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GASIFICATION OF RESIDUAL MATERIALS FROM COAL LIQUEFACTION

Type II Preliminary Pilot Plant Evaluations of SRC-II Vacuum Flash Drum Bottoms From Powhatan Coal

MASTER

Allen M. Robin

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Some of these waste materials will make non-liquefiable feedstocks for gasification using the Texaco Coal Gasification Process. Others are liquefiable and suitable for the Texaco Synthesis Gas Generation Process. Both Texaco processes produce synthesis gas, which is primarily a mixture of CO and H_2.

Texaco developed the Synthesis Gas Generation Process in the late 1940's to convert natural gas to synthesis gas which was then reacted with steam to form additional hydrogen. Further developments enabled the use of light oils, residual oils, and asphalts as feedstocks. Recently, Texaco has carried out work that has demonstrated the feasibility of gasifying pumpable coal liquefaction residues.

The Texaco Synthesis Gas Generation Process has been licensed for use in more than 75 plants in over 20 countries throughout the world using a variety of liquid feedstocks.

The process which has been modified to handle solid carbonaceous materials which are fed to the gasifier as a slurry in water or other carrier fluid has been designated the Texaco Coal Gasification Process. This technology may be utilized to gasify non-liquefiable coal liquefaction residues such as filter cakes.

Exploratory pilot plant runs conducted in the summer of 1975 demonstrated the feasibility of gasifying pumpable coal derived residues which contained as much as 28 percent ash. Early in 1976, under contract with the Electric Power Research Institute, Inc. (EPRI), approximately 40 tons each of two high ash coal liquefaction residues were successfully gasified. The residue were obtained from the H-Coal liquefaction of Wyodak and Illinois No. 6 coals and contained 11 percent and 20 percent ash respectively.

To determine the suitability of various residual materials from DOE-sponsored coal liquefaction projects as feedstocks to the Texaco Gasification Processes, DOE currently is sponsoring a series of tests to be conducted at Texaco's Montebello Research Laboratory. To date, a variety of coal liquefaction residues have been successfully gasified.

Scope

This report covers work performed at Texaco's Montebello Research Laboratory under contract EX-76-C-01-2247 with the United States Department of Energy (DOE) during the week of January 21, 1979.

About 7.5 tons of SRC-II vacuum flash drum bottoms from the liquefaction of Powhatan coal were successfully gasified at 24 atmospheres pressure.

Two Type II Preliminary Pilot Plant Evaluations were completed back to back to achieve a single continuous 15 hour run.

PILOT PLANT PROCESS FLOW

The Texaco Synthesis Gas Generation Process is a non-catalytic partial oxidation process that is based on certain reactions between oxygen and hydrocarbons that take place at high temperatures to produce a synthesis gas composed primarily of hydrogen and carbon monoxide. The high temperature reactions occur when the hydrocarbon and a deficiency of oxygen are introduced under pressure into a refractory lined vessel.

In order to control both the temperature and the conversion of hydrocarbon to gas, steam or liquid water is often added to the reactor. Gasification efficiency is enhanced to the degree that the steam-carbon reaction can be made to take place.

Figure 1 is a process flow diagram of the pilot plant.

Approximately 4 tons of solid residue and approximately 240 pounds of heavy distillate were charged to the 1300 gallon melt tank and melted at 450^{o}F under a nitrogen blanket. After the melted residue was transferred to a 1000-gallon day tank, the melt tank was refilled and a second 3.5 ton batch of residue and 250 pounds of heavy distillate was melted. Using this system, effectively two Type II evaluations were completed in a single run. The day tank is mounted on a scale to allow monitoring the charge rate. From the bottom of the day tank, the molten residue was circulated continuously through a line strainer past the suction of the high

