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RESULTS OF STANDARD COAL QUALITY ANALYSIS FOR COALREAP DRILLING FROM JANUARY 1988 TO FEBRUARY 1989, JK- SERIES BOREHOLES, JHERRUCK AREA OF THE SONDA COAL FIELD, SINDH PROVINCE, PAKISTAN

compiled by

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ABSTRACT

Results of standard coal analysis (proximate, ultimate, forms of sulfur, heating value and ash fusion temperature) for 139 coal and carbonaceous shale samples collected from twenty boreholes drilled in the northwestern part of the Sonda coal field are presented. Additional data, including air drying loss, hardgrove grindability, free swelling index, and apparent specific gravity, are also presented for most samples. The boreholes were drilled between January 1988 and February 1989 by the Geological Survey of Pakistan, with the technical assistance of the United States Geological Survey and grant funds from the U.S. Agency for International Development, as part of the cooperative Coal Resource Exploration and Assessment Program (COALREAP). These boreholes are the third phase of COALREAP drilling in the Sonda coal field, and are identified by the prefix JK-. A 180-square-kilometer area on the west bank of the Indus River, just north of the town of Jherruck, was explored during the JK- drilling program. All of the coal samples except one are from the Paleocene Bara Formation.

On an as-received basis, the JK- series samples averaged 30.64 percent moisture, 20.50 percent ash, 3.37 percent sulfur, and 6107 BTU. This suite of samples represents several coal beds distributed over a large geographic area, however, and the range of values for most coal quality parameters is wide. The thicker coal beds tend to be of lower ash and sulfur than the average values. The results of the JK- analyses are consistent with previous COALREAP sampling in the Sonda coal field.

INTRODUCTION

Project background

The United States Geological Survey (USGS) is assisting the Geological Survey of Pakistan (GSP) in a cooperative investigation of the coal resources of Pakistan. This cooperative coal resource assessment and exploration program began in 1985 and is referred to as COALREAP. COALREAP is Component 2A of the joint Government of Pakistan (GOP) and United States Agency for International Development (USAID) Energy Planning and Development Project[1], which is financed by GOP, and by grants from USAID. USGS participation in the project is directed by a Participating Agency Service Agreement[2] (PASA) with USAID.

The coal-mining industry in Pakistan is currently limited to small-scale underground mining, mostly in support of local brick-making. Most COALREAP activities have focused on either exploratory drilling programs in Sindh Province, which historically has been the area of Pakistan receiving the greatest interest in the potential for larger-scale development, or regional geologic studies in other coal bearing-areas of Pakistan (fig. 1). Most of the COALREAP (and other USAID-funded) drilling in Sindh has targeted the Paleocene Bara Formation of the Lakhra coal field (Schweinfurth and others, 1988), which currently supports a large number of small mines, and the adjacent, but as yet undeveloped, Sonda coal field. There have been three major COALREAP drilling programs in the Sonda Coal field. The first

[1]Project no. 391-0478 [2]PASA no. IPK-0478-P-IC-5068-00

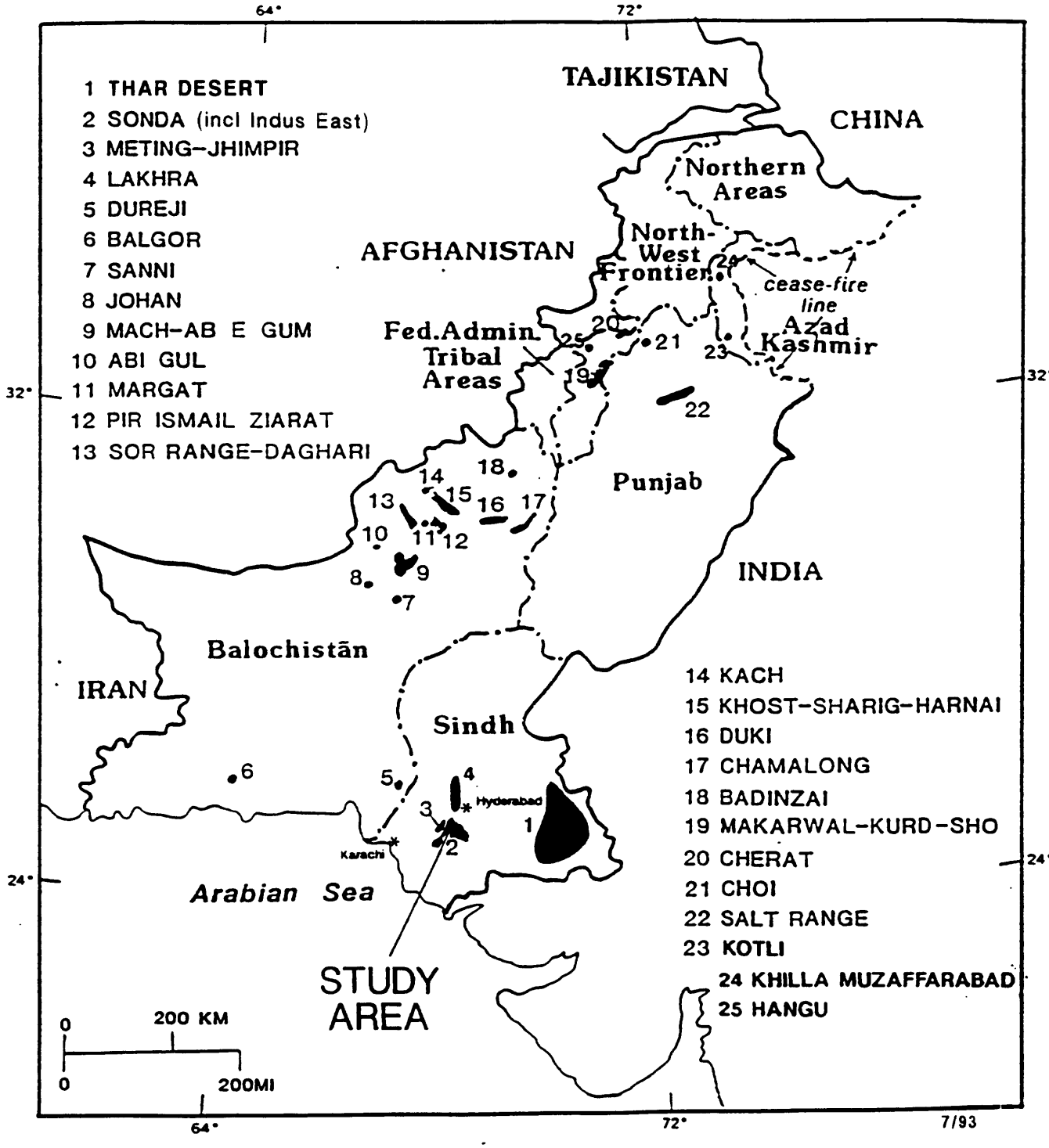

Figure 1. Index map, showing study area and location of Pakistani coal fields and occurrences.

program was completed between December 1986 and March 1987, and consisted of twenty reconnaissance boreholes which covered most of the coal field at about 3 mile (4.8 km) spacing (Schweinfurth and others, 1988). In that program nine holes were drilled in the northern part of the field (the UAS- series boreholes), eight holes drilled in the southern part of the field (UAT- series), and three holes drilled in the eastern part of the field, then known as the Indus East coal field (UAK- series). Thirteen additional UAK- series reconnaissance holes were drilled in the Indus East area in the second phase of drilling between September 1987 and February 1988 (Thomas and Khan, 1992). The last major phase of COALREAP drilling in the Sonda coal field, the JK- series, consisted of a twenty hole predevelopment drilling program that was completed between January 1988 and February 1989 near the town of Jherruck (fig. 2), an area of about 180 sq km in the northwestern part of the Sonda field, generally referred to as the "Jherruck Block". The Jherruck program essentially consisted of infilling the area covered by the UAS- series and an earlier GSP drilling program (the DH- series from 1985 to 1986; Khan, 1988), which appears to be the area with the most potential for large scale commercial coal development within the Sonda field. In early 1992, GSP drilled four additional USAID-funded holes in the Jherruck area, the JTB- series. The JTB- holes were drilled under the supervision of the John T. Boyd Co., Pittsburg PA, for the purpose of evaluating mineability of the Jherruck tract from a geomechanical and hydrologic standpoint (Boyd, 1992).

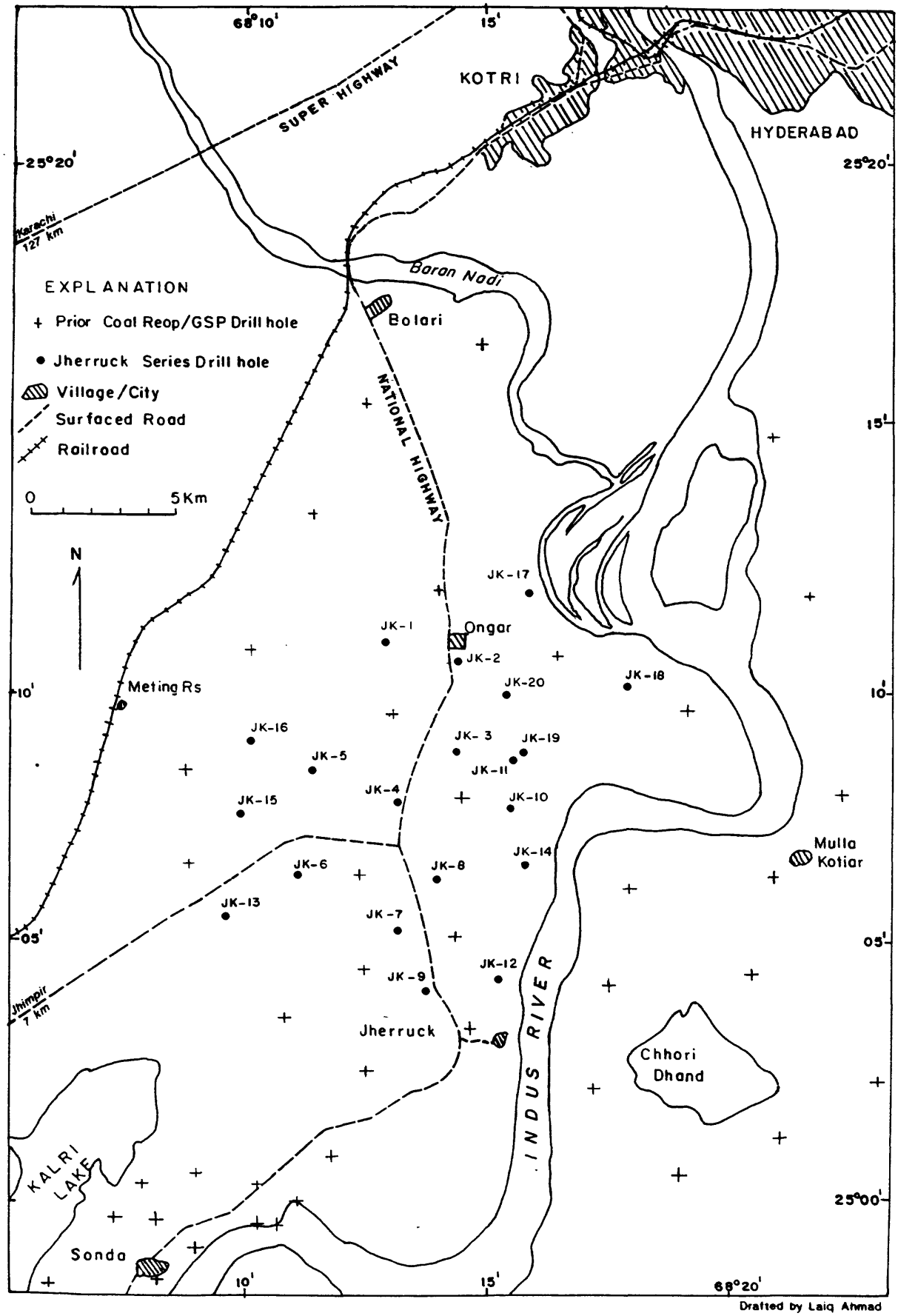

Figure 2. Drill-hole location map, Jherruck area, northwestern Sonda coal field. JTB- holes not shown. Note that the location of JK-18 has been corrected from SanFilipo and others (1989, fig. 2).

Purpose and scope

The purpose of this report is to release the results of standard (proximate and ultimate) coal quality analysis for the latest series of COALREAP drilling in the Sonda coal field, the JK- series. This report contains basic data and summary statistics only. Comprehensive geologic and statistical interpretations of the coal quality of the Sonda coal field, including the results of the data compiled herein, are included in SanFilipo and others (1993) and Finkelman and others (1993).

The data compiled in this report consist of the results of analytical tests that were conducted by private-sector laboratories that are under contract to the USGS. Additional analysis done by USGS laboratories (trace elements and major oxides) for the samples covered by this report are included in Finkelman and others (1993) and SanFilipo and others (1993).

Previous work

Proximate analyses of coal samples that were collected from the DH- series drilling and analysed in GSP and other Pakistani laboratories are included in Ahmed and others (1986) and Husain (1986). Proximate and ultimate analysis of samples collected during the first two phases of COALREAP drilling in the Sonda coal field are contained in Landis and others (1988, 1992). The results of analysis for the inorganic constituents of coal samples collected during COALREAP drilling in the Sonda coalfield are contained in Finkleman and others (1993). Statistical summaries and interpretation of the results of coal analysis for

the Sonda field as a whole are included in Finkleman and others (1993), and statisitcs on a bed-by-bed basis for the Jherruck area are included in SanFilipo and others (1993).

Proximate analyses of some of the JK- and UAK- samples were also conducted by the GSP coal analytical laboratory in Karachi, which was upgraded during the COALREAP program. Results of the GSP analysis are available in GSP files and are briefly discussed by Brown (1990). The results of samples from the four JTB- holes analysed by GSP and Pakistan Council of Science and Industrial Research (PCSIR) laboratories are also available in GSP files.

A summary of the availability of coal quality data from the Sonda coal field appears in Table 1. Basic drilling data for the boreholes covered by this report, including lithological and geophysical logs, are included in SanFilipo and others (1989), and geologic interpretation and coal resource calculations are included in SanFilipo and others (1993). The geology of the Sonda coalfield is discussed in detail in SanFilipo and others (1988, 1993).

Acknowledgements

Acknowledgement of each of the individual contributions to a drilling project of the magnitude of the Jherruck program is beyond the scope of this brief report. The contributions of the Geological Survey of Pakistan well-site geologists who collected the samples in the heat and frequent civil unrest of Sindh must however, be noted; in addition to the three GSP authors of this report, they are: Mohammad A. Tagar, Zameer M. Khan, M. Siddique Khan, Mohammad A. Tariq, Mumtaz L. Khan, Iqbal A. Khan, and Sardar S. Akhter. The GSP drilling supervisors and crews must

Table 1. Previous reports on the coal quality of the Sonda coal field. The reports listed for proximate analysis, ultimates analysis, major oxides and trace elements refer to the actual laboratory reports for individual samples. Statistics refers to statistical summaries of the major coal-quality parameters.

Borehole series	Proximate analysis	Ultimate analysis	Major oxides	Trace elements	Statistics
DH-	1,2*	2*	2*,4*	2*,4*	2*,4*
UAS-	2	2	4	4	2**,4,5
UAT-	2	2	4	4	2**,4,5
UAK-	3,7***	3	4	4	3**,4,5
JK-	6,7****	6	4	4	4,5,6
JTB-	7,8				

References:

1) Ahmed and others (1986), Husain (1986), GSP files

2) Landis and others (1988)

3) Landis and others (1992)

4) Finkleman and others (1993)

5) SanFilipo and others (1993) (USGS analysis only)

6) This report (USGS analysis)

7) GSP files (GSP analysis)

8) GSP files (PCSIR analysis)

* DH-22,23,24 analyses from USGS or contractor labs

** No trace elements

*** 10 UAK- splits ground in the U.S.

**** 107 field splits benched differently than USGS JK- splits

also be duely credited. The USGS personnel who oversaw the drilling operations for the first ten holes are also hereby acknowledged: Edwin A. Landis, William F. Outerbridge, Christopher Wnuk, and Nasir A. Durrani (USAID). It should be noted that the USGS authors of this report were not involved with any drill- site activities for this project, including coal sampling.

DATA COLLECTION

Drilling operations

Drilling operations for the JK- holes are covered in detail in SanFilipo and others (1989) and will only be briefly discussed herein. A list of surveyed drilling locations is shown in table 2. Drilling was done by GSP crews using GSP-owned equipment. One Longyear-44 and one Longyear-38 skid mounted drilling rigs were employed. The first few meters were generally drilled by conventional rotary methods to set surface casing; drilling was by continuous wireline coring thereafter. In order to insure sufficient sample for backup splits and trace element analysis, the preferred core size was HQ (63.5 mm), but occassionaly reduction to NQ (47.6 mm) was necessary (samples JK-1-2-88 through JK-1-7-88 and JK-11-2A and JK-11-2B were NQ). Bentonite or Johnson Revert polymer mud was the usual drilling medium. Overall core recovery for the JK- holes was 70 percent; based on geophysical log interpretation, the recover in coal was about 91 percent.

