4
1.4.1.4	Area Management																			
	Rust	23.7	36.6	5.7	6.7	10.9	9.8	10.1	10.9	12.2	11.2	10.3	10.2	10.6	10.4	119.0	129.7	51.2	-	360.2
	SWEC	-	-	-	-	-	-	-	-	-	-	.3	.3	.4	.4	1.4	7.3	2.6	-	11.3
	ICRC	16.2	13.9	1.8	1.3	1.7	1.8	1.7	1.9	2.3	1.9	2.0	2.3	2.0	1.9	22.6	8.9	6.2	-	67.8
	Subtotal 1.4.1.4	39.9	50.5	7.5	8.0	12.6	11.6	11.8	12.8	14.5	13.1	12.6	12.8	13.0	12.7	143.0	145.9	60.0	-	439.3
1.4.1.5	Engineering Tech. Support																			
	Rust	17.1	10.7	.6	.8	1.2	1.2	1.2	.7	.9	1.2	1.5	1.5	1.5	1.9	14.2	24.9	15.3	-	82.2
	ICRC	13.5	26.2	.4	.3	.4	.3	.4	.4	.4	.3	.4	.4	.4	.4	4.5	-	-	-	44.2
	Subtotal 1.4.1.5	30.6	36.9	1.0	1.1	1.6	1.5	1.6	1.1	1.3	1.5	1.9	1.9	1.9	2.3	18.7	24.9	15.3	-	126.4
	Engineering Services *	61.5	33.3	1.6	1.1	1.1	.8	1.0	1.0	1.0	.6	1.0	1.0	.6	.6	11.4	45.3	11.4	-	162.9
	Total Manhours 1.4.1	143.5	148.6	15.0	22.7	32.0	30.4	33.1	39.0	41.4	43.4	42.1	39.3	39.6	40.2	418.2	525.2	129.0	-	1364.5

15. Remarks * Rust Engineering Service manhours applicable to Utilities & Offsites Area detailed on following manpower plan. Manhours above are total Engineering Service. Applicable WBS Elements are detailed on following schedule.

Manhours Expressed in Thousands

17. Cost Plan Date
March, 1982

18. Signature of Contractor's Project Manager and Date

19. Signature of Contractor's Authorized Financial Representative and Date

20. Signature of Government Technical Representative and Date

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U. S. DEPARTMENT OF ENERGY
BASELINE
MANPOWER PLAN - WBS ELEMENTS

Phase I

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1. Contract Identification
Demonstration of the Solvent Refined Coal Process

2. Contract Number
DE-AC05-780R03054

3. Contractor (name, address)
International Coal Refining Company
P. O. Box 2752
Allentown, PA 18001

RUST ENGINEERING SERVICES

4. Contract Start Date
10 July 1978

5. Contract Completion Date

6. Identification Number	7. Reporting Category (e.g., contract line item or work breakdown structure element)			10. Planned Current Fiscal Year FY82																
		FY80	FY81	O	N	D	J	F	M	A	M	J	J	A	S	Total FY82	FY83	FY84	FY85	Total
1.2.1.0	Area Management	-	1.4	.2	.1	.2	.1	.2	.2	.2	.1	.2	.2	.1	.1	1.9	3.4	1.0	-	7.7
1.3.2.5	Gas Systems Area Management	-	1.4	.2	.1	.2	.1	.2	.2	.2	.1	.2	.2	.1	.1	1.9	3.4	1.0	-	7.7
1.4.1.4	Utilities & Offsites Area Management	-	.4	.2	.1	.2	.1	.2	.2	.2	.1	.2	.2	.1	.1	1.9	3.5	1.1	-	6.9
1.5.1	Project Management & Support	61.5	30.1	1.0	.8	.5	.5	.4	.4	.4	.3	.4	.4	.3	.3	5.7	35.0	8.3	-	140.6
	Total Manhours	61.5	33.3	1.6	1.1	1.1	.8	1.0	1.0	1.0	.6	1.0	1.0	.6	.6	11.4	45.3	11.4	-	162.9

15. Remarks NOTE: These manhours are not reflected in the WBS Elements presented for Phase I but are included in the total for 1.4.1

Manhours Expressed in Thousands

17. Cost Plan Date
March, 1982

18. Signature of Contractor's Project Manager and Date

19. Signature of Contractor's Authorized Financial Representative and Date

20. Signature of Government Technical Representative and Date

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1. Contract Identification
Demonstration of the Solvemt Refined Coal Process

2. Contract Number
DE-AC05-78OR03054

3. Contractor (name, address)
International Coal Refining Company
P. O. Box 2752
Allentown, PA 18001

CENTRAL CONTROL MANPOWER

4. Contract Start Date
10 July 1978

5. Contract Completion Date

6. Identification Number	7. Reporting Category (e.g., contract line item or work breakdown structure element)			10. Planned Current Fiscal Year FY82																
		FY80	FY81	O	N	D	J	F	M	A	M	J	J	A	S	Total FY82	FY83	FY84	FY85	Total
1.4.2.1	Central Control System	-	4.1	.3	-	-	-	-	.1	.2	.2	.2	.3	.3	.3	1.9	6.5	2.7	-	15.2
1.4.2.7	Area Management																			
	Johnson Control	-	5.8	.4	.3	.2	.3	.3	.3	.3	.3	.3	.3	.3	.4	3.7	4.0	2.4	-	15.9
	SWEC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	ICRC	-	3.7	.2	.1	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	2.3	-	-	-	6.0
	Subtotal 1.4.2.7	-	9.5	.6	.4	.4	.5	.5	.5	.5	.5	.5	.5	.5	.6	6.0	4.0	2.4	-	21.9
1.4.2.8	Engineering Tech. Support	-	1.5	.2	-	-	-	-	.1	.1	.1	.1	.2	.3	.3	1.4	4.0	.9	-	7.8
	Total Manhours 1.4.2	-	15.1	1.1	.4	.4	.5	.5	.7	.8	.8	.8	1.0	1.1	1.2	9.3	14.5	6.0	-	44.9

15. Remarks

Manhours Expressed in Thousands

17. Cost Plan Date
March, 1982

18. Signature of Contractor's Project Manager and Date

19. Signature of Contractor's Authorized Financial Representative and Date

20. Signature of Government Technical Representative and Date

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1. Contract Identification
Demonstration of the Solvent Refined Coal Process

2. Contract Number
DE-AC05-78OR03054

3. Contractor (name, address)
International Coal Refining Company
P. O. Box 2752
Allentown, PA 18001

PROJECT MANAGEMENT MANPOWER

4. Contract Start Date
10 July 1978

5. Contract Completion Date

6. Identification Number	7. Reporting Category (e.g., contract line item or work breakdown structure element)			10 Planned Current Fiscal Year FY82																
		FY80	FY81	O	N	D	J	F	M	A	M	J	J	A	S	Total FY82	FY83	FY84	FY85	Total
1.5.1	Project Management *																			
	SWEC	-	-	-	-	-	-	-	-	-	6.4	6.4	11.1	11.1	11.1	46.1	294.0	-	-	340.1
	ICRC	102.9	119.2	17.3	12.5	15.8	13.2	14.2	14.7	17.4	14.0	14.8	17.0	15.0	14.5	180.4	241.1	126.2	-	769.8
	Subtotal 1.5.1	102.9	119.2	17.3	12.5	15.8	13.2	14.2	14.7	17.4	20.4	21.2	28.1	26.1	25.6	226.5	535.1	126.2	-	1109.9
1.5.2	Administration & Planning	92.5	125.6	15.1	10.7	13.9	11.3	11.8	12.5	14.3	11.4	12.1	13.9	12.2	11.4	150.6	130.1	61.2	1.6	561.6
1.5.3	Technical Support	11.3	71.7	4.9	3.4	4.6	3.8	4.0	4.0	4.6	3.7	3.9	4.7	4.0	3.9	49.5	28.7	12.0	-	173.2
1.5.4	Product Utilization	24.7	23.5	1.6	1.2	1.7	1.4	1.6	1.5	1.7	1.3	1.4	1.7	1.5	1.4	18.0	18.8	18.8	2.2	106.0
1.5.5	E.P.L.A. Support	34.4	38.0	1.9	1.5	1.8	1.4	1.5	1.5	1.7	1.5	1.5	1.8	1.6	1.5	19.2	17.6	12.2	-	121.4
	Total Manhours 1.5	265.8	378.0	40.8	29.3	37.8	31.1	33.1	34.2	39.7	38.3	40.1	50.2	45.4	43.8	463.8	730.3	230.4	3.8	2072.1

15. Remarks * Rust Engineering Service manhours applicable to Project Management are detailed on supplemental manpower plan.

Manhours Expressed in Thousands

17. Cost Plan Date
March, 1982

18. Signature of Contractor's Project Manager and Date

19. Signature of Contractor's Authorized Financial Representative and Date

20. Signature of Government Technical Representative and Date

U. S. DEPARTMENT OF ENERGY
BASELINE

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Phase II

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1 Contract Identification
Demonstration of the Solvent Refined Coal Process

2 Contract Number
DE-AC05-78OR03054

3 Contractor (name, address)
International Coal Refining Company
P. O. Box 2752
Allentown, PA 18001

SUMMARY-MANPOWER

4. Contract Start Date
10 July 1978

5. Contract Completion Date

6. Identification Number	7. Reporting Category (e.g., contract line item or work breakdown structure element)	8 Planned Prior Fiscal Years	9. Actual Prior Fiscal Years	FY83	FY84	FY85	FY86	FY87	FY88	TOTAL
1.1	Construction Service									
	Facilities & Equipment									
	Craft Labor			21.4	46.0	46.0	43.3	27.8	-	184.5
1.2.1	SRC									
	Catalytic-H.O. Engineering			23.5	28.2	20.4	17.3	-	-	89.4
	-Field Staff			-	14.6	17.5	15.6	-	-	47.7
	SWEC Supervisior			-	52.9	100.7	91.9	18.2	-	263.7
	Craft Labor			-	999.9	1618.9	1364.3	168.7	-	4151.8
	ICRC			1.1	1.9	-	-	-	-	3.0
	Subtotal 1.2.1			24.6	1097.5	1757.5	1489.1	186.9	-	4555.6
1.2.2	Coke & Liquid Products									
	Lummus-H.O. Engineering			19.8	25.8	20.1	14.3	5.6	-	85.6
	-Field Staff			-	1.0	5.4	15.7	11.8	-	33.9
	SWEC Supervision			-	2.1	43.6	49.8	11.4	-	106.9
	Craft Labor			-	32.3	467.1	711.9	153.5	-	1364.8
	ICRC			1.0	1.8	-	-	-	-	2.8
	Subtotal 1.2.2			20.8	63.0	536.2	791.7	182.3	-	1594.0
1.3.1	Cryogenics									
	APCI-H.O. Engineering			-	9.6	25.7	25.0	4.0	-	63.8
	-Field Staff			-	-	11.8	15.0	1.1	- -	27.9
	SWEC Supervision			-	-	14.5	22.8	7.3	-	44.6
	Craft Labor			-	36.0	287.5	126.5	14.7	-	464.7
	ICRC			.5	.8	-	-	-	-	1.3
	Subtotal 1.3.1			.5	46.4	339.0	189.3	27.1	-	602.3

15. Remarks

Manhours Expressed in Thousands

Plan Date:
March, 1982

18 Signature of Contractor's Project Manager and Date

19 Signature of Contractor's Authorized Financial Representative and Date

20 Signature of Government Technical Representative and Date

U. S. DEPARTMENT OF ENERGY
BASELINE

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Phase II

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1. Contract Identification Demonstration of the Solvent Refined Coal Process	2. Contract Number DE-AC05-78OR03054
3. Contractor (name, address) International Coal Refining Company P. O. Box 2752 Allentown, PA 18001	4. Contract Start Date 10 July 1978
SUMMARY-MANPOWER	5. Contract Completion Date

6. Identification Number	7. Reporting Category (e.g., contract line item or work breakdown structure element)	8. Planned Prior Fiscal Years	9. Actual Prior Fiscal Years	FY83	FY84	FY85	FY86	FY87	FY88	TOTAL
1.3.2	Gas Systems									
	Parsons-H.O. Engineering			26.4	69.6	80.8	63.4	31.5	-	271.7
	-Field Staff			8.8	10.4	11.5	9.8	5.6	-	46.1
	SWEC Supervision			-	22.3	105.9	110.0	45.2	-	283.4
	Craft Labor			1.9	343.4	2254.9	1372.4	106.4	-	4079.0
	ICRC			1.8	3.1	-	-	-	-	4.9
	Subtotal 1.3.2			38.9	448.8	2453.1	1555.6	188.7	-	4685.1
1.4.1	Utilities & Offsites									
	Rust-H.O. Engineering			25.4	50.0	49.5	26.2	-	-	151.1
	-Field Staff			7.6	16.8	18.5	7.2	-	-	50.1
	SWEC Supervision			16.6	117.3	155.7	115.2	35.8	-	441.6
	Craft Labor			352.2	3416.7	3475.9	1273.3	162.8	-	8680.9
	ICRC			1.8	3.0	-	-	-	-	4.8
	Subtotal 1.4.1			403.6	3603.8	3699.6	1421.9	199.6	-	9328.5
1.4.2	Central Control System									
	Johnson-H.O. Engineering			-	2.2	3.5	1.9	-	-	7.6
	-Field Staff			-	1.5	3.6	3.1	-	-	8.2
	SWEC Supervision			-	-	-	-	-	-	-
	Craft Labor			-	-	-	-	-	-	-
	ICRC			-	-	-	-	-	-	-
	Subtotal 1.4.2			-	3.7	7.1	5.0	-	-	15.8

15. Remarks	Manhours Expressed in Thousands	Plan Date: March, 1982

18. Signature of Contractor's Project Manager and Date	19. Signature of Contractor's Authorized Financial Representative and Date	20. Signature of Government Technical Representative and Date

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U. S. DEPARTMENT OF ENERGY
BASELINE

Phase II

PAGE OF

1. Contract Identification
Demonstration of the Solvent Refined Coal Process

2. Contract Number
DE-AC05-78OR03054

3. Contractor (name, address)
International Coal Refining Company
P. O. Box 2752
Allentown, PA 18001

SUMMARY-MANPOWER

4. Contract Start Date
10 July 1978

5. Contract Completion Date

6. Identification Number	7. Reporting Category (e.g., contract line item or work breakdown structure element)	8. Planned Prior Fiscal Years	9. Actual Prior Fiscal Years	FY83	FY84	FY85	FY86	FY87	FY88	TOTAL
1.5.1	Project Management									
	SWEC Supervision			69.5	1096.6	1531.1	1226.4	519.5	8.3	4451.4
	ICRC			56.6	187.9	271.4	279.0	268.9	49.9	1113.7
	Subtotal 1.5.1			126.1	1284.5	1802.5	1505.4	788.4	58.2	5565.1
1.5.2	Administration & Planning			42.6	125.3	191.5	192.7	194.9	42.5	789.5
1.5.3	Technical Support			33.1	36.5	55.8	60.0	65.9	16.5	267.8
1.5.4	Product Utilization			-	-	24.2	32.0	39.6	10.8	106.6
1.5.5	E.P.L.A. Support			5.8	8.1	17.4	19.8	22.6	5.6	79.3
1.6.2	Checkout & Commissioning			-	18.4	64.1	148.4	701.8	234.5	1167.2
1.6.4	Recruiting & Training			-	4.7	26.8	263.8	196.9	13.2	505.4
	Total Manhours			717.4	6786.7	11020.8	7718.0	2822.5	381.3	29446.7
Memo:	Craft			375.5	4874.3	8150.3	4891.7	633.9	-	18925.7
	Area Contractor: H.O.			95.1	185.4	199.5	148.1	41.1	-	669.2
	Field			16.4	44.3	68.3	66.4	18.5	-	213.9
	SWEC			86.1	1291.2	1951.5	1616.1	638.4	8.3	5591.6
	ICRC			144.3	391.5	651.2	995.7	1490.6	373.0	4046.3
	Total Manhours			717.4	6786.7	11020.8	7718.0	2822.5	381.3	29446.7

15. Remarks

Manhours Expressed in Thousands

?lan Date:
March, 1982

18. Signature of Contractor's Project Manager and Date

19. Signature of Contractor's Authorized Financial Representative and Date

20. Signature of Government Technical Representative and Date

U. S. DEPARTMENT OF ENERGY
BASELINE

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Phase II

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1. Contract Identification
Demonstration of the Solvent Refined Coal Process

2. Contract Number
DE-AC05-78OR03054

3. Contractor (name, address)
International Coal Refining Company
P. O. Box 2752
Allentown, PA 18001

CONSTRUCTION SERVICE FACILITIES & EQUIPMENT

4. Contract Start Date
10 July 1978

5. Contract Completion Date

6. Identification Number	7. Reporting Category (e.g., contract line item or work breakdown structure element)	8. Planned Prior Fiscal Years	9. Actual Prior Fiscal Years	FY83	FY84	FY85	FY86	FY87	FY88	TOTAL
1.1	Construction Service Facilities & Equipment									
	Craft Labor			21.4	45.0	46.0	43.3	27.8	-	184.5

15. Remarks

Manhours Expressed in Thousands

Plan Date:
March, 1982

18. Signature of Contractor's Project Manager and Date

19. Signature of Contractor's Authorized Financial Representative and Date

20. Signature of Government Technical Representative and Date

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BASELINE

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1. Contract Identification
Demonstration of the Solvent Refined Coal Process

2. Contract Number
DE-AC05-78OR03054

3. Contractor (name, address)
International Coal Refining Company
P. O. Box 2752
Allentown, PA 18001

SRC MANPOWER

4. Contract Start Date
10 July 1978

5. Contract Completion Date

6. Identification Number	7. Reporting Category (e.g., contract line item or work breakdown structure element)	8. Planned Prior Fiscal Years	9. Actual Prior Fiscal Years	FY83	FY84	FY85	FY86	FY87	FY88	TOTAL
1.2.1.1	Catalytic-H.O. Engineering			1.0	7.3	4.5	.5	-	-	13.3
	-Field Staff			-	5.5	8.4	6.5	-	-	20.4
	Subtotal 1.2.1.1			1.0	12.8	12.9	7.0	-	-	33.7
1.2.1.9	Catalytic-H.O. Engineering			-	-	.7	.8	-	-	1.5
	-Field Staff			-	-	-	-	-	-	-
	Subtotal 1.2.1.9			-	-	.7	.8	-	-	1.5
1.2.1.0	Catalytic-H.O. Engineering			22.5	20.9	15.2	16.0	-	-	74.6
	-Field Staff			-	9.1	9.1	9.1	-	-	27.3
	SWEC			-	52.9	100.7	91.9	18.2	-	263.7
	ICRC			1.1	1.9	-	-	-	-	3.0
	Subtotal 1.2.1.0			23.6	84.8	125.0	117.0	18.2	-	368.6
	Catalytic-H.O. Engineering			23.5	28.2	20.4	17.3	-	-	89.4
	-Field Staff			-	14.6	17.5	15.6	-	-	47.7
	SWEC Supervision			-	52.9	100.7	91.9	18.2	-	263.7
	Craft Labor			-	999.9	1618.9	1364.3	168.7	-	4151.8
	ICRC			1.1	1.9	-	-	-	-	3.0
	Total Manhours 1.2.1			24.6	1097.5	1757.5	1489.1	186.9	-	4555.6

15. Remarks

Manhours Expressed in Thousands

Plan Date:
March, 1982

18. Signature of Contractor's Project Manager and Date

19. Signature of Contractor's Authorized Financial Representative and Date

20. Signature of Government Technical Representative and Date

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BASELINE

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2. Contract Number
DE-AC05-78OR03054

3. Contractor (name, address)
International Coal Refining Company
P. O. Box 2752
Allentown, PA 18001

COKE & LIQUID PRODUCTS MANPOWER

4. Contract Start Date
10 July 1978

5. Contract Completion Date

6. Identification Number	7. Reporting Category (e.g., contract line item or work breakdown structure element)	8. Planned Prior Fiscal Years	9. Actual Prior Fiscal Years	FY83	FY84	FY85	FY86	FY87	FY88	TOTAL
1.2.2.1	Home Office Engineering			-	2.8	4.1	3.5	1.2	-	11.7
	Field Support			-	.5	2.0	5.3	5.7	-	13.6
	Subtotal			-	3.3	6.1	9.0	6.9	-	25.3
1.2.2.2	Home Office Engineering			-	.6	5.6	5.0	1.5	-	12.7
	Field Support			-	.5	3.4	10.3	6.1	-	20.3
	Subtotal			-	1.1	9.0	15.3	7.6	-	33.0
1.2.2.3	Home Office Engineering			19.8	22.4	10.4	5.7	2.9	-	61.2
	Field Support			-	-	-	-	-	-	-
	SWEC			-	2.1	43.6	49.8	11.4	-	106.9
	ICRC			1.0	1.8	-	-	-	-	2.8
	Subtotal			20.8	26.3	54.0	55.5	14.3	-	170.9
	Craft Labor			-	32.3	467.1	711.9	153.5	-	1364.8
	Total Manhours 1.2.2			20.8	53.0	536.2	791.7	182.3	-	1594.0

15. Remarks

Manhours Expressed
in Thousands

Plan Date:
March, 1982

18. Signature of Contractor's Project Manager and Date

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DE-AC05-78OR03054

3. Contractor (name, address)
International Coal Refining Company
P. O. Box 2752
Allentown, PA 18001

4. Contract Start Date
10 July 1978

5. Contract Completion Date

CRYOGENICS MANPOWER

6. Identification Number	7. Reporting Category (e.g., contract line item or work breakdown structure element)	8. Planned Prior Fiscal Years	9. Actual Prior Fiscal Years	FY83	FY84	FY85	FY86	FY87	FY88	TOTAL
1.3.1.1	ASU									
	APCI-H.O. Engineering			-	-	3.5	5.4	-	-	8.9
	-Field Support			-	-	8.7	13.3	-	-	22.0
	Subtotal 1.3.1.1			-	-	12.2	18.7	-	-	30.9
1.3.2.2	HPU *									
	APCI-H.O. Engineering			-	-	1.2	.7	.8	-	2.7
	-Field Support			-	-	3.1	1.7	1.1	-	5.9
	Subtotal 1.3.1.2			-	-	4.3	2.4	1.9	-	8.6
1.3.1.3	Area Management									
	APCI-H.O. Engineering			-	9.6	20.5	18.9	3.2	-	52.2
	-Field Support			-	-	-	-	-	-	-
	SWEC			-	-	14.5	22.8	7.3	-	44.6
	ICRC			.5	.8	-	-	-	-	1.3
	Subtotal 1.3.1.3			.5	10.4	35.0	41.7	10.5	-	98.1
	Craft Labor			-	36.0	287.5	126.5	14.7	-	464.7
	Total Manhours 1.3.1			.5	46.4	339.0	189.3	27.1	-	602.3

15. Remarks * HPU manhours shown here should be added to Gas Treating (1.3.2.2) WBS Element.

Manhours Expressed in Thousands

Plan Date:
March, 1982

18. Signature of Contractor's Project Manager and Date

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20. Signature of Government Technical Representative and Date

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2. Contract Number
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3. Contractor (name, address)
International Coal Refining Company
P. O. Box 2752
Allentown, PA 18001

GAS SYSTEMS

4. Contract Start Date
10 July 1978

5. Contract Completion Date

6. Identification Number	7. Reporting Category (e.g., contract line item or work breakdown structure element)	8. Planned Prior Fiscal Years	9. Actual Prior Fiscal Years	FY83	FY84	FY85	FY86	FY87	FY88	TOTAL
1.3.2.1	Gasification									
	Home Office Engineering			6.3	6.3	2.6	-	-	-	15.2
	Field Staff			3.2	4.0	4.5	3.7	1.8	-	17.2
	Subtotal 1.3.2.1			9.5	10.3	7.1	3.7	1.8	-	32.4
1.3.2.2	Gas Treating *									
	Home Office Engineering			5.6	5.6	2.3	-	-	-	13.5
	Field Staff			2.9	3.5	4.0	3.3	1.6	-	15.3
	Subtotal 1.3.2.2			8.5	9.1	6.3	3.3	1.6	-	28.8
1.3.2.4	Sulfur Recovery									
	Home Office Engineering			2.1	2.2	.9	-	-	-	5.2
	Field Staff			1.1	1.3	1.4	1.2	.6	-	5.6
	Subtotal 1.3.2.4			3.2	3.5	2.3	1.2	.6	-	10.8
1.3.2.5	Area Management									
	Home Office Engineering			12.4	55.5	75.0	63.4	31.5	-	237.8
	Field Staff			1.6	1.6	1.6	1.5	1.6	-	8.0
	SWEC			-	22.3	105.9	110.0	45.2	-	283.4
	ICRC			1.8	3.1	-	-	-	-	4.9
	Subtotal 1.3.2.5			15.8	82.5	182.5	175.0	78.3	-	534.1
	Craft Labor			1.9	343.4	2254.9	1372.4	106.4	-	4079.0
	Total Manhours 1.3.2			38.9	448.8	2453.1	1555.6	188.7	-	4685.1

15. Remarks * Does not include HPU manhours. See Cryogenic Systems for detail.

Manhours Expressed in Thousands

Plan Date:
March, 1982

18. Signature of Contractor's Project Manager and Date

19. Signature of Contractor's Authorized Financial Representative and Date

20. Signature of Government Technical Representative and Date

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3 Contractor (name, address)
International Coal Refining Company
P. O. Box 2752
Allentown, PA 18001

UTILITIES & OFFSITES MANPOWER

4 Contract Start Date
10 July 1978

5 Contract Completion Date

6 Identification Number	7. Reporting Category (e.g., contract line item or work breakdown structure element)	8 Planned Prior Fiscal Years	9 Actual Prior Fiscal Years	FY83	FY84	FY85	FY86	FY87	FY88	TOTAL
1.4.1.4	Area Management									
	Rust-H.O. Engineering			23.4	40.9	39.9	18.7	-	-	122.9
	-Field Support			1.0	2.4	2.7	1.3	-	-	7.4
	SWEC			16.6	117.3	155.7	115.2	36.8	-	441.6
	ICRC			1.8	3.0	-	-	-	-	4.8
	Subtotal 1.4.1.4			42.8	163.6	198.3	135.2	36.8	-	576.7
1.4.1.5	Engineering Tech. Support									
	Rust-H.O. Engineering			2.0	9.1	9.6	7.5	-	-	28.2
	-Field Support			6.6	14.4	15.8	5.9	-	-	42.7
	ICRC			-	-	-	-	-	-	-
	Subtotal 1.4.1.5			8.6	23.5	25.4	13.4	-	-	70.9
	Craft Labor			352.2	3416.7	3475.9	1273.3	162.8	-	8680.9
	Total Manhours 1.4.1			403.6	3603.8	3699.6	1421.9	199.6	-	9328.5

15. Remarks

Manhours Expressed in Thousands

Plan Date:
March, 1982

18 Signature of Contractor's Project Manager and Date

19 Signature of Contractor's Authorized Financial Representative and Date

20 Signature of Government Technical Representative and Date

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3. Contractor (name, address)
International Coal Refining Company
P. O. Box 2752
Allentown, PA 18001

CENTRAL CONTROL

4. Contract Start Date
10 July 1978

5. Contract Completion Date

6. Identification Number	7. Reporting Category (e.g., contract line item or work breakdown structure element)	8. Planned Prior Fiscal Years	9. Actual Prior Fiscal Years	FY83	FY84	FY85	FY86	FY87	FY88	TOTAL
1.4.2.1	Central Control System									
	Home Office Engineering			-	-	-	-	-	-	-
	Field Support			-	-	-	-	-	-	-
	Subtotal 1.4.2.1			-	-	-	-	-	-	-
1.4.2.8	Engineering Tech. Support									
	Home Office Engineering			-	2.2	3.5	1.9	-	-	7.6
	Field Support			-	1.5	3.6	3.1	-	-	8.2
	Subtotal 1.4.2.8			-	3.7	7.1	5.0	-	-	15.8
	Total Manhours 1.4.2			-	3.7	7.1	5.0	-	-	15.8

15. Remarks

Manhours Expressed in Thousands

Plan Date: March, 1982

18. Signature of Contractor's Project Manager and Date

19. Signature of Contractor's Authorized Financial Representative and Date

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3. Contractor (name, address)
International Coal Refining Company
P. O. Box 2752
Allentown, PA 18001

PROJECT MANAGEMENT & SUPPORT

4. Contract Start Date
10 July 1978

5. Contract Completion Date

6. Identification Number	7. Reporting Category (e.g., contract line item or work breakdown structure element)	8. Planned Prior Fiscal Years	9. Actual Prior Fiscal Years	FY83	FY84	FY85	FY86	FY87	FY88	TOTAL
1.5.1	Project Management									
	SWEC			69.5	1096.6	1531.1	1226.4	519.5	8.3	4451.4
	ICRC			56.6	187.9	271.4	279.0	268.9	49.9	1113.7
	Subtotal 1.5.1			126.1	1284.5	1802.5	1505.4	788.4	58.2	5565.1
1.5.2	Administration & Planning			42.6	125.3	191.5	192.7	194.9	42.5	789.5
1.5.3	Technical Support			33.1	36.5	55.8	60.0	65.9	16.5	267.8
1.5.4	Product Utilization			-	-	24.2	32.0	39.6	10.8	106.6
1.5.5	E.P.L.A. Support			5.8	8.1	17.4	19.8	22.6	5.6	79.3
	Total Manhours 1.5			207.6	1454.4	2091.4	1809.9	1111.4	133.6	6808.3
1.6.2	Checkout & Commissioning			-	18.4	64.1	148.4	701.8	234.5	1167.2
1.6.4	Recruiting & Training			-	4.7	26.8	263.8	196.9	13.2	505.4
	Total Manhours 1.6			-	23.1	9.9	412.2	898.7	247.7	1672.6

15. Remarks

Manhours Expressed in Thousands

Plan Date:
March, 1982

18. Signature of Contractor's Project Manager and Date

19. Signature of Contractor's Authorized Financial Representative and Date

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7.0 CRITICAL TECHNOLOGY PLAN

The Critical Technology Plan defines Critical Technology, establishes criteria and priorities for identifying items of Critical Technology, and establishes procedures for identifying, reviewing, and reporting items of Critical Technology as well as for determining the action to be taken.

Critical Technology imposes significant technical risk to the success of the Demonstration Plant, if the risk could prevent achieving major objectives without modifying process or equipment outside the overall battery budgetary or scheduling requirements. Examples of failure to meet major objectives are an unacceptable plant capacity factor, unacceptable product quality or quantity, unreasonable hazards to plant personnel, and unacceptable performance with respect to environmental conditions.

The Critical Technology Plan is the formal ICRC document Master Project Procedure MPP 11-4, Revision 0, dated 24 August 1981. It was forwarded to DOE on 15 September 1981. There were no changes to the plan during the Post-Baseline period.

8.0 PRODUCT DEMONSTRATION PLAN

The Product Demonstration Plan describes the activities required to ensure that SRC-I technology is successfully commercialized and to support DOE objectives for the SRC-I Project. Coal-derived SRC-I products and their derivatives will be marketed as substitutes for petroleum-derived products. Priority will be given to the placement of SRC-I products in large-energy-demand, higher value, end-use market applications to demonstrate their technical feasibility, economic viability, and environmental acceptability.

The SRC-I solid and liquid products can be used in most energy sectors of the economy. The product characteristics make their use viable in the transportation, industrial, and utility sectors of the economy. By the year 2000, the available markets for solid and liquid products will be large and diverse.

Revision 1 of the Products Demonstration Plan was forwarded to DOE on 31 March 1982. No changes were made to the plan during the Post-Baseline period.

9.0 MASTER PROJECT PROCEDURES

The objective of the Master Project Procedures (MPPs) is to establish a uniform set of policies and management control criteria, procedures, and guidelines dealing with all project-related matters for all participants in the SRC-I Project, ICRC, Area Contractors, and the CM/C.

The Area Contractors will use the procedures to supplement their in-house procedures, so that control criteria, data, reports, and documents for ICRC follow a uniform philosophy and format. It is not intended that these Procedures replace those already in use by the various Area Contractors, nor is it intended for these Procedures to substitute or replace the Statement of Work or other contractual documents.

The Master Project Procedures are contained in one volume, which was forwarded to DOE on 10 June 1981. Additions and revisions are issued as they become available; none were issued during the Post-Baseline period.

10.0 ENVIRONMENTAL, PERMITS, AND LAND ACQUISITION (EPLA)

a. PERMIT PLAN

The Permit Plan presents a schedule for acquiring a comprehensive list of local, state, and federal permits and approvals which have been confirmed as required for some phase of the construction or operation of the Demonstration Plant.

Revision 2 of this plan was submitted to the DOE on 17 March 1982.

No additional changes to the plan are contemplated until a new Project Schedule is developed.

b. STATUS OF REZONING OF SITE

Rezoning activity will begin when the site in Newman, Daviess County, Kentucky, is determined to be acceptable upon completion of the NEPA process, and when all 28 parcels of land comprising the site are under the control of ICRC, the State of Kentucky, or the United States.

Of the entire tract, over 99% is zoned A-R, Agricultural-Rural; the remainder is zoned R-1A, Single-family Residential. The process for rezoning the tract to an I-2 classification, Heavy Industry, and for securing appropriate conditional use permits for the SRC-I facility has been extensively reviewed with appropriate officials and local counsel, who are skilled and experienced in local zoning and land development practices. The entire process is expected to require approximately six months, once the decision has been made to proceed with constructing the SRC-I facility at the Daviess County, Kentucky site.

c. ONGOING PROJECT-RELATED ENVIRONMENTAL ACTIVITIES

Inventory of Environmental Programs

The report entitled Inventory of SRC-I Environmental Programs enumerates the environmental programs that ICRC had initiated, or proposed to initiate, to support the SRC-I Demonstration Project. The programs were divided into three groups: prior programs (programs which had been completed), current programs (programs which were on-going), and proposed programs (programs which had not yet begun).

Each group of programs was also subdivided into functional areas such as construction, design, EIS-related, licensing, marketing, monitoring, industrial hygiene toxicology, and research and development programs.

Information was included for each program's scope, approximate cost, schedule, and associated work element number. This listing includes programs that were projected through Phase II. Construction was assumed to occur from April 1983 until December 1987.

The second revision of this report was forwarded to the DOE for approval on 16 February 1982. No update of the report has occurred nor is any now planned.

FEIS Environmental Commitments

This document summarizes the environmental commitments which were made in the Final Environmental Impact Statement (FEIS). It does not present a detailed listing of the exact wording nor restate all the elements of the process design presented in the FEIS.

It is implied that the environmental impacts shown in the FEIS are based upon the design presented in detail in Appendix C. If the design were changed significantly, it may change the predicted impact. Such a design change must be analyzed to determine the significance of the resulting change, if any, in the environmental impact

As a general rule, the design presented in Appendix C will be fixed in the Design Baseline. Thereafter, any changes in the design will require an Engineering Change Proposal (ECP). ICRC proposes that an environmental analysis be included in any ECP. DOE can then review this analysis to determine whether the impact is significant. This procedure, combined with the Design Baseline itself, would then be a means of ensuring that the implied commitment to the design is appropriately observed.

This analysis contains the commitments classified according to their general nature and followed by a cross-reference to the FEIS.

After each commitment is a comment on how that commitment is being covered. Most commitments are covered by an ICRC program element. However, in many cases, no ICRC program element exists because these commitments have been appropriately referred to DOE. A few commitments with exceptions are also discussed briefly.

This report was forwarded to the DOE for comments and approval on 15 February 1982. No changes have occurred since that date.

11.0 HAZARDS IDENTIFICATION SUMMARY REPORT

The Hazards Identification Summary Report was prepared to update the Phase 0 Preliminary Hazards Analysis Reports for each process area of the Demonstration Plant. The update reviews identified major hazards of operating equipment for each plant area, which could lead to hazardous exposures to plant personnel or the general public. The reviews considered were safety from toxic materials, fires, explosions and high pressures. The most significant hazards, i.e., those with the greatest consequence upon occurrence, have been qualitatively identified for each process area. Methods to eliminate or control the potential hazards were also developed.

This report was forwarded to the DOE for comments on 25 January 1982. No changes to the report were made during the Post-Baseline period.

12.0 CONSTRUCTION STRATEGY

The construction of the facility will be accomplished through the services of a Construction Manager/Constructor (CM/C), selected early in Phase I. The CM/C will prepare a detailed Construction Management Plan during the remainder of Phase I, describing the manner in which responsibilities will be discharged during Phase II of the Project.

For the Project Baseline, ICRC decided to use a construction strategy based on accomplishing the necessary work on a "least cost basis." With this approach, the method of execution for each of the construction packages will be determined as the design work is completed. The choice between Lump Sum, Unit Price, and direct hire (force account) will be made by taking into account cost and schedule impacts (risk/benefit) as the project develops. In this manner, maximum flexibility will be maintained to optimize schedule and cost benefits of each method of contracting. Lump sum contracts are the preferred method of contracting, although many factors must be considered at the time of contractor selection. The present construction strategy defines 82 separate design construction packages. This subdivision of the work is based on the capability to combine logical skills and techniques in construction within the framework of current engineering schedules. As detailed engineering and equipment procurement progress, the size, number, and content of the packages will be adjusted to suit the needs of the project.

The Construction Management Plan will develop the strategies further, as well as address at least the following items:

A. Maximum use shall be made of fixed-price contracts. Force account (direct hire) work shall be acceptable if it is cost/schedule justified and meets the project objectives.

B. The Plan shall consider the available construction contractors throughout the country, their individual sizes, capabilities, and work loads.

C. Minority and small businesses shall be considered in establishing package sizes.

D. The Plan shall define the work scope in the packages consistent with the strongest area of work matching the anticipated bidders.

E. The Plan shall define in detail the procurement responsibility of the CM/C and interface management with area-contractor-selected suppliers.

F. The Plan shall identify all facilities and services being provided by the CM/C.

The Construction Management Plan will also define the administrative and technical policies and procedures used to guide the construction of the Demonstration Plant, such as cost and schedule progress measurement and reporting, vehicles and equipment rental and usage, and materials management. The construction management procedures have been tested and incorporate proven experience from a variety of power, industrial, and petrochemical projects.

The services provided by the Project Management staff will consist of the following:

a. Planning, Cost, and Estimating Control
b. Procurement and Contract Administration
c. Expediting
d. Engineering and Design
e. Construction Surveying
f. Contractor and Craft Orientation and Training
g. Construction Inspection Control
h. Material Handling, Control, and Warehousing
i. Timekeeping and Accounting
j. Safety and Security
k. Labor Relations
l. Computer Services
m. Document Control and Reproduction
n. Preparation and Review of Construction Management Procedures

In addition, the site will be divided into four area offices, each concerned with a specific part of the process systems under construction. Each area office will be staffed by the CM/C, specialists from the engineering contractors, equipment suppliers, ICRC, and DOE support contractors. In this manner, the technical decisions and the cost/schedule considerations will be made in the most expeditious way.

The CM/C will furnish the basic utility systems and services to the various area subcontractors to minimize costs and conflicts and to maintain control.

These systems and services will include:

1. Sanitary systems
2. Waste disposal
3. Drinking water
4. Electric power for offices and heat for all areas up to 2500 kV
5. Perimeter security
6. Site safety programs
7. Site fire protection systems
8. First aid station with nurse and ambulance for emergency use
9. Maintenance of major access and roads
10. Telephone trunk line installation
11. Material warehousing and control

A more detailed description of the CM/C, obligations, responsibilities, and staffing are contained in Volume III, SWEC Cost and Schedule Baseline, distributed separately to DOE on 31 March 1982.

Since it has been decided not to construct the Demonstration Plant at the present time, no further work has been done on construction strategy.

13.0 COAL SUPPLY STRATEGY

Pursuing a two-stage coal procurement strategy will attain the goals of the Demonstration Plant program. The coal supply strategy will incorporate the following objectives to: assure a feed coal supply compatible with scheduled plant operations and overall operability requirements, maintain flexibility to cope with changing project feed requirements and market conditions, obtain maximum value through overall yield efficiency, obtain reasonable prices for coal delivered, develop competition and encourage small business participation, and facilitate transition to commercial operations.

The strategy to achieve these goals is contained in a report entitled ICRC Coal Supply Strategy, which has been submitted to DOE on several occasions for comments, with the submission of the latest update being 26 March 1982. No further work was done on coal supply strategy during the Post-Baseline period.

14.0 MATERIALS SELECTION REPORT

This report covers the selection of materials for the Demonstration Plant. It discusses the overall materials selection criteria, process considerations that affect materials selection, uncertainties in making selections, and the plans for their removal.

The report was forwarded to DOE on 15 February 1982 in response to its request for information to support the documentation of the Project Baseline.

ICRC will update the Materials Selection Report during the Post-Baseline period to incorporate: the latest revisions to the Materials Diagrams for all areas of the plant; the latest results from on-going corrosion test programs conducted at various pilot plants and research laboratories, and; the data gaps and recommended areas where future research and test programs should be concentrated.

15.0 INITIAL CATALYSTS AND CHEMICAL REQUIREMENTS

The initial charges of catalysts and chemicals required for the Demonstration Plant and their respective estimated costs in first-quarter FY 82 dollars are listed in Table 8. This list excludes the chemicals required, but yet to be determined, for fixing the solid wastes. The list also excludes insignificant costs for specific laundry and drycleaning chemicals to be used.

The lone revision to the requirements for initial catalysts and chemicals during the Post-Baseline period was the elimination of soda ash from the Coker/Calciner chemicals; it was replaced by a spent caustic stream supplied from the Gas Systems Area.

Table 8
Initial Catalyst and Chemical Requirements

Area[a]	Material	Quantity	Estimated Cost ($)
OBLF			
BFW	Hydrazine	55 gal	1,000
BFW	Cyclohexylamine	270 gal	1,950
BFW	Di- and Trisodium Phosphate	2,000 lbs	750
BFW, CW	Sulfuric Acid	42,000 gal	32,400
BFW, CW	Caustic Soda	10,000 gal	8,600
BFW	Rock Salt	40,000 lbs	1,450
BFW	Sodium Bisulfite, Dry	300 lbs	250
WWT	Sodium Bisulfite, Solution	1,200 gal	4,350
CW	Cooling Tower Inhibitor	14,000 lbs	29,700
CW, POT, PROC W	Chlorine	20,000 lbs	2,300
POT W	Sodium Hexametaphosphate	100 lbs	50
PROC W	Liquid Alum., 49%	18,000 gal	9,800
WWT	Quick Lime	54,000 lbs	14,400
PROC W, WWT	Lime	54,000 lbs	15,900
PROC W	Polyelectrolyte	2,000 lbs	1,000
WWT	Ferric Chloride	5,000 gal	5,500
WWT	Phosphoric Acid	3,000 gal	10,600
WWT	Hydrogen Peroxide, 50%	2,000 gal	7,100
WWT	Defoamer	3,000 gal	11,100
WWT	Emulsion Breaker	3,500 gal	16,200
WWT	Manganous Sulfate, 30%	1,000 gal	2,800
WWT	Scale Inhibitor	1,200 gal	12,100
WWT	Ferric Sulfate	200 lbs	50
WWT	Dry Polymer	8,000 lbs	24,700
MH	Dust Supressant	300 gal	1,600
MH	Crusting Agent	3,000 gal	6,500
ELECT	Diesel Fuel	725 gal	750
WWT	Granular Activated Carbon	176,400 lbs	70,500
WWT	Powdered Activated Carbon	436,000 lbs	313,900
BFW	Cation Resin, No. 1	509 cu ft	25,500
BFW	Cation Resin, No. 2	178 cu ft	13,400
BFW	Anion Resin	509 cu ft	71,300
PROC W	Anthracite	1,770 cu ft	17,700
PROC W	Sand	1,072 cu ft	1,100
Fuel	Fuel Oil	420,000 gal	503,000

[a] BFW, Boiler Feed Water; CW, Cooling Water; POT W, Potable Water; PROC W, Process Water; ELECT, Electric Power; WWT, Wastewater Treatment; and MH, Material Handling.

Table 8 (continued)

Initial Catalyst and Chemical Requirements

Area	Material	Quantity	Estimated Cost ($)
Cryogenic Systems			
ASU	Hydrocarbon Desiccant	100 cu ft	20,000
	Activated Carbon	150 cu ft	15,000
HPU	Mole Sieve	1,650 cu ft	118,000
	Refrigerant	1,500 cu ft	1,400
	Scrub Oil	4,500 gal	40,000
Gas Systems			
Gasification	Flocculating Agent	3,500 lbs	3,500
	Caustic Soda	(Incl in DEA)	
	Chelate	17,500 lbs	17,500
Compression	NOX Catalyst	650 cu ft	117,000
Shift	Shift Catalysts	5,825 cu ft	1,544,000
Selexol	Selexol Solution	210,000 gal	2,268,000
	Refrigerant	83,000 lbs	78,900
DEA	Diethanolamine	4,000 gal	20,000
	Antifoam	50 gal	600
	Corrosion Inhibitor	50 gal	1,000
	Caustic Soda, 50%	120,000 gal	103,700
	Activated Carbon	50 cu ft	10,000
Claus	Claus Catalyst	4,410 cu ft	106,000
Beavon	Hydrogenation Catalyst	640 cu ft	109,000
	Anthraquinone-2,7 Disulphonic Acid (ADA)	10,800 lbs	67,000
	Vanadium Solution	19,600 lbs	147,000
	Caustic Soda	(Incl in DEA)	
SRC Process			
SRC	Process Solvent	801,000 gal	1,001,000
	Dowtherm A	30,000 gal	368,000
	Critical Solvent	270,000 gal	391,500

Table 8 (continued)
Initial Catalyst and Chemical Requirements

Area	Material	Quantity	Estimated Cost ($)
Coke and Liquid Products			
Coker/Calciner	Antifoam	450 lbs	820
	Dust-Settling Oil	180,000 lbs	17,500
	Ethylene Glycol	610 gal	2,100
	BFW Chemicals	350 gal	3,125
EBH	Hydrotreating Catalyst	655,000 lbs	2,620,000
	Ebullating Pump Seal Oil	21,600 gal	60,700
	Filming Amine	2,232 lbs	1,920
	Neutralizing Amine	360 lbs	465
Hydrotreater	Hydrotreating Catalyst	40,000 lbs	130,000
Methanator	Methanator Catalyst	1,315 cu ft	230,000
All Areas	Lubricants	---	124,000

16.0 SPARE PARTS SUPPORT DATA

PREMISE

A plant cannot operate successfully for any period without the availability of properly selected spare parts. This section outlines the basis for ICRC's estimate of spare parts to be provided for the SRC-I Demonstration Plant.

OBJECTIVE

ICRC intends to maintain sufficient spare parts and materials at the plant site in order to provide for immediate replacement or repair of worn or damaged parts during preventive maintenance inspections and overhauls, and to provide insurance for major equipment that is subject to catastrophic failure, which could result in long, costly plant shutdowns if spares were unavailable. The spares for insurance are expensive, and require long-lead delivery times. Also, their absence results in lengthy plant outages. However, they do have a low probability of failure.

COSTS OF SPARE PARTS

There are several ways to estimate the costs of spare parts.

1. Estimating the Cost of Spare Parts from a Detailed Machinery and Equipment List

This method is currently impractical, because final equipment selections will not be made for some time and only a generic equipment list is available. Also, this method is very time consuming.

2. Estimating the Cost of Spare Parts as a Percent of Total Plant Investment

This method is possible if compatible figures are used, such as escalated replacement costs of spare parts and escalated total plant investment. For example, the Operations Department of Air Products and Chemicals, Inc. has a $43.2 million inventory in spare parts to serve $1.072 billion in plant investments (1980 figures). Both amounts are escalated, or replacement, costs. A $43.2 million inventory of spare parts represents 4.03% of the total plant investment.

3. Estimating the Cost of Spare Parts as a Percent of Total Materials and Equipment Costs in the Plant

Generally, the cost of materials and equipment purchased for plant construction is about 50% of the total plant investment. If this cost is used in Method 2, the cost of spare parts would be 8.06% of the materials and equipment used for plant construction.

Examples of the spare-parts costs for other recently constructed facilities using this method are listed below.

a. Polyvinyl Chloride Facility (Air Products and Chemicals, Inc., Calvert City, Kentucky)

Total investment	$69,793,289
Total material and equipment costs	$32,908,759
Total spare-part costs	$ 2,542,116
Material and equipment costs as a percent of total investment	47.7%
Spare-part costs as a percent of total investment	3.6%
Spare-part costs as a percent of material and equipment costs	7.7%

b. Air Separation Facility (Air Products and Chemicals, Inc., LaPorte, Texas)

Total plant investment	$53,500,000
Total material and equipment cost	$26,000,000
Total spare-part costs	$ 1,608,000
Material and equipment costs as a percent of total investment	48.6%
Spare-part costs as a percent of total investment (three plants)	1.99%
Spare part costs as a percent of total material and equipment costs (three plants)	4.10%

Spare-part costs as percent of cost of one plant	5.99%
Spare-part costs as percent of material and equipment costs of one plant	12.32%

At the LaPorte installation there were three identical plants, which resulted in considerable savings for spare parts. Although more spares were provided for three plants than for one, the amount was not proportional to the number of plants. Major spares were not duplicated.

c. Exxon Donor Solvent (EDS) Facility (Exxon, Baytown, Texas)

Total plant investment	$120,000,000
Materials and equipment cost	$ 45,000,000
Spare-part costs	$ 1,500,000
Spare-part costs as percent of materials and equipment	3.33%
Materials and equipment costs as percent of total plant investment	37.5%

The cost for equipment alone ($20,000,000) is 44.4% of the total material and equipment costs. No spare parts are provided for insurance for major equipment (e.g., rotors, gear sets, tube bundles). This information was obtained from Bob Paine, EDS Plant Manager.

d. H-Coal Facility (Ashland Synthetic Fuels, Inc., Catlettsburg, Kentucky)

Total estimated cost of facility	$300,000,000
Cost of spare parts and materials	
Spare parts	$ 2,500,000
General stores	$ 1,500,000
Ebullating pump	$ 750,000
	$ 4,750,000

Estimated cost of equipment and materials (0.45 x $300,000,000) = $135,000,000
Spare-part costs as percent of plant cost = 1.58%
Spare-part costs as percent of equipment and materials = 3.52%

This information was obtained from Herbert Bocook, Maintenance Superintendent at the H-Coal Plant. Few insurance spares were provided for major equipment failure, and Ashland stated that plant availability has suffered because of a lack of adequate spare parts.

Capital investment for the Demonstration Plant is not considered to be a reasonable basis for estimating the cost of spare parts, because there are a number of extraordinary costs beyond those normally incurred in a project. Such costs include the extra costs to engineer and design prototype technology; to conform to extraordinary management-control systems; to cope with repeated delays and schedule changes outside of the control of project management; to investigate and meet special environmental and industrial hygiene constraints; and to coordinate and integrate the designs among many contractors. Thus, the best basis for estimating the spare-part requirements seems to be using a percentage of the materials and equipment costs. Although only one facility is being constructed, there will be considerable duplication of equipment (e.g., pumps, compressors, and heaters) making it possible to reduce the cost of spare parts expressed as a percentage of materials and equipment costs. Instead of considering a factor of 4% of total capital investment or 8% of materials and equipment costs, a factor of 5% of materials and equipment costs is more realistic, although minimal. On this basis, the spare parts budget would be calculated as follows:

Spare parts budget = 0.05 x $609,100,000 = $30,460,000

This 5% factor is an overall average to cover all equipment and materials and must not be used as a guide for individual pieces of equipment. Some machinery will require a relatively high cost, or factor, for spare parts, whereas other equipment will require minimal spare parts or none at all. The following examples illustrate this point:

- Centrifugal compressors: 40 to 45% of compressor cost
- Reciprocating compressors: 25 to 30% of compressor cost
- Reciprocating slurry pumps: 20 to 25% of pump cost
- Storage tanks: minimal spare parts, e.g., gaskets and relief valves
- Dissolvers: minimal spare parts, e.g., gaskets and relief valves
- Fractionating columns: minimal spare parts, e.g., gaskets, relief valves, and bubble caps

- Flash drums: minimal spare parts, e.g., gaskets and relief valves
- Piping: minimal spare parts, e.g., flanges and gaskets

SELECTION OF SPARE PARTS

ICRC intends to have the Area Contractors make the initial selection of spare parts based on the Master Project Procedure and Spare Parts Guidelines, which have been prepared for the project. The guidelines cover mechanical and electrical equipment, and instrumentation related to the following equipment and systems:

a. Agitators and mixers
b. Conveyors (e.g., belt, screw, and bucket)
c. Compressors (e.g., reciprocating, centrifugal, and rotary)
d. Engines
e. Expanders
f. Industrial fans
g. Filters (e.g., rotary and dust collection)
h. Pumps (centrifugal, reciprocating, vacuum, and rotary)
i. Speed changers (reducers and increasers)
j. Cooling towers
k. Steam turbines
l. Refrigeration equipment
m. Motors (synchronous and induction)
n. Valves (relief, control, block, and throttling)
o. Electrical equipment (e.g., alarms, batteries, starters, relays, switch gear, transformers, generators, and exciters)
p. Instrumentation (e.g., flow, level, temperature, and pressure instruments, plus pressure switches and pressure gauges)
q. Heat exchanger equipment (bundles and tubes)
r. Furnaces and boilers
s. Air fan coolers
t. Pressure vessels
u. Sheaves and V-belts
v. Other equipment

In most cases, the Guidelines are tabulated (samples are attached). Spare parts for some items will be recommended as a percent of the total number of units installed. A copy of the Master Project Procedure MPP 6-2, Spare Parts and Special Tools Requirements, is also attached.

The spare parts selected by the Area Contractors will be reviewed for additions and deletions before purchase orders are placed.

SPARE-PARTS BUDGETS FOR AREAS

The cost of spare parts as a percentage of investment will vary among the various process areas of the Demonstration Plant, as it did for equipment, for the following reasons: the type and complexity of the operation; the degree of prototype and new-application technology and equipment involved; the expected corrosion problems; the spare-part requirements and costs; the level of preventive and recurring maintenance required to support the area.