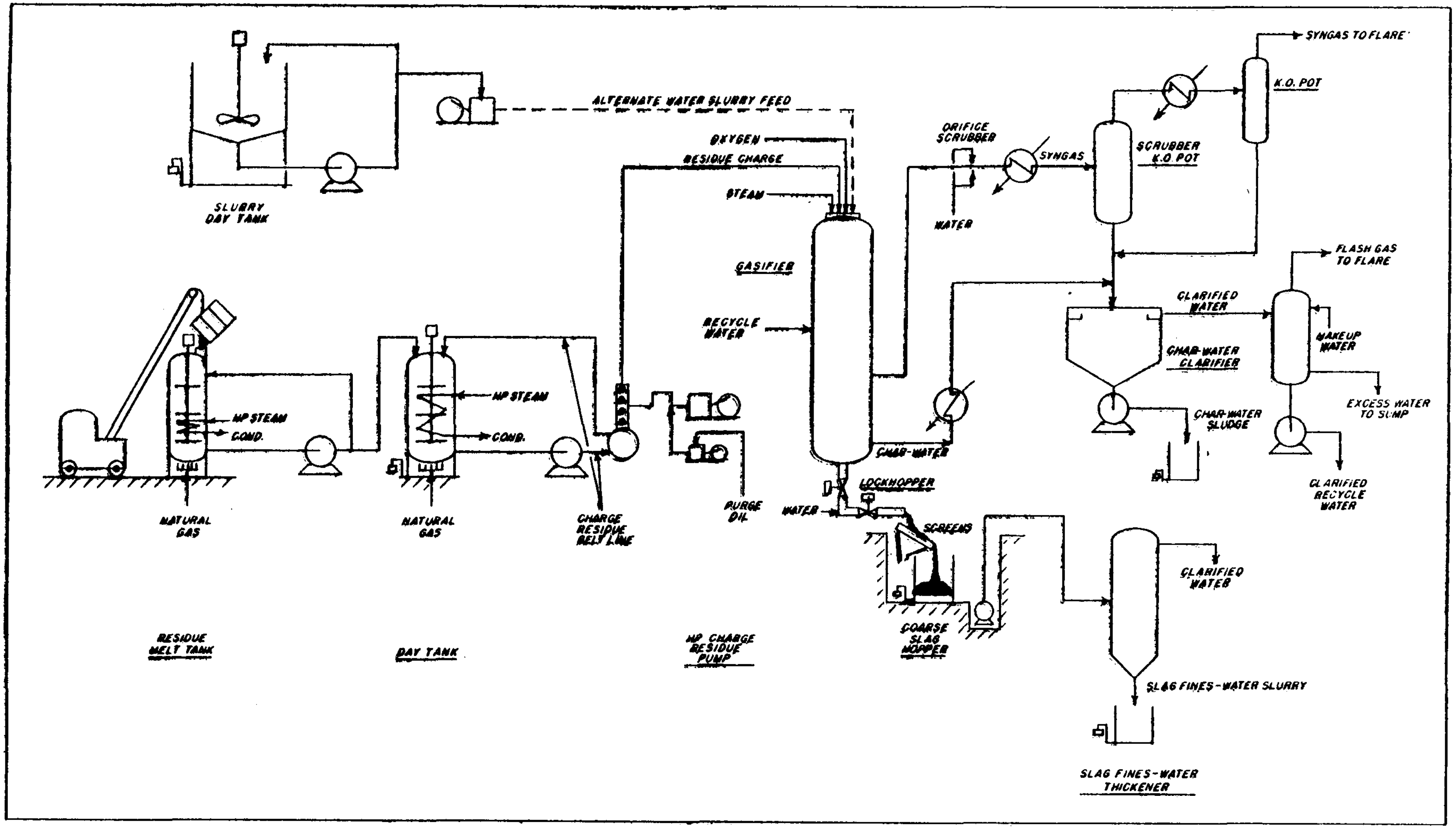

Figure 1 Pilot Plant Process Flow

pressure residue charge pump and back to the top of the day tank. This was done to insure that a positive pressure was maintained at all times at the suction of the high pressure residue charge pump. The day tank was also blanketed with nitrogen during the run.

Gasifier Feed System

Molten residue, oxygen and steam were fed through a proprietary Texaco burner into the top of the pilot plant gasifier.