Site selection and drilling depths for the Jherruck drilling were generally GSP management responsibilities. Short-term USGS TDY personnel, generally with overlapping duties at Indus East,

Table 2. Surveyed drill-hole coordinates and elevations, JK- series drilling, Jherruck area, Sindh Province Pakistan.

DRILL HOLE	EASTING[1] (meters)	NORTHING[1] (meters)	GROUND ELEVATION (meters above MSL)
JK-1	2161340.2	836583.0	49.40
JK-2	2163660.4	835863.0	17.90
JK-3	2163561.9	832738.3	17.41
JK-4	2161553.6	830913.4	19.81
JK-5	2158454.1	832200.5	32.50
JK-6	2157764.2	828467.3	30.80
JK-7	2161279.5	826607.3	24.47
JK-8	2162688.2	828219.0	18.65
JK-9	2162136.8	824463.6	20.29
JK-10	2165296.3	830597.7	18.04
JK-11	2165674.2	832205.3	15.11
JK-12	2164776.2	824569.8	14.75
JK-13	2155072.4	827132.4	31.39
JK-14	2165826.8	828676.6	15.78
JK-15	2155958.9	830932.5	33.74
JK-16	2156117.4	833411.0	39.71
JK-17	2166273.6	838264.9	20.48
JK-18	2169546.5	834513.1	15.91
JK-19	2165971.1	832495.9	17.86
JK-20	2165508.5	834676.5	15.48

[1]Survey of Pakistan rectangular grid system; quadrangles 40C/4 and 40C/8.

visited the first ten JK- sites in an oversight capacity, but rock description, coal sampling, and geophysical logging operations were done almost exclusively by GSP personnel.

In addition to drilling crews, two or three GSP geologists were assigned to each drill hole. Shifts were scheduled so that one geologist was always present during drilling. The geologist was responsible for insuring that the drillers maintained proper records of drilling depth, collected samples of cuttings at regular intervals during non-core drilling, and properly extracted core from the core barrels. Core was extracted from the inner-barrel onto a wooden core trough by means of hammering or mud pressure. The mud cake was washed off and the core was described by the geologist. Rock core was retained in wooden boxes and stored at the GSP core library at Sonda village.

Sampling and analytical methods

All coal beds 30 cm thick or greater were sampled; thinner beds were sampled at the site-geologist's discretion, but not necessarily submitted for USGS analysis. Immediately after being described in detail, coal samples were double bagged in plastic to preserve moisture, and labeled. At the discretion of the site geologist, some individual coal beds were divided into smaller sample benches on the basis of homogeneity and thickness of the coal. When coal was cored at night, it was usually placed in styrene sleeves and wrapped with wet towels, and then described and bagged in daylight. Immediately after bagging, all samples were placed in water-tight plastic barrels, each lined with a large plastic bag. Once filled, the barrels were shipped by air

to the U.S. for grinding and analysis of the coal. The split for GSP was usually obtained after grinding, but for the last ten holes (JK-1,2,6,13,15,16,17,18,19,20), GSP split the core by chisel in the field and retained a split for their labs (nb: SanFilipo and others, 1989, erroneously stated that field splits were obtained for only the last 5 holes drilled). The field splits were generally wrapped in plastic and put in metal cannisters, in order to maintain orientation, before being placed in barrels for shipment.

Upon arrival at USGS, the coal samples were unpacked and examined, generally without opening the bags. In some cases smaller samples were combined with the overlying or underlying samples to save money. The bagged samples were then boxed and shipped to the USGS contractor laboratory, Dickenson Laboratories, Inc., El Paso TX., where they were ground and analysed according to American Society for Testing Materials Standards. Splits of -100 and -20 mesh were returned to USGS from the contractor for trace element/oxide analysis and storage respectively; the storage splits are available for further study, such as coal petrology, or for calibration of GSP laboratory equipment. A flow chart for the complete analytical procedure for COALREAP samples is shown in figure 3.

The oriented coal samples from boreholes JK-13, JK-15, JK-16, JK-17, JK-18, and JK-19 were x-radiographed in Reston to identify stratification by fabric or zones of concentrated mineral matter. Based on the x-ray appearances, the samples from JK-15, JK-16, JK-17, JK-18, and JK-19 were rebenched (usually into smaller samples) before submittal to the laboratory. The samples

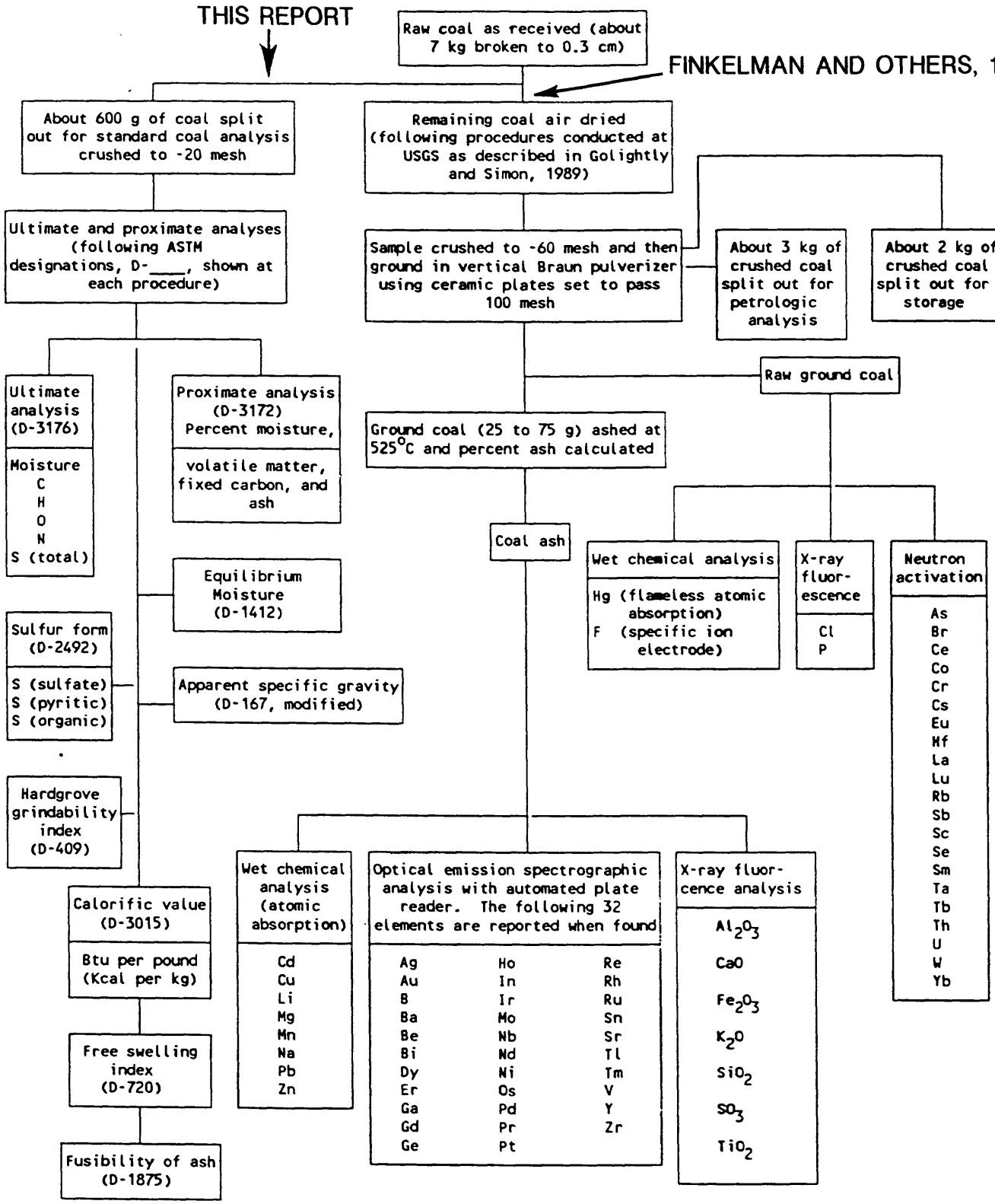

Figure 3 Flow diagram of procedures used for the analysis of coal samples collected as part of the Sind COALREAP.

from JK-15 and JK-17 were unfortunately lost in the U.S. mail system enroute from USGS to Dickenson, but hopefully the samples from JK-16,18 and 19 will be the subject of further detailed petrographic and analytical study.

DISCUSSION OF THE RESULTS

A list of all coal beds intercepted and the sample numbers is shown in Appendix 1. Note that the depths shown in Appendix 1 have been revised from previous reports (notably SanFilipo and others 1989) to reconcile core loss with the coal thicknesses from geophysical logs, and the sample numbers have been revised to reflect samples that have been split or combined. All of the JK- samples are from the Paleocene Bara Formation, with the exception of JK-18.1, which is from the ?Paleocene Sohnari Member of the Laki Formation. Of the 135 field samples taken from the JK- holes, 10 were not submitted for analysis due to small sample size and 15 were lost in transit (nb: SanFilipo and others [1989] inadvertently omitted carbonaceous shale samples JK-8-CS-1 and JK-8-CS-2 from the list of 133 samples included in that report). Splitting and recombining the remaining field samples resulted in 139 samples submitted for standard analysis. The results of standard coal analysis for the 139 JK- samples are shown in Appendix 2 and summarized in table 3. Eighty-five of the samples were also submitted for trace element and major oxide analysis (a few of the remaining 54 samples were not submitted due to insufficient sample size, but for the most part, budgetary restrictions prevented additional trace element analysis). Samples that were submitted for trace element analysis are noted

Table 3. Statistical summary of standard coal analyses for the JK-series boreholes, Jherruck area of the Sonda coal field, Sindh Province Pakistan. Analyses performed by Dickenson Laboratories (El Paso TX) under contract to the U.S. Geological Survey. Results are listed on the as-received basis. See and SanFilipo and others (1993) and Finkelman and others (1993) for more complete statistical analysis of the Jherruck area, including the results of additional samples.

DATA ITEM	VALUES USED	MEAN	STD DEV	MINIMUM	MAXIMUM	RANGE	GEO MEAN	GEO DEV
MOISTURE	139	30.64	4.83	14.71	39.78	25.07	30.21	1.19
VOLMAT	138	25.76	5.65	6.38	53.67	47.29	25.05	1.29
FIXEDC	138	23.10	8.05	0.02	53.57	53.55	20.34	2.14
BMASH	138	20.50	15.48	2.62	73.84	71.22	15.38	2.18
HYDROGEN	138	6.09	1.06	2.53	7.44	4.91	5.98	1.22
CARBON	138	34.45	11.17	3.64	50.42	46.78	31.65	1.61
NITROGEN	137	0.73	0.24	0.07	1.31	1.24	0.67	1.59
OXYGEN	137	34.65	5.04	18.29	42.69	24.40	34.24	1.17
CHLORINE	137	0.06	0.04	0.01	0.23	0.22	0.05	1.81
SULFUR	138	3.37	2.52	0.06	11.68	11.62	2.38	2.57
BTU	138	6106.67	1906.63	380.00	8997.00	8617.00	5611.83	1.64
ASHDEF	139	2128.56	218.58	1860.00	2700.00	840.00	2118.25	1.10
ASHSOF	139	2209.50	233.96	1880.00	2700.00	820.00	2197.68	1.11
ASHFLD	139	2319.28	234.59	1900.00	2700.00	800.00	2307.53	1.11
SULFATE	133	0.16	0.20	0.01	1.59	1.58	0.10	2.75
SULFPYR	133	2.52	2.33	0.01	11.47	11.46	1.39	3.94
SULFORG	133	0.71	0.46	0.01	2.87	2.86	0.52	2.69
FREESWEL	1	4.00		4.00	4.00		4.00	
AIRDLOS	139	23.89	5.46	9.89	37.11	27.22	23.17	1.30
ASG	21	1.42	0.23	1.21	1.97	0.76	1.40	1.16

in Appendix 1 and can also be identified by the presence of a six digit number preceeded by "W-" in the header of the standard analysis results in Appendix 2. Results of trace element and major oxide analysis for the Sonda coalfield (including the JK- samples) are presented in Finkleman and others (1993).

The results shown in table 3 are generally consistent with other COALREAP sampling in the Sonda coal field. It should be cautioned, however, that the JK- series is a subset of the analytical data available for the Jherruck area. The results shown in table 3 should therefore be used in conjunction with the more complete discussions of the coal quality of the Sonda coal field that appear in and SanFilipo and others (1993) and Finkleman and others (1993). It should be noted in particular that the results in table 3 include samples from at least seven coal zones, each of which contain multiple beds. As discussed in SanFilipo and others (1993), the sulfur and ash concentrations tend to decrease with bed thickness for the Jherruck coals, and the heating value tends to increase.

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APPENDICES

Appendix 1. Revised coal intercepts and sample numbers, JK- series boreholes, Jherruck area of the Sonda coal field, Sindh Province, Pakistan. Brackets indicate single coal beds divided into benches, some with unsampled partings or intervening core loss. The symbol + indicates partial sample. The symbol @ indicates the sample was submitted for trace element and oxide analysis. Depth adjustments are revisions from the original core descriptions and are based on geophysical logs accommodated by adjusting the position of core loss. Ash values are on a dry basis and are shown to distinguish "dirty" coal (25 - 50 pct dry ash); approximate (~) ash percentages for unsampled benches are estimated from density logs, na indicates no estimate was made. D.C. = dirty coal; ss = sandstone; sh = shale; carb = carbonaceous; 4pi = 4pi density log, GN = natural-gamma/neutron log; anl = analysis. Subzone abbreviations are: SOH = Sohnari; D = Daduri; USTR = upper strays; I = Inayatabad; SU = Sonda upper; S = Sonda main; SSL = Sonda lower main; W = Wassi; LSTR = lower strays; JRK = Jherruck (see SanFilipo and others, 1993, for further discussion).

Drill hole	Subzone	Description	From (m)	To (m)	Thickness (m)	Info source	Sample number	% ash	Remarks
JK-1	D1	Coal (loss)	129.38	129.63	0.25	4pi	---		see below
	D1	Dirty coal	?131.80	?131.94	?0.14	Core	---		Misplaced? no 4pi
	D2	Coal	141.58	141.88	0.30-	Core/4pi	@JK-1-1-88	11.30	depth adjusted
		Coal (loss)	141.88	141.93	0.05-	4pi	---		-do-
	USTR	Coal	166.85	166.95	0.10-	Core	---	~25	
		Coal (loss)	166.95	167.08	0.13-	4pi	---	~25	
	USTR	?D.C. (loss)	170.50	170.80	0.30	4pi/res	---	~45	Cave?
	I	?D.C. (loss)	187.03	187.58	0.55	4pi	---	~50	Coaly shale?
	SU	Coaly shale	192.10	192.61	0.51	Core	@JK-1-2-88	53.10	
	SU	Dirty coal	194.78	195.18	0.40	Core	@JK-1-3-88	25.90	
	SU	Coal	196.09	196.41	0.32	Core	@JK-1-4-88	16.37	
	SU	Coal	197.05	197.25	0.20-	Core	JK-1-5-88	na	no USGS analysis
		Coal (loss)	197.25	197.35	0.10-	4pi	---		
	S	Coal	198.98	199.42	0.44	Core	@JK-1-6-88	18.76	
	SSL	Coal (loss)	210.75	211.15	0.40-	4pi	---	~25	
		Claystone	211.15	211.30	0.15	4pi/core	---		10 cm lost
		Coal (loss)	211.30	211.50	0.20	4pi	---	~20	
		Coal	211.50	211.70	0.20	Core	---	~20	
		Claystone	211.70	211.90	0.20	Core	---		
		Dirty coal	211.90	212.10	0.20-	Core/4pi	---	~40	4pi lithology
	W	Coal	234.00	234.85	0.85	Core	@JK-1-7-88	19.71	
JK-2	D1	Dirty coal	98.17	98.82	0.65	Core	@JK-2-1-88	36.46	
	USTR	Dirty coal	146.01	146.12	0.11	Core	---		
	USTR	Dirty coal	159.55	159.65	0.10	Core/4pi	---		4pi lithology
	SU	D.C. (loss)	179.35	179.47	0.12-	4pi	---		
		Dirty coal	179.47	179.50	0.03-	Core/4pi	---		depth adjusted
	S	Coal	187.48	189.50	2.02	Core	@JK-2-2-88	14.17	
	SSL	Dirty coal	200.88	200.98	0.10	Core	---		
	SSL	Coal	205.98	207.54	1.56	Core	@JK-2-3-88	15.84	Thick adjusted
	SSL	Dirty coal	208.19	208.26	0.07	Core	---		depth adjusted
	SSL	?Dirty coal	210.83	211.23	0.40	Core/4pi	@+JK-2-4-88	<54.93	4pi lithology
		Carb shale	211.23	211.38	0.15	Core/4pi	@+JK-2-4-88	>54.93	
JK-3	USTR	Dirty coal	122.54	122.99	0.45	Core	@JK-3-1-B	36.12	
	I	Dirty coal	145.41	145.91	0.50	Core	@JK-3-1	25.16	
	I	Coaly shale	151.91	152.53	0.62	Core	@JK-3-1-A	57.24	
	S	Coaly shale	169.09	169.94	0.85	Core	@JK-3-2	68.29	
		Coal (loss)	169.94	170.23	0.29-	4pi	---		
		Coal	170.23	172.17	1.94-	Core	@JK-3-3	9.73	
	S	Dirty coal	174.71	174.86	0.15	Core/4pi	---		4pi lithology

