Section 3

Bechtel Activities

3.1 Linear Programming Model - Task 3

A report on the design basis of the linear programming model for direct coal liquids is being developed.

Section 4

Amoco Activities

There was no project activity for this reporting period.

Section 5

M.W. Kellogg Activities

5.1 Summary - DL2 Heavy Distillate Catalytic Cracking

A MAT (micro activity test) program was carried out to compare catalytic cracking of DL2 neat heavy distillate and DL2 heavy distillate that was hydrotreated at the Southwest Research Institute. The effect of cracking temperature on yields and quality was also studied by making runs at both 970°F and 1010°F. Additionally, to relate these data to the work carried out with DL1 coal liquids in the Kellogg MAT and pilot plant tests of 1995 (April-June 1995 Quarterly progress report), control runs with the same Amoco VGO as was used for baseline data last year were incorporated in the program. All data were plotted and regressed to obtain yields for the products of economic interest as a function of catalyst/oil ratio. Heat balance calculations were made for each feed at each temperature at previously specified operating conditions in order to compare yields at the appropriate cracking severity. GCOCTANE and PIANO analyses have been obtained on products of runs made near these conditions. Data are compared to similar data with DL1 feeds.

The Kellogg pilot plant was then run at the conditions established for heat balance with the VGO at a cracking temperature of 980°F and held at these conditions for runs with the DL2 heavy distillate liquid and with a blend of the two feeds. Yield data have been obtained by GC analysis, and the debutanized products have been shipped to SwRI for distillation and determination of the engine octanes. Preliminary data are compared to similar data with the hydrotreated DL1 feed that was run last year.

The pilot plant results indicate that gasoline yields with neat DL2 heavy distillate are almost identical to those obtained with the severely hydrotreated DL1 heavy distillate. From data supplied by SwRI, it appears that the hydrogen content of the DL2 heavy distillate (12.27%) matches that of the severely hydrotreated DL1 heavy distillate (12.23%). This is in line with the correlation made with coal liquids last year between hydrogen content and gasoline yield

The MAT results at 1010°F show significant losses in gasoline yield counteracted by increases in GCOCTANES and LPG yields with the DL2 heavy distillate. The hydrotreated heavy distillate produced substantially more gasoline than the neat heavy distillate. Temperature effects are similar, but the hydrotreated material did not show higher LPG yields at the higher temperature. These data should prove useful for economic projections.

5.2 Experimental

5.2.1 MAT

Feedstocks for the MAT runs were Amoco VGO (F-9819), neat DL2 heavy distillate (F-9888) and hydrotreated DL2 heavy distillate prepared by SwRI (F-9907). The catalyst was equilibrium Vektor-50 (F-9804) obtained from Conoco (Billings, MT).

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The MAT equipment and analytical operations were previously described (April-June 1995 Quarterly progress report). Experiments were designed to show the effects of cracking temperature and hydrotreating on the DL2 liquid. For each feed at each temperature, a series of runs with varying catalyst/oil ratio were made to provide data for interpolation. The VGO was used to set reference conditions and supply base case data. A total of 11 runs were made with the VGO, 8 runs with the DL2 heavy distillate and 8 runs with the hydrotreated DL2 heavy distillate.

5.2.2 Pilot Plant

Three runs were made in the FCC1 pilot plant. Feedstocks were Amoco vacuum gas oil (F-9819), neat DL2 heavy distillate (F-9888), and a 33.3 vol% (33.7 wt%) blend of the neat DL2 heavy distillate and the VGO. The catalyst used in all three runs was a sample of equilibrium Vektor-50 (F-9804) obtained from Conoco (Billings, MT).

The first run (H-2038-1) with VGO was used to set the operating conditions for all three runs. Base operating targets set for the pilot plant operators were:

Catalyst rate, lbs/hr	42.5
Catalyst temperature, °F	1255
Riser outlet pressure, psig	35
Riser isothermal temperatures, °F	985

The key target was a calculated coke yield of 5.0 wt%. In seeking this target, the catalyst rate was fixed, and the oil feed rate adjusted higher to lower coke yield or lower to increase coke yield. All three feedstocks ran well. Riser and stripper filter plugging tendencies appear to be low. This experience would indicate that the production run should proceed well.

5.3 Results

Table 5-1 summarizes the regressed yields from the MAT work at heat balanced conditions, using the convention established earlier that "torch oil" would be added to make up the heat deficiency when coal liquids (with low coke yields) are cracked at the same conditions as the VGO. In a real case, a lower value feed, such as a resid, probably would be added to the feed blend.

In the pilot plant the operating conditions were established to produce the heat-balanced coke yield with the Amoco VGO at the baseline operating temperature, and these conditions were maintained while running the DL2 heavy distillate and a blend of the VGO and DL2 heavy distillate. A summary of the conditions and yields is given in Table 5-2.

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Tables giving more detailed component yields and data for individual MAT runs are given in Section 5.5 - Appendix.

5.4 Discussion

Initial screening of the MAT data showed good precision and weight balances (typically 98%), but a difference in results from the Amoco VGO data gathered last year seemed significant.

To establish the baseline for the present work as firmly as possible, an additional 6 runs were made with the Amoco VGO, three at each temperature. It was discovered that an interim recalibration of chromatographic response factors resulted in changes for some of the gas components that accounted for a major part of the difference between the 1995 and 1996 results. Since the new factors are more reliable, they were applied to the earlier data, which caused an overall improvement in the weight balances. A set of corrected data has been prepared for official transmittal. The changes reduced the gasoline yields by about 1% for each feed, but do not influence the conclusions reached on the differences between feeds used as input for the linear model.

Table 5-3 gives a preliminary comparison of the gasoline and coke yields obtained in the MAT unit with the DL1 liquid and its hydrotreated products and with the DL2 liquid and its single hydrotreated product. The cracking conditions established for this comparison include a reaction temperature of 970 to 980°F and provide a heat-balanced coke yield with the Amoco VGO.

Table 5-4 gives a direct comparison of the pilot plant yields with the hydrotreated DL1 heavy distillate used in 1995 (H-2006) to the current pilot plant yields with DL2 heavy distillate. Since 1995, the riser length has been changed from 25 feet to 80 feet, which lowers the catalyst/oil ratio needed to obtain the specified coke yield. Conversion with the reference gas oil is higher this year, but the gasoline yield is the same as last year.

Also of interest is the comparison between a weighted average of the yields from the two runs with neat feeds and those of the run with a blend of these feeds (H-2038-3). For essentially every component and boiling range, the results of the run are not significantly different from the calculated values.

Samples of the condensed total liquid product were debutanized and sent to Southwest Research Institute for fractionation and determination of the octane number of the IBP to 430°F gasoline.

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Table 5-1 — Results at heat balanced conditions for Amoco VGO

Cracking Temperature		970°F			1010°F		
Feed Material		VGO	DL2	HT DL2	VGO	DL-2	HT DL2
Heat Required	BTU/#	0	234	291	0	161	249
Regenerator Temp	EF	1286	1301	1308	1333	1341	1349
Cat/Oil	wt	6.0	6.0	6.0	6.2	6.2	6.2
Coke	wt%	5.1	3.2	2.7	5.5	4.1	3.4
Conversion	wt%	77.0	76.8	84.7	77.8	78.3	83.7
Gasoline Yield	wt%	48.6	55.7	61.1	46.1	52.6	58.2
Total C4 Yield	wt%	12.0	9.2	11.1	12.9	10.2	11.2
Total C3 Yield	wt%	8.0	6.4	7.1	9.4	7.8	7.6
C2 Minus Yield	wt%	3.2	2.2	2.5	4.0	3.7	3.3
NOTE: Heat required is assumed to be supplied by torch oil.							

