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APPENDIX

ADVANCED DIRECT COAL LIQUEFACTION CONCEPTS

Contract No: DE-AC22-92PC91050

By
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Canadian Energy Development Inc.
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Edmonton, Alberta
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and

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July 1994

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SUMMARY OF BENCH UNIT TEST RUNS
(forced water balance and kept oil in V-220 as measured)

RUN No.:	DOE-BU-003	DOE-BU-004		DOE-BU-005
M.B.No.:	YP-01/C1	YP-01/C1	YP-02/C1	YP-01/C1
Coal	BTH	BTH	BTH	BTH
wt % maf	16.37%	39.62%	40.03%	36.13%
First Stage:				
Feed Rate (kg / hr) / l WHSV	2.06	1.89	1.60	0.90
Pressure Mpa	17.24	17.24	17.24	17.24
Temperature deg C	386	395	395	396
Catalyst	Carbonate	Carbonate	Carbonate	Carbonate
CO Rate kg / kg maf coal	6.50	2.36	2.81	6.01
moles / 100g maf coal	23.19	8.41	10.02	21.46
consumed moles / 100g maf coal	3.77	1.21	1.29	2.85
Water Rate kg / kg maf coal	6.50	2.36	2.81	6.01
moles / 100g maf coal	36.07	13.08	15.58	33.37
Hydrogen wt % maf co wt % coal	3.08%	1.40%	1.30%	2.10%
Second Stage:				
Feed Rate (kg / hr) / l WHSV				
Pressure Mpa				
Temperature deg C				
Catalyst				
Hydrogen kg / kg maf coal				
moles / 100g maf coal				
consumed wt % maf coal				
Coal Conversion (wt % maf coal)	51.38%	58.91%	63.68%	69.19%
Product Yield (wt % maf coal)				
H2O				
COx	9.40%	8.88%	11.73%	12.98%
H2S				
C1 to C3				
Pentane soluble (incl. C4)	-9.36%	14.88%	31.64%	23.47%
Asphaltenes	45.05%	28.86%	15.15%	28.04%
Preasphaltenes	9.37%	7.67%	6.47%	6.80%
IOM	48.62%	41.09%	36.32%	30.81%
TOTAL	103.08%	101.40%	101.30%	102.10%

NOTE:

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RUN No.: DOE-BU-003

M.B.No.: YP-01/C1

	Date	Time	Date	Time
START:			Jun. 03, 93	16:30
END:			Jun. 03, 93	17:30
DURATION (hours):				1.00

Feed:	Type	Wt% (maf)
Coal	BTH	16.37%
Solvent	V-1074	83.63%
Catalyst 1	Pot-Carb	15.00%
Catalyst 2		
Other		

OPERATING PARAMETERS:

FEED TANK WI-110):	(G)	
Start of Mass Balance		4170.00
End of Mass Balance		3610.00
Rate	(G/HR)	560
FIRST STAGE:		
Operating Pressure:	(MPa)	17.24
Feed Temp.:	(C)	
Reactor Temp.:	(C)	
TE-201I	(BTTM)	395
TE-202I		386
TE-203I		385
TE-204I	(Top)	380
Liquid Level	(mm)	300
Separator Temperature:	(C)	70
CO-Feed Rate:	(L/MIN)	7.59
Water Feed Rate:	(ML/MIN)	8.54
Temperature:	(C)	264
Catalyst Feed:	(ML/MIN)	1.20
Liquid Product (WI-220):	(G)	
Start of Mass Balance		1100.00
End of Mass Balance		1631.00
Nitrogen Rate:	(L/MIN)	6.49
SECOND STAGE:		
Operating Pressure:	(MPa)	
Feed Temp.:	(C)	
Reactor Temp.:	(C)	
TE-301I	(BTTM)	
TE-302I		
TE-303I		
TE-304I		
TE-305I		
TE-306I		
TE-307I		
TE-308I	(Top)	
TE-309I	(VAP)	
Liquid level	(mm)	
Separator Temperature:	(C)	
Hydrogen Feed Rate:	(L/MIN)	
Temperature:	(C)	
Liquid Product (WI-330):	(G)	
Start of Mass Balance		
End of Mass Balance		
Bottoms Product (V-340):	(G)	
Start of Mass Balance		
End of Mass Balance		460

MEASURED GAS COMPOSITIONS

NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02	4.82		4.27
CO2	44.01	7.93		7.74
CO	28.01	43.08		23.76
H2S	34.08			
Methane	16.04			
Ethylene	28.05			
Ethane	30.07			
Propane	44.01			
Propylene	42.08			
i-Butane	58.12			
n-Butane	58.12			
i-Butene	56.11			
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15			
Nitrogen	28.02			
TOTAL		55.83		35.77
Gas Meter Readings				
DTM-260	DTM-360	DTM-350		
Start of M.B. : (L)	5650	6644		
End of M.B. : (L)	6671	6657		
Total : (L)	1021	13		
Temperature: (C)	21	21	21	
Meter Pressure : (mmHg)	708	708	708	
Standard Volume: (L)	884		11	
Nitrogen to R-200: (L)	389			
Net Gas Out: (L)	494		11	

Run Conditions

Basis: MAF		First Stage	Second Stage
Pressure	Mpa	17.2	
Temperature	deg C	386	
Catalyst		Pot-Carb	
Feed	wt % maf coal	16.37%	
WHSV	(kg / hr) / l	2.06	
CO Rate	kg / kg maf coal	6.50	
	moles / 100g maf coal	23.19	
consumed	moles / 100g maf coal	3.77	
Water Rate	kg / kg maf coal	6.50	
	moles / 100g maf coal	36.07	
Hydrogen	kg / kg maf coal		
	moles / 100g maf coal		
consumed	wt % maf coal	3.08%	

M.B.No.: YP-01/C1

OVERALL MASS BALANCE			
Material In:	Grams	Material Out:	Grams
Feed Slurry	560	First Stage Liquid:	531
CO-Gas:	569	First Stage Product Gas:	618
Water:	512	Second Stage Liquid:	
Hydrogen:		Second Stage Reactor Bottoms:	460
Catalyst:	72	Second Stage Product Gas:	
		Dissolved Gas:	14
TOTAL IN:	1714	TOTAL OUT:	1624
Catalyst mf	11	OVERALL BALANCE: 94.8%	

WATER BALANCE	
TOTAL IN: 591	TOTAL OUT: 591
WATER BALANCE: 100.0%	

	Coal Conversion	wt.% maf	51.4%
	Ash Balance	wt.%	145.1%

PRODUCT YIELDS					
Description	Total Gross			Total Net	
	[grams]		wt. % maf feed	[grams]	wt. % maf coal
	measured	-----	normalized	-----	-----
H2O					
COx	6.74	8.24	1.54%	8.24	9.40%
H2S					
C1 to C3					
C4 +					
Oil	314.98	385.18	71.97%	-8.20	-9.36%
Asphaltene	76.56	93.63	17.50%	39.48	45.05%
Preasphalt.	6.71	8.21	1.53%	8.21	9.37%
IOM	34.84	42.61	7.96%	42.61	48.62%
Total	439.83	537.86	100.50%	90.33	103.08%

Distillation Profile THF-Extract					
Fraction [deg C]	Feed [grams]	Product			
		Total Gross		Total Net	
		[grams]	normalized [grams]	normalized [grams]	wt. % maf coal
IBP - 182					
182 - 343					
343 - 524					
524+					
TOTAL					

QAS ANALYSIS

GAS ANALYSIS														
First Stage Product Gas (DTM-260)														
Number of Samples: 1														
Name	vol %	vol %	vol %	vol %	vol %	Av.vol %	Number of Samples: 1							
	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %
Hydrogen	4.820													
CO ₂	7.830													
CO	43.080													
H ₂ S														
Methane														
Ethylene														
Ethane														
Propane														
Propylene														
i-Butane														
n-Butane														
i-Pentane														
n-Pentane														
CO ₂ -Butene														
i-Butene														
n-Butene														
Nitrogen														
TOTAL	55.830													
Second Stage Product Gas (DTM-350)														
Number of Samples: 1														
Name	vol %	vol %	vol %	vol %	vol %	Av.vol %	Number of Samples: 1							
	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %
Hydrogen	4.270													
CO ₂	7.740													
CO	23.760													
H ₂ S														
Methane														
Ethylene														
Ethane														
Propane														
Propylene														
i-Butane														
n-Butane														
i-Pentane														
n-Pentane														
CO ₂ -Butene														
i-Butene														
n-Butene														
Nitrogen														
TOTAL	35.770													
Dissolved Gas (DTM-350)														

RUN No.: DOE-BU-003

M.B.No.: YP-01/C1

GAS CALCULATIONS

Name	Mol.Weight	First Stage Product Gas (DTM-260)				Second Stage Product Gas (DTM-360)				Dissolved Gas (DTM-350)			
		Average Mol Weight:		15.69 (g/mole)		Average Mol Weight:		(g/mole)		Average Mol Weight:		28.37 (g/mole)	
		Volume		Weight (norm.)		Volume		Weight (norm.)		Volume		Weight (norm.)	
		meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%
Hydrogen	2.02	4.82	8.63	3.85	0.62					4.27	11.94	0.12	0.85
CO ₂	44.01	7.93	14.20	137.89	22.29					7.74	21.64	4.78	33.57
CO	28.01	43.08	77.16	476.74	77.08					23.76	66.42	9.34	65.58
H ₂ S	34.08												
Methane	16.04												
Ethylene	28.05												
Ethane	30.07												
Propane	44.01												
Propylene	42.08												
i-Butane	58.12												
n-Butane	58.12												
i-Butene	56.11												
n-Butene	56.11												
C ₂ -Butene	56.11												
i-Pentane	72.15												
n-Pentane	72.15												
Nitrogen	28.02												
TOTAL		55.83	100.00	618.47	100.00					35.77	100.00	14.24	100.00

First Stage Shift Reaction

		CO	+	H ₂ O	=	CO ₂	+	H ₂
Stochiom.	[moles]	3.30		3.30		3.30		3.30
Produced	[moles]					-0.17		-1.34
Total	[moles]	3.30		3.30		3.13		1.96
Stochiom.	[grams]	92.46		59.48		145.27		6.67
Produced	[grams]					-7.39		-2.70
Total	[grams]	92.46		59.48		137.89		3.97

Hydrocarbon Gases

		First	Second	Dissolved	Total
C1 to C3	[grams]				
C4 +	[grams]				
Total	[grams]				

Hydrogen

		First Up-Take	In	Second Out	Up-Take	Total Up-Take
Hydrogen	[grams]	2.70				2.70

RUN No.: DOE-BU-003	M.B.No.: YP-01/C1
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RUN No.: DOE-BU-003	M.B.No.: YP-01/C1
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Liquid / Slurry Stream Analysis

[illegible]

	Feed	V-220	Products V-340 (BTMS)	V-330
----- in grams of analysis sample -----				
Total Sample	44.63	14.92	45.91	
Water	1.40	14.57	1.30	
Oils+Asphaltenes	35.67	0.35	37.84	
Oils	31.35	0.35	30.20	
Asphaltenes	4.32		7.64	
Pre-Asphaltenes			0.67	
Insolubles	7.56		6.10	
IOM	6.98		3.48	
Ash	0.58		2.62	
TOTAL	44.63	14.92	45.91	
----- in wt% of analysis sample -----				
Water	3.14%	97.67%	2.83%	
Oils+Asphaltenes	79.92%	2.33%	82.43%	
Oils (on fraction)	87.90%	100.00%	79.81%	
(on total)	70.25%	2.33%	65.79%	
Asphalt. (on fract.)	12.10%		20.19%	
(on total)	9.67%		16.64%	
Pre-Asphaltenes			1.46%	
Insolubles	16.95%		13.28%	
IOM (on fraction)	92.34%		57.05%	
(on total)	15.65%		7.57%	
Ash (on fraction)	7.66%		42.95%	
(on total)	1.30%		5.70%	
TOTAL	100.00%	100.00%	100.00%	
----- in grams of feed / product -----				
Total Feed / Product	560	531	460	
Water	17.6	518.6	13.0	
Oils+Asphaltenes	447.5	12.4	379.2	
Oils (on fraction)	393.4	12.4	302.6	
(on total)	393.4	12.4	302.6	
Asphalt. (on fract.)	54.2		76.6	
(on total)	54.2		76.6	
Pre-Asphaltenes			6.7	
Insolubles	94.9		61.1	
IOM (on fraction)	87.6		34.8	
(on total)	87.6		34.8	
Ash (on fraction)	7.3		26.2	
(on total)	7.3		26.2	
TOTAL (as is)	560.0	531.0	460.0	
TOTAL (MAF)	535.2	12.4	420.7	

Distillation Profile THF-Extract					
Fractions deg C	Feed	Products			
		V-220	V-340 (BTMS)	V-330	Total
IBP - 182					
182 - 343					
343 - 524					
524+					
TOTAL					

Feed	Products (normalized)				Feed	Products (normalized)			
	V-220	V-340 (BTMS)	V-330	Total		V-220	V-340 (BTMS)	V-330	Total
----- In wt% of total feed (as is) -----					----- In wt% of total feed (MAF) -----				
3.81%	14.27%	2.82%		17.10%					
79.36%	2.68%	82.23%		84.91%	83.63%	2.82%	86.65%		89.47%
69.76%	2.68%	65.63%		68.31%	73.51%	2.82%	69.15%		71.97%
9.60%		16.60%		16.60%	10.12%		17.50%		17.50%
		1.46%		1.46%					
16.83%		13.24%		13.24%	16.37%		13.96%		13.96%
15.54%		7.56%		7.56%			7.96%		7.96%
1.29%		5.69%		5.69%					
100.00%	16.95%	99.75%		116.70%	100.00%	2.82%	96.14%		98.97%

RUN No.: DOE-BU-004

M.B.No.: YP-01/C1

	Date	Time	Date	Time
START:			Jun. 14, 93	13:00
END:			Jun. 14, 93	15:00
DURATION (hours):				2.00

Feed:	Type	Wt% (maf)
Coal	BTH	39.62%
Solvent	V-1074	60.38%
Catalyst 1	Pot-Carb	15.00%
Catalyst 2		
Other		

OPERATING PARAMETERS:

FEED TANK WI-110:	(G)	
Start of Mass Balance		14510.00
End of Mass Balance		13210.00
Rate	(G/HR)	650
FIRST STAGE:		
Operating Pressure:	(MPa)	17.24
Feed Temp.:	(C)	
Reactor Temp.:	(C)	
TE-201I	(BTM)	393
TE-202I		395
TE-203I		395
TE-204I	(Top)	385
Liquid Level	(mm)	380
Separator Temperature:	(C)	70
CO-Feed Rate:	(L/MIN)	7.29
Water Feed Rate:	(ML/MIN)	2.77
Temperature:	(C)	264
Catalyst Feed:	(ML/MIN)	1.46
Liquid Product (WI-220):	(G)	
Start of Mass Balance		
End of Mass Balance		530.37
Nitrogen Rate:	(L/MIN)	4.49
SECOND STAGE:		
Operating Pressure:	(MPa)	
Feed Temp.:	(C)	
Reactor Temp.:	(C)	
TE-301I	(BTM)	
TE-302I		
TE-303I		
TE-304I		
TE-305I		
TE-306I		
TE-307I		
TE-308I	(Top)	
TE-309I	(VAP)	
Liquid level	(mm)	
Separator Temperature:	(C)	
Hydrogen Feed Rate:	(L/MIN)	
Temperature:	(C)	
Liquid Product (WI-330):	(G)	
Start of Mass Balance		
End of Mass Balance		
Bottoms Product (V-340):	(G)	
Start of Mass Balance		
End of Mass Balance		950

MEASURED GAS COMPOSITIONS

NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02	3.63		3.47
CO2	44.01	8.90		15.55
CO	28.01	50.86		26.53
H2S	34.08			
Methane	16.04			
Ethylene	28.05			
Ethane	30.07			
Propane	44.01			
Propylene	42.08			
i-Butane	58.12			
n-Butane	58.12			
i-Butene	56.11			
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15			
Nitrogen	28.02			
TOTAL		63.39		45.55
Gas Meter Readings				
		DTM-260	DTM-360	DTM-350
Start of M.B. : (L)		9367		6837
End of M.B. : (L)		11095		6857
Total : (L)		1728		20
Temperature: (C)		18	21	18
Meter Pressure : (mmHg)		690	708	690
Standard Volume: (L)		1472		17
Nitrogen to R-200: (L)		538		
Net Gas Out: (L)		934		17

Run Conditions

Basis: MAF		First Stage	Second Stage
Pressure	Mpa	17.2	
Temperature	deg C	395	
Catalyst		Pot-Carb	
Feed	wt % maf coal	39.62%	
WHSV	(kg / hr) / l	1.89	
CO Rate	kg / kg maf coal	2.36	
	moles / 100g maf coal	8.41	
consumed	moles / 100g maf coal	1.21	
Water Rate	kg / kg maf coal	2.36	
	moles / 100g maf coal	13.08	
Hydrogen	kg / kg maf coal		
	moles / 100g maf coal		
consumed	wt % maf coal	1.40%	

RUN No.: DOE-BU-004 M.B.No.: YP-01/C1

OVERALL MASS BALANCE					
Material In:		Grams		Material Out:	Grams
	Feed Slurry	1300		First Stage Liquid:	530
	CO-Gas:	1093		First Stage Product Gas:	1199
	Water:	333		Second Stage Liquid:	
	Hydrogen:			Second Stage Reactor Bottoms:	950
	Catalyst:	175		Second Stage Product Gas:	
				Dissolved Gas:	24
TOTAL IN:		2901		TOTAL OUT:	2703
Catalyst mf		26		OVERALL BALANCE:	93.2%
WATER BALANCE					
TOTAL IN:		573		TOTAL OUT:	573
				WATER BALANCE:	100.0%
		Coal Conversion	wt. % maf	58.9%	
		Ash Balance	wt. %	66.0%	

PRODUCT YIELDS					
Description	Total Gross			Total Net	
	[grams]		wt. % maf feed	[grams]	wt. % maf coal
	measured	normalized			
H2O					
COx	35.05	41.21	3.52%	41.21	8.88%
H2S					
C1 to C3					
C4 +					
Oil	587.13	690.34	58.97%	69.04	14.88%
Asphaltene	186.60	219.40	18.74%	133.88	28.86%
Preasphalt.	30.28	35.60	3.04%	35.60	7.67%
IOM	162.12	190.62	16.28%	190.62	41.09%
Total	1001.19	1177.17	100.55%	470.35	101.40%

Distillation Profile THF-Extract					
Fraction [deg C]	Feed [grams]	Product			
		Total Gross		Total Net	
		[grams]	normalized	[grams]	wt. % maf coal
IBP - 182					
182 - 343					
343 - 524					
524+					
TOTAL					

RUN No.: DOE-BU-004 M.B.No.: YP-01/C1

GAS ANALYSIS

GAS ANALYSIS																					
	First Stage Product Gas (DTM-260)							Second Stage Product Gas (DTM-360)							Dissolved Gas (DTM-350)						
Name	Number of Samples: 1							Number of Samples: 1							Number of Samples: 1						
	vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	Av.vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	Av.vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	Av.vol. %	
Hydrogen	3.630						3.630								3.470					3.470	
CO2	8.900						8.900								15.550					15.550	
CO	50.860						50.860								26.530					26.530	
H2S																					
Methane																					
Ethylene																					
Ethane																					
Propane																					
Propylene																					
i-Butane																					
n-Butane																					
i-Butene																					
n-Butene																					
C2-Butene																					
i-Pentane																					
n-Pentane																					
Nitrogen																					
TOTAL	63.390						63.390								45.550					45.550	

GAS CALCULATIONS

GAS CALCULATIONS											
Name	Mol.Weight	First Stage Product Gas (DTM-260)				Second Stage Product Gas (DTM-360)				Dissolved Gas (DTM-350)	
		Average Mol Weight:		18.25 (g/mole)	Average Mol Weight:		(g/mole)	Average Mol Weight:		31.49 (g/mole)	
		Volume	% norm.	meas. %	Volume	% norm.	meas. %	Volume	% norm.	meas. %	
Hydrogen	2.02	3.63	5.73	4.82	0.40		3.47	7.62	0.12	0.49	
CO2	44.01	8.90	14.04	257.43	21.48		15.55	34.14	11.42	47.71	
CO	28.01	50.86	80.23	936.28	78.12		26.53	58.24	12.40	51.80	
H2S	34.08										
Methane	16.04										
Ethylene	28.05										
Ethane	30.07										
Propane	44.01										
Propylene	42.08										
i-Butane	58.12										
n-Butane	58.12										
i-Butene	56.11										
n-Butene	56.11										
C2-Butene	56.11										
i-Pentane	72.15										
n-Pentane	72.15										
Nitrogen	28.02										
TOTAL		63.39	100.00	1198.53	100.00		45.55	100.00	23.94	100.00	

First Stage Shift Reaction				
CO + H ₂ O = CO ₂ + H ₂				
Stochiom.	[moles]	5.59	5.59	5.59
Produced	[moles]			-3.21
Total	[moles]	5.59	5.59	2.39
Stochiom.	[grams]	156.69	100.81	246.20
Produced	[grams]			-6.48
Total	[grams]	156.69	100.81	4.82

Hydrocarbon Gases					
	First	Second	Dissolved	Total	
					C1 to C3 [grams]
					C4 + [grams]
					Total [grams]

Hydrogen				
	First	In	Second	Up-Take
	Up-Take		Out	Up-Take
Hydrogen [grams]	6.48			
				6.48

M.B.No.: YP-01/C1

Liquid / Slurry Stream Analysis

[illegible]

	Feed	V-220	Products V-340 (BTMS)	V-330
----- in grams of analysis sample -----				
Total Sample	47.06	16.10	44.24	
Water	3.30	13.86	0.70	
Oils+Asphaltenes	25.59	2.24	32.60	
Oils	22.49	2.15	24.05	
Asphaltenes	3.10	0.09	8.55	
Pre-Asphaltenes			1.41	
Insolubles	18.17		9.53	
IOM	16.79		7.55	
Ash	1.38		1.98	
TOTAL	47.06	16.1	44.24	
----- in wt% of analysis sample -----				
Water	7.01%	86.11%	1.58%	
Oils+Asphaltenes	54.37%	13.89%	73.69%	
Oils (on fraction)	87.90%	96.00%	73.77%	
(on total)	47.79%	13.33%	54.36%	
Asphalt. (on fract.)	12.10%	4.00%	26.23%	
(on total)	6.58%	0.56%	19.33%	
Pre-Asphaltenes			3.19%	
Insolubles	38.62%		21.54%	
IOM (on fraction)	92.40%		79.23%	
(on total)	35.68%		17.07%	
Ash (on fraction)	7.60%		20.77%	
(on total)	2.93%		4.47%	
TOTAL	100.00%	100.00%	100.00%	
----- in grams of feed / product -----				
Total Feed / Product	1300	530	950	
Water	91.2	456.7	15.0	
Oils+Asphaltenes	706.8	73.7	700.1	
Oils (on fraction)	621.3	70.7	516.4	
(on total)	621.3	70.7	516.4	
Asphalt. (on fract.)	85.5	2.9	183.7	
(on total)	85.5	2.9	183.7	
Pre-Asphaltenes			30.3	
Insolubles	502.0		204.6	
IOM (on fraction)	463.9		162.1	
(on total)	463.9		162.1	
Ash (on fraction)	38.2		42.5	
(on total)	38.2		42.5	
TOTAL (as is)	1300.0	530.4	950.0	
TOTAL (MAF)	1170.7	73.7	692.5	

Distillation Profile THF-Extract					
Fractions deg C	Feed	Products			
		V-220	V-340 (BTMS)	V-330	Total
IBP - 182					
182 - 343					
343 - 524					
524+					
TOTAL					

Feed	Products (normalized)				Feed	Products (normalized)			
	V-220	V-340 (BTMS)	V-330	Total		V-220	V-340 (BTMS)	V-330	Total
----- in wt% of total feed (as is) -----					----- in wt% of total feed (MAF) -----				
8.14%	20.08%	1.34%		21.42%					
53.71%	6.58%	62.55%		69.13%	60.38%	7.40%	70.31%		77.71%
47.21%	6.32%	46.14%		52.46%	53.07%	7.10%	51.87%		58.97%
6.50%	0.26%	16.41%		16.67%	7.31%	0.30%	18.45%		18.74%
38.15%		18.28%		18.28%	39.62%		20.55%		20.55%
35.25%		14.48%		14.48%			16.28%		16.28%
2.90%		3.80%		3.80%					
100.00%	26.66%	84.88%		111.53%					
					100.00%	7.40%	89.63%		97.03%

RUN No.: DOE-BU-004

M.B.No.: YP-02/C1

	Date	Time	Date	Time
START:			Jun. 14, 93	15:00
END:			Jun. 14, 93	17:00
DURATION (hours):				2.00

Feed:	Type	Wt% (maf)
Coal	BTH	40.03%
Solvent	V-1074	59.97%
Catalyst 1	Pot-Carb	15.00%
Catalyst 2		
Other		

OPERATING PARAMETERS:

FEED TANK WI-110:			
	(G)		
Start of Mass Balance		13210.00	
End of Mass Balance		12110.00	
Rate	(G/HR)	550	
FIRST STAGE:			
Operating Pressure:	(MPa)	17.24	
Feed Temp.:	(C)		
Reactor Temp.:	(C)		
TE-201I	(BTM)	393	
TE-202I		395	
TE-203I		395	
TE-204I	(Top)	385	
Liquid Level	(mm)	380	
Separator Temperature:	(C)	70	
CO-Feed Rate:	(L/MIN)	7.47	
Water Feed Rate:	(ML/MIN)	3.55	
Temperature:	(C)	264	
Catalyst Feed:	(ML/MIN)	1.55	
Liquid Product (WI-220):	(G)		
Start of Mass Balance			
End of Mass Balance		621	
Nitrogen Rate:	(L/MIN)	5.01	
SECOND STAGE:			
Operating Pressure:	(MPa)		
Feed Temp.:	(C)		
Reactor Temp.:	(C)		
TE-301I	(BTM)		
TE-302I			
TE-303I			
TE-304I			
TE-305I			
TE-306I			
TE-307I			
TE-308I	(Top)		
TE-309I	(VAP)		
Liquid level	(mm)		
Separator Temperature:	(C)		
Hydrogen Feed Rate:	(L/MIN)		
Temperature:	(C)		
Liquid Product (WI-330):	(G)		
Start of Mass Balance			
End of Mass Balance			
Bottoms Product (V-340):	(G)		
Start of Mass Balance			
End of Mass Balance		920	

MEASURED GAS COMPOSITIONS

NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02	3.64		3.57
CO2	44.01	8.47		20.43
CO	28.01	49.64		19.55
H2S	34.08			
Methane	16.04			
Ethylene	28.05			
Ethane	30.07			
Propane	44.01			
Propylene	42.08			
i-Butane	58.12			
n-Butane	58.12			
i-Butene	56.11			
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15			
Nitrogen	28.02			
TOTAL		61.75		43.55
Gas Meter Readings				
	DTM-260	DTM-360	DTM-350	
Start of M.B. : (L)	11095		6882	
End of M.B. : (L)	12943		6890	
Total : (L)	1848		8	
Temperature: (C)	18	21	18	
Meter Pressure : (mmHg)	690	708	690	
Standard Volume: (L)	1574		7	
Nitrogen to R-200: (L)	602			
Net Gas Out: (L)	972		7	

Run Conditions

Basis: MAF		First Stage	Second Stage
Pressure	Mpa	17.2	
Temperature	deg C	395	
Catalyst		Pot-Carb	
Feed	wt % maf coal	40.03%	
WHSV	(kg / hr) / l	1.60	
CO Rate	kg / kg maf coal	2.81	
	moles / 100g maf coal	10.02	
consumed	moles / 100g maf coal	1.29	
Water Rate	kg / kg maf coal	2.81	
	moles / 100g maf coal	15.58	
Hydrogen	kg / kg maf coal		
	moles / 100g maf coal		
consumed	wt % maf coal	1.30%	

OVERALL MASS BALANCE					
Material In:		Grams		Material Out:	Grams
	Feed Slurry	1100		First Stage Liquid:	621
	CO-Gas:	1121		First Stage Product Gas:	1244
	Water:	426		Second Stage Liquid:	
	Hydrogen:			Second Stage Reactor Bottoms:	920
	Catalyst:	186		Second Stage Product Gas:	
				Dissolved Gas:	10
TOTAL IN:		2832		TOTAL OUT:	2795
Catalyst mf		28		OVERALL BALANCE:	98.7%
WATER BALANCE					
TOTAL IN:		655		TOTAL OUT:	655
				WATER BALANCE:	100.0%
		Coal Conversion wt.% maf		63.7%	
		Ash Balance wt. %		68.8%	

PRODUCT YIELDS					
Description	Total Gross			Total Net	
	[grams]		wt. % maf feed	[grams]	wt. % maf coal
	measured	normalized			
H2O					
COx	45.98	46.85	4.70%	46.85	11.73%
H2S					
C1 to C3					
C4 +					
Oil	640.20	652.41	65.38%	126.37	31.64%
Asphaltene	130.44	132.93	13.32%	60.52	15.15%
Preasphait.	25.34	25.82	2.59%	25.82	6.47%
IOM	142.36	145.07	14.54%	145.07	36.32%
Total	984.32	1003.09	100.52%	404.64	101.30%

Distillation Profile THF-Extract					
Fraction [deg C]	Feed [grams]	Product			
		Total Gross		Total Net	
		[grams]	normalized [grams]	[grams]	wt. % maf coal
IBP - 182					
182 - 343					
343 - 524					
524+					
TOTAL					

RUN No.: DOE-BU-004

M.B.No.: YP-02/C1

GAS ANALYSIS

GAS ANALYSIS																					
	First Stage Product Gas (DTM-260)							Second Stage Product Gas (DTM-360)							Dissolved Gas (DTM-350)						
Name	Number of Samples: 1							Number of Samples: 1							Number of Samples: 1						
	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%
Hydrogen	3.640						3.640								3.570						3.570
CO2	8.470						8.470								20.430						20.430
CO	49.640						49.640								19.550						19.550
H2S																					
Methane																					
Ethylene																					
Ethane																					
Propane																					
Propylene																					
i-Butane																					
n-Butane																					
i-Butene																					
n-Butene																					
C2-Butene																					
i-Pentane																					
n-Pentane																					
Nitrogen																					
TOTAL	61.750						61.750								43.550						43.550

RUN No.: DOE-BU-004

M.B.No.: YP-02/C1

GAS CALCULATIONS

Name	Mol. Weight	First Stage Product Gas (DTM-260)				Second Stage Product Gas (DTM-360)				Dissolved Gas (DTM-350)			
		Average Mol Weight:		17.71 (g/mole)		Average Mol Weight:		(g/mole)		Average Mol Weight:		33.39 (g/mole)	
		Volume		Weight (norm.)		Volume		Weight (norm.)		Volume		Weight (norm.)	
		meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%
Hydrogen	2.02	3.64	5.89	5.17	0.42					3.57	8.20	0.05	0.50
CO2	44.01	8.47	13.72	261.96	21.05					20.43	46.91	6.28	61.84
CO	28.01	49.64	80.39	977.11	78.53					19.55	44.89	3.82	37.66
H2S	34.08												
Methane	16.04												
Ethylene	28.05												
Ethane	30.07												
Propane	44.01												
Propylene	42.08												
i-Butane	58.12												
n-Butane	58.12												
i-Butene	56.11												
n-Butene	56.11												
C2-Butene	56.11												
i-Pentane	72.15												
n-Pentane	72.15												
Nitrogen	28.02												
TOTAL		61.75	100.00	1244.24	100.00					43.55	100.00	10.15	100.00

First Stage Shift Reaction

		CO	+	H2O	=	CO2	+	H2
Stochiom.	[moles]	5.14		5.14		5.14		5.14
Produced	[moles]					0.82		-2.58
Total	[moles]	5.14		5.14		5.95		2.56
Stochiom.	[grams]	143.89		92.57		226.08		10.38
Produced	[grams]					35.88		-5.21
Total	[grams]	143.89		92.57		261.96		5.17

Hydrocarbon Gases

		First	Second	Dissolved	Total
C1 to C3	[grams]				
C4 +	[grams]				
Total	[grams]				

Hydrogen

		First Up-Take	In	Second Out	Up-Take	Total Up-Take
Hydrogen	[grams]	5.21				5.21

RUN No.: DOE-BU-004 M.B.No.: YP-02/C1

RUN No.: DOE-BU-004 M.B.No.: YP-02/C1

[illegible]

	Feed	V-220	Products V-340 (BTMS)	V-330
----- in grams of analysis sample -----				
Total Sample	44.44	16.10	43.93	
Water	2.90	14.26	0.60	
Oils+Asphaltenes	24.18	1.84	33.41	
Oils	21.25	1.77	27.32	
Asphaltenes	2.93	0.07	6.09	
Pre-Asphaltenes			1.21	
Insolubles	17.36		8.71	
IOM	16.14		6.80	
Ash	1.23		1.91	
TOTAL	44.44	16.1	43.93	
----- in wt% of analysis sample -----				
Water	6.53%	88.57%	1.37%	
Oils+Asphaltenes	54.40%	11.43%	76.05%	
Oils (on fraction)	87.90%	96.00%	81.76%	
(on total)	47.82%	10.97%	62.18%	
Asphalt. (on fract.)	12.10%	4.00%	18.24%	
(on total)	6.58%	0.46%	13.87%	
Pre-Asphaltenes			2.75%	
Insolubles	39.07%		19.83%	
IOM (on fraction)	92.94%		78.04%	
(on total)	36.31%		15.47%	
Ash (on fraction)	7.06%		21.96%	
(on total)	2.76%		4.35%	
TOTAL	100.00%	100.00%	100.00%	
----- in grams of feed / product -----				
Total Feed / Product	1100	621	920	
Water	71.8	550.0	12.6	
Oils+Asphaltenes	598.5	71.0	699.7	
Oils (on fraction)	526.0	68.1	572.1	
(on total)	526.0	68.1	572.1	
Asphalt. (on fract.)	72.4	2.8	127.6	
(on total)	72.4	2.8	127.6	
Pre-Asphaltenes			25.3	
Insolubles	429.8		182.4	
IOM (on fraction)	399.4		142.4	
(on total)	399.4		142.4	
Ash (on fraction)	30.3		40.1	
(on total)	30.3		40.1	
TOTAL (as is)	1100.0	621.0	920.0	
TOTAL (MAF)	997.9	71.0	867.4	

Distillation Profile THF-Extract					
Fractions deg C	Feed	Products			
		V-220	V-340 (BTMS)	V-330	Total
IBP - 182					
182 - 343					
343 - 524					
524+					
TOTAL					

Feed	V-220	Products (normalized) V-340 (BTMS)	V-330	Total	Feed	V-220	Products (normalized) V-340 (BTMS)	V-330	Total
----- in wt% of total feed (as is) -----					----- in wt% of total feed (MAF) -----				
6.64%	20.08%	1.16%		21.24%					
54.34%	6.57%	64.74%		71.31%	59.97%	7.25%	71.45%		78.70%
47.76%	6.30%	52.93%		59.24%	52.72%	6.96%	58.42%		65.38%
6.57%	0.26%	11.81%		12.07%	7.26%	0.29%	13.03%		13.32%
		2.34%		2.34%					
39.02%		16.88%		16.88%	40.03%		18.63%		18.63%
36.27%		13.17%		13.17%			14.54%		14.54%
2.75%		3.71%		3.71%					
100.00%	26.64%	85.13%		111.77%	100.00%	7.25%	88.58%		95.83%

RUN No.: DOE-BU-005

M.B.No.: YP-01/C1

	Date	Time	Date	Time
START:			Jun. 17, 93	14:30
END:			Jun. 17, 93	16:30
DURATION (hours):				2.00

Feed:	Type	Wt% (maf)
Coal	BTH	36.13%
Solvent	V-1074	63.87%
Catalyst 1	Pot-Carb	15.00%
Catalyst 2		
Other		

OPERATING PARAMETERS:

FEED TANK WI-110):	(G)	
Start of Mass Balance		6660.00
End of Mass Balance		6070.00
Rate	(G/HR)	295
FIRST STAGE:		
Operating Pressure:	(MPa)	17.24
Feed Temp.:	(C)	
Reactor Temp.:	(C)	
TE-201I	(BTM)	395
TE-202I		396
TE-203I		384
TE-204I	(Top)	365
Liquid Level	(mm)	360
Separator Temperature:	(C)	70
CO-Feed Rate:	(L/MIN)	7.89
Water Feed Rate:	(ML/MIN)	4.03
Temperature:	(C)	264
Catalyst Feed:	(ML/MIN)	1.41
Liquid Product (WI-220):	(G)	
Start of Mass Balance		
End of Mass Balance		560
Nitrogen Rate:	(L/MIN)	4.07
SECOND STAGE:		
Operating Pressure:	(MPa)	
Feed Temp.:	(C)	
Reactor Temp.:	(C)	
TE-301I	(BTM)	
TE-302I		
TE-303I		
TE-304I		
TE-305I		
TE-306I		
TE-307I		
TE-308I	(Top)	
TE-309I	(VAP)	
Liquid level	(mm)	
Separator Temperature:	(C)	
Hydrogen Feed Rate:	(L/MIN)	
Temperature:	(C)	
Liquid Product (WI-330):	(G)	
Start of Mass Balance		
End of Mass Balance		
Bottoms Product (V-340):	(G)	
Start of Mass Balance		
End of Mass Balance		433

MEASURED GAS COMPOSITIONS

NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02	5.16		1.80
CO2	44.01	8.72		8.10
CO	28.01	53.04		3.80
H2S	34.08			
Methane	16.04			
Ethylene	28.05			
Ethane	30.07			
Propane	44.01			
Propylene	42.08			
i-Butane	58.12			
n-Butane	58.12			
i-Butene	56.11			
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15			
Nitrogen	28.02			
TOTAL		66.92		13.70
Gas Meter Readings		DTM-260	DTM-360	DTM-350
Start of M.B. : (L)		9424		7092
End of M.B. : (L)		11194		7093
Total : (L)		1770		1
Temperature: (C)		19	21	19
Meter Pressure : (mmHg)		700	708	700
Standard Volume: (L)		1524		1
Nitrogen to R-200: (L)		488		
Net Gas Out: (L)		1036		1

Run Conditions

Basis: MAF		First Stage	Second Stage
Pressure	Mpa	17.2	
Temperature	deg C	396	
Catalyst		Pot-Carb	
Feed	wt % maf coal	36.13%	
WHSV	(kg / hr) / l	0.90	
CO Rate	kg / kg maf coal	6.01	
consumed	moles / 100g maf coal	21.46	
Water Rate	kg / kg maf coal	2.85	
consumed	moles / 100g maf coal	6.01	
Hydrogen	kg / kg maf coal	33.37	
consumed	moles / 100g maf coal		
consumed	wt % maf coal	2.10%	

RUN No.: DOE-BU-005 M.B.No.: YP-01/C1

OVERALL MASS BALANCE					
Material In:		Grams	Material Out:		Grams
	Feed Slurry	590		First Stage Liquid:	560
	CO-Gas:	1184		First Stage Product Gas:	1299
	Water:	484		Second Stage Liquid:	
	Hydrogen:			Second Stage Reactor Bottoms:	433
	Catalyst:	169		Second Stage Product Gas:	
				Dissolved Gas:	1
TOTAL IN:		2427	TOTAL OUT:		2294
Catalyst mfr		25	OVERALL BALANCE: 94.5%		

WATER BALANCE					
TOTAL IN:		657	TOTAL OUT:		657
			WATER BALANCE: 100.0%		

	Coal Conversion	wt. % maf	69.2%	
	Ash Balance	wt. %	90.1%	

PRODUCT YIELDS					
Description	Total Gross			Total Net	
	[grams]		wt. % maf feed	[grams]	wt. % maf coal
	measured	----- normalized -----			
H2O					
COx	19.54	25.57	4.69%	25.57	12.98%
H2S					
C1 to C3					
C4 +					
Oil	269.21	352.36	64.62%	46.23	23.47%
Asphaltene	74.40	97.38	17.86%	55.24	28.04%
Preasphalt.	10.23	13.39	2.46%	13.39	6.80%
IOM	46.36	60.68	11.13%	60.68	30.81%
Total	419.74	549.38	100.76%	201.11	102.10%

Distillation Profile THF-Extract					
Fraction [deg C]	Feed [grams]	Product			
		Total Gross		Total Net	
		----- normalized -----			
		[grams]	[grams]	[grams]	wt. % maf coal
IBP - 182					
182 - 343					
343 - 524					
524+					
TOTAL					

RUN No.: DOE-BU-005

M.B.No.: YP-01/C1

GAS ANALYSIS

Name	First Stage Product Gas (DTM-260)							Second Stage Product Gas (DTM-360)							Dissolved Gas (DTM-350)						
	Number of Samples: 1							Number of Samples: 1							Number of Samples: 1						
	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%
Hydrogen	5.160						5.160								1.800						1.800
CO2	8.720						8.720								8.100						8.100
CO	53.040						53.040								3.800						3.800
H2S																					
Methane																					
Ethylene																					
Ethane																					
Propane																					
Propylene																					
i-Butane																					
n-Butane																					
i-Butene																					
n-Butene																					
C2-Butene																					
i-Pentane																					
n-Pentane																					
Nitrogen																					
TOTAL	66.920						66.920								13.700						13.700

RUN No.: DOE-BU-005

M.B.No.: YP-01/C1

GAS CALCULATIONS

Name	Mol.Weight	First Stage Product Gas (DTM-260)				Second Stage Product Gas (DTM-360)				Dissolved Gas (DTM-350)			
		Average Mol Weight:		19.10 (g/mole)		Average Mol Weight:		(g/mole)		Average Mol Weight:		34.06 (g/mole)	
		Volume		Weight (norm.)		Volume		Weight (norm.)		Volume		Weight (norm.)	
		meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%
Hydrogen	2.02	5.16	7.71	7.20	0.55					1.80	13.14	0.01	0.78
CO ₂	44.01	8.72	13.03	265.20	20.41					8.10	59.12	1.00	76.41
CO	28.01	53.04	79.26	1026.64	79.03					3.80	27.74	0.30	22.81
H ₂ S	34.08												
Methane	16.04												
Ethylene	28.05												
Ethane	30.07												
Propane	44.01												
Propylene	42.08												
i-Butane	58.12												
n-Butane	58.12												
i-Butene	56.11												
n-Butene	56.11												
C ₂ -Butene	56.11												
i-Pentane	72.15												
n-Pentane	72.15												
Nitrogen	28.02												
TOTAL		66.92	100.00	1299.04	100.00					13.70	100.00	1.31	100.00

First Stage Shift Reaction

		CO	+	H ₂ O	=	CO ₂	+	H ₂
Stochiom.	[moles]	5.61		5.61		5.61		5.61
Produced	[moles]					0.41		-2.05
Total	[moles]	5.61		5.61		6.03		3.57
Stochiom.	[grams]	157.17		101.12		246.96		11.33
Produced	[grams]					18.24		-4.13
Total	[grams]	157.17		101.12		265.20		7.20

Hydrocarbon Gases

		First	Second	Dissolved	Total
C1 to C3	[grams]				
C4 +	[grams]				
Total	[grams]				

Hydrogen

		First Up-Take	In	Second Out	Up-Take	Total Up-Take
Hydrogen	[grams]	4.13				4.13

M.B.No.: YP-01/C1

Liquid / Slurry Stream Analysis

[illegible]

	Feed	Products V-220 V-340 (BTTMS)	V-330
----- in grams of analysis sample -----			
Total Sample	42.88	16.10	45.72
Water	2.10	15.73	0.90
Oils+Asphaltenes	25.31	0.37	34.92
Oils	22.25	0.36	27.12
Asphaltenes	3.06	0.01	7.80
Pre-Asphaltenes			1.08
Insolubles	15.47		8.82
IOM	14.32		4.90
Ash	1.15		3.92
TOTAL	42.88	16.1	45.72
----- in wt% of analysis sample -----			
Water	4.90%	97.70%	1.97%
Oils+Asphaltenes	59.03%	2.30%	76.38%
Oils (on fraction)	87.90%	96.00%	77.66%
(on total)	51.89%	2.21%	59.31%
Asphalt. (on fract.)	12.10%	4.00%	22.34%
(on total)	7.14%	0.09%	17.06%
Pre-Asphaltenes			2.36%
Insolubles	36.07%		19.29%
IOM (on fraction)	92.55%		55.50%
(on total)	33.39%		10.71%
Ash (on fraction)	7.45%		44.50%
(on total)	2.69%		8.58%
TOTAL	100.00%	100.00%	100.00%
----- in grams of feed / product -----			
Total Feed / Product	590	560	433
Water	28.9	547.3	8.5
Oils+Asphaltenes	348.3	12.9	330.7
Oils (on fraction)	306.1	12.4	256.8
(on total)	306.1	12.4	256.8
Asphalt. (on fract.)	42.1	0.5	73.9
(on total)	42.1	0.5	73.9
Pre-Asphaltenes			10.2
Insolubles	212.8		83.5
IOM (on fraction)	197.0		46.4
(on total)	197.0		46.4
Ash (on fraction)	15.9		37.2
(on total)	15.9		37.2
TOTAL (as is)	590.0	560.2	433.0
TOTAL (MAF)	545.2	12.9	387.3

Distillation Profile THF-Extract					
Fractions deg C	Feed	Products			
		V-220	V-340 (BTTMS)	V-330	Total
IBP - 182					
182 - 343					
343 - 524					
524+					
TOTAL					

Feed	Products (nomalized)				Feed	Products (nomalized)			
	V-220	V-340 (BTTMS)	V-330	Total		V-220	V-340 (BTTMS)	V-330	Total
----- in wt% of total feed (as is) -----					----- in wt% of total feed (MAF) -----				
6.31%	35.92%	1.86%		37.78%	63.87%	3.10%	79.39%		82.48%
58.15%	2.82%	72.27%		75.09%	56.15%	2.97%	61.65%		64.62%
51.11%	2.71%	56.13%		58.83%	7.73%	0.12%	17.74%		17.86%
7.04%	0.11%	16.15%		16.26%	36.13%		20.05%		20.05%
35.54%		18.25%		18.25%			11.13%		11.13%
32.89%		10.13%		10.13%					
2.65%		8.12%		8.12%					
100.00%	38.73%	94.63%		133.36%	100.00%	3.10%	92.97%		96.07%

SUMMARY OF BENCH UNIT TEST RUNS
(forced water balance in V-200 and kept oil as measured)

RUN No.:	DOE-BU-008		DOE-BU-009			
M.B.No.:	YP-01/C1	YP-02/C1	YP-01/C1	YP-02/C1	YP-04/C1	YP-05/C1
Coal	BTH	BTH	BTH	BTH	BTH	BTH
wt % maf	29.93%	31.92%	27.48%	38.34%	38.34%	37.10%
First Stage:						
Feed Rate (kg / hr) / I WHSV	2.24	2.19	2.01	1.99	1.95	1.92
Pressure Mpa	10.34	10.34	10.34	10.34	10.34	10.34
Temperature deg C	395	395	395	395	391	392
Catalyst				Aluminate		
CO Rate kg / kg maf coal	2.91	2.81	3.38	2.36	2.50	2.41
moles / 100g maf coal	10.39	10.01	12.07	8.41	8.92	8.62
consumed moles / 100g maf coal	0.31	0.36	0.25	0.75	0.39	0.32
Water Rate kg / kg maf coal	2.91	2.81	3.38	2.36	2.50	2.41
moles / 100g maf coal	16.15	15.58	18.78	13.08	13.88	13.40
Hydrogen wt % maf wt % coal	0.46%	0.57%	0.35%	1.03%	0.63%	0.48%
Second Stage:						
Feed Rate (kg / hr) / I WHSV	0.94	0.92	0.59	0.59	0.74	0.72
Pressure Mpa	17.24	17.24	17.24	17.24	17.24	13.79
Temperature deg C	434	434	434	443	442	442
Catalyst	ATM	ATM	ATM	ATM	ATM	ATM
Hydrogen kg / kg maf coal	0.89	0.96	0.93	0.32	0.36	0.36
moles / 100g maf coal	44.50	47.84	46.28	15.80	17.85	18.03
consumed wt % maf coal	2.70%	2.76%	2.87%	1.59%	2.31%	2.09%
Coal Conversion (wt % maf coal)	77.36%	78.76%	80.93%	81.53%	73.24%	74.58%
Product Yield (wt % maf coal)						
H2O	8.85%	13.44%	5.58%	1.91%	1.50%	2.17%
COx	7.83%	4.37%	12.60%	6.56%	7.50%	7.99%
H2S						
C1 to C3	9.93%	10.79%	11.90%	8.83%	10.54%	7.94%
Pentane soluble (incl. C4)	10.03%	15.91%	13.83%	39.77%	7.03%	-4.45%
Asphaltenes	40.96%	33.66%	35.97%	26.74%	42.71%	35.28%
Preasphaltenes	2.91%	3.92%	4.27%	0.35%	6.91%	28.23%
IOM	22.64%	21.24%	19.07%	18.47%	26.76%	25.42%
TOTAL	103.16%	103.33%	103.21%	102.63%	102.94%	102.58%

NOTE:

RUN No.: DOE-BU-008

M.B.No.: YP-01/C1

	Date	Time	Date	Time
START:			Sep. 8, 93	22:44
END:			Sep. 9, 93	05:44
DURATION (hours):				7.00

Feed:	Type	Wt% (maf)
Coal	BTH	29.93%
Solvent	V-1074 BL	70.07%
Catalyst 1		
Catalyst 2	Mol	0.90%
Other		

OPERATING PARAMETERS:

FEED TANK WI-110):	(G)	
Start of Mass Balance		7940.00
End of Mass Balance		3540.00
Rate	(G/HR)	
FIRST STAGE:		
Operating Pressure:	(MPa)	10.34
Feed Temp.:	(C)	
Reactor Temp.:	(C)	
TE-201I	(BTM)	
TE-202I		395
TE-203I		392
TE-204I	(Top)	395
Liquid Level	(mm)	310
Separator Temperature:	(C)	60
CO-Feed Rate:	(L/MIN)	6.92
Water Feed Rate:	(ML/MIN)	2.11
Temperature:	(C)	258
Catalyst Feed:	(ML/MIN)	1.45
Liquid Product (WI-220):	(G)	
Start of Mass Balance		
End of Mass Balance		2310.15
Nitrogen Rate:	(L/MIN)	
SECOND STAGE:		
Operating Pressure:	(MPa)	17.24
Feed Temp.:	(C)	
Reactor Temp.:	(C)	
TE-301I	(BTM)	439
TE-302I		438
TE-303I		427
TE-304I		437
TE-305I		437
TE-306I		437
TE-307I		435
TE-308I	(Top)	430
TE-309I	(VAP)	
Liquid level	(mm)	740
Separator Temperature:	(C)	
Hydrogen Feed Rate:	(L/MIN)	29.49
Temperature:	(C)	
Liquid Product (WI-330):	(G)	
Start of Mass Balance		1090
End of Mass Balance		1710
Bottoms Product (V-340):	(G)	
Start of Mass Balance		
End of Mass Balance		2511

MEASURED GAS COMPOSITIONS

NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02	0.45	96.50	
CO2	44.01	2.20	0.11	
CO	28.01	58.03	0.18	
H2S	34.08			
Methane	16.04		0.54	
Ethylene	28.05			
Ethane	30.07		0.24	
Propane	44.01		0.14	
Propylene	42.08			
i-Butane	58.12		0.02	
n-Butane	58.12		0.05	
i-Butene	56.11		0.22	
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15		0.06	
Nitrogen	28.02	40.62		
TOTAL		101.30	98.05	
Gas Meter Readings		DTM-260	DTM-350	DTM-360
Start of M.B. : (L)		7616	8405	962
End of M.B. : (L)		13330	22579	962
Total : (L)		5714	14174	
Temperature: (C)		19	19	19
Meter Pressure : (mmHg)		700	700	700
Standard Volume: (L)		4921	12206	

Run Conditions

Basis: MAF		First Stage	Second Stage
Pressure	Mpa	10.3	17.2
Temperature	deg C	395	434
Catalyst			Mol
Feed	wt % maf coal	29.93%	
WHSV	(kg / hr) / l	2.24	0.94
CO Rate	kg / kg maf coal	2.91	
	moles / 100g maf coal	10.39	
consumed	moles / 100g maf coal	0.31	
Water Rate	kg / kg maf coal	2.91	
	moles / 100g maf coal	16.15	
Hydrogen	kg / kg maf coal		0.89
	moles / 100g maf coal		44.50
consumed	wt % maf coal	0.46%	2.70%

M.B.No.: YP-01/C1

OVERALL MASS BALANCE					
Material In:		Grams	Material Out:		Grams
	Feed Slurry	4400		First Stage Liquid:	2310
	CO-Gas:	3631		First Stage Product Gas:	3735
	Water:	885		Second Stage Liquid:	620
	Hydrogen:	1116		Second Stage Reactor Bottoms:	2511
	Catalyst:	608		Second Stage Product Gas:	1374
	S-Agent			Dissolved Gas:	
TOTAL IN:		10640	TOTAL OUT:		10550
Catalyst mf		40	OVERALL BALANCE:		99.2%
WATER BALANCE					
TOTAL IN:		1627	TOTAL OUT:		1736
			WATER BALANCE:		106.7%
	Coal Conversion		wt.% maf	77.4%	
	Ash Balance		wt.%	84.4%	

PRODUCT YIELDS					
Description	Total Gross			Total Net	
	[grams]		wt. % maf feed	[grams]	wt. % maf coal
	measured	----- normalized			
H2O	108.66	110.51	2.65%	110.51	8.85%
COx	96.03	97.66	2.34%	97.66	7.83%
H2S					
C1 to C3	121.86	123.94	2.97%	123.94	9.93%
C4 +	114.42	116.37	2.79%	116.37	9.32%
Oil	2534.62	2577.73	61.81%	8.79	0.70%
Asphaltene	850.43	864.90	20.74%	511.27	40.96%
Preasphalt.	35.73	36.34	0.87%	36.34	2.91%
IOM	277.90	282.62	6.78%	282.62	22.64%
Total	4139.66	4210.08	100.95%	1287.50	103.16%

Distillation Profile THF-Extract					
Fraction [deg C]	Feed [grams]	Product			
		Total Gross		Total Net	
		[grams]	----- normalized ----- [grams]	[grams]	wt. % maf coal
IBP - 182		91.61	93.17	93.17	7.47%
182 - 343	116.90	392.95	399.64	282.74	22.65%
343 - 524	2805.67	2413.72	2454.78	-350.89	-28.11%
524+		522.49	531.38	531.38	42.58%
TOTAL	2922.57	3420.78	3478.97	556.40	44.58%

RUN No.: DOE-BU-008

M.B.No.: YP-01/C1

GAS ANALYSIS

Name	First Stage Product Gas (DTM-260)							Second Stage Product Gas (DTM-350)							Second Stage Dissolved Gas (DTM-350)					
	Number of Samples: 5							Number of Samples: 2							Number of Samples:					
	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%
Hydrogen	0.405	0.470	0.447	0.500	0.431		0.451	94.265	98.726					96.496						
CO2	2.133	2.120	2.173	2.379	2.194		2.200	0.105	0.110					0.108						
CO	56.481	56.904	56.447	61.532	58.784		58.030	0.203	0.166					0.185						
H2S																				
Methane								0.545	0.530					0.538						
Ethylene																				
Ethane								0.230	0.240					0.235						
Propane								0.164	0.120					0.142						
Propylene																				
i-Butane								0.023	0.015					0.019						
n-Butane								0.055	0.040					0.048						
i-Butene								0.237	0.200					0.219						
n-Butene																				
C2-Butene																				
i-Pentane																				
n-Pentane								0.074	0.050					0.062						
Nitrogen	39.617	39.972	39.331	42.910	41.261		40.618													
TOTAL	98.636	99.466	98.398	107.321	102.670		101.298	95.901	100.197					98.049						

GAS CALCULATIONS

Name	Mol.Weight	First Stage Product Gas (DTM-260)				Second Stage Product Gas (DTM-350)				Second Stage Dissolved Gas (DTM-350)			
		Average Mol Weight: 28.25 (g/mole)				Average Mol Weight: 2.52 (g/mole)				Average Mol Weight: (g/mole)			
		Volume		Weight (norm.)		Volume		Weight (norm.)		Volume		Weight (norm.)	
		meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%
Hydrogen	2.02	0.45	0.44	1.97	0.03	96.50	98.42	1082.79	78.80				
CO2	44.01	2.20	2.17	209.85	3.38	0.11	0.11	26.28	1.91				
CO	28.01	58.03	57.29	3523.21	56.81	0.18	0.19	28.71	2.09				
H2S	34.08												
Methane	16.04					0.54	0.55	47.89	3.49				
Ethylene	28.05												
Ethane	30.07					0.24	0.24	39.25	2.86				
Propane	44.01					0.14	0.14	34.72	2.53				
Propylene	42.08												
i-Butane	58.12					0.02	0.02	6.13	0.45				
n-Butane	58.12					0.05	0.05	15.34	1.12				
i-Butene	56.11					0.22	0.22	68.10	4.96				
n-Butene	56.11												
C2-Butene	56.11												
i-Pentane	72.15												
n-Pentane	72.15					0.06	0.06	24.85	1.81				
Nitrogen	28.02	40.62	40.10	2466.98	39.78%								
TOTAL		101.30	100.00	6202.02	60.62	98.05	100.00	1374.07	100.00				

First Stage Shift Reaction

		CO	+	H2O	=	CO2	+	H2
Stochiom.	[moles]	3.84		3.84		3.84		3.84
Produced	[moles]					0.93		-2.86
Total	[moles]	3.84		3.84		4.77		0.98
Stochiom.	[grams]	107.44		69.12		168.81		7.75
Produced	[grams]					41.04		-5.78
Total	[grams]	107.44		69.12		209.85		1.97

Hydrcarbon Gases

		First	Second	Dissolved	Total
C1 to C3	[grams]		121.86		121.86
C4 +	[grams]		114.42		114.42
Total	[grams]		236.29		236.29

Hydrogen

		First Up-Take	In	Second Out	Up-Take	Total Up-Take
Hydrogen	[grams]	5.78	1116.44	1082.79	33.64	39.42

M.B.No.: YP-01/C1

Liquid / Slurry Stream Analysis

[illegible]

	Feed	V-220	Products V-340 (BTMS)	V-330
----- in grams of analysis sample -----				
Total Sample	44.36	24.50	46.38	80.50
Water	1.41	16.53	0.30	12.00
Oils+Asphaltenes	29.46	7.97	38.89	68.50
Oils	25.90	7.01	25.17	66.37
Asphaltenes	3.57	0.96	13.72	2.13
Pre-Asphaltenes			0.66	
Insolubles	13.49		6.53	
IOM	12.58		5.13	
Ash	0.90		1.39	
TOTAL	44.36	24.5	46.38	80.5
----- in wt% of analysis sample -----				
Water	3.18%	67.45%	0.65%	14.91%
Oils+Asphaltenes	66.42%	32.55%	83.86%	85.09%
Oils (on fraction)	87.90%	87.90%	64.71%	96.89%
(on total)	58.39%	28.61%	54.26%	82.45%
Asphalt. (on fract.)	12.10%	12.10%	35.29%	3.11%
(on total)	8.04%	3.94%	29.59%	2.65%
Pre-Asphaltenes			1.42%	
Insolubles	30.40%		14.07%	
IOM (on fraction)	93.31%		78.63%	
(on total)	28.37%		11.07%	
Ash (on fraction)	6.69%		21.37%	
(on total)	2.03%		3.01%	
TOTAL	100.00%	100.00%	100.00%	100.00%
----- in grams of feed / product -----				
Total Feed / Product	4400	2310	2511	620
Water	139.86	1558.31	16.24	92.4
Oils+Asphaltenes	2922.57	751.84	2105.63	527.6
Oils (on fraction)	2568.94	660.87	1362.57	511.2
(on total)	2568.94	660.87	1362.57	511.2
Asphalt. (on fract.)	353.63	90.97	743.05	16.4
(on total)	353.63	90.97	743.05	16.4
Pre-Asphaltenes			35.73	
Insolubles	1337.57		353.40	
IOM (on fraction)	1248.09		277.90	
(on total)	1248.09		277.90	
Ash (on fraction)	89.48		75.50	
(on total)	89.48		75.50	
TOTAL (as is)	4400.00	2310.15	2511.00	620.0
TOTAL (MAF)	4170.66	751.84	2419.25	527.6

Distillation Profile THF-Extract					
Fractions deg C	Feed	Products			
		V-220	V-340 (BTMS)	V-330	Total
IBP - 182			23.55	68.06	91.61
182 - 343	116.90	30.07	66.38	296.50	392.95
343 - 524	2805.67	721.77	1528.93	163.02	2413.72
524+			522.49		522.49
TOTAL	2922.57	751.84	2141.36	527.58	3420.78

Feed	Products (nomalized)				Feed	Products (nomalized)			
	V-220	V-340 (BTMS)	V-330	Total		V-220	V-340 (BTMS)	V-330	Total
----- in wt% of total feed (as is) -----					----- in wt% of total feed (MAF) -----				
3.23%	17.14%	0.38%	2.14%	19.65%					
66.39%	17.37%	48.64%	12.19%	78.20%	70.07%	18.33%	51.35%	12.86%	82.54%
58.35%	15.27%	31.48%	11.81%	58.55%	61.60%	16.12%	33.23%	12.46%	61.81%
8.03%	2.10%	17.17%	0.38%	19.65%	8.48%	2.22%	18.12%	0.40%	20.74%
		0.83%		0.83%					
30.38%		8.16%		8.16%	29.93%		8.62%		8.62%
28.35%		6.42%		6.42%			6.78%		6.78%
2.03%		1.74%		1.74%					
100.00%	34.51%	58.01%	14.32%	106.84%	100.00%	18.33%	58.99%	12.86%	90.19%

RUN No.: DOE-BU-008

M.B.No.: YP-02/C1

	Date	Time	Date	Time
START:			Sep. 9, 93	07:00
END:			Sep. 9, 93	11:00
DURATION (hours):				4.00

Feed:	Type	Wt% (maf)
Coal	BTH	31.92%
Solvent	V-1074 BL	68.08%
Catalyst 1		
Catalyst 2	Mol	0.90%
Other		

OPERATING PARAMETERS:			
FEED TANK WI-110:	(G)		
Start of Mass Balance		10650.00	
End of Mass Balance		8190.00	
Rate	(G/HR)		
FIRST STAGE:			
Operating Pressure:	(MPa)	10.34	
Feed Temp.:	(C)		
Reactor Temp.:	(C)		
TE-201I	(BTM)		
TE-202I		395	
TE-203I		392	
TE-204I	(Top)	395	
Liquid Level	(mm)	310	
Separator Temperature:	(C)	60	
CO-Feed Rate:	(L/MIN)	6.98	
Water Feed Rate:	(ML/MIN)	3.32	
Temperature:	(C)	258	
Catalyst Feed:	(ML/MIN)	2.35	
Liquid Product (WI-220):	(G)		
Start of Mass Balance			
End of Mass Balance		1567.57	
Nitrogen Rate:	(L/MIN)		
SECOND STAGE:			
Operating Pressure:	(MPa)	17.24	
Feed Temp.:	(C)		
Reactor Temp.:	(C)		
TE-301I	(BTM)	439	
TE-302I		438	
TE-303I		427	
TE-304I		437	
TE-305I		437	
TE-306I		437	
TE-307I		435	
TE-308I	(Top)	430	
TE-309I	(VAP)		
Liquid level	(mm)	740	
Separator Temperature:	(C)		
Hydrogen Feed Rate:	(L/MIN)	33.18	
Temperature:	(C)		
Liquid Product (WI-330):	(G)		
Start of Mass Balance		960	
End of Mass Balance		1620	
Bottoms Product (V-340):	(G)		
Start of Mass Balance			
End of Mass Balance		1450	

MEASURED GAS COMPOSITIONS				
NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02	0.46	97.41	
CO2	44.01	2.18	0.10	
CO	28.01	58.51	0.18	
H2S	34.08			
Methane	16.04		0.54	
Ethylene	28.05		0.01	
Ethane	30.07		0.23	
Propane	44.01		0.17	
Propylene	42.08			
i-Butane	58.12		0.01	
n-Butane	58.12		0.04	
i-Butene	56.11		0.15	
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15		0.08	
Nitrogen	28.02	40.85		
TOTAL		101.99	98.92	
Gas Meter Readings		DTM-260	DTM-350	DTM-360
Start of M.B. : (L)		4360	4130	962
End of M.B. : (L)		7630	13252	962
Total : (L)		3270	9122	
Temperature: (C)		19	19	19
Meter Pressure : (mmHg)		700	700	700
Standard Volume: (L)		2816	7855	

Run Conditions			
Basis: MAF		First Stage	Second Stage
Pressure	Mpa	10.3	17.2
Temperature	deg C	395	434
Catalyst			Mol
Feed	wt % maf coal	31.92%	
WHSV	(kg / hr) / l	2.19	0.92
CO Rate	kg / kg maf coal	2.81	
	moles / 100g maf coal	10.01	
consumed	moles / 100g maf coal	0.36	
Water Rate	kg / kg maf coal	2.81	
	moles / 100g maf coal	15.58	
Hydrogen	kg / kg maf coal		0.96
	moles / 100g maf coal		47.84
consumed	wt % maf coal	0.57%	2.76%

OVERALL MASS BALANCE					
Material In:		Grams		Material Out:	Grams
	Feed Slurry	2460		First Stage Liquid:	1568
	CO-Gas:	2094		First Stage Product Gas:	2138
	Water:	797		Second Stage Liquid:	660
	Hydrogen:	718		Second Stage Reactor Bottoms:	1450
	Catalyst:	564		Second Stage Product Gas:	875
	S-Agent			Dissolved Gas:	
TOTAL IN:		6632		TOTAL OUT:	6691
Catalyst mf		22		OVERALL BALANCE:	100.9%
WATER BALANCE					
TOTAL IN:		1427		TOTAL OUT:	1531
				WATER BALANCE:	107.2%
		Coal Conversion	wt. % maf	78.8%	
		Ash Balance	wt. %	88.2%	

PRODUCT YIELDS					
Description	Total Gross			Total Net	
	[grams]		wt. % maf feed	[grams]	wt. % maf coal
	measured	normalized			
H2O	103.28	100.34	4.29%	100.34	13.44%
COx	33.61	32.65	1.40%	32.65	4.37%
H2S					
C1 to C3	82.87	80.51	3.44%	80.51	10.79%
C4 +	61.64	59.88	2.56%	59.88	8.02%
Oil	1501.06	1458.32	62.36%	58.89	7.89%
Asphaltene	456.91	443.90	18.98%	251.26	33.66%
Preasphalt.	30.11	29.25	1.25%	29.25	3.92%
IOM	163.16	158.51	6.78%	158.51	21.24%
Total	2432.63	2363.36	101.06%	771.29	103.33%

Distillation Profile THF-Extract					
Fraction [deg C]	Feed [grams]	Product			
		Total Gross		Total Net	
		[grams]	[grams]	[grams]	wt. % maf coal
IBP - 182		84.28	81.88	81.88	10.97%
182 - 343	63.68	415.37	403.55	339.86	45.53%
343 - 524	1528.39	1205.59	1171.26	-357.13	-47.84%
524+		282.84	274.78	274.78	36.81%
TOTAL	1592.07	1988.08	1931.47	339.40	45.47%

GAS ANALYSIS

Name	First Stage Product Gas (DTM-260)						Second Stage Product Gas (DTM-350)					
	Number of Samples:						Number of Samples:					
	vol %	vol %	vol %	vol %	Av.vol.%	vol %	vol %	vol %	vol %	vol %	Av.vol.%	vol %
Hydrogen	0.464	0.440	0.430	0.484	0.456	99.024	99.316	97.876	97.405			
CO ₂	2.193	2.270	2.136	2.098	2.178	0.089	0.097	0.098	0.098			
CO	59.193	59.206	58.179	56.758	58.506	0.160	0.108	0.277	0.182			
H ₂ S												
Methane						0.572	0.491	0.664	0.542			
Ethylene						0.016	0.016	0.016	0.011			
Propane						0.227	0.236	0.223	0.229			
Propylene						0.172	0.167	0.173	0.171			
i-Butane						0.014	0.014	0.014	0.014			
n-Butane						0.045	0.043	0.045	0.044			
i-Pentane						0.159	0.140	0.136	0.145			
n-Pentane						0.082	0.079	0.083	0.081			
Nitrogen	41.357	41.374	40.425	39.758	40.854							
TOTAL	103.207	103.330	101.180	99.044	101.994	100.570	96.691	99.505	98.922			

GAS CALCULATIONS

Name	Mol.Weight	First Stage Product Gas (DTM-260)					Second Stage Product Gas (DTM-350)					Second Stage Dissolved Gas (DTM-350)				
		Average Mol Weight:		28.24 (g/mole)			Average Mol Weight:		2.50 (g/mole)			Average Mol Weight:		(g/mole)		
		Volume		Weight (norm.)			Volume		Weight (norm.)			Volume		Weight (norm.)		
		meas. %	norm. %	(G)	%		meas. %	norm. %	(G)	%		meas. %	norm. %	(G)	%	
Hydrogen	2.02	0.46	0.45	1.13	0.03		97.41	98.47	697.22	79.68						
CO ₂	44.01	2.18	2.14	118.09	3.33		0.10	0.10	15.28	1.75						
CO	28.01	58.51	57.36	2018.95	56.90		0.18	0.18	18.03	2.06						
H ₂ S	34.08															
Methane	16.04						0.54	0.55	30.83	3.52						
Ethylene	28.05						0.01	0.01	1.06	0.12						
Ethane	30.07						0.23	0.23	24.37	2.78						
Propane	44.01						0.17	0.17	26.62	3.04						
Propylene	42.08															
i-Butane	58.12						0.01	0.01	2.88	0.33						
n-Butane	58.12						0.04	0.04	9.13	1.04						
i-Butene	56.11						0.15	0.15	28.83	3.29						
n-Butene	56.11															
C ₂ -Butene	56.11															
i-Pentane	72.15															
n-Pentane	72.15						0.08	0.08	20.79	2.38						
Nitrogen	28.02	40.85	40.06	1410.32	39.74%											
TOTAL		101.99	100.00	3548.49	60.65		98.92	100.00	875.04	100.00						

First Stage Shift Reaction

		CO	+	H ₂ O	=	CO ₂	+	H ₂
Stochiom.	[moles]	2.68		2.68		2.68		2.68
Produced	[moles]					0.01		-2.12
Total	[moles]	2.68		2.68		2.68		0.56
Stochiom.	[grams]	74.97		48.23		117.80		5.41
Produced	[grams]					0.29		-4.27
Total	[grams]	74.97		48.23		118.09		1.13

Hydrocarbon Gases

		First	Second	Dissolved	Total
C ₁ to C ₃	[grams]		82.87		82.87
C ₄ +	[grams]		61.64		61.64
Total	[grams]		144.50		144.50

Hydrogen

		First Up-Take	In	Second Out	Up-Take	Total Up-Take
Hydrogen	[grams]	4.27	717.79	697.22	20.57	24.84

M.B.No.: YP-02/C1

Liquid / Slurry Stream Analysis

[illegible]

	Feed	V-220	Products V-340 (BTMS)	V-330
----- in grams of analysis sample -----				
Total Sample	48.08	11.00	44.17	51.98
Water	1.40	9.68	0.40	7.10
Oils+Asphaltenes	31.12	1.32	36.57	44.81
Oils	27.35	1.16	23.98	43.16
Asphaltenes	3.77	0.16	12.59	1.65
Pre-Asphaltenes			0.89	0.07
Insolubles	15.56		6.31	
IOM	14.59		4.97	
Ash	0.97		1.34	
TOTAL	48.08	11	44.17	51.98
----- in wt% of analysis sample -----				
Water	2.91%	87.97%	0.91%	13.66%
Oils+Asphaltenes	64.72%	12.03%	82.79%	86.21%
Oils (on fraction)	87.90%	87.90%	65.58%	96.32%
(on total)	56.89%	10.57%	54.30%	83.04%
Asphalt. (on fract.)	12.10%	12.10%	34.42%	3.68%
(on total)	7.83%	1.46%	28.50%	3.17%
Pre-Asphaltenes			2.01%	0.13%
Insolubles	32.37%		14.29%	
IOM (on fraction)	93.74%		78.77%	
(on total)	30.34%		11.25%	
Ash (on fraction)	6.26%		21.24%	
(on total)	2.03%		3.03%	
TOTAL	100.00%	100.00%	100.00%	100.00%
----- in grams of feed / product -----				
Total Feed / Product	2460	1568	1450	660
Water	71.63	1379.06	13.13	90.2
Oils+Asphaltenes	1592.07	188.51	1200.50	569.0
Oils (on fraction)	1399.43	165.70	787.32	548.0
(on total)	1399.43	165.70	787.32	548.0
Asphalt. (on fract.)	192.64	22.81	413.19	20.9
(on total)	192.64	22.81	413.19	20.9
Pre-Asphaltenes			29.22	0.9
Insolubles	796.30		207.15	
IOM (on fraction)	746.45		163.16	
(on total)	746.45		163.16	
Ash (on fraction)	49.85		43.99	
(on total)	49.85		43.99	
TOTAL (as is)	2460.00	1567.57	1450.00	660.0
TOTAL (MAF)	2338.52	188.51	1392.88	569.8

Distillation Profile THF-Extract					
Fractions deg C	Feed	Products			
		V-220	V-340 (BTMS)	V-330	Total
IBP - 182			14.76	69.52	84.28
182 - 343	63.68	7.54	44.27	363.56	415.37
343 - 524	1528.39	180.97	887.86	136.76	1205.59
524+			282.84		282.84
TOTAL	1592.07	188.51	1229.72	569.85	1988.08

Feed	Products (normalized)				Feed	Products (normalized)			
	V-220	V-340 (BTMS)	V-330	Total		V-220	V-340 (BTMS)	V-330	Total
----- in wt% of total feed (as is) -----					----- in wt% of total feed (MAF) -----				
2.83%	24.92%	0.52%	3.56%	29.01%	68.08%	7.83%	49.87%	23.64%	81.34%
64.77%	7.45%	47.45%	22.49%	77.39%	59.84%	6.88%	32.71%	22.77%	62.36%
56.93%	6.55%	31.12%	21.66%	59.33%	8.24%	0.95%	17.17%	0.87%	18.98%
7.84%	0.90%	16.33%	0.83%	18.06%					
		1.15%	0.04%	1.19%					
32.40%		8.19%		8.19%	31.92%		8.61%		8.61%
30.37%		6.45%		6.45%			6.78%		6.78%
2.03%		1.74%		1.74%					
100.00%	32.38%	57.31%	26.09%	115.77%	100.00%	7.83%	57.87%	23.67%	89.37%

RUN No.: DOE-BU-009

M.B.No.: YP-01/C1

	Date	Time	Date	Time
START:			Sep. 13, 93	19:00
END:			Sep. 13, 93	23:00
DURATION (hours):				4.00

Feed:	Type	Wt% (maf)
Coal	BTH	27.48%
Solvent	V-1074 BL	72.52%
Catalyst 1		
Catalyst 2	Mol	0.90%
Other		

OPERATING PARAMETERS:

FEED TANK WI-110):	(G)	
Start of Mass Balance		2990.00
End of Mass Balance		510.00
Rate	(G/HR)	
FIRST STAGE:		
Operating Pressure:	(MPa)	10.34
Feed Temp.:	(C)	
Reactor Temp.:	(C)	
TE-201I	(BTM)	
TE-202I		395
TE-203I		392
TE-204I	(Top)	395
Liquid Level	(mm)	340
Separator Temperature:	(C)	60
CO-Feed Rate:	(L/MIN)	7.45
Water Feed Rate:	(ML/MIN)	2.22
Temperature:	(C)	258
Catalyst Feed:	(ML/MIN)	1.48
Liquid Product (WI-220):	(G)	
Start of Mass Balance		
End of Mass Balance		1282.85
Nitrogen Rate:	(L/MIN)	
SECOND STAGE:		
Operating Pressure:	(MPa)	17.24
Feed Temp.:	(C)	
Reactor Temp.:	(C)	
TE-301I	(BTM)	439
TE-302I		438
TE-303I		427
TE-304I		437
TE-305I		437
TE-306I		437
TE-307I		435
TE-308I	(Top)	430
TE-309I	(VAP)	
Liquid level	(mm)	1150
Separator Temperature:	(C)	
Hydrogen Feed Rate:	(L/MIN)	28.42
Temperature:	(C)	
Liquid Product (WI-330):	(G)	
Start of Mass Balance		780
End of Mass Balance		1230
Bottoms Product (V-340):	(G)	
Start of Mass Balance		
End of Mass Balance		1379

MEASURED GAS COMPOSITIONS

NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02	0.42	94.36	
CO2	44.01	1.82	0.24	
CO	28.01	58.61	0.19	
H2S	34.08			
Methane	16.04		0.58	
Ethylene	28.05		0.02	
Ethane	30.07		0.24	
Propane	44.01		0.18	
Propylene	42.08			
i-Butane	58.12		0.02	
n-Butane	58.12		0.05	
i-Butene	56.11		0.15	
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15		0.08	
Nitrogen	28.02	38.34		
TOTAL		99.18	96.11	
Gas Meter Readings		DTM-260	DTM-350	DTM-360
Start of M.B. : (L)		2201	3900	979
End of M.B. : (L)		5641	11719	979
Total : (L)		3440	7819	
Temperature: (C)		19	19	19
Meter Pressure : (mmHg)		700	700	700
Standard Volume: (L)		2962	6733	

Run Conditions

Basis: MAF		First Stage	Second Stage
Pressure	Mpa	10.3	17.2
Temperature	deg C	395	434
Catalyst			Mol
Feed	wt % maf coal	27.48%	
WHSV	(kg / hr) / l	2.01	0.59
CO Rate	kg / kg maf coal	3.38	
	moles / 100g maf coal	12.07	
consumed	moles / 100g maf coal	0.25	
Water Rate	kg / kg maf coal	3.38	
	moles / 100g maf coal	18.78	
Hydrogen	kg / kg maf coal		0.93
	moles / 100g maf coal		46.28
consumed	wt % maf coal	0.35%	2.87%

Distillation Profile THF-Extract					
Fraction [deg C]	Feed [grams]	Product			
		Total Gross		Total Net	
		[grams]	normalized [grams]	[grams]	wt. % maf coal
IBP - 182					
182 - 343					
343 - 524					
524+					
TOTAL					