Drill hole	Subzone	Description	From (m)	To (m)	Thickness (m)	Info source	Sample number	% ash	Remarks
JK-3 cont.	SSL	Coaly shale	177.66	177.76	0.10	Core/4pi	---		4pi lithology
	SSL	Coal	179.60	180.30	0.70-	Core	@+JK-3-4	18.51	
		Coal (loss)	180.30	180.39	0.09 |	4pi	---		
		Coal	180.39	180.69	0.30- |	Core	@+JK-3-4	18.51	
	SSL	Dirty coal	182.14	182.34	0.20	Core/4pi	---		4pi lithology
	SSL	Dirty coal	182.59	182.82	0.23	Core	---		
	SL	Dirty coal	190.99	191.24	0.25	Core	JK-3-6	40.00	
JK-4	D1	Dirty coal	66.11	66.41	0.30-	Core	JK-4-1	32.18	
		Coal (loss)	66.41	66.46	0.05- |	4pi	---		
	I	Coal	127.87	128.71	0.84	Core	@JK-4-2	14.09	
		Coaly shale	128.71	128.76	0.05	Core/4pi	---		4pi lithology
	S	Coal	155.92	157.77	1.85-	Core	@+JK-4-3	7.53	
		Coal (loss)	157.77	159.07	1.30 |	4pi	---		depth adjusted
		Coal	159.07	160.02	0.95- |	Core/4pi	@+JK-4-3	7.53	-do-
	S	Coal	162.34	162.69	0.35	Core	JK-4-4	24.33	
	SSL	Dirty coal	166.65	166.90	0.25	Core/4pi	---		4pi lithology
	SSL	Dirty coal	167.70	167.98	0.28	Core/4pi	---		4pi lithology
JK-5	D1	Dirty coal	131.75	132.10	0.35	Core	@JK-5-1	47.91	
	D1	Coaly shale	132.42	132.72	0.30	Core	@JK-5-2	58.10	
	I	Coal	189.50	190.40	0.90	Core	@JK-5-3	12.89	
	?S	Dirty coal	202.95	203.70	0.75	Core	@JK-5-4	38.82	not deep enough
JK-6	I	Dirty coal	171.38	171.63	0.25	Core/4pi	---		4pi lithology
	SU	Coal	183.22	183.62	0.40	Core	@JK-6-1-88	20.81	
		Carb shale	183.62	183.94	0.32	Core	---		
		Dirty coal	183.94	184.08	0.14	Core/4pi	---		4pi lithology
	S	Coal	191.28	193.18	1.90	Core	@JK-6-2-88	10.48	
	SSL	Coaly sh?	198.23	199.08	0.85	Core	@JK-6-3-88	57.40	
	SSL	Coal	200.90	201.15	0.25	Core	---		
	SSL	Coal	203.30	203.60	0.30	Core	@JK-6-4-88	18.62	
	SL	Dirty coal	216.56	217.00	0.44	Core	@JK-6-5-88	45.99	
	SL	Coaly shale	220.60	221.00	0.40	4pi	---		
JK-7	D1	Coaly shale	76.90	77.20	0.30	Core	@+JK-7-1	60.52	
		Dirty coal	77.20	77.50	0.30	Core/4pi	@+JK-7-1	60.52	4pi lithology
	USTR	Coal?	123.92	124.22	0.30	Core	JK-7-2	10.60	no 4pi response
	USTR	Dirty coal	129.38	129.81	0.43-	Core/4pi	@JK-7-3	34.88	samp 3+3A; depth adj
		D.C. (loss)	129.81	129.88	0.07- |	4pi	---		depth adjusted
	I	Dirty coal	148.60	148.70	0.10-	Core	JK-7-4	na	-do-; no USGS analys
		D.C. (loss)	148.70	148.87	0.17- |	4pi	---		
	?SU	Coal (loss)	165.67	165.78	0.11-	4pi	---		
		Coal	165.78	166.04	0.26- |	Core	JK-7-5	9.38?	switched 7-6? e-logs
	?SU	Coaly shale	166.98	167.20	0.22	Core/4pi	@+JK-7-6	>51.48?	switched 7-5? e-logs
		Dirty coal	167.20	167.60	0.40	Core/4pi	@+JK-7-6	<51.48?	-do-
	?S	Dirty coal	171.59	171.60	0.01	Core	---		
	LSTR/JRK	Coaly shale	240.50	240.80	0.30	Core/4pi	@+JK-7-7	>55.56	Burrowed coal
		Dirty coal	240.80	241.15	0.35	Core/4pi	@+JK-7-7	<55.56	4pi lithology
	LSTR/JRK	Dirty coal	243.33	243.83	0.50	Core	@JK-7-8	40.39	
	LSTR/JRK	Dirty coal	244.58	244.68	0.10	Core	---		
	LSTR/JRK	Carb shale	247.96	248.61	0.65	Core	---		

Drill hole	Subzone	Description	From (m)	To (m)	Thickness (m)	Info source	Sample number	% ash	Remarks
JK-8	I	Coaly sh (loss)	115.46	115.73	0.27	4pi/GN	---		depth adjusted
	I	Carb ss	?119.78	120.13	0.35	Core	@JK-8-CS-1	86.58	
	I	Core loss	120.13	120.58	0.45	Core/4pi			not coal
	I	Carb shale	121.41	121.68	0.27	Core/4pi	@JK-8-CS-2	81.29	depth adjusted
	I	Coal	120.58	121.41	0.83	Core	@JK-8-1	20.53	
	SU	Coaly sh (loss)	135.20	135.45	0.25	4pi/GN	---		depth adjusted
	S	Coal	141.90	145.20	3.30-	Core	@+JK-8-2	10.73	
		Carb shale	145.20	145.50	0.30	Core	@JK-8-CS-3	80.94	
		Coal	145.50	146.02	0.52-	Core	@JK-8-2	10.73	
	SSL	Dirty coal	160.20	160.96	0.76	Core	@JK-8-3	29.26	
JK-9	D1	Coal	68.23	69.08	0.85	Core	@JK-9-1	24.88	
	I	?Coaly sh (loss)	163.52	163.72	0.20	4pi/GN	---	~70	
	SU	D.C. (loss)	170.07	170.45	0.38	4pi/GN	---	~29	
	SU	Coaly shale	173.94	174.06	0.12	Core/4pi	JK-9-2	na	4pi lith; no USGS anl
	S	Dirty coal	179.29	179.69	0.40	Core	@JK-9-3	27.59	
	S	Coaly shale	183.14	183.45	0.31	Core	@JK-9-4	52.61	
	SSL	Coaly shale	193.75	193.87	0.12	Core/4pi	JK-9-5	na	4pi lith; no USGS anl
	SL	Dirty coal	198.77	198.97	0.20	Core	JK-9-6	na	no USGS analysis
	?SL	Dirty coal	201.84	201.99	0.15	Core	JK-9-7	na	-do-
JK-10	D1	Dirty coal	97.74	97.86	0.12	Core/4pi	---		4pi lithology
	USTR	Carb shale	125.44	125.87	0.43	Core	@JK-10-2	71.57	
	USTR	Coal	134.78	135.08	0.30-	Core	@JK-10-A	19.18	
		Dirty coal	135.08	135.23	0.15-	Core	---		
	I	Coal	159.57	160.32	0.75	Core/4pi	@JK-10-B	21.69	depth adjusted
	S	Coal	176.27	177.07	0.80-	Core/4pi	@JK-10-C-1	15.68	-do-
		Carb shale	177.07	177.27	0.20	Core/4pi	@JK-10-C-1A	67.85	-do-
		Coal	177.27	178.97	1.70	Core/4pi	@JK-10-C-2	8.00	-do-
		Coal (loss)	178.97	179.08	0.11	4pi	---		-do-
		Coal	179.08	180.14	1.06-	Core	@JK-10-C-3	5.66	
	S	Coaly shale	181.30	181.55	0.25	4pi			
	SSL	Coal	190.10	190.50	0.40	Core	@JK-10-D	24.38	
JK-11	I	Coal	168.09	168.49	0.40	Core	@JK-11-1	17.93	roof loss not coal
	I	Dirty coal	171.44	171.51	0.07	Core/4pi	---		4pi lithology
	S	Coal	188.48	189.29	0.81-	Core	@JK-11-2A	9.64	
	S	Coal	189.29	190.59	1.30-	Core	@JK-11-2B	8.00	
JK-12	D1	Dirty coal	54.70	55.15	0.45	Core	@JK-12-1	25.13	
	D2	Coaly shale	64.20	64.60	0.40	Core/4pi	@JK-12-2	58.38	depth adjusted
		Carb shale	64.60	65.00	0.40	Core	---		-do-
		Dirty coal	65.00	65.15	0.15	Core/4pi	@JK-12-3	32.83	-do-
		Coaly shale	65.15	65.45	0.30	Core/4pi	@JK-12-4	55.86	-do-
	USTR	Coal	89.13	89.76	0.63	Core/4pi	@JK-12-5	16.17	depth adjusted
		Underclay	89.76	90.25	0.49	Core/4pi	---		-do-
		Dirty coal	90.25	90.68	0.43	Core/4pi	@JK-12-6	39.64	-do-
		Coaly shale	90.68	91.08	0.40	Core/4pi	@JK-12-7	63.22	-do-
	I	?Coaly sh (loss)	113.50	113.70	0.20	4pi/GN	---	~70	
	S	Coal	129.23	130.88	1.65	Core	@JK-12-8	6.82	

Drill hole	Subzone	Description	From (m)	To (m)	Thickness (m)	Info source	Sample number	% ash	Remarks
JK-13	I	D.C. (loss)	171.35	171.59	0.24	4pi	---	~45	depth adjusted
	SU	Dirty coal	180.43	180.73	0.30-	Core/4pi	@JK-13-1	27.42	
		D.C. (loss)	180.73	181.00	0.27-	4pi/GN	---		depth adjusted
	S	Coal	187.89	190.74	2.85-	Core	@JK-13-2	14.74	Top 67cm dirty 4pi
		D.C. (loss)	190.74	191.29	0.55-	4pi			
JK-14	USTR	D.C. (loss)	107.50	108.21	0.71	4pi/GN	---	~28	
	I	Coaly sh (loss)	124.50	124.72	0.22	4pi	---		
	I	Dirty coal	125.90	126.25	0.35	Core/4pi	---		depth adjusted
	I	Coaly shale	131.83	131.90	0.07	Core/4pi	---		-
		Dirty coal	131.90	131.98	0.08	Core/4pi	---		Dropped from
		Coaly shale	131.98	132.08	0.10	Core/4pi	---		previous run? All
		Dirty coal	132.08	132.18	0.10	Core/4pi	---		depths adjusted.
		Coaly shale	132.18	132.30	0.12	Core/4pi	---		-
	I	Dirty coal	132.75	132.90	0.15	Core/4pi	---	~30	depth adjusted
	SU	Coal	143.47	144.02	0.55	Core	@JK-14-A	15.31	
	SU	Dirty coal	145.99	146.06	0.07	Core/4pi	---		4pi lithology
	SU	Dirty coal	147.90	147.95	0.05-	Core/4pi	---		4pi lithology
		D.C. (loss)	147.95	148.08	0.13-	4pi			
	S	Coaly shale	151.59	151.87	0.28	Core	---		
		Coal	151.87	152.93	1.06-	Core	@JK-14-B1	7.80	
		Coaly shale	152.93	153.21	0.28	Core	@JK-14-CS	54.52	
		Coal	153.21	154.84	1.63	Core	@JK-14-B2	5.49	
		Coal	154.84	156.04	1.20-	Core	@JK-14-B3	4.00	
JK-15	I	Coal	153.33	154.15	0.82-	Core/4pi	JK-15-1-88	~28	Sample lost in mail
		Coal (loss)	154.15	154.35	0.20-	4pi	---	~28	-do-
	?S	Coal	179.70	181.15	1.45	Core/4pi	JK-15-2-88	~19	-do-
	SSL	Coal (loss)	193.68	194.10	0.42	4pi	---	~24	
JK-16	USTR	Dirty coal	143.20	143.30	0.10	Core			
	I	Coal	160.81	160.90	0.09-	Core	JK-16.1	14.69	Petrographic bench
		Coal	160.90	161.16	0.26	Core	JK-16.2	8.73	-do-
		Coal	161.16	161.46	0.30	Core	JK-16.3	5.78	-do-
		Coal	161.46	161.67	0.21	Core	JK-16.4	11.64	-do-
		Dirty coal	161.67	161.76	0.09-	Core	JK-16.5	33.61	-do-
	?S	Coal	179.22	179.53	0.31	Core	JK-16.6	21.80	Petrographic bench
	?S	Coal	180.11	180.25	0.14-	Core	JK-16.7	23.68	Petrographic bench
		Dirty coal	180.25	180.35	0.10-	Core	JK-16.8	45.88	-do-
	?W	Coal	210.00	210.30	0.30	Core	JK-16.9	17.72	Petrographic bench
	?W	Coaly shale	212.04	212.21	0.17	Core	JK-16-4A-89	na	no USGS analysis
	?W	Coal	215.45	216.28	0.83-	Core	@JK-16.10	8.14	Petrographic bench
		Dirty coal	216.28	216.35	0.07-	Core	@JK-16.11	41.99	-do-
		Claystone	216.35	216.75	0.40	Core/4pi	---		depth adjusted
	?W	Coal (loss)	216.75	217.00	0.25	4pi	---		depth adjusted
	?W	Dirty coal	219.24	219.44	0.20	Core	JK-16-6-89	~26	no USGS analysis
		Coaly shale	219.44	219.71	0.27	Core	---		
	?W (?LSTR)	Dirty coal	239.36	239.48	0.12-	Core	JK-16.12	46.62	Petrographic bench
		Coal	239.48	239.81	0.33-	Core	JK-16.13	19.10	-do-
	?W (?LSTR)	D.C. (loss)	243.21	243.28	0.07-	4pi	---	~33	
		Dirty coal	243.28	243.38	0.10	Core	JK-16.14	32.56	Petrographic bench
		Coal	243.38	243.58	0.19-	Core	JK-16.15	22.07	-do-
	?W (?LSTR)	Coal	245.15	245.65	0.50	Core	JK-16.16	15.70	Petrographic bench

