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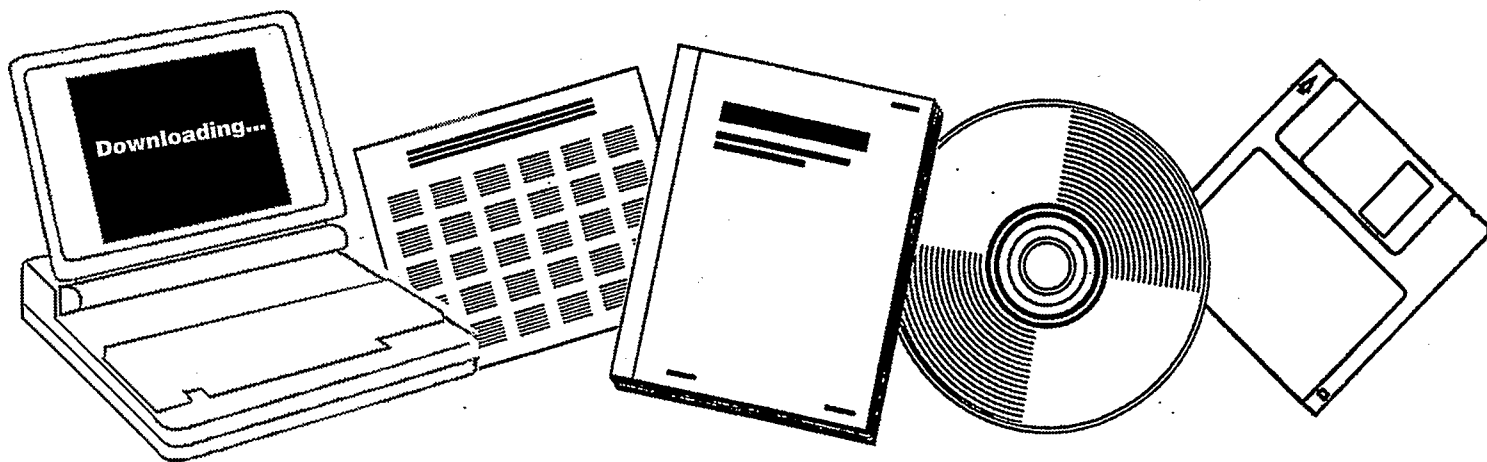
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TECHNICAL EVALUATION SERVICES, CLEAN LIQUID AND/OR SOLID FUELS FROM COAL

PARSONS (RALPH M.) CO., PASADENA, CALIF

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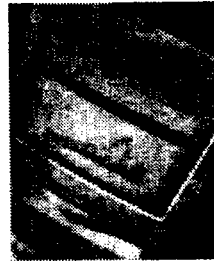
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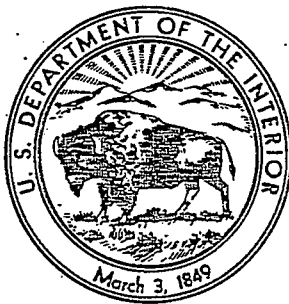
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INTERIM TECHNICAL PROGRESS REPORT
TECHNICAL EVALUATION SERVICES, CLEAN LIQUID
AND/OR SOLID FUELS FROM COAL
R & D REPORT NO. 82—INTERIM REPORT NO. 4

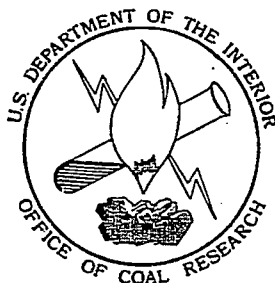
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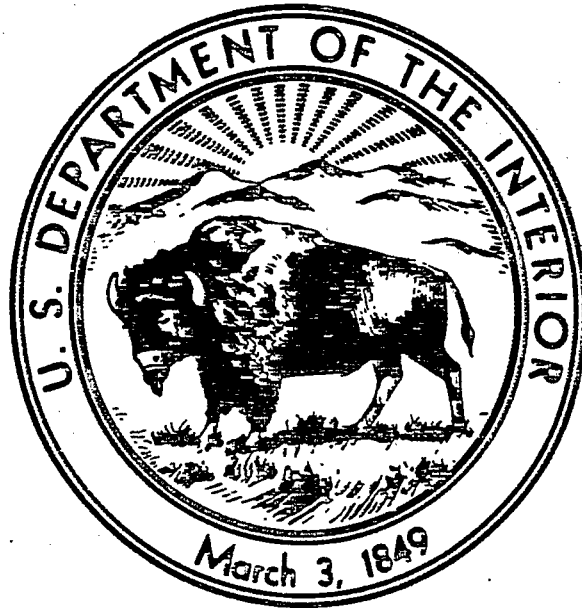
INTERIM REPORT FOR PERIOD OCTOBER 1972 - AUGUST 1974

Prepared by
THE RALPH M. PARSONS COMPANY
PASADENA, CALIFORNIA

Contract No. 14-82-0001-1284

for
UNITED STATES
DEPARTMENT OF THE INTERIOR
OFFICE OF COAL RESEARCH
WASHINGTON, D. C. 20240





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SECTION I'

INTRODUCTION

The Ralph M. Parsons Company is providing technical assistance services to the OCR staff in the program for conversion of coal to clean liquid and solid fuels. The work encompasses the following:

- Development of conceptional design and economic evaluations for commercial plants.
- Evaluation of the performance of pilot plants and other experimental operations.
- Evaluation of unit operations and processes for possible application in coal processing, including the design and construction of pilot plants and the independent evaluation of new work proposal or changes of ongoing work.

Engineering expertise was made available in such fields as coal mining and preparation, petroleum, power plant design, nuclear energy applications, systems engineering, economics, environmental impact analysis, pollution control, and energy conversion.

These activities concentrate upon the critical elements of the overall OCR program with the objective of permitting the U.S. to best realize the greatest benefits from its coal resources for the development of clean energy fuels.

SECTION 2
TASK ASSIGNMENTS

2.1 SRC PILOT PLANT

2.1.1 OBJECTIVE

The primary objective of this task was to review the design/ construction and planned operation of the SRC pilot plant; to define any problems, and to recommend corrective action to OCR. Additionally, the objective was to review construction progress for the SRC pilot plant and to make appropriate recommendations to OCR.

2.1.2 ACTIVITY SUMMARY

A. Design Review

Parsons reviewed the process data, material balances, P&IDs, overall process design, and three possible alternate modes of SRC pilot plant operation and the effect on the capacities of critical process equipment. The philosophy of process control was reviewed and a study was made on the Data Logging Computer to evaluate its performance in data procurement, process calculations, data interpretation, and printout records.

B. Mechanical Review

A complete review was made of critical equipment specifications for completeness of design, safety, operability and maintainability. A cursory review was made of structural, civil, piping, electrical, and instrument control drawings to evaluate the capability and operability of the process units. An environmental review was made to ensure adequacy of plant design to control effluent streams.

C. Construction Review

Parsons made monthly job site inspections to establish construction job progress and to advise OCR of any problems and recommend possible appropriate corrective action. The detailed supporting calculations for contractor job progress were reviewed and recommendations made to OCR, as appropriate.

2.2 DEMONSTRATION PLANT

2.2.1 OBJECTIVE

The primary objective was to develop a plan for design, engineering, construction and startup for a demonstration plant (DP) to produce clean boiler fuels from coal. The DP was to be capable of producing clean fuels with a total heat of combustion equal to 6 billion Btu per hour, minimum.

In order to achieve the above objectives, the goal was to develop a preliminary process configuration complete with material and utility balances, and an estimate of capital investment requirements; also, to prepare an economic analysis of the DP operation.

2.2.2 ACTIVITY SUMMARY

A. Preliminary Design and Estimate

In response to an OCR request, Parsons developed preliminary planning figures for the design and construction of a demonstration plant with a nominal capacity of 10,000 TPD of coal, then prepared and transmitted to OCR on December 15, 1972 a document titled Demonstration Plant, Clean Boiler Fuels from Coal, Planning Document. Following review of this document, OCR authorized preparation of a detailed preliminary process and mechanical design plus capital cost estimate for a demonstration plant that would process 10,000 TPD of Illinois No. 6 seam coal and produce two types of clean boiler fuels in an amount sufficient to supply 600 megawatts of power generation capacity. This work was finalized in the following listed reports:

- Internal transmittal to OCR, Demonstration Plant, Clean Boiler Fuels from Coal; Interim Revised Planning Document (April 24, 1973).
- OCR R&D Report No. 82, Interim Report No. 1, Demonstration Plant Clean Boiler Fuels from Coal, Preliminary Design/Capital Cost Estimate, Volume I (September 21, 1973).
- OCR R&D Report No. 82, Interim Report No. 1, Demonstration Plant Clean Boiler Fuels from Coal, Preliminary Design/Capital Cost Estimate, Volume II (November 2, 1973).

B. Economic Analysis

Parsons is preparing an economic analysis of the DP. The result will be a prediction of required product selling prices for defined economic parameters.

2.3 COED

2.3.1 OBJECTIVE

The objective was to assess the status of the pilot plant development program and to determine if adequate data were present for a commercial plant design; if data were inadequate, to then define additional development programs required to be carried out using the pilot plant facilities; finally, to develop a conceptual design and cost estimate for a commercial plant facility utilizing the COED process design concept.

2.3.2 ACTIVITY SUMMARY

A. Pilot Plant

A review of existing pilot plant data was performed with emphasis being placed upon the adequacy and completeness of these data for preparation of a commercial plant design and a further definition of any deficiencies and additional required data.

B. Preliminary Design/Capital Cost Estimate for Conceptual Commercial Plant

Parsons has proposed a design basis to OCR for the COED conceptual commercial plant design. This design was based upon pilot plant test results and their suitability, application, and consistency for direct scaleup to large-scale commercial plants.

Parsons prepared flow diagrams, material and energy balances, equipment specifications, plot and unit process area drawings to completely define a total facility and cost estimate for a commercial-scale COED plant. This plant utilizes coal mining and preparation facilities, coal pyrolysis, char utilization, and electrical power generation facilities plus necessary offsites and utilities required to support this total plant complex.

The COED conceptual design has been reviewed with representatives of OCR, and a report is being prepared for publication that will describe the design and its predicted economics.

2.4 COAL MINING AND PREPARATION

2.4.1 OBJECTIVE

The initial objective is to develop a conceptual design and economic evaluation for facilities to: (1) mine a minimum of 12 million TPY of Illinois No. 6 seam coal, and (2) prepare it in a form suitable for use as feed to the coal conversion process plants. The initial mine conceptual design/economic evaluation will be used for the COED process conceptual design/economic evaluation.

The long-range objective is development of conceptual designs and economic evaluations for mines in four additional geographic areas: Appalachia, Feather River (western area), Four Corners, and Utah. Mining plans and costs to supply feed to additional conceptual design plants, including the SRC, Cresap-developed processes, COG, and others, are to be developed.

2.4.2 ACTIVITY SUMMARY

A. Demonstration Plant

The preliminary design and cost estimate for 10,000 TPD coal preparation plant has been prepared and issued. This design and estimate was presented in OCR R&D Report No. 82, Interim Report No. 2, Volumes I and II, Demonstration Plant Clean Boiler Fuels from Coal and Preliminary Design/Capital Cost Estimate, issued September 21 and November 2, 1973, respectively.

B. 12-Million-TPY Coal Mine and Preparation Plant

The preliminary plan for a 12-million-TPY coal mine and the design flowsheet, equipment list, and cost estimate for a coal preparation plant to produce 25,000 tons per stream day of clean sized-coal feed to the process plant has been completed. This design concept is presently being utilized for the COED commercial-scale plant preliminary cost estimate.

C. 24-Million-TPY Coal Mine Conceptual Design

At the present, the mining plan and material and utility balances for a conceptual strip mine in the Powder River Basin of Wyoming are being finalized. Equipment sizing, pricing, and economics of the final facility are in progress.

2.5 PROPOSAL REVIEW AND EVALUATION

2.5.1 OBJECTIVE

The objective is to review and evaluate various coal conversion oriented proposals and to recommend their usefulness regarding the OCR program.

2.5.2 ACTIVITY SUMMARY

During the course of the work to date, 30 proposals pertaining to various coal conversion oriented programs have been reviewed, and recommendations regarding these proposals have been transmitted to OCR.

2.6 PROJECT INDEPENDENCE BLUEPRINT

2.6.1 OBJECTIVE

The objective was to develop rapid judgmental definitions of facility design, capital cost, equipment items, personnel requirements, and

operating cost factors for large-scale 100,000 bbl/day and 500 million standard cu ft/day SNG liquefaction and gas plants.

2.6.2 ACTIVITY SUMMARY

To date judgmental plant cost estimates and critical equipment listings for two large-scale liquefaction and SNG coal conversion plants have been prepared and transmitted to OCR. The two process concepts, cost estimates, and equipment evaluations were based upon coal liquefaction and Fischer-Tropsch (F-T) technologies.

2.7 COG PLANT

2.7.1 OBJECTIVE

The major objectives are to define the potential for large multi-product coal conversion facilities by developing process designs to increase the efficiency and reliability, and to improve the economics of the plant designs; also, to develop the profitability analysis for these facilities. To facilitate accomplishment of these objectives, mathematical models for various process steps would be developed to permit the rapid assessment of alternate process design configurations.

2.7.2 ACTIVITY SUMMARY

Work is underway on a program to achieve these objectives. The priority on this effort has been at a lower level than the earlier described demonstration plant design and project independence blueprint effort. It is expected that the level of effort on COG will be increased in the future.

2.8 FISCHER-TROPSCH PROCESS

2.8.1 OBJECTIVE

The objective was to prepare a conceptual design for an F-T process plant to consist of a coal gasification unit, plus appropriate product recovery/purification units; also to prepare an economic evaluation of this plant. The results of this preliminary design/economic evaluation were to be used to evaluate whether the F-T technology should have a place in filling future U.S. synthetic fuel requirements.

2.8.2 ACTIVITY SUMMARY

At OCR's request, Parsons developed the conceptual process design and a preliminary cost estimate for a plant to process 3,500 tons of coal per stream day of clean coal utilizing the F-T process. The purpose was to define the potential technological value, profitability, and the economical viability this process could have in future U.S. synthetic fuels requirements.

This work was completed and a report transmitted to OCR. The plant was conceived to process 3,500 tons per stream day of Appalachia coal to produce 58 MM SCFD of SNG (pipeline gas), 2,325 bbl/day of fuel oil and 88 TPD of

sulfur. The estimated fixed capital investment was \$175 million, which includes the escalation for a 4-year project schedule spanning from 1974 through 1977. The results of the mid-1973 preliminary economic study indicated that a significant increase in fuel values, such as projected in Case II of the National Petroleum Council's report U.S. Energy Outlook, and/or major improvements in process technology are required to make the F-T process attractive in the U.S.; such fuel price increases have since that time begun to materialize.

Plans are under way to develop alternate designs for larger scale (F-T)-type facilities.

2.9 ASSESSMENT OF THE POTASSIUM-STEAM BINARY CYCLE

2.9.1 OBJECTIVE

The objective is to develop a conceptual design and economic evaluation of this power cycle and, if appropriate, utilize this technology in conceptual plant designs.

A corrolary objective is to define and evaluate those advanced power cycles which have the potential of high energy efficiencies and improved economics relative to existing technology. Further, to adapt these advanced power cycles for use of coal-derived energy products to be produced in coal-conversion process plants.

2.9.2 ACTIVITY SUMMARY

In April 1973, Parsons completed a preliminary economic evaluation study of the potassium-steam cycle. It was our conclusion that, based upon successful development of process and equipment combined with projected forecasts of fuel values, operating and construction costs, this cycle could become economically attractive in the late seventies and early eighties.

2.10 CRESAP PILOT PLANT

2.10.1 OBJECTIVE

Parsons objectives are to assist OCR in the development of an effective program for the reactivation and modification of the Cresap Pilot Plant activities, to assist in the development of an effective pilot plant program for use of these facilities and, finally, and most importantly, to develop viable conceptual commercial plant designs based on information developed in the Cresap facilities.

2.10.2 ACTIVITY SUMMARY

Parsons has participated in planning discussions for reactivation and use of the Cresap facilities. Actual work on Cresap reactivation is in its early stages. We are prepared to proceed with our technical evaluation duties as the project proceeds.

2.11 UNIVERSITY OF NORTH DAKOTA - ENGINEERING ASSISTANCE

2.11.1 OBJECTIVE

The University of North Dakota (UND) has been awarded an OCR contract to develop technology to convert lignite to clean fuels. Parsons has been requested by OCR to assist UND in certain phases of their pilot plant design and equipment specification work. Our objective is to assess the UND needs, define procedures for working with them, and then to assist them as requested.

2.11.2 ACTIVITY SUMMARY

To date, our engineering assistance to UND has been on a very limited scale. In April 1973, a review of Project Lignite objectives, status, and schedule were completed, and a program proposed for Parsons cooperative effort to assist UND with technical and professional services as requested.

Parsons reviewed the instrumentation design for the PDU, which is under construction, and made appropriate recommendations. We regularly participated in the project advisory committee meetings.

2.12 OTHER TASK ASSIGNMENTS

2.12.1 WATER RESOURCES, WESTERN USA

Parsons is working to assemble information describing the water resources available in the Western USA for coal conversion plants. Our work includes the collection and assembly of available water resource data in the Upper and Lower Colorado River Basins and the correlation with coal deposits in Arizona, New Mexico, Utah, Colorado, Montana, Wyoming, and North Dakota. This information will be used in our COG and other design and economic evaluation activities.

2.12.2 PROCESS REVIEW AND COMPARISON OF THE DESIGN AND ECONOMICS FOR ALTERNATE LIQUEFACTION PROCESSES

Process review work continues on the preliminary conceptual design comparison and economic evaluation for commercial-sized plants using different coal liquefaction processes.



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