Table 5-2 — Pilot plant yields summary

Run number: H-2038-	1	2	3
Feed material	VGO	NEAT DL2	VGO/DL2 BLEND
Catalyst/oil ratio	10.0	10.2	10.3
Temperatures, deg F:			
Oil preheat	224	222	221
Catalyst inlet	1254	1252	1255
Riser average	984	985	985
Material balance:			
Closure, wt%	99.90	101.86	100.71
Conversion, wt%	77.10	76.96	76.15
Total C2 & lighter	2.47	1.76	2.21
Total C3's	7.22	6.14	6.78
Total C4's	12.38	10.34	11.45
Total gasoline	49.99	55.06	51.20
Total cycle oil	22.90	23.04	23.85
Coke	5.04	3.66	4.51

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Table 5-3 — Comparison of coal liquids as FCC feed (MAT)

Feed	Gasoline Yield, wt%	Coke Yield, wt%
Unhydrotreated DL1	50.1	3.8
Slightly HT DL1	50.8	3.7
V. Severe HT DL1	60.5	2.5
Severe HT DL1	52.5	3.8
Amoco VGO (1995)	48.5	5.2
Amoco VGO (1996)	48.6	5.1
As produced DL2	55.7	3.2
Hydrotreated DL2	61.1	2.7

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Table 5-4 — Comparison of hydrotreated DL1 and DL2 (pilot plant)

Run number:	H-2006-			H-2038-		
	1	2	3	1	2	3
Feed	VGO	HT DL1	BLEND	VGO	DL2	BLEND
Catalyst/oil ratio	12.2	12.2	12.0	10.0	10.2	10.3
Temperatures, deg F:						
Oil preheat	212	212	214	224	222	221
Catalyst inlet	1265	1253	1252	1254	1252	1255
Riser average	984	987	983	984	985	985
Material balance:						
Closure, wt%	98.5	98.5	98.5	99.9	101.9	100.7
Conversion, wt%	74.1	74.2	73.2	77.1	77.0	76.2
Total C2 & lighter	3.34	2.03	2.83	2.47	1.76	2.21
Total C3's	5.99	5.18	5.69	7.22	6.14	6.78
Total C4's	9.38	8.55	9.33	12.38	10.34	11.45
Total gasoline	50.52	55.17	51.01	49.99	55.06	51.20
Total cycle oil	25.87	25.80	26.82	22.90	23.04	23.85
Coke	4.90	3.27	4.32	5.04	3.66	4.51

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Table 5-5 — Comparison of blend and calculated blend results

Run number: H-2038-	1	2	3	Calc
Feed	VGO	DL2	Blend	Blend
Total C2 & lighter	2.47	1.76	2.21	2.23
Total C3's	7.22	6.14	6.78	6.86
Total C4's	12.38	10.34	11.45	11.69
Total gasoline	49.99	55.06	51.20	51.70
Total cycle oil	22.90	23.04	23.85	22.95
Coke	5.04	3.66	4.51	4.57
Conversion	77.10	76.96	76.15	77.05

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5.5 Appendix

Run Number	906a	883a	910a	908a	884a	881a	907a	911a	880a	885a	909a
Date (Day-Mon-Yr)	3/4/96	1/26/96	3/8/96	3/4/96	1/30/96	1/25/96	3/4/96	3/5/96	1/24/96	1/31/96	3/4/96
Catalyst F or AL Number	F-9804	F-9804	F-9804	F-9804	F-9804	F-9804	F-9804	F-9804	F-9804	F-9804	F-9804
Catalyst Source	Conoco	Conoco	Conoco	Conoco	Conoco	Conoco	Conoco	Conoco	Conoco	Conoco	Conoco
Catalyst Trade Name	Vector-50	Vector-50	Vector-50	Vector-50	Vector-50	Vector-50	Vector-50	Vector-50	Vector-50	Vector-50	Vector-50
Catalyst Activity	66	66	66	66	66	66	66	66	66	66	66
Oil Feed F# or AL#	F-9821	F-9821	F-9821	F-9821	F-9821	F-9821	F-9821	F-9821	F-9821	F-9821	F-9821
Feed API	26.6	26.6	26.6	26.6	26.6	26.6	26.6	26.6	26.6	26.6	26.6
Company supplying feedstock	AMOCO	AMOCO	AMOCO	AMOCO	AMOCO	AMOCO	AMOCO	AMOCO	AMOCO	AMOCO	AMOCO
Special Features	A 3L	A 4.5L	A 4.5L	A 6L	A 6L	A 3H	A 3H	A 4.5H	A 4.5H	A 6H	A 6H
Catalyst Charge, grams	3.00	4.50	4.51	6.01	6.01	3.01	3.00	4.51	4.50	6.01	6.01
Feed Charge, grams	1.01	1.00	0.99	1.00	0.99	1.00	0.99	1.00	0.99	0.99	0.96
Catalyst/Oil Ratio	2.99	4.51	4.54	6.01	6.07	3.02	3.04	4.51	4.53	6.09	6.25
Initial Bed Temperature, deg F	1000	1000	1000	1000	1000	1035	1035	1030	1040	1035	1030
Average Bed Temperature, deg F	975	975	980	978	975	1015	1005	1007	1014	1010	1008
Oil Inject Time, seconds	30	30	30	30	30	30	30	30	30	30	30
Paraffins, wt%	NA	NA	NA	NA	5.6	NA	NA	NA	NA	5.9	NA
Isoparaffins, wt%	NA	NA	NA	NA	41.8	NA	NA	NA	NA	36.5	NA
Naphthenes, wt%	NA	NA	NA	NA	10.2	NA	NA	NA	NA	10.2	NA
Aromatics, wt%	NA	NA	NA	NA	31.3	NA	NA	NA	NA	36.3	NA
Olefins, wt%	NA	NA	NA	NA	11.1	NA	NA	NA	NA	11.1	NA
GCRON	NA	NA	NA	NA	93.7	NA	NA	NA	NA	95.9	NA
GCMON	NA	NA	NA	NA	82.3	NA	NA	NA	NA	83.8	NA
Conversion, Wt %	62.50	70.22	73.43	78.09	74.96	63.35	68.80	73.67	74.94	76.17	77.36
Weight % Yields, normalized: H2S	0.54	0.52	0.62	0.07	0.08	0.47	0.62	0.51	0.00	0.08	0.08
H2	0.11	0.16	0.24	0.16	0.17	0.15	0.13	0.28	0.19	0.26	0.23
CH4	0.49	0.73	0.98	1.04	0.86	0.70	0.68	0.96	1.09	1.30	1.22
C2H2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C2H4	0.67	0.93	1.14	1.24	1.06	0.90	0.88	1.15	1.30	1.46	1.33
C2H6	0.39	0.59	0.72	0.76	0.64	0.57	0.53	0.76	0.80	0.97	0.89
C3H4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C3H6	4.17	4.71	6.13	6.29	5.64	4.64	5.32	6.12	6.42	7.17	6.82
C3H8	0.85	1.35	1.45	2.06	1.74	0.91	1.01	1.35	1.72	2.13	2.03
C4H6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-C4H8	0.89	1.01	1.27	1.26	1.10	0.97	1.11	1.30	1.43	1.36	1.30
I-C4H8	1.15	1.05	1.45	1.01	0.90	1.56	1.46	1.47	1.47	1.27	1.22
c-2-C4H8	0.81	0.86	1.06	1.09	0.92	0.97	0.95	1.10	1.13	1.16	1.05
t-2-C4H8	1.10	1.19	1.44	1.48	1.26	1.30	1.29	1.50	1.55	1.57	1.45
I-C4H10	3.08	4.18	4.41	6.35	5.42	2.99	3.29	4.16	5.50	5.94	5.64
N-C4H10	0.88	1.20	1.24	1.75	1.47	0.90	1.05	1.20	1.43	1.57	1.63
C5-430 deg F	44.91	47.99	47.25	48.25	48.72	43.96	48.02	47.96	46.97	44.53	46.93
430-680 deg F	27.24	23.51	21.23	17.38	18.84	27.03	24.17	20.84	19.60	17.97	17.87
680-800 deg F	7.07	4.53	3.70	3.18	3.57	6.82	5.01	3.82	3.69	3.55	3.26
800 deg F+	3.19	1.75	1.65	1.35	2.64	2.81	2.02	1.67	1.77	2.32	1.51
COKE	2.45	3.74	4.02	5.29	4.97	2.36	2.46	3.86	3.94	5.39	5.53
Weight Balance, %	99.17	98.31	98.03	98.71	99.38	98.51	99.08	100.28	98.61	99.40	99.51