The molten residue was pumped to the burner under pressure at a constant rate using a positive displacement plunger pump fitted with external ball check valves. The piping between each check valve assembly and the corresponding pump cylinder was filled with a clean purge solvent. An auxiliary pump was utilized to maintain a small purge rate (2% of residue feed rate) of fresh solvent into each connecting pipe to prevent molten residue from diffusing back to the charge pump cylinders. In a commercial plant the use of a solvent purge most likely would not be required.

Pilot Plant Gasifier

The pilot plant gasifier is a 5 ft. diameter by 20 ft. long vessel which is divided internally into two sections. It is designed to operate at a maximum pressure of 24 atmospheres.

The top section is lined with a special refractory material specifically designed to withstand the severe operating environment expected. In this section, the partial oxidation reactions take place.

The lower section is a quench vessel. A reservoir of water was maintained in the bottom of this vessel at all times. Syngas leaving the top section of the gasifier passed through a water cooled diptube into the water in the quench vessel. Slag, and most of the char, carried with the syngas remained in the water. The saturated syngas was removed from the gas space above the water, cooled to condense and remove most of its water content, metered and then flared. Water was continuously injected into the quench vessel to replace water lost by evaporation and solids removal.

Slag Removal System

Molten slag, which formed during the gasification of the residue, was carried into the quench chamber with the syngas. Upon contacting the reservoir of water in the quench chamber, the molten slag solidified. Most of the slag formed sand-like grains. The remainder of the slag formed teardrop-shaped glassy pieces of up to one half inch in length. Several long needles of glassy slag were also formed. Slag was removed from the bottom of the quench chamber during each run with a lockhopper system.

The slag and water removed through the lockhopper system were ducted to a vibrating dewatering screen where the slag was separated into coarse and fine fractions. The coarse fraction was collected and weighed as a solid with less than 10 percent moisture. The fine fraction was pumped as a slurry into a settler where it was allowed to concentrate for later weighing, sampling, and disposal.

Char Recovery and Water Recycle System

During the gasification process, a small amount of char is formed which must be removed and either recycled or disposed of in an environmentally acceptable manner.

Most of this material is removed from the syngas in the water reservoir at the bottom of the quench chamber. The char is less dense than slag and tends to remain dispersed in the water.

A continuous side draw-off of char water slurry was maintained during each run. This slurry was cooled and sent to a settling vessel where it was allowed to thicken for later removal, weighing, sampling, and disposal.

The clarified water off the top of the settling vessel was recycled to the process.

Final traces of char were removed in a scrubbing nozzle in which the syngas was contacted with additional water. The dilute char-water was collected in a scrubber knockout pot from which it was continuously withdrawn and combined with the quench water-char slurry in the settling vessel.

DISCUSSION AND RESULTS OF PILOT PLANT EVALUATION RUN

Raw Material Properties

The SRC-II Vacuum Flash Drum Bottoms from the liquefaction of Powhatan coal is a brittle solid at ambient temperature. It was shipped to the Montebello Research Laboratory in the form of random flakes of about one-quarter inch thickness. At 330-400°F it is a viscous fluid. The ultimate analysis and higher heating value of the residue is shown on Figure 2. It contained 66.7 (wt) percent carbon and 25.6 (wt) percent ash. In contrast to other coal liquefaction residue investigated to date, it apparently contained little or no oxygen. The ash was uniformly suspended in the carbonaceous material as micron sized particles. The ash fusion temperature in a reducing atmosphere was determined to be 2396°F.

Sample identification as received from the P&M Coal Company is included in Appendix C.

Material Balance

Figure 3 summarizes the material balance and analytical data obtained during the run. The residue was diluted with approximately 3 percent heavy distillate for viscosity control. In addition approximately 2 percent heavy distillate was added at the charge pump for purging the pump cylinder. The diluted residue was fed to the gasifier at a rate of 1006 pounds per hour.

A continuous 15 hour run was achieved at 24 atmospheres pressure. The unit was shut down manually when all of the residue had been gasified. A 99.5 percent conversion of carbon in the residue to syngas was achieved at an oxygen feed rate of 0.74 pounds per pound of diluted residue, producing 33.4 standard cubic feet of dry syngas per pound of residue gasified. The dry syngas contained 90.5 (vol) percent hydrogen plus carbon monoxide.

Figure 2

Analysis of SRC-II Vacuum Flash Drum Bottoms
From Powhatan Coal, as Received

Ultimate Analysis Wt. Pct.	
C	66.7
H	3.5
S	2.7
N	1.5
Ash	25.6
O(By Diff)	0.0
Higher Heating Value, Btu per Pound	11898
Melting Range (^{o}F)	330-400
Ash Fusion Temperature in a Reducing Atmosphere ASTMD 1857	
Initial Deformation Temperature, ^{o}F	2038
Softening Temperature, ^{o}F	2291
Hemispherical Temperature, ^{o}F	2372
Fluid Temperature, ^{o}F	2396

Figure 3

Comparison of Predicted vs. Actual Performance
For Gasification of SRC-II Vacuum Flash Drum Bottoms
From the Liquefaction of Powhatan Coal

	Predicted Data From DOE Report Fe 2247-21 Figure 1	Actual Data
Charge to Gasifier		
Residue (+5% Solvent) Pounds per Hour	1000	1006
Pure Oxygen, Pounds per Hour	746	742
Steam, Pounds per Hour	400	397
Total Input	2146	2145
Output From Gasifier		
Dry Product Syngas, Pounds per Hour	1725	1750
Flash Gas, Pounds per Hour	-	10
Char, Pounds per Hour	85	25
Coarse Slag, Pounds per Hour	183	87
Lockhopper Fines, Pounds per Hour	-	91
Missing Ash, Pounds per Hour	-	53
Forced Water, Pounds per Hour	149	120
Total Output	2142	2136
Analytical		
Charge Residue Analysis, Weight Percent		
C	66.7	66.1
H	3.5	3.8
N	1.5	1.1
S	2.7	2.7
O (By Diff)	0.0	1.2
Ash	25.6	25.1
Higher Heating Value, Btu per Pound	11898	11681

Figure 3 (Cont'd)

Comparison of Predicted vs. Actual Performance
For Gasification of SRC-II Vacuum Flash Drum Bottoms
From the Liquefaction of Powhatan Coal

	Predicted Data From DOE Report Fe 2247-21 Figure 1	Actual Data
Product Syngas Composition, Mole Percent		
H_2	35.5	37.0
CO	55.8	53.5
CO_2	7.1	8.4
N_2	0.60	0.20
H_2S	0.90	0.78
COS	0.07	0.04
CH_4	0.00	0.05
A	0.03	0.03
Carbon on Coarse Slag, Weight Percent	<0.5	0.8
Carbon on Lockhopper Fines, Weight Percent	-	0.9
Carbon on Char, Weight Percent	15	9.0
Percent Carbon Conversion	99.0	99.5
Gasifier Pressure-PSIG	350.	350.
Dry Product Gas, Standard Cubic Feet per Hour	32,800	33,550
Hydrogen Plus Carbon Monoxide, Standard Cubic Feet per Hour	29,900	30,360
Run Length, Hours	-	15

The values shown on Figure 3 have been slightly adjusted by computer to yield 100 percent recoveries of the elements C, H and O and of the ash.

Also shown on Figure 3 is the material balance predicted on the basis of a previous Type 1 Laboratory Evaluation of a sample of this residue (DOE Report Fe-2247-21, May, 1979). Good agreement between the two data sets is apparent.

The raw data obtained during the run are shown in Appendix A, and the Computer Processed Data are shown in Appendix B.

A small amount of dissolved gases are flashed off when the pressure of the quench and scrubber blowdown water is lowered to atmospheric. This flash gas consists of syngas with augmented amounts of CO_2 and H_2S. The exact composition is shown in Appendix A and B. It was released at a rate of 0.5 (vol) percent of the syngas produced.

Properties of the slag and char recovered at the conclusion of the run are listed in Figure 4.

