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U.S. Department of Energy Pittsburgh Energy Technology Center

Refining and End Use of Coal Liquids

Contract No. DE-AC22-93PC91029

Quarterly Report
November – December 1993

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Introduction and Summary

This report is Bechtel's first quarterly technical progress report and covers the period of November 1, 1993 through December 19, 1993.

1.1 Introduction

Bechtel, with Southwest Research Institute, Amoco Oil R&D, and the M.W. Kellogg Co. as subcontractors, initialed a study on November 1, 1993, for the U.S. Department of Energy's (DOE's) Pittsburgh Energy Technology Center (PETC) to determine the most cost effective and suitable combination of existing petroleum refinery processes needed to make specification transportation fuels or blending stocks, from direct and indirect coal liquefaction product liquids. This 47-month study, with an approved budget of \$4.4 million dollars, is being performed under DOE Contract Number DE-AC22-93PC91029.

A key objective is to determine the most desirable ways of integrating coal liquefaction liquids into existing petroleum refineries to produce transportation fuels meeting current and future, e.g. year 2000, Clean Air Act Amendment (CAAA) standards. An integral part of the above objectives is to test the fuels or blends produced and compare them with established ASTM fuels. The comparison will include engine tests to ascertain compliance of the fuels produced with CAAA and other applicable fuel quality and performance standards.

The final part of the project includes a detailed economic evaluation of the cost of processing the coal liquids to their optimum products. The cost analyses is for the incremental processing cost; in other words, the feed is priced at zero dollars CIF refinery. The study reflects costs for operations using state of the art refinery technology; no capital costs for building of new refineries or units is considered. Economy of scale dictates the minimum amount of feedstock that should be processed.

To enhance management of the study, the work has been divided into two parts, the Basic Program and Option 1.

The objectives of the Basic Program are to:

- Characterize the coal liquids
- Develop an optimized refinery configuration for processing indirect and direct coal liquids
- Develop a LP refinery model with the Process Industry Modeling System (PIMS) software.

The work has been divided into six tasks.

- Task 1 - Development of a detailed project management plan for the Basic Program
- Task 2 - Characterization of four coal liquid feeds supplied by DOE
- Task 3 - Optimization of refinery processing configurations by linear programming
- Task 4 - Pilot plant analysis of critical refinery process units to determine yield, product quality and cost assumptions. Petroleum cuts, neat coal liquids, and coal liquids/petroleum blends will be processed through the following process units: reforming, naphtha and distillate hydrotreating, catalytic cracking and hydrocracking.
- Task 5 - Development of the project management plan for Option 1
- Task 6 - Project management of the Basic Program and Option 1

The objectives of Option 1 are to:

- Confirm the validity of the optimization work of the Basic Program
- Produce large quantities of liquid transportation fuel blending stocks
- Conduct engine emission tests
- Determine the value and the processing costs of the coal liquids

This will be done by processing the coal liquids as determined by the optimization work, blending and characterizing the product liquids, and running engine emission tests of the blends. Option 1 has been divided into three tasks.

- Task 1 - Based on the pilot plant and linear programming optimization work of the Basic Program, production runs of pilot plants (hydrotreating, reforming, catalytic cracking, and hydrocracking) will be conducted to produce sufficient quantities for blending and engine testing.
- Task 2 - The pilot plant products will be blended, characterized, and engine tested
- Task 3 - An economic analysis will be conducted to determine the costs of processing the coal liquids through the existing refinery

Table 1-1 shows which organization has the primary responsibility for each task.

1.2 Summary

The major efforts conducted during the fourth quarter of 1993 were in the areas of:

- Subcontract preparation and negotiation

- Linear programming modeling
- Project management plan development

Table 1-1 Project Task Primary Responsibility Chart

Task	Description	Bechtel	SwRI	Amoco	Kellogg
1	Project Management Plan (PMP) development	x			
2	Feed characterization		x		
3	Linear programming	x			
4	Pilot plant analysis - Cat cracking of DL liquids Cat cracking of indirect wax Hydrocracking of wax Fractionation, reforming, hydrotreating, etc.			x x	x
5	Option 1 PMP development	x			
6	Project management	x			
Option 1 - Task 1	Pilot plant production - Cat cracking of DL liquids and wax All other production work				x
Option 1 - Task 2	Fuel blending, characterizing, engine testing		x		
Option 1 - Task 3	Economic analysis	x			

x = key participant

Section 2

Linear Programming model - Task 3

The primary objective of Task 3 is to develop a linear programming model which will assist in determining the optimum refinery configuration for processing coal liquids.

2.1 Development work

The primary focus of the work was to develop a flexible refinery processing configuration for the PIMS linear programming model. Preliminary work involved:

- Reviewing the linear programming models from the Direct and Indirect Baseline Studies
- Reviewing a linear programming model for a refinery producing reformulated gasoline meeting California regulations
- Determining the basic process units in the model
- Determining a basic approach for handling coal liquids in the model

Project Management - Task 6

3.1 Task 6 - Project Management

In the month of November, negotiations of subcontracts with SwRI, Amoco, and Kellogg were started. In addition, a preliminary version of the Project Management Plan was developed.

In the month of December, SwRI, Amoco, and Kellogg submitted their comments on their respective subcontracts.

Bechtel provided HRI with the shipping instructions and the overall coal liquid specifications. HRI is responsible for producing a 2500 gallon coal liquids sample from bituminous coal in their Proof-of-Concept pilot plant.

The milestone schedule and status for the Basic Program and Option 1 is shown in Figure 3-1.

Figure 3-1
Milestone Schedule for Basic Program & Option 1

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1. TITLE Refining and End Use Study of Coal Liquids		2. REPORTING PERIOD 11/1/93 TO 12/29/93		3. IDENTIFICATION NUMBER DE-RP22-93PC91029	
4. PARTICIPANT NAME AND ADDRESS Bechtel Corporation 50 Beale Street San Francisco, CA 94105		5. START DATE 10/1/93			
		6. COMPLETION DATE 9/30/97			

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		D	M	J	S	D	M	J	S	D	M	J	S	D	M	J	S	D	a. Plan	b. Actual				
Task 1	Project Work Plan																				80	80		
Task 2	Feed Characterization																				0	0		
Task 3	Linear Programming (LP) Analysis																				5	5		
Task 4	Pilot Plant Analysis																				0	0		
Task 5	Option 1 Work Plan																				0	0		
Task 6	Administration Task																				2	2		
Option 1 Task 1	Pilot Plant Analysis (Produce Fuels)																				0	0		
Option 1 Task 2	Characterization, Blending, and Testing																				0	0		
Option 1 Task 3	Economic Study																							

1 Submit final Project Work Plan	7 Conduct final IL LP runs	12 Production runs for DL1
2 Characterize DL1 liquid	8 Conduct final DL2 runs	13 Production runs for IL
3 Characterize IL liquid	9 Conduct DL1 pilot plant tests	14 Production runs for DL2
4 Characterize DL2 liquid	10 Conduct IL pilot plant tests	15 ASTM tests for DL1
5 Develop LP model	11 Conduct DL2 pilot plant tests	16 ASTM tests for IL
6 Conduct final DL1 LP runs		17 ASTM tests for DL2

11 SIGNATURE OF PARTICIPANT'S PROJECT MANAGER AND DATE	3/17/94
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DATE

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5/31/94

END