

# **PRODUCTION OF CARBON PRODUCTS USING A COAL EXTRACTION PROCESS**

**DE-FC26-02NT41596**

## **Semiannual Report**

For the period: Sept 11, 2002--March 10, 2003  
Resubmitted: December 12, 2005

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**Abstract**

The purpose of this DOE-funded effort is to develop technologies for carbon products from coal-derived feed-stocks. Carbon products can include precursor materials such as solvent extracted carbon ore (SECO) and synthetic pitch (Synpitch). In addition, derived products include carbon composites, fibers, foams and others.

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## **1.0 Executive Summary**

The purpose of this DOE-funded effort is to develop technologies for carbon products from coal-derived feedstocks. Carbon products can include precursor materials such as solvent extracted carbon ore (SECO) and synthetic pitch (Synpitch). In addition, derived products include carbon composites, fibers, foams and others.

## **2.0 Technical**

### **2.1 Isotropic and Mesophase-Based Fibers and Composites**

#### **2.1.1 Production of Fibers**

(This reporting includes work performed by James Bowers under a separate NETL-sponsored fellowship and may overlap reporting under separate cover).

The following pitches were investigated:

- a. AeroCarb 80 Baseline
- b. AeroCarb 80 with fibrils
- c. QI Free CTP Air blown 275°C for 15hr SP=208°C
- d. QI Free CTP Air blown 275°C for 21hr SP~230°C
- e. WVU SynPitch SP=204°C
- f. WVU SynPitch SP=243.1°C

Each pitch was ground with mortar and pestle and then sized less than 20 mesh. Fibers were spun using the Wayne Yellow Jacket extruder with a variable speed 0.5 inch screw and a 300 micron single hole spinneret. There are five programmable temperature control zones along the extruder. The uptake reel speed was adjusted to produce an array of fiber diameters.

The spinning conditions for the respective pitches are listed in Table 1.

**Table 1. Spinning Conditions for Pitches.**

<b>Sample</b>	<b>Zone Temperatures</b>	<b>Motor Speed</b>	<b>Comment</b>
AeroCarb 80 (Baseline)	DZ3=535 °C, DZ2=535 °C, DZ1 = 530 °C, Z2 = 490 °C, Z1 = 445 °C.	60 rpm	The large capacity screw and the old single hole spinneret were used.
AeroCarb 80 with fibrils.	DZ3=565 °C, DZ2 = 600 °C, DZ1 = 600 °C, Z2 = 580 °C, Z1 = 475 °C.	variable.	The small capacity screw and the new single hole spinneret were used.
QI Free CTP Air blown @ 275°C for 15hr, SP=208°C	DZ3=440 °C, DZ2=475 °C, DZ1=475 °C, Z2=475 °C, Z1=400 °C.	200 rpm	The small capacity screw and the old single hole spinneret were used.
WVU SynPitch SP=204°C	DZ3=440 °C, DZ2=475 °C, DZ1=475 °C, Z2=475 °C, Z1=400 °C.	60 rpm.	The small capacity screw and the old single hole spinneret were used.
WVU SynPitch SP=243.1°C	DZ3=490 °C, DZ2=525 °C, DZ1=525 °C, Z2=475 °C, Z1=435 °C.	45 rpm	The small capacity screw and the old single hole spinneret were used.

Each set of fibers was oxygen stabilized at 0.2 °C/min to 275 °C in air using the muffle furnace. The fibers were carbonized at 5 °C/min to 1100 °C under nitrogen (~10ml/min) in the small tube furnace.

A Thermogravimetric Analyzer (TGA) was used to measure the weight change for oxygen stabilization. The heating rate was set to match the heating rate of the muffle furnace.

The fibers were tested for strength using an Instron 5869 load frame and 10N load cell with the small pneumatic grips. Single fibers were attached to 50 mm paper coupons with Scotch tape and then super glued. The crosshead speed of the load frame was set to 0.2 mm/min.

The electrical resistivity of the fibers was measured using a Radio Shack digital multimeter to directly measure the resistance across single fibers. Two drops of silver paint along the length of the fiber was used for electrical contacts. The distances between the contacts were measured with a Starret dial caliper to the nearest thousandth inch.



The diameter of the fibers was measured using a Zeiss Axiostar plus microscope at 400X with a Pixera Pro 150ES digital camera. The analysis software was Image Pro Express V4.5.1.3.

*Results.*

**Table 2. AeroCarb 80 Baseline Instron data.**

No	Di	Max % Strain	Tensile Str (Mpa)	Young's Mod (Gpa)
1	33.2	0.56%	226.9	40.8
3	32.2	0.87%	348.7	40.0
4	31.7	0.59%	253.7	43.0
5	32.3	0.50%	188.6	37.4
6	42.6	0.65%	239.2	36.8
7	32.3	0.66%	275.7	41.7
8	50.4	0.49%	131.8	26.4
9	34.9	0.60%	215.3	35.6
10	30.1	0.69%	317.8	45.6
Average	35.5	0.62%	244.2	38.6
Std Dev	6.6	0.11%	65.5	5.6

**Table 3. AeroCarb 80 with fibrils Instron data.**

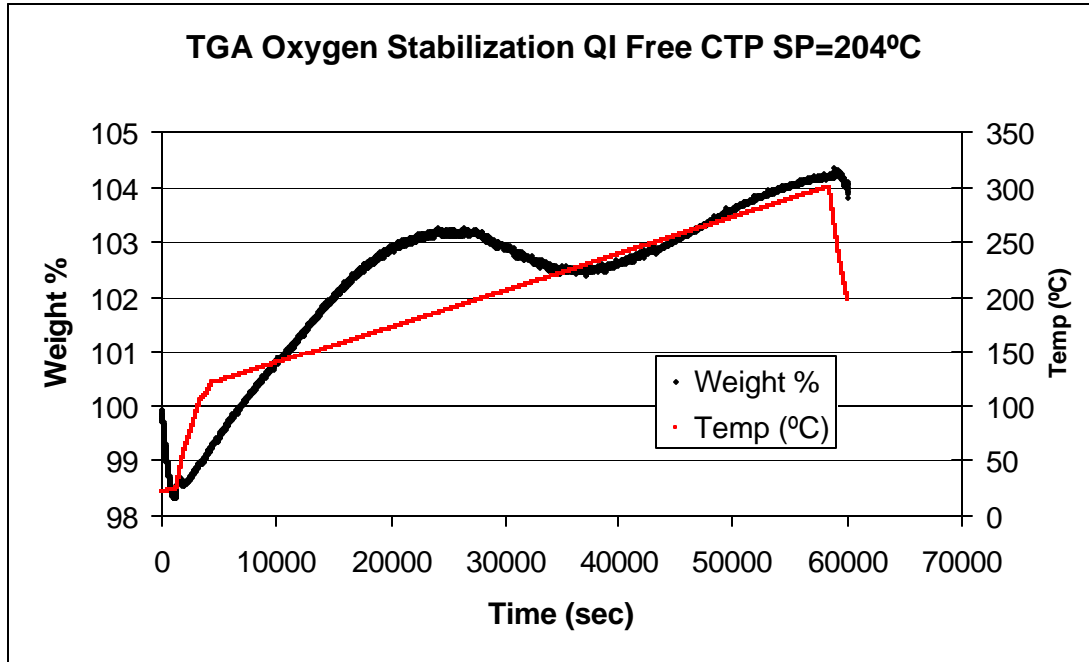
No	Di	Max % Strain	Tensile Str (Mpa)	Young's Mod (Gpa)
1	33.2	0.56%	226.9	40.8
3	32.2	0.87%	348.7	40.0
4	31.7	0.59%	253.7	43.0
5	32.3	0.50%	188.6	37.4
6	42.6	0.65%	239.2	36.8
7	32.3	0.66%	275.7	41.7
8	50.4	0.49%	131.8	26.4
9	34.9	0.60%	215.3	35.6
10	30.1	0.69%	317.8	45.6
Average	35.5	0.62%	244.2	38.6
Std Dev	6.6	0.11%	65.5	5.6

**Table 4. QI Free CTP Air blown 275°C for 15hr SP=208°C Instron data.**

No	Di	Max % Strain	Tensile Str (Mpa)	Young's Mod (Gpa)
Average	30.1	0.62%	353	37.4
Std Dev	1.6	0.11%	32.8	2.9

**Table 5. Resistivity of QI Free CTP SP=208°C**

No	Di(um)	L(mm)	R(kOhm)	rho(mO-m)
1	29.6	28.9	3.15	75.0
2	32.9	44.2	4.24	81.6
3	31.0	43.0	3.47	60.9
4	32.1	29.7	2.11	57.5
Average	31.4	36.4	3.24	68.7
Std Dev	1.4	8.3	0.88	11.4

**Figure 1. Air Stabilization Curve for CTP, SP = 204 °C.****Table 6. Resistivity for QI Free CTP Air blown 275°C for 21hr SP~230°C**

No	Di(um)	L(mm)	R(kOhm)	rho(uOhm- m)
1	28.9	26.8	2.10	51.6
2	28.9	25.1	2.32	60.6
3	29.8	42.8	3.84	62.6
4	25.0	28.7	2.90	49.7
Average	28.2	30.9	2.79	56.1
Std Dev	2.1	8.1	0.78	6.4

WVU SynPitch SP=204°C spun very well but melted together during oxygen stabilization.

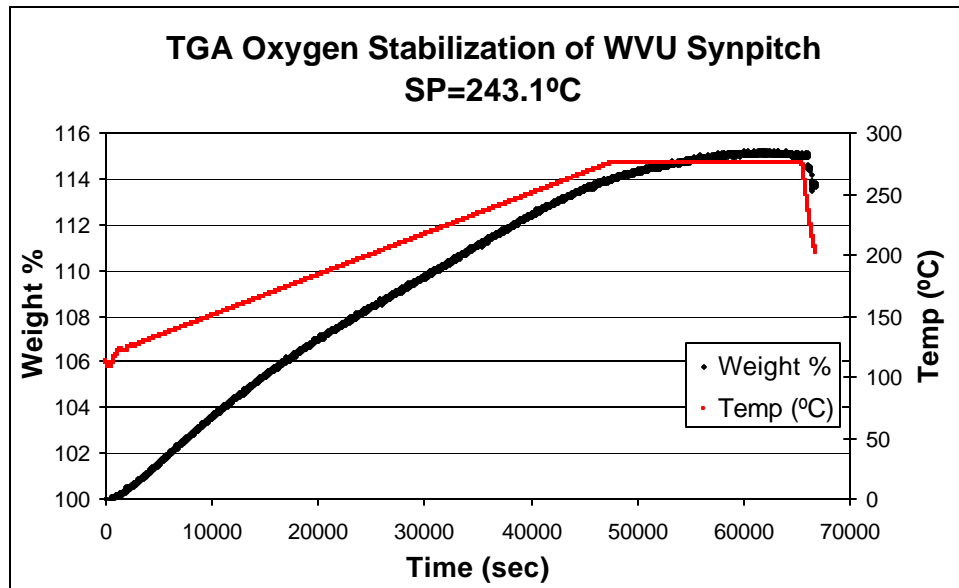


Figure 2. TGA analysis of WVU SynPitch SP=243.1°C, immediately after spinning.

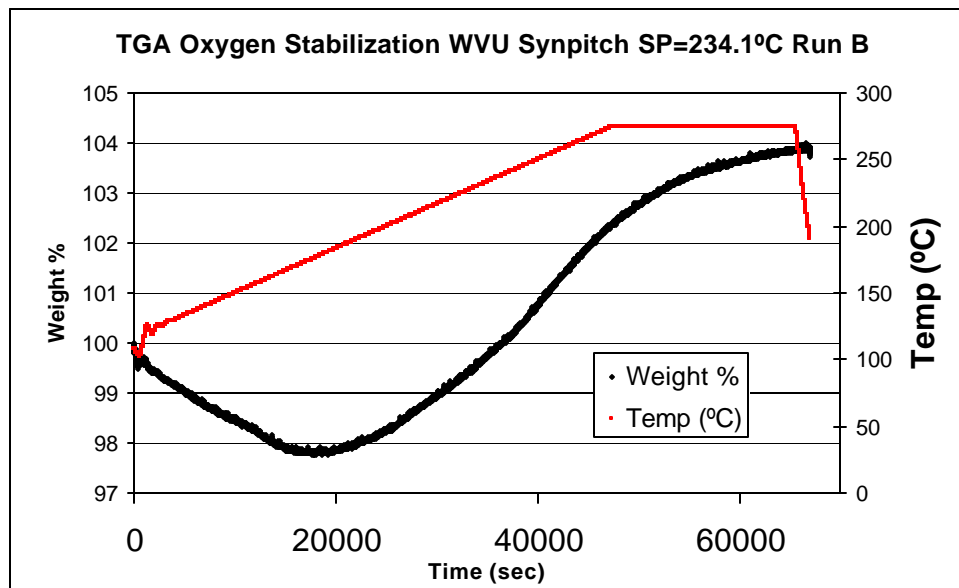


Figure 3. TGA analysis ~24hrs after spinning.

**Table 7. Resistivity of WVU SynPitch Fibers, SP=243.1°C**

No	Di(um)	L(mm)	R(kOhm)	rho(uOhm-m)
1	39.2	56.8	2.78	59.0
2	39.9	54.6	2.68	61.2
3	39.8	55.9	2.56	57.1
Average	39.6	55.8	2.67	59.1
Std Dev	0.38	1.1	0.11	2.1

### **2.1.2 Production of Composites**

No data this reporting period.

### **2.1.3 Processing Optimization**

No data this reporting period.

## **2.2 Coal Derived Carbon Foam**

### **2.2.1 Pretreatment on Manufacture of Carbon Foams at Low Pressures**

Coal based carbon foams were prepared from different coals, including Kingwood and Sewell coal. Both of them show good foaming properties and yield good products using high pressure method.

Investigated pitch based carbon foam; includes adjusting the properties of precursors by heat treatment, and foaming conditions. The precursors include A240 petroleum pitch and hydrogenated coal derived pitch. Coal tar pitch is also going to be involved in next step.

As an aside, SEM was used study silica fibers unintentionally generated from carbon foam. The fiber diameter is around 200 nm and typical length was more than several millimeters, which are located in the normal range of silica nanofibers.

In addition, the gas adsorption behavior of activated carbon foam was characterized. It was found that the adsorption follows type IV adsorption with surface area around 300 m<sup>2</sup>/g. Combined with SEM results, the surface area together with the burn-off rate could be controlled by the thickness of the wall of carbon foam.

### **2.2.2 Evaluation of Properties of Foams**

No data this reporting period.

## **2.3 Production of Coal-Derived Pitches and Cokes**

### **2.3.1 Construction of a Continuous Green Coker**

The design phase has been completed as reported in the 1Q03 report. The unit is being constructed by Northco Inc, Morgantown WV. Hydraulic equipment has been ordered from Enerpac. This equipment includes a pump, hoses, 4-way valve, and a double action cylinder with a 12 in stroke. This should be adequate for the 9 in long furnace. A double acting cylinder was used in the event that the thermal expansion or the pyrolyzation causes sticking.

### **2.3.2 Effects of Green Coking and Calcining Conditions**

No data in this reporting period.

### **2.3.3 Development of Matrix and Mesophase Pitches**

To test the hypothesis that coal dissolution is a function of the relative pressure inside the pores of the coal compared to the pressure of the atmosphere surrounding the solvent as the solute dissolves, an extraction run under vacuum was performed. The Clausius Clapeyron equation was used to predict the vapor pressure of NMP at unknown points, using two known vapor pressures at 20°C and 202°C. Figure 1 is a graph of the vapor pressure of NMP as a function of temperature, from which it is seen that NMP vapor pressure is approximately 37mm Hg at 110°C. Based on a vacuum capability of 40 mm Hg, an Erlenmeyer flask was connected to house vacuum and submerged in a sand bath at 115°C, as illustrated in Figure 2.

Initial results suggest that there was no significant change in yield when the dissolution was run under vacuum. This could be because the solubility limit of coal extract in NMP is reached, because the vapor pressure of NMP at 115°C is not high enough to drive out coal particles surrounded by NMP, or because the process is not diffusion controlled.

The next step will be to experiment with dissolution of coal under more extreme circumstances, namely ultrasonic mixing. Ultrasonic mixers may be able to provide the necessary temperature and pressure to drive the dissolution, although it may not matter if the solubility of coal in NMP is reached at that particular temperature.

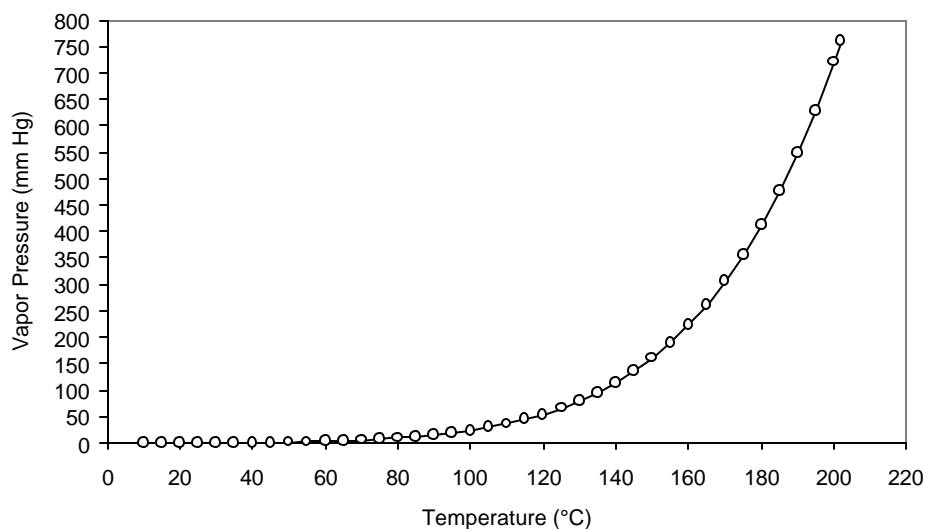


Figure 4. Vapor Pressure versus Temperature for n-methyl pyrrolidone.

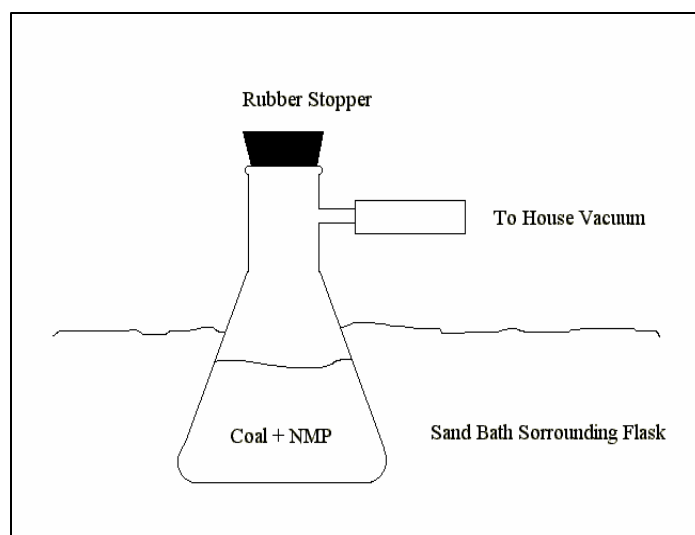


Figure 5. Flask Under Vacuum

The classes of compounds resulting from the dissolution of coal in NMP may be correlated with properties of Solvent Extracted Carbon Ore (SECO). For that reason, classes of compounds in SECO are separated and identified by high performance liquid chromatography (HPLC). The column is packed with an adsorbent (alumina in this case) with the sample at the top of the column. Both non-polar solvents and polar solvents have been trialed in the column. Carbon tetrachloride was been successfully replaced by combining hexane (less polar than  $\text{CCl}_4$ ) and toluene (which is more polar than  $\text{CCl}_4$ ).

Alcoa intends to supply a six pound sample chromatographic-grade alumina for this project.

The chromatography runs will be performed in a walk-in hood (Room 317 in West Virginia University's Engineering Research Building (ERB)). All trials are performed in 1 inch by 4 foot (Figure 3) chromatography columns.

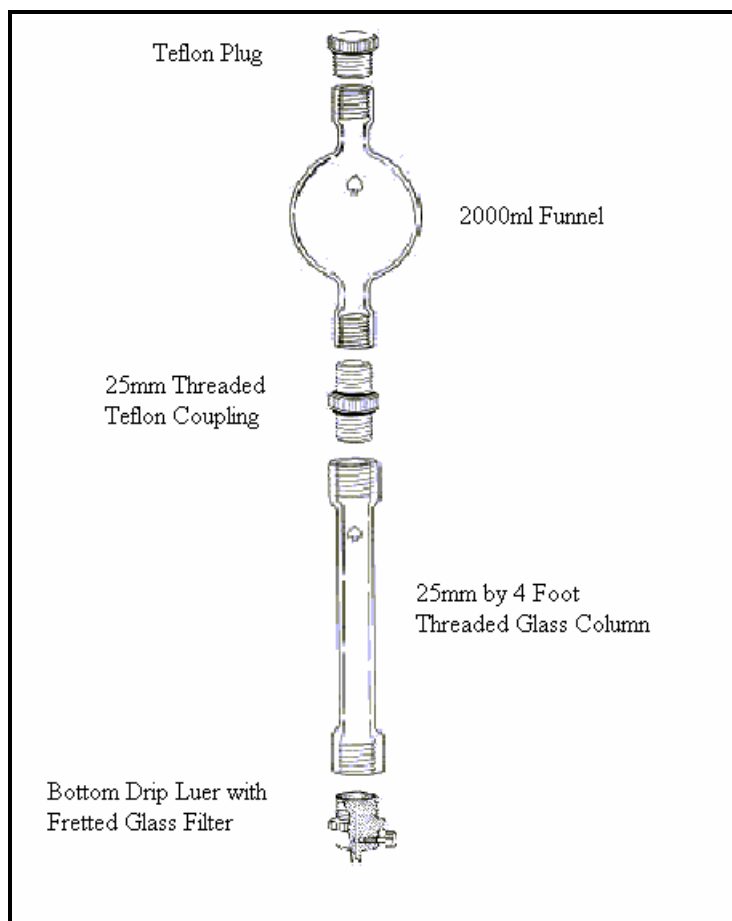


Figure 6. HPLC Tube.

More UV-VIS spectroscopy data has also been collected and used to calculate the variance present during the reactions thus far. Reactions of coal and NMP in 10cc test tubes were performed at different temperatures with many replicates to obtain an accurate estimate of the variance.

#### BET Surface Analysis Procedures

Surface area is estimated using the Brunauer-Emmett-Teller (BET) method.

1. Determine saturation pressure,  $P_0$
2. Prepare empty tube and fill reservoir with liquid nitrogen
3. Use supplied metal funnel/stand for filling test tube and weighing sample
4. Weigh empty test tube designed for BET surface analyzer

5. Add approximately 1 gram of the sample to the test tube
6. Place tube in VacPrep 061 apparatus and apply heat and vacuum
7. Standard temperature for coal and insoluble residues is 105°C
8. Slowly open the valve to vacuum, taking care to prevent particles from entering the tubing and/or the machine
9. Let sample dry for approximately 2 hours, weigh test tube and sample; subtract test tube weight and record dry sample weight.
10. Fill reservoir with liquid nitrogen
11. Place test tube into second port; and a blank tube in the first port to serve as a standard.
12. Choose/edit setup conditions; if using a powder-like sample, use an evacuation rate of 10 mmHg/min or less to prevent particles from entering the tubing and/or the machine
13. If analysis occurs for several hours, liquid nitrogen may need to be added to the reservoir to ensure a high operating level
14. Test tubes are cleaned in an ultrasonic bath, rinsed with distilled water, and placed in drying oven.

Data is summarized in Tables 8-13. Detailed data is contained in Appendix A.

**Table 8. Summary of BET Results.**

	Bailey Feed Coal	CPA#528 56 Insoluble Residue	Kingwood Feed Coal	CPA#52857 Insoluble Residue	Kingwood Float 1.35 Feed Coal	CPA#52857 Insoluble Residue
BET Surface Area (m <sup>2</sup> /g):	0.5137	0.4513	0.4290	0.9918	0.2253	0.7521
Correlation Coefficient:	0.96544	0.96231	0.96721	0.98534	0.96814	0.95685



**Table 9. Summary of BET Results (continued 2).**

	Lab Washed Feed Coal	CPA#527 85 Insoluble Residue	Not Lab Washed Feed Coal	CPA#52785 Insoluble Residue	Litwar Feed Coal	CPA#53077 Insoluble Residue
BET Surface Area (m <sup>2</sup> /g):	0.4568	0.4631	0.3891	0.4868	0.5308	0.9589
Correlation Coefficient:	0.95897	0.93866	0.97006	0.93779	0.96391	0.98106

**Table 10. Summary of BET Results (continued 3).**

	Poca #12 Feed Coal	CPA #53245 Insoluble Residue	Shoemaker Feed Coal	CPA#53047 Insoluble Residue
BET Surface Area (m <sup>2</sup> /g):	0.5321	0.2909	0.6636	0.5378
Correlation Coefficient:	0.96206	0.95432	0.96625	0.94807

**Table 11. Summary of Helium Pycnometry Results.**

	Bailey Feed Coal	CPA #52856 Insoluble Residue	Kingwood Feed Coal	CPA #52857 Insoluble Residue	Kingwood Float 1.35 Feed Coal	CPA#52857 Insol. Residue
Average Volume (cm <sup>3</sup> ):	2.3239	2.2843	2.1902	2.1545	1.5167	1.1697
Standard Deviation:	0.0085	0.0067	0.0086	0.0042	0.0027	0.0039
Average Density (g/cm <sup>3</sup> ):	1.3699	1.4019	1.4042	1.6494	1.4671	1.3230
Standard Deviation:	0.0050	0.0041	0.0055	0.0032	0.0026	0.0044

**Table 12. Summary of Helium Pycnometry Results (Continued 2)**

	Lab Washed Feed Coal	CPA#52785 Insoluble Residue	Not Lab Washed Feed Coal	CPA#52785 Insoluble Residue	Litwar Feed Coal	CPA #53077 Insoluble Residue
Average Volume (cm <sup>3</sup> ):	2.6637	2.5633	2.3857	2.6002	2.3077	2.2955
Standard Deviation:	0.0032	0.0029	0.0071	0.0039	0.0023	0.0066
Average Density (g/cm <sup>3</sup> ):	1.3314	1.4147	1.3572	1.4298	1.3562	1.4167
Standard Deviation:	0.0016	0.0016	0.0040	0.0021	0.0014	0.0041

**Table 13. Summary of Helium Pycnometry Results (Continued 3).**

	Poca #12 Feed Coal	CPA#53245 Insoluble Residue	Shoemaker Feed Coal	CPA#53047 Insoluble Residue
Average Volume (cm <sup>3</sup> ):	2.3489	2.3539	2.6302	2.5842
Standard Deviation:	0.0053	0.0034	0.0090	0.0048
Average Density (g/cm <sup>3</sup> ):	1.3690	1.3587	1.3299	1.4259
Standard Deviation:	0.0031	0.0020	0.0045	0.0026

## 2.4 Technology Transfer

No data this reporting period.

### 3.0 Appendix A. Detailed Data Sample.

#### A.1. BET Surface Area Measurements

Gemini 2375 V3.03  
Instrument ID:  
Setup Group: 2 - (used)

Sample ID:	1006 - Bailey Feed Coal	Started:	8/4/2003 15:01
Sample Weight: (g)	1.0045	Completed:	8/4/2003 18:21
Evacuation Rate:	10	Evacuation Time: (min)	3
(mmHg/min)			
Measured Free Space:	-3.119	Saturation Pressure: (mmHg)	748.43
(cm <sup>3</sup> ) STP			
Analysis Mode:	Equilibration	Equilibration Time: (sec)	5

##### BET Multipoint Surface Area Report

Surface Area: (m<sup>2</sup>/g) 0.5137  
Slope: 9.409854  
Y-Intercept: -0.935854  
C: -9.054828  
Vm: 0.118008  
Correlation Coefficient: 0.96544

##### Langmuir Surface Area Report

Surface Area: (m<sup>2</sup>/g) 3.1221  
Slope: 1.394316  
Y-Intercept: 0.692066  
b: 0.496348  
Vm: 0.717197  
Correlation Coefficient: 0.88377

Sample ID:	1006 - Bailey Feed Coal	Started:	8/4/2003 15:01
Sample Weight: (g)	1.0045	Completed:	8/4/2003 18:21
Evacuation Rate:	10	Evacuation Time: (min)	3
(mmHg/min)			
Measured Free Space:	-3.119	Saturation Pressure: (mmHg)	748.43
(cm <sup>3</sup> ) STP			
Analysis Mode:	Equilibration	Equilibration Time: (sec)	5

t-Method Micropore Report

Micropore Volume (cm <sup>3</sup> /g)	-0.000044
Micropore Area (m <sup>2</sup> /g)	-0.3420
External Surface Area: (m <sup>2</sup> /g)	0.8557
Slope:	0.055323
Y-Intercept:	-0.028671
Correlation Coefficient:	1
Thickness Values Between: (Å)	3.500 and 5.000
Area Correction Factor:	1

$$t = [13.9900 / (0.0340 - \log(P/P_o))]^{0.5000}$$

Analysis			Log		
Relative Pressure	Pressure (mmHg)	Volume Adsorbed (cm <sup>3</sup> /g) STP	Elapsed Time (h:m)	Statistical Thickness (Å)	Surface Area Point
0.1000	74.85	0.175	2:59	3.678	*
0.2002	149.84	0.213	3:01	4.370	*
0.3003	224.76	0.246	3:04	5.014	*
0.4005	299.72	0.280	3:06	5.694	*
0.5005	374.61	0.319	3:09	6.466	*
0.6006	449.48	0.367	3:12	7.400	*
0.7008	524.48	0.423	3:14	8.617	*
0.8006	599.17	0.521	3:17	10.350	*
0.9001	673.66	0.750	3:20		

Sample ID:	1006 - Bailey Feed Coal	Started:	8/4/2003 15:01
Sample Weight: (g)	1.0045	Completed:	8/4/2003 18:21
Evacuation Rate: (mmHg/min)	10	Evacuation Time: (min)	3
Measured Free Space: (cm <sup>3</sup> ) STP	-3.119	Saturation Pressure: (mmHg)	748.43
Analysis Mode:	Equilibration	Equilibration Time: (sec)	5