Run Number	890a	886a	894a	891a	893a	895a	889a	892a
Date (Day-Mon-Yr)	2/5/96	1/31/96	2/6/96	2/5/96	2/6/96	2/6/96	2/1/96	2/5/96
Catalyst F or AL Number	F-9804	F-9804	F-9804	F-9804	F-9804	F-9804	F-9804	F-9804
Catalyst Source	Conoco	Conoco	Conoco	Conoco	Conoco	Conoco	Conoco	Conoco
Catalyst Trade Name	Vector-50	Vector-50	Vector-50	Vector-50	Vector-50	Vector-50	Vector-50	Vector-50
Catalyst Activity	66	66	66	66	66	66	66	66
Oil Feed F# or AL#	F-9888	F-9888	F-9888	F-9888	F-9888	F-9888	F-9888	F-9888
Feed API	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5
Company supplying feedstock	SWRI	SWRI	SWRI	SWRI	SWRI	SWRI	SWRI	SWRI
Special Features	B 3L	B 4.5L1	B 4.5L2	B 6L	B 3H	B 4.5H1	B 4.5H2	B 6H
Catalyst Charge, grams	3.00	4.49	4.51	6.02	3.00	4.01	4.50	6.00
Feed Charge, grams	1.00	1.04	1.02	1.02	1.02	1.02	1.02	1.01
Catalyst/Oil Ratio	2.99	4.31	4.42	5.90	2.95	3.91	4.40	5.92
Initial Bed Temperature, deg F	1015	1015	1000	1015	1060	1060	1055	1055
Average Bed Temperature, deg F	974	967	970	970	1010	1010	1010	1012
Oil Inject Time, seconds	30	30	30	30	30	30	30	30
Paraffins, wt%	NA	NA	NA	3.1	NA	NA	NA	3.0
Isoparaffins, wt%	NA	NA	NA	41.8	NA	NA	NA	39.4
Naphthenes, wt%	NA	NA	NA	11.8	NA	NA	NA	10.8
Aromatics, wt%	NA	NA	NA	38.6	NA	NA	NA	41.4
Olefins, wt%	NA	NA	NA	4.7	NA	NA	NA	5.4
GCRON	NA	NA	NA	94.3	NA	NA	NA	97.3
GCMON	NA	NA	NA	83.4	NA	NA	NA	84.9
Conversion, Wt %	69.44	74.54	74.18	75.76	73.08	75.49	77.29	77.23
Weight % Yields, normalized: H2S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2	0.14	0.14	0.16	0.21	0.19	0.27	0.24	0.38
CH4	0.33	0.43	0.39	0.62	0.51	0.74	0.80	1.09
C2H2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C2H4	0.63	0.40	0.72	0.99	0.84	1.07	1.17	1.32
C2H6	0.26	0.33	0.31	0.48	0.36	0.50	0.56	0.73
C3H4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C3H6	3.62	3.92	3.57	4.21	4.56	4.91	4.98	5.05
C3H8	1.01	1.70	1.36	2.18	1.23	1.60	2.04	2.32
C4H6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-C4H8	0.81	0.82	0.53	0.81	0.96	1.57	1.02	0.89
I-C4H8	0.38	0.34	0.40	0.30	0.56	0.00	0.54	0.50
c-2-C4H8	0.62	0.61	0.72	0.61	0.69	0.69	0.79	0.62
t-2-C4H8	0.84	0.83	1.01	0.84	0.96	0.96	1.07	0.87
I-C4H10	3.25	4.43	3.77	4.99	3.63	4.00	5.42	5.03
N-C4H10	1.02	1.38	1.40	1.58	1.18	1.37	1.69	1.56
C5-430 deg F	55.26	57.01	57.52	54.90	55.94	55.51	54.26	53.03
430-680 deg F	26.49	21.54	22.45	20.14	23.54	20.76	19.65	18.68
680-800 deg F	3.54	2.89	2.84	3.41	2.83	2.95	2.50	3.42
800 deg F+	0.53	1.02	0.53	0.68	0.55	0.81	0.56	0.67
COKE	1.28	2.19	2.31	3.04	1.48	2.29	2.72	3.84
Weight Balance, %	98.15	97.44	96.94	98.14	98.85	97.51	99.79	98.24

Run Number	904a	897a	901a	902a	899a	896a	905a	903a
Date (Day-Mon-Yr)	2/12/96	2/8/96	2/9/96	2/12/96	2/8/96	2/6/96	2/12/96	2/12/96
Catalyst F or AL Number	F-9804	F-9804	F-9804	F-9804	F-9804	F-9804	F-9804	F-9804
Catalyst Source	Conoco	Conoco	Conoco	Conoco	Conoco	Conoco	Conoco	Conoco
Catalyst Trade Name	Vector-50	Vector-50	Vector-50	Vector-50	Vector-50	Vector-50	Vector-50	Vector-50
Catalyst Activity	66	66	66	66	66	66	66	66
Oil Feed F# or AL#	F-9907	F-9907	F-9907	F-9907	F-9907	F-9907	F-9907	F-9907
Feed API	25.8	25.8	25.8	25.8	25.8	25.8	25.8	25.8
Company supplying feedstock	SWRI	SWRI	SWRI	SWRI	SWRI	SWRI	SWRI	SWRI
Special Features	C 3L	C 4.5L1	C 3.5L2	C 6L	C 3H	C 4.5H1	C 6H	C 6H
Catalyst Charge, grams	3.01	4.50	4.51	6.00	3.00	4.51	6.00	6.00
Feed Charge, grams	1.01	1.00	1.00	0.99	1.01	0.99	1.02	1.01
Catalyst/Oil Ratio	2.98	4.48	4.52	6.05	2.95	4.55	5.91	5.92
Initial Bed Temperature, deg F	1000	1000	1000	1000	1055	1055	1050	1050
Average Bed Temperature, deg F	966	966	968	971	1006	1014	1010	1005
Oil Inject Time, seconds	30	30	30	30	30	30	30	30
Paraffins, wt%	NA	NA	NA	3.2	NA	NA	NA	4.2
Isoparaffins, wt%	NA	NA	NA	45.6	NA	NA	NA	42.9
Naphthenes, wt%	NA	NA	NA	13.5	NA	NA	NA	11.1
Aromatics, wt%	NA	NA	NA	31.1	NA	NA	NA	35.8
Olefins, wt%	NA	NA	NA	6.5	NA	NA	NA	6.1
GCRON	NA	NA	NA	94.5	NA	NA	NA	96.2
GCMON	NA	NA	NA	83.4	NA	NA	NA	84.5
Conversion, Wt %	75.00	80.52	81.98	84.05	79.54	81.93	84.35	82.48
Weight % Yields, normalized: H2S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2	0.18	0.18	0.16	0.26	0.16	0.28	0.37	0.30
CH4	0.23	0.40	0.48	0.66	0.35	0.81	0.94	0.77
C2H2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C2H4	0.52	0.79	0.94	1.09	0.81	1.24	1.38	1.16
C2H6	0.18	0.31	0.35	0.46	0.27	0.54	0.63	0.51
C3H4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C3H6	3.24	3.80	4.38	4.63	4.69	5.52	5.34	4.63
C3H8	0.93	1.56	1.79	2.36	1.23	2.02	2.49	2.06
C4H6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1-C4H8	1.31	0.90	0.99	0.94	1.01	1.12	0.99	0.99
I-C4H8	0.00	0.40	0.39	0.44	0.58	0.61	0.55	0.54
c-2-C4H8	0.68	0.68	0.69	0.91	0.75	0.77	0.77	0.69
t-2-C4H8	0.91	0.95	0.96	0.98	1.03	1.08	1.05	0.98
I-C4H10	3.41	4.55	5.04	6.03	4.36	5.61	6.59	5.12
N-C4H10	1.16	1.50	1.60	1.92	1.25	1.69	1.95	1.73
C5-430 deg F	60.99	62.78	62.29	60.49	61.79	58.18	57.88	60.04
430-680 deg F	22.90	16.81	15.64	13.61	18.33	15.38	13.36	15.00
680-800 deg F	1.34	2.10	1.92	1.91	1.62	2.02	1.77	1.92
800 deg F+	0.76	0.57	0.46	0.43	0.51	0.67	0.52	0.61
COKE	1.25	1.72	1.91	2.88	1.25	2.47	3.42	2.94
Weight Balance, %	96.72	97.18	98.77	97.05	98.73	99.39	96.80	99.81

1996 PILOT PLANT RESULTS

OPERATING CONDITIONS

FEEDSTOCK:		F-9819	F-9888	F-9819/9888
CATALYST:		F-9804	F-9804	F-9804
RUN NUMBER:	H-2038-	1	2	3
OIL FEED RATE , GRAM/HR		1924	1887	1912
CATALYST RATE , LB/HR		42.5	42.3	43.3
CATALYST/OIL RATIO		10.0	10.2	10.3
MATERIAL BALANCE:				
CLOSURE, WT%		99.90	101.86	100.71
GASOLINE, WT%		49.99	55.06	51.20
CONVERSION, WT%		77.10	76.96	76.15
COKE YIELD, WT%		5.04	3.66	4.51
SELECTIVITY, W/W		0.65	0.72	0.67
C/(1-C), W/W		3.37	3.34	3.19
RISER OUTLET PRESSURE , PSIG		35.0	35.0	35.0
TEMPERATURES, DEG F:				
OIL PREHEAT		224	222	221
CATALYST INLET		1254	1252	1255
RISER PROFILE, FT				
0.58 (MIXING ZONE)		984	997	994
5.47		992	992	992
9.22		985	986	986
17.10		985	987	986
19.18		979	981	978
22.87		989	991	990
26.12		980	982	980
33.99		991	993	992
36.08		986	988	987
41.33		982	982	981
45.08		982	980	978
50.92		990	991	991
55.64		991	992	992
60.45		974	975	975
64.78		987	988	987
69.53		974	974	974
75.45		987	987	987
RISER AVERAGE (EX MIX ZONE)		984	985	985

1996 PILOT PLANT RESULTS

PRODUCT YIELD SPECTRUM

NORMALIZED, BASIS FRESH FEED, WT%

FEEDSTOCK:		F-9819	F-9888	F-9819/9888	
CATALYST:		F-9804	F-9804	F-9804	
RUN NUMBER:	H-2038-	1	2	3	AVG
H2S		0.00	0.00	0.00	0.00
H2		0.13	0.17	0.14	0.14
CH4		1.16	0.77	1.02	1.03
C2H4		0.36	0.30	0.34	0.34
C2H6		0.82	0.52	0.71	0.72
C3H6		5.78	4.37	5.24	5.30
C3H8		1.44	1.77	1.54	1.55
C4H6		0.09	0.04	0.03	0.07
1-C4H8		2.04	1.13	1.61	1.73
I-C4H8		1.95	0.74	1.29	1.54
T-2-C4H8		1.74	1.07	1.49	1.51
C-2-C4H8		0.96	0.61	0.86	0.84
IC4H10		4.32	5.12	4.79	4.59
NC4H10		1.28	1.63	1.38	1.40
C5+ IN GAS		4.32	4.03	4.48	4.22
IBP-430 F		45.67	51.03	46.72	47.48
430-650 F		17.21	19.33	18.84	17.93
650+ F		5.69	3.70	5.01	5.02
COKE		5.04	3.66	4.51	4.57
TOTAL		100.00	100.00	100.00	100.00

SUMMARY

TOTAL C2 & LIGHTER	2.47	1.76	2.21	2.23
TOTAL C3'S	7.22	6.14	6.78	6.86
TOTAL C4'S	12.38	10.34	11.45	11.69
TOTAL GASOLINE	49.99	55.06	51.20	51.70
TOTAL CYCLE OIL	22.90	23.04	23.85	22.95
COKE	5.04	3.66	4.51	4.57
CONVERSION	77.10	76.96	76.15	77.05

	1995 FEED INSPECTIONS						1996 INSPECTIONS	
SOURCE	DL1	DL1	DL1	DL1	AMOCO	ASTM	DL2	DL2
TREATMENT	A-UNHYDR	B-SL HYDR	C-V SEV HT	D - SEV HT	E-PETR FD	ASTM FD	DL2	HT DL2
	F-9827	F-9824	F-9826	F-9823	F-9821	F-9803	F-9888	F9907
API	22.5	23.3	31.7	24.2	26.4	27.6	23.3	25.9
Sp Gr	0.9188	0.9141	0.8670	0.9088	0.8961	0.8894	0.9139	0.8987
H, wt%	12.03	12.13	12.69	12.23	13.10	NA	12.27	12.55
Sulfur, wt%	0.035						0.002	
Nitrogen, wt%	0.059						0.0043	
Basic N, wt%	0.041						0.0047	
Aniline Pt, F	Too dark						121.6	
HC Type,wt%								
Paraffins	11.7						11.6	
Cycloparaffins	35.3						52.3	
Alkyl Benzenes	6.7						25.9	
PAH	53.0						10.2	

BOILING RANGE DISTRIBUTION BY GCSD

WT%	DEG. F	DEG. F	DEG. F	DEG. F	DEG. F	DEG. F	DEG. F	DEG. F
0.5	453	396	168	284	336	286	452	313
5	499	495	378	484	458	524	481	458
10	512	509	464	502	516	577	494	479
20	529	528	502	521	579	633	515	502
30	544	542	520	537	629	676	533	521
40	561	559	536	554	673	716	551	540
50	576	575	554	571	710	756	569	561
60	593	591	573	587	750	798	585	578
70	610	609	591	605	792	841	604	596
80	632	631	614	628	840	889	627	618
90	663	662	647	659	901	942	657	652
95	689	688	674	684	942	973	684	679
99	749	742	730	733	993	1004	738	737
EP	788	769	758	753	>1014	>1014	760	761
Wt% at 430 F	0	0.8	7.6	1.8	3.1	1.3	0	2.8

NOTES:

1) Analysis of coal-derived feeds by SwRI
2) Used combined analysis of Hvy Distillate and Residue for S, N, Basic N amd Aniline Point .
3) Used only Hvy Distillate analysis for HC Type.
4) Analysis of petroleum feed for hydrogen by Amoco
5) Distillation data obtained by Kellogg using chromatography (ASTM D2887)

corrected petcgrid.wk4

M.W. KELLOGG MAT RESULTS

DOE/BECHTEL: REFINING AND END USE STUDY OF COAL LIQUIDS

"A" UNHYDROTREATED FEED

Run Number	790	786	802	810	814	805
Date (Mon-Day-Yr)	DEC-21-94	DEC-20-94	JAN-05-95	JAN-09-95	JAN-10-95	JAN-06-95
Catalyst F or AL Number	F-9804	F-9804	F-9804	F-9804	F-9804	F-9804
Catalyst Source	CONOCO	CONOCO	CONOCO	CONOCO	CONOCO	CONOCO
Catalyst Trade Name	Vektor 50	Vektor 50	Vektor 50	Vektor 50	Vektor 50	Vektor 50
Catalyst Activity	66	66	66	66	66	66
Oil Feed F# or AL#	F-9827	F-9827	F-9827	F-9827	F-9827	F-9827
Specific Gravity	0.919	0.919	0.919	0.919	0.919	0.919
Feed API	22.5	22.5	22.5	22.5	22.5	22.5
Feed 430 minus, wt%	0.0	0.0	0.0	0.0	0.0	0.0
Company supplying feedstock	SwRI	SwRI	SwRI	SwRI	SwRI	SwRI
Special Features	A-4.5	A-6	A-6	A-6	A-7.5	A-7.5
Catalyst Charge, grams	4.51	6.01	6.00	6.01	7.50	7.50
Feed Charge, grams	1.03	1.02	1.03	1.02	1.02	1.01
Catalyst/Oil Ratio	4.39	5.90	5.85	5.91	7.36	7.41
Initial Bed Temperature, deg F	998	995	999	999	999	999
Average Bed Temperature, deg F	987	970	980	975	980	975
Oil Inject Time, seconds	30	30	30	30	30	30
Weight % Yields, normalized: H2S	0.01	0.00	0.00	0.01	0.04	0.01
H2	0.15	0.32	0.19	0.17	0.24	0.25
CH4	0.40	0.55	0.50	0.64	0.89	0.81
C2H2	0.00	0.00	0.00	0.00	0.00	0.00
C2H4	0.63	0.68	0.69	0.83	0.98	0.92
C2H6	0.37	0.47	0.43	0.53	0.69	0.64
C3H4	0.00	0.00	0.00	0.00	0.00	0.00
C3H6	3.43	3.50	3.24	3.89	3.90	3.69
C3H8	1.04	1.11	1.27	1.59	1.96	1.87
C4H6	0.00	0.00	0.00	0.00	0.00	0.00
1-C4H8	0.94	0.93	0.87	0.90	0.83	0.86
I-C4H8	0.41	0.39	0.34	0.39	0.38	0.38
c-2-C4H8	0.73	0.72	0.67	0.71	0.63	0.65
t-2-C4H8	0.99	1.00	0.92	0.97	0.88	0.91
I-C4H10	3.00	2.98	2.97	3.84	3.67	3.54
N-C4H10	1.30	1.32	1.36	1.47	1.51	1.54
C5-430 deg F	51.08	50.79	51.14	50.13	48.59	50.61
430-680 deg F	29.85	27.84	28.60	27.17	26.57	25.41
680-800 deg F	2.89	3.06	3.10	3.12	3.18	3.09
800 deg F+	0.61	0.79	0.71	0.76	0.88	0.75
COKE	2.17	3.54	3.02	2.90	4.20	4.10
New Weight Balance, %	98.60	97.50	98.62	99.29	98.81	98.04
%Conversion, wt	67.32	68.96	68.25	69.65	70.08	71.43
100-TCO	66.64	68.31	67.60	68.94	69.37	70.75
C2 Minus	1.55	2.02	1.80	2.18	2.83	2.63
Total C3	4.47	4.61	4.51	5.47	5.86	5.56
Total C4	7.38	7.34	7.13	8.27	7.89	7.86
C5-430F	51.08	50.79	51.14	50.13	48.59	50.61
430-680	29.85	27.84	28.60	27.17	26.57	25.41
680+	3.50	3.85	3.81	3.88	4.06	3.84
Coke	2.17	3.54	3.02	2.90	4.20	4.10
	100	100	100	100	100	100

corrected petcgrid.wk4

M.W. KELLOGG MAT RESULTS

DOE/BECHTEL: REFINING AND END USE STUDY OF COAL LIQUIDS

"B" SL. HYDROTREATED FEED

Run Number	800	793	818	821
Date (Mon-Day-Yr)	DEC-28-94	DEC-27-94	JAN-11-95	JAN-12-95
Catalyst F or AL Number	F-9804	F-9804	F-9804	F-9804
Catalyst Source	CONOCO	CONOCO	CONOCO	CONOCO
Catalyst Trade Name	Vektor 50	Vektor 50	Vektor 50	Vektor 50
Catalyst Activity	66	66	66	66
Oil Feed F# or AL#	F-9824	F-9824	F-9824	F-9824
Specific Gravity	0.914	0.914	0.914	0.914
Feed API	23.3	23.3	23.3	23.3
Feed 430 minus, wt%	0.8	0.8	0.8	0.8
Company supplying feedstock	SwRI	SwRI	SwRI	SwRI
Special Features	B-4.5	B-6	B-6	B-7.5
Catalyst Charge, grams	4.50	6.00	6.00	7.50
Feed Charge, grams	1.03	1.02	0.99	1.01
Catalyst/Oil Ratio	4.36	5.89	6.05	7.45
Initial Bed Temperature, deg F	998	998	999	999
Average Bed Temperature, deg F	972	976	977	987
Oil Inject Time, seconds	30	30	30	30
Weight % Yields, normalized: H2S	0.00	0.01	0.00	0.02
H2	0.27	0.30	0.24	0.26
CH4	0.42	0.63	0.67	0.74
C2H2	0.00	0.00	0.00	0.00
C2H4	0.62	0.78	0.83	0.86
C2H6	0.34	0.49	0.54	0.60
C3H4	0.00	0.00	0.00	0.00
C3H6	3.63	3.75	3.95	3.65
C3H8	1.05	1.37	1.61	1.78
C4H6	0.00	0.00	0.00	0.00
1-C4H8	0.93	0.91	0.93	0.70
I-C4H8	0.40	0.40	0.40	0.28
c-2-C4H8	0.71	0.70	0.71	0.55
t-2-C4H8	0.98	0.96	0.98	0.75
I-C4H10	3.06	3.51	3.66	3.42
N-C4H10	1.23	1.40	1.48	1.29
C5-430 deg F	52.05	51.42	50.88	50.36
430-680 deg F	28.57	26.38	26.27	26.68
680-800 deg F	3.05	3.10	2.99	3.14
800 deg F+	0.70	0.78	0.77	0.85
COKE	1.99	3.09	3.09	4.07
Weight Balance, %	96.69	99.22	99.67	99.16
%Conversion, wt	68.32	70.39	70.66	69.96
100-TCO	67.68	69.74	69.97	69.33
C2 Minus	1.65	2.21	2.29	2.47
Total C3	4.68	5.12	5.56	5.43
Total C4	7.31	7.89	8.16	6.99
C5-430F	52.05	51.42	50.88	50.36
430-680	28.57	26.38	26.27	26.68
680+	3.75	3.88	3.75	3.99
Coke	1.99	3.09	3.09	4.07
	100	100	100	100

corrected petcgrid.wk4

M.W. KELLOGG MAT RESULTS

DOE/BECHTEL: REFINING AND END USE STUDY OF COAL LIQUIDS

"C" V. SEVERE HYDROTREATED FEED

Run Number	803	794	788	811	807	815
Date (Mon-Day-Yr)	JAN-05-95	DEC-27-94	DEC-21-94	JAN-09-95	JAN-06-95	JAN-10-95
Catalyst F or AL Number	F-9804	F-9804	F-9804	F-9804	F-9804	F-9804
Catalyst Source	CONOCO	CONOCO	CONOCO	CONOCO	CONOCO	CONOCO
Catalyst Trade Name	Vektor 50	Vektor 50	Vektor 50	Vektor 50	Vektor 50	Vektor 50
Catalyst Activity	66	66	66	66	66	66
Oil Feed F# or AL#	F-9826	F-9826	F-9826	F-9826	F-9826	F-9826
Specific Gravity	0.867	0.867	0.867	0.867	0.867	0.867
Feed API	31.7	31.7	31.7	31.7	31.7	31.7
Feed 430 minus, wt%	7.6	7.6	7.6	7.6	7.6	7.6
Company supplying feedstock	SwRI	SwRI	SwRI	SwRI	SwRI	SwRI
Special Features	C-3	C-4.5	C-6	C-3	C-4.5	C4.5
Catalyst Charge, grams	3.01	4.51	6.01	3.00	4.51	4.51
Feed Charge, grams	0.98	1.01	0.97	1.00	1.00	1.01
Catalyst/Oil Ratio	3.06	4.48	6.17	3.01	4.51	4.46
Initial Bed Temperature, deg F	1005	998	995	999	999	999
Average Bed Temperature, deg F	975	973	974	980	978	981
Oil Inject Time, seconds	30	30	30	30	30	30
Weight % Yields, normalized: H2S	0.00	0.01	0.01	0.00	0.01	0.02
H2	0.11	0.18	0.21	0.11	0.13	0.15
CH4	0.27	0.40	0.47	0.28	0.38	0.43
C2H2	0.00	0.00	0.00	0.00	0.00	0.00
C2H4	0.52	0.71	0.74	0.56	0.68	0.72
C2H6	0.22	0.32	0.37	0.23	0.30	0.35
C3H4	0.00	0.00	0.00	0.00	0.00	0.00
C3H6	3.43	4.06	3.82	3.47	3.93	3.98
C3H8	0.85	1.32	1.56	0.86	1.37	1.35
C4H6	0.00	0.00	0.00	0.00	0.00	0.00
1-C4H8	1.05	0.94	1.06	1.04	0.99	1.08
I-C4H8	0.56	0.42	0.45	0.55	0.44	0.47
c-2-C4H8	0.81	0.72	0.81	0.77	0.80	0.78
t-2-C4H8	1.12	0.99	1.12	1.07	1.09	1.10
I-C4H10	3.19	3.78	4.15	2.99	4.46	3.98
N-C4H10	1.44	1.41	1.80	1.43	1.57	1.62
C5-430 deg F	59.88	60.33	60.70	60.59	59.81	60.76
430-680 deg F	23.45	20.23	18.36	22.93	20.02	19.30
680-800 deg F	2.23	1.97	2.28	2.18	2.24	2.35
800 deg F+	0.00	0.54	0.00	0.00	0.00	0.00
COKE	0.86	1.68	2.09	0.95	1.72	1.57
New Weight Balance, %	97.99	97.47	98.16	98.16	98.41	97.45
%Conversion, wt	74.87	77.76	79.87	75.42	78.26	78.87
100-TCO	74.32	77.26	79.35	74.89	77.73	78.36
C2 Minus	1.13	1.61	1.80	1.16	1.49	1.66
Total C3	4.28	5.38	5.38	4.34	5.35	5.33
Total C4	8.18	8.26	9.39	7.86	9.35	9.04
C5-430F	59.88	60.33	60.70	60.59	59.81	60.76
430-680	23.45	20.23	18.36	22.93	20.02	19.30
680+	2.23	2.51	2.28	2.18	2.24	2.35
Coke	0.86	1.68	2.09	0.95	1.72	1.57
	100	100	100	100	100	100

corrected petcgrid.wk4

M.W. KELLOGG MAT RESULTS

DOE/BECHTEL: REFINING AND END USE STUDY OF COAL LIQUIDS

"D" SEVERLY HYDROTREATED FEED

Run Number	789	797	819	822
Date (Mon-Day-Yr)	DEC-21-94	DEC-27-94	JAN-11-95	JAN-12-95
Catalyst F or AL Number	F-9804	F-9804	F-9804	F-9804
Catalyst Source	CONOCO	CONOCO	CONOCO	CONOCO
Catalyst Trade Name	Vektor 50	Vektor 50	Vektor 50	Vektor 50
Catalyst Activity	66	66	66	66
Oil Feed F# or AL#	F-9823	F-9823	F-9823	F-9823
Specific Gravity	0.909	0.909	0.909	0.909
Feed API	24.2	24.2	24.2	24.2
Feed 430 minus, wt%	1.8	1.8	1.8	1.8
Company supplying feedstock	SwRI	SwRI	SwRI	SwRI
Special Features	D-3	D-4.5	D-4.5	D-6
Catalyst Charge, grams	3.00	4.50	4.50	6.00
Feed Charge, grams	1.03	1.01	1.02	0.99
Catalyst/Oil Ratio	2.92	4.47	4.43	6.04
Initial Bed Temperature, deg F	995	998	999	999
Average Bed Temperature, deg F	975	978	978	978
Oil Inject Time, seconds	30	30	30	30
Weight % Yields, normalized: H2S	0.00	0.01	0.01	0.02
H2	0.12	0.24	0.19	0.25
CH4	0.25	0.42	0.46	0.61
C2H2	0.00	0.00	0.00	0.00
C2H4	0.62	0.86	0.91	1.03
C2H6	0.22	0.35	0.37	0.49
C3H4	0.00	0.00	0.00	0.00
C3H6	3.42	3.64	3.67	3.50
C3H8	1.04	1.39	1.56	1.99
C4H6	0.00	0.00	0.00	0.00
1-C4H8	1.21	1.23	1.43	1.11
I-C4H8	0.42	0.40	0.48	0.34
c-2-C4H8	0.96	0.96	1.06	0.84
t-2-C4H8	1.30	1.32	1.47	1.17
I-C4H10	3.07	3.12	3.36	3.45
N-C4H10	1.34	1.64	1.97	1.80
C5-430 deg F	54.41	53.24	53.26	52.84
430-680 deg F	27.52	25.43	24.31	23.80
680-800 deg F	3.00	2.82	2.66	2.78
800 deg F+	0.00	0.73	0.69	0.87
COKE	1.12	2.20	2.14	3.13
New Weight Balance, %	96.83	97.34	101.35	98.57
%Conversion, wt	70.20	71.79	73.15	73.30
100-TCO	69.48	71.03	72.34	72.56
C2 Minus	1.20	1.88	1.95	2.39
Total C3	4.46	5.03	5.22	5.49
Total C4	8.30	8.68	9.76	8.70
C5-430F	54.41	53.24	53.26	52.84
430-680	27.52	25.43	24.31	23.80
680+	3.00	3.54	3.35	3.65
Coke	1.12	2.20	2.14	3.13
	100	100	100	100

corrected petcgrid.wk4

M.W. KELLOGG MAT RESULTS

DOE/BECHTEL: REFINING AND END USE STUDY OF COAL LIQUIDS

"E" AMOCO VIRGIN GAS OIL

Run Number	787	792	804	812	808	816
Date (Mon-Day-Yr)	DEC-21-94	DEC-27-94	JAN-05-95	JAN-09-95	JAN-09-95	JAN-10-95
Catalyst F or AL Number	F-9804	F-9804	F-9804	F-9804	F-9804	F-9804
Catalyst Source	CONOCO	CONOCO	CONOCO	CONOCO	CONOCO	CONOCO
Catalyst Trade Name	Vektor 50	Vektor 50	Vektor 50	Vektor 50	Vektor 50	Vektor 50
Catalyst Activity	66	66	66	66	66	66
Oil Feed F# or AL#	F-9821	F-9821	F-9821	F-9821	F-9821	F-9821
Specific Gravity	0.896	0.896	0.896	0.896	0.896	0.896
Feed API	26.4	26.4	26.4	26.4	26.4	26.4
Feed 430 minus, wt%	3.1	3.1	3.1	3.1	3.1	3.1
Company supplying feedstock	AMOCO	AMOCO	AMOCO	AMOCO	AMOCO	AMOCO
Special Features	E-3	E-4.5	E-4.5	E-4.5	E-6	E-6
Catalyst Charge, grams	3.01	4.50	4.50	4.50	6.00	6.00
Feed Charge, grams	0.99	1.00	1.00	1.00	1.00	0.99
Catalyst/Oil Ratio	3.04	4.51	4.51	4.52	5.98	6.07
Initial Bed Temperature, deg F	995	998	999	999	999	999
Average Bed Temperature, deg F	980	982	982	989	982	983
Oil Inject Time, seconds	30	30	30	30	30	30
Weight % Yields, normalized: H2S	0.48	0.63	0.55	0.63	0.63	0.68
H2	0.12	0.15	0.15	0.14	0.17	0.20
CH4	0.49	0.67	0.82	0.74	0.84	1.03
C2H2	0.00	0.00	0.00	0.00	0.00	0.00
C2H4	0.65	0.85	0.95	0.88	0.95	1.12
C2H6	0.43	0.56	0.65	0.61	0.67	0.83
C3H4	0.00	0.00	0.00	0.00	0.00	0.00
C3H6	4.01	4.83	5.05	4.58	4.69	5.47
C3H8	0.66	1.06	1.17	1.06	1.34	1.60
C4H6	0.00	0.00	0.00	0.00	0.00	0.00
1-C4H8	1.06	1.19	1.28	1.12	1.11	1.29
I-C4H8	1.28	1.14	1.24	1.13	0.89	1.03
c-2-C4H8	0.86	0.98	1.04	0.88	0.87	1.10
t-2-C4H8	1.17	1.34	1.42	1.21	1.20	1.49
I-C4H10	2.62	3.81	3.95	3.34	3.82	4.92
N-C4H10	1.07	1.31	1.39	1.29	1.44	1.46
C5-430 deg F	48.27	49.00	48.37	47.59	50.01	47.90
430-680 deg F	28.15	24.22	23.22	25.30	22.15	20.62
680-800 deg F	4.95	4.00	4.10	4.72	3.49	3.45
800 deg F+	1.79	1.47	1.69	1.79	1.27	1.47
COKE	1.93	2.79	2.95	2.99	4.48	4.35
New Weight Balance, %	97.46	100.13	98.03	98.72	98.91	99.07
%Conversion, wt	65.85	71.09	71.79	68.98	73.79	75.24
100-TCO	65.11	70.31	70.99	68.19	73.09	74.46
C2 Minus	2.17	2.85	3.11	3.00	3.26	3.87
Total C3	4.67	5.89	6.22	5.64	6.03	7.06
Total C4	8.06	9.77	10.33	8.97	9.32	11.28
C5-430F	48.27	49.00	48.37	47.59	50.01	47.90
430-680	28.15	24.22	23.22	25.30	22.15	20.62
680+	6.74	5.46	5.79	6.51	4.76	4.92
Coke	1.93	2.79	2.95	2.99	4.48	4.35
	100	100	100	100	100	100

corrected petcgrid.wk4

M.W. KELLOGG MAT RESULTS

DOE/BECHTEL: REFINING AND END USE STUDY OF COAL LIQUIDS

"F" BLEND OF "D" AND "E"

Run Number	796	798	820	824
Date (Mon-Day-Yr)	DEC-27-94	DEC-27-94	JAN-12-95	JAN-13-95
Catalyst F or AL Number	F-9804	F-9804	F-9804	F-9804
Catalyst Source	CONOCO	CONOCO	CONOCO	CONOCO
Catalyst Trade Name	Vektor 50	Vektor 50	Vektor 50	Vektor 50
Catalyst Activity	66	66	66	66
Oil Feed F# or AL#	F-9823/F-9821	F-9821/F-9823	F-9821/F-9823	F-9821/F-9823
Specific Gravity	0.902	0.902	0.902	0.902
Feed API	25.4	25.4	25.4	25.4
Feed 430 minus, wt%	2.5	2.5	2.5	2.5
Company supplying feedstock	NA	NA	NA	NA
Special Features	F-3	F-4.5	F-4.5	F-6
Catalyst Charge, grams	3.01	4.50	4.50	6.00
Feed Charge, grams	1.01	0.99	1.00	1.01
Catalyst/Oil Ratio	2.97	4.53	4.49	5.93
Initial Bed Temperature, deg F	998	998	999	999
Average Bed Temperature, deg F	977	975	986	975
Oil Inject Time, seconds	30	30	30	30
Weight % Yields, normalized: H2S	0.31	0.38	0.33	0.34
H2	0.11	0.15	0.18	0.22
CH4	0.39	0.54	0.75	0.82
C2H2	0.00	0.00	0.00	0.00
C2H4	0.61	0.76	0.92	0.94
C2H6	0.34	0.45	0.60	0.66
C3H4	0.00	0.00	0.00	0.00
C3H6	3.83	4.27	4.77	4.47
C3H8	0.73	1.10	1.39	1.58
C4H6	0.00	0.00	0.00	0.00
1-C4H8	1.05	1.00	1.19	1.14
I-C4H8	0.73	0.60	0.71	0.62
c-2-C4H8	0.81	0.77	0.99	0.88
t-2-C4H8	1.10	1.06	1.33	1.21
I-C4H10	2.83	3.42	4.43	4.12
N-C4H10	1.22	1.24	1.43	1.66
C5-430 deg F	51.81	52.62	49.41	51.71
430-680 deg F	28.17	25.20	24.54	21.99
680-800 deg F	3.24	3.27	3.35	3.01
800 deg F+	0.99	1.03	1.15	0.81
COKE	1.74	2.13	2.51	3.80
New Weight Balance, %	98.03	98.49	99.05	98.42
%Conversion, wt	68.27	71.17	71.75	74.88
100-TCO	67.60	70.51	70.97	74.18
C2 Minus	1.75	2.29	2.79	2.99
Total C3	4.56	5.38	6.16	6.06
Total C4	7.73	8.09	10.10	9.62
C5-430F	51.81	52.62	49.41	51.71
430-680	28.17	25.20	24.54	21.99
680+	4.23	4.30	4.50	3.83
Coke	1.74	2.13	2.51	3.80
	100	100	100	100

corrected petcgrid.wk4

M.W. KELLOGG MAT RESULTS

DOE/BECHTEL: REFINING AND END USE STUDY OF COAL LIQUIDS

ASTM REFERENCE FEED

Run Number	806	813	809	817
Date (Mon-Day-Yr)	JAN-06-95	JAN-10-95	JAN-09-95	JAN-10-95
Catalyst F or AL Number	F-9804	F-9804	F-9804	F-9804
Catalyst Source	CONOCO	CONOCO	CONOCO	NA
Catalyst Trade Name	Vektor 50	Vektor 50	Vektor 50	NA
Catalyst Activity	66	66	66	NA
Oil Feed F# or AL#	F-9603	F-9603	F-9603	F-9603
Specific Gravity	0.889	0.889	0.889	0.889
Feed API	27.6	27.6	27.6	27.6
Feed 430 minus, wt%	2.0	2.0	2.0	2.0
Company supplying feedstock	ASTM	ASTM	ASTM	ASTM
Special Features	ASTMGO-3	ASTMGO-3	ASTMGO-6	ASTMGO-6
Catalyst Charge, grams	3.00	3.00	6.00	6.00
Feed Charge, grams	0.98	1.00	0.97	1.01
Catalyst/Oil Ratio	3.05	2.99	6.19	5.94
Initial Bed Temperature, deg F	999	999	999	999
Average Bed Temperature, deg F	980	985	980	985
Oil Inject Time, seconds	30	30	30	30
Weight % Yields, normalized: H2S	0.25	0.25	0.33	0.34
H2	0.09	0.11	0.18	0.19
CH4	0.52	0.61	1.09	1.16
C2H2	0.00	0.00	0.00	0.00
C2H4	0.64	0.78	1.16	1.25
C2H6	0.43	0.53	0.84	0.90
C3H4	0.00	0.00	0.00	0.00
C3H6	4.01	4.26	5.72	6.28
C3H8	0.71	0.76	1.60	1.72
C4H6	0.00	0.00	0.00	0.00
1-C4H8	1.05	1.09	1.21	1.33
I-C4H8	1.31	1.39	1.11	1.24
c-2-C4H8	0.87	0.89	0.95	1.03
t-2-C4H8	1.18	1.21	1.31	1.42
I-C4H10	2.69	2.69	4.42	4.79
N-C4H10	1.09	1.16	1.41	1.45
C5-430 deg F	46.45	47.62	50.61	48.58
430-680 deg F	26.33	25.65	18.84	18.54
680-800 deg F	7.27	6.16	3.45	3.41
800 deg F+	3.18	2.70	1.61	1.75
COKE	1.94	2.13	4.19	4.64
New Weight Balance, %	97.60	99.32	98.17	97.73
%Conversion, wt	63.99	66.24	76.77	77.01
100-TCO	63.23	65.49	76.11	76.30
C2 Minus	1.92	2.28	3.60	3.84
Total C3	4.72	5.02	7.31	8.00
Total C4	8.19	8.43	10.40	11.25
C5-430F	46.45	47.62	50.61	48.58
430-680	26.33	25.65	18.84	18.54
680+	10.45	8.86	5.05	5.15
Coke	1.94	2.13	4.19	4.64
	100	100	100	100

PIANO AND GCOCTANE ANALYSES FOR 1995 AND 1996 MAT RUN PRODUCTS

Run	884	885	891	892	902	903	905	802	793	788	822	816	824
ID	A6L	A6H	B6L	B6H	C6L	C6H	C6H	DL1A	DL1B	DL1C	DL1D	DL1E	DL1F
FEED	VGO	VGO	DL2	DL2	HT DL2	HT DL2	HT DL2	DL1	SL HT DL1	VS HT DL1	SV HT DL1	VGO	BLEND
TEMP, F	970	1010	970	1010	970	1010	1010	980	980	980	980	980	980
PIANO AS REPORTED, WT%													
Paraffins	5.19	5.36	2.81	2.38	2.96	3.90	2.65	3.54	3.28	4.03	3.31	5.12	4.78
Isoparaffins	38.85	33.00	37.62	31.34	41.84	39.93	37.08	33.27	32.03	34.68	33.56	37.49	38.00
Naphthenes	9.48	9.20	10.65	8.58	12.43	10.36	10.50	19.94	19.12	21.98	19.66	9.35	13.50
Aromatics	29.06	32.90	34.77	32.90	28.57	33.32	38.56	36.31	38.29	32.31	37.32	33.00	32.20
Olefins	10.29	10.08	4.24	4.31	5.99	5.64	4.86	6.02	5.90	5.49	4.73	11.43	9.05
Unknowns	5.33	6.18	5.59	5.91	6.05	4.03	3.67	0.93	1.37	1.51	1.42	3.61	2.47
C14+	1.79	3.30	4.33	14.60	2.15	2.82	2.67	0.00	0.00	0.00	0.00	0.00	0.00
PIANO, NORMALIZED,WT%													
Paraffins	5.59	5.92	3.12	2.99	3.22	4.19	2.83	3.57	3.33	4.09	3.36	5.31	4.90
Isoparaffins	41.83	36.45	41.76	39.42	45.58	42.87	39.59	33.58	32.48	35.21	34.04	38.89	38.96
Naphthenes	10.21	10.16	11.82	10.79	13.54	11.12	11.21	20.13	19.39	22.32	19.94	9.70	13.84
Aromatics	31.29	36.34	38.59	41.38	31.13	35.77	41.17	36.65	38.83	32.81	37.86	34.24	33.02
Olefins	11.08	11.13	4.71	5.42	6.53	6.05	5.19	6.08	5.98	5.57	4.80	11.86	9.28
GCRON	93.7	95.9	94.3	97.3	94.5	96.2	95.5	91.2	NA	91.2	92.6	NA	NA
GCMON	82.3	83.8	83.4	84.9	83.4	84.5	82.9	82.7	NA	81.6	83.7	NA	NA

Section 6

Project Management

6.1 Plans

6.2 Reports and Schedules

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

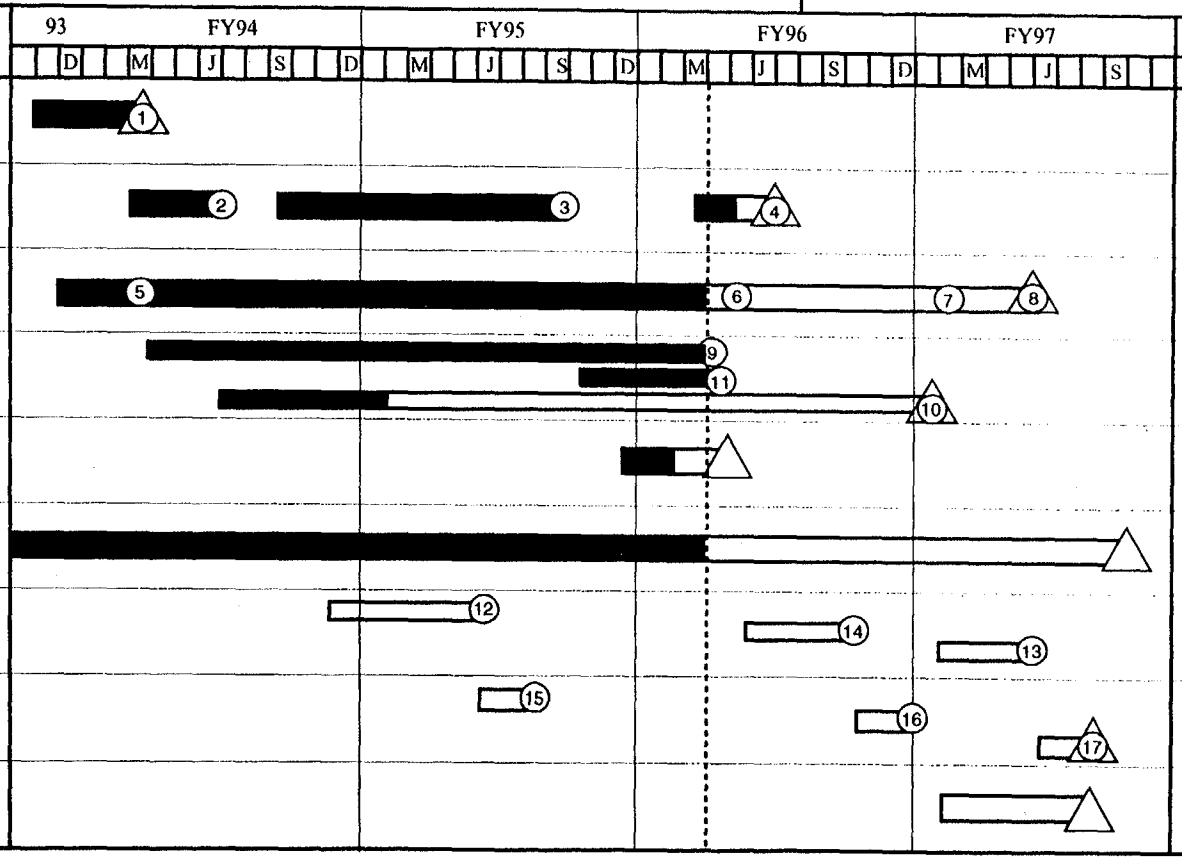
Figure 6-1
Milestone Schedule for Basic Program & Option 1

DOE F1332.3
(11.84)

☐ PLAN ■ STATUS REPORT

FORM APPROVED
OMB NO 1901-1400

1. TITLE	Refining and End Use Study of Coal Liquids	2. REPORTING PERIOD 1/1/96 to 3/31/96	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	10. PERCENT COMPLETE a. Plan	b. Actual
Task 1	Project Work Plan	100	100
Task 2	Feed Characterization	100	69
Task 3	Linear Programming (LP) Analysis	93	78
Task 4	Pilot Plant Analysis	93	65
Task 5	Option 1 Work Plan	100	0
Task 6	Administration Task	61	61
Option 1 Task 1	Pilot Plant Analysis (Produce Fuels)	43	0
Option 1 Task 2	Characterization, Blending, and Testing	0	0
Option 1 Task 3	Economic Study	0	0

1 Submit Final Work Plan
2 Characterize DL1 liquid
3 Characterize IL liquid
4 Characterize DL2 liquid
5 Develop LP model
6 Input DL pilot plant data
7 Input IL pilot plant data
8 Conduct evaluation runs
9 Conduct DL1 pilot plant tests
10 Conduct IL pilot plant tests
11 Conduct DL2 pilot plant tests
12 Production runs for DL1 (deleted from program)
13 Production runs for IL
14 Production runs for DL2
15 ASTM tests for DL1 (deleted from program)
16 ASTM tests for IL
17 ASTM tests for DL2

11. SIGNATURE OF PARTICIPANT'S PROJECT MANAGER AND DATE

Cliff Yon 4/30/96