Drill hole	Subzone	Description	From (m)	To (m)	Thickness (m)	Info source	Sample number	% ash	Remarks
JK-17	D1	Carb shale	173.75	173.90	0.15	Core	JK-17-1A-88	~75	Sample lost in mail
		Coal	173.90	174.30	0.40	Core	JK-17-1-88	~24	-do-
	D2	Coaly shale	185.52	185.82	0.30	Core/4pi	JK-17-2-88	~51	-do-
	D2	Dirty coal	186.08	186.42	0.34	Core	JK-17-3-88	~45	-do-
	USTR	Dirty coal	208.74	209.10	0.36	Core	JK-17-4-88	~40	-do-
	USTR	D.C. (loss)	217.85	217.95	0.10-	4pi		~30	depth adjusted
		Dirty coal	217.95	218.18	0.23-	Core/4pi	JK-17-5A-88	~30	Sample lost in mail
		Carb shale	218.18	218.41	0.23	Core	JK-17-5B-88	~65	-do-
	I	Coal	229.21	229.63	0.42	Core	JK-17-6A-88	~20	-do-
		Coal	229.63	230.05	0.42	Core	JK-17-6B-88	~20	-do-
	I	Carb shale	233.04	233.48	0.44	Core	JK-17-7-88	~55	-do-
	?S	Dirty coal	249.28	249.43	0.15-	Core	JK-17-8A-88	~30	Sample lost in mail
		Coal	249.43	249.63	0.20	Core	-do-	~15	-do-
		Coal	249.63	249.98	0.35	Core	JK-17-8B-88	~15	-do-
		Coal	249.98	250.20	0.22	Core	JK-17-8C-88	~20	-do-
		Dirty coal	250.20	250.30	0.10-	Core	-do-	~40	-do- NDE?
JK-18	SOH	Coal	50.05	50.38	0.33-	Core	JK-18.1	23.79	Petrographic bench
		Coal (loss)	50.38	50.43	0.05-	4pi	---		depth adjusted
	D1	Coal	166.19	166.79	0.60	Core	JK-18.2	22.42	Petrographic bench
		Coaly shale	166.79	166.94	0.15	Core/4pi	JK-18-2C-89	~55	4pi lith; no USGS anl
	D2	D.C. (loss)	178.48	178.73	0.25	4pi/GN	---	~26	depth adjusted
		Carb shale	178.73	179.23	0.50	Core	---		
		Dirty coal	179.23	179.38	0.15-	Core	JK-18.3	48.66	Petrographic bench
		Dirty coal	179.38	179.53	0.15-	Core	JK-18.4	30.26	-do-
	USTR	Dirty coal	205.94	206.42	0.48	Core	JK-18.5	28.62	-do-
		Coaly shale	206.42	206.58	0.16	Core	JK-18.6	55.14	-do-
	SU	Dirty coal	242.66	242.72	0.06-	Core	JK-18.7	33.60	-do-
		Dirty coal	242.72	242.91	0.19	Core	@+JK-18.8	30.73	-do-
		Sandy coal	242.91	242.99	0.08	Core	---		in qualifying thk
		Dirty coal	242.99	243.16	0.17	Core	@+JK-18.8	30.73	Petrographic bench
		Claystone	243.16	243.62	0.46	Core	---		-do-
		Coal	243.62	244.92	1.30-	Core	@JK-18.9	11.16	-do-
	SU	Dirty coal	247.45	247.80	0.35-	Core	JK-18.10	34.97	-do-
		Dirty coal	247.80	247.88	0.08-	Core/4pi	---	~49	
	SU	Coal	252.06	252.39	0.33-	Core	JK-18.11	21.39	-do-
		Carb shale	252.39	252.67	0.28	Core	---		
		Dirty coal	252.67	252.74	0.07	Core	JK-18.12	33.11	-do-
		Coal	252.74	252.97	0.23-	Core	JK-18.13	14.57	-do-
	SU	Dirty coal	254.80	254.95	0.15	Core	---		
	S	Coal	261.67	262.93	1.26-	Core	JK-18.14	6.45	-do-
		Coal	262.93	263.00	0.07	Core	JK-18.15	15.64	-do-
		Coal	263.00	263.39	0.39-	Core	JK-18-16	9.80	-do-
	S	D.C. (loss)	264.30	264.50	0.20	4pi	---	~40	
	S	D.C. (loss)	264.98	265.13	0.15	4pi	---	~35	depth adjusted
	S	Coal	265.85	266.08	0.23	Core/4pi	JK-18.17	24.60	-do-
		Coaly sh (loss)	266.08	266.64	0.56	4pi	---		-do-
		Coaly shale	266.64	267.02	0.38	Core/4pi	JK-18-11A-89	~55	no USGS analysis
	SSL	Dirty coal	275.57	275.83	0.26-	Core	JK-18.18	45.56	Petrographic split
		Coal	275.83	276.97	1.14-	Core	JK-18.19	12.28	-do-
		Coaly shale	276.97	277.31	0.34	Core	JK-18.20	51.63	-do-
		Coaly shale	277.31	277.47	0.16	Core	---		
	SSL	Dirty coal	279.27	279.42	0.15	Core/4pi	---	~35	4pi lithology
		Coaly shale	279.42	279.74	0.32	Core	---	~55	Dirty coal ?
		?Coaly sh (loss)	279.74	279.92	0.18	4pi	---	~65	cave? depth adjusted

Drill hole	Subzone	Description	From (m)	To (m)	Thickness (m)	Info source	Sample number	% ash	Remarks
JK-19	D2	D.C. (loss)	133.05	133.32	0.27-	4pi	---	~49	depth adjusted
		Dirty coal	133.32	133.40	0.08-	Core	---	~49	
	USTR	Coaly shale	165.65	165.85	0.20	Core	JK-19-19.1	71.82	
		Coaly shale	165.85	166.56	0.71	Core	JK-19-19.2	67.65	
		Dirty coal	166.56	166.70	0.14	Core	JK-19-19.3	32.95	
	I	Dirty coal	179.47	179.59	0.12-	Core/4pi	---	~40	depth adjusted
		D.C. (loss)	179.59	179.72	0.13-	4pi	---	~40	-do-
		Coaly shale (loss)	179.72	180.44	0.72	4pi	---	~65	-do-
		carb shale	180.44	180.97	0.53	Core	---	~75	
	S	Coal	194.38	194.60	0.22-	Core	@JK-19-19.4	18.34	Petrographic bench
		Coal	194.60	194.76	0.16	Core	@JK-19-19.5	16.76	-do-
		Coal	194.76	195.03	0.27-	Core	@JK-19-19.6	21.09	-do-
		Claystone	195.03	195.33	0.30	Core			
		Coaly shale	195.33	195.44	0.11	Core			
		Dirty coal	195.44	195.47	0.03	Core			
		Claystone	195.47	195.83	0.36	Core			
		Coal	195.83	196.03	0.20-	Core	@JK-19-19.7	10.10	Petrographic bench
		Coal	196.03	196.70	0.67	Core	@JK-19-19.8	7.75	-do-
		Coal	196.70	197.32	0.62	Core	@JK-19-19.9	5.12	-do-
		Coal	197.32	197.54	0.22	Core	@JK-19-19.10	15.10	-do-
		Coal	197.54	198.05	0.51	Core	@JK-19-19.11	6.08	-do-
		Coal	198.05	198.56	0.51	Core	@JK-19-19.12	6.62	-do-
		Coal	198.56	199.13	0.57-	Core	@JK-19-19.13	10.76	-do-
	S	Coal	202.35	202.60	0.25-	Core	JK-19-19.14	18.19	Petrographic bench
		Dirty coal	202.60	202.80	0.20-	Core	JK-19-19.15	26.02	-do-
	S	Dirty coal	204.03	204.28	0.25-	Core	JK-19-19.16	42.60	Petrographic bench
		Coal	204.28	204.66	0.38	Core	JK-19-19.17	11.52	-do-
		Dirty coal	204.66	204.81	0.15-	Core	JK-19-19.18	37.58	-do-
	S	Dirty coal	209.02	209.22	0.20-	Core	JK-19-19.19	32.71	Petrograhic bench
		Coal	209.22	209.32	0.10	Core	JK-19-19.20	18.21	-do-
		Coal	209.32	209.45	0.13	Core	JK-19-19.21	15.18	-do-
		Coal	209.45	209.57	0.12	Core	JK-19-19.22	12.38	-do-
		Dirty coal	209.57	209.62	0.05	Core	JK-19-19.23	29.38	-do-
	SSL	Coaly shale	210.26	210.36	0.10	Core	JK-19-19.24	54.63	Petrographic bench
		Dirty coal	210.36	210.81	0.45-	Core	JK-19-19.25	31.79	-do-
		Coal	210.81	212.08	1.27	Core	JK-19-19.26	7.00	-do-
		Coal	212.08	212.27	0.19-	Core	JK-19-19.27	8.52	-do-
	SSL	Dirty coal	215.17	215.24	0.07-	Core	---	~45	
		D.C. (loss)	215.24	215.41	0.17-	4pi	---	~45	
	SL	Coaly shale	224.10	224.25	0.15	Core/4pi	---	~60	4pi description
JK-20	D1	Dirty coal	122.45	122.50	0.05-	Core	---		
		Coal	122.50	122.95	0.45-	Core	@JK-20-1	16.65	
	S	Dirty coal	199.45	199.80	0.35-	Core	@JK-20-2AP	49.77	Combined sample A+P
		Coal	199.80	201.05	1.25	Core	@+JK-20-2BC	<11.93	Combined sample B+C
		Dirty coal	201.05	201.25	0.20	Core/4pi	@+JK-20-2BC	>11.93	-do-
		Coal	201.25	202.40	1.15-	Core	@+JK-20-2BC	<11.93	-do-
	S	Coal	204.32	204.82	0.50	Core	@JK-20-3	12.35	

Appendix 2.

Results of standard coal analysis
by Dickenson Laboratories (El Paso TX),
a contractor to the U. S. Geological Survey,
for 139 samples from the JK- series boreholes,
drilled by the Geological Survey of Pakistan in
the Jherruck area of the Sonda coal field.

COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

1495

DATE 12-15-88 LAB NO 880809 - 001

DRILL HOLE JK-1-1-88 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS. U)— 246449

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	34.03	35.63		
% Ash	7.46	7.28	11.30	
% Volatile	32.15	31.37	48.73	54.94
% Fixed Carbon	26.36	25.72	39.97	45.06
Btu	7806	7617	11833	13342
% Sulfur	3.13	3.06	4.75	5.35

lbs SUL/MM BTU = 4.02

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	43.46	42.40	65.88
Hydrogen	7.16	7.26	5.09
Nitrogen	0.89	0.87	1.34
Chlorine	0.08	0.08	0.13
Sulfur	3.13	3.06	4.75
Ash	7.46	7.28	11.30
Oxygen (diff)	37.82	39.05	11.51

SULFUR FORMS				
% Pyritic Sulfur	1.83	1.79	2.77	3.13
% Sulfate Sulfur	0.08	0.07	0.12	0.13
% Organic Sulfur	1.22	1.20	1.86	2.09
% Total Sulfur	3.13	3.06	4.75	5.35

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1930 °F	°F
Softening (H = W)	1990 °F	°F
Hemispherical (H = ½ W)	2000 °F	°F
Fluid	2080 °F	°F

H is Cone Height
W is Cone Width

AIR DRYING LOSS = 32.37
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

Terry Rollins
DICKINSON LABORATORIES, INC.

DICKINSON LABORATORIES, INC.
COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-0496

COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

JA95

DATE 12-15-88 LAB NO 880809 - 002

DRILL HOLE JK-1-2-88 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS. W- 246450

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	23.60	25.28		
% Ash	40.57	39.68	53.10	
% Volatile	20.31	19.87	26.59	56.69
% Fixed Carbon	15.52	15.17	20.31	43.31
Btu	3766	3683	4930	10511
% Sulfur	9.99	9.77	13.07	27.87

lbs SUL/MM BTU = 26.53

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	19.76	19.33	25.87
Hydrogen	4.48	4.63	2.41
Nitrogen	0.38	0.37	0.49
Chlorine	0.05	0.05	0.06
Sulfur	9.99	9.77	13.07
Ash	40.57	39.68	53.10
Oxygen (diff)	24.77	26.17	5.00

SULFUR FORMS				
% Pyritic Sulfur	9.38	9.18	12.28	26.18
% Sulfate Sulfur	0.11	0.11	0.14	0.31
% Organic Sulfur	0.50	0.48	0.65	1.38
% Total Sulfur	9.99	9.77	13.07	27.87

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

MINERAL ANALYSIS	% Wt Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2080 °F	°F
H is Cone Height / W is Cone Width — Softening (H = W)	2320 °F	°F
Hemispherical (H = ½ W)	2490 °F	°F
Fluid	2510 °F	°F

AIR DRYING LOSS = 23.15
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

Terry Rollins
DICKINSON LABORATORIES, INC.

28

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P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-0496

COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DH-25

DATE 12-15-88 LAB NO 880809 - 003

DRILL HOLE JK-1-3-88 SEAM: PROJECT.

PROPERTY W-246451 DEPTH: THICKNESS:

REMARKS

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	27.79	29.52		
% Ash	18.70	18.25	25.90	
% Volatile	29.20	28.50	40.43	54.56
% Fixed Carbon	24.31	23.73	33.67	45.44
Btu	6969	6802	9652	13025
% Sulfur	4.98	4.86	6.90	9.31

lbs SUL/MM BTU = 7.14

SULFUR FORMS				
% Pyritic Sulfur	4.39	4.28	6.07	8.19
% Sulfate Sulfur	0.05	0.05	0.07	0.10
% Organic Sulfur	0.54	0.53	0.76	1.02
% Total Sulfur	4.98	4.86	6.90	9.31

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	38.01	37.10	52.64
Hydrogen	6.27	6.39	4.38
Nitrogen	0.93	0.91	1.29
Chlorine	0.03	0.03	0.04
Sulfur	4.98	4.86	6.90
Ash	18.70	18.25	25.90
Oxygen (diff)	31.08	32.46	8.85

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2050 °F	°F
Softening (H = W)	2090 °F	°F
Hemispherical (H = ½ W)	2220 °F	°F
Fluid	2450 °F	°F

H is Cone Height
W is Cone Width

AIR DRYING LOSS = 26.46
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

Terry Rollins
DICKINSON LABORATORIES, INC.

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P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-0496

COAL-ANALYSIS REPORT

CF 95

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE 12-15-88 LAB NO 880809 - 004

DRILL HOLE JK-1-4-88 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

WI-416452

REMARKS.

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	30.83	32.34		
% Ash	11.32	11.07	16.37	
% Volatile	30.61	29.94	44.25	52.91
% Fixed Carbon	27.24	26.65	39.38	47.09
Btu	7605	7439	10995	13147
% Sulfur	3.95	3.87	5.71	6.83

lbs SUL/MM BTU = 5.20

SULFUR FORMS				
% Pyritic Sulfur	3.28	3.21	4.74	5.67
% Sulfate Sulfur	0.04	0.04	0.06	0.08
% Organic Sulfur	0.63	0.62	0.91	1.08
% Total Sulfur	3.95	3.87	5.71	6.83

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1950 °F	°F
H is Cone Height / W is Cone Width — Softening (H = W)	1980 °F	°F
Hemispherical (H = ½ W)	1990 °F	°F
Fluid	2170 °F	°F

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	42.25	41.33	61.09
Hydrogen	6.65	6.75	4.63
Nitrogen	0.73	0.72	1.06
Chlorine	0.04	0.04	0.06
Sulfur	3.95	3.87	5.71
Ash	11.32	11.07	16.37
Oxygen (diff)	35.06	36.22	11.08

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos. pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

AIR DRYING LOSS = 29.06
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

Terry Rollins
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COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-0496

COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE 12-15-88 LAB NO 880809 - 005

DRILL HOLE JK-1-6-88 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS. 1-2416453

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	30.49	32.74		
% Ash	13.04	12.62	18.76	
% Volatile	31.23	30.22	44.93	55.31
% Fixed Carbon	25.24	24.42	36.31	44.69
Btu	7363	7125	10593	13039
% Sulfur	2.06	1.99	2.96	3.65

lbs SUL/MM BTU = 2.79

SULFUR FORMS				
% Pyritic Sulfur	1.18	1.15	1.70	2.10
% Sulfate Sulfur	0.04	0.04	0.06	0.08
% Organic Sulfur	0.84	0.80	1.20	1.47
% Total Sulfur	2.06	1.99	2.96	3.65

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	41.56	40.22	59.80
Hydrogen	6.59	6.74	4.58
Nitrogen	0.88	0.86	1.27
Chlorine	0.03	0.03	0.04
Sulfur	2.06	1.99	2.96
Ash	13.04	12.62	18.76
Oxygen (diff)	35.84	37.54	12.59

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2090 °F	°F
Softening (H = W)	2230 °F	°F
Hemispherical (H = ½ W)	2240 °F	°F
Fluid	2510 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 29.30
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

Terry Rollins
DICKINSON LABORATORIES, INC.

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COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-0466

COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DH-35

DATE 12-15-88 LAB NO 880809 - 006

DRILL HOLE JK-1-7-88 SEAM: PROJECT:

PROPERTY W-246454 DEPTH: THICKNESS:

REMARKS:

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	29.03	32.00		
% Ash	13.99	13.40	19.71	
% Volatile	30.18	28.92	42.53	52.96
% Fixed Carbon	26.80	25.68	37.76	47.04
Btu	7498	7184	10565	13158
% Sulfur	5.83	5.58	8.21	10.23

lbs SUL/MM BTU = 7.77

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	41.07	39.35	57.87
Hydrogen	6.59	6.79	4.71
Nitrogen	0.82	0.79	1.16
Chlorine	0.02	0.02	0.03
Sulfur	5.83	5.58	8.21
Ash	13.99	13.40	19.71
Oxygen (diff)	31.68	34.07	8.31

SULFUR FORMS				
% Pyritic Sulfur	4.69	4.50	6.61	8.23
% Sulfate Sulfur	0.07	0.07	0.10	0.13
% Organic Sulfur	1.07	1.01	1.50	1.87
% Total Sulfur	5.83	5.58	8.21	10.23

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2000 °F	°F
Softening (H = W)	2020 °F	°F
Hemispherical (H = ½ W)	2070 °F	°F
Fluid	2220 °F	°F

H is Cone Height
W is Cone Width

AIR DRYING LOSS = 28.86
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

Jerry Rollins
DICKINSON LABORATORIES, INC.