BJH Adsorption Pore Distribution Report					
$t = 3.5400[-5.0000/\ln(P/P_0)].3330$					
Pore Diameter Range (Å)	Average Diameter (Å)	Incremental Pore Volume (cm <sup>3</sup> /g)	Cumulative Pore Volume (cm <sup>3</sup> /g)	Incremental Pore Area (m <sup>2</sup> /g)	Cumulative Pore Area (m <sup>2</sup> /g)
2.05.2 - 104.1	122.8	0.000492	0.000492	0.160	0.160
104.1 - 69.2	79.1	0.000202	0.000694	0.102	0.262
69.2 - 51.0	57.0	0.000113	0.000807	0.079	0.341
51.0 - 39.7	43.7	0.000101	0.000907	0.092	0.434
39.7 - 31.8	34.7	0.000084	0.000991	0.097	0.531
31.8 - 25.7	27.9	0.000068	0.001059	0.097	0.628
25.7 - 20.7	22.5	0.000064	0.001124	0.114	0.743
20.7 - 15.9	17.5	0.000077	0.001201	0.175	0.918

Gemini 2375 V3.03  
Instrument ID:  
Setup Group: 2 - (used)

Sample ID:	1014 - Bailey Insoluble Residue	Started:	8/14/2003 11:31
Sample Weight: (g)	0.9210	Completed:	8/14/2003 14:50
Evacuation Rate: (mmHg/min)	10	Evacuation Time: (min)	3
Measured Free Space: (cm <sup>3</sup> ) STP	-2.957	Saturation Pressure: (mmHg)	748.43
Analysis Mode:	Equilibration	Equilibration Time: (sec)	5

#### BET Multipoint Surface Area Report

Surface Area: (m <sup>2</sup> /g)	0.4513
Slope:	10.839115
Y-Intercept:	-1.193247
C:	-8.083715
Vm:	0.103671
Correlation Coefficient:	0.96231

#### Langmuir Surface Area Report

Surface Area: (m <sup>2</sup> /g)	2.5695
Slope:	1.694149
Y-Intercept:	0.693986
b:	0.409637
Vm:	0.590267
Correlation Coefficient:	0.90665

Sample ID:	1014 - Bailey Insoluble Residue	Started:	8/14/2003 11:31
Sample Weight: (g)	0.9210	Completed:	8/14/2003 14:50
Evacuation Rate: (mmHg/min)	10	Evacuation Time: (min)	3
Measured Free Space: (cm <sup>3</sup> ) STP	-2.957	Saturation Pressure: (mmHg)	748.43
Analysis Mode:	Equilibration	Equilibration Time: (sec)	5

t-Method Micropore Report	
Micropore Volume (cm <sup>3</sup> /g)	0.000001
Micropore Area (m <sup>2</sup> /g)	-0.2576
External Surface Area: (m <sup>2</sup> /g)	0.7089
Slope:	0.045829
Y-Intercept:	0.00046
Correlation	1
Coefficient:	
Thickness Values Between: (Å)	3.500 and 5.000
Area Correction Factor:	1
$t = [13.9900 / (0.0340 - \log(P/P_o))]^{0.5000}$	

Relative Pressure	Analysis		Log		
	Pressure (mmHg)	Volume Adsorbed (cm <sup>3</sup> /g) STP	Elapsed Time (h:m)	Statistical Thickness (Å)	Surface Area Point
0.1000	74.85	0.169	2:57	3.678	*
0.2002	149.81	0.201	3:00	4.370	*
0.3003	224.74	0.228	3:02	5.014	*
0.4004	299.64	0.258	3:05	5.694	*
0.5006	374.64	0.289	3:07	6.467	*
0.6005	449.43	0.324	3:10	7.400	*
0.7007	524.43	0.379	3:13	8.616	*
0.8008	599.35	0.454	3:16	10.355	*
0.9006	674.05	0.611	3:18		

Sample ID:	1014 - Bailey Insoluble Residue	Started:	8/14/2003 11:31
Sample Weight: (g)	0.9210	Completed:	8/14/2003 14:50
Evacuation Rate: (mmHg/min)	10	Evacuation Time: (min)	3
Measured Free Space: (cm <sup>3</sup> ) STP	-2.957	Saturation Pressure: (mmHg)	748.43
Analysis Mode:	Equilibration	Equilibration Time: (sec)	5

BJH Adsorption Pore Distribution Report					
$t = 3.5400[-5.0000/\ln(P/P_o)].3330$					
Pore Diameter Range (Å)	Average Diameter (Å)	Incremental Pore Volume (cm <sup>3</sup> /g)	Cumulative Pore Volume (cm <sup>3</sup> /g)	Incremental Pore Area (m <sup>2</sup> /g)	Cumulative Pore Area (m <sup>2</sup> /g)
207.6 - 105.6	124.4	0.000342	0.000342	0.110	0.110
105.6 - 70.5	80.5	0.000165	0.000507	0.082	0.192
70.5 - 52.4	58.4	0.000125	0.000632	0.086	0.278
52.4 - 41.1	45.1	0.000078	0.000710	0.070	0.347
41.1 - 33.1	36.1	0.000071	0.000781	0.079	0.426
33.1 - 27.1	29.3	0.000071	0.000852	0.096	0.522
27.1 - 22.0	23.9	0.000064	0.000916	0.107	0.629
22.0 - 17.3	18.9	0.000076	0.000992	0.161	0.790



Gemini 2375 V3.03  
Instrument ID:  
Setup Group: 2 - (used)

Sample ID:	1000 - Kingwood Feed Coal	Started:	7/29/2003 9:51
Sample Weight: (g)	1.1639	Completed:	7/29/2003 13:11
Evacuation Rate: (mmHg/min)	10	Evacuation Time: (min)	3
Measured Free Space: (cm <sup>3</sup> ) STP	-2.862	Saturation Pressure: (mmHg)	751.05
Analysis Mode:	Equilibration	Equilibration Time: (sec)	5

#### BET Multipoint Surface Area Report

Surface Area: (m<sup>2</sup>/g) 0.4290  
Slope: 11.189691  
Y-Intercept: -1.041966  
C: -9.739015  
Vm: 0.098544  
Correlation Coefficient: 0.96721

#### Langmuir Surface Area Report

Surface Area: (m<sup>2</sup>/g) 2.7159  
Slope: 1.602862  
Y-Intercept: 0.886729  
b: 0.553216  
Vm: 0.623884  
Correlation Coefficient: 0.86706

Sample ID:	1000 - Kingwood Feed Coal	Started:	7/29/2003 9:51
Sample Weight: (g)	1.1639	Completed:	7/29/2003 13:11
Evacuation Rate: (mmHg/min)	10	Evacuation Time: (min)	3
Measured Free Space: (cm <sup>3</sup> ) STP	-2.862	Saturation Pressure: (mmHg)	751.05
Analysis Mode:	Equilibration	Equilibration Time: (sec)	5

t-Method Micropore Report	
Micropore Volume (cm <sup>3</sup> /g)	-0.000047
Micropore Area (m <sup>2</sup> /g)	-0.2838
External Surface Area: (m <sup>2</sup> /g)	0.7128
Slope:	0.046084
Y-Intercept:	-0.030610
Correlation Coefficient:	1
Thickness Values Between: (Å)	3.500 and 5.000
Area Correction Factor:	1
$t = [13.9900 / (0.0340 - \log(P/P_o))]^{0.5000}$	

		Analysis		Log	
Relative Pressure	Pressure	Volume	Elapsed Time	Statistical	Surface Area
	(mmHg)	Adsorbed		Thickness	Point
		(cm <sup>3</sup> /g) STP	(h:m)	(Å)	
0.1000	75.13	0.139	2:58	3.679	*
0.2001	150.31	0.171	3:01	4.370	*
0.3003	225.57	0.199	3:03	5.014	*
0.4004	300.73	0.229	3:06	5.694	*
0.5005	375.88	0.262	3:08	6.466	*
0.6006	451.09	0.302	3:11	7.401	*
0.7006	526.22	0.353	3:14	8.615	*
0.8007	601.35	0.436	3:17	10.352	*
0.9003	676.20	0.623	3:20		

Sample ID:	1000 - Kingwood Feed Coal	Started:	7/29/2003 9:51
Sample Weight: (g)	1.1639	Completed:	7/29/2003 13:11
Evacuation Rate: (mmHg/min)	10	Evacuation Time: (min)	3
Measured Free Space: (cm <sup>3</sup> ) STP	-2.862	Saturation Pressure: (mmHg)	751.05
Analysis Mode:	Equilibration	Equilibration Time: (sec)	5

# BJH Adsorption Pore Distribution Report

$$t = 3.5400[-5.0000/\ln(P/P_o)].3330$$

Pore Diameter Range (Å)	Average Diameter (Å)	Incremental Pore Volume (cm <sup>3</sup> /g)	Cumulative Pore Volume (cm <sup>3</sup> /g)	Incremental Pore Area (m <sup>2</sup> /g)	Cumulative P (m <sup>2</sup> /g)
205.2 - 103.7	122.4	0.000398	0.000398	0.130	0.130
103.7 - 68.6	78.6	0.000170	0.000568	0.087	0.217
68.6 - 50.5	56.5	0.000105	0.000674	0.075	0.291
50.5 - 39.2	43.2	0.000080	0.000753	0.074	0.365
39.2 - 31.3	34.2	0.000070	0.000823	0.081	0.447
31.3 - 25.2	27.5	0.000059	0.000882	0.086	0.532
25.2 - 20.2	22.0	0.000054	0.000936	0.098	0.630
20.2 - 15.4	17.0	0.000058	0.000994	0.136	0.767

Sample ID:	1001 - Kingwood Float 1.35 Feed Coal	Started:	8/5/2003 13:02
Sample Weight: (g)	1.4813	Completed:	8/5/2003 16:23
Evacuation Rate: (mmHg/min)	10	Evacuation Time: (min)	3
Measured Free Space: (cm <sup>3</sup> ) STP	-4.106	Saturation Pressure: (mmHg)	748.43
Analysis Mode:	Equilibration	Equilibration Time: (sec)	5

BJH Adsorption Pore Distribution Report					
$t = 3.5400[-5.0000/\ln(P/P_0)].3330$					
Pore Diameter Range (Å)	Average Diameter (Å)	Incremental Pore Volume (cm <sup>3</sup> /g)	Cumulative Pore Volume (cm <sup>3</sup> /g)	Incremental Pore Area (m <sup>2</sup> /g)	Cumulative Pore Area (m <sup>2</sup> /g)
204.0 - 102.9	121.6	0.000241	0.000241	0.079	0.079
102.9 - 67.8	77.7	0.000084	0.000325	0.043	0.122
67.8 - 49.7	55.6	0.000058	0.000383	0.042	0.164
49.7 - 38.4	42.4	0.000040	0.000423	0.038	0.202
38.4 - 30.4	33.3	0.000036	0.000459	0.043	0.245
30.4 - 24.4	26.6	0.000025	0.000484	0.038	0.282
24.4 - 19.3	21.1	0.000025	0.000509	0.048	0.330
19.3 - 14.6	16.2	0.000036	0.000545	0.089	0.419

Gemini 2375 V3.03  
Instrument ID:  
Setup Group: 2 - (used)

Sample ID:	1009 - Kingwood Float 1.35 Insoluble Residue	Started:	8/6/2003 12:08
Sample Weight: (g)	1.0461	Completed:	8/6/2003 15:29
Evacuation Rate: (mmHg/min)	10	Evacuation Time: (min)	3
Measured Free Space: (cm <sup>3</sup> ) STP	-2.720	Saturation Pressure: (mmHg)	748.43
Analysis Mode:	Equilibration	Equilibration Time: (sec)	5

#### BET Multipoint Surface Area Report

Surface Area: 0.7521  
(m<sup>2</sup>/g)  
Slope: 6.060949  
Y-Intercept: -0.272630  
C: -21.231407  
Vm: 0.172762  
Correlation Coefficient: 0.95685

#### Langmuir Surface Area Report

Surface Area: 4.0978  
(m<sup>2</sup>/g)  
Slope: 1.062331  
Y-Intercept: 0.578445  
b: 0.544505  
Vm: 0.941326  
Correlation Coefficient: 0.70809

Sample ID:	1009 - Kingwood Float 1.35 Insoluble Residue	Started:	8/6/2003 12:08
Sample Weight: (g)	1.0461	Completed:	8/6/2003 15:29
Evacuation Rate: (mmHg/min)	10	Evacuation Time: (min)	3
Measured Free Space: (cm <sup>3</sup> ) STP	-2.720	Saturation Pressure: (mmHg)	748.43
Analysis Mode:	Equilibration	Equilibration Time: (sec)	5

t-Method Micropore Report	
Micropore Volume (cm <sup>3</sup> /g)	0.000033
Micropore Area (m <sup>2</sup> /g)	-0.1261
External Surface Area: (m <sup>2</sup> /g)	0.8782
Slope:	0.056776
Y-Intercept:	0.021144
Correlation Coefficient:	1
Thickness Values Between: (Å)	3.500 and 5.000
Area Correction Factor:	1
$t = [13.9900/(0.0340 - \log(P/P_o))]^{0.5000}$	

Relative Pressure	Analysis		Log		
	Pressure (mmHg)	Volume Adsorbed (cm <sup>3</sup> /g) STP	Elapsed Time (h:m)	Statistical Thickness (Å)	Surface Area Point
0.1000	74.85	0.230	3:00	3.678	*
0.2001	149.75	0.269	3:02	4.369	*
0.3001	224.60	0.304	3:04	5.013	*
0.4001	299.47	0.340	3:07	5.692	*
0.5002	374.39	0.379	3:09	6.464	*
0.6002	449.22	0.426	3:12	7.397	*
0.7004	524.23	0.485	3:14	8.612	*
0.7521	562.92	0.845	3:20	9.419	*

Sample ID:	1009 - Kingwood Float 1.35 Insoluble Residue	Started:	8/6/2003 12:08
Sample Weight: (g)	1.0461	Completed:	8/6/2003 15:29
Evacuation Rate: (mmHg/min)	10	Evacuation Time: (min)	3
Measured Free Space: (cm <sup>3</sup> ) STP	-2.720	Saturation Pressure: (mmHg)	748.43
Analysis Mode:	Equilibration	Equilibration Time: (sec)	5

BJH Adsorption Pore Distribution Report					
$t = 3.5400[-5.0000/\ln(P/P_0)]^{3330}$					
Pore Diameter Range (Å)	Average Diameter (Å)	Incremental Pore Volume (cm <sup>3</sup> /g)	Cumulative Pore Volume (cm <sup>3</sup> /g)	Incremental Pore Area (m <sup>2</sup> /g)	Cumulative Pore Area (m <sup>2</sup> /g)
85.0 - 70.3	76.0	0.000916	0.000916	0.482	0.482
70.3 - 52.2	58.1	0.000098	0.001014	0.068	0.549
52.2 - 40.9	44.9	0.000083	0.001097	0.074	0.623
40.9 - 33.0	35.9	0.000066	0.001163	0.073	0.697
33.0 - 26.9	29.1	0.000064	0.001227	0.088	0.784
26.9 - 21.9	23.7	0.000064	0.001291	0.108	0.892
21.9 - 17.1	18.7	0.000069	0.001360	0.147	1.039

Gemini 2375 V3.03  
Instrument ID:  
Setup Group: 2 - (used)

Sample ID:	1008 - Kingwood Insoluble Residue	Started:	8/6/2003 16:26
Sample Weight: (g)	1.0642	Completed:	6/8/2003 19:45
Evacuation Rate: (mmHg/min)	10	Evacuation Time: (min)	3
Measured Free Space: (cm <sup>3</sup> ) STP	-2.388	Saturation Pressure: (mmHg)	748.43
Analysis Mode:	Equilibration	Equilibration Time: (sec)	5