Eighty-two percent of the input ash was accounted for at the end of the run. Seventy-three percent of the input ash was recovered in the solids which were removed through the lockhopper. These solids were split almost evenly into a coarse slag fraction and a lockhopper fines fraction using an eight mesh vibrating screen. Neither fraction contained significant amounts of carbon.

<u>Figure 4</u>

Gasification of
SRC-II Vacuum Flash Drum Bottoms From
Powhatan Coal
Ash, Slag and Char Properties

Stream	Coarse Slag	Lockhopper Fines	Char
Ultimate Analysis			
Wt.%			
C	0.75	0.88	5.46-9.54
H	0.00	0.00	0.00-0.07
N	0.30	0.00	0.00
S	0.56	0.76	1.82
Ash	99.87	99.71	95.08-90.24
Bulk Density	1.906	1.652	1.137
True Density	2.727	2.666	
Sieve Analysis % on US Sieve No.			
6	21.3	0	0
10	7.6	0.3	0
14	5.1	0.8	0
20	8.7	3.2	0
40	16.4	15.8	0
100	30.4	52.0	1.6
200	6.6	12.7	4.8
325	1.8	5.4	9.0
-325	2.1	9.8	84.6
% of Input Ash Recovered	35.7	37.1	9.2

Nine percent of the input ash was recovered in the char which was removed from the bottom of the char-water clarifier at the conclusion of the run. The char contained about nine (wt) percent carbon. It was difficult to obtain a uniform sample of the char, because it was obtained as a thick non-uniform slurry of very fine solids in water, and both the amount and the chemical analysis were subject to significant errors. The range of analytical results obtained from several samples is shown on Figure 4 to illustrate the magnitude of the uncertainty.

Elemental analyses by emission spectrograph of the above three solids streams and of the ash in the feed residue are summarized in Figure 5. All values are on a 100 percent basis.

Figure 5

Semiquantitative Analyses by Emission Spectrograph of Ash From Various Solids Streams Obtained During Gasification of SRC-II Vacuum Flash Drum Bottoms From the Liquefaction of Powhatan Coal

Stream Element	Charge Residue	Coarse Slag	Lockhopper Fines	Char
Si	26.5	25.1	25.1	25.3
Fe	9.4	11.1	13.1	13.2
Al	8.4	11.1	9.3	9.6
Ca	3.15	1.6	1.9	1.5
Mg	0.298	0.29	0.36	0.33
Ti	0.64	0.88	0.82	0.63
Ba	TR<0.10	ND<0.10	ND<0.10	ND<0.11
B	0.040	0.010	0.034	0.046
Mn	0.037	0.069	0.066	0.090
Pb	0.047	0.033	0.029	0.076
Ga	0.0101	0.003	0.003	0.021
Cr	0.0084	0.028	0.015	0.0097
Ni	0.0141	0.018	0.016	0.019
Mo	0.0034	0.0032	0.0029	0.0031
V	0.0077	0.0099	0.017	0.012
Cu	0.0084	0.0086	0.0099	0.019
Na	0.47	0.36	0.30	0.19
Zn	ND<0.03	ND<0.04	ND<0.04	TR<0.04
K	TR<0.10	ND<0.10	ND<0.10	ND<0.11
Zr	0.0148	0.020	0.024	0.022
Co	0.0037	0.0075	0.0069	0.0061
Sr	0.0637	0.060	0.057	0.047

ND = None Detected
TR = Trace Detected

Pilot Plant Operations

Because Gulf Mineral Resources Company and DOE wished to obtain samples of all effluent streams from the pilot plant run for detailed environmental analyses, it was decided to double the length of the run to achieve a closer approach to equilibrium and to obtain more representative water samples. This was accomplished by running two type II Preliminary Pilot Plant Evaluations back to back, thus extending the normal seven hour run period to fifteen hours.

The necessity to reduce the viscosity of the molten residue by adding a small amount of heavy distillate for the pilot plant run was established during the previously completed type I Laboratory Evaluation of this material. Therefore heavy distillate obtained from the Ft. Lewis pilot plant was added to each melt tank batch in the amount of three percent of the residue charge. No problems were encountered in handling and pumping the diluted residue at 450°F. It is probable that the undiluted residue could be handled with no problem at temperatures above 500°F. Properties of the heavy distillate are summarized in Figure 6.

Each cylinder of the residue charge pump was purged with a small amount of heavy distillate (2.0 pct of residue rate) to prevent molten residue from backing up into the charge pump cylinder.

This material was included in the gasifier charge in the material balance.

Figure 6

Properties of Heavy Distillate Obtained From The Ft. Lewis Pilot Plant

Shipment No.	721-S
Sample No.	1466
Sample Point	414
Source Coal	Powhatan
Ultimate Analysis Wt. Percent	
C	89.28
H	7.72
N	1.22
S	0.42
Ash	0.009
O(by diff)	1.351
Specific Gravity 60/60°F	1.062
Initial Boiling Point at 2.0 mm Hg, °F	~ 230

It was noticed during the run that the vibrating screen used to separate coarse slag from lockhopper fines frequently plugged with fines causing fines and water to mix with the coarse slag. Quite a few pieces of needle slag were also observed in the coarse slag.

The char obtained was extremely fine. It settled to a 20 (wt) percent solids concentration at the bottom of the char-water clarifier.

No operational problems were encountered during the 15 hour run at 350 psig. At the conclusion of the run a significant amount of slag could be seen on the gasifier wall and on the sloping floor of the gasifier near the throat. This explains why only 82 percent of the input ash had been accounted for.

A large number of special samples were obtained during the run and these were sent to Gulf for analysis.

ESTIMATE OF OPERATION FOR EXTENDED PILOT PLANT TESTS

It appears that the conditions chosen for the Type II Preliminary Pilot Plant Test were near optimum and no major change in operating conditions is suggested for future pilot plant runs. A slightly better efficiency could be obtained at a lower ratio of oxygen to residue, but this would result in a lower overall conversion and more char to recycle or dispose of in an environmentally acceptable manner. In addition, a lower gasifier temperature would result in the production of less coarse slag in relation to lockhopper fines, an undesirable result.

An extended pilot plant run of 7 to 10 days would be most desirable to determine refractory, burner and pump wear and to achieve equilibrium concentrations of trace components in the blowdown water stream.

CONCLUSIONS & RECOMMENDATIONS

SRC-II Vacuum Flash Drum Bottoms from the liquefaction of Powhatan coal appears to be a suitable feedstock for the Texaco Synthesis Gas Generation Process. It was fed to the pilot plant gasifier at 450°F after adding 3 (wt) percent heavy distillate for viscosity control, with no operating problems. It is expected that this material may be fed to the pilot plant gasifier, undiluted, at a temperature above 500°F.

About 7½ tons of this residue were successfully gasified at 350 psig in a single 15 hour pilot plant run. A 99.5 percent conversion of carbon in the feed to syngas was achieved at an oxygen feed rate of 0.74 pounds per pound of diluted residue charged. An earlier prediction of gasifier performance was verified.

It is recommended that an extended pilot plant run of 7 to 10 days duration be completed with this material to determine refractory, burner and pump wear and to establish equilibrium concentration of trace components in the blowdown water.

APPENDIX A

Raw Data

RAW DATA
MONTEBELLO COAL GASIFICATION GENERATOR

RUN NUMBER	RUN PERIOD HOURS
57901	15.00

FUEL TYPE
SRC II RESIDUE FROM POWHATAN COAL

DRY PRODUCT GAS STREAMS FROM COAL GASIFICATION

COMPONENTS	INTERNAL SYNGAS		EXTERNAL SYNGAS		FLASH GAS	
	SCFH	MOLPCT	SCFH	MOLPCT	SCFH	MOLPCT
C6H6	0.00	0.00	0.00	0.00	0.00	0.00
A	23.42	0.07	0.00	0.00	0.10	0.07
H2	12073.56	37.12	0.00	0.00	50.88	32.30
CO	17462.17	53.68	0.00	0.00	59.63	37.85
CO2	2622.90	8.06	0.00	0.00	38.40	24.38
N2	63.10	0.19	0.00	0.00	0.25	0.16
CH4	17.56	0.05	0.00	0.00	0.00	0.00
H2S	253.08	0.78	0.00	0.00	8.25	5.24
COS	13.33	0.04	0.00	0.00	0.00	0.00
NH3	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	100.00		0.00		99.99	
AVG MOL WT	19.72		0.00		23.84	

RECOVERED SOLIDS DATA

LH SLAG LB/HR	87.26	
LH FINES LB/HR	91.40	
SETTLER FINES LB/HR	24.81	
FINES ANAL	LH	SETTLER
PCT C	0.88	9.00
PCT S	0.76	1.82
PCT H	0.00	0.00
PCT ASH	98.36	89.18

DRY FUEL ANALYSIS

	WTPCT
C	66.17
H	3.75
N	1.08
S	2.67
ASH	25.02
O	1.31
CL	0.00
TOT	100.00

O2/AIR ANALYSIS

	MOLPCT
O2	99.90
A	0.10
H2	0.00
CO	0.00
CO2	0.00
N2	0.00
TOT	100.00
AMWT	32.01

CHARGE DATA

FUEL RATE LBS/HR	983.99	
FUEL TEMP	453.00	
STEAM/FUEL RATIO	0.404	
STEAM TEMP, PRES.	864.	550.
O2/AIR RATE SCFH	9159.55	

PRODUCT DATA

INT SYN GAS SCFH	32529.15
EXT SYN GAS SCFH	0.00
FLASH GAS SCFH	157.55
SOLIDS LBS/HR	203.48
H2O,FORCED,LB/HR	166.66

APPENDIX B

Computer Processed Data

COMPUTER BALANCED DATA
MONTEBELLO COAL GASIFICATION GENERATOR

RUN NUMBER 57901
RUN PERIOD HOURS 15.00
FUEL TYPE
SRC II RESIDUE FROM POWHATAN COAL

DRY PRODUCT GAS STREAMS FROM COAL GASIFICATION

COMPONENTS	INTERNAL SYNGAS		EXTERNAL SYNGAS		FLASH GAS	
	SCFH	MOLPCT	SCFH	MOLPCT	SCFH	MOLPCT
C6H6	0.00	0.00	0.00	0.00	0.00	0.00
A	8.69	0.03	0.00	0.00	0.10	0.07
H2	12408.95	36.99	0.00	0.00	51.26	32.28
CO	17947.26	53.50	0.00	0.00	60.08	37.83
CO2	2826.05	8.42	0.00	0.00	38.80	24.43
N2	64.86	0.19	0.00	0.00	0.25	0.16
CH4	18.05	0.05	0.00	0.00	0.00	0.00
H2S	260.11	0.78	0.00	0.00	8.31	5.24
COS	13.70	0.04	0.00	0.00	0.00	0.00
NH3	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL		100.00		0.00		100.00
AVG MOL WT		19.80		0.00		23.86

RECOVERED SOLIDS DATA

LH SLAG	LB/HR		139.90
LH FINES	LB/HR		91.47
SETTLER FINES	LB/HR		24.83
FINES ANAL		LH	SETTLER
PCT C		0.88	9.00
PCT S		0.76	1.82
PCT H		0.00	0.00
PCT ASH		98.36	89.18

DRY FUEL ANALYSIS

	WTPCT
C	66.09
H	3.79
N	1.08
S	2.67
ASH	25.06
O	1.31
CL	0.00
TOT	100.00

O2/AIR ANALYSIS

	MOLPCT
O2	99.90
A	0.10
H2	0.00
CO	0.00
CO2	0.00
N2	0.00
TOT	100.00
AMWT	32.01

UNACCOUNTED FOR H2S 0.059 M/HR
UNACCOUNTED FOR NH3 0.433 M/HR

CHARGE DATA

FUEL RATE LBS/HR	1005.75	
FUEL TEMP	453.00	
STEAM/FUEL RATIO	0.395	
STEAM TEMP, PRES.	864.	550.
O2/AIR RATE SCFH	8802.11	

PRODUCT DATA

INT SYN GAS SCFH	33547.69
EXT SYN GAS SCFH	0.00
FLASH GAS SCFH	158.82
SOLIDS LBS/HR	256.21
H2O,FORCED,LB/HR	119.66

METERED TO CALCULATED FLOW RATIOS
O2=1.041 FUEL=0.978 UNC CARBON=0.999 TOT SYNGAS=0.970 FLASH GAS=0.992
INT SYNGAS- PCT N2=1.00 PCT H2S=1.00 EXT SYNGAS- PCT N2=1.00 PCT H2S=1.00

PERCENT CARBON CONVERSION 99.542

APPENDIX C

Laboratory Test Reports From
P&M Coal Mining Company

THE PITTSBURG & MIDWAY COAL MINING CO.
SOLVENT REFINED COAL PILOT PLANT
P.O.Box 199 Dupont, WA 98327
Phone: 206-964-8155

Laboratory Tests Report
on
SAMPLE SHIPMENTS

Shipment No. ______
Shipment Sample No. 1465

Date Sampled 12/19/78 Time Sampled ______ Sample Point 8101

Date Tested 12/20-27/78 Time Tested ______ Reference S.S. #1344R

Sample Kind SRC-II Vacuum Bottoms Sampled By: ______

Sample Shipped to : Attn: Mr. Allen M. Robin
Texaco, Inc.
Montbello Research Laboratory
South El Monte, CA 91733

DRUM NO.	% ASH	FUSION POINT °F *
108	26.79	325
109	26.71	320
110	27.50	315
111	27.62	315
112	28.14	315
113	27.05	325
114	27.58	345
115	27.83	345
116	29.13	320
117	27.91	310
118	27.73	305
119	27.56	310
120	29.02	300
121	30.30	285
122	31.19	305
123	30.92	305
124	26.75	310
126	27.11	315
127	29.09	325
134	28.96	425

DRUM NO.	% ASH	FUSION POINT °F *
135	28.75	400
212	26.92	395
213	30.63	335
889	27.75	335
890	27.26	335
893	27.53	345
895	27.37	310
896	27.81	320
897	29.60	345
932	27.94	375
903	27.84	335
904	27.65	325
905	27.46	325
906	27.52	320
907	27.32	320
908	27.18	315
909	27.30	320
910	26.79	315
930	27.54	355
931	28.22	370

* Fusion Point done by Gradient Bar Method P&M # F-120.

PITTSBURG & MIDWAY COAL MINING COMPANY
SOLVENT REFINED COAL PILOT PLANT
P.O.Box 199 Dupont, Wa 98327
Phone: 206-964-8155

P&M

Laboratory Tests Report on SAMPLE SHIPMENTS

Shipment No. ____

Shipment Sample No. 1466

Date Sampled 12-27-78 Time Sampled 1900 Sample Point 414

Date Tested 12-27-78 Time Tested 2100 Tag No. ____

Sample Kind Heavy Distillate - Powhatan Coal Sampled By: J. Chambers

Sample Shipped to: Attn: Mr. Allen M. Robin
Texaco, Inc.
Montbello Research Laboratory
Southel Monte, CA

Sp. Gravity 60/60°F	1.062	Fusion Point (Gradient Bar)	°F
Density @ 60°F		% Ash	
Kin. Vis. @ 77°F		% Sulfur	
@100°F		% Water	
@210°F	2.984	....	

Distillation: ASTM D-1160 @ 2.0 mm Hg

Initial Boiling Point	- °F	70%	336 °F
5%	237 °F	80%	367 °F
10%	244 °F	90%	415 °F
20%	257 °F	95%	459 °F
30%	270 °F	End Point	495 °F
40%	284 °F	Recovery	98 %
50%	304 °F	Residue	2 %
60%	320 °F	Lost	- %

Elementals :

% Carbon		%	
% Hydrogen		%	
% Nitrogen		%	
% Sulfur		%	
% Oxygen		%	

Remarks : Pyridine Insoluble = Trace

Analyst : MKC

Chemist : F. Chan

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