DICKINSON LABORATORIES, INC.
COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-9496

COAL-ANALYSIS REPORT

CH 75

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE 12-15-88 LAB NO 880809 - 007

DRILL HOLE JK-2-1-88 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS: JJ - 246455

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	32.97	33.01		
% Ash	24.44	24.42	36.46	
% Volatile	23.31	23.30	34.78	54.74
% Fixed Carbon	19.28	19.27	28.76	45.26
Btu	4990	4987	7444	11715
% Sulfur	5.86	5.86	8.74	13.76

lbs SUL/MM BTU = 11.75

SULFUR FORMS				
% Pyritic Sulfur	3.97	3.97	5.92	9.32
% Sulfate Sulfur	0.32	0.32	0.47	0.74
% Organic Sulfur	1.57	1.57	2.35	3.70
% Total Sulfur	5.86	5.86	8.74	13.76

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	27.70	27.68	41.33
Hydrogen	5.84	5.85	3.21
Nitrogen	0.77	0.77	1.14
Chlorine	0.11	0.11	0.16
Sulfur	5.86	5.86	8.74
Ash	24.44	24.42	36.46
Oxygen (diff)	35.28	35.31	8.96

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2060 °F	°F
H is Cone Height / W is Cone Width — Softening (H = W)	2340 °F	°F
Hemispherical (H = ½ W)	2480 °F	°F
Fluid	2530 °F	°F

AIR DRYING LOSS = 26.41
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

Jerry Rollins
DICKINSON LABORATORIES, INC.

DICKINSON LABORATORIES, INC.
COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-0466

COAL-ANALYSIS REPORT

CA 95

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE 12-15-88 LAB. NO: 880809 - 008

DRILL HOLE: JK-2-2-88 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS: W-246456

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	32.87	34.40		
% Ash	9.51	9.30	14.17	
% Volatile	29.98	29.29	44.65	52.03
% Fixed Carbon	27.64	27.01	41.18	47.97
Btu	7560	7388	11262	13122
% Sulfur	1.78	1.73	2.64	3.08

lbs SUL/MM BTU = 2.34

SULFUR FORMS				
% Pyritic Sulfur	0.99	0.97	1.47	1.72
% Sulfate Sulfur	0.08	0.08	0.12	0.14
% Organic Sulfur	0.71	0.68	1.05	1.22
% Total Sulfur	1.78	1.73	2.64	3.08

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1980 °F	°F
Softening (H = W)	2080 °F	°F
Hemispherical (H = ½ W)	2160 °F	°F
Fluid	2340 °F	°F

H is Cone Height / W is Cone Width

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	43.36	42.37	64.59
Hydrogen	6.67	6.78	4.46
Nitrogen	0.53	0.52	0.79
Chlorine	0.03	0.03	0.05
Sulfur	1.78	1.73	2.64
Ash	9.51	9.30	14.17
Oxygen (diff)	38.12	39.27	13.30

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

AIR DRYING LOSS = 23.91
HARDGROVE GRINDABILITY INDEX = 72 @ 13.78 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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Terry Rollins
DICKINSON LABORATORIES, INC.

COAL-ANALYSIS REPORT

Ch. 75

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE 12-15-88 LAB. NO 880809 - 009

DRILL HOLE JK-2-3-88 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS: W-246457

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	31.89	31.65		
% Ash	10.79	10.83	15.84	
% Volatile	30.57	30.68	44.89	53.34
% Fixed Carbon	26.75	26.84	39.27	46.66
Btu	7626	7653	11197	13304
% Sulfur	2.87	2.88	4.21	5.00

lbs SUL/MM BTU = 3.76

SULFUR FORMS				
% Pyritic Sulfur	1.93	1.94	2.83	3.36
% Sulfate Sulfur	0.12	0.12	0.18	0.21
% Organic Sulfur	0.82	0.82	1.20	1.43
% Total Sulfur	2.87	2.88	4.21	5.00

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1980 °F	°F
Softening (H = W)	2000 °F	°F
Hemispherical (H = ½ W)	2100 °F	°F
Fluid	2220 °F	°F

H is Cone Height / W is Cone Width

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	43.47	43.62	63.82
Hydrogen	6.56	6.55	4.40
Nitrogen	0.88	0.88	1.29
Chlorine	0.04	0.04	0.06
Sulfur	2.87	2.88	4.21
Ash	10.79	10.83	15.84
Oxygen (diff)	35.39	35.20	10.38

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

AIR DRYING LOSS = 22.89
HARDGROVE GRINDABILITY INDEX = 67 @ 11.36 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

CA95

DATE 12-15-88 LAB NO 880809 - 010

DRILL HOLE JK-2-4-88 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS. W-246458

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	25.02	24.44		
% Ash	41.19	41.51	54.93	
% Volatile	21.62	21.79	28.84	63.99
% Fixed Carbon	12.17	12.26	16.23	36.01
Btu	3685	3713	4915	10905
% Sulfur	2.20	2.21	2.93	6.50

lbs SUL/MM BTU = 5.95

SULFUR FORMS				
% Pyritic Sulfur	1.58	1.60	2.11	4.69
% Sulfate Sulfur	0.09	0.09	0.11	0.25
% Organic Sulfur	0.53	0.52	0.71	1.56
% Total Sulfur	2.20	2.21	2.93	6.50

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	21.35	21.52	28.48
Hydrogen	4.97	4.92	2.89
Nitrogen	0.87	0.88	1.16
Chlorine	0.03	0.03	0.04
Sulfur	2.20	2.21	2.93
Ash	41.19	41.51	54.93
Oxygen (diff)	29.39	28.93	9.57

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos. pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	>2700 °F	°F
Softening (H = W)	>2700 °F	°F
Hemispherical (H = ½ W)	>2700 °F	°F
Fluid	>2700 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 21.79
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

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COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

3M 25

DATE 11-7-88 LAB NO 880618 - 003

DRILL HOLE JK-3-1-B SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS. W - 2H6461

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	29.61	30.28		
% Ash	25.42	25.18	36.12	
% Volatile	24.77	24.53	35.19	55.08
% Fixed Carbon	20.20	20.01	28.69	44.92
Btu	5159	5110	7329	11473
% Sulfur	5.92	5.86	8.41	13.16

lbs SUL/MM BTU = 11.47

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	28.69	28.42	40.76
Hydrogen	5.39	5.45	2.95
Nitrogen	0.61	0.61	0.87
Chlorine	0.08	0.07	0.11
Sulfur	5.92	5.86	8.41
Ash	25.42	25.18	36.12
Oxygen (diff)	33.89	34.41	10.78

SULFUR FORMS

% Pyritic Sulfur	4.22	4.18	6.00	9.39
% Sulfate Sulfur	0.54	0.53	0.76	1.19
% Organic Sulfur	1.16	1.15	1.65	2.58
% Total Sulfur	5.92	5.86	8.41	13.16

WATER SOLUBLE ALKALIES

% Na_2O =

% K_2O =

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos. pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2000 °F	°F
Softening (H = W)	2280 °F	°F
Hemispherical (H = ½ W)	2430 °F	°F
Fluid	2470 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 16.98

HARDGROVE GRINDABILITY INDEX = *

FREE SWELLING INDEX = 0.0

WATER SOLUBLE CHLORINE =

APPARENT SPECIFIC GRAVITY = 1.46

* Insufficient Sample

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COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE 11-7-88 LAB NO 880618 - 001

DRILL HOLE JK-3-1 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS: W - 24659

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	31.38	32.51		
% Ash	17.26	16.98	25.16	
% Volatile	34.54	33.97	50.34	67.26
% Fixed Carbon	16.82	16.54	24.50	32.74
Btu	6601	6492	9620	12853
% Sulfur	1.48	1.46	2.16	2.88

lbs SUL/MM BTU = 2.25

SULFUR FORMS				
% Pyritic Sulfur	0.97	0.95	1.41	1.88
% Sulfate Sulfur	0.08	0.07	0.11	0.15
% Organic Sulfur	0.43	0.44	0.64	0.85
% Total Sulfur	1.48	1.46	2.16	2.88

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	37.34	36.73	54.42
Hydrogen	6.42	6.50	4.24
Nitrogen	0.77	0.76	1.13
Chlorine	0.04	0.04	0.06
Sulfur	1.48	1.46	2.16
Ash	17.26	16.98	25.16
Oxygen (diff)	36.69	37.53	12.83

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2180 °F	°F
Softening (H = W)	2380 °F	°F
Hemispherical (H = ½ W)	2510 °F	°F
Fluid	2560 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 17.22
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY = 1.32
* Insufficient Sample

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COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

CA95

DATE 11-7-88 LAB NO 880618 - 002

DRILL HOLE JK-3-1-A SEAM: PROJECT.

PROPERTY DEPTH: THICKNESS:

REMARKS. W - 246460

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	22.05	21.84		
% Ash	44.62	44.74	57.24	
% Volatile	18.40	18.45	23.60	55.19
% Fixed Carbon	14.93	14.97	19.16	44.81
Btu	2571	2979	3811	8913
% Sulfur	10.81	10.84	13.87	32.43

lbs SUL/MM BTU = 36.39

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	15.65	15.69	20.07
Hydrogen	3.96	3.95	1.92
Nitrogen	0.28	0.28	0.36
Chlorine	0.04	0.04	0.05
Sulfur	10.81	10.84	13.87
Ash	44.62	44.74	57.24
Oxygen (diff)	24.64	24.46	6.49

SULFUR FORMS

% Pyritic Sulfur	9.98	10.00	12.80	29.93
% Sulfate Sulfur	0.71	0.71	0.91	2.13
% Organic Sulfur	0.12	0.13	0.16	0.37
% Total Sulfur	10.81	10.84	13.87	32.43

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2020 °F	°F
H is Cone Height / W is Cone Width — Softening (H = W)	2470 °F	°F
Hemispherical (H = ½ W)	2510 °F	°F
Fluid	2570 °F	°F

AIR DRYING LOSS = 9.89
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY = 1.78

* Insufficient Sample

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COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

UA #5

DATE 6-21-88 LAB NO 880303 - 001

DRILL HOLE JK-3-2 SEAM: PROJECT.

PROPERTY DEPTH: THICKNESS:

REMARKS. W-246462

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	18.40	20.27		
% Ash	55.72	54.44	68.29	
% Volatile	17.34	16.94	21.25	67.00
% Fixed Carbon	8.54	8.35	10.46	33.00
Btu	2573	2514	3153	9942
% Sulfur	0.72	0.71	0.89	2.80

lbs SUL/MM BTU = 2.82

SULFUR FORMS				
% Pyritic Sulfur	0.48	0.47	0.59	1.87
% Sulfate Sulfur	0.03	0.03	0.04	0.13
% Organic Sulfur	0.21	0.21	0.26	0.80
% Total Sulfur	0.72	0.71	0.89	2.80

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture	16.26	15.88	19.92
Carbon	3.82	3.99	2.16
Hydrogen	0.38	0.37	0.47
Nitrogen	0.03	0.03	0.04
Chlorine	0.72	0.71	0.89
Sulfur	55.72	54.44	68.29
Ash	23.07	24.58	8.23
Oxygen (diff)			

MINERAL ANALYSIS	% Wt Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2550 °F	°F
Softening (H = W)	2690 °F	°F
Hemispherical (H = ½ W)	>2700 °F	°F
Fluid	>2700 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 18.59
HARDGROVE GRINDABILITY INDEX = 58 @ 2.06 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-0466

COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DT 75

DATE 6-21-88 LAB NO 880303 - 002

DRILL HOLE JK-3-3 SEAM: PROJECT.

PROPERTY DEPTH: THICKNESS:

REMARKS: US - 2H6463

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	30.27	33.59		
% Ash	6.79	6.46	9.73	
% Volatile	6.70	6.38	9.61	10.65
% Fixed Carbon	56.24	53.57	80.66	89.35
Btu	8339	7942	11959	13249
% Sulfur	0.39	0.37	0.56	0.62

lbs SUL/MM BTU = 0.47

SULFUR FORMS				
% Pyritic Sulfur	0.09	0.08	0.12	0.14
% Sulfate Sulfur	0.02	0.02	0.03	0.04
% Organic Sulfur	0.28	0.27	0.41	0.44
% Total Sulfur	0.39	0.37	0.56	0.62

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	48.12	45.83	69.00
Hydrogen	6.74	6.96	4.81
Nitrogen	0.97	0.93	1.40
Chlorine	0.05	0.05	0.07
Sulfur	0.39	0.37	0.56
Ash	6.79	6.46	9.73
Oxygen (diff)	36.94	39.40	14.43

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2010 °F	°F
Softening (H = W)	2020 °F	°F
Hemispherical (H = ½ W)	2040 °F	°F
Fluid	2110 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 24.65
HARDGROVE GRINDABILITY INDEX = 60 @ 11.86 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-9486

COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

1475

DATE 6-21-88 LAB NO 880303 - 003

DRILL HOLE JK-3-4 SEAM: PROJECT.

PROPERTY DEPTH: THICKNESS:

REMARKS. V - 244644

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	30.04	28.81		
% Ash	12.95	13.18	18.51	
% Volatile	30.54	31.08	43.66	53.57
% Fixed Carbon	26.47	26.93	37.83	46.43
Btu	7500	7632	10721	13157
% Sulfur	1.87	1.90	2.67	3.28

lbs SUL/MM BTU = 2.49

SULFUR FORMS				
% Pyritic Sulfur	1.48	1.51	2.12	2.60
% Sulfate Sulfur	0.03	0.03	0.04	0.05
% Organic Sulfur	0.36	0.36	0.51	0.63
% Total Sulfur	1.87	1.90	2.67	3.28

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	42.35	43.09	60.53
Hydrogen	6.61	6.53	4.64
Nitrogen	0.85	0.87	1.22
Chlorine	0.03	0.03	0.04
Sulfur	1.87	1.90	2.67
Ash	12.95	13.18	18.51
Oxygen (diff)	35.34	34.40	12.39

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2180 °F	°F
Softening (H = W)	2290 °F	°F
Hemispherical (H = ½ W)	2310 °F	°F
Fluid	2500 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 22.34
HARDGROVE GRINDABILITY INDEX = 55 @ 8.33 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

Jerry Rollins
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DICKINSON LABORATORIES, INC.
COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-0466

COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE 6-21-88 LAB NO 880303 - 004

DRILL HOLE JK-3-6 SEAM PROJECT

PROPERTY DEPTH THICKNESS

REMARKS

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	25.60	26.35		
% Ash	29.76	29.46	40.00	
% Volatile	25.15	24.90	33.80	56.34
% Fixed Carbon	19.49	19.29	26.20	43.66
Btu	5287	5233	7106	11844
% Sulfur	4.01	3.97	5.39	8.98

lbs SUL/MM BTU = 7.59

ULTIMATE ANALYSIS	E.M basis	As received	Dry basis
Moisture			
Carbon	29.33	29.03	39.42
Hydrogen	5.56	5.61	3.62
Nitrogen	0.59	0.58	0.79
Chlorine	0.04	0.04	0.05
Sulfur	4.01	3.97	5.39
Ash	29.76	29.46	40.00
Oxygen (diff)	30.71	31.31	10.73

SULFUR FORMS

% Pyritic Sulfur	3.10	3.07	4.17	6.95
% Sulfate Sulfur	0.20	0.20	0.27	0.45
% Organic Sulfur	0.71	0.70	0.95	1.58
% Total Sulfur	4.01	3.97	5.39	8.98

WATER SOLUBLE ALKALIES

% Na_2O =

% K_2O =

MINERAL ANALYSIS	% Wt Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania TiO_2	
Lime, CaO	
Magnesia MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2400 °F	°F
H is Cone Height / W is Cone Width — Softening (H = W)	2620 °F	°F
Hemispherical (H = ½ W)	2640 °F	°F
Fluid	>2700 °F	°F

AIR DRYING LOSS = 24.14

HARDGROVE GRINDABILITY INDEX = Insufficient Sample

FREE SWELLING INDEX = 0.0

WATER SOLUBLE CHLORINE =

APPARENT SPECIFIC GRAVITY =

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COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE 6-21-88 LAB NO 880303 - 005

DRILL HOLE JK-4-1 SEAM PROJECT

PROPERTY DEPTH THICKNESS

REMARKS

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	33.69	34.96		
% Ash	21.34	20.93	32.18	
% Volatile	24.47	24.00	36.90	54.41
% Fixed Carbon	20.50	20.11	30.92	45.59
Btu	5517	5411	8319	12267
% Sulfur	5.08	4.99	7.67	11.30

lbs SUL/MM BTU = 9.22

SULFUR FORMS				
% Pyritic Sulfur	3.91	3.83	5.89	8.69
% Sulfate Sulfur	0.12	0.11	0.18	0.26
% Organic Sulfur	1.05	1.05	1.60	2.35
% Total Sulfur	5.08	4.99	7.67	11.30

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M basis	As received	Dry basis
Moisture			
Carbon	30.06	29.48	45.33
Hydrogen	6.31	6.40	3.82
Nitrogen	0.65	0.63	0.98
Chlorine	0.06	0.06	0.09
Sulfur	5.08	4.99	7.67
Ash	21.34	20.93	32.18
Oxygen (diff)	36.50	37.51	9.93

MINERAL ANALYSIS	% Wt Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina Al_2O_3	
Titania TiO_2	
Lime, CaO	
Magnesia MgO	
Sulfur trioxide, SO_3	
Potassium oxide K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH		Reducing	Oxidizing
	Initial Deformation	2030 °F	°F
H is Cone Height / W is Cone Width	Softening (H = W)	2150 °F	°F
	Hemispherical (H = ½ W)	2160 °F	°F
	Fluid	2490 °F	°F