RUN No.: DOE-BU-009

M.B.No.: YP-01/C1

GAS ANALYSIS

Name	First Stage Product Gas (DTM-260)							Second Stage Product Gas (DTM-350)							Second Stage Dissolved Gas (DTM-350)					
	Number of Samples: 6							Number of Samples: 5							Number of Samples:					
	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%
Hydrogen	0.422	0.454	0.401	0.384	0.415	0.418	0.416	93.980	100.024	93.346	92.559	91.885		94.359						
CO2	1.873	1.788	1.798	1.806	1.782	1.860	1.818	0.086	0.096	0.084	0.081	0.870		0.243						
CO	59.670	56.551	57.169	59.082	59.313	59.852	58.606		0.256	0.204	0.200	0.297		0.191						
H2S																				
Methane								0.567	0.590	0.595	0.580	0.582		0.583						
Ethylene								0.019	0.019	0.018	0.018	0.017		0.018						
Ethane								0.244	0.243	0.238	0.232	0.231		0.238						
Propane								0.184	0.188	0.180	0.178	0.178		0.182						
Propylene																				
i-Butane								0.012	0.022	0.016	0.020	0.020		0.018						
n-Butane								0.045	0.057	0.050	0.054	0.054		0.052						
i-Butene								0.084	0.196	0.101	0.178	0.186		0.149						
n-Butene																				
C2-Butene																				
i-Pentane																				
n-Pentane								0.078	0.077	0.076	0.074	0.075		0.076						
Nitrogen	38.733	37.993	38.310	38.213	38.394	38.418	38.344													
TOTAL	100.698	96.786	97.678	99.485	99.904	100.548	99.183	95.299	101.768	94.908	94.174	94.395		96.109						

GAS CALCULATIONS

Name	Mol.Weight	First Stage Product Gas (DTM-260)				Second Stage Product Gas (DTM-350)				Second Stage Dissolved Gas (DTM-350)			
		Average Mol Weight		Weight (norm.)		Average Mol Weight		Weight (norm.)		Average Mol Weight		Weight (norm.)	
		Volume	meas. %	norm. %	(G)	Volume	meas. %	norm. %	(G)	Volume	meas. %	norm. %	(G)
Hydrogen	2.02	0.42	1.12	0.03	94.36	98.18	595.88	76.37	76.37				
CO ₂	44.01	1.82	106.63	2.86	0.24	0.25	33.49	4.29	4.29				
CO	28.01	58.61	59.09	2187.84	58.69	0.19	16.76	2.15	2.15				
H ₂ S	34.08												
Methane	16.04												
Ethylene	28.05												
Propane	44.01												
Propylene	42.08												
i-Butane	58.12												
n-Butane	58.12												
i-Butene	56.11												
n-Butene	56.11												
C ₂ -Butene	56.11												
i-Pentane	72.15												
n-Pentane	72.15												
Nitrogen	28.02												
TOTAL													

First Stage Shift Reaction					
Stochiom.	[moles]	1.68	1.68	1.68	1.68
Produced	[moles]		0.74	-1.13	
Total	[moles]	1.68	1.68	2.42	0.55
Stochiom.	[grams]	47.17	30.35	74.11	3.40
Produced	[grams]		32.51	-2.28	
Total	[grams]	47.17	30.35	106.63	1.12

Hydcarbon Gases					
		First	Second	Dissolved	Total
C ₁ to C ₃	[grams]		78.14		78.14
C ₄ +	[grams]		56.00		56.00
Total	[grams]		134.14		134.14

Hydrogen					
		First	Second	Out	Up-Take
		Up-Take	In		
	[grams]	2.28	614.82	595.88	18.93
					21.22

RUN No.: DOE-BU-009	M.B.No.: YP-01/C1
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M.B.No.: YP-01/C1

[illegible]

	Feed	Products		
		V-220	V-340 (BTTMS)	V-330
----- in grams of analysis sample -----				
Total Sample	48.13	13.60	49.81	52.84
Water	0.60	9.38		4.30
Oils+Asphaltenes	33.86	4.22	43.11	48.50
Oils	29.76	3.71	29.35	46.52
Asphaltenes	4.10	0.51	13.76	1.98
Pre-Asphaltenes			1.00	0.04
Insolubles	13.67		5.70	
IOM	12.83		4.52	
Ash	0.85		1.18	
TOTAL	48.13	13.6	49.81	52.84

----- in wt% of analysis sample -----				
Water	1.25%	68.98%		8.14%
Oils+Asphaltenes	70.34%	31.02%	86.54%	91.79%
Oils (on fraction)	87.90%	87.90%	68.08%	95.93%
(on total)	61.83%	27.27%	58.92%	88.05%
Asphalt. (on fract.)	12.10%	12.10%	31.92%	4.07%
(on total)	8.51%	3.75%	27.63%	3.74%
Pre-Asphaltenes			2.01%	0.08%
Insolubles	28.41%		11.45%	
IOM (on fraction)	93.79%		79.30%	
(on total)	26.65%		9.08%	
Ash (on fraction)	6.21%		20.70%	
(on total)	1.76%		2.37%	
TOTAL	100.00%	100.00%	100.00%	100.00%

----- in grams of feed / product -----				
Total Feed / Product	2480	1283	1379	450
Water	30.92	884.86		36.6
Oils+Asphaltenes	1744.46	397.99	1193.43	413.0
Oils (on fraction)	1533.38	349.84	812.44	396.2
(on total)	1533.38	349.84	812.44	396.2
Asphalt. (on fract.)	211.08	48.16	380.99	16.8
(on total)	211.08	48.16	380.99	16.8
Pre-Asphaltenes			27.69	0.3
Insolubles	704.63		157.88	
IOM (on fraction)	660.87		125.20	
(on total)	660.87		125.20	
Ash (on fraction)	43.76		32.68	
(on total)	43.76		32.68	
TOTAL (as is)	2480.00	1282.85	1379.00	450.0
TOTAL (MAF)	2405.33	397.99	1346.32	413.4

Distillation Profile THF-Extract					
Fractions deg C	Feed	Products			
		V-220	V-340 (BTTMS)	V-330	Total
IBP - 182					
182 - 343					
343 - 524					
524+					
TOTAL					

Feed	Products (normalized)				Feed	Products (normalized)			
	V-220	V-340 (BTTMS)	V-330	Total		V-220	V-340 (BTTMS)	V-330	Total
----- in wt% of total feed (as is) -----					----- in wt% of total feed (MAF) -----				
1.25%	15.53%		1.49%	17.01%	72.52%	16.65%	49.93%	17.28%	83.86%
70.34%	16.15%	48.42%	16.76%	81.33%	63.75%	14.64%	33.99%	16.58%	65.21%
61.82%	14.19%	32.97%	16.08%	63.24%	8.78%	2.01%	15.94%	0.70%	18.66%
8.51%	1.95%	15.46%	0.68%	18.10%					
		1.12%	0.01%	1.14%					
28.41%		6.41%		6.41%	27.48%		6.61%		6.61%
26.65%		5.08%		5.08%			5.24%		5.24%
1.76%		1.33%		1.33%					
100.00%	31.68%	55.95%	18.26%	105.89%	100.00%	16.65%	56.33%	17.30%	90.28%

RUN No.: DOE-BU-009

M.B.No.: YP-02/C1

	Date	Time	Date	Time
START:			Sep. 16, 93	15:00
END:			Sep. 16, 93	19:00
DURATION (hours):				4.00

Feed:	Type	Wt% (maf)
Coal	BTH	38.34%
Solvent	V-1074-BL	61.66%
Catalyst 1	AL	15.00%
Catalyst 2	MO	0.90%
Other		

OPERATING PARAMETERS:		
FEED TANK WI-110:	(G)	
Start of Mass Balance		3500.00
End of Mass Balance		1044.00
Rate	(G/HR)	
FIRST STAGE:		
Operating Pressure:	(MPa)	10.34
Feed Temp.:	(C)	
Reactor Temp.:	(C)	
TE-201I	(BTM)	
TE-202I		395
TE-203I		395
TE-204I	(Top)	392
Liquid Level	(mm)	340
Separator Temperature:	(C)	62
CO-Feed Rate:	(L/MIN)	6.74
Water Feed Rate:	(ML/MIN)	2.40
Temperature:	(C)	258
Catalyst Feed:	(ML/MIN)	1.73
Liquid Product (WI-220):	(G)	
Start of Mass Balance		
End of Mass Balance		1420.46
Nitrogen Rate:	(L/MIN)	
SECOND STAGE:		
Operating Pressure:	(MPa)	17.24
Feed Temp.:	(C)	99
Reactor Temp.:	(C)	
TE-301I	(BTM)	443
TE-302I		443
TE-303I		443
TE-304I		443
TE-305I		443
TE-306I		443
TE-307I		441
TE-308I	(Top)	434
TE-309I	(VAP)	
Liquid level	(mm)	1150
Separator Temperature:	(C)	24
Hydrogen Feed Rate:	(L/MIN)	12.60
Temperature:	(C)	
Liquid Product (WI-330):	(G)	
Start of Mass Balance		840
End of Mass Balance		1064
Bottoms Product (V-340):	(G)	
Start of Mass Balance		
End of Mass Balance		1710

MEASURED GAS COMPOSITIONS				
NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02	1.68	98.94	
CO2	44.01	5.81	0.25	
CO	28.01	53.18	0.43	
H2S	34.08			
Methane	16.04		1.56	
Ethylene	28.05		0.02	
Ethane	30.07		0.64	
Propane	44.01		0.43	
Propylene	42.08			
i-Butane	58.12		0.03	
n-Butane	58.12		0.10	
i-Butene	56.11		0.08	
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15		0.12	
Nitrogen	28.02	39.64	1.67	
TOTAL		100.32	104.27	
Gas Meter Readings				
DTM-260		DTM-350	DTM-360	
Start of M.B. : (L)		70	4086	981
End of M.B. : (L)		3341	7649	981
Total : (L)		3271	3563	
Temperature: (C)	23	23	23	
Meter Pressure : (mmHg)	700	700	700	
Standard Volume: (L)	2779	3027		

Run Conditions			
Basis: MAF		First Stage	Second Stage
Pressure	Mpa	10.3	17.2
Temperature	deg C	395	443
Catalyst		AL	MO
Feed	wt % maf coal	38.34%	
WHSV	(kg / hr) / l	1.99	0.59
CO Rate	kg / kg maf coal	2.36	
	moles / 100g maf coal	8.41	
consumed	moles / 100g maf coal	0.75	
Water Rate	kg / kg maf coal	2.36	
	moles / 100g maf coal	13.08	
Hydrogen	kg / kg maf coal		0.32
	moles / 100g maf coal		15.80
consumed	wt % maf coal	1.03%	1.59%

OVERALL MASS BALANCE					
Material In:		Grams	Material Out:		Grams
	Feed Slurry	2456		First Stage Liquid:	1420
	CO-Gas:	2022		First Stage Product Gas:	2162
	Water:	577		Second Stage Liquid:	224
	Hydrogen:	273		Second Stage Reactor Bottoms:	1710
	Catalyst:	416		Second Stage Product Gas:	398
	S-Agent			Dissolved Gas:	
TOTAL IN:		5744	TOTAL OUT:		5914
Catalyst mlf				391	OVERALL BALANCE: 103.0%
WATER BALANCE					
TOTAL IN:		1086	TOTAL OUT:		1104
				WATER BALANCE:	101.6%
	Coal Conversion		wt. % maf	81.5%	
	Ash Balance		wt. %	134.6%	

PRODUCT YIELDS					
Description	Total Gross			Total Net	
	[grams]		wt. %	[grams]	
	measured	normalized	maf feed	maf coal	
H2O	17.92	16.36	0.73%	16.36	1.91%
COx	61.72	56.33	2.52%	56.33	6.56%
H2S					
C1 to C3	83.04	75.80	3.39%	75.80	8.83%
C4 +	25.90	23.64	1.06%	23.64	2.75%
Oil	1677.85	1531.42	68.39%	317.73	37.02%
Asphaltene	434.53	396.61	17.71%	229.54	26.74%
Preasphalt.	3.26	2.97	0.13%	2.97	0.35%
IOM	173.70	158.54	7.08%	158.54	18.47%
Total	2477.93	2261.67	101.01%	880.91	102.63%

Distillation Profile THF-Extract					
Fraction [deg C]	Feed [grams]	Product			
		Total Gross		Total Net	
		[grams]	normalized	[grams]	wt. % maf coal
IBP - 182		73.94	67.49	67.49	7.86%
182 - 343	55.23	293.71	268.08	212.85	24.80%
343 - 524	1325.53	1500.22	1369.29	43.76	5.10%
524+		241.27	220.21	220.21	25.65%
TOTAL	1380.76	2109.14	1925.07	544.31	63.41%

M.B.No.: YP-02/C1

GAS ANALYSIS

GAS ANALYSIS																				
First Stage Product Gas (DTM-260)										Second Stage Product Gas (DTM-350)										Second Stage Dissolved Gas (DTM-350)
Name	Number of Samples:						Number of Samples:						Number of Samples:						Number of Samples:	
	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%
Hydrogen	1.670	2.475	2.197	1.742	1.587	0.418	1.693	1.598	1.493	1.467										88.942
CO2	6.265	7.600	7.108	6.209	5.833	1.860	105.958	95.488	98.370	85.950										0.251
CO	50.248	50.953	51.648	53.438	52.967	59.852	0.323	0.353	0.303	0.025										0.428
H2S							0.320	0.485	0.454	0.454										
Methane																				
Ethylene							1.693	1.598	1.493	1.467										1.563
Ethane							0.022	0.025	0.026	0.025										0.025
Propane							0.897	0.637	0.624	0.604										0.641
Propylene							0.452	0.425	0.436	0.422										0.434
i-Butane							0.028	0.028	0.026	0.026										0.027
n-Butane							0.095	0.098	0.098	0.094										0.096
i-Butene							0.078	0.091	0.080	0.072										0.080
n-Butene																				
C2-Butene																				
i-Pentane																				
n-Pentane							0.110	0.114	0.120	0.117										0.115
Nitrogen	40.402	39.384	39.688	40.304	39.650	38.418	2.469	1.753	1.119	1.336										1.669
TOTAL	98.585	100.412	100.642	101.693	100.037	100.548	112.245	101.096	103.150	100.592										104.271

GAS CALCULATIONS

Name	Mol.Weight	First Stage Product Gas (DTM-260)				Second Stage Product Gas (DTM-350)				Second Stage Dissolved Gas (DTM-350)			
		Average Mol Weight:		28.51 (g/mole)		Average Mol Weight:		3.39 (g/mole)		Average Mol Weight:		(g/mole)	
		Volume		Weight (norm.)		Volume		Weight (norm.)		Volume		Weight (norm.)	
		meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%
Hydrogen	2.02	1.68	1.68	4.20	0.12	98.94	94.89	258.89	56.49				
CO2	44.01	5.81	5.79	316.19	8.95	0.25	0.24	14.31	3.12				
CO	28.01	53.18	53.02	1841.30	52.09	0.43	0.41	15.54	3.39				
H2S	34.08												
Methane	16.04					1.56	1.50	32.47	7.09				
Ethylene	28.05					0.02	0.02	0.90	0.20				
Ethane	30.07					0.64	0.61	24.95	5.44				
Propane	44.01					0.43	0.42	24.73	5.40				
Propylene	42.08												
i-Butane	58.12					0.03	0.03	2.05	0.45				
n-Butane	58.12					0.10	0.09	7.25	1.58				
i-Butene	56.11					0.08	0.08	5.83	1.27				
n-Butene	56.11												
C2-Butene	56.11												
i-Pentane	72.15												
n-Pentane	72.15					0.12	0.11	10.77	2.35				
Nitrogen	28.02	39.64	39.51	1372.90	38.84%	1.67	1.60	60.59	0.15				
TOTAL		100.32	100.00	3534.59	61.55	104.27	100.00	458.27	86.93				

First Stage Shift Reaction

		CO	+	H2O	=	CO2	+	H2
Stochiom.	[moles]	6.46		6.46		6.46		6.46
Produced	[moles]					0.72		-4.38
Total	[moles]	6.46		6.46		7.18		2.08
Stochiom.	[grams]	180.95		116.41		284.32		13.05
Produced	[grams]					31.87		-8.85
Total	[grams]	180.95		116.41		316.19		4.20

Hydrocarbon Gases

		First	Second	Dissolved	Total
C1 to C3	[grams]		83.04		83.04
C4 +	[grams]		25.90		25.90
Total	[grams]		108.95		108.95

Hydrogen

		First Up-Take	In	Second Out	Up-Take	Total Up-Take
Hydrogen	[grams]	8.85	272.58	258.89	13.69	22.54

M.B.No.: YP-02/C1

Liquid / Slurry Stream Analysis

[illegible]

RUN No.: DOE-BU-009

M.B.No.: YP-02/C1

	Feed	V-220	Products V-340 (BTMS)	V-330
----- In grams of analysis sample -----				
Total Sample	50.80	13.40	47.27	51.87
Water	3.30	9.15	0.40	0.80
Oils+Asphaltenes	28.56	4.25	39.85	51.07
Oils	25.10	3.73	29.53	49.45
Asphaltenes	3.46	0.51	10.31	1.62
Pre-Asphaltenes			0.09	
Insolubles	18.94		6.93	
IOM	17.75		4.80	
Ash	1.19		2.13	
TOTAL	50.8	13.4	47.27	51.87

----- In wt% of analysis sample -----				
Water	6.50%	68.29%	0.85%	1.54%
Oils+Asphaltenes	56.22%	31.71%	84.30%	98.46%
Oils (on fraction)	87.90%	87.90%	74.12%	96.82%
(on total)	49.42%	27.87%	62.48%	95.33%
Asphalt. (on fract.)	12.10%	12.10%	25.88%	3.18%
(on total)	6.80%	3.84%	21.81%	3.13%
Pre-Asphaltenes			0.19%	
Insolubles	37.28%		14.67%	
IOM (on fraction)	93.74%		69.25%	
(on total)	34.95%		10.16%	
Ash (on fraction)	6.26%		30.75%	
(on total)	2.33%		4.51%	
TOTAL	100.00%	100.00%	100.00%	100.00%

----- In grams of feed / product -----				
Total Feed / Product	2456	1420	1710	224
Water	159.54	970.07	14.47	3.5
Oils+Asphaltenes	1380.76	450.39	1441.45	220.5
Oils (on fraction)	1213.69	395.89	1068.42	213.5
(on total)	1213.69	395.89	1068.42	213.5
Asphalt. (on fract.)	167.07	54.50	373.02	7.0
(on total)	167.07	54.50	373.02	7.0
Pre-Asphaltenes			3.26	
Insolubles	915.70		250.83	
IOM (on fraction)	858.37		173.70	
(on total)	858.37		173.70	
Ash (on fraction)	57.32		77.13	
(on total)	57.32		77.13	
TOTAL (as is)	2456.00	1420.46	1710.00	224.0
TOTAL (MAF)	2239.13	450.39	1618.40	220.5

Distillation Profile THF-Extract					
Fractions deg C	Feed	Products			
		V-220	V-340 (BTMS)	V-330	Total
IBP - 182			0.72	73.22	73.94
182 - 343	55.23	18.02	144.47	131.22	293.71
343 - 524	1325.53	432.38	1051.74	16.10	1500.22
524+			241.27		241.27
TOTAL	1380.76	450.39	1438.20	220.55	2109.14

Feed	Products (nomalized)				Feed	Products (nomalized)			
	V-220	V-340 (BTMS)	V-330	Total		V-220	V-340 (BTMS)	V-330	Total
----- In wt% of total feed (as is) -----					----- In wt% of total feed (MAF) -----				
5.96%	19.05%	0.54%	0.13%	19.72%					
56.54%	16.83%	53.87%	8.24%	78.95%	61.66%	18.36%	58.76%	8.99%	86.11%
49.70%	14.80%	39.93%	7.98%	62.71%	54.20%	16.14%	43.55%	8.70%	68.39%
6.84%	2.04%	13.94%	0.26%	16.24%	7.46%	2.22%	15.21%	0.29%	17.71%
37.50%		9.37%		9.37%	38.34%		10.22%		10.22%
35.15%		6.49%		6.49%			7.08%		7.08%
2.35%		2.88%		2.88%					
100.00%	35.88%	63.91%	8.37%	108.16%	100.00%	18.36%	65.97%	8.99%	93.32%

Run No.: DOE-BU-009

M.B.No.: YP-04/C1

	Date	Time	Date	Time
START:			Sep. 17, 93	05:30
END:			Sep. 17, 93	09:30
DURATION (hours):				4.00

Feed:	Type	Wt% (maf)
Coal	BTH	38.34%
Solvent	V-1074	61.66%
Catalyst 1		
Catalyst 2	Mol	0.90%
Other		

OPERATING PARAMETERS:		
FEED TANK WI-110):	(G)	
Start of Mass Balance		11610.00
End of Mass Balance		9210.00
Rate	(G/HR)	
FIRST STAGE:		
Operating Pressure:	(MPa)	10.34
Feed Temp.:	(C)	
Reactor Temp.:	(C)	
TE-201I	(BTM)	
TE-202I		391
TE-203I		391
TE-204I	(Top)	385
Liquid Level	(mm)	340
Separator Temperature:	(C)	68
CO-Feed Rate:	(L/MIN)	6.99
Water Feed Rate:	(ML/MIN)	2.10
Temperature:	(C)	258
Catalyst Feed:	(ML/MIN)	2.10
Liquid Product (WI-220):	(G)	
Start of Mass Balance		
End of Mass Balance		1292.09
Nitrogen Rate:	(L/MIN)	
SECOND STAGE:		
Operating Pressure:	(MPa)	17.24
Feed Temp.:	(C)	
Reactor Temp.:	(C)	
TE-301I	(BTM)	443
TE-302I		444
TE-303I		440
TE-304I		443
TE-305I		444
TE-306I		441
TE-307I		438
TE-308I	(Top)	435
TE-309I	(VAP)	
Liquid level	(mm)	900
Separator Temperature:	(C)	24
Hydrogen Feed Rate:	(L/MIN)	13.91
Temperature:	(C)	
Liquid Product (WI-330):	(G)	
Start of Mass Balance		1140
End of Mass Balance		1390
Bottoms Product (V-340):	(G)	
Start of Mass Balance		
End of Mass Balance		1410

MEASURED GAS COMPOSITIONS				
NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02	0.47	94.90	
CO2	44.01	2.85	0.21	
CO	28.01	52.92	0.36	
H2S	34.08			
Methane	16.04		1.37	
Ethylene	28.05		0.02	
Ethane	30.07		0.53	
Propane	44.01		0.34	
Propylene	42.08			
i-Butane	58.12		0.02	
n-Butane	58.12		0.08	
i-Butene	56.11		0.07	
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15		0.11	
Nitrogen	28.02	41.98	5.37	
TOTAL		98.22	103.38	
Gas Meter Readings				
Start of M.B. : (L)		DTM-260	DTM-350	DTM-360
End of M.B. : (L)		2314	7521	981
Total : (L)		5820	11526	988
Temperature: (C)		23	23	23
Meter Pressure : (mmHg)		700	700	700
Standard Volume: (L)		2978	3402	6

Run Conditions			
Basis: MAF		First Stage	Second Stage
Pressure	Mpa	10.3	17.2
Temperature	deg C	391	442
Catalyst			Mol
Feed	wt % maf coal	38.34%	
WHSV	(kg / hr) / l	1.95	0.74
CO Rate	kg / kg maf coal	2.50	
	moles / 100g maf coal	8.92	
consumed	moles / 100g maf coal	0.39	
Water Rate	kg / kg maf coal	2.50	
	moles / 100g maf coal	13.88	
Hydrogen	kg / kg maf coal		0.36
	moles / 100g maf coal		17.85
consumed	wt % maf coal	0.63%	2.31%

OVERALL MASS BALANCE					
Material In:		Grams	Material Out:		Grams
	Feed Slurry	2400		First Stage Liquid:	1292
	CO-Gas:	2096		First Stage Product Gas:	2176
	Water:	504		Second Stage Liquid:	250
	Hydrogen:	301		Second Stage Reactor Bottoms:	1410
	Catalyst:	505		Second Stage Product Gas:	414
	S-Agent			Dissolved Gas:	
TOTAL IN:		5806	TOTAL OUT:		5542
Catalyst mfr		22	OVERALL BALANCE:		95.5%

WATER BALANCE		
TOTAL IN:	1160	TOTAL OUT: 1171
		WATER BALANCE: 101.0%

	Coal Conversion	wt. % maf	73.2%
	Ash Balance	wt. %	88.1%

PRODUCT YIELDS					
Description	Total Gross			Total Net	
	[grams]		wt. % maf feed	[grams]	wt. % maf coal
	measured	normalized			
H2O	11.16	12.60	0.58%	12.60	1.50%
COx	55.73	62.89	2.87%	62.89	7.50%
H2S					
C1 to C3	78.32	88.39	4.04%	88.39	10.54%
C4 +	25.60	28.90	1.32%	28.90	3.44%
Oil	1077.45	1216.05	55.58%	30.04	3.58%
Asphaltene	462.04	521.48	23.83%	358.21	42.71%
Preasphalt.	51.33	57.94	2.65%	57.94	6.91%
IOM	198.90	224.48	10.26%	224.48	26.76%
Total	1960.53	2212.72	101.13%	863.45	102.94%

Distillation Profile THF-Extract					
Fraction [deg C]	Feed [grams]	Product			
		Total Gross		Total Net	
		[grams]	normalized		wt. % maf coal
[grams]	[grams]		[grams]		
IBP - 182					
182 - 343					
343 - 524					
524+					
TOTAL					

GAS ANALYSIS

Name	First Stage Product Gas (DTM-260)							Second Stage Product Gas (DTM-350)							Second Stage Dissolved Gas (DTM-350)					
	Number of Samples: 4							Number of Samples: 4							Number of Samples:					
	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%
Hydrogen	0.485	0.362	0.537	0.486			0.468	95.267	103.058	96.850	84.422			94.899						
CO ₂	3.069	2.501	2.988	2.838			2.849	0.217	0.237	0.223	0.169			0.212						
CO	53.486	46.830	56.815	54.546			52.919	0.384	0.419	0.393	0.248			0.361						
H ₂ S																				
Methane								1.445	1.544	1.449	1.022			1.365						
Ethylene								0.019	0.021	0.019	0.017			0.019						
Ethane								0.558	0.591	0.552	0.404			0.526						
Propane								0.362	0.385	0.359	0.264			0.343						
Propylene																				
i-Butane								0.024	0.024	0.022	0.017			0.022						
n-Butane								0.082	0.086	0.080	0.060			0.077						
i-Butene								0.069	0.085	0.065	0.072			0.073						
n-Butene																				
C ₂ -Butene																				
i-Pentane																				
n-Pentane								0.107	0.121	0.110	0.084			0.106						
Nitrogen	42.595	45.752	40.564	39.013			41.981	0.829	0.526	0.466	19.678			5.375						
TOTAL	99.635	95.445	100.904	96.883			98.217	99.363	107.097	100.588	106.457			103.376						

Run No.: DOE-BU-009

M.B.No.: YP-04/C1

GAS CALCULATIONS

Name	Mol.Weight	First Stage Product Gas (DTM-260)				Second Stage Product Gas (DTM-350)				Second Stage Dissolved Gas (DTM-350)			
		Average Mol Weight:		28.35 (g/mole)		Average Mol Weight:		4.18 (g/mole)		Average Mol Weight:		(g/mole)	
		Volume		Weight (norm.)		Volume		Weight (norm.)		Volume		Weight (norm.)	
		meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%
Hydrogen	2.02	0.47	0.48	1.28	0.03	94.90	91.80	281.53	44.33				
CO2	44.01	2.85	2.90	169.64	4.50	0.21	0.20	13.67	2.15				
CO	28.01	52.92	53.88	2005.50	53.23	0.36	0.35	14.85	2.34				
H2S	34.08												
Methane	16.04					1.37	1.32	32.16	5.06				
Ethylene	28.05					0.02	0.02	0.78	0.12				
Ethane	30.07					0.53	0.51	23.24	3.66				
Propane	44.01					0.34	0.33	22.14	3.49				
Propylene	42.08												
i-Butane	58.12					0.02	0.02	1.86	0.29				
n-Butane	58.12					0.08	0.07	6.57	1.03				
i-Butene	56.11					0.07	0.07	5.99	0.94				
n-Butene	56.11												
C2-Butene	56.11												
i-Pentane	72.15												
n-Pentane	72.15					0.11	0.10	11.18	1.76				
Nitrogen	28.02	41.98	42.74	1591.54	42.24%	5.37	5.20	221.18	0.53				
TOTAL		98.22	100.00	3767.96	58.18	103.38	100.00	635.15	65.71				

First Stage Shift Reaction

		CO	+	H2O	=	CO2	+	H2
Stochiom.	[moles]	3.24		3.24		3.24		3.24
Produced	[moles]					0.62		-2.60
Total	[moles]	3.24		3.24		3.85		0.63
Stochiom.	[grams]	90.66		58.32		142.44		6.54
Produced	[grams]					27.20		-5.26
Total	[grams]	90.66		58.32		169.64		1.28

Hydrocarbon Gases

		First	Second	Dissolved	Total
C1 to C3	[grams]		78.32		78.32
C4 +	[grams]		25.60		25.60
Total	[grams]		103.92		103.92

Hydrogen

		First Up-Take	In	Second Out	Up-Take	Total Up-Take
Hydrogen	[grams]	5.26	300.92	281.53	19.39	24.65

Run No.: DOE-BU-009	M.B.No.: YP-04/C1
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Run No.: DOE-BU-009	M.B.No.: YP-04/C1
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Liquid / Slurry Stream Analysis

[illegible]

Run No.: DOE-BU-009

M.B.No.: YP-04/C1

	Feed	Products		
		V-220	V-340 (BTTMS)	V-330
----- in grams of analysis sample -----				
Total Sample	50.80	15.12	51.64	57.01
Water	3.30	12.89	0.20	1.30
Oils+Asphaltenes	28.56	2.23	40.47	55.71
Oils	25.10	1.96	24.68	53.92
Asphaltenes	3.46	0.27	15.79	1.79
Pre-Asphaltenes			1.88	
Insolubles	18.94		9.09	
IOM	17.75		7.28	
Ash	1.19		1.81	
TOTAL	50.8	15.12	51.64	57.01
----- in wt% of analysis sample -----				
Water	6.50%	85.28%	0.39%	2.28%
Oils+Asphaltenes	56.22%	14.72%	78.37%	97.72%
Oils (on fraction)	87.90%	87.90%	60.98%	96.79%
(on total)	49.42%	12.94%	47.79%	94.58%
Asphalt. (on fract.)	12.10%	12.10%	39.02%	3.21%
(on total)	6.80%	1.78%	30.58%	3.14%
Pre-Asphaltenes			3.64%	
Insolubles	37.28%		17.61%	
IOM (on fraction)	93.74%		80.12%	
(on total)	34.95%		14.11%	
Ash (on fraction)	6.26%		19.88%	
(on total)	2.33%		3.50%	
TOTAL	100.00%	100.00%	100.00%	100.00%
----- In grams of feed / product -----				
Total Feed / Product	2400	1292	1410	250
Water	155.91	1101.85	5.46	5.7
Oils+Asphaltenes	1349.28	190.24	1104.96	244.3
Oils (on fraction)	1186.02	167.22	673.78	236.5
(on total)	1186.02	167.22	673.78	236.5
Asphalt. (on fract.)	163.26	23.02	431.18	7.8
(on total)	163.26	23.02	431.18	7.8
Pre-Asphaltenes			51.33	
Insolubles	894.82		248.25	
IOM (on fraction)	838.80		198.90	
(on total)	838.80		198.90	
Ash (on fraction)	56.02		49.35	
(on total)	56.02		49.35	
TOTAL (as is)	2400.00	1292.09	1410.00	250.0
TOTAL (MAF)	2188.08	190.24	1355.19	244.3

Distillation Profile THF-Extract					
Fractions deg C	Feed	Products			
		V-220	V-340 (BTMS)	V-330	Total
IBP - 182					
182 - 343					
343 - 524					
524+					
TOTAL					

Feed	Products (normalized)				Feed	Products (normalized)			
	V-220	V-340 (BTMS)	V-330	Total		V-220	V-340 (BTMS)	V-330	Total
----- In wt% of total feed (as is) -----					----- In wt% of total feed (MAF) -----				
7.27%	30.59%	0.25%	0.27%	31.11%					
55.75%	8.87%	51.53%	11.39%	71.80%	61.66%	9.81%	56.99%	12.60%	79.41%
49.01%	7.80%	31.42%	11.03%	50.25%	54.20%	8.63%	34.75%	12.20%	55.58%
6.75%	1.07%	20.11%	0.37%	21.55%	7.46%	1.19%	22.24%	0.40%	23.83%
		2.39%		2.39%					
36.98%		11.58%		11.58%	38.34%		12.80%		12.80%
34.66%		9.28%		9.28%			10.26%		10.26%
2.31%		2.30%		2.30%					
100.00%	39.46%	65.76%	11.66%	116.88%	100.00%	9.81%	69.90%	12.60%	92.32%

RUN No.: DOE-BU-009

M.B.No.: YP-05/C1

	Date	Time	Date	Time
START:			Sep. 17, 93	13:00
END:			Sep. 17, 93	19:00
DURATION (hours):				6.00

Feed:	Type	Wt% (maf)
Coal	BTH	37.10%
Solvent	V-1074	62.90%
Catalyst 1		
Catalyst 2	Mol	0.90%
Other		

OPERATING PARAMETERS:		
FEED TANK WI-110:	(G)	
Start of Mass Balance		6410.00
End of Mass Balance		2860.00
Rate	(G/HR)	
FIRST STAGE:		
Operating Pressure:	(MPa)	10.34
Feed Temp.:	(C)	
Reactor Temp.:	(C)	
TE-201I	(BTTM)	
TE-202I		392
TE-203I		392
TE-204I	(Top)	388
Liquid Level	(mm)	340
Separator Temperature:	(C)	70
CO-Feed Rate:	(L/MIN)	6.48
Water Feed Rate:	(ML/MIN)	2.31
Temperature:	(C)	264
Catalyst Feed:	(ML/MIN)	1.68
Liquid Product (WI-220):	(G)	
Start of Mass Balance		
End of Mass Balance		2238.01
Nitrogen Rate:	(L/MIN)	
SECOND STAGE:		
Operating Pressure:	(MPa)	13.79
Feed Temp.:	(C)	86
Reactor Temp.:	(C)	
TE-301I	(BTTM)	443
TE-302I		443
TE-303I		439
TE-304I		443
TE-305I		443
TE-306I		438
TE-307I		435
TE-308I	(Top)	432
TE-309I	(VAP)	
Liquid level	(mm)	900
Separator Temperature:	(C)	24
Hydrogen Feed Rate:	(L/MIN)	13.50
Temperature:	(C)	
Liquid Product (WI-330):	(G)	
Start of Mass Balance		1040
End of Mass Balance		1514
Bottoms Product (V-340):	(G)	
Start of Mass Balance		
End of Mass Balance		2150

MEASURED GAS COMPOSITIONS				
NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02	0.50	90.02	
CO2	44.01	2.80	0.19	
CO	28.01	52.09	0.25	
H2S	34.08		0.31	
Methane	16.04		1.12	
Ethylene	28.05		0.02	
Ethane	30.07		0.44	
Propane	44.01		0.29	
Propylene	42.08			
i-Butane	58.12		0.02	
n-Butane	58.12		0.07	
i-Butene	56.11		0.09	
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15		0.09	
Nitrogen	28.02	42.63	11.50	
TOTAL		98.02	104.40	
Gas Meter Readings				
	DTM-260	DTM-350	DTM-360	
Start of M.B. : (L)	8560	5280	994	
End of M.B. : (L)	13556	11553	1015	
Total : (L)	4996	6273	21	
Temperature: (C)	24	24	24	
Meter Pressure : (mmHg)	700	700	700	
Standard Volume: (L)	4230	5311	18	

Run Conditions			
Basis: MAF		First Stage	Second Stage
Pressure	Mpa	10.3	13.8
Temperature	deg C	392	442
Catalyst			Mol
Feed	wt % maf coal	37.10%	
WHSV	(kg / hr) / l	1.92	0.72
CO Rate	kg / kg maf coal	2.41	
	moles / 100g maf coal	8.62	
consumed	moles / 100g maf coal	0.32	
Water Rate	kg / kg maf coal	2.41	
	moles / 100g maf coal	13.40	
Hydrogen	kg / kg maf coal		0.36
	moles / 100g maf coal		18.03
consumed	wt % maf coal	0.48%	2.09%

RUN No.: DOE-BU-009 M.B.No.: YP-05/C1

OVERALL MASS BALANCE					
Material In:		Grams		Material Out:	Grams
	Feed Slurry	3550		First Stage Liquid:	2238
	CO-Gas:	2918		First Stage Product Gas:	3049
	Water:	833		Second Stage Liquid:	474
	Hydrogen:	438		Second Stage Reactor Bottoms:	2150
	Catalyst:	605		Second Stage Product Gas:	611
	S-Agent			Dissolved Gas:	
TOTAL IN:		8344		TOTAL OUT:	8521
Catalyst mf		32		OVERALL BALANCE:	102.1%
WATER BALANCE					
TOTAL IN:		1645		TOTAL OUT:	1672
				WATER BALANCE:	101.7%
		Coal Conversion	wt.% maf	74.6%	
		Ash Balance	wt.%	89.7%	

PRODUCT YIELDS					
Description	Total Gross		wt. % maf feed	Total Net	
	[grams]			[grams]	wt. % maf coal
	measured	normalized			
H2O	27.53	26.21	0.80%	26.21	2.17%
COx	101.47	96.58	2.96%	96.58	7.99%
H2S					
C1 to C3	100.80	95.94	2.94%	95.94	7.94%
C4 +	38.83	36.96	1.13%	36.96	3.06%
Oil	1797.64	1710.95	52.51%	-90.75	-7.51%
Asphaltene	708.57	674.40	20.70%	426.38	35.28%
Preasphalt.	358.55	341.26	10.47%	341.26	28.23%
IOM	322.88	307.31	9.43%	307.31	25.42%
Total	3456.27	3289.60	100.96%	1239.88	102.58%

Distillation Profile THF-Extract					
Fraction [deg C]	Feed [grams]	Product			
		Total Gross		Total Net	
		[grams]	normalized [grams]	[grams]	wt. % maf coal
IBP - 182					
182 - 343					
343 - 524					
524+					
TOTAL					

GAS ANALYSIS

Name	First Stage Product Gas (DTM-260)							Second Stage Product Gas (DTM-350)							Second Stage Dissolved Gas (DTM-350)					
	Number of Samples: 6							Number of Samples: 6							Number of Samples:					
	vol %	vol %	vol %	vol %	vol %	vol %	Av.vol.%	vol %	vol %	vol %	vol %	vol %	vol %	Av.vol.%	vol %	vol %	vol %	vol %	vol %	Av.vol.%
Hydrogen	0.387	0.468	0.494	0.525	0.598	0.505	0.496	95.816	87.774	88.738	85.479	90.990	91.323	90.020						
CO2	2.298	2.588	2.638	3.024	3.168	3.064	2.797	0.188	0.182	0.180	0.171	0.202	0.188	0.185						
CO	43.636	48.455	49.711	55.946	56.984	57.803	52.089	0.241	0.272	0.279	0.267	0.098	0.321	0.246						
H2S								1.874						0.312						
Methane								1.070	1.054	1.084	1.048	1.188	1.265	1.118						
Ethylene								0.020	0.016	0.018	0.016	0.019	0.019	0.018						
Ethane								0.429	0.420	0.425	0.408	0.493	0.481	0.443						
Propane								0.277	0.272	0.278	0.267	0.319	0.312	0.288						
Propylene																				
i-Butane								0.018	0.018	0.020	0.019	0.023	0.023	0.020						
n-Butane								0.063	0.062	0.064	0.061	0.076	0.074	0.067						
i-Butene								0.060	0.077	0.143	0.116	0.087	0.085	0.095						
n-Butene																				
C2-Butene																				
i-Pentane																				
n-Pentane								0.091	0.089	0.093	0.089	0.099	0.100	0.094						
Nitrogen	46.313	43.196	44.236	40.419	40.687	40.958	42.635	19.076	18.666	15.841	15.216	0.055	0.132	11.498						
TOTAL	92.634	94.707	97.079	99.914	101.437	102.330	98.017	119.223	108.902	107.163	103.157	93.649	94.323	104.403						

RUN No.: DOE-BU-009

M.B.No.: YP-05/C1

GAS CALCULATIONS

Name	Mol.Weight	First Stage Product Gas (DTM-260)				Second Stage Product Gas (DTM-350)				Second Stage Dissolved Gas (DTM-350)			
		Average Mol Weight: 28.34 (g/mole)				Average Mol Weight: 5.66 (g/mole)				Average Mol Weight: (g/mole)			
		Volume		Weight (norm.)		Volume		Weight (norm.)		Volume		Weight (norm.)	
		meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%
Hydrogen	2.02	0.50	0.51	1.93	0.04	90.02	86.22	412.78	30.76				
CO2	44.01	2.80	2.85	237.02	4.43	0.19	0.18	18.50	1.38				
CO	28.01	52.09	53.14	2809.64	52.53	0.25	0.24	15.66	1.17				
H2S	34.08					0.31	0.30	24.16	1.80				
Methane	16.04					1.12	1.07	40.71	3.03				
Ethylene	28.05					0.02	0.02	1.15	0.09				
Ethane	30.07					0.44	0.42	30.22	2.25				
Propane	44.01					0.29	0.28	28.72	2.14				
Propylene	42.08												
i-Butane	58.12					0.02	0.02	2.66	0.20				
n-Butane	58.12					0.07	0.06	8.80	0.66				
i-Butene	56.11					0.09	0.09	12.06	0.90				
n-Butene	56.11												
C2-Butene	56.11												
i-Pentane	72.15												
n-Pentane	72.15					0.09	0.09	15.31	1.14				
Nitrogen	28.02	42.63	43.50	2300.50	43.01%	11.50	11.01	731.32	1.20				
TOTAL		98.02	100.00	5349.09	57.42	104.40	100.00	1342.06	46.70				

First Stage Shift Reaction

		CO	+	H2O	=	CO2	+	H2
Stochiom.	[moles]	3.86		3.86		3.86		3.86
Produced	[moles]					1.53		-2.90
Total	[moles]	3.86		3.86		5.39		0.96
Stochiom.	[grams]	108.01		69.49		169.71		7.79
Produced	[grams]					67.31		-5.86
Total	[grams]	108.01		69.49		237.02		1.93

Hydrocarbon Gases

		First	Second	Dissolved	Total
C1 to C3	[grams]		100.80		100.80
C4 +	[grams]		38.83		38.83
Total	[grams]		139.63		139.63

Hydrogen

		First Up-Take	In	Second Out	Up-Take	Total Up-Take
Hydrogen	[grams]	5.86	438.07	412.78	25.29	31.15

Liquid / Slurry Stream Analysis						
	Coal	Solvent	Feed	V-220	V-340 (BTMS)	V-330
Type	BTH	V-1074				
Total Feed / Product			3550	2238	2150	474
Total Sample			50.35	23.72	49.89	48.68
Water			3	16.69	0.3	1.5
Oils+Asphaltenes			29.07	7.03	40.43	47.18
Oils	100.00%	87.90%	87.90%	87.90%	64.41%	98.21%
Asphaltene		12.10%	12.10%	12.10%	35.59%	1.79%
Pre-Asphaltenes					8.32	
Insolubles			18.59		9.25	
IOM			92.12%		80.82%	
Ash			6.21%		18.19%	
Moisture			1.68%		1.00%	
Distill. THF-Extract						
IBP - 182 deg C						
182 - 343						
343 - 524						
524+						
Elemental Analysis: [wt.%]						
Carbon			87.80%			
Hydrogen			8.50%			
Nitrogen			0.85%			
Sulphur			0.05%			
Oxygen (diff)			2.80%			

	Feed	V-220	Products V-340 (BTMS)	V-330
----- in grams of analysis sample -----				
Total Sample	50.35	23.72	49.89	48.68
Water	3.00	16.69	0.30	1.50
Oils+Asphaltenes	29.07	7.03	32.11	47.18
Oils	25.55	6.18	17.72	46.34
Asphaltenes	3.52	0.85	14.39	0.84
Pre-Asphaltenes			8.32	
Insolubles	18.28		9.16	
IOM	17.14		7.49	
Ash	1.14		1.67	
TOTAL	50.35	23.72	49.89	48.68

----- in wt% of analysis sample -----				
Water	5.96%	70.38%	0.60%	3.08%
Oils+Asphaltenes	57.74%	29.62%	64.37%	96.92%
Oils (on fraction)	87.90%	87.90%	55.19%	98.21%
(on total)	50.75%	26.04%	35.52%	95.18%
Asphalt. (on fract.)	12.10%	12.10%	44.81%	1.79%
(on total)	6.99%	3.58%	28.84%	1.73%
Pre-Asphaltenes			16.68%	
Insolubles	36.30%		18.36%	
IOM (on fraction)	93.79%		81.82%	
(on total)	34.05%		15.02%	
Ash (on fraction)	6.21%		18.19%	
(on total)	2.25%		3.34%	
TOTAL	100.00%	100.00%	100.00%	100.00%

----- in grams of feed / product -----				
Total Feed / Product	3550	2238	2150	474
Water	211.52	1575.08	12.93	14.6
Oils+Asphaltenes	2049.72	662.93	1383.88	459.4
Oils (on fraction)	1801.70	582.72	763.75	451.2
(on total)	1801.70	582.72	763.75	451.2
Asphalt. (on fract.)	248.02	80.21	620.13	8.2
(on total)	248.02	80.21	620.13	8.2
Pre-Asphaltenes			358.55	
Insolubles	1288.76		394.64	
IOM (on fraction)	1208.73		322.88	
(on total)	1208.73		322.88	
Ash (on fraction)	80.03		71.77	
(on total)	80.03		71.77	
TOTAL (as is)	3550.00	2238.01	2150.00	474.0
TOTAL (MAF)	3258.45	662.93	2065.31	459.4

Distillation Profile THF-Extract

Fractions deg C	Feed	Products			
		V-220	V-340 (BTMS)	V-330	Total
IBP - 182					
182 - 343					
343 - 524					
524+					
TOTAL					

Feed	Products (normalized)				Feed	Products (normalized)			
	V-220	V-340 (BTMS)	V-330	Total		V-220	V-340 (BTMS)	V-330	Total
----- in wt% of total feed (as is) -----					----- in wt% of total feed (MAF) -----				
5.69%	21.82%	0.35%	0.39%	22.56%	62.90%	19.36%	40.42%	13.42%	73.21%
57.90%	17.82%	37.21%	12.35%	67.39%	55.29%	17.02%	22.31%	13.18%	52.51%
50.90%	15.67%	20.54%	12.13%	48.33%	7.01%	2.34%	18.11%	0.24%	20.70%
7.01%	2.16%	16.67%	0.22%	19.05%					
36.41%		9.64%		9.64%					
		10.61%		10.61%			11.53%		11.53%
34.15%		8.68%		8.68%			9.43%		9.43%
2.26%		1.93%		1.93%					
100.00%	39.65%	57.81%	12.74%	110.20%	100.00%	19.36%	60.33%	13.42%	93.11%

SUMMARY OF BENCH UNIT MASS BALANCES

(forced water balance and kept V-220 oil as measured)

RUN No.:	DOE-BU-010				DOE-BU-011		
M.B.No.:	YP-01/C1	YP-02/C1	YP-03/C1	YP-04/C1	YP-01/C1	YP-02/C2	YP-03/C1
Coal	BTH	BTH	BTH	BTH	BTH	BTH	BTH
wt % maf	36.48%	37.93%	36.06%	36.06%	36.40%	37.51%	39.64%
First Stage:							
Feed Rate (kg / hr) / IWHSV	1.74	1.78	2.00	2.13	1.18	1.20	1.49
Pressure Mpa	10.34	15.17	10.34	10.34	10.34	10.34	10.34
Temperature deg C	392	390	410	412	410	411	410
Catalyst	Aluminate	Aluminate	Aluminate	Aluminate	Aluminate	Aluminate	Aluminate
CO Rate kg / kg maf coal	1.42	1.38	1.25	2.28	1.75	3.07	2.39
moles / 100g maf coal	5.08	4.92	4.47	8.14	6.26	10.95	8.52
consumed moles / 100g maf coal	0.42	0.55	0.44	0.82	0.82	1.30	1.10
Water Rate kg / kg maf coal	1.42	1.38	1.25	2.28	1.75	3.07	2.39
moles / 100g maf coal	7.90	7.65	6.95	12.66	9.74	17.03	13.25
Hydrogen wt % maf coal	-0.89%	-0.76%	0.56%	1.11%	1.04%	1.60%	1.36%
Second Stage:							
Feed Rate (kg / hr) / IWHSV							
Pressure Mpa							
Temperature deg C							
Catalyst							
Hydrogen kg / kg maf coal							
moles / 100g maf coal							
consumed wt % maf coal							
Coal Conversion (wt % maf coal)	54.93%	61.68%	67.88%	67.94%	66.63%	75.89%	72.86%
Product Yield (wt % maf coal)							
H2O							
COx	10.81%	9.79%	10.99%	8.42%	11.05%	11.35%	11.35%
H2S							
C1 to C3	0.20%	0.27%	0.44%	0.10%	0.67%	0.99%	0.80%
Pentane soluble (incl. C4)	4.74%	10.98%	15.34%	8.66%	11.79%	20.91%	16.47%
Asphaltenes	30.91%	33.13%	31.35%	43.39%	35.92%	36.06%	36.79%
Preasphaltenes	7.38%	6.75%	10.32%	8.50%	8.24%	8.18%	8.81%
IOM	45.07%	38.32%	32.12%	32.06%	33.37%	24.11%	27.14%
TOTAL	99.11%	99.24%	99.24%	100.56%	101.04%	101.60%	101.36%

NOTE:

RUN No.: DOE-BU-010

M.B.No.: YP-01/C1

	Date	Time	Date	Time
START:			Oct. 19, 93	20:00
END:			Oct. 19, 93	24:00
DURATION (hours):				4.00

Feed:	Type	Wt% (maf)
Coal	BTH	36.48%
Solvent	V-1074	63.52%
Catalyst 1	Aluminate	10.00%
Catalyst 2		
Other		

OPERATING PARAMETERS:

FEED TANK WI-110):	(G)	
Start of Mass Balance		3880.00
End of Mass Balance		1610.00
Rate	(G/HR)	567.5
FIRST STAGE:		
Operating Pressure:	(MPa)	10.34
Feed Temp.:	(C)	
Reactor Temp.:	(C)	
TE-201I	(BTTM)	
TE-202I		392
TE-203I		392
TE-204I	(Top)	388
Liquid Level	(mm)	360
Separator Temperature:	(C)	70
CO-Feed Rate:	(L/MIN)	3.57
Water Feed Rate:	(ML/MIN)	1.36
Temperature:	(C)	264
Catalyst Feed:	(ML/MIN)	3.54
Liquid Product (WI-220):	(G)	
Start of Mass Balance		
End of Mass Balance		1317
Nitrogen Rate:	(L/MIN)	3.91
SECOND STAGE:		
Operating Pressure:	(MPa)	
Feed Temp.:	(C)	
Reactor Temp.:	(C)	
TE-301I	(BTTM)	
TE-302I		
TE-303I		
TE-304I		
TE-305I		
TE-306I		
TE-307I		
TE-308I	(Top)	
TE-309I	(VAP)	
Liquid level	(mm)	
Separator Temperature:	(C)	
Hydrogen Feed Rate:	(L/MIN)	
Temperature:	(C)	
Liquid Product (WI-330):	(G)	
Start of Mass Balance		
End of Mass Balance		
Bottoms Product (V-340):	(G)	
Start of Mass Balance		
End of Mass Balance		2070

MEASURED GAS COMPOSITIONS

NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02	5.84		0.50
CO2	44.01	4.52		21.73
CO	28.01	31.51		17.57
H2S	34.08			
Methane	16.04	0.09		0.14
Ethylene	28.05			
Ethane	30.07			
Propane	44.01			
Propylene	42.08			
i-Butane	58.12			
n-Butane	58.12			
i-Butene	56.11			
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15			
Nitrogen	28.02			
TOTAL		41.95		39.93
Gas Meter Readings				
DTM-260			DTM-360	DTM-350
Start of M.B. : (L)	7305			1401
End of M.B. : (L)	9598			1404
Total : (L)	2293			3
Temperature: (C)	21		21	21
Meter Pressure : (mmHg)	708		708	708
Standard Volume: (L)	1985			3
Nitrogen to R-200: (L)	938			
Net Gas Out: (L)	1047			3

Run Conditions

Basis: MAF		First Stage	Second Stage
Pressure	Mpa	10.3	
Temperature	deg C	392	
Catalyst		Aluminate	
Feed	wt % maf coal	36.48%	
WHSV	(kg / hr) / l	1.74	
CO Rate	kg / kg maf coal	1.42	
	moles / 100g maf coal	5.08	
consumed	moles / 100g maf coal	0.42	
Water Rate	kg / kg maf coal	1.42	
	moles / 100g maf coal	7.90	
Hydrogen	kg / kg maf coal		
	moles / 100g maf coal		
consumed	wt % maf coal	-0.89%	

RUN No.: DOE-BU-010 M.B.No.: YP-01/C1

OVERALL MASS BALANCE					
Material In:		Grams		Material Out:	Grams
	Feed Slurry	2270		First Stage Liquid:	1317
	CO-Gas:	1072		First Stage Product Gas:	1219
	Water:	327		Second Stage Liquid:	
	Hydrogen:			Second Stage Reactor Bottoms:	2070
	Catalyst:	849		Second Stage Product Gas:	
				Dissolved Gas:	4
TOTAL IN:		4517		TOTAL OUT:	4610
Catalyst mf		85		OVERALL BALANCE:	102.1%
WATER BALANCE					
TOTAL IN:		1248		TOTAL OUT:	1248
				WATER BALANCE:	100.0%
		Coal Conversion	wt. % maf	54.9%	
		Ash Balance	wt. %	87.7%	

PRODUCT YIELDS					
Description	Total Gross			Total Net	
	[grams]		wt. % maf feed	[grams]	wt. % maf coal
	measured	----- normalized -----			
H2O					
COx	85.71	81.39	3.94%	81.39	10.81%
H2S					
C1 to C3	1.61	1.53	0.07%	1.53	0.20%
C4 +					
Oil	1251.12	1188.06	57.56%	35.71	4.74%
Asphaltene	412.19	391.41	18.96%	232.78	30.91%
Preasphalt.	58.50	55.56	2.69%	55.56	7.38%
IOM	357.40	339.39	16.44%	339.39	45.07%
Total	2166.54	2057.34	99.68%	746.36	99.11%

Distillation Profile THF-Extract					
Fraction [deg C]	Feed [grams]	Product			
		Total Gross		Total Net	
		[grams]	normalized	[grams]	wt. % maf coal
IBP - 182					
182 - 343					
343 - 524					
524+					
TOTAL					

RUN No.: DOE-BU-010

M.B.No.: YP-01/C1

GAS ANALYSIS

Name	First Stage Product Gas (DTM-260)							Second Stage Product Gas (DTM-360)							Dissolved Gas (DTM-350)						
	Number of Samples: 6							Number of Samples: 1							Number of Samples: 2						
	vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	Av. vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	Av. vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	Av. vol. %
Hydrogen	5.918	5.892	6.002	5.985	5.379	5.839	5.836								0.493	0.501					0.497
CO ₂	4.835	4.529	4.487	4.435	4.122	4.752	4.523								21.741	21.709					21.725
CO	27.048	27.321	32.984	34.065	32.887	34.747	31.505								17.838	17.510					17.573
H ₂ S																					
Methane	0.119	0.096	0.082	0.078	0.077	0.087	0.090								0.137	0.141					0.139
Ethylene																					
Ethane																					
Propane																					
Propylene																					
i-Butane																					
n-Butane																					
i-Butene																					
n-Butene																					
C2-Butene																					
i-Pentane																					
n-Pentane																					
Nitrogen																					
TOTAL	37.918	37.838	43.535	44.563	42.445	45.425	41.954								40.007	39.881					39.934

RUN No.: DOE-BU-010

M.B.No.: YP-01/C1

GAS CALCULATIONS

Name	Mol.Weight	First Stage Product Gas (DTM-260)				Second Stage Product Gas (DTM-360)				Dissolved Gas (DTM-350)			
		Average Mol Weight:		13.77 (g/mole)		Average Mol Weight:		(g/mole)		Average Mol Weight:		36.35 (g/mole)	
		Volume		Weight (norm.)		Volume		Weight (norm.)		Volume		Weight (norm.)	
		meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%
Hydrogen	2.02	5.84	13.91	13.13	1.08					0.50	1.24	0.00	0.07
CO2	44.01	4.52	10.78	221.67	18.18					21.73	54.40	2.77	65.87
CO	28.01	31.51	75.09	982.63	80.61					17.57	44.01	1.43	33.91
H2S	34.08												
Methane	16.04	0.09	0.21	1.60	0.13					0.14	0.35	0.01	0.15
Ethylene	28.05												
Ethane	30.07												
Propane	44.01												
Propylene	42.08												
i-Butane	58.12												
n-Butane	58.12												
i-Butene	56.11												
n-Butene	56.11												
C2-Butene	56.11												
i-Pentane	72.15												
n-Pentane	72.15												
Nitrogen	28.02												
TOTAL		41.95	100.00	1219.04	100.00					39.93	100.00	4.21	100.00

First Stage Shift Reaction

		CO	+	H2O	=	CO2	+	H2
Stochiom.	[moles]	3.18		3.18		3.18		3.18
Produced	[moles]					1.85		3.31
Total	[moles]	3.18		3.18		5.04		6.50
Stochiom.	[grams]	89.21		57.39		140.16		6.43
Produced	[grams]					81.51		6.69
Total	[grams]	89.21		57.39		221.67		13.13

Hydrocarbon Gases

		First	Second	Dissolved	Total
C1 to C3	[grams]	1.60		0.01	1.61
C4 +	[grams]				
Total	[grams]	1.60		0.01	1.61

Hydrogen

		First Up-Take	In	Second Out	Up-Take	Total Up-Take
Hydrogen	[grams]	-6.69				-6.69

RUN No.: DOE-BU-010 **M.B.No.:** YP-01/C1

M.B.No.: YP-01/C1

Liquid / Slurry Stream Analysis

[illegible]

RUN No.: DOE-BU-010

M.B.No.: YP-01/C1

	Feed	V-220	Products V-340 (BTTMS)	V-330
----- in grams of analysis sample -----				
Total Sample	49.13	16.10	46.35	
Water	3.40	14.50	0.10	
Oils+Asphaltenes	28.37	1.60	34.31	
Oils	24.94	1.54	25.20	
Asphaltenes	3.43	0.06	9.11	
Pre-Asphaltenes			1.31	
Insolubles	17.36		10.63	
IOM	16.30		8.00	
Ash	1.06		2.63	
TOTAL	49.13	16.1	46.35	
----- in wt% of analysis sample -----				
Water	6.92%	90.06%	0.22%	
Oils+Asphaltenes	57.75%	9.94%	74.03%	
Oils (on fraction)	87.90%	96.00%	73.44%	
(on total)	50.76%	9.54%	54.37%	
Asphalt. (on fract.)	12.10%	4.00%	26.56%	
(on total)	6.99%	0.40%	19.66%	
Pre-Asphaltenes			2.83%	
Insolubles	35.33%		22.93%	
IOM (on fraction)	93.91%		75.30%	
(on total)	33.17%		17.27%	
Ash (on fraction)	6.10%		24.70%	
(on total)	2.15%		5.66%	
TOTAL	100.00%	100.00%	100.00%	
----- in grams of feed / product -----				
Total Feed / Product	2270	1317	2070	
Water	157.1	1185.9	4.5	
Oils+Asphaltenes	1311.0	130.9	1532.4	
Oils (on fraction)	1152.3	125.7	1125.4	
(on total)	1152.3	125.7	1125.4	
Asphalt. (on fract.)	158.6	5.2	407.0	
(on total)	158.6	5.2	407.0	
Pre-Asphaltenes			58.5	
Insolubles	801.9		474.6	
IOM (on fraction)	753.1		357.4	
(on total)	753.1		357.4	
Ash (on fraction)	48.9		117.2	
(on total)	48.9		117.2	
TOTAL (as is)	2270.0	1316.8	2070.0	
TOTAL (MAF)	2064.0	130.9	1948.3	

Distillation Profile THF-Extract					
Fractions deg C	Feed	Products			
		V-220	V-340 (BTTMS)	V-330	Total
IBP - 182					
182 - 343					
343 - 524					
524+					
TOTAL					

Feed	V-220	Products (nomalized) V-340 (BTTMS)	V-330	Total	Feed	V-220	Products (nomalized) V-340 (BTTMS)	V-330	Total
----- in wt% of total feed (as is) -----					----- in wt% of total feed (MAF) -----				
6.59%	38.47%	0.19%		38.66%	63.52%	6.02%	70.50%		76.52%
57.95%	5.50%	64.33%		69.82%					
50.94%	5.28%	47.24%		52.52%	55.83%	5.78%	51.78%		57.56%
7.01%	0.22%	17.08%		17.30%	7.69%	0.24%	18.72%		18.96%
		2.46%		2.46%					
35.45%		19.92%		19.92%	36.48%		21.84%		21.84%
33.29%		15.00%		15.00%			16.44%		16.44%
2.16%		4.92%		4.92%					
100.00%	43.97%	86.90%		130.87%	100.00%	6.02%	89.64%		95.66%

RUN No.: DOE-BU-010

M.B.No.: YP-02/C1

	Date	Time	Date	Time
START:			Oct. 20, 93	3:00
END:			Oct. 20, 93	7:00
DURATION (hours):				4.00

Feed:	Type	Wt% (maf)
Coal	BTH	37.93%
Solvent	V-1074	62.07%
Catalyst 1	Aluminate	10.00%
Catalyst 2		
Other		

OPERATING PARAMETERS:

FEED TANK WI-110):	(G)	
Start of Mass Balance		6920.00
End of Mass Balance		4590.00
Rate	(G/HR)	582.5
FIRST STAGE:		
Operating Pressure:	(MPa)	15.17
Feed Temp.:	(C)	
Reactor Temp.:	(C)	
TE-201I	(BTM)	
TE-202I		390
TE-203I		390
TE-204I	(Top)	390
Liquid Level	(mm)	360
Separator Temperature:	(C)	70
CO-Feed Rate:	(L/MIN)	3.73
Water Feed Rate:	(ML/MIN)	1.34
Temperature:	(C)	264
Catalyst Feed:	(ML/MIN)	3.45
Liquid Product (WI-220):	(G)	
Start of Mass Balance		
End of Mass Balance		1220.91
Nitrogen Rate:	(L/MIN)	3.90
SECOND STAGE:		
Operating Pressure:	(MPa)	
Feed Temp.:	(C)	
Reactor Temp.:	(C)	
TE-301I	(BTM)	
TE-302I		
TE-303I		
TE-304I		
TE-305I		
TE-306I		
TE-307I		
TE-308I	(Top)	
TE-309I	(VAP)	
Liquid level	(mm)	
Separator Temperature:	(C)	
Hydrogen Feed Rate:	(L/MIN)	
Temperature:	(C)	
Liquid Product (WI-330):	(G)	
Start of Mass Balance		
End of Mass Balance		
Bottoms Product (V-340):	(G)	
Start of Mass Balance		
End of Mass Balance		2044

MEASURED GAS COMPOSITIONS

NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02	8.50		0.50
CO2	44.01	6.98		21.73
CO	28.01	40.24		17.57
H2S	34.08			
Methane	16.04	0.15		0.14
Ethylene	28.05			
Ethane	30.07			
Propane	44.01			
Propylene	42.08			
i-Butane	58.12			
n-Butane	58.12			
i-Butene	56.11			
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15			
Nitrogen	28.02			
TOTAL		55.88		39.934
Gas Meter Readings				
DTM-260			DTM-360	DTM-350
Start of M.B. : (L)	1141			2017
End of M.B. : (L)	3489			2020
Total : (L)	2348			3
Temperature: (C)	21		21	21
Meter Pressure : (mmHg)	711		711	711
Standard Volume: (L)	2041			3
Nitrogen to R-200: (L)	935			
Net Gas Out: (L)	1106			3

Run Conditions

Basis: MAF		First Stage	Second Stage
Pressure	Mpa	15.2	
Temperature	deg C	390	
Catalyst		Aluminate	
Feed	wt % maf coal	37.93%	
WHSV	(kg / hr) / l	1.78	
CO Rate	kg / kg maf coal	1.38	
	moles / 100g maf coal	4.92	
consumed	moles / 100g maf coal	0.55	
Water Rate	kg / kg maf coal	1.38	
	moles / 100g maf coal	7.65	
Hydrogen	kg / kg maf coal		
	moles / 100g maf coal		
consumed	wt % maf coal	-0.76%	

RUN No.: DOE-BU-010 M.B.No.: YP-02/C1

OVERALL MASS BALANCE					
Material In:		Grams		Material Out:	Grams
	Feed Slurry	2330		First Stage Liquid:	1221
	CO-Gas:	1120		First Stage Product Gas:	1284
	Water:	321		Second Stage Liquid:	
	Hydrogen:			Second Stage Reactor Bottoms:	2044
	Catalyst:	829		Second Stage Product Gas:	
				Dissolved Gas:	4
TOTAL IN:		4599		TOTAL OUT:	4553
Catalyst mlf		83		OVERALL BALANCE:	99.0%
WATER BALANCE					
TOTAL IN:		1200		TOTAL OUT:	1200
				WATER BALANCE:	100.0%
		Coal Conversion wt.% maf		61.7%	
		Ash Balance wt. %		63.3%	

PRODUCT YIELDS					
Description	Total Gross			Total Net	
	[grams]		wt. % maf feed	[grams]	wt. % maf coal
	measured	normalized			
H2O					
COx	79.77	79.61	3.71%	79.61	9.79%
H2S					
C1 to C3	2.19	2.19	0.10%	2.19	0.27%
C4 +					
Oil	1260.91	1258.53	58.72%	89.23	10.98%
Asphaltene	431.08	430.27	20.08%	269.31	33.13%
Preasphalt.	54.96	54.85	2.56%	54.85	6.75%
IOM	312.06	311.47	14.53%	311.47	38.32%
Total	2140.96	2136.92	99.71%	806.66	99.24%

Distillation Profile THF-Extract					
Fraction [deg C]	Feed [grams]	Product			
		Total Gross		Total Net	
		normalized		normalized	
		[grams]	[grams]	[grams]	wt. % maf coal
IBP - 182					
182 - 343					
343 - 524					
524+					
TOTAL					

RUN No.: DOE-BU-010 M.B.No.: YP-02/C1

GAS ANALYSIS

Name	First Stage Product Gas (DTM-260)							Second Stage Product Gas (DTM-360)							Dissolved Gas (DTM-350)						
	Number of Samples: 5							Number of Samples: 1							Number of Samples: 2						
	vol %	vol %	vol %	vol %	vol %	vol %	Av.vol.%	vol %	vol %	vol %	vol %	vol %	vol %	Av.vol.%	vol %	vol %	vol %	vol %	vol %	vol %	Av.vol.%
Hydrogen	9.514	9.514	8.838	8.872	5.972		8.502								0.493	0.501					0.497
CO2	6.704	6.698	6.043	6.081	9.380		6.981								21.741	21.709					21.725
CO	39.812	40.024	40.379	40.558	40.443		40.243								17.838	17.510					17.573
H2S																					
Methane	0.115	0.115	0.102	0.104	0.335		0.154								0.137	0.141					0.139
Ethylene																					
Ethane																					
Propane																					
Propylene																					
i-Butane																					
n-Butane																					
i-Butene																					
n-Butene																					
C2-Butene																					
i-Pentane																					
n-Pentane																					
Nitrogen																					
TOTAL	58.145	58.351	55.382	55.415	58.130		55.881								40.007	39.881					39.934

RUN No.: DOE-BU-010

M.B.No.: YP-02/C1

GAS CALCULATIONS

Name	Mol. Weight	First Stage Product Gas (DTM-260)				Second Stage Product Gas (DTM-360)				Dissolved Gas (DTM-350)			
		Average Mol Weight:		14.10 (g/mole)		Average Mol Weight:		(g/mole)		Average Mol Weight:		36.35 (g/mole)	
		Volume		Weight (norm.)		Volume		Weight (norm.)		Volume		Weight (norm.)	
		meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%
Hydrogen	2.02	8.50	15.21	15.16	1.18					0.50	1.24	0.00	0.07
CO ₂	44.01	6.98	12.49	271.28	21.13					21.73	54.40	2.79	65.87
CO	28.01	40.24	72.02	995.26	77.52					17.57	44.01	1.43	33.91
H ₂ S	34.08												
Methane	16.04	0.15	0.28	2.18	0.17					0.14	0.35	0.01	0.15
Ethylene	28.05												
Ethane	30.07												
Propane	44.01												
Propylene	42.08												
i-Butane	58.12												
n-Butane	58.12												
i-Butene	56.11												
n-Butene	56.11												
C ₂ -Butene	56.11												
i-Pentane	72.15												
n-Pentane	72.15												
Nitrogen	28.02												
TOTAL		55.88	100.00	1283.89	100.00					39.93	100.00	4.23	100.00

First Stage Shift Reaction

		CO	+	H ₂ O	=	CO ₂	+	H ₂
Stochiom.	[moles]	4.45		4.45		4.45		4.45
Produced	[moles]					1.72		3.06
Total	[moles]	4.45		4.45		6.16		7.51
Stochiom.	[grams]	124.57		80.14		195.73		8.98
Produced	[grams]					75.55		6.18
Total	[grams]	124.57		80.14		271.28		15.16

Hydrocarbon Gases

		First	Second	Dissolved	Total
C1 to C3	[grams]	2.18		0.01	2.19
C4 +	[grams]				
Total	[grams]	2.18		0.01	2.19

Hydrogen

		First Up-Take	In	Second Out	Up-Take	Total Up-Take
Hydrogen	[grams]	-6.18				-6.18

RUN No.: DOE-BU-010

M.B.No.: YP-02/C1

Liquid / Slurry Stream Analysis

[illegible]

RUN No.: DOE-BU-010

M.B.No.: YP-02/C1

	Feed	V-220	Products V-340 (BTMS)	V-330
----- in grams of analysis sample -----				
Total Sample	48.82	16.10	46.13	
Water	2.80	14.71	0.10	
Oils+Asphaltenes	27.87	1.39	35.81	
Oils	24.50	1.33	26.17	
Asphaltenes	3.37	0.06	9.63	
Pre-Asphaltenes			1.24	
Insolubles	18.15		8.98	
IOM	17.03		7.04	
Ash	1.12		1.94	
TOTAL	48.82	16.1	46.13	
----- in wt% of analysis sample -----				
Water	5.74%	91.39%	0.22%	
Oils+Asphaltenes	57.09%	8.61%	77.62%	
Oils (on fraction)	87.90%	96.00%	73.10%	
(on total)	50.18%	8.27%	56.74%	
Asphalt. (on fract.)	12.10%	4.00%	26.90%	
(on total)	6.91%	0.34%	20.88%	
Pre-Asphaltenes			2.69%	
Insolubles	37.17%		19.48%	
IOM (on fraction)	93.85%		78.37%	
(on total)	34.89%		15.26%	
Ash (on fraction)	6.15%		21.63%	
(on total)	2.29%		4.21%	
TOTAL	100.00%	100.00%	100.00%	
----- in grams of feed / product -----				
Total Feed / Product	2330	1221	2044.444	
Water	133.6	1115.8	4.4	
Oils+Asphaltenes	1330.3	105.1	1586.9	
Oils (on fraction)	1169.3	100.9	1160.0	
(on total)	1169.3	100.9	1160.0	
Asphalt. (on fract.)	161.0	4.2	426.9	
(on total)	161.0	4.2	426.9	
Pre-Asphaltenes			55.0	
Insolubles	866.1		398.2	
IOM (on fraction)	812.8		312.1	
(on total)	812.8		312.1	
Ash (on fraction)	53.3		86.1	
(on total)	53.3		86.1	
TOTAL (as is)	2330.0	1220.9	2044.4	
TOTAL (MAF)	2143.1	105.1	1953.9	

Distillation Profile THF-Extract					
Fractions deg C	Feed	Products			
		V-220	V-340 (BTMS)	V-330	Total
IBP - 182					
182 - 343					
343 - 524					
524+					
TOTAL					

Feed	V-220	Products (normalized) V-340 (BTMS)	V-330	Total	Feed	V-220	Products (normalized) V-340 (BTMS)	V-330	Total
----- In wt% of total feed (as is) -----					----- In wt% of total feed (MAF) -----				
5.73%	37.50%	0.19%		37.69%	62.07%	4.90%	73.91%		78.80%
57.10%	4.50%	67.99%		72.49%					
50.19%	4.32%	49.70%		54.02%	54.56%	4.70%	54.02%		58.72%
6.91%	0.18%	18.29%		18.47%	7.51%	0.20%	19.88%		20.08%
		2.35%		2.35%					
37.18%		17.06%		17.06%	37.93%		18.54%		18.54%
34.89%		13.37%		13.37%			14.53%		14.53%
2.29%		3.69%		3.69%					
100.00%	42.00%	87.59%		129.59%	100.00%	4.90%	91.00%		95.89%

RUN No.: DOE-BU-010

M.B.No.: YP-03/C1

	Date	Time	Date	Time
START:			Oct. 21, 93	15:30
END:			Oct. 21, 93	18:00
DURATION (hours):				2.50

Feed:	Type	Wt% (maf)
Coal	BTH	36.06%
Solvent	V-1074	63.94%
Catalyst 1	Aluminate	10.00%
Catalyst 2		
Other		

OPERATING PARAMETERS:			
FEED TANK WI-110):	(G)		
Start of Mass Balance		4950.00	
End of Mass Balance		3320.00	
Rate	(G/HR)	652	
FIRST STAGE:			
Operating Pressure:	(MPa)	10.34	
Feed Temp.:	(C)		
Reactor Temp.:	(C)		
TE-201I	(BTTM)		
TE-202I		410	
TE-203I		410	
TE-204I	(Top)	390	
Liquid Level	(mm)	360	
Separator Temperature:	(C)	70	
CO-Feed Rate:	(L/MIN)	3.60	
Water Feed Rate:	(ML/MIN)	1.28	
Temperature:	(C)	264	
Catalyst Feed:	(ML/MIN)	2.97	
Liquid Product (WI-220):	(G)		
Start of Mass Balance			
End of Mass Balance		837	
Nitrogen Rate:	(L/MIN)	3.93	
SECOND STAGE:			
Operating Pressure:	(MPa)		
Feed Temp.:	(C)		
Reactor Temp.:	(C)		
TE-301I	(BTTM)		
TE-302I			
TE-303I			
TE-304I			
TE-305I			
TE-306I			
TE-307I			
TE-308I	(Top)		
TE-309I	(VAP)		
Liquid level	(mm)		
Separator Temperature:	(C)		
Hydrogen Feed Rate:	(L/MIN)		
Temperature:	(C)		
Liquid Product (WI-330):	(G)		
Start of Mass Balance			
End of Mass Balance			
Bottoms Product (V-340):	(G)		
Start of Mass Balance			
End of Mass Balance		1280	

MEASURED GAS COMPOSITIONS				
NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02	1.64		0.28
CO2	44.01	6.80		13.21
CO	28.01	41.15		6.55
H2S	34.08			
Methane	16.04	0.27		0.07
Ethylene	28.05			
Ethane	30.07			
Propane	44.01			
Propylene	42.08			
i-Butane	58.12			
n-Butane	58.12			
i-Butene	56.11			
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15			
Nitrogen	28.02			
TOTAL		49.86		20.1185
Gas Meter Readings				
	DTM-260	DTM-360	DTM-350	
Start of M.B. : (L)	2105		2357	
End of M.B. : (L)	3474		2359	
Total : (L)	1369		2	
Temperature: (C)	21	21	21	
Meter Pressure : (mmHg)	706	706	706	
Standard Volume: (L)	1181		2	
Nitrogen to R-200: (L)	590			
Net Gas Out: (L)	591		2	

Run Conditions			
Basis: MAF		First Stage	Second Stage
Pressure	Mpa	10.3	
Temperature	deg C	410	
Catalyst		Aluminate	
Feed	wt % maf coal	36.06%	
WHSV	(kg / hr) / l	2.00	
CO Rate	kg / kg maf coal	1.25	
	moles / 100g maf coal	4.47	
consumed	moles / 100g maf coal	0.44	
Water Rate	kg / kg maf coal	1.25	
	moles / 100g maf coal	6.95	
Hydrogen	kg / kg maf coal		
	moles / 100g maf coal		
consumed	wt % maf coal	0.56%	

OVERALL MASS BALANCE					
Material In:		Grams		Material Out:	Grams
	Feed Slurry	1630		First Stage Liquid:	837
	CO-Gas:	676		First Stage Product Gas:	772
	Water:	192		Second Stage Liquid:	
	Hydrogen:			Second Stage Reactor Bottoms:	1280
	Catalyst:	445		Second Stage Product Gas:	
				Dissolved Gas:	3
TOTAL IN:		2942		TOTAL OUT:	2892
Catalyst mf		45		OVERALL BALANCE:	98.3%
WATER BALANCE					
TOTAL IN:		689		TOTAL OUT:	689
				WATER BALANCE:	100.0%
		Coal Conversion		wt. % maf	67.9%
		Ash Balance		wt. %	92.7%

PRODUCT YIELDS					
Description	Total Gross			Total Net	
	[grams]		wt. % maf feed	[grams]	wt. % maf coal
	measured	normalized			
H2O					
COx	57.61	59.37	3.96%	59.37	10.99%
H2S					
C1 to C3	2.32	2.39	0.16%	2.39	0.44%
C4 +					
Oil	897.17	924.43	61.73%	82.81	15.34%
Asphaltene	276.71	285.12	19.04%	169.26	31.35%
Preasphalt.	54.08	55.72	3.72%	55.72	10.32%
IOM	168.33	173.44	11.58%	173.44	32.12%
Total	1456.22	1500.47	100.20%	542.99	100.56%

Distillation Profile THF-Extract					
Fraction [deg C]	Feed [grams]	Product			
		Total Gross		Total Net	
		[grams]	normalized	[grams]	wt. % maf coal
IBP - 182					
182 - 343					
343 - 524					
524+					
TOTAL					

RUN No.: DOE-BU-010

M.B.No.: YP-03/C1

GAS ANALYSIS

GAS ANALYSIS																				
	First Stage Product Gas (DTM-260)							Second Stage Product Gas (DTM-360)							Dissolved Gas (DTM-350)					
Name	Number of Samples: 2							Number of Samples: 1							Number of Samples: 2					
	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%
Hydrogen	1.629	1.644					1.637								0.343	0.215				0.279
CO2	6.808	6.788					6.798								15.809	10.819				13.214
CO	41.135	41.165					41.150								7.875	5.228				6.552
H2S																				
Methane	0.235	0.311					0.273								0.089	0.059				0.074
Ethylene																				
Ethane																				
Propane																				
Propylene																				
i-Butane																				
n-Butane																				
i-Butene																				
n-Butene																				
C2-Butene																				
i-Pentane																				
n-Pentane																				
Nitrogen																				
TOTAL	49.607	49.908					49.658								24.118	16.121				20.119

RUN No.: DOE-BU-010

M.B.No.: YP-03/C1

GAS CALCULATIONS

Name	Mol.Weight	First Stage Product Gas (DTM-260)				Second Stage Product Gas (DTM-360)				Dissolved Gas (DTM-350)			
		Average Mol Weight:		14.65 (g/mole)		Average Mol Weight:		(g/mole)		Average Mol Weight:		38.11 (g/mole)	
		Volume		Weight (norm.)		Volume		Weight (norm.)		Volume		Weight (norm.)	
		meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%
Hydrogen	2.02	1.64	3.28	1.75	0.23					0.28	1.39	0.00	0.07
CO ₂	44.01	6.80	13.63	158.29	20.50					13.21	65.68	2.23	75.84
CO	28.01	41.15	82.54	609.82	78.97					6.55	32.56	0.70	23.93
H ₂ S	34.08												
Methane	16.04	0.27	0.55	2.32	0.30					0.07	0.37	0.00	0.15
Ethylene	28.05												
Ethane	30.07												
Propane	44.01												
Propylene	42.08												
i-Butane	58.12												
n-Butane	58.12												
i-Butene	56.11												
n-Butene	56.11												
C ₂ -Butene	56.11												
i-Pentane	72.15												
n-Pentane	72.15												
Nitrogen	28.02												
TOTAL		49.86	100.00	772.17	100.00					20.12	100.00	2.93	100.00

First Stage Shift Reaction

		CO	+	H ₂ O	=	CO ₂	+	H ₂
Stochiom.	[moles]	2.35		2.35		2.35		2.35
Produced	[moles]					1.24		-1.49
Total	[moles]	2.35		2.35		3.60		0.87
Stochiom.	[grams]	65.94		42.42		103.60		4.76
Produced	[grams]					54.69		-3.01
Total	[grams]	65.94		42.42		158.29		1.75

Hydrocarbon Gases

		First	Second	Dissolved	Total
C1 to C3	[grams]	2.32		0.00	2.32
C4 +	[grams]				
Total	[grams]	2.32		0.00	2.32

Hydrogen

		First Up-Take	In	Second Out	Up-Take	Total Up-Take
Hydrogen	[grams]	3.01				3.01

Liquid / Slurry Stream Analysis					Coal	Solvent	Feed	V-220	V-340 (BTMS)	V-330
Total Feed / Product					BTH	V-1074				
Type										
Total Sample					[grams]		47.2	9.73	47.34	
Water					[grams]		2.8	7.48	0.1	
Oils+Asphaltenes					[grams]		27.73	2.25	38.26	
Oils					[wt%] calc	100.00%	87.90%	96.00%	74.00%	100.00%
Asphaltene					[wt%]		12.10%	4.00%	26.00%	
Pre-Asphaltenes					[grams]				2	
Insolubles					[grams]		16.78		9.1	
IOM					[wt%] calc		93.15%		68.01%	
Ash					[wt%]		6.23%		30.67%	
Moisture					[wt%]		0.63%		1.33%	
Distill. THF-Extract					[wt%]					
IBP - 182 deg C										
182 - 343										
343 - 524										
524+										
Elemental Analysis:					[wt.%]					
Carbon						87.80%				
Hydrogen						8.50%				
Nitrogen						0.85%				
Sulphur						0.05%				
Oxygen (diff)						2.80%				

RUN No.: DOE-BU-010

M.B.No.: YP-03/C1

	Feed	V-220	Products V-340 (BTMS)	V-330
----- in grams of analysis sample -----				
Total Sample	47.20	9.73	47.34	
Water	2.80	7.48	0.10	
Oils+Asphaltenes	27.73	2.25	36.26	
Oils	24.37	2.16	26.31	
Asphaltenes	3.35	0.09	9.95	
Pre-Asphaltenes			2.00	
Insolubles	16.67		8.98	
IOM	15.64		6.23	
Ash	1.04		2.75	
TOTAL	47.2	9.73	47.34	
----- in wt% of analysis sample -----				
Water	5.93%	76.89%	0.21%	
Oils+Asphaltenes	58.74%	23.11%	76.60%	
Oils (on fraction)	87.90%	96.00%	72.57%	
(on total)	51.63%	22.18%	55.58%	
Asphalt. (on fract.)	12.10%	4.00%	27.43%	
(on total)	7.11%	0.92%	21.01%	
Pre-Asphaltenes			4.22%	
Insolubles	35.33%		18.97%	
IOM (on fraction)	93.78%		69.33%	
(on total)	33.13%		13.15%	
Ash (on fraction)	6.23%		30.67%	
(on total)	2.20%		5.82%	
TOTAL	100.00%	100.00%	100.00%	
----- in grams of feed / product -----				
Total Feed / Product	1630	837	1280	
Water	96.7	643.8	2.7	
Oils+Asphaltenes	957.5	193.4	980.4	
Oils (on fraction)	841.6	185.7	711.5	
(on total)	841.6	185.7	711.5	
Asphalt. (on fract.)	115.9	7.7	269.0	
(on total)	115.9	7.7	269.0	
Pre-Asphaltenes			54.1	
Insolubles	575.8		242.8	
IOM (on fraction)	540.0		168.3	
(on total)	540.0		168.3	
Ash (on fraction)	35.8		74.5	
(on total)	35.8		74.5	
TOTAL (as is)	1630.0	837.2	1280.0	
TOTAL (MAF)	1497.5	193.4	1202.8	

Distillation Profile THF-Extract					
Fractions deg C	Feed	Products			
		V-220	V-340 (BTMS)	V-330	Total
IBP - 182					
182 - 343					
343 - 524					
524+					
TOTAL					

Feed	Products (normalized)				Feed	Products (normalized)			
	V-220	V-340 (BTMS)	V-330	Total		V-220	V-340 (BTMS)	V-330	Total
----- in wt% of total feed (as is) -----					----- in wt% of total feed (MAF) -----				
6.10%	31.21%	0.17%		31.38%					
58.64%	12.21%	61.87%		74.07%	63.94%	13.31%	67.46%		80.77%
51.54%	11.72%	44.89%		56.61%	56.20%	12.78%	48.95%		61.73%
7.09%	0.49%	16.97%		17.46%	7.74%	0.53%	18.51%		19.04%
		3.41%		3.41%					
35.26%		15.32%		15.32%	36.06%		16.71%		16.71%
33.07%		10.62%		10.62%			11.58%		11.58%
2.20%		4.70%		4.70%					
100.00%	43.41%	80.77%		124.18%	100.00%	13.31%	82.77%		96.08%

RUN No.: DOE-BU-010

M.B.No.: YP-04/C1

	Date	Time	Date	Time
START:			Oct. 21, 93	19:00
END:			Oct. 21, 93	21:00
DURATION (hours):				2.00

Feed:	Type	Wt% (maf)
Coal	BTH	36.06%
Solvent	V-1074	63.94%
Catalyst 1	Aluminate	10.00%
Catalyst 2		
Other		

OPERATING PARAMETERS:			
FEED TANK WI-110:	(G)		
Start of Mass Balance		2660.00	
End of Mass Balance		1270.00	
Rate	(G/HR)	695	
FIRST STAGE:			
Operating Pressure:	(MPa)	10.34	
Feed Temp.:	(C)		
Reactor Temp.:	(C)		
TE-201I	(BTM)		
TE-202I		412	
TE-203I		412	
TE-204I	(Top)	390	
Liquid Level	(mm)	360	
Separator Temperature:	(C)	70	
CO-Feed Rate:	(L/MIN)	7.00	
Water Feed Rate:	(ML/MIN)	2.20	
Temperature:	(C)	264	
Catalyst Feed:	(ML/MIN)	3.26	
Liquid Product (WI-220):	(G)		
Start of Mass Balance			
End of Mass Balance		794	
Nitrogen Rate:	(L/MIN)	3.86	
SECOND STAGE:			
Operating Pressure:	(MPa)		
Feed Temp.:	(C)		
Reactor Temp.:	(C)		
TE-301I	(BTM)		
TE-302I			
TE-303I			
TE-304I			
TE-305I			
TE-306I			
TE-307I			
TE-308I	(Top)		
TE-309I	(VAP)		
Liquid level	(mm)		
Separator Temperature:	(C)		
Hydrogen Feed Rate:	(L/MIN)		
Temperature:	(C)		
Liquid Product (WI-330):	(G)		
Start of Mass Balance			
End of Mass Balance			
Bottoms Product (V-340):	(G)		
Start of Mass Balance			
End of Mass Balance		1112	

MEASURED GAS COMPOSITIONS				
NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02	1.70		0.28
CO2	44.01	6.20		13.21
CO	28.01	46.87		6.55
H2S	34.08			
Methane	16.04	0.04		0.07
Ethylene	28.05			
Ethane	30.07			
Propane	44.01			
Propylene	42.08			
i-Butane	58.12			
n-Butane	58.12			
i-Butene	56.11			
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15			
Nitrogen	28.02			
TOTAL		54.80		20.1185
Gas Meter Readings				
		DTM-260	DTM-360	DTM-350
Start of M.B. : (L)		4052		2359
End of M.B. : (L)		5618		2364
Total : (L)		1566		5
Temperature: (C)		22	22	23.7
Meter Pressure : (mmHg)		706	706	706
Standard Volume: (L)		1346		4
Nitrogen to R-200: (L)		463		
Net Gas Out: (L)		883		4

Run Conditions			
Basis: MAF		First Stage	Second Stage
Pressure	Mpa	10.3	
Temperature	deg C	412	
Catalyst		Aluminate	
Feed	wt % maf coal	36.06%	
WHSV	(kg / hr) / l	2.13	
CO Rate	kg / kg maf coal	2.28	
	moles / 100g maf coal	8.14	
consumed	moles / 100g maf coal	0.82	
Water Rate	kg / kg maf coal	2.28	
	moles / 100g maf coal	12.66	
Hydrogen	kg / kg maf coal		
	moles / 100g maf coal		
consumed	wt % maf coal	1.11%	

OVERALL MASS BALANCE					
Material In:		Grams	Material Out:		Grams
	Feed Slurry	1390		First Stage Liquid:	794
	CO-Gas:	1050		First Stage Product Gas:	1143
	Water:	264		Second Stage Liquid:	
	Hydrogen:			Second Stage Reactor Bottoms:	1112
	Catalyst:	391		Second Stage Product Gas:	
				Dissolved Gas:	7
TOTAL IN:		3095	TOTAL OUT:		3057
Catalyst mf		39	OVERALL BALANCE:		98.8%
WATER BALANCE					
TOTAL IN:		699	TOTAL OUT:		699
			WATER BALANCE:		100.0%
	Coal Conversion		wt. % maf	67.9%	
	Ash Balance		wt. %	88.6%	

PRODUCT YIELDS					
Description	Total Gross			Total Net	
	[grams]		wt. % maf feed	[grams]	wt. % maf coal
	measured	normalized			
H2O					
COx	37.85	38.77	3.04%	38.77	8.42%
H2S					
C1 to C3	0.44	0.45	0.04%	0.45	0.10%
C4 +					
Oil	739.57	757.56	59.32%	39.86	8.66%
Asphaltene	291.49	298.58	23.38%	199.79	43.39%
Preasphalt.	38.20	39.13	3.06%	39.13	8.50%
IOM	144.10	147.61	11.56%	147.61	32.06%
Total	1251.65	1282.11	100.40%	465.61	101.11%

Distillation Profile THF-Extract					
Fraction [deg C]	Feed [grams]	Product			
		Total Gross		Total Net	
		[grams]	[grams]	[grams]	wt. % maf coal
IBP - 182					
182 - 343					
343 - 524					
524+					
TOTAL					

GAS ANALYSIS

GAS ANALYSIS																														
First Stage Product Gas (DTM-260)										Second Stage Product Gas (DTM-360)										Dissolved Gas (DTM-350)										
Name	Number of Samples:					1					Number of Samples:					1					Number of Samples:					2				
	vol. %	vol. %	vol. %	vol. %	vol. %	Av.vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	Av.vol. %		
Hydrogen	1.697					1.697																							0.343	
CO2	6.197					6.197																							15.809	
CO	46.868					46.868																							7.875	
H2S																													5.228	
Methane	0.037					0.037																							0.089	
Ethylene																													0.059	
Ethane																														
Propane																														
Propylene																														
i-Butane																														
n-Butane																														
i-Butene																														
n-Butene																														
C2-Butene																														
i-Pentane																														
n-Pentane																														
Nitrogen																														
TOTAL	54.789					54.789																							24.118	
																													16.121	
																													20.119	

RUN No.: DOE-BU-010

M.B.No.: YP-04/C1

GAS CALCULATIONS

Name	Mol.Weight	First Stage Product Gas (DTM-260)				Second Stage Product Gas (DTM-360)				Dissolved Gas (DTM-350)			
		Average Mol Weight:		19.03 (g/mole)		Average Mol Weight:		(g/mole)		Average Mol Weight:		38.11 (g/mole)	
		Volume		Weight (norm.)		Volume		Weight (norm.)		Volume		Weight (norm.)	
		meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%
Hydrogen	2.02	1.70	3.10	2.47	0.22					0.28	1.39	0.01	0.07
CO ₂	44.01	6.20	11.31	196.18	17.16					13.21	65.68	5.51	75.84
CO	28.01	46.87	85.53	944.28	82.59					6.55	32.56	1.74	23.93
H ₂ S	34.08												
Methane	16.04	0.04	0.07	0.43	0.04					0.07	0.37	0.01	0.15
Ethylene	28.05												
Ethane	30.07												
Propane	44.01												
Propylene	42.08												
i-Butane	58.12												
n-Butane	58.12												
i-Butene	56.11												
n-Butene	56.11												
C ₂ -Butene	56.11												
i-Pentane	72.15												
n-Pentane	72.15												
Nitrogen	28.02												
TOTAL		54.80	100.00	1143.35	100.00					20.12	100.00	7.27	100.00

First Stage Shift Reaction

		CO	+	H ₂ O	=	CO ₂	+	H ₂
Stochiom.	[moles]	3.76		3.76		3.76		3.76
Produced	[moles]					0.70		-2.54
Total	[moles]	3.76		3.76		4.46		1.22
Stochiom.	[grams]	105.38		67.80		165.58		7.60
Produced	[grams]					30.60		-5.13
Total	[grams]	105.38		67.80		196.18		2.47

Hydrocarbon Gases

		First	Second	Dissolved	Total
C1 to C3	[grams]	0.43		0.01	0.44
C4 +	[grams]				
Total	[grams]	0.43		0.01	0.44

Hydrogen

		First Up-Take	In	Second Out	Up-Take	Total Up-Take
Hydrogen	[grams]	5.13				5.13

M.B.No.: YP-04/C1

Liquid / Slurry Stream Analysis

[illegible]

RUN No.: DOE-BU-010

M.B.No.: YP-04/C1

	Feed	V-220	Products V-340 (BTMS)	V-330
----- In grams of analysis sample -----				
Total Sample	47.20	11.62	43.66	
Water	2.80	9.23		
Oils+Asphaltenes	27.73	2.39	34.08	
Oils	24.37	2.10	23.41	
Asphaltenes	3.35	0.29	10.67	
Pre-Asphaltenes			1.50	
Insolubles	16.67		8.08	
IOM	15.64		5.66	
Ash	1.04		2.42	
TOTAL	47.2	11.62	43.66	
----- In wt% of analysis sample -----				
Water	5.93%	79.45%		
Oils+Asphaltenes	58.74%	20.55%	78.05%	
Oils (on fraction)	87.90%	87.90%	68.69%	
(on total)	51.63%	18.06%	53.61%	
Asphalt. (on fract.)	12.10%	12.10%	31.31%	
(on total)	7.11%	2.49%	24.44%	
Pre-Asphaltenes			3.44%	
Insolubles	35.33%		18.51%	
IOM (on fraction)	93.78%		70.00%	
(on total)	33.13%		12.96%	
Ash (on fraction)	6.23%		30.00%	
(on total)	2.20%		5.55%	
TOTAL	100.00%	100.00%	100.00%	
----- In grams of feed / product -----				
Total Feed / Product	1390	794	1112	
Water	82.5	630.8		
Oils+Asphaltenes	816.5	163.1	867.9	
Oils (on fraction)	717.7	143.4	596.2	
(on total)	717.7	143.4	596.2	
Asphalt. (on fract.)	98.8	19.7	271.8	
(on total)	98.8	19.7	271.8	
Pre-Asphaltenes			38.2	
Insolubles	491.0		205.9	
IOM (on fraction)	460.5		144.1	
(on total)	460.5		144.1	
Ash (on fraction)	30.6		61.8	
(on total)	30.6		61.8	
TOTAL (as is)	1390.0	793.9	1112.0	
TOTAL (MAF)	1277.0	163.1	1050.2	

Distillation Profile THF-Extract					
Fractions deg C	Feed	Products			
		V-220	V-340 (BTMS)	V-330	Total
IBP - 182					
182 - 343					
343 - 524					
524+					
TOTAL					

Feed	V-220	Products (nomalized) V-340 (BTMS)	V-330	Total	Feed	V-220	Products (nomalized) V-340 (BTMS)	V-330	Total
----- In wt% of total feed (as is) -----					----- In wt% of total feed (MAF) -----				
6.07%	31.97%			31.97%					
58.66%	12.00%	63.87%		75.87%	63.94%	13.08%	69.62%		82.71%
51.56%	10.55%	43.87%		54.42%	56.20%	11.50%	47.82%		59.32%
7.10%	1.45%	20.00%		21.45%	7.74%	1.58%	21.80%		23.38%
35.28%		2.81%		2.81%	36.06%		16.51%		16.51%
33.08%		15.15%		15.15%			11.56%		11.56%
2.20%		10.60%		10.60%					
100.00%	43.97%	4.54%		4.54%					
100.00%	43.97%	81.83%		125.80%	100.00%	13.08%	84.25%		97.33%

RUN No.: DOE-BU-011

M.B.No.: YP-01/C1

	Date	Time	Date	Time
START:			Oct. 26, 93	12:00
END:			Oct. 26, 93	16:00
DURATION (hours):				4.00

Feed:	Type	Wt% (maf)
Coal	BTH	36.40%
Solvent	V-1074	63.60%
Catalyst 1	Aluminate	10.00%
Catalyst 2		
Other		

OPERATING PARAMETERS:		
FEED TANK WI-110:	(G)	
Start of Mass Balance		4140.00
End of Mass Balance		2120.00
Rate	(G/HR)	505
FIRST STAGE:		
Operating Pressure:	(MPa)	10.34
Feed Temp.:	(C)	
Reactor Temp.:	(C)	
TE-201I	(BTM)	
TE-202I		410
TE-203I		409
TE-204I	(Top)	388
Liquid Level	(mm)	470
Separator Temperature:	(C)	70
CO-Feed Rate:	(L/MIN)	3.91
Water Feed Rate:	(ML/MIN)	1.51
Temperature:	(C)	224
Catalyst Feed:	(ML/MIN)	3.09
Liquid Product (WI-220):	(G)	
Start of Mass Balance		
End of Mass Balance		1354
Nitrogen Rate:	(L/MIN)	3.93
SECOND STAGE:		
Operating Pressure:	(MPa)	
Feed Temp.:	(C)	
Reactor Temp.:	(C)	
TE-301I	(BTM)	
TE-302I		
TE-303I		
TE-304I		
TE-305I		
TE-306I		
TE-307I		
TE-308I	(Top)	
TE-309I	(VAP)	
Liquid level	(mm)	
Separator Temperature:	(C)	
Hydrogen Feed Rate:	(L/MIN)	
Temperature:	(C)	
Liquid Product (WI-330):	(G)	
Start of Mass Balance		
End of Mass Balance		
Bottoms Product (V-340):	(G)	
Start of Mass Balance		
End of Mass Balance		1730

MEASURED GAS COMPOSITIONS				
NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02	2.23		0.50
CO2	44.01	7.85		21.73
CO	28.01	39.26		17.57
H2S	34.08			
Methane	16.04	0.33		0.14
Ethylene	28.05			
Ethane	30.07			
Propane	44.01			
Propylene	42.08			
i-Butane	58.12			
n-Butane	58.12			
i-Butene	56.11			
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15			
Nitrogen	28.02			
TOTAL		49.67		39.934
Gas Meter Readings	DTM-260	DTM-360	DTM-350	
Start of M.B. : (L)	8908.0		2362.7	
End of M.B. : (L)	11182.0		2364.0	
Total : (L)	2274.0		1.3	
Temperature: (C)	21.5	22.0	22.2	
Meter Pressure : (mmHg)	712	712	712	
Standard Volume: (L)	1975		1	
Nitrogen to R-200: (L)	943			
Net Gas Out: (L)	1032		1	

Run Conditions			
Basis: MAF		First Stage	Second Stage
Pressure	Mpa	10.3	
Temperature	deg C	410	
Catalyst		Aluminate	
Feed	wt % maf coal	36.40%	
WHSV	(kg / hr) / l	1.18	
CO Rate	kg / kg maf coal	1.75	
	moles / 100g maf coal	6.26	
consumed	moles / 100g maf coal	0.82	
Water Rate	kg / kg maf coal	1.75	
	moles / 100g maf coal	9.74	
Hydrogen	kg / kg maf coal		
	moles / 100g maf coal		
consumed	wt % maf coal	1.04%	

M.B.No.: YP-01/C1

OVERALL MASS BALANCE

Material In:		Grams	Material Out:		Grams
	Feed Slurry	2020		First Stage Liquid:	1354
	CO-Gas:	1174		First Stage Product Gas:	1349
	Water:	363		Second Stage Liquid:	
	Hydrogen:			Second Stage Reactor Bottoms:	1730
	Catalyst:	741		Second Stage Product Gas:	
				Dissolved Gas:	2
TOTAL IN:		4297	TOTAL OUT:		4435
	Catalyst mf	74	OVERALL BALANCE: 103.2%		

WATER BALANCE			
TOTAL IN:		1168	TOTAL OUT:
			1168
		WATER BALANCE: 100.0%	
	Coal Conversion	wt.% maf	66.6%
	Ash Balance	wt.%	84.7%

PRODUCT YIELDS

Description	Total Gross			Total Net	
	[grams]		wt. % maf feed	[grams]	wt. % maf coal
	measured	normalized			
H2O					
COx	80.19	73.95	4.02%	73.95	11.05%
H2S					
C1 to C3	4.86	4.48	0.24%	4.48	0.67%
C4 +					
Oil	1199.61	1106.34	60.20%	78.87	11.79%
Asphaltene	413.90	381.72	20.77%	240.28	35.92%
Preasphalt.	59.76	55.11	3.00%	55.11	8.24%
IOM	242.07	223.25	12.15%	223.25	33.37%
Total	2000.39	1844.85	100.38%	675.94	101.04%

Distillation Profile THF-Extract

Fraction [deg C]	Feed [grams]	Product			
		Total Gross		Total Net	
		[grams]	----- normalized ----- [grams]	[grams]	wt. % maf coal
IBP - 182					
182 - 343					
343 - 524					
524+					
TOTAL					

RUN No.: DOE-BU-011

M.B.No.: YP-01/C1

GAS ANALYSIS

Name	First Stage Product Gas (DTM-260)							Second Stage Product Gas (DTM-360)							Dissolved Gas (DTM-350)						
	Number of Samples: 4							Number of Samples: 1							Number of Samples: 2						
	vol %	vol %	vol %	vol %	vol %	vol %	Av.vol %	vol %	vol %	vol %	vol %	vol %	vol %	Av.vol %	vol %	vol %	vol %	vol %	vol %	vol %	Av.vol %
Hydrogen	2.353	2.369	2.125	2.077			2.231								0.493	0.501					0.497
CO2	8.015	8.094	7.734	7.588			7.852								21.741	21.709					21.725
CO	39.083	38.579	40.179	39.198			39.259								17.638	17.510					17.573
H2S																					
Methane	0.380	0.389	0.162	0.374			0.326								0.137	0.141					0.139
Ethylene																					
Ethane																					
Propane																					
Propylene																					
i-Butane																					
n-Butane																					
i-Butene																					
n-Butene																					
C2-Butene																					
i-Pentane																					
n-Pentane																					
Nitrogen																					
TOTAL	49.831	49.431	50.200	49.213			49.669								40.007	39.861					39.934

RUN No.: DOE-BU-011

M.B.No.: YP-01/C1

GAS CALCULATIONS

Name	Mol.Weight	First Stage Product Gas (DTM-260)					Second Stage Product Gas (DTM-360)					Dissolved Gas (DTM-350)			
		Average Mol Weight:		15.31 (g/mole)			Average Mol Weight:		(g/mole)			Average Mol Weight:		36.35 (g/mole)	
		Volume		Weight (norm.)			Volume		Weight (norm.)			Volume		Weight (norm.)	
		meas. %	norm. %	(G)	%		meas. %	norm. %	(G)	%		meas. %	norm. %	(G)	%
Hydrogen	2.02	2.23	4.49	4.18	0.31							0.50	1.24	0.00	0.07
CO ₂	44.01	7.85	15.81	320.43	23.75							21.73	54.40	1.20	65.87
CO	28.01	39.26	79.04	1019.63	75.58							17.57	44.01	0.62	33.91
H ₂ S	34.08														
Methane	16.04	0.33	0.66	4.85	0.36							0.14	0.35	0.00	0.15
Ethylene	28.05														
Ethane	30.07														
Propane	44.01														
Propylene	42.08														
i-Butane	58.12														
n-Butane	58.12														
i-Butene	56.11														
n-Butene	56.11														
C ₂ -Butene	56.11														
i-Pentane	72.15														
n-Pentane	72.15														
Nitrogen	28.02														
TOTAL		49.67	100.00	1349.09	100.00							39.93	100.00	1.83	100.00

First Stage Shift Reaction

		CO	+	H ₂ O	=	CO ₂	+	H ₂
Stochiom.	[moles]	5.50		5.50		5.50		5.50
Produced	[moles]					1.78		-3.43
Total	[moles]	5.50		5.50		7.28		2.07
Stochiom.	[grams]	154.06		99.11		242.07		11.11
Produced	[grams]					78.36		-6.93
Total	[grams]	154.06		99.11		320.43		4.18

Hydrocarbon Gases

		First	Second	Dissolved	Total
C1 to C3	[grams]	4.85		0.00	4.86
C4 +	[grams]				
Total	[grams]	4.85		0.00	4.86

Hydrogen

		First Up-Take	In	Second Out	Up-Take	Total Up-Take
Hydrogen	[grams]	6.93				6.93

[illegible]

	Feed	V-220	Products V-340 (BTMS)	V-330
----- In grams of analysis sample -----				
Total Sample	48.30	14.15	44.87	
Water	3.30	11.17		
Oils+Asphaltenes	27.95	2.98	34.45	
Oils	24.57	2.86	24.01	
Asphaltenes	3.38	0.12	10.44	
Pre-Asphaltenes			1.55	
Insolubles	17.05		8.87	
IOM	16.00		6.28	
Ash	1.05		2.60	
TOTAL	48.3	14.15	44.87	

----- In wt% of analysis sample -----				
Water	6.83%	78.92%		
Oils+Asphaltenes	57.87%	21.08%	76.77%	
Oils (on fraction)	87.90%	96.00%	69.70%	
(on total)	50.86%	20.24%	53.50%	
Asphalt. (on fract.)	12.10%	4.00%	30.30%	
(on total)	7.00%	0.84%	23.26%	
Pre-Asphaltenes			3.45%	
Insolubles	35.30%		19.78%	
IOM (on fraction)	93.82%		70.76%	
(on total)	33.12%		13.99%	
Ash (on fraction)	6.18%		29.25%	
(on total)	2.18%		5.78%	
TOTAL	100.00%	100.00%	100.00%	

----- In grams of feed / product -----				
Total Feed / Product	2020	1354	1730	
Water	138.0	1068.5		
Oils+Asphaltenes	1168.9	285.4	1328.1	
Oils (on fraction)	1027.5	274.0	925.6	
(on total)	1027.5	274.0	925.6	
Asphalt. (on fract.)	141.4	11.4	402.5	
(on total)	141.4	11.4	402.5	
Pre-Asphaltenes			59.8	
Insolubles	713.1		342.1	
IOM (on fraction)	669.0		242.1	
(on total)	669.0		242.1	
Ash (on fraction)	44.1		100.1	
(on total)	44.1		100.1	
TOTAL (as is)	2020.0	1353.9	1730.0	
TOTAL (MAF)	1837.9	285.4	1629.9	

Distillation Profile THF-Extract					
Fractions deg C	Feed	Products			
		V-220	V-340 (BTMS)	V-330	Total
IBP - 182					
182 - 343					
343 - 524					
524+					
TOTAL					

Feed	Products (normalized)				Feed	Products (normalized)			
	V-220	V-340 (BTMS)	V-330	Total		V-220	V-340 (BTMS)	V-330	Total
----- in wt% of total feed (as is) -----					----- in wt% of total feed (MAF) -----				
6.33%	36.93%			36.93%					
58.18%	13.10%	60.96%		74.06%	63.60%	14.32%	66.64%		80.96%
51.14%	12.58%	42.49%		55.06%	55.90%	13.75%	46.45%		60.20%
7.04%	0.52%	18.47%		19.00%	7.70%	0.57%	20.20%		20.77%
35.49%		2.74%		2.74%					
		15.70%		15.70%	36.40%		17.17%		17.17%
33.30%									
		11.11%		11.11%			12.15%		12.15%
2.19%		4.59%		4.59%					
100.00%	50.03%	79.41%		129.44%					
					100.00%	14.32%	81.79%		96.11%

RUN No.: DOE-BU-011

M.B.No.: YP-02/C2

	Date	Time	Date	Time
START:			Oct. 26, 93	07:00
END:			Oct. 26, 93	16:00
DURATION (hours):				4.00

Feed:	Type	Wt% (maf)
Coal	BTH	37.51%
Solvent	V-1074	62.49%
Catalyst 1	Aluminate	10.00%
Catalyst 2		
Other		

OPERATING PARAMETERS:		
FEED TANK WI-110):	(G)	
Start of Mass Balance		7120.00
End of Mass Balance		5080.00
Rate	(G/HR)	510
FIRST STAGE:		
Operating Pressure:	(MPa)	10.34
Feed Temp.:	(C)	
Reactor Temp.:	(C)	
TE-201I	(BTM)	
TE-202I		411
TE-203I		411
TE-204I	(Top)	390
Liquid Level	(mm)	470
Separator Temperature:	(C)	70
CO-Feed Rate:	(L/MIN)	7.14
Water Feed Rate:	(ML/MIN)	1.98
Temperature:	(C)	256
Catalyst Feed:	(ML/MIN)	2.35
Liquid Product (WI-220):	(G)	
Start of Mass Balance		
End of Mass Balance		1246
Nitrogen Rate:	(L/MIN)	3.95
SECOND STAGE:		
Operating Pressure:	(MPa)	
Feed Temp.:	(C)	
Reactor Temp.:	(C)	
TE-301I	(BTM)	
TE-302I		
TE-303I		
TE-304I		
TE-305I		
TE-306I		
TE-307I		
TE-308I	(Top)	
TE-309I	(VAP)	
Liquid level	(mm)	
Separator Temperature:	(C)	
Hydrogen Feed Rate:	(L/MIN)	
Temperature:	(C)	
Liquid Product (WI-330):	(G)	
Start of Mass Balance		
End of Mass Balance		
Bottoms Product (V-340):	(G)	
Start of Mass Balance		
End of Mass Balance		1530

MEASURED GAS COMPOSITIONS				
NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02	2.33		0.50
CO2	44.01	7.10		21.73
CO	28.01	44.53		17.57
H2S	34.08			
Methane	16.04	0.28		0.14
Ethylene	28.05			
Ethane	30.07			
Propane	44.01			
Propylene	42.08			
i-Butane	58.12			
n-Butane	58.12			
i-Butene	56.11			
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15			
Nitrogen	28.02			
TOTAL		54.24		39.934
Gas Meter Readings				
		DTM-260	DTM-360	DTM-350
Start of M.B. : (L)		5104.0		2361.5
End of M.B. : (L)		8308.0		2363.9
Total : (L)		3204.0		2.4
Temperature: (C)		21.5	22.0	22.2
Meter Pressure : (mmHg)		712.9	712.9	712.9
Standard Volume: (L)		2786		2
Nitrogen to R-200: (L)		947		
Net Gas Out: (L)		1839		2

Run Conditions			
Basis: MAF		First Stage	Second Stage
Pressure	Mpa	10.3	
Temperature	deg C	411	
Catalyst		Aluminate	
Feed	wt % maf coal	37.51%	
WHSV	(kg / hr) / l	1.20	
CO Rate	kg / kg maf coal	3.07	
	moles / 100g maf coal	10.95	
consumed	moles / 100g maf coal	1.30	
Water Rate	kg / kg maf coal	3.07	
	moles / 100g maf coal	17.03	
Hydrogen	kg / kg maf coal		
	moles / 100g maf coal		
consumed	wt % maf coal	1.60%	

RUN No.: DOE-BU-011

M.B.No.: YP-02/C2

OVERALL MASS BALANCE					
Material In:		Grams		Material Out:	Grams
	Feed Slurry	2040		First Stage Liquid:	1246
	CO-Gas:	2141		First Stage Product Gas:	2374
	Water:	476		Second Stage Liquid:	
	Hydrogen:			Second Stage Reactor Bottoms:	1530
	Catalyst:	564		Second Stage Product Gas:	
				Dissolved Gas:	3
TOTAL IN:		5221		TOTAL OUT:	5153
Catalyst mf		56		OVERALL BALANCE:	98.7%
WATER BALANCE					
TOTAL IN:		1119		TOTAL OUT:	1119
				WATER BALANCE:	100.0%
		Coal Conversion	wt. % maf	75.9%	
		Ash Balance	wt. %	73.0%	

PRODUCT YIELDS					
Description	Total Gross		Total Net		
	[grams]		[grams]	wt. %	
	measured	normalized		maf feed	maf coal
H2O					
COx	77.49	79.20	4.26%	79.20	11.35%
H2S					
C1 to C3	6.76	6.91	0.37%	6.91	0.99%
C4 +					
Oil	1142.37	1167.57	62.77%	145.88	20.91%
Asphaltene	383.81	392.27	21.09%	251.63	36.06%
Preasphalt.	55.85	57.08	3.07%	57.08	8.18%
IOM	164.62	168.25	9.05%	168.25	24.11%
Total	1830.89	1871.28	100.60%	708.95	101.60%

Distillation Profile THF-Extract					
Fraction	Feed	Product			
		Total Gross		Total Net	
		[grams]	normalized	[grams]	wt. %
[deg C]	[grams]	[grams]	[grams]	[grams]	maf coal
IBP - 182					
182 - 343					
343 - 524					
524+					
TOTAL					

RUN No.: DOE-BU-011

M.B.No.: YP-02/C2

GAS ANALYSIS

	First Stage Product Gas (DTM-260)							Second Stage Product Gas (DTM-360)							Dissolved Gas (DTM-350)						
Name	Number of Samples: 5							Number of Samples: 1							Number of Samples: 2						
	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%
Hydrogen	3.201	3.311	1.547	1.839	1.953		2.330								0.483	0.501					0.497
CO2	9.141	9.129	5.274	5.391	6.576		7.102								21.741	21.709					21.725
CO	12.394	53.532	52.335	50.597	53.778		44.527								17.638	17.510					17.573
H2S																					
Methane	0.301	0.300	0.283	0.263	0.284		0.278								0.137	0.141					0.139
Ethylene																					
Ethane																					
Propane																					
Propylene																					
i-Butane																					
n-Butane																					
i-Butene																					
n-Butene																					
C2-Butene																					
i-Pentane																					
n-Pentane																					
Nitrogen																					
TOTAL	25.037	88.272	59.419	57.890	62.571		54.238								40.007	39.861					39.934

RUN No.: DOE-BU-011

M.B.No.: YP-02/C2

GAS CALCULATIONS

Name	Mol.Weight	First Stage Product Gas (DTM-260)				Second Stage Product Gas (DTM-360)				Dissolved Gas (DTM-350)			
		Average Mol Weight:		19.09 (g/mole)		Average Mol Weight:		(g/mole)		Average Mol Weight:		36.35 (g/mole)	
		Volume		Weight (norm.)		Volume		Weight (norm.)		Volume		Weight (norm.)	
		meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%
Hydrogen	2.02	2.33	4.30	7.12	0.30					0.50	1.24	0.00	0.07
CO2	44.01	7.10	13.09	472.87	19.92					21.73	54.40	2.22	65.87
CO	28.01	44.53	82.10	1886.86	79.49					17.57	44.01	1.15	33.91
H2S	34.08												
Methane	16.04	0.28	0.51	6.75	0.28					0.14	0.35	0.01	0.15
Ethylene	28.05												
Ethane	30.07												
Propane	44.01												
Propylene	42.08												
i-Butane	58.12												
n-Butane	58.12												
i-Butene	56.11												
n-Butene	56.11												
C2-Butene	56.11												
i-Pentane	72.15												
n-Pentane	72.15												
Nitrogen	28.02												
TOTAL		54.24	100.00	2373.61	100.00					39.93	100.00	3.38	100.00

First Stage Shift Reaction

		CO	+	H2O	=	CO2	+	H2
Stochiom.	[moles]	9.06		9.06		9.06		9.06
Produced	[moles]					1.68		-5.54
Total	[moles]	9.06		9.06		10.74		3.53
Stochiom.	[grams]	253.78		163.27		398.75		18.30
Produced	[grams]					74.12		-11.18
Total	[grams]	253.78		163.27		472.87		7.12

Hydrocarbon Gases

		First	Second	Dissolved	Total
C1 to C3	[grams]	6.75		0.01	6.76
C4 +	[grams]				
Total	[grams]	6.75		0.01	6.76

Hydrogen

		First Up-Take	In	Second Out	Up-Take	Total Up-Take
Hydrogen	[grams]	11.18				11.18

Liquid / Slurry Stream Analysis						
	Coal	Solvent	Feed	V-220	V-340 (BTMS)	V-330
Type	BTH	V-1074				
Total Feed / Product			2040	1246	1530	
Total Sample			51.33	13.53	47.67	
Water			3.4	10.34	0.1	
Oils+Asphaltenes			29.25	3.19	40.14	
Oils	100.00%	87.90%	87.90%	96.00%	71.12%	100.00%
Asphaltene	[wt%]	12.10%	12.10%	4.00%	28.88%	
Pre-Asphaltenes	[grams]				1.74	
Insolubles	[grams]		19.72		7.49	
IOM	[wt%] calc		88.72%		68.24%	
Ash	[wt%]		6.03%		30.98%	
Moisture	[wt%]		5.26%		0.79%	
Distill. THF-Extract	[wt%]					
IBP - 182 deg C						
182 - 343						
343 - 524						
524+						
Elemental Analysis: [wt.%]						
Carbon			87.80%			
Hydrogen			8.50%			
Nitrogen			0.85%			
Sulphur			0.05%			
Oxygen (diff)			2.80%			

RUN No.: DOE-BU-011

M.B.No.: YP-02/C2

	Feed	V-220	Products V-340 (BTMS)	V-330
----- in grams of analysis sample -----				
Total Sample	51.33	13.53	47.67	
Water	3.40	10.34	0.10	
Oils+Asphaltenes	29.25	3.19	38.40	
Oils	25.71	3.06	26.81	
Asphaltenes	3.54	0.13	11.59	
Pre-Asphaltenes			1.74	
Insolubles	18.68		7.43	
IOM	17.56		5.13	
Ash	1.13		2.30	
TOTAL	51.33	13.53	47.67	
----- in wt% of analysis sample -----				
Water	6.62%	76.43%	0.21%	
Oils+Asphaltenes	56.98%	23.57%	80.55%	
Oils (on fraction)	87.90%	96.00%	69.81%	
(on total)	50.08%	22.63%	56.23%	
Asphalt. (on fract.)	12.10%	4.00%	30.19%	
(on total)	6.89%	0.94%	24.32%	
Pre-Asphaltenes			3.65%	
Insolubles	36.40%		15.59%	
IOM (on fraction)	93.97%		69.02%	
(on total)	34.20%		10.76%	
Ash (on fraction)	6.03%		30.98%	
(on total)	2.19%		4.83%	
TOTAL	100.00%	100.00%	100.00%	
----- in grams of feed / product -----				
Total Feed / Product	2040	1246	1530	
Water	135.1	952.3	3.2	
Oils+Asphaltenes	1162.3	293.7	1232.4	
Oils (on fraction)	1021.7	282.0	860.4	
(on total)	1021.7	282.0	860.4	
Asphalt. (on fract.)	140.6	11.7	372.1	
(on total)	140.6	11.7	372.1	
Pre-Asphaltenes			55.8	
Insolubles	742.5		238.5	
IOM (on fraction)	697.8		164.6	
(on total)	697.8		164.6	
Ash (on fraction)	44.8		73.9	
(on total)	44.8		73.9	
TOTAL (as is)	2040.0	1246.0	1530.0	
TOTAL (MAF)	1860.1	293.7	1452.9	

Distillation Profile THF-Extract					
Fractions deg C	Feed	Products			
		V-220	V-340 (BTMS)	V-330	Total
IBP - 182					
182 - 343					
343 - 524					
524+					
TOTAL					

Feed	V-220	Products (normalized) V-340 (BTMS)	V-330	Total	Feed	V-220	Products (normalized) V-340 (BTMS)	V-330	Total
----- in wt% of total feed (as is) -----					----- in wt% of total feed (MAF) -----				
6.76%	31.99%	0.16%		32.16%	62.49%	16.14%	67.72%		83.86%
56.89%	14.70%	61.66%		76.35%					
50.01%	14.11%	43.04%		57.15%	54.93%	15.49%	47.27%		62.77%
6.88%	0.59%	18.61%		19.20%	7.56%	0.65%	20.44%		21.09%
		2.79%		2.79%					
36.35%		11.93%		11.93%	37.51%		13.11%		13.11%
34.15%		8.24%		8.24%			9.05%		9.05%
2.19%		3.70%		3.70%					
100.00%	46.69%	76.54%		123.23%	100.00%	16.14%	79.83%		95.97%

RUN No.: DOE-BU-011

M.B.No.: YP-03/C1

	Date	Time	Date	Time
START:			Oct. 26, 93	20:00
END:			Oct. 26, 93	23:50
DURATION (hours):				3.50

Feed:	Type	Wt% (maf)
Coal	BTH	39.64%
Solvent	V-1074	60.36%
Catalyst 1	Aluminate	10.00%
Catalyst 2		
Other		

OPERATING PARAMETERS:

FEED TANK WI-110):	(G)	
Start of Mass Balance		6480.00
End of Mass Balance		4260.00
Rate	(G/HR)	634
FIRST STAGE:		
Operating Pressure:	(MPa)	10.34
Feed Temp.:	(C)	
Reactor Temp.:	(C)	
TE-201I	(BTM)	
TE-202I		410
TE-203I		408
TE-204I	(Top)	389
Liquid Level	(mm)	470
Separator Temperature:	(C)	70
CO-Feed Rate:	(L/MIN)	7.29
Water Feed Rate:	(ML/MIN)	1.82
Temperature:	(C)	264
Catalyst Feed:	(ML/MIN)	4.44
Liquid Product (WI-220):	(G)	
Start of Mass Balance		
End of Mass Balance		1423
Nitrogen Rate:	(L/MIN)	3.67
SECOND STAGE:		
Operating Pressure:	(MPa)	
Feed Temp.:	(C)	
Reactor Temp.:	(C)	
TE-301I	(BTM)	
TE-302I		
TE-303I		
TE-304I		
TE-305I		
TE-306I		
TE-307I		
TE-308I	(Top)	
TE-309I	(VAP)	
Liquid level	(mm)	
Separator Temperature:	(C)	
Hydrogen Feed Rate:	(L/MIN)	
Temperature:	(C)	
Liquid Product (WI-330):	(G)	
Start of Mass Balance		
End of Mass Balance		
Bottoms Product (V-340):	(G)	
Start of Mass Balance		
End of Mass Balance		1740

MEASURED GAS COMPOSITIONS

NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02	3.07		0.72
CO2	44.01	9.62		29.28
CO	28.01	53.85		17.46
H2S	34.08			
Methane	16.04	0.35		0.22
Ethylene	28.05			
Ethane	30.07			
Propane	44.01			
Propylene	42.08			
i-Butane	58.12			
n-Butane	58.12			
i-Butene	56.11			
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15			
Nitrogen	28.02			
TOTAL		66.89		47.67867
Gas Meter Readings		DTM-260	DTM-360	DTM-350
Start of M.B. : (L)		4013.0		2365.0
End of M.B. : (L)		6827.0		2369.3
Total : (L)		2814.0		4.3
Temperature: (C)		21.5	22.0	22.2
Meter Pressure : (mmHg)		707	707	707
Standard Volume: (L)		2426		4
Nitrogen to R-200: (L)		770		
Net Gas Out: (L)		1656		4

Run Conditions

Basis: MAF		First Stage	Second Stage
Pressure	Mpa	10.3	
Temperature	deg C	410	
Catalyst		Aluminate	
Feed	wt % maf coal	39.64%	
WHSV	(kg / hr) / l	1.49	
CO Rate	kg / kg maf coal	2.39	
	moles / 100g maf coal	8.52	
consumed	moles / 100g maf coal	1.10	
Water Rate	kg / kg maf coal	2.39	
	moles / 100g maf coal	13.25	
Hydrogen	kg / kg maf coal		
	moles / 100g maf coal		
consumed	wt % maf coal	1.36%	

OVERALL MASS BALANCE					
Material In:		Grams	Material Out:		Grams
	Feed Slurry	2220		First Stage Liquid:	1423
	CO-Gas:	1912		First Stage Product Gas:	2147
	Water:	381		Second Stage Liquid:	
	Hydrogen:			Second Stage Reactor Bottoms:	1740
	Catalyst:	932		Second Stage Product Gas:	
				Dissolved Gas:	6
TOTAL IN:		5445	TOTAL OUT:		5317
Catalyst mf		93	OVERALL BALANCE:		97.6%

WATER BALANCE		
TOTAL IN:	1365	TOTAL OUT: 1365
		WATER BALANCE: 100.0%

	Coal Conversion	wt.% maf	72.9%
	Ash Balance	wt.%	63.6%

PRODUCT YIELDS					
Description	Total Gross			Total Net	
	[grams]		wt. % maf feed	[grams]	wt. % maf coal
	measured	normalized			
H2O					
COx	87.56	90.94	4.50%	90.94	11.35%
H2S					
C1 to C3	6.15	6.39	0.32%	6.39	0.80%
C4 +					
Oil	1159.89	1204.68	59.58%	132.04	16.47%
Asphaltene	426.09	442.55	21.89%	294.89	36.79%
Preasphalt.	68.00	70.63	3.49%	70.63	8.81%
IOM	209.45	217.54	10.76%	217.54	27.14%
Total	1957.14	2032.72	100.54%	812.43	101.36%

Distillation Profile THF-Extract					
Fraction [deg C]	Feed [grams]	Product			
		Total Gross		Total Net	
		[grams]	[grams]	[grams]	wt. % maf coal
IBP - 182					
182 - 343					
343 - 524					
524+					
TOTAL					

GAS ANALYSIS

Name	First Stage Product Gas (DTM-260)							Second Stage Product Gas (DTM-360)							Dissolved Gas (DTM-350)						
	Number of Samples: 3							Number of Samples: 1							Number of Samples: 3						
	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%
Hydrogen	3.046	3.084	3.079				3.070								0.709	0.735	0.721				0.722
CO2	9.678	9.505	9.680				9.621								28.874	29.025	29.950				29.283
CO	54.462	54.505	52.581				53.849								17.187	17.193	17.988				17.455
H2S																					
Methane	0.345	0.340	0.354				0.346								0.207	0.221	0.228				0.219
Ethylene																					
Ethane																					
Propane																					
Propylene																					
i-Butane																					
n-Butane																					
i-Butene																					
n-Butene																					
C2-Butene																					
i-Pentane																					
n-Pentane																					
Nitrogen																					
TOTAL	67.531	67.434	65.694				66.866								46.977	47.174	46.885				47.679

GAS CALCULATIONS

Name	Mol.Weight	First Stage Product Gas (DTM-260)				Second Stage Product Gas (DTM-360)				Dissolved Gas (DTM-350)			
		Average Mol Weight:		19.83 (g/mole)		Average Mol Weight:		(g/mole)		Average Mol Weight:		37.39 (g/mole)	
		Volume		Weight (norm.)		Volume		Weight (norm.)		Volume		Weight (norm.)	
		meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%
Hydrogen	2.02	3.07	4.59	6.85	0.32					0.72	1.51	0.01	0.08
CO ₂	44.01	9.62	14.38	467.80	21.79					29.28	61.42	4.46	72.29
CO	28.01	53.85	80.51	1666.39	77.61					17.46	36.61	1.69	27.43
H ₂ S	34.08												
Methane	16.04	0.35	0.52	6.14	0.29					0.22	0.46	0.01	0.20
Ethylene	28.05												
Ethane	30.07												
Propane	44.01												
Propylene	42.08												
i-Butane	58.12												
n-Butane	58.12												
i-Butene	56.11												
n-Butene	56.11												
C ₂ -Butene	56.11												
i-Pentane	72.15												
n-Pentane	72.15												
Nitrogen	28.02												
TOTAL		66.89	100.00	2147.18	100.00					47.68	100.00	6.17	100.00

First Stage Shift Reaction

		CO	+	H ₂ O	=	CO ₂	+	H ₂
Stochiom.	[moles]	8.78		8.78		8.78		8.78
Produced	[moles]					1.85		-5.39
Total	[moles]	8.78		8.78		10.63		3.39
Stochiom.	[grams]	245.92		158.21		386.39		17.73
Produced	[grams]					81.40		-10.88
Total	[grams]	245.92		158.21		467.80		6.85

Hydrocarbon Gases

		First	Second	Dissolved	Total
C1 to C3	[grams]	6.14		0.01	6.15
C4 +	[grams]				
Total	[grams]	6.14		0.01	6.15

Hydrogen

		First Up-Take	In	Second Out	Up-Take	Total Up-Take
Hydrogen	[grams]	10.88				10.88

RUN No.: DOE-BU-011	M.B.No.: YP-03/C1
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RUN No.: DOE-BU-011	M.B.No.: YP-03/C1
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Liquid / Slurry Stream Analysis

[illegible]

	Feed	V-220	Products V-340 (BTMS)	V-330
----- in grams of analysis sample -----				
Total Sample	50.27	14.35	44.01	
Water	3.30	12.17		
Oils+Asphaltenes	27.63	2.18	34.65	
Oils	24.29	2.09	24.09	
Asphaltenes	3.34	0.09	10.55	
Pre-Asphaltenes			1.72	
Insolubles	19.34		7.64	
IOM	18.15		5.30	
Ash	1.19		2.34	
TOTAL	50.27	14.35	44.01	
----- in wt% of analysis sample -----				
Water	6.56%	84.82%		
Oils+Asphaltenes	54.97%	15.18%	78.73%	
Oils (on fraction)	87.90%	95.92%	69.54%	
(on total)	48.32%	14.56%	54.75%	
Asphalt. (on fract.)	12.10%	4.08%	30.46%	
(on total)	6.65%	0.62%	23.98%	
Pre-Asphaltenes			3.91%	
Insolubles	38.47%		17.36%	
IOM (on fraction)	93.86%		69.33%	
(on total)	36.11%		12.04%	
Ash (on fraction)	6.14%		30.67%	
(on total)	2.36%		5.33%	
TOTAL	100.00%	100.00%	100.00%	
----- in grams of feed / product -----				
Total Feed / Product	2220	1423	1740	
Water	145.7	1207.2		
Oils+Asphaltenes	1220.3	216.1	1369.9	
Oils (on fraction)	1072.6	207.3	952.6	
(on total)	1072.6	207.3	952.6	
Asphalt. (on fract.)	147.7	8.8	417.3	
(on total)	147.7	8.8	417.3	
Pre-Asphaltenes			68.0	
Insolubles	854.0		302.1	
IOM (on fraction)	801.5		209.4	
(on total)	801.5		209.4	
Ash (on fraction)	52.4		92.7	
(on total)	52.4		92.7	
TOTAL (as is)	2220.0	1423.3	1740.0	
TOTAL (MAF)	2021.8	216.1	1647.3	

Distillation Profile THF-Extract					
Fractions deg C	Feed	Products			
		V-220	V-340 (BTMS)	V-330	Total
IBP - 182					
182 - 343					
343 - 524					
524+					
TOTAL					

Feed	V-220	Products (normalized) V-340 (BTMS)	V-330	Total	Feed	V-220	Products (normalized) V-340 (BTMS)	V-330	Total
----- in wt% of total feed (as is) -----					----- in wt% of total feed (MAF) -----				
6.80%	45.93%			45.93%					
54.83%	10.08%	63.93%		74.01%	60.36%	11.10%	70.37%		81.47%
48.19%	9.67%	44.45%		54.13%	53.05%	10.65%	48.94%		59.58%
6.63%	0.41%	19.47%		19.88%	7.30%	0.45%	21.44%		21.89%
38.37%		3.17%		3.17%					
		14.10%		14.10%	39.64%		15.52%		15.52%
36.01%		9.77%		9.77%			10.76%		10.76%
2.36%		4.32%		4.32%					
100.00%	56.01%	81.20%		137.21%	100.00%	11.10%	84.62%		95.72%

SUMMARY OF BENCH UNIT TEST RUNS
(forced water balance in V-200 and kept oil as measured)

RUN No.:	DOE-BU-012				DOE-BU-013			
M.B.No.:	YP-01/ C1	YP-02/ C1	YP-03/C1	YP-04/C1	YP-01/C1	YP-02/C1	YP-03/C1	YP-04/C1
Coal	BTH	BTH	BTH	BTH	BTH	BTH	BTH	BTH
wt % maf	39.47%	40.12%	39.25%	38.63%	37.15%	38.30%	36.74%	40.62%
First Stage:								
Feed Rate (kg / hr) / IWHSV	1.91	2.07	1.55	1.91	2.20	1.75	2.15	2.35
Pressure Mpa	10.34	10.34	10.34	10.34	10.34	10.34	10.34	10.34
Temperatu deg C	410	410	410	409	411	409	411	412
Catalyst	Aluminate	Aluminate	Aluminate	Aluminate	Aluminate	Aluminate	Aluminate	Aluminate
CO Rate kg / kg maf coal	1.12	0.98	1.32	1.17	0.99	1.24	1.04	0.90
moles / 100g maf coal	3.98	3.49	4.72	4.17	3.53	4.43	3.70	3.20
consumed moles / 100g maf coal	0.82	0.73	0.89	0.87	1.35	0.84	0.76	0.89
Water Rate kg / kg maf coal	1.12	0.98	1.32	1.17	0.99	1.24	1.04	0.90
moles / 100g maf coal	6.19	5.43	7.34	6.49	5.50	6.88	5.75	4.98
Hydrogen wt % maf coal	1.15%	1.05%	1.22%	1.23%	2.15%	1.18%	1.09%	1.17%
Second Stage:								
Feed Rate (kg / hr) / IWHSV	1.12	1.21	0.91	1.50	1.47	1.18	1.44	1.58
Pressure Mpa	17.24	17.24	17.24	17.24	17.24	17.24	17.24	17.24
Temperatu deg C	408	424	433	426	425	425	424	424
Catalyst	FeO+DMDS	FeO+DMDS	FeO+DMDS	FeO+DMDS	Pyrite	ATM	ATM+DMDS	Moly+DMDS
Hydrogen kg / kg maf coal	0.64	0.60	0.81	0.66	0.61	0.74	0.62	0.54
moles / 100g maf coal	31.71	29.72	40.21	32.83	30.49	36.64	31.04	26.86
consumed wt % maf coal	7.17%	6.43%	8.30%	6.28%	5.12%	6.70%	6.84%	6.17%
Coal Conversion (wt % maf coal)	80.73%	86.43%	83.69%	81.78%	78.71%	75.61%	75.26%	77.02%
Product Yield (wt % maf coal)								
H2O	4.49%	4.50%	5.63%	3.98%	6.87%	1.16%	4.25%	4.59%
COx	11.92%	11.85%	12.05%	11.40%	13.42%	13.14%	13.81%	12.09%
H2S				3.33%	0.35%		1.52%	1.58%
C1 to C3	2.71%	5.45%	5.72%	4.39%	4.65%	5.09%	5.34%	5.19%
Pentane soluble (incl. C4)	40.00%	52.02%	52.15%	42.05%	30.73%	31.65%	30.13%	36.33%
Asphaltenes	24.65%	15.83%	11.84%	19.28%	25.18%	27.60%	23.30%	19.40%
Preasphaltenes	5.27%	4.26%	5.82%	4.85%	4.79%	4.86%	4.85%	5.18%
IOM	19.27%	13.57%	16.31%	18.22%	21.29%	24.39%	24.74%	22.98%
TOTAL	108.32%	107.48%	109.52%	107.50%	107.27%	107.88%	107.93%	107.35%

NOTE:

RUN No.: DOE-BU-012

M.B.No.: YP-01/C1

	Date	Time	Date	Time
START:			Nov. 09 93	13:00
END:			Nov. 09 93	21:00
DURATION (hours):				8.00

Feed:	Type	Wt% (maf)
Coal	BTH	39.47%
Solvent	V-1074	60.53%
Catalyst 1	Aluminate	2.00%
Catalyst 2	FeO+DMDS	2.00%
Other		

OPERATING PARAMETERS:

FEED TANK WI-110:	(G)	
Start of Mass Balance		15750.00
End of Mass Balance		9250.00
Rate	(G/HR)	813
FIRST STAGE:		
Operating Pressure:	(MPa)	10.34
Feed Temp.:	(C)	
Reactor Temp.:	(C)	
TE-201I	(BTM)	
TE-202I		410
TE-203I		405
TE-204I	(Top)	398
Liquid Level	(mm)	470
Separator Temperature:	(C)	47
CO-Feed Rate:	(L/MIN)	4.28
Water Feed Rate:	(ML/MIN)	1.18
Temperature:	(C)	176
Catalyst Feed:	(ML/MIN)	
Liquid Product (WI-220):	(G)	
Start of Mass Balance		
End of Mass Balance		876.40
Nitrogen Rate:	(L/MIN)	4.00
SECOND STAGE:		
Operating Pressure:	(MPa)	17.24
Feed Temp.:	(C)	142
Reactor Temp.:	(C)	
TE-301I	(BTM)	241
TE-302I		408
TE-303I		408
TE-304I		408
TE-305I		409
TE-306I		408
TE-307I		406
TE-308I	(Top)	397
TE-309I	(VAP)	396
Liquid level	(mm)	800
Separator Temperature:	(C)	24
Hydrogen Feed Rate:	(L/MIN)	33.93
Temperature:	(C)	425
Liquid Product (WI-330):	(G)	
Start of Mass Balance		490
End of Mass Balance		965
Bottoms Product (V-340):	(G)	
Start of Mass Balance		
End of Mass Balance		5090
		8.07

MEASURED GAS COMPOSITIONS

NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02	2.58	94.79	1.67
CO2	44.01	9.94	0.20	13.96
CO	28.01	32.78	0.13	7.14
H2S	34.08			
Methane	16.04	0.21	0.22	0.24
Ethylene	28.05			
Ethane	30.07		0.07	
Propane	44.01		0.05	
Propylene	42.08			
i-Butane	58.12		0.01	
n-Butane	58.12		0.02	
i-Butene	56.11			
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15		0.03	
Nitrogen	28.02			
TOTAL		45.51	95.53	23.0095
Gas Meter Readings				
		DTM-260	DTM-360	DTM-350
Start of M.B. : (L)		975.0	8050.0	2409.0
End of M.B. : (L)		5854.0	25015.0	2434.0
Total : (L)		4879.0	16965.0	25.0
Temperature: (C)		22.0	22.0	23.2
Meter Pressure : (mmHg)		705	705	705
Standard Volume: (L)		4189	14564	21
Nitrogen to R-200: (L)		1921		
Net Gas Out: (L)		2268	14564	21

Run Conditions

Basis: MAF		First Stage	Second Stage
Pressure	Mpa	10.3	17.2
Temperature	deg C	410	408
Catalyst		Aluminate	FeO+DMD
Feed	wt % maf coal	39.47%	
WHSV	(kg / hr) / l	1.91	1.12
CO Rate	kg / kg maf coal	1.12	
	moles / 100g maf coal	3.98	
consumed	moles / 100g maf coal	0.82	
Water Rate	kg / kg maf coal	1.12	
	moles / 100g maf coal	6.19	
Hydrogen	kg / kg maf coal		0.64
	moles / 100g maf coal		31.71
consumed	wt % maf coal	1.15%	7.17%

OVERALL MASS BALANCE					
Material In:		Grams		Material Out:	Grams
	Feed Slurry	6500		First Stage Liquid:	876
	CO-Gas:	2569		First Stage Product Gas:	3033
	Water:	569		Second Stage Liquid:	475
	Hydrogen:	1468		Second Stage Reactor Bottoms:	5090
	Catalyst:			Second Stage Product Gas:	1470
	S-Agent	65		Dissolved Gas:	34
TOTAL IN:		11170		TOTAL OUT:	10979
Catalyst mf		260		OVERALL BALANCE:	98.3%
WATER BALANCE					
TOTAL IN:		925		TOTAL OUT:	1024
				WATER BALANCE:	110.8%
		Coal Conversion	wt. % maf	80.7%	
		Ash Balance	wt. %	136.1%	

PRODUCT YIELDS					
Description	Total Gross			Total Net	
	[grams]		wt. % maf feed	[grams]	wt. % maf coal
	measured	normalized			
H2O	99.43	103.52	1.77%	103.52	4.49%
COx	263.73	274.57	4.71%	274.57	11.92%
H2S					
C1 to C3	60.04	62.51	1.07%	62.51	2.71%
C4 +	29.69	30.91	0.53%	30.91	1.34%
Oil	3836.86	3994.61	68.46%	890.33	38.65%
Asphaltene	955.83	995.12	17.05%	567.80	24.65%
Preasphalt.	116.56	121.36	2.08%	121.36	5.27%
IOM	426.36	443.89	7.61%	443.89	19.27%
Total	5788.49	6026.47	103.28%	2494.88	108.32%

Distillation Profile THF-Extract					
Fraction [deg C]	Feed [grams]	Product			
		Total Gross		Total Net	
		[grams]	normalized	[grams]	wt. % maf coal
IBP - 182		40.37	42.03	42.03	1.82%
182 - 343	141.26	391.26	407.35	266.08	11.55%
343 - 524	3390.33	3525.51	3670.46	280.13	12.16%
524+		952.10	991.24	991.24	43.04%
TOTAL	3531.60	4909.25	5111.09	1579.49	68.57%

GAS ANALYSIS																					
	First Stage Product Gas (DTM-280)							Second Stage Product Gas (DTM-350)							Dissolved Gas (DTM-350)						
Name	Number of Samples: 3							Number of Samples: 5							Number of Samples: 2						
	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%	vol.%	vol.%	vol.%		vol.%	vol.%	vol.%	Av.vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%
Hydrogen	2.807	2.439	2.479				2.575	100.974	90.937	107.554		88.120	88.375		94.792	1.013	2.336				1.675
CO2	10.589	9.107	10.119				9.938	0.203	0.201	0.209		0.198	0.208		0.204	12.189	15.724				13.957
CO	33.506	32.024	32.823				32.784			0.218		0.206	0.222		0.129	3.920	10.355				7.138
H2S																					
Methane	0.363	0.236	0.035				0.211	0.199	0.170	0.177		0.265	0.286		0.219	0.129	0.353				0.241
Ethylene																					
Ethane								0.063	0.063	0.072		0.068	0.071		0.067						
Propane								0.048	0.046	0.052		0.047	0.051		0.049						
Propylene																					
i-Butane								0.020	0.015	0.010		0.009	0.014		0.014						
n-Butane								0.026	0.024	0.018		0.017	0.025		0.022						
i-Butene																					
n-Butene																					
C2-Butene																					
i-Pentane																					
n-Pentane								0.036	0.037	0.034		0.018	0.034		0.032						
Nitrogen																					
TOTAL	47.265	43.806	45.456				46.609	101.569	91.493	108.344		86.948	89.286		95.628	17.251	28.768				23.010

RUN No.: DOE-BU-012

M.B.No.: YP-01/C1

GAS CALCULATIONS

Name	Mol.Weight	First Stage Product Gas (DTM-260)				Second Stage Product Gas (DTM-360)				Dissolved Gas (DTM-350)			
		Average Mol Weight:		16.23 (g/mole)		Average Mol Weight:		2.26 (g/mole)		Average Mol Weight:		35.70 (g/mole)	
		Volume		Weight (norm.)		Volume		Weight (norm.)		Volume		Weight (norm.)	
		meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%
Hydrogen	2.02	2.58	5.66	11.56	0.38	94.79	99.23	1302.68	88.60	1.67	7.28	0.14	0.41
CO ₂	44.01	9.94	21.84	972.48	32.06	0.20	0.21	61.02	4.15	13.96	60.66	25.46	74.78
CO	28.01	32.78	72.04	2041.72	67.31	0.13	0.14	24.62	1.67	7.14	31.02	8.29	24.34
H ₂ S	34.08												
Methane	16.04	0.21	0.46	7.54	0.25	0.22	0.23	23.94	1.63	0.24	1.05	0.16	0.47
Ethylene	28.05												
Ethane	30.07					0.07	0.07	13.79	0.94				
Propane	44.01					0.05	0.05	14.61	0.99				
Propylene	42.08												
i-Butane	58.12					0.01	0.01	5.38	0.37				
n-Butane	58.12					0.02	0.02	8.70	0.59				
i-Butene	56.11												
n-Butene	56.11												
C ₂ -Butene	56.11												
i-Pentane	72.15												
n-Pentane	72.15					0.03	0.03	15.61	1.06				
Nitrogen	28.02												
TOTAL		45.51	100.00	3033.30	100.00	95.53	100.00	1470.35	100.00	23.01	100.00	34.05	100.00

First Stage Shift Reaction

		CO	+	H ₂ O	=	CO ₂	+	H ₂
Stochiom.	[moles]	18.82		18.82		18.82		18.82
Produced	[moles]					3.28		-13.09
Total	[moles]	18.82		18.82		22.10		5.73
Stochiom.	[grams]	527.07		339.09		828.14		38.01
Produced	[grams]					144.34		-26.45
Total	[grams]	527.07		339.09		972.48		11.56

Hydrocarbon Gases

		First	Second	Dissolved	Total
C ₁ to C ₃	[grams]	7.54	52.34	0.16	60.04
C ₄ +	[grams]		29.69		29.69
Total	[grams]	7.54	82.03	0.16	89.72

Hydrogen

		First Up-Take	In	Second Out	Up-Take	Total Up-Take
Hydrogen	[grams]	26.45	1467.93	1302.82	165.11	191.55

M.B.No.: YP-01/C1

Liquid / Slurry Stream Analysis

[illegible]

RUN No.: DOE-BU-012

M.B.No.: YP-01/C1

	Feed	V-220	Products V-340 (BTMS)	V-330
----- In grams of analysis sample -----				
Total Sample	51.14	10.11	49.78	66.50
Water	2.80	6.76		13.92
Oils+Asphaltenes	27.79	3.35	40.36	52.58
Oils	24.42	3.22	31.26	50.57
Asphaltenes	3.36	0.14	9.09	2.01
Pre-Asphaltenes			1.14	
Insolubles	20.55		8.28	
IOM	18.12		4.17	
Ash	2.43		4.12	
TOTAL	51.14	10.11	49.78	66.5

----- in wt% of analysis sample -----				
Water	5.48%	66.82%		20.93%
Oils+Asphaltenes	54.33%	33.18%	81.07%	79.07%
Oils (on fraction)	87.90%	95.92%	77.47%	96.18%
(on total)	47.76%	31.83%	62.80%	76.05%
Asphalt. (on fract.)	12.10%	4.08%	22.53%	3.82%
(on total)	6.57%	1.35%	18.26%	3.02%
Pre-Asphaltenes			2.29%	
Insolubles	40.19%		16.64%	
IOM (on fraction)	88.17%		50.33%	
(on total)	35.44%		8.38%	
Ash (on fraction)	11.84%		49.67%	
(on total)	4.76%		8.27%	
TOTAL	100.00%	100.00%	100.00%	100.00%

----- In grams of feed / product -----				
Total Feed / Product	6500	876	5090	475
Water	355.9	585.6		99.4
Oils+Asphaltenes	3531.6	290.8	4126.3	375.6
Oils (on fraction)	3104.3	278.9	3196.7	361.2
(on total)	3104.3	278.9	3196.7	361.2
Asphalt. (on fract.)	427.3	11.9	929.6	14.3
(on total)	427.3	11.9	929.6	14.3
Pre-Asphaltenes			116.6	
Insolubles	2612.5		847.1	
IOM (on fraction)	2303.3		426.4	
(on total)	2303.3		426.4	
Ash (on fraction)	309.2		420.8	
(on total)	309.2		420.8	
TOTAL (as is)	6500.0	876.4	5090.0	475.0
TOTAL (MAF)	5834.9	290.8	4669.2	375.6

Distillation Profile THF-Extract					
Fractions deg C	Feed	Products			
		V-220	V-340 (BTMS)	V-330	Total
IBP - 182				40.37	40.37
182 - 343	141.26	11.63	140.01	239.61	391.26
343 - 524	3390.33	279.17	3150.76	95.58	3525.51
524+			952.10		952.10
TOTAL	3531.60	290.81	4242.87	375.57	4909.25

Feed	Products (normalized)				Feed	Products (normalized)			
	V-220	V-340 (BTMS)	V-330	Total		V-220	V-340 (BTMS)	V-330	Total
----- In wt% of total feed (as is) -----					----- In wt% of total feed (MAF) -----				
5.69%	5.69%		1.59%	7.28%				1.77%	1.77%
54.21%	4.65%	65.94%	6.00%	76.59%	60.53%	5.19%	73.62%	6.70%	85.51%
47.65%	4.46%	51.09%	5.77%	61.32%	53.20%	4.98%	57.04%	6.45%	68.46%
6.56%	0.19%	14.86%	0.23%	15.28%	7.32%	0.21%	16.59%	0.26%	17.05%
		1.86%		1.86%			2.08%		2.08%
40.10%		11.56%		11.56%					
35.36%		6.81%		6.81%	39.47%		7.61%		7.61%
4.75%		4.75%		4.75%					
100.00%	10.33%	79.37%	7.59%	97.29%					
					100.00%	5.19%	83.31%	8.48%	96.98%

PROCESS YIELD STRUCTURE

RUN No.: DOE-BU-012 M.B. No.: YP-01/C1

FEED		PRODUCT	
wt% (coal+solvent) as is	maf	wt% (coal+solvent) as is	maf
54.2%	60.5%	15.2%	17.0%
45.8%	39.5%	0.1%	0.1%
100.0%	100.0%	4.6%	5.2%
8.1%	9.0%	5.7%	
5.2%	5.8%	1.9%	2.1%
		1.3%	1.5%
		6.0%	6.7%
2.5%	2.8%	1.6%	1.8%
115.8%	117.7%	67.8%	75.7%
		6.8%	7.6%
		4.7%	
		115.8%	117.7%

Remarks:

RUN No.: DOE-BU-012 M.B.No.: YP-02/C1

	Date	Time	Date	Time
START:			Nov. 10, 93	01:00
END:			Nov. 10, 93	09:00
DURATION (hours):				8.00

Feed:	Type	Wt% (maf)
Coal	BTH	40.12%
Solvent	V-1074	59.88%
Catalyst 1	Aluminate	2.00%
Catalyst 2	FeO+DMDS	2.00%
Other		

OPERATING PARAMETERS:			
FEED TANK WI-110:	(G)		
Start of Mass Balance			10600.00
End of Mass Balance			3550.00
Rate	(G/HR)		881
FIRST STAGE:			
Operating Pressure:	(MPa)		10.34
Feed Temp.:	(C)		
Reactor Temp.:	(C)		
TE-201I	(BTM)		
TE-202I			410
TE-203I			408
TE-204I	(Top)		398
Liquid Level	(mm)		470
Separator Temperature:	(C)		47
CO-Feed Rate:	(L/MIN)		4.12
Water Feed Rate:	(ML/MIN)		1.24
Temperature:	(C)		176
Catalyst Feed:	(ML/MIN)		
Liquid Product (WI-220):	(G)		
Start of Mass Balance			
End of Mass Balance			1157.62
Nitrogen Rate:	(L/MIN)		4.00
SECOND STAGE:			
Operating Pressure:	(MPa)		17.24
Feed Temp.:	(C)		142
Reactor Temp.:	(C)		
TE-301I	(BTM)		241
TE-302I			423
TE-303I			424
TE-304I			424
TE-305I			424
TE-306I			423
TE-307I			421
TE-308I	(Top)		397
TE-309I	(VAP)		396
Liquid level	(mm)		800
Separator Temperature:	(C)		24
Hydrogen Feed Rate:	(L/MIN)		34.96
Temperature:	(C)		425
Liquid Product (WI-330):	(G)		
Start of Mass Balance			319
End of Mass Balance			1335
Bottoms Product (V-340):	(G)		
Start of Mass Balance			
End of Mass Balance			4330
Sulfiding Agent	(mL/HR)		7.58

MEASURED GAS COMPOSITIONS				
NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02	2.70	88.75	1.67
CO2	44.01	10.65	0.14	13.96
CO	28.01	35.20	0.33	7.14
H2S	34.08			
Methane	16.04	0.38	0.43	0.24
Ethylene	28.05		0.02	
Ethane	30.07		0.12	
Propane	44.01		0.09	
Propylene	42.08			
i-Butane	58.12		0.01	
n-Butane	58.12		0.03	
i-Butene	56.11			
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15		0.04	
Nitrogen	28.02			
TOTAL		48.93	89.94	23.0095
Gas Meter Readings				
		DTM-260	DTM-360	DTM-350
Start of M.B. : (L)		8290.0	4990.0	2434.0
End of M.B. : (L)		13076.0	22779.0	2469.0
Total : (L)		4786.0	17789.0	35.0
Temperature: (C)		22.2	23.0	21.6
Meter Pressure : (mmHg)		703	703	703
Standard Volume: (L)		4094	15177	30
Nitrogen to R-200: (L)		1921		
Net Gas Out: (L)		2173	15177	30

Run Conditions			
Basis: MAF		First Stage	Second Stage
Pressure	Mpa	10.3	17.2
Temperature	deg C	410	424
Catalyst		Aluminate	FeO+DMD
Feed	wt % maf coal	40.12%	
WHSV	(kg / hr) / l	2.07	1.21
CO Rate	kg / kg maf coal	0.98	
	moles / 100g maf coal	3.49	
consumed	moles / 100g maf coal	0.73	
Water Rate	kg / kg maf coal	0.98	
	moles / 100g maf coal	5.43	
Hydrogen	kg / kg maf coal		0.60
	moles / 100g maf coal		29.72
consumed	wt % maf coal	1.05%	6.43%

RUN No.: DOE-BU-012

M.B.No.: YP-02/C1

	Feed	V-220	Products V-340 (BTMS)	V-330
----- in grams of analysis sample -----				
Total Sample	50.27	13.42	48.94	55.02
Water	2.70	7.41		5.60
Oils+Asphaltenes	26.95	6.01	40.07	48.42
Oils	23.69	5.77	32.17	45.18
Asphaltenes	3.26	0.25	7.90	3.24
Pre-Asphaltenes			0.90	1.00
Insolubles	20.62		7.97	
IOM	18.06		3.53	
Ash	2.56		4.45	
TOTAL	50.27	13.42	48.94	55.02
----- in wt% of analysis sample -----				
Water	5.37%	55.20%		10.18%
Oils+Asphaltenes	53.62%	44.80%	81.87%	88.00%
Oils (on fraction)	87.90%	95.92%	80.29%	93.30%
(on total)	47.13%	42.97%	65.73%	82.11%
Asphalt. (on fract.)	12.10%	4.08%	19.71%	6.70%
(on total)	6.49%	1.83%	16.14%	5.89%
Pre-Asphaltenes			1.84%	1.82%
Insolubles	41.01%		16.29%	
IOM (on fraction)	87.59%		44.24%	
(on total)	35.92%		7.21%	
Ash (on fraction)	12.41%		55.77%	
(on total)	5.09%		9.09%	
TOTAL	100.00%	100.00%	100.00%	100.00%
----- in grams of feed / product -----				
Total Feed / Product	7050	1158	4330	1016
Water	378.7	639.0		103.4
Oils+Asphaltenes	3780.2	518.6	3544.8	894.1
Oils (on fraction)	3322.8	497.4	2846.0	834.3
(on total)	3322.8	497.4	2846.0	834.3
Asphalt. (on fract.)	457.4	21.2	698.8	59.9
(on total)	457.4	21.2	698.8	59.9
Pre-Asphaltenes			79.6	18.5
Insolubles	2891.1		705.5	
IOM (on fraction)	2532.3		312.1	
(on total)	2532.3		312.1	
Ash (on fraction)	358.8		393.4	
(on total)	358.8		393.4	
TOTAL (as is)	7050.0	1157.6	4330.0	1016.0
TOTAL (MAF)	6312.6	518.6	3936.6	912.6

Distillation Profile THF-Extract					
Fractions deg C	Feed	Products			
		V-220	V-340 (BTMS)	V-330	Total
IBP - 182				86.70	86.70
182 - 343	151.21	20.74	139.18	474.55	634.47
343 - 524	3629.02	497.85	2481.31	351.35	3330.51
524+			1003.98		1003.98
TOTAL	3780.22	518.60	3624.47	912.59	5055.65

Feed	V-220	Products (nomalized) V-340 (BTMS)	V-330	Total	Feed	V-220	Products (nomalized) V-340 (BTMS)	V-330	Total
----- in wt% of total feed (as is) -----					----- in wt% of total feed (MAF) -----				
5.88%	5.88%		1.61%	7.49%				1.80%	1.80%
53.33%	8.05%	55.05%	13.89%	76.99%	59.88%	9.04%	61.81%	15.59%	86.45%
46.88%	7.73%	44.20%	12.96%	64.88%	52.64%	8.67%	49.63%	14.55%	72.85%
6.45%	0.33%	10.85%	0.93%	12.11%	7.25%	0.37%	12.19%	1.04%	13.60%
		1.24%	0.29%	1.52%			1.39%	0.32%	1.71%
40.79%		9.91%		9.91%					
35.73%		4.85%		4.85%	40.12%		5.44%		5.44%
5.06%		5.06%		5.06%					
100.00%	13.93%	66.20%	15.78%	95.91%					
					100.00%	9.04%	68.64%	17.72%	95.40%

Liquid / Slurry Stream Analysis					
	Coal	Solvent	Feed	V-220	V-340 (BTMS)
Type	BTH	V-1074			
Total Feed / Product			7050	1158	4330
Total Sample			50.27	13.42	48.94
Water			2.7	7.41	5.6
Oils+Asphaltenes			26.95	6.01	40.97
Oils			87.90%	87.90%	80.72%
Asphaltene			12.10%	12.10%	19.28%
Pre-Asphaltenes					0.9
Insolubles			20.75		8.05
IOM			86.94%		43.30%
Ash			12.41%		55.77%
Moisture			0.65%		0.94%
----- D-2887 -----					
Distill. THF-Extract					
IBP - 182 deg C					
182 - 343			4.00%	4.00%	3.84%
343 - 524			96.00%	96.00%	68.46%
524+					27.70%
Elemental Analysis: [wt.%]					
Carbon			87.80%		
Hydrogen			8.50%		
Nitrogen			0.85%		
Sulphur			0.05%		
Oxygen (diff)			2.80%		

RUN No.: DOE-BU-012

M.B.No.: YP-02/C1

GAS CALCULATIONS

Name	Mol.Weight	First Stage Product Gas (DTM-260)				Second Stage Product Gas (DTM-360)				Dissolved Gas (DTM-350)			
		Average Mol Weight:		15.91 (g/mole)		Average Mol Weight:		2.38 (g/mole)		Average Mol Weight:		35.70 (g/mole)	
		Volume		Weight (norm.)		Volume		Weight (norm.)		Volume		Weight (norm.)	
		meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%
Hydrogen	2.02	2.70	5.52	10.81	0.37	88.75	98.67	1349.78	83.61	1.67	7.28	0.20	0.41
CO ₂	44.01	10.65	21.76	928.70	31.96	0.14	0.15	45.07	2.79	13.96	60.66	35.74	74.78
CO	28.01	35.20	71.95	1954.34	67.25	0.33	0.36	68.75	4.26	7.14	31.02	11.63	24.34
H ₂ S	34.08												
Methane	16.04	0.38	0.77	12.05	0.41	0.43	0.48	52.17	3.23	0.24	1.05	0.22	0.47
Ethylene	28.05					0.02	0.02	3.38	0.21				
Ethane	30.07					0.12	0.13	27.40	1.70				
Propane	44.01					0.09	0.10	30.16	1.87				
Propylene	42.08												
i-Butane	58.12					0.01	0.01	4.38	0.27				
n-Butane	58.12					0.03	0.03	12.69	0.79				
i-Butene	56.11												
n-Butene	56.11												
C ₂ -Butene	56.11												
i-Pentane	72.15												
n-Pentane	72.15					0.04	0.04	20.64	1.28				
Nitrogen	28.02												
TOTAL		48.93	100.00	2905.90	100.00	89.94	100.00	1614.42	100.00	23.01	100.00	47.79	100.00

First Stage Shift Reaction

		CO	+	H ₂ O	=	CO ₂	+	H ₂
Stochiom.	[moles]	18.57		18.57		18.57		18.57
Produced	[moles]					2.53		-13.22
Total	[moles]	18.57		18.57		21.10		5.35
Stochiom.	[grams]	520.17		334.65		817.30		37.51
Produced	[grams]					111.40		-26.70
Total	[grams]	520.17		334.65		928.70		10.81

Hydrocarbon Gases

		First	Second	Dissolved	Total
C1 to C3	[grams]	12.05	113.10	0.22	125.38
C4 +	[grams]		37.71		37.71
Total	[grams]	12.05	150.82	0.22	163.09

Hydrogen

		First Up-Take	In	Second Out	Up-Take	Total Up-Take
Hydrogen	[grams]	26.70	1512.77	1349.98	162.79	189.49

GAS ANALYSIS

Name	First Stage Product Gas (DTM-260)					Second Stage Product Gas (DTM-360)					Dissolved Gas (DTM-350)				
	Number of Samples: 3					Number of Samples: 1					Number of Samples: 2				
	vol. %	vol. %	vol. %	vol. %	Av.vol. %	vol. %	vol. %	vol. %	vol. %	Av.vol. %	vol. %	vol. %	vol. %	vol. %	Av.vol. %
Hydrogen	2.588	2.743	2.770	88.745	2.700	88.745	1.013	2.336	1.675						
CO ₂	10.424	10.732	10.786	10.647	0.136	0.136	12.189	15.724	13.957						
CO	34.157	35.497	35.960	35.205	0.326	0.326	3.920	10.355	7.138						
H ₂ S															
Methane	0.359	0.383	0.395	0.379	0.432	0.432	0.129	0.353	0.241						
Ethylene					0.016	0.016									
Ethane					0.121	0.121									
Propane					0.091	0.091									
Propylene					0.010	0.010									
n-Butane					0.029	0.029									
i-Butane															
n-Pentane					0.038	0.038									
i-Pentane															
n-Hexane															
Heptane															
Octane															
Nonane															
Decane															
Undecane															
Dodecane															
Tridecane															
Tetradecane															
Pentadecane															
Hexadecane															
Heptadecane															
Octadecane															
Nonadecane															
Eicosane															
Arane															
Alkane															
Alkene															
Alkyne															
Alcohol															
Aldehyde															
Ketone															
Amine															
Nitrogen															
Oxygen															
Water															
Acid															
Base															
Salt															
Other															
TOTAL	47.528	49.911	49.355	48.931	89.944	89.944	17.251	28.768	23.010						

M.B.No.: YP-02/C1

PRODUCT YIELDS					
Description	Total Gross			Total Net	
	[grams]		wt. % maf feed	[grams]	wt. % maf coal
	measured	normalized			
H2O	103.41	113.83	1.80%	113.83	4.50%
COx	272.59	300.06	4.75%	300.06	11.85%
H2S					
C1 to C3	125.38	138.01	2.19%	138.01	5.45%
C4 +	37.71	41.51	0.66%	41.51	1.64%
Oil	4177.74	4598.71	72.85%	1275.90	50.38%
Asphaltene	779.82	858.40	13.60%	400.99	15.83%
Preasphalt.	98.09	107.98	1.71%	107.98	4.26%
IOM	312.09	343.54	5.44%	343.54	13.57%
Total	5906.84	6502.05	103.00%	2721.83	107.48%

Distillation Profile THF-Extract					
Fraction [deg C]	Feed [grams]	Product			
		Total Gross		Total Net	
		[grams]	[grams]	[grams]	wt. % maf coal
IBP - 182		86.70	95.43	95.43	3.77%
182 - 343	151.21	634.47	698.40	547.19	21.61%
343 - 524	3629.02	3330.51	3666.11	37.10	1.46%
524+		1003.98	1105.14	1105.14	43.64%
TOTAL	3780.22	5055.65	5565.09	1784.87	70.48%

PROCESS YIELD STRUCTURE

RUN No.: DOE-BU-012

M.B. No.: YP-02/C1

FEED
wt% (coal+solvent)
as is maf

PRODUCT
wt% (coal+solvent)
as is maf

				COx+H2	13.4%	15.1%
				C1 - C4	0.2%	0.2%
53.3%	59.9%	Solvent		Oil	8.1%	9.0%
46.7%	40.1%	Coal		Water	5.9%	
100.0%	100.0%					
7.3%	8.2%	CO (shift)		COx	2.5%	2.8%
4.7%	5.3%	Water (shift)		C1 - C4	2.3%	2.6%
				Oil	14.2%	15.9%
				Water	1.6%	1.8%
2.3%	2.6%	Hydrogen (consumed)				
				Oil	56.3%	63.2%
				Coal (maf)	4.8%	5.4%
				Ash	5.1%	
114.4%	116.1%				114.4%	116.1%

Remarks:

RUN No.: DOE-BU-012

M.B.No.: YP-03/C1

	Date	Time	Date	Time
START:			Nov. 10, 93	15:30
END:			Nov. 10, 93	23:30
DURATION (hours):				8.00

Feed:	Type	Wt% (maf)
Coal	BTH	39.25%
Solvent	V-1074	60.75%
Catalyst 1	Aluminate	2.00%
Catalyst 2	FeO+DMDS	2.00%
Other		

OPERATING PARAMETERS:

FEED TANK WI-110):	(G)	
Start of Mass Balance		24400.00
End of Mass Balance		19100.00
Rate	(G/HR)	663
FIRST STAGE:		
Operating Pressure:	(MPa)	10.34
Feed Temp.:	(C)	
Reactor Temp.:	(C)	
TE-201I	(BTM)	
TE-202I		410
TE-203I		408
TE-204I	(Top)	398
Liquid Level	(mm)	470
Separator Temperature:	(C)	47
CO-Feed Rate:	(L/MIN)	4.12
Water Feed Rate:	(ML/MIN)	1.24
Temperature:	(C)	176
Catalyst Feed:	(ML/MIN)	
Liquid Product (WI-220):	(G)	
Start of Mass Balance		
End of Mass Balance		648.00
Nitrogen Rate:	(L/MIN)	4.00
SECOND STAGE:		
Operating Pressure:	(MPa)	17.24
Feed Temp.:	(C)	127
Reactor Temp.:	(C)	
TE-301I	(BTM)	241
TE-302I		432
TE-303I		433
TE-304I		433
TE-305I		433
TE-306I		434
TE-307I		432
TE-308I	(Top)	430
TE-309I	(VAP)	432
Liquid level	(mm)	800
Separator Temperature:	(C)	24
Hydrogen Feed Rate:	(L/MIN)	34.96
Temperature:	(C)	425
Liquid Product (WI-330):	(G)	
Start of Mass Balance		583
End of Mass Balance		2360
Bottoms Product (V-340):	(G)	
Start of Mass Balance		
End of Mass Balance		2526
Sulfiding Agent	(mL/HR)	5.77

MEASURED GAS COMPOSITIONS

NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02	2.66	88.98	1.67
CO2	44.01	9.77	0.08	13.96
CO	28.01	36.22	0.09	7.14
H2S	34.08			
Methane	16.04	0.31	0.29	0.24
Ethylene	28.05		0.01	
Ethane	30.07		0.09	
Propane	44.01		0.08	
Propylene	42.08			
i-Butane	58.12		0.01	
n-Butane	58.12		0.03	
i-Butene	56.11			
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15		0.02	
Nitrogen	28.02			
TOTAL		48.96	89.68	23.0095
Gas Meter Readings				
		DTM-260	DTM-360	DTM-350
Start of M.B. : (L)		8290.0	4990.0	2434.0
End of M.B. : (L)		13076.0	22779.0	2459.0
Total : (L)		4786.0	17789.0	25.0
Temperature: (C)		22.2	23.0	21.6
Meter Pressure : (mmHg)		703	703	703
Standard Volume: (L)		4094	15177	21
Nitrogen to R-200: (L)		1921		
Net Gas Out: (L)		2173	15177	21

Run Conditions

Basis: MAF		First Stage	Second Stage
Pressure	Mpa	10.3	17.2
Temperature	deg C	410	433
Catalyst		Aluminate	FeO+DMD
Feed	wt % maf coal	39.25%	
WHSV	(kg / hr) / l	1.55	0.91
CO Rate	kg / kg maf coal	1.32	
	moles / 100g maf coal	4.72	
consumed	moles / 100g maf coal	0.89	
Water Rate	kg / kg maf coal	1.32	
	moles / 100g maf coal	7.34	
Hydrogen	kg / kg maf coal		0.81
	moles / 100g maf coal		40.21
consumed	wt % maf coal	1.22%	8.30%

OVERALL MASS BALANCE

Material In:		Grams	Material Out:		Grams
	Feed Slurry	5300		First Stage Liquid:	648
	CO-Gas:	2475		First Stage Product Gas:	2882
	Water:	595		Second Stage Liquid:	1777
	Hydrogen:	1513		Second Stage Reactor Bottoms:	2526
	Catalyst:			Second Stage Product Gas:	1515
	S-Agent	46		Dissolved Gas:	34
TOTAL IN:		9928	TOTAL OUT:		9382
	Catalyst mf	212			OVERALL BALANCE: 94.5%

WATER BALANCE			
TOTAL IN:		886	TOTAL OUT:
			979
		WATER BALANCE: 110.5%	
	Coal Conversion	wt.% maf	83.7%
	Ash Balance	wt.%	140.8%

PRODUCT YIELDS

Description	Total Gross			Total Net	
	[grams]		wt. % maf feed	[grams]	wt. % maf coal
	measured	normalized			
H2O	92.66	105.41	2.21%	105.41	5.63%
COx	198.30	225.60	4.73%	225.60	12.05%
H2S					
C1 to C3	94.07	107.01	2.24%	107.01	5.72%
C4 +	30.03	34.16	0.72%	34.16	1.83%
Oil	3066.38	3488.39	73.15%	941.78	50.32%
Asphaltene	502.92	572.14	12.00%	221.58	11.84%
Preasphalt.	95.81	108.99	2.29%	108.99	5.82%
IOM	268.26	305.18	6.40%	305.18	16.31%
Total	4348.43	4946.87	103.74%	2049.71	109.52%

Distillation Profile THF-Extract

Fraction [deg C]	Feed [grams]	Product			
		Total Gross		Total Net	
		[grams]	normalized		wt. % maf coal
			[grams]	[grams]	
IBP - 182		116.22	132.21	132.21	7.06%
182 - 343	115.89	800.24	910.37	794.48	42.45%
343 - 524	2781.28	2612.18	2971.68	190.41	10.17%
524+		136.47	155.25	155.25	8.30%
TOTAL	2897.16	3665.11	4169.52	1272.35	67.98%

RUN No.: DOE-BU-012 M.B.No.: YP-03/C1

GAS ANALYSIS																					
	First Stage Product Gas (DTM-260)							Second Stage Product Gas (DTM-360)							Dissolved Gas (DTM-350)						
Name	Number of Samples: 4							Number of Samples: 6							Number of Samples: 2						
	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%	vol.%	vol.%	vol.%		vol.%	vol.%	vol.%	Av.vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%
Hydrogen	2.743	2.668	2.599	2.634			2.661	88.749	88.745	87.593		96.101	85.234	87.488	88.985	1.013	2.336				1.675
CO2	10.119	9.930	9.639	9.398			9.772	0.099	0.055	0.067		0.063	0.082	0.090	0.076	12.189	15.724				13.957
CO	36.885	36.165	36.351	35.463			36.216	0.120					0.206	0.200	0.089	3.920	10.355				7.138
H2S																					
Methane	0.351	0.346	0.347	0.214			0.316	0.212	0.122	0.156		0.415	0.422	0.438	0.294	0.129	0.353				0.241
Ethylene								0.019					0.021	0.024	0.011						
Ethane								0.097	0.036	0.066		0.045	0.150	0.162	0.093						
Propane								0.070	0.028	0.053		0.045	0.124	0.131	0.076						
Propylene																					
i-Butane								0.009	0.008	0.010		0.007	0.019	0.017	0.012						
n-Butane								0.022	0.011	0.022		0.012	0.045	0.046	0.026						
i-Butene																					
n-Butene																					
C2-Butene																					
i-Pentane																					
n-Pentane								0.020	0.007	0.017		0.005	0.046	0.052	0.026						
Nitrogen																					
TOTAL	50.098	49.107	48.936	47.709			48.963	89.417	89.012	87.984		96.693	86.349	88.646	89.684	17.251	28.768				23.010

GAS CALCULATIONS

Name	Mol.Weight	First Stage Product Gas (DTM-260)			Second Stage Product Gas (DTM-350)			Dissolved Gas (DTM-350)		
		Average Mol Weight 15.77 (g/mole)	Volume Weight (norm.) (G)	meas. % norm. %	Average Mol Weight 2.24 (g/mole)	Volume Weight (norm.) (G)	meas. % norm. %	Average Mol Weight 35.70 (g/mole)	Volume Weight (norm.) (G)	%
Hydrogen	2.02	2.66	5.43	10.64	88.98	99.22	1357.36	1.67	7.28	0.41
CO ₂	44.01	9.77	19.96	851.77	0.08	25.26	13.96	60.66	25.53	74.78
CO	28.01	36.22	73.97	2009.20	0.09	18.54	7.14	31.02	8.31	24.34
H ₂ S	34.08					1.22				
Methane	16.04	0.31	0.64	9.99	0.29	35.63	2.35	0.24	1.05	0.47
Ethylene	28.05				0.01	2.26	0.15			
Ethane	30.07				0.09	21.04	1.39			
Propane	44.01				0.08	24.98	1.65			
Propylene	42.08									
i-Butane	58.12				0.01	5.12	0.34			
n-Butane	58.12				0.03	11.56	0.76			
i-Butene	56.11									
n-Butene	56.11									
C2-Butene	56.11									
i-Pentane	72.15									
n-Pentane	72.15				0.02	13.35	0.88			
Nitrogen	28.02									
TOTAL		48.96	100.00	2881.60	89.68	100.00	1515.10	23.01	100.00	100.00

First Stage Shift Reaction					
CO + H ₂ O = CO ₂ + H ₂					
Stochiom.	[moles]	16.61	16.61	16.61	16.61
Produced	[moles]			2.74	-11.34
Total	[moles]	16.61	16.61	19.35	5.27
Stochiom.	[grams]	465.31	299.35	731.10	33.56
Produced	[grams]			120.67	-22.91
Total	[grams]	465.31	299.35	851.77	10.64

Hydocarbon Gases					
		First	Second	Dissolved	Total
C1 to C3	[grams]	9.99	83.91	0.16	94.07
C4 +	[grams]		30.03		30.03
Total	[grams]	9.99	113.94	0.16	124.09

Hydrogen					
		First	Second	Up-Take	Total
		Up-Take	In	Out	Up-Take
		22.91	1512.77	1357.50	155.27
					178.18

M.B.No.: YP-03/C1

Liquid / Slurry Stream Analysis

[illegible]

	Feed	V-220	Products V-340 (BTMS)	V-330
----- in grams of analysis sample -----				
Total Sample	51.00	83.15	47.48	51.78
Water	2.80	75.28		2.70
Oils+Asphaltenes	27.88	7.87	35.15	47.73
Oils	24.51	7.55	27.81	44.53
Asphaltenes	3.37	0.32	7.34	3.20
Pre-Asphaltenes			0.93	1.35
Insolubles	20.32		11.40	
IOM	18.01		5.04	
Ash	2.31		6.36	
TOTAL	51	83.15	47.48	51.78

----- in wt% of analysis sample -----				
Water	5.49%	90.53%		5.21%
Oils+Asphaltenes	54.66%	9.47%	74.03%	92.18%
Oils (on fraction)	87.90%	95.92%	79.11%	93.30%
(on total)	48.05%	9.08%	58.56%	86.00%
Asphalt. (on fract.)	12.10%	4.08%	20.89%	6.70%
(on total)	6.61%	0.39%	15.46%	6.18%
Pre-Asphaltenes			1.96%	2.61%
Insolubles	39.85%		24.01%	
IOM (on fraction)	88.62%		44.23%	
(on total)	35.31%		10.62%	
Ash (on fraction)	11.38%		55.78%	
(on total)	4.53%		13.39%	
TOTAL	100.00%	100.00%	100.00%	100.00%

----- in grams of feed / product -----				
Total Feed / Product	5300	648	2526	1777
Water	291.0	586.6		92.7
Oils+Asphaltenes	2897.2	61.4	1869.9	1638.0
Oils (on fraction)	2546.6	58.9	1479.3	1528.2
(on total)	2546.6	58.9	1479.3	1528.2
Asphalt. (on fract.)	350.6	2.5	390.6	109.8
(on total)	350.6	2.5	390.6	109.8
Pre-Asphaltenes			49.5	46.3
Insolubles	2111.9		606.6	
IOM (on fraction)	1871.5		268.3	
(on total)	1871.5		268.3	
Ash (on fraction)	240.3		338.3	
(on total)	240.3		338.3	
TOTAL (as is)	5300.0	648.0	2526.0	1777.0
TOTAL (MAF)	4768.7	61.4	2187.7	1684.3

Distillation Profile THF-Extract					
Fractions deg C	Feed	Products			
		V-220	V-340 (BTMS)	V-330	Total
IBP - 182				116.22	116.22
182 - 343	115.89	2.45	88.68	709.11	800.24
343 - 524	2781.28	58.90	1694.27	859.01	2612.18
524+			136.47		136.47
TOTAL	2897.16	61.36	1919.42	1684.34	3665.11

Feed	Products (normalized)				Feed	Products (normalized)			
	V-220	V-340 (BTMS)	V-330	Total		V-220	V-340 (BTMS)	V-330	Total
----- in wt% of total feed (as is) -----					----- in wt% of total feed (MAF) -----				
6.20%	6.20%		1.97%	8.17%				2.21%	2.21%
54.25%	1.31%	39.84%	34.90%	76.04%	60.75%	1.46%	44.61%	39.08%	85.15%
47.69%	1.25%	31.52%	32.56%	65.33%	53.40%	1.40%	35.29%	36.46%	73.15%
6.56%	0.05%	8.32%	2.34%	10.71%	7.35%	0.06%	9.32%	2.62%	12.00%
		1.05%	0.99%	2.04%			1.18%	1.11%	2.29%
39.55%		10.22%		10.22%					
35.05%		5.71%		5.71%	39.25%		6.40%		6.40%
4.50%		4.50%		4.50%					
100.00%	7.51%	51.11%	37.86%	96.47%	100.00%	1.46%	52.19%	42.39%	96.05%

PROCESS YIELD STRUCTURE

RUN No.: DOE-BU-012

M.B. No.: YP-03/C1

FEED		PRODUCT	
wt% (coal+solvent) as is	maf	wt% (coal+solvent) as is	maf
54.3%	60.8%	16.5%	18.4%
45.7%	39.2%	0.2%	0.2%
100.0%	100.0%	1.3%	1.5%
8.7%	9.8%	6.2%	
5.6%	6.3%	1.7%	1.9%
		2.4%	2.7%
		35.9%	40.2%
2.9%	3.3%	2.0%	2.2%
		40.9%	45.8%
		5.7%	6.4%
		4.5%	
		117.2%	119.3%

Remarks:

RUN No.: DOE-BU-012

M.B.No.: YP-04/C1

	Date	Time	Date	Time
START:			Nov. 11, 93	03:00
END:			Nov. 11, 93	07:54
DURATION (hours):				4.90

Feed:	Type	Wt% (maf)
Coal	BTH	38.63%
Solvent	V-1074	61.37%
Catalyst 1	Aluminate	2.00%
Catalyst 2	FeO+DMDS	2.00%
Other		

OPERATING PARAMETERS:		
FEED TANK WI-110:	(G)	
Start of Mass Balance		8290.00
End of Mass Balance		4290.00
Rate	(G/HR)	816
FIRST STAGE:		
Operating Pressure:	(MPa)	10.34
Feed Temp.:	(C)	
Reactor Temp.:	(C)	
TE-201I	(BTM)	
TE-202I		409
TE-203I		400
TE-204I	(Top)	397
Liquid Level	(mm)	470
Separator Temperature:	(C)	46
CO-Feed Rate:	(L/MIN)	4.41
Water Feed Rate:	(ML/MIN)	1.21
Temperature:	(C)	180
Catalyst Feed:	(ML/MIN)	
Liquid Product (WI-220):	(G)	
Start of Mass Balance		
End of Mass Balance		664.05
Nitrogen Rate:	(L/MIN)	4.02
SECOND STAGE:		
Operating Pressure:	(MPa)	17.24
Feed Temp.:	(C)	125
Reactor Temp.:	(C)	
TE-301I	(BTM)	
TE-302I		425
TE-303I		426
TE-304I		426
TE-305I		426
TE-306I		426
TE-307I		422
TE-308I	(Top)	420
TE-309I	(VAP)	422
Liquid level	(mm)	600
Separator Temperature:	(C)	24
Hydrogen Feed Rate:	(L/MIN)	34.55
Temperature:	(C)	394
Liquid Product (WI-330):	(G)	
Start of Mass Balance		740
End of Mass Balance		1120
Bottoms Product (V-340):	(G)	
Start of Mass Balance		
End of Mass Balance		2969
Sulfiding Agent	(mL/HR)	7.48

MEASURED GAS COMPOSITIONS				
NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02	2.77	91.27	1.67
CO2	44.01	10.11	0.21	13.96
CO	28.01	34.93	0.18	7.14
H2S	34.08		0.30	
Methane	16.04	0.36	0.29	0.24
Ethylene	28.05		0.01	
Ethane	30.07		0.11	
Propane	44.01		0.08	
Propylene	42.08			
i-Butane	58.12		0.01	
n-Butane	58.12		0.03	
i-Butene	56.11			
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15		0.05	
Nitrogen	28.02			
TOTAL		48.17	92.54	23.0095
Gas Meter Readings				
DTM-260		DTM-350	DTM-360	
Start of M.B. : (L)	4039.0	2915.0	2459.0	
End of M.B. : (L)	7096.0	13851.0	2489.0	
Total : (L)	3057.0	10936.0	30.0	
Temperature: (C)	22.5	21.7	23.8	
Meter Pressure : (mmHg)	699	699	699	
Standard Volume: (L)	2598	9318	25	
Nitrogen to R-200: (L)	1181			
Net Gas Out: (L)	1417	9318	25	

Run Conditions			
Basis: MAF		First Stage	Second Stage
Pressure	Mpa	10.3	17.2
Temperature	deg C	409	426
Catalyst		Aluminate	FeO+DMD
Feed	wt % maf coal	38.63%	
WHSV	(kg / hr) / l	1.91	1.50
CO Rate	kg / kg maf coal	1.17	
	moles / 100g maf coal	4.17	
consumed	moles / 100g maf coal	0.87	
Water Rate	kg / kg maf coal	1.17	
	moles / 100g maf coal	6.49	
Hydrogen	kg / kg maf coal		0.66
	moles / 100g maf coal		32.83
consumed	wt % maf coal	1.23%	6.28%

OVERALL MASS BALANCE					
Material In:		Grams	Material Out:		Grams
	Feed Slurry	4000		First Stage Liquid:	664
	CO-Gas:	1622		First Stage Product Gas:	1883
	Water:	357		Second Stage Liquid:	380
	Hydrogen:	916		Second Stage Reactor Bottoms:	2969
	Catalyst:			Second Stage Product Gas:	1016
	S-Agent	37		Dissolved Gas:	40
TOTAL IN:		6931	TOTAL OUT:		6953
Catalyst mlf		160	OVERALL BALANCE:		100.3%
WATER BALANCE					
TOTAL IN:		581	TOTAL OUT:		636
			WATER BALANCE:		109.5%
	Coal Conversion		wt. % maf	81.8%	
	Ash Balance		wt. %	136.7%	

PRODUCT YIELDS					
Description	Total Gross			Total Net	
	[grams]		wt. % maf feed	[grams]	wt. % maf coal
	measured	normalized			
H2O	55.07	55.20	1.54%	55.20	3.98%
COx	157.87	158.24	4.40%	158.24	11.40%
H2S	46.06	46.17	1.29%	46.17	3.33%
C1 to C3	60.76	60.91	1.70%	60.91	4.39%
C4 +	24.81	24.87	0.69%	24.87	1.79%
Oil	2490.97	2496.75	69.50%	558.73	40.26%
Asphaltene	533.16	534.39	14.88%	267.61	19.28%
Preasphalt.	67.10	67.25	1.87%	67.25	4.85%
IOM	252.28	252.87	7.04%	252.87	18.22%
Total	3688.08	3696.65	102.90%	1491.85	107.50%

Distillation Profile THF-Extract					
Fraction [deg C]	Feed [grams]	Product			
		Total Gross		Total Net	
		[grams]	normalized [grams]	[grams]	wt. % maf coal
IBP - 182		23.69	23.74	23.74	1.71%
182 - 343	88.19	299.20	299.89	211.70	15.26%
343 - 524	2116.61	2255.61	2260.85	144.24	10.39%
524+		512.72	513.91	513.91	37.03%
TOTAL	2204.80	3091.22	3098.40	893.60	64.39%

RUN No.: DOE-BU-012

M.B.No.: YP-04/C1

GAS ANALYSIS

GAS ANALYSIS																					
	First Stage Product Gas (DTM-260)							Second Stage Product Gas (DTM-350)							Dissolved Gas (DTM-360)						
Name	Number of Samples: 6							Number of Samples: 5							Number of Samples: 2						
	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%	vol.%	vol.%	vol.%		vol.%	vol.%	vol.%	Av.vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%
Hydrogen	2.724	2.720	2.739	2.722	2.876	2.816	2.768	89.143	88.253	93.289		89.225	88.448		91.272	1.013	2.336				1.675
CO2	9.622	9.620	10.399	10.107	10.110	10.830	10.116	0.224	0.204	0.222		0.212	0.203		0.213	12.189	15.724				13.957
CO	35.424	35.446	35.009	34.421	35.177	34.090	34.928	0.145	0.197	0.183		0.191	0.159		0.176	3.920	10.355				7.138
H2S								1.504							0.301						
Methane	0.344	0.345	0.368	0.359	0.366	0.374	0.359	0.355	0.428	0.209		0.253	0.223		0.284	0.129	0.353				0.241
Ethylene								0.017	0.016	0.014		0.013	0.014		0.015						
Ethane								0.116	0.108	0.106		0.102	0.098		0.106						
Propane								0.087	0.079	0.080		0.077	0.073		0.079						
Propylene																					
i-Butane								0.011	0.014	0.008		0.014	0.007		0.011						
n-Butane								0.027	0.033	0.024		0.032	0.022		0.028						
i-Butene																					
n-Butene																					
C2-Butene																					
i-Pentane																					
n-Pentane								0.049	0.042	0.048		0.043	0.046		0.046						
Nitrogen																					
TOTAL	48.114	48.131	48.515	47.609	48.529	48.110	48.168	101.678	89.374	94.183		90.162	87.293		92.638	17.251	28.768				23.010

GAS CALCULATIONS

Name	Mol.Weight	First Stage Product Gas (DTM-260)				Second Stage Product Gas (DTM-350)				Dissolved Gas (DTM-360)			
		Average Mol Weight:		16.25 (g/mole)		Average Mol Weight:		2.44 (g/mole)		Average Mol Weight:		35.70 (g/mole)	
		Volume		Weight (norm.)		Volume		Weight (norm.)		Volume		Weight (norm.)	
		meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%
Hydrogen	2.02	2.77	5.74	7.33	0.39	91.27	98.63	828.41	81.50	1.67	7.28	0.17	0.41
CO ₂	44.01	10.11	21.00	584.32	31.02	0.21	0.23	42.12	4.14	13.96	60.66	30.23	74.78
CO	28.01	34.93	72.51	1284.19	68.18	0.18	0.19	22.02	2.17	7.14	31.02	9.84	24.34
H ₂ S	34.08					0.30	0.33	46.06	4.53				
Methane	16.04	0.36	0.75	7.57	0.40	0.29	0.32	21.16	2.08	0.24	1.05	0.19	0.47
Ethylene	28.05					0.01	0.02	1.87	0.18				
Ethane	30.07					0.11	0.11	14.32	1.41				
Propane	44.01					0.08	0.09	15.66	1.54				
Propylene	42.08												
i-Butane	58.12					0.01	0.01	2.82	0.28				
n-Butane	58.12					0.03	0.03	7.21	0.71				
i-Butene	56.11												
n-Butene	56.11												
C ₂ -Butene	56.11												
i-Pentane	72.15												
n-Pentane	72.15					0.05	0.05	14.78	1.45				
Nitrogen	28.02												
TOTAL		48.17	100.00	1883.41	100.00	92.54	100.00	1016.44	100.00	23.01	100.00	40.43	100.00

First Stage Shift Reaction

		CO	+	H ₂ O	=	CO ₂	+	H ₂
Stochiom.	[moles]	12.06		12.06		12.06		12.06
Produced	[moles]					1.22		-8.43
Total	[moles]	12.06		12.06		13.28		3.63
Stochiom.	[grams]	337.74		217.28		530.66		24.36
Produced	[grams]					53.65		-17.02
Total	[grams]	337.74		217.28		584.32		7.33

Hydrocarbon Gases

		First	Second	Dissolved	Total
C ₁ to C ₃	[grams]	7.57	53.01	0.19	60.76
C ₄ +	[grams]		24.81		24.81
Total	[grams]	7.57	77.82	0.19	85.58

Hydrogen

		First Up-Take	In	Second Out	Up-Take	Total Up-Take
Hydrogen	[grams]	17.02	915.68	828.58	87.10	104.13

M.B.No.: YP-04/C1

Liquid / Slurry Stream Analysis

[illegible]

	Feed	V-220	Products V-340 (BTTMS)	V-330
----- In grams of analysis sample -----				
Total Sample	49.95	8.86	52.87	52.44
Water	2.80	4.86		7.60
Oils+Asphaltenes	27.53	4.00	42.76	44.57
Oils	24.20	3.84	33.74	42.52
Asphaltenes	3.33	0.16	9.01	2.05
Pre-Asphaltenes			1.16	0.27
Insolubles	19.62		8.95	
IOM	17.33		4.49	
Ash	2.29		4.46	
TOTAL	49.95	8.86	52.87	52.44

----- In wt% of analysis sample -----				
Water	5.61%	54.81%		14.49%
Oils+Asphaltenes	55.12%	45.19%	80.87%	84.99%
Oils (on fraction)	87.90%	95.92%	78.92%	95.40%
(on total)	48.45%	43.35%	63.83%	81.08%
Asphalt. (on fract.)	12.10%	4.08%	21.08%	4.60%
(on total)	6.67%	1.84%	17.04%	3.91%
Pre-Asphaltenes			2.19%	0.51%
Insolubles	39.27%		16.94%	
IOM (on fraction)	88.34%		50.18%	
(on total)	34.69%		8.50%	
Ash (on fraction)	11.67%		49.83%	
(on total)	4.58%		8.44%	
TOTAL	100.00%	100.00%	100.00%	100.00%

----- In grams of feed / product -----				
Total Feed / Product	4000	664	2969	380
Water	224.2	364.0		55.1
Oils+Asphaltenes	2204.8	300.1	2401.1	323.0
Oils (on fraction)	1938.0	287.9	1895.0	308.1
(on total)	1938.0	287.9	1895.0	308.1
Asphalt. (on fract.)	266.8	12.2	506.1	14.8
(on total)	266.8	12.2	506.1	14.8
Pre-Asphaltenes			65.1	2.0
Insolubles	1571.0		502.8	
IOM (on fraction)	1387.7		252.3	
(on total)	1387.7		252.3	
Ash (on fraction)	183.3		250.5	
(on total)	183.3		250.5	
TOTAL (as is)	4000.0	664.1	2969.0	380.0
TOTAL (MAF)	3592.5	300.1	2718.5	324.9

Distillation Profile THF-Extract					
Fractions deg C	Feed	Products			
		V-220	V-340 (BTTMS)	V-330	Total
IBP - 182				23.69	23.69
182 - 343	88.19	12.00	81.38	205.81	299.20
343 - 524	2116.61	288.09	1872.09	95.43	2255.61
524+			512.72		512.72
TOTAL	2204.80	300.10	2466.20	324.93	3091.22

Feed	Products (normalized)				Feed	Products (normalized)			
	V-220	V-340 (BTTMS)	V-330	Total		V-220	V-340 (BTTMS)	V-330	Total
----- In wt% of total feed (as is) -----					----- In wt% of total feed (MAF) -----				
5.61%	5.61%		1.38%	6.99%	61.37%	8.37%	66.99%	1.54%	1.54%
55.12%	7.52%	60.17%	8.09%	75.78%				9.01%	84.37%
48.45%	7.21%	47.48%	7.72%	62.42%	53.95%	8.03%	52.87%	8.60%	69.50%
6.67%	0.31%	12.68%	0.37%	13.36%	7.43%	0.34%	14.12%	0.41%	14.88%
		1.63%	0.05%	1.68%			1.82%	0.05%	1.87%
39.27%		10.90%		10.90%					
34.69%		6.32%		6.32%	38.63%		7.04%		7.04%
4.58%		4.58%		4.58%					
100.00%	13.13%	72.70%	9.52%	95.35%	100.00%	8.37%	75.85%	10.60%	94.82%

PROCESS YIELD STRUCTURE

RUN No.: DOE-BU-012

M.B. No.: YP-04/C1

FEED				PRODUCT		
wt% (coal+solvent)				wt% (coal+solvent)		
as is	maf			as is	maf	
55.1%	61.4%	Solvent	<div>R-200</div>	COx+H2	14.8%	16.5%
44.9%	38.6%	Coal		C1 - C4	0.2%	0.2%
100.0%	100.0%			Oil	7.5%	8.4%
				Water	5.6%	
8.4%	9.4%	CO (shift)				
5.4%	6.0%	Water (shift)				
			<div>R-300</div>	COx	3.8%	4.2%
				C1 - C4	2.0%	2.2%
				Oil	8.1%	9.1%
				Water	1.4%	1.5%
2.2%	2.4%	Hydrogen (consumed)				
				Oil	61.8%	68.8%
				Coal (maf)	6.3%	7.0%
				Ash	4.6%	
116.1%	117.9%				116.1%	117.9%

Solvent

Coal

CO (shift)

Water (shift)

Hydrogen (consumed)

R-200

V-220

R-300

V-330

Remarks:

RUN No.: DOE-BU-013

M.B.No.: YP-01/C1

	Date	Time	Date	Time
START:			Nov. 16, 93	12:00
END:			Nov. 16, 93	19:00
DURATION (hours):				7.00

Feed:	Type	Wt% (maf)
Coal	BTH	37.15%
Solvent	V-1074	62.85%
Catalyst 1	Aluminate	2.00%
Catalyst 2	Pyrite	2.00%
Other		

OPERATING PARAMETERS:

FEED TANK WI-110:	(G)	
Start of Mass Balance		7860.00
End of Mass Balance		1310.00
Rate	(G/HR)	936
FIRST STAGE:		
Operating Pressure:	(MPa)	10.34
Feed Temp.:	(C)	
Reactor Temp.:	(C)	
TE-201I	(BTM)	410
TE-202I		411
TE-203I		410
TE-204I	(Top)	396
Liquid Level	(mm)	470
Separator Temperature:	(C)	46
CO-Feed Rate:	(L/MIN)	4.07
Water Feed Rate:	(ML/MIN)	1.95
Temperature:	(C)	180
Catalyst Feed:	(ML/MIN)	
Liquid Product (WI-220):	(G)	
Start of Mass Balance		
End of Mass Balance		1314.32
Nitrogen Rate:	(L/MIN)	3.91
SECOND STAGE:		
Operating Pressure:	(MPa)	17.24
Feed Temp.:	(C)	125
Reactor Temp.:	(C)	
TE-301I	(BTM)	
TE-302I		424
TE-303I		425
TE-304I		425
TE-305I		424
TE-306I		425
TE-307I		422
TE-308I	(Top)	419
TE-309I	(VAP)	419
Liquid level	(mm)	700
Separator Temperature:	(C)	24
Hydrogen Feed Rate:	(L/MIN)	34.93
Temperature:	(C)	394
Liquid Product (WI-330):	(G)	
Start of Mass Balance		
End of Mass Balance		703
Bottoms Product (V-340):	(G)	
Start of Mass Balance		
End of Mass Balance		4831
Sulfiding Agent	(mL/HR)	

MEASURED GAS COMPOSITIONS

NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02	1.70	93.07	17.76
CO2	44.01	9.27	0.21	15.57
CO	28.01	13.04	0.16	12.72
H2S	34.08		0.04	
Methane	16.04	0.40	0.32	0.30
Ethylene	28.05			0.03
Ethane	30.07		0.12	0.51
Propane	44.01		0.09	0.88
Propylene	42.08			
i-Butane	58.12		0.01	0.11
n-Butane	58.12		0.05	0.79
i-Butene	56.11			
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15		0.12	1.82
Nitrogen	28.02			
TOTAL		24.42	94.18	50.50233
Gas Meter Readings		DTM-260	DTM-360	DTM-350
Start of M.B. : (L)		8034.0	7560.0	2544.0
End of M.B. : (L)		12270.0	23442.0	2578.0
Total : (L)		4236.0	15882.0	34.0
Temperature: (C)		21.8	21.2	23.4
Meter Pressure : (mmHg)		701	701	701
Standard Volume: (L)		3618	13594	29
Nitrogen to R-200: (L)		1641		
Net Gas Out: (L)		1978	13594	29

Run Conditions

Basis: MAF		First Stage	Second Stage
Pressure	Mpa	10.3	17.2
Temperature	deg C	411	425
Catalyst		Aluminate	Pyrite
Feed	wt % maf coal	37.15%	
WHSV	(kg / hr) / l	2.20	1.47
CO Rate	kg / kg maf coal	0.99	
	moles / 100g maf coal	3.53	
consumed	moles / 100g maf coal	1.35	
Water Rate	kg / kg maf coal	0.99	
	moles / 100g maf coal	5.50	
Hydrogen	kg / kg maf coal		0.61
	moles / 100g maf coal		30.49
consumed	wt % maf coal	2.15%	5.12%

OVERALL MASS BALANCE					
Material In:		Grams	Material Out:		Grams
	Feed Slurry	6550		First Stage Liquid:	1314
	CO-Gas:	2136		First Stage Product Gas:	2831
	Water:	819		Second Stage Liquid:	703
	Hydrogen:	1322		Second Stage Reactor Bottoms:	4831
	Catalyst:			Second Stage Product Gas:	1467
	S-Agent			Dissolved Gas:	34
TOTAL IN:		10827	TOTAL OUT:		11180
Catalyst mf		262	OVERALL BALANCE:		103.3%

WATER BALANCE					
TOTAL IN:		1269	TOTAL OUT:		1426
			WATER BALANCE:		112.3%

	Coal Conversion	wt. % maf	78.7%	
	Ash Balance	wt. %	102.6%	

PRODUCT YIELDS					
Description	Total Gross			Total Net	
	[grams]		wt. % maf feed	[grams]	wt. % maf coal
	measured	normalized			
H2O	156.75	148.19	26.01%	148.19	6.87%
COx	306.27	289.55	50.82%	289.55	13.42%
H2S	7.90	7.47	1.31%	7.47	0.35%
C1 to C3	106.01	100.22	1.73%	100.22	4.65%
C4 +	84.39	79.78	1.37%	79.78	3.70%
Oil	4010.63	3791.68	65.29%	583.20	27.03%
Asphaltene	1041.92	985.04	16.96%	543.37	25.18%
Preasphalt.	109.27	103.31	1.78%	103.31	4.79%
IOM	485.86	459.34	7.91%	459.34	21.29%
Total	6309.00	5964.57	173.17%	2314.42	107.27%

Distillation Profile THF-Extract					
Fraction [deg C]	Feed [grams]	Product			
		Total Gross		Total Net	
		[grams]	normalized	[grams]	wt. % maf coal
IBP - 182		55.99	52.93	52.93	2.45%
182 - 343	146.01	707.43	668.81	522.81	24.23%
343 - 524	3504.14	3463.01	3273.96	-230.18	-10.67%
524+		935.38	884.32	884.32	40.99%
TOTAL	3650.15	5161.82	4880.02	1229.87	57.00%

GAS ANALYSIS

GAS ANALYSIS																						
	First Stage Product Gas (DTM-260)							Second Stage Product Gas (DTM-360)							Dissolved Gas (DTM-350)							
Name	Number of Samples: 2						Av.vol.%	Number of Samples: 4						Av.vol.%	Number of Samples: 3							Av.vol.%
	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%		vol.%	vol.%	vol.%	vol.%	vol.%	vol.%		vol.%	vol.%	vol.%	vol.%	vol.%	vol.%		
Hydrogen	1.643	1.759					1.701	93.089	92.693	91.751		94.743		93.069	16.617	19.068	17.602					17.762
CO2	9.043	9.498					9.271	0.299	0.294	0.116		0.119		0.207	15.488	15.635	15.585					15.569
CO	14.140	11.948					13.044	0.162	0.158	0.157		0.159		0.169	12.590	12.821	12.751					12.721
H2S								0.039	0.033	0.027		0.045		0.036								
Methane	0.394	0.414					0.404	0.274	0.298	0.295		0.410		0.319	0.264	0.336	0.301					0.300
Ethylene															0.031	0.031	0.031					0.031
Ethane								0.119	0.118	0.116		0.119		0.118	0.511	0.516	0.516					0.514
Propane								0.090	0.091	0.087		0.088		0.089	0.869	0.883	0.880					0.877
Propylene																						
i-Butane								0.015	0.010	0.015		0.011		0.013	0.114	0.115	0.114					0.114
n-Butane								0.052	0.040	0.051		0.043		0.047	0.789	0.793	0.787					0.790
i-Butene																						
n-Butene																						
C2-Butene																						
i-Pentane																						
n-Pentane								0.123	0.123	0.124		0.125		0.124	1.864	1.835	1.770					1.823
Nitrogen																						
TOTAL	25.220	23.619					24.420	94.262	93.858	92.739		95.862		94.180	49.137	52.033	50.337					50.602

RUN No.: DOE-BU-013

M.B.No.: YP-01/C1

GAS CALCULATIONS

Name	Mol.Weight	First Stage Product Gas (DTM-260)				Second Stage Product Gas (DTM-360)				Dissolved Gas (DTM-350)			
		Average Mol Weight:		17.53 (g/mole)		Average Mol Weight:		2.42 (g/mole)		Average Mol Weight:		26.16 (g/mole)	
		Volume		Weight (norm.)		Volume		Weight (norm.)		Volume		Weight (norm.)	
		meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%
Hydrogen	2.02	1.70	6.97	12.42	0.44	93.07	98.82	1210.88	82.55	17.76	35.17	0.92	2.72
CO ₂	44.01	9.27	37.96	1474.41	52.09	0.21	0.22	58.68	4.00	15.57	30.83	17.49	51.86
CO	28.01	13.04	53.42	1320.34	46.65	0.16	0.17	28.69	1.96	12.72	25.19	9.09	26.97
H ₂ S	34.08					0.04	0.04	7.90	0.54				
Methane	16.04	0.40	1.65	23.42	0.83	0.32	0.34	32.98	2.25	0.30	0.59	0.12	0.36
Ethylene	28.05									0.03	0.06	0.02	0.07
Ethane	30.07					0.12	0.13	22.85	1.56	0.51	1.02	0.39	1.17
Propane	44.01					0.09	0.09	25.23	1.72	0.88	1.74	0.99	2.92
Propylene	42.08												
i-Butane	58.12					0.01	0.01	4.77	0.33	0.11	0.23	0.17	0.50
n-Butane	58.12					0.05	0.05	17.41	1.19	0.79	1.56	1.17	3.47
i-Butene	56.11												
n-Butene	56.11												
C ₂ -Butene	56.11												
i-Pentane	72.15												
n-Pentane	72.15					0.12	0.13	57.51	3.92	1.82	3.61	3.36	9.96
Nitrogen	28.02												
TOTAL		24.42	100.00	2830.58	100.00	94.18	100.00	1466.90	100.00	50.50	100.00	33.72	100.00

First Stage Shift Reaction

		CO	+	H ₂ O	=	CO ₂	+	H ₂
Stochiom.	[moles]	29.13		29.13		29.13		29.13
Produced	[moles]					4.37		-22.98
Total	[moles]	29.13		29.13		33.50		6.15
Stochiom.	[grams]	815.97		524.95		1282.08		58.85
Produced	[grams]					192.33		-46.43
Total	[grams]	815.97		524.95		1474.41		12.42

Hydrocarbon Gases

		First	Second	Dissolved	Total
C1 to C3	[grams]	23.42	81.06	1.53	106.01
C4 +	[grams]		79.69	4.70	84.39
Total	[grams]	23.42	160.75	6.22	190.39

Hydrogen

		First Up-Take	In	Second Out	Up-Take	Total Up-Take
Hydrogen	[grams]	46.43	1322.22	1211.80	110.42	156.85

M.B.No.: YP-01/C1

Liquid / Slurry Stream Analysis

[illegible]

PROCESS YIELD STRUCTURE

FEED		PRODUCT	
wt% (coal+solvent) as is	maf	wt% (coal+solvent) as is	maf
55.7%	62.8%	22.5%	25.4%
44.3%	37.2%	0.3%	0.4%
100.0%	100.0%	8.2%	9.3%
12.5%	14.0%	6.9%	
8.0%	9.0%	1.8%	2.0%
		2.4%	2.7%
		7.9%	8.9%
		2.3%	2.6%
1.7%	1.9%	58.4%	65.9%
		7.0%	7.9%
		4.5%	
122.2%	125.0%	122.2%	125.0%

Remarks:

RUN No.: DOE-BU-013

M.B.No.: YP-02/C1

	Date	Time	Date	Time
START:			Nov. 18, 93	02:00
END:			Nov. 18, 93	08:00
DURATION (hours):				6.00

Feed:	Type	Wt% (maf)
Coal	BTH	38.30%
Solvent	V-1074	61.70%
Catalyst 1	Aluminate	2.00%
Catalyst 2	ATM	0.06%
Other		

OPERATING PARAMETERS:			
FEED TANK WI-110:	(G)		
Start of Mass Balance			18560.00
End of Mass Balance			14080.00
Rate	(G/HR)		747
FIRST STAGE:			
Operating Pressure:	(MPa)		10.34
Feed Temp.:	(C)		
Reactor Temp.:	(C)		
TE-201I	(BTM)		410
TE-202I			409
TE-203I			409
TE-204I	(Top)		385
Liquid Level	(mm)		470
Separator Temperature:	(C)		46
CO-Feed Rate:	(L/MIN)		4.25
Water Feed Rate:	(ML/MIN)		1.45
Temperature:	(C)		180
Catalyst Feed:	(ML/MIN)		
Liquid Product (WI-220):	(G)		
Start of Mass Balance			
End of Mass Balance			784.70
Nitrogen Rate:	(L/MIN)		4.00
SECOND STAGE:			
Operating Pressure:	(MPa)		17.24
Feed Temp.:	(C)		125
Reactor Temp.:	(C)		
TE-301I	(BTM)		
TE-302I			424
TE-303I			425
TE-304I			425
TE-305I			424
TE-306I			425
TE-307I			421
TE-308I	(Top)		421
TE-309I	(VAP)		422
Liquid level	(mm)		700
Separator Temperature:	(C)		24
Hydrogen Feed Rate:	(L/MIN)		34.98
Temperature:	(C)		394
Liquid Product (WI-330):	(G)		
Start of Mass Balance			625
End of Mass Balance			1090
Bottoms Product (V-340):	(G)		
Start of Mass Balance			
End of Mass Balance			3180
Sulfiding Agent	(mL/HR)		

MEASURED GAS COMPOSITIONS				
NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02	2.85	95.31	17.76
CO2	44.01	11.57	0.22	15.57
CO	28.01	40.63	0.10	12.72
H2S	34.08			
Methane	16.04	0.47	0.32	0.30
Ethylene	28.05		0.01	0.03
Ethane	30.07		0.11	0.51
Propane	44.01		0.08	0.88
Propylene	42.08			
i-Butane	58.12		0.01	0.11
n-Butane	58.12		0.04	0.79
i-Butene	56.11			
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15		0.08	1.82
Nitrogen	28.02			
TOTAL		55.53	96.28	50.50233
Gas Meter Readings				
DTM-260	DTM-360	DTM-350		
Start of M.B. : (L)	4552.0	2323.0	2579.0	
End of M.B. : (L)	8249.0	15909.0	2582.0	
Total : (L)	3697.0	13586.0	3.0	
Temperature: (C)	21.8	21.2	23.4	
Meter Pressure : (mmHg)	696	697	697	
Standard Volume: (L)	3135	11562	3	
Nitrogen to R-200: (L)	1442			
Net Gas Out: (L)	1694	11562	3	

Run Conditions			
Basis: MAF		First Stage	Second Stage
Pressure	Mpa	10.3	17.2
Temperature	deg C	409	425
Catalyst		Aluminate	ATM
Feed	wt % maf coal	38.30%	
WHSV	(kg / hr) / l	1.75	1.18
CO Rate	kg / kg maf coal	1.24	
	moles / 100g maf coal	4.43	
	consumed moles / 100g maf coal	0.84	
Water Rate	kg / kg maf coal	1.24	
	moles / 100g maf coal	6.88	
Hydrogen	kg / kg maf coal		0.74
	moles / 100g maf coal		36.64
	consumed wt % maf coal	1.18%	6.70%

M.B.No.: YP-02/C1

OVERALL MASS BALANCE					
Material In:		Grams	Material Out:		Grams
	Feed Slurry	4480		First Stage Liquid:	785
	CO-Gas:	1911		First Stage Product Gas:	2261
	Water:	522		Second Stage Liquid:	465
	Hydrogen:	1135		Second Stage Reactor Bottoms:	3180
	Catalyst:			Second Stage Product Gas:	1213
	S-Agent			Dissolved Gas:	3
TOTAL IN:		8048	TOTAL OUT:		7907
Catalyst mf		92	OVERALL BALANCE:		98.2%
WATER BALANCE					
TOTAL IN:		818	TOTAL OUT:		835
			WATER BALANCE:		102.1%
	Coal Conversion		wt.% maf	75.6%	
	Ash Balance		wt.%	105.3%	

PRODUCT YIELDS					
Description	Total Gross			Total Net	
	[grams]		wt. % maf feed	[grams]	wt. % maf coal
	measured	normalized			
H2O	17.21	17.86	8.96%	17.86	1.16%
COx	195.12	202.44	101.55%	202.44	13.14%
H2S					
C1 to C3	75.61	78.45	1.95%	78.45	5.09%
C4 +	49.24	51.09	1.27%	51.09	3.32%
Oil	2524.41	2619.21	65.09%	436.73	28.34%
Asphaltene	699.47	725.74	18.03%	425.31	27.60%
Preasphalt.	72.13	74.84	1.86%	74.84	4.86%
IOM	362.36	375.97	9.34%	375.97	24.39%
Total	3995.57	4145.61	208.05%	1662.69	107.88%

Distillation Profile THF-Extract					
Fraction [deg C]	Feed [grams]	Product			
		Total Gross		Total Net	
		[grams]	----- normalized -----		wt. % maf coal
		[grams]	[grams]		
IBP - 182		40.30	41.81	41.81	2.71%
182 - 343	99.32	416.23	431.86	332.54	21.58%
343 - 524	2383.60	2192.90	2275.25	-108.35	-7.03%
524+		646.59	670.87	670.87	43.53%
TOTAL	2482.92	3296.02	3419.79	936.88	60.79%

GAS ANALYSIS

Name	First Stage Product Gas (DTM-260)							Second Stage Product Gas (DTM-360)							Dissolved Gas (DTM-350)						
	Number of Samples: 3							Number of Samples: 3							Number of Samples: 3						
	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%	vol.%	vol.%	vol.%		vol.%	vol.%	vol.%	Av.vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%
Hydrogen	2.880	2.860	2.821				2.854	102.305	89.528	84.091					88.308	16.617	19.068	17.602			17.762
CO ₂	11.653	11.602	11.469				11.575	0.164	0.240	0.261					0.222	15.488	15.635	15.585			15.588
CO	40.939	40.747	40.207				40.631	0.058	0.070	0.176					0.101	12.590	12.821	12.751			12.721
H ₂ S																					
Methane	0.470	0.466	0.465				0.467	0.332	0.270	0.360					0.321	0.264	0.336	0.301			0.300
Ethylene									0.015						0.005	0.031	0.031	0.031			0.031
Ethane								0.085	0.100	0.133					0.106	0.511	0.516	0.516			0.514
Propane								0.068	0.083	0.102					0.084	0.869	0.883	0.880			0.877
Propylene																					
i-Butane								0.008	0.016	0.010					0.011	0.114	0.115	0.114			0.114
n-Butane								0.031	0.053	0.047					0.044	0.789	0.793	0.787			0.790
i-Butene																					
n-Butene																					
C ₂ -Butene																					
i-Pentane																					
n-Pentane								0.052	0.107	0.087					0.082	1.864	1.835	1.770			1.823
Nitrogen																					
TOTAL	55.942	55.675	54.962				55.828	103.103	90.482	85.267					88.284	49.137	52.033	50.337			50.502

RUN No.: DOE-BU-013

M.B.No.: YP-02/C1

GAS CALCULATIONS

Name	Mol.Weight	First Stage Product Gas (DTM-260)				Second Stage Product Gas (DTM-360)				Dissolved Gas (DTM-350)			
		Average Mol Weight:		16.16 (g/mole)		Average Mol Weight:		2.35 (g/mole)		Average Mol Weight:		26.16 (g/mole)	
		Volume		Weight (norm.)		Volume		Weight (norm.)		Volume		Weight (norm.)	
		meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%
Hydrogen	2.02	2.85	5.14	7.85	0.35	95.31	98.99	1031.65	85.03	17.76	35.17	0.08	2.72
CO ₂	44.01	11.57	20.85	693.44	30.67	0.22	0.23	52.28	4.31	15.57	30.83	1.53	51.86
CO	28.01	40.63	73.17	1549.24	68.53	0.10	0.11	15.21	1.25	12.72	25.19	0.80	26.97
H ₂ S	34.08												
Methane	16.04	0.47	0.84	10.20	0.45	0.32	0.33	27.56	2.27	0.30	0.59	0.01	0.36
Ethylene	28.05					0.01	0.01	0.75	0.06	0.03	0.06	0.00	0.07
Ethane	30.07					0.11	0.11	17.08	1.41	0.51	1.02	0.03	1.17
Propane	44.01					0.08	0.09	19.89	1.64	0.88	1.74	0.09	2.92
Propylene	42.08												
i-Butane	58.12					0.01	0.01	3.53	0.29	0.11	0.23	0.01	0.50
n-Butane	58.12					0.04	0.05	13.60	1.12	0.79	1.56	0.10	3.47
i-Butene	56.11												
n-Butene	56.11												
C ₂ -Butene	56.11												
i-Pentane	72.15												
n-Pentane	72.15					0.08	0.09	31.70	2.61	1.82	3.61	0.29	9.96
Nitrogen	28.02												
TOTAL		55.53	100.00	2260.72	100.00	96.28	100.00	1213.25	100.00	50.50	100.00	2.96	100.00

First Stage Shift Reaction

		CO	+	H ₂ O	=	CO ₂	+	H ₂
Stochiom.	[moles]	12.91		12.91		12.91		12.91
Produced	[moles]					2.85		-9.02
Total	[moles]	12.91		12.91		15.76		3.88
Stochiom.	[grams]	361.59		232.63		568.14		26.08
Produced	[grams]					125.30		-18.23
Total	[grams]	361.59		232.63		693.44		7.85

Hydrocarbon Gases

		First	Second	Dissolved	Total
C1 to C3	[grams]	10.20	65.28	0.13	75.61
C4 +	[grams]		48.83	0.41	49.24
Total	[grams]	10.20	114.11	0.55	124.86

Hydrogen

		First Up-Take	In	Second Out	Up-Take	Total Up-Take
Hydrogen	[grams]	18.23	1134.96	1031.73	103.23	121.46

RUN No.: DOE-BU-013	M.B.No.: YP-02/C1
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M.B.No.: YP-02/C1

Liquid / Slurry Stream Analysis

[illegible]

	Feed	V-220	Products V-340 (BTTMS)	V-330
----- In grams of analysis sample -----				
Total Sample	50.02	90.20	56.43	36.20
Water	3.30	67.28		1.34
Oils+Asphaltenes	27.72	22.92	45.73	34.86
Oils	24.37	21.98	33.77	33.48
Asphaltenes	3.35	0.93	11.95	1.38
Pre-Asphaltenes			1.28	
Insolubles	19.00		9.42	
IOM	17.21		6.43	
Ash	1.79		2.99	
TOTAL	50.02	90.2	56.43	36.2

----- In wt% of analysis sample -----				
Water	6.60%	74.59%		3.70%
Oils+Asphaltenes	55.42%	25.41%	81.03%	96.30%
Oils (on fraction)	87.90%	95.92%	73.86%	96.04%
(on total)	48.72%	24.37%	59.85%	92.48%
Asphalt. (on fract.)	12.10%	4.08%	26.14%	3.96%
(on total)	6.71%	1.04%	21.18%	3.81%
Pre-Asphaltenes			2.27%	
Insolubles	37.98%		16.70%	
IOM (on fraction)	90.58%		68.23%	
(on total)	34.40%		11.40%	
Ash (on fraction)	9.42%		31.78%	
(on total)	3.58%		5.31%	
TOTAL	100.00%	100.00%	100.00%	100.00%

----- In grams of feed / product -----				
Total Feed / Product	4480	785	3180	465
Water	295.6	585.3		17.2
Oils+Asphaltenes	2482.9	199.4	2576.7	447.8
Oils (on fraction)	2182.5	191.2	1903.1	430.1
(on total)	2182.5	191.2	1903.1	430.1
Asphalt. (on fract.)	300.4	8.1	673.6	17.7
(on total)	300.4	8.1	673.6	17.7
Pre-Asphaltenes			72.1	
Insolubles	1701.5		531.1	
IOM (on fraction)	1541.2		362.4	
(on total)	1541.2		362.4	
Ash (on fraction)	160.3		168.8	
(on total)	160.3		168.8	
TOTAL (as is)	4480.0	784.7	3180.0	465.0
TOTAL (MAF)	4024.2	199.4	3011.2	447.8

Distillation Profile THF-Extract					
Fractions deg C	Feed	Products			
		V-220	V-340 (BTTMS)	V-330	Total
IBP - 182				40.30	40.30
182 - 343	99.32	7.97	102.78	305.48	416.23
343 - 524	2383.60	191.39	1899.51	102.01	2192.90
524+			646.59		646.59
TOTAL	2482.92	199.36	2648.87	447.79	3296.02

Feed	Products (nomalized)				Feed	Products (nomalized)			
	V-220	V-340 (BTTMS)	V-330	Total		V-220	V-340 (BTTMS)	V-330	Total
----- In wt% of total feed (as is) -----					----- In wt% of total feed (MAF) -----				
6.60%	6.60%		0.40%	7.00%				0.44%	0.44%
55.42%	4.62%	59.68%	10.37%	74.66%	61.70%	5.14%	66.44%	11.55%	83.12%
48.72%	4.43%	44.08%	9.96%	58.46%	54.23%	4.93%	49.07%	11.09%	65.09%
6.71%	0.19%	15.60%	0.41%	16.20%	7.47%	0.21%	17.37%	0.46%	18.03%
		1.67%		1.67%			1.86%		1.86%
37.98%		11.97%		11.97%					
34.40%		8.39%		8.39%	38.30%		9.34%		9.34%
3.58%		3.58%		3.58%					
100.00%	11.21%	73.32%	10.77%	95.30%					
					100.00%	5.14%	77.64%	11.99%	94.77%

PROCESS YIELD STRUCTURE

RUN No.: DOE-BU-013

M.B. No.: YP-02/C1

FEED				PRODUCT	
wt% (coal+solvent)				wt% (coal+solvent)	
as is	maf			as is	maf
55.4%	61.7%	Solvent		COx+H2	15.8% 17.5%
44.6%	38.3%	Coal		C1 - C4	0.2% 0.3%
100.0%	100.0%			Oil	4.6% 5.1%
8.1%	9.0%	CO (shift)		Water	6.6%
5.2%	5.8%	Water (shift)		COx	1.6% 1.8%
				C1 - C4	2.7% 3.0%
				Oil	10.4% 11.5%
				Water	0.4% 0.4%
2.3%	2.6%	Hydrogen (consumed)		Oil	61.3% 68.3%
				Coal (maf)	8.4% 9.3%
				Ash	3.6%
115.6%	117.3%			115.6%	117.3%

Remarks:

RUN No.: DOE-BU-013

M.B.No.: YP-03/C1

	Date	Time	Date	Time
START:			Nov. 18, 93	20:00
END:			Nov. 19, 93	04:00
DURATION (hours):				8.00

Feed:	Type	Wt% (maf)
Coal	BTH	36.74%
Solvent	V-1074	63.26%
Catalyst 1	Aluminate	2.00%
Catalyst 2	ATM+DMDS	0.06%
Other		

OPERATING PARAMETERS:			
FEED TANK WI-110:	(G)		
Start of Mass Balance		9920.00	
End of Mass Balance		2600.00	
Rate	(G/HR)	915	
FIRST STAGE:			
Operating Pressure:	(MPa)	10.34	
Feed Temp.:	(C)		
Reactor Temp.:	(C)		
TE-201I	(BTM)	410	
TE-202I		411	
TE-203I		411	
TE-204I	(Top)	395	
Liquid Level	(mm)	470	
Separator Temperature:	(C)	47	
CO-Feed Rate:	(L/MIN)	4.26	
Water Feed Rate:	(ML/MIN)	1.67	
Temperature:	(C)	180	
Catalyst Feed:	(ML/MIN)		
Liquid Product (WI-220):	(G)		
Start of Mass Balance			
End of Mass Balance		1196.70	
Nitrogen Rate:	(L/MIN)	4.01	
SECOND STAGE:			
Operating Pressure:	(MPa)	17.24	
Feed Temp.:	(C)	125	
Reactor Temp.:	(C)		
TE-301I	(BTM)		
TE-302I		424	
TE-303I		424	
TE-304I		425	
TE-305I		422	
TE-306I		422	
TE-307I		421	
TE-308I	(Top)	409	
TE-309I	(VAP)	405	
Liquid level	(mm)	700	
Separator Temperature:	(C)	45	
Hydrogen Feed Rate:	(L/MIN)	35.54	
Temperature:	(C)	406	
Liquid Product (WI-330):	(G)		
Start of Mass Balance		740	
End of Mass Balance		1420	
Bottoms Product (V-340):	(G)		
Start of Mass Balance			
End of Mass Balance		5405	
Sulfiding Agent	(mL/HR)	10.40	

MEASURED GAS COMPOSITIONS				
NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02	2.59	98.29	50.75
CO2	44.01	11.35	0.28	17.59
CO	28.01	35.00	0.16	10.70
H2S	34.08		0.16	
Methane	16.04	0.45	0.48	0.45
Ethylene	28.05		0.01	0.05
Ethane	30.07		0.13	0.78
Propane	44.01		0.10	1.33
Propylene	42.08			
i-Butane	58.12		0.01	0.14
n-Butane	58.12		0.04	1.16
i-Butene	56.11			
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15		0.09	4.51
Nitrogen	28.02			
TOTAL		49.40	99.74	87.459
Gas Meter Readings		DTM-260	DTM-360	DTM-350
Start of M.B. : (L)		5456.0	3824.0	2580.0
End of M.B. : (L)		10387.0	21787.0	2584.0
Total : (L)		4931.0	17963.0	4.0
Temperature: (C)		21.3	20.5	23.0
Meter Pressure : (mmHg)		701	701	701
Standard Volume: (L)		4219	15412	3
Nitrogen to R-200: (L)		1925		
Net Gas Out: (L)		2294	15412	3

Run Conditions			
Basis: MAF		First Stage	Second Stage
Pressure	Mpa	10.3	17.2
Temperature	deg C	411	424
Catalyst		Aluminate	ATM+DMD
Feed	wt % maf coal	36.74%	
WHSV	(kg / hr) / l	2.15	1.44
CO Rate	kg / kg maf coal	1.04	
	moles / 100g maf coal	3.70	
consumed	moles / 100g maf coal	0.76	
Water Rate	kg / kg maf coal	1.04	
	moles / 100g maf coal	5.75	
Hydrogen	kg / kg maf coal		0.62
	moles / 100g maf coal		31.04
consumed	wt % maf coal	1.09%	6.84%

M.B.No.: YP-03/C1

OVERALL MASS BALANCE

Material In:		Grams	Material Out:		Grams
	Feed Slurry	7320		First Stage Liquid:	1197
	CO-Gas:	2554		First Stage Product Gas:	3093
	Water:	803		Second Stage Liquid:	680
	Hydrogen:	1538		Second Stage Reactor Bottoms:	5405
	Catalyst:			Second Stage Product Gas:	1698
	S-Agent	83		Dissolved Gas:	3
TOTAL IN:		12298	TOTAL OUT:		12075
Catalyst mf		151	OVERALL BALANCE: 98.2%		

WATER BALANCE

TOTAL IN: 1188		TOTAL OUT: 1289	
		WATER BALANCE: 108.6%	

	Coal Conversion	wt.% maf	75.3%	
	Ash Balance	wt.%	122.9%	

PRODUCT YIELDS

Description	Total Gross			Total Net	
	[grams]		wt. % maf feed	[grams]	wt. % maf coal
	measured	normalized			
H2O	101.81	104.70	30.34%	104.70	4.25%
COx	330.95	340.37	98.64%	340.37	13.81%
H2S	36.42	37.46	10.86%	37.46	1.52%
C1 to C3	127.92	131.56	1.96%	131.56	5.34%
C4 +	66.25	68.14	1.02%	68.14	2.76%
Oil	4282.75	4404.72	65.66%	674.56	27.37%
Asphaltene	1057.67	1087.79	16.22%	574.31	23.30%
Preasphalt.	116.11	119.42	1.78%	119.42	4.85%
IOM	592.78	609.66	9.09%	609.66	24.74%
Total	6712.65	6903.81	235.56%	2660.17	107.93%

Distillation Profile THF-Extract

Fraction [deg C]	Feed [grams]	Product			
		Total Gross		Total Net	
		[grams]	----- normalized -----		wt. % maf coal
			[grams]	[grams]	
IBP - 182		76.09	78.26	78.26	3.18%
182 - 343	169.75	658.32	677.06	507.32	20.58%
343 - 524	4073.89	3779.65	3887.29	-186.60	-7.57%
524+		942.47	969.31	969.31	39.33%
TOTAL	4243.64	5456.53	5611.92	1368.28	55.52%

GAS ANALYSIS																					
Name	First Stage Product Gas (DTM-260)							Second Stage Product Gas (DTM-360)							Dissolved Gas (DTM-350)						
	Number of Samples: 4							Number of Samples: 3							Number of Samples: 1						
	vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	Av.vol. %	vol. %	vol. %	vol. %		vol. %	vol. %	vol. %	Av.vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	Av.vol. %
Hydrogen	2.308	2.622	2.477	2.968			2.593	98.642	98.425	97.799					98.289	50.752					50.752
CO ₂	10.230	11.363	11.011	12.797			11.350	0.270	0.282	0.276					0.276	17.594					17.594
CO	33.579	34.627	34.979	36.832			35.004	0.133	0.143	0.198					0.168	10.700					10.700
H ₂ S								0.101	0.164	0.200					0.155						
Methane	0.415	0.449	0.437	0.504			0.461	0.351	0.479	0.600					0.477	0.448					0.448
Ethylene								0.015							0.005	0.052					0.052
Ethane								0.121	0.143	0.140					0.135	0.779					0.779
Propane								0.093	0.111	0.104					0.103	1.328					1.328
Propylene																					
i-Butane								0.012	0.008	0.009					0.010	0.142					0.142
n-Butane								0.042	0.046	0.046					0.046	1.158					1.158
i-Butene																					
n-Butene																					
C2-Butene																					
i-Pentane																					
n-Pentane								0.074	0.090	0.100					0.088	4.506					4.506
Nitrogen																					
TOTAL	46.532	49.061	48.904	53.099			49.399	99.854	99.891	99.472					99.739	87.459					87.459

GAS CALCULATIONS

Name	Mol.Weight	First Stage Product Gas (DTM-260)				Second Stage Product Gas (DTM-350)				Dissolved Gas (DTM-350)			
		Average Mol Weight		Volume		Average Mol Weight		Volume		Average Mol Weight		Volume	
		Weight (norm.)	meas. %	Weight (norm.)	meas. %	Weight (norm.)	meas. %	Weight (norm.)	meas. %	Weight (norm.)	meas. %	Weight (norm.)	meas. %
Hydrogen	2.02	2.59	5.25	10.86	0.35	98.29	98.55	1369.00	80.62	50.75	58.03	0.18	6.15
CO ₂	44.01	11.35	22.98	1035.15	33.47	0.28	0.28	83.75	4.93	17.59	20.12	1.34	46.43
CO	28.01	35.00	70.86	2031.80	65.69	0.16	0.16	30.52	1.80	10.70	12.23	0.52	17.97
H ₂ S	34.08					0.16	0.16	36.42	2.15				
Methane	16.04	0.45	0.91	15.00	0.48					0.45	0.51	0.01	0.43
Ethylene	28.05					0.01	0.01	0.97	0.06	0.05	0.06	0.00	0.09
Ethane	30.07					0.13	0.14	27.92	1.64	0.78	0.89	0.04	1.40
Propane	44.01					0.10	0.10	31.16	1.83	1.33	1.52	0.10	3.50
Propylene	42.08												
i-Butane	58.12					0.01	0.01	3.87	0.23	0.14	0.16	0.01	0.49
n-Butane	58.12					0.04	0.04	17.90	1.05	1.16	1.32	0.12	4.04
i-Butene	56.11												
n-Butene	56.11												
C2-Butene	56.11												
i-Pentane	72.15												
n-Pentane	72.15												
TOTAL	28.02												
Nitrogen													
TOTAL		49.40	100.00	3092.80	100.00	99.74	100.00	1698.01	100.00	87.46	100.00	2.90	100.00

First Stage Shift Reaction						
CO + H2O = CO2 + H2						
Stochiom.	[moles]	18.64	18.64	18.64	18.64	
Produced	[moles]				4.88	-13.27
Total	[moles]	18.64	18.64	18.64	23.52	5.37
Stochiom.	[grams]	522.10	335.89	820.34	37.65	
Produced	[grams]				214.81	-26.80
Total	[grams]	522.10	335.89	1035.15	10.86	

Hydrocarbon Gases					
	First	Second	Dissolved	Total	
C1 to C3	[grams]	15.00	112.76	0.16	127.92
C4 +	[grams]		65.55	0.70	66.25
Total	[grams]	15.00	178.32	0.85	194.17

Hydrogen					
	First	In	Out	Second	Up-Take
	Up-Take				Up-Take
					Total
	[grams]	26.80	1537.85	1369.17	168.68
					195.47

M.B.No.: YP-03/C1

Liquid / Slurry Stream Analysis

[illegible]

	Feed	V-220	Products V-340 (BTMS)	V-330
----- in grams of analysis sample -----				
Total Sample	53.27	15.11	50.74	70.00
Water	2.80	10.75		10.48
Oils+Asphaltenes	30.88	4.36	41.47	59.52
Oils	27.15	4.18	31.84	57.60
Asphaltenes	3.74	0.18	9.62	1.92
Pre-Asphaltenes			1.09	
Insolubles	19.59		8.18	
IOM	17.94		5.56	
Ash	1.65		2.62	
TOTAL	53.27	15.11	50.74	70

----- in wt% of analysis sample -----				
Water	5.26%	71.17%		14.97%
Oils+Asphaltenes	57.97%	28.83%	81.72%	85.03%
Oils (on fraction)	87.90%	95.92%	76.80%	96.78%
(on total)	50.96%	27.66%	62.76%	82.29%
Asphalt. (on fract.)	12.10%	4.08%	23.20%	3.22%
(on total)	7.01%	1.18%	18.96%	2.74%
Pre-Asphaltenes			2.15%	
Insolubles	36.77%		16.13%	
IOM (on fraction)	91.57%		68.00%	
(on total)	33.67%		10.97%	
Ash (on fraction)	8.43%		32.00%	
(on total)	3.10%		5.16%	
TOTAL	100.00%	100.00%	100.00%	100.00%

----- in grams of feed / product -----				
Total Feed / Product	7320	1197	5405	680
Water	384.8	851.6		101.8
Oils+Asphaltenes	4243.6	345.1	4417.2	578.2
Oils (on fraction)	3730.2	331.0	3392.2	559.6
(on total)	3730.2	331.0	3392.2	559.6
Asphalt. (on fract.)	513.5	14.1	1025.0	18.6
(on total)	513.5	14.1	1025.0	18.6
Pre-Asphaltenes			116.1	
Insolubles	2691.6		871.7	
IOM (on fraction)	2464.7		592.8	
(on total)	2464.7		592.8	
Ash (on fraction)	226.9		279.0	
(on total)	226.9		279.0	
TOTAL (as is)	7320.0	1196.7	5405.0	680.0
TOTAL (MAF)	6708.3	345.1	5126.0	578.2

Distillation Profile THF-Extract

Fractions deg C	Feed	Products			
		V-220	V-340 (BTMS)	V-330	Total
IBP - 182				76.09	76.09
182 - 343	169.75	13.80	215.78	428.73	658.32
343 - 524	4073.89	331.26	3375.02	73.37	3779.65
524+			942.47		942.47
TOTAL	4243.64	345.07	4533.27	578.19	5456.53

Feed	Products (normalized)				Feed	Products (normalized)			
	V-220	V-340 (BTMS)	V-330	Total		V-220	V-340 (BTMS)	V-330	Total
----- in wt% of total feed (as is) -----					----- in wt% of total feed (MAF) -----				
5.26%	5.26%		1.43%	6.69%				1.56%	1.56%
57.97%	4.85%	62.06%	8.12%	75.03%	63.26%	5.29%	67.72%	8.86%	81.88%
50.96%	4.65%	47.66%	7.86%	60.17%	55.60%	5.07%	52.01%	8.58%	65.66%
7.01%	0.20%	14.40%	0.26%	14.86%	7.65%	0.22%	15.71%	0.29%	16.22%
		1.63%		1.63%			1.78%		1.78%
36.77%		11.43%		11.43%					
33.67%		8.33%		8.33%	36.74%		9.09%		9.09%
3.10%		3.10%		3.10%					
100.00%	10.10%	75.12%	9.55%	94.78%	100.00%	5.29%	78.59%	10.43%	94.30%

PROCESS YIELD STRUCTURE

RUN No.: DOE-BU-013

M.B. No.: YP-03/C1

FEED
wt% (coal+solvent)
as is maf

PRODUCT
wt% (coal+solvent)
as is maf

				COx+H2	14.4%	15.7%
				C1 - C4	0.2%	0.2%
58.0%	63.3%	Solvent		Oil	4.8%	5.3%
42.0%	36.7%	Coal		Water	5.3%	
100.0%	100.0%					
7.1%	7.8%	CO (shift)		COx	2.1%	2.3%
4.6%	5.0%	Water (shift)		C1 - C4	2.5%	2.7%
				Oil	8.1%	8.9%
				Water	1.4%	1.6%
2.3%	2.5%	Hydrogen (consumed)		Oil	63.7%	69.5%
				Coal (maf)	8.3%	9.1%
				Ash	3.1%	
114.0%	115.3%				114.0%	115.3%

Remarks:

RUN No.: DOE-BU-013

M.B.No.: YP-04/C1

	Date	Time	Date	Time
START:			Nov. 19, 93	08:00
END:			Nov. 19, 93	15:00
DURATION (hours):				7.00

Feed:	Type	Wt% (maf)
Coal	BTH	40.62%
Solvent	V-1074	59.38%
Catalyst 1	Aluminate	2.00%
Catalyst 2	Moly+DMDS	0.12%
Other		

OPERATING PARAMETERS:

FEED TANK WI-110:	(G)	
Start of Mass Balance		21060.00
End of Mass Balance		14040.00
Rate	(G/HR)	1003
FIRST STAGE:		
Operating Pressure:	(MPa)	10.34
Feed Temp.:	(C)	
Reactor Temp.:	(C)	
TE-201I	(BTM)	410
TE-202I		412
TE-203I		412
TE-204I	(Top)	393
Liquid Level	(mm)	470
Separator Temperature:	(C)	47
CO-Feed Rate:	(L/MIN)	4.25
Water Feed Rate:	(ML/MIN)	1.81
Temperature:	(C)	180
Catalyst Feed:	(ML/MIN)	
Liquid Product (WI-220):	(G)	
Start of Mass Balance		
End of Mass Balance		1270.80
Nitrogen Rate:	(L/MIN)	4.01
SECOND STAGE:		
Operating Pressure:	(MPa)	17.24
Feed Temp.:	(C)	125
Reactor Temp.:	(C)	
TE-301I	(BTM)	
TE-302I		424
TE-303I		424
TE-304I		425
TE-305I		424
TE-306I		424
TE-307I		422
TE-308I	(Top)	410
TE-309I	(VAP)	405
Liquid level	(mm)	700
Separator Temperature:	(C)	45
Hydrogen Feed Rate:	(L/MIN)	35.52
Temperature:	(C)	406
Liquid Product (WI-330):	(G)	
Start of Mass Balance		700
End of Mass Balance		1320
Bottoms Product (V-340):	(G)	
Start of Mass Balance		
End of Mass Balance		5120
Sulfiding Agent	(mL/HR)	11.88

MEASURED GAS COMPOSITIONS

NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02	4.55	93.53	34.81
CO2	44.01	14.60	0.27	22.30
CO	28.01	33.58	0.17	8.21
H2S	34.08		0.18	0.45
Methane	16.04	0.54	0.53	0.56
Ethylene	28.05		0.01	0.48
Ethane	30.07		0.13	0.48
Propane	44.01		0.10	1.53
Propylene	42.08			
i-Butane	58.12		0.01	0.14
n-Butane	58.12		0.05	1.25
i-Butene	56.11			
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15		0.09	3.34
Nitrogen	28.02			
TOTAL		53.26	95.07	73.555
Gas Meter Readings		DTM-260	DTM-360	DTM-350
Start of M.B. : (L)		2850.0	780.0	2584.0
End of M.B. : (L)		7227.0	16475.0	2698.0
Total : (L)		4377.0	15695.0	114.0
Temperature: (C)		21.8	21.5	23.0
Meter Pressure : (mmHg)		699	699	699
Standard Volume: (L)		3728	13382	97
Nitrogen to R-200: (L)		1686		
Net Gas Out: (L)		2042	13382	97

Run Conditions

Basis: MAF		First Stage	Second Stage
Pressure	Mpa	10.3	17.2
Temperature	deg C	412	424
Catalyst		Aluminate	Moly+DMD
Feed	wt % maf coal	40.62%	
WHSV	(kg / hr) / l	2.35	1.58
CO Rate	kg / kg maf coal	0.90	
consumed	moles / 100g maf coal	3.20	
Water Rate	kg / kg maf coal	0.90	
consumed	moles / 100g maf coal	4.98	
Hydrogen	kg / kg maf coal		0.54
consumed	moles / 100g maf coal		26.86
consumed	wt % maf coal	1.17%	6.17%

OVERALL MASS BALANCE					
Material In:		Grams		Material Out:	Grams
	Feed Slurry	7020		First Stage Liquid:	1271
	CO-Gas:	2232		First Stage Product Gas:	2739
	Water:	758		Second Stage Liquid:	620
	Hydrogen:	1345		Second Stage Reactor Bottoms:	5120
	Catalyst:			Second Stage Product Gas:	1498
	S-Agent	83		Dissolved Gas:	101
TOTAL IN:		11439		TOTAL OUT:	11349
Catalyst mf		149		OVERALL BALANCE:	99.2%
WATER BALANCE					
TOTAL IN:		1380		TOTAL OUT:	1492
				WATER BALANCE:	108.2%
		Coal Conversion	wt. % maf	77.0%	
		Ash Balance	wt. %	129.9%	

PRODUCT YIELDS					
on	Total Gross		Total Net		wt. % maf coal
	[grams]	wt. % maf feed	[grams]	wt. % maf coal	
	measured	normalized	measured	normalized	
	112.81	114.38	39.16%	114.38	4.59%
	296.86	300.99	103.06%	300.99	12.09%
	38.90	39.44	13.50%	39.44	1.58%
3	127.57	129.34	2.11%	129.34	5.19%
	79.64	80.74	1.32%	80.74	3.24%
	3969.26	4024.46	65.64%	824.06	33.09%
rene	911.04	923.71	15.06%	483.16	19.40%
halt.	127.20	128.97	2.10%	128.97	5.18%
	564.59	572.44	9.34%	572.44	22.98%
	6227.88	6314.48	251.29%	2673.52	107.35%

Distillation Profile THF-Extract					
Fraction [deg C]	Feed [grams]	Product			
		Total Gross		Total Net	
		[grams]	normalized	[grams]	wt. % maf coal
IBP - 182		64.06	64.95	64.95	2.61%
182 - 343	145.64	580.13	588.20	442.56	17.77%
343 - 524	3495.32	3551.54	3600.93	105.61	4.24%
524+		811.77	823.06	823.06	33.05%
TOTAL	3640.95	5007.51	5077.13	1436.18	57.66%

648 ANALYSIS

	First Stage Product Gas (DTM-250)						Second Stage Product Gas (DTM-350)						Dissolved Gas (DTM-350)					
Name	Number of Samples:						Number of Samples:						Number of Samples:					
	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	
Hydrogen	4.459	4.785	4.524	4.694	4.567	4.548	92.788	94.224	93.287	93.812	93.530	31.289	38.321	34.805	22.286	8.214	0.451	
CO ₂	14.563	14.554	14.725	14.559	14.688	0.254	0.270	0.286	0.287	0.274	0.277	22.497	22.095	22.286	8.214	0.451		
CO	34.622	34.667	34.683	33.601	33.607	0.174	0.225	0.228	0.228	0.174	0.168	8.066	8.361	22.286	8.214	0.451		
H ₂ S								0.181	0.169	0.173	0.178	0.297	0.604					
Methane	0.456	0.606	0.542	0.549	0.541	0.539	0.529	0.514	0.542	0.547	0.533	0.580	0.536	0.558	0.485	0.479	1.632	
Ethylene								0.166	0.137	0.135	0.133	0.060	0.088	0.485	0.479	1.632		
Propane								0.091	0.098	0.097	0.097	1.541	1.523	0.485	0.479	1.632		
i-Butane								0.010	0.016	0.014	0.008	0.011	0.145	0.144	0.144	0.144		
n-Butane								0.043	0.046	0.053	0.042	0.046	1.257	1.244	0.144	0.144		
i-Pentane																		
n-Pentane								0.097	0.107	0.075	0.075	0.089	3.280	3.404	3.342			
Nitrogen																		
TOTAL	54.100	54.309	54.343	50.275	53.268	53.268	94.307	95.633	94.901	95.419	95.065	69.923	77.187	73.553				

GAS CALCULATIONS

Name	Mol.Weight	First Stage Product Gas (DTM-260)				Second Stage Product Gas (DTM-360)				Dissolved Gas (DTM-350)			
		Average Mol Weight:		16.46 (g/mole)		Average Mol Weight:		2.51 (g/mole)		Average Mol Weight:		23.43 (g/mole)	
		Volume		Weight (norm.)		Volume		Weight (norm.)		Volume		Weight (norm.)	
		meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%
Hydrogen	2.02	4.55	8.54	15.71	0.57	93.53	98.39	1186.75	79.24	34.81	47.32	4.12	4.08
CO ₂	44.01	14.60	27.41	1099.34	40.14	0.27	0.29	75.82	5.06	22.30	30.31	57.57	56.93
CO	28.01	33.58	63.04	1609.22	58.75	0.17	0.18	29.73	1.99	8.21	11.17	13.50	13.35
H ₂ S	34.08					0.18	0.19	38.00	2.54	0.45	0.61	0.90	0.89
Methane	16.04	0.54	1.01	14.79	0.54	0.53	0.56	53.70	3.59	0.56	0.76	0.53	0.52
Ethylene	28.05					0.01	0.01	1.37	0.09	0.48	0.66	0.80	0.79
Ethane	30.07					0.13	0.14	25.12	1.68	0.48	0.65	0.85	0.84
Propane	44.01					0.10	0.10	26.47	1.77	1.53	2.08	3.96	3.91
Propylene	42.08												
i-Butane	58.12					0.01	0.01	3.83	0.26	0.14	0.20	0.49	0.49
n-Butane	58.12					0.05	0.05	16.79	1.12	1.25	1.70	4.26	4.22
i-Butene	56.11												
n-Butene	56.11												
C ₂ -Butene	56.11												
i-Pentane	72.15												
n-Pentane	72.15					0.09	0.09	40.11	2.68	3.34	4.54	14.15	13.99
Nitrogen	28.02												
TOTAL		53.26	100.00	2739.06	100.00	95.07	100.00	1497.69	100.00	73.56	100.00	101.12	100.00

First Stage Shift Reaction

		CO	+	H ₂ O	=	CO ₂	+	H ₂
Stochiom.	[moles]	22.25		22.25		22.25		22.25
Produced	[moles]					2.73		-14.47
Total	[moles]	22.25		22.25		24.98		7.78
Stochiom.	[grams]	623.14		400.89		979.09		44.94
Produced	[grams]					120.25		-29.23
Total	[grams]	623.14		400.89		1099.34		15.71

Hydrocarbon Gases

		First	Second	Dissolved	Total
C ₁ to C ₃	[grams]	14.79	106.66	6.12	127.57
C ₄ +	[grams]		60.74	18.90	79.64
Total	[grams]	14.79	167.39	25.02	207.21

Hydrogen

		First Up-Take	In	Second Out	Up-Take	Total Up-Take
Hydrogen	[grams]	29.23	1344.59	1190.87	153.72	182.95

M.B.No.: YP-04/C1

Liquid / Slurry Stream Analysis

[illegible]

	Feed	V-220	Products V-340 (BTMS)	V-330
----- in grams of analysis sample -----				
Total Sample	51.98	15.44	49.51	58.20
Water	4.60	11.89		10.59
Oils+Asphaltenes	26.96	3.55	39.46	47.61
Oils	23.70	3.40	30.94	45.97
Asphaltenes	3.26	0.14	8.53	1.64
Pre-Asphaltenes			1.23	
Insolubles	20.42		8.82	
IOM	18.44		5.46	
Ash	1.98		3.36	
TOTAL	51.98	15.44	49.51	58.2
----- in wt% of analysis sample -----				
Water	8.85%	77.02%		18.20%
Oils+Asphaltenes	51.87%	22.98%	79.71%	81.80%
Oils (on fraction)	87.90%	95.92%	78.40%	96.55%
(on total)	45.59%	22.04%	62.49%	78.98%
Asphalt. (on fract.)	12.10%	4.08%	21.60%	3.45%
(on total)	6.28%	0.94%	17.22%	2.82%
Pre-Asphaltenes			2.48%	
Insolubles	39.29%		17.81%	
IOM (on fraction)	90.31%		61.93%	
(on total)	35.48%		11.03%	
Ash (on fraction)	9.69%		38.08%	
(on total)	3.81%		6.78%	
TOTAL	100.00%	100.00%	100.00%	100.00%
----- in grams of feed / product -----				
Total Feed / Product	7020	1271	5120	620
Water	621.2	978.7		112.8
Oils+Asphaltenes	3641.0	292.1	4081.1	507.2
Oils (on fraction)	3200.4	280.1	3199.4	489.7
(on total)	3200.4	280.1	3199.4	489.7
Asphalt. (on fract.)	440.6	11.9	881.6	17.5
(on total)	440.6	11.9	881.6	17.5
Pre-Asphaltenes			127.2	
Insolubles	2757.8		911.7	
IOM (on fraction)	2490.6		564.6	
(on total)	2490.6		564.6	
Ash (on fraction)	267.2		347.1	
(on total)	267.2		347.1	
TOTAL (as is)	7020.0	1270.8	5120.0	620.0
TOTAL (MAF)	6131.5	292.1	4772.9	507.2

Distillation Profile THF-Extract					
Fractions deg C	Feed	Products			
		V-220	V-340 (BTMS)	V-330	Total
IBP - 182				64.06	64.06
182 - 343	145.64	11.68	199.47	368.98	580.13
343 - 524	3495.32	280.38	3197.02	74.15	3551.54
524+			811.77		811.77
TOTAL	3640.95	292.06	4208.26	507.19	5007.51

Feed	Products (normalized)				Feed	Products (normalized)			
	V-220	V-340 (BTMS)	V-330	Total		V-220	V-340 (BTMS)	V-330	Total
----- in wt% of total feed (as is) -----					----- in wt% of total feed (MAF) -----				
8.85%	8.85%		1.63%	10.48%	59.38%	4.83%	67.48%	1.87%	1.87%
51.87%	4.22%	58.94%	7.33%	70.49%				8.39%	80.70%
45.59%	4.05%	46.21%	7.07%	57.33%	52.20%	4.63%	52.91%	8.10%	65.64%
6.28%	0.17%	12.73%	0.25%	13.16%	7.19%	0.20%	14.58%	0.29%	15.06%
		1.84%		1.84%			2.10%		2.10%
39.29%		11.96%		11.96%					
35.48%		8.15%		8.15%	40.62%		9.34%		9.34%
3.81%		3.81%		3.81%					
100.00%	13.07%	72.74%	8.95%	94.76%	100.00%	4.83%	78.92%	10.25%	94.01%

PROCESS YIELD STRUCTURE

RUN No.: DOE-BU-013

M.B. No.: YP-04/C1

FEED				PRODUCT		
wt% (coal+solvent)				wt% (coal+solvent)		
as is	maf			as is	maf	
				COx+H2	15.9%	18.2%
				C1 - C4	0.2%	0.2%
51.9%	59.4%	Solvent				
48.1%	40.6%	Coal				
100.0%	100.0%			Oil	4.2%	4.8%
				Water	8.8%	
8.9%	10.2%	CO (shift)				
5.7%	6.5%	Water (shift)				
				COx	3.1%	3.6%
				C1 - C4	2.8%	3.2%
				Oil	7.3%	8.4%
				Water	1.6%	1.9%
2.2%	2.5%	Hydrogen (consumed)				
				Oil	60.8%	69.6%
				Coal (maf)	8.2%	9.3%
				Ash	3.8%	
116.8%	119.2%				116.8%	119.2%

Remarks:

SUMMARY OF BENCH UNIT TEST RUNS
(forced water balance in V-200 and kept oil as measured)

RUN No.:	DOE-BU-014				DOE-BU-015					
M.B.No.:	YP-01/ C1	YP-02/ C1	YP-03/ C1	YP-04/ C1	YP-01/ C1	YP-02/ C1	YP-03/ C1	YP-04/ C1	YP-05/ C1	YP-06/ C1
Coal	BTH	BTH	BTH	BTH	BTH	BTH	BTH	BTH	BTH	BTH
wt % maf	39.80%	41.98%	41.81%	41.81%	38.42%	40.61%	42.94%	44.70%	41.88%	41.62%
First Stage:										
Feed Rate (kg / hr) / IWHSV	1.77	1.79	1.76	1.73	1.62	2.29	1.74	1.86	1.83	1.85
Pressure Mpa	10.34	10.34	10.34	10.34	10.34	10.34	10.34	10.34	10.34	10.34
Temperature deg C	411	411	411	410	411	412	412	409	411	411
Catalyst	Aluminate	Aluminate	Aluminate	Aluminate	Aluminate	Aluminate	Aluminate	Aluminate	Aluminate	Aluminate
CO Rate kg / kg maf coal	0.96	0.90	0.92	0.94	1.22	0.84	0.92	0.82	0.89	0.87
moles / 100g maf coal	3.42	3.22	3.27	3.34	4.34	3.01	3.29	2.93	3.17	3.12
consumed moles / 100g maf coal	1.09	0.99	1.06	1.09	1.38	0.99	1.08	0.96	1.02	1.01
Water Rate kg / kg maf coal	0.96	0.90	0.92	0.94	1.22	0.84	0.92	0.82	0.89	0.87
moles / 100g maf coal	5.32	5.00	5.08	5.20	6.75	4.68	5.11	4.56	4.93	4.85
Hydrogen wt % maf coal	1.35%	1.18%	1.35%	1.37%	1.71%	1.28%	1.37%	1.23%	1.28%	1.27%
Second Stage:										
Feed Rate (kg / hr) / IWHSV	1.06	1.07	1.06	1.04	0.85	1.20	1.04	1.11	1.10	1.11
Pressure Mpa	17.24	17.24	17.24	17.24	17.24	17.24	17.24	17.24	17.24	17.24
Temperature deg C	430	435	439	445	430	434	435	429	440	436
Catalyst	FeO+DMDS	FeO+DMDS	FeO+DMDS	FeO+DMDS	Molybdate	Molybdate	Molybdate	Molybdate	Molybdate	Molybdate
Hydrogen kg / kg maf coal	0.58	0.55	0.56	0.57	0.74	0.51	0.56	0.50	0.54	0.53
moles / 100g maf coal	29.02	27.30	27.79	28.35	36.88	25.56	27.89	24.94	26.94	26.52
consumed wt % maf coal	5.78%	5.29%	5.63%	5.50%	2.61%	7.13%	6.12%	6.18%	6.39%	6.33%
Coal Conversion (wt % maf coal)	91.54%	92.51%	92.44%	93.74%	82.63%	89.78%	92.34%	91.36%	92.46%	93.16%
Product Yield (wt % maf coal)										
H2O	6.19%	6.02%	6.67%	7.80%	2.40%	5.15%	4.64%	5.30%	3.62%	4.88%
COx	13.51%	14.54%	10.06%	10.19%	16.88%	10.64%	12.60%	9.25%	11.37%	11.40%
H2S										
C1 to C3	7.15%	7.70%	8.82%	10.77%	7.04%	7.17%	7.26%	5.47%	7.13%	6.72%
C4 - 182	5.99%	4.43%	3.46%	7.22%	7.05%	6.47%	6.53%	5.82%	6.51%	6.94%
182 - 343	35.09%	34.73%	32.39%	36.76%	41.63%	41.35%	43.92%	42.29%	51.77%	46.85%
343 - 524	9.37%	16.12%	23.07%	8.42%	1.27%	11.19%	6.43%	14.69%	4.02%	1.88%
IBP - 524	50.44%	55.28%	58.92%	52.41%	49.95%	59.01%	56.88%	62.79%	62.29%	55.66%
524+	29.84%	22.95%	22.50%	25.71%	28.06%	26.43%	26.11%	24.59%	23.26%	28.94%
TOTAL	107.13%	106.48%	106.98%	106.88%	104.32%	108.40%	107.49%	107.42%	107.67%	107.60%
Yields based on Solubility										
Pentane soluble (incl. C4)	50.79%	51.78%	53.92%	55.46%	45.57%	57.64%	59.33%	60.74%	62.62%	61.06%
Asphaltenes	17.71%	15.63%	17.40%	13.94%	12.09%	14.72%	14.05%	16.08%	13.29%	14.45%
Preasphaltenes	3.31%	3.33%	2.54%	2.47%	2.97%	2.87%	1.96%	1.92%	2.11%	2.25%
IOM	8.46%	7.49%	7.56%	6.26%	17.37%	10.22%	7.66%	8.64%	7.54%	6.84%
TOTAL	80.28%	78.22%	81.43%	78.12%	78.00%	85.45%	82.99%	87.39%	85.55%	84.60%

NOTE:

RUN No.: DOE-BU-014

M.B.No.: YP-01/ C1

	Date	Time	Date	Time
START:			Dec. 07, 93	02:00
END:			Dec. 07, 93	10:00
DURATION (hours):				8.00

Feed:	Type	Wt% (maf)
Coal	BTH	39.80%
Solvent	V-1074	60.20%
Catalyst 1	Aluminate	2.00%
Catalyst 2	FeO+DMDS	2.00%
Other		

OPERATING PARAMETERS:			
FEED TANK WI-110:	(G)		
Start of Mass Balance		11100.00	
End of Mass Balance		4150.00	
Rate	(G/HR)	869	
FIRST STAGE:			
Operating Pressure:	(MPa)	10.34	
Feed Temp.:	(C)		
Reactor Temp.:	(C)		
TE-201I	(BTM)	410	
TE-202I		411	
TE-203I		411	
TE-204I	(Top)	390	
Liquid Level	(mm)	540	
Separator Temperature:	(C)	47	
CO-Feed Rate:	(L/MIN)	4.05	
Water Feed Rate:	(ML/MIN)	1.69	
Temperature:	(C)	180	
Catalyst Feed:	(ML/MIN)		
Liquid Product (WI-220):	(G)		
Start of Mass Balance			
End of Mass Balance		1048.50	
Nitrogen Rate:	(L/MIN)	3.95	
SECOND STAGE:			
Operating Pressure:	(MPa)	17.24	
Feed Temp.:	(C)	138	
Reactor Temp.:	(C)		
TE-301I	(BTM)	431	
TE-302I		431	
TE-303I		430	
TE-304I		429	
TE-305I		428	
TE-306I		427	
TE-307I		423	
TE-308I	(Top)	419	
TE-309I	(VAP)	419	
Liquid level	(mm)	900	
Separator Temperature:	(C)	45	
Hydrogen Feed Rate:	(L/MIN)	34.21	
Temperature:	(C)	399	
Liquid Product (WI-330):	(G)		
Start of Mass Balance		1640	
End of Mass Balance		4720	
Bottoms Product (V-340):	(G)		
Start of Mass Balance		-130	
End of Mass Balance		2400	
Sulfiding Agent	(mL/HR)	10.40	

MEASURED GAS COMPOSITIONS				
NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02	4.28	97.42	34.81
CO2	44.01	13.03	0.09	22.30
CO	28.01	23.81	0.31	8.21
H2S	34.08			
Methane	16.04	0.50	0.71	0.56
Ethylene	28.05		0.02	0.48
Ethane	30.07		0.17	0.48
Propane	44.01		0.11	1.53
Propylene	42.08			
i-Butane	58.12		0.03	0.14
n-Butane	58.12		0.06	1.25
i-Butene	56.11			
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15		0.08	3.34
Nitrogen	28.02			
TOTAL		41.61	99.01	73.1045
Gas Meter Readings		DTM-260	DTM-360	DTM-350
Start of M.B. : (L)		3045.0	3262.0	9091.0
End of M.B. : (L)		8002.0	20883.0	9128.0
Total : (L)		4957.0	17621.0	37.0
Temperature: (C)		22.2	21.6	23.3
Meter Pressure : (mmHg)		699	699	699
Standard Volume: (L)		4216	15019	31
Nitrogen to R-200: (L)		1894		
Net Gas Out: (L)		2322	15019	31

Run Conditions			
Basis: MAF		First Stage	Second Stage
Pressure	Mpa	10.3	17.2
Temperature	deg C	411	430
Catalyst		Aluminate	FeO+DMDS
Feed	wt % maf coal	39.80%	
WHSV	(kg / hr) / l	1.77	1.06
CO Rate	kg / kg maf coal	0.96	
	moles / 100g maf coal	3.42	
consumed	moles / 100g maf coal	1.09	
Water Rate	kg / kg maf coal	0.96	
	moles / 100g maf coal	5.32	
Hydrogen	kg / kg maf coal		0.58
	moles / 100g maf coal		29.02
consumed	wt % maf coal	1.35%	5.78%

OVERALL MASS BALANCE					
Material In:		Grams	Material Out:		Grams
	Feed Slurry	6950		First Stage Liquid:	1049
	CO-Gas:	2432		First Stage Product Gas:	3130
	Water:	809		Second Stage Liquid:	3080
	Hydrogen:	1480		Second Stage Reactor Bottoms:	2530
	Catalyst:			Second Stage Product Gas:	1640
	S-Agent	83		Dissolved Gas:	33
TOTAL IN:		11754	TOTAL OUT:		11461
Catalyst mf		278	OVERALL BALANCE:		97.5%
WATER BALANCE					
TOTAL IN:		1038	TOTAL OUT:		1187
			WATER BALANCE:		114.4%
	Coal Conversion		wt. % maf	91.5%	
	Ash Balance		wt. %	134.2%	

PRODUCT YIELDS					
Description	Total Gross			Total Net	
	[grams]		wt. % maf feed	[grams]	wt. % maf coal
	measured	normalized			
H ₂ O	149.20	157.06	2.46%	157.06	6.19%
CO _x	325.59	342.73	5.38%	342.73	13.51%
H ₂ S					
C1 to C3	172.43	181.51	2.85%	181.51	7.15%
C4 +	77.02	81.07	1.27%	81.07	3.20%
Oil	4352.22	4581.38	71.86%	1207.77	47.60%
Asphaltene	868.07	913.77	14.33%	449.37	17.71%
Preasphalt.	79.83	84.03	1.32%	84.03	3.31%
IOM	204.00	214.74	3.37%	214.74	8.46%
Total	6228.35	6556.29	102.84%	2718.29	107.13%

Simulated Distillation Profile THF-Extract						Crude Sim. Dist. Comp. Sample)				
Fraction [deg C]	Feed [grams]	Product				Feed [grams]	Product			
		Total Gross		Total Net			Total Gross		Total Net	
		[grams]	----- normalized -----		[grams]		wt. % maf coal	[grams]	----- normalized -----	
[grams]	[grams]		[grams]	wt. % maf coal						
C4 - 182		199.41	209.91	209.91	8.27%		144.30	151.90	151.90	5.99%
182 - 343	153.52	1240.82	1306.16	1152.64	45.43%	69.08	911.42	959.41	890.32	35.09%
343 - 524	3684.48	3282.91	3455.77	-228.72	-9.01%	3220.08	3284.78	3457.73	237.65	9.37%
524+		857.99	903.16	903.16	35.59%	548.83	1240.63	1305.95	757.12	29.84%
TOTAL	3838.00	5581.14	5875.00	2036.99	80.28%	3838.00	5581.14	5875.00	2036.99	80.28%
IBP - 524	3838.00	4723.15	4971.83	1133.83	44.68%	3289.17	4340.50	4569.04	1279.87	50.44%

RUN No.: DOE-BU-014

M.B.No.: YP-01/ C1

GAS ANALYSIS

Name	First Stage Product Gas (DTM-260)							Second Stage Product Gas (DTM-360)							Dissolved Gas (DTM-350)						
	Number of Samples: 1							Number of Samples: 6							Number of Samples: 2						
	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%
Hydrogen	4.275						4.275	94.878	100.475	100.227	94.387	94.778	99.693	97.420	31.289	38.321					34.805
CO ₂	13.029						13.029	0.113	0.092	0.098	0.108	0.091	0.085	0.093	22.497	22.095					22.296
CO	23.812						23.812	0.273	0.304	0.291	0.381	0.309	0.310	0.311	8.068	8.361					8.214
H ₂ S																					
Methane	0.495						0.495	0.754	0.684	0.712	0.729	0.711	0.695	0.714	0.580	0.538					0.558
Ethylene								0.021	0.023	0.022	0.021	0.023	0.021	0.022	0.911	0.058					0.485
Ethane								0.168	0.173	0.169	0.174	0.180	0.179	0.174	0.060	0.898					0.479
Propane								0.130	0.131	0.130	0.134	0.138	0.014	0.113	1.541	1.523					1.532
Propylene																					
i-Butane								0.025	0.025	0.028	0.026	0.026	0.027	0.026	0.145	0.143					0.144
n-Butane								0.057	0.057	0.061	0.059	0.061	0.060	0.059	1.257	1.244					1.251
i-Butene																					
n-Butene																					
C2-Butene																					
i-Pentane																					
n-Pentane								0.079	0.075	0.075	0.075	0.079	0.075	0.076	3.280	3.404					3.342
Nitrogen																					
TOTAL	41.611						41.611	98.298	102.039	101.783	98.074	98.397	101.459	99.008	89.626	76.583					73.105

GAS CALCULATIONS

Name	Mol.Weight	First Stage Product Gas (DTM-260)				Second Stage Product Gas (DTM-360)				Dissolved Gas (DTM-350)			
		Average Mol Weight:		16.64 (g/mole)		Average Mol Weight:		2.45 (g/mole)		Average Mol Weight:		23.37 (g/mole)	
		Volume		Weight (norm.)		Volume		Weight (norm.)		Volume		Weight (norm.)	
		meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%
Hydrogen	2.02	4.28	10.27	21.50	0.69	97.42	98.40	1332.07	81.21	34.81	47.61	1.35	4.12
CO ₂	44.01	13.03	31.31	1427.84	45.62	0.09	0.09	27.66	1.69	22.30	30.50	18.78	57.44
CO	28.01	23.81	57.23	1660.83	53.06	0.31	0.31	59.03	3.60	8.21	11.24	4.40	13.47
H ₂ S	34.08												
Methane	16.04	0.50	1.19	19.77	0.63	0.71	0.72	77.54	4.73	0.56	0.76	0.17	0.52
Ethylene	28.05					0.02	0.02	4.15	0.25	0.48	0.66	0.26	0.80
Ethane	30.07					0.17	0.18	35.38	2.16	0.48	0.66	0.28	0.84
Propane	44.01					0.11	0.11	33.59	2.05	1.53	2.10	1.29	3.95
Propylene	42.08												
i-Butane	58.12					0.03	0.03	10.29	0.63	0.14	0.20	0.16	0.49
n-Butane	58.12					0.06	0.06	23.28	1.42	1.25	1.71	1.39	4.25
i-Butene	56.11												
n-Butene	56.11												
C ₂ -Butene	56.11												
i-Pentane	72.15												
n-Pentane	72.15					0.08	0.08	37.28	2.27	3.34	4.57	4.62	14.12
Nitrogen	28.02												
TOTAL		41.61	100.00	3129.95	100.00	99.01	100.00	1640.27	100.00	73.10	100.00	32.69	100.00

First Stage Shift Reaction

		CO	+	H ₂ O	=	CO ₂	+	H ₂
Stochiom.	[moles]	27.54		27.54		27.54		27.54
Produced	[moles]					4.90		-16.90
Total	[moles]	27.54		27.54		32.44		10.65
Stochiom.	[grams]	771.45		496.31		1212.12		55.63
Produced	[grams]					215.72		-34.13
Total	[grams]	771.45		496.31		1427.84		21.50

Hydrocarbon Gases

		First	Second	Dissolved	Total
C1 to C3	[grams]	19.77	150.66	2.00	172.43
C4 +	[grams]		70.85	6.17	77.02
Total	[grams]	19.77	221.51	8.16	249.45

Hydrogen

		First Up-Take	In	Second Out	Up-Take	Total Up-Take
Hydrogen	[grams]	34.13	1480.17	1333.42	146.76	180.89

Liquid / Slurry Stream Analysis

[illegible]

	Feed	V-220	Products V-340 (BTTMS)	V-330
----- In grams of analysis sample -----				
Total Sample	54.61	14.50	50.58	61.93
Water	1.80	7.49		3.00
Oils+Asphaltenes	30.16	7.01	39.96	54.58
Oils	26.51	6.63	30.70	47.00
Asphaltenes	3.65	0.38	9.26	7.59
Pre-Asphaltenes			0.90	0.70
Insolubles	22.65		9.72	3.65
IOM	19.94		3.33	0.75
Ash	2.71		6.39	2.89
TOTAL	54.61	14.5	50.58	61.93

----- In wt% of analysis sample -----				
Water	3.30%	51.65%		4.84%
Oils+Asphaltenes	55.22%	48.35%	79.00%	88.14%
Oils (on fraction)	87.90%	94.57%	76.82%	86.10%
(on total)	48.54%	45.72%	60.69%	75.89%
Asphalt. (on fract.)	12.10%	5.43%	23.18%	13.90%
(on total)	6.68%	2.63%	18.31%	12.25%
Pre-Asphaltenes			1.78%	1.13%
Insolubles	41.48%		19.22%	5.89%
IOM (on fraction)	88.02%		34.27%	20.60%
(on total)	36.51%		6.59%	1.21%
Ash (on fraction)	11.99%		65.73%	79.40%
(on total)	4.97%		12.63%	4.67%
TOTAL	100.00%	100.00%	100.00%	100.00%

----- In grams of feed / product -----				
Total Feed / Product	6950	1049	2530	3080
Water	229.1	541.6		149.2
Oils+Asphaltenes	3838.0	506.9	1998.7	2714.7
Oils (on fraction)	3373.6	479.4	1535.4	2337.4
(on total)	3373.6	479.4	1535.4	2337.4
Asphalt. (on fract.)	464.4	27.5	463.3	377.2
(on total)	464.4	27.5	463.3	377.2
Pre-Asphaltenes			45.0	34.8
Insolubles	2882.9		486.3	181.3
IOM (on fraction)	2537.4		166.6	37.4
(on total)	2537.4		166.6	37.4
Ash (on fraction)	345.5		319.6	144.0
(on total)	345.5		319.6	144.0
TOTAL (as is)	6950.0	1048.5	2530.0	3080.0
TOTAL (MAF)	6375.4	506.9	2210.4	2786.8

Distillation Profile THF-Extract						D-1160		
Fractions deg C	Feed	Products				Feed	Product	
		V-220	V-340 (BTMS)	V-330	Total		Comp. Sample	
							as is	corr.
IBP - 182		34.88	67.44	20.07	122.39		67.29	67.29
182 - 343	153.52	188.77	96.06	956.00	1240.82	69.08	911.42	911.42
343 - 524	3684.48	283.26	1226.24	1773.42	3282.91	3220.08	3284.78	3284.78
524+			820.64	37.35	857.99	548.83	1853.42	1240.63
TOTAL	3838.00	506.91	2210.37	2786.84	5504.12	3838.00	6116.91	5504.12

Feed	Products (normalized)				Feed	Products (normalized)			
	V-220	V-340	V-330	Total		V-220	V-340	V-330	Total
	(BTTMS)					(BTTMS)			
----- in wt% of total feed (as is) -----					----- in wt% of total feed (MAF) -----				
3.46%	3.46%		2.26%	5.72%				2.46%	2.46%
55.13%	7.66%	30.22%	41.05%	78.93%	60.20%	8.37%	33.00%	44.82%	86.19%
48.46%	7.25%	23.21%	35.34%	65.80%	52.92%	7.92%	25.35%	38.59%	71.86%
6.67%	0.42%	7.01%	5.70%	13.13%	7.28%	0.45%	7.65%	6.23%	14.33%
		0.68%	0.53%	1.21%			0.74%	0.57%	1.32%
41.41%		5.94%	2.11%	8.05%					
36.45%		2.52%	0.56%	3.08%	39.80%		2.75%	0.62%	3.37%
4.96%		3.42%	1.54%	4.96%					
100.00%	11.13%	36.84%	45.93%	93.90%					
					100.00%	8.37%	36.50%	48.48%	93.34%

PROCESS YIELD STRUCTURE

RUN No.: DOE-BU-014

M.B. No.: YP-01/ C1

FEED		PRODUCT	
wt% (coal+solvent)		wt% (coal+solvent)	
as is	maf	as is	maf
55.1%	60.2%	21.0%	22.9%
44.9%	39.8%	0.3%	0.3%
100.0%	100.0%	7.7%	8.4%
11.1%	12.1%	3.5%	
7.1%	7.8%	1.7%	1.8%
		3.5%	3.8%
		41.6%	45.4%
		2.3%	2.5%
2.1%	2.3%	30.9%	33.7%
		3.1%	3.4%
		5.0%	
120.3%	122.2%	120.3%	122.2%

Remarks:

RUN No.: DOE-BU-014

M.B.No.: YP-02/ C1

	Date	Time	Date	Time
START:			Dec. 08, 93	03:00
END:			Dec. 08, 93	11:00
DURATION (hours):				8.00

Feed:	Type	Wt% (maf)
Coal	BTH	41.98%
Solvent	V-1074	58.02%
Catalyst 1	Aluminate	2.00%
Catalyst 2	FeO+DMDS	2.00%
Other		

OPERATING PARAMETERS:

FEED TANK WI-110): (G)		
Start of Mass Balance		9670.00
End of Mass Balance		2670.00
Rate	(G/HR)	875
FIRST STAGE:		
Operating Pressure:	(MPa)	10.34
Feed Temp.:	(C)	
Reactor Temp.:	(C)	
TE-201I	(BTTM)	410
TE-202I		411
TE-203I		411
TE-204I	(Top)	390
Liquid Level	(mm)	540
Separator Temperature:	(C)	47
CO-Feed Rate:	(L/MIN)	4.04
Water Feed Rate:	(ML/MIN)	1.88
Temperature:	(C)	180
Catalyst Feed:	(ML/MIN)	
Liquid Product (WI-220):	(G)	
Start of Mass Balance		
End of Mass Balance		1233.60
Nitrogen Rate:	(L/MIN)	3.93
SECOND STAGE:		
Operating Pressure:	(MPa)	17.24
Feed Temp.:	(C)	138
Reactor Temp.:	(C)	
TE-301I	(BTTM)	434
TE-302I		436
TE-303I		435
TE-304I		434
TE-305I		434
TE-306I		435
TE-307I		431
TE-308I	(Top)	430
TE-309I	(VAP)	430
Liquid level	(mm)	900
Separator Temperature:	(C)	45
Hydrogen Feed Rate:	(L/MIN)	34.10
Temperature:	(C)	379
Liquid Product (WI-330):	(G)	
Start of Mass Balance		1670
End of Mass Balance		4790
Bottoms Product (V-340):	(G)	
Start of Mass Balance		-310
End of Mass Balance		2290
Sulfiding Agent	(mL/HR)	10.47

MEASURED GAS COMPOSITIONS

NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02	4.28	98.17	34.81
CO2	44.01	13.03	0.11	22.30
CO	28.01	23.81	0.37	8.21
H2S	34.08			
Methane	16.04	0.50	0.80	0.56
Ethylene	28.05		0.03	0.48
Ethane	30.07		0.22	0.48
Propane	44.01		0.16	1.53
Propylene	42.08			
i-Butane	58.12		0.02	0.14
n-Butane	58.12		0.07	1.25
i-Butene	56.11			
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15		0.07	3.34
Nitrogen	28.02			
TOTAL		41.61	100.02	73.1045
Gas Meter Readings				
Start of M.B. : (L)	DTM-260	DTM-360	DTM-350	
End of M.B. : (L)	8627.0	8566.0	9167.0	
Total : (L)	13650.0	26270.0	9171.0	
	5023.0	17704.0	4.0	
Temperature: (C)	22.7	22.1	23.7	
Meter Pressure : (mmHg)	694	699	699	
Standard Volume: (L)	4235	15064	3	
Nitrogen to R-200: (L)	1886			
Net Gas Out: (L)	2348	15064	3	

Run Conditions

Basis: MAF		First Stage	Second Stage
Pressure	Mpa	10.3	17.2
Temperature	deg C	411	435
Catalyst		Aluminate	FeO+DMDS
Feed	wt % maf coal	41.98%	
WHSV	(kg / hr) / l	1.79	1.07
CO Rate	kg / kg maf coal	0.90	
consumed	moles / 100g maf coal	3.22	
Water Rate	kg / kg maf coal	0.99	
consumed	moles / 100g maf coal	5.00	
Hydrogen	kg / kg maf coal		0.55
consumed	moles / 100g maf coal		27.30
	wt % maf coal	1.18%	5.29%

OVERALL MASS BALANCE					
Material In:		Grams	Material Out:		Grams
	Feed Slurry	7000		First Stage Liquid:	1234
	CO-Gas:	2422		First Stage Product Gas:	3166
	Water:	902		Second Stage Liquid:	3120
	Hydrogen:	1475		Second Stage Reactor Bottoms:	2600
	Catalyst:			Second Stage Product Gas:	1690
	S-Agent	84		Dissolved Gas:	4
TOTAL IN:		11883	TOTAL OUT:		11813
Catalyst mf		280	OVERALL BALANCE:		99.4%

WATER BALANCE		
TOTAL IN:	1188	TOTAL OUT: 1346
		WATER BALANCE: 113.3%

	Coal Conversion	wt.% maf	92.5%
	Ash Balance	wt.%	147.8%

PRODUCT YIELDS					
Description	Total Gross			Total Net	
	[grams]		wt. % maf feed	[grams]	wt. % maf coal
	measured	normalized			
H2O	158.43	161.73	2.53%	161.73	6.02%
COx	382.80	390.79	6.10%	390.79	14.54%
H2S					
C1 to C3	202.83	207.06	3.23%	207.06	7.70%
C4 +	72.87	74.39	1.16%	74.39	2.77%
Oil	4489.36	4582.99	71.57%	1317.57	49.01%
Asphaltene	851.86	869.62	13.58%	420.12	15.63%
Preasphalt.	87.71	89.54	1.40%	89.54	3.33%
IOM	197.19	201.30	3.14%	201.30	7.49%
Total	6443.05	6577.42	102.72%	2862.49	106.48%

Simulated Distillation Profile THF-Extract						Crude Sim. Dist. (Comp. Sample)						
Fraction [deg C]	Feed [grams]	Product				Feed [grams]	Product					
		Total Gross		Total Net			Total Gross		Total Net			
		[grams]	normalized		[grams]		wt. % maf coal	[grams]	normalized		[grams]	wt. % maf coal
			[grams]						[grams]			
C4 - 182		174.01	177.64	177.64	6.61%		116.57	119.00	119.00	4.43%		
182 - 343	148.60	1337.24	1365.12	1216.53	45.25%		980.21	1000.65	933.78	34.73%		
343 - 524	3566.33	3239.14	3306.69	-259.64	-9.66%	3116.83	3477.56	3550.08	433.25	16.12%		
524+		948.61	968.39	968.39	36.02%	531.23	1124.65	1148.11	616.87	22.95%		
TOTAL	3714.93	5698.99	5817.84	2102.91	78.22%	3714.93	5698.99	5817.84	2102.91	78.22%		
IBP - 524	3714.93	4750.39	4849.45	1134.52	42.20%	3183.69	4574.34	4669.73	1486.04	55.28%		

	First Stage Product Gas (DTM-260)										Second Stage Product Gas (DTM-350)										Dissolved Gas (DTM-350)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
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RUN No.: DOE-BU-014

M.B.No.: YP-02/ C1

GAS CALCULATIONS

Name	Mol.Weight	First Stage Product Gas (DTM-260)				Second Stage Product Gas (DTM-360)				Dissolved Gas (DTM-350)			
		Average Mol Weight:		16.75 (g/mole)		Average Mol Weight:		2.51 (g/mole)		Average Mol Weight:		23.37 (g/mole)	
		Volume		Weight (norm.)		Volume		Weight (norm.)		Volume		Weight (norm.)	
		meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%
Hydrogen	2.02	4.28	10.27	21.75	0.69	98.17	98.15	1332.73	78.84	34.81	47.61	0.15	4.12
CO ₂	44.01	13.03	31.31	1444.11	45.62	0.11	0.11	32.83	1.94	22.30	30.50	2.03	57.44
CO	28.01	23.81	57.23	1679.76	53.06	0.37	0.37	70.03	4.14	8.21	11.24	0.48	13.47
H ₂ S	34.08												
Methane	16.04	0.50	1.19	20.00	0.63	0.80	0.80	85.79	5.08	0.56	0.76	0.02	0.52
Ethylene	28.05					0.03	0.03	5.00	0.30	0.48	0.66	0.03	0.80
Ethane	30.07					0.22	0.22	43.72	2.59	0.48	0.66	0.03	0.84
Propane	44.01					0.16	0.16	48.11	2.85	1.53	2.10	0.14	3.95
Propylene	42.08												
i-Butane	58.12					0.02	0.02	8.85	0.52	0.14	0.20	0.02	0.49
n-Butane	58.12					0.07	0.07	27.67	1.64	1.25	1.71	0.15	4.25
i-Butene	56.11												
n-Butene	56.11												
C ₂ -Butene	56.11												
i-Pentane	72.15												
n-Pentane	72.15					0.07	0.07	35.68	2.11	3.34	4.57	0.50	14.12
Nitrogen	28.02												
TOTAL		41.61	100.00	3165.62	100.00	100.02	100.00	1690.41	100.00	73.10	100.00	3.53	100.00

First Stage Shift Reaction

		CO	+	H ₂ O	=	CO ₂	+	H ₂
Stochiom.	[moles]	26.51		26.51		26.51		26.51
Produced	[moles]					6.30		-15.74
Total	[moles]	26.51		26.51		32.81		10.77
Stochiom.	[grams]	742.52		477.70		1166.67		53.55
Produced	[grams]					277.44		-31.80
Total	[grams]	742.52		477.70		1444.11		21.75

Hydrocarbon Gases

		First	Second	Dissolved	Total
C1 to C3	[grams]	20.00	182.62	0.22	202.83
C4 +	[grams]		72.20	0.67	72.87
Total	[grams]	20.00	254.82	0.88	275.70

Hydrogen

		First Up-Take	In	Second Out	Up-Take	Total Up-Take
Hydrogen	[grams]	31.80	1475.19	1332.87	142.32	174.12

M.B.No.: YP-02/ C1

[illegible]

	Feed	V-220	Products V-340 (BTMS)	V-330
----- in grams of analysis sample -----				
Total Sample	51.34	14.70	52.41	61.05
Water	2.10	8.46		3.10
Oils+Asphaltenes	27.25	6.24	41.42	54.06
Oils	23.95	5.90	32.48	46.63
Asphaltenes	3.30	0.34	8.94	7.43
Pre-Asphaltenes			1.15	0.60
Insolubles	21.99		9.84	3.29
IOM	19.72		3.41	0.55
Ash	2.28		6.43	2.73
TOTAL	51.34	14.7	52.41	61.05
----- in wt% of analysis sample -----				
Water	4.09%	57.57%		5.08%
Oils+Asphaltenes	53.07%	42.43%	79.03%	88.56%
Oils (on fraction)	87.90%	94.57%	78.42%	86.25%
(on total)	46.65%	40.12%	61.98%	76.38%
Asphalt. (on fract.)	12.10%	5.43%	21.58%	13.75%
(on total)	6.42%	2.30%	17.06%	12.18%
Pre-Asphaltenes			2.19%	0.98%
Insolubles	42.84%		18.77%	5.38%
IOM (on fraction)	89.65%		34.62%	16.80%
(on total)	38.41%		6.50%	0.90%
Ash (on fraction)	10.35%		65.38%	83.20%
(on total)	4.43%		12.27%	4.48%
TOTAL	100.00%	100.00%	100.00%	100.00%
----- in grams of feed / product -----				
Total Feed / Product	7000	1234	2600	3120
Water	286.3	710.2		158.4
Oils+Asphaltenes	3714.9	523.4	2054.9	2763.0
Oils (on fraction)	3265.4	495.0	1611.4	2383.0
(on total)	3265.4	495.0	1611.4	2383.0
Asphalt. (on fract.)	449.5	28.4	443.5	379.9
(on total)	449.5	28.4	443.5	379.9
Pre-Asphaltenes			57.1	30.7
Insolubles	2998.7		488.1	167.9
IOM (on fraction)	2688.4		169.0	28.2
(on total)	2688.4		169.0	28.2
Ash (on fraction)	310.4		319.1	139.7
(on total)	310.4		319.1	139.7
TOTAL (as is)	7000.0	1233.6	2600.0	3120.0
TOTAL (MAF)	6403.3	523.4	2280.9	2821.9

Distillation Profile THF-Extract						D-1160		
Fractions deg C	Feed	Products				Feed	Product	
		V-220	V-340 (BTMS)	V-330	Total		Comp. Sample	
							as is	corr.
IBP - 182		36.01	49.21	15.92	101.14		43.70	43.70
182 - 343	148.60	194.90	98.63	1043.71	1337.24	66.87	980.21	980.21
343 - 524	3566.33	292.46	1212.66	1734.02	3239.14	3116.83	3477.56	3477.56
524+			920.39	28.21	948.61	531.23	1741.90	1124.65
TOTAL	3714.93	523.37	2280.89	2821.86	5626.12	3714.93	6243.37	5626.12

Feed	Products (nomalized)				Feed	Products (nomalized)			
	V-220	V-340	V-330	Total		V-220	V-340	V-330	Total
	(BTTMS)					(BTTMS)			
----- in wt% of total feed (as is) -----					----- in wt% of total feed (MAF) -----				
4.17%	4.17%		2.31%	6.48%				2.53%	2.53%
53.03%	7.63%	29.94%	40.26%	77.83%	58.02%	8.34%	32.76%	44.05%	85.15%
46.61%	7.21%	23.48%	34.72%	65.42%	51.00%	7.89%	25.69%	37.99%	71.57%
6.42%	0.41%	6.46%	5.54%	12.41%	7.02%	0.45%	7.07%	6.06%	13.58%
		0.83%	0.45%	1.28%			0.91%	0.49%	1.40%
42.80%		5.54%	1.76%	7.30%					
38.37%		2.46%	0.41%	2.87%	41.98%		2.69%	0.45%	3.14%
4.43%		3.08%	1.35%	4.43%					
100.00%	11.80%	36.32%	44.78%	92.89%					
					100.00%	8.34%	36.36%	47.51%	92.22%

PROCESS YIELD STRUCTURE

RUN No.: DOE-BU-014

M.B. No.: YP-02/ C1

FEED		PRODUCT	
wt% (coal+solvent)		wt% (coal+solvent)	
as is	maf	as is	maf
53.0%	58.0%	COx+H2	21.0% 23.0%
47.0%	42.0%	C1 - C4	0.3% 0.3%
100.0%	100.0%	Oil	7.6% 8.3%
		Water	4.2%
10.6%	11.6%	COx	1.5% 1.7%
6.8%	7.5%	C1 - C4	3.7% 4.1%
		Oil	40.7% 44.5%
		Water	2.3% 2.5%
2.0%	2.2%	Oil	30.8% 33.7%
		Coal (maf)	2.9% 3.1%
		Ash	4.4%
119.4%	121.3%	119.4%	121.3%

Remarks:

RUN No.: DOE-BU-014

M.B.No.: YP-03/ C1

	Date	Time	Date	Time
START:			Dec. 09, 93	21:00
END:			Dec. 10, 93	05:00
DURATION (hours):				8.00

Feed:	Type	Wt% (maf)
Coal	BTH	41.81%
Solvent	V-1074	58.19%
Catalyst 1	Aluminate	2.00%
Catalyst 2	FeO+DMDS	2.00%
Other		

OPERATING PARAMETERS:

FEED TANK WI-110):	(G)	
Start of Mass Balance		14600.00
End of Mass Balance		7710.00
Rate	(G/HR)	861
FIRST STAGE:		
Operating Pressure:	(MPa)	10.34
Feed Temp.:	(C)	
Reactor Temp.:	(C)	
TE-201I	(BTM)	410
TE-202I		411
TE-203I		411
TE-204I	(Top)	389
Liquid Level	(mm)	540
Separator Temperature:	(C)	47
CO-Feed Rate:	(L/MIN)	4.03
Water Feed Rate:	(ML/MIN)	1.22
Temperature:	(C)	180
Catalyst Feed:	(ML/MIN)	
Liquid Product (WI-220):	(G)	
Start of Mass Balance		
End of Mass Balance		522.10
Nitrogen Rate:	(L/MIN)	3.93
SECOND STAGE:		
Operating Pressure:	(MPa)	17.24
Feed Temp.:	(C)	140
Reactor Temp.:	(C)	
TE-301I	(BTM)	438
TE-302I		440
TE-303I		440
TE-304I		438
TE-305I		438
TE-306I		438
TE-307I		434
TE-308I	(Top)	432
TE-309I	(VAP)	432
Liquid level	(mm)	900
Separator Temperature:	(C)	45
Hydrogen Feed Rate:	(L/MIN)	34.08
Temperature:	(C)	398
Liquid Product (WI-330):	(G)	
Start of Mass Balance		1240
End of Mass Balance		5360
Bottoms Product (V-340):	(G)	
Start of Mass Balance		-480
End of Mass Balance		1460
Sulfiding Agent	(mL/HR)	10.47

MEASURED GAS COMPOSITIONS

NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02	4.28	99.18	34.81
CO2	44.01	13.03	0.08	22.30
CO	28.01	23.81	0.37	8.21
H2S	34.08			
Methane	16.04	0.50	0.94	0.56
Ethylene	28.05		0.03	0.48
Ethane	30.07		0.25	0.48
Propane	44.01		0.18	1.53
Propylene	42.08			
i-Butane	58.12		0.01	0.14
n-Butane	58.12		0.08	1.25
i-Butene	56.11			
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15		0.11	3.34
Nitrogen	28.02			
TOTAL		41.61	101.24	73.1045
Gas Meter Readings				
Start of M.B. : (L)	DTM-260	DTM-360	DTM-350	
End of M.B. : (L)	5653.0	3703.0	9314.0	
Total : (L)	10593.0	21350.0	9316.0	
	4940.0	17647.0	2.0	
Temperature: (C)	22.7	22.1	23.7	
Meter Pressure : (mmHg)	694	699	699	
Standard Volume: (L)	4165	15016	2	
Nitrogen to R-200: (L)	1886			
Net Gas Out: (L)	2279	15016	2	

Run Conditions

Basis: MAF		First Stage	Second Stage
Pressure	Mpa	10.3	17.2
Temperature	deg C	411	439
Catalyst		Aluminate	FeO+DMDS
Feed	wt % maf coal	41.81%	
WHSV	(kg / hr) / l	1.76	1.06
CO Rate	kg / kg maf coal	0.92	
	moles / 100g maf coal	3.27	
consumed	moles / 100g maf coal	1.06	
Water Rate	kg / kg maf coal	0.92	
	moles / 100g maf coal	5.08	
Hydrogen	kg / kg maf coal		0.56
	moles / 100g maf coal		27.79
consumed	wt % maf coal	1.35%	5.63%

OVERALL MASS BALANCE					
Material In:		Grams	Material Out:		Grams
	Feed Slurry	6890		First Stage Liquid:	522
	CO-Gas:	2416		First Stage Product Gas:	3072
	Water:	585		Second Stage Liquid:	4120
	Hydrogen:	1475		Second Stage Reactor Bottoms:	1940
	Catalyst:			Second Stage Product Gas:	1717
	S-Agent	84		Dissolved Gas:	2
TOTAL IN:		11449	TOTAL OUT:		11372
Catalyst mf		276	OVERALL BALANCE:		99.3%

WATER BALANCE			
TOTAL IN:		816	TOTAL OUT: 988
		WATER BALANCE: 121.1%	

	Coal Conversion	wt. % maf	92.4%
	Ash Balance	wt. %	139.7%

PRODUCT YIELDS					
Description	Total Gross			Total Net	
	[grams]		wt. %	[grams]	wt. %
	measured	-----	maf feed	normalized	maf coal
H2O	172.53	176.07	2.79%	176.07	6.67%
COx	260.30	265.64	4.21%	265.64	10.06%
H2S					
C1 to C3	228.16	232.84	3.69%	232.84	8.82%
C4 +	89.53	91.37	1.45%	91.37	3.46%
Oil	4469.38	4561.07	72.24%	1332.09	50.46%
Asphaltene	885.66	903.83	14.32%	459.34	17.40%
Preasphalt.	65.78	67.13	1.06%	67.13	2.54%
IOM	195.64	199.66	3.16%	199.66	7.56%
Total	6366.98	6497.60	102.92%	2824.13	106.98%

Simulated Distillation Profile THF-Extract						Crude Sim. Dist. (Comp. Sample)				
Fraction [deg C]	Feed [grams]	Product				Feed [grams]	Product			
		Total Gross		Total Net			Total Gross		Total Net	
		[grams]	----- normalized -----		[grams]		[grams]	[grams]	[grams]	wt. % maf coal
			[grams]	[grams]						
C4 - 182		144.33	147.29	147.29	5.58%		89.53	91.37	91.37	3.46%
182 - 343	146.94	1428.82	1458.13	1311.19	49.67%	66.12	902.67	921.19	855.06	32.39%
343 - 524	3526.53	3544.24	3616.95	90.42	3.43%	3082.04	3616.94	3691.14	609.10	23.07%
524+		588.61	600.68	600.68	22.75%	525.31	1096.85	1119.36	594.05	22.50%
TOTAL	3673.47	5705.99	5823.05	2149.58	81.43%	3673.47	5705.99	5823.05	2149.58	81.43%
IBP - 524	3673.47	5117.39	5222.37	1548.90	58.67%	3148.16	4609.14	4703.69	1555.53	58.92%

RUN No.: DOE-BU-014

M.B.No.: YP-03/C1

GAS ANALYSIS

GAS ANALYSIS																
First Stage Product Gas (DTM-260)							Second Stage Product Gas (DTM-360)							Dissolved Gas (DTM-350)		
Number of Samples: 1							Number of Samples: 6							Number of Samples: 2		
CO ₂	23.812															
CO																8.214
H ₂ S																
Methane	0.495					0.495	0.889	0.961	0.888	0.883	0.886	1.010	0.936	0.580	0.536	0.558
Ethylene							0.031	0.030	0.032	0.030	0.030	0.030	0.031	0.911	0.058	0.485
Ethane							0.241	0.237	0.258	0.257	0.258	0.251	0.250	0.060	0.898	0.479
Propane							0.198	0.193	0.201	0.199	0.119	0.199	0.185	1.541	1.523	1.532
Propylene																
i-Butane							0.012	0.015	0.011	0.011	0.010	0.016	0.013	0.145	0.143	0.144
n-Butane							0.084	0.082	0.084	0.085	0.083	0.084	0.084	1.257	1.244	1.251
i-Butene																
n-Butene																
C2-Butene																
i-Pentane																
n-Pentane							0.110	0.107	0.110	0.110	0.110	0.109	0.109	3.280	3.404	3.342
Nitrogen																
TOTAL	41.611					41.611	102.127	102.021	101.812	99.747	99.820	102.119	101.241	69.628	76.583	73.105

RUN No.: DOE-BU-014

M.B.No.: YP-03/ C1

GAS CALCULATIONS

Name	Mol.Weight	First Stage Product Gas (DTM-260)				Second Stage Product Gas (DTM-360)				Dissolved Gas (DTM-350)			
		Average Mol Weight:		16.53 (g/mole)		Average Mol Weight:		2.56 (g/mole)		Average Mol Weight:		23.37 (g/mole)	
		Volume		Weight (norm.)		Volume		Weight (norm.)		Volume		Weight (norm.)	
		meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%
Hydrogen	2.02	4.28	10.27	21.10	0.69	99.18	97.96	1325.93	77.24	34.81	47.61	0.07	4.12
CO ₂	44.01	13.03	31.31	1401.30	45.62	0.08	0.08	23.84	1.39	22.30	30.50	1.01	57.44
CO	28.01	23.81	57.22	1629.96	53.06	0.37	0.37	69.02	4.02	8.21	11.24	0.24	13.47
H ₂ S	34.08												
Methane	16.04	0.50	1.19	19.42	0.63	0.94	0.92	99.38	5.79	0.56	0.76	0.01	0.52
Ethylene	28.05					0.03	0.03	5.66	0.33	0.48	0.66	0.01	0.80
Ethane	30.07					0.25	0.25	49.75	2.90	0.48	0.66	0.01	0.84
Propane	44.01					0.18	0.18	53.84	3.14	1.53	2.10	0.07	3.95
Propylene	42.08												
i-Butane	58.12					0.01	0.01	4.81	0.28	0.14	0.20	0.01	0.49
n-Butane	58.12					0.08	0.08	32.18	1.87	1.25	1.71	0.08	4.25
i-Butene	56.11												
n-Butene	56.11												
C ₂ -Butene	56.11												
i-Pentane	72.15												
n-Pentane	72.15					0.11	0.11	52.21	3.04	3.34	4.57	0.25	14.12
Nitrogen	28.02												
TOTAL		41.61	100.00	3071.78	100.00	101.24	100.00	1716.63	100.00	73.10	100.00	1.76	100.00

First Stage Shift Reaction

		CO	+	H ₂ O	=	CO ₂	+	H ₂
Stochiom.	[moles]	28.06		28.06		28.06		28.06
Produced	[moles]					3.78		-17.62
Total	[moles]	28.06		28.06		31.84		10.45
Stochiom.	[grams]	786.08		505.72		1235.10		56.69
Produced	[grams]					166.19		-35.59
Total	[grams]	786.08		505.72		1401.30		21.10

Hydcarbon Gases

		First	Second	Dissolved	Total
C1 to C3	[grams]	19.42	208.63	0.11	228.16
C4 +	[grams]		89.20	0.33	89.53
Total	[grams]	19.42	297.83	0.44	317.69

Hydrogen

		First Up-Take	In	Second Out	Up-Take	Total Up-Take
Hydrogen	[grams]	35.59	1474.66	1326.01	148.66	184.24

RUN No.: DOE-BU-014	M.B.No.: YP-03/ C1
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M.B.No.: YP-03/ C1

[illegible]

	Feed	V-220	Products V-340 (BTTMS)	V-330
----- in grams of analysis sample -----				
Total Sample	53.71	14.70	56.15	60.92
Water	1.80	8.73	0.10	2.50
Oils+Asphaltenes	28.64	5.97	41.76	54.71
Oils	25.17	5.64	32.19	46.68
Asphaltenes	3.46	0.32	9.57	8.04
Pre-Asphaltenes			1.16	0.38
Insolubles	23.27		13.13	3.33
IOM	20.58		4.79	0.45
Ash	2.70		8.34	2.88
TOTAL	53.71	14.7	56.15	60.92

----- in wt% of analysis sample -----				
Water	3.35%	59.40%	0.18%	4.10%
Oils+Asphaltenes	53.32%	40.60%	74.37%	89.81%
Oils (on fraction)	87.90%	94.57%	77.09%	85.31%
(on total)	46.86%	38.40%	57.33%	76.62%
Asphalt. (on fract.)	12.10%	5.43%	22.91%	14.69%
(on total)	6.45%	2.20%	17.04%	13.19%
Pre-Asphaltenes			2.07%	0.62%
Insolubles	43.33%		23.39%	5.46%
IOM (on fraction)	88.42%		36.48%	13.40%
(on total)	38.31%		8.53%	0.73%
Ash (on fraction)	11.58%		63.52%	86.60%
(on total)	5.02%		14.85%	4.73%
TOTAL	100.00%	100.00%	100.00%	100.00%

----- in grams of feed / product -----				
Total Feed / Product	6890	522	1940	4120
Water	230.9	310.1	3.5	169.1
Oils+Asphaltenes	3673.5	212.0	1442.8	3700.3
Oils (on fraction)	3229.0	200.5	1112.3	3156.6
(on total)	3229.0	200.5	1112.3	3156.6
Asphalt. (on fract.)	444.5	11.5	330.5	543.6
(on total)	444.5	11.5	330.5	543.6
Pre-Asphaltenes			40.1	25.7
Insolubles	2985.6		453.7	225.0
IOM (on fraction)	2639.9		165.5	30.1
(on total)	2639.9		165.5	30.1
Ash (on fraction)	345.7		288.2	194.8
(on total)	345.7		288.2	194.8
TOTAL (as is)	6890.0	522.1	1940.0	4120.0
TOTAL (MAF)	6313.4	212.0	1648.4	3756.1

Distillation Profile THF-Extract						D-1160		
Fractions deg C	Feed	Products				Feed	Product	
		V-220	V-340 (BTTMS)	V-330	Total		Comp. Sample	
							as is	corr.
IBP - 182		14.58	20.46	19.75	54.80			
182 - 343	146.94	78.94	96.09	1253.79	1428.82	66.12	902.67	902.67
343 - 524	3526.53	118.45	973.36	2452.43	3544.24	3082.04	3616.94	3616.94
524+			558.46	30.15	588.61	525.31	1748.92	1096.85
TOTAL	3673.47	211.98	1648.37	3756.11	5616.46	3673.47	6268.52	5616.46

Feed	Products (normalized)				Feed	Products (normalized)			
	V-220	V-340	V-330	Total		V-220	V-340	V-330	Total
	(BTTMS)					(BTTMS)			
----- in wt% of total feed (as is) -----					----- in wt% of total feed (MAF) -----				
3.42%	3.42%	0.05%	2.50%	5.97%				2.79%	2.79%
53.28%	3.14%	21.36%	54.77%	79.26%	58.19%	3.43%	23.32%	59.81%	86.56%
46.83%	2.97%	16.46%	46.72%	66.15%	51.15%	3.24%	17.98%	51.03%	72.24%
6.45%	0.17%	4.89%	8.05%	13.11%	7.04%	0.19%	5.34%	8.79%	14.32%
		0.59%	0.38%	0.97%			0.65%	0.42%	1.06%
43.30%		5.44%	2.47%	7.91%					
38.29%		2.45%	0.45%	2.90%	41.81%		2.68%	0.49%	3.16%
5.01%		2.99%	2.02%	5.01%					
100.00%	6.56%	27.44%	60.12%	94.12%					
					100.00%	3.43%	26.64%	63.50%	93.58%

PROCESS YIELD STRUCTURE

RUN No.: DOE-BU-014

M.B. No.: YP-03/ C1

FEED		PRODUCT	
wt% (coal+solvent)		wt% (coal+solvent)	
as is	maf	as is	maf
53.3%	58.2%	20.7%	22.6%
46.7%	41.8%	0.3%	0.3%
100.0%	100.0%	3.1%	3.4%
11.4%	12.5%	3.4%	
7.3%	8.0%	1.4%	1.5%
		4.4%	4.8%
		55.1%	60.2%
		2.5%	2.8%
2.2%	2.4%	21.9%	24.0%
		2.9%	3.2%
		5.0%	
120.9%	122.8%	120.8%	122.8%

Remarks:

RUN No.: DOE-BU-014

M.B.No.: YP-04/ C1

	Date	Time	Date	Time
START:			Dec. 10, 93	10:00
END:			Dec. 10, 93	17:10
DURATION (hours):				7.17

Feed:	Type	Wt% (maf)
Coal	BTH	41.81%
Solvent	V-1074	58.19%
Catalyst 1	Aluminate	2.00%
Catalyst 2	FeO+DMDS	2.00%
Other		

OPERATING PARAMETERS:

FEED TANK WI-110):	(G)	
Start of Mass Balance		8830.00
End of Mass Balance		2760.00
Rate	(G/HR)	847
FIRST STAGE:		
Operating Pressure:	(MPa)	10.34
Feed Temp.:	(C)	311
Reactor Temp.:	(C)	
TE-201I	(BTM)	410
TE-202I		410
TE-203I		410
TE-204I	(Top)	389
Liquid Level	(mm)	540
Separator Temperature:	(C)	48
CO-Feed Rate:	(L/MIN)	4.05
Water Feed Rate:	(ML/MIN)	1.28
Temperature:	(C)	180
Catalyst Feed:	(ML/MIN)	
Liquid Product (WI-220):	(G)	
Start of Mass Balance		
End of Mass Balance		819.40
Nitrogen Rate:	(L/MIN)	3.91
SECOND STAGE:		
Operating Pressure:	(MPa)	17.24
Feed Temp.:	(C)	144
Reactor Temp.:	(C)	
TE-301I	(BTM)	444
TE-302I		445
TE-303I		446
TE-304I		444
TE-305I		444
TE-306I		443
TE-307I		440
TE-308I	(Top)	436
TE-309I	(VAP)	436
Liquid level	(mm)	900
Separator Temperature:	(C)	45
Hydrogen Feed Rate:	(L/MIN)	34.20
Temperature:	(C)	390
Liquid Product (WI-330):	(G)	
Start of Mass Balance		2480
End of Mass Balance		6160
Bottoms Product (V-340):	(G)	
Start of Mass Balance		-380
End of Mass Balance		1050
Sulfiding Agent	(mL/HR)	11.69

MEASURED GAS COMPOSITIONS

NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02	4.28	97.08	34.81
CO2	44.01	13.03	0.07	22.30
CO	28.01	23.81	0.39	8.21
H2S	34.08			
Methane	16.04	0.50	1.05	0.56
Ethylene	28.05		0.04	0.48
Ethane	30.07		0.33	0.48
Propane	44.01		0.26	1.53
Propylene	42.08			
i-Butane	58.12		0.01	0.14
n-Butane	58.12		0.11	1.25
i-Butene	56.11			
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15		0.13	3.34
Nitrogen	28.02			
TOTAL		41.61	99.45	73.1045
Gas Meter Readings				
Start of M.B. : (L)	DTM-260	DTM-360	DTM-350	
End of M.B. : (L)	3727.0	2400.0	9315.0	
Total : (L)	8163.0	18394.0	9317.0	
	4436.0	15994.0	2.0	
Temperature: (C)	22.7	22.1	23.7	
Meter Pressure : (mmHg)	694	699	699	
Standard Volume: (L)	3740	13609	2	
Nitrogen to R-200: (L)	1683			
Net Gas Out: (L)	2057	13609	2	

Run Conditions

Basis: MAF		First Stage	Second Stage
Pressure	Mpa	10.3	17.2
Temperature	deg C	410	445
Catalyst		Aluminate	FeO+DMDS
Feed	wt % maf coal	41.81%	
WHSV	(kg / hr) / I	1.73	1.04
CO Rate	kg / kg maf coal	0.94	
consumed	moles / 100g maf coal	3.34	
Water Rate	kg / kg maf coal	1.09	
	moles / 100g maf coal	0.94	
Hydrogen	kg / kg maf coal	5.20	
consumed	moles / 100g maf coal		0.57
	wt % maf coal		28.35
		1.37%	5.50%

OVERALL MASS BALANCE

Material In:		Grams	Material Out:		Grams
	Feed Slurry	6070		First Stage Liquid:	819
	CO-Gas:	2179		First Stage Product Gas:	2773
	Water:	551		Second Stage Liquid:	3680
	Hydrogen:	1326		Second Stage Reactor Bottoms:	1430
	Catalyst:			Second Stage Product Gas:	1618
	S-Agent	84		Dissolved Gas:	2
TOTAL IN:		10208	TOTAL OUT:		10322
	Catalyst mf	243	OVERALL BALANCE:		101.1%

WATER BALANCE				
TOTAL IN:		754	TOTAL OUT:	939
			WATER BALANCE:	124.5%
	Coal Conversion	wt.% maf	93.7%	
	Ash Balance	wt.%	132.3%	

PRODUCT YIELDS

Description	Total Gross			Total Net	
	[grams]		wt. % maf feed	[grams]	wt. % maf coal
	measured	normalized			
H2O	184.49	181.35	3.26%	181.35	7.80%
COx	241.22	237.10	4.26%	237.10	10.19%
H2S					
C1 to C3	254.72	250.37	4.50%	250.37	10.77%
C4 +	97.75	96.08	1.73%	96.08	4.13%
Oil	4108.44	4038.40	72.61%	1193.72	51.33%
Asphaltene	728.14	715.73	12.87%	324.14	13.94%
Preasphalt.	58.35	57.35	1.03%	57.35	2.47%
IOM	148.04	145.51	2.62%	145.51	6.26%
Total	5821.13	5721.90	102.88%	2485.63	106.88%

Simulated Distillation Profile THF-Extract

Simulated Distillation Profile THF-Extract						Crude Sim. Dist. (Comp. Sample)				
Fraction [deg C]	Feed [grams]	Product				Feed [grams]	Product			
		Total Gross		Total Net			Total Gross		Total Net	
		[grams]	----- normalized -----		[grams]		[grams]	[grams]	[grams]	wt. % maf coal
			[grams]	wt. % maf coal						
C4 - 182		166.24	163.41	163.41	7.03%		170.94	168.03	168.03	7.22%
182 - 343	129.45	1386.98	1363.33	1233.88	53.05%	58.25	929.01	913.18	854.92	36.76%
343 - 524	3106.83	3157.86	3104.03	-2.80	-0.12%	2715.24	2961.58	2911.10	195.86	8.42%
524+		429.31	422.00	422.00	18.14%	462.79	1079.17	1060.78	597.99	25.71%
TOTAL	3236.28	5140.39	5052.76	1816.48	78.10%	3236.28	5140.71	5053.08	1816.80	78.12%
IBP - 524	3236.28	4711.07	4630.77	1394.49	59.96%	2773.49	4061.54	3992.30	1218.81	52.41%

Crude Sim. Dist. (Comp. Sample)

Fraction [deg C]	Feed [grams]	Product				Feed [grams]	Product			
		Total Gross		Total Net			Total Gross		Total Net	
		[grams]	normalized		[grams]		wt. % maf coal	[grams]	normalized	
[grams]	[grams]		[grams]	wt. % maf coal						
C4 - 182		166.24	163.41	163.41	7.03%		170.94	168.03	168.03	7.22%
182 - 343	129.45	1386.98	1363.33	1233.88	53.05%	58.25	929.01	913.18	854.92	36.76%
343 - 524	3106.83	3157.86	3104.03	-2.80	-0.12%	2715.24	2961.58	2911.10	195.86	8.42%
524+		429.31	422.00	422.00	18.14%	462.79	1079.17	1060.78	597.99	25.71%
TOTAL	3236.28	5140.39	5052.76	1816.48	78.10%	3236.28	5140.71	5053.08	1816.80	78.12%
IBP - 524	3236.28	4711.07	4630.77	1394.49	59.96%	2773.49	4061.54	3992.30	1218.81	52.41%

RUN No.: DOE-BU-014

M.B.No.: YP-04/C1

GAS ANALYSIS

Name	First Stage Product Gas (DTM-260)							Second Stage Product Gas (DTM-360)							Dissolved Gas (DTM-350)						
	Number of Samples: 1							Number of Samples: 6							Number of Samples: 2						
	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%
Hydrogen	4.275						4.275	97.184	97.238	97.148	97.118	98.902	98.819	97.081	31.289	38.321					34.805
CO2	13.029						13.029	0.083	0.087	0.082	0.077	0.071	0.065	0.074	22.497	22.095					22.296
CO	23.812						23.812	0.425	0.342	0.412	0.401	0.408	0.347	0.389	8.068	8.381					8.214
H2S																					
Methane	0.495						0.495	1.068	1.042	1.029	1.078	1.034	1.025	1.046	0.580	0.538					0.558
Ethylene								0.035	0.038	0.035	0.035	0.035	0.037	0.036	0.911	0.058					0.485
Ethane								0.325	0.338	0.324	0.328	0.320	0.320	0.326	0.060	0.898					0.479
Propane								0.253	0.283	0.252	0.257	0.252	0.256	0.255	1.541	1.523					1.532
Propylene																					
i-Butane								0.009	0.009	0.010	0.010	0.011	0.009	0.010	0.145	0.143					0.144
n-Butane								0.104	0.108	0.105	0.107	0.107	0.107	0.106	1.257	1.244					1.251
i-Butene																					
n-Butene																					
C2-Butene																					
i-Pentane																					
n-Pentane								0.127	0.129	0.127	0.128	0.127	0.128	0.128	3.280	3.404					3.342
Nitrogen																					
TOTAL	41.611						41.611	99.593	99.574	99.522	99.539	99.287	99.213	99.451	69.628	76.583					73.105

RUN No.: DOE-BU-014

M.B.No.: YP-04/ C1

GAS CALCULATIONS

Name	Mol.Weight	First Stage Product Gas (DTM-260)				Second Stage Product Gas (DTM-360)				Dissolved Gas (DTM-350)			
		Average Mol Weight: 16.61 (g/mole)				Average Mol Weight: 2.67 (g/mole)				Average Mol Weight: 23.37 (g/mole)			
		Volume		Weight (norm.)		Volume		Weight (norm.)		Volume		Weight (norm.)	
		meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%
Hydrogen	2.02	4.28	10.27	19.05	0.69	97.08	97.62	1197.47	73.99	34.81	47.61	0.07	4.12
CO ₂	44.01	13.03	31.31	1264.84	45.62	0.07	0.07	19.93	1.23	22.30	30.50	1.01	57.44
CO	28.01	23.81	57.22	1471.23	53.06	0.39	0.39	66.56	4.11	8.21	11.24	0.24	13.47
H ₂ S	34.08												
Methane	16.04	0.50	1.19	17.53	0.63	1.05	1.05	102.45	6.33	0.56	0.76	0.01	0.52
Ethylene	28.05					0.04	0.04	6.14	0.38	0.48	0.66	0.01	0.80
Ethane	30.07					0.33	0.33	59.83	3.70	0.48	0.66	0.01	0.84
Propane	44.01					0.26	0.26	68.66	4.24	1.53	2.10	0.07	3.95
Propylene	42.08												
i-Butane	58.12					0.01	0.01	3.43	0.21	0.14	0.20	0.01	0.49
n-Butane	58.12					0.11	0.11	37.74	2.33	1.25	1.71	0.08	4.25
i-Butene	56.11												
n-Butene	56.11												
C ₂ -Butene	56.11												
i-Pentane	72.15												
n-Pentane	72.15					0.13	0.13	56.25	3.48	3.34	4.57	0.25	14.12
Nitrogen	28.02												
TOTAL		41.61	100.00	2772.64	100.00	99.45	100.00	1618.46	100.00	73.10	100.00	1.76	100.00

First Stage Shift Reaction

		CO	+	H ₂ O	=	CO ₂	+	H ₂
Stochiom.	[moles]	25.25		25.25		25.25		25.25
Produced	[moles]					3.49		-15.82
Total	[moles]	25.25		25.25		28.74		9.43
Stochiom.	[grams]	707.32		455.05		1111.37		51.01
Produced	[grams]					153.47		-31.96
Total	[grams]	707.32		455.05		1264.84		19.05

Hydrocarbon Gases

		First	Second	Dissolved	Total
C1 to C3	[grams]	17.53	237.08	0.11	254.72
C4 +	[grams]		97.41	0.33	97.75
Total	[grams]	17.53	334.49	0.44	352.46

Hydrogen

		First Up-Take	In	Second Out	Up-Take	Total Up-Take
Hydrogen	[grams]	31.96	1325.50	1197.55	127.96	159.92

RUN No.: DOE-BU-014 M.B.No.: YP-04/ C1

RUN No.: DOE-BU-014 M.B.No.: YP-04/ C1

[illegible]

	Feed	V-220	Products V-340 (BTMS)	V-330
----- In grams of analysis sample -----				
Total Sample	53.71	14.70	53.85	63.83
Water	1.80	5.36		3.20
Oils+Asphaltenes	28.64	9.34	39.65	56.60
Oils	25.17	8.83	29.90	48.96
Asphaltenes	3.46	0.51	9.75	7.65
Pre-Asphaltenes			1.09	0.51
Insolubles	23.27		13.11	3.52
IOM	20.58		4.74	0.38
Ash	2.70		8.37	3.13
TOTAL	53.71	14.7	53.85	63.83
----- In wt% of analysis sample -----				
Water	3.35%	36.49%		5.01%
Oils+Asphaltenes	53.32%	63.51%	73.63%	88.68%
Oils (on fraction)	87.90%	94.57%	75.40%	86.49%
(on total)	46.86%	60.06%	55.52%	76.70%
Asphalt. (on fract.)	12.10%	5.43%	24.60%	13.51%
(on total)	6.45%	3.45%	18.11%	11.98%
Pre-Asphaltenes			2.02%	0.80%
Insolubles	43.33%		24.35%	5.51%
IOM (on fraction)	88.42%		36.17%	10.90%
(on total)	38.31%		8.81%	0.60%
Ash (on fraction)	11.58%		63.83%	89.10%
(on total)	5.02%		15.54%	4.91%
TOTAL	100.00%	100.00%	100.00%	100.00%
----- In grams of feed / product -----				
Total Feed / Product	6070	819	1430	3680
Water	203.4	299.0		184.5
Oils+Asphaltenes	3236.3	520.4	1052.9	3263.3
Oils (on fraction)	2844.7	492.1	793.9	2822.4
(on total)	2844.7	492.1	793.9	2822.4
Asphalt. (on fract.)	391.6	28.3	259.0	440.9
(on total)	391.6	28.3	259.0	440.9
Pre-Asphaltenes			28.9	29.4
Insolubles	2630.3		348.2	202.8
IOM (on fraction)	2325.7		125.9	22.1
(on total)	2325.7		125.9	22.1
Ash (on fraction)	304.6		222.2	180.7
(on total)	304.6		222.2	180.7
TOTAL (as is)	6070.0	819.4	1430.0	3680.0
TOTAL (MAF)	5562.0	520.4	1207.8	3314.8

Distillation Profile THF-Extract						D-1160		
Fractions deg C	Feed	Products				Feed	Product	
		V-220	V-340 (BTMS)	V-330	Total		Comp. Sample	
							as is	corr.
IBP - 182		35.80	16.23	16.46	68.49		73.20	73.20
182 - 343	129.45	193.79	66.75	1126.43	1386.98	58.25	929.01	929.01
343 - 524	3106.83	290.79	717.26	2149.81	3157.86	2715.24	2961.58	2961.58
524+			407.21	22.11	429.31	462.79	1666.59	1079.17
TOTAL	3236.28	520.38	1207.44	3314.81	5042.64	3236.28	5630.38	5042.97

Feed	Products (nomalized)				Feed	Products (nomalized)			
	V-220	V-340 (BTMS)	V-330	Total		V-220	V-340 (BTMS)	V-330	Total
----- In wt% of total feed (as is) -----					----- In wt% of total feed (MAF) -----				
3.30%	3.30%		2.99%	6.29%				3.26%	3.26%
53.35%	8.43%	17.06%	52.87%	78.37%	58.19%	9.20%	18.61%	57.67%	85.48%
46.89%	7.97%	12.86%	45.73%	66.57%	51.15%	8.70%	14.03%	49.88%	72.61%
6.45%	0.46%	4.20%	7.14%	11.80%	7.04%	0.50%	4.58%	7.79%	12.87%
		0.47%	0.48%	0.95%			0.51%	0.52%	1.03%
43.36%		4.81%	2.61%	7.42%					
38.34%		2.04%	0.36%	2.40%	41.81%		2.23%	0.39%	2.62%
5.02%		2.77%	2.25%	5.02%					
100.00%	11.73%	22.34%	58.95%	93.02%					
					100.00%	9.20%	21.34%	61.84%	92.38%

PROCESS YIELD STRUCTURE

RUN No.: DOE-BU-014

M.B. No.: YP-04/ C1

FEED		PRODUCT	
wt% (coal+solvent)		wt% (coal+solvent)	
as is	maf	as is	maf
53.3%	58.2%	COx+H2	21.1% 23.0%
46.7%	41.8%	C1 - C4	0.3% 0.3%
100.0%	100.0%	Oil	8.4% 9.2%
		Water	3.3%
11.7%	12.7%	COx	1.4% 1.6%
7.5%	8.2%	C1 - C4	5.4% 5.9%
		Oil	53.4% 58.2%
		Water	3.0% 3.3%
2.1%	2.3%	Oil	17.5% 19.1%
		Coal (maf)	2.4% 2.6%
		Ash	5.0%
121.3%	123.2%	121.3%	123.2%

Remarks:

RUN No.: DOE-BU-015

M.B.No.: YP-01/ C1

	Date	Time	Date	Time
START:			Dec. 14, 93	05:00
END:			Dec. 14, 93	13:00
DURATION (hours):				8.00

Feed:	Type	Wt% (maf)
Coal	BTH	38.42%
Solvent	V-1074	61.58%
Catalyst 1	Aluminate	2.00%
Catalyst 2	Molybdate	0.28%
Other	CS2	

OPERATING PARAMETERS:

FEED TANK WI-110:	(G)	
Start of Mass Balance		10440.00
End of Mass Balance		4920.00
Rate	(G/HR)	690
FIRST STAGE:		
Operating Pressure:	(MPa)	10.34
Feed Temp.:	(C)	311
Reactor Temp.:	(C)	
TE-201I	(BTM)	411
TE-202I		411
TE-203I		411
TE-204I	(Top)	395
Liquid Level	(mm)	470
Separator Temperature:	(C)	46
CO-Feed Rate:	(L/MIN)	4.03
Water Feed Rate:	(ML/MIN)	1.26
Temperature:	(C)	184
Catalyst Feed:	(ML/MIN)	
Liquid Product (WI-220):	(G)	
Start of Mass Balance		
End of Mass Balance		910.40
Nitrogen Rate:	(L/MIN)	3.90
SECOND STAGE:		
Operating Pressure:	(MPa)	17.24
Feed Temp.:	(C)	138
Reactor Temp.:	(C)	
TE-301I	(BTM)	432
TE-302I		431
TE-303I		430
TE-304I		429
TE-305I		429
TE-306I		429
TE-307I		425
TE-308I	(Top)	425
TE-309I	(VAP)	425
Liquid level	(mm)	900
Separator Temperature:	(C)	45
Hydrogen Feed Rate:	(L/MIN)	34.05
Temperature:	(C)	391
Liquid Product (WI-330):	(G)	
Start of Mass Balance		1270
End of Mass Balance		3150
Bottoms Product (V-340):	(G)	
Start of Mass Balance		-320
End of Mass Balance		2100
Sulfiding Agent	(mL/HR)	9.02

MEASURED GAS COMPOSITIONS

NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02	4.28	98.31	69.87
CO2	44.01	13.03	0.17	5.84
CO	28.01	23.81	0.30	3.97
H2S	34.08			
Methane	16.04	0.05	0.49	1.44
Ethylene	28.05		0.02	0.06
Ethane	30.07		0.18	0.98
Propane	44.01		0.12	1.20
Propylene	42.08			
i-Butane	58.12		0.01	0.01
n-Butane	58.12		0.06	0.84
i-Butene	56.11			
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15		0.09	1.69
Nitrogen	28.02			
TOTAL		41.17	99.73	85.898
Gas Meter Readings		DTM-260	DTM-360	DTM-350
Start of M.B. : (L)		9938.0	5390.0	7632.0
End of M.B. : (L)		14852.0	24254.0	7711.0
Total : (L)		4914.0	18864.0	79.0
Temperature: (C)		22.0	22.0	23.0
Meter Pressure : (mmHg)		694	694	694
Standard Volume: (L)		4153	15942	67
Nitrogen to R-200: (L)		1870		
Net Gas Out: (L)		2283	15942	67

Run Conditions

Basis: MAF		First Stage	Second Stage
Pressure	Mpa	10.3	17.2
Temperature	deg C	411	430
Catalyst		Aluminate	Molybdate
Feed	wt % maf coal	38.42%	
WHSV	(kg / hr) / l	1.62	0.85
CO Rate	kg / kg maf coal	1.22	
	moles / 100g maf coal	4.34	
consumed	moles / 100g maf coal	1.38	
Water Rate	kg / kg maf coal	1.22	
	moles / 100g maf coal	6.75	
Hydrogen	kg / kg maf coal		0.74
	moles / 100g maf coal		36.88
consumed	wt % maf coal	1.71%	2.61%

M.B.No.: YP-01/ C1

OVERALL MASS BALANCE					
Material In:		Grams	Material Out:		Grams
	Feed Slurry	5520		First Stage Liquid:	910
	CO-Gas:	2417		First Stage Product Gas:	3093
	Water:	607		Second Stage Liquid:	1880
	Hydrogen:	1473		Second Stage Reactor Bottoms:	2420
	Catalyst:			Second Stage Product Gas:	1736
	S-Agent	72		Dissolved Gas:	27
TOTAL IN:		10090	TOTAL OUT:		10066
Catalyst mlf		126	OVERALL BALANCE:		99.8%
WATER BALANCE					
TOTAL IN:		761	TOTAL OUT:		809
			WATER BALANCE:		106.3%
	Coal Conversion	wt.% maf	82.6%		
	Ash Balance	wt.%	96.6%		

PRODUCT YIELDS					
Description	Total Gross			Total Net	
	[grams]		wt. % maf feed	[grams]	wt. % maf coal
	measured	normalized			
H ₂ O	48.18	47.68	0.92%	47.68	2.40%
CO _x	338.93	335.43	6.48%	335.43	16.88%
H ₂ S					
C1 to C3	141.33	139.87	2.70%	139.87	7.04%
C4 +	77.33	76.53	1.48%	76.53	3.85%
Oil	3667.19	3629.31	70.16%	829.13	41.72%
Asphaltene	632.28	625.75	12.10%	240.28	12.09%
Preasphalt.	59.73	59.11	1.14%	59.11	2.97%
IOM	348.70	345.10	6.67%	345.10	17.37%
Total	5313.67	5258.79	101.66%	2073.14	104.32%

Simulated Distillation Profile THF-Extract						Crude Sim. Dist. (Comp. Sample)					
Fraction [deg C]	Feed [grams]	Product				Feed [grams]	Product				
		Total Gross		Total Net			Total Gross		Total Net		
		[grams]	----- normalized -----		[grams]		[grams]	----- normalized -----			
			[grams]	wt. % maf coal				[grams]	wt. % maf coal		
C4 - 182		127.15	125.83	125.83	6.33%		141.53	140.07	140.07	7.05%	
182 - 343	127.43	1203.13	1190.71	1063.28	53.50%		57.34	893.89	884.66	827.32	41.63%
343 - 524	3058.22	2591.36	2564.59	-493.63	-24.84%	2672.76	2726.12	2697.97	25.21	1.27%	
524+		863.59	854.67	854.67	43.01%	455.55	1023.68	1013.11	557.56	28.06%	
TOTAL	3185.65	4785.23	4735.81	1550.16	78.00%	3185.65	4785.23	4735.81	1550.16	78.00%	
IBP - 524	3185.65	3921.64	3881.13	695.49	35.00%	2730.10	3761.55	3722.69	992.60	49.95%	

RUN No.: DOE-BU-015

M.B.No.: YP-01/C1

GAS ANALYSIS

Name	First Stage Product Gas (DTM-260)							Second Stage Product Gas (DTM-360)							Dissolved Gas (DTM-350)						
	Number of Samples: 1							Number of Samples: 6							Number of Samples: 2						
	vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	Av. vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	Av. vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	Av. vol. %
Hydrogen	4.275						4.275	98.383	97.604	98.298	98.844	98.504	98.448	98.310	73.403	88.340					69.872
CO2	13.029						13.029	0.160	0.142	0.151	0.131	0.220	0.198	0.167	6.680	5.022					5.841
CO	23.812						23.812	0.342	0.300	0.339	0.203	0.383	0.248	0.299	4.432	3.504					3.968
H2S																					
Methane	0.050						0.050	0.513	0.443	0.489	0.459	0.492	0.531	0.488	1.588	1.291					1.440
Ethylene								0.021	0.021	0.021	0.019	0.017	0.018	0.020	0.063	0.050					0.037
Ethane								0.188	0.178	0.179	0.168	0.187	0.198	0.183	1.113	0.858					0.985
Propane								0.143	0.139	0.014	0.128	0.138	0.143	0.117	1.394	1.003					1.199
Propylene																					
i-Butane								0.009	0.007	0.007	0.007	0.007	0.006	0.007	0.008	0.002					0.005
n-Butane								0.062	0.058	0.059	0.054	0.057	0.060	0.058	0.895	0.889					0.842
i-Butene																					
n-Butene																					
C2-Butene																					
i-Pentane																					
n-Pentane								0.088	0.085	0.085	0.081	0.088	0.091	0.086	2.201	1.182					1.692
Nitrogen																					
TOTAL	41.188						41.188	99.889	98.977	99.842	99.894	100.069	99.939	99.735	91.857	79.939					85.898

RUN No.: DOE-BU-015

M.B.No.: YP-01/ C1

GAS CALCULATIONS

Name	Mol.Weight	First Stage Product Gas (DTM-260)				Second Stage Product Gas (DTM-360)				Dissolved Gas (DTM-350)			
		Average Mol Weight:		16.69 (g/mole)		Average Mol Weight:		2.44 (g/mole)		Average Mol Weight:		9.17 (g/mole)	
		Volume		Weight (norm.)		Volume		Weight (norm.)		Volume		Weight (norm.)	
		meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%
Hydrogen	2.02	4.28	10.38	21.37	0.69	98.31	98.57	1416.44	81.61	69.87	81.34	4.88	17.92
CO2	44.01	13.03	31.65	1418.90	45.88	0.17	0.17	52.42	3.02	5.84	6.80	8.89	32.64
CO	28.01	23.81	57.84	1650.44	53.37	0.30	0.30	59.77	3.44	3.97	4.62	3.84	14.11
H2S	34.08												
Methane	16.04	0.05	0.12	1.96	0.06	0.49	0.49	55.81	3.22	1.44	1.68	0.80	2.93
Ethylene	28.05					0.02	0.02	3.90	0.22	0.06	0.07	0.05	0.20
Ethane	30.07					0.18	0.18	39.18	2.26	0.98	1.15	1.02	3.76
Propane	44.01					0.12	0.12	36.77	2.12	1.20	1.40	1.82	6.70
Propylene	42.08												
i-Butane	58.12					0.01	0.01	2.97	0.17	0.01	0.01	0.01	0.04
n-Butane	58.12					0.06	0.06	24.18	1.39	0.84	0.98	1.69	6.21
i-Butene	56.11												
n-Butene	56.11												
C2-Butene	56.11												
i-Pentane	72.15												
n-Pentane	72.15					0.09	0.09	44.26	2.55	1.69	1.97	4.22	15.49
Nitrogen	28.02												
TOTAL		41.17	100.00	3092.67	100.00	99.73	100.00	1735.71	100.00	85.90	100.00	27.22	100.00

First Stage Shift Reaction

		CO	+	H2O	=	CO2	+	H2
Stochiom.	[moles]	27.38		27.38		27.38		27.38
Produced	[moles]					4.86		-16.80
Total	[moles]	27.38		27.38		32.24		10.58
Stochiom.	[grams]	766.85		493.35		1204.89		55.30
Produced	[grams]					214.01		-33.93
Total	[grams]	766.85		493.35		1418.90		21.37

Hydrocarbon Gases

		First	Second	Dissolved	Total
C1 to C3	[grams]	1.96	135.67	3.70	141.33
C4 +	[grams]		71.41	5.92	77.33
Total	[grams]	1.96	207.08	9.62	218.66

Hydrogen

		First Up-Take	In	Second Out	Up-Take	Total Up-Take
Hydrogen	[grams]	33.93	1473.27	1421.32	51.95	85.88

RUN No.: DOE-BU-015	M.B.No.: YP-01/ C1
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RUN No.: DOE-BU-015	M.B.No.: YP-01/ C1
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[illegible]

	Feed	V-220	Products V-340 (BTTMS)	V-330
----- In grams of analysis sample -----				
Total Sample	50.33	14.70	54.33	64.49
Water	1.40	4.32	0.10	1.50
Oils+Asphaltenes	29.05	10.38	41.76	61.62
Oils	25.53	9.98	32.28	55.27
Asphaltenes	3.51	0.40	9.48	6.34
Pre-Asphaltenes			1.21	0.20
Insolubles	19.88		11.26	1.17
IOM	18.12		7.49	0.52
Ash	1.76		3.77	0.65
TOTAL	50.33	14.7	54.33	64.49

----- In wt% of analysis sample -----				
Water	2.78%	29.36%	0.18%	2.33%
Oils+Asphaltenes	57.71%	70.64%	76.87%	95.54%
Oils (on fraction)	87.90%	96.12%	77.29%	89.71%
(on total)	50.73%	67.90%	59.41%	85.71%
Asphalt. (on fract.)	12.10%	3.88%	22.71%	10.29%
(on total)	6.98%	2.74%	17.46%	9.83%
Pre-Asphaltenes			2.23%	0.31%
Insolubles	39.51%		20.72%	1.82%
IOM (on fraction)	91.13%		66.50%	44.48%
(on total)	36.00%		13.78%	0.81%
Ash (on fraction)	8.88%		33.50%	55.52%
(on total)	3.51%		6.94%	1.01%
TOTAL	100.00%	100.00%	100.00%	100.00%

----- In grams of feed / product -----				
Total Feed / Product	5520	910	2420	1880
Water	153.5	267.3	4.5	43.7
Oils+Asphaltenes	3185.6	643.1	1860.2	1796.2
Oils (on fraction)	2800.2	618.1	1437.7	1611.3
(on total)	2800.2	618.1	1437.7	1611.3
Asphalt. (on fract.)	385.5	25.0	422.4	184.9
(on total)	385.5	25.0	422.4	184.9
Pre-Asphaltenes			53.9	5.8
Insolubles	2180.8		501.5	34.2
IOM (on fraction)	1987.3		333.5	15.2
(on total)	1987.3		333.5	15.2
Ash (on fraction)	193.5		168.0	19.0
(on total)	193.5		168.0	19.0
TOTAL (as is)	5520.0	910.4	2420.0	1880.0
TOTAL (MAF)	5172.9	643.1	2247.6	1817.3

Distillation Profile THF-Extract						D-1160		
Fractions deg C	Feed	Products				Feed	Product	
		V-220	V-340 (BTTMS)	V-330	Total		Comp. Sample as is	corr.
IBP - 182		31.83	8.61	9.37	49.82		64.20	64.20
182 - 343	127.43	351.70	98.00	753.43	1203.13	57.34	893.89	893.89
343 - 524	3058.22	259.55	1292.58	1039.23	2591.36	2672.76	2726.12	2726.12
524+			848.36	15.23	863.59	455.55	1254.41	1023.68
TOTAL	3185.65	643.08	2247.56	1817.26	4707.90	3185.65	4938.63	4707.90

Feed	Products (normalized)				Feed	Products (normalized)			
	V-220	V-340 (BTTMS)	V-330	Total		V-220	V-340 (BTTMS)	V-330	Total
----- In wt% of total feed (as is) -----					----- In wt% of total feed (MAF) -----				
2.75%	2.75%	0.08%	0.78%	3.62%				0.92%	0.92%
57.73%	11.53%	33.36%	32.21%	77.11%	61.58%	12.30%	35.59%	34.36%	82.26%
50.74%	11.09%	25.78%	28.90%	65.77%	54.13%	11.83%	27.51%	30.83%	70.16%
6.99%	0.45%	7.58%	3.32%	11.34%	7.45%	0.48%	8.08%	3.54%	12.10%
39.52%		0.97%	0.10%	1.07%			1.03%	0.11%	1.14%
		8.13%	0.63%	9.76%					
36.01%		5.98%	0.27%	6.25%	38.42%		6.38%	0.29%	6.67%
3.51%		3.15%	0.36%	3.51%					
100.00%	14.29%	43.54%	33.73%	91.56%	100.00%	12.30%	43.00%	35.69%	90.99%

PROCESS YIELD STRUCTURE

RUN No.: DOE-BU-015

M.B. No.: YP-01/ C1

FEED			PRODUCT	
wt% (coal+solvent)			wt% (coal+solvent)	
as is	maf		as is	maf
57.7%	61.6%	Solvent	COx+H2	26.1% 27.8%
42.3%	38.4%	Coal	C1 - C4	0.0% 0.0%
100.0%	100.0%		Oil	11.5% 12.3%
			Water	2.8%
13.9%	14.8%	CO (shift)	COx	2.2% 2.4%
8.9%	9.5%	Water (shift)	C1 - C4	3.9% 4.1%
			Oil	32.3% 34.5%
			Water	0.8% 0.9%
0.9%	1.0%	Hydrogen (consumed)	Oil	34.3% 36.6%
			Coal (maf)	6.3% 6.7%
			Ash	3.5%
123.8%	125.4%		123.7%	125.4%

Remarks:

RUN No.: DOE-BU-015

M.B.No.: YP-02/ C1

	Date	Time	Date	Time
START:			Dec. 14, 93	19:00
END:			Dec. 15, 93	03:00
DURATION (hours):				8.00

Feed:	Type	Wt% (maf)
Coal	BTH	40.61%
Solvent	V-1074	59.39%
Catalyst 1	Aluminate	2.00%
Catalyst 2	Molybdate	0.28%
Other	CS2	

OPERATING PARAMETERS:		
FEED TANK WI-110):	(G)	
Start of Mass Balance		15500.00
End of Mass Balance		7680.00
Rate	(G/HR)	978
FIRST STAGE:		
Operating Pressure:	(MPa)	10.34
Feed Temp.:	(C)	295
Reactor Temp.:	(C)	
TE-201I	(BTTM)	411
TE-202I		412
TE-203I		412
TE-204I	(Top)	392
Liquid Level	(mm)	470
Separator Temperature:	(C)	46
CO-Feed Rate:	(L/MIN)	4.04
Water Feed Rate:	(ML/MIN)	1.57
Temperature:	(C)	184
Catalyst Feed:	(ML/MIN)	
Liquid Product (WI-220):	(G)	
Start of Mass Balance		
End of Mass Balance		1392.30
Nitrogen Rate:	(L/MIN)	3.93
SECOND STAGE:		
Operating Pressure:	(MPa)	17.24
Feed Temp.:	(C)	148
Reactor Temp.:	(C)	
TE-301I	(BTTM)	436
TE-302I		435
TE-303I		435
TE-304I		433
TE-305I		432
TE-306I		432
TE-307I		428
TE-308I	(Top)	426
TE-309I	(VAP)	425
Liquid level	(mm)	900
Separator Temperature:	(C)	45
Hydrogen Feed Rate:	(L/MIN)	34.13
Temperature:	(C)	391
Liquid Product (WI-330):	(G)	
Start of Mass Balance		1250
End of Mass Balance		5190
Bottoms Product (V-340):	(G)	
Start of Mass Balance		-530
End of Mass Balance		1570
Sulfiding Agent	(mL/HR)	10.47

MEASURED GAS COMPOSITIONS				
NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02	4.28	100.35	15.99
CO2	44.01	13.03	0.11	11.22
CO	28.01	23.81	0.43	36.91
H2S	34.08			
Methane	16.04	0.50	0.66	0.58
Ethylene	28.05		0.03	0.02
Ethane	30.07		0.25	0.28
Propane	44.01		0.18	0.18
Propylene	42.08		0.03	
i-Butane	58.12		0.01	0.01
n-Butane	58.12		0.08	0.07
i-Butene	56.11			
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15		0.11	0.11
Nitrogen	28.02			
TOTAL		41.61	102.25	65.35175
Gas Meter Readings				
DTM-260		DTM-360		DTM-350
Start of M.B. : (L)	8304.0	8910.0		7744.0
End of M.B. : (L)	13183.0	25740.0		7796.0
Total : (L)	4879.0	16830.0		52.0
Temperature: (C)	22.1	21.6		23.1
Meter Pressure : (mmHg)	700	700		700
Standard Volume: (L)	4157	14365		44
Nitrogen to R-200: (L)	1887			
Net Gas Out: (L)	2270	14365		44

Run Conditions			
Basis: MAF		First Stage	Second Stage
Pressure	Mpa	10.3	17.2
Temperature	deg C	412	434
Catalyst		Aluminate	Molybdate
Feed	wt % maf coal	40.61%	
WHSV	(kg / hr) / l	2.29	1.20
CO Rate	kg / kg maf coal	0.84	
	moles / 100g maf coal	3.01	
	consumed moles / 100g maf coal	0.99	
Water Rate	kg / kg maf coal	0.84	
	moles / 100g maf coal	4.68	
Hydrogen	kg / kg maf coal		0.51
	moles / 100g maf coal		25.56
	consumed wt % maf coal	1.28%	7.13%

RUN No.: DOE-BU-015

M.B.No.: YP-02/C1

GAS ANALYSIS

Name	First Stage Product Gas (DTM-260)							Second Stage Product Gas (DTM-360)							Dissolved Gas (DTM-350)						
	Number of Samples: 1							Number of Samples: 6							Number of Samples: 4						
	vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	Av. vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	Av. vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	Av. vol. %
Hydrogen	4.275						4.275	103.330	100.989	101.101	101.003	97.812	97.872	100.351	22.954	13.972	13.557	13.482			15.991
CO ₂	13.029						13.029	0.128	0.147	0.103	0.103	0.099	0.100	0.113	7.732	12.313	12.293	12.522			11.215
CO	23.812						23.812	0.495	0.439	0.389	0.370	0.452	0.483	0.435	34.427	37.323	38.019	37.874			36.911
H ₂ S																					
Methane	0.495						0.495	0.661	0.706	0.658	0.658	0.619	0.629	0.655	0.513	0.552	0.614	0.628			0.577
Ethylene								0.029	0.029	0.028	0.029	0.028	0.028	0.029	0.017	0.014	0.015	0.014			0.015
Ethane								0.254	0.273	0.256	0.254	0.241	0.245	0.254	0.242	0.267	0.301	0.291			0.275
Propane								0.196	0.203	0.195	0.128	0.181	0.183	0.181	0.160	0.181	0.199	0.192			0.183
Propylene											0.193			0.032							
i-Butane								0.007	0.006	0.006	0.006	0.006	0.006	0.006	0.004	0.008	0.007	0.006			0.006
n-Butane								0.083	0.085	0.083	0.082	0.076	0.077	0.081	0.069	0.070	0.073	0.072			0.071
i-Butene																					
n-Butene																					
C2-Butene																					
i-Pentane																					
n-Pentane								0.120	0.120	0.117	0.115	0.108	0.109	0.115	0.112	0.106	0.107	0.105			0.108
Nitrogen																					
TOTAL	41.611						41.611	105.303	102.997	102.938	102.941	99.822	99.712	102.252	68.230	64.806	65.185	65.186			65.362

OVERALL MASS BALANCE					
Material In:		Grams	Material Out:		Grams
	Feed Slurry	7820		First Stage Liquid:	1392
	CO-Gas:	2424		First Stage Product Gas:	3060
	Water:	752		Second Stage Liquid:	3940
	Hydrogen:	1477		Second Stage Reactor Bottoms:	2100
	Catalyst:			Second Stage Product Gas:	1639
	S-Agent	84		Dissolved Gas:	48
TOTAL IN:		12556	TOTAL OUT:		12180
Catalyst mf		178	OVERALL BALANCE:		97.0%
WATER BALANCE					
TOTAL IN:		1221	TOTAL OUT:		1363
WATER BALANCE:					111.6%
	Coal Conversion		wt.% maf	89.8%	
	Ash Balance		wt.%	106.1%	

PRODUCT YIELDS					
Description	Total Gross			Total Net	
	[grams]		wt. %	[grams]	wt. %
	measured	normalized	maf feed		maf coal
H2O	141.75	148.01	2.09%	148.01	5.15%
COx	292.78	305.71	4.32%	305.71	10.64%
H2S					
C1 to C3	197.28	205.99	2.91%	205.99	7.17%
C4 +	84.07	87.78	1.24%	87.78	3.05%
Oil	5041.09	5263.60	74.37%	1568.85	54.59%
Asphaltene	892.38	931.78	13.17%	423.17	14.72%
Preasphalt.	78.87	82.35	1.16%	82.35	2.87%
IOM	281.25	293.66	4.15%	293.66	10.22%
Total	7009.47	7318.88	103.41%	3115.51	108.40%

Simulated Distillation Profile THF-Extract						Sim. Dist. (Comp. Sample)				
Fraction [deg C]	Feed [grams]	Product				Feed [grams]	Product			
		Total Gross		Total Net			Total Gross		Total Net	
		[grams]	----- normalized -----		[grams]		[grams]	[grams]	[grams]	wt. % maf coal
			[grams]	[grams]						
C4 - 182		192.84	201.36	201.36	7.01%		178.23	186.09	186.09	6.47%
182 - 343	168.13	1718.09	1793.93	1625.79	56.57%	75.66	1210.58	1264.02	1188.36	41.35%
343 - 524	4035.23	3783.57	3950.58	-84.65	-2.95%	3526.62	3685.55	3848.24	321.62	11.19%
524+		683.16	713.31	713.31	24.82%	601.08	1303.30	1360.82	759.74	26.43%
TOTAL	4203.36	6377.66	6659.18	2455.82	85.45%	4203.36	6377.66	6659.18	2455.82	85.45%
IBP - 524	4203.36	5694.50	5945.86	1742.50	60.63%	3602.28	5074.36	5298.35	1696.07	59.01%

GAS CALCULATIONS

Name	Mol.Weight	First Stage Product Gas (DTM-260)				Second Stage Product Gas (DTM-360)				Dissolved Gas (DTM-350)			
		Average Mol Weight: 16.49 (g/mole)				Average Mol Weight: 2.56 (g/mole)				Average Mol Weight: 24.45 (g/mole)			
		Volume		Weight (norm.)		Volume		Weight (norm.)		Volume		Weight (norm.)	
		meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%
Hydrogen	2.02	4.28	10.27	21.02	0.69	100.35	98.14	1270.80	77.52	15.99	24.47	0.97	2.02
CO ₂	44.01	13.03	31.31	1395.89	45.62	0.11	0.11	31.27	1.91	11.22	17.16	14.88	30.89
CO	28.01	23.81	57.23	1623.67	53.06	0.43	0.43	76.33	4.66	36.91	56.48	31.17	64.70
H ₂ S	34.08												
Methane	16.04	0.50	1.19	19.33	0.63	0.66	0.64	65.88	4.02	0.58	0.88	0.28	0.58
Ethylene	28.05					0.03	0.03	5.01	0.31	0.02	0.02	0.01	0.03
Ethane	30.07					0.25	0.25	47.85	2.92	0.28	0.42	0.25	0.52
Propane	44.01					0.18	0.18	49.94	3.05	0.18	0.28	0.24	0.50
Propylene	42.08					0.03	0.03	8.49	0.52				
i-Butane	58.12					0.01	0.01	2.25	0.14	0.01	0.01	0.01	0.02
n-Butane	58.12					0.08	0.08	29.51	1.80	0.07	0.11	0.12	0.26
i-Butene	56.11												
n-Butene	56.11												
C ₂ -Butene	56.11												
i-Pentane	72.15												
n-Pentane	72.15					0.11	0.11	51.94	3.17	0.11	0.16	0.23	0.49
Nitrogen	28.02												
TOTAL		41.61	100.00	3059.91	100.00	102.25	100.00	1639.26	100.00	65.35	100.00	48.18	100.00

First Stage Shift Reaction

		CO	+	H ₂ O	=	CO ₂	+	H ₂
Stochiom.	[moles]	28.56		28.56		28.56		28.56
Produced	[moles]					3.16		-18.15
Total	[moles]	28.56		28.56		31.72		10.41
Stochiom.	[grams]	799.86		514.58		1256.76		57.68
Produced	[grams]					139.13		-36.66
Total	[grams]	799.86		514.58		1395.89		21.02

Hydrocarbon Gases

		First	Second	Dissolved	Total
C ₁ to C ₃	[grams]	19.33	177.17	0.78	197.28
C ₄ +	[grams]		83.70	0.37	84.07
Total	[grams]	19.33	260.87	1.15	281.35

Hydrogen

		First Up-Take	In	Second Out	Up-Take	Total Up-Take
Hydrogen	[grams]	36.66	1476.59	1271.77	204.82	241.48

M.B.No.: YP-02/ C1

Liquid / Slurry Stream Analysis

[illegible]

	Feed	V-220	Products V-340 (BTMS)	V-330
----- in grams of analysis sample -----				
Total Sample	51.68	14.70	57.61	63.93
Water	3.10	7.46		2.30
Oils+Asphaltenes	27.78	7.24	45.32	58.35
Oils	24.42	6.96	35.15	50.32
Asphaltenes	3.36	0.28	10.17	8.03
Pre-Asphaltenes			1.20	0.57
Insolubles	20.80		11.09	2.71
IOM	18.99		6.09	0.96
Ash	1.81		5.00	1.75
TOTAL	51.68	14.7	57.61	63.93
----- in wt% of analysis sample -----				
Water	6.00%	50.77%		3.60%
Oils+Asphaltenes	53.75%	49.23%	78.67%	91.27%
Oils (on fraction)	87.90%	96.12%	77.55%	86.24%
(on total)	47.25%	47.32%	61.01%	78.71%
Asphalt. (on fract.)	12.10%	3.88%	22.45%	13.76%
(on total)	6.50%	1.91%	17.66%	12.56%
Pre-Asphaltenes			2.08%	0.89%
Insolubles	40.25%		19.25%	4.24%
IOM (on fraction)	91.31%		54.90%	35.50%
(on total)	36.75%		10.57%	1.51%
Ash (on fraction)	8.69%		45.10%	64.50%
(on total)	3.50%		8.68%	2.74%
TOTAL	100.00%	100.00%	100.00%	100.00%
----- in grams of feed / product -----				
Total Feed / Product	7820	1392	2100	3940
Water	469.1	706.8		141.7
Oils+Asphaltenes	4203.4	685.5	1652.1	3595.9
Oils (on fraction)	3694.8	658.9	1281.2	3101.0
(on total)	3694.8	658.9	1281.2	3101.0
Asphalt. (on fract.)	508.6	26.6	370.9	494.9
(on total)	508.6	26.6	370.9	494.9
Pre-Asphaltenes			43.7	35.1
Insolubles	3147.6		404.2	167.2
IOM (on fraction)	2874.0		221.9	59.4
(on total)	2874.0		221.9	59.4
Ash (on fraction)	273.5		182.3	107.8
(on total)	273.5		182.3	107.8
TOTAL (as is)	7820.0	1392.3	2100.0	3940.0
TOTAL (MAF)	7077.4	685.5	1917.7	3690.4

Distillation Profile THF-Extract						D-1160		
Fractions deg C	Feed	Products				Feed	Product	
		V-220	V-340 (BTMS)	V-330	Total		Comp. Sample	
							as is	corr.
IBP - 182		33.93	55.96	18.88	108.77		94.16	94.16
182 - 343	168.13	374.88	101.75	1241.46	1718.09	75.66	1210.58	1210.58
343 - 524	4035.23	276.65	1136.20	2370.72	3783.57	3526.62	3685.55	3685.55
524+			623.80	59.35	683.16	601.08	1735.17	1303.30
TOTAL	4203.36	685.46	1917.71	3690.41	6293.59	4203.36	6725.46	6293.59

Feed	Products (normalized)				Feed	Products (normalized)			
	V-220	V-340	V-330	Total		V-220	V-340	V-330	Total
	(BTTMS)					(BTTMS)			
----- in wt% of total feed (as is) -----					----- in wt% of total feed (MAF) -----				
6.25%	6.25%		1.89%	8.13%				2.09%	2.09%
53.61%	9.13%	22.00%	47.89%	79.02%	59.39%	10.11%	24.37%	53.05%	87.54%
47.12%	8.77%	17.06%	41.30%	67.13%	52.20%	9.72%	18.90%	45.75%	74.37%
6.49%	0.35%	4.94%	6.59%	11.88%	7.19%	0.39%	5.47%	7.30%	13.17%
		0.58%	0.47%	1.05%			0.65%	0.52%	1.16%
40.14%		5.15%	2.09%	7.23%					
36.66%		2.95%	0.79%	3.75%	40.61%		3.27%	0.88%	4.15%
3.49%		2.19%	1.30%	3.49%					
100.00%	15.37%	27.73%	52.33%	95.43%					
					100.00%	10.11%	28.29%	56.54%	94.94%

PROCESS YIELD STRUCTURE

RUN No.: DOE-BU-015

M.B. No.: YP-02/ C1

FEED			PRODUCT	
wt% (coal+solvent)			wt% (coal+solvent)	
as is	maf		as is	maf
53.6%	59.4%	Solvent	COx+H2	18.1% 20.1%
46.4%	40.6%	Coal	C1 - C4	0.3% 0.3%
100.0%	100.0%		Oil	9.1% 10.1%
			Water	6.2%
10.2%	11.3%	CO (shift)	COx	2.0% 2.3%
6.6%	7.3%	Water (shift)	C1 - C4	3.5% 3.9%
			Oil	48.4% 53.6%
			Water	1.9% 2.1%
2.6%	2.9%	Hydrogen (consumed)	Oil	22.6% 25.0%
			Coal (maf)	3.7% 4.1%
			Ash	3.5%
119.4%	121.5%		119.4%	121.5%

Remarks:

RUN No.: DOE-BU-015

M.B.No.: YP-03/ C1

	Date	Time	Date	Time
START:			Dec. 15, 93	07:00
END:			Dec. 15, 93	15:00
DURATION (hours):				8.00

Feed:	Type	Wt% (maf)
Coal	BTH	42.94%
Solvent	V-1074	57.06%
Catalyst 1	Aluminate	2.00%
Catalyst 2	Molybdate	0.28%
Other	CS2	

OPERATING PARAMETERS:			
FEED TANK WI-110:	(G)		
Start of Mass Balance		14720.00	
End of Mass Balance		7920.00	
Rate	(G/HR)	850	
FIRST STAGE:			
Operating Pressure:	(MPa)	10.34	
Feed Temp.:	(C)	289	
Reactor Temp.:	(C)		
TE-201I	(BTTM)	410	
TE-202I		412	
TE-203I		412	
TE-204I	(Top)	389	
Liquid Level	(mm)	540	
Separator Temperature:	(C)	47	
CO-Feed Rate:	(L/MIN)	4.03	
Water Feed Rate:	(ML/MIN)	1.51	
Temperature:	(C)	193	
Catalyst Feed:	(ML/MIN)		
Liquid Product (WI-220):	(G)		
Start of Mass Balance			
End of Mass Balance		1535.30	
Nitrogen Rate:	(L/MIN)	3.91	
SECOND STAGE:			
Operating Pressure:	(MPa)	17.24	
Feed Temp.:	(C)	136	
Reactor Temp.:	(C)		
TE-301I	(BTTM)	436	
TE-302I		436	
TE-303I		435	
TE-304I		434	
TE-305I		433	
TE-306I		433	
TE-307I		429	
TE-308I	(Top)	426	
TE-309I	(VAP)	426	
Liquid level	(mm)	900	
Separator Temperature:	(C)	45	
Hydrogen Feed Rate:	(L/MIN)	34.00	
Temperature:	(C)	394	
Liquid Product (WI-330):	(G)		
Start of Mass Balance		1230	
End of Mass Balance		4222	
Bottoms Product (V-340):	(G)		
Start of Mass Balance		-830	
End of Mass Balance		1340	
Sulfiding Agent	(mL/HR)	10.08	

MEASURED GAS COMPOSITIONS				
NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02	4.28	97.46	15.99
CO2	44.01	13.03	0.18	11.22
CO	28.01	23.81	0.44	36.91
H2S	34.08			
Methane	16.04	0.50	0.61	0.58
Ethylene	28.05		0.03	0.02
Ethane	30.07		0.25	0.28
Propane	44.01		0.18	0.18
Propylene	42.08			
i-Butane	58.12		0.01	0.01
n-Butane	58.12		0.08	0.07
i-Butene	56.11			
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15		0.11	0.11
Nitrogen	28.02			
TOTAL		41.61	99.34	65.35175
Gas Meter Readings				
	DTM-260	DTM-360	DTM-350	
Start of M.B. : (L)	6043.0	5709.0	7825.0	
End of M.B. : (L)	10886.0	22960.0	7878.0	
Total : (L)	4843.0	17251.0	53.0	
Temperature: (C)	22.2	21.6	23.0	
Meter Pressure : (mmHg)	704	704	704	
Standard Volume: (L)	4149	14809	45	
Nitrogen to R-200: (L)	1878			
Net Gas Out: (L)	2271	14809	45	

Run Conditions			
Basis: MAF		First Stage	Second Stage
Pressure	Mpa	10.3	17.2
Temperature	deg C	412	435
Catalyst		Aluminate	Molybdate
Feed	wt % maf coal	42.94%	
WHSV	(kg / hr) / l	1.74	1.04
CO Rate	kg / kg maf coal	0.92	
	moles / 100g maf coal	3.29	
consumed	moles / 100g maf coal	1.08	
Water Rate	kg / kg maf coal	0.92	
	moles / 100g maf coal	5.11	
Hydrogen	kg / kg maf coal		0.56
	moles / 100g maf coal		27.89
consumed	wt % maf coal	1.37%	6.12%

OVERALL MASS BALANCE						
Material In:		Grams		Material Out:		Grams
	Feed Slurry:	6800			First Stage Liquid:	1535
	CO-Gas:	2415			First Stage Product Gas:	3061
	Water:	724			Second Stage Liquid:	2992
	Hydrogen:	1471			Second Stage Reactor Bottoms:	2170
	Catalyst:				Second Stage Product Gas:	1701
	S-Agent	81			Dissolved Gas:	49
TOTAL IN:		11491		TOTAL OUT:		11508
Catalyst mf		155		OVERALL BALANCE: 100.2%		

WATER BALANCE					
TOTAL IN:		1120	TOTAL OUT:		1244
			WATER BALANCE: 111.1%		

	Coal Conversion	wt. % maf	92.3%
	Ash Balance	wt. %	97.4%

PRODUCT YIELDS					
Description	Total Gross			Total Net	
	[grams]		wt. % maf feed	[grams]	wt. % maf coal
	measured	normalized			
H2O	123.81	121.77	1.99%	121.77	4.64%
COx	336.09	330.56	5.41%	330.56	12.60%
H2S					
C1 to C3	193.69	190.51	3.12%	190.51	7.26%
C4 +	82.99	81.62	1.34%	81.62	3.11%
Oil	4616.28	4540.32	74.30%	1475.08	56.22%
Asphaltene	803.74	790.51	12.94%	368.56	14.05%
Preasphalt.	52.36	51.49	0.84%	51.49	1.96%
IOM	204.27	200.91	3.29%	200.91	7.66%
Total	6413.22	6307.69	103.22%	2820.50	107.49%

Simulated Distillation Profile THF-Extract						Crude Sim. Dist. (Comp. Sample)				
Fraction [deg C]	Feed [grams]	Product				Feed [grams]	Product			
		Total Gross		Total Net			Total Gross		Total Net	
		[grams]	-----normalized-----				[grams]	-----normalized-----		
			[grams]	[grams]	wt. % maf coal			[grams]	[grams]	wt. % maf coal
C4 - 182		188.72	185.61	185.61	7.07%		174.27	171.41	171.41	6.53%
182 - 343	139.49	1743.30	1714.61	1575.13	60.03%	62.77	1235.42	1215.09	1152.32	43.92%
343 - 524	3347.71	3109.81	3058.64	-289.06	-11.02%	2925.75	3146.36	3094.59	168.83	6.43%
524+		717.80	705.99	705.99	26.91%	498.67	1203.58	1183.77	685.11	26.11%
TOTAL	3487.19	5759.63	5664.86	2177.67	82.99%	3487.19	5759.63	5664.86	2177.67	82.99%
IBP - 524	3487.19	5041.83	4958.87	1471.68	56.09%	2988.52	4556.05	4481.09	1492.56	56.88%

QAS ANALYSIS

[illegible]

RUN No.: DOE-BU-015

M.B.No.: YP-03/ C1

GAS CALCULATIONS

Name	Mol.Weight	First Stage Product Gas (DTM-260)				Second Stage Product Gas (DTM-360)				Dissolved Gas (DTM-350)			
		Average Mol Weight:		16.53 (g/mole)		Average Mol Weight:		2.57 (g/mole)		Average Mol Weight:		24.45 (g/mole)	
		Volume		Weight (norm.)		Volume		Weight (norm.)		Volume		Weight (norm.)	
		meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%
Hydrogen	2.02	4.28	10.27	21.03	0.69	97.46	98.10	1309.54	77.00	15.99	24.47	1.00	2.02
CO ₂	44.01	13.03	31.31	1396.24	45.62	0.18	0.18	52.50	3.09	11.22	17.16	15.26	30.89
CO	28.01	23.81	57.23	1624.07	53.06	0.44	0.45	82.51	4.85	36.91	56.48	31.97	64.70
H ₂ S	34.08												
Methane	16.04	0.50	1.19	19.33	0.63	0.61	0.62	65.39	3.84	0.58	0.88	0.29	0.58
Ethylene	28.05					0.03	0.03	5.41	0.32	0.02	0.02	0.01	0.03
Ethane	30.07					0.25	0.25	50.41	2.96	0.28	0.42	0.26	0.52
Propane	44.01					0.18	0.18	52.35	3.08	0.18	0.28	0.25	0.50
Propylene	42.08												
i-Butane	58.12					0.01	0.01	2.19	0.13	0.01	0.01	0.01	0.02
n-Butane	58.12					0.08	0.08	29.70	1.75	0.07	0.11	0.13	0.26
i-Butene	56.11												
n-Butene	56.11												
C ₂ -Butene	56.11												
i-Pentane	72.15												
n-Pentane	72.15					0.11	0.11	50.71	2.98	0.11	0.16	0.24	0.49
Nitrogen	28.02												
TOTAL		41.61	100.00	3060.67	100.00	99.34	100.00	1700.72	100.00	65.35	100.00	49.41	100.00

First Stage Shift Reaction

		CO	+	H ₂ O	=	CO ₂	+	H ₂
Stochiom.	[moles]	28.23		28.23		28.23		28.23
Produced	[moles]					3.50		-17.82
Total	[moles]	28.23		28.23		31.73		10.41
Stochiom.	[grams]	790.71		508.70		1242.39		57.02
Produced	[grams]					153.85		-36.00
Total	[grams]	790.71		508.70		1396.24		21.03

Hydrocarbon Gases

		First	Second	Dissolved	Total
C1 to C3	[grams]	19.33	173.56	0.80	193.69
C4 +	[grams]		82.61	0.38	82.99
Total	[grams]	19.33	256.17	1.18	276.68

Hydrogen

		First Up-Take	In	Second Out	Up-Take	Total Up-Take
Hydrogen	[grams]	36.00	1471.17	1310.54	160.63	196.62

RUN No.: DOE-BU-015 M.B.No.: YP-03/ C1

RUN No.: DOE-BU-015 M.B.No.: YP-03/ C1

[illegible]

	Feed	V-220	Products V-340 (BTMS)	V-330
----- In grams of analysis sample -----				
Total Sample	53.22	14.70	53.19	65.25
Water	3.10	5.85		2.70
Oils+Asphaltenes	27.29	8.85	43.52	59.33
Oils	23.99	8.50	33.88	51.16
Asphaltenes	3.30	0.34	9.64	8.17
Pre-Asphaltenes			0.80	0.43
Insolubles	22.83		8.87	2.79
IOM	20.54		4.05	0.85
Ash	2.29		4.81	1.94
TOTAL	53.22	14.7	53.19	65.25
----- In wt% of analysis sample -----				
Water	5.82%	39.83%		4.14%
Oils+Asphaltenes	51.28%	60.17%	81.82%	90.93%
Oils (on fraction)	87.90%	96.12%	77.85%	86.23%
(on total)	45.08%	57.84%	63.70%	78.41%
Asphalt. (on fract.)	12.10%	3.88%	22.15%	13.77%
(on total)	6.21%	2.33%	18.12%	12.52%
Pre-Asphaltenes			1.50%	0.66%
Insolubles	42.89%		16.67%	4.27%
IOM (on fraction)	89.96%		45.72%	30.40%
(on total)	38.59%		7.62%	1.30%
Ash (on fraction)	10.04%		54.28%	69.60%
(on total)	4.31%		9.05%	2.97%
TOTAL	100.00%	100.00%	100.00%	100.00%
----- In grams of feed / product -----				
Total Feed / Product	6800	1535	2170	2992
Water	396.1	611.5		123.8
Oils+Asphaltenes	3487.2	923.8	1775.6	2720.6
Oils (on fraction)	3065.2	888.0	1382.3	2346.0
(on total)	3065.2	888.0	1382.3	2346.0
Asphalt. (on fract.)	422.0	35.8	393.3	374.6
(on total)	422.0	35.8	393.3	374.6
Pre-Asphaltenes			32.6	19.7
Insolubles	2916.7		361.8	127.8
IOM (on fraction)	2623.9		165.4	38.9
(on total)	2623.9		165.4	38.9
Ash (on fraction)	292.8		196.4	89.0
(on total)	292.8		196.4	89.0
TOTAL (as is)	6800.0	1535.3	2170.0	2992.0
TOTAL (MAF)	6111.1	923.8	1973.6	2779.2

Distillation Profile THF-Extract						D-1160		
Fractions deg C	Feed	Products				Feed	Product	
		V-220	V-340 (BTMS)	V-330	Total		Comp. Sample as is	corr.
IBP - 182		45.73	45.21	14.80	105.73		91.29	91.29
182 - 343	139.49	505.23	108.49	1129.58	1743.30	62.77	1235.42	1235.42
343 - 524	3347.71	372.85	1140.97	1595.99	3109.81	2925.75	3146.36	3146.36
524+			678.94	38.86	717.80	498.67	1612.74	1203.58
TOTAL	3487.19	923.80	1973.62	2779.23	5676.64	3487.19	6085.80	5676.64

Feed	V-220	Products (normalized)		Total	Feed	V-220	Products (normalized)		Total
		V-340 (BTMS)	V-330				V-340 (BTMS)	V-330	
----- In wt% of total feed (as is) -----					----- In wt% of total feed (MAF) -----				
5.73%	5.73%		1.79%	7.53%				1.99%	1.99%
51.33%	13.37%	25.71%	39.39%	78.47%	57.06%	14.87%	28.58%	43.79%	87.23%
45.12%	12.86%	20.01%	33.97%	66.83%	50.16%	14.29%	22.25%	37.76%	74.30%
6.21%	0.52%	5.69%	5.42%	11.64%	6.90%	0.58%	6.33%	6.03%	12.94%
42.93%		0.47%	0.29%	0.76%			0.53%	0.32%	0.84%
		5.36%	1.91%	7.27%					
38.62%		2.39%	0.56%	2.96%	42.94%		2.66%	0.63%	3.29%
4.31%		2.97%	1.34%	4.31%					
100.00%	19.11%	31.54%	43.37%	94.02%	100.00%	14.87%	31.76%	46.72%	93.36%

PROCESS YIELD STRUCTURE

RUN No.: DOE-BU-015

M.B. No.: YP-03/ C1

FEED		PRODUCT	
wt% (coal+solvent)		wt% (coal+solvent)	
as is	maf	as is	maf
51.3%	57.1%	COx+H2	20.8% 23.2%
48.7%	42.9%	C1 - C4	0.3% 0.3%
100.0%	100.0%	Oil	13.4% 14.9%
		Water	5.7%
11.6%	12.9%	COx	2.6% 2.9%
7.5%	8.3%	C1 - C4	3.7% 4.1%
		Oil	39.7% 44.1%
		Water	1.8% 2.0%
2.4%	2.6%	Oil	26.2% 29.1%
		Coal (maf)	3.0% 3.3%
		Ash	4.3%
121.5%	123.9%	121.5%	123.9%

Remarks:

RUN No.: DOE-BU-015

M.B.No.: YP-04/ C1

	Date	Time	Date	Time
START:			Dec. 15, 93	21:00
END:			Dec. 16, 93	05:00
DURATION (hours):				8.00

Feed:	Type	Wt% (maf)
Coal	BTH	44.70%
Solvent	V-1074	55.30%
Catalyst 1	Aluminate	2.00%
Catalyst 2	Molybdate	0.28%
Other	CS2	

OPERATING PARAMETERS:		
FEED TANK WI-110):	(G)	
Start of Mass Balance		10580.00
End of Mass Balance		3300.00
Rate	(G/HR)	910
FIRST STAGE:		
Operating Pressure:	(MPa)	10.34
Feed Temp.:	(C)	298
Reactor Temp.:	(C)	
TE-201I	(BTM)	409
TE-202I		409
TE-203I		409
TE-204I	(Top)	387
Liquid Level	(mm)	540
Separator Temperature:	(C)	47
CO-Feed Rate:	(L/MIN)	4.03
Water Feed Rate:	(ML/MIN)	1.40
Temperature:	(C)	192
Catalyst Feed:	(ML/MIN)	
Liquid Product (WI-220):	(G)	
Start of Mass Balance		
End of Mass Balance		1490.10
Nitrogen Rate:	(L/MIN)	3.93
SECOND STAGE:		
Operating Pressure:	(MPa)	17.24
Feed Temp.:	(C)	144
Reactor Temp.:	(C)	
TE-301I	(BTM)	430
TE-302I		430
TE-303I		430
TE-304I		428
TE-305I		428
TE-306I		428
TE-307I		425
TE-308I	(Top)	422
TE-309I	(VAP)	422
Liquid level	(mm)	900
Separator Temperature:	(C)	45
Hydrogen Feed Rate:	(L/MIN)	34.11
Temperature:	(C)	394
Liquid Product (WI-330):	(G)	
Start of Mass Balance		1290
End of Mass Balance		4700
Bottoms Product (V-340):	(G)	
Start of Mass Balance		-770
End of Mass Balance		1510
Sulfiding Agent	(mL/HR)	10.08

MEASURED GAS COMPOSITIONS				
NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02	4.28	98.51	55.28
CO2	44.01	13.03	0.07	11.42
CO	28.01	23.81	0.39	21.03
H2S	34.08			
Methane	16.04	0.50	0.56	1.61
Ethylene	28.05		0.03	0.07
Ethane	30.07		0.21	1.10
Propane	44.01		0.12	1.19
Propylene	42.08			
i-Butane	58.12		0.01	0.00
n-Butane	58.12		0.07	0.69
i-Butene	56.11			
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15		0.10	1.16
Nitrogen	28.02			
TOTAL		41.61	100.07	93.557
Gas Meter Readings				
		DTM-260	DTM-360	DTM-350
Start of M.B. : (L)		4347.0	5962.0	7912.0
End of M.B. : (L)		9175.0	22820.0	7988.0
Total : (L)		4828.0	16858.0	76.0
Temperature: (C)		22.0	21.4	22.8
Meter Pressure : (mmHg)		707	707	707
Standard Volume: (L)		4157	14543	65
Nitrogen to R-200: (L)		1884		
Net Gas Out: (L)		2272	14543	65

Run Conditions			
Basis: MAF		First Stage	Second Stage
Pressure	Mpa	10.3	17.2
Temperature	deg C	409	429
Catalyst		Aluminate	Molybdate
Feed	wt % maf coal	44.70%	
WHSV	(kg / hr) / l	1.86	1.11
CO Rate	kg / kg maf coal	0.82	
	moles / 100g maf coal	2.93	
consumed	moles / 100g maf coal	0.96	
Water Rate	kg / kg maf coal	0.82	
	moles / 100g maf coal	4.56	
Hydrogen	kg / kg maf coal		0.50
	moles / 100g maf coal		24.94
consumed	wt % maf coal	1.23%	6.18%

OVERALL MASS BALANCE					
Material In:		Grams		Material Out:	Grams
	Feed Slurry	7280		First Stage Liquid:	1490
	CO-Gas:	2420		First Stage Product Gas:	3063
	Water:	670		Second Stage Liquid:	3410
	Hydrogen:	1476		Second Stage Reactor Bottoms:	2280
	Catalyst:			Second Stage Product Gas:	1597
	S-Agent	81		Dissolved Gas:	45
TOTAL IN:		11926		TOTAL OUT:	11885
Catalyst mf		166		OVERALL BALANCE:	99.7%
WATER BALANCE					
TOTAL IN:		1024		TOTAL OUT:	1182
				WATER BALANCE:	115.4%
		Coal Conversion	wt. % maf	91.4%	
		Ash Balance	wt. %	96.8%	

PRODUCT YIELDS					
Description	Total Gross			Total Net	
	[grams]		wt. % maf feed	[grams]	wt. % maf coal
	measured	normalized			
H2O	157.25	156.10	2.37%	156.10	5.30%
COx	274.39	272.38	4.14%	272.38	9.25%
H2S					
C1 to C3	162.30	161.11	2.45%	161.11	5.47%
C4 +	79.23	78.65	1.19%	78.65	2.67%
Oil	4946.67	4910.55	74.56%	1709.43	58.07%
Asphaltene	920.90	914.18	13.88%	473.52	16.08%
Preasphalt.	56.99	56.57	0.86%	56.57	1.92%
IOM	256.29	254.41	3.86%	254.41	8.64%
Total	6854.01	6803.96	103.31%	3162.18	107.42%

Simulated Distillation Profile THF-Extract						Crude Sim. Dist. (Comp. Sample)				
Fraction [deg C]	Feed [grams]	Product				Feed [grams]	Product			
		Total Gross		Total Net			Total Gross		Total Net	
		[grams]	----- normalized -----		[grams]		wt. % maf coal	[grams]	----- normalized -----	
			[grams]	[grams]					[grams]	[grams]
C4 - 182		189.39	188.01	188.01	6.39%		172.57	171.31	171.31	5.82%
182 - 343	145.67	1757.28	1744.45	1598.78	54.31%	65.55	1320.07	1310.43	1244.87	42.29%
343 - 524	3496.10	3544.63	3518.75	22.64	0.77%	3055.45	3513.51	3487.85	432.40	14.69%
524+		768.77	763.15	763.15	25.92%	520.77	1253.93	1244.77	724.00	24.59%
TOTAL	3641.78	6260.07	6214.36	2572.59	87.39%	3641.78	6260.07	6214.36	2572.59	87.39%
IBP - 524	3641.78	5491.31	5451.21	1809.43	61.46%	3121.00	5006.14	4969.59	1848.59	62.79%

SV9 NY 781515

RUN No.: DOE-BU-015

M.B.No.: YP-04/ C1

GAS CALCULATIONS

Name	Mol.Weight	First Stage Product Gas (DTM-260)				Second Stage Product Gas (DTM-360)				Dissolved Gas (DTM-350)			
		Average Mol Weight:		16.51 (g/mole)		Average Mol Weight:		2.46 (g/mole)		Average Mol Weight:		15.40 (g/mole)	
		Volume		Weight (norm.)		Volume		Weight (norm.)		Volume		Weight (norm.)	
		meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%
Hydrogen	2.02	4.28	10.27	21.04	0.69	98.51	98.44	1290.46	80.81	55.28	59.09	3.48	7.75
CO ₂	44.01	13.03	31.31	1397.19	45.62	0.07	0.07	21.33	1.34	11.42	12.21	15.65	34.91
CO	28.01	23.81	57.23	1625.18	53.06	0.39	0.39	70.39	4.41	21.03	22.48	18.33	40.89
H ₂ S	34.08												
Methane	16.04	0.50	1.19	19.35	0.63	0.56	0.56	58.20	3.64	1.61	1.72	0.81	1.80
Ethylene	28.05					0.03	0.03	4.73	0.30	0.07	0.08	0.06	0.14
Ethane	30.07					0.21	0.21	41.49	2.60	1.10	1.18	1.03	2.30
Propane	44.01					0.12	0.12	35.02	2.19	1.19	1.27	1.63	3.63
Propylene	42.08												
i-Butane	58.12					0.01	0.01	2.17	0.14	0.00	0.00	0.00	0.01
n-Butane	58.12					0.07	0.07	25.72	1.61	0.69	0.74	1.25	2.79
i-Butene	56.11												
n-Butene	56.11												
C ₂ -Butene	56.11												
i-Pentane	72.15												
n-Pentane	72.15					0.10	0.10	47.49	2.97	1.16	1.24	2.60	5.79
Nitrogen	28.02												
TOTAL		41.61	100.00	3062.76	100.00	100.07	100.00	1596.99	100.00	93.56	100.00	44.83	100.00

First Stage Shift Reaction

		CO	+	H ₂ O	=	CO ₂	+	H ₂
Stochiom.	[moles]	28.37		28.37		28.37		28.37
Produced	[moles]					3.38		-17.95
Total	[moles]	28.37		28.37		31.75		10.42
Stochiom.	[grams]	794.60		511.20		1248.50		57.30
Produced	[grams]					148.69		-36.26
Total	[grams]	794.60		511.20		1397.19		21.04

Hydrocarbon Gases

		First	Second	Dissolved	Total
C1 to C3	[grams]	19.35	139.43	3.52	162.30
C4 +	[grams]		75.38	3.85	79.23
Total	[grams]	19.35	214.81	7.37	241.53

Hydrogen

		First Up-Take	In	Second Out	Up-Take	Total Up-Take
Hydrogen	[grams]	36.26	1475.98	1293.94	182.04	218.30

RUN No.: DOE-BU-015	M.B.No.: YP-04/ C1
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RUN No.: DOE-BU-015	M.B.No.: YP-04/ C1
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[illegible]

	Feed	V-220	Products V-340 (BTMS)	V-330
----- In grams of analysis sample -----				
Total Sample	53.37	14.70	52.26	60.72
Water	2.60	5.06		2.80
Oils+Asphaltenes	26.70	9.64	41.94	54.51
Oils	23.47	9.26	31.57	46.83
Asphaltenes	3.23	0.37	10.36	7.67
Pre-Asphaltenes			0.92	0.30
Insolubles	24.07		9.40	3.11
IOM	21.58		4.58	1.01
Ash	2.49		4.83	2.11
TOTAL	53.37	14.7	52.26	60.72

----- In wt% of analysis sample -----				
Water	4.87%	34.43%		4.61%
Oils+Asphaltenes	50.02%	65.57%	80.24%	89.77%
Oils (on fraction)	87.90%	96.12%	75.29%	85.92%
(on total)	43.97%	63.02%	60.42%	77.13%
Asphalt. (on fract.)	12.10%	3.88%	24.71%	14.08%
(on total)	6.05%	2.54%	19.83%	12.64%
Pre-Asphaltenes			1.76%	0.49%
Insolubles	45.10%		18.00%	5.13%
IOM (on fraction)	89.66%		48.69%	32.31%
(on total)	40.44%		8.76%	1.66%
Ash (on fraction)	10.35%		51.31%	67.69%
(on total)	4.67%		9.23%	3.47%
TOTAL	100.00%	100.00%	100.00%	100.00%

----- In grams of feed / product -----				
Total Feed / Product	7280	1490	2280	3410
Water	354.7	513.1		157.2
Oils+Asphaltenes	3641.8	977.0	1829.6	3061.0
Oils (on fraction)	3201.1	939.1	1377.5	2630.1
(on total)	3201.1	939.1	1377.5	2630.1
Asphalt. (on fract.)	440.7	37.9	452.1	430.9
(on total)	440.7	37.9	452.1	430.9
Pre-Asphaltenes			40.1	16.8
Insolubles	3283.6		410.3	174.9
IOM (on fraction)	2943.9		199.8	56.5
(on total)	2943.9		199.8	56.5
Ash (on fraction)	339.7		210.5	118.4
(on total)	339.7		210.5	118.4
TOTAL (as is)	7280.0	1490.1	2280.0	3410.0
TOTAL (MAF)	6585.7	977.0	2069.5	3134.4

Distillation Profile THF-Extract						D-1160		
Fractions deg C	Feed	Products				Feed	Product	
		V-220	V-340 (BTMS)	V-330	Total		Comp. as is	Sample corr.
IBP - 182		48.36	44.87	16.93	110.16		93.34	93.34
182 - 343	145.67	534.32	110.31	1112.65	1757.28	65.55	1320.07	1320.07
343 - 524	3496.10	394.32	1202.03	1948.29	3544.63	3055.45	3513.51	3513.51
524+			712.26	56.51	768.77	520.77	1740.09	1253.93
TOTAL	3641.78	977.00	2069.47	3134.37	6180.84	3641.78	6667.00	6180.84

Feed	V-220	Products (normalized)			Total	Feed	V-220	Products (normalized)			Total
		V-340 (BTMS)	V-330					V-340 (BTMS)	V-330		
----- In wt% of total feed (as is) -----						----- In wt% of total feed (MAF) -----					
4.84%	4.84%		2.14%	6.98%					2.37%	2.37%	
50.04%	13.33%	24.96%	41.75%	80.04%		55.30%	14.73%	27.58%	46.14%	88.45%	
43.99%	12.81%	18.79%	35.88%	67.48%		48.61%	14.16%	20.76%	39.65%	74.56%	
6.06%	0.52%	6.17%	5.88%	12.56%		6.69%	0.57%	6.81%	6.50%	13.88%	
		0.55%	0.23%	0.78%				0.61%	0.25%	0.86%	
45.12%		5.71%	2.45%	8.16%							
40.45%		2.73%	0.77%	3.50%		44.70%		3.01%	0.85%	3.86%	
4.67%		2.99%	1.68%	4.67%							
100.00%	18.16%	31.22%	46.58%	95.96%		100.00%	14.73%	31.19%	49.62%	95.54%	

PROCESS YIELD STRUCTURE

RUN No.: DOE-BU-015 M.B. No.: YP-04/ C1

FEED		PRODUCT	
wt% (coal+solvent) as is	maf	wt% (coal+solvent) as is	maf
50.0%	55.3%	19.5%	21.5%
50.0%	44.7%	0.3%	0.3%
100.0%	100.0%	13.3%	14.7%
10.9%	12.1%	4.8%	
7.0%	7.8%	1.7%	1.9%
		3.0%	3.3%
		42.0%	46.4%
2.5%	2.8%	2.1%	2.4%
		25.5%	28.2%
		3.5%	3.9%
		4.7%	
	122.6%	120.4%	122.6%

Remarks:

RUN No.: DOE-BU-015

M.B.No.: YP-05/C1

	Date	Time	Date	Time
START:			Dec. 16, 93	12:00
END:			Dec. 16, 93	20:00
DURATION (hours):				8.00

Feed:	Type	Wt% (maf)
Coal	BTH	41.88%
Solvent	V-1074	58.12%
Catalyst 1	Aluminate	2.00%
Catalyst 2	Molybdate	0.28%
Other	CS2	

OPERATING PARAMETERS:

FEED TANK WI-110:	(G)	
Start of Mass Balance		13180.00
End of Mass Balance		6020.00
Rate	(G/HR)	895
FIRST STAGE:		
Operating Pressure:	(MPa)	10.34
Feed Temp.:	(C)	283
Reactor Temp.:	(C)	
TE-201I	(BTM)	409
TE-202I		411
TE-203I		411
TE-204I	(Top)	389
Liquid Level	(mm)	540
Separator Temperature:	(C)	46
CO-Feed Rate:	(L/MIN)	4.03
Water Feed Rate:	(ML/MIN)	1.62
Temperature:	(C)	188
Catalyst Feed:	(ML/MIN)	
Liquid Product (WI-220):	(G)	
Start of Mass Balance		
End of Mass Balance		1553.20
Nitrogen Rate:	(L/MIN)	3.93
SECOND STAGE:		
Operating Pressure:	(MPa)	17.24
Feed Temp.:	(C)	137
Reactor Temp.:	(C)	
TE-301I	(BTM)	440
TE-302I		440
TE-303I		440
TE-304I		439
TE-305I		438
TE-306I		437
TE-307I		434
TE-308I	(Top)	431
TE-309I	(VAP)	430
Liquid level	(mm)	900
Separator Temperature:	(C)	45
Hydrogen Feed Rate:	(L/MIN)	34.11
Temperature:	(C)	402
Liquid Product (WI-330):	(G)	
Start of Mass Balance		1200
End of Mass Balance		5310
Bottoms Product (V-340):	(G)	
Start of Mass Balance		-880
End of Mass Balance		870
Sulfiding Agent	(mL/HR)	10.49

MEASURED GAS COMPOSITIONS

NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02	4.28	98.45	47.23
CO2	44.01	13.03	0.09	11.53
CO	28.01	23.81	0.46	26.57
H2S	34.08			
Methane	16.04	0.05	0.72	1.26
Ethylene	28.05		0.04	0.05
Ethane	30.07		0.29	0.82
Propane	44.01		0.22	0.89
Propylene	42.08			
i-Butane	58.12		0.01	0.00
n-Butane	58.12		0.09	0.55
i-Butene	56.11			
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15		0.13	1.45
Nitrogen	28.02			
TOTAL		41.17	100.49	90.3605
Gas Meter Readings		DTM-260	DTM-360	DTM-350
Start of M.B. : (L)		2290.0	7356.0	8038.0
End of M.B. : (L)		7132.0	24481.8	8100.0
Total : (L)		4842.0	17125.8	62.0
Temperature: (C)		21.8	21.4	22.8
Meter Pressure : (mmHg)		704	704	704
Standard Volume: (L)		4154	14711	53
Nitrogen to R-200: (L)		1884		
Net Gas Out: (L)		2269	14711	53

Run Conditions

Basis: MAF		First Stage	Second Stage
Pressure	Mpa	10.3	17.2
Temperature	deg C	411	440
Catalyst		Aluminate	Molybdate
Feed	wt % maf coal	41.88%	
WHSV	(kg / hr) / l	1.83	1.10
CO Rate	kg / kg maf coal	0.89	
	moles / 100g maf coal	3.17	
consumed	moles / 100g maf coal	1.02	
Water Rate	kg / kg maf coal	0.89	
	moles / 100g maf coal	4.93	
Hydrogen	kg / kg maf coal		0.54
	moles / 100g maf coal		26.94
consumed	wt % maf coal	1.28%	6.39%

OVERALL MASS BALANCE

Material In:		Grams	Material Out:		Grams
	Feed Slurry	7160		First Stage Liquid:	1553
	CO-Gas:	2420		First Stage Product Gas:	3074
	Water:	779		Second Stage Liquid:	4110
	Hydrogen:	1476		Second Stage Reactor Bottoms:	1750
	Catalyst:			Second Stage Product Gas:	1709
	S-Agent	84		Dissolved Gas:	41
TOTAL IN:		11918	TOTAL OUT:		12238
	Catalyst mf	163	OVERALL BALANCE:		102.7%

WATER BALANCE

TOTAL IN:		1134	TOTAL OUT:		1239
				WATER BALANCE:	109.2%
	Coal Conversion		wt.% maf	92.5%	
	Ash Balance		wt.%	92.4%	

PRODUCT YIELDS

Description	Total Gross			Total Net	
	[grams]		wt. % maf feed	[grams]	wt. % maf coal
	measured	normalized			
H2O	104.90	98.64	1.52%	98.64	3.62%
COx	329.56	309.91	4.76%	309.91	11.37%
H2S					
C1 to C3	206.77	194.44	2.99%	194.44	7.13%
C4 +	100.46	94.47	1.45%	94.47	3.47%
Oil	5250.68	4937.61	75.86%	1612.45	59.15%
Asphaltene	871.89	819.90	12.60%	362.18	13.29%
Preasphalt.	61.03	57.39	0.88%	57.39	2.11%
IOM	218.65	205.61	3.16%	205.61	7.54%
Total	7143.93	6717.98	103.21%	2935.09	107.67%

Simulated Distillation Profile THF-Extract						Crude Sim. Dist. (Comp. Sample)				
Fraction [deg C]	Feed [grams]	Product				Feed [grams]	Product			
		Total Gross		Total Net			Total Gross		Total Net	
		[grams]	normalized [grams]	[grams]	wt. % maf coal		[grams]	normalized [grams]	[grams]	wt. % maf coal
C4 - 182		188.91	177.65	177.65	6.52%		188.60	177.35	177.35	6.51%
182 - 343	151.32	2136.34	2008.97	1857.65	68.15%	68.09	1572.95	1479.17	1411.08	51.77%
343 - 524	3631.57	3534.11	3323.39	-308.18	-11.31%	3173.84	3491.69	3283.50	109.65	4.02%
524+		643.33	604.98	604.98	22.19%	540.95	1249.47	1174.97	634.02	23.26%
TOTAL	3782.89	6502.70	6114.98	2332.10	85.55%	3782.89	6502.70	6114.98	2332.10	85.55%
IBP - 524	3782.89	5859.37	5510.01	1727.12	63.36%	3241.93	5253.23	4940.01	1698.08	62.29%

QVS VNYTVS

		First Stage Product Gas (DTM-260)										Second Stage Product Gas (DTM-350)										Dissolved Gas (DTM-350)										
Name		Number of Samples:										Number of Samples:										Number of Samples:										
		vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	vol %	
Hydrogen	4.275	13.029	0.086	0.086	0.086	0.084	0.083	0.102	0.084	0.090	88.446	50.202	44.257	50.202	44.257	11.379	26.518	13.029	0.086	0.086	0.086	0.084	0.083	0.102	0.084	0.090	88.446	50.202	44.257	50.202	44.257	
CO2	23.812																															
H2S																																
Methane	0.050																															
Ethylene		0.032	0.031	0.031	0.029	0.031	0.028	0.031	0.070	0.030	0.037	0.052	0.046	0.052	0.046	0.049	0.825	0.032	0.031	0.031	0.029	0.031	0.028	0.031	0.070	0.030	0.037	0.052	0.046	0.049	0.825	
Propylene		0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.007	0.005	0.005	0.004	0.003	0.005	0.004	0.003	0.004	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.007	0.005	0.005	0.005	0.004	0.003	0.004	0.003
i-Butane		0.094	0.094	0.095	0.095	0.095	0.095	0.093	0.094	0.093	0.094	0.508	0.508	0.508	0.508	0.508	0.508	0.094	0.094	0.095	0.095	0.095	0.095	0.093	0.094	0.093	0.094	0.508	0.508	0.508	0.508	0.508
n-Butane																																
i-Pentane																																
n-Pentane		0.126	0.126	0.127	0.127	0.125	0.124	0.124	0.124	0.124	1.555	1.353	1.555	1.353	1.454	0.004	0.825	0.126	0.126	0.127	0.127	0.125	0.124	0.124	0.124	0.124	1.555	1.353	1.555	1.353	1.454	0.004
Nitrogen																																
TOTAL	41.166																															

GAS CALCULATIONS

Name	Mol. Weight	First Stage Product Gas (DTM-260)				Second Stage Product Gas (DTM-360)				Dissolved Gas (DTM-350)			
		Average Mol Weight:		16.59 (g/mole)		Average Mol Weight:		2.60 (g/mole)		Average Mol Weight:		17.37 (g/mole)	
		Volume		Weight (norm.)		Volume		Weight (norm.)		Volume		Weight (norm.)	
		meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%
Hydrogen	2.02	4.28	10.38	21.24	0.69	98.45	97.97	1299.07	76.02	47.23	52.27	2.50	6.08
CO ₂	44.01	13.03	31.65	1410.56	45.88	0.09	0.09	25.78	1.51	11.53	12.76	13.28	32.33
CO	28.01	23.81	57.84	1640.73	53.37	0.46	0.46	84.54	4.95	26.57	29.40	19.48	47.41
H ₂ S	34.08												
Methane	16.04	0.05	0.12	1.95	0.06	0.72	0.72	75.71	4.43	1.26	1.40	0.53	1.29
Ethylene	28.05					0.04	0.04	6.81	0.40	0.05	0.05	0.04	0.09
Ethane	30.07					0.29	0.29	56.38	3.30	0.82	0.91	0.65	1.58
Propane	44.01					0.22	0.22	63.68	3.73	0.89	0.98	1.03	2.50
Propylene	42.08												
i-Butane	58.12					0.01	0.01	2.02	0.12	0.00	0.00	0.01	0.01
n-Butane	58.12					0.09	0.09	35.69	2.09	0.55	0.61	0.84	2.04
i-Butene	56.11												
n-Butene	56.11												
C ₂ -Butene	56.11												
i-Pentane	72.15												
n-Pentane	72.15					0.13	0.12	59.15	3.46	1.45	1.61	2.75	6.68
Nitrogen	28.02												
TOTAL		41.17	100.00	3074.48	100.00	100.49	100.00	1708.83	100.00	90.36	100.00	41.09	100.00

First Stage Shift Reaction

		CO	+	H ₂ O	=	CO ₂	+	H ₂
Stochiom.	[moles]	27.81		27.81		27.81		27.81
Produced	[moles]					4.24		-17.30
Total	[moles]	27.81		27.81		32.05		10.52
Stochiom.	[grams]	779.05		501.20		1224.07		56.18
Produced	[grams]					186.49		-34.94
Total	[grams]	779.05		501.20		1410.56		21.24

Hydrocarbon Gases

		First	Second	Dissolved	Total
C1 to C3	[grams]	1.95	202.57	2.24	206.77
C4 +	[grams]		96.87	3.59	100.46
Total	[grams]	1.95	299.44	5.83	307.22

Hydrogen

		First Up-Take	In	Second Out	Up-Take	Total Up-Take
Hydrogen	[grams]	34.94	1475.80	1301.57	174.23	209.17

RUN No.: DOE-BU-015	M.B.No.: YP-05/C1
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M.B.No.: YP-05/C1

[illegible]

	Feed	V-220	Products V-340 (BTMS)	V-330
In grams of analysis sample				
Total Sample	50.30	14.70	52.27	62.69
Water	2.50	5.99		1.60
Oils+Asphaltenes	26.58	8.71	41.98	57.92
Oils	23.36	8.37	31.14	50.70
Asphaltenes	3.22	0.34	10.84	7.22
Pre-Asphaltenes			1.02	0.41
Insolubles	21.22		9.27	2.76
IOM	19.15		4.55	1.01
Ash	2.07		4.72	1.75
TOTAL	50.3	14.7	52.27	62.69

In wt% of analysis sample				
Water	4.97%	40.77%		2.55%
Oils+Asphaltenes	52.83%	59.23%	80.31%	92.39%
Oils (on fraction)	87.90%	96.12%	74.19%	87.53%
(on total)	46.44%	56.93%	59.58%	80.87%
Asphalt. (on fract.)	12.10%	3.88%	25.81%	12.47%
(on total)	6.39%	2.30%	20.73%	11.52%
Pre-Asphaltenes			1.95%	0.65%
Insolubles	42.20%		17.74%	4.41%
IOM (on fraction)	90.23%		49.09%	36.60%
(on total)	38.07%		8.71%	1.61%
Ash (on fraction)	9.78%		50.91%	63.40%
(on total)	4.12%		9.03%	2.79%
TOTAL	100.00%	100.00%	100.00%	100.00%

in grams of feed / product				
Total Feed / Product	7160	1553	1750	4110
Water	355.9	633.2		104.9
Oils+Asphaltenes	3782.9	920.0	1405.5	3797.1
Oils (on fraction)	3325.2	884.3	1042.7	3323.7
(on total)	3325.2	884.3	1042.7	3323.7
Asphalt. (on fract.)	457.7	35.7	362.8	473.4
(on total)	457.7	35.7	362.8	473.4
Pre-Asphaltenes			34.1	26.9
Insolubles	3021.2		310.4	181.1
IOM (on fraction)	2725.9		152.4	66.3
(on total)	2725.9		152.4	66.3
Ash (on fraction)	295.3		158.0	114.8
(on total)	295.3		158.0	114.8
TOTAL (as is)	7160.0	1553.2	1750.0	4110.0
TOTAL (MAF)	6508.8	920.0	1592.0	3890.3

Distillation Profile THF-Extract						D-1160		
Fractions deg C	Feed	Products				Feed	Product	
		V-220	V-340 (BTMS)	V-330	Total		Comp. Sample	
							as is	corr.
IBP - 182		45.54	23.03	19.88	88.46		88.14	88.14
182 - 343	151.32	503.13	92.14	1541.08	2136.34	68.09	1572.95	1572.95
343 - 524	3631.57	371.30	899.76	2263.05	3534.11	3173.84	3491.69	3491.69
524+			577.05	66.28	643.33	540.95	1627.19	1249.47
TOTAL	3782.89	919.97	1591.98	3890.29	6402.24	3782.89	6779.97	6402.24