BET Multipoint Surface Area  
Report

Surface Area: (m<sup>2</sup>/g) 0.9918  
Slope: 4.748041  
Y-Intercept: -0.359043  
C: -12.22414  
Vm: 0.227842  
Correlation Coefficient: 0.98534

Langmuir Surface Area Report

Surface Area: (m<sup>2</sup>/g) 4.5454  
Slope: 0.957722  
Y-Intercept: 0.327364  
b: 0.341816  
Vm: 1.044145  
Correlation Coefficient: 0.91393

Sample ID:	1008 - Kingwood Insoluble Residue	Started:	8/6/2003 16:26
Sample Weight: (g)	1.0642	Completed:	6/8/2003 19:45
Evacuation Rate: (mmHg/min)	10	Evacuation Time : (min)	3
Measured Free Space: (cm <sup>3</sup> ) STP	-2.388	Saturation Pressure: (mmHg)	748.43
Analysis Mode:	Equilibration	Equilibration Time: (sec)	5



t-Method Micropore Report

Micropore Volume (cm <sup>3</sup> /g)	0.000023
Micropore Area (m <sup>2</sup> /g)	-0.3518
External Surface Area: (m <sup>2</sup> /g)	1.3436
Slope:	0.086865
Y-Intercept:	0.014653
Correlation Coefficient:	1
Thickness Values Between: (Å)	3.500 and 5.000
Area Correction Factor:	1

$$t = [13.9900 / (0.0340 - \log(P/P_0))]^{0.5000}$$

Analysis Log					
Relative Pressure	Pressure (mmHg)	Volume Adsorbed (cm <sup>3</sup> /g) STP	Elapsed Time (h:m)	Statistical Thickness (Å)	Surface Area Point
0.1000	74.84	0.334	2:57	3.678	*
0.2001	149.74	0.394	2:59	4.369	*
0.3001	224.58	0.446	3:02	5.013	*
0.4003	299.58	0.499	3:04	5.693	*
0.5004	374.52	0.554	3:07	6.465	*
0.6003	449.29	0.621	3:09	7.398	*
0.7006	524.38	0.712	3:12	8.615	*
0.7214	539.96	0.842	3:18	8.921	*

Sample ID:	1008 - Kingwood Insoluble Residue	Started:	8/6/2003 16:26
Sample Weight: (g)	1.0642	Completed:	6/8/2003 19:45
Evacuation Rate: (mmHg/min)	10	Evacuation Time: (min)	3
Measured Free Space: (cm <sup>3</sup> ) STP	-2.388	Saturation Pressure: (mmHg)	748.43
Analysis Mode:	Equilibration	Equilibration Time: (sec)	5

# BJH Adsorption Pore Distribution Report

$$t = 3.5400[-5.0000/\ln(P/P_0)].3330$$

Pore Diameter Range (Å)	Average Diameter (Å)	Incremental Pore Volume (cm <sup>3</sup> /g)	Cumulative Pore Volume (cm <sup>3</sup> /g)	Incremental Pore Area (m <sup>2</sup> /g)	Cumulative Pore Area (m <sup>2</sup> /g)
77.0 - 71.7	74.2	0.000351	0.000351	0.189	0.189
71.7 - 53.6	59.6	0.000241	0.000592	0.162	0.351
53.6 - 42.3	46.3	0.000180	0.000772	0.156	0.507
42.3 - 34.4	37.3	0.000153	0.000926	0.165	0.672
34.4 - 28.3	30.6	0.000155	0.001081	0.204	0.875
28.3 - 23.3	25.1	0.000156	0.001238	0.249	1.124
23.3 - 18.5	20.1	0.000192	0.001430	0.382	1.507

Gemini 2375 V3.03  
Instrument ID:  
Setup Group: 2 - (used)

Sample ID:	1002 - Lab Washed Feed Coal	Started:	7/30/2003 11:49
Sample Weight: (g)	1.3272	Completed:	7/30/2003 15:08
Evacuation Rate: (mmHg/min)	10	Evacuation Time: (min)	3
Measured Free Space: (cm <sup>3</sup> ) STP	-3.640	Saturation Pressure: (mmHg)	751.05
Analysis Mode:	Equilibration	Equilibration Time: (sec)	5

#### BET Multipoint Surface Area Report

Surface Area: (m<sup>2</sup>/g) 0.4568  
Slope: 10.721000  
Y-Intercept: -1.191235  
C: -7.999902  
Vm: 0.104934  
Correlation Coefficient: 0.95897

#### Langmuir Surface Area Report

Surface Area: (m<sup>2</sup>/g) 2.6169  
Slope: 1.663488  
Y-Intercept: 0.685912  
b: 0.412333  
Vm: 0.601146  
Correlation Coefficient: 0.91796

Sample ID:	1002 - Lab Washed Feed Coal	Started:	7/30/2003 11:49
Sample Weight: (g)	1.3272	Completed:	7/30/2003 15:08
Evacuation Rate: (mmHg/min)	10	Evacuation Time: (min)	3
Measured Free Space: (cm <sup>3</sup> ) STP	-3.640	Saturation Pressure: (mmHg)	751.05
Analysis Mode:	Equilibration	Equilibration Time: (sec)	5

t-Method Micropore Report

Micropore Volume (cm<sup>3</sup>/g) -0.000037  
 Micropore Area (m<sup>2</sup>/g) -0.3442  
 External Surface Area: (m<sup>2</sup>/g) 0.8010  
 Slope: 0.051785  
 Y-Intercept: -0.024052  
 Correlation Coefficient: 1  
 Thickness Values Between: (Å) 3.500 and 5.000  
 Area Correction Factor: 1

$$t = [13.9900 / (0.0340 - \log(P/P_o))]^{0.5000}$$

Analysis Log					
Relative Pressure	Pressure (mmHg)	Volume Adsorbed (cm <sup>3</sup> /g) STP	Elapsed Time (h:m)	Statistical Thickness (Å)	Surface Area Point
0.1000	75.14	0.166	2:57	3.679	*
0.2001	150.30	0.202	3:00	4.370	*
0.3003	225.54	0.233	3:02	5.014	*
0.4004	300.68	0.263	3:05	5.694	*
0.5007	376.02	0.296	3:08	6.468	*
0.6010	451.36	0.333	3:11	7.405	*
0.7008	526.31	0.384	3:13	8.617	*
0.8006	601.26	0.456	3:16	10.350	*
0.9004	676.26	0.617	3:19		

Sample ID:	1002 - Lab Washed Feed Coal	Started:	7/30/2003 11:49
Sample Weight: (g)	1.3272	Completed:	7/30/2003 15:08
Evacuation Rate: (mmHg/min)	10	Evacuation Time: (min)	3
Measured Free Space: (cm <sup>3</sup> ) STP	-3.640	Saturation Pressure: (mmHg)	751.05
Analysis Mode:	Equilibration	Equilibration Time: (sec)	5

BJH Adsorption Pore Dis tribution Report					
$t = 3.5400[-5.0000/\ln(P/P_o)]^{.3330}$					
Pore Diameter Range (Å)	Average Diameter (Å)	Incremental Pore Volume (cm <sup>3</sup> /g)	Cumulative Pore Volume (cm <sup>3</sup> /g)	Incremental Pore Area (m <sup>2</sup> /g)	Cumulative Pore Area (m <sup>2</sup> /g)
206.5 - 104.8	123.5	0.000348	0.000348	0.113	0.113
104.8 - 69.8	79.7	0.000155	0.000503	0.078	0.190
69.8 - 51.7	57.7	0.000111	0.000614	0.077	0.268
51.7 - 40.4	44.4	0.000080	0.000694	0.072	0.340
40.4 - 32.4	35.3	0.000073	0.000768	0.083	0.423
32.4 - 26.4	28.6	0.000072	0.000840	0.101	0.524
26.4 - 21.3	23.1	0.000072	0.000912	0.125	0.649
21.3 - 16.6	18.2	0.000088	0.001000	0.194	0.843

Gemini 2375 V3.03  
Instrument ID:  
Setup Group: 2 - (used)

Sample ID:	1010 - Lab Washed Insoluble Residue	Started:	8/7/2003 13:06
Sample Weight: (g)	1.0603	Completed:	8/7/2003 16:30
Evacuation Rate: (mmHg/min)	10	Evacuation Time: (min)	3
Measured Free Space: (cm <sup>3</sup> ) STP	-2.810	Saturation Pressure: (mmHg)	748.43
Analysis Mode:	Equilibration	Equilibration Time: (sec)	5

BET Multipoint Surface Area Report	
Surface Area: (m <sup>2</sup> /g)	0.4631
Slope:	9.690264
Y-Intercept:	-0.290425
C:	-32.365814
Vm:	0.106385
Correlation Coefficient:	0.93866

Langmuir Surface Area Report	
Surface Area: (m <sup>2</sup> /g)	2.5630
Slope:	1.698487
Y-Intercept:	1.019775
b:	0.600402
Vm:	0.588759
Correlation Coefficient:	0.67771

Sample ID:	1010 - Lab Washed Insoluble Residue	Started:	8/7/2003 13:06
Sample Weight: (g)	1.0603	Completed:	8/7/2003 16:30
Evacuation Rate: (mmHg/min)	10	Evacuation Time: (min)	3
Measured Free Space: (cm <sup>3</sup> ) STP	-2.810	Saturation Pressure: (mmHg)	748.43
Analysis Mode:	Equilibration	Equilibration Time: (sec)	5

t-Method Micropore Report	
Micropore Volume (cm <sup>3</sup> /g)	-0.000018
Micropore Area (m <sup>2</sup> /g)	-0.1299
External Surface Area: (m <sup>2</sup> /g)	0.5930
Slope:	0.038338
Y-Intercept:	-0.011521
Correlation Coefficient:	1
Thickness Values Between: (Å)	3.500 and 5.000
Area Correction Factor:	1
$t = [13.9900/(0.0340 - \log(P/P_o))]^{0.5000}$	

Analysis		Log			
Relative Pressure	Pressure (mmHg)	Volume Adsorbed (cm <sup>3</sup> /g) STP	Elapsed Time (h:m)	Statistical Thickness (Å)	Surface Area Point
0.1000	74.83	0.129	3:03	3.678	*
0.2001	149.74	0.156	3:06	4.369	*
0.3000	224.56	0.176	3:08	5.012	*
0.4002	299.52	0.201	3:10	5.693	*
0.5003	374.42	0.225	3:13	6.464	*
0.6004	449.36	0.252	3:15	7.399	*
0.7006	524.39	0.293	3:18	8.615	*
0.7333	548.84	0.516	3:24	9.106	*

Sample ID:	1010 - Lab Washed Insoluble Residue	Started:	8/7/2003 13:06
Sample Weight: (g)	1.0603	Completed:	8/7/2003 16:30
Evacuation Rate: (mmHg/min)	10	Evacuation Time: (min)	3
Measured Free Space: (cm <sup>3</sup> ) STP	-2.810	Saturation Pressure: (mmHg)	748.43
Analysis Mode:	Equilibration	Equilibration Time: (sec)	5

BJH Adsorption Pore Distribution Report					
$t = 3.5400[-5.0000/\ln(P/P_0)]^{.3330}$					
Pore Diameter Range (Å)	Average Diameter (Å)	Incremental Pore Volume (cm <sup>3</sup> /g)	Cumulative Pore Volume (cm <sup>3</sup> /g)	Incremental Pore Area (m <sup>2</sup> /g)	Cumulative Pore Area (m <sup>2</sup> /g)
77.9 - 69.2	73.0	0.000560	0.000560	0.307	0.307
69.2 - 51.1	57.1	0.000067	0.000627	0.047	0.354
51.1 - 39.8	43.8	0.000040	0.000667	0.037	0.391
39.8 - 31.8	34.8	0.000040	0.000708	0.047	0.437
31.8 - 25.8	28.0	0.000042	0.000750	0.060	0.498
25.8 - 20.7	22.6	0.000028	0.000778	0.049	0.547
20.7 - 16.0	17.6	0.000047	0.000825	0.107	0.654



Gemini 2375 V3.03  
Instrument ID:  
Setup Group: 2 - (used)

Sample ID:	1005 - Litwar Feed Coal	Started:	8/1/2003 13:21
Sample Weight:	0.9932	Completed:	8/1/2003 16:42
(g)			
Evacuation Rate: (mmHg/min)	10	Evacuation Time: (min)	3
Measured Free Space: (cm <sup>3</sup> ) STP	-2.777	Saturation Pressure: (mmHg)	748.43
Analysis Mode:	Equilibration	Equilibration Time: (sec)	5

#### BET Multipoint Surface Area Report

Surface Area: (m <sup>2</sup> /g)	0.5308
Slope:	9.100383
Y-Intercept:	-0.899044
C:	-9.122288
Vm:	0.121931
Correlation Coefficient:	0.96391

#### Langmuir Surface Area Report

Surface Area: (m <sup>2</sup> /g)	3.2614
Slope:	1.334766
Y-Intercept:	0.678671
b:	0.508457
Vm:	0.749195
Correlation Coefficient:	0.88638

Sample ID:	1005 - Litwar Feed Coal	Started:	8/1/2003 13:21
Sample Weight:	0.9932	Completed:	8/1/2003 16:42
(g)			
Evacuation Rate: (mmHg/min)	10	Evacuation Time: (min)	3
Measured Free Space: (cm <sup>3</sup> ) STP	-2.777	Saturation Pressure: (mmHg)	748.43
Analysis Mode:	Equilibration	Equilibration Time: (sec)	5

# t-Method Micropore Report

Micropore Volume (cm <sup>3</sup> /g)	-0.000068
Micropore Area (m <sup>2</sup> /g)	-0.3963
External Surface Area: (m <sup>2</sup> /g)	0.9271
Slope:	0.059935
Y-Intercept:	-0.0439935
Correlation Coefficient:	1
Thickness Values Between: (Å)	3.500 and 5.000
Area Correction Factor:	1

$$t = [13.9900 / (0.0340 - \log(P/P_0))]^{0.5000}$$

Analysis Log					
Relative Pressure	Pressure (mmHg)	Volume Adsorbed (cm <sup>3</sup> /g) STP	Elapsed Time (h:m)	Statistical Thickness (Å)	Surface Area Point
0.1000	74.85	0.176	2:58	3.678	*
0.2000	149.72	0.218	3:01	4.369	*
0.3001	224.62	0.254	3:03	5.013	*
0.4003	299.59	0.290	3:06	5.693	*
0.5003	374.45	0.330	3:08	6.465	*
0.6005	449.45	0.377	3:11	7.400	*
0.7006	524.36	0.442	3:14	8.614	*
0.8006	599.19	0.535	3:17	10.350	*
0.0000	673.62	0.748	3:20		

Sample ID:	1005 - Litwar Feed Coal	Started:	8/1/2003 13:21
Sample Weight: (g)	0.9932	Completed:	8/1/2003 16:42
Evacuation Rate: (mmHg/min)	10	Evacuation Time: (min)	3
Measured Free Space: (cm <sup>3</sup> ) STP	-2.777	Saturation Pressure: (mmHg)	748.43
Analysis Mode:	Equilibration	Equilibration Time: (sec)	5

BJH Adsorption Pore Distribution Report					
$t = 3.5400[-5.0000/\ln(P/P_o)]^{-3330}$					
Pore Diameter Range (Å)	Average Diameter (Å)	Incremental Pore Volume (cm <sup>3</sup> /g)	Cumulative Pore Volume (cm <sup>3</sup> /g)	Incremental Pore Area (m <sup>2</sup> /g)	Cumulative Pore Area (m <sup>2</sup> /g)
204.7 - 103.8	122.5	0.000455	0.000455	0.149	0.149
103.8 - 68.8	78.7	0.000191	0.000646	0.097	0.246
68.8 - 50.7	56.6	0.000139	0.000785	0.098	0.344
50.7 - 39.3	43.4	0.000096	0.000881	0.089	0.432
39.3 - 31.4	34.3	0.000084	0.000965	0.098	0.530
31.4 - 25.4	27.6	0.000073	0.001037	0.105	0.635
25.4 - 20.3	22.1	0.000076	0.001114	0.138	0.773
20.3 - 15.6	17.2	0.000085	0.001198	0.197	0.970

Gemini 2375 V3.03  
Instrument ID:  
Setup Group: 2 - (used)

Sample ID:	1007 - Litwar Insoluble Residue	Started:	8/12/2003 9:04
Sample Weight: (g)	0.8937	Completed:	8/12/2003 12:27
Evacuation Rate: (mmHg/min)	10	Evacuation Time: (min)	3
Measured Free Space: (cm <sup>3</sup> ) STP	-2.366	Saturation Pressure: (mmHg)	748.43
Analysis Mode:	Equilibration	Equilibration Time: (sec)	5

#### BET Multipoint Surface Area Report

Surface Area: (m <sup>2</sup> /g)	0.9589
Slope:	4.945227
Y-Intercept:	-0.405568
C:	-11.193346
Vm:	0.220281
Correlation Coefficient:	0.98106

#### Langmuir Surface Area Report

Surface Area: (m <sup>2</sup> /g)	4.3724
Slope:	0.995610
Y-Intercept:	0.318952
b:	0.320358
Vm:	1.004409
Correlation Coefficient:	0.88851

Sample ID:	1007 - Litwar Insoluble Residue	Started:	8/12/2003 9:04
Sample Weight: (g)	0.8937	Completed:	8/12/2003 12:27
Evacuation Rate: (mmHg/min)	10	Evacuation Time: (min)	3
Measured Free Space: (cm <sup>3</sup> ) STP	-2.366	Saturation Pressure: (mmHg)	748.43
Analysis Mode:	Equilibration	Equilibration Time: (sec)	5

# t-Method Micropore Report

Micropore Volume (cm <sup>3</sup> /g)	0.000096
Micropore Area (m <sup>2</sup> /g)	-0.2410
External Surface Area: (m <sup>2</sup> /g)	1.1999
Slope:	0.077575
Y-Intercept:	0.062132
Correlation Coefficient:	1
Thickness Values Between: (Å)	3.500 and 5.000
Area Correction Factor:	1

$$t = [13.9900 / (0.0340 - \log(P/P_0))]^{0.5000}$$

Analysis Log					
Relative Pressure	Pressure (mmHg)	Volume Adsorbed (cm <sup>3</sup> /g) STP	Elapsed Time (h:m)	Statistical Thickness (Å)	Surface Area Point
0.1000	74.83	0.347	3:01	3.678	*
0.2000	149.71	0.401	3:03	4.369	*
0.3001	224.57	0.448	3:06	5.013	*
0.4001	299.46	0.492	3:08	5.692	*
0.5001	374.30	0.542	3:10	6.463	*
0.6003	449.26	0.595	3:13	7.397	*
0.7006	524.37	0.671	3:16	8.615	*
0.7359	550.78	0.889	3:22	9.148	*

Sample ID:	1007 - Litwar Insoluble Residue	Started:	8/12/2003 9:04
Sample Weight: (g)	0.8937	Completed:	8/12/2003 12:27
Evacuation Rate: (mmHg/min)	10	Evacuation Time: (min)	3
Measured Free Space: (cm <sup>3</sup> ) STP	-2.366	Saturation Pressure: (mmHg)	748.43
Analysis Mode:	Equilibration	Equilibration Time: (sec)	5

# BJH Adsorption Pore Distribution Report

$$t = 3.5400[-5.0000/\ln(P/P_0)]^{-3330}$$

Pore Diameter Range (Å)	Average Diameter (Å)	Incremental Pore Volume (cm <sup>3</sup> /g)	Cumulative Pore Volume (cm <sup>3</sup> /g)	Incremental Pore Area (m <sup>2</sup> /g)	Cumulative Pore Area (m <sup>2</sup> /g)
80.1 - 70.6	74.7	0.000568	0.000568	0.304	0.304
70.6 - 52.5	58.5	0.000172	0.000740	0.118	0.422
52.5 - 41.2	45.2	0.000118	0.000858	0.105	0.527
41.2 - 33.3	36.2	0.000121	0.000980	0.134	0.661
33.3 - 27.2	29.5	0.000106	0.001086	0.144	0.805
27.2 - 22.2	24.0	0.000123	0.001209	0.205	1.010
22.2 - 17.4	19.0	0.000144	0.001353	0.303	1.313

Gemini 2375 V3.03  
Instrument ID:  
Setup Group: 2 - (used)

Sample ID:	1003 - Not Lab Washed Feed Coal	Started:	7/30/2003 15:17
Sample Weight: (g)	0.9564	Completed:	7/30/2003 18:39
Evacuation Rate: (mmHg/min)	10	Evacuation Time: (min)	3
Measured Free Space: (cm <sup>3</sup> ) STP	-2.711	Saturation Pressure: (mmHg)	751.05
Analysis Mode:	Equilibration	Equilibration Time: (sec)	5

BET Multipoint Surface Area Report

Surface Area: (m<sup>2</sup>/g) 0.3891  
Slope: 12.279375  
Y-Intercept: -1.090570  
C: -10.259590  
Vm: 0.089375  
Correlation Coefficient: 0.97006

Langmuir Surface Area Report

Surface Area: (m<sup>2</sup>/g) 2.5169  
Slope: 1.729578  
Y-Intercept: 1.014775  
b: 0.586718  
Vm: 0.578176  
Correlation Coefficient: 0.85044

Sample ID:	1003 - Not Lab Washed Feed Coal	Started:	7/30/2003 15:17
Sample Weight: (g)	0.9564	Completed:	7/30/2003 18:39
Evacuation Rate: (mmHg/min)	10	Evacuation Time: (min)	3
Measured Free Space: (cm <sup>3</sup> ) STP	-2.711	Saturation Pressure: (mmHg)	751.05
Analysis Mode:	Equilibration	Equilibration Time: (sec)	5

t-Method Micropore Report

Micropore Volume (cm <sup>3</sup> /g)	-0.000035
Micropore Area (m <sup>2</sup> /g)	-0.2271
External Surface Area: (m <sup>2</sup> /g)	0.6162
Slope:	0.039838
Y-Intercept:	-0.022587
Correlation Coefficient:	1
Thickness Values Between: (Å)	3.500 and 5.000
Area Correction Factor:	1

$$t = [13.9900 / (0.0340 - \log(P/P_o))]^{0.5000}$$

Analysis		Log			
Relative Pressure	Pressure	Volume Adsorbed	Elapsed Time	Statistical Thickness	Surface Area Point
	(mmHg)	(cm <sup>3</sup> /g) STP	(h:m)	(Å)	
0.1000	75.11	0.124	2:59	3.678	*
0.2001	150.31	0.151	3:02	4.370	*
0.3003	225.52	0.177	3:04	5.014	*
0.4002	300.59	0.204	3:07	5.693	*
0.5003	375.77	0.235	3:09	6.465	*
0.6015	451.73	0.271	3:13	7.410	*
0.7005	526.13	0.318	3:16	8.613	*
0.8009	601.55	0.399	3:19	10.358	*
0.9005	676.35	0.571	3:22		

Sample ID:	1003 - Not Lab Washed Feed Coal	Started:	7/30/2003 15:17
Sample Weight: (g)	0.9564	Completed:	7/30/2003 18:39
Evacuation Rate: (mmHg/min)	10	Evacuation Time: (min)	3
Measured Free Space: (cm <sup>3</sup> ) STP	-2.711	Saturation Pressure: (mmHg)	751.05
Analysis Mode:	Equilibration	Equilibration Time: (sec)	5



BJH Adsorption Pore Distribution Report					
$t = 3.5400[-5.0000/\ln(P/P_0)]^{-3330}$					
Pore Diameter Range (Å)	Average Diameter (Å)	Incremental Pore Volume (cm <sup>3</sup> /g)	Cumulative Pore Volume (cm <sup>3</sup> /g)	Incremental Pore Area (m <sup>2</sup> /g)	Cumulative Pore Area (m <sup>2</sup> /g)
205.5 - 103.8	122.6	0.000366	0.000366	0.119	0.119
103.8 - 68.6	78.5	0.000169	0.000535	0.086	0.206
68.6 - 50.6	56.5	0.000093	0.000628	0.066	0.271
50.6 - 39.1	43.2	0.000072	0.000700	0.067	0.338
39.1 - 31.2	34.1	0.000066	0.000766	0.077	0.415
31.2 - 25.2	27.4	0.000052	0.000818	0.076	0.491
25.2 - 20.1	21.9	0.000046	0.000864	0.083	0.575
20.1 - 15.4	17.0	0.000045	0.000909	0.107	0.681

Gemini 2375 V3.03  
Instrument ID:  
Setup Group: 2 - (used)

Sample ID:	1011 - Not Lab Washed Insoluble Residue	Started:	8/8/2003 9:15
Sample Weight: (g)	1.0560	Completed:	8/8/2003 12:28
Evacuation Rate: (mmHg/min)	10	Evacuation Time: (min)	3
Measured Free Space: (cm <sup>3</sup> ) STP	-2.769	Saturation Pressure: (mmHg)	748.43
Analysis Mode:	Equilibration	Equilibration Time: (sec)	5

#### BET Multipoint Surface Area Report

Surface Area: (m<sup>2</sup>/g) 0.4868  
Slope: 9.121081  
Y-Intercept: -0.178312  
C: -50.152390  
Vm: 0.111822  
Correlation Coefficient: 0.93779

#### Langmuir Surface Area Report

Surface Area: (m<sup>2</sup>/g) 2.9206  
Slope: 1.490524  
Y-Intercept: 1.054788  
b: 0.707662  
Vm: 0.670905  
Correlation Coefficient: 0.63488

Sample ID:	1011 - Not Lab Washed Insoluble Residue	Started:	8/8/2003 9:15
Sample Weight: (g)	1.0560	Completed:	8/8/2003 12:28
Evacuation Rate: (mmHg/min)	10	Evacuation Time: (min)	3
Measured Free Space: (cm <sup>3</sup> ) STP	-2.769	Saturation Pressure: (mmHg)	748.43
Analysis Mode:	Equilibration	Equilibration Time: (sec)	5

# t-Method Micropore Report

Micropore Volume (cm<sup>3</sup>/g) -0.000026  
Micropore Area (m<sup>2</sup>/g) -0.1249  
External Surface Area: (m<sup>2</sup>/g) 0.6116  
Slope: 0.039542  
Y-Intercept: -0.016679  
Correlation Coefficient: 1  
Thickness Values Between: (Å) 3.500 and 5.000  
Area Correction Factor: 1

$$t = [13.9900 / (0.0340 - \log(P/P_o))]^{0.5000}$$

Analysis Log					
Relative Pressure	Pressure (mmHg)	Volume Adsorbed (cm <sup>3</sup> /g) STP	Elapsed Time (h:m)	Statistical Thickness (Å)	Surface Area Point
0.1000	74.85	0.129	2:52	3.678	*
0.2001	149.74	0.156	2:55	4.369	*
0.3002	224.68	0.180	2:57	5.014	*
0.4001	299.44	0.207	2:59	5.692	*
0.5003	374.45	0.231	3:02	6.465	*
0.6003	449.25	0.265	3:04	7.397	*
0.7003	524.16	0.306	3:07	8.611	*
0.7422	555.46	0.558	3:13	9.250	*

Sample ID:	1011 - Not Lab Washed Insoluble Residue	Started:	8/8/2003 9:15
Sample Weight: (g)	1.0560	Completed:	8/8/2003 12:28
Evacuation Rate: (mmHg/min)	10	Evacuation Time: (min)	3
Measured Free Space: (cm <sup>3</sup> ) STP	-2.769	Saturation Pressure: (mmHg)	748.43
Analysis Mode:	Equilibration	Equilibration Time: (sec)	5

# BJH Adsorption Pore Distribution Report

$$t = 3.5400[-5.0000/\ln(P/P_0)]^{3330}$$

Pore Diameter Range (Å)	Average Diameter (Å)	Incremental Pore Volume (cm <sup>3</sup> /g)	Cumulative Pore Volume (cm <sup>3</sup> /g)	Incremental Pore Area (m <sup>2</sup> /g)	Cumulative Pore Area (m <sup>2</sup> /g)
80.0 - 68.5	73.2	0.000617	0.000617	0.337	0.337
68.5 - 50.4	56.4	0.000063	0.000680	0.045	0.382
50.4 - 39.1	43.1	0.000054	0.000734	0.050	0.432
39.1 - 31.2	34.1	0.000033	0.000767	0.039	0.470
31.2 - 25.2	27.4	0.000046	0.000813	0.067	0.537
25.2 - 20.1	21.9	0.000034	0.000847	0.062	0.600
20.1 - 15.4	17.0	0.000039	0.000886	0.092	0.692

Gemini 2375 V3.03  
Instrument ID:  
Setup Group: 2 - (used)

Sample ID:	1007 - Poca #12 Feed Coal	Started:	8/5/2003 9:14
Sample Weight: (g)	1.0583	Completed:	8/5/2003 12:35
Evacuation Rate: (mmHg/min)	10	Evacuation Time : (min)	3
Measured Free Space: (cm <sup>3</sup> ) STP	-2.883	Saturation Pressure: (mmHg)	748.43
Analysis Mode:	Equilibration	Equilibration Time: (sec)	5

#### BET Multipoint Surface Area Report

Surface Area: 0.5321  
(m<sup>2</sup>/g)  
Slope: 9.192469  
Y-Intercept: -1.011911  
C: -8.084270  
Vm: 0.122241  
Correlation Coefficient: 0.96206

#### Langmuir Surface Area Report

Surface Area: 3.0329  
(m<sup>2</sup>/g)  
Slope: 1.435337  
Y-Intercept: 0.589135  
b: 0.410451  
Vm: 0.696700  
Correlation Coefficient: 0.90634

Sample ID:	1007 - Poca #12 Feed Coal	Started:	8/5/2003 9:14
Sample Weight: (g)	1.0583	Completed:	8/5/2003 12:35
Evacuation Rate: (mmHg/min)	10	Evacuation Time: (min)	3
Measured Free Space: (cm <sup>3</sup> ) STP	-2.883	Saturation Pressure: (mmHg)	748.43
Analysis Mode:	Equilibration	Equilibration Time: (sec)	5

t-Method Micropore Report	
Micropore Volume (cm <sup>3</sup> /g)	-0.000005
Micropore Area (m <sup>2</sup> /g)	-0.3179
External Surface Area: (m <sup>2</sup> /g)	0.8501
Slope:	0.054957
Y-Intercept:	-0.003231
Correlation Coefficient:	1
Thickness Values Between: (Å)	3.500 and 5.000
Area Correction Factor:	1
$t = [13.9900/(0.0340 - \log(P/P_0))]^{0.5000}$	

Analysis Log					
Relative Pressure	Pressure (mmHg)	Volume Adsorbed (cm <sup>3</sup> /g) STP	Elapsed Time (h:m)	Statistical Thickness (Å)	Surface Area Point
0.1000	74.85	0.199	3:00	3.678	*
0.2000	149.72	0.237	3:02	4.369	*
0.3000	224.57	0.270	3:05	5.013	*
0.4002	299.49	0.302	3:07	5.692	*
0.5002	374.38	0.339	3:10	6.464	*
0.6003	449.31	0.384	3:13	7.398	*
0.7004	524.17	0.446	3:15	8.611	*
0.8010	599.48	0.536	3:19	10.359	*
0.9000	673.60	0.763	3:21		

Sample ID:	1007 - Poca #12 Feed Coal	Started:	8/5/2003 9:14
Sample Weight: (g)	1.0583	Completed:	8/5/2003 12:35
Evacuation Rate: (mmHg/min)	10	Evacuation Time: (min)	3
Measured Free Space: (cm <sup>3</sup> ) STP	-2.883	Saturation Pressure: (mmHg)	748.43
Analysis Mode:	Equilibration	Equilibration Time: (sec)	5

BJH Adsorption Pore Distribution Report					
$t = 3.5400[-5.0000/\ln(P/P_0)]^{.3330}$					
Pore Diameter Range (Å)	Average Diameter (Å)	Incremental Pore Volume (cm <sup>3</sup> /g)	Cumulative Pore Volume (cm <sup>3</sup> /g)	Incremental Pore Area (m <sup>2</sup> /g)	Cumulative Pore Area (m <sup>2</sup> /g)
206.2 - 105.5	124.3	0.000496	0.000496	0.160	0.160
105.5 - 70.3	80.2	0.000189	0.000685	0.094	0.254
70.3 - 52.2	58.1	0.000136	0.000820	0.093	0.347
52.2 - 40.9	44.9	0.000098	0.000918	0.088	0.435
40.9 - 32.9	35.8	0.000082	0.001000	0.091	0.526
32.9 - 26.9	29.1	0.000068	0.001068	0.094	0.620
26.9 - 21.8	23.7	0.000076	0.001145	0.129	0.748
21.8 - 17.1	18.7	0.000089	0.001233	0.190	0.938

Gemini 2375 V3.03  
Instrument ID:  
Setup Group: 2 - (used)

Sample ID:	1015 - Poca #12 Insoluble Residue	Started:	8/14/2003 16:08
Sample Weight: (g)	1.1117	Completed:	8/14/2003 19:28
Evacuation Rate: (mmHg/min)	10	Evacuation Time: (min)	3
Measured Free Space: (cm <sup>3</sup> ) STP	-3.027	Saturation Pressure: (mmHg)	748.43
Analysis	Equilibration	Equilibration Time: (sec)	5
Mode:			

BET Multipoint Surface Area  
Report

Surface Area: (m<sup>2</sup>/g) 0.2909  
Slope: 17.352116  
Y-Intercept: -2.384979  
C: -6.275586  
Vm: 0.066813  
Correlation Coefficient: 0.95432

Langmuir Surface Area Report

Surface Area: (m<sup>2</sup>/g) 1.4159  
Slope: 3.074561  
Y-Intercept: 0.687215  
b: 0.223516  
Vm: 0.325250  
Correlation Coefficient: 0.95618

Sample ID:	1015 - Poca #12 Insoluble Residue	Started:	8/14/2003 16:08
Sample Weight: (g)	1.1117	Completed:	8/14/2003 19:28
Evacuation Rate: (mmHg/min)	10	Evacuation Time: (min)	3
Measured Free Space: (cm <sup>3</sup> ) STP	-3.027	Saturation Pressure: (mmHg)	748.43
Analysis	Equilibration	Equilibration Time: (sec)	5
Mode:			



t-Method Micropore Report

Micropore Volume (cm <sup>3</sup> /g)	0.000080
Micropore Area (m <sup>2</sup> /g)	-0.0933
External Surface Area: (m <sup>2</sup> /g)	0.3841
Slope:	0.024834
Y-Intercept:	0.051911
Correlation Coefficient:	1
Thickness Values Between: (Å)	3.500 and 5.000
Area Correction Factor:	1

$$t = [13.9900 / (0.0340 - \log(P/P_o))]^{0.5000}$$

Analysis Log					
Relative Pressure	Pressure (mmHg)	Volume Adsorbed (cm <sup>3</sup> /g) STP	Elapsed Time (h:m)	Statistical Thickness (Å)	Surface Area Point
0.1000	74.83	0.143	2:58	3.678	*
0.2001	149.78	0.160	3:01	4.370	*
0.3001	224.60	0.173	3:03	5.013	*
0.4003	299.60	0.190	3:06	5.693	*
0.5003	374.47	0.205	3:08	6.465	*
0.6005	449.45	0.222	3:11	7.400	*
0.7007	524.40	0.243	3:14	8.615	*
0.8004	599.04	0.290	3:17	10.346	*
0.9006	674.03	0.367	3:19		

Sample ID:	1015 - Poca #12 Insoluble Residue	Started:	8/14/2003 16:08
Sample Weight: (g)	1.1117	Completed:	8/14/2003 19:28
Evacuation Rate: (mmHg/min)	10	Evacuation Time: (min)	3
Measured Free Space: (cm <sup>3</sup> ) STP	-3.027	Saturation Pressure: (mmHg)	748.43
Analysis Mode:	Equilibration	Equilibration Time: (sec)	5

BJH Adsorption Pore Distribution Report					
$t = 3.5400[-5.0000/\ln(P/P_o)]^{-3330}$					
Pore Diameter Range (Å)	Average Diameter (Å)	Incremental Pore Volume (cm <sup>3</sup> /g)	Cumulative Pore Volume (cm <sup>3</sup> /g)	Incremental Pore Area (m <sup>2</sup> /g)	Cumulative Pore Area (m <sup>2</sup> /g)
207.7 - 105.6	124.3	0.000169	0.000169	0.054	0.054
105.6 - 70.6	80.6	0.000107	0.000276	0.053	0.107
70.6 - 52.5	58.5	0.000043	0.000319	0.030	0.137
52.5 - 41.2	45.2	0.000037	0.000356	0.033	0.170
41.2 - 33.3	36.2	0.000036	0.000392	0.040	0.209
33.3 - 27.2	29.5	0.000042	0.000434	0.057	0.267
27.2 - 22.2	24.0	0.000028	0.000462	0.047	0.313
22.2 - 17.4	19.0	0.000046	0.000509	0.098	0.411

Gemini 2375 V3.03  
Instrument ID:  
Setup Group: 2 - (used)

Sample ID:	1004 - Shoemaker Feed Coal	Started:	8/1/2003 9:36
Sample Weight: (g)	1.0744	Completed:	8/1/2003 12:57
Evacuation Rate: (mmHg/min)	10	Evacuation Time: (min)	3
Measured Free Space: (cm <sup>3</sup> ) STP	-2.874	Saturation Pressure: (mmHg)	748.43
Analysis Mode:	Equilibration	Equilibration Time: (sec)	5

BET Multipoint Surface Area  
Report

Surface Area: (m<sup>2</sup>/g) 0.6636  
Slope: 7.261278  
Y-Intercept: -0.701470  
C: -9.351511  
Vm: 0.152443  
Correlation Coefficient: 0.96625

Langmuir Surface Area Report

Surface Area: (m<sup>2</sup>/g) 4.1018  
Slope: 1.061302  
Y-Intercept: 0.551963  
b: 0.520081  
Vm: 0.942239  
Correlation Coefficient: 0.87496

Sample ID:	1004 - Shoemaker Feed Coal	Started:	8/1/2003 9:36
Sample Weight: (g)	1.0744	Completed:	8/1/2003 12:57
Evacuation Rate: (mmHg/min)	10	Evacuation Time: (min)	3
Measured Free Space: (cm <sup>3</sup> ) STP	-2.874	Saturation Pressure: (mmHg)	748.43
Analysis Mode:	Equilibration	Equilibration Time: (sec)	5

t-Method Micropore Report

Micropore Volume (cm<sup>3</sup>/g) -0.000032  
 Micropore Area (m<sup>2</sup>/g) -0.3624  
 External Surface Area: (m<sup>2</sup>/g) 1.026  
 Slope: 0.066333  
 Y-Intercept: -0.020743  
 Correlation Coefficient: 1  
 Thickness Values Between: (Å) 3.500 and 5.000  
 Area Correction Factor: 1

$$t = [13.9900 / (0.0340 - \log(P/P_o))]^{0.5000}$$

Analysis Log					
Relative Pressure	Pressure (mmHg)	Volume Adsorbed (cm <sup>3</sup> /g) STP	Elapsed Time (h:m)	Statistical Thickness (Å)	Surface Area Point
0.1	74.85	0.223	3:00	3.678	
0.2001	149.75	0.269	3:02	4.369	*
0.3001	224.57	0.312	3:05	5.013	*
0.4001	299.45	0.358	3:07	5.692	*
0.5003	374.41	0.409	3:10	6.464	*
0.6003	449.26	0.469	3:12	7.397	*
0.7006	524.35	0.549	3:15	8.614	*
0.8006	599.35	0.673	3:18	10.350	*
0.9001	673.66	0.960	3:20		*

Sample ID:	1004 - Shoemaker Feed Coal	Started:	8/1/2003 9:36
Sample Weight: (g)	1.0744	Completed:	8/1/2003 12:57
Evacuation Rate: (mmHg/min)	10	Evacuation Time: (min)	3
Measured Free Space: (cm <sup>3</sup> ) STP	-2.874	Saturation Pressure: (mmHg)	748.43
Analysis Mode:	Equilibration	Equilibration Time: (sec)	5

# BJH Adsorption Pore Distribution Report

$$t = 3.5400[-5.0000/\ln(P/P_0)]^{3330}$$

Pore Diameter Range (Å)	Average Diameter (Å)	Incremental Pore Volume (cm <sup>3</sup> /g)	Cumulative Pore Volume (cm <sup>3</sup> /g)	Incremental Pore Area (m <sup>2</sup> /g)	Cumulative Pore Area (m <sup>2</sup> /g)
205.2 - 104.2	122.9	0.000615	0.000615	0.2	0.2
104.2 - 69.1	79.1	0.000258	0.000873	0.130	0.331
69.1 - 51.0	57.0	0.000167	0.001040	0.117	0.448
51.0 - 39.7	43.7	0.000124	0.001164	0.113	0.561
39.7 - 31.8	34.7	0.000107	0.001270	0.123	0.685
31.8 - 25.7	28.0	0.000098	0.001369	0.141	0.825
25.7 - 20.7	22.5	0.000085	0.001454	0.151	0.976
20.7 - 15.9	17.5	0.000080	0.001534	0.183	1.159

Gemini 2375 V3.03  
 Instrument ID:  
 Setup Group: 2 - (used)

Sample ID:	1012 - Shoemaker Insoluble Residue	Started:	8/11/2003 14:02
Sample Weight: (g)	1.0105	Completed:	8/11/2003 17:23
Evacuation Rate: (mmHg/min)	10	Evacuation Time: (min)	3
Measured Free Space: (cm <sup>3</sup> )	-2.646	Saturation Pressure: (mmHg)	748.43
STP Analysis Mode:	Equilibration	Equilibration Time: (sec)	5

BET Multipoint Surface Area Report	
Surface Area: (m <sup>2</sup> /g)	0.5378
Slope:	8.314479
Y-Intercept:	-0.220194
C:	-36.759850
Vm:	0.123544
Correlation Coefficient:	0.94807

Langmuir Surface Area Report	
Surface Area: (m <sup>2</sup> /g)	3.1434
Slope:	1.384883
Y-Intercept:	0.915602
b:	0.661140
Vm:	0.722082
Correlation Coefficient:	0.65788

Sample ID:	1012 - Shoemaker Insoluble Residue	Started:	8/11/2003 14:02
Sample Weight: (g)	1.0105	Completed:	8/11/2003 17:23
Evacuation Rate: (mmHg/min)	10	Evacuation Time: (min)	3
Measured Free Space: (cm <sup>3</sup> )	-2.646	Saturation Pressure: (mmHg)	748.43
STP Analysis Mode:	Equilibration	Equilibration Time: (sec)	5

t-Method Micropore Report	
Micropore Volume (cm <sup>3</sup> /g)	-0.000019
Micropore Area (m <sup>2</sup> /g)	-0.1349
External Surface Area: (m <sup>2</sup> /g)	0.6727
Slope:	0.043493
Y-Intercept:	-0.012374
Correlation Coefficient:	1
Thickness Values Between: (Å)	3.500 and 5.000
Area Correction Factor:	1
$t = [13.9900/(0.0340 - \log(P/P_o))]^{0.5000}$	

		Analysis		Log	
Relative Pressure	Pressure	Volume Adsorbed	Elapsed Time	Statistical Thickness	Surface Area Point
	(mmHg)	(cm <sup>3</sup> /g) STP	(h:m)	(Å)	
0.1000	74.85	0.148	3:00	3.678	*
0.2001	149.76	0.178	3:03	4.369	*
0.3002	224.65	0.205	3:05	5.013	*
0.4002	299.53	0.231	3:07	5.693	*
0.5004	374.52	0.258	3:10	6.465	*
0.6003	449.28	0.295	3:12	7.398	*
0.7005	524.24	0.344	3:15	8.612	*
0.7454	557.89	0.608	3:20	9.304	*

Sample ID:	1012 - Shoemaker Insoluble Residue	Started:	8/11/2003 14:02
Sample Weight: (g)	1.0105	Completed:	8/11/2003 17:23
Evacuation Rate: (mmHg/min)	10	Evacuation Time: (min)	3
Measured Free Space: (cm <sup>3</sup> ) STP	-2.646	Saturation Pressure: (mmHg)	748.43
Analysis Mode:	Equilibration	Equilibration Time: (sec)	5

BJH Adsorption Pore Distribution Report					
$t = 3.5400[-5.0000/\ln(P/P_0)]^{3330}$					
Pore Diameter Range (Å)	Average Diameter (Å)	Incremental Pore Volume (cm <sup>3</sup> /g)	Cumulative Pore Volume (cm <sup>3</sup> /g)	Incremental Pore Area (m <sup>2</sup> /g)	Cumulative Pore Area (m <sup>2</sup> /g)
81.4 - 68.9	74.0	0.000651	0.000651	0.352	0.352
68.9 - 50.8	56.8	0.000082	0.000733	0.058	0.410
50.8 - 39.5	43.5	0.000062	0.000795	0.057	0.467
39.5 - 31.6	34.5	0.000039	0.000834	0.045	0.512
31.6 - 25.6	27.8	0.000042	0.000876	0.060	0.572
25.6 - 20.5	22.3	0.000045	0.000922	0.081	0.654
20.5 - 15.8	17.4	0.000047	0.000969	0.109	0.762



## A.2 Helium Pycnometry Data

AccuPyc 1330 V1.03  
Serial Number: 0  
Density and Volume Report

Sample ID:	Kingwood Float 1.35 Feed Coal	Sample Weight:	2.2251
Number of	20	(g)	
Purges:		Equilibration	0.0050
Cell Volume:	12.0428	Rate: (psig/min)	
(cm <sup>3</sup> )		Expansion	8.2904
		Volume: (cm <sup>3</sup> )	

Run #	Volume (cm <sup>3</sup> )	Deviation (cm <sup>3</sup> )	Density (g/cm <sup>3</sup> )	Deviation (g/cm <sup>3</sup> )
1	1.5157	-0.0010	1.4681	0.0010
2	1.5217	0.0050	1.4623	-0.0048
3	1.5201	0.0034	1.4638	-0.0033
4	1.5202	0.0035	1.4637	-0.0033
5	1.5184	0.0017	1.4655	-0.0016
6	1.5210	0.0043	1.4629	-0.0042
7	1.5189	0.0022	1.4649	-0.0021
8	1.5166	-0.0001	1.4672	0.0001
9	1.5177	0.0010	1.4661	-0.0010
10	1.5158	-0.0009	1.4680	0.0009
11	1.5151	-0.0016	1.4686	0.0016
12	1.5155	-0.0012	1.4682	0.0011
13	1.5173	0.0005	1.4665	-0.0005
14	1.5148	-0.0019	1.4689	0.0019
15	1.5173	0.0006	1.4665	-0.0005
16	1.5142	-0.0026	1.4695	0.0025
17	1.5132	-0.0035	1.4705	0.0034
18	1.5124	-0.0043	1.4712	0.0042
19	1.5142	-0.0026	1.4695	0.0025
20	1.5144	-0.0023	1.4693	0.0022
Average Volume: (cm <sup>3</sup> )	1.5167		Standard Deviation: (cm <sup>3</sup> )	0.0027
Average Density: (g/cm <sup>3</sup> )	1.4671		Standard Deviation: (g/cm <sup>3</sup> )	0.0026

AccuPyc 1330 V1.03  
Serial Number: 0  
Density and Volume Report

Sample ID:	Lab Washed In Centigrav 1.45 sg Feed Coal	Sample Weight: (g)	3.5464
Number of Purges:	20	Equilibration Rate: (psig/min)	0.0050
Cell Volume: (cm <sup>3</sup> )	12.0344	Expansion Volume: (cm <sup>3</sup> )	8.2628

Run #	Volume (cm <sup>3</sup> )	Deviation (cm <sup>3</sup> )	Density (g/cm <sup>3</sup> )	Deviation (g/cm <sup>3</sup> )
1	2.6570	-0.0067	1.3347	0.0034
2	2.6584	-0.0053	1.3340	0.0027
3	2.6598	-0.0039	1.3333	0.0020
4	2.6608	-0.0029	1.3328	0.0014
5	2.6616	-0.0021	1.3324	0.0011
6	2.6616	-0.0021	1.3324	0.0010
7	2.6615	-0.0022	1.3325	0.0011
8	2.6645	0.0008	1.3310	-0.0004
9	2.6634	-0.0003	1.3315	0.0002
10	2.6646	0.0009	1.3309	-0.0005
11	2.6641	0.0004	1.3312	-0.0002
12	2.6660	0.0023	1.3302	-0.0011
13	2.6648	0.0011	1.3308	-0.0005
14	2.6654	0.0017	1.3305	-0.0009
15	2.6669	0.0032	1.3298	-0.0016
16	2.6675	0.0038	1.3295	-0.0019
17	2.6667	0.0030	1.3299	-0.0015
18	2.6675	0.0038	1.3295	-0.0019
19	2.6638	0.0001	1.3313	-0.0001
20	2.6682	0.0045	1.3291	-0.0022
Average Volume: (cm <sup>3</sup> )	2.6637		Standard Deviation: (cm <sup>3</sup> )	0.0032
Average Density: (g/cm <sup>3</sup> )	1.3314		Standard Deviation: (g/cm <sup>3</sup> )	0.0016

AccuPyc 1330  
V1.03  
Serial Number: 0  
Density and Volume Report

Sample ID:	Litwar Insoluble Residue	Sample Weight: (g)	3.2519
Number of	20	Equilibration Rate:	0.0050
Purges:		(psig/min)	
Cell Volume:	12.0258	Expansion Volume:	8.3013
(cm <sup>3</sup> )		(cm <sup>3</sup> )	

Run #	Volume (cm <sup>3</sup> )	Deviation (cm <sup>3</sup> )	Density (g/cm <sup>3</sup> )	Deviation (g/cm <sup>3</sup> )
1	2.3020	0.0065	1.4126	-0.0040
2	2.3077	0.0122	1.4091	-0.0075
3	2.3054	0.0100	1.4105	-0.0061
4	2.3055	0.0100	1.4105	-0.0062
5	2.3009	0.0054	1.4133	-0.0033
6	2.3000	0.0046	1.4138	-0.0028
7	2.3013	0.0058	1.4131	-0.0036
8	2.2969	0.0014	1.4158	-0.0009
9	2.2949	-0.0006	1.4170	0.0003
10	2.2954	-0.0001	1.4167	0.0001
11	2.2930	-0.0025	1.4182	0.0015
12	2.2913	-0.0041	1.4192	0.0025
13	2.2919	-0.0035	1.4188	0.0022
14	2.2890	-0.0065	1.4207	0.0040
15	2.2917	-0.0038	1.4190	0.0023
16	2.2898	-0.0056	1.4201	0.0035
17	2.2905	-0.0050	1.4198	0.0031
18	2.2893	-0.0061	1.4205	0.0038
19	2.2859	-0.0096	1.4226	0.0059
20	2.2870	-0.0084	1.4219	0.0052

Average Volume:	2.2955	Standard Deviation:	0.0066
(cm <sup>3</sup> )		(cm <sup>3</sup> )	
Average Density:	1.4167	Standard Deviation:	0.0041
(g/cm <sup>3</sup> )		(g/cm <sup>3</sup> )	

## AccuPyc 1330 V1.03

Serial Number: 0

## Density and Volume Report

Sample ID:	Not Lab Washed Insoluble Residue	Sample Weight: (g)	3.7178
Number of Purges:	20	Equilibration Rate: (psig/min)	0.0050
Cell Volume: (cm <sup>3</sup> )	12.0377	Expansion Volume: (cm <sup>3</sup> )	8.2922

Run #	Volume (cm <sup>3</sup> )	Deviation (cm <sup>3</sup> )	Density (g/cm <sup>3</sup> )	Deviation (g/cm <sup>3</sup> )
1	2.5859	-0.0143	1.4377	0.0079
2	2.5960	-0.0042	1.4321	0.0023
3	2.5966	-0.0036	1.4318	0.0020
4	2.5997	-0.0005	1.4301	0.0003
5	2.6027	0.0025	1.4284	-0.0014
6	2.6033	0.0031	1.4281	-0.0017
7	2.6025	0.0023	1.4285	-0.0013
8	2.6007	0.0005	1.4295	-0.0003
9	2.6009	0.0007	1.4294	-0.0004
10	2.6001	-0.0001	1.4299	0.0000
11	2.6008	0.0006	1.4295	-0.0003
12	2.6004	0.0002	1.4297	-0.0001
13	2.6024	0.0022	1.4286	-0.0012
14	2.6003	0.0001	1.4298	0.0000
15	2.6021	0.0019	1.4287	-0.0011
16	2.6021	0.0019	1.4287	-0.0011
17	2.6023	0.0021	1.4286	-0.0012
18	2.6013	0.0011	1.4292	-0.0006
19	2.6024	0.0022	1.4286	-0.0012
20	2.6015	0.0013	1.4291	-0.0007

Average Volume: (cm <sup>3</sup> )	2.6002	Standard Deviation: (cm <sup>3</sup> )	0.0039
Average Density: (g/cm <sup>3</sup> )	1.4298	Standard Deviation: (g/cm <sup>3</sup> )	0.0021

AccuPyc 1330 V1.03  
Serial Number: 0  
Density and Volume  
Report

Sample ID:	Not Lab Washed Feed Coal	Sample Weight: (g)	3.2379
Number of	20	Equilibration Rate:	0.0050
Purges:		(psig/min)	
Cell Volume:	12.0373	Expansion Volume:	8.3089
(cm <sup>3</sup> )		(cm <sup>3</sup> )	

Run #	Volume (cm <sup>3</sup> )	Deviation (cm <sup>3</sup> )	Density (g/cm <sup>3</sup> )	Deviation (g/cm <sup>3</sup> )
1	2.4018	0.0161	1.3481	-0.0091
2	2.3981	0.0124	1.3502	-0.0070
3	2.3961	0.0104	1.3513	-0.0059
4	2.3926	0.0069	1.3533	-0.0039
5	2.3911	0.0054	1.3542	-0.0031
6	2.3896	0.0039	1.3550	-0.0022
7	2.3883	0.0025	1.3558	-0.0015
8	2.3852	-0.0005	1.3575	0.0003
9	2.3859	0.0002	1.3571	-0.0001
10	2.3834	-0.0023	1.3585	0.0013
11	2.3829	-0.0028	1.3588	0.0016
12	2.3819	-0.0038	1.3594	0.0022
13	2.3777	-0.0080	1.3618	0.0046
14	2.3814	-0.0043	1.3596	0.0024
15	2.3818	-0.0039	1.3594	0.0022
16	2.3803	-0.0054	1.3603	0.0030
17	2.3796	-0.0061	1.3607	0.0035
18	2.3799	-0.0058	1.3605	0.0033
19	2.3781	-0.0077	1.3616	0.0044
20	2.3787	-0.0070	1.3612	0.0040

Average	2.3857	Standard Deviation:	0.0071
Volume: (cm <sup>3</sup> )		(cm <sup>3</sup> )	
Average Density:	1.3572	Standard Deviation:	0.0040
(g/cm <sup>3</sup> )		(g/cm <sup>3</sup> )	

AccuPyc 1330  
V1.03  
Serial Number: 0  
Density and Volume Report

Sample ID:	Kingwood Insoluble Residue	Sample Weight: (g)	3.5536
Number of Purges:	20	Equilibration Rate: (psig/min)	0.0050
Cell Volume: (cm <sup>3</sup> )	12.0428	Expansion Volume: (cm <sup>3</sup> )	8.2904

Run #	Volume (cm <sup>3</sup> )	Deviation (cm <sup>3</sup> )	Density (g/cm <sup>3</sup> )	Deviation (g/cm <sup>3</sup> )
1	2.1427	-0.0118	1.6585	0.0091
2	2.1474	-0.0071	1.6548	0.0054
3	2.1485	-0.0060	1.6540	0.0046
4	2.1521	-0.0024	1.6513	0.0019
5	2.1534	-0.0011	1.6502	0.0008
6	2.1535	-0.0010	1.6502	0.0008
7	2.1532	-0.0013	1.6504	0.0010
8	2.1575	0.0031	1.6471	-0.0023
9	2.1577	0.0032	1.6470	-0.0024
10	2.1584	0.0039	1.6464	-0.0030
11	2.1584	0.0039	1.6464	-0.0030
12	2.1555	0.0010	1.6486	-0.0008
13	2.1556	0.0012	1.6485	-0.0009
14	2.1548	0.0003	1.6492	-0.0002
15	2.1584	0.0040	1.6464	-0.0030
16	2.1559	0.0014	1.6483	-0.0011
17	2.1556	0.0011	1.6485	-0.0009
18	2.1574	0.0029	1.6472	-0.0022
19	2.1560	0.0015	1.6482	-0.0012
20	2.1577	0.0033	1.6469	-0.0025

Average Volume: (cm <sup>3</sup> )	2.1545	Standard Deviation: (cm <sup>3</sup> )	0.0042
Average Density: (g/cm <sup>3</sup> )	1.6494	Standard Deviation: (g/cm <sup>3</sup> )	0.0032

AccuPyc 1330 V1.03

Serial Number: 0

Density and Volume Report

Sample ID:	Kingwood Feed Coal	Sample Weight: (g)	3.0755
Number of Purges:	20	Equilibration Rate: (psig/min)	0.0050
Cell Volume: (cm <sup>3</sup> )	12.0814	Expansion Volume: (cm <sup>3</sup> )	8.3288

Run #	Volume (cm <sup>3</sup> )	Deviation (cm <sup>3</sup> )	Density (g/cm <sup>3</sup> )	Deviation (g/cm <sup>3</sup> )
1	2.2041	0.0139	1.3953	-0.0089
2	2.2013	0.0111	1.3971	-0.0071
3	2.2063	0.0161	1.3940	-0.0103
4	2.2037	0.0135	1.3956	-0.0086
5	2.1971	0.0069	1.3998	-0.0045
6	2.1950	0.0048	1.4011	-0.0031
7	2.1929	0.0027	1.4025	-0.0018
8	2.1917	0.0015	1.4033	-0.0010
9	2.1928	0.0026	1.4025	-0.0017
10	2.1876	-0.0026	1.4059	0.0017
11	2.1866	-0.0036	1.4065	0.0023
12	2.1851	-0.0051	1.4075	0.0033
13	2.1849	-0.0053	1.4076	0.0034
14	2.1854	-0.0048	1.4073	0.0031
15	2.1835	-0.0067	1.4085	0.0043
16	2.1837	-0.0065	1.4084	0.0041
17	2.1807	-0.0095	1.4104	0.0061
18	2.1810	-0.0092	1.4101	0.0059
19	2.1782	-0.0120	1.4120	0.0077
20	2.1823	-0.0079	1.4093	0.0051

Average Volume: (cm <sup>3</sup> )	2.1902	Standard Deviation: (cm <sup>3</sup> )	0.0086
Average Density: (g/cm <sup>3</sup> )	1.4042	Standard Deviation: (g/cm <sup>3</sup> )	0.0055

AccuPyc 1330 V1.03  
Serial Number: 0  
Density and Volume Report

Sample ID:	Bailey Insoluble Residue	Sample Weight: (g)	3.2022
Number of Purges:	20	Equilibration Rate: (psig/min)	0.0050
Cell Volume: (cm <sup>3</sup> )	12.0377	Expansion Volume: (cm <sup>3</sup> )	8.2922

Run #	Volume (cm <sup>3</sup> )	Deviation (cm <sup>3</sup> )	Density (g/cm <sup>3</sup> )	Deviation (g/cm <sup>3</sup> )
1	2.2948	0.0105	1.3954	-0.0064
2	2.2952	0.0109	1.3952	-0.0067
3	2.2939	0.0096	1.3960	-0.0059
4	2.2911	0.0068	1.3977	-0.0042
5	2.2926	0.0083	1.3968	-0.0051
6	2.2893	0.0050	1.3988	-0.0031
7	2.2871	0.0028	1.4001	-0.0018
8	2.2882	0.0039	1.3995	-0.0024
9	2.2834	-0.0008	1.4024	0.0005
10	2.2827	-0.0016	1.4028	0.0009
11	2.2832	-0.0011	1.4025	0.0007
12	2.2806	-0.0037	1.4041	0.0022
13	2.2800	-0.0042	1.4045	0.0026
14	2.2795	-0.0047	1.4048	0.0029
15	2.2814	-0.0029	1.4036	0.0018
16	2.2773	-0.0070	1.4062	0.0043
17	2.2770	-0.0073	1.4063	0.0045
18	2.2773	-0.0069	1.4061	0.0042
19	2.2759	-0.0083	1.4070	0.0051
20	2.2748	-0.0095	1.4077	0.0058

Average Volume: (cm <sup>3</sup> )	2.2843	Standard Deviation: (cm <sup>3</sup> )	0.0067
Average Density: (g/cm <sup>3</sup> )	1.4019	Standard Deviation: (g/cm <sup>3</sup> )	0.0041



AccuPyc 1330 V1.03

Serial Number: 0

Density and Volume Report

Sample ID:	Bailey Feed Coal	Sample Weight: (g)	3.1835
Number of Purges:	20	Equilibration Rate: (psig/min)	0.0050
Cell Volume: (cm <sup>3</sup> )	12.0428	Expansion Volume: (cm <sup>3</sup> )	8.2904

Run #	Volume (cm <sup>3</sup> )	Deviation (cm <sup>3</sup> )	Density (g/cm <sup>3</sup> )	Deviation (g/cm <sup>3</sup> )
1	2.3430	0.0192	1.3587	-0.0112
2	2.3375	0.0136	1.3620	-0.0080
3	2.3361	0.0122	1.3628	-0.0072
4	2.3339	0.0100	1.3641	-0.0059
5	2.3307	0.0069	1.3659	-0.0040
6	2.3267	0.0028	1.3683	-0.0017
7	2.3293	0.0054	1.3667	-0.0032
8	2.3253	0.0014	1.3691	-0.0008
9	2.3227	-0.0011	1.3706	0.0006
10	2.3212	-0.0027	1.3715	0.0016
11	2.3204	-0.0035	1.3720	0.0020
12	2.3176	-0.0063	1.3736	0.0037
13	2.3174	-0.0065	1.3737	0.0038
14	2.3204	-0.0035	1.3720	0.0020
15	2.3151	-0.0088	1.3751	0.0052
16	2.3175	-0.0063	1.3737	0.0037
17	2.3153	-0.0086	1.3750	0.0051
18	2.3157	-0.0082	1.3748	0.0048
19	2.3159	-0.0080	1.3746	0.0047
20	2.3158	-0.0081	1.3747	0.0048
Average Volume: (cm <sup>3</sup> )	2.3239		Standard Deviation: (cm <sup>3</sup> )	0.0085
Average Density: (g/cm <sup>3</sup> )	1.3699		Standard Deviation: (g/cm <sup>3</sup> )	0.0050

## AccuPyc 1330 V1.03

Serial Number: 0

## Density and Volume Report

Sample ID:	Lab Washed In Centigrav 1.45 sg Insoluble Residue	Sample Weight: (g)	3.6263
Number of Purges:	20	Equilibration Rate: (psig/min)	0.0050
Cell Volume: (cm <sup>3</sup> )	12.0377	Expansion Volume: (cm <sup>3</sup> )	8.2922

Run #	Volume (cm <sup>3</sup> )	Deviation (cm <sup>3</sup> )	Density (g/cm <sup>3</sup> )	Deviation (g/cm <sup>3</sup> )
1	2.5545	-0.0088	1.4196	0.0049
2	2.5577	-0.0055	1.4178	0.0031
3	2.5609	-0.0024	1.4160	0.0013
4	2.5621	-0.0012	1.4154	0.0006
5	2.5616	-0.0017	1.4156	0.0009
6	2.5646	0.0014	1.4140	-0.0008
7	2.5664	0.0031	1.4130	-0.0017
8	2.5653	0.0020	1.4136	-0.0011
9	2.5655	0.0022	1.4135	-0.0012
10	2.5649	0.0016	1.4138	-0.0009
11	2.5629	-0.0004	1.4149	0.0002
12	2.5639	0.0006	1.4144	-0.0003
13	2.5655	0.0023	1.4135	-0.0012
14	2.5652	0.0020	1.4136	-0.0011
15	2.5634	0.0002	1.4146	-0.0001
16	2.5643	0.0010	1.4141	-0.0006
17	2.5647	0.0014	1.4139	-0.0008
18	2.5651	0.0018	1.4137	-0.0010
19	2.5644	0.0012	1.4141	-0.0006
20	2.5624	-0.0009	1.4152	0.0005

Average Volume: (cm <sup>3</sup> )	2.5633	Standard Deviation: (cm <sup>3</sup> )	0.0029
Average Density: (g/cm <sup>3</sup> )	1.4147	Standard Deviation: (g/cm <sup>3</sup> )	0.0016

AccuPyc 1330 V1.03  
Serial Number: 0  
Density and Volume Report

Sample ID:	Shoemaker Insoluble Residue	Sample Weight:	3.6847
		(g)	
Number of Purges:	20	Equilibration Rate:	0.0050
		(psig/min)	
Cell Volume:	12.0377	Expansion	8.2922
(cm <sup>3</sup> )		Volume: (cm <sup>3</sup> )	

Run #	Volume (cm <sup>3</sup> )	Deviation (cm <sup>3</sup> )	Density (g/cm <sup>3</sup> )	Deviation (g/cm <sup>3</sup> )
1	2.5673	-0.0169	1.4352	0.0094
2	2.5770	-0.0072	1.4298	0.0040
3	2.5817	-0.0025	1.4272	0.0014
4	2.5851	0.0008	1.4254	-0.0005
5	2.5837	-0.0006	1.4262	0.0003
6	2.5825	-0.0017	1.4268	0.0009
7	2.5835	-0.0007	1.4262	0.0004
8	2.5894	0.0052	1.4230	-0.0029
9	2.5856	0.0013	1.4251	-0.0007
10	2.5842	0.0000	1.4258	0.0000
11	2.5873	0.0030	1.4242	-0.0017
12	2.5856	0.0014	1.4251	-0.0008
13	2.5869	0.0027	1.4244	-0.0015
14	2.5857	0.0015	1.4250	-0.0008
15	2.5864	0.0022	1.4246	-0.0012
16	2.5871	0.0029	1.4242	-0.0016
17	2.5867	0.0024	1.4245	-0.0014
18	2.5853	0.0011	1.4252	-0.0006
19	2.5862	0.0019	1.4248	-0.0011
20	2.5870	0.0028	1.4243	-0.0016
Average Volume: (cm <sup>3</sup> )	2.5842		Standard Deviation: (cm <sup>3</sup> )	0.0048
Average Density: (g/cm <sup>3</sup> )	1.4259		Standard Deviation: (g/cm <sup>3</sup> )	0.0026

AccuPyc 1330 V1.03  
Serial Number: 0  
Density and Volume Report

Sample ID:	Shoemaker Feed Coal	Sample Weight: (g)	3.4980
Number of Purges:	20	Equilibration Rate: (psig/min)	0.0050
Cell Volume: (cm <sup>3</sup> )	12.0344	Expansion Volume: (cm <sup>3</sup> )	8.2628

Run #	Volume (cm <sup>3</sup> )	Deviation (cm <sup>3</sup> )	Density (g/cm <sup>3</sup> )	Deviation (g/cm <sup>3</sup> )
1	2.6475	0.0173	1.3212	-0.0087
2	2.6453	0.0150	1.3224	-0.0076
3	2.6446	0.0143	1.3227	-0.0072
4	2.6413	0.0111	1.3243	-0.0056
5	2.6363	0.0060	1.3269	-0.0031
6	2.6359	0.0057	1.3270	-0.0028
7	2.6358	0.0056	1.3271	-0.0028
8	2.6307	0.0005	1.3297	-0.0002
9	2.6306	0.0004	1.3297	-0.0002
10	2.6271	-0.0032	1.3315	0.0016
11	2.6251	-0.0051	1.3325	0.0026
12	2.6251	-0.0052	1.3325	0.0026
13	2.6259	-0.0044	1.3321	0.0022
14	2.6244	-0.0059	1.3329	0.0030
15	2.6221	-0.0081	1.3340	0.0041
16	2.6237	-0.0066	1.3332	0.0033
17	2.6220	-0.0082	1.3341	0.0042
18	2.6196	-0.0106	1.3353	0.0054
19	2.6212	-0.0090	1.3345	0.0046
20	2.6208	-0.0095	1.3347	0.0048

Average Volume: (cm <sup>3</sup> )	2.6302	Standard Deviation: (cm <sup>3</sup> )	0.0090
Average Density: (g/cm <sup>3</sup> )	1.3299	Standard Deviation: (g/cm <sup>3</sup> )	0.0045

AccuPyc 1330 V1.03

Serial Number: 0

Density and Volume Report

Sample ID:	Poca #12 Insoluble Residue	Sample Weight: (g)	3.1983
Number of	20	Equilibration Rate:	0.0050
Purges:		(psig/min)	
Cell Volume:	12.0188	Expansion Volume:	8.2712
(cm <sup>3</sup> )		(cm <sup>3</sup> )	

Run #	Volume (cm <sup>3</sup> )	Deviation (cm <sup>3</sup> )	Density (g/cm <sup>3</sup> )	Deviation (g/cm <sup>3</sup> )
1	2.3418	-0.0121	1.3658	0.0070
2	2.3485	-0.0053	1.3618	0.0031
3	2.3522	-0.0017	1.3597	0.0010
4	2.3543	0.0005	1.3585	-0.0003
5	2.3573	0.0034	1.3568	-0.0020
6	2.3554	0.0015	1.3579	-0.0009
7	2.3561	0.0022	1.3575	-0.0013
8	2.3558	0.0019	1.3576	-0.0011
9	2.3559	0.0021	1.3575	-0.0012
10	2.3570	0.0031	1.3569	-0.0018
11	2.3553	0.0015	1.3579	-0.0008
12	2.3548	0.0009	1.3582	-0.0005
13	2.3534	-0.0005	1.3590	0.0003
14	2.3538	0.0000	1.3588	0.0000
15	2.3537	-0.0002	1.3589	0.0001
16	2.3560	0.0021	1.3575	-0.0012
17	2.3534	-0.0005	1.3590	0.0003
18	2.3544	0.0005	1.3584	-0.0003
19	2.3548	0.0009	1.3582	-0.0005
20	2.3536	-0.0002	1.3589	0.0001
Average	2.3539		Standard Deviation:	0.0034
Volume: (cm <sup>3</sup> )			(cm <sup>3</sup> )	
Average	1.3587		Standard Deviation:	0.0020
Density:			(g/cm <sup>3</sup> )	
(g/cm <sup>3</sup> )				

AccuPyc 1330 V1.03  
Serial Number: 0  
Density and Volume Report

Sample ID:	Poca #12 Feed Coal	Sample Weight: (g)	3.2156
Number of Purges:	20	Equilibration Rate: (psig/min)	0.0050
Cell Volume: (cm <sup>3</sup> )	12.0271	Expansion Volume: (cm <sup>3</sup> )	8.2965

Run #	Volume (cm <sup>3</sup> )	Deviation (cm <sup>3</sup> )	Density (g/cm <sup>3</sup> )	Deviation (g/cm <sup>3</sup> )
1	2.3341	-0.0148	1.3777	0.0087
2	2.3415	-0.0074	1.3733	0.0043
3	2.3464	-0.0025	1.3705	0.0015
4	2.3489	0.0000	1.3690	0.0000
5	2.3502	0.0013	1.3682	-0.0008
6	2.3491	0.0002	1.3689	-0.0001
7	2.3538	0.0049	1.3661	-0.0029
8	2.3552	0.0063	1.3653	-0.0037
9	2.3529	0.0041	1.3666	-0.0024
10	2.3534	0.0045	1.3664	-0.0026
11	2.3523	0.0034	1.3670	-0.0020
12	2.3539	0.0050	1.3661	-0.0029
13	2.3525	0.0036	1.3669	-0.0021
14	2.3468	-0.0021	1.3702	0.0012
15	2.3496	0.0007	1.3686	-0.0004
16	2.3461	-0.0028	1.3706	0.0016
17	2.3476	-0.0012	1.3697	0.0007
18	2.3550	0.0061	1.3654	-0.0036
19	2.3441	-0.0048	1.3718	0.0028
20	2.3444	-0.0044	1.3716	0.0026
Average Volume: (cm <sup>3</sup> )	2.3489		Standard Deviation: (cm <sup>3</sup> )	0.0053
Average Density: (g/cm <sup>3</sup> )	1.3690		Standard Deviation: (g/cm <sup>3</sup> )	0.0031

AccuPyc 1330 V1.03  
Serial Number: 0  
Density and Volume Report

Sample ID:	Litwar Feed Coal	Sample Weight: (g)	3.1296
Number of Purges:	20	Equilibration Rate: (psig/min)	0.0050
Cell Volume: (cm <sup>3</sup> )	12.0344	Expansion Volume: (cm <sup>3</sup> )	8.2628

Run #	Volume (cm <sup>3</sup> )	Deviation (cm <sup>3</sup> )	Density (g/cm <sup>3</sup> )	Deviation (g/cm <sup>3</sup> )
1	2.3025	-0.0052	1.3592	0.0030
2	2.3050	-0.0027	1.3577	0.0016
3	2.3049	-0.0028	1.3578	0.0016
4	2.3049	-0.0028	1.3578	0.0016
5	2.3067	-0.0010	1.3568	0.0006
6	2.3096	0.0019	1.3550	-0.0011
7	2.3085	0.0008	1.3557	-0.0005
8	2.3082	0.0005	1.3559	-0.0003
9	2.3085	0.0008	1.3557	-0.0005
10	2.3093	0.0016	1.3552	-0.0009
11	2.3092	0.0015	1.3553	-0.0009
12	2.3080	0.0003	1.3560	-0.0002
13	2.3079	0.0002	1.3560	-0.0001
14	2.3136	0.0059	1.3527	-0.0035
15	2.3066	-0.0011	1.3568	0.0006
16	2.3093	0.0016	1.3552	-0.0009
17	2.3090	0.0013	1.3554	-0.0007
18	2.3079	0.0002	1.3561	-0.0001
19	2.3062	-0.0015	1.3571	0.0009
20	2.3083	0.0006	1.3558	-0.0004

Average Volume: (cm <sup>3</sup> )	2.3077	Standard Deviation: (cm <sup>3</sup> )	0.0023
Average Density: (g/cm <sup>3</sup> )	1.3562	Standard Deviation: (g/cm <sup>3</sup> )	0.0014

AccuPyc 1330 V1.03

Serial Number: 0

Density and Volume Report

Sample ID:	Kingwood Float 1.35 Insoluble Residue	Sample Weight: (g)	1.5475
Number of Purges:	20	Equilibration Rate: (psig/min)	0.0050
Cell Volume: (cm <sup>3</sup> )	12.0188	Expansion Volume: (cm <sup>3</sup> )	8.2712

Run #	Volume (cm <sup>3</sup> )	Deviation (cm <sup>3</sup> )	Density (g/cm <sup>3</sup> )	Deviation (g/cm <sup>3</sup> )
1	1.1781	0.0084	1.3136	-0.0095
2	1.1769	0.0072	1.3149	-0.0082
3	1.1736	0.0039	1.3186	-0.0045
4	1.1706	0.0009	1.3220	-0.0010
5	1.1743	0.0046	1.3179	-0.0052
6	1.1736	0.0039	1.3186	-0.0044
7	1.1688	-0.0009	1.3241	0.0010
8	1.1713	0.0016	1.3212	-0.0018
9	1.1704	0.0008	1.3222	-0.0009
10	1.1664	-0.0033	1.3267	0.0037
11	1.1686	-0.0010	1.3242	0.0012
12	1.1674	-0.0023	1.3256	0.0025
13	1.1665	-0.0031	1.3266	0.0035
14	1.1673	-0.0024	1.3257	0.0027
15	1.1644	-0.0052	1.3290	0.0059
16	1.1703	0.0007	1.3223	-0.0008
17	1.1662	-0.0035	1.3270	0.0040
18	1.1650	-0.0047	1.3283	0.0053
19	1.1683	-0.0013	1.3245	0.0015
20	1.1655	-0.0042	1.3278	0.0048

Average Volume: (cm <sup>3</sup> )	1.1697	Standard Deviation: (cm <sup>3</sup> )	0.0039
Average Density: (g/cm <sup>3</sup> )	1.3230	Standard Deviation: (g/cm <sup>3</sup> )	0.0044