AIR DRYING LOSS = 32.52
HARDGROVE GRINDABILITY INDEX = Insufficient Sample
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

:A75

DATE 6-21-88 LAB NO 880303 - 006

DRILL HOLE JK-4-2 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS. W - 24645

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	32.85	35.50		
% Ash	9.46	9.09	14.09	
% Volatile	29.39	28.23	43.76	50.94
% Fixed Carbon	28.30	27.18	42.15	49.06
Btu	7668	7365	11419	13293
% Sulfur	0.83	0.80	1.24	1.45

lbs SUL/MM BTU = 1.09

SULFUR FORMS				
% Pyritic Sulfur	0.58	0.56	0.86	1.01
% Sulfate Sulfur	0.04	0.04	0.06	0.08
% Organic Sulfur	0.21	0.20	0.32	0.36
% Total Sulfur	0.83	0.80	1.24	1.45

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	43.07	41.37	64.14
Hydrogen	6.87	7.04	4.76
Nitrogen	0.91	0.87	1.35
Chlorine	0.04	0.03	0.05
Sulfur	0.83	0.80	1.24
Ash	9.46	9.09	14.09
Oxygen (diff)	38.82	40.80	14.37

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1970 °F	°F
Softening (H = W)	2120 °F	°F
Hemispherical (H = ½ W)	2160 °F	°F
Fluid	2240 °F	°F

H is Cone Height
W is Cone Width

AIR DRYING LOSS = 30.29
HARDGROVE GRINDABILITY INDEX = 57 @ 7.48 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

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DATE 6-21-88 LAB NO 880303 - 007

DRILL HOLE JK-4-3 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS. W-246466

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	32.51	35.17		
% Ash	5.08	4.88	7.53	
% Volatile	30.60	29.39	45.34	49.03
% Fixed Carbon	31.81	30.56	47.13	50.97
Btu	8257	7932	12235	13232
% Sulfur	1.03	0.99	1.53	1.65

lbs SUL/MM BTU = 1.25

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	47.55	45.68	70.46
Hydrogen	6.88	7.05	4.81
Nitrogen	0.97	0.93	1.44
Chlorine	0.05	0.05	0.08
Sulfur	1.03	0.99	1.53
Ash	5.08	4.88	7.53
Oxygen (diff)	38.44	40.42	14.15

SULFUR FORMS				
% Pyritic Sulfur	0.59	0.57	0.87	0.95
% Sulfate Sulfur	0.03	0.03	0.04	0.05
% Organic Sulfur	0.41	0.39	0.62	0.65
% Total Sulfur	1.03	0.99	1.53	1.65

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos. pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1900 °F	°F
Softening (H = W)	2060 °F	°F
Hemispherical (H = ½ W)	2070 °F	°F
Fluid	2090 °F	°F

H is Cone Height
W is Cone Width

AIR DRYING LOSS = 28.28
HARDGROVE GRINDABILITY INDEX = 64 @ 9.61 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL-ANALYSIS REPORT

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DATE 6-21-88 LAB NO 880303 - 008

DRILL HOLE JK-4-4 SEAM PROJECT

PROPERTY DEPTH THICKNESS

REMARKS

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	29.24	31.82		
% Ash	17.22	16.59	24.33	
% Volatile	28.15	27.12	39.78	52.57
% Fixed Carbon	25.39	24.47	35.89	47.43
Btu	6866	6616	9704	12824
% Sulfur	7.45	7.18	10.53	13.92

lbs SUL/MM BTU = 10.85

ULTIMATE ANALYSIS	E.M basis	As received	Dry basis
Moisture			
Carbon	36.69	35.35	51.85
Hydrogen	6.15	6.33	4.06
Nitrogen	0.74	0.71	1.04
Chlorine	0.03	0.03	0.04
Sulfur	7.45	7.18	10.53
Ash	17.22	16.59	24.33
Oxygen (diff)	31.72	33.81	8.15

SULFUR FORMS				
% Pyritic Sulfur	6.57	6.33	9.28	12.27
% Sulfate Sulfur	0.07	0.07	0.10	0.14
% Organic Sulfur	0.81	0.78	1.15	1.51
% Total Sulfur	7.45	7.18	10.53	13.92

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

MINERAL ANALYSIS	% Wt Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina Al_2O_3	
Titania TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1970 °F	°F
H is Cone Height / W is Cone Width — Softening (H = W)	1990 °F	°F
Hemispherical (H = ½ W)	2020 °F	°F
Fluid	2210 °F	°F

AIR DRYING LOSS = 29.59
HARDGROVE GRINDABILITY INDEX = 78 @ 3.17 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
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DATE 6-21-88 LAB NO 880303 - 009

DRILL HOLE JK-5-1 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS. W-246467

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	23.69	25.98		
% Ash	36.56	35.46	47.91	
% Volatile	22.13	21.46	28.99	55.66
% Fixed Carbon	17.62	17.10	23.10	44.34
Btu	4506	4371	5905	11334
% Sulfur	7.83	7.60	10.27	19.71

lbs SUL/MM BTU = 17.39

SULFUR FORMS				
% Pyritic Sulfur	6.97	6.76	9.14	17.54
% Sulfate Sulfur	0.13	0.13	0.17	0.34
% Organic Sulfur	0.73	0.71	0.96	1.83
% Total Sulfur	7.83	7.60	10.27	19.71

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	24.38	23.65	31.95
Hydrogen	4.87	5.06	2.90
Nitrogen	0.55	0.53	0.72
Chlorine	0.10	0.10	0.13
Sulfur	7.83	7.60	10.27
Ash	36.56	35.46	47.91
Oxygen (diff)	25.71	27.60	6.12

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos. pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1960 °F	°F
Softening (H = W)	2210 °F	°F
Hemispherical (H = ½ W)	2300 °F	°F
Fluid	2350 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 24.00
HARDGROVE GRINDABILITY INDEX = 112 @ 2.60 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL-ANALYSIS REPORT

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DATE 6-21-88 LAB NO 880303 - 010

DRILL HOLE JK-5-2 SEAM: PROJECT.

PROPERTY DEPTH: THICKNESS:

REMARKS. W- 24646 8

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	22.38	24.68		
% Ash	45.10	43.76	58.10	
% Volatile	18.63	18.08	24.00	57.29
% Fixed Carbon	13.89	13.48	17.90	42.71
Btu	3357	3257	4325	10322
% Sulfur	7.37	7.16	9.50	22.68

lbs SUL/MM BTU = 21.98

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	18.49	17.94	23.82
Hydrogen	4.27	4.47	2.27
Nitrogen	0.38	0.37	0.49
Chlorine	0.11	0.11	0.14
Sulfur	7.37	7.16	9.50
Ash	45.10	43.76	58.10
Oxygen (diff)	24.28	26.19	5.68

SULFUR FORMS

% Pyritic Sulfur	6.20	6.02	7.99	19.06
% Sulfate Sulfur	0.14	0.14	0.18	0.44
% Organic Sulfur	1.03	1.00	1.33	3.18
% Total Sulfur	7.37	7.16	9.50	22.68

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos. pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2070 °F	°F
Softening (H = W)	2400 °F	°F
Hemispherical (H = ½ W)	2490 °F	°F
Fluid	2560 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 22.98
HARDGROVE GRINDABILITY INDEX = 116 @ 2.21 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
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DATE 6-21-88 LAB NO 880303 - 011

DRILL HOLE JK-5-3 SEAM: PROJECT.

PROPERTY DEPTH: THICKNESS:

REMARKS. W-246469

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	31.88	31.83		
% Ash	8.78	8.79	12.89	
% Volatile	30.57	30.60	44.88	51.52
% Fixed Carbon	28.77	28.78	42.23	48.48
Btu	7858	7864	11536	13243
% Sulfur	2.87	2.87	4.21	4.83

lbs SUL/MM BTU = 3.65

SULFUR FORMS				
% Pyritic Sulfur	2.45	2.45	3.59	4.12
% Sulfate Sulfur	0.06	0.06	0.09	0.10
% Organic Sulfur	0.36	0.36	0.53	0.61
% Total Sulfur	2.87	2.87	4.21	4.83

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	43.69	43.72	64.14
Hydrogen	6.82	6.81	4.77
Nitrogen	0.95	0.95	1.39
Chlorine	0.03	0.03	0.04
Sulfur	2.87	2.87	4.21
Ash	8.78	8.79	12.89
Oxygen (diff)	36.86	36.83	12.56

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1870 °F	°F
Softening (H = W)	1890 °F	°F
Hemispherical (H = ½ W)	1910 °F	°F
Fluid	2020 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 26.47
HARDGROVE GRINDABILITY INDEX = 56 @ 7.29 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

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DATE 6-21-88 LAB NO 880303 - 012

DRILL HOLE JK-5-4 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS. W - 216470

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	24.82	24.59		
% Ash	29.18	29.27	38.82	
% Volatile	25.56	25.64	34.00	55.58
% Fixed Carbon	20.44	20.50	27.18	44.42
Btu	5469	5486	7275	11890
% Sulfur	5.87	5.89	7.81	12.77

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	30.00	30.09	39.90
Hydrogen	5.32	5.31	3.39
Nitrogen	0.61	0.61	0.81
Chlorine	0.02	0.02	0.03
Sulfur	5.87	5.89	7.81
Ash	29.18	29.27	38.82
Oxygen (diff)	29.00	28.81	9.24

lbs SUL/MM BTU = 10.74

SULFUR FORMS				
% Pyritic Sulfur	5.12	5.14	6.81	11.14
% Sulfate Sulfur	0.23	0.23	0.31	0.50
% Organic Sulfur	0.52	0.52	0.69	1.13
% Total Sulfur	5.87	5.89	7.81	12.77

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2120 °F	°F
Softening (H = W)	2300 °F	°F
Hemispherical (H = ½ W)	2430 °F	°F
Fluid	2510 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 20.59
HARDGROVE GRINDABILITY INDEX = 96 @ 5.04 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
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Reston, Virginia 22092

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DATE 12-15-88 LAB NO 880809 - 011

DRILL HOLE JK-6-1-88 SEAM: PROJECT.

PROPERTY DEPTH: THICKNESS:

REMARKS. W-246471

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	37.72	39.78		
% Ash	12.96	12.53	20.81	
% Volatile	28.07	27.14	45.08	56.92
% Fixed Carbon	21.25	20.55	34.11	43.08
Btu	6529	6313	10483	13238
% Sulfur	3.12	3.01	5.00	6.32

lbs SUL/MM BTU = 4.77

SULFUR FORMS				
% Pyritic Sulfur	2.45	2.37	3.94	4.97
% Sulfate Sulfur	0.07	0.06	0.10	0.13
% Organic Sulfur	0.60	0.58	0.96	1.22
% Total Sulfur	3.12	3.01	5.00	6.32

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	35.63	34.45	57.21
Hydrogen	7.17	7.30	4.74
Nitrogen	0.33	0.32	0.53
Chlorine	0.05	0.05	0.08
Sulfur	3.12	3.01	5.00
Ash	12.96	12.53	20.81
Oxygen (diff)	40.74	42.34	11.63

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos. pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2020 °F	°F
Softening (H = W)	2120 °F	°F
Hemispherical (H = ½ W)	2300 °F	°F
Fluid	2460 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 37.11
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

Terry Rollins
DICKINSON LABORATORIES, INC.

DICKINSON LABORATORIES, INC.
COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-0466

COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

CA 95

DATE 12-15-88 LAB NO 880809 - 012

DRILL HOLE JK-6-2-88 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS. W-246472

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	36.73	37.37		
% Ash	6.63	6.56	10.48	
% Volatile	28.65	28.36	45.28	50.58
% Fixed Carbon	27.99	27.71	44.24	49.42
Btu	7342	7267	11604	12962
% Sulfur	1.03	1.02	1.63	1.83

lbs SUL/MM BTU = 1.40

SULFUR FORMS				
% Pyritic Sulfur	0.32	0.32	0.51	0.56
% Sulfate Sulfur	0.04	0.04	0.06	0.07
% Organic Sulfur	0.67	0.66	1.06	1.20
% Total Sulfur	1.03	1.02	1.63	1.83

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	43.47	43.03	68.71
Hydrogen	6.80	6.85	4.25
Nitrogen	0.84	0.83	1.33
Chlorine	0.04	0.04	0.07
Sulfur	1.03	1.02	1.63
Ash	6.63	6.56	10.48
Oxygen (diff)	41.19	41.67	13.53

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1950 °F	°F
Softening (H = W)	2080 °F	°F
Hemispherical (H = ½ W)	2130 °F	°F
Fluid	2290 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 26.36
HARDGROVE GRINDABILITY INDEX = 74 @ 14.95 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL-ANALYSIS REPORT

CA95

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE 12-15-88 LAB NO 880809 - 013

DRILL HOLE JK-6-3-88 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS. W - 246473

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	20.06	20.22		
% Ash	45.88	45.79	57.40	
% Volatile	19.37	19.33	24.23	56.87
% Fixed Carbon	14.69	14.66	18.37	43.13
Btu	3515	3507	4396	10320
% Sulfur	7.23	7.21	9.04	21.22

lbs SUL/MM BTU = 20.56

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	20.19	20.15	25.25
Hydrogen	3.79	3.81	1.94
Nitrogen	1.04	1.04	1.30
Chlorine	0.04	0.04	0.05
Sulfur	7.23	7.21	9.04
Ash	45.88	45.79	57.40
Oxygen (diff)	21.83	21.96	5.02

SULFUR FORMS				
% Pyritic Sulfur	6.19	6.18	7.74	18.17
% Sulfate Sulfur	0.43	0.43	0.54	1.26
% Organic Sulfur	0.61	0.60	0.76	1.79
% Total Sulfur	7.23	7.21	9.04	21.22

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2060 °F	°F
H is Cone Height / W is Cone Width — Softening (H = W)	2340 °F	°F
Hemispherical (H = ½ W)	2460 °F	°F
Fluid	2550 °F	°F

AIR DRYING LOSS = 15.75
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

Terry Rollins
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P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-0466

COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

CA95

DATE 12-15-88 LAB. NO 880809 - 014

DRILL HOLE JK-6-4-88 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS: W-246474

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	30.92	32.49		
% Ash	12.86	12.57	18.62	
% Volatile	30.23	29.55	43.77	53.78
% Fixed Carbon	25.99	25.39	37.61	46.22
Btu	7397	7229	10708	13157
% Sulfur	5.80	5.66	8.39	10.31

lbs SUL/MM BTU = 7.83

SULFUR FORMS				
% Pyritic Sulfur	4.86	4.75	7.03	8.64
% Sulfate Sulfur	0.09	0.08	0.13	0.15
% Organic Sulfur	0.85	0.83	1.23	1.52
% Total Sulfur	5.80	5.66	8.39	10.31

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1950 °F	°F
H is Cone Height / W is Cone Width — Softening (H = W)	1960 °F	°F
Hemispherical (H = ½ W)	1990 °F	°F
Fluid	2080 °F	°F

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	40.42	39.50	58.52
Hydrogen	6.48	6.59	4.37
Nitrogen	0.36	0.35	0.52
Chlorine	0.03	0.03	0.04
Sulfur	5.80	5.66	8.39
Ash	12.86	12.57	18.62
Oxygen (diff)	34.05	35.30	9.54

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

AIR DRYING LOSS = 29.28
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =
* Insufficient Sample

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P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-0496

COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

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DATE 12-15-88 LAB. NO 880809 - 015

DRILL HOLE JK-6-5-88 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS. W-246475

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	28.10	28.78		
% Ash	33.07	32.76	45.99	
% Volatile	22.90	22.68	31.85	58.97
% Fixed Carbon	15.93	15.78	22.16	41.03
Btu	4585	4542	6377	11808
% Sulfur	0.98	0.97	1.36	2.51

lbs SUL/MM BTU = 2.14

SULFUR FORMS				
% Pyritic Sulfur	0.59	0.59	0.82	1.53
% Sulfate Sulfur	0.02	0.02	0.03	0.06
% Organic Sulfur	0.37	0.36	0.51	0.92
% Total Sulfur	0.98	0.97	1.36	2.51

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2690 °F	°F
Softening (H = W)	>2700 °F	°F
Hemispherical (H = ½ W)	>2700 °F	°F
Fluid	>2700 °F	°F

H is Cone Height / W is Cone Width

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	26.64	26.39	37.05
Hydrogen	5.58	5.63	3.39
Nitrogen	0.86	0.85	1.19
Chlorine	0.04	0.04	0.05
Sulfur	0.98	0.97	1.36
Ash	33.07	32.76	45.99
Oxygen (diff)	32.83	33.36	10.97

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

AIR DRYING LOSS = 25.70
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

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P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-0466

COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

CM-95

DATE 6-21-88 LAB NO 880303 - 013

DRILL HOLE JK-7-1 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS. W-246476

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	23.01	24.75		
% Ash	46.59	45.54	60.52	
% Volatile	18.69	18.27	24.28	61.50
% Fixed Carbon	11.71	11.44	15.20	38.50
Btu	2757	2695	3581	9071
% Sulfur	9.36	9.15	12.16	30.80

lbs SUL/MM BTU = 33.95

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	14.83	14.50	19.27
Hydrogen	4.22	4.37	2.13
Nitrogen	0.31	0.31	0.41
Chlorine	0.10	0.09	0.13
Sulfur	9.36	9.15	12.16
Ash	46.59	45.54	60.52
Oxygen (diff)	24.59	26.04	5.38

SULFUR FORMS				
% Pyritic Sulfur	7.97	7.79	10.36	26.23
% Sulfate Sulfur	0.23	0.23	0.30	0.77
% Organic Sulfur	1.16	1.13	1.50	3.80
% Total Sulfur	9.36	9.15	12.16	30.80

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2180 °F	°F
Softening (H = W)	2500 °F	°F
Hemispherical (H = ½ W)	2550 °F	°F
Fluid	2600 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 21.11
HARDGROVE GRINDABILITY INDEX = 142 @ 4.61 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-0496

Terry Rollins
DICKINSON LABORATORIES, INC.

COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE 6-21-88 LAB NO 880303 - 014

DRILL HOLE JK-7-2 SEAM PROJECT

PROPERTY DEPTH THICKNESS

REMARKS

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	29.82	38.60		
% Ash	7.44	6.51	10.60	
% Volatile	31.42	27.49	44.77	50.08
% Fixed Carbon	31.32	27.40	44.63	49.92
Btu	8251	7218	11756	13151
% Sulfur	2.48	2.17	3.54	3.96

lbs SUL/MM BTU = 3.01

SULFUR FORMS				
% Pyritic Sulfur	2.00	1.75	2.85	3.19
% Sulfate Sulfur	0.07	0.06	0.11	0.12
% Organic Sulfur	0.41	0.36	0.58	0.65
% Total Sulfur	2.48	2.17	3.54	3.96

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M basis	As received	Dry basis
Moisture			
Carbon	46.37	40.57	66.07
Hydrogen	6.62	7.19	4.67
Nitrogen	1.06	0.92	1.51
Chlorine	0.04	0.03	0.05
Sulfur	2.48	2.17	3.54
Ash	7.44	6.51	10.60
Oxygen (diff)	35.99	42.61	13.56

MINERAL ANALYSIS	% Wt Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1860 °F	°F
H is Cone Height / W is Cone Width — Softening (H = W)	1950 °F	°F
Hemispherical (H = ½ W)	1960 °F	°F
Fluid	2000 °F	°F

AIR DRYING LOSS = 35.35
HARDGROVE GRINDABILITY INDEX = Insufficient Sample
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-9496

COAL-ANALYSIS REPORT

1-75

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE 6-21-88 LAB NO 880303 - 015

DRILL HOLE JK-7-3 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS. W-246477

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	29.71	31.32		
% Ash	24.52	23.96	34.88	
% Volatile	24.97	24.40	35.53	54.56
% Fixed Carbon	20.80	20.32	29.59	45.44
Btu	5609	5480	7979	12254
% Sulfur	0.53	0.51	0.75	1.15

lbs SUL/MM BTU = 0.93

SULFUR FORMS				
% Pyritic Sulfur	0.33	0.32	0.47	0.72
% Sulfate Sulfur	0.03	0.03	0.04	0.06
% Organic Sulfur	0.17	0.16	0.24	0.37
% Total Sulfur	0.53	0.51	0.75	1.15

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2600 °F	°F
Softening (H = W)	>2700 °F	°F
Hemispherical (H = ½ W)	>2700 °F	°F
Fluid	>2700 °F	°F

H is Cone Height / W is Cone Width

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	32.05	31.32	45.60
Hydrogen	6.14	6.26	4.01
Nitrogen	0.75	0.73	1.06
Chlorine	0.04	0.04	0.05
Sulfur	0.53	0.51	0.75
Ash	24.52	23.96	34.88
Oxygen (diff)	35.97	37.18	13.65

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

AIR DRYING LOSS = 28.61
HARDGROVE GRINDABILITY INDEX = 60 @ 3.79 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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DICKINSON LABORATORIES, INC.
COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-0466

COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE 6-21-88 LAB NO 880303 - 016

DRILL HOLE JK-7-5 SEAM PROJECT

PROPERTY DEPTH THICKNESS

REMARKS

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	33.91	39.27		
% Ash	6.20	5.69	9.38	
% Volatile	29.22	26.85	44.21	48.79
% Fixed Carbon	30.67	28.19	46.41	51.21
Btu	8003	7354	12109	13362
% Sulfur	1.27	1.17	1.92	2.12

lbs SUL/MM BTU = 1.59

SULFUR FORMS				
% Pyritic Sulfur	0.99	0.91	1.50	1.65
% Sulfate Sulfur	0.03	0.03	0.04	0.05
% Organic Sulfur	0.25	0.23	0.38	0.42
% Total Sulfur	1.27	1.17	1.92	2.12

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M basis	As received	Dry basis
Moisture			
Carbon	45.81	42.09	69.31
Hydrogen	7.00	7.34	4.86
Nitrogen	1.07	0.98	1.62
Chlorine	0.05	0.04	0.07
Sulfur	1.27	1.17	1.92
Ash	6.20	5.69	9.38
Oxygen (diff)	38.60	42.69	12.84

MINERAL ANALYSIS	% Wt Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina Al_2O_3	
Titania TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1940 °F	°F
Softening (H = W)	2040 °F	°F
Hemispherical (H = ½ W)	2050 °F	°F
Fluid	2080 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 35.88
ARDGROVE GRINDABILITY INDEX = Insufficient Sample
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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Jerry Rollins
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COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE 6-21-88 LAB NO 880303 - 017

DRILL HOLE JK-7-6 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS. W - 246448

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	25.12	25.09		
% Ash	38.55	38.56	51.48	
% Volatile	20.87	20.87	27.87	57.43
% Fixed Carbon	15.46	15.48	20.65	42.57
Btu	3787	3788	5057	10423
% Sulfur	7.46	7.47	9.97	20.54

lbs SUL/MM BTU = 19.72

SULFUR FORMS				
% Pyritic Sulfur	6.29	6.30	8.41	17.32
% Sulfate Sulfur	0.27	0.27	0.36	0.73
% Organic Sulfur	0.90	0.90	1.20	2.49
% Total Sulfur	7.46	7.47	9.97	20.54

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2180 °F	°F
Softening (H = WI	2530 °F	°F
Hemispherical (H = ½ WI	2550 °F	°F
Fluid	2580 °F	°F

H is Cone Height
W is Cone Width

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	20.48	20.49	27.35
Hydrogen	4.81	4.81	2.67
Nitrogen	0.39	0.39	0.52
Chlorine	0.03	0.03	0.04
Sulfur	7.46	7.47	9.97
Ash	38.55	38.56	51.48
Oxygen (diff)	28.28	28.25	7.97

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina Al_2O_3	
Titania TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

AIR DRYING LOSS = 21.59
HARDGROVE GRINDABILITY INDEX = 125 @ 4.47 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL-ANALYSIS REPORT

JA 75

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE 6-21-88 LAB NO 880303 - 018

DRILL HOLE JK-7-7 SEAM: PROJECT.

PROPERTY DEPTH: THICKNESS:

REMARKS. W-246477

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	21.28	20.98		
% Ash	43.74	43.90	55.56	
% Volatile	21.11	21.19	26.82	60.35
% Fixed Carbon	13.87	13.93	17.62	39.65
Btu	3526	3540	4479	10080
% Sulfur	10.02	10.06	12.73	28.64

lbs SUL/MM BTU = 28.42

SULFUR FORMS				
% Pyritic Sulfur	8.81	8.85	11.19	25.19
% Sulfate Sulfur	0.36	0.36	0.46	1.03
% Organic Sulfur	0.85	0.85	1.08	2.42
% Total Sulfur	10.02	10.06	12.73	28.64

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2120 °F	°F
H is Cone Height / W is Cone Width — Softening (H = W)	2180 °F	°F
Hemispherical (H = ½ W)	2200 °F	°F
Fluid	2480 °F	°F

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	18.76	18.83	23.83
Hydrogen	4.18	4.15	2.28
Nitrogen	0.37	0.37	0.47
Chlorine	0.02	0.02	0.03
Sulfur	10.02	10.06	12.73
Ash	43.74	43.90	55.56
Oxygen (diff)	22.91	22.67	5.10

MINERAL ANALYSIS	% Wt Ignited Basis
Phos. pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

AIR DRYING LOSS = 17.57
HARDGROVE GRINDABILITY INDEX = 130 @ 4.14 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL-ANALYSIS REPORT

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CF 95

DATE 6-21-88 LAB NO 880303 - 019

DRILL HOLE JK-7-8 SEAM: PROJECT.

PROPERTY DEPTH: THICKNESS:

REMARKS. W-SH6480

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	23.78	25.81		
% Ash	30.79	29.97	40.39	
% Volatile	26.47	25.76	34.72	58.25
% Fixed Carbon	18.96	18.46	24.89	41.75
Btu	5528	5381	7253	12169
% Sulfur	5.00	4.86	6.56	11.00

lbs SUL/MM BTU = 9.03

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	29.99	29.19	39.34
Hydrogen	5.50	5.65	3.73
Nitrogen	0.61	0.60	0.80
Chlorine	0.02	0.02	0.03
Sulfur	5.00	4.86	6.56
Ash	30.79	29.97	40.39
Oxygen (diff)	28.09	29.71	9.15

SULFUR FORMS				
% Pyritic Sulfur	4.39	4.28	5.76	9.67
% Sulfate Sulfur	0.17	0.17	0.23	0.38
% Organic Sulfur	0.44	0.41	0.57	0.95
% Total Sulfur	5.00	4.86	6.56	11.00

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2440 °F	°F
Softening (H = W)	2580 °F	°F
Hemispherical (H = ½ W)	2590 °F	°F
Fluid	2640 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 23.65
HARDGROVE GRINDABILITY INDEX = 88 @ 2.83 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL-ANALYSIS REPORT

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TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE 6-21-88 LAB NO 880303 - 021

DRILL HOLE JK-8-CS-1 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS. W-24648(

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	13.56	14.71		
% Ash	74.84	73.84	86.58	
% Volatile	11.58	11.43	13.40	99.85
% Fixed Carbon	0.02	0.02	0.02	0.15
Btu	385	380	445	3316
% Sulfur	1.62	1.60	1.87	13.94

lbs SUL/MM BTU = 42.11

SULFUR FORMS				
% Pyritic Sulfur	1.50	1.48	1.73	12.89
% Sulfate Sulfur	0.10	0.09	0.11	0.83
% Organic Sulfur	0.02	0.03	0.03	0.22
% Total Sulfur	1.62	1.60	1.87	13.94

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	3.69	3.64	4.27
Hydrogen	2.41	2.53	1.04
Nitrogen	0.07	0.07	0.08
Chlorine	0.03	0.03	0.04
Sulfur	1.62	1.60	1.87
Ash	74.84	73.84	86.58
Oxygen (diff)	17.34	18.29	6.12

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2370 °F	°F
Softening (H = W)	2480 °F	°F
Hemispherical (H = ½ W)	2600 °F	°F
Fluid	2660 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 13.74
HARDGROVE GRINDABILITY INDEX = Insufficient Sample
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
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DATE 6-21-88 LAB NO 880303 - 022

DRILL HOLE JK-8-CS-2 SEAM: PROJECT.

PROPERTY DEPTH: THICKNESS:

REMARKS. W- 246483

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	18.63	18.26		
% Ash	66.14	66.44	81.29	
% Volatile	12.66	12.71	15.55	83.12
% Fixed Carbon	2.57	2.59	3.16	16.88
Btu	741	744	910	4864
% Sulfur	0.23	0.23	0.28	1.52

lbs SUL/MM BTU = 3.09

SULFUR FORMS				
% Pyritic Sulfur	0.17	0.17	0.21	1.14
% Sulfate Sulfur	0.04	0.04	0.05	0.27
% Organic Sulfur	0.02	0.02	0.02	0.11
% Total Sulfur	0.23	0.23	0.28	1.52

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	5.70	5.72	7.00
Hydrogen	3.45	3.42	1.68
Nitrogen	0.12	0.12	0.14
Chlorine	0.03	0.03	0.04
Sulfur	0.23	0.23	0.28
Ash	66.14	66.44	81.29
Oxygen (diff)	24.33	24.04	9.57

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	>2700 °F	°F
Softening (H = W)	>2700 °F	°F
Hemispherical (H = ½ W)	>2700 °F	°F
Fluid	>2700 °F	°F

H is Cone Height
W is Cone Width

AIR DRYING LOSS = 16.96
HARDGROVE GRINDABILITY INDEX = Insufficient Sample
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE 6-21-88 LAB NO 880303 - 020

DRILL HOLE JK-8-1 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS: W-245482

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	33.82	34.25		
% Ash	13.59	13.50	20.53	
% Volatile	26.93	26.76	40.70	51.21
% Fixed Carbon	25.66	25.49	38.77	48.79
Btu	6726	6682	10163	12789
% Sulfur	1.27	1.26	1.92	2.41

lbs SUL/MM BTU = 1.89

SULFUR FORMS				
% Pyritic Sulfur	1.03	1.02	1.56	1.96
% Sulfate Sulfur	0.04	0.04	0.06	0.08
% Organic Sulfur	0.20	0.20	0.30	0.37
% Total Sulfur	1.27	1.26	1.92	2.41

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	38.64	38.39	58.38
Hydrogen	6.81	6.84	4.57
Nitrogen	0.83	0.83	1.26
Chlorine	0.04	0.04	0.05
Sulfur	1.27	1.26	1.92
Ash	13.59	13.50	20.53
Oxygen (diff)	38.82	39.14	13.29

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2060 °F	°F
Softening (H = W)	2110 °F	°F
Hemispherical (H = ½ W)	2140 °F	°F
Fluid	2300 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 28.85
HARDGROVE GRINDABILITY INDEX = 57 @ 7.59 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
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Reston, Virginia 22092

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DATE 6-21-88 LAB NO 880303 - 026

DRILL HOLE JK-8-2 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS: W-246484

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	33.28	35.90		
% Ash	7.16	6.88	10.73	
% Volatile	28.17	27.07	42.22	47.30
% Fixed Carbon	31.39	30.15	47.05	52.70
Btu	7740	7436	11601	12995
% Sulfur	0.43	0.42	0.65	0.73

lbs SUL/MM BTU = 0.56

SULFUR FORMS				
% Pyritic Sulfur	0.20	0.19	0.30	0.34
% Sulfate Sulfur	0.01	0.01	0.02	0.02
% Organic Sulfur	0.22	0.22	0.33	0.37
% Total Sulfur	0.43	0.42	0.65	0.73

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2040 °F	°F
Softening (H = W)	2090 °F	°F
Hemispherical (H = ½ W)	2180 °F	°F
Fluid	2400 °F	°F

H is Cone Height / W is Cone Width

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	44.81	43.05	67.17
Hydrogen	6.93	7.10	4.81
Nitrogen	0.93	0.89	1.39
Chlorine	0.04	0.03	0.05
Sulfur	0.43	0.42	0.65
Ash	7.16	6.88	10.73
Oxygen (diff)	39.70	41.63	15.20

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

AIR DRYING LOSS = 30.81
HARDGROVE GRINDABILITY INDEX = 66 @ 7.35 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL-ANALYSIS REPORT

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TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE 6-21-88 LAB NO 880303 - 023

DRILL HOLE JK-8-CS-3 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS. W-246485

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	18.80	19.28		
% Ash	65.73	65.34	80.94	
% Volatile	13.92	13.84	17.14	89.95
% Fixed Carbon	1.55	1.54	1.92	10.05
Btu	611	608	753	3950
% Sulfur	0.06	0.06	0.07	0.37

lbs SUL/MM BTU = 0.99

SULFUR FORMS				
% Pyritic Sulfur	0.03	0.03	0.04	0.21
% Sulfate Sulfur	0.02	0.02	0.02	0.11
% Organic Sulfur	0.01	0.01	0.01	0.05
% Total Sulfur	0.06	0.06	0.07	0.37

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	>2700 °F	°F
Softening (H = W)	>2700 °F	°F
Hemispherical (H = ½ W)	>2700 °F	°F
Fluid	>2700 °F	°F

H is Cone Height / W is Cone Width

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	5.01	4.98	6.17
Hydrogen	3.67	3.72	1.93
Nitrogen	0.12	0.12	0.15
Chlorine	0.03	0.03	0.04
Sulfur	0.06	0.06	0.07
Ash	65.73	65.34	80.94
Oxygen (diff)	25.38	25.75	10.70

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

AIR DRYING LOSS = 18.22
HARDGROVE GRINDABILITY INDEX = Insufficient Sample
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-9496

COAL-ANALYSIS REPORT

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TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE 6-21-88 LAB. NO 880303 - 025

DRILL HOLE JK-8-3 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS: W- 246486

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	25.95	27.24		
% Ash	21.66	21.29	29.26	
% Volatile	29.17	28.67	39.40	55.69
% Fixed Carbon	23.22	22.80	31.34	44.31
Btu	6923	6802	9349	13215
% Sulfur	1.56	1.54	2.11	2.99

lbs SUL/MM BTU = 2.26

SULFUR FORMS				
% Pyritic Sulfur	1.31	1.29	1.77	2.51
% Sulfate Sulfur	0.05	0.05	0.06	0.09
% Organic Sulfur	0.20	0.20	0.28	0.39
% Total Sulfur	1.56	1.54	2.11	2.99

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	38.36	37.69	51.80
Hydrogen	6.18	6.27	4.43
Nitrogen	0.74	0.73	1.00
Chlorine	0.03	0.03	0.04
Sulfur	1.56	1.54	2.11
Ash	21.66	21.29	29.26
Oxygen (diff)	31.47	32.45	11.36

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2070 °F	°F
Softening (H = W)	2400 °F	°F
Hemispherical (H = ½ W)	2560 °F	°F
Fluid	2600 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 23.13
HARDGROVE GRINDABILITY INDEX = 74 @ 5.35 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL-ANALYSIS REPORT

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TO: UNITED STATES GEOLOGICAL SURVEY
National Center
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Reston, Virginia 22092

DATE 6-21-88 LAB NO 880303 - 027

DRILL HOLE JK-9-1 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS: W - 246487

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	33.70	34.99		
% Ash	16.49	16.17	24.88	
% Volatile	25.97	25.46	39.17	52.14
% Fixed Carbon	23.84	23.38	35.95	47.86
Btu	6209	6088	9365	12466
% Sulfur	4.16	4.07	6.27	8.34

lbs SUL/MM BTU = 6.69

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	34.68	34.00	52.30
Hydrogen	6.46	6.55	4.06
Nitrogen	0.71	0.70	1.08
Chlorine	0.19	0.19	0.29
Sulfur	4.16	4.07	6.27
Ash	16.49	16.17	24.88
Oxygen (diff)	37.31	38.32	11.12

SULFUR FORMS				
% Pyritic Sulfur	3.15	3.09	4.75	6.33
% Sulfate Sulfur	0.16	0.15	0.23	0.31
% Organic Sulfur	0.85	0.83	1.29	1.70
% Total Sulfur	4.16	4.07	6.27	8.34

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2030 °F	°F
Softening (H = W)	2110 °F	°F
Hemispherical (H = ½ W)	2190 °F	°F
Fluid	2380 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 30.71
HARDGROVE GRINDABILITY INDEX = 72 @ 6.18 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE 6-21-88 LAB NO 880303 - 028

DRILL HOLE JK-9-3 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS. W - 246488

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	27.05	30.11		
% Ash	20.13	19.28	27.59	
% Volatile	27.66	26.50	37.92	52.37
% Fixed Carbon	25.16	24.11	34.49	47.63
Btu	6934	6643	9505	13127
% Sulfur	0.88	0.84	1.21	1.67

lbs SUL/MM BTU = 1.26

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	38.96	37.33	53.41
Hydrogen	6.02	6.24	4.11
Nitrogen	0.84	0.81	1.15
Chlorine	0.03	0.03	0.04
Sulfur	0.88	0.84	1.21
Ash	20.13	19.28	27.59
Oxygen (diff)	33.14	35.47	12.49

SULFUR FORMS				
% Pyritic Sulfur	0.72	0.69	0.99	1.36
% Sulfate Sulfur	0.04	0.04	0.05	0.07
% Organic Sulfur	0.12	0.11	0.17	0.24
% Total Sulfur	0.88	0.84	1.21	1.67

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos. pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2120 °F	°F
H is Cone Height / W is Cone Width — Softening (H = W)	2330 °F	°F
Hemispherical (H = ½ W)	2420 °F	°F
Fluid	2590 °F	°F

AIR DRYING LOSS = 27.31
HARDGROVE GRINDABILITY INDEX = 91 @ 3.85 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

CA96

DATE 6-21-88 LAB. NO 880303 - 029

DRILL HOLE JK-9-4 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS: W - 246489

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	23.44	25.57		
% Ash	40.28	39.16	52.61	
% Volatile	21.51	20.91	28.09	59.28
% Fixed Carbon	14.77	14.36	19.30	40.72
Btu	4122	4008	5385	11363
% Sulfur	0.24	0.23	0.31	0.65

lbs SUL/MM BTU = 0.57

SULFUR FORMS				
% Pyritic Sulfur	0.17	0.16	0.22	0.46
% Sulfate Sulfur	0.03	0.03	0.04	0.09
% Organic Sulfur	0.04	0.04	0.05	0.10
% Total Sulfur	0.24	0.23	0.31	0.65

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	23.72	23.06	30.98
Hydrogen	5.05	5.22	3.17
Nitrogen	0.55	0.53	0.72
Chlorine	0.02	0.02	0.03
Sulfur	0.24	0.23	0.31
Ash	40.28	39.16	52.61
Oxygen (diff)	30.14	31.78	12.18

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos. pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	>2700 °F	°F
Softening (H = W)	>2700 °F	°F
Hemispherical (H = ½ W)	>2700 °F	°F
Fluid	>2700 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 23.58
HARDGROVE GRINDABILITY INDEX = Insufficient Sample
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE 11-7-88 LAB NO 880618 - 016

DRILL HOLE JK-10-2 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS: W-246490

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	24.73	19.97		
% Ash	53.87	57.28	71.57	
% Volatile	14.33	15.23	19.03	66.95
% Fixed Carbon	7.07	7.52	9.40	33.05
Btu	1620	1722	2152	7571
% Sulfur	5.44	5.79	7.23	25.43

lbs SUL/MM BTU = 33.62

SULFUR FORMS				
% Pyritic Sulfur	4.97	5.29	6.60	23.23
% Sulfate Sulfur	0.26	0.28	0.35	1.22
% Organic Sulfur	0.21	0.22	0.28	0.98
% Total Sulfur	5.44	5.79	7.23	25.43

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	4.55	4.84	6.05
Hydrogen	3.81	3.34	1.38
Nitrogen	0.21	0.22	0.28
Chlorine	0.08	0.08	0.10
Sulfur	5.44	5.79	7.23
Ash	53.87	57.28	71.57
Oxygen (diff)	32.04	28.45	13.39

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos. pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2150 °F	°F
Softening (H = W)	2450 °F	°F
Hemispherical (H = ½ W)	2580 °F	°F
Fluid	2640 °F	°F

H is Cone Height
W is Cone Width

AIR DRYING LOSS = 10.71
HARDGROVE GRINDABILITY INDEX = 132 @ 10.37 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY = 1.90

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COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

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DATE 11-7-88 LAB NO 880618 - 009

DRILL HOLE JK-10-A SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS. W - 241691

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	30.80	32.47		
% Ash	13.27	12.95	19.18	
% Volatile	29.33	28.62	42.39	52.45
% Fixed Carbon	26.60	25.96	38.43	47.55
Btu	7260	7085	10491	12981
% Sulfur	5.25	5.12	7.58	9.38

lbs SUL/MM BTU = 7.23

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	40.22	39.25	58.12
Hydrogen	6.19	6.31	3.97
Nitrogen	0.81	0.80	1.18
Chlorine	0.07	0.07	0.11
Sulfur	5.25	5.12	7.58
Ash	13.27	12.95	19.18
Oxygen (diff)	34.19	35.50	9.86

SULFUR FORMS				
% Pyritic Sulfur	4.32	4.22	6.25	7.73
% Sulfate Sulfur	0.14	0.14	0.20	0.25
% Organic Sulfur	0.79	0.76	1.13	1.40
% Total Sulfur	5.25	5.12	7.58	9.38

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1930 °F	°F
Softening (H = W)	1950 °F	°F
Hemispherical (H = ½ W)	1960 °F	°F
Fluid	2080 °F	°F

H is Cone Height
W is Cone Width

AIR DRYING LOSS = 18.86
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY = 1.33
* Insufficient Sample

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COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

LA 95

DATE 11-7-88 LAB NO 880618 - 010

DRILL HOLE JK-10-B SEAM: PROJECT.

PROPERTY DEPTH: THICKNESS:

REMARKS: W - 246492

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	32.73	32.84		
% Ash	14.59	14.57	21.69	
% Volatile	29.83	29.78	44.34	56.63
% Fixed Carbon	22.85	22.81	33.97	43.37
Btu	6794	6783	10100	12897
% Sulfur	2.44	2.43	3.62	4.62

lbs SUL/MM BTU = 3.58

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	38.15	38.09	56.72
Hydrogen	7.02	7.03	5.00
Nitrogen	0.79	0.79	1.17
Chlorine	0.03	0.03	0.05
Sulfur	2.44	2.43	3.62
Ash	14.59	14.57	21.69
Oxygen (diff)	36.98	37.06	11.75

SULFUR FORMS				
% Pyritic Sulfur	1.63	1.63	2.42	3.09
% Sulfate Sulfur	0.10	0.10	0.15	0.19
% Organic Sulfur	0.71	0.70	1.05	1.34
% Total Sulfur	2.44	2.43	3.62	4.62

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2060 °F	°F
Softening (H = W)	2150 °F	°F
Hemispherical (H = ½ W)	2210 °F	°F
Fluid	2420 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 16.13
HARDGROVE GRINDABILITY INDEX = 62 @ 19.92 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY = 1.30

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COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

JK-10

DATE 11-7-88 LAB NO 880618 - 011

DRILL HOLE JK-10-C1 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS: W-2H6493

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	33.36	34.62		
% Ash	10.45	10.25	15.68	
% Volatile	31.13	30.54	46.71	55.40
% Fixed Carbon	25.06	24.59	37.61	44.60
Btu	7382	7242	11077	13137
% Sulfur	4.36	4.28	6.55	7.76

lbs SUL/MM BTU = 5.91

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	40.41	39.64	60.64
Hydrogen	7.12	7.19	5.08
Nitrogen	0.78	0.76	1.17
Chlorine	0.03	0.03	0.05
Sulfur	4.36	4.28	6.55
Ash	10.45	10.25	15.68
Oxygen (diff)	36.85	37.85	10.83

SULFUR FORMS				
% Pyritic Sulfur	2.67	2.62	4.01	4.76
% Sulfate Sulfur	0.15	0.15	0.23	0.27
% Organic Sulfur	1.54	1.51	2.31	2.73
% Total Sulfur	4.36	4.28	6.55	7.76

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos. pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1950 °F	°F
Softening (H = W)	1960 °F	°F
Hemispherical (H = ½ W)	1970 °F	°F
Fluid	2130 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 21.47
HARDGROVE GRINDABILITY INDEX = 60 @ 16.75 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY = 1.28

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Jerry Rollins
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COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

21795

DATE 11-7-88 LAB NO 880618 - 012

DRILL HOLE JK-10-C1A SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS: W- 246494

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	23.89	18.94		
% Ash	51.55	54.90	67.73	
% Volatile	16.67	17.75	21.90	67.85
% Fixed Carbon	7.89	8.41	10.37	32.15
Btu	1789	1906	2351	7285
% Sulfur	9.21	9.81	12.11	37.51

lbs SUL/MM BTU = 51.47

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	9.49	10.10	12.47
Hydrogen	3.92	3.44	1.64
Nitrogen	0.20	0.21	0.26
Chlorine	0.02	0.03	0.03
Sulfur	9.21	9.81	12.11
Ash	51.55	54.90	67.73
Oxygen (diff)	25.61	21.51	5.76

SULFUR FORMS				
% Pyritic Sulfur	8.81	9.38	11.57	35.85
% Sulfate Sulfur	0.35	0.38	0.46	1.43
% Organic Sulfur	0.05	0.05	0.08	0.23
% Total Sulfur	9.21	9.81	12.11	37.51

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos. pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2070 °F	°F
Softening (H = W)	2480 °F	°F
Hemispherical (H = ½ W)	2540 °F	°F
Fluid	2630 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 16.63
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY = 1.97

* Insufficient Sample

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DICKINSON LABORATORIES, INC.
COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-0466

COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

CA 96

DATE 11-7-88 LAB. NO: 880618 - 013

DRILL HOLE: JK-10-C2 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS: D-2-419495

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	32.58	33.60		
% Ash	5.39	5.31	8.00	
% Volatile	32.08	31.59	47.58	51.71
% Fixed Carbon	29.95	29.50	44.42	48.29
Btu	8265	8140	12259	13324
% Sulfur	1.63	1.61	2.42	2.63

lbs SUL/MM BTU = 1.98

SULFUR FORMS				
% Pyritic Sulfur	0.73	0.72	1.08	1.17
% Sulfate Sulfur	0.07	0.07	0.11	0.12
% Organic Sulfur	0.83	0.82	1.23	1.34
% Total Sulfur	1.63	1.61	2.42	2.63

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	47.28	46.57	70.13
Hydrogen	7.38	7.44	5.54
Nitrogen	0.93	0.91	1.38
Chlorine	0.04	0.04	0.05
Sulfur	1.63	1.61	2.42
Ash	5.39	5.31	8.00
Oxygen (diff)	37.35	38.12	12.48

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos. pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2110 °F	°F
Softening (H = W)	2170 °F	°F
Hemispherical (H = ½ W)	2190 °F	°F
Fluid	2220 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 10.31
HARDGROVE GRINDABILITY INDEX = 74 @ 25.97 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY = 1.25

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COAL & OIL SHALE ANALYSTS
P.O. BOX 12008 EL PASO, TEXAS 79913-0008 915/584-0466

COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
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Reston, Virginia 22092

CX-796

DATE 11-7-88 LAB. NO 880618 - 014

DRILL HOLE JK-10-C3 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS: W - 2H6H96

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	33.73	35.50		
% Ash	3.75	3.65	5.66	
% Volatile	33.13	32.24	49.99	52.99
% Fixed Carbon	29.39	28.61	44.35	47.01
Btu	3444	8219	12742	13507
% Sulfur	0.87	0.85	1.32	1.40

lbs SUL/MM BTU = 1.03

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	48.80	47.50	73.64
Hydrogen	7.11	7.22	5.03
Nitrogen	0.94	0.92	1.42
Chlorine	0.04	0.04	0.07
Sulfur	0.87	0.85	1.32
Ash	3.75	3.65	5.66
Oxygen (diff)	38.49	39.82	12.86

SULFUR FORMS				
% Pyritic Sulfur	0.30	0.29	0.46	0.48
% Sulfate Sulfur	0.03	0.03	0.04	0.04
% Organic Sulfur	0.54	0.53	0.82	0.88
% Total Sulfur	0.87	0.85	1.32	1.40

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2130 °F	°F
Softening (H = W)	2220 °F	°F
Hemispherical (H = ½ W)	2280 °F	°F
Fluid	2470 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 15.82
HARDGROVE GRINDABILITY INDEX = 71 @ 23.38 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY = 1.22

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COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

CA 96

DATE 11-7-88 LAB. NO 880618 - 015

DRILL HOLE JK-10-D SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS: W-246497

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	31.14	33.17		
% Ash	16.79	16.29	24.38	
% Volatile	29.54	28.66	42.89	56.72
% Fixed Carbon	22.53	21.88	32.73	43.28
Btu	6697	6499	9725	12860
% Sulfur	2.53	2.45	3.67	4.85

lbs SUL/MM BTU = 3.77

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	38.32	37.19	55.66
Hydrogen	6.45	6.59	4.31
Nitrogen	0.77	0.74	1.11
Chlorine	0.04	0.04	0.06
Sulfur	2.53	2.45	3.67
Ash	16.79	16.29	24.38
Oxygen (diff)	35.10	36.70	10.81

SULFUR FORMS				
% Pyritic Sulfur	1.60	1.55	2.33	3.07
% Sulfate Sulfur	0.23	0.22	0.33	0.43
% Organic Sulfur	0.70	0.68	1.01	1.35
% Total Sulfur	2.53	2.45	3.67	4.85

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos. pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2120 °F	°F
Softening (H = W)	2330 °F	°F
Hemispherical (H = ½ W)	2440 °F	°F
Fluid	2470 °F	°F

H is Cone Height
W is Cone Width

AIR DRYING LOSS = 19.07
HARDGROVE GRINDABILITY INDEX = 58 @ 17.42 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY = 1.30

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COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

CA 24

DATE 11-7-88 LAB NO 880618 - 029

DRILL HOLE JK-11-1 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS: W-246498

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	29.16	29.09		
% Ash	12.70	12.72	17.93	
% Volatile	*	*	*	*
% Fixed Carbon	*	*	*	*
Btu	*	*	*	*
% Sulfur	3.45	3.46	4.88	5.94

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon		*	*
Hydrogen		*	*
Nitrogen		*	*
Chlorine		*	*
Sulfur			
Ash			
Oxygen (diff)			

SULFUR FORMS				
% Pyritic Sulfur	2.35	2.35	3.31	4.04
% Sulfate Sulfur	0.10	0.10	0.14	0.17
% