



**U.S. Department of Energy
Federal Energy Technology Center**

**Refining and End Use Study of
Coal Liquids**

Contract No. DE-AC22-93PC91029

**Quarterly Report
January - March 1997**

Section 1

Introduction and Summary

This report is Bechtel's twelfth quarterly technical progress report and covers the period of January 1, 1997 through March 31, 1997.

1.1 Introduction

Bechtel, with Southwest Research Institute, Amoco Oil R&D, and the M.W. Kellogg Co. as subcontractors, initiated 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. The study reflects costs for operations using state of the art refinery technology; no capital costs for building new refineries is considered. Some modifications to the existing refinery may be required. 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.

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- 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 first quarter of 1997 were in the areas of:

- Option 1 fuel blending

Section 1

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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

SwRI Activities

2.0 Option 1 Fuel Production

During this reporting period the following tasks were completed for Option 1 fuel production:

- Reformer production run
- Analysis of all blendstocks
- Blending and analysis of small volume test fuels - gasolines, jet, diesel
- Blending and analysis of large volume test fuels - gasolines, jet, diesel

A separate report summarizing the completed Option 1 work and the plan for the engine performance and emission testing has been developed and is being reviewed.

Section 3

Bechtel Activities

3.0 Option 1 Fuel Production

During this reporting period the following tasks were completed for Option 1 fuel production:

- Development of fuel blending recipes - gasolines, jet, diesel

A separate report summarizing the completed Option 1 work and the plan for the engine performance and emission testing has been developed and is being reviewed.

Section 4

Amoco Activities

A draft of a report on the hydrocracking potential of the heavy distillate portion of direct liquids was issued.

Section 5

M.W. Kellogg Activities

There was no project activity for this reporting period.

Section 6

Project Management

6.1 Reports and Schedules

The milestone schedule and status for the Basic Program and Option 1 is shown in Figure 6-1.

Figure 6-1 Milestone Schedule for Basic Program & Option 1

□ PLAN ■ STATUS REPORT

1. TITLE Refining and End Use Study of Coal Liquids		2. REPORTING PERIOD 4/1/97 to 4/30/97		3. IDENTIFICATION NUMBER DE-AC22-93PC91029														
4. PARTICIPANT NAME AND ADDRESS Bechtel Corporation 50 Beale Street San Francisco, CA 94105		5. START DATE 11/1/93		6. ESTIMATED COMPLETION DATE 9/30/97														
7. ELEMENT CODE	8. REPORTING ELEMENT	93			FY94			FY95			FY96			FY97			10. PERCENT COMPLETE	
		D	M	J	S	D	M	J	S	D	M	J	S	D	M	J	S	a. Plan
Task 1	Project Work Plan	■ 1 ▲															100	100
Task 2	Feed Characterization	■ 2 ■ 3 ■ 4 ▲															100	70
Task 3	Linear Programming (LP) Analysis	■ 5 ■ 6 ■ 7 ■ 8 ▲															98	82
Task 4	Pilot Plant Analysis	■ 9 ■ 10 ■ 11 ▲															100	75
Task 5	Option 1 Work Plan	■ ▲															100	80
Task 6	Administration Task	■ ▲															83	81
Option 1 Task 1	Pilot Plant Analysis (Produce Fuels)	■ 12 ■ 13 ■ 14															75	33
Option 1 Task 2	Characterization, Blending, and Testing	■ 15 ■ 16 ■ 17 ▲															0	0
Option 1 Task 3	Economic Study	■ ▲															0	0
1 Submit Final Work Plan		7 Input IL pilot plant data		12 Production runs for DL1 (deleted from program)														
2 Characterize DL1 liquid		8 Conduct evaluation 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 (deleted from program)														
5 Develop LP model		11 Conduct DL2 pilot plant tests		16 ASTM tests for IL														
6 Input DL pilot plant data				17 ASTM tests for DL2														
11. SIGNATURE OF PARTICIPANT'S PROJECT MANAGER AND DATE																		