Feed	V-220	Products (normalized) V-340 (BTMS)	V-330	Total	Feed	Products (normalized) V-220	V-340 (BTMS)	V-330	Total
In wt% of total feed (as is)					In wt% of total feed (MAF)				
4.69%	4.69%		1.38%	6.07%				1.52%	1.52%
52.99%	12.12%	18.51%	50.02%	80.65%	58.12%	13.29%	20.31%	54.86%	88.46%
46.58%	11.65%	13.74%	43.78%	69.17%	51.09%	12.78%	15.06%	48.02%	75.86%
6.41%	0.47%	4.78%	6.24%	11.49%	7.03%	0.52%	5.24%	6.84%	12.60%
42.32%		0.45%	0.35%	0.80%			0.49%	0.39%	0.88%
		4.40%	2.61%	7.02%					
38.18%		2.01%	0.87%	2.88%	41.88%		2.20%	0.96%	3.16%
4.14%		2.40%	1.74%	4.14%					
100.00%	16.81%	23.37%	54.37%	94.54%	100.00%	13.29%	23.00%	57.72%	94.01%

PROCESS YIELD STRUCTURE

RUN No.: DOE-BU-015

M.B. No.: YP-05/C1

FEED		PRODUCT	
wt% (coal+solvent)		wt% (coal+solvent)	
as is	maf	as is	maf
53.0%	58.1%	COx+H2	19.9% 21.8%
47.0%	41.9%	C1 - C4	0.0% 0.0%
100.0%	100.0%	Oil	12.1% 13.3%
		Water	4.7%
10.9%	12.0%	COx	1.9% 2.1%
7.0%	7.7%	C1 - C4	4.0% 4.4%
		Oil	50.4% 55.2%
		Water	1.4% 1.5%
2.4%	2.7%	Oil	19.0% 20.8%
		Coal (maf)	2.9% 3.2%
		Ash	4.1%
120.4%	122.3%		120.4% 122.3%

Remarks:

RUN No.: DOE-BU-015

M.B.No.: YP-06/C1

	Date	Time	Date	Time
START:			Dec. 16, 93	23:00
END:			Dec. 17, 93	07:00
DURATION (hours):				8.00

Feed:	Type	Wt% (maf)
Coal	BTH	41.62%
Solvent	V-1074	58.38%
Catalyst 1	Aluminate	2.00%
Catalyst 2	Molybdate	0.28%
Other	CS2	

OPERATING PARAMETERS:			
FEED TANK WI-110:	(G)		
Start of Mass Balance		12720.00	
End of Mass Balance		5490.00	
Rate	(G/HR)	904	
FIRST STAGE:			
Operating Pressure:	(MPa)	10.34	
Feed Temp.:	(C)	283	
Reactor Temp.:	(C)		
TE-201I	(BTM)	409	
TE-202I		411	
TE-203I		411	
TE-204I	(Top)	387	
Liquid Level	(mm)	540	
Separator Temperature:	(C)	46	
CO-Feed Rate:	(L/MIN)	4.03	
Water Feed Rate:	(ML/MIN)	1.75	
Temperature:	(C)	188	
Catalyst Feed:	(ML/MIN)		
Liquid Product (WI-220):	(G)		
Start of Mass Balance			
End of Mass Balance		1524.30	
Nitrogen Rate:	(L/MIN)	3.92	
SECOND STAGE:			
Operating Pressure:	(MPa)	17.24	
Feed Temp.:	(C)	137	
Reactor Temp.:	(C)		
TE-301I	(BTM)	435	
TE-302I		436	
TE-303I		436	
TE-304I		435	
TE-305I		434	
TE-306I		434	
TE-307I		4300	
TE-308I	(Top)	428	
TE-309I	(VAP)	427	
Liquid level	(mm)	900	
Separator Temperature:	(C)	45	
Hydrogen Feed Rate:	(L/MIN)	34.09	
Temperature:	(C)	402	
Liquid Product (WI-330):	(G)		
Start of Mass Balance		1300	
End of Mass Balance		5720	
Bottoms Product (V-340):	(G)		
Start of Mass Balance		-1210	
End of Mass Balance		210	
Sulfiding Agent	(mL/HR)	10.42	

MEASURED GAS COMPOSITIONS				
NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02	4.28	95.47	74.34
CO2	44.01	13.03	0.10	13.69
CO	28.01	23.81	0.49	8.86
H2S	34.08			
Methane	16.04	0.50	0.60	2.06
Ethylene	28.05		0.03	0.12
Ethane	30.07		0.23	1.70
Propane	44.01		0.18	2.04
Propylene	42.08			
i-Butane	58.12		0.00	0.08
n-Butane	58.12		0.08	1.21
i-Butene	56.11			
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15		0.11	2.50
Nitrogen	28.02			
TOTAL		41.61	97.28	106.6
Gas Meter Readings				
DTM-260	DTM-360	DTM-350		
Start of M.B. : (L)	7888.0	9373.0	8337.0	
End of M.B. : (L)	12749.0	26395.6	8404.0	
Total : (L)	4861.0	17022.6	67.0	
Temperature: (C)	22.2	21.4	22.8	
Meter Pressure : (mmHg)	706	706	706	
Standard Volume: (L)	4173	14654	57	
Nitrogen to R-200: (L)	1882			
Net Gas Out: (L)	2291	14654	57	

Run Conditions			
Basis: MAF		First Stage	Second Stage
Pressure	Mpa	10.3	17.2
Temperature	deg C	411	436
Catalyst		Aluminate	Molybdate
Feed	wt % maf coal	41.62%	
WHSV	(kg / hr) / l	1.85	1.11
CO Rate	kg / kg maf coal	0.87	
	moles / 100g maf coal	3.12	
consumed	moles / 100g maf coal	1.01	
Water Rate	kg / kg maf coal	0.87	
	moles / 100g maf coal	4.85	
Hydrogen	kg / kg maf coal		0.53
	moles / 100g maf coal		26.52
consumed	wt % maf coal	1.27%	6.33%

OVERALL MASS BALANCE

Material In:		Grams	Material Out:		Grams
	Feed Slurry	7230		First Stage Liquid:	1524
	CO-Gas:	2419		First Stage Product Gas:	3088
	Water:	841		Second Stage Liquid:	4420
	Hydrogen:	1475		Second Stage Reactor Bottoms:	1420
	Catalyst:			Second Stage Product Gas:	1672
	S-Agent	83		Dissolved Gas:	34
TOTAL IN:		12048	TOTAL OUT:		12158
	Catalyst mf	165	OVERALL BALANCE: 100.9%		

WATER BALANCE

TOTAL IN: 1106		TOTAL OUT: 1246	
		WATER BALANCE: 112.6%	

	Coal Conversion	wt.% maf	93.2%
	Ash Balance	wt.%	87.7%

PRODUCT YIELDS

Description	Total Gross			Total Net	
	[grams]		wt. % maf feed	[grams]	wt. % maf coal
	measured	normalized			
H2O	139.52	134.95	2.03%	134.95	4.88%
COx	326.15	315.47	4.74%	315.47	11.40%
H2S					
C1 to C3	192.41	186.11	2.80%	186.11	6.72%
C4 +	90.30	87.34	1.31%	87.34	3.16%
Oil	5184.39	5014.57	75.42%	1602.73	57.91%
Asphaltene	898.99	869.54	13.08%	399.88	14.45%
Preasphalt.	64.43	62.32	0.94%	62.32	2.25%
IOM	195.65	189.24	2.85%	189.24	6.84%
Total	7091.84	6859.54	103.16%	2978.04	107.60%

Simulated Distillation Profile THF-Extract						Crude Sim. Dist. (Comp. Sample)				
Fraction [deg C]	Feed [grams]	Product				Feed [grams]	Product			
		Total Gross		Total Net			Total Gross		Total Net	
		[grams]	normalized [grams]	[grams]	wt. % maf coal		[grams]	normalized [grams]	[grams]	wt. % maf coal
C4 - 182		175.85	170.09	170.09	6.15%		198.46	191.96	191.96	6.94%
182 - 343	155.26	1987.51	1922.41	1767.15	63.85%	69.87	1412.83	1366.55	1296.69	46.85%
343 - 524	3726.23	3714.21	3592.55	-133.69	-4.83%	3256.57	3420.54	3308.50	51.93	1.88%
524+		556.18	537.96	537.96	19.44%	555.05	1401.92	1356.00	800.95	28.94%
TOTAL	3881.49	6433.76	6223.01	2341.52	84.60%	3881.49	6433.76	6223.01	2341.52	84.60%
IBP - 524	3881.49	5877.58	5685.05	1803.56	65.16%	3326.44	5031.84	4867.01	1540.57	55.66%

QAS ANALYSIS

RUN No.: DOE-BU-015

M.B.No.: YP-06/C1

GAS CALCULATIONS

Name	Mol.Weight	First Stage Product Gas (DTM-260)				Second Stage Product Gas (DTM-360)				Dissolved Gas (DTM-350)			
		Average Mol Weight:		16.58 (g/mole)		Average Mol Weight:		2.56 (g/mole)		Average Mol Weight:		13.45 (g/mole)	
		Volume		Weight (norm.)		Volume		Weight (norm.)		Volume		Weight (norm.)	
		meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%
Hydrogen	2.02	4.28	10.27	21.22	0.69	95.47	98.13	1296.21	77.55	74.34	69.74	3.61	10.47
CO ₂	44.01	13.03	31.31	1408.70	45.62	0.10	0.10	30.02	1.80	13.69	12.84	14.48	42.02
CO	28.01	23.81	57.23	1638.57	53.06	0.49	0.50	92.49	5.53	8.86	8.31	5.96	17.31
H ₂ S	34.08												
Methane	16.04	0.50	1.19	19.51	0.63	0.60	0.62	64.66	3.87	2.06	1.93	0.79	2.30
Ethylene	28.05					0.03	0.03	5.23	0.31	0.12	0.11	0.08	0.24
Ethane	30.07					0.23	0.24	46.84	2.80	1.70	1.59	1.23	3.56
Propane	44.01					0.18	0.18	51.92	3.11	2.04	1.91	2.16	6.26
Propylene	42.08												
i-Butane	58.12					0.00	0.00	1.27	0.08	0.08	0.08	0.12	0.34
n-Butane	58.12					0.08	0.08	29.30	1.75	1.21	1.13	1.69	4.89
i-Butene	56.11												
n-Butene	56.11												
C ₂ -Butene	56.11												
i-Pentane	72.15												
n-Pentane	72.15					0.11	0.11	53.59	3.21	2.50	2.35	4.34	12.60
Nitrogen	28.02												
TOTAL		41.61	100.00	3087.99	100.00	97.28	100.00	1671.53	100.00	106.60	100.00	34.45	100.00

First Stage Shift Reaction

		CO	+	H ₂ O	=	CO ₂	+	H ₂
Stochiom.	[moles]	27.85		27.85		27.85		27.85
Produced	[moles]					4.16		-17.34
Total	[moles]	27.85		27.85		32.01		10.50
Stochiom.	[grams]	779.97		501.78		1225.50		56.25
Produced	[grams]					183.20		-35.03
Total	[grams]	779.97		501.78		1408.70		21.22

Hydrocarbon Gases

		First	Second	Dissolved	Total
C1 to C3	[grams]	19.51	168.65	4.26	192.41
C4 +	[grams]		84.16	6.14	90.30
Total	[grams]	19.51	252.80	10.40	282.71

Hydrogen

		First Up-Take	In	Second Out	Up-Take	Total Up-Take
Hydrogen	[grams]	35.03	1475.10	1299.82	175.28	210.31

M.B.No.: YP-06/C1

M.B.No.: YP-06/C1

[illegible]

	Feed	V-220	Products V-340 (BTTMS)	V-330
----- In grams of analysis sample -----				
Total Sample	54.56	14.70	49.02	63.36
Water	2.00	5.83		2.00
Oils+Asphaltenes	29.29	8.87	39.39	57.66
Oils	25.75	8.53	28.97	49.61
Asphaltenes	3.54	0.34	10.42	8.05
Pre-Asphaltenes			1.02	0.50
Insolubles	23.27		8.61	3.20
IOM	20.89		4.11	1.10
Ash	2.38		4.50	2.10
TOTAL	54.56	14.7	49.02	63.36

----- In wt% of analysis sample -----				
Water	3.67%	39.65%		3.16%
Oils+Asphaltenes	53.69%	60.35%	80.35%	91.00%
Oils (on fraction)	87.90%	96.12%	73.55%	86.04%
(on total)	47.19%	58.01%	59.10%	78.30%
Asphalt. (on fract.)	12.10%	3.88%	26.45%	13.96%
(on total)	6.50%	2.34%	21.25%	12.70%
Pre-Asphaltenes			2.08%	0.79%
Insolubles	42.65%		17.57%	5.05%
IOM (on fraction)	89.76%		47.78%	34.26%
(on total)	38.28%		8.39%	1.73%
Ash (on fraction)	10.24%		52.22%	65.74%
(on total)	4.37%		9.17%	3.32%
TOTAL	100.00%	100.00%	100.00%	100.00%

----- In grams of feed / product -----				
Total Feed / Product	7230	1524	1420	4420
Water	265.0	604.3		139.5
Oils+Asphaltenes	3881.5	920.0	1141.0	4022.4
Oils (on fraction)	3411.8	884.3	839.2	3460.9
(on total)	3411.8	884.3	839.2	3460.9
Asphalt. (on fract.)	469.7	35.7	301.8	561.5
(on total)	469.7	35.7	301.8	561.5
Pre-Asphaltenes			29.5	34.9
Insolubles	3083.5		249.5	223.2
IOM (on fraction)	2767.7		119.2	76.5
(on total)	2767.7		119.2	76.5
Ash (on fraction)	315.7		130.3	146.7
(on total)	315.7		130.3	146.7
TOTAL (as is)	7230.0	1524.3	1420.0	4420.0
TOTAL (MAF)	6649.2	920.0	1289.7	4133.8

Distillation Profile THF-Extract						D-1160		
Fractions deg C	Feed	Products				Feed	Product	
		V-220	V-340 (BTTMS)	V-330	Total		Comp. Sample	
							as is	corr.
IBP - 182		45.54	14.05	25.97	85.55		108.16	108.16
182 - 343	155.26	503.13	65.55	1418.83	1987.51	69.87	1412.83	1412.83
343 - 524	3726.23	371.30	730.42	2612.49	3714.21	3256.57	3420.54	3420.54
524+			479.72	76.46	556.18	555.05	1818.43	1401.92
TOTAL	3881.49	919.97	1289.74	4133.75	6343.46	3881.49	6759.97	6343.46

Feed	Products (normalized)				Feed	Products (normalized)			
	V-220	V-340	V-330	Total		V-220	V-340	V-330	Total
	(BTTMS)					(BTTMS)			
----- in wt% of total feed (as is) -----					----- in wt% of total feed (MAF) -----				
3.55%	3.55%		1.87%	5.42%				2.03%	2.03%
53.75%	12.32%	15.28%	53.88%	81.48%	58.38%	13.38%	16.60%	58.51%	88.49%
47.25%	11.84%	11.24%	46.36%	69.44%	51.31%	12.86%	12.21%	50.34%	75.42%
6.50%	0.48%	4.04%	7.52%	12.04%	7.06%	0.52%	4.39%	8.17%	13.08%
		0.40%	0.47%	0.86%			0.43%	0.51%	0.94%
42.70%		3.65%	3.34%	6.99%					
38.33%		1.60%	1.02%	2.62%	41.62%		1.73%	1.11%	2.85%
4.37%		2.06%	2.32%	4.37%					
100.00%	15.87%	19.33%	59.55%	94.76%					
					100.00%	13.38%	18.76%	62.16%	94.31%

PROCESS YIELD STRUCTURE

RUN No.: DOE-BU-015

M.B. No.: YP-06/C1

FEED		PRODUCT	
wt% (coal+solvent)		wt% (coal+solvent)	
as is	maf	as is	maf
53.8%	58.4%	COx+H2	19.7% 21.4%
46.2%	41.6%	C1 - C4	0.3% 0.3%
100.0%	100.0%	Oil	12.3% 13.4%
		Water	3.5%
10.8%	11.7%	COx	1.9% 2.1%
6.9%	7.5%	C1 - C4	3.5% 3.8%
		Oil	54.3% 59.0%
		Water	1.9% 2.0%
2.4%	2.6%	Oil	15.7% 17.0%
		Coal (maf)	2.6% 2.8%
		Ash	4.4%
120.2%	121.9%	120.2%	121.9%

Remarks:

SUMMARY OF BENCH UNIT TEST RUNS

RUN No.:	DOE-BU-016		DOE-BU-017		
M.B.No.:	YP-01/ C1	YP-02/ C1	YP-01/ C1	YP-02/ C1	YP-03/ C1
Coal	Illinois#6	Illinois#6	Illinois#6	Illinois#6	Illinois#6
wt % maf	32.56%	32.56%	39.80%	38.15%	39.87%
First Stage:					
Feed Rate (kg / hr) / IWHSV					
Pressure Mpa					
Temperatu deg C					
Catalyst					
CO Rate kg / kg maf coal					
moles / 100g maf coal					
consumed moles / 100g maf coal					
Water Rate kg / kg maf coal					
moles / 100g maf coal					
Hydrogen wt % maf coal					
Second Stage:					
Feed Rate (kg / hr) / IWHSV	0.92	0.80	1.06	0.94	0.88
Pressure Mpa	17.24	17.24	17.24	17.24	17.24
Temperatu deg C	428	440	428	442	431
Catalyst	FeO+DMDS	FeO+DMDS	Moly+DMDS	Moly+DMDS	Moly+DMDS
Hydrogen kg / kg maf coal	0.69	0.79	0.57	0.67	0.69
moles / 100g maf coal	34.22	39.55	28.37	33.30	34.34
consumed wt % maf coal	3.50%	4.55%	2.47%	2.46%	1.82%
Coal Conversion (wt % maf coal)					
	82.85%	87.42%	86.01%	87.83%	89.36%
Product Yield (wt % maf coal)					
H2O	-0.74%	0.40%	-0.90%	0.18%	0.01%
COx	1.09%	1.04%	0.89%	0.75%	0.69%
H2S	0.76%	1.30%	1.75%	1.73%	1.22%
C1 to C3					
	5.97%	9.17%	4.32%	6.56%	3.90%
Pentane soluble (incl. C4)	30.76%	35.36%	41.87%	40.89%	40.94%
Asphaltenes	44.32%	41.90%	36.77%	35.82%	39.45%
Preasphalt.	4.19%	2.81%	3.78%	4.35%	4.97%
IOM	17.15%	12.58%	13.99%	12.17%	10.64%
TOTAL	96.42%	92.64%	96.41%	93.24%	96.01%

NOTE:

RUN No.: DOE-BU-016

M.B.No.: YP-01/ C1

	Date	Time	Date	Time
START:			Mar. 24, 94	23:00
END:			Mar. 25, 94	05:00
DURATION (hours):				6.00

Feed:	Type	Wt% (maf)
Coal	Illinois#6	32.56%
Solvent	O-43	67.44%
Catalyst 1		
Catalyst 2	FeO+DMDS	
Other		

OPERATING PARAMETERS:

FEED TANK WI-110):	(G)	
Start of Mass Balance		12410.00
End of Mass Balance		7650.00
Rate	(G/HR)	793
FIRST STAGE:		
Operating Pressure:	(MPa)	
Feed Temp.:	(C)	
Reactor Temp.:	(C)	
TE-201I	(BTM)	
TE-202I		
TE-203I		
TE-204I	(Top)	
Liquid Level	(mm)	
Separator Temperature:	(C)	
CO-Feed Rate:	(L/MIN)	
Water Feed Rate:	(ML/MIN)	
Temperature:	(C)	
Catalyst Feed:	(ML/MIN)	
Liquid Product (WI-220):	(G)	
Start of Mass Balance		
End of Mass Balance		
Nitrogen Rate:	(L/MIN)	5.89
SECOND STAGE:		
Operating Pressure:	(MPa)	17.24
Feed Temp.:	(C)	138
Reactor Temp.:	(C)	
TE-301I	(BTM)	426
TE-302I		427
TE-303I		429
TE-304I		429
TE-305I		429
TE-306I		429
TE-307I		423
TE-308I	(Top)	422
TE-309I	(VAP)	419
Liquid level	(mm)	950
Separator Temperature:	(C)	45
Hydrogen Feed Rate:	(L/MIN)	30.22
Temperature:	(C)	399
Liquid Product (WI-330):	(G)	
Start of Mass Balance		
End of Mass Balance		969
Bottoms Product (V-340):	(G)	
Start of Mass Balance		705
End of Mass Balance		3820
Sulfiding Agent	(mL/HR)	9.65

MEASURED GAS COMPOSITIONS

NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02		83.36	86.20
CO2	44.01		0.06	0.17
CO	28.01			
H2S	34.08		0.05	2.43
Methane	16.04		0.42	0.97
Ethylene	28.05		0.02	0.05
Ethane	30.07		0.09	0.53
Propane	44.01		0.08	0.70
Propylene	42.08			
i-Butane	58.12		0.00	0.06
n-Butane	58.12		0.04	0.69
i-Butene	56.11			
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15		0.10	1.35
Nitrogen	28.02			
TOTAL			84.21	93.154667
Gas Meter Readings				
		DTM-260	DTM-360	DTM-350
Start of M.B. : (L)				
End of M.B. : (L)			14710.0	14.0
Total : (L)			14710.0	14.0
Temperature: (C)		22.2	21.6	23.3
Meter Pressure : (mmHg)		699	699	699
Standard Volume: (L)			12538	12
Nitrogen to R-200: (L)			2119	
Net Gas Out: (L)			10419	12

Run Conditions

Basis: MAF		First Stage	Second Stage
Pressure	Mpa		17.2
Temperature	deg C		428
Catalyst			FeO+DMDS
Feed	wt % maf coal	32.56%	
WHSV	(kg / hr) / l		0.92
CO Rate	kg / kg maf coal		
	moles / 100g maf coal		
consumed	moles / 100g maf coal		
Water Rate	kg / kg maf coal		
	moles / 100g maf coal		
Hydrogen	kg / kg maf coal		0.69
	moles / 100g maf coal		34.22
consumed	wt % maf coal		3.50%

RUN No.: DOE-BU-016 M.B.No.: YP-01/ C1

OVERALL MASS BALANCE			
Material In:	Grams	Material Out:	Grams
Feed Slurry	4760	First Stage Liquid:	
CO-Gas:		First Stage Product Gas:	
Water:		Second Stage Liquid:	969
Hydrogen:	981	Second Stage Reactor Bottoms:	3115
Catalyst:		Second Stage Product Gas:	1080
S-Agent	58	Dissolved Gas:	3
TOTAL IN:	5798	TOTAL OUT:	5166
Catalyst mf		OVERALL BALANCE:	89.1%

WATER BALANCE			
TOTAL IN:	142	TOTAL OUT:	133
		WATER BALANCE:	93.6%

	Coal Conversion	wt. % maf	82.8%
	Ash Balance	wt. %	108.6%

PRODUCT YIELDS					
Description	Total Gross			Total Net	
	[grams]		wt. % maf feed	[grams]	wt. % maf coal
	measured	----- normalized -----			
H2O	-9.15	-10.57	-0.24%	-10.57	-0.74%
COx	13.49	15.58	0.36%	15.58	1.09%
H2S	9.35	10.80	0.25%	10.80	0.76%
C1 to C3	73.67	85.09	1.94%	85.09	5.97%
C4 +	55.28	63.86	1.46%	63.86	4.48%
Oil	2844.77	3286.12	75.06%	374.55	26.28%
Asphaltene	582.60	672.99	15.37%	631.65	44.32%
Preasphalt.	51.76	59.79	1.37%	59.79	4.19%
IOM	211.64	244.47	5.58%	244.47	17.15%
Total	3833.39	4428.12	101.14%	1475.22	103.50%

Simulated Distillation Profile THF-Extract						Crude Sim. Dist. Comp. Sample)				
Fraction [deg C]	Feed [grams]	Product				Feed [grams]	Product			
		Total Gross		Total Net			Total Gross		Total Net	
		[grams]	----- normalized -----		[grams]		wt. % maf coal	[grams]	----- normalized -----	
[grams]	[grams]		[grams]	wt. % maf coal		[grams]			[grams]	wt. % maf coal
C4 - 182		55.28	63.86	63.86	4.48%		98.74	114.06	114.06	8.00%
182 - 343						53.15	588.70	680.03	626.88	43.98%
343 - 524						2477.49	2121.69	2450.86	-26.63	-1.87%
524+		211.64	244.47	244.47	17.15%	422.27	936.91	1082.27	660.01	46.30%
TOTAL		266.92	308.33	308.33	21.63%	2952.91	3746.04	4327.23	1374.32	96.42%
IBP - 524		55.28	63.86	63.86	4.48%	2530.64	2809.13	3244.95	714.31	50.11%

RUN No.: DOE-BU-016

M.B.No.: YP-01/C1

GAS ANALYSIS

GAS ANALYSIS																					
	First Stage Product Gas (DTM-260)							Second Stage Product Gas (DTM-360)							Dissolved Gas (DTM-350)						
Name	Number of Samples: 1							Number of Samples: 6							Number of Samples: 1						
	vol %	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%	
Hydrogen								84.388	83.522	83.243	83.981	82.681	82.372	83.358	88.202						86.202
CO2								0.081	0.058	0.055	0.058	0.051	0.049	0.055	0.168						0.168
CO																					
H2S								0.055	0.051	0.029	0.048	0.043	0.059	0.047	2.433						2.433
Methane								0.453	0.423	0.395	0.408	0.403	0.414	0.416	0.969						0.969
Ethylene								0.015	0.014	0.017	0.017	0.017	0.018	0.016	0.048						0.048
Ethane								0.092	0.092	0.092	0.095	0.092	0.093	0.093	0.529						0.529
Propane								0.077	0.077	0.078	0.077	0.078	0.077	0.077	0.701						0.701
Propylene																					
i-Butane								0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.056						0.056
n-Butane								0.043	0.044	0.042	0.042	0.042	0.043	0.043	0.693						0.693
i-Butene																					
n-Butene																					
C2-Butene																					
i-Pentane																					
n-Pentane								0.098	0.099	0.099	0.099	0.099	0.101	0.099	1.354						1.354
Nitrogen																					
TOTAL								85.288	84.384	84.052	84.805	83.488	83.228	84.207	93.155						93.155

RUN No.: DOE-BU-016

M.B.No.: YP-01/ C1

GAS CALCULATIONS

Name	Mol.Weight	First Stage Product Gas (DTM-260)				Second Stage Product Gas (DTM-360)				Dissolved Gas (DTM-350)			
		Average Mol Weight: (g/mole)				Average Mol Weight: 1.93 (g/mole)				Average Mol Weight: 5.04 (g/mole)			
		Volume		Weight (norm.)		Volume		Weight (norm.)		Volume		Weight (norm.)	
		meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%
Hydrogen	2.02					83.36	98.99	929.68	86.10	86.20	92.54	0.99	37.10
CO2	44.01					0.06	0.07	13.45	1.25	0.17	0.18	0.04	1.58
CO	28.01												
H2S	34.08					0.05	0.06	8.88	0.82	2.43	2.61	0.47	17.66
Methane	16.04					0.42	0.49	36.81	3.41	0.97	1.04	0.09	3.31
Ethylene	28.05					0.02	0.02	2.48	0.23	0.05	0.05	0.01	0.29
Ethane	30.07					0.09	0.11	15.38	1.42	0.53	0.57	0.09	3.39
Propane	44.01					0.08	0.09	18.63	1.73	0.70	0.75	0.18	6.58
Propylene	42.08												
i-Butane	58.12					0.00	0.00	1.28	0.12	0.06	0.06	0.02	0.70
n-Butane	58.12					0.04	0.05	13.69	1.27	0.69	0.74	0.23	8.58
i-Butene	56.11												
n-Butene	56.11												
C2-Butene	56.11												
i-Pentane	72.15												
n-Pentane	72.15					0.10	0.12	39.50	3.66	1.35	1.45	0.56	20.82
Nitrogen	28.02												
TOTAL						84.21	100.00	1079.78	100.00	93.15	100.00	2.67	100.00

First Stage Shift Reaction

		CO	+	H2O	=	CO2	+	H2
Stochiom.	[moles]							
Produced	[moles]							
Total	[moles]							
Stochiom.	[grams]							
Produced	[grams]							
Total	[grams]							

Hydrocarbon Gases

	First	Second	Dissolved	Total
C1 to C3 [grams]		73.30	0.36	73.67
C4 + [grams]		54.48	0.80	55.28
Total [grams]		127.78	1.16	128.95

Hydrogen

	First Up-Take	In	Second Out	Up-Take	Total Up-Take
Hydrogen [grams]		980.52	930.67	49.86	49.86

M.B.No.: YP-01/ C1

[illegible]

RUN No.: DOE-BU-016

M.B.No.: YP-01/ C1

	Feed	V-220	Products V-340 (BTMS)	V-330
----- in grams of analysis sample -----				
Total Sample	46.88		52.36	61.93
Water	1.40			8.50
Oils+Asphaltenes	29.08		43.56	53.43
Oils	28.68		33.94	52.77
Asphaltenes	0.41		9.62	0.66
Pre-Asphaltenes			0.87	
Insolubles	16.40		7.93	
IOM	14.04		3.56	
Ash	2.36		4.37	
TOTAL	46.88		52.36	61.93
----- in wt% of analysis sample -----				
Water	2.99%			13.73%
Oils+Asphaltenes	62.04%		83.19%	86.27%
Oils (on fraction)	98.60%		77.92%	98.76%
(on total)	61.17%		64.82%	85.21%
Asphalt. (on fract.)	1.40%		22.08%	1.24%
(on total)	0.87%		18.37%	1.07%
Pre-Asphaltenes			1.66%	
Insolubles	34.98%		15.15%	
IOM (on fraction)	85.61%		44.85%	
(on total)	29.94%		6.79%	
Ash (on fraction)	14.39%		55.15%	
(on total)	5.03%		8.35%	
TOTAL	100.00%		100.00%	100.00%
----- in grams of feed / product -----				
Total Feed / Product	4760	0	3115	969
Water	142.2			133.0
Oils+Asphaltenes	2952.9		2591.4	836.0
Oils (on fraction)	2911.6		2019.1	825.6
(on total)	2911.6		2019.1	825.6
Asphalt. (on fract.)	41.3		572.2	10.4
(on total)	41.3		572.2	10.4
Pre-Asphaltenes			51.8	
Insolubles	1664.9		471.9	
IOM (on fraction)	1425.4		211.6	
(on total)	1425.4		211.6	
Ash (on fraction)	239.6		260.2	
(on total)	239.6		260.2	
TOTAL (as is)	4760.0		3115.0	969.0
TOTAL (MAF)	4378.3	0.0	2854.8	836.0

Distillation Profile THF-Extract						D-1160		
Fractions deg C	Feed	Products				Feed	Product	
		V-220	V-340 (BTMS)	V-330	Total		Comp. Sample as is	corr.
IBP - 182							43.46	43.46
182 - 343						53.15	588.70	588.70
343 - 524						2477.49	2121.69	2121.69
524+			211.64		211.64	422.27	1197.15	936.91
TOTAL			211.64		211.64	2952.91	3951.00	3690.76

Feed	Products (normalized)				Feed	Products (normalized)			
	V-220	V-340 (BTMS)	V-330	Total		V-220	V-340 (BTMS)	V-330	Total
----- in wt% of total feed (as is) -----					----- in wt% of total feed (MAF) -----				
						ERR			
3.43%			3.21%	3.21%				-0.24%	-0.24%
61.75%		62.60%	20.19%	82.79%	67.44%		68.37%	22.06%	90.43%
60.89%		48.77%	19.94%	68.72%	66.50%		53.27%	21.78%	75.06%
0.86%		13.82%	0.25%	14.07%	0.94%		15.10%	0.27%	15.37%
		1.25%		1.25%			1.37%		1.37%
34.82%		10.12%		10.12%					
29.81%		5.11%		5.11%	32.56%		5.58%		5.58%
5.01%		5.01%		5.01%					
100.00%		73.97%	23.41%	97.38%					
					100.00%		75.32%	21.82%	97.13%

PROCESS YIELD STRUCTURE

RUN No.: DOE-BU-016

M.B. No.: YP-01/ C1

FEED
wt% (coal+solvent)
as is maf

PRODUCT
wt% (coal+solvent)
as is maf

61.7%	67.4%	Solvent	COx+H2		
38.3%	32.6%	Coal	C1 - C4		
100.0%	100.0%		Oil		
		CO (shift)	Water		
		Water (shift)			
			COx	0.6%	0.6%
			C1 - C4	3.1%	3.4%
			Oil	20.2%	22.1%
			Water	3.2%	-0.2%
1.0%	1.1%	Hydrogen (consumed)			
			Oil	63.8%	69.7%
			Coal (maf)	5.1%	5.6%
			Ash	5.0%	
101.0%	101.1%			101.0%	101.1%

Remarks:

RUN No.: DOE-BU-016

M.B.No.: YP-02/ C1

	Date	Time	Date	Time
START:			Mar. 25, 94	09:00
END:			Mar. 25, 94	17:00
DURATION (hours):				8.00

Feed:	Type	Wt% (maf)
Coal	Illinois#6	32.56%
Solvent	O-43	67.44%
Catalyst 1		
Catalyst 2	FeO+DMDS	
Other		

OPERATING PARAMETERS:

FEED TANK WI-110): (G)		
Start of Mass Balance		8820.00
End of Mass Balance		3330.00
Rate	(G/HR)	686
FIRST STAGE:		
Operating Pressure:	(MPa)	
Feed Temp.:	(C)	
Reactor Temp.:	(C)	
TE-201I	(BTM)	
TE-202I		
TE-203I		
TE-204I	(Top)	
Liquid Level	(mm)	
Separator Temperature:	(C)	
CO-Feed Rate:	(L/MIN)	
Water Feed Rate:	(ML/MIN)	
Temperature:	(C)	
Catalyst Feed:	(ML/MIN)	
Liquid Product (WI-220):	(G)	
Start of Mass Balance		
End of Mass Balance		
Nitrogen Rate:	(L/MIN)	5.88
SECOND STAGE:		
Operating Pressure:	(MPa)	17.24
Feed Temp.:	(C)	138
Reactor Temp.:	(C)	
TE-301I	(BTM)	437
TE-302I		439
TE-303I		440
TE-304I		440
TE-305I		440
TE-306I		440
TE-307I		433
TE-308I	(Top)	432
TE-309I	(VAP)	420
Liquid level	(mm)	950
Separator Temperature:	(C)	45
Hydrogen Feed Rate:	(L/MIN)	30.21
Temperature:	(C)	399
Liquid Product (WI-330):	(G)	
Start of Mass Balance		495
End of Mass Balance		1880
Bottoms Product (V-340):	(G)	
Start of Mass Balance		1590
End of Mass Balance		5100
Sulfiding Agent	(mL/HR)	7.24

MEASURED GAS COMPOSITIONS

NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02		80.54	86.20
CO2	44.01		0.05	0.17
CO	28.01			
H2S	34.08		0.07	2.43
Methane	16.04		0.52	0.97
Ethylene	28.05		0.02	0.05
Ethane	30.07		0.13	0.53
Propane	44.01		0.12	0.70
Propylene	42.08			
i-Butane	58.12		0.01	0.06
n-Butane	58.12		0.06	0.69
i-Butene	56.11			
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15		0.14	1.35
Nitrogen	28.02			
TOTAL			81.66	93.154667
Gas Meter Readings				
Start of M.B. : (L)		DTM-260	DTM-360	DTM-350
End of M.B. : (L)			19500.0	7.0
Total : (L)			19500.0	7.0
Temperature: (C)		22.2	20.6	21.0
Meter Pressure : (mmHg)		699	699	699
Standard Volume: (L)			16677	6
Nitrogen to R-200: (L)			2823	
Net Gas Out: (L)			13855	6

Run Conditions

Basis: MAF		First Stage	Second Stage
Pressure	Mpa		17.2
Temperature	deg C		440
Catalyst			FeO+DMDS
Feed	wt % maf coal	32.56%	
WHSV	(kg / hr) / l		0.80
CO Rate	kg / kg maf coal		
	moles / 100g maf coal		
consumed	moles / 100g maf coal		
Water Rate	kg / kg maf coal		
	moles / 100g maf coal		
Hydrogen	kg / kg maf coal		0.79
	moles / 100g maf coal		39.55
consumed	wt % maf coal		4.55%

RUN No.: DOE-BU-016

M.B.No.: YP-02/C1

GAS ANALYSIS

Name	First Stage Product Gas (DTM-260)							Second Stage Product Gas (DTM-360)							Dissolved Gas (DTM-350)						
	Number of Samples: 1							Number of Samples: 6							Number of Samples: 1						
	vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	Av. vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	Av. vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	Av. vol. %
Hydrogen								80.168	81.298	81.230	80.179	80.197	80.170	80.340	88.202						86.202
CO ₂								0.049	0.049	0.050	0.046	0.045	0.042	0.047	0.168						0.168
CO																					
H ₂ S								0.078	0.055	0.079	0.081	0.076	0.079	0.075	2.433						2.433
Methane								0.502	0.488	0.567	0.506	0.500	0.548	0.518	0.969						0.969
Ethylene								0.021	0.025	0.025	0.022	0.022	0.022	0.023	0.048						0.048
Ethane								0.131	0.138	0.136	0.135	0.135	0.134	0.135	0.529						0.529
Propane								0.115	0.119	0.119	0.119	0.119	0.119	0.118	0.701						0.701
Propylene																					
i-Butane								0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.056						0.056
n-Butane								0.063	0.065	0.065	0.064	0.064	0.064	0.064	0.693						0.693
i-Butene																					
n-Butene																					
C2-Butene																					
i-Pentane																					
n-Pentane								0.132	0.135	0.138	0.139	0.137	0.138	0.137	1.354						1.354
Nitrogen																					
TOTAL								81.284	82.379	82.418	81.298	81.302	81.321	81.663	93.155						93.155

RUN No.: DOE-BU-016

M.B.No.: YP-02/ C1

GAS CALCULATIONS

Name	Mol.Weight	First Stage Product Gas (DTM-260)				Second Stage Product Gas (DTM-360)				Dissolved Gas (DTM-350)			
		Average Mol Weight:		(g/mole)		Average Mol Weight:		2.03 (g/mole)		Average Mol Weight:		5.04 (g/mole)	
		Volume		Weight (norm.)		Volume		Weight (norm.)		Volume		Weight (norm.)	
		meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%
Hydrogen	2.02					80.54	98.62	1231.65	81.55	86.20	92.54	0.50	37.10
CO2	44.01					0.05	0.06	15.60	1.03	0.17	0.18	0.02	1.58
CO	28.01												
H2S	34.08					0.07	0.09	19.26	1.28	2.43	2.61	0.24	17.66
Methane	16.04					0.52	0.63	62.92	4.17	0.97	1.04	0.04	3.31
Ethylene	28.05					0.02	0.03	4.85	0.32	0.05	0.05	0.00	0.29
Ethane	30.07					0.13	0.17	30.69	2.03	0.53	0.57	0.05	3.39
Propane	44.01					0.12	0.14	39.43	2.61	0.70	0.75	0.09	6.58
Propylene	42.08												
i-Butane	58.12					0.01	0.01	3.08	0.20	0.06	0.06	0.01	0.70
n-Butane	58.12					0.06	0.08	28.23	1.87	0.69	0.74	0.12	8.58
i-Butene	56.11												
n-Butene	56.11												
C2-Butene	56.11												
i-Pentane	72.15												
n-Pentane	72.15					0.14	0.17	74.56	4.94	1.35	1.45	0.28	20.82
Nitrogen	28.02												
TOTAL						81.66	100.00	1510.29	100.00	93.15	100.00	1.34	100.00

First Stage Shift Reaction

		CO	+	H2O	=	CO2	+	H2
Stochiom.	[moles]							
Produced	[moles]							
Total	[moles]							
Stochiom.	[grams]							
Produced	[grams]							
Total	[grams]							

Hydcarbon Gases

		First	Second	Dissolved	Total
C1 to C3	[grams]		137.89	0.18	138.07
C4 +	[grams]		105.87	0.40	106.28
Total	[grams]		243.76	0.59	244.35

Hydrogen

		First Up-Take	In	Second Out	Up-Take	Total Up-Take
Hydrogen	[grams]		1306.92	1232.15	74.76	74.76

M.B.No.: YP-02/ C1

	Feed	V-220	Products V-340 (BTMS)	V-330
----- in grams of analysis sample -----				
Total Sample	46.88		52.30	61.93
Water	1.40		0.20	7.00
Oils+Asphaltenes	29.08		43.89	54.93
Oils	28.68		34.01	54.46
Asphaltenes	0.41		9.89	0.47
Pre-Asphaltenes			0.63	
Insolubles	16.40		7.58	
IOM	14.04		2.82	
Ash	2.36		4.75	
TOTAL	46.88		52.3	61.93

----- in wt% of analysis sample -----				
Water	2.99%		0.38%	11.30%
Oils+Asphaltenes	62.04%		83.93%	88.70%
Oils (on fraction)	98.60%		77.47%	99.14%
(on total)	61.17%		65.02%	87.93%
Asphalt. (on fract.)	1.40%		22.53%	0.86%
(on total)	0.87%		18.91%	0.76%
Pre-Asphaltenes			1.20%	
Insolubles	34.98%		14.48%	
IOM (on fraction)	85.61%		37.23%	
(on total)	29.94%		5.39%	
Ash (on fraction)	14.39%		62.77%	
(on total)	5.03%		9.09%	
TOTAL	100.00%		100.00%	100.00%

	----- in grams of feed / product -----			
Total Feed / Product	5490	0	3510	1385
Water	164.0		13.4	156.5
Oils+Asphaltenes	3405.8		2945.9	1228.5
Oils (on fraction)	3358.1		2282.2	1217.9
(on total)	3358.1		2282.2	1217.9
Asphalt. (on fract.)	47.7		663.7	10.6
(on total)	47.7		663.7	10.6
Pre-Asphaltenes			42.3	
Insolubles	1920.3		508.4	
IOM (on fraction)	1644.0		189.3	
(on total)	1644.0		189.3	
Ash (on fraction)	276.3		319.1	
(on total)	276.3		319.1	
TOTAL (as is)	5490.0		3510.0	1385.0
TOTAL (MAF)	5049.7	0.0	3177.5	1228.5

Distillation Profile THF-Extract						D-1160		
Fractions deg C	Feed	Products				Feed	Product	
		V-220	V-340 (BTMS)	V-330	Total		Comp. Sample	
							as is	corr.
IBP - 182							51.98	51.98
182 - 343						61.30	704.03	704.03
343 - 524						2857.44	2537.34	2537.34
524+			189.27		189.27	487.02	1431.68	1112.57
TOTAL			189.27		189.27	3405.77	4725.03	4405.92

Feed	Products (normalized)				Feed	Products (normalized)			
	V-220	V-340 (BTTMS)	V-330	Total		V-220	V-340 (BTTMS)	V-330	Total
----- in wt% of total feed (as is) -----					----- in wt% of total feed (MAF) -----				
						ERR			
3.25%		0.27%	3.11%	3.37%			0.13%	0.13%	
61.87%		58.45%	24.37%	82.83%	67.44%		63.72%	26.57%	90.30%
61.00%		45.28%	24.16%	69.45%	66.50%		49.37%	26.34%	75.71%
0.87%		13.17%	0.21%	13.38%	0.94%		14.36%	0.23%	14.58%
		0.84%		0.84%			0.91%		0.91%
34.88%		8.77%		8.77%					
29.86%		3.76%		3.76%	32.56%		4.09%		4.09%
5.02%		5.02%		5.02%					
100.00%		68.33%	27.48%	95.81%					
					100.00%		68.73%	26.70%	95.44%

Liquid / Slurry Stream Analysis							
	Coal	Solvent	Feed	V-220	V-340 (BTMS)	V-330	Comp. Sample
Type	Illinois#6	O-43			0		
Total Feed / Product			5490		3510	1385	
Total Sample [grams]			46.88		52.3	61.93	7
Water [grams]			1.4		0.2		
Oils+Asphaltenes [grams]			29.08		44.52	54.93	
Oils [wt%] calc		98.60%	98.60%		77.79%	99.14%	
Asphaltene [wt%]		1.40%	1.40%		22.21%	0.86%	
Pre-Asphaltenes [grams]					0.63		
Insolubles [grams]			16.48		7.62		
IOM [wt%] calc			85.11%		36.64%		
Ash [wt%]			14.39%		62.77%		
Moisture [wt%]			0.50%		0.59%		
Distillation [wt.%]		Cr.S.D.				Cr.S.D.	
IBP - 182 deg C							1.10%
182 - 343							14.90%
343 - 524							53.70%
524+			14.30%				30.30%
Elemental Analysis: [wt.%]							
Carbon			87.80%				
Hydrogen			8.50%				
Nitrogen			0.85%				
Sulphur			0.05%				
Oxygen (diff)			2.80%				

RUN No.: DOE-BU-016

Remarks:

RUN No.: DOE-BU-017

M.B.No.: YP-01/ C1

	Date	Time	Date	Time
START:			Mar. 28, 94	19:45
END:			Mar. 29, 94	02:00
DURATION (hours):				6.25

Feed:	Type	Wt% (maf)
Coal	Illinois#6	39.80%
Solvent	O-43	60.20%
Catalyst 1		
Catalyst 2	Moly+DMDS	
Other		

OPERATING PARAMETERS:			
FEED TANK WI-110:	(G)		
Start of Mass Balance		9690.70	
End of Mass Balance		3980.00	
Rate	(G/HR)	914	
FIRST STAGE:			
Operating Pressure:	(MPa)		
Feed Temp.:	(C)		
Reactor Temp.:	(C)		
	TE-201I (BTM)		
	TE-202I		
	TE-203I		
	TE-204I (Top)		
Liquid Level	(mm)		
Separator Temperature:	(C)		
CO-Feed Rate:	(L/MIN)		
Water Feed Rate:	(ML/MIN)		
Temperature:	(C)		
Catalyst Feed:	(ML/MIN)		
Liquid Product (WI-220):	(G)		
Start of Mass Balance			
End of Mass Balance			
Nitrogen Rate:	(L/MIN)	5.90	
SECOND STAGE:			
Operating Pressure:	(MPa)	17.24	
Feed Temp.:	(C)	138	
Reactor Temp.:	(C)		
	TE-301I (BTM)	425	
	TE-302I	427	
	TE-303I	428	
	TE-304I	429	
	TE-305I	428	
	TE-306I	428	
	TE-307I	420	
	TE-308I (Top)	418	
	TE-309I (VAP)	415	
Liquid level	(mm)	950	
Separator Temperature:	(C)	45	
Hydrogen Feed Rate:	(L/MIN)	35.18	
Temperature:	(C)	399	
Liquid Product (WI-330):	(G)		
Start of Mass Balance		110	
End of Mass Balance		1360	
Bottoms Product (V-340):	(G)		
Start of Mass Balance		3111	
End of Mass Balance		7050	
Sulfiding Agent	(mL/HR)	9.26	

MEASURED GAS COMPOSITIONS				
NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02		85.29	86.20
CO2	44.01		0.06	0.17
CO	28.01			
H2S	34.08		0.13	2.43
Methane	16.04		0.34	0.97
Ethylene	28.05		0.02	0.05
Ethane	30.07		0.10	0.53
Propane	44.01		0.07	0.70
Propylene	42.08			
i-Butane	58.12		0.00	0.06
n-Butane	58.12		0.04	0.69
i-Butene	56.11			
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15		0.11	1.35
Nitrogen	28.02			
TOTAL			86.16	93.154667
Gas Meter Readings				
Start of M.B. : (L)		DTM-260	DTM-360	DTM-350
End of M.B. : (L)			17420.0	80.0
Total : (L)			17420.0	80.0
Temperature: (C)		22.2	20.6	21.0
Meter Pressure : (mmHg)		699	699	699
Standard Volume: (L)			14898	68
Nitrogen to R-200: (L)			2213	
Net Gas Out: (L)			12686	68

Run Conditions			
Basis: MAF		First Stage	Second Stage
Pressure	Mpa		17.2
Temperature	deg C		428
Catalyst			Moly+DMDS
Feed	wt % maf coal	39.80%	
WHSV	(kg / hr) / l		1.06
CO Rate	kg / kg maf coal		
	moles / 100g maf coal		
consumed	moles / 100g maf coal		
Water Rate	kg / kg maf coal		
	moles / 100g maf coal		
Hydrogen	kg / kg maf coal		0.57
	moles / 100g maf coal		28.37
consumed	wt % maf coal		2.47%

M.B.No.: YP-01/ C1

OVERALL MASS BALANCE			
Material In:		Grams	Material Out:
	Feed Slurry	5711	First Stage Liquid:
	CO-Gas:		First Stage Product Gas:
	Water:		Second Stage Liquid:
	Hydrogen:	1189	Second Stage Reactor Bottoms:
	Catalyst:		Second Stage Product Gas:
	S-Agent	58	Dissolved Gas:
TOTAL IN:		6958	TOTAL OUT:
Catalyst mf			OVERALL BALANCE:
			93.8%
WATER BALANCE			
TOTAL IN:		188	TOTAL OUT:
			WATER BALANCE:
			91.1%
	Coal Conversion	wt. % maf	86.0%
	Ash Balance	wt. %	175.3%

PRODUCT YIELDS					
Description	Total Gross			Total Net	
	[grams]		wt. % maf feed	[grams]	wt. % maf coal
	measured	normalized			
H2O	-16.67	-18.73	-0.36%	-18.73	-0.90%
COx	16.53	18.58	0.35%	18.58	0.89%
H2S	32.38	36.40	0.69%	36.40	1.75%
C1 to C3	80.09	90.03	1.72%	90.03	4.32%
C4 +	74.05	83.23	1.59%	83.23	3.99%
Oil	3468.92	3899.25	74.43%	789.78	37.88%
Asphaltene	721.34	810.82	15.48%	766.67	36.77%
Preasphalt.	70.09	78.78	1.50%	78.78	3.78%
IOM	259.45	291.64	5.57%	291.64	13.99%
Total	4706.19	5290.01	100.98%	2136.39	102.47%

Simulated Distillation Profile THF-Extract						Crude Sim. Dist. Comp. Sample)				
Fraction [deg C]	Feed [grams]	Product				Feed [grams]	Product			
		Total Gross		Total Net			Total Gross		Total Net	
		[grams]	normalized [grams]	wt. % maf coal			[grams]	normalized [grams]	wt. % maf coal	
C4 - 182		74.05	83.23	83.23	3.99%		129.24	145.27	145.27	6.97%
182 - 343						56.77	747.60	840.34	783.58	37.58%
343 - 524						2645.89	2694.36	3028.61	382.72	18.36%
524+		259.45	291.64	291.64	13.99%	450.97	1022.65	1149.51	698.54	33.50%
TOTAL		333.50	374.87	374.87	17.98%	3153.62	4593.85	5163.74	2010.11	96.41%
IBP - 524		74.05	83.23	83.23	3.99%	2702.66	3571.20	4014.22	1311.57	62.91%

RUN No.: DOE-BU-017

M.B.No.: YP-01/C1

GAS ANALYSIS

Name	First Stage Product Gas (DTM-260)							Second Stage Product Gas (DTM-360)							Dissolved Gas (DTM-350)						
	Number of Samples: 1							Number of Samples: 6							Number of Samples: 3						
	vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	Av. vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	Av. vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	Av. vol. %
Hydrogen								88.237	85.910	85.783	85.824	84.412	83.804	85.292	88.821	83.818	88.170				86.202
CO2								0.069	0.073	0.048	0.049	0.051	0.048	0.056	0.162	0.157	0.188				0.168
CO																					
H2S								0.184	0.144	0.128	0.115	0.120	0.128	0.133	2.375	2.388	2.525				2.433
Methane								0.351	0.354	0.342	0.328	0.331	0.328	0.339	0.934	0.969	1.005				0.969
Ethylene								0.018	0.024	0.014	0.018	0.018	0.018	0.018	0.048	0.044	0.055				0.048
Ethane								0.108	0.113	0.098	0.098	0.097	0.093	0.101	0.498	0.519	0.589				0.529
Propane								0.081	0.083	0.078	0.075	0.075	0.007	0.066	0.683	0.688	0.755				0.701
Propylene																					
i-Butane								0.005	0.005	0.004	0.004	0.004	0.004	0.004	0.054	0.055	0.060				0.056
n-Butane								0.044	0.045	0.041	0.040	0.040	0.038	0.041	0.671	0.674	0.734				0.693
i-Butene																					
n-Butene																					
C2-Butene																					
i-Pentane																					
n-Pentane								0.111	0.117	0.113	0.102	0.107	0.108	0.110	1.462	1.288	1.313				1.354
Nitrogen																					
TOTAL								87.188	86.868	86.625	86.849	85.255	84.370	86.159	93.688	90.408	95.372				93.155

RUN No.: DOE-BU-017

M.B.No.: YP-01/ C1

GAS CALCULATIONS

Name	Mol.Weight	First Stage Product Gas (DTM-260)				Second Stage Product Gas (DTM-360)				Dissolved Gas (DTM-350)			
		Average Mol Weight: (g/mole)				Average Mol Weight: 1.99 (g/mole)				Average Mol Weight: 5.04 (g/mole)			
		Volume		Weight (norm.)		Volume		Weight (norm.)		Volume		Weight (norm.)	
		meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%
Hydrogen	2.02					85.29	98.99	1131.96	85.41	86.20	92.54	5.70	37.10
CO2	44.01					0.06	0.07	16.29	1.23	0.17	0.18	0.24	1.58
CO	28.01												
H2S	34.08					0.13	0.15	29.67	2.24	2.43	2.61	2.71	17.66
Methane	16.04					0.34	0.39	35.69	2.69	0.97	1.04	0.51	3.31
Ethylene	28.05					0.02	0.02	3.26	0.25	0.05	0.05	0.04	0.29
Ethane	30.07					0.10	0.12	19.92	1.50	0.53	0.57	0.52	3.39
Propane	44.01					0.07	0.08	19.14	1.44	0.70	0.75	1.01	6.58
Propylene	42.08												
i-Butane	58.12					0.00	0.01	1.65	0.12	0.06	0.06	0.11	0.70
n-Butane	58.12					0.04	0.05	15.78	1.19	0.69	0.74	1.32	8.58
i-Butene	56.11												
n-Butene	56.11												
C2-Butene	56.11												
i-Pentane	72.15												
n-Pentane	72.15					0.11	0.13	51.99	3.92	1.35	1.45	3.20	20.82
Nitrogen	28.02												
TOTAL						86.16	100.00	1325.35	100.00	93.15	100.00	15.36	100.00

First Stage Shift Reaction

		CO	+	H2O	=	CO2	+	H2
Stochiom.	[moles]							
Produced	[moles]							
Total	[moles]							
Stochiom.	[grams]							
Produced	[grams]							
Total	[grams]							

Hydrocarbon Gases

		First	Second	Dissolved	Total
C1 to C3	[grams]		78.01	2.08	80.09
C4 +	[grams]		69.42	4.62	74.05
Total	[grams]		147.43	6.71	154.14

Hydrogen

		First Up-Take	In	Second Out	Up-Take	Total Up-Take
Hydrogen	[grams]		1189.10	1137.66	51.45	51.45

RUN No.: DOE-BU-017	M.B.No.: YP-01/ C1
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RUN No.: DOE-BU-017	M.B.No.: YP-01/ C1
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[illegible]

RUN No.: DOE-BU-017

M.B.No.: YP-01/ C1

	Feed	V-220	Products V-340 (BTMS)	V-330
----- in grams of analysis sample -----				
Total Sample	54.61		50.58	61.93
Water	1.80			8.50
Oils+Asphaltenes	30.16		39.96	53.43
Oils	29.74		30.70	53.43
Asphaltenes	0.42		9.26	
Pre-Asphaltenes			0.90	
Insolubles	22.65		9.72	
IOM	19.94		3.33	
Ash	2.71		6.39	
TOTAL	54.61		50.58	61.93
----- in wt% of analysis sample -----				
Water	3.30%			13.73%
Oils+Asphaltenes	55.22%		79.00%	86.27%
Oils (on fraction)	98.60%		76.82%	100.00%
(on total)	54.45%		60.69%	86.27%
Asphalt. (on fract.)	1.40%		23.18%	
(on total)	0.77%		18.31%	
Pre-Asphaltenes			1.78%	
Insolubles	41.48%		19.22%	
IOM (on fraction)	88.02%		34.27%	
(on total)	36.51%		6.59%	
Ash (on fraction)	11.99%		65.73%	
(on total)	4.97%		12.63%	
TOTAL	100.00%		100.00%	100.00%
----- in grams of feed / product -----				
Total Feed / Product	5710.7	0	3939	1250
Water	188.2			171.6
Oils+Asphaltenes	3153.6		3111.8	1078.4
Oils (on fraction)	3109.5		2390.5	1078.4
(on total)	3109.5		2390.5	1078.4
Asphalt. (on fract.)	44.2		721.3	
(on total)	44.2		721.3	
Pre-Asphaltenes			70.1	
Insolubles	2368.8		757.1	
IOM (on fraction)	2084.9		259.5	
(on total)	2084.9		259.5	
Ash (on fraction)	283.9		497.6	
(on total)	283.9		497.6	
TOTAL (as is)	5710.7		3939.0	1250.0
TOTAL (MAF)	5238.6	0.0	3441.4	1078.4

Distillation Profile THF-Extract						D-1160		
Fractions deg C	Feed	Products				Feed	Product	
		V-220	V-340 (BTMS)	V-330	Total		Comp. Sample as is	corr.
IBP - 182							55.19	55.19
182 - 343						56.77	747.60	747.60
343 - 524						2645.89	2694.36	2694.36
524+			259.45		259.45	450.97	1520.28	1022.65
TOTAL			259.45		259.45	3153.62	5017.44	4519.80

Feed	V-220	Products (normalized) V-340 (BTMS)	V-330	Total	Feed	Products (normalized) V-220	V-340 (BTMS)	V-330	Total
----- in wt% of total feed (as is) -----					----- in wt% of total feed (MAF) -----				
						ERR			
3.69%			3.36%	3.36%				-0.36%	-0.36%
55.00%		61.00%	21.14%	82.14%	60.20%		66.77%	23.14%	89.91%
54.23%		46.86%	21.14%	68.00%	59.36%		51.29%	23.14%	74.43%
0.77%		14.14%		14.14%	0.84%		15.48%		15.48%
41.31%		1.37%		1.37%			1.50%		1.50%
		10.04%		10.04%					
36.36%		5.09%		5.09%	39.80%		5.57%		5.57%
4.95%		4.95%		4.95%					
100.00%		72.41%	24.50%	96.92%	100.00%		73.84%	22.78%	96.63%

PROCESS YIELD STRUCTURE

RUN No.: DOE-BU-017

M.B. No.: YP-01/ C1

FEED		PRODUCT	
wt% (coal+solvent)		wt% (coal+solvent)	
as is	maf	as is	maf
55.0%	60.2%		
45.0%	39.8%		
100.0%	100.0%		
Solvent		COx+H2	
Coal		C1 - C4	
CO (shift)		Oil	
Water (shift)		Water	
0.9%	1.0%	COx	1.0% 1.0%
		C1 - C4	3.0% 3.3%
		Oil	21.1% 23.1%
		Water	3.4% -0.4%
		Hydrogen (consumed)	
		Oil	62.4% 68.3%
		Coal (maf)	5.1% 5.6%
		Ash	5.0%
100.9%	101.0%	100.9%	101.0%

Remarks:

RUN No.: DOE-BU-017

M.B.No.: YP-02/ C1

	Date	Time	Date	Time
START:			Mar. 29, 94	6:00
END:			Mar. 29, 94	12:00
DURATION (hours):				6.00

Feed:	Type	Wt% (maf)
Coal	Illinois#6	38.15%
Solvent	O-43	61.85%
Catalyst 1		
Catalyst 2	Moly+DMDS	
Other		

OPERATING PARAMETERS:

FEED TANK WI-110):	(G)	
Start of Mass Balance		9750.00
End of Mass Balance		4890.00
Rate	(G/HR)	810
FIRST STAGE:		
Operating Pressure:	(MPa)	
Feed Temp.:	(C)	
Reactor Temp.:	(C)	
TE-201I	(BTM)	
TE-202I		
TE-203I		
TE-204I	(Top)	
Liquid Level	(mm)	
Separator Temperature:	(C)	
CO-Feed Rate:	(L/MIN)	
Water Feed Rate:	(ML/MIN)	
Temperature:	(C)	
Catalyst Feed:	(ML/MIN)	
Liquid Product (WI-220):	(G)	
Start of Mass Balance		
End of Mass Balance		
Nitrogen Rate:	(L/MIN)	5.88
SECOND STAGE:		
Operating Pressure:	(MPa)	17.24
Feed Temp.:	(C)	138
Reactor Temp.:	(C)	
TE-301I	(BTM)	439
TE-302I		440
TE-303I		443
TE-304I		442
TE-305I		440
TE-306I		440
TE-307I		432
TE-308I	(Top)	430
TE-309I	(VAP)	425
Liquid level	(mm)	950
Separator Temperature:	(C)	45
Hydrogen Feed Rate:	(L/MIN)	35.13
Temperature:	(C)	399
Liquid Product (WI-330):	(G)	
Start of Mass Balance		70
End of Mass Balance		1580
Bottoms Product (V-340):	(G)	
Start of Mass Balance		1600
End of Mass Balance		4750
Sulfiding Agent	(mL/HR)	9.65

MEASURED GAS COMPOSITIONS

NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02		84.19	67.63
CO2	44.01		0.04	0.14
CO	28.01			
H2S	34.08		0.13	1.56
Methane	16.04		0.46	0.89
Ethylene	28.05			0.05
Ethane	30.07		0.15	0.55
Propane	44.01		0.12	0.74
Propylene	42.08			
i-Butane	58.12		0.01	0.06
n-Butane	58.12		0.06	0.67
i-Butene	56.11			
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15		0.15	1.16
Nitrogen	28.02			
TOTAL			85.31	73.444333
Gas Meter Readings				
	DTM-260	DTM-360	DTM-350	
Start of M.B. : (L)				
End of M.B. : (L)		16860.0		54.0
Total : (L)		16860.0		54.0
Temperature: (C)	22.2	20.6		21.0
Meter Pressure : (mmHg)	699	699		699
Standard Volume: (L)		14419		46
Nitrogen to R-200: (L)		2118		
Net Gas Out: (L)		12301		46

Run Conditions

Basis: MAF		First Stage	Second Stage
Pressure	Mpa		17.2
Temperature	deg C		442
Catalyst			Moly+DMDS
Feed	wt % maf coal	38.15%	
WHSV	(kg / hr) / l		0.94
CO Rate	kg / kg maf coal		
	moles / 100g maf coal		
consumed	moles / 100g maf coal		
Water Rate	kg / kg maf coal		
	moles / 100g maf coal		
Hydrogen	kg / kg maf coal		0.67
	moles / 100g maf coal		33.30
consumed	wt % maf coal		2.46%

RUN No.: DOE-BU-017

M.B.No.: YP-02/ C1

OVERALL MASS BALANCE					
Material In:		Grams		Material Out:	Grams
	Feed Slurry	4860		First Stage Liquid:	
	CO-Gas:			First Stage Product Gas:	
	Water:			Second Stage Liquid:	1510
	Hydrogen:	1140		Second Stage Reactor Bottoms:	3150
	Catalyst:			Second Stage Product Gas:	1339
	S-Agent	58		Dissolved Gas:	11
TOTAL IN:		6058		TOTAL OUT:	6010
Catalyst mf				OVERALL BALANCE:	99.2%
WATER BALANCE					
TOTAL IN:		149		TOTAL OUT:	152
				WATER BALANCE:	102.1%
		Coal Conversion wt.% maf		87.8%	
		Ash Balance wt.%		98.6%	

PRODUCT YIELDS					
Description	Total Gross			Total Net	
	[grams]		wt. % maf feed	[grams]	wt. % maf coal
	measured	normalized			
H2O	3.09	3.08	0.07%	3.08	0.18%
COx	12.75	12.71	0.28%	12.71	0.75%
H2S	29.47	29.39	0.66%	29.39	1.73%
C1 to C3	112.14	111.81	2.50%	111.81	6.56%
C4 +	97.42	97.13	2.18%	97.13	5.70%
Oil	3331.95	3322.06	74.41%	599.42	35.19%
Asphaltene	650.79	648.85	14.53%	610.20	35.82%
Preasphalt.	74.36	74.14	1.66%	74.14	4.35%
IOM	207.96	207.34	4.64%	207.34	12.17%
Total	4519.92	4506.50	100.94%	1745.21	102.46%

Simulated Distillation Profile THF-Extract						Crude Sim. Dist. Comp. Sample)				
Fraction [deg C]	Feed [grams]	Product				Feed [grams]	Product			
		Total Gross		Total Net			Total Gross		Total Net	
		[grams]	----- normalized -----		[grams]		wt. % maf coal	[grams]	----- normalized -----	
			[grams]	[grams]					[grams]	[grams]
C4 - 182		97.42	97.13	97.13	5.70%		147.00	146.56	146.56	8.60%
182 - 343						49.70	671.65	669.66	619.95	36.40%
343 - 524						2316.72	2420.64	2413.45	96.73	5.68%
524+		207.96	207.34	207.34	12.17%	394.86	1123.18	1119.84	724.98	42.56%
TOTAL		305.38	304.47	304.47	17.88%	2761.29	4362.47	4349.52	1588.22	93.24%
IBP - 524		97.42	97.13	97.13	5.70%	2366.43	3239.29	3229.67	863.25	50.68%

RUN No.: DOE-BU-017

M.B.No.: YP-02/C1

GAS ANALYSIS

GAS ANALYSIS																					
	First Stage Product Gas (DTM-260)							Second Stage Product Gas (DTM-360)							Dissolved Gas (DTM-350)						
Name	Number of Samples: 1							Number of Samples: 5							Number of Samples: 3						
	vol %	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%
Hydrogen								84.803	84.215	83.988	84.034	84.104		84.188	77.248	58.848	68.798				67.630
CO2								0.043	0.045	0.048	0.048	0.042		0.044	0.134	0.127	0.188				0.143
CO																					
H2S								0.138	0.132	0.131	0.130	0.107		0.128	1.189	1.432	2.060				1.560
Methane								0.485	0.483	0.489	0.481	0.438		0.459	0.776	0.803	1.078				0.886
Ethylene															0.039	0.045	0.063				0.049
Ethane								0.151	0.153	0.150	0.148	0.145		0.149	0.411	0.514	0.721				0.549
Propane								0.122	0.122	0.122	0.118	0.118		0.120	0.525	0.897	1.007				0.743
Propylene																					
i-Butane								0.007	0.007	0.007	0.007	0.007		0.007	0.042	0.055	0.082				0.060
n-Butane								0.065	0.065	0.064	0.063	0.062		0.064	0.469	0.612	0.921				0.667
i-Butene																					
n-Butene																					
C2-Butene																					
i-Pentane																					
n-Pentane								0.143	0.148	0.148	0.148	0.145		0.145	0.653	0.913	1.907				1.158
Nitrogen																					
TOTAL								85.737	85.348	85.121	85.151	85.188		85.305	81.484	62.044	76.805				73.444

RUN No.: DOE-BU-017

M.B.No.: YP-02/ C1

GAS CALCULATIONS

Name	Mol.Weight	First Stage Product Gas (DTM-260)				Second Stage Product Gas (DTM-360)				Dissolved Gas (DTM-350)			
		Average Mol Weight:		(g/mole)		Average Mol Weight:		2.08 (g/mole)		Average Mol Weight:		5.26 (g/mole)	
		Volume		Weight (norm.)		Volume		Weight (norm.)		Volume		Weight (norm.)	
		meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%
Hydrogen	2.02					84.19	98.69	1094.32	81.72	67.63	92.08	3.83	35.33
CO2	44.01					0.04	0.05	12.57	0.94	0.14	0.19	0.18	1.63
CO	28.01												
H2S	34.08					0.13	0.15	27.98	2.09	1.56	2.12	1.49	13.75
Methane	16.04					0.46	0.54	47.40	3.54	0.89	1.21	0.40	3.67
Ethylene	28.05									0.05	0.07	0.04	0.36
Ethane	30.07					0.15	0.17	28.83	2.15	0.55	0.75	0.46	4.27
Propane	44.01					0.12	0.14	34.10	2.55	0.74	1.01	0.92	8.46
Propylene	42.08												
i-Butane	58.12					0.01	0.01	2.62	0.20	0.06	0.08	0.10	0.90
n-Butane	58.12					0.06	0.07	23.86	1.78	0.67	0.91	1.09	10.03
i-Butene	56.11												
n-Butene	56.11												
C2-Butene	56.11												
i-Pentane	72.15												
n-Pentane	72.15					0.15	0.17	67.41	5.03	1.16	1.58	2.34	21.60
Nitrogen	28.02												
TOTAL						85.31	100.00	1339.09	100.00	73.44	100.00	10.83	100.00

First Stage Shift Reaction

		CO	+	H2O	=	CO2	+	H2
Stochi.	[moles]							
Produced	[moles]							
Total	[moles]							
Stochi.	[grams]							
Produced	[grams]							
Total	[grams]							

Hydrocarbon Gases

	First	Second	Dissolved	Total
C1 to C3 [grams]		110.32	1.82	112.14
C4 + [grams]		93.89	3.52	97.42
Total [grams]		204.22	5.34	209.56

Hydrogen

	First Up-Take	In	Second Out	Up-Take	Total Up-Take
Hydrogen [grams]		1140.07	1098.14	41.93	41.93

Liquid / Slurry Stream Analysis	
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[illegible]

RUN No.: DOE-BU-017

M.B.No.: YP-02/ C1

	Feed	V-220	Products V-340 (BTMS)	V-330
----- in grams of analysis sample -----				
Total Sample	48.86		52.53	61.93
Water	1.50		0.10	6.00
Oils+Asphaltenes	27.76		43.68	55.93
Oils	27.37		33.09	55.28
Asphaltenes	0.39		10.59	0.65
Pre-Asphaltenes			1.24	
Insolubles	19.60		7.51	
IOM	17.12		3.47	
Ash	2.48		4.05	
TOTAL	48.86		52.53	61.93
----- in wt% of analysis sample -----				
Water	3.07%		0.19%	9.69%
Oils+Asphaltenes	56.82%		83.14%	90.31%
Oils (on fraction)	98.60%		75.76%	98.83%
(on total)	56.02%		62.99%	89.25%
Asphalt. (on fract.)	1.40%		24.24%	1.17%
(on total)	0.80%		20.15%	1.06%
Pre-Asphaltenes			2.36%	
Insolubles	40.11%		14.31%	
IOM (on fraction)	87.37%		46.15%	
(on total)	35.05%		6.60%	
Ash (on fraction)	12.63%		53.85%	
(on total)	5.07%		7.70%	
TOTAL	100.00%		100.00%	100.00%
----- in grams of feed / product -----				
Total Feed / Product	4860	0	3150	1510
Water	149.2		6.0	146.3
Oils+Asphaltenes	2761.3		2619.0	1363.7
Oils (on fraction)	2722.6		1984.2	1347.8
(on total)	2722.6		1984.2	1347.8
Asphalt. (on fract.)	38.7		634.8	16.0
(on total)	38.7		634.8	16.0
Pre-Asphaltenes			74.4	
Insolubles	1949.5		450.6	
IOM (on fraction)	1703.3		208.0	
(on total)	1703.3		208.0	
Ash (on fraction)	246.2		242.7	
(on total)	246.2		242.7	
TOTAL (as is)	4860.0		3150.0	1510.0
TOTAL (MAF)	4464.6	0.0	2901.3	1363.7

Distillation Profile THF-Extract						D-1160		
Fractions deg C	Feed	Products				Feed	Product	
		V-220	V-340 (BTMS)	V-330	Total		Comp. Sample as is	corr.
IBP - 182							49.58	49.58
182 - 343						49.70	671.65	671.65
343 - 524						2316.72	2420.64	2420.64
524+			207.96		207.96	394.86	1365.84	1123.18
TOTAL			207.96		207.96	2761.29	4507.71	4265.05

Feed					Products (normalized)					Feed				
V-220					V-340 (BTMS)					V-220				
In wt% of total feed (as is)					In wt% of total feed (MAF)					In wt% of total feed (MAF)				
										ERR				
3.06%			0.12%	3.00%	3.12%							0.07%	0.07%	
56.82%			53.73%	27.98%	81.71%	61.85%				58.49%		30.45%	88.94%	
56.03%			40.71%	27.65%	68.36%	60.98%				44.31%		30.10%	74.41%	
0.80%			13.02%	0.33%	13.35%	0.87%				14.18%		0.36%	14.53%	
			1.53%		1.53%					1.66%			1.66%	
40.12%			9.33%		9.33%									
35.05%			4.27%		4.27%	38.15%				4.64%			4.64%	
5.07%			5.07%		5.07%									
100.00%			64.72%	30.98%	95.70%									
						100.00%				64.79%		30.52%	95.32%	

PROCESS YIELD STRUCTURE

RUN No.: DOE-BU-017

M.B. No.: YP-02/ C1

FEED
wt% (coal+solvent)
as is maf

PRODUCT
wt% (coal+solvent)
as is maf

Remarks:

RUN No.: DOE-BU-017

M.B.No.: YP-03/ C1

	Date	Time	Date	Time
START:			Mar. 29, 94	14:00
END:			Mar. 29, 94	20:00
DURATION (hours):				6.00

Feed:	Type	Wt% (maf)
Coal	Illinois#6	39.87%
Solvent	O-43	60.13%
Catalyst 1		
Catalyst 2	Moly+DMDS	
Other		

OPERATING PARAMETERS:			
FEED TANK WI-110):	(G)		
Start of Mass Balance		7730.00	
End of Mass Balance		3190.00	
Rate	(G/HR)	757	
FIRST STAGE:			
Operating Pressure:	(MPa)		
Feed Temp.:	(C)		
Reactor Temp.:	(C)		
TE-201I	(BTM)		
TE-202I			
TE-203I			
TE-204I	(Top)		
Liquid Level	(mm)		
Separator Temperature:	(C)		
CO-Feed Rate:	(L/MIN)		
Water Feed Rate:	(ML/MIN)		
Temperature:	(C)		
Catalyst Feed:	(ML/MIN)		
Liquid Product (WI-220):	(G)		
Start of Mass Balance			
End of Mass Balance			
Nitrogen Rate:	(L/MIN)	5.91	
SECOND STAGE:			
Operating Pressure:	(MPa)	17.24	
Feed Temp.:	(C)	138	
Reactor Temp.:	(C)		
TE-301I	(BTM)	429	
TE-302I		430	
TE-303I		431	
TE-304I		431	
TE-305I		430	
TE-306I		430	
TE-307I		422	
TE-308I	(Top)	420	
TE-309I	(VAP)	418	
Liquid level	(mm)	950	
Separator Temperature:	(C)	45	
Hydrogen Feed Rate:	(L/MIN)	35.30	
Temperature:	(C)	399	
Liquid Product (WI-330):	(G)		
Start of Mass Balance		50	
End of Mass Balance		1300	
Bottoms Product (V-340):	(G)		
Start of Mass Balance		1340	
End of Mass Balance		4780	
Sulfiding Agent	(mL/HR)	9.65	

MEASURED GAS COMPOSITIONS				
NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02		84.07	89.84
CO2	44.01		0.04	0.16
CO	28.01			
H2S	34.08		0.09	2.21
Methane	16.04		0.24	0.92
Ethylene	28.05			0.05
Ethane	30.07		0.10	0.51
Propane	44.01		0.08	0.67
Propylene	42.08			
i-Butane	58.12			0.05
n-Butane	58.12		0.04	0.66
i-Butene	56.11			
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15		0.12	1.15
Nitrogen	28.02			
TOTAL			84.79	96.228
Gas Meter Readings				
DTM-260		DTM-360	DTM-350	
Start of M.B. : (L)				
End of M.B. : (L)		17030.0	52.0	
Total : (L)		17030.0	52.0	
Temperature: (C)		22.2	20.6	21.0
Meter Pressure : (mmHg)		699	699	699
Standard Volume: (L)			14565	44
Nitrogen to R-200: (L)			2128	
Net Gas Out: (L)			12437	44

Run Conditions			
Basis: MAF		First Stage	Second Stage
Pressure	Mpa		17.2
Temperature	deg C		431
Catalyst			Moly+DMDS
Feed	wt % maf coal	39.87%	
WHSV	(kg / hr) / l		0.88
CO Rate	kg / kg maf coal		
	moles / 100g maf coal		
consumed	moles / 100g maf coal		
Water Rate	kg / kg maf coal		
	moles / 100g maf coal		
Hydrogen	kg / kg maf coal		0.69
	moles / 100g maf coal		34.34
consumed	wt % maf coal		1.82%

OVERALL MASS BALANCE					
Material In:		Grams		Material Out:	Grams
	Feed Slurry	4540		First Stage Liquid:	
	CO-Gas:			First Stage Product Gas:	
	Water:			Second Stage Liquid:	1250
	Hydrogen:	1145		Second Stage Reactor Bottoms:	3440
	Catalyst:			Second Stage Product Gas:	1287
	S-Agent	58		Dissolved Gas:	9
TOTAL IN:		5743		TOTAL OUT:	5986
Catalyst mf				OVERALL BALANCE:	104.2%
WATER BALANCE					
TOTAL IN:		141		TOTAL OUT:	141
				WATER BALANCE:	100.1%
		Coal Conversion		wt. % maf	89.4%
		Ash Balance		wt. %	92.7%

PRODUCT YIELDS					
Description	Total Gross			Total Net	
	[grams]		wt. % maf feed	[grams]	wt. % maf coal
	measured	normalized			
H2O	0.15	0.14	0.00%	0.14	0.01%
COx	12.25	11.38	0.27%	11.38	0.69%
H2S	21.85	20.31	0.49%	20.31	1.22%
C1 to C3	69.56	64.66	1.55%	64.66	3.90%
C4 +	77.23	71.79	1.72%	71.79	4.33%
Oil	3308.50	3075.31	73.89%	607.71	36.62%
Asphaltene	742.09	689.78	16.57%	654.75	39.45%
Preasphalt.	88.74	82.49	1.98%	82.49	4.97%
IOM	189.99	176.60	4.24%	176.60	10.64%
Total	4510.37	4192.47	100.73%	1689.83	101.82%

Simulated Distillation Profile THF-Extract						Crude Sim. Dist. Comp. Sample)						
Fraction [deg C]	Feed [grams]	Product				Feed [grams]	Product					
		Total Gross		Total Net			Total Gross		Total Net			
		[grams]	normalized		[grams]		wt. % maf coal	[grams]	normalized		[grams]	wt. % maf coal
			[grams]						[grams]			
C4 - 182		77.23	71.79	71.79	4.33%		127.27	118.30	118.30	7.13%		
182 - 343						45.05	677.76	629.99	584.94	35.25%		
343 - 524						2099.71	2442.66	2270.49	170.78	10.29%		
524+		189.99	176.60	176.60	10.64%	357.88	1158.88	1077.20	719.32	43.34%		
TOTAL		267.23	248.39	248.39	14.97%	2502.63	4406.56	4095.98	1593.34	96.01%		
IBP - 524		77.23	71.79	71.79	4.33%	2144.76	3247.69	3018.78	874.02	52.67%		