ICRC evaluated these conditions and the types of materials and equipment used in the process areas. Factors were assigned to each process area to represent the estimated cost and thus the budget for spare parts as a percentage of the materials and equipment costs that were included in the Baseline Cost Estimate prepared by the Area Contractors and ICRC. These percentages, the costs of materials and equipment, and the resulting spare-parts budgets for each area are tabulated below:

Area	Factor (%)	Material & equipment costs (MM $)	Spare-parts budget (MM $)
SRC Process	7.0	180.1	12.61
Coke and Liquid Products	4.5	72.8	3.28
Cryogenic (ASU)	4.2	27.1	1.14
Cryogenic (HPU)	4.2	5.8	0.24
Gas Systems	5.0	141.8	7.09
Outside Battery Limits Facility	3.4	170.9	5.81
Central Control System	5.0	3.1	0.16
ICRC (capital operating equipment)	1.0	7.5	0.07
		609.1	30.40

The total budget of $30,400,000 for spare parts is in substantial agreement with the $30,460,000 estimate developed above by using an overall factor of 5%. The Revised Cost Baseline will use the $30,400,000 budget.

TABLE NO. I-2

SPARE PARTS REQUIREMENTS

FOR

Compressor, centrifugal

(1) ITEM	SPARE PART DESCRIPTION	NO. OF Compressors INSTALLED — DON'T COUNT INSTALLED SPARES				
		1	2	3	4	5 OR MORE
		QUANTITIES TO BE SPARED				
1	Rotor - each type consisting of either shaft and impellers for avial compressor or pinion and impellers for poster type compressor	1	1	1	1	1
2	Bull gear with integral shaft (for poster type compressor)	1	1	1	1	1
3	Bearings (set) includes all radial and thrust bearings	1	1	2	2	2
4	Coupling - each size in compressor train	1	1	1	1	1
5	Oil Seals (set) - All Bearings	1	1	1	2	2
6	Gas Seals (set) - includes impeller eye, shaft end seals, balance drum, etc.	1	1	1	2	2

NOTES

(1) THE PARTS LISTED ARE THE PRINCIPAL PARTS ONLY. ANY OTHER PARTS NOT INDICATED HERE SHOULD BE CONSIDERED FOR THE RECOMMENDATION IN QUANTITIES CONSISTENT WITH THE ABOVE TABLE.

(2) THESE PARTS MAY BE ORIGINAL PART MANUFACTURERS (OPM) PARTS. REFER TO SECTION G FOR FURTHER INFORMATION ON SPARE PARTS RECOMMENDATIONS.

TABLE NO. I-2

SPARE PARTS REQUIREMENTS

FOR

Compressor, centifugal

ITEM	SPARE PART DESCRIPTION	NO. OF Compressors INSTALLED — DON'T COUNT INSTALLED SPARES				
		1	2	3	4	5 OR MORE
		QUANTITIES TO BE SPARED				
7	Gaskets (set) - All Gaskets	1	2	2	2	2
8	Thrust Collar - if it is a separate piece from the rotor	1	1	1	1	1
9	Oil Pump	1	1	1	1	1
10	Lube Oil Filter Elements	1	1	1	1	1

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TABLE NO. I-3

SPARE PARTS REQUIREMENTS

FOR

Compressor, reciprocating

(1) ITEM	SPARE PART DESCRIPTION	NO. OF Compressors INSTALLED — DON'T COUNT INSTALLED SPARES				
		1	2	3	4	5 OR MORE
		QUANTITIES TO BE SPARED				
1	Piston Rings - set for each cylinder	1	2	2	2	2
2	Piston (each size)	1	1	1	1	1
3	Piston Rod - each piston rod size	1	1	1	2	2
4	Crosshead with shoes	1	1	1	1	1
5	Crosshead shoes (set of 2)	1	1	2	2	2
6	Conrod	1	1	1	1	1
7	Suction Valves (set) - includes valves for all cylinders	1	1	1½	2	2
8	Discharge Valves (set) - includes valves for all cylinders	1	1	1½	2	2
9	Unloading Valves (set) - includes valves for all cylinders	1	1	1	1	1

NOTES

(1) THE PARTS LISTED ARE THE PRINCIPAL PARTS ONLY. ANY OTHER PARTS NOT INDICATED HERE SHOULD BE CONSIDERED FOR THE RECOMMENDATION IN QUANTITIES CONSISTENT WITH THE ABOVE TABLE.

(2) THESE PARTS MAY BE ORIGINAL PART MANUFACTURERS (OPM) PARTS. REFER TO SECTION G FOR FURTHER INFORMATION ON SPARE PARTS RECOMMENDATIONS.

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TABLE NO. I-3

SPARE PARTS REQUIREMENTS

FOR

Compressor, reciprocating

ITEM	SPARE PART DESCRIPTION	NO. OF Compressors INSTALLED – DON'T COUNT INSTALLED SPARES				
		1	2	3	4	5 OR MORE
		QUANTITIES TO BE SPARED				
10	Crosshead Pin Bushing (set) - set includes all cylinders	½	1	1	1	1
11	Crosshead Pin (set) - set includes all cylinders	½	1	1	1	1
12	Canrod Bearing Set - includes bearings for all canrods	½	1	1	1	1
13	Main Crankshaft Bearings (set) - includes all main bearings	½	1	1	1	1
14	Main Crankshaft Thrust Bearing	1	1	1	1	1
15	Cylinder Lines - each size	1	1	1	1	1
16	Lubricator Pumps	25% of installed pumps				
17	Frame Oil Pump	1	1	1	1	1
18	Suction Valve Parts (set) - set includes springs and plates for all cylinder valves	1	1	1	1	2
19	Discharge Valve Parts (set) - set includes springs and plates for all cylinder valves	1	1	1	1	2
20	Suction Valve Seat (set) - set includes seats for all valves	¼	½	3/4	1	1 - minimum of 1
21	Discharge Valve Seat (set) - set includes seats for all valves	¼	½	3/4	1	1 - minimum of 1
22	Pressure Packing - includes a complete set of packing for each cylinder	1	1	2	2	2

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TABLE NO. I-3

SPARE PARTS REQUIREMENTS

FOR

Compressor, reciprocating

ITEM	SPARE PART DESCRIPTION	NO. OF Compressors INSTALLED – DON'T COUNT INSTALLED SPARES				
		1	2	3	4	5 OR MORE
		QUANTITIES TO BE SPARED				
23	Packing Case (set) - includes cases for	1	1	1	1	1
	each cylinder					
24	Oil Scraper Packing (set) - includes	1	1	1	1	1
	packing for each cylinder					
25	Frame Lube Oil Filter Elements (set)	1	1	1	1	1
26	Valve Gaskets (set) - set includes all	1	2	3	3	3
	cylinder valves					
27	O Rings - complete set including O rings	2	2	2	2	2
	for lines, packing, etc.					
28	Crankshaft Seal - Drive End	1	1	1	1	1

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TABLE NO. I-48

SPARE PARTS REQUIREMENTS

FOR

Valve, Pressure Relief

(1) ITEM	SPARE PART DESCRIPTION		NO. OF Valves INSTALLED – DON'T COUNT INSTALLED SPARES				
			1	2	3	4	5 OR MORE
			QUANTITIES TO BE SPARED				
1	Complete Spare Valve		1	1	1	2	33% of valves
2	Spring	(2)	1	1	1	1	20% of valves
3	Seat	(2)	1	1	1	2	33% of valves
4	Plug	(2)	1	1	1	2	33% of valves
5	Stem	(2)	1	1	1	2	33% of valves
6	Orifice	(2)	1	1	1	2	33% of valves

NOTES

(1) THE PARTS LISTED ARE THE PRINCIPAL PARTS ONLY. ANY OTHER PARTS NOT INDICATED HERE SHOULD BE CONSIDERED FOR THE RECOMMENDATION IN QUANTITIES CONSISTENT WITH THE ABOVE TABLE.

(2) THESE PARTS MAY BE ORIGINAL PART MANUFACTURERS (OPM) PARTS. REFER TO SECTION G FOR FURTHER INFORMATION ON SPARE PARTS RECOMMENDATIONS.

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Allentown, PA

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Project: SRC-I DEMONSTRATION PLANT, NEWMAN KENTUCKY

MASTER PROJECT PROCEDURES

SPARE PARTS AND SPECIAL TOOLS REQUIREMENTS

1.0 OBJECTIVE:

The objective of this procedure is to establish the requirements for Area Contractors' spare parts and special tools programs. It addresses shelf spares and not installed spares: requirements for the latter are defined in the Process Design Criteria.

2.0 GENERAL:

Throughout this procedure the spare parts refers to normal and insurance spares and special tools as required for start-up and continuous operation of the equipment for 330 days/yr for two (2) years. Insurance spares are required to prevent long outages resulting from catastrophic failures. Each Area Contractor shall establish a spare parts program enabling him to correctly recommend spares, to procure approved items and to maintain spares records.

3.0 AREA CONTRACTOR SPARE PARTS PROGRAM:

Each Area Contractor shall establish and maintain a program to recommend and to procure all spare parts in his particular area of responsibility. The program must include at least the following features:

a) Central Coordination
b) Control Log to assure all purchased equipment and material has been considered for spare requirements.

REVISION	DATE	APPROVALS
1	28 Jan. 82	R. M. Kroc

FORM 9621 (3/80)

c) Spare Parts Analysis which shall include a review of Vendor's recommendations.
d) Cost Control System.
e) Spare Parts Purchasing
f) Expediting/Tracking System
g) Spare Parts Packaging Requirements which shall consider probable storage conditions.
h) Spare Parts Records to enable ICRC to locate, identify, code, and catalog the spare parts and identify the equipment for which they were purchased.

4.0 ICRC RESPONSIBILITIES:

ICRC's Project Manager is responsible for overall supervision of the Area Contractor's spare parts program. ICRC's Manufacturing Department is assigned to review the Contractor's Spare Parts recommendations, check the Area Contractor's Spare Parts Program, to maintain overall spares records and to advise on spare parts requirements.

5.0 SPARE PARTS RECOMMENDATIONS:

Area Contractors should consider at least the following factors when recommending purchase of spare parts:

a) The probability that the part will fail or be used.
b) The impact on plant operation of part failure.
c) The repairability of the part.
d) The availability of the replacement parts.
e) The availability of a temporary substitute such as: leased equipment, process alteration, increased labor etc.
f) The ability to fabricate the part from stock materials.
g) The cost of the spare part.
h) The affect on safety of not having the spare part.

i) The impact of replacing a component part as compared to replacing the complete assembly or unit.

j) The use of common spare parts for various pieces of equipment.

k) The probable lead time between recognizing the need for replacing the part and actually needing the part.

6.0 GUIDELINES FOR SPARES SELECTION:

ICRC will provide charts indicating the typical quantities of spares required for various types and numbers of equipment. Examples are included on pages 6 to 9.

7.0 ORIGINAL PART MANUFACTURER'S INTERCHANGEABLE SPARE PARTS:

Equipment suppliers frequently purchase some components of their equipment from other manufacturers. Different pieces of equipment may include identical components. Examples are bearings, V-belts, seals, gaskets, lubricants, nuts and bolts or other such items. It is essential, therefore, that the Area Contractor keeps a record by component and not by equipment alone so that the stocking level of these parts can be minimized. The Area Contractor must segregate these identical components from other spare parts and develop recommendations which take into account this multiplicity.

The Area Contractor must prevent duplication of V-belts, bearings, sheaves or other items which may be identical except for vendor name and identification number. Parts which have different brand names but which are interchangeable must be grouped together before spare parts recommendations are made.

8.0 SPARE PARTS PROCUREMENT:

8.1 Unless agreed to the contrary, the Area Contractors shall submit to ICRC, simultaneously with recommendations for equipment purchase, a detailed list of Area Contractor recommended spares with unit prices. Upon ICRC approval, the Area Contractor will procure the original equipment and the spares together.

8.2 When it is necessary to purchase equipment prior to a complete evaluation of spare parts requirements, the Area Contractor may recommend the equipment to be purchased but omit the detailed spare parts recommendation. However, the Contractor shall submit unit prices and delivery time for spares when recommending equipment purchase. Unit prices should be fixed for a minimum period of 180 days.

8.3 Original Part Manufacturer's spares (mentioned earlier is section 7). The Area Contractor shall recommend when spares should be procured from the detailed lists of spares with unit prices.

8.4 Two copies of the spare parts purchase order must be promptly delivered to the ICRC Manufacturing department for coding and cataloging purposes.

9.0 SPARE PARTS RECORDS:

The spare part records are to contain the following information:

a) Identification of the equipment for which the spare part is intended. This information should include equipment description, equipment number, equipment supplier and purchase order.
b) The equipment supplier's spare part number and description, including the type of material from which the spare was made.
c) The original part manufacturer and his part number.
d) Sectional drawings showing location, part number, and total quantity required.

e) Actual quantities of each spare part purchased

f) The price of the individual spare part and of the total quantity purchased.

g) The weight of each part, both net weight and shipping weight.

h) The delivery time for each part.

i) The interchangeability of the spare part with other equipment furnished on the project.

10.0 SPARE PARTS PACKING:

a) The Area Contractor must assure that the spare parts are packaged separately from original equipment; are protected for long term storage; and, when appropriate, are packed individually.

b) Also, the spares must be packed with the appropriate documentation which shall include the purchase order number, Area Contractors reference number, and ICRC reference number.

SPARE GUIDELINES FOR BOILERS AND EJECTORS

The minimum recommended spare parts for boilers and jet ejectors are:

Boilers

1. Tubes - 5 percent with a minimum of one of each type of tube.
2. Tube plugs - 4 percent of the number of tubes.
3. Handhole and manhole gaskets - two complete sets.
4. Refractory and insulation - 5 percent.
5. Water gauge glasses - one complete set.
6. Burners - see furnace burners.
7. Low water cutoff devices - all moving parts, replaceable electric probes, floats, etc., - one set.

Jet Ejectors

1. Nozzles - one each size
2. Diffusers - one each size

SPARES GUIDELINES FOR AIR FIN COOLERS

1. Tubes - normally no spares required unless there are reasons to believe that process problems may cause damage such as the severe stress corrosion failure problems experienced at the Ft. Lewis pilot plant on the air cooled exchanger cooling the over heads from the high pressure flash tank.
2. Plugs - Steel - 1 percent of total required all coolers. Brass or non-ferrous - 2 percent of total required all coolers.
3. Plug gaskets - 5 percent of total required all coolers.
4. Cover plate gaskets - 100 percent of total required all coolers.
5. Tube support boxes (if used) - 10 percent of total required all coolers.

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Allentown, PA

MASTER PROJECT PROCEDURES
AREA CONTRACTOR SPARE
PARTS REQUIREMENTS

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TABLE NO. I-2
SPARE PARTS REQUIREMENTS FOR CENTRIFUGAL COMPRESSOR

(1) Item	Spare Parts Description	No. of Compressors installed - Don't count installed spares				
		1	2	3	4	5 or more
		Quantities to be spared				
1	Rotor - each type consisting of either shaft and impellers for axial compressor or pinion and impellers for poster type compressor	1	1	1	1	1
2	Bull gear with integral shaft (for poster type compressor)	1	1	1	1	1
3	Bearings (Set) includes all radial 2nd thrust bearings	1	1	2	2	2
4	Coupling - each size in compressor train	1	1	1	1	1
5	Oil seals (Set) - all bearings	1	1	1	2	2
6	Gas seals (Set) - includes impeller eye, shaft end seals, balance drum, etc.	1	1	1	2	2
7	Gaskets (Set) - all gaskets	1	2	2	2	2
8	Thrust collar - if it is a separate piece from the rotor	1	1	1	1	1
9	Oil pump	1	1	1	1	1
10	Lube oil filter elements	1	1	1	1	1

NOTES:

(1) The parts listed are the principal parts only. Any other parts not indicated here should be considered for the recommendation in quantities consistent with the above table.

(2) These parts may be Original Part Manufacturers (OPM) parts. Refer to Section 7.0 for further information on spare parts recommendations.

TABLE NO. I-29
SPARE PARTS REQUIREMENTS FOR CENTRIFUGAL PUMPS - ABRASIVE SERVICE

(1) Item	Spare Parts Description		No. of Pumps installed - Don't count installed spares 1	 2	 3	 4	 5 or more
			Quantities to be spared				
1	Impeller	(3)	1	2	3	3	3
2	Pump shaft		1	1	2	2	2
3	Casing ring		1	2	3	3	3
4	Impeller ring		1	2	3	3	3
5	Mechanical seal (Assume 1 per pump)	(2)	2	4	6	6	6
6	Shaft sleeve		1	2	3	3	3
7	Bearings (Set)	(2)	1	1	2	2	2
8	Gland		1	1	1	1	1
9	Shaft sleeve nut		1	2	3	3	3
10	Bearing lock nut		1	1	1	2	2
11	Impellers nut		1	2	3	3	3
12	Bearing seals (Set)	(2)	1	1	2	2	2
13	Deflector		1	1	2	2	2
14	Coupling or sheaves (Set)	(2)	1	1	1	1	1
15	Inspection cover gasket		1	2	3	3	3
16	Gaskets (Set)		1	2	3	4	4
17	V-belts (Set)	(2)	1	1	2	2	2
18	Bearing lock washer	(2)	1	2	3	4	4
19	Throat bushing		1	1	2	2	3
20	Mechanical seal O-rings (Set)	(2)	1	2	3	3	3
21	Mechanical seal rotating face (Set)	(2)	2	2	2	2	3
22	Mechanical seal stationary face (Set)	(2)	2	2	2	2	3
23	Suction liner		1	2	3	3	3
24	Hub liner		1	2	3	3	3
25	Case liner		1	2	3	3	3

NOTES:

(1) The parts listed are the principal parts only. Any other parts not indicated here should be considered for the recommendation in quantities consistent with the above table.

(2) These parts may be Original Part Manufacturers parts. Refer to Section 7.0 for further information on spare parts recommendations.

(3) Spare impellers are ordered in the maximum diameter and trimmed to proper diameter prior to installation.

17.0 OPERATIONS CAPITAL EQUIPMENT SUPPORT DATA

Seven categories of capital equipment, which will be procured to support the commissioning and operating schedule for the Demonstration Plant, are: mobile equipment, plant maintenance equipment, building furnishings, plant analytical laboratory equipment, field laboratory equipment, communications equipment, and safety equipment.

For each category, the report which sets forth the recommendations for the specific types and quantities of equipment items, and their area of use, was forwarded to the DOE for approval on 28 January and 4 February 1982.

There were no revisions made to the report during the Post-Baseline period.

18.0 COST ESTIMATE BACKUP DETAIL

Cost Baseline submittals from each of the Area Contractors and the CM/C are maintained in the central files of ICRC. Data is voluminous and much of it is proprietary. One copy of the cost estimates from the Area Contractors and the CM/C was forwarded to the DOE and to its support contractor, as they became available. Cost Baselines are available for examination by authorized personnel from DOE and its support contractors.

The Cost Baselines of each Area Contractor contain the following detailed data: Phase I engineering, Phase I vendor engineering, Phase II field support engineering, and Phase II equipment costs. The Cost Baseline of the CM/C contains Phases IA and IB home office support, Phase II construction management, Phase II equipment, and Phase II construction costs (direct and indirect). ICRC's Cost Baseline contains Phase I engineering, Phase II engineering, Phase II equipment (capital plant equipment), Phase II spare-parts costs, Phase III management, and Phase III operating costs.

The Independent Check Estimate Detail by ICRC of the inputs of all subcontractors is available from its files, for both the basic Cost Baseline and ECP data. The Utilities and Off-Sites Area Contractor prepared his cost estimates entirely by means of a computer program. In general, the other Area Contractors and CM/C prepared estimates in the following manner.

The development of the Revised Cost Baseline involved the integration of Category B, Category C, and Post Baseline ECPs into the cost estimate. The original baseline presented the Category B and C ECP cost estimates, as they existed at that time, as a line item only without showing their effects on equipment, materials, labor and engineering. Some of the ECPs were incorporated into the revised baseline estimate by establishing the engineering and equipment cost changes and generating the construction cost impacts from factors developed for the baseline estimate for the process unit(s) involved. For other ECPs, construction, costs were estimated independent of the equipment cost changes since the appropriate bulk material takeoffs were revised by ICRC cost estimators. Finally, the equipmnt and engineering cost changes established by ECPs for the Dust Preparation and Gasification Units were incorporated directly into the revised baseline estimate, but the ECP construction costs were superceded by the results of the revised material take-offs prepared for these areas.

ENGINEERING

The overall scope of work and project requirements were defined and estimated by the project estimators within the time frame of the originally assumed schedule. These were reviewed by each of the cost account managers (engineering discipline leaders), who then established the actual estimates, time spans, and labor loadings, with the concurrence of the project estimators.

EQUIPMENT COSTS

Firm quotations from vendors for equipment items based on mechanical specifications were used if available. Informal budget-type estimates from vendors were used when detailed mechanical specifications were unavailable and when the formal solicitation of bids was not authorized by DOE. Otherwise, subcontractors estimated equipment costs from in-house data such as procurements of similar equipment on other recent projects, cost curves, computer programs, and published prices.

BULK MATERIALS

Quantities of bulk materials were estimated by the Area Contractors for ultimate pricing by the CM/C. Piping material takeoffs were made on the basis of the plot plan; P&IDs, where available, otherwise Process Flow Diagrams; piping specifications; and schematic utility distribution diagrams. Similarly, the electrical estimates were made from studies of the plot plan; electrical single-line diagrams; motor lists; and hazardous area classification drawings.

Estimates for concrete and piling were prepared on the basis of the plot plan and preliminary soil reports. Structural steel was estimated by studying the plot plan and general equipment arrangement drawings; definition models were used when they were available. Site development was estimated on the basis of the plot plan and the established grade elevations, and insulation and painting were estimated on the basis of surface areas.

When the supply definitions were unclear during the development of the Technical Baseline, some material take-offs were factored from previously built, similar plants and computer programs.

CONSTRUCTION LABOR

Direct and indirect labor costs were estimated by the CM/C using equipment costs and quantities supplied by the Area Contractors, applying in-house base rates to the quantities and an overall project factor to the base rates to adjust them for the location, size, and complexity of the SRC-I project.

19.0 INTERMEDIATE SCHEDULE BACKUP DETAIL

Detail Schedules that had been prepared by the Area Contractors, CM/C, and ICRC cost account managers serve as the data base, through a traceability system approved by ICRC, for the original consolidated Intermediate Schedule. The Detail Schedule is a Critical Path Method (CPM) logic network, which consists of approximately 10,000 activities per subnet and is stored on the computer of the preparer.

The original Intermediate Schedule is an integrated, computerized critical path network consisting of about 10,000 activities that form a consolidated summary of the Detail Schedules of ICRC, the Area Contractors and the CM/C. This schedule serves as the data base for all higher level schedules (Master and Executive Schedules) and is stored on the ICRC computer. It is the lowest level that integrates the entire Project Schedule.

The data base of the Original Baseline Intermediate Schedule provided the status of the project as of 1 October 1981. ICRC assumed that the Area Contractors would not be constrained in their activities by additional funding problems or labor restrictions.

The following assumptions or restrictions were incorporated during the development of the Intermediate Schedule data base:

- Procurement activites will not commence before 15 June 1982.
- Purchase orders will not be issued prior to November 1982.
- CM/C will mobilize and move on site on 15 April 1982.
- The date for the FEIS Record of Decision will be 15 October 1982.
- The acquisition of the land will be completed so that site work can begin on 15 April 1982.

All schedules were to be reevaluated and updated on a monthly basis by using the data base derived from the updated Detail Schedule. The Intermediate Schedule was transmitted to DOE in March 1982.

Because the DOE has decided to shut down the project, no work has been done during the Post-Baseline period to update the Intermediate Schedule.

20.0 MAJOR CHANGES SINCE PHASE 0

Since the completion of Phase 0, there have been numerous changes in the SRC-I Project dealing with innovations in process considerations, and sizing and sparing of equipment. Most of these have been covered by Engineering Change Proposals (ECPs). The major, substantive changes are set forth below.

a. DEMONSTRATION PLANT SIZE

The design capacity of the Demonstration Plant has been reduced by approximately 10%. During Phase 0, the design allowed the SRC Process Area to process into hydrocarbon liquids 6,000 TPSD of moisture-free coal and the Gas Systems Area to gasify approximately 630 TPSD of coal in addition to liquefaction residue to produce the required makeup hydrogen for the process. At the direction of DOE, the design of the plant was cut back to accommodate a total coal supply of 6,000 TPSD to the battery limits of the facility. Of this amount, 5,590 TPSD will be liquefied, and the remainder will be fed to the gasifiers.

b. CRITICAL SOLVENT DEASHING IN LIEU OF FILTRATION

During Phase 0, parallel designs were carried out for both the filtration system utilizing vertical, leaf filters and the Kerr-McGee Critical Solvent Deashing (CSD) System. The filtration case was chosen for the base design because of its higher recovery and economic advantages. The Critical Solvent Deashing (CSD) System of Kerr-McGee and the Anti-Solvent Deashing (ASD) Systems of The Lummus Company, both continuous operations, were to be tested at the Wilsonville, Alabama and Fort Lewis, Washington pilot plants, respectively. The recovery efficiency of filtration was over 95%; the efficiency of the CSD system was rated at 81%; the ASD System was tested very briefly. Because it was recognized that filtration was a batch-type, mechanical operation requiring periodic maintenance of equipment, which could result in the exposure of personnel to potentially carcinogenic materials, the DOE directed that the continuous, closed CSD system be pursued as the design case. Because of the above-mentioned reduction in Demonstration Plant size and the lower recovery of SRC resulting from the change in the deashing schemes, the SRC feed rate to the Coker/Calciner was reduced from 1,120 to 887 TPSD.

c. SRC DISTRIBUTION AND UPGRADING

In Phase 0, two-thirds of the SRC produced was solidified to use as a boiler fuel, and one-third was fed to the Coker/Calciner to produce anode coke. Late in the phase, a separate conceptual study was made for the consideration of the addition of an EBH into the facility to upgrade to liquid fuels two-thirds of the SRC produced.

The EBH was actually incorporated into the scope of the Demonstration Plant during Phase I. However, instead of processing two-thirds of the SRC on a once-through basis for 50% conversion as the base design case, DOE specified the design basis to be to process in a recycle mode, only one-third of the SRC produced to achieve a targeted high conversion rate of 85%. In the final analysis, the equipment, as designed, will be capable of operation in either mode. The nominal rates of conversion are 80 and 50% for the high and low conversion modes, respectively.

d. SOURCE OF HYDROGEN FOR EBH

Because of the late authorization in Phase 0 for the consideration of the EBH in the Demonstration Plant to upgrade the SRC product, it was necessary to include an integrated steam reformer as its source of hydrogen. During Phase I, in the interest of economics and ease of operation, it was decided to eliminate the reformer in favor of an additional Gasifier in the Gas Systems Area. Thus, the Gas Systems Area will now produce 77.3 MM SCFD of hydrogen and CO, an increase of 26.9 MM SCFD.

e. NUMBER AND SIZE OF AIR SEPARATION UNITS

In Phase 0, the design required the supply of 1,500 TPD of oxygen at a pressure of 1,200 psia to be provided by two units, each with a production capability of 750 TPD.

Because of the change from the high-pressure Texaco gasifiers to the low-pressure GKT gasifiers and because of other changes in the overall size and configuration of the Demonstration Plant, the oxygen requirements in Phase I are 1,400 TPD at a pressure of 60 psia. Three units, each with a production capability of 467 TPD, will provide the oxygen. The three-train design was chosen over the original two-train design for reasons of greater reliability, improved turndown operation, and reduced shipping problems, with no attendant increase in capital cost.

f. GASIFICATION

During Phase 0, the design was based on the use of high-pressure Texaco gasifiers to generate 50 MM SCFD of hydrogen from filter cake and supplementary coal. During Phase I, the deashing scheme was changed from filtration to the Kerr-McGee Critical Solvent Deashing system. This change reduced the average particle size of the gasification feedstock since the Kerr-McGee Ash Concentrate (KMAC) has a finer particle size than filter cake. As a result of this change, the slurry concentration that could be obtained with the KMAC was reduced to 70% of the design value selected for the filter cake. This reduced the efficiency of the Texaco process relative to the GKT low-pressure, dry feed process and resulted in an overall economic penalty for Texaco.

An alternative would have been to install a briquetting/crushing process between the Kerr-McGee CSD process and the Texaco process to optimize the particle size of the gasification feedstock. While this option would have made the Texaco coal gasification process economically attractive, it required another unproven process step, briquetting/crushing, and was judged to be technically undesirable. The commercially-proven GKT gasification process was preferred to generate makeup hydrogen for the SRC, EBH and Naphtha Hydrotreating Processes while converting the Kerr-McGee Ash Concentrate into environmentally acceptable fly ash and slag by-products.

g. NUMBER OF COAL SLURRY HEATERS

In Phase 0, the design of the Coal Slurry Heater consisted of a fuel-fired zone with a convective heat transfer box. Within the convective box, six separate coils containing the coal/solvent/hydrogen mixture were heated by the flue gases. Each of the coils was fed by a separate reciprocating pump. In Phase I, it was recognized that a shutdown of one pump and coil would cause the shutdown of the entire facility; therefore, the heater design was changed from one heater box to six separate boxes, each containing one coil. The design of the heater was also changed from all-convective to radiant-convective based on the test data from the Ft. Lewis, Washington, Pilot Plant.

This six heater design was further modified to four heaters, although the concept of a single coil per heater and its associated feed pump was maintained. The reduction in the number of pump/heater trains reduced the capital cost significantly with marginally increased process risk due to the increase in slurry velocity from 12 to 18 feet per second.

h. INTEGRATED FACILITIES

During Phase 0, the auxiliary equipment portion of the SRC Process Area was not analyzed because of the emphasis placed on the development of the process. In Phase I, various auxiliary systems necessary for support of the process were developed as part of the Integrated Facilities (WBS 1.2.1.1) section of the SRC Process Area. The Integrated Facilities consist of the Flush Solvent System for cleaning of process lines and purging of instrument taps; Slop Collection and Draining System for reprocessing of hydrocarbon liquids during start-up, shutdown, and normal operation; Heater Decoking Systems for cleaning carbon deposits in heaters; Vent Vapor Systems for collection of hydrocarbon vents to meet environmental regulations; Compressor Jacket Water System for providing tempered water for compressor cylinder jacket cooling to prevent fouling; and Flare Knock-Out System for preventing solids and liquids from entering the elevated flare.

i. ZERO WASTEWATER DISCHARGE

To mitigate the potential impact on the quality of the water in the Green River resulting from the wastewater discharges from the Demonstration Plant, which could contain heavy metals and trace organic contaminants, a commitment was made in the Final Environmental Impact Statement (FEIS), prepared during Phase I, to design and install a Zero Water Discharge System. The system required adding several wastewater treatment processes including reverse osmosis and evaporation.

j. METHANATOR

In Phase 0, the makeup hydrogen supply for the EBH was obtained by steam-reforming the light hydrocarbon gases produced in the SRC and EBH Areas. The steam reformer plant was designed by Lummus and included a Methanator as the final treatment step to purify this hydrogen stream.

During Phase I, the source of hydrogen for the EBH was modified. The reformer was deleted. The hydrogen will be obtained from an expansion of the facilities in the Gas Systems Area, which produces makeup hydrogen for the SRC Process Area. In order to achieve the same required purity with respect to carbon oxides for the makeup hydrogen to the EBH in Phase I, as was provided in Phase 0, it became necessary to add a Methanator to treat that stream. The Methanator will also treat the makeup hydrogen for the Naphtha Hydrotreater.

k. PRODUCT OIL FRACTIONATION UNIT

During Phase 0, ICRC anticipated that the liquid hydrocarbon products from the Demonstration Plant would be made as two cuts--a mixed fuel oil substitute for No. 2 fuel oil and raw naphtha for reformer feedstocks. However, product utilization activities during Phase I revealed that additional equipment and processing would be required to upgrade the cuts to marketable products. ICRC studied several processing schemes with the result that the additional equipment includes a common Product Oil Fractination Unit in the SRC Process Area to fractionate the liquid hydrocarbons produced in the SRC Process, Delayed Coker and EBH Areas into naphtha, middle and heavy distillate fractions, and a Naphtha Hydrotreater to upgrade raw naphtha into reformer feedstock by reducing its sulfur, oxygen and nitrogen contents to acceptable limits.

l. NAPHTHA HYDROTREATER

During Phase 0, it was believed that the naphtha produced in the Demonstration Plant was marketable as raw naphtha. As a result, no provisions were made in the design for a Naphtha Hydrotreater. However, during Phase I, various potential markets for the raw naphtha were explored, including its use as a boiler or turbine fuel, a synthetic natural gas feedstock, a benzene/toluene/xylene plant extraction feedstock, and a catalytic reformer feedstock. It was determined that the raw naphtha produced from SRC was not appropriate for these applications. However, an upgraded naphtha would make an excellent catalytic reformer feedstock to produce high-octane gasoline and thus yield higher revenues. Evaluation of various upgrading techniques revealed that hydrotreating was the best method available, for the following reasons: it is an experimentally proven technology; it requires no further treatment before reforming; it is the most cost-effective upgrading process; and it stabilizes the naphtha. Thus, the decision was made to add a hydrotreater to process the naphtha produced in the Demonstration Plant for sale and to demonstrate the commercial viability of processing it into a high-octane gasoline blendstock.

m. ELECTRIC POWER DISTRIBUTION

As a result of the engineering done during Phase I, including that associated with the various Engineering Change Proposals, the electrical power requirements of the various areas are much better defined than they were during the conceptual study in Phase 0. As a result, the power distribution system increased from a four-transformer, 85-megawatt system to a four-transformer, 150-megawatt system and an emergency power system was included, consisting of a 22-megawatt, skid-mounted gas turbine and four diesel-generator hospital sets.

n. STEAM PRESSURE LEVELS

During Phase 0, the steam system design included three steam pressure levels--450, 150, and 75 psig. A single 200,000 lb/hr boiler generated 450-psig, 650°F superheated steam to backup the steam supply from the Calciner plant. A 15-megawatt turbine-generator, operating from the 150 psig steam system, provided electrical power to process equipment.

In the Phase I design, the steam system comprised five pressure levels: 900 psig 850°F superheated and 450, 150, 75 and 27 psig saturated. Two boilers generate 900 psig 850°F superheated steam; one is in continuous use and the other is backup for the steam generated by the Calciner plant. In the interest of cost reduction, the turbine-generator was eliminated and the steam made available by its elimination will power turbines which will replace electrical motor drives on the appropriate applications.

o. COAL STORAGE, DISTRIBUTION AND PREPARATION

The Demonstration Plant now includes a system capable of blending six different coals from their respective 30,000-ton storage piles to provide the Demonstration Plant with variations in coal feedstock, and hence, operating parameters.

p. LIQUID STORAGE CAPACITY

The liquid storage capacity was increased from 10 tanks of 300,000 bbls total capacity to 14 tanks of 450,000 bbls total capacity to accommodate process requirements and the larger product lines resulting from the inclusion of the Product Oil Fractionation Unit and the Naphtha Hydrotreater.

q. FIRE PROTECTION

The fire protection system in Phase 0 consisted of a single 800,000 gallon firewater tank, two electric-motor and two diesel driver firewater pumps having a total capacity of 3,300 gpm. Because of the better definition of the facility design during Phase I and, as a result of many discussions with insurance underwriters, the fire protection system grew to include two identical firewater supply systems (primarily and secondary), each having a 2 million gallon storage tank and four diesel-driven firewater pumps capable of delivering a total of 7,500 gpm.

21. DESIGN BASELINE CATEGORY A ENGINEERING CHANGE PROPOSALS

The following Category A Engineering Change Proposals (ECPs) were incorporated into the Original Design Baseline of the Area Contractors, as indicated. These ECPs covered changes to the technical designs as submitted with the Interim Project Baseline on 29 January 1981.

ECP No.	Description	Value
	A. SRC Process Area	
4-0054	C/S/A Standards Review Additional civil/structural/architectural specifications were reviewed by Catalytic. These additional specifications were not anticipated when Rev. 0 was issued.	11,000
4-0056	Parallel Medium Pressure Flash Drums The addition of parallel Medium Pressure Flash Drums will improve the reliability of the high-pressure slurry letdown valve system by allowing the letdown valve to be located at the vessel inlet nozzle. The downstream block valves are located in the "clean" overhead vapor stream. Removing the downstream block valves from three phase service (liquid-solid-vapor) will reduce the erosion of the valves, improve reliability in switching from the on-stream letdown valve to the standby valve, and allow tight shut-off of this failed letdown valve system for safer maintenance.	771,000
4-0057	Quench Slurry from Dissolver Effluent Separator The quench of the liquid from the bottom of the Dissolver Effluent Separator will improve the SRC recovery rate by minimizing the formation of pre-asphaltenes that are generated at 800°F or higher temperatures in the separator. The increase in available liquid capacity within the separator will provide enough time for operator response in case of failure of the high-pressure slurry letdown system.	3,771,000
4-0058 & 4-0062	Intermediate Fluid for Steam Generation, Hot Oil System These combined ECPs reduce the risk of having solids or hydrocarbons enter the steam system by reducing the operating pressure of the process system in the steam generators below that of the steam through use of an intermediate hot oil. Also included is optimization of the hot oil system and reduction of the capital cost of heat exchangers by raising the oil temperature from 650°F to 700°F.	220,000

ECP No.	Description	Value
4-0059 & 4-0060	Eliminate CSD Feed Drum and Pump These combined ECPs eliminate two circulation pumps and a feed drum for the Critical Solvent Deashing (CSD) system, increase the size of the Vacuum Column bottoms section to provide adequate residence time, and provide for jacketed process piping from the Vacuum Column to the CSD Unit. The capacity of the Emergency Drum Circulation pumps was increased so that the Emergency Drum material can be worked off at a satisfactory rate.	372,000
4-0061	3rd-Stage Light Phase Pump, CSD Heat Recovery Discussions with Kerr-McGee indicated that the Critical Solvent Feed Drum and associated equipment could be eliminated without jeopardizing the process design. By redesigning the heat recovery system, an annual operating cost savings of $1,000,000 is possible. Furthermore, a safety feature which reduces the risk of getting hydrocarbons into the steam generating system by lowering the process pressure below that of the steam, was incorporated.	(2,415,000)
4-0063	High-Temperature Heat Transfer Fluid Heater This ECP adds to Catalytic's scope of work a high-temperature heat transfer fluid heater and pump system for maintaining temperature and prevention of solidification in various process lines.	892,000
4-0101	Remote Electrical Power Centers This ECP relocates the electrical motor-control centers from a central location to seven remote motor-control buildings.	(678,000)
4-0104	Molten SRC & TSL Steam Generators To insure that the molten SRC does not set up in the exchanger tubes, the design of the exchangers was changed to raise the operating temperature from 423°F to 460°F.	1,453,000
4-0106	Eliminate One of Three P-12706 Pumps After re-examining the service of the 1st-Stage Recycle Critical Solvent Pump (P-12706), it was determined that the third pump is not essential.	(327,000)
4-0107	Increase Coal Slurry Drum Size Residence time for the Coal Slurry Drum (V-12201) was increased from 15 minutes to 30 minutes to provide adequate time for operator reactions during upsets in the coal/solvent mixing system.	151,000

Category A ECPs

ECP No.	Description	Value
4-0108	1st-Stage Heavy Phase Start-Up System Re-evaluation of the start-up sequence for the Kerr-McGee CSD Unit indicated that a problem existed in the quality of KMAC that would be generated until proper operating temperatures in the three settlers are achieved. Poor quality of KMAC could plug the Ash Conveying Systems. This ECP adds equipment that allows the material to be recycled until acceptable operating temperatures are reached.	900,000
4-0109	Pipe Rack Modifications The North-South pipe rack along the west side of the SRC Products Area Battery Limits was removed from Catalytic's scope of work and included in the Utilities and Off-Sites Area Contractor's scope of Work. Catalytic will locate some of its process pipes on the rack, which is mainly used for Area Contractor interconnecting piping.	(782,000)
4-0110	Removal of Fire Protection Supply Loop and Modifications to System This ECP eliminates the costs associated with the fire protection water supply loop surrounding the SRC Area. The loop will be provided by the Utilities and Off Sites Area Contractor.	(188,000)
4-0111	Hazardous Substance and Waste Inventory Additional engineering costs were required to develop the Hazardous Substances and Waste Inventory Report for the National Pollution Discharge Elimination System (NPDES) Permit.	6,000
4-0115	Reduction in Spare Pump Inventory The Process Design Baseline contained eight (8) spare (warehoused) process pumps. The SRC Area Matrix Team reevaluated the actual spare pump requirements for the SRC-I Demonstration Plant. The pumps are essentially all duplicates and only two (2) units are required in storage. The remaining six (6) pumps were removed from the baseline.	(85,000)
4-0119	Modifications to Maintenance Access Roads This ECP modifies and extends maintenance roads throughout the SRC Products area to provide adequate access for equipment maintenance.	1,662,000

Category A ECPs

ECP No.	Description	Value
4-0120	Slurry Preparation Structure This ECP adds the slurry preparation building and structure to Catalytic's scope of work. The original costs were in the Coal Pulverizer Building in the Utility and Off-Site Contractor's scope of work.	3,070,000
4-0121	Modifications to Coal Bin (BH-12201 A&B) The residence time of the Coal Calibration Bin (BH-12201 A&B) was increased from 15 minutes to 1 hour because the mass flow design by Jenke & Johanson required increased time for deaeration of the coal and ratio flow control of the pulverized coal and the process solvent system required increased capacity.	656,000
4-0122	Single Level BFW - 1100 PSIG By changing the boiler feed water supply to a single source, the process design was able to utilize the hot oil heat exchangers more efficiently and eliminate some pumps.	44,000
4-0124	Remove Design Factors for Vacuum Column Heater and Precondenser The Vacuum Column Heater (H-12601) and Vacuum Column Precondenser (E-12603) are not used during normal operation. The need for this equipment is during the start-up mode; therefore, the 1.1 design factor is not required.	(62,000)
4-0125	Increase Pressure of Wastewater Accumulator The maximum operating pressure in the Wastewater Accumulator (V-12507) was increased from 5 psig to 15 psig so that the flash gases (Stream #4542) can be delivered to the Gas Treating Area sour gas stripper without prior compression.	0
4-0126	Eliminate Spare Slurry Heater Coils The spare coil assembly for the Slurry Preheaters is no longer deemed necessary. Materials to effect any necessary repairs to operating coils are included in the facility spare-parts budget.	(1,841,000)
4-0999	Schedule Delay This ECP summarizes the costs incurred as a result of the schedule delay and extension of the project. This value includes funds actually expended due to the schedule delay plus additional costs caused by extending the schedule completion date of both Phase I and Phase II.	

ECP No.	Description	Value
	B. Coke and Liquid Products Area	
	Coker Area	
L-001	Cost and Schedule Control System Criteria (C/SCSC) A reduction in the Lummus budget for the consulting fees of Decision Planning Corporation resulted from negotiations between ICRC and Lummus. Part of this reduction was not included in the Interim Baseline (IBL).	(23,000)
L-018	Enclosing of Green Coke Conveyors Initially, it was believed that, to prevent the dispersion of potentially carcinogenic coke fines to the atmosphere, the green coke conveyors should be installed in fully enclosed galleries.	648,000
L-019	Cost Not Included in ECP L-011 As a result of screening meetings by Lummus and the review by ICRC of early PFDs, additional equipment was added to improve the operation of the Delayed Coker Plant: to emulsify the anti-foam agent with process solvent; to recover in a tank the hot SRC during flushings of the feedline; to provide more positive water flow from the Clear Water Tank to the Sluiceway by pumping it rather than resorting to gravity, and; to regulate by Vibratory Feeder the flow of green coke from emergency dump storage to the Calciner for processing.	835,000
L-022	Hot and Cold Drain Systems Because of the classification of process fluids to be potentially carcinogenic, separate drain systems were added for colder light oils and hot heavy oils. Separate drains prevent the mixing of the light oils with the hotter heavy oils which would release too many volatiles.	530,000
L-023	Dry Slop Oil System Separate Dry and Wet Slop Oil Tanks were incorporated into the blowdown system so that dry slop oil could be collected and recycled directly to the Combination Tower for recovery. Wet slop oil will be recycled normally within the blowdown system. Previously, all slop oil was collected in a Slop Oil Tank and, if dry, was recycled to the Combination Tower or, if wet, was sent off-site for disposal or incineration.	226,000
L-024	Added Equipment to Meet Design Criteria Additional equipment was added: to insure the return of steam condensate to the system in a subcooled condition; to protect by filtration the Jet Pump from fines generated by the coke-cutting equipment, and; to protect the slurry pumps installed in a pit from possible flooding from rain by the addition of sump pumps.	153,000

ECP No.	Description	Value
L-026	Wet Gas Compressors A second (spare) full-size Wet Gas Compressor, which had been overlooked in the Interim Baseline, was added into the system.	959,000
L-027	Clarifier Flow Scheme The flow of clear water from the Clarifier to the Clear Water Tank was changed from a pressure system with pumps to a gravity flow system. The Clarifier was elevated while the Clear Water Tank was shortened in height.	(89,000)
L-028	Miscellaneous Equipment Additions and Deletions Since the central BFW supply pressure was increased from 200 psig to 1,100 psig, the BFW Booster Pumps and associated BFW Surge Drum were eliminated.	(206,000)
L-029	Wire Mesh Mist Eliminators In order to protect the Wet Gas Compressor and sour gas transfer line from corrosion due to the carry-over of sour water mist, wire mesh mist eliminators were added to the Combination Tower Overhead Accumulator, Wet Gas Compressor Suction and Discharge Drums.	20,000
L-031	Disposal of Hydrocarbon Vapors In order to comply with environmental regulations, the vapors from liquid hydrocarbon hold drums must not be vented to the atmosphere. Accordingly, the Wet Slop Oil, Flushing Oil and Anti-Foam Tanks were changed from atmospheric tanks to pressure vessels and their discharges were directed to an Incinerator.	321,000
L-034	Redution in Project Control Budget As a result of contract negotiations between Lummus and ICRC, Lummus reduced its Project Control Budget by 7,500 man-hours.	(254,000)
L-041	Coker Equipment Changes Spare units will be installed for the Coke Drum Cooling Pump and Coke Slurry Sump Pump. It will also be necessary to add the hydraulic power pack to position the Coker Crusher and telescoping chutes under the Coke Drums and to include slide gates on the Hydrobins.	161,000

ECP No.	Description	Value
	Calciner Area	
L-021	Coke Silo Design Study Lummus performed a study to determine the optimum calcined coke storage system.	12,000
L-025	Addition of Fuel Gas System Equipment Additional equipment was added as required for the proper operation of the fuel gas system. This included the condensate knock-out drums for the heater, kiln, and incinerator firing systems as well as a duplex oil filter for the fuel oil system.	99,000
L-032	Revision of Coke Product Silo Design In the interest of economy, the two Coke Product Silos of 14,000 tons total capacity have been reduced to 7,000 tons of total capacity. Peripheral silo equipment not included in the Interim Baseline has been added, as required.	(970,000)
L-040	Calciner Conveyor Enclosures As part of an ICRC cost reduction effort, the requirement for totally-enclosed galleries on the calcined coke conveyors has been modified to require covers over the conveyors only.	0
L-042	Calciner Equipment Changes To improve the operation of the Calciner, equipment not accounted for in the Interim Baseline has been added to: provide on-site dedusting oil storage after the elimination of offsite storage; provide the capability of bypassing the SO_2 Scrubber and venting the flue gas to the stack; allow manual isolation of the Soda Ash Bin; remove excess water from the sump area. Also, one soda ash feed system was deleted and will be substituted by an alternate system which is under design.	169,000

ECP No.	Description	Value
	Expanded Bed Hydrocracker Area	
L-014	ICRC's Proposed LC-Finer Recovery Scheme Lummus performed a study to determine the efficiency of an alternate scheme for recovering Expanded Bed Hydrocracker (EBH) liquids. ICRC proposed this scheme in the belief that it would be more thermally efficient.	61,000
L-015	EBH Makeup Gas Compressor Changes The ICRC Interim Baseline (IBL) included three Hydrogen Makeup Gas Compressors, each designed to handle a nominal 50% of the design makeup hydrogen flow. After evaluating the advantages of this design and the capital costs for the compressors, it was decided that it would be more cost-effective to use two machines instead, each designed to handle a nominal 100% of the design makeup hdyrogen flow.	(2,692,000)
L-016	Compressor Closed Loop Cool Water Systems Closed loop cooling water systems, using a 50/50 mixture of ethylene glycol and softened water instead of cooling tower water, were incorporated to eliminate fouling in the cooling water jackets of reciprocating compressors and to reduce the associated maintenance costs.	183,000
L-030	EBH Fractionation Design An increase of fractionation capabilities in the Catalytic area to produce marketable products has allowed the original liquid product specifications for the EBH to be relaxed. This resulted in cost reductions in investment and operating costs largely from the elimination of the naphtha stabilizer.	(594,000)
L-033	Revised Fractionation Scheme Due to a change in the product specifications, Lummus was required to revise the fractionation scheme. This is a supplement to the work performed in ECP L-014.	23,000
L-035	Added Equipment for Atmospheric Tower To obtain better control, and increase the ease of operability and startup of the Atmospheric Tower, ICRC required Lummus to add two trapout trays and a pump to the tower design. This equipment will aid in the control of liquid traffic in the tower.	31,000

ECP No.	Description	Value
L-036	EBH Hot and Cold Drain Systems To recover valuable oils and to prevent the contamination of the waste treatment system with possibly hazardous oils, separate equipment drains were added for light oils and hot heavy oils. Separate drains prevent the mixing of light oils with the hotter heavy oils which could cause flashing of the more volatile components of the light oils.	584,000
L-037	HP Off-Gas Compressor Size In the interest of economy, it was decided that the two 100% capacity HP Off-Gas Compressors should be reduced in size to nominal 60% capacity machines.	(2,973,500)
L-038	EBH Knockout Pots Additional equipment was added as required for the proper operation of the fuel gas system. This included condensate knockout drums for each of the three EBH heaters plus two decoking knockout drums for the Fuel Oil Heater and Vacuum Tower Heater.	174,000
L-039	EBH Startup/Shutdown System To startup the Expanded Bed Hydrocracker, a reserve of light and heavy oils must be available to feed the reactors. The additional equipment necessary includes two 5,000 bbl. tanks to store the oils, pumps to feed the oils to the EBH, and an air cooler to cool the hot oil returning to the tanks.	772,000
L-043	EBH Equipment Changes To improve the operation of the Expanded Bed Hydrocracker, equipment not accounted for in the IBL has been added to: remove heat from the recycle flow around the Vent Blower from the Startup Tanks; remove liquid from the flare gas to the incinerator system which will help minimize discharges to the atmosphere and prevent blockage of flare lines; protect pumps located in pits from flooding; remove condensate from compressor knockout pots; pump steam condensate into a higher pressure return header.	365,000

ECP No.	Description	Value
L-999	Schedule Delay This ECP summarizes the costs incurred as a result of the schedule delay and extension of the project. This value includes funds actually expended due to the schedule delay plus additional costs caused by extending the schedule completion date of both Phase I and Phase II.	

ECP No. Description Value

C. Cryogenic Systems Area

3-0006 HPU Integration into the Gas Systems Area (338,000)

The design of the Hydrogen Purification Unit (HPU) of the Cryogenic Systems Area (Area 14) will be integrated with the design of the Gas Systems Area (Area 15) being done by R. M. Parsons Co. (RMP). Physically, the HPU will be located within the Gas Systems Area battery limits, but will not become part of the Gas Systems scope of work. That is, all responsibility for the HPU battery limits scope of work will remain with Air Products and Chemicals, Inc. (APCI). As detailed below, all interfaces to the HPU will be with the Gas Systems Area, and several pieces of non-process equipment will be transfered from the Cryogenic Systems scope of work to the Gas Systems scope.

3-0007 Reactivation Heater (31,000)

During the Phase 0 design of the SRC-I facility, the concentration of CO_2 in the recycle-hydrogen stream leaving the DEA Unit for processing in the HPU was set at 10 ppmv. At this level of concentration and with the composition of the recycle gas stream, the CO_2 was soluble in the fuel gas stream leaving the HPU, and it was only necessary to process the stream through alumina adsorbers to remove water. The Reactivation Heater for the alumina adsorbers was rated at 1.3 MM Btu/hr, and represented a reasonable size for an electric heater.

During the Phase I design, the content of the inert gases (nitrogen, argon, and carbon monoxide) of the recycle-hydrogen stream increased, requiring a lower temperature in the HPU to achieve the same hydrogen purity and to decrease the CO_2 solubility in the fuel stream. This required that molecular sieve adsorbers be used for reducing the CO_2 content to 1 ppmv. The larger size of these adsorbers compared to the alumina adsorbers resulted in an increase in the size of the Reactivation Heater to 4.0 MM Btu/hr. Thus, it is no longer practical to use an electric heater for this large size and a change to a gas-fired heater is jusitified.

3-0008 Third Feed Drier Vessel 367,000

During Phase 0, the composition of the process gas leaving the DEA Unit was established to contain 10 ppmv of CO_2. At cryogenic temperatures, this level of concentration was soluble in the hydrocarbons also contained in this stream. While the CO_2 concentration has remained constant, the gas composition in Phase I includes a higher level of nitrogen, argon and carbon monoxide. This requires the operation of the HPU at lower temperatures which would cause the CO_2 to

ECP No.	Description	Value
	freeze. To prevent this, the driers were changed from alumina to molecular sieve units. However, inadequate reactivation gas was available for these larger vessels. To overcome the shortage of reactivation gas, a third vessel has been added which permits the use of the reactivation gas twice to cool one vessel and heat a second vessel consecutively.	
3-0010	Increased Capacity for HPU Because of new Expanded Bed Hydrocracker yield structures, a design modification of the HPU is required so that sufficient hydrocarbons are rejected in the HPU to maintain hydrogen purity for the SRC Process Area. This modification will require a revised design for the HPU to reflect an increase in feed flow by approximately 13 percent. This modification should not increase the expected surface requirement of the main heat exchanger.	$211,000
3-0011	Power Distribution to Air Separation Unit The ASU Interim Baseline assumed low voltage power distribution to the ASU. Subsequent to the Interim Baseline, the U&O Area Subcontractor determined that this arrangement presented problems in the main substation, and that high voltage distribution to the ASU would provide greater reliability and reduce the cost of equipment on a plant-wide basis. The necessity to add transformers and switchgear results in a cost increase in the ASU area.	952,500
1-0012	Removal of Vacuum-Jacketed Liquid Nitrogen (LIN) Line This ECP covers the removal of the vacuum-jacketed (V-J) LIN line between the ASU and the HPU. The transfer of LIN can be achieved by the use of a cryogenic tank truck which would be provided. The ASU and the HPU have truck loading and unloading facilities, respectively, already included in their scope of supply.	(51,000)
3-0999	Schedule Delay This ECP summarizes the costs incurred as a result of the schedule delay and extension of the project. This value includes funds actually expended due to the schedule delay plus additional costs caused by extending the schedule completion date of both Phase I and Phase II.	

ECP No.	Description	Value
	D. Gas Systems Area	
1-6009	HPU Integration into Gas Systems Area This ECP covers the increased Gas Systems engineering and material costs resulting from the integration of the Hydrogen Purification Unit directly with the Gas Systems Area Contractor instead of the Outside Battery Limits Facility Area Contractor.	--
1-6018	Dust Preparation Unit Design Changes This ECP covers the GKT engineering costs to design a two-stage classification system for the removal of oversized KMAC. This system replaced the grinding equipment in the Interim Baseline. The costs for the classification system are included in ECP 1-6019.	(9,000)
1-6019	Modifications to DPU Grinding Equipment This ECP covers the deletion of grinding equipment for oversized KMAC in the Dust Preparation Unit and the replacement of it with a two-stage classification sytem for the removal of the oversized material. The oversized material is currently collected and reblended into the feed to the Gasification Unit.	(3,717,000)
1-6020	Selexol Carbon Dioxide Stack This ECP allows for the venting of CO_2 waste gas from the Selexol Unit via a stack located in the Shift Unit. This will eliminate the possibility of H_2S odors at ground level. The compression of the CO_2 and preheating against the Shift Unit effleunt are included in this change.	2,468,000
1-6021	Jacket Cooling Water System for Reciprocating Compressors This ECP will provide for a separate water-cooled, closed loop cooling system using treated water for each reciprocating compressor service. There are two such compressors affected by this change: the Hydrogen Compressors and the H_2S Recycle Compressors in the Selexol Unit.	358,000
1-6022	GKT Participation in KMAC Lab Study GKT provided technical direction to Jenike and Johanson for their lab study which examined KMAC flow properties. The extent of GKT's participation included the review of test procedures, definition of coal samples, provision of relevant equipment parameters, and the review of the test report.	58,000

ECP No.	Description	Value
1-6023	Chloride Study - ASWS A study was performed to investigate the use of caustic and lime additions to reduce the concentration of free and fixed ammonia in the ASWS stripped water. High ammonia concentrations could inhibit the biological reaction in the Wastewater Treatment System.	10,000
1-6027	GKT Coal Gasification Tests - Additional Analyses GKT performed additional trace analyses of the gasifier raw synthesis gas. This ECP covers those analyses plus the analysis of the raw gas particulates, filtered wash water, dried fly ash and gasifier slag.	10,000
1-6028	Beavon SRU LPG Vaporizer The operation of the Reducing Gas Generator in the Beavon Unit requires a constant composition of vaporized LPG. There is an LPG vaporizer in the LPG storage area, but its operation is intermittent and not satisfactory for the small flow required by the Beavon SRU. A small vaporizer singularly dedicated to the Beavon SRU service will be used.	87,000
1-6029	DEA System Rework A redefinition of the feedstock specifications to the DEA Unit required that several changes be made in its design. A cost savings resulted from the reduction in size of NH_3 and HCl columns and from the deletion of the Gas Coolers and Wash Pumps. Costs are also included for Parsons assistance in performing the SRC sour water flash calculations.	(196,000)
1-6030	LPG System Rework on Feed Compressors In routing the Drier Reactivation Gas to the HPU, it was necessary to increase the size of the LP Feed Gas Compressor from one stage to two stages. This ECP covers the cost of implementing this change.	1,330,000
1-6031	Parsons Manhour Gap for GKT Work Scope This ECP covers the cost for R. M. Parsons to perform additional engineering on the Dust Preparation Unit and the Wash Water Treatment Unit prepared by GKT. This engineering was not originally in Parsons scope of work.	882,000
1-6032	Contractual Changes Since March 16, 1981 This ECP covers the costs for Parsons to perform additional tasks as required by the Master Project Procedures (MPP 11-1 and MPP 11-2). These requirements were not in Parsons original scope of work.	738,000

ECP No.	Description	Value
1-6033	Add Centrifuges, Second Decanter Centrifuge equipment has been added in order to reduce the consumption of Stretford solution in the Beavon SRU.	1,732,000
1-6999	Schedule Delay This ECP summarizes the costs incurred as a result of the schedule delay and extension of the project. This value includes funds actually expended due to the schedule delay plus additional costs caused by extending the schedule completion date of both Phase I and Phase II.	

ECP No.	Description	Value
	E. Outside Battery Limits Facility Area	
1-7101	Revise Electric Power Distribution This ECP covers the cost to increase the power distribution system from a four-transformer, 100 megawatt system to a four-transformer, 150 megawatt system. The need for the increase is attributed to a better definition of contractor requirements. Also, included is the cost of an emergency power system consisting of a 22 megawatt, skid-mounted gas turbine and four diesel-generator hospital sets.	$14,900,000
1-7102	Revise Plant Utilities Utility requirements have increased 25 to 50 percent to accommodate overall plant requirements. The maximum requirements of compressed air have increased by 300 percent. Flare and utility requirements have changed as a result of better definition from the Area Contractors. The ground flare was eliminated and the Thermal Oxidizer and Vent Gas Incinerators were better defined. In addition, improved capital equipment estimates resulted in significant increases in capital costs and vendor engineering.	22,400,000
1-7103	Revise Interconnecting Systems The extent of interconnecting system increased in order to accommodate the expansion in the overall site plan from 3.9 to 4.5 MM square feet to accommodate the requirements of the other Area Contractors. Redefinition of the waste water collection system resulted in a reduction in the number of sewers from six to three. Area Contractors redefined their requirements to effect a reduction in the number of lines entering or leaving the interconnecting systems from 320 to 303.	14,900,000
1-7104	Revise Water and Waste Treatment A better definition of waste streams including the analysis of chlorides and ammonia recycles made it evident that Reverse Osmosis and Evaporator Residue Fixation will be required for the zero discharge mode of operation. Also, the Wet Oxidation process has been added to regenerate powdered activiated carbon.	36,900,000

Category A ECPs

ECP No.	Description	Value
1-7105	Revise Site Development This ECP covers the increased cost of site landscaping, site lighting, and expanded tabletop grading packages. These changes resulted from better definition of the site development requirements. The major change is the elimination of the barge dock which resulted after the CM/C developed an alternative method to receive heavy equipment.	($1,500,000)
1-7106	Revise Non-Process Buildings Redefinition of building function requirements has resulted in an increase in the areas for non-process buildings from 164,245 square feet to 194,044 square feet.	10,900,000
1-7107	Revise Liquid Storage Capacity Liquid storage capacity increased from ten tanks at 300,000 bbls capacity to fifteen tanks with 430,000 bbls capacity. The current tank farm design is based on process requirements and the current marketing analysis of product storage requirements. A reduction in scope resulted when the DEA, Selexol, caustic, sulfur and LPG storage systems were transferred for inclusion in the Gas Systems Area.	5,500,000
1-7108	Revise Coal Storage and Transfer An improvement in the understanding of the design requirements resulting from the Design Baseline has resulted in changes in conveyor configuration, an increase in one sampling tower and a better understanding of electrical system requirements. In addition, the quality of the capital cost estimates has improved significantly.	4,200,000
1-7109	Revise Coal Preparation To improve on-stream reliability, the coal pulverizing system has been changed from two 125 TPH pulverizers to three 85 TPH pulverizers. Also, the improved definition of the Design Baseline has resulted in an increased estimate for engineering manhours.	11,400,000
1-7110	Revise SRC Storage SRC blending capability has been added and the system design has been changed to reduce fugitive emission and product degradation. Reduction of SRC storage capacity, from 70,000 tons to 60,000 tons, based on marketing input, resulted in a partially offsetting cost decrease.	10,500,000

ECP No.	Description	Value
1-7111	Revise Program Management - Phase I This ECP covers program management costs resulting from the increases in the scope of the project as a result of better definition of reporting requirements in such areas as Quality Assurance Procedures and Assessments; Procurement Procedures and Reporting; Documentation Requirements; CM/C Interface Coordination; Definition Model; and Safety and Environmental Reviews and Reports.	8,400,000
1-7112	Revise Engineering Technical Support - Phase I Additional technical studies were required to support the expanded scope of work described by ECPs 1-7101 through 1-7110.	100,000
1-7113	Revise Engineering Services This ECP covers the increases in costs which result from the extension of the project due to funding restraints and redefinition of engineering services requirements.	3,700,000
1-7999	Schedule Delay This ECP summarizes the costs incurred as a result of the schedule delay and extension of the project. This value includes funds actually expended due to the schedule delay plus additional costs caused by extending the schedule completion date of both Phase I and Phase II.	

ECP No.	Description	Value
	F. CENTRAL CONTROL SYSTEM	
9-0999	Schedule Delay This ECP summarizes the costs incurred as a result of the schedule delay and extension of the project. This value includes funds actually expended due to the schedule delay plus additional costs caused by extending the schedule completion date of both Phase I and Phase II.	

ECP No.	Description	Value
	G. ICRC	
1-0010	Spare Parts Budget Increase The spare parts philosophy for the total facility requires the inclusion of additional costs not contained in the Interim Baseline for all process areas.	15,744,000
1-0011	Corrosion/Erosion Monitoring Program A total facility corrosion/erosion monitoring program includes a combination of corrosion probes and coupons for selective corrosion monitoring and selected locations for ultrasonic testing for erosion. The value of this ECP includes the costs for the SRC and the Coke and Liquid Products Areas. The Gas Systems Area costs are included as a Category B ECP. The Utilities and Offsite Area costs are distributed among their Category A ECPs.	169,000
1-0014	SRC Toxicology Investigation This program will investigate the mutagenesis potential, acute toxicity and long-term chronic toxicity (including carcinogenic and teratogenic potential) of SRC products, selected intermediate process streams and waste products. The data generated will be used for four main purposes: 1. to support TSCA Premanufacturing Notification 2. to help assess worker safety and health hazards 3. to help estimate environmental impacts of SRC-I technology 4. to promote public and regulatory acceptance of SRC-I products and waste disposal practices	5,490,000
	Schedule Delay	
1-0999	This ECP summarizes the costs incurred as a result of the schedule delay and extension of the project. This value includes funds actually expended due to the schedule delay plus additional costs caused by extending the schedule completion date of both Phase I and Phase II.	

22.0 STATEMENT OF WORK CROSS-REFERENCE

This document is a Cross-Reference from the Statement of Work to the Baseline or other deliverables. Chapter references are for Phases I & II of the Project Baseline book unless identified otherwise.

Statement of Work Requirements	Baseline/Deliverable Reference
I. PHASE I	
A. GENERAL	
The Demonstration Plant shall have a nominal capacity to process 6,000 tons-per-stream-day (TPSD) of moisture-free coal.	a) Chapter I.A. - SRC-I Project (WBS 1.0) b) Appendix B - 3.0 Design Basis Memoranda - Summary Project
The Demonstration Plant shall be planned and constructed so as not to preclude the ultimate expansion to a commercial-size plant of approximately 30,000 TPSD of coal capacity.	
The Plant shall be designed to process high sulfur coal with a minimum sulfur content of 2 ½%.	
The advantages of a product slate which results from the inclusion of the coking/calcining and Expanded Bed Hydrocracking processes shall be explored.	
The Demonstration Plant design shall include the components to process a nominal one-third of the SRC product through coking and calcining and a maximum one-third through an Expanded Bed Hydrocracker.	
B. SUMMARY OF SCOPE	
The primary product of the Phase I effort shall be a complete engineering design of the SRC-I Demonstration Plant. The Phase I work will use the Phase 0 technical output, including bridging tasks, as the basis.	Chapter I.A. - SRC-I Project (WBS 1.0)
C. PROJECT MANAGEMENT	
1. General	
The Contractor shall perform all activities to effectively plan, organize, staff, and execute	Appendix B - 4.0 Project Management Plan

Statement of Work Requirements	Baseline/Deliverable Reference
all work under this contract.	
2. Project Management Plan The Contractor shall prepare a comprehensive plan for the accomplishment of the Project. The Project Management Plan (PMP) shall be updated and revised as detailed information is developed and becomes available. The Contractor shall implement the procedures and systems defined in the PMP.	
3. Supplementary Plans The Contractor shall develop and implement various plans which will supplement the Project Management Plan.	
4. Project Schedule The Contractor shall develop a Master Project Schedule for execution of Phases I, II and III.	a) Chapter I.C. - SRC-I Project (WBS 1.0) - Schedule Summary b) Chapter III.A.3 - Milestone Schedul III.B.1.c - III.B.2.c - IV.A.3 - IV.B.3 - V.A.3 - V.B.3 - VI.C.3 - VI.D.3 - VI.E.3 - c) Appendix B - 19.0 Intermediate Schedule Back-Up Detail
5. Procurement a. General The Contractor shall develop a list of components for which vendor engineering data is required for completion of detailed engineering during Phase I.	Appendix B - 4.0 Procurement Manual
b. Procurement Procedure The Contractor shall develop a set of procurement procedures to be utilized during execution of the Project.	Appendix B - 4.0 Procurement Manual
c. Vendor/Subcontractor Selection The Contractor shall develop and maintain a list of acceptable qualified vendors and subcontractors.	Appendix B - 4.0 Procurement Manual

Statement of Work Requirements	Baseline/Deliverable Reference
d. Proprietary Process Licenses	
The Contractor shall negotiate the licensing agreements for the use of proprietary processes in the Demonstration Plant.	Appendix B - 4.0 Procurement Manual
6. Quality Assurance	
The Contractor shall prepare a quality assurance program for all phases of the project.	Appendix B - 4.0 QA Plan
7. Construction	
The Contractor shall prepare a comprehensive construction plan.	Appendix B - 12.0 Construction Strategy
The Contractor shall identify the amount of field construction work to be performed by Force Account for each of the project areas.	
8. Project Cost Forecasts (Estimates)	a) Chapter 1.B - SRC-I Project Cost Plan
The Contractor shall prepare a Project Cost Estimate.	b) Appendix B - 18.0 Cost Estimate Backup Detail c) Phases IIIA & IIIB - Appendix 2.0 Operating Cost Assumptions and Support Data
9. Phase II CWBS	
The Contractor shall prepare a Phase II Contract Work Breakdown Structure (CWBS).	Appendix B - 1.0 PWBS and Dictionary
D. SITE ACQUISITION, FINALIZATION	
1. Site Evaluation	
The Contractor shall identify criteria to be considered in a site confirmation study. The Contractor shall evaluate a single site based on these criteria, utilizing preliminary field investigations and private and public organization data.	Site Evaluation Criteria (Transmitted 4/29/80 to J.F. Pearson)

Statement of Work Requirements	Baseline/Deliverable Reference
2. Site Data	
The Contractor shall complete the geotechnical investigation.	Rust Utilities and Offsites Subcontract
3. Site Confirmation Report	
The Contractor shall prepare a Site Confirmation Report.	Site Confirmation Study Final Draft Issued 12/10/80
4. Draft Site Agreement	
The Contractor shall continue the work begun in Phase 0 to develop draft agreements for the acquisition, lease, or other utilization of the site for the construction and operation of the Demonstration Plant.	Chapter VI.E.1.b. Land Acquisition
5. Infrastructure Plan	a) Phase IIIA & IIIB - Appendix 2.0 - Operating Cost Assumptions and Support Data
The Contractor shall develop plans and draft contracts for obtaining all raw materials and major chemical/catalysts and supplies.	b) Appendix B - 13.0 Coal Supply Strate c) Appendix B - 15.0 Catalysts and Chemical Requirements
The Contractor shall develop a plan to obtain the water supply for the Demonstration Plant.	a) Chapter V.A.1.b - Off-Site Facilitie River Structures b) Appendix B - 10.0 a - E.P.L.A. - Per Plan
The Contractor shall develop and draft contracts to secure the electricity required for the Demonstration Plant.	Chapter V.A.1.a - Utility Systems/ Electrical Power Distribution System
The Contractor shall develop plans for the transportation of raw materials and products to and from the facility.	a) Appendix A - 1.4.1.A - Utilities and Offsites - Design Baseline b) Appendix B - 13.0 Coal Supply Strateg
The Contrator shall develop plans for the on-site disposal of all solid wastes.	a) Chapter V.A.1.b - Offsite Facilities/ Solid Waste Disposal b) Chapter VI.E.1.a - Environmental and Permits c) Appendix B - 10.0 c - On-Going Projec Related Environmental Activities
E. OPERATIONS REVIEW & PLANNING	
1. Review	a) Appendix B - 9.0 Master Project Procedure 1-4, ICRC Review and Approval of Contractor Technical Documents and 6-3, Reliability Analysis by Area Contractors.
The Contractor's operations staff shall review all P&IDs, equipment selection(s), plot plans, and models for operability, reliability and ease of maintenance throughout the life of the facility.	b) Phases IIIA & IIIB - Appendix 1.0 Reliability - Maintenance Discussion

Statement of Work Requirements	Baseline/Deliverable Reference
2. Operations Planning	
The Contractor shall develop detailed plans, including time tables, for staffing the facility, training operators and mechanics, and hiring qualified personnel.	Chapter VII.D. - Recruiting and Train (WBS 1.6.4)
The Contractor shall prepare operating plans and outlines of handbooks, maintenance manuals, spare parts catalogs, and mechanical catalogs.	a) Appendix B - 9.0 Master Project Procedure 6-1, Operating and Maintenance Manuals b) Chapter VII.B. - Checkout and Commissioning (WBS 1.6.2)
3. Health and Safety The Contractor shall prepare a facility safety manual, plans and procedures for the implementation of an industrial hygiene program, and procedures for handling emergencies.	a) Phases IIIA & IIIB - Appendix 3.0 Occupational Safety and Health Philosophy and Program b) Appendix B - 4.0 Safety Program c) Chapter VI.E.1.a - Environmental Permits
4. Equipment The Contractor shall prepare lists and general specifications for equipment required for the start-up, operation, and maintenance of the facility.	a) Chapter VII.A. - Spare Parts b) Chapter VII.C. - Capital Equipment c) Appendix B - 15.0 Initial Catalys and Chemical Requirements d) Appendix B - 16.0 Spare Parts Sup Data e) Appendix B - 17.0 Operations Capit Equipment Support Data f) Phases IIIA & IIIB - Appendix 1.0 Reliability - Maintenance Discussio g) Phases IIIA & IIIB - Appendix 2.0 Operating Cost Assumptions and Support Data
F. TECHNICAL SUPPORT	
1. General The Contractor shall prepare and implement an overall Process R&D plan and a support studies plan.	Appendix B - 5.0 R&D Plan
2. Design Basis Memorandum (DBM) The Contractor shall prepare a Design Basis Memorandum for each Plant area, utilizing the results of the Phase 0 deliverables and the bridging tasks.	Appendix B - 3.0 Design Basis Memoranda
3. Process Design Criteria The Contractor shall prepare Process Design Criteria that will serve as a general guideline to all Area Subcontractors on process	a) Appendix A - 1.0 Process Design Criteria b) Appendix B - 3.0 Design Basis Memoranda

Statement of Work Requirements	Baseline/Deliverable Reference
design philosophy, turndown objectives, installed spares philosophy and other process related areas.	
4. Pilot Plant Liaison The Contractor shall maintain effective liaison with all DOE-sponsored coal liquefaction pilot plant programs to insure timely planning and the transfer of technology.	a) Chapter VI.C. - Technical Support (WBS 1.5.3) b) Appendix B - 5.0 R&D Plan c) Appendix B - 25.0 Wilsonville Pilot Plant Support
5. Data Base Requirements The Contractor shall identify critical data base needs, provide for these needs internally or through subcontract if necessary, and recommend to the DOE those needs which can be satisfied through on-going DOE programs.	
6. Process Steady-State and Dynamic Modeling The Contractor shall develop steady-state and dynamic models of the facility and its components to permit verification of process control design and intermediate holdup vessel design.	Chapter VI.C.1.c - Modeling (WBS 1.5.3.3)
7. Critical Equipment Design The Contractor shall establish a list of "Critical Technology Equipment."	Appendix B - 7.0 Critical Technology Plan
8. Trade-Off and Technical Uncertainty Studies The Contractor shall conduct process trade-off and technical uncertainty studies. The Contractor shall maintain a list of studies to be performed and their schedule for completion.	TOS/TUS Status List (issued bi-monthly)
9. Studies of Varying Process Parameters As directed by DOE, the Contractor shall analyze the as-designed Demonstration Plant	a) Chapter VI.C. - Technical Support (WBS 1.5.3) b) Appendix B - 5.0 R&D Plan

Statement of Work Requirements	Baseline/Deliverable Reference
to determine the ability and flexibility of the Plant to handle various process parameters.	
G. PRODUCT UTILIZATION ACTIVITY	
1. General	
2. Product Utilization Activities	
a. Market Analysis	
The Contractor shall analyze the specific market needs for the various products of the SRC-I process in solid, liquid, gaseous, or mixture form. The economic analysis shall include a review, and update if required, of the conceptual product slate for the commercial plant.	a) Chapter VI.D. - Product Utilization (WBS 1.5.4) b) Appendix B - 4.0 By-Product Disposition Plan c) Appendix B - 8.0 Product Demonstration Plan
A special part of this market analysis activity will be the reassessment of the potential market for SRC burned in solid form, not as part of a mixture, in utility and industrial boilers. The contractor shall submit an interim report on this reassessment by October, 1980.	Solids Market Assessment Transmitted 10/10/80 to J.F. Pearson
b. Product Demonstration and Application Engineering	
The Contractor will prepare and implement a Product Demonstration and Application Engineering program to demonstrate the feasibility of using SRC-I products from the Demonstration Plant.	Appendix B - 8.0 Product Demonstration Plan
c. Sales	
The Contractor shall develop a marketing plan to satisfy all objectives in subparagraph G.1. The Contractor's sales activities	a) Chapter VI.D. - Product Utilization (WBS 1.5.4) b) Appendix B - 4.0 By-Product Disposition Plan c) Appendix B - 8.0 Product Demonstration Plan

Statement of Work Requirements	Baseline/Deliverable Reference
shall be concentrated on securing commitments from an appropriate number of customers for the purchase of the different products of the SRC-I Demonstration Plant.	
d. Interface with Federal, State and Local Environmental Agencies.	
The Contractor shall interface with the above agencies on matters regarding product utilization	Appendix B - 8.0 Product Demonstration Plan
H. COAL SUPPLY	
The Contractor shall obtain the commitments required to assure the supply of Kentucky No. 9 or other appropriate coal(s) in adequate quantities to serve as feedstock for the Demonstration Plant.	Appendix B - 13.0 Coal Supply Strategy
I. TRANSFER OF TECHNOLOGY AND PUBLIC AFFAIRS	
Technology shall be transferred to the public domain in accordance with this contract. The Contractor shall develop and implement a Technology Transfer Plan to assure transfer of process, end-use, end product, and other technologies.	Appendix B - 4.0 Technology Transfer Plan
The Contractor shall develop and implement a Public Affairs program to inform the public of the SRC-I Project and related synthetic fuels issues.	Chapter VI.B.1.a - Administration (WBS 1.5.2.1)
J. ENVIRONMENTAL	a) Chapter VI.E.1.a - Environmental and Permits
The Contractor shall continue the work initiated in Phase 0 to provide information in support of the preparation of an Environmental Impact Statement and for the preparation of the applications for required environmental permits.	b) Appendix B - 4.0 Safety Program Plan c) Appendix B - 10.0 a,c Permit Plan; On-Going Project Related Environmenta Activities d) Phases IIIA & IIIB - Appendix 3.0 Occupational Safety and Health Philosophy and Program
The Contractor shall supply information necessary for the preparation of responses to comments	e) FEIS issued July, 1981 f) Pre-construction Monitoring Plan issued 10 August 1981

Statement of Work Requirements	Baseline/Deliverable Reference
received on the Draft Environmental Impact Statement.	
The Contractor shall initiate a program to investigate the toxicity, including mutagenic and carcinogenic potential, of SRC products and selected process intermediates and waste products.	
K. DESIGN	
1. General	
The Contractor shall complete all engineering design activities required to successfully construct the Demonstration Plant.	
2. Process Design	
a. Heat and Material Balances	
The Contractor shall prepare detailed heat and material balances and shall tabulate all process and recycle stream data, including operating conditions, flow rates, compositions, and chemical and physical properties of the process streams, required for equipment design.	Appendix A - Individual Plant Area Design Baselines
b. Process Flow Diagrams (PFDs)	
The Contractor shall prepare Process Flow Diagrams for each Area of the Plant.	
c. Control and Operating Philosophy	
The Contractor shall prepare an operating philosophy document.	Appendix B - 4.0 General Engineering Specification 0001-50-005, Control Systems Design Criteria (CSDC)
d. Process Specifications	
The Contractor shall prepare a process specification for each piece of equipment in each Area of the Plant.	Appendix A - Individual Plant Area Design Baselines

Statement of Work Requirements	Baseline/Deliverable Reference
3. Equipment-Mechanical Specifications The Contractor shall develop a mechanical specification for each piece of equipment and hardware.	Individual Area Contractor Subcontracts
4. Piping and Instrument Diagrams (P&IDs) The Contractor shall prepare complete and detailed Piping and Instrument Diagrams for each processing unit.	
5. Plot Plan The Contractor shall prepare a series of plot plan studies for the overall facility.	Appendix A - Individual Plant Area Design Baselines
6. Equipment Arrangement The Contractor shall develop a detailed equipment arrangement for each physical, process area of the Plant and shall subject the arrangement to a series of reviews to verify constructability, maintainability, safety, and economy.	Individual Area Contractor Subcontracts
7. Piping Model The Contractor shall develop a detailed, scaled piping model of each process unit. The Contractor shall hold frequent model reviews with the operations or construction staffs on matters of safety, constructibility, and maintainability.	
8. Drawings The Contractor shall prepare orthographic drawings and isometrics, or plans and isometrics, to represent areas of the Plant that do not readily lend themselves to modeling.	

Statement of Work Requirements	Baseline/Deliverable Reference
The Contractor shall prepare drawings for all disciplines, i.e., civil, structural, architectural, electrical, instrumentation, etc., in sufficient detail to permit the solicitation of bids for that portion of the work, or to permit the constructor to install and check the units.	
9. Instrumentation	
The Contractor shall design and specify the instrumentation and control system for the entire facility.	
The Contractor shall perform evaluation of potential suppliers of key instrumentation systems based on competitive bidding and select a common supplier for use by the Area Subcontractors.	Johnson Controls, Inc. Subcontract
10. Electrical Systems	
The Contractor shall design and specify the electrical systems for the entire facility. Prior to the preparation of detailed specifications, a single line diagram(s) shall be prepared and approved. Plant and area lighting, grounding and other electrical utility systems shall also be designed and specified.	Individual Area Contractor Subcontracts
11. Material Take-Offs (MTOs)	
The Contractor shall prepare Material Take-offs for all bulk materials.	Appendix A - Individual Plant Area Design Baselines
12. Utilities	
The Contractor shall develop drawings and specifications for all utility systems.	
13. Buildings and Site Facilities	
The Contractor shall develop and finalize requirements for control rooms and laboratories,	

Statement of Work Requirements

medical treatment facilities, maintenance buildings, warehouses, chemical storage, staff offices, change rooms, and other necessary facilities. Detailed drawings and specifications for each generic design will be developed in sufficient detail to permit solicitation of bids for the construction or design/construction.

14. Bid/Proposal Evaluation

The Contractor shall perform technical evaluations of bids/proposals for all materials and equipment.

15. Construction

The Contractor shall develop drawings and specifications required for the specialized assembly, erection, and check out of complex pieces of equipment.

The Contractor shall prepare detailed specifications and instructions for use during construction.

16. Vendor Engineering

The Contractor shall purchase detailed engineering from equipment suppliers to permit the detailed facility design to proceed.

The Contractor shall review and exercise approval authority over the designs and drawings submitted by the suppliers, to ensure conformance with specifications, codes, and other technical requirements of the project.

L. PROJECT BASELINE

The Contractor shall develop a Project Baseline consisting of a Design Baseline, a Schedule Baseline, and a Cost Baseline.

Baseline/Deliverable Reference

Individual Area Contractor Subcontracts

Appendix B - 4.0 Project Baselining Plan

Statement of Work Cross-Reference

Statement of Work Requirements	Baseline/Deliverable Reference
M. PROJECT OBJECTIVES	a) Chapter I.A.1 - SRC-I Project (WBS 1.0) b) Appendix B - 3.0 Design Basis Memoranda - Summary Project
1. Product Slate/Specifications The SRC-I facility shall be designed to produce a wide range of products of varying specifications, according to the requirements of the marketplace.	
2. Feed Rate and Capacity The plant shall be capable of processing 6000 TPSD of Kentucky #9 coal, or other appropriate coal, to specification products.	
3. Environmental The Demonstration Plant be designed and constructed in full compliance with both current and expected Federal, State and local environmental regulations.	
4. Health and Safety The Demonstration Plant be designed, constructed and operated in full compliance with Federal, State and local regulations concerning employee health and safety, as well as in full compliance with good industrial practice for occupational safety and health.	
5. Commercial Expansion The design and construction of the Demonstration Plant shall be carried out in a way which will not preclude its eventual expansion to a 30,000 TPSD facility.	

Statement of Work Requirements	Baseline/Deliverable Reference
II. PHASE II	
A. GENERAL	
B. SUMMARY OF SCOPE	
The Contractor shall prepare and implement plans and procedures to permit the timely construction of an environmentally-acceptable and operable Demonstration Plant and shall assure a smooth transition into Phase III.	Appendix B - 12.0 Construction Strategy
C. PROJECT MANAGEMENT	
The Contractor shall update and modify its Project Management Plan and supplementary plans, developed during Phase I, as required to reflect any changes in the work during Phase II.	Appendix B - 4.0 Project Management Plan
The Contractor shall revise the Work Breakdown Structure Dictionary, as necessary, to reflect project activities during Phase II.	Appendix B - 1.0 PWBS and Dictionary
The Contractor shall revise and further develop, for Phases II and III, the Master Project Schedule and the Critical Path Schedule covering the engineering, procurement, and construction activities and shall keep these schedules current. The Contractor shall analyze and define the impact of changes which affect the detailed construction schedule, including but not limited to, changes in construction milestones and in manning and cost differentials, and shall recommend program modifications to minimize impacts.	a) Chapter I.C. - SRC-I Project (WBS 1.0 Schedule Summary b) Chapter III.A. 3 - Milestone Schedul III.B.1.c - III.B.2.c - IV.A.3 - IV.B.3 - V.A.3 - V.B.3 - VI.C.3 - VI.D.3 - VI.E.3 - c) Appendix B - 19.0 Intermediate Schedule Back-Up Detail
The Contractor shall continue to prepare Cost Performance Reports and supporting documents in accordance with contract Appendix D.	Management Systems Procedure MS 16.1 - Reporting Instructions to ICRC and Area Contractors
D. PROCUREMENT	
1. Major Subcontracts	
The Contractor shall prepare a Statement of Work for each portion of Phase II that is to be	Appendix B - 4.0 Procurement Manual

Statement of Work Cross-Reference

Statement of Work Requirements	Baseline/Deliverable Reference
performed by the Area Subcontractors and by the Construction Manager/Constructor. The Contractor shall solicit, receive, analyze, and evaluate proposals from the Area Subcontractors and Construction Manager/Constructor to perform their respective portions of Phase II and shall negotiate and issue appropriate amendments to the respective subcontracts, incorporating the Phase II Statements of Work.	↓
The Contractor shall finalize the Phase I portion of the subcontract with each Area Subcontractor and the Construction Manager/ Constructor.	↓
2. General	
The Contractor shall continue to maintain an Approved Bidders List.	Appendix B - 4.0 Procurement Manual
The Contractor shall complete the preparation of estimates for each work package to be done by subcontract or by force account.	Management Systems Procedure 3.1, Estimating Procedure
The Contractor shall procure items of equipment per the requirements established in Phase I and shall procure the items of construction materials to be centrally procured.	Appendix B - 9.0 Master Project Procedures 5-1, Area Contractor's Procurement and Support of CM/C Procurement and 5-2, Interfaces During CM/C Bulk Purchases
The Contractor shall perform inspections in the vendor's shops. The Contractor shall witness certification or performance tests conducted in the vendor's shops.	Appendix B - 4.0 QA Plan
The Contractor shall inspect all process equipment and construction material upon its arrival at the construction site.	Appendix B - 4.0 QA Plan
The Contractor shall endeavor to achieve a maximum degree of standardization among equipment.	Appendix B - 9.0 Master Project Procedure 5-1, Area Contractor's Procurement and Support of CM/C Procurement

Statement of Work Requirements	Baseline/Deliverable Reference
The Contractor shall implement the Spare Parts Plan for each area.	Appendix B - 9.0 Master Project Procedure 6-2, Spare Parts and Special Tools Requirements
3. Raw Materials, Feedstocks, and Supplies	
The Contractor shall finalize and execute all agreements necessary for the procurement, shipment, and receipt of Western Kentucky No. 9 or other appropriate coal(s), raw materials, chemicals, catalysts, lubricants, water, and electric power.	a) Appendix B - 13.0 Coal Supply Strategy b) Appendix B - 15.0 Catalysts and Chemical Requirements c) Phases IIIA & IIIB - Chapter 1.A - Technical Scope (Operating Plan) d) Phases IIIA & IIIB - Appendix 2.0 - Operating Cost Assumptions and Support Data
The Contractor shall conduct an appropriate testing program to evaluate all qualified coal suppliers.	Appendix B - 13.0 Coal Supply Strategy
The Contractor shall arrange for the disposal of non-usable by-products and wastes.	a) Chapter V.A.1.b - Off-Site Facilities, Solid Waste Disposal b) Chapter VI.E.1.a - Environmental and Permits c) Appendix B - 10.0 c - On-Going Project Related Environmental Activities
E. ENGINEERING AND TECHNICAL	
The Contractor shall provide engineering/design support to monitor the quality and physical progress of work performed by the various subcontractors, shall review vendor drawings, and shall take corrective action as necessary to preserve technical integrity and the Master Project Schedule.	Chapter VI.A. - Project Management (WBS 1.5.1)
The Contractor shall maintain effective liaison with all DOE-sponsored coal liquefaction pilot plant programs to insure timely planning and the transfer of technology.	a) Chapter VI.C - Technical Support (WBS 1.5.3) b) Appendix B - 5.0 R&D Plan c) Appendix B - 25.0 Wilsonville Pilot Plant Support
The Contractor shall identify critical data base needs and, insofar as possible, shall provide for those needs which cannot be satisifed through on-going DOE programs by means of a program of in-house and subcontracted R&D support.	
The Contractor shall develop state-of-the-art advanced control algorithms to assist the efficient operation of the Demonstration Plant and to enable the validation and optimization of critical technology processes.	

Statement of Work Requirements	Baseline/Deliverable Reference
The Contractor shall develop steady-state models to verify the designs of critical plant equipment and shall develop dynamic models of the facility and its critical equipment to assist such control system design and to assist in operator training.	Chapter VI.C.1.c - Modeling (WBS 1.5.3.3)
F. CONSTRUCTION	
The Contractor shall provide for the construction of the entire plant facilities in accordance with the project specifications, detailed engineering documents, engineering model, and construction plans and procedures prepared in Phase I.	a) Chapter VI.A - Project Management (WBS 1.5.1) b) Appendix B - 12.0 Construction Strategy
The Contractor shall be responsible for maintaining a coordinated, controlled construction effort, for ensuring the availability of continuing support from the Area Subcontractors and suppliers during the construction phase, for resolving questions of engineering interpretation, and for providing modifications as required due to field interferences.	↓
The Contractor shall provide the overall direction, quality and progress monitoring, interface control, and coordination for the construction effort.	a) Chapter VI.A - Project Management (WBS 1.5.1) b) Appendix B - 4.0 QA Plan
The Contractor shall have the engineering capability for preparing change orders, for maintaining alignment and grade control; for testing of systems; and for preparation of as-built drawings.	↓
The Contractor shall maintain a log of all change orders, indicating the reason for the change, the subcontractors or suppliers affected, and the cost of the materials, labor, and equipment required.	Appendix B - 4.0 Configuration Management Plan
The Contractor shall prepare a site health and safety plan and shall establish and enforce a construction site health and safety program.	a) Chapter VI.A - Project Management (WBS 1.5.1) b) Appendix B - 4.0 Safety Program Plan

Statement of Work Requirements	Baseline/Deliverable Reference
The Contractor shall have on-site capability for preparing cost estimates for change order packages, claims submitted by subcontractors, new contracts, purchase orders, and other estimates as required.	a) Chapter VI.A - Project Management (WBS 1.5.1) b) Appendix B - 12.0 Construction Strategy
The Contractor shall maintain one complete set of contract drawings depicting the actual, as-built conditions.	
The Contractor shall supply overall support and common services.	a) Chapter VI.B.1.a - Administration (WBS 1.5.2.1) b) Appendix B - 12.0 Construction Strategy
The Contractor shall provide adequate security for all property and material, including construction equipment, and shall control ingress and egress at the Demonstration Plant.	
The Contractor shall establish an on-site fire protection organization.	
The Contractor shall establish a system for managing vehicles and transportation.	
G. CHECKOUT AND ACCEPTANCE	
The Contractor shall implement checkout and acceptance procedures to prepare the facilities for start-up and operation.	a) Chapter VII.B. - Checkout and Commissioning (WBS 1.6.2) b) Appendix B - 12.0 Construction Strategy
The Contractor shall insure that the construction and the equipment installation adhere to design and project specifications.	
The Contractor shall prepare acceptance test plans and procedures.	
The Contractor shall perform mechanical tests.	
H. CONSTRUCTION/OPERATION STAFFING AND TRAINING	
The Contractor shall maintain and update staffing and training plans for Phases II and III.	Chapter VII.D. - Recruiting and Training (WBS 1.6.4)
The Contractor shall plan and implement construction-site apprentice and training programs.	Appendix B - 12.0 Construction Strategy

Statement of Work Cross-Reference

Statement of Work Requirements	Baseline/Deliverable Reference
I. RELIABILITY, AVAILABILTY, AND MAINTAINABILITY	
The Contractor shall ensure that functions related to reliability, availability, and maintainability are continued during Phase II.	a) Appendix B - 9.0 Master Project Procedures 1-4, ICRC Review and Approval of Contractor Technical Documents and 6-3, Reliability Analysis by Area Contractors
The Contractor shall continue to provide reliability and availability assessments.	b) Phases IIIA and IIIB - Appendix 1.0 Reliability - Maintenance Discussion
J. QUALITY ASSURANCE SURVEILLANCE	
The Contractor shall provide the quality assurance surveillance necessary to ascertain that the subcontractors, fabricators, and constructors are performing in accordance with the Quality Assurance Plan.	Appendix B - 4.0 QA Plan
K. OPERATIONS PLANNING	
The Contractor shall prepare a Facilities Operation program.	Phases IIIA & IIIB - Chapter I.A. Technical Scope (Operating Plan)
1. Safety and Industrial Hygiene	
The Contractor shall prepare a Final Safety Analysis Report. The FSAR shall also contain an assessment of the risks associated with the as-built plant, in consideration of design changes made subsequent to the issuance of the PSAR.	a) Appendix B - 4.0 Safety Program Plan b) Phases IIIA & IIIB - Appendix 3.0 Occupational Safety and Health c) Chapter VII.B. - Checkout and Commissioning (WBS 1.6.2)
The Contractor shall prepare Operations Safety Requirements.	
The Contractor shall prepare a Plant Safety Procedures Manual.	
The Contractor shall prepare a Plant Industrial Hygiene Manual.	
2. Operations and Maintenance Manuals and Procedures	a) Chapter VII.B. - Checkout and Commissioning (WBS 1.6.2)
The Contractor shall prepare operating manuals and standard procedures.	b) Appendix B - 9.0 Master Project Procedure 6-1, Operating and Maintenance Manuals c) Phases IIIA & IIIB - Appendix 1.0 Reliability - Maintenance Discussion

Statement of Work Requirements	Baseline/Deliverable Reference
The Contractor shall prepare maintenance and preventive maintenance manuals and standard procedures.	
The Contractor shall prepare a Master Equipment List (MEL).	
3. Recruiting and Training	
The Contractor shall recruit the initial supervisory, technical, administrative, operating, and maintenance personnel required to staff the Plant and shall provide adequate personnel preparation for the staged commissioning of the Plant.	Chapter VII.D - Recruiting and Training (WBS 1.6.4)
The Contractor shall train the initial supervisory, technical, administrative, operating, and maintenance staff.	
4. Commissioning	
The Contractor shall conduct all required precommissioning activities.	Chapter VII.B - Checkout and Commissioning (WBS 1.6.2)
The Contractor shall conduct mechanical equipment run-in with simulants and/or process materials.	
The Contractor shall commission all equipment, systems, and areas.	
The Contractor shall identify and define the problems and limitations of any equipment, system, or area.	
The Contractor shall make any modifications, debottlenecking, additions, or upgrading considered necessary before start-up, as directed by the DOE.	
The Contractor shall prepare complete and detailed plans for start-up and operation of the plant.	

Statement of Work Requirements	Statement of Work Cross-Reference Baseline/Deliverable Reference
L. PRODUCT UTILIZATION ACTIVITIES	
The Contractor shall continue market studies, product-characterization R&D, and Product Demonstration and Applications Engineering programs and shall enter into appropriate Demonstration Use Contracts to support sales efforts.	a) Chapter VI.D - Product Utilization (WBS 1.5.4) b) Appendix B - 4.0 By-Product Disposition Plan c) Appendix B - 8.0 Product Demonstration Plan
The Contractor shall conduct site engineering and economic evaluations, to determine if any product demonstration retrofit costs are involved.	
The Contractor shall continue financial activities, including the preparation and maintenance of regular cost reports, the support of capital fund raising efforts, and the reassessment/reaffirmation of project financial objectives.	a) Chapter VI.A - Project Management (WBS 1.5.1) b) Chapter VI.B.1.a - Administration (WBS 1.5.2.1)
M. TRANSFER OF TECHNOLOGY AND PUBLIC AFFAIRS	
The Contractor shall continue to transfer technology to the public.	Appendix B - 4.0 Technology Transfer Plan
The Contractor shall continue a Public Affairs program to inform the public of the SRC-I project and related synthetic fuels issues.	Chapter VI.B.1.a - Administration (WBS 1.5.2.1)
N. ENVIRONMENTAL ACTIVITIES	
The Contractor shall identify, define, develop, and conduct activities intended to satisfy and comply with all applicable federal, state, and local environmental requirements.	a) Chapter VI.E.1.a - Environmental and Permits b) Appendix B - 4.0 Environmental Plan for Construction c) Appendix B - 10.0 a, c Permit Plan; On-Going Project Related Environmenta Activities
The Contractor shall cooperate and work closely with EPA, OSHA, and other cognizant federal and state, agencies and their contractors in their efforts to develop new environmental and occupational health standards, regulations, or guidelines that may be applicable to the SRC-I process.	d) Appendix B - 4.0 Safety Program Plan e) Phases IIIA & IIIB - Appendix 3.0 Occupational Safety and Health Philosophy and Program
The Contractor shall investigate the toxicity of SRC products and selected process intermediates and waste products.	

Statement of Work Requirements	Baseline/Deliverable Reference
The Contractor shall continue the environmental monitoring program at the site.	↓
The Contractor shall continue to support the environmental activities of DOE as required under the National Environmental Policy Act.	

Statement of Work Cross-Reference

Statement of Work Requirements	Baseline/Deliverable Reference
III. PHASE III	
A. GENERAL	
B. SUMMARY OF SCOPE	
The Contractor shall perform all start-up activities, modifications, operation, data collection and evaluation, technical support, product utilization activities, and continuing activities necessary to demonstrate the environmental acceptability and commercial viability of the Demonstration Plant.	Phases IIIA & IIIB - Chapters I-V Technical Scope
C. PROJECT MANAGEMENT	
The Contractor shall modify and expand the Project Management Plan and supplementary plans, as necessary, to reflect any changes in these plans during Phase III.	Appendix B - 4.0 Project Management Plan
The Contractor shall reassess all management and control systems developed in Phases I and II and shall modify them, as necessary, to reflect the delineation of project activities in Phase III.	
The Contractor shall continue to prepare cost Performance reports and supporting documents in accordance with contract Appendix D.	Management Systems Procedure MS 16.1, Reporting Instructions to ICRC and Area Contractors
D. RECRUITING, TRAINING AND STAFFING	
The Contractor shall continue the recruiting, training, and staffing efforts initiated in Phase II.	Chapter VII.D - Recruiting and Training (WBS 1.6.4)
The Contractor shall maintain an on-site staff typical of a refinery or chemical plant of similar size.	
The Contractor shall staff the Demonstration Plant as necessary to sustain operations on a 24-hour-a-day, seven-day-a-week basis.	

Statement of Work Requirements	Baseline/Deliverable Reference
E. START-UP The Contractor shall continuously monitor process/facility performance and shall recommend any modifications necessary to maintain safe and environmentally-acceptable, steady-state operations. The Contractor shall assess operations and shall recommend any modifications needed to meet the Plant design capacities and yields. The Contractor shall implement any approved modifications required to accomplish these objectives. After all equipment items have demonstrated the ability to operate at design conditions, the Contractor shall commence controlled Plant operations.	a) Phases IIIA & IIIB - Chapter I.A - Technical Scope (Operating Plan) b) Phases IIIA & IIIB - Chapter V.C - Technical Support (WBS 1.5.3) c) Phases IIIA & IIIB - Chapter V.E. - Environmental, Permits, and Land Acquisition Support (WBS 1.5.5)
F. OPERATION The Contractor shall operate the plant for an extended period, approximately two years, to establish optimum operating parameters when using the design coal or different coal feedstock(s) as may be compatible with the Operating Objectives. The Contractor shall operate the Plant in compliance with all applicable federal, state, and local safety and health regulations and with the Plant Occupational Safety and Health Program. G. OPERATING OBJECTIVES The Contractor shall prepare specific objectives and procedures, which shall be detailed in a Plant Test Program. The Contractor shall prioritize his specific objectives in the Test Program. The Contractor shall prepare plans to deal with equipment breakdowns, equipment and process malfunctions, and other disruptions that will result in unscheduled shutdowns during this period.	

Statement of Work Requirements	Baseline/Deliverable Reference
The Contractor shall schedule shutdowns for turn-arounds and for process and equipment changes and adjustments.	
H. EVALUATION The Contractor shall collect all data necessary to fully evaluate the SRC-I technology, as it is defined by the Demonstration Plant operation. The Contractor shall continue to provide technical support services, shall continuously evaluate all performance data, and shall recommend modifications necessary to achieve Project goals. The Contractor shall regularly publish the data and its evaluations of that data for review. The Contractor shall implement all approved modifications to the facility.	a) Phases IIIA & IIIB - Chapter I.A - Technical Scope (Operating Plan) b) Phases IIIA & IIIB - Chapter V.C - Technical Support (WBS 1.5.3)
I. COMMERCIAL PLANT REASSESSMENT The Contractor shall make an analysis of operating experience and data to identify any bottlenecks, process deficiencies, equipment problems, etc., that could affect or penalize commercial operation.	
J. PRODUCT UTILIZATION ACTIVITIES 1. Market analysis The Contractor shall continue to evaluate product value and cost, market needs, regulatory-economic-social impacts, and amenable market segment characterization, as required to establish the basis to assess commercial viability.	Phases IIIA & IIIB - Chapter V.D - Product Utilization (WBS 1.5.4)
2. Product Demonstration and Application Engineering (PD&AE) The Contractor shall continue activities to identify, implement, and supervise the applications and development tests and evaluations	

Statement of Work Cross-Reference

Statement of Work Requirements	Baseline/Deliverable Reference
required for the utilization of SRC-I products in the target markets.	
The Contractor shall supervise and coordinate the installation of any retrofit equipment necessary to demonstrate SRC products on user equipment.	
3. Sales	
The Contractor shall focus sales activities on servicing product users, determining product price/revenues, evaluating product fits, establishing market/business acceptance, and obtaining an overall market and regulatory response to the various products and their uses.	
K. TRANSFER OF TECHNOLOGY AND PUBLIC AFFAIRS	
The Contractor shall continue to transfer technology to the public.	Appendix B - 4.0 Technology Transfer Plan
The Contractor shall continue a Public Affairs program to inform the public of the SRC-I project and related synthetic fuels issues.	Phases IIIA & IIIB - Chapter V.B.1 - Administration and Planning (WBS 1.5.2)
L. ENVIRONMENTAL	
The Contractor shall provide pollution control engineering during start-up to ensure that pollution control equipment and systems are operating.	a) Appendix B - 4.0 Safety Program Pla b) Appendix B - 10.0 c - On-Going Projec Related Environmental Activities c) Phases IIIA & IIIB - Chapter V.E - Environmental, Permits and Land Acquisition Support (WBS 1.5.5) d) Phases IIIA & IIIB - Appendix 3.0 Occupational Safety and Health Philosophy and Program
The Contractor shall evaluate control system efficacy by relating system performance both to control committments and to observed environmental quality needs.	
The Contractor shall provide confirmation tests to verify that toxicity test results obtained from product analogs are representative of test results obtained from actual products.	

Statement of Work Requirements

Baseline/Deliverable Reference

The Contractor shall also conduct toxicity testing on "plant samples", to determine potential toxicity of those materials released into the environment and of those materials to which plant workers are known to be directly exposed.

The Contractor shall undertake a secondary test program to identify opportunities for process/product changes consistent with a reduced overall toxic hazard for the SRC-I process.

The Contractor shall conduct a battery of toxicity tests as part of a comprehensive risk assessment for the commercial product slate of a commercial scale SRC-I plant.

The Contractor shall conduct a Phase III environmental monitoring program which closely resembles the Baseline Monitoring Program conducted in Phases I & II.

The Contractor shall conduct a compliance evaluation program consisting of all activities necessary to confirm and report plant compliance with environmental laws, regulations, and permit conditions.

The Contractor shall perform environmental assessment activities to summarize the Demonstration Plant experience and to prospectively evaluate the environmental implications of a commercial scale facility at the same site.

The Contractor shall provide support to the occupational health professionals at the Demonstration Plant to facilitate their efforts to analyze and interpret data collected in the workplace and during medical monitoring programs.

Statement of Work Requirements	Baseline/Deliverable Reference
M. TECHNICAL SUPPORT	
1. Design Confirmation The Contractor shall provide field and home-office engineering assistance to support plant start-up and to help to resolve any major equipment or process problems. The Contractor shall identify pilot plant or laboratory R&D support needed to help to resolve any major problems.	Phases IIIA & IIIB - Chapter V.C - Technical Support (WBS 1.5.3)
2. Data Base The Contractor shall provide technical support to control, monitor, and verify the operations of individual process stages within the Plant. The Contractor shall provide support to develop, expand, and refine operating models for both process control and optimization and to resolve potential coking problems in process equipment.	
3. Modeling The Contractor shall provide a professional staff to maintain, enhance, conduct studies with, and support the use of the computer-based, steady-state and dynamic modeling capabilities.	
4. Pilot Plant Liaison The Contractor shall maintain effective liaison with all DOE-sponsored coal liquefaction pilot plant programs to obtain operations support, to provide rapid solutions to operating problems, and to screen secondary coal-supply sources.	Phases IIIA & IIIB - Appendix 6.0 - Wilsonville Pilot Plant Support

Statement of Work Requirements	Baseline/Deliverable Reference
5. Coal Supply	
The Contractor shall continue to qualify, evaluate, and test secondary sources of the coal supply.	a) Phases IIIA & IIIB - Chapter I.A. - Technical Scope (Operating Plan) b) Appendix B - 13.0 Coal Supply Strategy c) Phases IIIA & IIIB - Chapter V.C. - Technical Support (WBS 1.5.3)

23.0 DESIGN UNCERTAINTY

Currently identified technical risks are described herein, and actions to minimize such risks are outlined.

A design uncertainty/technical risk is defined as any activity that could adversely affect the current cost and/or schedule, an action that could result in the facility being unable to meet its design parameters or feed capacity, or an activity that might result in plant operation for only short periods. Such activities can be process-design and mechanical-design related, or they can be functions of the experience level or capabilities of equipment suppliers. All of these areas are considered in the assessments of risk. The 19 items listed below are some of the major concerns; many others will be handled in the detailed design without any impact on cost, schedule, or technical aspects of the plant.

1. The current plant design is based on a technically feasible temperature of 400°F in the coal/solvent mixing process. Blending at high temperature reduces the cooling required for the recycle process solvent, thus lowering capital cost and improving thermal efficiency. Slurry mix tests performed at the Ft. Lewis Pilot Plant demonstrated the feasibility of blending coal and solvent at design concentration, residence time, and temperature. No operational problems were encountered at design conditions. However, due to equipment limitation, design makedown rate has not been tested or demonstrated. It was determined that it is not practical to handle large coal makedown rates combined with high temperature and the resultant vapors in a conventional turbine agitator system. The mixing system designed consists of a high-intensity premix unit, which provides a continuous, consistent, and vapor-free slurry, and a slurry drum, which serves as a hold tank for pumping with mild agitation provided to keep slurry in suspension. Premixing tests were performed, in a batch mode and at a temperature lower than actual process conditions due to vendors' equipment limitation, and results indicated that premixing is effective and feasible. The inability to reach design temperature would have significant effects on downstream equipment and plant throughput, therefore, it would be desirable to retest on a larger scale over the range of expected operating conditions.

2. The towers installed at Wilsonville to steam strip the critical solvent from SRC have experienced flooding and subsequent carryover of SRC. In turn, the carryover has resulted in both plugging of the overhead condenser and severe emulsion formation.

   Off-line tests conducted with reduced SRC throughput and a preflashing step before stripping significantly reduced the plugging and emulsion problems encountered, thereby pinpointing the cause of the problem to be undersized towers.

   Two potential solutions exist to reduce the design uncertainties associated with the removal of the DAS from the SRC: (1) improve the steam stripping design, and (2) use alternative equipment.

   Ways to improve the steam stripping system are as follows: (1) properly size the diameter and internals of the column to prevent flooding, (2) increase the number of theoretical stages of the strippers to facilitate the contact between the stripping steam and the feed material, (3) superheat the stripping steam to approximately the bottom temperature to maintain the vapors as superheated as possible, and (4) reduce the operating pressure of the strippers to enhance the flashing and separation of the solvent from the heavier SRC material.

   A wiped-film evaporator has been proposed as an alternative to the stripping system. Such a device increases the contact surface area of the feed fluid and also reduces the diffusion resistance of the contact film.

   Test runs have been carried out on SRC using a wiped-film evaporator and the critical solvent content in the SRC was successfully reduced to the specification level of 0.1%. However, the wiped-film evaporator is a costly approach to solving this problem.

3. Four parallel trains have been specified for the slurry pumping and heating systems. Because of the conservative design of the components of each train, the withdrawal of one train would result in a plant capacity reduction of less than the operating capacity of the withdrawn

train since the parallel trains could pick up some of the withdrawn capacity.

To improve thermal efficiency, preheating of coal slurry is accomplished by a hot-oil loop, which cools the dissolver effluents and then exchanges heat with the incoming coal slurry in the Coal Slurry/Hot Oil Heat Exchanger. Heat transfer rate, rate of fouling and plugging in these heat exchangers is not well understood, and therefore, these exchangers are included on the Critical Technology List. To minimize the impact on plant performance due to possible loss of heat exchanger effectiveness and to prevent premature train shutdown, each exchanger train can be bypassed and the slurry heaters have been overdesigned. Loss of one exchanger train would cause a minimum reduction in plant capacity.

4. The demonstration plant requires a Critical Solvent Deashing unit to separate the SRC fraction from the residual reaction solids, ash, and unreacted coal. Wilsonville pilot plant experience with the operation of the Kerr-McGee Critical Solvent Deashing unit has been inconsistent, with several system outages caused by solids plugging of the CSD unit. The demonstration plant will utilize parallel CSD trains in order to minimize the impact of CSD operation on overall plant performance. The operating parameters of the CSD unit are not fully understood and this unit is on the Critical Technology List.
5. Design of the demonstration plant coal slurry-fired heater has been based on the conservative scale-up of the data obtained from the pilot plants. Cold-flow modeling has been conducted to verify several of the scale-up assumptions made in the design. However, uncertainty still exists in the areas of: heat transfer coefficient, upset operation, corrosion, and coking. In order to minimize the impact of fired-heater outage on the demonstration plant, four parallel fired-heater units have been incorporated in the demonstration plant design. These units are on the Critical Technology List.
6. The current plant design for the Demonstration Plant coal dissolvers is based on a gas hold-up of 17%. Subsequent data from the Exxon pilot plant at superficial velocities near demonstration design rates indicate a gas hold-up of 40-45%. The reduction in liquid residence time in the reactor would result in less distillate produc-

tion than used in the demonstration design. Switching the dissolvers to parallel operation (already allowed for in the design) would result in lower superficial reactor velocities, reduce gas holdup, and thus improve distillate yields. However, it may be necessary to reduce plant capacity in order to provide sufficient residence time for the desired yield structure. The original design of the demonstration plant incorporated a continuous solids withdrawal system based on the experience of the Wilsonville pilot plant. Subseuqent data from the Exxon pilot plant at superficial velocities near the demonstration plant values have demonstrated limited solids accumulation with only batch removal of solids required. The demonstration design has been modified to use only batch removal of dissolver solids.

7. The various wastewater streams produced in all process areas are collected in the off-sites area for treatment. Laboratory-scale studies have generated much information that has somewhat mitigated the design uncertainty although the studies were based on samples available from small-scale pilot plants which are not perfect simulations of the large Demonstration Plant. As more is learned about the SRC-I processes and steps, it is likely that further complications in treatment will be encountered. The most significant complications will probably exist with the zero discharge mode of operation since two of the process units employed (reverse osmosis, and zero discharge residue stabilization) is not well demonstrated commercially.

   During the Post-Baseline period, an Engineering study was completed and was reported in September 1983. This study was entitled: Volumes 1 and 2 Wastewater Treatment and Solid Waste Landfill Design Baseline Revision. Volume 3. Wastewater Treatment System and Solid Waste Landfill Cost Baseline Revision.

8. Although it is believed that gaseous emissions are better understood than wastewater, new contaminants are likely to be found as detailed design and equipment selection proceeds. The possibility of new regulations (Federal or State) must not be overlooked.
9. Although the predominant solid waste stream--gasifier flyash/slag--is well understood, other smaller but significant streams are not.

Many of the smaller streams are produced from wastewater treatment and the zero discharge mode of operation. Dewatering properties of the wastewater treatment sludges are not well defined and laboratory evaluations of them are still in progress. The disposal of the residue from zero discharge operation has the same uncertainty as other equipment in that area.

10. Although knowledge of coal-derived fluid thermophysical slurry properties has increased markedly over the last several years, many properties and behaviors must still be better understood. As ICRC and other companies proceed with data development, changes in designs are conceivable.
11. Corrosion is perhaps one of the most significant areas of concern. Major steps have been taken during design to improve materials of construction to limit corrosion, particularly chloride attack. Chemical processes to neutralize the chlorides are also being reviewed. As design progresses, other corrodents may be identified.
12. At four sites in the SRC Process Area, slurry is let down through high-pressure-drop throttle valves. At other pilot and demonstration plants, experiences with various valve designs and manufacturers have been poor, requiring parallel systems, long downtime and maintenance periods, and high spare stocking programs. All valves have been of significantly smaller size than that needed for SRC-I. Design, selection and testing of these valves are all identified as critical technology items.
13. The high-pressure/high-temperature slurry pumps have been used only in sizes much smaller than design in the existing pilot plant program, and have proven to be low-reliability, high-maintenance items. Multiple units of these pumps with installed spares are already being used. These pumps have been classified as a component of the Critical Technology List.
14. The vibrating deck solidifiers currently specified are being used at the Wilsonville Pilot Plant. Many facets of the operation of these units are not thoroughly understood, e.g. fume generation, heat transfer mechanism, and sticking of SRC, in spite of extensive testing and data collection. The feasibility of scale-up and successful operation are questionable, and require much additional knowledge.

Presently underway is the evaluation of an alternate water bath solidification system.

15. The mechanical design parameter of the Expanded-Bed Hydrocracker (EBH) reactors, internal versus external insulation, needs further definition. Although systems of similar size have been used in refineries, the number is limited, and all are outside the United States. These vessels have been classified as a component of the Critical Technology List.
16. The screw feeders to the gasifiers have operated satisfactorily on coal and petroleum coke at many other installations. However, the transport properties of KMAC are not well understood (see 1 above). Although a full-scale screw feeder test was considered, it was eliminated due to the extremely high costs. ICRC is currently evaluating an alternative pneumatic feeding system which has been reported in an engineering study entitled "Alternate KMAC Conveying and Gasifier Feeding Systems" (September 1983).
17. The liquid waste incinerator, principally handling the "oil type" waste produced, will require technical considerations similar to those of the flare, and will present similar hazards. However, only few small-scale units of this type have been designed and built.
18. The Gasifier Waste Heat Boilers and screwfeeders may have to be purchased from German suppliers, since it is unlikely that ICRC will find U.S. fabricators with the experience required at the currently contemplated price. Although the Gasifier vessels have not been built in the U.S., with GKT input and assistance, their fabrication is not anticipated to be a problem.
19. Analysis indicates that the feed to the Hydrogen Purification Unit (HPU) contains trace concentrations of NO_x, acetylene, dienes, and mercury. These components must be removed to avoid the potential occurrences of explosion, freeze-out, corrosion, and deterioration of molecular sieves. Methods of removal to be developed and tested is proposed in Program 16.2 of Task 203.

During the Phase 0 and Phase I portions of the project, ICRC and its subcontractors have taken and will continue to take steps to minimize such technical risk through the following activities and plans:

- The support processes selections during Phase 0 and Phase I have been aimed at using commercially proven processes, such as gasification, coking and calcining, and the various gas treating units (e.g., DEA, Selexol). In this manner, process uncertainties can be limited to the SRC Process, Expanded-Bed Hydrocracker, and Wastewater Treatment.
- ICRC R&D Plan (Appendix B, 5.0) identifies many of the design data uncertainties and establishes a program for dealing with those uncertainties in a timely manner. Many problems have already been resolved during the past 4 years of ongoing R&D work. Where design decisions were needed to allow work to proceed, conservative assumptions were made to ensure technical compatibility of the project.
- ICRC Quality Assurance plan requires a thorough review of all systems and equipment, and where uncertainty or potential problems are identified, a Project Quality Assurance Assessment (PQAA) is prepared. These PQAA's will define and mandate special design reviews, special quality control measures, and/or detailed field assembly/inspection procedures.
- ICRC Quality Assurance Plan and the General Engineering Specifications mandate minimum Quality Control (QC) requirements for all equipment and components. Special QC instructions will be prepared by the CM/C and appropriate Area Contractor for use during the construction and checkout phases of the project.
- ICRC established a Critical Technology List (Appendix B, Section 7.0) to define components and systems considered critical to facility operation, but whose commercial acceptability is not yet proven. The Critical Technology components and systems will undergo a rigorous examination by various ICRC Technical Staffs, as well as subcontractor staffs. Special development or testing programs may be initiated to verify design concepts or component life.
- In the Process Design Criteria and the Mechanical Design Criteria, ICRC has specified certain levels of installed spares for common equipment such as pumps, compressors, and heat exchangers to ensure high equipment on-stream factors. Special evaluations of high-cost equipment, e.g. gasifiers, heaters, and large process compressors,

were made to determine redundancy requirements. The results of these studies are incorporated in the Project Baseline.

- A reliability, availability, and maintainability analysis of equipment will be conducted by ICRC and its Area Subcontractors to consider actual operating history of the selected equipment. The analysis may dictate further installed sparing, a greater spare parts inventory, or perhaps redesign of components.
- A process hazards review, culminating in a Safety Analysis Report, will be required for each process and utility system. This review will ensure that the necessary measures have been taken to prevent dangerous failure of systems equipment, and that proper devices and measures are designed into the system to protect human life and property. This program will be closely coordinated with the Quality Assurance program.

24.0 APPRAISAL OF COST AND SCHEDULE RISKS

COST RISK

The cost estimate for the SRC-I Project was assembled from estimates prepared by the Area Contractors for their respective areas of the plant and by the Construction Manager/Constructor (CM/C) for the construction costs. ICRC developed the Project Management and Operations estimates.

A risk analysis was conducted by ICRC to determine the appropriate level of recommended project contingency. An allowance has been developed and is included on the estimate summary sheets using the following guidelines: engineering at 10%, equipment at 10%, construction at 20%, and manufacturing at 10%. In addition, an allowance has been included for post-mechanical-completion modifications.

Indicated below is a discussion of the cost risks associated with the various WBS elements of the estimate.

1.1 The Construction Facilities and Equipment estimate was prepared by Stone and Webster Engineering Corporation based on the scope of work defined by the Area Contractors and ICRC. A detailed and comprehensive plan formed the basis of this estimate, and there is a high degree of confidence in all aspects except for the transporting of heavy process equipment. Durations for equipment use are sensitive to schedule extension.

1.2.1 In the SRC Process Area, the engineering design is developed enough to allow good quantity takeoffs to be made as the basis for cost estimates. However, the equipment estimate is sensitive and may be too high. The estimate for construction is sensitive to productivity of the craft labor. This risk also exists for each process section of the plant listed below.

1.2.2.1 In the Coker/Calciner Area, the Area Contractor has had previous experience in designing these units and could develop a detailed estimate. Risks associated with this area are moderate.

1.2.2.2 The estimate for the EBH unit was factored from historical data; costs in both the design and construction estimates could increase.

1.3.1 The estimates for the Cryogenic Systems Area probably will not change, since the Area Contractor had considerable experience and cost data.

1.3.2 The cost estimates for engineering of the Gas Systems Area could change, but the equipment costs and the construction estimate are quite reliable.

1.4.1 Design of the Utilities and Off-sites Area has not progressed substantially. Because the cost estimates were computer-generated, the design, equipment, and construction estimates for this area are fairly risky.

1.4.2 The Central Control System Area consists of the Control System hardware and the technical assistance required to design and install this hardware. Risks associated with this estimate are minor.

1.5.1 The ICRC Project Management estimate was based on manpower plans. Both engineering and construction costs are sensitive to schedule duration and contractor performance. The possible imposition of additional DOE procedures, reviews, or approvals could also increase the costs.

1.5.3 The detailed R&D Plan forms the basis for developing costs in the Technical Support Area. Labor costs are based on manpower projections by position, using actual salaries. Subcontract costs are based on Requests for Quotations (RFQs), independent cost estimates, and historical data. Although the cost basis is sound, the nature of R&D work introduces some risk.

1.5.4 The Product Utilization Area estimate includes costs for marketing, product demonstration, and coal supply. The marketing and product demonstration activities are included in the ICRC/DOE Contract of 1979 and the Product Demonstration Plan approved by DOE in December

1981. The coal supply activities are based on the ICRC/DOE Contract and ICRC's Coal Procurement Strategy. The estimates are not based on definitive scopes of work or quotations, but rather on past contracts and contacts with vendors and other organizations involved in similar activities. Generally, the cost estimates for early years are more reliable because the activities are fairly well defined. Estimates for later years are less certain because activities then will depend on the results of the earlier programs; costs could vary because of changes in scope or the cost basis.

1.5.5 Some of the EPLA support estimates are based on a scope of work that considers current regulatory requirements and reasonable projections that consider changes anticipated during the life of the project. In the toxics, licensing, and monitoring programs, DOE and ICRC do not have full control because the Environmental Protection Agency, Kentucky Department of Natural Resources and Environmental Protection, and other regulatory agencies will have some control over the program scope. Much of the work in the toxics and monitoring programs is successive; i.e., it builds upon work previously completed, thus making this area sensitive to cost changes. Land acquisition is also sensitive; a delay beyond the scheduled November 1982 acquisition date would increase land costs.

1.6.1 A detailed analysis of Spare Parts requirements was made, and the estimate generated indicates minimal risk for this area.

1.6.2 Detailed work plans were developed by cost element for each plant area for Checkout and Commissioning. The detailed plans established a sound basis for the estimate, but there are moderate risks associated with these costs due to the unpredictable scope and nature of problems encountered in commissioning a process plant.

1.6.3 Current historical data from all the Area Contractors provided a good basis for the Capital Equipment estimate. Because vendor quotations were used for much of the pricing, there is little risk involved in these estimates.

1.6.4 Staffing plans provided the base from which Recruiting and Training costs were estimated. Such factors as relocation, travel, and fees are based on assumptions. Although the estimates are conservative, they do pose a moderate risk.

In addition, the escalation rates approved by DOE for Original Baseline use are considerably higher than current rates. If this trend continues and the rates projected by the Office of Management and Budget (OMB) in the FY82 budget revision of March 1981 were to materialize, a project savings of $200 million would result. The OMB projected rates are: 1982, 7.7%; 1983, 6.6%; 1984, 5.7%; 1985, 5.2%; and 1986 through 1988, 4.7%. Because of the lack of a specific project restart date, and hence, a definitive schedule and; because meaningful escalation rates have not been given nor agreed by DOE, no attempt has been made to escalate the revised costs. In this Revised Project Baseline, all capital costs are expressed in first-quarter FY 1982 dollars only.

SCHEDULE RISK

In developing the Project Baseline Schedule Risk Analysis, critical and subcritical paths were investigated. The risks and contingencies associated with the paths and their probable effect on project completion are discussed below.

Considerations that could adversely affect the schedule include the following:

- The Project Baseline Schedule has been developed based on a 1 October 1981 status. Until the project receives full authorization to proceed, schedule delays will accumulate.

- The Milestone Report (MSR) and Preliminary Safety Analysis Report (PSAR) reviews, because of their scope and formal nature, could slow the flow of design work and delay design completion or the start of construction.

- The standard Procurement Cycle used in the schedule is four and one-half months. Because of ICRC/DOE reviews and the serious nature of some critical technology equipment, this cycle of receiving and reviewing bids and awarding contracts may be extended.

- ICRC has assumed that condemnation proceedings will not be necessary to acquire the land on which the plant will be built.
- There may be unforeseen delays due to funding limitations.
- Problems may be encountered with material logistics and material control.
- Manpower, particularly special labor skills, may not be available in the numbers required.
- Governmental agencies, regulations, and Partnerships/Joint Venture arrangements add a further dimension to the magnitude and complexity of the project, resulting in interface and coordination problems.
- R&D and other technological advancements could impact the design basis.

However, other factors could favorably affect the schedule:

- The schedule as developed is consistent with DOE instructions in regard to subcontracting equipment procurement and construction work on a lump-sum basis. If sole-source procurement and a direct-hire construction philosophy were adopted, the overall duration of the project could possibly be reduced.
- Additionally, as the project proceeds and schedules are developed at a more detailed level, continued optimization of the engineering and construction logic could reduce the project duration further.

25.0 WILSONVILLE PILOT PLANT SUPPORT

INTRODUCTION

To ensure the reliability of the SRC-I Demonstration Plant project, the data base for its design, construction, and operation must be supported during Phases I, II, and III. Operation of the Wilsonville SRC Pilot Plant serves a vital role in the support of the project. ICRC is heavily dependent on the Wilsonville plant for an essentially continuous flow of current process and development information which directly affects process design and analysis activities.

It is the purpose of this section (and of Phase III Appendix 6.0) to present a long-range view of the need for continued support through the operation of the Wilsonville plant. Estimates of operations time requirements are presented. It should be noted that the budget for operations of the Wilsonville Pilot Plant is not included in the Prime Contract and, therefore, is not identified in the Project Baseline. Operations are funded through another DOE contract. In order to provide some additional perspective, the needs of ICRC at Wilsonville are defined as they relate to the support of Engineering Technology, Business Management, and Manufacturing Department activities.

BACKGROUND

ICRC input to pilot plant operations has been through participation in technical review, planning, and scheduling meetings at Wilsonville, and through various program reviews with DOE, Southern Company Services (SCS), and the Electric Power Research Institute (EPRI).

To ensure that data base needs are satisfied, programs are proposed to DOE/ORO as part of the Wilsonville Technical Support Plan formulated by ICRC Engineering Technology. The plan encompasses one year of work and is updated periodically to reflect progress, accomplishment, and additional program definition.

The plan contains four elements: process runs, process-variable studies, projects, and samples. Process runs, generally four to six weeks long, are needed to verify Demonstration Plant design parameters or to test potential changes in such parameters. Part of the coal screening procurement strategy will necessitate the testing of new coals at Wilsonville. Also, additional operating time may be required to generate samples for product utilization needs. Justification is presented to ensure that the Wilsonville contractual Statement of Work is satisfied.

Process-variable studies for pilot plant operation examine the specific effects of an independent variable on a dependent variable. Such studies vary in duration and may require specific operating conditions for process units not directly affected in the study. An example of such a study is the stripping of LSRC/SRC to remove the deashing solvent.

The projects area will include equipment additions, changes, and testing programs for areas such as product solidification and corrosion treatment.

Normally, sample needs are met through an established procedure for their request, collection, and shipment. Special handling procedures are considered individually. A projection of long-term sample needs for product utilization is included in the plan.

Additional discussion of the Technical Support Plan and specific Wilsonville programs is contained in the Project Baseline, Phases I and II, Appendix B, Section 5.0, Research and Development Plan.

ENGINEERING TECHNOLOGY

As the Demonstration Plant project moves through the design and construction phases, it will be necessary to continue support programs of the type identified in the Wilsonville Technical Support Plan. Each program is classified into one of the following categories: direct design support, design verification, operations support, or evaluation of process improvement. As the sophistication of the technical data base increases, programs will be developed to study start-up operations relevant to the Demonstration Plant in several areas, e.g., liquefaction, critical solvent deashing, and expanded-bed hydrocracking. The studies will help to define and verify those start-up procedures for the larger scale plant. Transient behavior studies will improve understanding of plant integration and help to verify and tune the dynamic simulations to be developed.

The definition of proposed runs will also be integrated with current market development activities. Objectives for a specific run will be keyed to demonstrate a given product yield structure. Pilot plant operations in a non-Demonstration Plant mode can also provide valuable parametric data relevant to Demonstration Plant operations.

Specific projects will be proposed that are likely to require additions of equipment or changes as needs are identified and justified. Scaled-down hardware at Wilsonville can provide valuable verification of the design concepts used in the Demonstration Plant.

MANUFACTURING

As part of the training program, the Manufacturing Department will require that the Demonstration Plant staff--engineers, supervisors, operators, and laboratory technicians--be able to visit the pilot plant for familiarization if it were operating and available for visitation. It is estimated that 20-25 people, in groups of one to six, would visit the plant for periods ranging from a few days to one month during FY 1984 and 1985. Total visitation would amount to approximately 52 work-weeks during this period.

BUSINESS MANAGEMENT--FUELS

The most critical requirement for the demonstration of SRC fuels use from the Wilsonville Pilot Plant during Phases I and II will be the production of suitable samples for product demonstration and application engineering (PD&AE) tests. These tests are required to establish technical feasibility, design criteria, and acceptability for safety, health, and environmental considerations, and to assess the potential commercial viability of the various products. First- and second-stage solvent-refined coal as well as middle distillates and heavy oils are required for baseline product tests. During calender year 1982, approximately 600 tons of first-stage SRC, 125 tons of TSL-SRC, and 12,000 gallons of combined first- and second-stage process solvent were required. These needs, as well as those of other groups within ICRC, were identified to DOE/ORO and the Pittsburgh Engineering Technology Center (PETC).

To support the approved fuels PD&AE program, a total of about 1,100 tons of first-stage solids, 250 tons of TSL-SRC, and 72,000 gallons of first- and second-stage process solvent will be required during Phases I and II (calendar years 1982-1985). Additional samples will probably be required as programs are more precisely defined and as demonstration results are received and evaluated. The process-solvent-range material must, for the most part, be refractionated to meet the standard marketable product distillation cut points, i.e., 400-650°F for middle distillate and 650-850°F for heavy oil. In addition, the solid material must be ground to a controlled particle size. To date, the modification of pilot plant products to meet market criteria has been done by third parties. During Phase II, a recommendation to modify the pilot plant to produce products which meet market specifications without the requirements of outside contracts will be evaluated.

New products will require production and testing. An example of this is the SRC residual fuel. This liquid fuel form will require some modification or additions to pilot plant systems to enable it to be produced in sufficient quantities to be tested.

BUSINESS MANAGEMENT--PROCESS INDUSTRIES

The Process Industries Division will continue to depend upon support from the Wilsonville Pilot Plant, in the form of samples of light oil, process solvent, and SRC for its PD&AE test programs and product development activities. Both first- and second-stage materials will be required. Subsequently, these samples will be blended and fractionated offsite into the appropriate product cut points, because the Wilsonville Pilot Plant does not have adequate fractionation capability to produce the Demonstration Plant liquid product fractions consisting of a C_5-400°F naphtha, 400-650°F middle distillate, and 650-850°F heavy oil.

The sample needs from the Wilsonville Pilot Plant for Process Industries will be small compared to that for the Fuels Division; typical sample requirements are in the range of one to five drums. However, the continuing availability of samples for the PD&AE and prospective customer evaluation programs for Process Industries is essential to carry out the product development activities outlined in the SRC-I Product Demonstration Plan. Furthermore, the Process Industries Division has been directed by DOE to "conduct small laboratory scale feasibility studies necessary to identify markets and establish customer relations for performance of larger scale PD&AE tests with products produced from the Demonstration Plant." Failure to secure samples for these programs will severely inhibit product application and customer development activities in preparation for operations of the Demonstration Plant.

BUSINESS MANAGEMENT--COAL SUPPLY

Background and Justification

A multistep coal procurement screening program has been developed to identify, evaluate, and select suitable primary and secondary feedstocks for the Demonstration Plant. The preliminary source screening process includes: reviews by ICRC personnel and a consultant of supplier technical, economic, and business proposals; the sampling and laboratory analyses of current coal production; and single-pass runs in the Coal Process Development Unit (CPDU). Following these evaluation activities, up to six sources of supply will be nominated for contract negotiations and advanced screening during both the primary and secondary feedstock selection processes.

Operational feasibility testing in the Wilsonville Pilot Plant is a vital part of the advanced screening process. Successful pilot plant runs of four to six weeks duration will be the minimum acceptable prerequisite for activation of an agreement to supply the Demonstration Plant. Such tests will be conducted simultaneously with contract negotiations and will include recycle runs in the CPDU, microautoclave (tubing bomb) tests of cores from reserves to be mined during the contract term, and may include coal gasification tests. A negative test result could nullify the procurement obligation.

Testing at the Wilsonville Pilot Plant is required to evaluate coals in an integrated facility that includes the critical solvent deashing (CSD) process of Kerr-McGee, and the second-stage EBH. Processing criteria that cannot be addressed at the CPDU scale will be evaluated from the Wilsonville data. These criteria include, but are not limited to: slurry preparation, coking of the preheater, accumulation of solids, yield structures for both stages, yields of CSD process and characteristics of its ash concentrate, desulfurization of SRC, and corrosion. Although laboratory data will be used to screen these coals before they are tested in the Wilsonville Pilot Plant, the processing data will be the final test criterion.

The coal procurement screening program is designed to evaluate the merits of each prospective source in successive stages of complexity and scale-up. The results from the successive scale-up tests for each coal will be correlated, and the correlations will be used to predict the performances of coal to be delivered to the Demonstration Plant. Results of these tests will also be used to make thorough technical performance and economic evaluations of each coal offered for purchase. The phased screening process has been developed to minimize the expenditure of funds and to maximize the productive use of scarce resources such as processing time at the Wilsonville Pilot Plant. Unsuitable coals will be eliminated during the lower cost, earlier stages of the evaluation.

The screening tests will be performed on currently mined coals, whereas the coals which will be delivered to the Demonstration Plant will be mined at a much later time. The composition and physical characteristics of a coal change significantly from seam to seam, as well as from location to location within the same seam. Therefore, small core-drilled samples representative of the production during the Demonstration Plant operating period will be taken from mines whose coals have performed satisfactorily in the previous tests and tested in the microautoclave. The results of these tests will be compared with the correlations established in the screening tests to determine the liquefaction and gasification performance of a coal before it is delivered to the Demonstration Plant.

Objectives

The objectives of the coal procurement screening program are: to test and qualify up to six prescreened coals in both the primary- and secondary-source selection processes, to develop performance characteristics data in various pilot plant units for scale-up application in the Demonstration Plant, and to develop correlations that will enable prediction of the performance of a coal liquefaction plant feedstock from microautoclave tests made on a small core-drilled sample.

Schedule

The baseline schedule shows the delivery of coal to the Demonstration Plant to begin during July 1986. Accordingly, the Wilsonville Pilot Plant tests will be required to be run during the periods May 1984 to June 1985 for primary-source screening, and August 1987 to May 1988, for secondary-source screening.

26.0 CATEGORY C ENGINEERING CHANGE PROPOSALS

The Category C Engineering Change Proposals (ECPs) appeared to be desirable but were not well-defined for the Original Design Baseline. During the Post-Baseline period, these ECPs were upgraded in quality and approved by the ICRC Configuration Control Board under authority granted to ICRC by the DOE. Those Class 1 ECPs included below also were approved by the DOE Project Configuration Control Board. These design changes were included in the Revised Design Baseline documentation. Additional costs and savings (bracketed) are expressed in first quarter fiscal year 1982 dollars.

ECP No.	Description	Value
SRC Process Area		
4-1004	Elimination of Batch Solids Withdrawal System The batch solids withdrawal system was eliminated and provisions were made for the future addition of a continuous withdrawal system where the material withdrawn from the Dissolvers would be sent directly to the M.P. Flash Drums. This elimination was the result of a detailed review of the process and mechancial problems associated with intermittent operation of a high-pressure, high-temperature vessel containing coal slurry. This ECP was estimated to save $1,400,000 in the original Design Baseline.	($2,272,000)
4-1008	Portable Decoking Scrubbers The Design Baseline utilized five (5) stationary Heater Decoking Drums. Vents from the drums were piped to the plant incinerator. The Revised Design Baseline uses three portable units with improved emission control devices which allow direct discharge to the atmosphere. This approach generates savings in ductwork, and the redundant decoking piping manifolds required on each heater in the stationary drum approach. This ECP was estimated to save $200,000 in the Original Design Baseline.	($226,000)
4-1013	Limiting KMAC Size to 1 MM Large chunks of Kerr-McGee Ash Concentrate (KMAC) within the Critical Solvent Deashing System may be the result of process instability or accumulated layers of KMAC falling from certain vessel or pipeline walls. Such chunks will have adverse effects on both the pneumatic conveying system and certain gasification mechanical equipment. In order to ensure operability of these mechanically-oriented systems, an Air Classifier with the necessary associated support equipment was included to perform on a continuous basis to process the entire KMAC production rate and be capable of functioning in an inert atmosphere where the principal size particle is in the -200 mesh range. Air Classifiers in severe service have commercially-proven track records in excess of 50 years. This ECP was estimated to cost $2,200,000 in the original Design Baseline.	$4,951,000

ECP No.	Description	Value
4-1020	Flare System Modifications Based on an intensive study of the overall plant flare system, all vessels relieving to the flare were designed to operate at 50 psig. To minimize additional costs, a low-pressure subheader was designed instead of increasing tank thicknesses to be commensurate with increased design pressures. The Slurry Slop Tank and Vacuum Column will relieve into the 25 psig flare header. This ECP was estimated to cost $400,000 in the original Design Baseline.	$445,000
4-1022	Design Improvements and Modifications Improvements to the Integrated Facilities Section of the SRC Process Area included changes to the vent vapor system, flush solvent system, slop oil collection equipment, and compressor jacket water cooling system. The improvements resulted from the design review for operability and maintainability. This ECP was estimated to cost $400,000 in the original Design Baseline.	$507,000
4-1029	Solidifier Fume Control Unit In the Original Design Baseline, the Solidifier fumes were ducted to the Coal Slurry Heaters (H-12301 A-D) for incineration. There was no particulate (fume) collection. This ECP revised the design to include collection devices capable of eliminating the fouling potential of the Solidifier fume stream. In the original Design Baseline, this ECP was estimated to cost $1,700,000.	$1,692,000
4-1030	Vari-Speed Drive Modifications This ECP effected savings which result from the use of constant speed drivers in the following applications where variable speed clutches were previously employed: High pressure purge pumps, SRC flush pumps, and high pressure water injection pumps. In the Original Design Baseline, this ECP was estimated to save $400,000.	($255,000)
4-1032	Increase Solidifier Flexibility ECP 4-1006, "Modifications to Solidification Section," removed the diverter valves which had allowed the product from any Solidifier to be directed to either of two parallel conveyors feeding the storage area. This ECP restored most of the reliability lost by elimination of those diverter valves by the addition of new diverter valves at the end of the conveyors picking up SRC from the Solidifiers. This prevents a failure of one of the long transfer conveyors to the storage area from impacting on the operation of the Solidifiers. The solidification section equipment was rearranged and two small conveyors were added. The ECP was estimated to cost $220,000 in the original Design Baseline.	$700,000
	SRC Process Area Total	$ 5,542,000

ECP No.	Description	Value
Coke and Liquid Products Area		
5-1013	Naphtha Hydrotreater The hydrocarbon liquids from the SRC Process, Coker and EBH Areas were upgraded to be marketable. The raw naphtha from the Product Oil Fractionator was hydrotreated to reduce its sulfur, nitrogen and oxygen to acceptable limits for use as reformer feedstock. In the Original Design Baseline, this ECP was estimated to cost $14,200,000 also.	$14,200,000
5-1014	Replace Soda Ash System for Calciner Scrubber A waste stream from the Gas Systems Area (Area 15) containing a sufficiently high caustic concentration was utilized in the Calciner Area (Area 13) for removing the sulfur dioxide contained in the Calciner flue gas. This stream is utilized in the Venturi Scrubber and replaced the soda ash system previously employed, thereby reducing the plant capital cost and eliminating the operating cost associated with the purchase of soda ash. The saving for this ECP did not change from the Original Design Baseline.	($121,000)
5-1015	Rotate Lummus Plot Plan Rotating the previous plot plan by 90° and then making a "mirror image" of the Area 13 layout produced large savings in the installation of electric feed cables, utility piping and interconnecting piping between other processing areas. The operation of the plant is also enhanced by the shortening of the SRC feed lines from Area 12. The cost of this ECP has not changed from that in the Original Project Baseline; however, a large saving in the Utilities and Offsites Area is now noted.	$27,000
5-1016	Revise Fresh and Spent Catalyst Handling Systems With ICRC now planning to receive the fresh catalyst and to send spent catalyst to a metal reclamation company in metal bins, the original loading system was changed from a pneumatic type to an elevator carrying the fresh catalyst bins up to the hopper loading platform. Because of the excess oil that is expected to cling to the spent catalyst, a Vibroscreen Circular Screen Separator has been added to correct this problem before the spent catalyst is sent to the reclaimer.	$115,000
5-1017	Seal Oil Storage for EBH Reactor Pump A special petroleum-based oil is required by the EBH Reactor Pump vendors which is not available from the SRC-I plant. A storage system with a controlled seal oil storage temperature and a seal oil pumping system with closely controlled seal and bypass flows was incorporated into the latest Plant design.	$154,000
	Coke and Liquid Products Area Total	$14,375,000

ECP No.	Description	Value
Cryogenic Systems Area		
3-1004	Hot Water Bath LIN Vaporizer In order to ensure an instantaneous supply of emergency nitrogen for purging and blanketing, even during a general plant power outage, the present system, which depends on circulated cooling water, was replaced by a closed-loop, hot-water system. The system comprises an insulated water storage tank, steam injectors, and vaporizers. The cost of this ECP in the original Design Baseline was $750,000.	$104,000
	Cryogenic Systems Area Total	$ 104,000
Gas Systems Area		
6-1007	Delete DPU Classification System The oversized KMAC classification capability in the Dust Preparation Unit of the Gas Systems Area was eliminated. Reviews of particle size distribution and bulk density data from parallel testing conducted by both ICRC and GKT led to the conclusion that the KMAC from the deashing unit will be sufficiently consistent in particle size distribution and will not exceed the specified particle size range such that inclusion of the classification feature is not technically justified. The savings of this ECP in the Original Design Baseline were estimated to be $8,237,000.	($11,435,000)
6-1014	Single H_2S Recycle Compressor The spare H_2S Recycle Compressor was deleted. Provisions were made to direct H_2S gas back to the feed of the Raw Gas Compressor in the event of a shutdown of the H_2S Recycle Compressor. The proposed bypass line is used on an emergency basis to offset the need for a plant shutdown in the case of an operational failure of the H_2S Recycle Compressor. The cost reduction in the Original Design Baseline was estimate to be $2,418,000.	($3,092,000)
6-1017	Min./Max. Changes The design of the Gas Systems Area units was assessed for accommodation of the minimum and maximum cases. It was established that four units required modifications: LPG, DEA, Selexol, and Shift. Conditions which affected the various units were high-ash gasifier feeds, feed coals with maximum PDC sulfur and oxygen contents and varying operating conditions of dependent units of the SRC-I plant such as the SRC unit, the coker, the EBH, and the hydrotreater. The assessment of the design, min., and max. operating conditions for the units resulted in equipment and related changes costing $1,480,000, which is $380,000 more than the Original Design Baseline.	$1,480,000
6-1018	N_2 Recycle/Solvent Recovery Unit Solvent-saturated nitrogen returned from the Dust Preparation Unit is now routed to a two-train N_2 Recycle/Solvent Recovery	$4,543,000

ECP No.	Description	Value
	Unit, one for each of the two Dust Preparation trains, for the removal of solvent before the gas is vented to the atmosphere. In the Original Design Baseline, the additional cost for this ECP was estimated to be $8,392,000.	
6-1019	Seal Nitrogen Booster Compressor A compressor was required to boost the plant nitrogen supply pressure to 250 psig for use in the shaft sealing system third casing, of the Raw Syngas Compressor during start-up when the normal hydrogen seal gas was not available. The estimated cost for this ECP has not changed.	$133,000
6-1020	Delete Centrifuges, and Decanters; Use Vacuum Belted Filter in BSRU Centrifuges and decanting were deleted and a vacuum filter arrangement with an endless belt was utilized. The vacuum belted filcter first cost, operating materials cost and utilities cost are lower than those of the centrifuges/ decanters while producing a better product. The estimated saving for this ECP in the Original Design Baseline was $826,000.	($1,121,000)
6-1021	Reduction of Fixed-Ammonia in Stripped Water by Lime Addition This ECP covered the cost of lime addition for the Ammonia Sulfide Water Stripper (ASWS) Unit and the addition of a fixed ammonia stripper. A high level of ammonia will inhibit biological reaction in the wastewater treatment system and cause violations of effluent limits. The concentration of both free- and fixed-ammonia in the stripped water must be reduced from 1,085 ppmw to 50 ppmw. Lime addition achieves this by increasing the pH of the water to free the fixed-ammonia. Also, lime addition in the wash water decreases corrosion problems due to high chlorine concentration in the system. In the Original Design Baseline, the cost of this ECP was estimated to be $2,850,000.	$1,912,000
6-1023	Kettle Type Steam Boilers To reduce costs, to improve unit reliability and to eliminate a potential hazard which could result from a loss of BFW circulation, the steam generation system in the Shift Unit was replaced by kettle-type boilers. The prior estimate of the saving for this ECP was $496,000.	($396,000)
6-1025	Gasification Materials Revisions As a result of a review of material selections for equipment, the gasification process licensor, GKT, upgraded the specifications of the materials coming in contact with wash water. In addition, the steam generation pressure in the waste heater boiler was reduced. The previous cost estimate for this ECP was $2,810,000.	$3,799,000

ECP No.	Description	Value
6-1026	Shift Condensate to Gasification Unit This ECP modified the Shift Unit to reduce process water usage in the Gas Systems Area. This is a new ECP; it and Post-Baseline ECP 6-1112, ASWS Capacity Reduction, evolved from the original ECP 7-1006, Wastewater Treatment System Modifications.	$638,000
5-1014	Replace Soda Ash System for Calciner Scrubber This value covers the impact on the Gas Systems Area of the Coke and Liquid Products ECP 5-1014. It is a new ECP. The brine flash drum will be relocated in the Coker/Calciner Area.	($33,000)
	Gas Systems Area Total	($3,572,000)
Utilities and Offsites Area		
7-1003	Flare Stack Relocation The flare stack was relocated closer to the process areas in order to reduce capital costs. The estimated cost for this ECP has not changed.	($1,500,000)
7-1006	Wastewater Treatment System Modifications Lower flow rates than anticipated from the Ammonia Sulfide Water Stripper decreased the flow of wastewater to the strong waste treatment system by approximately 250 gpm. Initially it was thought that the size of the system would have to be increased. However, the system proved to be adequate for the duty. Then the effects of ECPs 6-1026, Shift Condensate to Gasification Unit, and 6-1112, ASWS Capacity Reduction, actually reduced the required size. The prior estimate for this ECP was a cost increase of $6,420,000.	($800,000)
4-1032	Increase Solidifier Flexibility This values represents the impact of SRC Products Area ECP 4-1032, Increase Solidifier Flexibility, on the Utilities and Offsites Area. In the original Design Baseline, the total effect was charged against the SRC Products Area only.	($59,000)
5-1014	Replace Soda Ash System for Calciner Scrubber This value represents the impact of the Coke and Liquid Products ECP 5-1014, same title, on the Utilities and Offsites Area. In the original Design Baseline, the total effect of the ECP was charged against the Coke and Liquid Products Area only.	$106,000
5-1015	Rotate Lummus Plot Plan This value represents the impact of the Coke and Liquid Products ECP 5-1015, same title, on the Utilities and Offsites Area. In the original Design Baseline, the total effect of the ECP was charged against the Coke and Liquid Products Area only.	($3,590,000)
	Utilities and Offsites Area Total	($5,843,000)

27.0 POST-BASELINE ENGINEERING CHANGE PROPOSALS

Post-Baseline Engineering Change Proposals (ECPs) were developed as a result of the continuing design effort after the submission of the Original Project Baseline. All of the following ECPs were approved by the ICRC Configuration Control Board under authority granted to ICRC by the DOE. Those Class 1 ECPs included below also were approved by the DOE Project Configuration Control Board. The design changes were incorporated into the Revised Design Baseline technical documentation and their costs are included in the revised Cost Baseline. Cost and savings (bracketed) are expressed in first quarter FY 82 dollars.

ECP No.	Description	Value
SRC Products		
4-1101	Integrated Facilities Modifications Further review of the Integrated Facilities Section of the SRC Process Area revealed that modifications were required to the compressor jacket water system and the sizes of the Flush Solvent Storage Drum, Slurry Slop Tank, Critical Solvent Rundown Tank, and Heat Transfer Fluid Storage Tank. Additional underground drain tanks and pumps were added.	$1,648,000
4-1102	Critical Solvent Deashing Unit Modification Design changes were incorporated into the system based on recent pilot plant experience and development work by the Kerr-McGee Corporation. Improvements were made to increase thermal efficiency and to reduce the size of the heater, pumpressor, and heat exchangers. The diameter of the Second-Stage Settlers was reduced in size significantly.	($3,283,000)
4-1103	Coal Slurry Heater Safety Factor Revision The DOE suggested that the over-design factor for the fired duty of the Coal Slurry Heater be increased from 8 to 15% because of the uncertainty of the data base. Subsequent review by Catalytic and ICRC determined that the best method of achieving an increased design safety factor was by increasing the size of the Coal Slurry/Hot Oil Exchangers and holding constant the Coal Slurry Heater design duty.	$950,000
4-1104	Plot Plan Revisions The overall site plot plan was rearranged to move the CSD Area closer to the Gasification Area to reduce the distance for the pneumatic conveyance of KMAC. In addition, the effects of other ECPs were incorporated into the plot plan and the space set aside for a future filtration system was eliminated.	$3,615,000

ECP No.	Description	Value
4-1105	Product Oil Fractionation Revisions The Naphtha Column operating pressure was increased to eliminate the Product Fractionation Off-Gas Compressor and associated equipment. In addition, naphtha heat exchanger fouling factors were increased to allow for longer periods of operation between cleanings.	$216,000
4-1106	Vapor/Oil/Water Separator Modifications A review of the residence time available versus the time required for good separation of the various mixtures entering the separators resulted in the decision to increase the capacity of the High-Pressure Separator and High-Pressure Water Separator.	$598,000
4-1107	Sour Gas Compressor Modifications Review of the operation of two Sour Gas Compressors in parallel resulted in the addition of a recycle cooler for start-up, and an additional suction knockout drum and the elimination of a high-pressure discharge drum. The over-design factor for the compressor motor was reduced. This allowed the motor to be reduced in size from 7,000 to 6,000 hp.	($318,000)
4-1108	Column/Drum Residence Time The residence times for the sumps of the following equipment items were increased to allow ample time for operator response to upsets: Solvent Column, Off-Gas Suction Knock-Out Drums, and Product Vacuum Column Feed Drum.	$60,000
4-1109	Service Elevator Addition The structures for holding the coal-feed bins and metering equipment and Kerr-McGee Critical Solvent Deashing equipment are both over 200 feet high. An elevator was designed for each structure to allow for ready access to the equipment for operation and maintenance.	$988,000
	SRC Process Area Total	$4,474,000
Coke and Liquid Products Area		
5-1101	Coker/Calciner Design Changes As a result of changes in process conditions and intensive P&ID reviews, changes to equipment, deletions and additions of equipment and their respective installed costs resulted. This ECP covers these changes in the Coker/Calciner Area.	($253,000)
5-1102	EBH Design Changes As a result of changes in process conditions and intensive P&ID reviews, changes to equipment, deletions and additions of equipment and their respective installed costs resulted. This ECP covers these changes in the EBH Area.	($259,000)
	Coke and Liquid Products Area Total	($512,000)

ECP No.	Description	Value
Gas Systems Area		
6-1101	Baseline Estimate Review and Samples Collections This ECP covers the following: a. GKT's review of R. M. Parsons Baseline material take-offs estimate. b. GKT's costs associated with obtaining slag samples and data to support the ICRC solid waste technology program.	$7,000
6-1102	Delete LP Fuel Gas Absorber in BSRU The LP Fuel Gas from the LP DEA Absorber was routed directly to the plant fuel gas header, thus eliminating the LP fuel gas absorber and associated equipment.	($657,000)
6-1104	Delete Coal Receiving Cyclone/Filter The coal receiving cyclone/filter was made part of an overall coal dust conveying system specified by Rust Engineering, the costs for which are in the Utilities and Off-Sites Area.	($98,000)
6-1105	Single Mixed Feed Gasification H&MB-Additional Scope Parsons expended additional process engineering effort to provide mixed-feed heat and material balances in the ICRC format for the Dust Preparation Unit, Gasification Unit, Wash Water Treatment Unit, and the Raw Syngas Compression Unit.	$10,000
6-1106	Methanation Unit Revisions The scope and costs included in Category B ECP 6-1024, Methanation Unit, were revised downward.	($315,000)
6-1107	Revised Wash Water Treatment Pumps The scope and costs included in Category B ECP 6-1016, Wash Water Treatment Pump Revisions, were reevaluated.	$377,000
6-1108	Caustic Storage Distribution System Caustic storage and distribution were provided to the DEA, GKT, and Beavon units and for demineralization regeneration in the Utilities and Off-Sites Area.	$521,000
6-1109	Blowdown, Condensate, and Relief Systems for Gas Systems Area Additional equipment was required to standardize the boiler feedwater blowdown, condensate, and flare relief systems since each Area Contractor must supply a common pressure for each of the three utility services at his battery limits.	$998,000

ECP No.	Description	Value
6-1110	Add Separator and Heat Exchanger - Selexol Unit The pressure drop across the LP Hydraulic Turbine created a two-phase flow that reduced the heat transfer effectiveness downstream in the CO_2 Absorber Feed Exchanger. Adding a separator to the discharge side of the LP Hydraulic Turbine eliminated the problem since it separates the gaseous and liquid phases. The liquid was routed to the CO_2 Absorber Feed Exchanger Bank and the gaseous phase was directed to the new exchanger.	$411,000
6-1111	Steam Turbine Selection for Raw Syngas Compressor The Waste Heat Recovery System (WHRS) steam pressure reduction from 850 to 450 psig (sat), necessitated a changes in the selection of the steam turbine driver for the Raw Syngas Compressor. Also, costs were included for a surface condenser that had been inadvertently omitted from the Original Cost Baseline.	$3,645,000
6-1112	ASWS Capacity Reduction Design considerations resulted in reduced flow to the Ammonia Sulfide Water Stripper (ASWS) Unit by the recycling of the shift condensate stream to the Gasification Area. Also, the maximum sour water flows to the ASWS from the SRC and EBH Areas were reduced. These changes caused a reduction in the design capacity of the ASWS Unit.	($528,000)
	Gas Systems Area Total	$4,371,000

28.0 ENGINEERING STUDIES FOR PROCESS DESIGN IMPROVEMENTS

Since the establishment of the Original Project Baseline, ICRC has continuously performed activities to resolve areas of technical uncertainty, confirm integration and compatibility of process unit designs, and identify and evaluate potential design improvements for improved operability, reliability or economics. The major process design improvements are set forth below, and they should be seriously considered for incorporation when the SRC-I Project is reactivated. These improvements will reduce some of the concerns addressed in Section 23.0 "Design Uncertainty."

a. ALTERNATE KMAC CONVEYING AND GASIFIER FEEDING SYSTEMS

The hydrogen required in the SRC-I process is generated by gasifying Kerr-McGee ash concentrate (KMAC) supplemented with coal. In the current Design Baseline, KMAC is transported by a dense-phase blow-tank conveying system from the Ash Concentrator in the SRC Deashing Area to the Dust Preparation Unit in the Gasification Area, where it is blended with coal and humidified to control its flowability and fed to the gasifiers by means of screw feeders. These systems, and their auxiliary Nitrogen Recycle/Solvent Recovery Units, are complex and expensive. Also, the compatibility and reliability of the KMAC and coal feeding through the screw feeders depends upon a precise solid feed and proper dispersion of this feed in the oxygen/steam mixture.

GKT, the designer of the Gasification Process for the SRC-I Project, has vast experience in handling solids and has patented its method of measuring and controlling the solid feed flow to the Gasifiers. During the Post-Baseline period, GKT has developed and offered commercially a process design package, DOE/OR/03054-46, dated September, 1983, for alternate pneumatic conveying and feeding systems. The proposed systems simplify the current design, reduce the cost, and are expected to improve performance and reliability.

This study was forwarded to DOE on 29 September 1983.

b. WATER-BATH SOLIDIFICATION IN LIEU OF REXNORD SYSTEMS

Because of its high softening point of about 300± 25°F, SRC fuel is solidified to simplify storage, handling, and shipping. Solidification also facilitates handling by the customer, and conventional equipment and procedures can be used, without special modifications.

The current SRC-I solidification design is based on the Rexnord system, which consists of several parallel, multi-deck, water-jacketed Solidifiers. Each Solidifier is operated in a batch mode. Solidification by the Rexnord systems has several drawbacks, the most significant being the emission of heavy hydrocarbon fumes during the initial solidification phase of the cycle and the dust generation during the SRC break-up and discharge phase. The fumes must be collected, pretreated, and combusted to be environmentally acceptable before they are vented to the atmosphere.

ICRC has been searching for an alternative to Rexnord Solidification for several years. The most promising system is water-bath solidification. The water-bath technique is commerically-proven for coal-tar pitch. Tests on 30 tons of SRC in May 1981 were very successful. The water-bath system mitigates the problem of fumes generation by injecting and solidifying the SRC under water. Also, the resultant solids-handling process minimizes dust generation. Because the system operates continuously, it is expected to have higher operating reliability and availability than the batch-type Rexnord process.

ICRC has obtained a process design package for the water-bath solidifcation system from Koppers Company, Inc. of Pittsburgh, Pennsylvania. This study, DOE/OR/03054-92 dated January 1984, was forwarded to DOE on 23 January 1984.

c. PHENOL REMOVAL UNIT

Removing phenolics and other organic compounds from the sour waters of the processes would be both technically and economically advantageous. It would improve the stability and operability of several downstream processes such as the Claus Sulfur Plants and the Wastewater Treatment System in particular, and would reduce capital and operating costs. Phenol extraction significantly reduces volatile organic compounds (VOC) that would be stripped in the Ammonia Sulfide Water Stripper and eventually be sent to the Claus Sulfur Plant. Too much VOC can foul the catalyst, and contaminate the by-product sulfur to render it unsaleable. Also, phenol extraction not only reduces organic loading to the Wastewater Treatment System but, also dampens the shock loads that are detrimental to the biological treatment.

ICRC has evaluated two commercially available phenol recovery processes, the Chem-Pro Corporation system and the Lurgi Phenosolvan process, and has selected the Chem-Pro process. Tests were conducted by Chem-Pro Corporation using SRC-I wastewaters to successfully demonstrate its process. It has supplied a conceptual process design package to ICRC to treat process sour water streams before they are treated in the Ammonia Sulfide Water Stripper.

This study, DOE/OR/03054-83 was forwarded to DOE on 22 December 1983.

d. WASTEWATER TREATMENT AND SOLID WASTE DISPOSAL SYSTEMS

The designs for the wastewater treatment and solid waste disposal facilities in the current Design Baseline have much uncertainty. They were among the last activities performed before the establishment of the Project Baseline, and consequently they lacked the high degree of experimental confirmation that other process areas have. Experimental data now available have indicated that the designs can be improved. Test data have confirmed that, with the addition of a Phenol Recovery Unit in the gas-treating area, the quality of the treated wastewater to the Wastewater Treatment System would be significantly improved.

To reflect the favorable impacts on the wastewater treatment and solid wastewater disposal facilities by the addition of phenol extraction upstream, and to incorporate other revisions that the recent environmental data have justified, ICRC has contracted with Catalytic, Inc. to prepare a three-volume report DOE/OR/03054-71 dated September, 1983 and entitled:

Volumes 1 and 2:	Wastewater Treatment and Solid Waste Landfill Design Baseline Revision
Volume 3:	Wastewater Treatment System and Solid Waste Landfill Cost Baseline Revision

The reports were forwarded to DOE on 26 September 1983.

e. NAPHTHA HYDROTREATER DESIGN UPDATE

Process and cost information on the Naphtha Hydrotreater Unit in the Original Design Baseline was developed as a Class C ECP. It was based on limited data and engineering activities.

During the Post-Baseline period, the Naphtha Hydrotreater testing program was carried out to characterize and evaluate the processing capability of the SRC naphtha and to determine commercial operating conditions for a hydrotreater to prepare SRC naphtha for reforming. Following the completion of the program, a process design package was prepared by Stearns-Roger Engineering Corporation to obtain better defined capital and operating cost data.

The process design package, DOE/OR/03054-72, was forwarded to DOE on 27 Spetember 1983.

f. DISCHARGE IN LIEU OF ZERO WASTEWATER DISCHARGE

The feasibility of and necessity for zero wastewater discharge, which is included in the current Design Baseline, have been investigated further. Process systems associated with zero wastewater discharge are complex, expensive, and technically uncertain. Operability and reliability of the reverse osmosis and evaporator units, and the effect of corrosion on high chloride concentration in the cooling water are major concerns.

Data from Environmental R&D programs have indicated that the fully treated wastewater, after mixing with the river water, will meet all of the applicable water quality standards for the Green River except for five parameters for which the background river water is already in non-compliance. For those five parameters, the treated wastewater has lower concentrations than the river water. Preliminary aquatic ecotoxicity studies have not shown conclusively that the wastewater, after full treatment, including phenol extraction, is too toxic to discharge. Definitive tests are required to confirm the results of the preliminary studies.

The following Environmental R&D reports are being prepared by and for ICRC for release during the first quarter of 1984.

Evaluation of Effects of Phenol Recovery on Biooxidation and Tertiary Treatment, DOE/OR/03054-49, 1984, by ICRC

Comparative Toxicity of SRC-I Wastewater to Aquatic Organisms, DOE/OR/03054-91, 1984, by SRI International

g. U&O DESIGN UPDATE

The development of the U&O Area design and cost estimate has not kept pace with the changes and refinements in the designs of the various process areas. Based on the Revised U&O DBM, which takes into account all ECPs and Post-Baseline design improvements, and the steam/fuel system optimization, a better defined process and cost package will be developed for ICRC by Kellogg Rust Synfuels, Inc. by 30 April 1984. This update will contribute to a consistent overall plant design.

h. SITE PLAN CHANGES

Due to the concern that the 161 kv electrical feeder cable to the facility's main substation could have detrimental effects on the digital communication lines and digital process control equipment, a review was initiated to resite the substation and feeder cable. This review resulted in a recommendation that the substation be resited in the vicinity of coordinates N-5000, E-12,500 on Site Plan drawing 00-17-10001D.

This is believed to be an improvement (reduction of 161 KV switched noise effects); however, this relocation increases the lengths of the many 13.8 KV feeder circuits throughout the plant. Further study is believed to be needed.

In addition, locational changes of equipment due to other previously approved ECPs were incorporated into the Site Plan drawing to bring it up to date.

i. DEVELOPED ENGINEERING CHANGE PROPOSAL

Subsequent to the completion of the Engineering Studies described in the preceeding pages of this section, Engineering Change Proposals (ECPs) were developed for each of the studies described.

All of the following ECPs were approved by the ICRC Configuration Control Board under authority granted to ICRC by the DOE. Those Class 1 ECPs included below were also submitted for approval by the DOE Project Configuration Control Board.

ECP No.	Description	Value
4-1201	Alternate KMAC Transport System	$ (3,523,900)
4-1202	Water-Batch Solidification in Lieu of Rexnord Systems	(11,780,000)
*5-1013, Rev. 1	Naphtha Hydrotreater Design Update	581,000
6-1201	Phenol Removal Unit	2,740,000
7-1201	Site Plant Changes	7,100,000
7-1202	Wastewater Treatment and Solid Waste Handling Disposal System	(5,378,000)
7-1203	Discharge vs. Zero Wastewater Discharge	(29,315,000)
7-1204	U&O Design Update	17,007,100
4-1205	SRC Area Equipment Material Revisions	2,900

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*The total estimated cost for the Hydrotreater Design update is $14,781,000 which compares to the previous estimate of $14,200,000, which is tabulated on Page I-110 and described on page B-149.

SRC-I PROJECT BASELINE

PHASES IIIA AND IIIB

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SRC-I PROJECT BASELINE

PHASES IIIA AND IIB

CHAPTER I. SRC-I (WBS 1.0)

A. TECHNICAL SCOPE (OPERATING PLAN)

The SRC-I Demonstration Plant is being designed and built to demonstrate the technical feasibility, the environmental acceptability, and the economic viability of the SRC-I process. This demonstration is intended to allow an industry based on the SRC-I process to be established in the private sector without the need for additional experiments or demonstrations. The Demonstration Plant will be constructed so as not to preclude its ultimate expansion to a commercial-size plant.

The general approach to be used to design and construct the plant has been outlined in the ICRC Project Management Plan and in Appendix A of the DOE/ICRC Contract. The following concept is set forth in Appendix A.

Because the Demonstration Plant will contain some prototype equipment and processes, some areas will be equipped with more than the normal commercial plant instrumentation and controls, to allow analysis of the test operation required of a demonstration facility.

Because the plant is also planned as the first module of a commercial facility, and must show economic viability in the demonstration phase, it will be designed in accordance with good industrial practice for a commercial plant, with the potential to operate for 20 years at a cost-effective production rate. The plant will be designed to attain design capacity with commercially available coal feedstock, with a target of 90% on-stream and utilization factors, after an initial period of commissioning, start-up, shakedown, and test operation, and after required modifications identified during this period are completed. The plant will be designed with the equipment redundancy, installed spares, operating flexibility, and product-line flexibility required by good industrial practice for commercial operation. Other facilities necessary for long-term commercial operation, including buildings, roads, maintenance facilities, and spare-parts stocks, will be provided.

As defined in the Contract, the current project schedule provides approximately one and one-half years to commission the plant. The first half of this period will be devoted to commissioning the utilities, the coal-handling system, the ASU and the Gas Systems Area. The remaining time will be devoted to commissioning the SRC Process Area, the Coker-Calciner and EBH. When all of these units are commissioned, plant start-up will begin. The Contract states that the plant will be ready for start-up when:

- all areas have been fully commissioned;
- necessary modifications, additions, debottlenecking, or upgrading have been accomplished, or can be scheduled without interfering with operating objectives; and
- the plant is ready for sustained operation to produce the full product slate, including solid SRC, anode-grade coke, and hydrotreated oil products.

A period of two and one-half years is provided in the Contract for start-up, shakedown, and test operation. Thus, a total period of approximately four years is provided from the beginning of the commissioning of utilities to the end of the test operation period. Four years is recognized as being a relatively short period to evaluate a plant of this size and complexity, which also contains new technology and equipment prototypes. To minimize problems that might reduce on-stream time, which is essential for producing operating data needed for process evaluation and products needed for market evaluation, more equipment or system redundancy will be provided for prototype or new-application units than normal commercial practice would dictate for an established process. In other cases, normal industrial practice will be followed.

Examples of the extra redundancy to be provided on prototype units to improve on-stream time during the test operation period include the installation of:

- a spare 100% coal-feed and slurry-preparation system;
- six 25% capacity slurry-feed pumps;
- four parallel 25% slurry preheater trains;
- spare slurry-pressure letdown valves;
- a spare first-stage separator and heavy-phase handling system in the Kerr-McGee CSD area;
- a spare 100% Kerr-McGee ash concentrate conveyor; and
- a zero discharge wastewater system, plus a NPDES permit to allow discharge of effluents into the Green River when the zero-discharge system is inoperative.

Examples of redundancy to be provided in accordance with industrial practice include the installation of:

- spare 100% process pumps;
- parallel 50% reciprocating compressors;
- multiple ASUs with cryogenic liquid storage and vaporization; and
- parallel 70% Claus sulfur recovery plants.

The Phase III operation period of 30 months has been divided into two parts:

- Phase IIIA: start-up and shakedown of the integrated facility, assumed to last six months
- Phase IIIB: plant test operation, assumed to last 24 months

The general objectives of the test operation period, listed in Appendix A of the Contract, include the following:

- Operation: The Contractor will operate the plant for an extended period (approximately two years) following completion of start-up activities, in order to establish optimum operating parameters using the design coal or different coal feedstock(s) as may be compatible with the operating objectives. The Contractor will confirm: environmental acceptability, safety of operation, maximum conversion, various product slates, evaluation of selected technologies, optimum solvent balance and deashing, and maximum hydrogen production efficiency.
- Operating objectives, in descending order of priority, will be: to optimize production as dictated by existing or developing product market requirements; to define the capabilities of the plant to commercially produce each of the plant products; to define plant capacity, efficiency, and flexibility, and variation of key process parameters; to develop the information needed to design and build a 30,000-TPD commercial facility; to test performance of the plant using different coal feedstocks, after the first four objectives are accomplished, or if it can be done without interfering with the first four objectives; and, to perform other testing as agreed.

These general objectives will be the basis for preparing specific objectives and procedures that will be detailed in a Plant Test Program prepared during

Phase II, after the Phase I design is substantially complete. The objectives of the Plant Test Program will be to provide enough system and plant operating data to permit evaluation of the reliability and operability of plant equipment, and of the technical feasibility and efficiency of the process. The program will also provide sufficient products to allow evaluation of their commercial marketability.

In a complex plant having the prototype equipment and technology of the Demonstration Plant, equipment breakdown and equipment and process malfunction can be expected to continue into the test operation period, resulting in unscheduled shutdowns. In addition to unscheduled shutdowns, shutdowns will be scheduled for plant turnarounds and for process and equipment changes and adjustments. Because some of these modifications may require substantial lead time for engineering and procurement, sustained operation at a target production rate of 90% for extended periods during the start-up period is unlikely. In view of this, the following plant on-stream and utilization factors have been estimated for the Project Baseline operating cost estimate:

Period	On-Stream Factor (% of Calendar Time)	Throughput Factor (% of Design)	Overall Utilization Factor (% of Design Production Rate)
Phase IIIA, 6 mo	65	69	45
Phase IIIB, first 12 mo	75	78	59
Phase IIIB, second 12 mo	85	83	71

Although one objective of the Plant Test Program will be to perform a high percentage on-stream run, it will have a lower priority than the objectives to obtain information on the processes, system, and equipment performances and capabilities. A sustained test run of the plant at near design rates would be very reassuring; however, the top priority of the Plant Test Program will be to provide data to support the economic analysis on which to base business decisions on process commercialization.

Operating experiences and data will be analyzed to identify bottlenecks, process deficiencies, and equipment problems that could affect or penalize commercial operation. Trade-off studies will be made, and the cost to remedy each of these deficiencies will be approximated to produce a total cost estimate for upgrading the plant to commercial performance standards. This information, together with marketing and financial input, will be the basis of the economic analysis that will determine the commercial viability of the process and plant.

B. COST PLAN AND SUMMARY

SRC-I
REVISED BASELINE
PHASE III SUMMARY
First-Quarter FY82 Dollars ($000s)

Revenues	IIIA	IIIB	Total
LPG	$ 1,100	$ 6,600	$ 7,700
Naphtha	11,400	92,400	103,800
Medium Oil	12,500	101,700	114,200
Heavy Oil	2,100	17,800	19,900
SRC/TSL-SRC	11,700	90,700	102,400
Anode Coke	8,300	67,200	75,500
Sulfur	2,400	13,900	16,300
Off Spec - Liquids	7,100	-	7,100
Off Spec - Solids	1,700	-	1,700
Total Revenues	$ 58,300	$390,300	$448,600
Operating Costs			
Labor	$ 5,256	$ 20,022	$ 25,278
Overhead	3,367	13,466	16,833
Chemicals	2,246	11,974	14,220
Catalysts	1,741	9,286	11,027
Lubricants	132	698	830
Power	9,853	45,472	55,325
Fuel	4,802	12,711	17,513
Coal	23,644	119,085	142,729
LIN	387	1,548	1,935
Maintenance	29,508	103,278	132,786
Total Operating Costs	$ 80,936	$337,540	$418,476
Gross Margin	22,636	(52,760)	(30,124)
Insurance	245	980	1,225
ICRC Overhead: Home Office	8,738	34,291	43,029
Site	3,377	8,145	11,522
G&A	4,665	17,263	21,928
License Fees	1,070	-	1,070
Retrofit Costs - Prior Years	45,100		45,100
Total Net (Revenues) Costs	$ 85,831	$ 7,919	$ 93,750

SRC-I
ORIGINAL BASELINE
PHASE III SUMMARY
First-Quarter FY82 Dollars ($000s)

	IIIA	IIIB	Total
Revenues			
LPG	$ 1,700	$ 10,900	$ 12,600
Naphtha	15,300	127,700	143,000
Medium Oil	18,800	159,300	178,100
Heavy Oil	3,000	25,200	28,200
SRC/TSL–SRC	17,200	141,600	158,800
Anode Coke	11,400	95,300	106,700
Sulfur	2,300	13,600	15,900
Off Spec - Liquids	10,200	-	10,200
Off Spec - Solids	1,700	-	1,700
Total Revenues	$81,600	$573,600	$655,200
Operating Costs			
Labor	$ 5,256	$ 20,022	$ 25,278
Overhead	3,367	13,466	16,833
Chemicals	3,381	18,036	21,417
Catalysts	1,784	9,520	11,304
Lubricants	113	604	717
Power	9,396	43,364	52,760
Fuel	9,090	24,687	33,777
Coal	23,456	118,140	141,596
LIN	387	1,548	1,935
Maintenance	30,000	105,000	135,000
Total Operating Costs	$86,230	$354,387	$440,617
Gross Margin	4,630	(219,213)	(214,583)
Insurance	245	980	1,225
ICRC Overhead: Home Office	8,738	34,291	43,029
Site	3,377	8,145	11,522
G & A	4,665	17,263	21,928
License Fees	1,070	-	1,070
Retrofit Costs - Prior Years	45,100	-	45,100
Total Net (Revenues) Costs	$67,825	$(158,534)	$(90,709)

SRC-I

ORIGINAL BASELINE
PHASE III SUMMARY
Escalated Dollars ($000s)

	IIIA	IIIB	Total
Revenues			
LPG	$ 2,900	$ 20,800	$ 23,700
Naphtha	26,300	243,700	270,000
Medium Oil	32,400	304,100	336,500
Heavy Oil	5,200	48,100	53,300
SRC/TSL	29,500	270,300	299,800
Anode Coke	19,600	181,900	201,500
Sulfur	4,000	26,000	30,000
Off Spec - Liquids	17,500	-	17,500
Off Spec - Solids	2,900	-	2,900
Total Revenues	$140,300	$1,094,900	$1,235,200
Operating Costs			
Labor	$ 8,943	$ 37,867	$ 46,810
Overhead	5,793	25,520	31,313
Chemicals	5,814	34,170	39,984
Catalysts	3,068	18,044	21,112
Lubricants	194	1,148	1,342
Power	16,161	82,356	98,517
Fuel	15,636	46,513	62,149
Coal	40,345	224,068	264,413
LIN	666	2,937	3,603
Maintenance	50,601	198,640	249,241
Total Operating Costs	$147,221	$ 671,263	$ 818,484
Gross Margin	6,921	(423,637)	(416,716)
Insurance	422	1,857	2,279
ICRC Overhead: Home Office	15,029	64,985	80,014
Site	5,807	15,309	21,116
G & A	8,009	32,635	40,644
License Fees	1,070	-	1,070
Retrofit Costs - Prior Years	68,878	-	68,878
Total Net (Revenues) Costs	$106,136	$ (308,851)	$ (202,715)

U. S. DEPARTMENT OF ENERGY

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(1-78)

ORIGINAL BASELINE Phase III

PAGE OF

1. Contract Identification
Demonstration of the Solvent Refined Coal Process

2. Contract Number
DE-AC05-78OR03054

3. Contractor (name, address)
International Coal Refining Company
P. O. Box 2752
Allentown, PA 18001

4. Contract Start Date
10 July 1978

5. Contract Completion Date

6. Identification Number	7. Reporting Category (e.g., contract line item or work breakdown structure element)	8. Planned Prior Fiscal Years	9. Actual Prior Fiscal Years	IIIA	IIIB				Phase III
				FY88	FY88	FY89	FY 90	TOTAL	TOTAL
1.2.1	SRC			38636	21613	86586	64937	173136	211,772
1.2.2.1	Coker/Calciner			3522	1679	6650	4712	13041	16,563
1.2.2.2	EBH			6242	2877	11461	8433	22771	29,013
1.2.2.5	Naphtha Hydrotreater			1270	506	2017	1462	3985	5,255
1.3.1.1	ASU			2968	1539	6292	5000	12831	15,799
1.3.2	Gas Systems			17367	8263	32806	23240	64309	81,676
1.4.1	Utilities & Outside Battery Limits			14946	7051	28021	20018	55090	70,036
1.5.1	Project Management			2782	1395	2932	1933	6260	9,042
1.5.2	Administration & Planning			3296	1651	6424	4899	12974	16,270
1.5.3	Technical Support			5430	2693	10701	8008	21402	26,832
1.5.4	Product Utilization			46726 *	810	3139	2455	6404	53,130
1.5.5	EPLA			1575	779	2952	1869	5600	7,175
	G & A			4665	2333	7988	6942	17263	21,928
	Total Costs			149425	53189	207969	153908	415066	564,491
	Cost Escalation			97011	40774	178327	151882	370983	467,994
	(Revenues)			(81600)	(59800)	(268100)	(245700)	(573600)	(655,200)
	(Revenues Escalation)			(58700)	(43100)	(230000)	(248200)	(521300)	(580,000)
	Net (Revenues) Costs			106136	(8937)	(111804)	(188110)	(308851)	(202,715)

15. Remarks * Includes $45,100 Retrofit Conversion Program.

Dollars Expressed in Thousands-1st Qtr. FY82 Dollars

17. Cost Plan Date
March, 1982

18. Signature of Contractor's Project Manager and Date

19. Signature of Contractor's Authorized Financial Representative and Date

20. Signature of Government Technical Representative and Date

DOE Form CR-533P
(1-78)

U. S. DEPARTMENT OF ENERGY

ORIGINAL BASELINE

Phase III

PAGE OF

1. Contract Identification Demonstration of the Solvent Refined Coal Process	2. Contract Number DE-AC05-78OR03054
3. Contractor (name, address) International Coal Refining Company P. O. Box 2752 Allentown, PA 18001	4. Contract Start Date 10 July 1978 5. Contract Completion Date

6. Identification Number	7. Reporting Category (e.g., contract line item or work breakdown structure element)	8. Planned Prior Fiscal Years	9. Actual Prior Fiscal Years	IIIA	IIIB				PHASE III
				FY88	FY88	FY89	FY90	TOTAL	TOTAL
1.2.1	SRC			66454	38233	160876	129010	328119	394,573
1.2.2.1	Coker/Calciner			6055	2968	12350	9364	24682	30,737
1.2.2.2	EBH			9030	5088	21289	16757	43134	52,164
1.2.2.5	Naphtha Hydrotreater			2022	895	3744	2908	7547	9,569
1.3.1.1	ASU			5104	2722	11699	9935	24356	29,460
1.3.2	Gas Systems			29874	14617	60920	46168	121705	151,579
1.4.1	U & O			25713	12472	51997	39777	104246	129,959
1.5.1	Project Mgmt.			4784	2468	5446	3841	11755	16,539
1.5.2	Admin. & Planning			5668	2920	11937	9734	24591	30,259
1.5.3	Tech. Support			9339	4764	19882	15914	40560	49,899
1.5.4	Prod. Util.			71675	1433	5832	4878	12143	83,818
1.5.5	EPLA			2709	1378	5485	3713	10576	13,285
	G & A			8009	4005	14839	13791	32635	40,644
	Total Costs			246436	93963	386296	305790	786049	1,032,485
	(Revenues)			(140300)	(102900)	(498100)	(493900)	(1094900)	(1,235,200)
	Net (Revenues) Costs			106136	(8937)	(111804)	(188110)	(308851)	(202,715)

15. Remarks	Dollars Expressed in Thousands-Escalated Dollars	17. Cost Plan Date March, 1982

18. Signature of Contractor's Project Manager and Date	19. Signature of Contractor's Authorized Financial Representative and Date	20. Signature of Government Technical Representative and Date

C. SCHEDULE

The original Project Master Schedule showed significant milestones based on early start/complete dates, for Operations during Phase III of the SRC-I Project. A bar chart format was used to graphically show the scheduled, predicted and actual occurence dates and it was supported by computerized tabulations of the same data. This information had been extracted electronically from the Intermediate Schedule developed by ICRC.

The schedules indicated completion of Phase IIIA in June 1988 and completion of Phase IIIB in June 1990.

While there is no current schedule for the resumption and completion of the SRC-I Project, the time durations for the original project activities can and should be considered in the development of any new preliminary schedules.

DOE Form CR-535
(1-78)

U.S. DEPARTMENT OF ENERGY

MILESTONE SCHEDULE AND STATUS REPORT

PAGE 1 OF 1

1. Contract Identification: PHASE III - MASTER SCHEDULE

2. Reporting Period: through

3. Contract Number:

4. Contractor (name, address):

5. Contract Start Date:

6. Contract Completion Date:

7. Identification Number	8. Reporting Category (e.g., contract line item or work breakdown structure element)	9. Fiscal Years and Months 1988				1989				1990					10. Percent Complete a) Planned	b) Actual
		OND	JFM	AMJ	JAS	OND	JFM	AMJ	JAS	OND	JFM	AMJ	JAS	OND		
910	OPERATIONS PHASE III															

11. Remarks: Milestone dates are based on Early Start and Complete. For available float see Log Sheets.

12. Signature of Contractor's Project Manager and Date:

13. Signature of Government Technical Representative and Date:

```
1REPORT DATE  1OCT81  CRITICAL PATH        INTERNATIONAL COAL REFINING COMPANY                                     REPORT 99   PAGE   1
 CONTRACT 00100      RUN  26MAR82        00-1-4821   ICRC MASTER SCHEDULE - REV #01-U                                        UNIT=DAY
 REPORTING ELEMENT: PH III                                                  WBS ELEMENT #: 1.6.2
    ID #      MILE                                          EARLY      ACTUAL     CURRENT   LATE          COMMENTS
              STONE                                         PLANNED    DATE       PLANNED   PLANNED

     910A     COMPL OPER PH IIIA                            24JUN88                24JUN88  24JUN88
     910B     COMPL OPER PH IIIB                            22JUN90                22JUN90  22JUN90
0     2 RECORDS, TOTAL ACTIVITY WEIGHT =           0
```

CHAPTER II. PRODUCT (WBS 1.2)

A. SRC (WBS 1.2.1)

1. TECHNICAL SCOPE (OPERATING PLAN)

The overall approach to operations and the operating objectives have been outlined in Chapter I, SRC-I Operations (WBS 1.0).

The Plant Test Program will outline plans for operating of the SRC Process Area at rates from 50 to 100% of design capacity, while optimizing process conditions. Product will be produced for market development and for feed to the Coker/Calciner and the EBH. Among the key operating variables are Dissolver temperature, pressure, and space velocity and slurry preparation temperature.

In addition to the solid and molten SRC products, crude oil liquids from the SRC Process Area will be separated and refined in the Product Oil Fractionator. After the Coke and Liquid Products Area is commissioned, oils from that area also will be processed in the Product Oil Fractionator. Operation of the fractionation system will be adjusted to provide the liquid product mix desired for market development.

Several key pieces of equipment will be of a size or application that is at, or beyond, the limit of the state-of-the-art. Included in this category are the vibrating-deck Solidifiers, the high-pressure and high-temperature Slurry Pumps, and the Critical Solvent Circulating Pumps. It is anticipated that major modifications to some of these critical equipment items will be required before the plant can be operated consistently at design rate.

Operating experience in the various coal liquefaction pilot plants indicates that, even with a sound engineering design, problems with equipment and pipeline plugging and failures due to corrosion and erosion can be expected. Therefore, it is expected that, during Phase IIIA operation, considerable downtime will be required to make piping repairs and modifications. An extensive corrosion/erosion monitoring program is planned to minimize the downtime by anticipating impending failures.

After the initial shakedown, sustained operation at design rates will be attempted to generate sufficient SRC to permit test operation and optimization of the Coker/Calciner and EBH. However, during this period the primary goal of the test operation will be to provide data on the performance capabilities of the process, systems, and equipment. Such data will be used to support the economic analysis on which the business decision on the commercialization of the process will be based.

Before the end of the test operation period, a direct-contact, water-cooled SRC solidification system will probably be installed and tested. This will be a modification of the technology which is now used commercially to solidify coal tar pitch. Space will be provided for the addition of this equipment in the area layout. Use of this solidification system will reduce the mechanical complexity and vapor effluent associated with the vibrating tray Solidifier of the present design. The cost for installing and testing this system, which is not included in the Cost Baseline, would be authorized under configuration management procedures.

The SRC Process Area will be maintained to attain the goal of a 20-year operating life. Preventative and predictive maintenance programs consistent with good industrial practice will be used.

The cost plan for operating the SRC Process Area has been developed to support this operating plan. Derivation of the costs and support information for them are contained in Appendix 2.0, Operating Cost Assumptions and Support Data.

2. COST PLAN

ICRC

REVISED BASELINE

SRC AREA 1.2.1

	IIIA	IIIB (1)			IIIB (2)			
	FY 88 6 Mos.	FY 88 3 Mos.	FY 89 9 Mos.	Subtotal IIIB (1)	FY 89 3 Mos.	FY 90 9 Mos.	Subtotal IIIB (2)	Grand Total
I. FY 82 Dollars								
Chemicals	$ 437	$ 291	$ 873	$ 1,164	$ 291	$ 873	$ 1,164	$ 2,765
Catalysts	-	-	-	-	-	-	-	-
Lubricants	21	13	42	55	13	42	55	131
Power	1,127	607	1,820	2,427	694	2,080	2,774	6,328
Fuel	1,161	435	1,377	1,812	306	948	1,254	4,227
Coal	21,023	13,305	39,914	53,219	13,935	41,804	55,739	129,981
LIN	-	-	-	-	-	-	-	-
Maintenance	11,886	5,448	16,343	21,791	4,952	14,858	19,810	53,487
Operating Labor	961	478	1,440	1,918	428	1,298	1,726	4,605
Plant Overhead	591	294	887	1,181	294	887	1,181	2,953
Total	$37,207	$20,871	$62,696	$83,567	$20,913	$62,790	$83,703	$204,477

ICRC
BASELINE
SRC AREA 1.2.1

	IIIA	IIIB (1)			IIIB (2)			
	FY88 6 Mos.	FY88 3 Mos.	FY89 9 Mos.	Subtotal IIIB (1)	FY89 3 Mos.	FY90 9 Mos.	Subtotal IIIB (2)	Grand Total
I. FY82 Dollars								
Chemicals	$ 965	$ 643	$ 1,931	$ 2,574	$ 643	$ 1,931	$ 2,574	$ 6,113
Catalysts	-	-	-	-	-	-	-	-
Lubricants	21	13	42	55	13	42	55	131
Power	1,183	636	1,909	2,545	727	2,181	2,908	6,636
Fuel	1,480	555	1,788	2,343	397	1,278	1,675	5,498
Coal	21,023	13,305	39,914	53,219	13,935	41,804	55,739	129,981
LIN	-	-	-	-	-	-	-	-
Maintenance	12,412	5,689	17,067	22,756	5,171	15,516	20,687	55,855
Operating Labor	961	478	1,440	1,918	428	1,298	1,726	4,605
Plant Overhead	591	294	887	1,181	294	887	1,181	2,953
Total	$38,636	$21,613	$ 64,978	$ 86,591	$21,608	$ 64,937	$ 86,545	$211,772
II. Escalated Dollars								
Chemicals	$ 1,659	$ 1,137	$ 3,553	$ 4,690	$ 1,229	$ 3,837	$ 5,066	$ 11,415
Catalysts	-	-	-	-	-	-	-	-
Lubricants	36	23	77	100	25	83	108	244
Power	2,035	1,125	3,513	4,638	1,389	4,334	5,723	12,396
Fuel	2,546	982	3,291	4,273	759	2,539	3,298	10,117
Coal	36,160	23,537	73,455	96,992	26,630	83,064	109,694	242,846
LIN	-	-	-	-	-	-	-	-
Maintenance	21,349	10,064	31,410	41,474	9,882	30,830	40,712	103,535
Operating Labor	1,652	845	2,651	3,496	818	2,561	3,379	8,527
Plant Overhead	1,017	520	1,632	2,152	562	1,762	2,324	5,493
Total	$66,454	$38,233	$119,582	$157,815	$41,294	$129,010	$170,304	$394,573

B. COKE AND LIQUID PRODUCTS (WBS 1.2.2)

1. COKER/CALCINER (WBS 1.2.2.1)

a. Technical Scope (Operating Plan)

The overall approach to operations and operating objectives are outlined in Chapter I, SRC-I Operations (WBS 1.0).

The Plant Test Program will outline plans for operation of the Delayed Coker/Calciner. To accomplish the objectives, bottlenecks, process deficiencies, and equipment problems must be identified and corrected.

Delayed Coker

The operating plan for the Delayed Coker is to thermally crack about one-third of the molten SRC produced in the SRC Process Area into off-gas, light and middle distillates, and green coke that is subsequently upgraded in a calciner into a suitable anode-grade coke for marketing to the aluminum industry. The basis for the design was developed from bench-scale pilot runs and The Lummus Company technology for the delayed coking of coal tar pitch. Process operating variables that affect coke yield and purity include recycle ratios, coke drum pressures, and coke drum temperatures, all of which will be varied within the limits of the design in an effort to optimize product quality and yield. Also, SRC thermal reactivity will be defined in order to establish unit capacity limits and to provide sufficient information for potential commercialization.

The light and middle distillates and sour off-gas will be routed to the Product Oil Fractionator in the SRC Process Area and the DEA Unit in the Gas Systems Area, for additional processing. Yields and product quality will be analyzed for marketing product dispositions, further clarifying unit profitability. The corrosivity and stability of the distillate streams will be reviewed for confirmation of the suitability of the metallurgy selections and possible future downstream processing.

The coke handling system (coke cutting, slurrying, and dewatering) also will be tested for equipment reliability and capacity limitations. Delayed coking process variables that affect the quality and physical characteristics of the green coke will be varied, if necessary, to facilitate the cutting of the coke and to avoid the handling problems associated with the production of shot coke, which is a green coke with a low volatile matter content.

The Delayed Coker process, although proven commercially on various petroleum oils, heavy tars, and slurries, has not been demonstrated successfully on molten SRC. Therefore, confirmation of the process design basis and coke quality will be necessary in order to establish the marketability of products, and operability and profitability of the Delayed Coker. Upon completion of the initial startup and shakedown, alternate heavy oil feeds produced internally in the SRC Process Area (LSRC, TSL-SRC) may be blended and charged to the Coker in an effort to produce a premium, low-sulfur coke that would improve the profitability of the Coker and hence the marketing position of the SRC-I plant.

In accordance with plant operating objectives, the Coker will be mechanically maintained to attain the goal of a 20-year operating life. Preventative and predictive maintenance programs consistent with good industrial practice will be used.

The cost plan for operating the Coker has been developed to support this operating plan. Derivation of the costs and support information for them are contained in Appendix 2.0, Operating Cost Assumptions and Support Data.

Calciner

The operating plan for the Calciner is to convert about 690 TPSD of green coke (dry basis) produced from molten SRC in the Delayed Coker into 570 TPSD of anode-grade coke. The principal reactions in the Coker include devolatilization, drying, dehydrogenation, carbonization, and densification, which are controlled by varying the Kiln speed, feed rate, and reaction temperatures. The aluminum industry imposes density, volatile-matter, and moisture-content specifications, which must be met in the manufacture of anode-grade coke. Other impurity specification limits on the product anode coke such as sulfur and ash content will be controlled upstream of the calciner in the dissolver and deashing units of the SRC Process Area and in the Delayed Coker. An additional variable that will improve the physical characteristics of the calcined coke is the use of air staging in the Kiln, more commonly referred to as tertiary air. The injection of tertiary air will reduce the temperature gradient across the Kiln and thus improve the uniform heating and porosity of the calcined coke. Also, tertiary air will be varied to optimize unit efficiency and profitability by reducing excess Kiln air flow and fuel consumption.

In order to determine the economic viability and technical feasibility of the Calciner, the previously mentioned process variables of feed rate, Kiln speed, Kiln temperature, and air injection staging will be changed within the limits of the design.

The effluent flue gas leaving the Kiln is directed through auxiliary units including an Incinerator, Waste Heat Boiler, and SO_2 Scrubber for heat recovery and particulate and sulfur dioxide removal to ensure maximum thermal efficiency and environmental acceptability of the Calciner process.

Similar to the Delayed Coker, the Calciner process has been commercially proved on green coke produced from petroleum oils, but not from molten SRC. Operating variables will be changed to optimize the calcination of green coke manufactured from molten SRC. Capacity limitations and product quality will be defined in Phase III for the commercialization of anode-grade coke. Isolated test runs for the production of alternate grades of calcined coke, e.g., needle coke, may be implemented to determine the maximum profitability for the Calciner and SRC-I plant.

In accordance with plant operating objectives, the Calciner will be mechanically maintained to attain the goal of a 20-year operating life. Preventative and predictive maintenance programs consistent with good industrial practice will be used.

The cost plan for operating the Calciner has been developed to support the above operating plan. The derivation of the costs and support information for them are contained in Appendix 2.0, Operating Cost Assumptions and Support Data.

b. Cost Plan

ICRC

REVISED BASELINE

COKER/CALCINER 1.2.2.1

	IIIA	IIIB (1)			IIIB (2)			
	FY 88 6 Mos.	FY 88 3 Mos.	FY 89 9 Mos.	Subtotal IIIB (1)	FY 89 3 Mos.	FY 90 9 Mos.	Subtotal IIIB (2)	Grand Total
I. FY 82 Dollars								
Chemicals	$ 90	$ 60	$ 180	$ 240	$ 60	$ 180	$ 240	$ 570
Catalysts	-	-	-	-	-	-	-	-
Lubricants	6	4	12	16	4	12	16	38
Power	360	194	582	776	221	665	886	2,022
Fuel	368	138	436	574	97	300	397	1,339
Coal	-	-	-	-	-	-	-	-
LIN	-	-	-	-	-	-	-	-
Mairtenance	1,326	608	1,823	2,431	552	1,658	2,210	5.967
Operating Labor	663	331	995	1,326	293	884	1,177	3,166
Plart Overhead	395	197	594	791	197	594	791	1,977
Total	$ 3,208	$ 1,532	$ 4,622	$ 6,154	$ 1,424	$ 4,293	$ 5,717	$ 15,079

ICRC

BASELINE

COKER/CALCINER 1.2.2.1

	IIIA	IIIB (1)			IIIB (2)			
	FY88 6 Mos.	FY88 3 Mos.	FY89 9 Mos.	Subtotal IIIB (1)	FY89 3 Mos.	FY90 9 Mos.	Subtotal IIIB (2)	Grand Total
I. FY82 Dollars								
Chemicals	$ 180	$ 120	$ 361	$ 481	$ 120	$ 361	$ 481	$ 1,142
Catalysts	-	-	-	-	-	-	-	-
Lubricants	5	3	11	14	3	11	14	33
Power	376	202	608	810	231	695	926	2,112
Fuel	546	204	660	864	147	471	618	2,028
Coal	-	-	-	-	-	-	-	-
LIN	-	-	-	-	-	-	-	-
Maintenance	1,357	622	1,865	2,487	565	1,696	2,261	6,105
Operating Labor	663	331	995	1,326	293	884	1,177	3,166
Plant Overhead	395	197	594	791	197	594	791	1,977
Total	$3,522	$1,679	$5,094	$6,773	$1,556	$4,712	$6,268	$16,563
II. Escalated Dollars								
Chemicals	$ 309	$ 212	$ 665	$ 877	$ 229	$ 717	$ 946	$ 2,132
Catalysts	-	-	-	-	-	-	-	-
Lubricants	8	5	21	26	6	22	28	62
Power	646	357	1,120	1,477	441	1,381	1,822	3,945
Fuel	939	361	1,215	1,576	281	936	1,217	3,732
Coal	-	-	-	-	-	-	-	-
LIN	-	-	-	-	-	-	-	-
Maintenance	2,334	1,100	3,432	4,532	1,080	3,370	4,450	11,316
Operating Labor	1,139	585	1,832	2,417	560	1,758	2,318	5,874
Plant Overhead	680	348	1,092	1,440	376	1,180	1,556	3,676
Total	$6,055	$2,968	$9,377	$12,345	$2,973	$9,364	$12,337	$30,737

2. EXPANDED BED HYDROCRACKER (WBS 1.2.2.2)

a. Technical Scope (Operating Plan)

The overall approach to operations and operating objectives are outlined in Chapter I, SRC-I Operations (WBS 1.0).

The Plant Test Program will outline plans for operating the EBH. To accomplish the objectives, bottlenecks, process deficiencies, and equipment problems must be identified and corrected.

The operating plan for the EBH is to upgrade or convert molten SRC produced in the SRC Process Area into naphtha, distillate, heavy oils, TSL-SRC, and gas. To provide optimum marketing flexibility in the production of light- and heavy-distillate oils, two operating cases have been selected for the design of the EBH. Conversion of the molten SRC into product oils with an end point of less than 850°F can be varied from 50 to 79% by adjusting the recycle oil and SRC charge rates. Thus, the charge rate to the EBH can range from 886 to 1,772 TPSD, depending on the operating status of the Solidifier and Delayed Coker and the maximum plant profitability derived from marketing values for solid SRC, anode-grade coke, and distillates.

Operating variables that affect unit conversion, heteroatom removal, and unit profitability include hydrogen partial pressure, reactor temperature, recycle oil rates, equilibrium catalyst activity, feed viscosity, and feed rates. During Phase III, these conditions will be varied within the limits of the design to determine the optimum operating condition of the EBH. Because the catalyst plays an integral role in both the conversion and heteroatom removal of SRC, alternate catalysts may be tested for further unit optimization. The reactivity of SRC to distillate fuels will also be established for future commercialization or scale-up of the Hydrocracker.

The fractionation system within the EBH is designed to produce both an internal recycle solvent that meets the specifications of the licensed process and a Vacuum Column bottoms stream (TSL-SRC) which meets feed specifications to the Solidifiers. Product quality, corrosiveness, heteroatom content, and stability will be closely analyzed for marketing value. Hydrogen donor value and characteristics for blending with products produced in other areas of the SRC-I plant will be analyzed also. Finally, any coking and thermal cracking tendencies of the heavy oil streams produced in the Hydrocracker will be reviewed for potential improvements in the sizing of vacuum furnaces and separators to minimize unit outages from carbon/coke buildup within the process equipment.

After the product market values are clearly defined, operating severity may be varied to maximize plant profitability within the limits of the design. If the heavy distillate product were to prove to be an excellent hydrogen shuttling agent, the recycling of this solvent to the SRC Dissolver may prove beneficial to minimize hydrogen consumption and to ensure an excess of process solvent in the plant. The scheme to integrate the EBH with the SRC Process Area, together with various other alternatives, may be attempted to improve the overall plant integration and profitability.

In accordance with plant operating objectives, the EBH will be mechanically maintained to attain the goal of a 20-year operating life. Preventative and predictive maintenance programs consistent with good industrial practice will be used.

The cost plan for operating the EBH has been developed to support this operating plan. Cost derivations and support information are contained in Appendix 2.0, Operating Cost Assumptions and Support Data.

b. Cost Plan

ICRC

REVISED BASELINE

EBH AREA 1.2.2.2

	IIIA	IIIB (1)			IIIB (2)			
	FY 88 6 Mos.	FY 88 3 Mos.	FY 89 9 Mos.	Subtotal IIIB (1)	FY 89 3 Mos.	FY 90 9 Mos.	Subtotal IIIB (2)	Grand Total
I. FY 82 Dollars								
Chemicals	$ 259	$ 172	$ 518	$ 690	$ 172	$ 518	$ 690	$ 1,639
Catalysts	1,274	849	2,547	3,396	849	2,547	3,396	8,066
Lubricants	14	9	27	36	9	27	36	86
Power	785	423	1,268	1,691	483	1,450	1,933	4,409
Fuel	145	54	171	225	38	118	156	526
Coal	-	-	-	-	-	-	-	-
LIN	-	-	-	-	-	-	-	-
Maintenance	1,896	869	2,607	3,476	790	2,370	3,160	8,532
Operating Labor	573	286	860	1,146	254	764	1,018	2,737
Plant Overhead	343	171	515	686	171	515	686	1,715
Total	$ 5,289	$ 2,833	$ 8,513	$11,346	$ 2,766	$ 8,309	$11,075	$ 27,710

ICRC
BASELINE
EBH 1.2.2.2

	IIIA	IIIB (1)			IIIB (2)			
	FY88 6 Mos.	FY88 3 Mos.	FY89 9 Mos.	Subtotal IIIB (1)	FY89 3 Mos.	FY90 9 Mos.	Subtotal IIIB (2)	Grand Total
I. FY82 Dollars								
Chemicals	$ 259	$ 172	$ 518	$ 690	$ 172	$ 518	$ 690	$ 1,639
Catalysts	1,274	849	2,547	3,396	849	2,547	3,396	8,066
Lubricants	11	7	21	28	7	21	28	67
Power	797	429	1,288	1,717	490	1,472	1,962	4,476
Fuel	206	77	246	323	55	177	232	761
Coal	-	-	-	-	-	-	-	-
LIN	-	-	-	-	-	-	-	-
Maintenance	1,934	886	2,662	3,548	806	2,419	3,225	8,707
Operating Labor	573	286	860	1,146	254	764	1,018	2,737
Plant Overhead	343	171	515	686	171	515	686	1,715
Total	$5,397	$2,877	$ 8,657	$11,534	$2,804	$ 8,433	$11,237	$28,168
II. Escalated Dollars								
Chemicals	$ 446	$ 304	$ 953	$ 1,257	$ 329	$ 1,029	$ 1,358	$ 3,061
Catalysts	2,191	1,502	4,687	6,189	1,622	5,061	6,683	15,063
Lubricants	19	12	39	51	13	42	55	125
Power	1,371	759	2,370	3,129	936	2,925	3,861	8,361
Fuel	355	136	453	589	105	351	456	1,400
Coal	-	-	-	-	-	-	-	-
LIN	-	-	-	-	-	-	-	-
Maintenance	2,328	1,567	4,899	6,466	1,540	4,807	6,347	15,141
Operating Labor	885	506	1,583	2,089	485	1,519	2,004	4,978
Plant Overhead	590	302	948	1,250	327	1,023	1,350	3,190
Total	$8,185	$5,088	$15,932	$21,020	$5,357	$16,757	$22,114	$51,319

3. NAPHTHA HYDROTREATER (WBS 1.2.2.5)

a. Technical Scope (Operating Plan)

The Plant Test Program will outline plans for operating the Naphtha Hydrotreating Unit. The Hydrotreater will process all the naphtha from the Product-Oil Fractionator Unit in the SRC Area at a severity sufficient to reduce the nitrogen, sulfur, and oxygen feed content to levels required for specification reformer feed. The quantity of methanated makeup hydrogen added to the Hydrotreater will be controlled to meet the demands of upgrading reactions that desulfurize sulfur compounds to hydrogen sulfide, denitrogenate nitrogen compounds to ammonia, deoxygenate oxygen compounds to water, and hydrogenate olefins to saturates. Heteroatom removal is required to prevent poisoning, sintering, and coking of the bimetallic reforming catalyst. In addition to hydrogen makeup, the reaction temperature, unit pressure, and space velocity will be optimized to maximize heteroatom removal from naphtha.

The stripper, diethanolamine (DEA), and ammonia columns in the Hydrotreater will be operated at the production rate to remove water, hydrogen sulfide, and ammonia generated in the Hydrotreater reactor. Hydrotreated naphtha will be withdrawn from the bottom of the stripper and pumped to product storage.

After initial start-up and shakedown, the Hydrotreater Unit will be optimized in the following manner. The recycle and makeup hydrogen flow rates will be minimized to a level that still provides specification hydrotreated naphtha. The firing rate of the steam reboiler heater will be optimized so that the column performs optimally with minimal reflux. The DEA and condensate circulation rates will be optimized to produce acceptable absorber overhead performance with the least circulation. Other optimizations will be defined in a future, more-detailed Plant Test Program.

Although hydrotreating has been commercially proven with virgin and cracked petroleum naphthas produced in refineries, this technology has not been commercially demonstrated on coal-derived naphthas. Their increased heteroatom content (primarily nitrogen and oxygen) requires a substantial increase in unit severity and catalyst volume. Severity optimization will be defined in the operating plan in an effort to produce a hydrotreated naphtha suitable for processing in a gasoline reformer while also minimizing cracking of the naphtha to light gases. Because catalysts are essential in the hydrotreating process, alternative catalysts may replace the original catalyst load after its deactivation. This attempt at process optimization will only occur after bench-scale catalyst testing. The effect of increased impurities in the naphtha on unit operation, equipment, and catalysts will be closely analyzed and defined for future commercialization or scale-up of the Naphtha Hydrotreater.

The Hydrotreater Unit will be mechanically maintained in order to ensure a potential 20-year plant life consistent with good maintenance practices. The cost plan for operating the Hydrotreater has been developed to support the operating plan.

b. Cost Plan

ICRC

REVISED BASELINE

NAPHTHA HYDROTREATER 1.2.2.5

	IIIA	IIIB (1)			IIIB (2)			
	FY 88	FY 88	FY 89	Subtotal	FY 89	FY 90	Subtotal	
	6 Mos.	3 Mos.	9 Mos.	IIIB (1)	3 Mos.	9 Mos.	IIIB (2)	Grand Total
I. FY 82 Dollars								
Chemicals	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Catalysts	5	3	10	13	3	10	13	31
Lubricants	1	1	1	2	1	1	2	5
Power	56	30	90	120	34	103	137	313
Fuel	25	9	30	39	7	21	28	92
Coal	-	-	-	-	-	-	-	-
LIN	331	165	498	663	165	498	663	1,657
Maintenance	270	124	371	495	112	338	450	1,215
Operating Labor	66	32	101	133	28	88	116	315
Plant Overhead	37	18	56	74	18	56	74	185
Total	$ 791	$ 382	$ 1,157	$ 1,539	$ 368	$ 1,115	$ 1,483	$ 3,813

ICRC
BASELINE
NAPTHA HYDROTREATER 1.2.2.5

	IIIA	IIIB (1)			IIIB (2)			
	FY88 6 Mos.	FY88 3 Mos.	FY89 9 Mos.	Subtotal IIIB (1)	FY89 3 Mos.	FY90 9 Mos.	Subtotal IIIB (2)	Grand Total
I. FY82 Dollars								
Chemicals	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Catalysts	48	32	98	130	32	98	130	308
Lubricants	-	-	1	1	-	1	1	2
Power	31	16	51	67	19	58	77	175
Fuel	-	-	-	-	-	-	-	-
Coal	-	-	-	-	-	-	-	-
LIN	331	165	498	663	165	498	663	1,657
Maintenance	532	243	729	972	221	663	884	2,388
Operating Labor	66	32	101	133	28	88	116	315
Plant Overhead	37	18	56	74	18	56	74	185
Total	$1,045	$506	$1,534	$2,040	$483	$1,462	$1,945	$5,030
II. Escalated Dollars								
Chemicals	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Catalysts	83	57	181	238	61	195	256	577
Lubricants	-	-	2	2	-	2	2	4
Power	54	28	94	122	36	116	152	328
Fuel	-	-	-	-	-	-	-	-
Coal	-	-	-	-	-	-	-	-
LIN	569	292	916	1,208	315	990	1,305	3,082
Maintenance	914	430	1,342	1,772	422	1,318	1,740	4,426
Operating Labor	113	56	185	241	53	176	229	583
Plant Overhead	64	32	103	135	34	111	145	344
Total	$1,797	$895	$2,823	$3,718	$921	$2,908	$3,829	$9,344

CHAPTER III. SUPPORT PROCESSES (WBS 1.3)

A. CRYOGENIC SYSTEMS (WBS 1.3.1)

1. TECHNICAL SCOPE (OPERATING PLAN)

The overall approach to operations and the operating objectives have been outlined in Chapter I, SRC-I Operations (WBS 1.0).

The Plant Test Program will outline plans for the operation of the Air Separation Units (ASUs) at the gaseous production rates necessary to meet the oxygen requirement of the gasification reactors and the demands of the plant utility nitrogen system. The liquid oxygen storage and vaporization system will be operated to provide backup gaseous oxygen to the gasification reactors in the event of an ASU outage. The liquid nitrogen storage and vaporization system will be operated to provide backup gaseous nitrogen to the facility during an ASU outage and to meet short-term peak loads in the nitrogen utility header when it is impractical or uneconomical to increase the ASU nitrogen production.

Consistent with oxygen and nitrogen gas demands, the ASUs will be operated at a liquid-to-gas production ratio, for both oxygen and nitrogen, to maintain the maximum liquid oxygen and nitrogen inventories. When cryogenics liquid demands exceed production capacity, liquid will be purchased from outside sources. However, this additional liquid will be procured only when the liquid inventory is below the desired level and a continued heavy liquid demand is projected for the facility.

After initial start-up and shakedown, operation of the ASU will be optimized in an effort to minimize the venting of gaseous oxygen and nitrogen, and to achieve the minimum oxygen losses in the waste nitrogen streams consistent with good operating practices.

Because the 467 TPD ASU duplicates a commercially proven and operating design, no production limitations or revisions are anticipated that will require future corrective action.

In accordance with plant operating objectives, the ASUs will be mechanically maintained to attain the goal of a 20-year operating life. Preventative and predictive maintenance programs consistent with good industrial practice will be used.

The cost plan for the operation of the ASUs has been developed to support the above operating plan. The derivation of the costs and support information for them are contained in Appendix 2.0, Operating Cost Assumptions and Support Data.

2. COST PLAN

ICRC

REVISED BASELINE

ASU 1.3.1.1

	IIIA	IIIB (1)			IIIB (2)			
	FY 88 6 Mos.	FY 88 3 Mos.	FY 89 9 Mos.	Subtotal IIIB (1)	FY 89 3 Mos.	FY 90 9 Mos.	Subtotal IIIB (2)	Grand Total
I. FY 82 Dollars								
Chemicals	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Catalysts	4	3	9	12	3	9	12	28
Lubricants	23	15	47	62	15	47	62	147
Power	2,052	1,104	3,315	4,419	1,262	3,788	5,050	11,521
Fuel	-	-	-	-	-	-	-	-
Coal	-	-	-	-	-	-	-	-
LIN	-	-	-	-	-	-	-	-
Maintenance	648	297	891	1,188	270	810	1,080	2,916
Operating Labor	119	59	181	240	53	162	215	574
Plant Overhead	74	37	111	148	37	111	148	370
Total	$ 2,920	$ 1,515	$ 4,554	$ 6,069	$ 1,640	$ 4,927	$ 6,567	$ 15,556

ICRC
BASELINE
ASU 1.3.1.1

	IIIA	IIIB (1)			IIIB (2)			
	FY88 6 Mos.	FY88 3 Mos.	FY89 9 Mos.	Subtotal IIIB (1)	FY89 3 Mos.	FY90 9 Mos.	Subtotal IIIB (2)	Grand Total
I. FY82 Dollars								
Chemicals	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Catalysts	4	3	9	12	3	9	12	28
Lubricants	23	15	47	62	15	47	62	147
Power	2,072	1,115	3,348	4,463	1,275	3,825	5,100	11,635
Fuel	-	-	-	-	-	-	-	-
Coal	-	-	-	-	-	-	-	-
LIN	-	-	-	-	-	-	-	-
Maintenance	676	310	931	1,241	282	846	1,128	3,045
Operating Labor	119	59	181	240	53	162	215	574
Plant Overhead	74	37	111	148	37	111	148	370
Total	$2,968	$1,539	$4,627	$6,166	$1,665	$5,000	$6,665	$15,799
II. Escalated Dollars								
Chemicals	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Catalysts	6	5	17	22	6	18	24	52
Lubricants	40	27	87	114	29	94	123	277
Power	3,563	1,972	6,162	8,134	2,437	7,600	10,037	21,734
Fuel	-	-	-	-	-	-	-	-
Coal	-	-	-	-	-	-	-	-
LIN	-	-	-	-	-	-	-	-
Maintenance	1,163	548	1,713	2,261	539	1,681	2,220	5,644
Operating Labor	205	105	333	438	101	321	422	1,065
Plant Overhead	127	65	204	269	71	221	292	688
Total	$5,104	$2,722	$8,516	$11,238	$3,183	$9,935	$13,118	$29,460

B. GAS SYSTEMS (WBS 1.3.2)

1. TECHNICAL SCOPE (OPERATING PLAN)

The overall approach to operations and the operating objectives have been outlined in Chapter I, SRC-I Operations (WBS 1.0).

The Plant Test Program will outline plans for operating the units within the Gas Systems Area. The dust preparation, gasification, wash water treatment, raw syngas compression, shift, Selexol, and methanation systems will be operated at production rates required to meet the makeup-hydrogen demands of both the SRC Process and EBH areas. This part of the Gas Systems Area is referred to as the Makeup Hydrogen Production System. The Diethanolamine (DEA), Hydrogen Purification Unit (HPU) and Liquefied Petroleum Gas (LPG) units will be operated at production rates required to remove and control the quantity of impurities in the SRC-I plant recycle-hydrogen stream. This part of the Gas Systems Area is referred to as the Recycle-Hydrogen Treatment Production System. The hydrogen compression system will be operated at rates required to meet the demands of both the makeup- and recycle-hydrogen production systems.

The Ammonia Sour Water Stripping (ASWS) unit will be operated at a production rate required to process the average flows of sour water from the SRC Process, EBH, Coker/Calciner, and Gas Systems Areas. The Claus Plant will be operated at a production rate required to process the acid gas flows from the ASWS, DEA, and Selexol strippers to remove hydrogen sulfide and convert it to elemental sulfur. The Beavon Unit will be operated at the rate required to process flows from both the low-pressure DEA final gas absorber and the Claus Plant effluent for removal of low-level hydrogen sulfide and subsequent conversion to elemental sulfur. The Claus and Beavon units of the Gas Systems Area are referred to as the Sulfur Recovery Production System.

The dust preparation and gasification units of the makeup hydrogen production system will be operated at a KMAC-to-coal ratio that consumes all the KMAC material that is suitable for gasification. Supplemental coal will be added at a rate that balances both makeup-hydrogen and SRC-I plant fuel system demands.

The HPU unit will be operated at the bypass-to-recycle (feed) production rate and ratio necessary to control impurities in the plant recycle-hydrogen stream. The impurities will be removed as a rejected hydrocarbon gas stream, which will then be sent to the LPG unit for separation into LPG for sale and plant fuel gas.

The LPG unit will be operated in a manner that meets the demands of both the plant fuel-gas system and the SRC-I recycle-hydrogen treatment production system. The feed gas compressor for the LPG unit will compress all of the rejected hydrocarbon gas from the HPU for subsequent use in both the plant fuel gas and the LPG production systems. After the feed gas is compressed, the ratio of plant fuel gas makeup-to-LPG by-product to be produced will determine the overall plant fuel balance. The LPG storage and vaporization system will either vaporize LPG into the plant-fuel or pilot-gas systems or export excess LPG by-product (by rail or truck), or receive LPG procured from outside sources. LPG will be procured only for start-up requirements and periods of plant fuel-system deficiencies, to ensure an adequate inventory for use in the plant pilot-gas system and sulfur recovery system burner.

The sulfur storage and handling system will store by-product sulfur for interim periods and then load it into railcars for shipment.

After initial start-up and shakedown, operation of the Gas Systems Area will be optimized. Venting to the flare will be minimized, consistent with good operating practices, to optimize the use of coal feed to the Gasifiers to generate makeup hydrogen. Reciprocating-compressor recycle flow will be minimized by properly selecting compressor loadings. The DEA, Selexol, and Stretford solution circulation rates will be optimized to produce acceptable Absorber overhead performance with minimum circulation. The level of medium- and high-pressure steam supplied to the raw syngas turbine will be adjusted to provide the best balance for the plant steam system. Steam consumption in the Shift system and other unit reboilers will be optimized to produce good performance with minimum consumption, and nitrogen consumption for process and purge requirements will be optimized. Other optimizations will be detailed in the Plant Test Program.

In the Gas Systems Area, most of the process system designs are considered sufficiently proven that few production limitations or problems are anticipated which will require future correction. The DEA, HPU, LPG, Claus and Beavon Units do have the potential to produce significant limitations. Although these units are proven commercially, a significant change in the feed gas compositions from those listed in the Design Basis Memoranda and Process Design Criteria could limit the capacities of the DEA and downstream units.

Therefore, feed gas compositions to the DEA, HPU, and LPG units will be monitored continuously by on-stream process analyzers; if the composition changes significantly from design, corrective action can be taken immediately. Another system having the potential to cause significant production limitations requiring future revisions is the dust preparation system that handles and humidifies KMAC. While this system is a proven design for handling similar material in sintering plants, it is a first-of-a-kind installation for KMAC. The unit will be operated initially on coal, a feedstock for which similar equipment has been designed and operated satisfactorily. Subsequent operation on KMAC will define inherent handling problems which should expedite the design and installation of any modifications.

In accordance with plant operating objectives, all units in the Gas Systems Area will be mechanically maintained to attain the goal of a 20-year operating life. Preventative and predictive maintenance programs consistent with good industrial practice will be used.

The cost plan for the operation of the Gas Systems Area has been developed to support the above operating plan. The derivation of the costs and support information for them are contained in Appendix 2.0, Operating Cost Assumptions and Support Data.

2. COST PLAN

ICRC

REVISED BASELINE

GAS SYSTEMS 1.3.2

	IIIA	IIIB (1)			IIIB (2)			
	FY 88 6 Mos.	FY 88 3 Mos.	FY 89 9 Mos.	Subtotal IIIB (1)	FY 89 3 Mos.	FY 90 9 Mos.	Subtotal IIIB (2)	Grand Total
I. FY 82 Dollars								
Chemicals	$ 651	$ 434	$ 1,301	$ 1,735	$ 434	$ 1,301	$ 1,735	$ 4,121
Catalysts	440	293	881	1,174	293	881	1,174	2,788
Lubricants	31	21	62	83	21	62	83	197
Power	2,542	1,369	4,106	5,475	1,564	4,693	6,257	14,274
Fuel	2,084	782	2,485	3,267	552	1,707	2,259	7,610
Coal	2,621	1,298	3,897	5,195	1,233	3,699	4,932	12,748
LIN	56	27	84	111	27	84	111	278
Maintenance	6,948	3,184	9,554	12,738	2,895	8,685	11,580	31,266
Operating Labor	707	351	1,061	1,412	310	938	1,248	3,367
Plant Overhead	415	207	621	828	207	621	828	2,071
Total	$16,495	$ 7,966	$24,052	$32,018	$ 7,536	$22,671	$30,207	$ 78,720

ICRC
BASELINE
GAS SYSTEMS 1.3.2

	IIIA	IIB (1)			IIB (2)			
	FY88 6 Mos.	FY88 3 Mos.	FY89 9 Mos.	Subtotal IIB (1)	FY89 3 Mos.	FY90 9 Mos.	Subtotal IIB (2)	Grand Total
I. FY82 Dollars								
Chemicals	$ 1,168	$ 778	$ 2,337	$ 3,115	$ 778	$ 2,337	$ 3,115	$ 7,398
Catalysts	440	293	881	1,174	293	881	1,174	2,788
Lubricants	24	15	48	63	15	48	63	150
Power	2,266	1,220	3,660	4,880	1,394	4,183	5,577	12,723
Fuel	3,934	1,475	4,758	6,233	1,057	3,405	4,462	14,629
Coal	2,433	1,182	3,549	4,731	1,113	3,338	4,451	11,615
LIN	56	27	84	111	27	84	111	278
Maintenance	5,924	2,715	8,145	10,860	2,468	7,405	9,873	26,657
Operating Labor	707	351	1,061	1,412	310	938	1,248	3,367
Plant Overhead	415	207	621	828	207	621	828	2,071
Total	$17,367	$ 8,263	$25,144	$33,407	$ 7,662	$23,240	$30,902	$ 81,676
II. Escalated Dollars								
Chemicals	$ 2,009	$ 1,376	$ 4,300	$ 5,676	$ 1,487	$ 4,633	$ 6,120	$ 13,805
Catalysts	757	518	1,622	2,140	560	1,750	2,310	5,207
Lubricants	41	27	88	115	29	95	124	280
Power	3,898	2,158	6,736	8,894	2,664	8,312	10,976	23,768
Fuel	6,767	2,609	8,756	11,365	2,020	6,765	8,785	26,917
Coal	4,185	2,091	6,531	8,622	2,127	6,633	8,760	21,567
LIN	97	48	156	204	52	168	220	521
Maintenance	10,189	4,803	14,990	19,793	4,716	14,714	19,430	49,412
Operating Labor	1,217	621	1,954	2,575	593	1,865	2,458	6,250
Plant Overhead	714	366	1,143	1,509	396	1,233	1,629	3,852
Total	$29,874	$14,617	$46,276	$60,893	$14,644	$46,168	$60,812	$151,579

CHAPTER IV. OUTSIDE BATTERY LIMITS FACILITIES (WBS 1.4)

Chapter IV Outside Battery Limits Facilities

A. UTILITIES AND OFF SITES (WBS 1.4.1)

1. Technical Scope (Operating Plan

The overall approach to operations and the operating objectives have been outlined in Chapter I, SRC-I Operations (WBS 1.0).

The outside Battery Limits Facilities consist of Raw Material and Product Handling and Storage, all Utilities, and Off Sites. These areas comprise the following sub-systems:

Raw Material and Products Handling and Storage

- Coal Receiving and Storage
- Liquid Storage and Shipping
- Coal Reclaiming
- SRC-TSL Storage and Shipping
- Coal Preparation

Utilities

- Electrical
- Condensate Return
- Plant and Instrument Air
- Boiler
- Boiler Feedwater
- Fuel Distribution
- Cooling Tower System
- Flare and Incineration
- Nitrogen
- Fire Protection

Off Sites

- Nonprocess Bldg.
- Wastewater Treatment
- Water Treatment
- Solids Disposal
- Railroads
- River Structures
- Ash Handling and Storage

The Plant Test Program will outline plans to safely and systematically handle coal, solvents, liquid and solid products, and ash in an environmentally acceptable manner and at a rate that meets the demands of plant operation. Coal will be received in trainloads of up to 100-ton railcars and placed in compacted emergency or noncompacted active storages. The active storage will be divided into multiple piles and reclaimed on a first-in/first-out basis to prevent spontaneous combustion. Coal will be reclaimed, blended, and pulverized, and dried at a rate that satisfies the demands of the Gasifiers and the SRC Dissolvers. The process solvents and liquid products will be received, stored, and pumped to the process or export loading stations in equipment and vessels designed for this purpose, with inert gas blanketing provided as necessary. The liquid products will be loaded by dedicated, trained personnel at a multi-station loading system to meet the demands of the product marketing plan and product availability. SRC and TSL-SRC solid products will be stored in isolated, exposed piles and loaded into open top hopper railcars by a tunnel reclaim system at a rate consistent with the marketing plan for these products. Slag and fly ash will be mechanically transferred to on-site, decanted ash disposal ponds.

The Plant Test Program will outline plans for operating the utility systems in a manner that is consistent with refinery-type support systems and that meets the requirements of each plant operating area:

- Electrical: The 13.8-KV power will be supplied to each area substation on a reliable basis. An adequate emergency power system will also be provided and maintained to prevent the occurrence of hazardous conditions during a power failure.
- Plant and Instrument Air: The compressed air system will provide a reliable supply of plant and instrument air to all areas of the plant.
- Boiler Feedwater (BFW) and Condensate: Condensate and the demineralizer treatment system will feed a standard deaerator to provide a chemically treated, oxygen-free BFW to the steam generation facilities in each area of the plant, as required.
- Boiler: The boiler will supply the steam required for both plant start-up and maintenance of the steam/gaseous fuel balance needed to sustain stable plant operation.
- Fuel Distribution: The liquid and gaseous fuel distribution systems will provide a reliable supply of fuels for all burner systems during start-up, normal, and emergency operations.
- Cooling Tower System: The chemically treated, circulating cooling tower system will supply a reliable source of passivated water to meet the cooling water requirements of all areas.
- Flare and Incinerator: These systems will be operated to permit thermal oxidation of emergency venting, and routine disposition of unrecoverable hydrocarbon waste streams in an environmentally acceptable manner.
- Nitrogen: This system will distribute gaseous nitrogen from the ASUs to meet the plant requirements for inert purging, blanketing, and solids conveying.
- Fire Protection: This system will be operated consistent with standard refinery practice and National Fire Protection Association (NFPA) and Factory Mutual (FM) guidelines and requirements.

Under the Plant Test Program, process water will be pumped from the Green River and treated to a quality at a rate to meet the demands of the cooling tower, BFW treatment, fire protection, and other systems.

The Test Program will also provide for operation of the wastewater treatment system at a rate consistent with the collection system and commensurate with plant operations to a quality in compliance with the National Pollutant Discharge Elimination System (NPDES) permit. Plans to demonstrate the technical feasibility and requirements for zero-discharge operation will be outlined. Also, the program will provide for satisfactory disposal of any solid wastes generated in the plant.

The Plant Test Program will also provide for the operation of the railroad system to handle the raw materials, products, and by-products at rates consistent with plant operation and the marketing plan.

After initial start-up and shakedown of the plant, each operating unit will be optimized to minimize chemical costs and the quantities of wastes for disposal, while maximizing the overall energy efficiencies consistent with sound operating practices.

With exception of the zero discharge mode of operation of the wastewater treatment system, each operating system is of proven technology and no production limitations or modifications are anticipated that will require future corrective action.

In accordance with plant operating objectives, all areas within the Utilities and Off Sites Area will be mechanically maintained to attain the goal of a 20-year operating life. Preventative and predictive maintenance programs consistent with good industrial practice will be used.

The cost plan for the operation of the Utilities and Off-Sites Area has been developed to support the above operating plan. Derivation of the costs and support information for them are contained in Appendix 2.0, Operating Cost Assumptions and Support Data.

2. Cost Plan

ICRC

REVISED BASELINE

UTILITIES & OFFSITES BATTERY LIMITS 1.4.1

	IIIA	IIIB (1)			IIIB (2)			
	FY 88 6 Mos.	FY 88 3 Mos.	FY 89 9 Mos.	Subtotal IIIB (1)	FY 89 3 Mos.	FY 90 9 Mos.	Subtotal IIIB (2)	Grand Total
I. FY 82 Dollars								
Chemicals	$ 809	$ 539	$ 1,619	$ 2,158	$ 539	$ 1,619	$ 2,158	$ 5,125
Catalysts	18	12	36	48	12	36	48	114
Lubricants	36	24	71	95	24	71	95	226
Power	2,931	1,578	4,735	6,313	1,804	5,410	7,214	16,458
Fuel	1,019	382	1,214	1,596	270	834	1,104	3,719
Coal	-	-	-	-	-	-	-	-
LIN	-	-	-	-	-	-	-	-
Maintenance	6,534	2,995	8,984	11,979	2,722	8,168	10,890	29,403
Operating Labor	804	401	1,208	1,609	364	1,098	1,462	3,875
Plant Overhead	526	262	789	1,051	262	789	1,051	2,628
Total	$12,677	$ 6,193	$18,656	$24,849	$ 5,997	$18,025	$24,022	$ 61,548

ICRC
BASELINE
UTILITIES & OFFSITES BATTERY LIMITS 1.4.1

	IIIA	IIIB (1)			IIIB (2)			
	FY88 6 Mos.	FY88 3 Mos.	FY89 9 Mos.	Subtotal IIIB (1)	FY89 3 Mos.	FY90 9 Mos.	Subtotal IIIB (2)	Grand Total
I. FY82 Dollars								
Chemicals	$ 809	$ 539	$ 1,619	$ 2,158	$ 539	$ 1,619	$ 2,158	$ 5,125
Catalysts	18	12	36	48	12	36	48	114
Lubricants	29	19	60	79	19	60	79	187
Power	2,671	1,438	4,317	5,755	1,644	4,933	6,577	15,003
Fuel	2,924	1,096	3,531	4,627	784	2,526	3,310	10,861
Coal	-	-	-	-	-	-	-	-
LIN	-	-	-	-	-	-	-	-
Maintenance	7,165	3,284	9,852	13,136	2,985	8,957	11,942	32,243
Operating Labor	804	401	1,208	1,609	364	1,098	1,462	3,875
Plant Overhead	526	262	789	1,051	262	789	1,051	2,628
Total	$14,946	$ 7,051	$21,412	$28,463	$ 6,609	$20,018	$26,627	$ 70,036
II. Escalated Dollars								
Chemicals	$ 1,391	$ 953	$ 2,980	$ 3,933	$ 1,030	$ 3,217	$ 4,247	$ 9,571
Catalysts	31	21	67	88	23	71	94	213
Lubricants	50	34	110	144	36	120	156	350
Power	4,594	2,544	7,903	10,447	3,142	9,802	12,944	27,985
Fuel	5,029	1,939	6,498	8,437	1,493	5,019	6,517	19,983
Coal	-	-	-	-	-	-	-	-
LIN	-	-	-	-	-	-	-	-
Maintenance	12,324	5,809	18,132	23,941	5,704	17,798	23,502	59,767
Operating Labor	1,389	709	2,224	2,933	697	2,181	2,878	7,200
Plant Overhead	905	463	1,452	1,915	501	1,569	2,070	4,890
Total	$25,713	$12,472	$39,366	$51,338	$12,631	$39,777	$52,408	$129,959

CHAPTER V PROJECT MANAGEMENT & SUPPORT (WBS 1.5)

Chapter V Project Management and Support (WBS 1.5)

A. TECHNICAL SCOPE (OPERATING PLAN)

1. PROJECT MANAGEMENT (WBS 1.5.1)

Project Management assistance will be provided in the field and home office to support start-up and operation of the Demonstration Plant. Assistance will be provided by participating in Operational Safety Reviews; equipment performance and plant operating conditions will be observed to evaluate the safety of operations. Punch lists will be prepared to enumerate any unsafe or undesirable conditions for which remedies will be recommended. ECPs will be processed through configuration control procedures for substantive remedies that require such action. Similarly, punch lists will be prepared and processed for modifications to the plant that are needed to improve its performance by yielding a more economically acceptable operation.

Extensive plant modifications authorized by ECPs approved by the Project Configuration Control Board (PCCB) will be carried out in a manner similar to the original construction of the plant. Scopes of work will be prepared and drawings and specifications will be generated for which fixed-price bids will be solicited from subcontractors. Less extensive, approved modifications may be made by the plant maintenance subcontractor, selected annually on the basis of the lowest qualifying bid.

Project Management will control engineering, procurement, and construction. Assistance will be obtained from support groups to process any required construction permits and to develop budgets and schedule and cost plans. Inputs will be provided to the Finance Department for the preparation of financial statements, budgets, forecasts, and reports to DOE, as required.

2. ADMINISTRATION AND PLANNING (WBS 1.5.2)

a. Administration

Top management will:

- establish operating policies for ICRC,
- manage ICRC as an operating entity in the best interests of the partners and DOE, and
- serve as the interface between the partners and DOE concerning the operability and viability of the Demonstration Plant as a commercial business and successful source of synthetic fuel.

b. Purchasing and Contracts

The Purchasing Department will:

- procure all expendable materials used at the plant, including chemicals, catalysts, lubricants, fuel, and other operating supplies;
- work with the Operations and Finance Departments to develop and successfully implement inventory control procedures;
- procure any capital equipment items necessary to operate ICRC and the Demonstration Plant;
- ensure the delivery of coal and other materials; and
- ensure adherence to terms and conditions set forth in all supply contracts.

c. Planning

The Planning group will:

- continue to develop long-term strategies for ICRC,
- identify new markets for SRC-I products, and
- identify new business opportunities.

d. Human Resources

The Human Resources group will:

- coordinate the relocation of employees to Kentucky;
- recruit qualified exempt/nonexempt, operating, maintenance and support personnel;
- administer the ICRC benefits program;
- develop job descriptions; and
- coordinate community affairs such as the United Fund Campaign.

e. Legal

The Legal Department will:

- provide general legal advice to all functional departments within ICRC;
- provide advice and counsel involving property legal matters;
- process patent applications, domestic and foreign;
- represent ICRC in all litigation matters, particularly with regard to final payment of license fees;
- prepare and/or approve all contracts entered into by ICRC; including those for raw materials provided and finished goods supplied; and
- maintain the corporate files of the originals of all ICRC contracts.

f. Traffic

The Traffic Department will:

- work with common carriers to ensure the timely delivery of raw materials,
- be responsible for the prompt delivery of final products,
- minimize demurrage charges, and
- negotiate freight rates with common carriers and present arguments to the Interstate Commerce Commission.

g. Accounting

The General Accounting Department will:

- pay all material, equipment, freight, and other invoices through the Accounts Payable Office;
- record all receipts from sales and deposit them daily to the account of the U.S. Treasury by the Accounts Receivable Office;
- issue paychecks from the ICRC Payroll Office for all ICRC employees including plant operations and maintenance personnel, exempt, nonexempt, and hourly personnel, plant functional support personnel, and the home office staff;
- issue internal monthly operating reports for use as management tools, and, in accordance with the ICRC/DOE Contract, issue monthly reports to DOE regarding operating costs and actual and net revenues; the latter report will determine ICRC's monthly profit share;
- keep records to provide the basis for standard operating costs, a key element in deriving the buyout price;
- furnish data to the partners for inclusion in their financial statements;
- manage the government property, because all assets are U.S. Government property until the buyout option is exercised after the two-year test operation; this function includes adherence to the policy dictated in the Property Manual, property control and record keeping, and preparation and filing of required reports to DOE;
- control inventory, which will involve interfaces with Sales, Purchasing, and Operations Departments to ensure an adequate supply of raw materials and finished goods without excessive investment in working capital;
- use an analysis function to coordinate detailed planning and forecasting on an annual and quarterly basis, and to develop annual operating and overhead budgets and forecasts; and
- continually maintain and periodically upgrade the financial system to facilitate these analyses.

h. Occupational Health

The Occupational Safety and Health Department will:

- maintain on-site medical facilities in accordance with standard industrial practices,
- give special attention to the monitoring of any possible physiological reactions that may occur due to the toxicity of coal or any materials and products processed in the plant, and
- ensure conformity with Occupational Safety and Health Administration (OSHA) and Environmental Protection Agency (EPA) regulations.

The occupational health and safety program to be developed for the SRC-I Demonstration Plant will be developed on the basis of current standard industrial safety practices. In general, the program will include the following practices and procedures: general plant safety rules and regulations, monthly safety meetings, work permit procedures, vessel entry procedures, equipment lock-out procedures, personal protection equipment maintenance, safety audits/inspections, fire brigade training and testing, new employee safety training, continuing safety training, plant safety committee, report requirements, and emergency procedures.

A major area of concern involved with operating the SRC-I Demonstration Plant is the health effects of the coal-liquefaction materials produced. Because of these concerns, ICRC is committed to providing a comprehensive worker protection program that will better define potential adverse health effects and minimize exposure to the hazardous compounds. This program will include: a toxicological testing program, worker education, employee use of special change-rooms, workplace monitoring, medical examinations, and record keeping.

All safety and health procedures will be developed to comply with federal, state, and local safety and health regulations and will be documented in a plant safety and health manual, available to all plant personnel for easy reference. Thorough operator awareness of these practices and procedures will be ensured through a comprehensive training program, and compliance with the plant safety and health program will be required by ICRC as a condition for employment.

i. Government and Public Affairs

ICRC will continue the Public Affairs Program to inform the public of the SRC-I Project and related synthetic fuels issues. This will be accomplished by personnel located at the plant to inform the community and nation of the status of SRC-I.

3. TECHNICAL SUPPORT (WBS 1.5.3)

a. Design Confirmation (WBS 1.5.3.1)

Design Confirmation will provide expertise in data-analysis instrumentation, materials selection, corrosion control, process-equipment design, mechanical equipment review, process development, and critical technology analysis. Such expertise will maximize the probability of successful operation of the Demonstration Plant and will help to ensure optimal performance during the demonstration period.

Field and home-office engineering assistance will be provided to support plant start-up and to resolve any major equipment or process problems. Assistance will be provided during the collection of data necessary to fully evaluate the SRC-I technology. Operating data will be compared against design expectations and used to reassess the commercial-plant design criteria in detail. Operational or equipment modifications will be recommended.

Pilot plant or laboratory R&D support needed to resolve any major problems will be identified, and any additional development work will be recommended. Subcontracts to resolve equipment-specific problems will be initiated and monitored.

b. Data Base (WBS 1.5.3.2)

Technical support will be provided to control, monitor, and verify the operations of individual process stages within the plant. Data will be supplied to maintain reliable and safe operation of the liquefaction, solid-separation, and hydroprocessing sections. Facilities and personnel will be available to quickly evaluate operational problems as they arise in the preheaters, heat exchangers, dissolvers, critical solvent deashing equipment, transfer lines, hydroprocessing reactors, coke drums, environmental control equipment, and other areas.

ICRC will identify and obtain the critical data that is needed. Problems arising during start-up, turndown, or normal operation will be analyzed in a process development unit and related equipment that provide data rapidly. New data will continue to be collected to ensure smooth operation.

To successfully operate the Demonstration Plant, established technical, economic, and environmental goals must be met. Meeting these goals depends on new and developing technologies that will liquefy coal by direct hydrogenation, separate and refine the resulting products into marketable products and fuels, store products without adversely changing their properties, upgrade products to enhance their value, and dispose all waste effluents in an environmentally acceptable manner. Furthermore, product application technology, appropriate to the needs of the intended markets, will be provided as needed.

Procuring specific data that will ensure the operability of the plant may require testing the effects of the following parameters: variations in the coal feedstock, recycle flows, solids accumulations, preheater variabilities, dissolver operations, feed residence times, the maintenance of reactants and intermediates at high temperatures for long periods, varying operation of the critical solvent deashing unit, hydrocracking catalyst performance, hydrocracker feed variations, hydrocracker process variables, and coker feed compositions and variations.

Support will be available to develop, expand, and refine operating models for both process control and optimization, and technical support will be available to help resolve potential coking problems in process equipment. Also, assistance will be provided to correlate plant product data that will be developed on specialized technology. Finally, data will be developed to control and modify the properties of SRC-derived liquid and solid fuels for both the Coker/Calciner and the EBH feeds and products.

Support requirements for the Wilsonville Pilot Plant through Phase III are more comprehensively defined in Appendix 6.0.

c. Modeling (WBS 1.5.3.3)

A professional staff will maintain, enhance, conduct studies with, and support the use of available computer-based, steady-state, and dynamic modeling capabilities.

4. PRODUCT UTILIZATION (WBS 1.5.4)

Product utilization activities will confirm the technical feasibility and environmental acceptance of SRC-I products, and demonstrate their commercial viability in selected market applications. Overall activities will be based on integrating five action programs: market analysis, product demonstration and application engineering (PD&AE), sales, coal supply, and distribution.

a. Market Analysis

These programs have continued the evaluation of product value and cost, market needs, regulatory/economic/social impacts, and amenable market segment characterization necessary to assess commercial viability. These activities will be integrated with operation of the Demonstration Plant.

b. Product Demonstration and Application Engineering (PD&AE)

This program has identified and provided a plan for implementation and supervision of the applications and development tests and evaluations required to market SRC-I products. Any challenges related to product utilization have been evaluated and addressed. PD&AE activities have interfaced with Engineering Technology activities to ensure the production of usable products.

Based on the results of bench-scale tests conducted during the pre-Demonstration Plant period, larger scale tests are planned for middle distillate, heavy oil and solid SRC products. These tests will consist of limited customer evaluations for those applications that could result in premium markets for SRC products. Initially, intensive customer activity will be required to secure commitments for trial evaluation of specific SRC products during Phase III. Considerable data-gathering and monitoring will be necessary during these limited evaluations to aid in determining the products' ultimate commercialization potential.

PD&AE activities for SRC fuel products, naphtha, and by-products will consist of commercial-scale demonstration tests at customer sites. Included will be the design modifications, procurement, commissioning, and start-up of the demonstration facilities and systems.

SRC fuel products will be received at customer site and tested as soon as practical, in a commercial operating mode, to demonstrate their technical and environmental acceptance and to assess their value. Specialized performance and normal operating tests will be conducted at all demonstration sites. PD&AE evaluations and tests at other facilities and by other organizations will also be performed, as appropriate, for confirmation of test data and trouble-shooting as well as for applications not investigated previously. Necessary product, equipment, or systems changes will be made for final evaluation of product-market acceptance. Preliminary evaluation work for the retrofits of the major SRC fuel users have been completed and are presented in Volume II of the DOE/OR/03054-38 Report.

Under contracts for demonstration test use, hydrotreated SRC-I naphtha will be sold to appropriate refiners to be catalytically reformed into a high-octane, unleaded gasoline blendstock and/or benzene/toluene/xylene (BTX). Similarly, anode coke will be sold to one or more aluminum producers for conversion into anodes that will be evaluated in commercial aluminum smelting. The actual demonstration tests at the customer locations will be monitored and data will be gathered.

Sulfur and liquefied petroleum gas (LPG) by-products will be sold under more conventional supply contracts during Phase III, without the intensive data-gathering or evaluations associated with SRC-I products. Limited monitoring may be conducted if warranted by the uniqueness of the by-product application.

c. Sales

Sales activities will focus on servicing product users, studying demonstration-product price and revenues; evaluating product fits, establishing market and business acceptance, and, the obtaining of an overall market and regulatory response to the products and their uses. Sales programs will integrate plant production and operation with the end-user requirements to obtain product acceptance. These activities will be a logical continuation and extension of the Phase II activities in order to provide an integrated evaluation of the technical feasibility, environmental acceptability and commercial viability of the SRC-I process. Without establishing a basis for commercial product(s) sales, a viable process cannot be achieved.

d. Coal Supply

During Phase III, Coal-Supply activities will fall into two broad categories: (1) operations to support the Demonstration Plant and (2) operations to support commercialization. The activities are distinctive in nature, and decisions relating to commercialization will not directly impact the Demonstration Plant support activities.

Demonstration Plant Support: The Coal-Supply Group will monitor coal received from suppliers to ensure compliance with contractual commitments, to verify all coal-price adjustments, and to handle any disputes between parties. Quality control will be conducted through on-site visits to suppliers' facilities. After the plant starts operating, the Coal-Supply Group will initiate a program to identify and evaluate secondary-supply sources. Supply proposals will be solicited and evaluated according to established objectives (e.g., broadening the geographic supply base, qualifying small operators, and testing other coal types). A testing and qualification program will be conducted, and short-term agreements will be executed with successful candidates.

Commercial Plant Support. The Coal-Supply Group will also develop the strategy for obtaining adequate quantities of acceptable coal to supply the commercial plant. Long-term assessment of coal supply/demand factors, coal availability and production, and market economics will be conducted. Commercialization objectives will be incorporated into the progam to identify secondary-supply sources. Contracts with Demonstration Plant suppliers will be extended, if advisable. To support a greatly increased annual coal requirement, investigation of suppliers with large reserves not currently under development will be mandatory. The Coal-Supply Group will consider reserve acquisitions and joint-venture coal-development proposals, as well as construction and operation of preparation facilities to process coals produced by small, independent mining companies. All of these activities will be initiated during Phase IIIB, but will continue through extended demonstration-period operations because of the long lead time required to develop new coal properties.

e. Distribution

The Distribution Group will plan, implement, and control all transportation and logistics activities associated with receipt of coal feedstocks and shipment of SRC-I products. To ensure reliable product delivery and adequate coal supply, contacts with coal suppliers and customers will be maintained. The Distribution Group will select, monitor, and control transportation carriers for coal supply and finished products on the basis of cost effectiveness and service reliability. In addition, the group will participate in negotiating all contracts and leases for transportation services and equipment related to moving coal and products.

Other activities will include representing ICRC before government agencies that regulate transportation; selecting and implementing alternative routes and methods for shipping coal and products; preparing alll transportation operating budgets and cost-account plans; and administering the payment of freight charges to transportation vendors.

5. ENVIRONMENTAL, PERMITS, AND LAND ACQUISITION SUPPORT (WBS 1.5.5)

During Phase III, environmental support will be required in six program areas: pollution control engineering, toxicity testing, environmental monitoring, compliance evaluation, environmental assessment, and industrial hygiene.

Pollution control engineering during Phase IIIA will be devoted primarily to the support of operations to commission and place into operation the pollution control equipment and systems. During Phase IIIB, ICRC will evaluate control system efficiency by relating system performance both to control commitments and to observed environmental quality needs. An attempt will be made to determine the appropriateness of the degree of control being achieved and then, where indicated, to recommend increases or decreases in control-system performance requirements.

The toxicity test program will have four main components. First, confirmation tests will verify that toxicity test results obtained from product analogs represent test results obtained from actual products. Second, toxicity tests will be conducted on "plant samples" (i.e., treated wastewater samples, landfill leachate samples, stack and vent samples, personal-exposure-monitor filter samples, and wipe samples) in order to determine the potential toxicity of materials released into the environment and those to which plant workers are known to be exposed directly. Third, a secondary test program, suggested in the Final Environmental Impact Statement (FEIS), must be undertaken to identify opportunities for process and product changes consistent with a reduced overall toxic hazard for the SRC-I process. Finally, as part of a comprehensive risk assessment, a battery of toxicity tests will be conducted on the commercial product slate of a commercial-scale SRC-I plant.

The Phase III environmental monitoring program will resemble closely the monitoring program described in Chapter VI, Section E of the Project Baseline, Phases I and II. Atmospheric terrestrial and aquatic systems will be investigated intensively, and system structure and function will be carefully defined. Statistically valid comparisons can then be made between the environment of the operating plant and the preconstruction environment. Environmental changes, even small and subtle ones, will be identified and attributed to plant operations or other causes. This information will specifically address many of the most serious questions about likely environmental impacts, questions that were left unanswered in part in the FEIS because of inherent limitations in the science of environmental impact prediction. As promised, the EPA, other government agencies, and the public will then have a complete, accurate, scientifically defensible assessment of the environmental acceptability of the SRC-I process.

The compliance evaluation program will include all activities necessary to confirm and routinely report plant compliance with environmental laws, regulations, and permit conditions. With the exception of stack sampling, all compliance measurements will be made by plant operations personnel. All costs for measurements are included in the operations cost plan. Costs for data analysis and reports are included in the environmental support cost plan, as are the costs for special compliance evaluation studies of fugitive dust emissions, trace element emissions, and fugitive emissions controls. The need for special studies will be established and agreed upon during the permit application review process. Also included will be a contingency for the resolution, in the regulatory arena, of the compliance "problems" that may occur during plant operation.

Near the end of Phase III, environmental assessments will summarize the experience from the Demonstration Plant and evaluate the environmental implications of a commercial-scale facility on the same site. The likely result will be a major addition to the National Environmental Policy Act (NEPA) report for the SRC-I project.

Finally, support will be provided to the occupational health professionals at the Demonstration Plant in their efforts to analyze and interpret data collected in the workplace and from the medical monitoring programs. Changes in methods or procedures will be recommended, as appropriate, to enhance the effectiveness of the occupational health program and, ultimately, the health and safety of the plant work force.

B. COST PLANS

U. S. DEPARTMENT OF ENERGY
BASELINE

Phase III

DOE Form CR 533P
(1-78)

PAGE OF

1. Contract Identification Demonstration of the Solvent Refined Coal Process	2. Contract Number DE-AC05-78OR03054
3. Contractor (name, address) International Coal Refining Company P. O. Box 2752 Allentown, PA 18001	4. Contract Start Date 10 July 1978
	5. Contract Completion Date

6. Identification Number	7. Reporting Category (e.g., contract line item or work breakdown structure element)	8. Planned Prior Fiscal Years	9. Actual Prior Fiscal Years	IIIA	IIIB				PHASE III
				FY88	FY88	FY89	FY90	TOTAL	TOTAL
1.5.1	Home Office			838	421	1516	1247	3184	4022
	Site Support			1944	974	1416	686	3076	5020
	Plant			-	-	-	-	-	-
	Total 1.5.1			2782	1395	2932	1933	6260	9042
1.5.2	Home Office			1808	909	3726	2885	7520	9328
	Site Support			455	228	645	497	1370	1825
	Plant			788	392	1563	1149	3104	3892
	Insurance			245	122	490	368	980	1225
	Total 1.5.2			3296	1651	6424	4899	12974	16270
1.5.3	Home Office			3568	1814	7206	5339	14359	18027
	Site Support			201	100	401	422	923	1124
	Plant			1561	779	3094	2247	6120	7681
	Total 1.5.3			5430	2693	10701	8008	21402	26832
1.5.4	Home Office			46726 *	810	3139	2455	6404	53130
	Site Support			-	-	-	-	-	-
	Plant			-	-	-	-	-	-
	Total 1.5.4			46726	810	3139	2455	6404	53130
1.5.5	Home Office			798	394	1486	944	2824	3622
	Site Support			777	385	1466	925	2776	3553
	Plant			-	-	-	-	-	-
	Total 1.5.5			1575	779	2952	1869	5600	7175
	Total Costs			59809	7378	26148	19164	52640	112449
	Escalation			34366	5635	22434	18916	46985	81351
	Total 1.5 - Escalated			94175	12963	48582	38080	99625	193800

15. Remarks * Includes $45,100 Retrofit Conversion Program.	Dollars Expressed in Thousands - 1st Qtr. FY82 Dollars	17. Cost Plan Date March, 1982

18. Signature of Contractor's Project Manager and Date	19. Signature of Contractor's Authorized Financial Representative and Date	20. Signature of Government Technical Representative and Date

U. S. DEPARTMENT OF ENERGY
BASELINE

DOE Form CR 533P
(1-78)

Phase III

PAGE OF

1 Contract Identification
Demonstration of the Solvent Refined Coal Process

2 Contract Number
DE-AC05-78OR03054

3 Contractor (name, address)
International Coal Refining Company
P. O. Box 2752
Allentown, PA 18001

4. Contract Start Date
10 July 1978

5. Contract Completion Date

6. Identification Number	7. Reporting Category (e.g., contract line item or work breakdown structure element)	8 Planned Prior Fiscal Years	9. Actual Prior Fiscal Years	IIIA				IIIB								PHASE III
				FY88				FY88		FY89		FY90		TOTAL		TOTAL
1.5.1	Home Office			1441				745		2816		2478		6039		7480
	Site Support			3343				1723		2630		1363		5716		9059
	Plant			-				-		-		-		-		-
	Total 1.5.1			4784				2468		5446		3841		11755		16539
1.5.2	Home Office			3109				1608		6923		5732		14263		17372
	Site Support			783				403		1199		987		2589		3372
	Plant			1354				693		2905		2284		5882		7236
	Insurance			422				216		910		731		1857		2279
	Total 1.5.2			5668				2920		11937		9734		24591		30259
1.5.3	Home Office			6309				3209		13389		10609		27207		33516
	Site Support			345				177		745		839		1761		2106
	Plant			2685				1378		5748		4466		11592		14277
	Total 1.5.3			9339				4764		19882		15914		40560		49899
1.5.4	Home Office			71675	*			1433		5832		4878		12143		83818
	Site Support			-				-		-		-		-		-
	Plant			-				-		-		-		-		-
	Total 1.5.4			71675				1433		5832		4878		12143		83818
1.5.5	Home Office			1373				697		2761		1875		5333		6706
	Site Support			1336				681		2724		1838		5243		6579
	Plant			-				-		-		-		-		-
	Total 1.5.5			2709				1378		5485		3713		10576		13285
	Total 1.5			94175				12963		48582		38080		99625		193800

15. Remarks * Includes $68,878 Retrofit Conversion Program.

Dollars Expressed in Thousands - Escalated Dollars

17. Cost Plan Date
March, 1982

18 Signature of Contractor's Project Manager and Date

19 Signature of Contractor's Authorized Financial Representative and Date

20 Signature of Government Technical Representative and Date

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SRC-I PROJECT BASELINE
PHASES IIIA AND IIIB
APPENDICES

APPENDIX 1.0: RELIABILITY-MAINTENANCE DISCUSSION

A. RELIABILITY

Because the Demonstration Plant will contain some prototype equipment and processes, certain areas will be equipped with more than the normal commercial plant instrumentation and controls, to allow analysis of the test operation.

Also, since the plant is planned as the first module of a commercial plant and must demonstrate its economic viability during the demonstration phase, it will be designed in accordance with good industrial practice for a commercial plant, with the potential to operate for 20 years at a cost-effective production rate. The plant will be designed to attain design capacity with commercially available coal feedstock, with a target of 90% on-stream and utilization factors, after the initial period for commissioning, start-up, shakedown, and test operation, and after completing any modifications found necessary during this period. The plant will be designed with the equipment redundancy, installed spares, operating flexibility, and product-line flexibility required by good industrial practice for commercial operation. It will be provided adequately with other facilities required for long-term commercial operation, including buildings, roads, maintenance facilities, and spare parts stock.

To minimize problems that might reduce on-stream time, which is essential in producing operating data needed for process evaluation and the products needed for market evaluation, more equipment or system redundancy has been provided in the Design Baseline for prototype units or units of new applications than normal industrial practice would dictate for established processes. In most other cases, normal industrial practice for equipment redundancy has been followed. In borderline cases, an economic trade-off analysis was made, based on a two and one-half year payout, since this is the length of the test operations period specified in the DOE/ICRC Contract.

Examples of the extra redundancy provided on prototype units to improve on-stream time during the test operations period include the following:

- A spare 100% coal-feed and slurry-preparation system
- Six 25% capacity coal-slurry feed pumps
- Four parallel 25% coal-slurry preheater trains

- Spare slurry-pressure letdown valves
- A spare first-stage separator and heavy-phase handling system in the Kerr-McGee SRC deashing area
- A spare 100% Kerr-McGee ash concentrate conveyor train
- A zero-discharge wastewater system, including an NPDES permit

Examples of redundancy provided in accordance with industrial practice include the installation of the following:

- Spare 100% process pumps
- Parallel 50% reciprocating compressors
- Multiple Air Separation Units with cryogenic liquid storage and vaporization
- Parallel 70% Claus sulfur recovery plants

Although the equipment redundancy level provided in the Design Baseline is considered to be reasonable and well-based, some changes may possibly be made as a detailed Reliability Analysis Plan is implemented during Phase I. Under this plan, each Area Contractor will perform the Operations Reliability Analysis outlined in the ICRC Master Project Procedure MPP 6-3, Revision 1, Reliability Analysis by Area Contractors, a copy of which is attached. These analyses will be directed and coordinated by ICRC's Manager of Reliability Engineering, who will integrate all reliability considerations into a Reliability Analysis Report for the entire plant.

During Phase II, a Failure Analysis Plan will be developed also for implementation during commissioning (Phase II) and start-up and operation (Phase III). This plan will provide uniform procedures for failure analysis and data on the suitability of equipment and materials for use in the Demonstration Plant and future commercial plants. The data will also be used to update the maintenance and predictive/preventive maintenance programs and procedures.

B. MAINTENANCE

The Phases I and II cost estimates for maintenance and mechanical engineering are based on the following scope of activity.

During Phase I, a maintenance and mechanical engineering group in the Manufacturing Department of ICRC reviewed mechanical and engineering specifications, equipment specifications, requests for quotations, bid tabulations, and equipment selection, for reliability and maintainability. Also, this group will develop a spare-parts policy, and plans for the preparation of a maintenance management system; a preventive maintenance system; a parts and materials control system; maintenance manual procedures, standards and catalogs; and a maintenance recruiting and training plan.

During Phase II, the maintenance engineering group will be expanded by the addition of supervisors, professionals, and technicians, who will be responsible for maintenance and mechanical engineering activity in the Demonstration Plant. In addition to implementing the plans made during Phase I, this expanded group will monitor the installation of equipment and machinery, review the inspection and test procedures, and monitor these test procedures when they are implemented.

The information developed for the reliability analysis, together with past experience and vendor input, will be used to prepare maintenance and predictive/preventive maintenance programs and procedures. One major objective will be to plan to take advantage of the unscheduled shutdowns anticipated during initial operation of the Demonstration Plant to accomplish needed inspections and predictive/preventive maintenance.

The final activity in the maintenance area prior to commissioning will be recruiting and training mechanics and technicians. As commissioning begins and progresses into start-up and test operation, the plant Maintenance and Mechanical Engineering Department will be ready to support the operations with procedures and systems in place and qualified professionals, supervisors, planners, technicians and mechanics on the staff.

The factors used to estimate the maintenance costs during commissioning and test operations were based on past in-house experience and the experience of others in comparable operations. This experience indicates that an overall factor for maintenance costs of 4% of investment is reasonable, provided that the percent factor is adjusted for this specific type of operation and that the term "investment" is defined. Maintenance costs as a percentage of investment will vary among the various areas of the Demonstration Plant, due to the type and complexity of the area operation, the amount of prototype equipment and new technology employed, the expected level of corrosion problems, the spare part requirements and costs, and the level of preventive and recurring maintenance required to support the area.

After ICRC considered such factors, the maintenance costs as a percentage of their respective investments were estimated for the several plant areas:

SRC Products Area	5.5
Coke and Liquid Products Area	4.0
Air Separation Units	2.0
Gas Systems Area	4.0
Utilities and Off Sites	3.0

In the definition of the investment portion of the factor, any extraordinary costs that would inflate the investment beyond that normally incurred on a comparable project should be excluded. In the case of the Demonstration Plant, such costs would include those resulting from the engineering and designing of prototype technology; the conformance to extraordinary management control systems; the repeated delays and schedule changes outside the control of project management; the need to investigate and meet special environmental and industrial hygiene requirements; and the need to monitor, coordinate, and integrate the design among a number of contractors.

Experience indicates that the costs of materials and equipment constitute approximately 50% of plant investment if there are no unusual costs to inflate the total investment. To compensate for the unusual costs involved in the Demonstration Plant project, the investment base for the calculation of maintenance costs will be considered to be twice the total material and equipment cost. On this basis, the maintenance costs are estimated as follows:

SRC Products Area	2 x $180,100,000 x 0.055	= $19,810,000
Coke and Liquid Products Area	2 x $ 72,800,000 x 0.04	= 5,820,000
Air Separation and Hydrogen Purification Units	2 x $ 32,900,000 x 0.02	= 1,320,000
Gas Systems Area	2 x $141,800,000 x 0.04	= 11,340,000
Utilities, Off Sites, Central Control System and Capital Equipment	2 x $181,500,000 x 0.03	= 10,890,000
Total Maintenance Costs		= $49,180,000

APPENDIX 2.0: OPERATING COST ASSUMPTIONS AND SUPPORT DATA

The assumptions and data to support the estimate of the operating costs for the Demonstration Plant during Phase III are contained in the following attachments. The operating cost data is divided into four categories: (1) labor; (2) chemicals, lubricants, and catalysts; (3) energy; and (4) coal. The plant utilization factors, which affect operating costs also, are discussed in Appendix 4.0. Details are provided in Attachments, as follows:

1. Labor
    - A. Staffing--See Attachment A
    - B. Rates - FY 1982 1st Quarter Dollars

1.	Exempt	$34,320/yr
2.	Clerical	14,350/yr
3.	Nonexempt	20,590/yr

2. Chemicals, Lubricants, and Catalysts--see Attachments B, C, D, E, and F
3. Energy
    - A. Power--see Attachments B, C, D, E, and F
    - B. Purchased Fuel--see Attachments B, C, D, E, and F
4. Coal--see Attachments C and D

The average staffing at the SRC-I plant site during Phase III has been estimated to be approximately 757 individuals. Of these, about 210 will be employed on a contract basis. The rest of the employees will be ICRC employees, who will be supplemented by the administrative and technical staffs at Company headquarters as needed. The on-site organization is typical of a refinery or chemical plant of similar size, with production, maintenance, and process departments, administered and supported by a management staff, occupational safety and health group, Personnel Department, industrial engineering staff, and an administrative group to handle accounting, payroll, public relations, traffic, and purchasing. Operations and maintenance functions will be organized and staffed to sustain operations on a 24-hours-per-day, seven-days-per-week basis.

Plant level staffing was estimated on a "bottoms-up" basis; i.e., operating labor was estimated for each area on the basis of past experience, visits to similar operations, discussions with contractors and vendors, and experienced judgment. Maintenance requirements were estimated as outlined in Appendix 1.0, Maintenance and Reliability. From this work-force estimate, line and area supervisions were estimated, followed by estimates of personnel required for technical support, and department and plant management. The health and safety staff was estimated by considering the number of people involved and the extent of the planned occupational safety and health program. Plant control laboratory staffing was estimated by a task force composed of ICRC Manufacturing and Engineering Technology Department representatives plus personnel from Air Products and Chemicals, Inc. experienced in coal-processing research and development and pilot-plant analytical procedures. The number of personnel required for plant purchasing and traffic was estimated by analyzing the scope of work required. Finally, administrative staffing (personnel, accounting, secretarial, and clerical) was estimated to be commensurate with the estimated size of the plant staff.

As is customary in similar operations, security, janitorial, and grounds maintenance will be subcontracted. Also, rather than employ a permanent maintenance crew large enough to handle all plant maintenance, contractor personnel will be used to supplement plant forces to even out peak loads and handle special projects and plant turnarounds. ICRC estimated that an average of 210 contractor personnel will be employed in the plant, 175 of which will be used in contract maintenance. Peak loads, such as plant turnarounds, are expected to require several times this number of people for short periods.

Attachment A summarizes the plant level staffing used for the Baseline Cost Plan.

As a result of the additional engineering performed before issuance of the Revised Baseline, the area requirements for chemicals, lubricants, catalysts, and energy have been refined and the resulting revisions are reflected in the costs shown in Attachments B, C, D, E, and F. In addition, these attachments also reflect revised costs for fuel, i.e., fuel oil and fuel gas. These fuel costs are based upon the Energy Information Administration's (EIA) "1982 Annual Energy Outlook" (p. 131). The net change in these facility costs is a reduction of $1,216,000 or less than 1% change.

Appendix 2.0, Attachment A

6,000-tpd SRC-I Demonstration Plant Staff

	Exempt	Nonexempt	Hourly	Total
Plant management				3
Plant manager	1			
Assistant plant manager	1			
Secretary		1		
Personnel				5
Personnel manager	1			
Assistant personnel manager	1			
Training director	1			
Clerk		1		
Secretary		1		
Health and Safety				8
Director	1			
Safety engineer	1			
Industrial hygienist	1			
Plant nurses	2			
Technicians			2	
Secretary		1		
Industrial engineering				2
Manager	1			
Industrial engineer	1			
Administration				27
Manager	1			
Traffic manager	1			
Traffic coordinators	2			
Public information director	1			
Public information coordinator	1			
Accounting manager	1			
Receivables and payables accountant	1			
Plant accountant	1			
Payroll accountant	1			
Accounting Clerks		4		
Contract Specialist	1			
Property Administrators	1			
Purchasing manager	1			
Purchasing specialists	2			
Buyer	1			
Expeditor	1			
Clerk		1		
Secretaries		3		
Receptionist		1		
Computer Operator	1			

Appendix 2.0, Attachment A (continued)

	Exempt	Nonexempt	Hourly	Total
Production management				4
General production manager	1			
Secretary		1		
Relief shift supervisors	2			
SRC-process area				56
SRC area production manager	1			
Assistant area production managers	3			
Shift supervisors	4			
Clerk		1		
Operators			44	
Relief operators			3	
Gas systems area				46
Gas systems area production manager	1			
Assistant area production managers	2			
Shift supervisors	4			
Clerk		1		
Operators			36	
Relief operators			2	
Coke and EBH area				73
Coke and EBH area production manager	1			
Assistant area production manager	2			
Shift supervisors	4			
Clerk		1		
Operators			61	
Relief operators			4	
Utilities aresa				49
Utilities area production manager	1			
Assistant area production manager	3			
Shift supervisors	4			
Clerk		1		
Operators			36	
Relief operators			4	
Process management				2
Process manager	1			
Secretary		1		
Quality control				38
Quality control manager	1			
Chemists	2			
Shift leaders	4			
Laboratory technicians			31	

Appendix 2.0, Attachment A (continued)

	Exempt	Nonexempt	Hourly	Total
Process engineering				8
Senior process engineers	2			
Process engineers	6			
Process control				3
Process control manager	1			
Process control engineers	2			
Maintenance and mechanical eng. management				2
Manager	1			
Secretary		1		
Maintenance				207
Maintenance manager	1			
Maintenance supervisors	12			
Maintenance planners	2			
Clerks		2		
Mechanics			190	
Mechanical engineering				7
Senior mechanical engineer	1			
Mechanical engineers	2			
Instrument engineer	1			
Electrical engineer	1			
Project engineer	1			
Project technician		1		
Materials handling				7
Materials handling supervisor	1			
Warehouse supervisor	1			
Warehouse workers		5		
Total ICRC employees - Plant	106	28	413	547
Contractors (average estimate)		Supervisory and hourly		
Security		10		
Janitorial and grounds		25		
Contract maintenance		175		
Total contractors				210
Total average plant staffing level				757

Appendix 2.0, Attachment B

Standard Operating Cost Budget Estimate

Utilities and Outside Battery Limits Area

(Basis: 90% On Stream, 100% Production Rate)
FY 1982 1st Quarter $

		$/yr
I	Energy	
	A. Purchased power	$ 9,018,000
	B. Start-up fuel	69,000
	C. Burner maintenance fuel	51,000
	D. Pilot (liquefied petroleum gas)	335,000
II.	Lubes	95,000
III.	Catalysts	48,000
IV.	Chemicals	2,158,000
	TOTAL	$11,774,000

Appendix 2.0, Attachment B (Continued)

I. Energy

A. Purchased Power:

Ref.: Rust Transmittal from E. S. Conner to K. D. Sharma/D. J. Blue dated 11/4/81 "Design Baseline Electrical Load Summary."

36,120 kW x 24 hr/day x 365 day/yr x 0.95[a] x \$0.03/kWhr = \$9,018,000/yr

B. Start-up fuel:

Ref. Memo: J. A. Firley to A. F. Yen dated 1/2/81, "Demonstratoin Plant Start-up - Fuel Use and SO_2 Emission."

Fuel for start-up 3,171 MM Btu (LHV)[b]/start-up x 1.10 HHv/LVH x 3 start-ups/yr x \$6.60/MM Btu (PDC) = \$69,000/yr

C. Burner maintenance fuel:

Basis:

a. The only burners which have to be highly reliable are those required for an emergency shutdown or those which would be used if the plant is operating in a fuel-deficient mode. The boilers, thermal oxidizer, and Dowtherm heater are in the former category and the slurry heaters are in the latter category. These burners have a normal operating use of 480 MM Btu/hr.

b. Test fire these burners for eight hours every three months. Assume one of these tests will be satisfied during a startup.

c. Additionally, assume that one test can be carried out when the plant is in an operating mode which requires LPG for fuel. The fuel oil burned during this test will free an equivalent amount of LPG for sale resulting in no net cost.

d. Cost = 480 MM Btu/hr x 8 hr x 2/yr x \$6.60/MM Btu
Cost = \$51,000/yr

D. Pilot (LPG)

1. Assume on-stream factor = 97%
2. LPG for pilots and flares 6.4 MM Btu (LHV)/hr x 1.10 HHV/LHV x 8,760 hr/yr x 0.97 x \$5.60/MM Btu = \$335,000/yr

II. Lubes

Lube costs at \$1.98/hp 36,120 kW (per T. Damas 12/18/81) ÷ 0.75 kW/hp x 1.98/hp = \$95,000/yr

---

[a] Mean correction factor that accounts for transition periods different from normal load, i.e., start-ups, shutdown, continuation of utilities and support areas during shutdown, standby switchover, etc.

[b] LHV and HHV lower and higher heating values, respectively.

Appendix 2.0, Attachment B (Continued)

III. Catalysts

Boiler feedwater	$45,000
Potable water	3,000
Total	$48,000/yr

IV. Chemicals

A. Waste treatment	
1. Wastewater	$1,359,200
2. Process water	57,300
3. Cooling water	421,300
4. Potable water	1,600
5. BFW	204,600
Total	$2,044,000
B. Solids handling	84,000
C. Laboratory	30,000
Total chemicals	$2,158,000/yr

Appendix 2.0, Attachment B (continued)

Annual Cost of Catalysts and Chemicals

	Area[a]	Consumption Rate	Annual Consumption	Unit Price	Annual Cost
Hydrazine	BFW	10 lb/day	330 lb	$2.50/lb	800
Cyclohexylamine	BFW	60 lb/day	19,800 lb	$1.259/lb	25,600
Di- or Trisodium phosphate or mix		45 lb/day	14,850 lb	$0.37/lb	5,500
Sulfuric acid, 93%	(BFW and CS)	10,500 lb/day	1,730 tons	$100.24/ton	173,000
Sulfuric acid, 93%	WWT	5,500 lb/day	910 tons	$100.24/ton	91,200
Caustic soda	BFW	170 gpd/day	55,100 gal	$0.86/gal	48,200
Rock salt	BFW	193 lb/day	63,700 lb	$0.036/lb	2,300
Sodium Bisulfite	BFW	1.5 lb/day	500 lb	$0.033/lb	200
Sodium Bisulfite	WWT	500 lb/day	165,000 lb	$0.22/lb	104,500
Cooling tower inhib.	CW	437 lb/day	144,000 lb	$2.12/lb	305,000
Chlorine	CW	1,719 lb/day	568,000 lb	$0.115/lb	65,300
Chlorine	POT and PROC W	315 lb/day	113,000 lb	$0.115/lb	13,000
Sodium hexametaphos.	POT W	1 lb/day	400 lb	$0.67/lb	300
Liquid alum., 49%	PROC W	75 gpd	25,000 gal	$0.36/gal	8,900
Liquid alum., 49%	WWT	240 gpd	79,200 gal	$0.36/bal	28,500
Quick lime (96% CaO)	WWT	3,000 lb/day	990,000 lb	$0.0266/lb	26,300
Lime (CaO)	PROC W	3,000 lb/day	990,000 lb	$0.029/lb	28,700
Polyelectrolyte	PROC W	48 lb/day	15,900 lb	$0.50/lb	8,000
Ferric chloride, 42%	WWT	100 gpd	36,300 gal	$1.10 gal	39,900
Phosphoric acid	WWT	35 gpd	11,500 gal	$3.53/gal	40,800

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[a] BFW, boiler feedwater; CW, cooling water; WWT, wastewater treatment; POT W, potable water; PROC W, process water.

Appendix 2.0, Attachment B
(continued)

	Area[a]	Consumption Rate	Annual Consumption	Unit Price	Annual Cost
Hydrogen peroxide, 50%	WWT	60 gpd	20,000 gal	$3.41/gal	68,000
Defoamer	WWT	60 gpd	20,000 gal	$2.03/gal	41,000
Emulsion breaker	WWT	160 gpd	52,800 gal	$6.36/gal	244,000
Manganous sulfate, 30%	WWT	30 gpd	9,900 gal	$2.82/gal	28,000
Dry polymer	WWT	200 lb/day	66,000 lb	$3.09/lb	204,000
Ferric sulfate, 20%	WWT	60 gpd	20,000 gal	$0.23/lb	4,600
Scale inhibitor	WWT	120 gpd	40,000 gal	$10.07/gal	399,000
Granular activated carbon	WWT	N.A.	N.A.	$0.72	--
Powdered activated carbon	WWT	300 lb/day	99,000 lb	$0.40/lb	39,600
Wetting agent	SRC/coal	N.A.	3,165 gal	$5.25/gal	16,600
Crusting agent	SRC	N.A.	31,350 gal	$2.15/gal	67,400

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[a] BFW, boiler feedwater; CW, cooling water; WWT, wastewater treatment; POT W, potable water; PROC W, process water.

Appendix 2.0, Attachment C

Standard Operating Cost Budget Estimate

Support Processes

(Basis: 90% On Stream, 100% Production Rate)
FY 1982 1st Quarter $

	Gas Systems (including HPU) $/yr	ASU $/yr
I. Energy		
A. Power	7,821,000	6,313,000
B. Fuel oil	232,000	--
C. LPG	699,000	--
II. Lubes	83,000	62,000
III. Catalysts	1,174,000	12,000
IV. Chemicals	1,735,000	--
V. Other variables		
A. Coal	6,658,000	--
B. Purchased liquid nitrogen	111,000	--
Total	18,513,000	6,387,000

Appendix 2.0, Attachment C (Continued)

Phase III Standard Cost Budget Estimate

I. Energy

A. Power

1. Gas System (including HPU)

Ref.: ICRC letter to RMP "Gas Systems Utilities for Normal Case," Letter No. ICRC/RMP-L-742, G. M. Adamshick to E. J. Jirus, 1/10/83.

Cost = 31,326 kW x 24 hr/day x 365 day/yr x 0.95 x $0.03/kw hr = $7,821,000/yr

2. Air Separation Unit

a. Input power $= \dfrac{\text{(23,511, kW operating motor load)}}{(0.955 - 0.005 - 0.02)} = 25{,}280$ kW

b. Cost = 25,280 kW x 24 hr/day x 365 day/yr x 0.95[a] x $0.03/kW hr $6,313,000/yr

B. Fuel Oil

1. Gas Systems (including HPU)

a. GKT gasifiers: basis, one start-up per week at 5,000-gal usage 12 mo/yr x 5,000 gal/wk x 4.33 wk/mo x 0.95 x 0.14 MM Btu/gal x $6.60/MM Btu = $228,000

b. Shift start-up heater: basis, three start-ups per yr x 1.1 HHV/LHV x 15 MM Btu/hr x 8 hr/start-up x $6.60/MM Btu = $2,600 (usage rate estimated due to varying conditions)

c. Methanator start-up heater (4.50 MM Btu/hr) at three start-ups/yr for 12-hr heatup cycle
4.50 MM Btu/hr x 12 hr/start-up x 1.1 HHV/LHV x $6.60/MM Btu x three start-ups = $1,200/yr

2. Gas Systems and HPU Summary

GKT gasifiers	$228,000
Shift heater	2,600
Methanator heater	1,200
	$232,000/yr

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[a] Mean correction factor that accounts for transition periods different from normal load, i.e., start-ups, shutdown, continuation of utilities and support areas during shutdown, standby switchover, etc.

Appendix 2.0, Attachment C (Continued)

C. Purchased LPG

1. Gas Systems and HPU

   a. GKT gasifier: basis, three continuous flares at 100 scfh total CH_4 equivalent 1,008 scf/hr x 1,000 Btu/scf x $5.60/MM Btu x 24 hr/day x 365 day/yr x 0.95 = $47,000

   b. Beavon Unit reducing gas generator (RGG): basis, continuous use LPG at 4.607 M scfh. 4.607 M scf/hr x 2.5 M Btu/scf x $5.60 MM Btu x 24 hr/day x 365 days/yr x 0.95 = $537,000

   c. SRU thermal oxidizer: estimate, 1.5 M scfh will keep unit in hot standby of CH_4 equivalent heat. 1.5 M scf/hr x 1.0 M Btu/scf x $5.60/MM Btu x 24 hr/day x 365 days /yr x 0.95 = $70,000

   d. Claus start-up: basis, each unit has 95% on-stream time. Start-up is 1% of downtime or 4 days/unit per year. 16.9 M scf/hr x 2.5 M Btu/scf x $5.60/MM Btu x 24 hr/day x 4 days/unit x 2 units = $45,000

2. Gas systems and HPU summary

GKT gasifier flare	$ 47,000
Beavon RGG	537,000
SRU thermal oxidizer	70,000
Claus start-ups	45,000
	$699,000/yr

3. ASU: none

II. Lubes

1. Gas Systems and HPU

   Lube oil: basis, $1.98/yr per connected motor hp; 31,326 connected motor kW; $1.98/yr per hp x 31,326 x 1 hp/0.75 kW = $83,000/yr

2. ASU

   Lube oil: basis, $1.98/yr per connected motor hp; 23,500 kW connected; $1.98/yr per hp x 23,500 kW x 1 hp/0.75 kW = $62,000/yr

III. Catalysts

1. Gas Systems and HPU

   a. Raw gas compressor area: (NO_x), 650 ft^3 x $200/$ft^3$ x life/2 yr = $65,000/yr

b. Shift (BASF, K8-11): 5,825 ft^3 x \$300/ft^3 x life/2 yr = \$874,000/yr

c. HPU (Linde mole sieve, ED-2380): 1,650 ft^3 x \$75/ft^3 x life/4 yr = \$31,000/yr

d. Claus (Kaiser, 5-210): 6,300 ft^3 x 0.7 (ECP size change x \$25/ft^3 x life/2 yr = \$55,000/yr

e. BSR (UC, C-29-2): 640 ft^3 x \$175/ft^3 x life/2 yr = \$56,000/yr

f. Methanation addition (Katalco, 32-4 and 471 and 11-3 types):

$$\frac{615\ ft^3\ (\$137/ft^3)}{2\text{-yr life}} + \frac{350\ ft^3\ (\$164/ft^3)}{2\text{-yr life}} + \frac{350\ ft^3\ (\$253/ft^3)}{4\text{-yr life}}$$

= \$93,000/yr

2. ASU

Charcoal for direct-contact aftercooler (DCAC) makeup water dechlorinator vessels. Hydrocarbon vessel beds. Estimated \$12,000/yr

IV. Chemicals

1. Gas Systems and HPU

a. Boiler chemicals: basis, treat 308,000 lb/hr MP and LP steam drums, all condensate return. Estimate 15 drums per mo at \$500/each. 15 drums/mo x 12 mo/yr x 0.95 x \$500/drum = \$85,500/yr

b. Freon: basis, 50 lb/day makeup to Selexol and HPU chillers 50 lb/day x \$0.40/lb x 365 days/yr x 0.95 = \$7,000/yr

c. DEA: basis, 14 gal/day makeup rates, 14 gal/day x \$5.00/gal x 365 days/yr x 0.95 = \$24,000/yr

d. Selexol: basis, 150 lb/day makeup rate, 150 lb/day x 1 gal/8.64 lb x \$10.80/gal x 365 days/yr x 0.95 = \$65,000/yr

e. HPU scrub oil: same as DEA = \$24,000/yr

f. GKT floc. agent: basis, 0.75 kg/hr at \$1.00/lb, Nalco 225 0.75 kg/hr x 2.2 lb/kg x 365 days/yr x 24 hr/day x 0.95 = \$14,000/yr

g. NCAR corrosion inhibitor: basis, estimate at \$12,000/yr

h. DEA/Selexol side stream precoat filter aid estimated at \$12,000/yr

Appendix 2.0, Attachment C (Continued)

i. Stretford solution: basis, no centrifuges and makeup rate per day per Ralph M. Parsons memo (P/ICRC-L-518), 18 August 1981. $1,292/day x 365 days/yr x 0.95 = $448,000/yr. Plus annual replacement of entire 340,000-gal inventory at 10¢/gal waste disposal cost = $34,000/yr

j. Caustic soda:

Area	50% NaOH usage rate
DEA	1,000 lb/hr
Beavon	260
GKT	
	1,260 lb/hr

1,260 lb/hr x ton/2,000 lb x 24 hr/day x 365 days/yr x 0.95 x $140/ton = $734,000/yr

k. Lime: 1,203 lb/hr in Material Balance: 1,203 lb/hr x 8,760 hr/yr x 0.9 x $0.209/lb = $275,000/yr

2. ASU: none used

V. Other variables

A. Raw materials

1. Gas Systems and HPU

a. Coal to gasifiers at 446 tons/day, 446 tons/day x 2,000 lb/ton x 0.0129 MM Btu/lb (dry) x $1.62/MM Btu x 365 days/yr x 0.95 x 1.03 (loss) = $6,658,000

b. Oxygen/nitrogen cost will be allocated from ASU power cost

c. KMAC is by-product from SRC area

2. ASU: none used

B. Purchased liquid nitrogen

1. Gas systems and HPU

HPU: 10% of 40 ton/day maximum requirement. 40 tons/day x 0.10 x 365 days/yr x 0.95 x $80/ton = $111,000/yr

2. ASU: none

Appendix 2.0, Attachment D

Standard Operating Cost Budget Estimate

SRC Area

(Basis: 90% On Stream, 100% Production Rate)
FY 1982 1st Quarter $

		$/yr
I.	Energy	
	A. Power	$ 3,467,000
	B. Start-up fuel	317,000
	C. Pilot	211,000
II.	Lubes	55,000
III.	Catalysts	---
IV.	Chemicals	1,164,000
V.	Other variable costs	79,053,000
	Total	$84,267,000

Appendix 2.0, Attachment D (Continued)

I. Energy

General assumptions:

1. 90% On-stream at 100% of design rates
2. Use Design Baseline dated 22 October 1982 for rates, material, and energy usage
3. Three total shutdowns per year
4. First-quarter FY 82 prices

A. Power

1. Assumptions used in calculations:
    - a. Average motor efficiency = 94%
    - b. 4,160 V: transformer (2) and line losses = 2.5%
    - c. 480 V: transformer (3) and line losses = 3.5%
2. SRC
    - a. Operating bhp of process motors = 17,013
    - b. Power required for motors = 17,013/(0.94) = 18,099 hp
    - c. 18,099 hp = (10,735 hp at 4,160 VAC) + 7,364 hp at 480 VAC)
    - d. 4,160 VAC distribution loss = 2 transformers x 1%/trans. + 0.5% line loss = 2.5%

      480 VAC distribution loss = 3 transformers x 1%/trans. + 0.5% line loss = 3.5%
    - e. Total load = 10,735 hp x 1.025 + 7,364 x 1.035 = 18,625 hp
    - f. Cost = (18,625 hp x 0.7457 (24 hr/day) x (365 days/yr) ($0.03/kW hr)(0.95)[a] = $3,467,000/yr

B. Start-up fuel:

1. Fuel oil will be used to fire the process heaters at one-half design rate for 60 hr during the start-up following each of the three shutdowns.
2. 424 MM Btu/hr x 3 x 0.50 x 60 x 1.1 HHV/1.0 LHV = 42,000 MM Btu/yr

---

[a] Mean correction factor that accounts for transition periods different from normal load, i.e., start-ups, shutdown, continuation of utilities and support areas during shutdown, standby switchover, etc.

Appendix 2.0, Attachment D (Continued)

3. Since the incinerator will be loaded only during upsets or turnaround, budget 6,000 MM Btu/yr for fuel oil to the burner

4. (42,000 + 6,000) $6.60/MM Btu = $317,000/yr for fuel oil

Intermittent power (electric heat tracing): none used

C. Pilot (LPG): purchased fuel

1. LPG will be used for pilot fuel in all fired heaters. Estimate LPG use to be 1% of fuel use in fired heaters

2. 424 x 0.01 (7,884 hr + 3 x 60 hr) = 34,200 MM Btu/yr

3. 34,200 x 1.1 HHV/LHV x $5.60/MM Btu = $211,000/yr for LPG

II. Lubes

Lubricants based on $1.98/hp. Basis is the rated hp of normally operated equipment plus 25% of the hp of spare and standby equipment. (22,410 + 0.25 x 20,000) 1.98 = $54,700/yr

III. Catalysts: none

IV. Chemicals

A. Deashing solvent

1. Makeup rate from heat and material balance adjusted for return from gasifier area is 605 lb/hr

2. 605 lb/hr x 7,884 hr/yr x 1 gal/7.23 lb = 659,726 gal/yr

3. 659,726 gal/yr x $1.45 gal = $956,603/yr

B. Dowtherm

1. System volume estimated by Catalytic, 30,000 gal

2. Life expectancy of Dowtherm operating at 650°F is 28-40 mo

3. Assuming a life of 34 mo., 30,000/34 x 12 = 10,600 gal/yr will be required for replacement

4. In addition, an estimated 5,000 gal/yr will be lost to the process or effluent system, due to leaks and material lost when draining equipment for maintenance.

5. Current price $1.43/lb delivered. (10,600 + 5,000) gal/yr X 8.82 lb/gal X $1.43/lb = $197,000/yr.

Appendix 2.0, Attachment D (Continued)

C. Miscellaneous

Antifoams, de-emulsifiers, dust supressants, boiler treatment, anti-stick compounds for solidifiers, soda ash for washing heater tubes, etc. Estimate $10,000/yr.

V. Other Variable Costs

Coal

1. 5,590 tons/day x .90 x 365 day/yr x 1.03 losses = 1,891,400 tons/yr (Dry Basis)
2. 1,891,400 tons/yr x 2,000 lb/ton x 12,900 Btu/lb x $1.62/MM Btu = $79,053,000

Appendix 2.0, Attachment E

Standard Operating Cost Budget Estimate

Coke and Liquid Products Area

(Basis: 90% On-Stream, 100% Production Rate)

FY 1982 1st Quarter $

		Coker $/yr	Calciner $/yr	Expanded-Bed Hydrocracker (high-conversion) $/yr
I.	Energy			
	A. Power	$300,000	$731,000	$2,369,000
	B. Intermittent power	77,000	--	47,000
	D. Start-Up Fuel	23,000	107,000	43,000
	E. Pilot (LPG)	33,000	6,000	23,000
II.	Lubes	8,000	8,000	36,000
III.	Catalysts	---	---	3,396,000
IV.	Chemicals	9,000	231,000	690,000
		$450,000	$1,083,000	$6,604,000

Operating Cost Assumptions and Support Data

Appendix 2.0, Attachment E (Continued)

I. ENERGY

A. Power

1. Coker

a. Information source: drawing no. 00-13-60001D, revision C

b. Normal operating power = 1,334 KVA with assumed p.f. = 0.9

c. Converting of p.f. = 1.0. P = 1,334 x 0.9 = 1,201 kW

d. Cost = 1,201 kW (24 hr/day)($0.03/kWhr)(365 days/yr) (0.95[a]) = $300,000/yr

2. Calciner

a. Information source: drawing no. 00-13-60001D, revision C

b. Normal operating power = 3,254 KVA with assumed p.f. = 0.9

c. Converting to p.f. = 1.0. P = 3,254 x 0.9 = 2,929 kW

d. Cost = 2,929 kW (24 hr/day)($0.03/kWhr)(365 days/yr)(0.95) = $731,000/yr

3. Expanded Bed Hydrocracker

a. Information source: drawing no. 00-13-60001D, revision A and motor list from Baseline Manual

b. Normal operating power = 10,546 KVA with assumed p.f. = 0.9

c. Converting to p.f. = 1.0. P = 10,546 x 0.9 = 9,491 kW

d. Cost = 9,491 kW (24 hr/day)(365 days/yr)($0.03/kWhr) (0.95) = $2,369,000/yr

B. Intermittent power (electric heat tracing)

1. Coker

a. Electric heat tracing (EHT) power = 200 kW (Source: drawing no. 00-13-60001D, revision A)

b. Assume 20% continuous operation for instrumentation heat tracing and 80% for start-ups and shutdowns

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[a] Mean correction factor that accounts for transition periods different from normal load, i.e., start-ups, shutdown, continuation of utilities and support areas during shutdowns, standby switchover, etc.

Appendix 2.0, Attachment E (Continued)

c. EHT cost - (continuous) = 200 kW (0.2)(24 hr/day)(365 days/yr)(0.95)($0.03/kW) = $10,000/yr

d. EHT cost - (intermittent) = 200 kW (0.8)(24 hr/start-up and shutdown)(6)(0.95)($0.03/kWhr) = $656.64/yr

e. Water jet pump operation cost (intermittent) = 1,419 KVA x 0.9 x (5 hr/day)(365 days/yr)(0.95) x (0.03) = $66,000/yr

f. Total cost = $9,986.40 + $656.64 + $66,400/yr = $77,000

2. Expanded Bed Hydrocracker

   a. Power = 832 kW (Source: drawing no. 00-13-60301D, revision C)

   b. Assume 20% continuous operation for instrumentation heat tracing and 80% for start-ups and shutdowns

   c. Cost (continuous) = 832 kW (0.2)(24 hr/day)(365 days/yr) (0.95)($0.03/kWhr) = $41,537.92/yr

   d. Cost (intermittent) = 832 kW (0.8)(48 hr/start-up and shutdown)(6)(0.95)($.03/kWhr) = $5,463.24

   e. Total cost = $41,536.92/yr + 5,463.24/yr = $47,000/yr

C. Start-up fuel

1. Coker

   a. Fuel required - 44.16 MM Btu/hr (source - Utility Summary)

   b. Assume 24 hr start-up and three start-ups a year

   c. Costs = (3) (44.16 MM Btu/hr) x 1.1 HHV/LHV x (24 hr/start-up) ($6.60/MM Btu) = $23,000/yr

2. Calciner

   a. Fuel required for start-up = 135.67 MM Btu/hr (Source: Utility Summary)

   b. Assume a 36-hr start-up and three start-ups a year

   c. Costs = (3)(135.67 MM Btu/hr) x 1.1 HHV/LHV x (36 H/start-up) ($6.60 MM Btu) = $107,000/yr

3. Expanded Bed Hydrocracker

   a. Fuel required for start-up = 40.7 MM Btu/hr (Source: Fuel Requirements Summary in LC-Finer Baseline)

Appendix 2.0, Attachment E (Continued)

b. Assume a 48-hr start-up and three start-ups a year

c. Costs = (3)(40.7 MM Btu/hr) x 1.1 HHV/LHV x (48 hr/start-up) ($6.60 MM Btu) = $43,000/yr

D. Pilot Operation

1. Pilot gas consumption = 70,000 Btu/hr per burner or 1.67% of total heater duty (source: conversation with Perry Russo of Lummus)

2. Coker

a. Pilot LPG use = (0.0167)(44.982 MM Btu/hr) = 0.7512 Btu/hr

b. Cost = 0.8425 MM Btu/hr (24 hr/day)(330 days/yr)($5.60/MM Btu) = $33,000/yr

3. Calciner

a. Pilot LPG use = 0.14 MM Btu/hr, only (2) burners

b. Cost = 0.14 MM Btu (24 hr/day)(330 days/yr)($5.60/MM Btu) = $6,000/yr

4. Expanded Bed Hydrocracker (high-conversion)

a. Pilot LPG use: (0.0167) (31.6 MM Btu/hr) = 0.5277 Btu/hr

b. Cost = 0.5277 MM Btu/hr (24 hr/day) (330 days/yr) ($5.60/ MM Btu) = $23,000/yr

II. <u>Lubes</u>

A. Coker

1. Power = 4,188 installed horsepower

2. Lubricant cost = $1.98(4,188) = $8,000/yr

B. Calciner

1. Power = 4,385 installed horsepower

2. Lubricant cost = $1.98(4,385) = $8,000/yr

C. Expanded Bed Hydrocracker

1. Power = 17,300 installed horsepower

2. Steam turbine = 727 rated hp (recycle compressor)

3. Lubricant cost = (17,300 + 727)($1.98) = $36,000 yr

Operating Cost Assumptions and Support Data

Appendix 2.0, Attachment E (Continued)

III. Catalyst Cost[b]

- A. Coker: no catalyst used
- B. Calciner: no catalyst used
- C. Expanded Bed Hydrocracker (high-conversion)
  - a. Catalyst addition rate = 0.61 lb/bbl (based on bench-scale pilot tests)
  - b. SRC feed = 886 tpsd (2,000 lb/ton)(8.337 lb/gal)(1.2)(42 gal/bbl) = 4,217 bpsd
  - c. Catalyst addition rate = 0.61 lb/bbl(4,217 bpsd) = 2,572.5 lb/day
  - d. Catalyst cost = 2,572.2 lb/day (330 days/yr) ($4.00/lb) = $3,396,000/yr

IV. Chemicals

- a. Coker
  - 1. Antifoam
    - a. Rate = 15 lb/day (source: Utility Summary)
    - b. Cost of chemical = $1.82/lb
    - c. Chemical cost = 15 lb/day(330 days/yr) ($1.82/lb) = $9,000
    - d. Chemical cost provided by Nalco Chemical Company
  - 2. Soda ash
    - a. Rate = 1 ton/yr (assumed)
    - b. Design purpose is for washing stainless steel on shutdown to prevent stress corrosion
    - c. Costs = $112/yr
    - d. Chemical cost provided by Allied Chemical Company
- B. Calciner
  - 1. Ethylene glycol
    - a. Rate = 500 gal/yr
    - b. Cost = $3.44/gal

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[b] Catalyst cost was determined by averaging Shell 324 ($3.80/lb), Armak-KF-840 ($3.90/lb), and American Cyanamid HDS-1442 ($4.30/lb). Currently, Wilsonville is utilizing HDS-1442, and the bench-scale pilot tests were performed on Shell 324.

c. Chemical costs = 500($3.44) = $1,720/yr

d. Chemical cost provided by PPG

2. Dedusting oil

   a. Design rate maximum = 0.5 wt% of anode grade coke rate. Rate = 0.005(600 tpsd)(2,000 lb/ton) = 6,000 lb/day

   b. Assume utilizing heavy fuel oil for dedusting oil at $34/bbl

   c. Cost of chemical = 6,000 lb/day(330 days/yr) ($34/bbl) (1/42 bbl/gal)(1/8.337) = $192,258/yr

3. Caustic Soda

   a. Assume 4 days per year of calciner operation with the DEA unit down. Purchased caustic soda will be used to replace the spent DEA solution as scrubber makeup

   b. Cost = $\frac{478 \text{ x } 24 \text{ lb/day}}{2{,}000 \text{ lb/ton}}$ ($140/ton)(4 days/yr) = $3,000/yr

4. Calciner BFW chemicals (chelating agent) (Source: Betz)

   a. Steam production 125,000 lb/hr

   b. Chemical injection rate = 0.382 gal per 100,000 lb/hr steam production

   c. Chemical cost = $9.09/gal

   d. Costs per year = 0.382 gal per 100,000 lb/hr(125,000 lb/hr)($9.09/gal)(24 hr/day)(330 days/yr) = $34,377/yr

C. Expanded Bed Hydrocracker

1. Filming amine

   a. Injection rate (based on Nalco experience) = 10 ppm of stream rate or 2.14 lb/hr

   b. Phase I rate = 2.8 lb/hr (high-conversion) (Baseline Book) 3.1 lb/hr (low-conversion)

   c. Assume Phase I rate until study completed by chemical vendor

   d. Costs = 2.8 lb/hr(24 hr/day)(330 days/yr) ($0.86/lb) = $19,071/yr

   e. Chemical costs provided by Nalco Chemical Company

Appendix 2.0, Attachment E (Continued)

2. Neutralizing amine

   a. Calculated injection rate based on Nalco experience = 10 ppm of stream rate of 0.79 lb/hr

   b. Phase I rate = 0.4 lb/hr (high-conversion)

   c. Assume Phase I rate until study completed by chemical vendor

   d. Cost = 0.4 lb/hr(24 hr/day) (330 days/yr) ($1.12/lb) = $3,548.15/yr

   e. Chemical cost provided by Nalco Chemical Company

3. Seal oil

   a. Rate = 0.25 gpm per ebullating pump (source: Lummus Equipment Specifications)

   b. Seal oil utilized is Witco LP-100

   c. Cost of chemical = $2.81/gal

   d. Cost = 0.25 gpm(2)(60 min/hr)(24 hr/day) (330 days/yr) ($2.81/gal) = $667,656/yr

   e. Chemical cost provided by Witco Chemical Company

Appendix 2.0, Attachment F

Standard Operating Cost Budget Estimate

Hydrotreater Area

(Basis: 90% On Stream, 100% Production Rate)

I.	Energy	
	A. Power	$171,000
	B. Fuel oil	--
	C. LPG	11,000
II.	Lubes	2,000
III.	Catalysts	13,000
IV.	Chemicals	--
V.	Other variables	
	A. Coal	--
	B. Purchased liquid nitrogen	663,000

I. Energy

A. Power

1. Assumptions used in calculations: motor efficiency (av) = 93.5% transformers and line lossess = 2.5% (2 and 0.5%, respectively)
2. Shaft power: ECP estimate of 624 kW
3. Input power = $\frac{624 \text{ kW}}{(0.935 - 0.005 - 0.020)}$ = 686 kW
4. Cost = 686 kW x 24 hr/day x 365 days/yr x 0.95 x lb .03/kWhr = $171,000

B. Pilot Fuel

1. Pilot gas consumption = 70,000 Btu/hr per burner or 1.67% of total heater duty (source: Lummus Co.)
2. Fuel gas burner use = 13.2 MM Btu/hr (LHV)
3. Cost = 13.2 MM Btu/hr x 0.0167 x 24 hr/day x 330 day/yr x 1.1 HHV/LHV x $5.60/MM Btu = $10,755/yr

II. Lubes

Lube oil basis: $1.98/yr per connected motor hp $1.98 x 956 hp = $1,893 ≠ $2,000

III. Catalysts

Estimate of $130,000/yr based upon 40,000 lb charge at $3.25/lb (initial charge) 10 yr life = 13,000/yr

IV. Other variables, purchased liquid nitrogen

ECP estimate of 23.9 tpd added to HPU for additional H_2 recovery 23.9 tpd x 365 days/yr x 0.95 x $80/ton = $663,000

APPENDIX 3.0: OCCUPATIONAL SAFETY AND HEALTH PHILOSOPHY AND PROGRAM

A. PHILOSOPHY

During operation of the SRC-I Demonstration Plant, ICRC's policy will be to insure safe and healthy working conditions for all of its employees. All operations will be conducted with a maximum concern for the safety and health of its employees, its customers, the community in which it operates, and the general public.

The objective of this policy will be to attain a degree of control over individual activities, processes, and physical conditions to eliminate undesirable incidents that could result in hazardous exposures to plant personnel or the general public. To achieve this objective, all employees will be required to participate in a continuing occupational safety and health program during Demonstration Plant operation.

The program that will be implemented at the plant will be based on the following guidelines.

1. Accident Prevention

Every accident is avoidable. Means can be developed to prevent accidents when their potential causes are properly identified and analyzed. All accidents will be thoroughly investigated to determine the cause(s) and to recommend implementation of necessary corrective actions. Accident investigation teams will be promptly appointed to investigate serious accidents and prepare comprehensive reports documented with photographs, interviews, and other necessary evidence.

2. Employee Safety

All employees will be provided with the training, equipment, and supervision needed to safely accomplish their assigned tasks. Employees will be required to follow established safety procedures and to report any potential hazards. It will be ICRC's policy to strictly enforce the plant safety and health requirements. Any major or repeated violation of these rules will be used by ICRC as grounds for disciplinary action. Supervisors will promote safety on the job by education, encouragement, and example.

3. Facilities, Products, and Processes

Practices, programs, and organizations will be established to ensure that all Demonstration Plant facilities, products, and processes comply with applicable codes, standards, and regulations. This is discussed further in Section B, the Worker Protection Program. These practices will be developed to ensure that existing or potential hazards are identified and that necessary corrective actions are determined and implemented.

4. Cooperation with Other Interested Parties

Assistance will be provided to employees, customers, carriers, and civic and governmental agencies to deal with safety and health matters that relate to the facilities, products, and operations of the Demonstration Plant. Sufficient information and instructions to permit the safe transportation, handling, storage, and use of its products will be provided to carriers, customers, and, where practical, to others who will actually use the products.

A comprehensive safety and health program will be developed for the operation of the Demonstration Plant based on the above philosophy. The written policies, procedures, and practices will be included in a plant safety and health manual, which will be made available to all plant personnel for easy reference.

B. WORKER PROTECTION PROGRAM

In order to fully assess the potential health hazards associated with coal liquefaction, ICRC has developed a comprehensive Worker Protection Program to protect employees. Components of this program include an extensive toxicological program, engineering controls, worker education, protective clothing, change-room facilities, work practices, monitoring of the work place environment, monitoring of employee health, and record keeping. Product users will be informed of the specific aspects of this program that apply to their situation.

A comprehensive toxicological testing program for carefully simulated Demonstration Plant materials is currently being formulated between ICRC, DOE, and Battelle Pacific Northwest Laboratory. The program will use a modified tier-testing approach, involving in vitro and in vivo assays to determine potential occupational and environmental health consequences of exposure to SRC-I materials. The purpose of these studies will be to identify potentially hazardous streams, thereby giving guidance to the design of engineering controls and the occupational health program.

Although testing results are incomplete, ICRC believes that the toxic properties of SRC-I and TSL-SRC solid products will be similar to those of coal, and anode-grade coke dust will be considered a nuisance dust, or one in which individual components are nontoxic in low concentrations. High-boiling-point hydrocarbon liquids must be handled as other toxic petroleum products such as catalytic cracker bottoms. Low-boiling-point liquids will probably be handled similarly to cuts from petroleum refineries. Sulfur and LPG are currently produced by industry and therefore, the health and safety precautions to be taken will be identical to those practiced.

The most effective means of limiting worker exposure to hazardous chemicals is to eliminate their source of emission through the use of engineering controls. ICRC has given considerable attention to this area, both through research and development efforts and experience at pilot and bench-scale facilities. Design review will be conducted before construction to consider the potential for possible incidents that could lead to uncontrolled releases.

Engineering systems will be employed that will minimize the likelihood of any situation occurring which could result in worker overexposure. For example, frequent hydrocarbon emissions from safety valves, vents, and other enclosed sources will be sent to a controlled combustion system. High integrity seals and packings will minimize emissions from mechanical equipment such as valves and pumps that handle hazardous streams. Specialized cooling of high-pressure, heavy hydrocarbon streams will prevent potential exposure from leaks to the cooling tower. Where necessary, controls will be incorporated into product user facilities.

Worker education and training is the first line of defense against potential health hazards that cannot be eliminated by engineeering designs. The core of any successful occupational health program is worker acceptance and participation, and this is the stated goal. The means of attaining this goal are threefold: initial training of new employees and visitors; periodic retraining; and periodic health and safety meetings, to allow the airing of individual concerns and permit review of emergency procedures. ICRC will educate product users concerning the safe use of the products in question.

The proper use of protective equipment and clothing will help to minimize any adverse health effects of worker exposure to coal liquefaction materials that may pose health hazards. For normal operations, employees will be issued overalls, underwear, socks, leather boots with oil-resistant soles, and rain suits and parkas, when needed. In the event of a spill of toxic materials during a work assignment which might lead to personal contamination, the employee may be asked to wear special protective equipment such as synthetic rubber boots, special gloves, an impervious rain suit, face shield, goggles, and respirator. Hearing protection will be provided in areas having high noise levels. Visitors entering the plant will be provided with protective clothing to prevent contamination of their street clothing.

To protect the worker and to prevent transport of coal-liquefaction contaminants off site, special procedures will be developed for employees working in areas where contamination may occur. The key elements in the design and use of the change facility are segregated clean and dirty areas and a mandatory daily shower and shampoo.

Protective clothing and a specialized change facility are necessitated at the Demonstration Plant by the presence of the high-boiling-point hydrocarbon liquids that may be potentially carcinogenic. For third-party exposure to all other products, such stringent measures will not be necessary.

The backbone of any worker protection program is the specific work practices. The Demonstration Plant will follow comprehensive and specifically defined work practices covering the following subjects: personal contamination; eating, drinking, and smoking; material transferrals; material storage; material disposal; maintenance procedures; and emergency plans and procedures. Appropriate work practices will be provided to product users as a part of normal services.

Industrial hygiene monitoring at the Demonstration Plant, using methods equivalent to or more current than those specified by the National Institute for Occupational Safety and Health (NIOSH), will assess worker exposures to potentially harmful substances. Frequency of monitoring will depend on an assessment of the potency of the toxin, and the initial concentrations measured. Protocols will be developed by an industrial hygienist. Initial area and personnel monitoring will be conducted for, but not limited to, the following agents: coal dust, coal tar pitch volatiles (CTPVs), polycyclic aromatic hydrocarbons (PAHs), aromatic amines, phenols, cresols, hexane, carbon monoxide, nickel carbonyl, carbonyl sulfide, hydrogen sulfide, sulfur dioxide, hydrogen cyanide, welding fumes, silica, trace metals, noise, lighting, and radiation. Recommendations for monitoring will be developed before the Demonstration Plant is placed into operation.

Medical monitoring is an important element in the program to protect workers against adverse, work-related health effects and will be made available to all employees who may be exposed to coal liquefaction products. Examinations designed to detect potential coal-liquefaction-related symptoms will be made before employment and annually thereafter, unless a different frequency is indicated on the basis of professional medical judgment. Any medical tests not included in regular physical examinations will be suggested to product users.

It is of the utmost importance to retain employee records for a sufficient time period. Because of the occupational health uncertainties inherent in a new industry and the long latency period of potential cancers, Demonstration Plant employee records will be kept for a period of time consistent with or longer than those stipulated in federal regulations. These records will include demographic information as well as comprehensive work histories, exposure-monitoring data, and medical surveillance results. Requirements will be made known to product users.

Almost all of the products from the Demonstration Plant will pose no additional health risk to product users when compared to the products they are currently using. High-boiling-point hydrocarbon liquids are the exception, but with minor adjustments to facilities and work practices, these risks can be mitigated.

APPENDIX 4.0: PLANT UTILIZATION FACTORS

The Demonstration Plant, planned as the first module of a commercial plant, will be designed in accordance with good industrial practice with the potential to operate for 20 years at a cost-effective production rate. The plant will be designed to attain design capacity with commercially available coal feedstock, with a target of 90% on-stream and utilization factors, after the initial period of commissioning, start-up, shakedown, and test operation, and after completion of modifications found to be required during this period. The plant will be designed with the equipment redundancy, installed spares, operating flexibility, and product-line flexibility required by good industrial practice for commercial operation.

The current project schedule provides a period of approximately one and one-half years for commissioning the plant, after which plant start-up will begin. A period of two and one-half years is provided for start-up, shakedown, and test operation.

Experience indicates that any large, complex refinery or chemicals plant can be expected to have unscheduled equipment breakdowns and equipment and process malfunctions during initial operation, and that these problems continue at a diminishing rate as the "learning curve" is surmounted. This history can be expected to repeat itself in the Demonstration Plant because of its complexity and prototype technology and equipment; however, the rate may be reduced somewhat because of the extraordinary redundancy that will be provided for some of the prototype equipment.

In addition to the unscheduled shutdowns during test operation, shutdowns must be scheduled for plant turnarounds to accomplish maintenance work and inspections. These are required at a much greater frequency in a new plant than in a mature plant. Scheduled shutdowns will also be required for process and equipment modifications and debottlenecking. Because some of these modifications may require substantial lead time for engineering and procurement, they will be expected to continue throughout the test operation period of two and one-half years. Every effort will be made to combine these shutdowns by performing turnaround and other scheduled work during unscheduled and modification outages.

Although final results from the Reliability Analysis Plan will be unavailable until late in Phase I, plant on-stream and throughput factors have been estimated for the commissioning, start-up, and test operation period for use in preparing the Project Baseline operating cost estimate.

Estimated Demonstration Plant Production

	Commiss. (Phase II)	Oper. (Phase III)	Cum. Time Span	On-stream Factor (% Time)	Through-put Factor (% Design)	Util Factor[(a)] (% Design)
Checkout and Accept Utilities	3 mo		.25 yr			
Commission Utilities Coal Handling, and ASU; Stockpile Coal	3 mo		.50 yr			
Commission Gas Systems	3 mo		.75 yr			
Commission SRC Process	3 mo		1.00 yr	20	50	10
Commission Coke and Liquid Products Area	3 mo		1.25 yr	33	60	20
Commission Plant	3 mo		1.50 yr	45	64	29
Start-up and Shakedown Phase IIIA		6 mo	2.00 yr	65	69	45
Test Operation, Phase IIIB		12 mo	3.00 yr	75	78	59
		12 mo	4.00 yr	85	83	71

(a) On-stream Factor X Throughput Factor = Utilization Factor.

Although these throughput estimates are considered to be reasonable, they are subject to relatively minor changes resulting from the formal Reliability Analysis or subsequent changes in equipment redundancy that are found to be desirable as detail design progresses.

APPENDIX 5.0: PHASE III COST ESTIMATE

INTRODUCTION

During Phase III of the SRC-I project, the Demonstration Plant will be operated and evaluated as an economically viable source of synthetic fuel. The SRC-I Demonstration Plant is being designed to operate in two modes: a one-third high-conversion mode that produces both first-stage solids (SRC) and second-stage solids (TSL-SRC), and a two-thirds low-conversion mode, which produces only second-stage solids. The operating plans assume that the plant will run each mode approximately 50% of the time during Phase III.

Phase III is divided into two subphases, IIIA and IIIB. Phase IIIA, the six-month period following completion of the plant, is dedicated to start-up and shakedown, and Phase IIIB is a two-year test operation period, during which ICRC will manage the facility and market the product.

The Phase III Cost Estimate of the Revised Baseline is based on first-quarter FY 82 dollars only. Included for comparison is the Phase III cost estimate of the Original Baseline which is presented as pro forma Income Statements and as Cost Plans by WBS elements. The original data are summarized in both first-quarter FY82 and escalated dollars. Supporting these Income Statements and Cost Plans are sections on Revenues and Costs. The Revenue section describes the SRC-I product slate, product prices used, and the total revenues expected. The Cost section translates the operating costs defined in Appendix 2.0 to the costs for Phases IIIA and IIIB.

SRC-I
REVISED BASELINE
PHASE III SUMMARY
First-Quarter FY82 Dollars ($000s)

Revenues	IIIA	IIIB	Total
LPG	$ 1,100	$ 6,600	$ 7,700
Naphtha	11,400	92,400	103,800
Medium Oil	12,500	101,700	114,200
Heavy Oil	2,100	17,800	19,900
SRC/TSL-SRC	11,700	90,700	102,400
Anode Coke	8,300	67,200	75,500
Sulfur	2,400	13,900	16,300
Off Spec - Liquids	7,100	-	7,100
Off Spec - Solids	1,700	-	1,700
Total Revenues	$ 58,300	$390,300	$448,600
Operating Costs			
Labor	$ 5,256	$ 20,022	$ 25,278
Overhead	3,367	13,466	16,833
Chemicals	2,246	11,974	14,220
Catalysts	1,741	9,286	11,027
Lubricants	132	698	830
Power	9,853	45,472	55,325
Fuel	4,802	12,711	17,513
Coal	23,644	119,085	142,729
LIN	387	1,548	1,935
Maintenance	29,508	103,278	132,786
Total Operating Costs	$ 80,936	$337,540	$418,476
Gross Margin	22,636	(52,760)	(30,124)
Insurance	245	980	1,225
ICRC Overhead: Home Office	8,738	34,291	43,029
Site	3,377	8,145	11,522
G&A	4,665	17,263	21,928
License Fees	1,070	-	1,070
Retrofit Costs - Prior Years	45,100		45,100
Total Net (Revenues) Costs	$ 85,831	$ 7,919	$ 93,750

Phase III Cost Estimate

SRC-I
ORIGINAL BASELINE
PHASE III SUMMARY
First-Quarter FY82 Dollars ($000s)

	IIIA	IIIB	Total
Revenues			
LPG	$ 1,700	$ 10,900	$ 12,600
Naphtha	15,300	127,700	143,000
Medium Oil	18,800	159,300	178,100
Heavy Oil	3,000	25,200	28,200
SRC/TSL-SRC	17,200	141,600	158,800
Anode Coke	11,400	95,300	106,700
Sulfur	2,300	13,600	15,900
Off Spec - Liquids	10,200	-	10,200
Off Spec - Solids	1,700		1,700
Total Revenues	$81,600	$573,600	$655,200
Operating Costs			
Labor	$ 5,256	$ 20,022	$ 25,278
Overhead	3,367	13,466	16,833
Chemicals	3,381	18,036	21,417
Catalysts	1,784	9,520	11,304
Lubricants	113	604	717
Power	9,396	43,364	52,760
Fuel	9,090	24,687	33,777
Coal	23,456	118,140	141,596
LIN	387	1,548	1,935
Maintenance	30,000	105,000	135,000
Total Operating Costs	$86,230	$354,387	$440,617
Gross Margin	4,630	(219,213)	(214,583)
Insurance	245	980	1,225
ICRC Overhead: Home Office	8,738	34,291	43,029
Site	3,377	8,145	11,522
G & A	4,665	17,263	21,928
License Fees	1,070	-	1,070
Retrofit Costs - Prior Years	45,100	-	45,100
Total Net (Revenues) Costs	$67,825	$(158,534)	$(90,709)

SRC-I
ORIGINAL BASELINE
PHASE III SUMMARY
Escalated Dollars ($000s)

	IIIA	IIIB	Total
Revenues			
LPG	$ 2,900	$ 20,800	$ 23,700
Naphtha	26,300	243,700	270,000
Medium Oil	32,400	304,100	336,500
Heavy Oil	5,200	48,100	53,300
SRC/TSL	29,500	270,300	299,800
Anode Coke	19,600	181,900	201,500
Sulfur	4,000	26,000	30,000
Off Spec - Liquids	17,500	-	17,500
Off Spec - Solids	2,900	-	2,900
Total Revenues	$140,300	$1,094,900	$1,235,200
Operating Costs			
Labor	$ 8,943	$ 37,867	$ 46,810
Overhead	5,793	25,520	31,313
Chemicals	5,814	34,170	39,984
Catalysts	3,068	18,044	21,112
Lubricants	194	1,148	1,342
Power	16,161	82,356	98,517
Fuel	15,636	46,513	62,149
Coal	40,345	224,068	264,413
LIN	666	2,937	3,603
Maintenance	50,601	198,640	249,241
Total Operating Costs	$147,221	$ 671,263	$ 818,484
Gross Margin	6,921	(423,537)	(416,716)
Insurance	422	1,857	2,279
ICRC Overhead: Home Office	15,029	64,985	80,014
Site	5,807	15,309	21,116
G & A	8,009	32,635	40,644
License Fees	1,070	-	1,070
Retrofit Costs - Prior Years	68,878	-	68,878
Total Net (Revenues) Costs	$106,136	$ (308,851)	$ (202,715)

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(1/78)

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ORIGINAL BASELINE Phase III

PAGE OF

1. Contract Identification: Demonstration of the Solvent Refined Coal Process

2. Contract Number: DE-AC05-780R03054

3. Contractor (name, address):
International Coal Refining Company
P. O. Box 2752
Allentown, PA 18001

4. Contract Start Date: 10 July 1978

5. Contract Completion Date:

6. Identification Number	7. Reporting Category (e.g., contract line item or work breakdown structure element)	8. Planned Prior Fiscal Years	9. Actual Prior Fiscal Years	IIIA	IIIB				Phase III
				FY88	FY88	FY89	FY 90	TOTAL	TOTAL
1.2.1	SRC			38636	21613	86586	64937	173136	211,772
1.2.2.1	Coker/Calciner			3522	1679	6650	4712	13041	16,563
1.2.2.2	EBH			6242	2877	11461	8433	22771	29,013
1.2.2.5	Naphtha Hydrotreater			1270	506	2017	1462	3985	5,255
1.3.1.1	ASU			2968	1539	6292	5000	12831	15,799
1.3.2	Gas Systems			17367	8263	32806	23240	64309	81,676
1.4.1	Utilities & Outside Battery Limits			14946	7051	28021	20018	55090	70,036
1.5.1	Project Management			2782	1395	2932	1933	6260	9,042
1.5.2	Administration & Planning			3296	1651	6424	4899	12974	16,270
1.5.3	Technical Support			5430	2693	10701	8008	21402	26,832
1.5.4	Product Utilization			46726 *	810	3139	2455	6404	53,130
1.5.5	EPLA			1575	779	2952	1869	5600	7,175
	G & A			4665	2333	7988	6942	17263	21,928
	Total Costs			149425	53189	207969	153908	415066	564,491
	Cost Escalation			97011	40774	178327	151882	370983	467,994
	(Revenues)			(81600)	(59800)	(268100)	(245700)	(573600)	(655,200)
	(Revenues Escalation)			(58700)	(43100)	(230000)	(248200)	(521300)	(580,000)
	Net (Revenues) Costs			106136	(8937)	(111804)	(188110)	(308851)	(202,715)

15. Remarks: * Includes $45,100 Retrofit Conversion Program.

Dollars Expressed in Thousands-1st Qtr. FY82 Dollars

17. Cost Plan Date: March, 1982

18. Signature of Contractor's Project Manager and Date

19. Signature of Contractor's Authorized Financial Representative and Date

20. Signature of Government Technical Representative and Date

DOE Form CR-533P
(1-78)

U. S. DEPARTMENT OF ENERGY

ORIGINAL BASELINE

Phase III

PAGE OF

1. Contract Identification
Demonstration of the Solvent Refined Coal Process

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P. O. Box 2752
Allentown, PA 18001

4. Contract Start Date
10 July 1978

5. Contract Completion Date

6. Identification Number	7. Reporting Category (e.g., contract line item or work breakdown structure element)	8. Planned Prior Fiscal Years	9. Actual Prior Fiscal Years	IIIA	IIIB				PHASE III
				FY88	FY88	FY89	FY90	TOTAL	TOTAL
1.2.1	SRC			66454	38233	160876	129010	328119	394,573
1.2.2.1	Coker/Calciner			6055	2968	12350	9364	24682	30,737
1.2.2.2	EBH			9030	5088	21289	16757	43134	52,164
1.2.2.5	Naphtha Hydrotreater			2022	895	3744	2908	7547	9,569
1.3.1.1	ASU			5104	2722	11699	9935	24356	29,460
1.3.2	Gas Systems			29874	14617	60920	46168	121705	151,579
1.4.1	U & O			25713	12472	51997	39777	104246	129,959
1.5.1	Project Mgmt.			4784	2468	5446	3841	11755	16,539
1.5.2	Admin. & Planning			5668	2920	11937	9734	24591	30,259
1.5.3	Tech. Support			9339	4764	19882	15914	40560	49,899
1.5.4	Prod. Util.			71675	1433	5832	4878	12143	83,818
1.5.5	EPLA			2709	1378	5485	3713	10576	13,285
	G & A			8009	4005	14839	13791	32635	40,644
	Total Costs			246436	93963	386296	305790	786049	1,032,485
	(Revenues)			(140300)	(102900)	(498100)	(493900)	(1094900)	(1,235,200)
	Net (Revenues) Costs			106136	(8937)	(111804)	(188110)	(308851)	(202,715)

15. Remarks

Dollars Expressed in Thousands-Escalated Dollars

17. Cost Plan Date
March, 1982

18. Signature of Contractor's Project Manager and Date

19. Signature of Contractor's Authorized Financial Representative and Date

20. Signature of Government Technical Representative and Date

REVENUES

Revenue Update

The estimate of Demonstration Plant revenues submitted in the Original Project Baseline must be updated to reflect changes in the product slate and product pricing. The product slate has changed because of higher naphtha recovery and a small increase in middle distillate production. The product pricing change is due to an update in energy price projections by DOE. The price projections in the Original Project Baseline were based on the DOE Energy Information Administration (EIA) publication "1981 Annual Report to Congress." The product prices are now based on EIA's publication "1982 Annual Energy Outlook."

Background

The SRC-I Demonstration Plant manufactures a wide range of products. Determining the revenues that could be obtained from these products required assessments of their qualities and of potential available markets. A brief summary of the products and their qualities, the available markets, and the projected product prices follows.

Product Descriptions

The SRC-I Demonstration Plant is being designed to operate in two modes: the one-third high-conversion mode that produces both first-stage solids (SRC) and second-stage solids (TSL-SRC), and the two-thirds low-conversion mode that produces only second-stage solids. The plant is designed to produce the following products and volumes.

	1/3 High Conversion	2/3 Low Conversion
Naphtha, BPSD*	3,809	3,912
Middle Distillate, BPSD	4,846	4,834
Heavy Oil, BPSD	827	800
SRC, TPSD*	884	--
TSL-SRC, TPSD	169	983
Anode Coke, TPSD	573	573
LPG, BPSD	505	568
Sulfur, TPSD	193	199

*Note: BPSD = barrels per stream day and TPSD = tons per stream day.

Total plant output at design capacity is approximately 18,000 BPSD with the solid product calculated at its oil equivalent (6 MM Btu/BOE).

The revenues during Phases IIIA and IIIB are based on the plant's operating half the time in the one-third high-conversion mode and the other half in two-thirds low-conversion mode. Since it is impractical to forecast exact timing of the plant operation in each mode, the revenues for each time period are based on the 50:50 split of operation modes.

All SRC-I products, with the exception of sulfur, will be used in markets now supplied by petroleum products. Naphtha, after hydrotreating and reforming, can be used either as a high-octane unleaded gasoline blendstock or a feedstock for petrochemical applications. Middle distillate can directly substitute for No. 2 fuel oil. The heavy oil, SRC, and TSL-SRC can be used in electric utility and industrial markets now served by No. 6 fuel oil. SRC-derived anode coke will displace petroleum-based coke. LPG can be used in markets now served by propane and butane.

Naphtha

SRC-I naphtha consists of the C_5-400°F liquid fraction produced from the SRC, Expanded Bed Hydrocracker (EBH), and Coker/Calciner units. This boiling range has been selected because it is typical of raw petroleum naphtha that is currently being reformed into gasoline or petrochemical feedstocks in the United States. Catalytic reforming presents an excellent application for hydrotreated SRC-I naphtha.

The high aromatic and naphthene contents of SRC-I naphtha make it a desirable catalytic reforming feedstock once it is hydrotreated to remove heteroatoms. A refiner has indicated that an approximately 6% premium price over straight-run naphtha could be justified based on SRC-I naphtha's reformability. However, Demonstration Plant revenue projections are conservatively based on straight-run naphtha value. Catalytically reformed naphtha could be used either as a high-octane unleaded gasoline blendstock or as a petrochemical feedstock. By the year 2000, the available market for hydrotreated SRC-I naphtha will approximate 5 million barrels per day, based on a 1981 forecast by the Pace Co. Consultants and Engineers.

Middle Distillate

SRC-I middle distillate is the 400-650°F liquid hydrocarbon produced at the Demonstration Plant. This boiling range is typical of the petroleum distillate streams used to produce No. 2 fuel oil, turbine fuel, jet fuel, and diesel fuel. Although the API gravity is lower than petroleum-distillate fuel oil, the viscosity and pour point are comparable or better. Use as turbine, jet, or diesel fuels would require upgrading or end-use equipment changes. ICRC expects that the middle distillate will be marketed initially as a No. 2 fuel oil substitute for industrial or electric utility boilers. By the year 2000, the demand for No. 2 fuel oil is projected to be in excess of 6 million barrels per day, based on the Pace Co. forecast.

Heavy Oil

SRC-I heavy oil, the 650-850°F liquid fraction, is expected to be marketed as a low-sulfur No. 6 fuel oil substitute. Other uses for heavy oil (e.g., as carbon black feedstock) are being evaluated and may provide future markets. Although residual fuel oil use in utility and industrial sectors is expected to decline, significant demand will still exist in the year 2000.

SRC and TSL-SRC (Solids)

SRC consists of the 850°F+ solid hydrocarbon material from the first- (SRC-I) and second-stage (EBH) liquefaction areas. SRC from the SRC-I unit is expected to contain 0.8% sulfur, whereas TSL-SRC produced in the EBH will have a lower sulfur content of 0.3%. The SRC and TSL-SRC products have unique engineering properties that are distinct from coal, and will permit them to directly displace oil:

- virtually no ash content
- high heat value
- low sulfur content
- soluble in coal liquids
- homogeneity
- easily pulverized
- low melting point

Since SRC contains virtually no ash, it can be used in boilers that are not designed to compensate for the slagging and fouling characteristics of coal ashes. Therefore, boilers and furnaces that are designed solely for oil and do not include coal-ash design modifications can substitute SRC for No. 6 fuel oil. Environmentally, the SRC is more acceptable than coal because of minimal levels of ash and sulfur.

Electric-utility boilers have been identified as a large unit-volume oil-displacement segment. Thus, sales activities have concentrated on obtaining demonstration-use agreements to burn SRC in such utility boilers. At this time, five electric utilities have signed or are in the final stages of negotiating Demonstration-Use Agreements. Currently, the utilities involved are all burning large amounts of oil; are under economic, regulatory, and supply pressure to reduce oil consumption; and are potential commercial-product customers. During the demonstration phase, the SRC will displace about 3 million barrels of crude oil equivalent. The demonstrations include oil-fired coal-designed and oil-fired oil-designed units that represent the designs of three major boiler manufacturers.

Industrial boilers and furnaces are a secondary priority sales target for demonstration use. Penetration of the individual market segment with a minimum of one demonstration unit would create a supportive and interested group of future commercial customers. Currently, ICRC has one Demonstration Use Agreement for an industrial furnace application.

Calcined Anode Coke

SRC-I calcined anode coke is produced by processing SRC in the Coker/Calciner units. SRC-I calcined anode coke appears to be a premium anode coke because of its high bulk density, and low sulfur, metals, and ash content compared to petroleum-derived cokes. The quality of petroleum-derived coke is deteriorating because of the lower quality of crudes being processed, which may enhance the marketability of SRC-I anode coke.

The calcined anode coke will be used to produce anodes for aluminum smelting. The United States demand for calcined coke for aluminum anodes will be approximately 3.5 million tons per year by 2000. A major consumer of calcined coke is willing to purchase most, if not all, of the calcined coke produced at the Demonstration Plant.

LPG

SRC-I LPG consists of the mixed propane/butane stream. Analysis of its expected characteristics indicates that it should meet the specifications for a commercial butane/propane mixture, as outlined in Gas Processors Association

Publication #2140-77. Contracts with companies marketing butane and propane indicate that they would be willing to purchase LPG at its equivalent market price. Because of fractionation and transportation costs, the LPG value is expected to be approximately equal to propane prices.

Sulfur

The Claus Process, used to produce sulfur at the SRC-I Demonstration Plant, has been widely used with proven performance of product quality. Discussions with major purchasers of elemental sulfur have indicated a high level of interest in SRC-I sulfur. Domestic supply and reduced freight costs are reasons specified by potential purchasers for buying SRC-I sulfur.

Pricing

Projected energy prices are essential in developing the expected revenues from the SRC-I Demonstration Plant and in evaluating the commercial viability of the technology. Over the last few years, energy prices have escalated rapidly and erratically. Although currently the prices seem to have stabilized, future prices will depend on many factors over which the United States has very little control.

The price projections used in developing revenues are based on projections by DOE's Energy Information Administration (EIA) in its "1982 Annual Energy Outlook." EIA's projections for Distillate Fuel Oil (No. 2 oil) and Residual Fuel Oil (No. 6 oil) have been used directly. Since EIA does not project detailed pricing for the whole range of petroleum products, the naphtha, LPG, and SRC prices are estimated based on differentials for each product from distillate or residual fuel oil prices. All prices and revenues are FOB at the Newman, Kentucky plant.

SRC and TSL-SRC (Solid)

At this time, several electric utility and industrial companies have signed or are in the final stages of negotiating demonstration-use agreements for SRC. All of these companies are currently burning residual fuel oil.

SRC can be used as a substitute for the No. 6 fuel oil now being used by utilities. Agreements with these companies indicate that the SRC price would be equivalent to the utility's cost of using fuel oil. For example, Utility C, a southeastern electric utility, presently uses 2.2% sulfur No. 6 fuel. Since SRC would displace a 2.2% sulfur No. 6 fuel, it would be priced accordingly. On the other hand, Utility A, a northeastern utility, plans to use TSL-SRC to displace 0.3% sulfur No. 6 fuel oil, and would price TSL-SRC on an equivalent basis.

Price projections for No. 6 fuel oil at the Gulf Coast and New York Harbor are shown in Exhibit 1. The prices commanded by residual fuel oil vary with the sulfur content. The net FOB price at Newman, Kentucky would be discounted for transportation costs and for additional operating and maintenance (O&M) costs incurred by the product user.

EXHIBIT 1

1988 RESIDUAL FUEL OIL PRICES

(1982 dollars)

% S	Gulf Coast Price ($/MM BTU)	NY Harbor Price ($/MM BTU)	FOB Newman, KY ($/MM BTU)
0.3	6.55	6.90	5.90
0.7	6.40	6.65	5.65
1.0	6.15	6.40	5.40
2.2	5.15	5.40	4.40

The FOB Demonstration Plant price was derived by using a $0.75/MM BTU transportation cost to the user site, and a $0.25/MM BTU discount for O&M costs. Retrofit costs required for SRC fuel use are assumed to be funded as part of the demonstration project.

LPG

The LPG produced at the Demonstration Plant will be a mixture of approximately 60% propane and 40% butane. Contacts with potential buyers have indicated that the mixture would most probably be refractionated to obtain propane and butane. Because of the cost of fractionation, the LPG value would be closer to propane prices.

Since EIA does not project propane prices, it is estimated as a differential from distillate oil prices. Based on evaluation of historic and projected price differentials, propane is priced at $1.00/MM Btu below No. 2 fuel oil in 1985 to year 2000 period. As a further conservative measure, the LPG prices are reduced 7% as per DOE suggestions.

Naphtha

The SRC-I naphtha has a high aromatic and naphthene content and would be a desirable catalytic reformer feedstock. Although hydrotreated SRC-I naphtha is expected to command a premium over petroleum naphtha, projected revenues are based on valuing SRC-I naphtha at a price equivalent to petroleum-based benzene/toluene/xylene (BTX) naphtha. Recent historical data indicates that the BTX naphtha is generally priced approximately 5¢ per gallon higher than No. 2 distillate fuel oil. Therefore, the naphtha prices in Exhibit 4 are based on a 5¢ per gallon differential from distillate oil prices projected by EIA's "1982 Annual Energy Outlook," using a naphtha higher heating value (HHV) of 5.44 MM Btu per barrel.

Middle Distillate

The middle distilate boiling range of 400-650°F is typical of No. 2 distillate fuel oil from petroleum. Furthermore, it has a comparatively lower pour point and similar viscosity. Evaluation of middle distillates from SRC-I and other coal-liquefaction technologies indicates that they could be used in boiler applications now served by No. 2 fuel oil.

The middle distillate price is based on the petroleum distillate prices for industrial applications, as projected by DOE's EIA in the "1982 Annual Energy Outlook." As per DOE suggestion, the middle distillate price is reduced 10% from the EIA's price forecast for distillate oil.

Heavy Oil

The SRC-I heavy oil is expected to be marketed as a substitute for No. 6 fuel oil. The heavy oil has an approximately 0.3% sulfur content, which is below almost all of the No. 6 fuel oil used in this country. However, for revenue calculation, the heavy oil is priced equal to EIA's price projection for United States low sulfur residual fuel oil, which is approximately 0.7% to 1% sulfur.

Anode Coke

The SRC-I calcined anode-quality coke will be used in aluminum smelting and would displace petroleum-based coke. In 1981, the price of 2.5% sulfur calcined coke was $170 per ton. SRC-I anode coke contains an average of 0.5% and a maximum of 0.8% sulfur and could be used directly or blended with high-sulfur petroleum coke to produce acceptable coke.

The SRC-I anode coke price in 1981 was calculated by assuming a 60/40 blend of 0.8% sulfur anode coke with 5% sulfur coke at $135/ton to produce 2.5% sulfur coke priced at $170/ton. The SRC-I anode coke price was estimated to be $195/ton in 1981. This price is projected to escalate with petroleum prices estimated by DOE's EIA in "1982 Annual Energy Outlook."

ICRC believes that SRC-I coke will command an even higher premium, because of its unique qualities and blending properties, and an average sulfur content of 0.5%. However, to be conservative, the SRC-I coke is priced as the equivalent of 0.8% sulfur petroleum coke.

Sulfur

Sulfur prices are based on discussions with sulfur producers and consumers. Most purchasers and suppliers are hesitant to discuss price forecasts formally; estimates vary over a wide range. On an average, the sulfur prices are projected to show a slow continuous growth from $140 per short ton in 1982 to about $150 per short ton by 1990 in constant 1982 dollars.

Products During Commissioning

The production forecasts and revenue projections presume that all of the coal liquid, solid, and coke products during commissioning and 25% of the products, with the exception of LPG, will not meet commercial specifications during the start-up period. However, these products will be useful for at least their fuel value, and the revenue forecasts reflect this. During this period, a certain portion of these products prbably will meet specifications and, thus, could generate significantly higher revenues than projected.

The distillate coal liquids produced during commissioning can be grouped into two major classifications for disposal: naphtha and fuel oil distillate range. Both types may be off-specification with regard to sulfur, nitrogen, and oxygen content and/or viscosity and flash point. A system designed to handle heavy No. 6 oil would be able to handle the fuel oil range product. The naphtha probably would be blended into a large refinery feedstock. The value of naphtha used in this way would equal that of No. 6 oil or greater. For the revenue forecasts, all commissioning liquids were valued at No. 6 fuel oil prices.

The solid products may contain off-specification amounts of sulfur and/or ash--as much as 1.5% sulfur and as much as 14% ash. Even if both of these properties were off-specification, the solid product would be equivalent to a high-ash, medium-sulfur bituminous coal. The revenue forecast for this product is based on prices for high-sulfur bituminous coal. The marketing plan is to locate a large coal-fired utility that could blend small portions of this product in its coal supplies.

The structure of coke produced during commissioning and some that is produced during start-up probably will not be suitable for anode coke consumption, but it will have fuel value. The revenue forecast takes a conservative approach and assumes that this material would be sold to a high-sulfur, bituminous coal-fired boiler at a commensurate price. Most probably this coke could be sold to alternative industrial users such as silicon carbide producters at a much higher value. Selling only 20% of the total commissioning coke at projected coke prices would provide the forecasted revenue.

Transportation Costs

The prices for SRC, FOB at the Demonstration Plant, Newman, Kentucky, are based on $0.75/MM Btu transportation costs to the user site. This figure was calculated from cost analyses performed by the product users and verified by transportation personnel from ICRC and Southern Company Services, a consultant to ICRC.

The cost to transport SRC from Newman to the northeastern United States via a rail/water route is estimated to be $25-30/ton (first-quarter 1982). Likewise, the cost to transport SRC to the southeast via an all-rail route has also been calculated at $25-30/ton. The U.S. Department of Transportation

(DOT) in its publication "Carload Waybill Statistics" reports that the average cost to transport prepared bituminous coal (analogous to SRC) from the south to the balance of the U.S. was 2.53 cents per ton-mile in 1979. With the addition of historical rail-rate increases, this figure becomes 3.15 cents per ton-mile in 1982. Therefore, a shipment of SRC from Newman, Kentucky to a proposed customer in the northeast (875 miles) would incur freight charges of $27.55/ton, which is consistent with the estimates provided by the product user and confirmed by ICRC and Southern Company Services. In addition, the DOT data supports the $25-30 cost estimate for transporting SRC from Newman to the southeast (950 miles at 3.15 cents per ton-mile).

SRC production rates are approximately equal to customer consumption rates. Thus, the SRC can be shipped directly to users, eliminating the need for significant storage capacity.

In the one-third high-conversion production mode, the plant will produce 16,000 and 19,000 tons per month at 59 and 71% utilization factors, respectively. One SRC customer alone can burn about 16,000 tons of SRC per month. In the two-thirds low-conversion mode, the plant will produce 18,000 and 21,000 tons of TSL-SRC per month at 59 and 71% utilization factors, respectively. A major customer for TSL-SRC can use about 20,000 tons per month at its current load factor.

The parity between production rates and product-user rates indicates that the storage capacities at the Demonstration Plant and user sites would be sufficient to permit transportation and use at desired rates.

The prices for SRC-I liquid products are based on average United States prices projected by EIA. A regional analysis of the EIA data shows that petroleum distillate prices in the South Atlantic region (which includes Kentucky) are approximately $0.50/MM Btu higher than the average United States forecasts.

No specific costs have been estimated for transporting SRC-I liquid products from the Demonstration Plant to the end user. However, ICRC assumes that the $0.50/MM Btu price differential between the average United States and South Atlantic forecasts would be sufficient to cover any transportation costs to the end user. Moreover, since naphtha and distillate oils are widely used in the South Atlantic and Midwest regions, the SRC-I liquids would be expected to be transported shorter distances compared to other SRC products.

EXHIBIT 2

DEMONSTRATION PLANT REVENUES
(million dollars)

	Commissioning II		IIIA Start-Up	IIIB				
In 1982 $'s	1987 (6 Mo.)	1988 (3 Mo.)	1988 (6 Mo.)	1988 (3 Mo.)	1989 (9 Mo.)	1989 (3 Mo.)	1990 (9 Mo.)	Total
Utilization, %	--	--	45%	59%	59%	71%	71%	
LPG	--	--	1.1	0.7	2.2	0.9	2.8	7.7
Naphtha	--	--	11.4	9.9	31.2	12.5	38.8	103.8
Medium Oil	--	--	12.5	10.9	34.3	13.8	42.7	114.2
Heavy Oil	--	--	2.1	1.9	6.0	2.4	7.5	19.9
SRC and TSL-SRC								
Utility A	--	--	7.0	6.1	19.3	7.7	24.1	64.2
Utility B	--	--	4.7	0.8	2.4	0.6	1.9	10.4
Utility C	--	--	--	2.3	7.4	3.4	10.6	23.7
Industrial	--	--	--	0.5	1.5	0.5	1.6	4.1
Anode Coke	--	--	8.3	7.2	22.7	9.1	28.2	75.5
Sulfur	0.7	0.8	2.4	1.6	4.7	1.9	5.7	17.8
Commissioning Liquids	7.6	9.5	7.1	--	--	--	--	24.2
Commissioning Solids	2.8	2.2	1.7	--	--	--	--	6.7
Total Revenues (1982 $)	11.1	12.5	58.3	41.9	131.7	52.8	163.9	472.2

EXHIBIT 3

DEMONSTRATION PLANT PRODUCTION/SUPPLY
(MMM Btu)

	Commissioning II		IIIA Start-Up	IIIB			
In 1982 $'s	1987 (6 Mo.)	1988 (3 Mo.)	1988 (6 Mo.)	1988 (3 Mo.)	1989 (9 Mo.)	1989 (3 Mo.)	1990 (9 Mo.)
Utilization, %	10/20%	29%	45%	59%	59%	71%	71%
LPG	--	--	168	110	329	132	397
Naphtha	--	--	1,294	1,130	3,392	1,360	4,082
Medium Oil	--	--	1,756	1,535	4,605	1,847	5,542
Heavy Oil	--	--	341	298	896	359	1,078
SRC and TSL-SRC							
Utility A	--	--	1,186	1,037	3,111	1,248	3,743
Utility B	--	--	870	141	421	106	316
Utility C	--	--	--	524	1,572	714	2,140
Industrial	--	--	--	96	288	96	288
Anode Coke (tons)	--	--	35,293	30,849	92,547	37,123	111,370
Sulfur (tons)	5,082	5,107	16,096	10,552	31,656	12,698	38,095
Commissioning Liquids	1,311	1,504	1,130	--	--	--	--
Commissioning Solids	1,688	1,329	1,020	--	--	--	--

EXHIBIT 4

PRODUCT PRICING

(1982 Dollars)

Products	Units	1987	1988	1989	1990
LPG	$/MM Btu	5.80	6.35	6.75	6.95
Naphtha	$/MM Btu	8.05	8.80	9.20	9.50
Medium Oil	$/MM Btu	6.55	7.10	7.45	7.70
Heavy Oil	$/MM Btu	5.80	6.30	6.65	6.95
SRC and TSL SRC(1)					
Utility A	$/MM Btu	5.40	5.90	6.20	6.45
Utility B	$/MM Btu	4.90	5.40	5.70	5.95
Utility C	$/MM Btu	3.90	4.40	4.70	4.95
Industrial	$/MM Btu	4.30	4.80	5.15	5.45
Anode Coke	$/Ton	220	234	245	253
Sulfur	$/Ton	147	148	149	150
Commissioning Liquids	$/MM Btu	5.80	6.30	6.65	6.95
Commissioning Solids	$/MM Btu	1.62	1.62	1.62	1.62
Crude Oil (U.S. Avg. Aquisition Cost)	$/BBL	31.55	34.10	35.70	36.70

(1) Price to utilities based on their current fuel oil sulfur specifications.

DEVELOPMENT OF COAL PRICE PROJECTIONS FOR SRC-I BASELINE

The market for bituminous coal produced in the Illinois Basin, ICRC's primary source of supply for the Demonstration Plant, is presently depressed and is expected to remain that way through 1985-1987. Coal mines in the basin are operating at less than 80% of available capacity. An objective of ICRC's coal-procurement strategy is to obtain commitments to supply the Demonstration Plant requirements during this "soft market" period. Conversations with various coal company representatives have confirmed our expectations that ICRC would be able to obtain contracts with pricing provisions similar to those applicable to utility-grade steam coal. Therefore, the price developed for the Project Baseline is based upon actual prices reported by public utilities to the Federal Energy Regulating Commission (FERC), in combination with our expectations of price escalation to be experienced through Phase III of the Demonstration Plant operations. A detailed description of the price development follows.

ICRC identified nine potentially qualified coal suppliers among the respondents to our solicitation notice in the Commerce Business Daily. Current contract delivered prices, heat content, and delivered tonnages coming from these sources are reported monthly by public utilities to FERC on Form 423. This information was gathered from these publicly available reports for the period fourth-quarter FY80 through fourth-quarter FY81. Transportation expenses from each source mine to each destination utility were estimated and subtracted from the delivered prices to obtain FOB mine prices. Then transportation expenses from each mine to Newman were estimated to develop estimated FOB Demonstration Plant prices.

A quarterly weighted average FOB Newman price was calculated based on the tonnage each of the prospective sources had available for sale. Using these five points, a regression line of prices was constructed to provide a first-quarter FY82 FOB Newman price estimate. This price was escalated using the escalation rates for coal prices published in Energy Information Administration's "1982 Annual Energy Outlook" plus internally developed coal-price component factors and escalation rates. The initial coal-price component factors are: (1) labor costs--41%; (2) variable costs: materials, supplies, royalties, and taxes--36%; (3) fixed costs: capital and profit--14%; and (4) transportation costs--9%. Labor and transportation costs are expected to increase at a rate somewhat above general inflation. Fixed and variable costs are projected to increase at the inflation rate, with the provision that fixed costs would not change after the bid closure date for primary and secondary supply sources. The Energy Information Administration expects coal prices to increase at the rate of 0.57% per year in 1982 dollars during the term 1980-1988. This is the period during which the Demonstration Plant would be contracting for its primary and secondary coal supply. For this study, the assumed bid closure dates were second-quarter FY83 and first-quarter FY88, for primary and secondary supply sources, respectively. Primary sources represent 100% of supply through third-quarter 1988 and 80% of supply thereafter; secondary sources make up the difference. A weighted average price was calculated on a quarterly basis through third-quarter FY90 in constant and current dollars in both ¢/MM Btu and $/ton.

Use of the regression line method just described, which was based on actual prices paid by public utilities, resulted in an increase in the expected average FY81 price of 12.3¢/MM Btu over the estimate made in December, 1980 to 154.3¢/MM Btu. This price reflected an increase of 5.7% in the coal price estimate and approximately 52% in the transportation expense estimate. The large increase in transportation expense over the previous estimate is the result of including coals from more distant sources outside western Kentucky. In addition, rail freight charges increased at a greater than 14% annual rate and low-cost barge direct deliveries were omitted.

The cost of coal is based on "as-received" washed coal at 11,400 BTU/lb. The average fiscal year prices FOB Newman are reported below, rounded to the nearest whole ¢/MM Btu or 25¢/ton in current and constant dollars.

	First-Quarter FY 82 $	
Fiscal Year	¢/MM BTU	$/Ton
82	161	36.75
83	162	37.00
84	162	37.00
85	161	36.75
86	161	36.75
87	161	36.75
88	162	37.00
89	162	37.00
90	162	37.00

The coal price will remain unchanged during the term in constant dollars as a result of our expectation that ICRC will be able to "fix" a portion of the contract price (capital cost and profit) as of the bid closure date.

SRC-I

BASELINE

STANDARD YEAR - COAL COST

	Source
I. Assumptions:	
A. Total Daily Coal Requirement: 6,000 tons/day, d.b. (dry basis)	Process Design Criteria
1. SRC Process Area: 5,590 tons/day, d.b.	SRC DBM
2. Gas Systems: 446 tons/day, d.b.	Gas Systems DBM
B. Annual Coal Consumption Factor: .90 SRC, .95 Gas Systems	ICRC Manufacturing
C. Coal Heat Content: 12,900 Btu/lb = 25.8 MM Btu/ton	Process Design Criteria
D. Coal Cost: $1.62/MM Btu	ICRC Business Management
E. Coal Losses for Oxidation and Handling: 3%	ICRC Management

II. Computations:

A. SRC Process Area:

5,590 tons/day x 365 days/year x .90 x 25.8 MM Btu/ton x $1.62 MM Btu x 1.03 losses = $79,053,000/year

B. Gas Systems:

446 tons/day x 365 days/year x .95 x 25.8 MM Btu/ton x $1.62 MM Btu x 1.03 losses = $6,658,000/year

C. Total Standard Year Coal Cost:

SRC Process Area	$79,053,000
Gas Systems	6,658,000
Total	$85,711,000

SRC-I DEMONSTRATION PLANT

COAL RECEIPTS AND CONSUMPTION

			Coal Received - M Dry Tons				Coal Consumption	
Activity	Phase	Period	Received	Stock-piled	Inventory at End(1)	Cumulative Receipts	M dry tons	% of Design Feed Rate
Checkout and Accept Utilities	II	4th Qtr '86						
Commission Utilities, Coal Handling, ASU; Stockpile Coal	II	1st Qtr '87	60.5	60.5	60.5	60.5	0	0
Commission Gas Systems	II	2nd Qtr '87	49.3	0	60.5	109.8	49.3	9
Commission SRC Process Area	II	3rd Qtr '87	66.5	1.5	62.0	176.3	65.0	12
Commission Coke & Liquid Prod. Area	II	4th Qtr '87	150.2	24.5	86.5	326.5	125.7	23
Commission Plant	II	1st Qtr '88	218.3	43.5	130.0	545.3	175.3	32
Startup and Shutdown	III A	1/88-6/88	565.7	38.4	168.4	1,111.0	527.3	48
Test Operation	III B-1	7/88-6/89	1,397.6	31.5	199.9	2,508.6	1,366.1	62
	III B-2	7/89-6/90	1,451.6	(169.7)	30.2	3,960.2	1,621.3	73
Extended Operation	III C-1	7/90-6/91	--(2)	--	--	--	1,667.3	76
	III C-2	7/91-6/92	--	--	--	--	1,775.8	80
	III C-3	7/92-6/93	--	--	--	--	1,886.2	85

(1) 45-day inventory based on average consumption during subsequent operating period.

(2) Does not include coal to rebuild coal inventory (e.g., 270M T for 45 day inventory).

Various upside and downside price risks were identified and assessed for probability of occurrence. The most volatile factor is related to transportation. However, Newman facility, the net effect of an upside or downside change in transportation cost would be minimal. The net effect of risks relating to coal production costs is judged to be mutually offsetting.

OPERATING COSTS

Phase III of the SRC-I project, operation and evaluation of the Demonstration Plant, consists of a six-month start-up and shakedown period (Phase IIIA), followed by two years of operations (Phase IIIB). The Baseline assumes that the plant will operate 50% of the time in the "low-conversion" mode and 50% in the "high-conversion" mode. The cost difference, approximately $50,000 per year, is immaterial, and all costs have been generated by utilizing the high-conversion basis.

Phase III operating costs were estimated by using the "standard" costs described in Appendix 2.0 (Operating Cost Assumptions and Support Data). A summary of the annual standard operating costs is provided in Exhibit 5. Indices, based on the experience of the Manufacturing Department's management, judgment, and expected plant performance, were applied to these standard costs. The indices are as follows:

	Phase IIIA (%)	Phase IIIB (1) (%)	Phase IIIB (2) (%)
Exempt Labor	120	120	120
Clerical	100	100	100
Overtime	300	300	200
Chemicals, Catalysts, & Lubricants	75	100	100
Power	65	70	80
Fuel	400	300	200
LIN	100	100	100
Maintenance	120	110	100

The coal costs were generated on the basis of tonnage received at the plant. Translated to a percentage of the annual standard coal consumption,

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SRC-I STANDARD YEAR OPERATING COSTS
REVISED BASELINE ($000s)
Fuel in FY 1982 Dollars, FY 1982 Price
Exhibit 5

	SRC 1.2.1	Coker/ Calciner 1.2.2.1	EBH 1.2.2.2	Naphtha Hydro-treater 1.2.2.5	ASU 1.3.1.1	Gas Systems 1.3.2	U&O 1.4.1	Project Mgt. 1.5.1	Admin. 1.5.2	Tech. Support 1.5.3	Product Utilization 1.5.4	EPLA 1.5.5	Total
Chemicals	$ 1,164	$ 240	$ 690	$	$	$ 1,735	$ 2,158	$	$	$	$	$	$ 5,987
Catalysts			3,396	13	12	1,174	48						4,643
Lubricants	55	16	36	2	62	83	95						349
Power	3,467	1,108	2,416	171	6,313	7,821	9,018						30,314
Fuel	528	169	66	11		931	455						2,160
Coal	79,053					6,658							85,711
LIN				663		111							774
Maintenance	19,810	2,210	3,160	450	1,080	11,580	10,890						49,180
Operating Labor	1,459	1,004	866	99	183	1,043	1,260		700	1,438			8,052
Plant Overhead	1,131	770	664	74	142	791	1,002		590	1,174			6,338
TOTAL	$106,667	$5,517	$11,294	$1,483	$7,792	$31,927	$24,926	$	$1,290	$2,612	$	$	$193,508

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BASELINE

PLANT OVERHEAD - STANDARD ANNUAL

($000s 1st Quarter FY82)

Exhibit 6

Standard Annual Direct Labor Base	$7,042	
Communications	300	
Office Supplies	200	
Guard Service	135	
Janitorial Service	110	
Vehicle Rental, Fuel	50	
Public Relations	50	
Educational Assistance	10	
Travel & Living	240	
Donations	10	
Professional Licenses	17	
Subscriptions	20	
Occupational Health	1,950	
Consultants	50	
Operating Supplies	300	
Lab Supplies	150	
Data Processing	250	
	$3,842	
Overhead Rate	54.6%	
Plus Fringes	35.0%	
	89.6%	= 90%

the Baseline costs are as follows: Phase IIIA, 55%; Phase IIIB (1), 68%; Phase IIIB (2), 71%. The plant overhead rate is 90%, including 35% Fringe benefits. Details are shown in Exhibit 6. The operating costs are presented in first-quarter FY82 dollars and escalated dollars, and are summarized by time and by Work Breakdown Structure.

PRODUCT USER RETROFIT CONVERSION PROGRAM

The Product User Retrofit Conversion Program is designed to convert oil-fired boiler furnaces for demonstration of SRC solid product as a combustion fuel. Although the liquid SRC products are assumed to be usable with little or no modifications to existing oil-fired installations, using the solid products will require significant equipment modifications. The retrofit work for the solids users is intended to demonstrate product utilization. Logically then, the program should be treated as a Phase III activity, necesssary for the demonstration and evaluation of SRC-I solid as a viable alternative to petroleum-based fuel.

The costs and timing of the Phase III portion of this progarm are:

	$000s	
	FY82 1st Quarter	Escalated
FY 1985	$ 8,800	$11,981
FY 1986	13,500	19,913
FY 1987	18,200	28,996
FY 1988	4,600	7,988
	$45,100	$68,878

Spending the funds accordingly will ensure the availability of users who are capable and, more importantly, committed to using SRC-solid as an alternate energy source.

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BASELINE - PHASE III

HOME OFFICE

1st Quarter FY82 Dollars ($000s)

		IIIA	IIIB		
WBS		FY88 6 Months	FY88 3 Months	FY89 12 Months	FY90 9 Months
1.5.1	Engineering Technology	$ 643	$ 321	$ 1,281	$ 1,065
	Contract Administration	122	60	235	182
	Purchasing	6	4	-	-
	Management Systems	67	36	-	-
	Total 1.5.1	$ 838	$ 421	$ 1,516	$ 1,247
1.5.2	Office Services	$ 115	$ 58	$ 229	$ 178
	Business Management	353	177	702	554
	Legal	163	81	324	249
	Finance	245	124	626	481
	Administration	886	444	1,763	1,362
	Human Resources	39	21	82	61
	Public Affairs	7	4	-	-
	Total 1.5.2	$ 1,808	$ 909	$ 3,726	$ 2,885
1.5.3	Engineering Technology	3,668	1,814	7,206	5,339
1.5.4	Business Management	46,726	810	3,139	2,455
1.5.5	Engineering Technology	798	394	1,486	944
	Total Home Office	$53,838	$ 4,348	$17,073	$12,870

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BASELINE - PHASE III

SITE SUPPORT

1st Quarter FY82 Dollars ($000s)

WBS		IIIA FY88 6 Months	IIIB FY88 3 Months	IIIB FY89 12 Months	IIIB FY90 9 Months
1.5.1	Engineering Technology	$ 189	$ 95	$ 387	$ 223
	Project Engineering	1,253	627	427	-
	Contract Administration	19	10	43	34
	Purchasing	206	104	432	333
	Management Systems	235	116	127	96
	Finance	42	22	-	-
	Total 1.5.1	$ 1,944	$ 974	$ 1,416	$ 686
1.5.2	Finance	$ 312	$ 157	$ 339	$ 260
	Human Resources	63	32	129	100
	Public Affairs	80	39	177	137
	Total 1.5.2	$ 455	$ 228	$ 645	$ 497
1.5.3	Engineering Technology	201	100	401	422
1.5.5	Engineering Technology	777	386	1,466	925
	Total Site	$ 3,377	$ 1,687	$ 3,928	$ 2,530

ICRC

BASELINE - PHASE III

HOME OFFICE

Escalated Dollars ($000s)

		IIIA	IIIB		
		FY88 6 Months	FY88 3 Months	FY89 12 Months	FY90 9 Months
WBS					
1.5.1	Engineering Technology	$ 1,106	$ 568	$ 2,380	$ 2,116
	Contract Administration	210	106	436	362
	Purchasing	10	7	-	-
	Management Systems	115	64	-	-
	Total 1.5.1	$ 1,441	$ 745	$ 2,816	$ 2,478
1.5.2	Office Services	$ 198	$ 103	$ 425	$ 353
	Business Management	607	313	1,304	1,101
	Legal	280	143	602	495
	Finance	421	219	1,163	956
	Administration	1,524	786	3,277	2,706
	Human Resources	67	37	152	121
	Public Affairs	12	7	-	-
	Total 1.5.2	$ 3,109	$ 1,608	$ 6,923	$ 5,732
1.5.3	Engineering Technology	6,309	3,209	13,389	10,609
1.5.4	Business Management	71,675	1,433	5,832	4,878
1.5.5	Engineering Technology	1,373	697	2,761	1,875
	Total Home Office	$83,907	$ 7,692	$31,721	$25,572

ICRC

BASELINE - PHASE III

SITE SUPPORT

Escalated Dollars ($000s)

		IIIA	IIIB		
WBS		FY88 6 Months	FY88 3 Months	FY89 12 Months	FY90 9 Months
1.5.1	Engineering Technology	$ 325	$ 168	$ 719	$ 443
	Project Engineering	2,155	1,109	793	-
	Contract Administration	33	18	80	68
	Purchasing	354	184	802	661
	Management Systems	404	205	236	191
	Finance	72	39	-	-
	Total 1.5.1	$3,343	$1,723	$2,630	$1,363
1.5.2	Finance	$ 537	$ 277	$ 630	$ 517
	Human Resources	108	57	240	199
	Public Affairs	138	69	329	271
	Total 1.5.2	$ 783	$ 403	$1,199	$ 987
1.5.3	Engineering Technology	345	177	745	839
1.5.5	Engineering Technology	1,336	681	2,724	1,838
	Total Site	$5,807	$2,984	$7,298	$5,027

ICRC
SRC-I OPERATING COSTS
REVISED BASELINE ($000s)
Basis: FY 1982 1st Quarter Dollars
Phase IIIA - FY 88 (6 Months)

	SRC 1.2.1	Coker/ Calciner 1.2.2.1	EBH 1.2.2.2	Naphtha Hydro-treater 1.2.2.5	ASU 1.3.1.1	Gas Systems 1.3.2	U&O 1.4.1	Project Mgt. 1.5.1	Admin. 1.5.2	Tech. Support 1.5.3	Product Utilization 1.5.4	EPLA 1.5.5	G&A	Total
Chemicals	$ 437	$ 90	$ 259	$	$	$ 651	$ 809	$	$	$	$	$	$	$ 2,246
Catalysts			1,274	5	4	440	18							1,741
Lubricants	21	6	14	1	23	31	36							132
Power	1,127	360	785	56	2,052	2,542	2,931							9,853
Fuel	1,161	368	145	25		2,084	1,019							4,802
Coal	21,023					2,621								23,644
LIN				331		56								387
Maintenance	11,886	1,326	1,896	270	648	6,948	6,534							29,508
Operating Labor	961	663	573	66	119	707	804		446	917				5,256
Plant Overhead	591	395	343	37	74	415	526		342	644				3,367
Subtotal	$37,207	$3,208	$5,289	$ 791	$2,920	$16,495	$12,677	$ -	$ 788	$1,561	$ -	$ -	$ -	$80,936
ICRC Overhead														
Site								1,944	455	201	-	777		3,377
Home Office								838	1,808	3,668	46,726	798		53,838
G&A													4,665	4,665
License Fees			845	225										1,070
Insurance									245					245
Total	$37,207	$3,208	$6,134	$1,016	$2,920	$16,495	$12,677	$2,782	$3,296	$5,430	$46,726	$1,575	$4,665	$144,131
Total Revenues														(58,300)
Net														$ 85,831

ICRC
SRC-I OPERATING COSTS
REVISED BASELINE ($000s)
Basis: FY 1982 1st Quarter Dollars
Phase IIIB - FY 88 (3 Months)

	SRC 1.2.1	Coker/ Calciner 1.2.2.1	EBH 1.2.2.2	Naphtha Hydro-treater 1.2.2.5	ASU 1.3.1.1	Gas Systems 1.3.2	U&O 1.4.1	Project Mgt. 1.5.1	Admin. 1.5.2	Tech. Support 1.5.3	Product Utilization 1.5.4	EPLA 1.5.5	G&A	Total
Chemicals	$ 291	$ 60	$ 172	$	$	$ 434	$ 539	$	$	$	$	$	$	$ 1,496
Catalysts			849	3	3	293	12							1,160
Lubricants	13	4	9	1	15	21	24							87
Power	607	194	423	30	1,104	1,369	1,578							5,305
Fuel	435	138	54	9		782	382							1,800
Coal	13,305					1,298								14,603
LIN				165		27								192
Maintenance	5,448	608	869	124	297	3,184	2,995							13,525
Operating Labor	478	331	286	32	59	351	401		222	457				2,617
Plant Overhead	294	197	171	18	37	207	262		170	322				1,678
Subtotal	$20,871	$1,532	$2,833	$ 382	$1,515	$ 7,966	$ 6,193	$ -	$ 392	$ 779	$ -	$ -	$ -	$ 42,463
ICRC Overhead														
Site								974	228	100	-	385		1,687
Home Office								421	909	1,814	810	394		4,348
G&A													2,333	2,333
License Fees														
Insurance									122					122
Total	$20,871	$1,532	$2,833	$ 382	$1,515	$ 7,966	$ 6,193	$1,395	$1,651	$2,693	$ 810	$ 779	$2,333	$ 50,953
Total Revenues														(41,900)
Net														$ 9,053

ICRC
SRC-I OPERATING COSTS
REVISED BASELINE ($000s)
Basis: FY 1982 1st Quarter Dollars
Phase IIIB - FY 89 (9 Months)

	SRC 1.2.1	Coker/ Calciner 1.2.2.1	EBH 1.2.2.2	Naphtha Hydro- treater 1.2.2.5	ASU 1.3.1.1	Gas Systems 1.3.2	U&O 1.4.1	Project Mgt. 1.5.1	Admin. 1.5.2	Tech. Support 1.5.3	Product Utilization 1.5.4	EPLA 1.5.5	G&A	Total
Chemicals	$ 873	$ 180	$ 518	$	$	$ 1,301	$ 1,619	$	$	$	$	$	$	$ 4,491
Catalysts			2,547	10	9	881	36							3,483
Lubricants	42	12	27	1	47	62	71							262
Power	1,820	582	1,268	90	3,315	4,106	4,735							15,916
Fuel	1,377	436	171	30		2,485	1,214							5,713
Coal	39,914					3,897								43,811
LIN				498		84								582
Maintenance	16,343	1,823	2,607	371	891	9,554	8,984							40,573
Operating Labor	1,440	995	860	101	181	1,061	1,208		669	1,379				7,894
Plant Overhead	887	594	515	56	111	621	789		513	969				5,055
Subtotal	$62,696	$4,622	$8,513	$1,157	$4,554	$24,052	$18,656	$ -	$1,182	$2,348	$ -	$ -	$ -	$127,780
ICRC Overhead														
Site								1,062	484	301	-	1,100		2,947
Home Office								1,137	2,795	5,405	2,354	1,115		12,806
G&A													5,991	5,991
License Fees														
Insurance									368					368
Total	$62,696	$4,622	$8,513	$1,157	$4,554	$24,052	$18,656	$2,199	$4,829	$8,054	$2,354	$2,215	$5,991	$149,892
Total Revenues														(131,700)
Net														$ 18,192

ICRC
SRC-I OPERATING COSTS
REVISED BASELINE ($000s)
Basis: FY 1982 1st Quarter Dollars
Phase IIIB - FY 89 (3 Months)

	SRC 1.2.1	Coker/ Calciner 1.2.2.1	EBH 1.2.2.2	Naphtha Hydro-treater 1.2.2.5	ASU 1.3.1.1	Gas Systems 1.3.2	U&O 1.4.1	Project Mgt. 1.5.1	Admin. 1.5.2	Tech. Support 1.5.3	Product Utilization 1.5.4	EPLA 1.5.5	G&A	Total
Chemicals	$ 291	$ 60	$ 172	$	$	$ 434	$ 539	$	$	$	$	$	$	$ 1,496
Catalysts			849	3	3	293	12							1,160
Lubricants	13	4	9	1	15	21	24							87
Power	694	221	483	34	1,262	1,564	1,804							6,062
Fuel	306	97	38	7		552	270							1,270
Coal	13,935					1,233								15,168
LIN				165		27								192
Maintenance	4,952	552	790	112	270	2,895	2,722							12,293
Operating Labor	428	293	254	28	53	310	364		211	424				2,365
Plant Overhead	294	197	171	18	37	207	262		170	322				1,678
Subtotal	$20,913	$1,424	$2,766	$ 368	$1,640	$ 7,536	$ 5,997	$	$ 381	$ 746	$	$	$	$ 41,771
ICRC Overhead														
Site								354	161	100	-	366		981
Home Office								379	931	1,801	785	371		4,267
G&A													1,997	1,997
License Fees														
Insurance									122					122
Total	$20,913	$1,424	$2,766	$ 368	$1,640	$ 7,536	$ 5,997	$ 733	$1,595	$2,647	$ 785	$ 737	$1,997	$ 49,138
Total Revenues														(52,800)
Net														$ (3,662)

ICRC
SRC-I OPERATING COSTS
REVISED BASELINE ($000s)
Basis: FY 1982 1st Quarter Dollars
Phase IIIB - FY 90 (9 Months)

	SRC 1.2.1	Coker/ Calciner 1.2.2.1	EBH 1.2.2.2	Naphtha Hydro-treater 1.2.2.5	ASU 1.3.1.1	Gas Systems 1.3.2	U&O 1.4.1	Project Mgt. 1.5.1	Admin. 1.5.2	Tech. Support 1.5.3	Product Utilization 1.5.4	EPLA 1.5.5	G&A	Total
Chemicals	$ 873	$ 180	$ 518	$	$	$ 1,301	$ 1,619	$	$	$	$	$	$	$ 4,491
Catalysts			2,547	10	9	881	36							3,483
Lubricants	42	12	27	1	47	62	71							262
Power	2,080	665	1,450	103	3,788	4,693	5,410							18,189
Fuel	948	300	118	21		1,707	834							3,928
Coal	41,804					3,699								45,503
LIN				498		84								582
Maintenance	14,858	1,658	2,370	338	810	8,685	8,168							36,887
Operating Labor	1,298	884	764	88	162	938	1,098		636	1,278				7,146
Plant Overhead	887	594	515	56	111	621	789		513	969				5,055
Subtotal	$62,790	$4,293	$8,309	$1,115	$4,927	$22,671	$18,025	$	$1,149	$2,247	$ -	$ -	$ -	$125,526
ICRC Overhead														
Site								686	497	422	-	925		2,530
Home Office								1,247	2,885	5,339	2,455	944		12,870
G&A													6,942	6,942
License Fees														
Insurance									368					368
Total	$62,790	$4,293	$8,309	$1,115	$4,927	$22,671	$18,025	$1,933	$4,899	$8,008	$ 2,455	$1,869	$6,942	$148,236
Total Revenues														(163,900)
Net														$(15,664)

ICRC
SRC-I OPERATING COSTS
ORIGINAL BASELINE ($000s)
Basis: Escalated Dollars
Phase II-A - FY88 (6 Months)

	SRC 1.2.1	Coker/ Calciner 1.2.2.1	EBH 1.2.2.2	Naphtha Hydro-Treater 1.2.2.5	ASU 1.3.1.1	Gas Systems 1.3.2	U & O 1.4.1	Project Mgt. 1.5.1	Admin. 1.5.2	Tech. Support 1.5.3	Product Utilization 1.5.4	EPLA 1.5.5	Total
Chemicals	$ 1,659	$ 309	$ 446	$	$	$ 2,009	$ 1,391	$	$	$	$	$	$ 5,814
Catalysts			2,191	83	6	757	31						3,068
Lubricants	36	8	19		40	41	50						194
Power	2,035	646	1,371	54	3,563	3,898	4,594						16,161
Fuel	2,546	939	355			6,767	5,029						15,636
Coal	36,160					4,185							40,345
LIN				569		97							666
Maintenance	21,349	2,334	2,328	914	1,163	10,189	12,324						50,601
Operating Labor	1,652	1,139	885	113	205	1,217	1,389		766	1,577			8,943
Plant Overhead	1,017	680	590	64	127	714	905		588	1,108			5,793
Subtotal	$66,454	$6,055	$8,185	$1,797	$5,104	$29,874	$25,713	$ -	$1,354	$2,685	$ -	$ -	$147,221
ICRC Overhead -													
Site								3,343	783	345	-	1,336	5,807
Home Office								1,441	3,109	6,309	71,675	1,373	83,907
G & A													8,009
License Fees			845	225									1,070
Insurance									422				422
Total	$66,454	$6,055	$9,030	$2,022	$5,104	$29,874	$25,713	$4,784	$5,668	$9,339	$71,675	$2,709	246,436
Total Revenues													(140,300)
Net													$106,136

ICRC
SRC-I OPERATING COSTS
ORIGINAL BASELINE ($000s)
Basis: Escalated Dollars
Phase IIIB - FY88 (3 Months)

	SRC 1.2.1	Coker/ Calciner 1.2.2.1	EBH 1.2.2.2	Naphtha Hydro- Treater 1.2.2.5	ASU 1.3.1.1	Gas Systems 1.3.2	U & O 1.4.1	Project Mgt. 1.5.1	Admin. 1.5.2	Tech. Support 1.5.3	Product Utilization 1.5.4	EPLA 1.5.5	Total
Chemicals	$ 1,137	$ 212	$ 304	$	$	$ 1,376	$ 953	$	$	$	$	$	$ 3,982
Catalysts			1,502	57	5	518	21						2,103
Lubricants	23	5	12		27	27	34						128
Power	1,125	357	759	28	1,972	2,158	2,544						8,943
Fuel	982	361	136			2,609	1,939						6,027
Coal	23,537					2,091							25,628
LIN				292		48							340
Maintenance	10,064	1,100	1,567	430	548	4,803	5,809						24,321
Operating Labor	845	585	506	56	105	621	709		392	808			4,627
Plant Overhead	520	348	302	32	65	366	463		301	570			2,967
Subtotal	$38,233	$2,968	$5,088	$895	$2,722	$14,617	$12,472	$ -	$ 693	$1,378	$ -	$ -	$79,066
ICRC Overhead -													
Site								1,723	403	177	-	681	2,984
Home Office								745	1,608	3,209	1,433	697	7,692
G & A													4,005
License Fees													
Insurance									216				216
Total	$38,233	$2,968	$5,088	$895	$2,722	$14,617	$12,472	$2,468	$2,920	$4,764	$1,433	$1,378	93,963
Total Revenues													(102,900)
Net													$(8,937)

ICRC
SRC-I OPERATING COSTS
ORIGINAL BASELINE ($000s)
Basis: Escalated Dollars
Phase IIIB - FY89 (9 Months)

	SRC 1.2.1	Coker/ Calciner 1.2.2.1	EBH 1.2.2.2	Naphtha Hydro-Treater 1.2.2.5	ASU 1.3.1.1	Gas Systems 1.3.2	U & O 1.4.1	Project Mgt. 1.5.1	Admin. 1.5.2	Tech. Support 1.5.3	Product Utilization 1.5.4	EPLA 1.55	Total
Chemicals	$ 3,553	$ 665	$ 953	$	$	$ 4,300	$ 2,980	$	$	$	$	$	$ 12,451
Catalysts			4,687	181	17	1,622	67						6,574
Lubricants	77	21	39	2	87	88	110						424
Power	3,513	1,120	2,370	94	6,162	6,736	7,903						27,890
Fuel	3,291	1,215	453			8,756	6,498						20,213
Coal	73,455					6,531							79,906
LIN				916		156							1,072
Maintenance	31,410	3,432	4,899	1,342	1,713	14,990	18,132						75,918
Operating Labor	2,651	1,032	1,503	185	333	1,954	2,224		1,232	2,539			14,533
Plant Overhead	1,632	1,092	948	103	204	1,143	1,452		945	1,783			9,302
Subtotal	$119,502	$9,377	$15,932	$2,823	$8,516	$46,276	$39,366	$ -	$2,177	$4,322	$ -	$ -	$248,371
ICRC Overhead -													
Site								1,954	891	554	-	2,025	5,424
Home Office								2,092	5,144	9,947	4,332	2,052	23,567
G & A													11,129
License Fees													
Insurance									677				677
Total	$119,502	$9,377	$15,932	$2,823	$8,516	$46,276	$39,366	$4,046	$8,889	$14,823	$4,332	$4,077	289,168
Total Revenues													(355,200)
Net													$(66,032)

ICRC
SRC-I OPERATING COSTS
ORIGINAL BASELINE ($000s)
Basis: Escalated Dollars
Phase IIIB - FY89 (3 Months)

	SRC 1.2.1	Coker/ Calciner 1.2.2.1	EBH 1.2.2.2	Naphtha Hydro- Treater 1.2.2.5	ASU 1.3.1.1	Gas Systems 1.3.2	U & O 1.4.1	Project Mgt. 1.5.1	Admin. 1.5.2	Tech. Support 1.5.3	Product Utilization 1.5.4	EPLA 1.5.5	Total
Chemicals	$ 1,229	$ 229	$ 329	$	$	$ 1,487	$ 1,030	$	$	$	$	$	$ 4,304
Catalysts			1,622	61	6	560	23						2,272
Lubricants	25	6	13		29	29	36						138
Power	1,389	441	936	36	2,437	2,664	3,142						11,045
Fuel	759	281	105			2,020	1,498						4,663
Coal	26,630					2,127							28,757
LIN				315		52							367
Maintenance	9,802	1,080	1,540	422	539	4,716	5,704						23,803
Operating Labor	818	560	485	53	101	593	697		403	811			4,521
Plant Overhead	562	276	327	34	71	396	501		325	615			3,207
Subtotal	$41,294	$2,973	$5,357	$921	$3,183	$14,644	$12,631	$ -	$ 728	$1,426	$ -	$ -	$83,157
ICRC Overhead -													
Site								676	308	191	-	699	1,874
Home Office								724	1,779	3,442	1,500	709	8,154
G & A													3,710
License Fees													
Insurance									233				233
Total	$41,294	$2,973	$5,357	$921	$3,183	$14,644	$12,631	$1,400	$3,048	$5,059	$1,500	$1,408	97,128
Total Revenues													(142,900)
Net													$(45,772)

ICRC
SRC-I OPERATING COSTS
ORIGINAL BASELINE ($000s)
Basis: Escalated Dollars
Phase IIIB - FY90 (9 Months)

	SRC 1.2.1	Coker/ Calciner 1.2.2.1	EBH 1.2.2.2	Naphtha Hydro- Treater 1.2.2.5	ASU 1.3.1.1	Gas Systems 1.3.2	U & O 1.4.1	Project Mgt. 1.5.1	Admin. 1.5.2	Tech. Support 1.5.3	Product Utilization 1.5.4	EPIA 1.5.5	Total
Chemicals	$ 3,837	$ 717	$ 1,029	$	$	$ 4,633	$ 3,217	$	$	$	$	$	$ 13,433
Catalysts			5,061	195	18	1,750	71						7,095
Lubricants	83	22	42	2	94	95	120						458
Power	4,334	1,381	2,925	116	7,600	8,312	9,802						34,470
Fuel	2,539	936	351			6,765	5,019						15,610
Coal	83,064					6,633							89,697
LIN				990		168							1,158
Maintenance	30,830	3,370	4,807	1,318	1,681	14,714	17,798						74,518
Operating Labor	2,561	1,758	1,519	176	321	1,865	2,181		1,265	2,540			14,186
Plant Overhead	1,762	1,180	1,023	111	221	1,233	1,569		1,019	1,926			10,044
Subtotal	$129,010	$9,364	$16,757	$2,908	$9,935	$46,168	$39,777	$ -	$2,284	$ 4,466	$ -	$ -	$260,669
ICRC Overhead -													
Site								1,363	987	839	-	1,838	5,027
Home Office								2,478	5,732	10,609	4,878	1,875	25,572
G & A													13,791
License Fees													
Insurance									731				731
Total	$129,010	$9,364	$16,757	$2,908	$9,935	$46,168	$39,777	$3,841	$9,734	$15,914	$4,878	$3,713	305,790
Total Revenues													(493,900)
Net													$(108,110)

APPENDIX 6.0: WILSONVILLE PILOT PLANT SUPPORT

As indicated in the SRC-I Project Baseline, Phases I and II, Appendix B, Section 25.0, ICRC will depend extensively on Wilsonville Pilot Plant support through Phase II of the Demonstration Plant project. During start-up and operation of the plant, operations support programs must be continued and quick turnaround studies must be developed at the pilot-plant scale to solve operating problems. With its strong technical data base that was developed during Phase II and its integration of liquefaction, deashing, and expanded-bed hydrocracking units, the Wilsonville Pilot Plant is ideally suited for scaled-down experimental programs. Sound economics dictate the need to maximize operating time at the larger scale plant and to use the smaller scale pilot plant to accomplish that objective.

Easy access to Wilsonville operating schedules will be required. Secondary screening of coal supply sources at the pilot plant will be needed during the 10-month period, August 1987 through May 1988. Table 10 indicates operations time requirements for Wilsonville for the entire period of the Demonstration Plant project.

SUMMARY

The operations time requirements for Wilsonville pilot plant support are summarized in Table 10. An increasing need through Phase II completion has been identified to carry out technical and product acceptance-related programs at the pilot plant. Additional discussion of Phase II requirements is contained in the SRC-I Project Baseline, Phases I and II, Appendix B, Section 25.0.

Table 10

Wilsonville Pilot Plant Support
Operations Time Requirements[a]

Fiscal Year	Time Required (%)
1982	50
1983	50
1984	50
1985	50
1986	50
1987	75
1988	100
1989	75
1990	50

[a] Complete Phase II and start Phase IIIA, 11 December 1987.
Complete Phase IIIA and start Phase IIIB, 11 June 1988.
Complete Phase IIIB, 11 June 1990.

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