QAS ANALYSIS

GAS ANALYSIS									
First Stage Product Gas (DTM-250)									
Second Stage Product Gas (DTM-350)									
Dissolved Gas (DTM-350)									
Name	Number of Samples:			Number of Samples:			Number of Samples:		
	vol. %	vol. %	Av.vol. %	vol. %	vol. %	Av.vol. %	vol. %	vol. %	Av.vol. %
Hydrogen				84.157	84.100	84.085	91.358	85.359	89.639
CO ₂				0.039	0.043	0.044	0.042	0.158	0.164
CO				0.097	0.103	0.098	0.091	2.276	2.213
H ₂ S								1.855	
Methane				0.320	0.324	0.288	0.241	0.841	0.918
Ethylene							0.052	0.044	0.048
Ethane				0.104	0.102	0.100	0.102	0.504	0.514
Propane				0.083	0.081	0.078	0.080	0.662	0.675
Propylene								0.053	0.054
i-Butane				0.045	0.043	0.042	0.043	0.645	0.657
n-Butane								0.029	
i-Pentane									
C ₂ -Butene									
n-Pentane				0.132	0.124	0.118	0.124	1.127	1.147
Nitrogen									
TOTAL				84.977	84.928	84.801	84.789	91.799	96.228

RUN No.: DOE-BU-017

M.B.No.: YP-03/ C1

GAS CALCULATIONS

Name	Mol.Weight	First Stage Product Gas (DTM-260)				Second Stage Product Gas (DTM-360)				Dissolved Gas (DTM-350)			
		Average Mol Weight:		(g/mole)		Average Mol Weight:		1.98 (g/mole)		Average Mol Weight:		4.67 (g/mole)	
		Volume		Weight (norm.)		Volume		Weight (norm.)		Volume		Weight (norm.)	
		meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%
Hydrogen	2.02					84.07	99.15	1111.48	86.37	89.84	93.36	3.74	40.38
CO2	44.01					0.04	0.05	12.10	0.94	0.16	0.17	0.15	1.60
CO	28.01												
H2S	34.08					0.09	0.11	20.30	1.58	2.21	2.30	1.55	16.78
Methane	16.04					0.24	0.28	25.28	1.96	0.92	0.95	0.30	3.28
Ethylene	28.05									0.05	0.05	0.03	0.30
Ethane	30.07					0.10	0.12	19.98	1.55	0.51	0.53	0.32	3.44
Propane	44.01					0.08	0.09	23.04	1.79	0.67	0.70	0.61	6.61
Propylene	42.08												
i-Butane	58.12									0.05	0.06	0.06	0.70
n-Butane	58.12					0.04	0.05	16.36	1.27	0.66	0.68	0.79	8.50
i-Butene	56.11												
n-Butene	56.11												
C2-Butene	56.11												
i-Pentane	72.15												
n-Pentane	72.15					0.12	0.15	58.32	4.53	1.15	1.19	1.70	18.41
Nitrogen	28.02												
TOTAL						84.79	100.00	1286.86	100.00	96.23	100.00	9.26	100.00

First Stage Shift Reaction

		CO	+	H2O	=	CO2	+	H2
Stochiom.	[moles]							
Produced	[moles]							
Total	[moles]							
Stochiom.	[grams]							
Produced	[grams]							
Total	[grams]							

Hydrocarbon Gases

		First	Second	Dissolved	Total
C1 to C3	[grams]		68.30	1.26	69.56
C4 +	[grams]		74.68	2.56	77.23
Total	[grams]		142.98	3.82	146.79

Hydrogen

		First Up-Take	In	Second Out	Up-Take	Total Up-Take
Hydrogen	[grams]		1145.48	1115.22	30.26	30.26

RUN No.: DOE-BU-017 **M.B.No.:** YP-03/ C1

RUN No.: DOE-BU-017 **M.B.No.:** YP-03/ C1

[illegible]

	Feed	V-220	Products V-340 (BTMS)	V-330
----- In grams of analysis sample -----				
Total Sample	48.25		52.33	61.93
Water	1.50			7.00
Oils+Asphaltenes	26.60		44.75	54.93
Oils	26.23		33.60	54.49
Asphaltenes	0.37		11.15	0.44
Pre-Asphaltenes			1.35	
Insolubles	20.15		6.23	
IOM	17.64		2.89	
Ash	2.52		3.34	
TOTAL	48.25		52.33	61.93
----- In wt% of analysis sample -----				
Water	3.11%			11.30%
Oils+Asphaltenes	55.12%		85.52%	88.70%
Oils (on fraction)	98.60%		75.08%	99.19%
(on total)	54.35%		64.21%	87.98%
Asphalt. (on fract.)	1.40%		24.92%	0.81%
(on total)	0.77%		21.31%	0.72%
Pre-Asphaltenes			2.58%	
Insolubles	41.77%		11.90%	
IOM (on fraction)	87.52%		46.41%	
(on total)	36.55%		5.52%	
Ash (on fraction)	12.48%		53.59%	
(on total)	5.21%		6.38%	
TOTAL	100.00%		100.00%	100.00%
----- In grams of feed / product -----				
Total Feed / Product	4540	0	3440	1250
Water	141.1			141.3
Oils+Asphaltenes	2502.6		2941.9	1108.7
Oils (on fraction)	2467.6		2208.8	1099.7
(on total)	2467.6		2208.8	1099.7
Asphalt. (on fract.)	35.0		733.1	9.0
(on total)	35.0		733.1	9.0
Pre-Asphaltenes			88.7	
Insolubles	1896.2		409.4	
IOM (on fraction)	1659.6		190.0	
(on total)	1659.6		190.0	
Ash (on fraction)	236.6		219.4	
(on total)	236.6		219.4	
TOTAL (as is)	4540.0		3440.0	1250.0
TOTAL (MAF)	4162.2	0.0	3220.6	1108.7

Distillation Profile THF-Extract						D-1160		
Fractions deg C	Feed	Products				Feed	Product	
		V-220	V-340 (BTMS)	V-330	Total		Comp. Sample	
							as is	corr.
IBP - 182							50.04	50.04
182 - 343						45.05	677.76	677.76
343 - 524						2099.71	2442.66	2442.66
524+			189.99		189.99	357.88	1378.26	1158.88
TOTAL			189.99		189.99	2502.63	4548.71	4329.33

Feed	Products (normalized)				Feed	Products (normalized)			
	V-220	V-340	V-330	Total		V-220	V-340	V-330	Total
	in wt% of total feed (as is)					in wt% of total feed (MAF)			
						ERR			
2.90%			2.90%	2.90%				0.00%	0.00%
55.25%		60.36%	22.75%	83.11%	60.13%		65.70%	24.76%	90.46%
54.47%		45.32%	22.57%	67.89%	59.29%		49.33%	24.56%	73.89%
0.77%		15.04%	0.18%	15.23%	0.84%		16.37%	0.20%	16.57%
		1.82%		1.82%			1.98%		1.98%
41.86%		9.12%		9.12%					
36.63%		3.90%		3.90%	39.87%		4.24%		4.24%
5.22%		5.22%		5.22%					
100.00%		71.31%	25.65%	96.96%					
					100.00%		71.92%	24.76%	96.69%

PROCESS YIELD STRUCTURE

RUN No.: DOE-BU-017

M.B. No.: YP-03/ C1

FEED
wt% (coal+solvent)
as is maf

PRODUCT
wt% (coal+solvent)
as is maf

Remarks:

SUMMARY OF BENCH UNIT TEST RUNS

RUN No.:	DOE-BU-018				
M.B.No.:	YP-01/ C1	YP-02/ C1	YP-03/ C1	YP-04/ C1	YP-05/ C1
Coal	Illinois#6	Illinois#6	Illinois#6	Illinois#6	Illinois#6
wt % maf	34.04%	37.08%	38.59%	37.88%	38.14%
First Stage:					
Feed Rate (kg / hr) / I WHSV	1.48	1.40	1.55	1.79	1.64
Pressure Mpa					
Temperature deg C	428	425	422	417	415
Catalyst					
CO Rate kg / kg maf coal					
moles / 100g maf coal					
consumed moles / 100g maf coal					
Water Rate kg / kg maf coal					
moles / 100g maf coal					
Hydrogen wt % maf coal					
Second Stage:					
Feed Rate (kg / hr) / I WHSV	0.96	0.91	1.42	1.16	1.06
Pressure Mpa	17.24	17.24	17.24	17.24	17.24
Temperature deg C	430	439	440	440	431
Catalyst	Moly	Moly	Moly	Iron Oxide	Iron Oxide
Hydrogen kg / kg maf coal	1.04	1.02	0.88	0.80	0.86
moles / 100g maf coal	51.78	50.79	43.74	39.65	42.86
consumed wt % maf coal	4.52%	4.20%	3.46%	3.89%	2.95%
Coal Conversion (wt % maf coal)	95.03%	95.16%	94.57%	93.17%	92.99%
Product Yield (wt % maf coal)					
H2O	6.15%	2.74%	7.21%	6.84%	4.90%
COx	0.99%	0.87%	0.71%	1.85%	1.28%
H2S		0.02%	0.02%		
C1 to C3	6.86%	8.33%	6.33%	7.33%	5.67%
C4 - 182	12.65%	12.46%	10.18%	12.16%	18.25%
182 - 343	31.00%	33.16%	36.75%	32.74%	30.19%
343 - 524	-6.12%	2.44%	4.42%	-0.54%	0.25%
IBP - 524	37.53%	48.05%	51.35%	44.36%	48.69%
524+	52.99%	44.43%	37.84%	43.51%	42.41%
TOTAL	104.52%	104.20%	103.46%	103.89%	102.95%
Yields based on Solubility					
Pentane soluble (incl. C4)	47.56%	60.07%	50.06%	43.60%	47.77%
Asphaltenes	37.13%	26.81%	32.83%	36.23%	34.88%
Preasphaltenes	0.86%	0.52%	0.87%	1.21%	1.45%
IOM	4.97%	4.84%	5.43%	6.83%	7.01%
TOTAL	90.52%	92.24%	89.19%	87.87%	91.11%

NOTE:

RUN No.: DOE-BU-018

M.B.No.: YP-01/ C1

	Date	Time	Date	Time
START:			Apr. 27, 94	12:00
END:			Apr. 27, 94	18:00
DURATION (hours):				6.00

Feed:	Type	Wt% (maf)
Coal	Illinois#6	34.04%
Solvent	O-43	65.96%
Catalyst 1		
Catalyst 2	Moly	
Other		

OPERATING PARAMETERS:		
FEED TANK WI-110):	(G)	
Start of Mass Balance		6900.00
End of Mass Balance		2480.00
Rate	(G/HR)	737
FIRST STAGE:		
Operating Pressure:	(MPa)	
Feed Temp.:	(C)	
Reactor Temp.:	(C)	
TE-201I	(BTM)	
TE-202I		428
TE-203I		
TE-204I	(Top)	385
Liquid Level	(mm)	550
Separator Temperature:	(C)	
CO-Feed Rate:	(L/MIN)	
Water Feed Rate:	(ML/MIN)	
Temperature:	(C)	
Catalyst Feed:	(ML/MIN)	
Liquid Product (WI-220):	(G)	
Start of Mass Balance		
End of Mass Balance		
Nitrogen Rate:	(L/MIN)	9.77
SECOND STAGE:		
Operating Pressure:	(MPa)	17.24
Feed Temp.:	(C)	138
Reactor Temp.:	(C)	
TE-301I	(BTM)	427
TE-302I		429
TE-303I		430
TE-304I		431
TE-305I		430
TE-306I		428
TE-307I		426
TE-308I	(Top)	425
TE-309I	(VAP)	420
Liquid level	(mm)	850
Separator Temperature:	(C)	45
Hydrogen Feed Rate:	(L/MIN)	35.03
Temperature:	(C)	430
Liquid Product (WI-330):	(G)	
Start of Mass Balance		115
End of Mass Balance		1530
Bottoms Product (V-340):	(G)	
Start of Mass Balance		150
End of Mass Balance		2840
Sulfiding Agent	(mL/HR)	

MEASURED GAS COMPOSITIONS				
NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02		96.65	87.03
CO2	44.01			0.12
CO	28.01		0.07	
H2S	34.08			
Methane	16.04		0.32	0.54
Ethylene	28.05			0.22
Ethane	30.07		0.13	0.40
Propane	44.01		0.09	0.85
Propylene	42.08			
i-Butane	58.12		0.01	0.07
n-Butane	58.12		0.05	0.63
i-Butene	56.11			
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15		0.11	0.73
Nitrogen	28.02			
TOTAL			97.42	90.590333
Gas Meter Readings				
		DTM-260	DTM-360	DTM-350
Start of M.B. : (L)				
End of M.B. : (L)			18130.0	32.0
Total : (L)			18130.0	32.0
Temperature: (C)		22.2	21.4	21.8
Meter Pressure : (mmHg)		702	702	702
Standard Volume: (L)			15525	27
Hydrogen to R-200: (L)		3518		
Net Gas Out: (L)			15525	27

Run Conditions			
Basis: MAF		First Stage	Second Stage
Pressure	Mpa		17.2
Temperature	deg C	428	430
Catalyst			Moly
Feed	wt % maf coal	34.04%	
WHSV	(kg / hr) / l	1.48	0.96
CO Rate	kg / kg maf coal		
	moles / 100g maf coal		
consumed	moles / 100g maf coal		
Water Rate	kg / kg maf coal		
	moles / 100g maf coal		
Hydrogen	kg / kg maf coal		1.04
	moles / 100g maf coal		51.78
consumed	wt % maf coal		4.52%

OVERALL MASS BALANCE			
Material In:		Grams	
	Feed Slurry	4420	
	CO-Gas:		
	Water:		
	Hydrogen:	1454	
	Catalyst:		
	S-Agent		
TOTAL IN:		5874	
Catalyst maf			
Material Out:			Grams
	First Stage Liquid:		
	First Stage Product Gas:		
	Second Stage Liquid:		1415
	Second Stage Reactor Bottoms:		2690
	Second Stage Product Gas:		1573
	Dissolved Gas:		5
TOTAL OUT:			5683
			OVERALL BALANCE: 96.8%

WATER BALANCE			
TOTAL IN:		120	
TOTAL OUT:			203
			WATER BALANCE: 169.5%

	Coal Conversion	wt. % maf	95.0%
	Ash Balance	wt. %	71.7%

PRODUCT YIELDS					
Description	Total Gross			Total Net	
	[grams]		wt. % maf feed	[grams]	wt. % maf coal
	measured	normalized			
H ₂ O	83.16	85.95	2.09%	85.95	6.15%
CO _x	13.42	13.87	0.34%	13.87	0.99%
H ₂ S					
C1 to C3	92.70	95.80	2.33%	95.80	6.86%
C4 +	81.24	83.96	2.05%	83.96	6.01%
Oil	3143.71	3249.02	79.18%	580.44	41.55%
Asphaltene	538.53	556.57	13.56%	518.68	37.13%
Preasphalt.	11.59	11.98	0.29%	11.98	0.86%
IOM	67.19	69.44	1.69%	69.44	4.97%
Total	4031.54	4166.59	101.54%	1460.12	104.52%

Simulated Distillation Profile THF-Extract						Crude Sim. Dist. Comp. Sample)				
Fraction [deg C]	Feed [grams]	Product				Feed [grams]	Product			
		Total Gross		Total Net			Total Gross		Total Net	
		[grams]	----- normalized -----		[grams]		[grams]	----- normalized -----		
			[grams]	wt. % maf coal				[grams]	wt. % maf coal	
C4 - 182							170.99	176.72	176.72	12.65%
182 - 343						784.88	1178.44	1217.91	433.04	31.00%
343 - 524						1751.09	1611.57	1665.56	-85.53	-6.12%
524+						170.51	881.27	910.79	740.28	52.99%
TOTAL						2706.47	3842.26	3970.97	1264.51	90.52%
IBP - 524						2535.96	2961.00	3060.19	524.22	37.53%

QAS ANALYSIS

GAS ANALYSIS												
First Stage Product Gas (DTM-250)												
Name	Number of Samples:			Number of Samples:			Number of Samples:			Dissolved Gas (DTM-350)		
	vol.%	vol.%	Av.vol.%	vol.%	vol.%	Av.vol.%	vol.%	vol.%	Av.vol.%	vol.%	vol.%	Av.vol.%
Hydrogen			87.278	88.905	88.455	88.421	98.167	96.647	83.080	80.576	67.423	87.026
CO2												0.123
H2S			0.069	0.070	0.072	0.068	0.058	0.067				
Methane			0.308	0.317	0.318	0.331	0.329	0.321	0.532	0.434	0.656	0.541
Ethyene			0.126	0.133	0.131	0.132	0.131	0.131	0.058	0.441	1.045	0.399
Propane			0.104	0.105	0.105	0.105	0.016	0.087	0.849	0.652		0.849
Propylene			0.008	0.007	0.007	0.007	0.007	0.007	0.072	0.055	0.068	0.072
n-Butane			0.052	0.052	0.052	0.052	0.052	0.052	0.838	0.480	0.788	0.628
i-Butane												
C2-Butene												
n-Pentane			0.108	0.108	0.108	0.108	0.107	0.108	0.692	0.595	0.902	0.730
Nitrogen												
TOTAL			98.057	97.698	97.258	97.221	96.868	97.420	98.600	83.375	81.786	90.590

RUN No.: DOE-BU-018

M.B.No.: YP-01/ C1

GAS CALCULATIONS

Name	Mol. Weight	First Stage Product Gas (DTM-260)				Second Stage Product Gas (DTM-360)				Dissolved Gas (DTM-350)			
		Average Mol Weight:		(g/mole)		Average Mol Weight:		2.27 (g/mole)		Average Mol Weight:		3.74 (g/mole)	
		Volume		Weight (norm.)		Volume		Weight (norm.)		Volume		Weight (norm.)	
		meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%
Hydrogen	2.02					96.65	99.21	1388.32	88.23	87.03	96.07	2.37	51.89
CO2	44.01									0.12	0.14	0.07	1.60
CO	28.01					0.07	0.07	13.35	0.85				
H2S	34.08												
Methane	16.04					0.32	0.33	36.59	2.33	0.54	0.60	0.12	2.56
Ethylene	28.05									0.22	0.25	0.08	1.85
Ethane	30.07					0.13	0.13	28.01	1.78	0.40	0.44	0.16	3.54
Propane	44.01					0.09	0.09	27.23	1.73	0.85	0.94	0.50	11.02
Propylene	42.08												
i-Butane	58.12					0.01	0.01	2.98	0.19	0.07	0.08	0.06	1.23
n-Butane	58.12					0.05	0.05	21.49	1.37	0.63	0.69	0.49	10.77
i-Butene	56.11												
n-Butene	56.11												
C2-Butene	56.11												
i-Pentane	72.15												
n-Pentane	72.15					0.11	0.11	55.52	3.53	0.73	0.81	0.71	15.54
Nitrogen	28.02												
TOTAL						97.42	100.00	1573.48	100.00	90.59	100.00	4.57	100.00

First Stage Shift Reaction

		CO	+	H2O	=	CO2	+	H2
Stochiom.	[moles]							
Produced	[moles]							
Total	[moles]							
Stochiom.	[grams]							
Produced	[grams]							
Total	[grams]							

Hydrocarbon Gases

		First	Second	Dissolved	Total
C1 to C3	[grams]		91.83	0.87	92.70
C4 +	[grams]		79.98	1.26	81.24
Total	[grams]		171.82	2.12	173.94

Hydrogen

		First Up-Take	In	Second Out	Up-Take	Total Up-Take
Hydrogen	[grams]		1453.85	1390.69	63.16	63.16

RUN No.: DOE-BU-018 M.B.No.: YP-01/C1

RUN No.: DOE-BU-018 M.B.No.: YP-01/C1

[illegible]

RUN No.: DOE-BU-018

M.B.No.: YP-01/ C1

	Feed	V-220	Products V-340 (BTMS)	V-330
----- in grams of analysis sample -----				
Total Sample	47.99		48.74	61.93
Water	1.30			8.88
Oils+Asphaltenes	29.39		44.76	53.05
Oils	28.97		35.00	53.05
Asphaltenes	0.41		9.76	
Pre-Asphaltenes			0.21	
Insolubles	17.30		3.77	
IOM	15.17		1.22	
Ash	2.14		2.56	
TOTAL	47.99		48.74	61.93
----- in wt% of analysis sample -----				
Water	2.71%			14.34%
Oils+Asphaltenes	61.23%		91.83%	85.66%
Oils (on fraction)	98.60%		78.20%	100.00%
(on total)	60.38%		71.81%	85.66%
Asphalt. (on fract.)	1.40%		21.80%	
(on total)	0.86%		20.02%	
Pre-Asphaltenes			0.43%	
Insolubles	36.06%		7.74%	
IOM (on fraction)	87.65%		32.26%	
(on total)	31.61%		2.50%	
Ash (on fraction)	12.35%		67.74%	
(on total)	4.45%		5.24%	
TOTAL	100.00%		100.00%	100.00%
----- in grams of feed / product -----				
Total Feed / Product	4420	0	2690	1415
Water	119.7			202.9
Oils+Asphaltenes	2706.5		2470.1	1212.1
Oils (on fraction)	2668.6		1931.6	1212.1
(on total)	2668.6		1931.6	1212.1
Asphalt. (on fract.)	37.9		538.5	
(on total)	37.9		538.5	
Pre-Asphaltenes			11.6	
Insolubles	1593.8		208.3	
IOM (on fraction)	1397.0		67.2	
(on total)	1397.0		67.2	
Ash (on fraction)	196.8		141.1	
(on total)	196.8		141.1	
TOTAL (as is)	4420.0		2690.0	1415.0
TOTAL (MAF)	4103.4	0.0	2548.9	1212.1

Distillation Profile THF-Extract						D-1160		
Fractions deg C	Feed	Products				Feed	Product	
		V-220	V-340 (BTMS)	V-330	Total		Comp. Sample	
							as is	corr.
IBP - 182							89.75	89.75
182 - 343						784.88	1178.44	1178.44
343 - 524						1751.09	1611.57	1611.57
524+						170.51	1022.35	881.27
TOTAL						2706.47	3902.11	3761.02

Feed	Products (normalized)				Feed	Products (normalized)			
	V-220	V-340 (BTMS)	V-330	Total		V-220	V-340 (BTMS)	V-330	Total
	----- in wt% of total feed (as is) -----					----- in wt% of total feed (MAF) -----			
						ERR			
2.80%			4.74%	4.74%			2.09%	2.09%	
61.18%		57.71%	28.32%	86.02%	65.96%		62.21%	30.53%	92.74%
60.32%		45.12%	28.32%	73.44%	65.03%		48.65%	30.53%	79.18%
0.86%		12.58%		12.58%	0.92%		13.56%		13.56%
36.03%		0.27%		0.27%			0.29%		0.29%
		6.02%		6.02%					
31.58%		1.57%		1.57%	34.04%		1.69%		1.69%
4.45%		4.45%		4.45%					
100.00%		63.99%	33.06%	97.05%					
					100.00%		64.20%	32.62%	96.82%

PROCESS YIELD STRUCTURE

RUN No.: DOE-BU-018 M.B. No.: YP-01/C1

FEED		PRODUCT	
wt% (coal+solvent)	as is	wt% (coal+solvent)	as is
61.2%	66.0%		
38.8%	34.0%		
100.0%	100.0%		
<div> <div>Solvent</div> <div>Coal</div> <div>CO (shift)</div> <div>Water (shift)</div> </div>		<div> <div>COx+H2</div> <div>C1 - C4</div> <div>Oil</div> <div>Water</div> </div>	
<div> <div>1.4%</div> <div>1.5%</div> </div>		<div> <div>0.3%</div> <div>4.1%</div> <div>28.3%</div> <div>4.7%</div> </div>	
<div> <div>Hydrogen (consumed)</div> </div>		<div> <div>0.3%</div> <div>4.4%</div> <div>30.5%</div> <div>2.1%</div> </div>	
<div> <div>101.4%</div> <div>101.5%</div> </div>		<div> <div>58.0%</div> <div>1.6%</div> <div>4.4%</div> <div>101.4%</div> <div>101.5%</div> </div>	

Remarks:

RUN No.: DOE-BU-018

M.B.No.: YP-02/ C1

	Date	Time	Date	Time
START:			Apr. 27, 94	21:00
END:			Apr. 28, 94	03:00
DURATION (hours):				6.00

Feed:	Type	Wt% (maf)
Coal	Illinois#6	37.08%
Solvent	O-43	62.92%
Catalyst 1		
Catalyst 2	Moly	
Other		

OPERATING PARAMETERS:

FEED TANK WI-110):	(G)	
Start of Mass Balance		10580.00
End of Mass Balance		6380.00
Rate	(G/HR)	700
FIRST STAGE:		
Operating Pressure:	(MPa)	
Feed Temp.:	(C)	
Reactor Temp.:	(C)	
TE-201I	(BTM)	
TE-202I		425
TE-203I		
TE-204I	(Top)	380
Liquid Level	(mm)	550
Separator Temperature:	(C)	
CO-Feed Rate:	(L/MIN)	
Water Feed Rate:	(ML/MIN)	
Temperature:	(C)	
Catalyst Feed:	(ML/MIN)	
Liquid Product (WI-220):	(G)	
Start of Mass Balance		
End of Mass Balance		
Nitrogen Rate:	(L/MIN)	9.90
SECOND STAGE:		
Operating Pressure:	(MPa)	17.24
Feed Temp.:	(C)	138
Reactor Temp.:	(C)	
TE-301I	(BTM)	437
TE-302I		438
TE-303I		439
TE-304I		440
TE-305I		440
TE-306I		441
TE-307I		437
TE-308I	(Top)	435
TE-309I	(VAP)	425
Liquid level	(mm)	850
Separator Temperature:	(C)	45
Hydrogen Feed Rate:	(L/MIN)	35.15
Temperature:	(C)	430
Liquid Product (WI-330):	(G)	
Start of Mass Balance		90
End of Mass Balance		1480
Bottoms Product (V-340):	(G)	
Start of Mass Balance		50
End of Mass Balance		2350
Sulfiding Agent	(mL/HR)	

MEASURED GAS COMPOSITIONS

NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02		95.48	84.02
CO2	44.01			0.11
CO	28.01		0.06	
H2S	34.08			0.49
Methane	16.04		0.34	0.63
Ethylene	28.05			0.08
Ethane	30.07		0.14	0.74
Propane	44.01		0.12	1.31
Propylene	42.08			
i-Butane	58.12		0.01	0.41
n-Butane	58.12		0.06	1.25
i-Butene	56.11			
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15		0.11	2.63
Nitrogen	28.02			
TOTAL			96.31	91.677
Gas Meter Readings		DTM-260	DTM-360	DTM-350
Start of M.B. : (L)				
End of M.B. : (L)			18190.0	40.0
Total : (L)			18190.0	40.0
Temperature: (C)		22.2	22.2	21.8
Meter Pressure : (mmHg)		707	707	707
Standard Volume: (L)			15654	34
Hydrogen to R-200: (L)		3563		
Net Gas Out: (L)			15654	34

Run Conditions

Basis: MAF		First Stage	Second Stage
Pressure	Mpa		17.2
Temperature	deg C	425	439
Catalyst			Moly
Feed	wt % maf coal	37.08%	
WHSV	(kg / hr) / l	1.40	0.91
CO Rate	kg / kg maf coal		
	moles / 100g maf coal		
consumed	moles / 100g maf coal		
Water Rate	kg / kg maf coal		
	moles / 100g maf coal		
Hydrogen	kg / kg maf coal		1.02
	moles / 100g maf coal		50.79
consumed	wt % maf coal		4.20%

OVERALL MASS BALANCE

Material In:		Grams	Material Out:		Grams
	Feed Slurry	4200		First Stage Liquid:	
	CO-Gas:			First Stage Product Gas:	
	Water:			Second Stage Liquid:	1390
	Hydrogen:	1462		Second Stage Reactor Bottoms:	2300
	Catalyst:			Second Stage Product Gas:	1605
	S-Agent			Dissolved Gas:	10
	TOTAL IN:	5662		TOTAL OUT:	5304
Catalyst mf			OVERALL BALANCE:		93.7%

WATER BALANCE

TOTAL IN: 134		TOTAL OUT: 170	
		WATER BALANCE: 127.1%	

	Coal Conversion	wt. % maf	95.2%
	Ash Balance	wt. %	74.3%

PRODUCT YIELDS

Description	Total Gross			Total Net	
	[grams]		wt. % maf feed	[grams]	wt. % maf coal
	measured	normalized			
H2O	36.23	39.29	1.02%	39.29	2.74%
COx	11.49	12.46	0.32%	12.46	0.87%
H2S	0.28	0.30	0.01%	0.30	0.02%
C1 to C3	109.96	119.25	3.09%	119.25	8.33%
C4 +	90.64	98.30	2.55%	98.30	6.86%
Oil	2912.14	3158.00	81.77%	762.04	53.21%
Asphaltene	385.39	417.93	10.82%	383.91	26.81%
Preasphalt.	6.90	7.48	0.19%	7.48	0.52%
IOM	63.90	69.30	1.79%	69.30	4.84%
Total	3616.95	3922.31	101.56%	1492.33	104.20%

Simulated Distillation Profile THF-Extract						Crude Sim. Dist. Comp. Sample)				
Fraction [deg C]	Feed [grams]	Product				Feed [grams]	Product			
		Total Gross		Total Net			Total Gross		Total Net	
		[grams]	-----normalized-----		[grams]		[grams]	[grams]	-----normalized-----	
			[grams]	wt. % maf coal					[grams]	wt. % maf coal
C4 - 182							164.57	178.46	178.46	12.46%
182 - 343						704.69	1087.71	1179.54	474.85	33.16%
343 - 524						1572.20	1481.96	1607.08	34.88	2.44%
524+						153.09	727.91	789.36	636.27	44.43%
TOTAL						2429.98	3462.14	3754.44	1324.46	92.48%
IBP - 524						2276.89	2734.24	2965.08	688.19	48.05%

DATA ANALYSIS

[illegible]

RUN No.: DOE-BU-018

M.B.No.: YP-02/C1

GAS CALCULATIONS

Name	Mol. Weight	First Stage Product Gas (DTM-260)				Second Stage Product Gas (DTM-360)				Dissolved Gas (DTM-350)			
		Average Mol Weight: (g/mole)				Average Mol Weight: 2.30 (g/mole)				Average Mol Weight: 6.22 (g/mole)			
		Volume		Weight (norm.)		Volume		Weight (norm.)		Volume		Weight (norm.)	
		meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%
Hydrogen	2.02					95.48	99.14	1398.85	87.18	84.02	91.65	2.85	29.78
CO ₂	44.01									0.11	0.12	0.08	0.86
CO	28.01					0.06	0.06	11.41	0.71				
H ₂ S	34.08									0.49	0.54	0.28	2.94
Methane	16.04					0.34	0.35	39.07	2.43	0.63	0.69	0.17	1.77
Ethylene	28.05									0.08	0.08	0.04	0.38
Ethane	30.07					0.14	0.15	31.04	1.93	0.74	0.80	0.37	3.89
Propane	44.01					0.12	0.12	38.30	2.39	1.31	1.43	0.97	10.14
Propylene	42.08												
i-Butane	58.12					0.01	0.01	3.23	0.20	0.41	0.45	0.40	4.20
n-Butane	58.12					0.06	0.06	24.87	1.55	1.25	1.36	1.22	12.74
i-Butene	56.11												
n-Butene	56.11												
C ₂ -Butene	56.11												
i-Pentane	72.15												
n-Pentane	72.15					0.11	0.11	57.74	3.60	2.63	2.87	3.18	33.30
Nitrogen	28.02												
TOTAL						96.31	100.00	1604.51	100.00	91.68	100.00	9.56	100.00

First Stage Shift Reaction

		CO	+	H ₂ O	=	CO ₂	+	H ₂
Stochiom.	[moles]							
Produced	[moles]							
Total	[moles]							
Stochiom.	[grams]							
Produced	[grams]							
Total	[grams]							

Hydrocarbon Gases

		First	Second	Dissolved	Total
C1 to C3	[grams]		108.42	1.55	109.96
C4 +	[grams]		85.84	4.81	90.64
Total	[grams]		194.26	6.35	200.61

Hydrogen

		First Up-Take	In	Second Out	Up-Take	Total Up-Take
Hydrogen	[grams]		1461.90	1401.69	60.20	60.20

Liquid / Slurry Stream Analysis	
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RUN No.: DOE-BU-018

M.B.No.: YP-02/ C1

	Feed	V-220	Products V-340 (BTMS)	V-330
----- In grams of analysis sample -----				
Total Sample grams of analysis sample			50.03	61.93
Water	1.50			7.57
Oils+Asphaltenes	27.27		45.19	54.36
Oils	26.89		36.81	54.36
Asphaltenes	0.38		8.38	
Pre-Asphaltenes			0.15	
Insolubles	18.36		4.69	
IOM	16.07		1.39	
Ash	2.29		3.30	
TOTAL	47.13		50.03	61.93

----- In wt% of analysis sample -----				
Water	3.18%			12.22%
Oils+Asphaltenes	57.86%		90.32%	87.78%
Oils (on fraction)	98.60%		81.45%	100.00%
(on total)	57.05%		73.57%	87.78%
Asphalt. (on fract.)	1.40%		18.55%	
(on total)	0.81%		16.76%	
Pre-Asphaltenes			0.30%	
Insolubles	38.96%		9.38%	
IOM (on fraction)	87.52%		29.63%	
(on total)	34.10%		2.78%	
Ash (on fraction)	12.48%		70.37%	
(on total)	4.86%		6.60%	
TOTAL	100.00%		100.00%	100.00%

----- In grams of feed / product -----				
Total Feed / Product	4200	0	2300	1390
Water	133.7			169.9
Oils+Asphaltenes	2430.0		2077.4	1220.1
Oils (on fraction)	2396.0		1692.0	1220.1
(on total)	2396.0		1692.0	1220.1
Asphalt. (on fract.)	34.0		385.4	
(on total)	34.0		385.4	
Pre-Asphaltenes			6.9	
Insolubles	1636.3		215.7	
IOM (on fraction)	1432.1		63.9	
(on total)	1432.1		63.9	
Ash (on fraction)	204.2		151.8	
(on total)	204.2		151.8	
TOTAL (as is)	4200.0		2300.0	1390.0
TOTAL (MAF)	3862.1	0.0	2148.2	1220.1

Distillation Profile THF-Extract						D-1160		
Fractions deg C	Feed	Products				Feed	Product	
		V-220	V-340 (BTMS)	V-330	Total		Comp. Sample	
							as is	corr.
IBP - 182							73.92	73.92
182 - 343						704.69	1087.71	1087.71
343 - 524						1572.20	1481.96	1481.96
524+						153.09	879.67	727.91
TOTAL						2429.98	3523.26	3371.50

Feed	V-220	Products (normalized) V-340 (BTMS)	V-330	Total	Feed	Products (normalized) V-220 (BTMS)	V-340 (BTMS)	V-330	Total
----- In wt% of total feed (as is) -----					----- In wt% of total feed (MAF) -----				
						ERR			
3.44%			4.38%	4.38%				1.02%	1.02%
57.70%		53.50%	31.42%	84.91%	62.92%		58.33%	34.26%	92.59%
56.89%		43.57%	31.42%	74.99%	62.04%		47.51%	34.26%	81.77%
0.81%		9.92%		9.92%	0.88%		10.82%		10.82%
		0.18%		0.18%			0.19%		0.19%
38.86%		6.49%		6.49%					
34.01%		1.65%		1.65%	37.08%		1.79%		1.79%
4.85%		4.85%		4.85%					
100.00%		60.17%	35.79%	95.96%					
					100.00%		60.32%	35.28%	95.60%

PROCESS YIELD STRUCTURE

RUN No.: DOE-BU-018

M.B. No.: YP-02/ C1

FEED		PRODUCT	
wt% (coal+solvent)		wt% (coal+solvent)	
as is	maf	as is	maf
57.7%	62.9%		
42.3%	37.1%		
100.0%	100.0%		
Solvent		COx+H2	
Coal		C1 - C4	
CO (shift)		Oil	
Water (shift)		Water	
1.4%	1.6%	COx	0.3% 0.3%
		C1 - C4	5.2% 5.6%
		Oil	31.4% 34.3%
		Water	4.4% 1.0%
		Oil	53.7% 58.5%
		Coal (maf)	1.6% 1.8%
		Ash	4.8%
101.4%	101.6%	101.4%	101.6%

Remarks:

RUN No.: DOE-BU-018

M.B.No.: YP-03/ C1

	Date	Time	Date	Time
START:			Apr. 28, 94	06:00
END:			Apr. 28, 94	12:00
DURATION (hours):				6.00

Feed:	Type	Wt% (maf)
Coal	Illinois#6	38.59%
Solvent	O-43	61.41%
Catalyst 1		
Catalyst 2	Moly	
Other		

OPERATING PARAMETERS:

FEED TANK WI-110:	(G)	
Start of Mass Balance		13150.00
End of Mass Balance		8500.00
Rate	(G/HR)	775
FIRST STAGE:		
Operating Pressure:	(MPa)	
Feed Temp.:	(C)	
Reactor Temp.:	(C)	
TE-201I	(BTM)	
TE-202I		422
TE-203I		
TE-204I	(Top)	385
Liquid Level	(mm)	550
Separator Temperature:	(C)	
CO-Feed Rate:	(L/MIN)	
Water Feed Rate:	(ML/MIN)	
Temperature:	(C)	
Catalyst Feed:	(ML/MIN)	
Liquid Product (WI-220):	(G)	
Start of Mass Balance		
End of Mass Balance		
Nitrogen Rate:	(L/MIN)	9.78
SECOND STAGE:		
Operating Pressure:	(MPa)	17.24
Feed Temp.:	(C)	138
Reactor Temp.:	(C)	
TE-301I	(BTM)	438
TE-302I		439
TE-303I		440
TE-304I		440
TE-305I		440
TE-306I		441
TE-307I		437
TE-308I	(Top)	435
TE-309I	(VAP)	428
Liquid level	(mm)	600
Separator Temperature:	(C)	45
Hydrogen Feed Rate:	(L/MIN)	35.07
Temperature:	(C)	430
Liquid Product (WI-330):	(G)	
Start of Mass Balance		90
End of Mass Balance		1630
Bottoms Product (V-340):	(G)	
Start of Mass Balance		100
End of Mass Balance		2940
Sulfiding Agent	(mL/HR)	

MEASURED GAS COMPOSITIONS

NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02		95.26	89.51
CO2	44.01			0.12
CO	28.01		0.06	
H2S	34.08			0.31
Methane	16.04		0.32	0.68
Ethylene	28.05			0.08
Ethane	30.07		0.13	0.73
Propane	44.01		0.11	1.10
Propylene	42.08			
i-Butane	58.12		0.01	0.09
n-Butane	58.12		0.05	0.78
i-Butene	56.11			
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15		0.10	0.92
Nitrogen	28.02			
TOTAL			96.04	94.3125
Gas Meter Readings				
Start of M.B. : (L)	DTM-260	DTM-360	DTM-350	
End of M.B. : (L)		18050.0	60.0	
Total : (L)		18050.0	60.0	
Temperature: (C)		21.9	21.4	
Meter Pressure : (mmHg)	709	709	709	
Standard Volume: (L)		15585	52	
Hydrogen to R-200: (L)	3519			
Net Gas Out: (L)		15585	52	

Run Conditions

Basis: MAF		First Stage	Second Stage
Pressure	Mpa		17.2
Temperature	deg C	422	440
Catalyst			Moly
Feed	wt % maf coal	38.59%	
WHSV	(kg / hr) / l	1.55	1.42
CO Rate	kg / kg maf coal		
	moles / 100g maf coal		
consumed	moles / 100g maf coal		
Water Rate	kg / kg maf coal		
	moles / 100g maf coal		
Hydrogen	kg / kg maf coal		0.88
	moles / 100g maf coal		43.74
consumed	wt % maf coal		3.46%

RUN No.: DOE-BU-018 M.B.No.: YP-03/ C1

OVERALL MASS BALANCE					
Material In:		Grams	Material Out:		Grams
	Feed Slurry	4650		First Stage Liquid:	
	CO-Gas:			First Stage Product Gas:	
	Water:			Second Stage Liquid:	1540
	Hydrogen:	1455		Second Stage Reactor Bottoms:	2840
	Catalyst:			Second Stage Product Gas:	1585
	S-Agent			Dissolved Gas:	10
TOTAL IN:		6105	TOTAL OUT:		5975
Catalyst m/f			OVERALL BALANCE:		97.9%

WATER BALANCE		
TOTAL IN:	125	TOTAL OUT: 242
		WATER BALANCE: 193.7%

	Coal Conversion	wt.% maf	94.6%
	Ash Balance	wt.%	81.2%

PRODUCT YIELDS					
Description	Total Gross			Total Net	
	[grams]		wt. % maf feed	[grams]	wt. % maf coal
	measured	normalized			
H ₂ O	117.06	119.42	2.78%	119.42	7.21%
CO _x	11.56	11.79	0.27%	11.79	0.71%
H ₂ S	0.26	0.26	0.01%	0.26	0.02%
C1 to C3	102.70	104.77	2.44%	104.77	6.33%
C4 +	82.48	84.14	1.96%	84.14	5.08%
Oil	3275.23	3341.39	77.90%	744.39	44.97%
Asphaltene	568.86	580.35	13.53%	543.48	32.83%
Preasphalt.	14.09	14.38	0.34%	14.38	0.87%
IOM	88.13	89.91	2.10%	89.91	5.43%
Total	4260.36	4346.42	101.34%	1712.55	103.46%

Simulated Distillation Profile THF-Extract						Crude Sim. Dist. Comp. Sample)				
Fraction [deg C]	Feed [grams]	Product				Feed [grams]	Product			
		Total Gross		Total Net			Total Gross		Total Net	
		-----normalized-----					-----normalized-----			
		[grams]	[grams]	[grams]	wt. % maf coal		[grams]	[grams]	[grams]	wt. % maf coal
C4 - 182							165.24	168.58	168.58	10.18%
182 - 343						763.82	1344.87	1372.03	608.21	36.75%
343 - 524						1704.11	1742.12	1777.31	73.19	4.42%
524+						165.93	776.57	792.26	626.32	37.84%
TOTAL						2633.87	4028.79	4110.17	1476.30	89.19%
IBP - 524						2467.93	3252.22	3317.91	849.98	51.35%

GAS ANALYSIS																		
First Stage Product Gas (DTM-250)																		
Second Stage Product Gas (DTM-350)																		
Dissolved Gas (DTM-350)																		
Name	Number of Samples:						Number of Samples:						Number of Samples:					
	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%	
Hydrogen						85.330	\$5.317	\$5.123			85.257	87.025	82.004			89.513		
CO ₂													0.134	0.113			0.124	
CO						0.053	0.081	0.055			0.056			0.413	0.188		0.306	
H ₂ S																		
Methane						0.318	0.317	0.327			0.321	0.727	0.631			0.679		
Ethylene												0.083	0.068			0.076		
Ethane						0.132	0.128	0.132			0.131	0.790	0.684			0.727		
Propylene						0.111	0.107	0.110			0.109	1.223	0.886			1.105		
Propane						0.006	0.006	0.006			0.006	0.097	0.078			0.088		
i-Butane						0.054	0.053	0.054			0.054	0.832	0.627			0.780		
n-Butane																		
i-Butene																		
m-Butene																		
C ₂ -Butene																		
i-Pentane						0.107	0.103	0.103			0.104	1.407	0.423			0.915		
n-Pentane																		
Nitrogen																		
TOTAL						88.112	88.083	85.910			96.038	102.831	85.784			94.313		

RUN No.: DOE-BU-018

M.B.No.: YP-03/ C1

GAS CALCULATIONS

Name	Mol. Weight	First Stage Product Gas (DTM-260)				Second Stage Product Gas (DTM-360)				Dissolved Gas (DTM-350)			
		Average Mol Weight: (g/mole)				Average Mol Weight: 2.28 (g/mole)				Average Mol Weight: 4.21 (g/mole)			
		Volume		Weight (norm.)		Volume		Weight (norm.)		Volume		Weight (norm.)	
		meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%
Hydrogen	2.02					95.26	99.19	1393.33	87.91	89.51	94.91	4.44	45.59
CO2	44.01									0.12	0.13	0.13	1.37
CO	28.01					0.06	0.06	11.43	0.72				
H2S	34.08									0.31	0.32	0.26	2.63
Methane	16.04					0.32	0.33	37.28	2.35	0.68	0.72	0.27	2.75
Ethylene	28.05									0.08	0.08	0.05	0.54
Ethane	30.07					0.13	0.14	28.52	1.80	0.73	0.77	0.54	5.51
Propane	44.01					0.11	0.11	34.84	2.20	1.10	1.17	1.19	12.26
Propylene	42.08												
i-Butane	58.12					0.01	0.01	2.53	0.16	0.09	0.09	0.13	1.29
n-Butane	58.12					0.05	0.06	22.59	1.42	0.78	0.83	1.11	11.42
i-Butene	56.11												
n-Butene	56.11												
C2-Butene	56.11												
i-Pentane	72.15												
n-Pentane	72.15					0.10	0.11	54.51	3.44	0.92	0.97	1.62	16.65
Nitrogen	28.02												
TOTAL						96.04	100.00	1585.02	100.00	94.31	100.00	9.74	100.00

First Stage Shift Reaction

		CO	+	H2O	=	CO2	+	H2
Stochiom.	[moles]							
Produced	[moles]							
Total	[moles]							
Stochiom.	[grams]							
Produced	[grams]							
Total	[grams]							

Hydrocarbon Gases

		First	Second	Dissolved	Total
C1 to C3	[grams]		100.65	2.05	102.70
C4 +	[grams]		79.62	2.86	82.48
Total	[grams]		180.27	4.91	185.18

Hydrogen

		First Up-Take	In	Second Out	Up-Take	Total Up-Take
Hydrogen	[grams]		1455.11	1397.77	57.34	57.34

M.B.No.: YP-03/ C1

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[illegible]

	Feed	V-220	Products V-340 (BTMS)	V-330
----- In grams of analysis sample -----				
Total Sample	48.40		50.38	61.93
Water	1.30			9.73
Oils+Asphaltenes	27.41		45.17	52.20
Oils	27.03		35.07	52.20
Asphaltenes	0.38		10.09	
Pre-Asphaltenes			0.25	
Insolubles	19.69		4.96	
IOM	17.23		1.56	
Ash	2.46		3.40	
TOTAL	48.4		50.38	61.93

----- in wt% of analysis sample -----				
Water	2.69%			15.71%
Oils+Asphaltenes	56.64%		89.65%	84.29%
Oils (on fraction)	98.60%		77.66%	100.00%
(on total)	55.85%		69.62%	84.29%
Asphalt. (on fract.)	1.40%		22.34%	
(on total)	0.79%		20.03%	
Pre-Asphaltenes			0.50%	
Insolubles	40.67%		9.85%	
IOM (on fraction)	87.52%		31.49%	
(on total)	35.60%		3.10%	
Ash (on fraction)	12.48%		68.51%	
(on total)	5.08%		6.75%	
TOTAL	100.00%		100.00%	100.00%

----- In grams of feed / product -----				
Total Feed / Product	4650	0	2840	1540
Water	124.9			242.0
Oils+Asphaltenes	2633.9		2546.0	1298.0
Oils (on fraction)	2597.0		1977.2	1298.0
(on total)	2597.0		1977.2	1298.0
Asphalt. (on fract.)	36.9		568.9	
(on total)	36.9		568.9	
Pre-Asphaltenes			14.1	
Insolubles	1891.2		279.9	
IOM (on fraction)	1655.2		88.1	
(on total)	1655.2		88.1	
Ash (on fraction)	236.0		191.7	
(on total)	236.0		191.7	
TOTAL (as is)	4650.0		2840.0	1540.0
TOTAL (MAF)	4289.1	0.0	2648.3	1298.0

Distillation Profile THF-Extract						D-1160		
Fractions deg C	Feed	Products				Feed	Product	
		V-220	V-340 (BTMS)	V-330	Total		Comp. Sample	
							as is	corr.
IBP - 182							82.76	82.76
182 - 343						763.82	1344.87	1344.87
343 - 524						1704.11	1742.12	1742.12
524+						165.93	968.30	776.57
TOTAL						2633.87	4138.05	3946.31

Feed	Products (normalized)				Feed	Products (normalized)			
	V-220	V-340 (BTMS)	V-330	Total		V-220	V-340 (BTMS)	V-330	Total
	----- in wt% of total feed (as is) -----					----- in wt% of total feed (MAF) -----			
						ERR			
2.74%			5.31%	5.31%				2.78%	2.78%
56.61%		55.83%	28.46%	84.29%	61.41%		60.56%	30.88%	91.44%
55.82%		43.36%	28.46%	71.82%	60.55%		47.03%	30.88%	77.90%
0.79%		12.47%		12.47%	0.86%		13.53%		13.53%
		0.31%		0.31%			0.34%		0.34%
40.65%		7.01%		7.01%					
35.58%		1.93%		1.93%	38.59%		2.10%		2.10%
5.07%		5.07%		5.07%					
100.00%		63.14%	33.77%	96.91%					
					100.00%		62.99%	33.66%	96.65%

PROCESS YIELD STRUCTURE

RUN No.: DOE-BU-018

M.B. No.: YP-03/ C1

FEED
wt% (coal+solvent)
as is maf

PRODUCT
wt% (coal+solvent)
as is maf

Remarks:

RUN No.: DOE-BU-018

M.B.No.: YP-04/ C1

	Date	Time	Date	Time
START:			Apr. 28, 94	21:00
END:			Apr. 29, 94	03:00
DURATION (hours):				5.90

Feed:	Type	Wt% (maf)
Coal	Illinois#6	37.88%
Solvent	O-43	62.12%
Catalyst 1		
Catalyst 2	Iron Oxide	
Other		

OPERATING PARAMETERS:

FEED TANK WI-110):	(G)	
Start of Mass Balance		6760.00
End of Mass Balance		1500.00
Rate	(G/HR)	892
FIRST STAGE:		
Operating Pressure:	(MPa)	
Feed Temp.:	(C)	
Reactor Temp.:	(C)	
TE-201I	(BTTM)	
TE-202I		417
TE-203I		
TE-204I	(Top)	385
Liquid Level	(mm)	550
Separator Temperature:	(C)	
CO-Feed Rate:	(L/MIN)	
Water Feed Rate:	(ML/MIN)	
Temperature:	(C)	
Catalyst Feed:	(ML/MIN)	
Liquid Product (WI-220):	(G)	
Start of Mass Balance		
End of Mass Balance		
Nitrogen Rate:	(L/MIN)	9.94
SECOND STAGE:		
Operating Pressure:	(MPa)	17.24
Feed Temp.:	(C)	138
Reactor Temp.:	(C)	
TE-301I	(BTTM)	437
TE-302I		439
TE-303I		440
TE-304I		440
TE-305I		441
TE-306I		440
TE-307I		437
TE-308I	(Top)	436
TE-309I	(VAP)	428
Liquid level	(mm)	850
Separator Temperature:	(C)	45
Hydrogen Feed Rate:	(L/MIN)	35.70
Temperature:	(C)	430
Liquid Product (WI-330):	(G)	
Start of Mass Balance		90
End of Mass Balance		1820
Bottoms Product (V-340):	(G)	
Start of Mass Balance		440
End of Mass Balance		3500
Sulfiding Agent	(mL/HR)	

MEASURED GAS COMPOSITIONS

NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02		99.92	86.54
CO2	44.01		0.06	0.10
CO	28.01		0.07	
H2S	34.08			
Methane	16.04		0.37	0.74
Ethylene	28.05			0.08
Ethane	30.07		0.18	0.82
Propane	44.01		0.15	1.21
Propylene	42.08			
i-Butane	58.12		0.01	0.10
n-Butane	58.12		0.07	0.86
i-Butene	56.11			
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15		0.12	0.91
Nitrogen	28.02			
TOTAL			100.94	91.3765
Gas Meter Readings		DTM-260	DTM-360	DTM-350
Start of M.B. : (L)				
End of M.B. : (L)			18030.0	69.0
Total : (L)			18030.0	69.0
Temperature: (C)			22.1	21.1
Meter Pressure : (mmHg)		705	705	705
Standard Volume: (L)			15469	59
Hydrogen to R-200: (L)		3518		
Net Gas Out: (L)			15469	59

Run Conditions

Basis: MAF		First Stage	Second Stage
Pressure	Mpa		17.2
Temperature	deg C	417	440
Catalyst			Iron Oxide
Feed	wt % maf coal	37.88%	
WHSV	(kg / hr) / l	1.79	1.16
CO Rate	kg / kg maf coal		
	moles / 100g maf coal		
consumed	moles / 100g maf coal		
Water Rate	kg / kg maf coal		
	moles / 100g maf coal		
Hydrogen	kg / kg maf coal		0.80
	moles / 100g maf coal		39.65
consumed	wt % maf coal		3.89%

M.B.No.: YP-04/ C1

OVERALL MASS BALANCE					
Material In:		Grams	Material Out:		Grams
	Feed Slurry	5260		First Stage Liquid:	
	CO-Gas:			First Stage Product Gas:	
	Water:			Second Stage Liquid:	1730
	Hydrogen:	1456		Second Stage Reactor Bottoms:	3060
	Catalyst:			Second Stage Product Gas:	1626
	S-Agent			Dissolved Gas:	11
TOTAL IN:		6716	TOTAL OUT:		6427
Catalyst mf			OVERALL BALANCE:		95.7%
WATER BALANCE					
TOTAL IN:		175	TOTAL OUT:		292
			WATER BALANCE:		166.7%
	Coal Conversion		wt.% maf	93.2%	
	Ash Balance		wt.%	111.3%	

PRODUCT YIELDS					
Description	Total Gross			Total Net	
	[grams]		wt. % maf feed	[grams]	wt. % maf coal
	measured	-----	normalized	-----	
H2O	116.80	124.93	2.59%	124.93	6.84%
COx	31.68	33.88	0.70%	33.88	1.85%
H2S					
C1 to C3	125.28	133.99	2.78%	133.99	7.33%
C4 +	95.32	101.94	2.11%	101.94	5.58%
Oil	3412.45	3649.74	75.65%	694.87	38.02%
Asphaltene	658.28	704.06	14.59%	662.10	36.23%
Preasphalt.	20.65	22.09	0.46%	22.09	1.21%
IOM	116.72	124.84	2.59%	124.84	6.83%
Total	4577.19	4895.47	101.48%	1898.64	103.89%

Simulated Distillation Profile THF-Extract						Crude Sim. Dist. Comp. Sample)				
Fraction [deg C]	Feed [grams]	Product				Feed [grams]	Product			
		Total Gross		Total Net			Total Gross		Total Net	
		[grams]	----- normalized -----		[grams]		[grams]	----- normalized -----		
			[grams]	wt. % maf coal				[grams]	wt. % maf coal	
C4 - 182							207.77	222.22	222.22	12.16%
182 - 343						869.08	1371.91	1467.31	598.23	32.74%
343 - 524						1938.95	1803.73	1929.16	-9.79	-0.54%
524+						188.80	920.01	983.98	795.18	43.51%
TOTAL						2996.83	4303.42	4602.67	1605.84	87.87%
IBP - 524						2808.03	3383.41	3618.69	810.66	44.36%

RUN No.: DOE-BU-018

M.B.No.: YP-04/C1

GAS ANALYSIS

Name	First Stage Product Gas (DTM-260)							Second Stage Product Gas (DTM-360)							Dissolved Gas (DTM-350)						
	Number of Samples: 1							Number of Samples: 6							Number of Samples: 2						
	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	vol.%	Av.vol.%
Hydrogen								99.607	100.368	100.281	100.339	99.440	99.481	99.316	87.110	85.972					86.541
CO2								0.055	0.057	0.064	0.065	0.066	0.068	0.063	0.102	0.102					0.102
CO								0.049	0.089	0.086	0.088	0.046	0.043	0.067							
H2S																					
Methane								0.392	0.457	0.465	0.448	0.399	0.043	0.367	0.684	0.804					0.744
Ethylene															0.076	0.084					0.080
Ethane								0.180	0.184	0.190	0.180	0.187	0.192	0.182	0.771	0.877					0.824
Propane								0.146	0.149	0.154	0.145	0.149	0.152	0.149	1.133	1.291					1.212
Propylene																					
i-Butane								0.008	0.009	0.009	0.009	0.009	0.009	0.009	0.093	0.105					0.099
n-Butane								0.070	0.071	0.073	0.069	0.070	0.071	0.071	0.812	0.910					0.861
i-Butene																					
n-Butene																					
C2-Butene																					
i-Pentane																					
n-Pentane								0.121	0.122	0.125	0.120	0.121	0.123	0.122	0.658	0.969					0.914
Nitrogen																					
TOTAL								100.628	101.484	101.427	101.459	100.487	100.182	100.945	91.639	91.114					91.377

RUN No.: DOE-BU-018

M.B.No.: YP-04/ C1

GAS CALCULATIONS

Name	Mol.Weight	First Stage Product Gas (DTM-260)				Second Stage Product Gas (DTM-360)				Dissolved Gas (DTM-350)			
		Average Mol Weight		(g/mole)		Average Mol Weight		2.36 (g/mole)		Average Mol Weight		4.30 (g/mole)	
		Volume		Weight (norm.)		Volume		Weight (norm.)		Volume		Weight (norm.)	
		meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%
Hydrogen	2.02					99.92	98.98	1380.13	84.88	86.54	94.71	5.07	44.45
CO2	44.01					0.06	0.06	18.81	1.16	0.10	0.11	0.13	1.14
CO	28.01					0.07	0.07	12.74	0.78				
H2S	34.08												
Methane	16.04					0.37	0.36	40.26	2.48	0.74	0.81	0.35	3.03
Ethylene	28.05									0.08	0.09	0.07	0.57
Ethane	30.07					0.18	0.18	37.46	2.30	0.82	0.90	0.72	6.30
Propane	44.01					0.15	0.15	44.89	2.76	1.21	1.33	1.55	13.56
Propylene	42.08												
i-Butane	58.12					0.01	0.01	3.51	0.22	0.10	0.11	0.17	1.46
n-Butane	58.12					0.07	0.07	28.09	1.73	0.86	0.94	1.45	12.72
i-Butene	56.11												
n-Butene	56.11												
C2-Butene	56.11												
i-Pentane	72.15												
n-Pentane	72.15					0.12	0.12	60.19	3.70	0.91	1.00	1.91	16.76
Nitrogen	28.02												
TOTAL						100.94	100.00	1626.07	100.00	91.38	100.00	11.41	100.00

First Stage Shift Reaction

		CO	+	H2O	=	CO2	+	H2
Stochiom.	[moles]							
Produced	[moles]							
Total	[moles]							
Stochiom.	[grams]							
Produced	[grams]							
Total	[grams]							

Hydrocarbon Gases

		First	Second	Dissolved	Total
C1 to C3	[grams]		122.61	2.68	125.28
C4 +	[grams]		91.79	3.53	95.32
Total	[grams]		214.39	6.21	220.60

Hydrogen

		First Up-Take	In	Second Out	Up-Take	Total Up-Take
Hydrogen	[grams]		1456.37	1385.20	71.17	71.17

RUN No.: DOE-BU-018	M.B.No.: YP-04/ C1
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RUN No.: DOE-BU-018	M.B.No.: YP-04/ C1
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[illegible]

RUN No.: DOE-BU-018

M.B.No.: YP-04/ C1

	Feed	V-220	Products V-340 (BTMS)	V-330
----- in grams of analysis sample -----				
Total Sample	48.06		50.38	61.93
Water	1.60			10.45
Oils+Asphaltenes	27.38		43.34	51.48
Oils	27.00		32.51	51.48
Asphaltenes	0.38		10.84	
Pre-Asphaltenes			0.34	
Insolubles	19.08		6.70	
IOM	16.70		1.92	
Ash	2.38		4.77	
TOTAL	48.06		50.38	61.93
----- in wt% of analysis sample -----				
Water	3.33%			16.87%
Oils+Asphaltenes	56.97%		86.03%	83.13%
Oils (on fraction)	98.60%		75.00%	100.00%
(on total)	56.18%		64.52%	83.13%
Asphalt. (on fract.)	1.40%		25.00%	
(on total)	0.80%		21.51%	
Pre-Asphaltenes			0.67%	
Insolubles	39.70%		13.29%	
IOM (on fraction)	87.52%		28.70%	
(on total)	34.74%		3.81%	
Ash (on fraction)	12.48%		71.30%	
(on total)	4.95%		9.48%	
TOTAL	100.00%		100.00%	100.00%
----- in grams of feed / product -----				
Total Feed / Product	5260	0	3060	1730
Water	175.1			291.9
Oils+Asphaltenes	2996.8		2632.7	1438.1
Oils (on fraction)	2954.9		1974.4	1438.1
(on total)	2954.9		1974.4	1438.1
Asphalt. (on fract.)	42.0		658.3	
(on total)	42.0		658.3	
Pre-Asphaltenes			20.7	
Insolubles	2088.1		406.7	
IOM (on fraction)	1827.5		116.7	
(on total)	1827.5		116.7	
Ash (on fraction)	260.6		290.0	
(on total)	260.6		290.0	
TOTAL (as is)	5260.0		3060.0	1730.0
TOTAL (MAF)	4824.3	0.0	2770.0	1438.1

Distillation Profile THF-Extract						D-1160		
Fractions deg C	Feed	Products				Feed	Product	
		V-220	V-340 (BTMS)	V-330	Total		Comp. Sample	
							as is	corr.
IBP - 182							112.45	112.45
182 - 343						869.08	1371.91	1371.91
343 - 524						1938.95	1803.73	1803.73
524+						188.80	1209.98	920.01
TOTAL						2996.83	4498.08	4208.11

Feed	V-220	Products (normalized) V-340 (BTMS)	V-330	Total	Feed	Products (normalized) V-220	V-340 (BTMS)	V-330	Total
----- in wt% of total feed (as is) -----					----- in wt% of total feed (MAF) -----				
						ERR			
3.55%			5.92%	5.92%				2.59%	2.59%
56.84%		53.41%	29.17%	82.58%	62.12%		58.37%	31.88%	90.25%
56.05%		40.05%	29.17%	69.23%	61.25%		43.77%	31.88%	75.65%
0.80%		13.35%		13.35%	0.87%		14.59%		14.59%
		0.42%		0.42%			0.46%		0.46%
39.61%		7.31%		7.31%					
34.66%		2.37%		2.37%	37.88%		2.59%		2.59%
4.94%		4.94%		4.94%					
100.00%		61.14%	35.10%	96.23%					
					100.00%		61.41%	34.47%	95.88%

PROCESS YIELD STRUCTURE

RUN No.: DOE-BU-018

M.B. No.: YP-04/ C1

FEED
wt% (coal+solvent)
as is maf

PRODUCT
wt% (coal+solvent)
as is maf

56.8%	62.1%	Solvent		COx+H2			
43.2%	37.9%	Coal		C1 - C4			
100.0%	100.0%			Oil			
		CO (shift)		Water			
		Water (shift)					
				COx	0.6%	0.7%	
				C1 - C4	4.5%	4.9%	
				Oil	29.2%	31.9%	
				Water	5.9%	2.6%	
1.3%	1.5%	Hydrogen (consumed)					
				Oil	53.8%	58.8%	
				Coal (maf)	2.4%	2.6%	
				Ash	4.9%		
101.3%	101.5%				101.3%	101.5%	

Remarks:

RUN No.: DOE-BU-018

M.B.No.: YP-05/ C1

	Date	Time	Date	Time
START:			Apr. 29, 94	06:00
END:			Apr. 29, 94	12:00
DURATION (hours):				5.90

Feed:	Type	Wt% (maf)
Coal	Illinois#6	38.14%
Solvent	O-43	61.86%
Catalyst 1		
Catalyst 2	Iron Oxide	
Other		

OPERATING PARAMETERS:

FEED TANK WI-110):	(G)	
Start of Mass Balance		8900.00
End of Mass Balance		4060.00
Rate	(G/HR)	820
FIRST STAGE:		
Operating Pressure:	(MPa)	
Feed Temp.:	(C)	
Reactor Temp.:	(C)	
TE-201I	(BTM)	
TE-202I		415
TE-203I		
TE-204I	(Top)	385
Liquid Level	(mm)	550
Separator Temperature:	(C)	
CO-Feed Rate:	(L/MIN)	
Water Feed Rate:	(ML/MIN)	
Temperature:	(C)	
Catalyst Feed:	(ML/MIN)	
Liquid Product (WI-220):	(G)	
Start of Mass Balance		
End of Mass Balance		
Nitrogen Rate:	(L/MIN)	9.94
SECOND STAGE:		
Operating Pressure:	(MPa)	17.24
Feed Temp.:	(C)	138
Reactor Temp.:	(C)	
TE-301I	(BTM)	428
TE-302I		430
TE-303I		431
TE-304I		431
TE-305I		432
TE-306I		431
TE-307I		429
TE-308I	(Top)	426
TE-309I	(VAP)	420
Liquid level	(mm)	850
Separator Temperature:	(C)	45
Hydrogen Feed Rate:	(L/MIN)	35.63
Temperature:	(C)	430
Liquid Product (WI-330):	(G)	
Start of Mass Balance		110
End of Mass Balance		1610
Bottoms Product (V-340):	(G)	
Start of Mass Balance		530
End of Mass Balance		3470
Sulfiding Agent	(mL/HR)	

MEASURED GAS COMPOSITIONS

NAME	MW	Measured Volume %		
		Product Gas 11	Product Gas 21	Dissolved Gas 22
Hydrogen	2.02		94.32	87.03
CO2	44.01		0.05	0.12
CO	28.01		0.03	
H2S	34.08			
Methane	16.04		0.28	0.54
Ethylene	28.05			0.22
Ethane	30.07		0.12	0.40
Propane	44.01		0.10	0.85
Propylene	42.08			
i-Butane	58.12		0.01	0.07
n-Butane	58.12		0.05	0.63
i-Butene	56.11			
n-Butene	56.11			
C2-Butene	56.11			
i-Pentane	72.15			
n-Pentane	72.15		0.37	0.73
Nitrogen	28.02			
TOTAL			95.31	90.590333
Gas Meter Readings				
		DTM-260	DTM-360	DTM-350
Start of M.B. : (L)				
End of M.B. : (L)			18290.0	59.0
Total : (L)			18290.0	59.0
Temperature: (C)			21.5	21.4
Meter Pressure : (mmHg)		703	703	703
Standard Volume: (L)			15690	51
Hydrogen to R-200: (L)		3517		
Net Gas Out: (L)			15690	51

Run Conditions

Basis: MAF		First Stage	Second Stage
Pressure	Mpa		17.2
Temperature	deg C	415	431
Catalyst			Iron Oxide
Feed	wt % maf coal	38.14%	
WHSV	(kg / hr) / l	1.64	1.06
CO Rate	kg / kg maf coal		
	moles / 100g maf coal		
consumed	moles / 100g maf coal		
Water Rate	kg / kg maf coal		
	moles / 100g maf coal		
Hydrogen	kg / kg maf coal		0.86
	moles / 100g maf coal		42.86
consumed	wt % maf coal		2.95%

M.B.No.: YP-05/ C1

OVERALL MASS BALANCE

Material In:		Grams	Material Out:		Grams
	Feed Slurry	4840		First Stage Liquid:	
	CO-Gas:			First Stage Product Gas:	
	Water:			Second Stage Liquid:	1500
	Hydrogen:	1454		Second Stage Reactor Bottoms:	2940
	Catalyst:			Second Stage Product Gas:	1727
	S-Agent			Dissolved Gas:	8
TOTAL IN:		6294	TOTAL OUT:		6176
Catalyst mf			OVERALL BALANCE:		98.1%

WATER BALANCE

TOTAL IN:		174	TOTAL OUT:		254
				WATER BALANCE:	145.9%
	Coal Conversion	wt. % maf	93.0%		
	Ash Balance	wt. %	112.8%		

PRODUCT YIELDS

Description	Total Gross			Total Net	
	[grams]		wt. % maf feed	[grams]	wt. % maf coal
	measured	normalized			
H2O	79.94	82.70	1.87%	82.70	4.90%
COx	20.84	21.56	0.49%	21.56	1.28%
H2S					
C1 to C3	92.44	95.63	2.16%	95.63	5.67%
C4 +	218.21	225.74	5.10%	225.74	13.37%
Oil	3170.25	3279.56	74.11%	580.45	34.39%
Asphaltene	606.07	626.97	14.17%	588.65	34.88%
Preasphalt.	23.64	24.45	0.55%	24.45	1.45%
IOM	114.44	118.38	2.68%	118.38	7.01%
Total	4325.84	4474.99	101.13%	1737.56	102.95%

Simulated Distillation Profile THF-Extract						Crude Sim. Dist. Comp. Sample)				
Fraction [deg C]	Feed [grams]	Product				Feed [grams]	Product			
		Total Gross		Total Net			Total Gross		Total Net	
		[grams]	----- normalized -----		[grams]		wt. % maf coal	[grams]	----- normalized -----	
[grams]	[grams]		[grams]	wt. % maf coal		[grams]			[grams]	wt. % maf coal
C4 - 182							297.75	308.01	308.01	18.25%
182 - 343						793.85	1259.96	1303.40	509.55	30.19%
343 - 524						1771.12	1716.23	1775.40	4.28	0.25%
524+						172.46	858.68	888.28	715.82	42.41%
TOTAL						2737.43	4132.61	4275.10	1537.67	91.11%
IBP - 524						2564.97	3273.94	3386.82	821.85	48.69%

RUN No.: DOE-BU-018

M.B.No.: YP-05/ C1

GAS ANALYSIS

Name	First Stage Product Gas (DTM-260)							Second Stage Product Gas (DTM-360)							Dissolved Gas (DTM-350)						
	Number of Samples: 1							Number of Samples: 6							Number of Samples: 3						
	vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	Av. vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	Av. vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	vol. %	Av. vol. %
Hydrogen								83.428	83.487	83.531	84.694	84.688	88.164	84.325	83.080	80.578	87.423				87.028
CO2								0.058	0.047	0.049	0.045	0.043	0.043	0.048	0.121	0.099	0.150				0.123
CO											0.045	0.052	0.059	0.026							
H2S																					
Methane								0.271	0.263	0.233	0.298	0.283	0.307	0.278	0.532	0.434	0.656				0.541
Ethylene															0.558	0.043	0.068				0.223
Ethane								0.124	0.124	0.121	0.119	0.119	0.122	0.121	0.058	0.441	0.698				0.399
Propane								0.098	0.098	0.097	0.096	0.094	0.098	0.097	0.849	0.652	1.045				0.849
Propylene																					
i-Butane								0.008	0.008	0.008	0.008	0.008	0.008	0.006	0.072	0.055	0.088				0.072
n-Butane								0.047	0.046	0.047	0.048	0.045	0.047	0.046	0.638	0.480	0.766				0.628
i-Butene																					
n-Butene																					
C2-Butene																					
i-Pentane																					
n-Pentane								0.091	0.090	0.090	0.090	0.900	0.930	0.365	0.692	0.595	0.902				0.730
Nitrogen																					
TOTAL								94.121	94.141	94.174	95.439	96.218	97.778	95.312	96.600	83.375	91.798				90.590

RUN No.: DOE-BU-018

M.B.No.: YP-05/ C1

GAS CALCULATIONS

Name	Mol.Weight	First Stage Product Gas (DTM-260)				Second Stage Product Gas (DTM-360)				Dissolved Gas (DTM-350)			
		Average Mol Weight: (g/mole)				Average Mol Weight: 2.47 (g/mole)				Average Mol Weight: 3.74 (g/mole)			
		Volume		Weight (norm.)		Volume		Weight (norm.)		Volume		Weight (norm.)	
		meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%	meas. %	norm. %	(G)	%
Hydrogen	2.02					94.32	98.96	1399.67	81.04	87.03	96.07	4.38	51.89
CO ₂	44.01					0.05	0.05	15.36	0.89	0.12	0.14	0.14	1.60
CO	28.01					0.03	0.03	5.35	0.31				
H ₂ S	34.08												
Methane	16.04					0.28	0.29	32.70	1.89	0.54	0.60	0.22	2.56
Ethylene	28.05									0.22	0.25	0.16	1.85
Ethane	30.07					0.12	0.13	26.84	1.55	0.40	0.44	0.30	3.54
Propane	44.01					0.10	0.10	31.31	1.81	0.85	0.94	0.93	11.02
Propylene	42.08												
i-Butane	58.12					0.01	0.01	2.56	0.15	0.07	0.08	0.10	1.23
n-Butane	58.12					0.05	0.05	19.78	1.15	0.63	0.69	0.91	10.77
i-Butene	56.11												
n-Butene	56.11												
C ₂ -Butene	56.11												
i-Pentane	72.15												
n-Pentane	72.15					0.37	0.38	193.54	11.21	0.73	0.81	1.31	15.54
Nitrogen	28.02												
TOTAL						95.31	100.00	1727.10	100.00	90.59	100.00	8.45	100.00

First Stage Shift Reaction

		CO	+	H ₂ O	=	CO ₂	+	H ₂
Stochiom.	[moles]							
Produced	[moles]							
Total	[moles]							
Stochiom.	[grams]							
Produced	[grams]							
Total	[grams]							

Hydrocarbon Gases

		First	Second	Dissolved	Total
C1 to C3	[grams]		90.84	1.60	92.44
C4 +	[grams]		215.89	2.33	218.21
Total	[grams]		306.73	3.93	310.66

Hydrogen

		First Up-Take	In	Second Out	Up-Take	Total Up-Take
Hydrogen	[grams]		1453.85	1404.05	49.79	49.79

Liquid / Slurry Stream Analysis						
	Coal	Solvent	Feed	V-220	V-340 (BTMS)	V-330
Type	Illinois#6	O-43				
Total Feed / Product			4840	0	2940	1500
Total Sample [grams]			50.03		51	61.93
Water [grams]			1.8			10.49
Oils+Asphaltenes [grams]			28.30		44.30	51.44
Oils [wt%] calc		98.60%	98.60%		76.27%	100.00%
Asphaltene [wt%]		1.40%	1.40%		23.73%	
Pre-Asphaltenes [grams]					0.41	
Insolubles [grams]			20.04		6.71	
IOM [wt%] calc			86.99%		29.43%	
Ash [wt%]			12.48%		70.35%	
Moisture [wt%]			0.53%		0.22%	
Distillation [wt.%]		C.R.S.D.				C.R.S.D.
IBP - 182 deg C						1.90%
182 - 343			29.00%			30.10%
343 - 524			64.70%			41.00%
524+			6.30%			27.00%
Elemental Analysis: [wt.%]						
Carbon			88.60%			
Hydrogen			10.70%			
Nitrogen			0.13%			
Sulphur			0.08%			
Oxygen (diff)			0.49%			

	Feed	V-220	Products V-340 (BTMS)	V-330
----- In grams of analysis sample -----				
Total Sample	50.03		51.00	61.93
Water	1.80			10.49
Oils+Asphaltenes	28.30		43.89	51.44
Oils	27.90		33.38	51.44
Asphaltenes	0.40		10.51	
Pre-Asphaltenes			0.41	
Insolubles	19.93		6.70	
IOM	17.45		1.99	
Ash	2.49		4.71	
TOTAL	50.03		51	61.93

----- In wt% of analysis sample -----				
Water	3.60%			16.94%
Oils+Asphaltenes	56.56%		86.07%	83.06%
Oils (on fraction)	98.60%		76.05%	100.00%
(on total)	55.77%		65.45%	83.06%
Asphalt. (on fract.)	1.40%		23.95%	
(on total)	0.79%		20.61%	
Pre-Asphaltenes			0.80%	
Insolubles	39.84%		13.13%	
IOM (on fraction)	87.52%		29.65%	
(on total)	34.87%		3.89%	
Ash (on fraction)	12.48%		70.35%	
(on total)	4.97%		9.24%	
TOTAL	100.00%		100.00%	100.00%

----- in grams of feed / product -----				
Total Feed / Product	4840	0	2940	1500
Water	174.1			254.1
Oils+Asphaltenes	2737.4		2530.4	1245.9
Oils (on fraction)	2699.1		1924.3	1245.9
(on total)	2699.1		1924.3	1245.9
Asphalt. (on fract.)	38.3		606.1	
(on total)	38.3		606.1	
Pre-Asphaltenes			23.6	
Insolubles	1928.4		386.0	
IOM (on fraction)	1687.8		114.4	
(on total)	1687.8		114.4	
Ash (on fraction)	240.7		271.5	
(on total)	240.7		271.5	
TOTAL (as is)	4840.0		2940.0	1500.0
TOTAL (MAF)	4425.2	0.0	2668.5	1245.9

Distillation Profile THF-Extract						D-1160		
Fractions deg C	Feed	Products				Feed	Product	
		V-220	V-340 (BTMS)	V-330	Total		Comp. Sample	
							as is	corr.
IBP - 182							79.53	79.53
182 - 343						793.85	1259.96	1259.96
343 - 524						1771.12	1716.23	1716.23
524+						172.46	1130.20	858.68
TOTAL						2737.43	4185.92	3914.40

Feed	Products (normalized)				Feed	Products (normalized)			
	V-220	V-340	V-330	Total		V-220	V-340	V-330	Total
	(BTMS)					(BTMS)			
----- in wt% of total feed (as is) -----					----- In wt% of total feed (MAF) -----				
						ERR			
3.72%			5.42%	5.42%				1.87%	1.87%
56.49%		54.02%	26.60%	80.61%	61.86%		59.15%	29.13%	88.28%
55.70%		41.08%	26.60%	67.68%	60.99%		44.99%	29.13%	74.11%
0.79%		12.94%		12.94%	0.87%		14.17%		14.17%
		0.50%		0.50%			0.55%		0.55%
39.79%		7.41%		7.41%					
34.83%		2.44%		2.44%	38.14%		2.68%		2.68%
4.97%		4.97%		4.97%					
100.00%		61.93%	32.02%	93.95%					
					100.00%		62.38%	30.99%	93.38%

PROCESS YIELD STRUCTURE

RUN No.: DOE-BU-018

M.B. No.: YP-05/ C1

FEED				PRODUCT		
wt% (coal+solvent)				wt% (coal+solvent)		
as is	maf			as is	maf	
56.5%	61.9%	Solvent	R-200	COx+H2		
43.5%	38.1%	Coal		C1 - C4		
100.0%	100.0%	CO (shift)		Oil		
		Water (shift)		Water		
				COx	0.4%	0.5%
				C1 - C4	6.6%	7.3%
				Oil	26.6%	29.1%
				Water	5.4%	1.9%
1.0%	1.1%	Hydrogen (consumed)	R-300			
				Oil	54.5%	59.7%
				Coal (maf)	2.4%	2.7%
				Ash	5.0%	
101.0%	101.1%				101.0%	101.1%

Remarks: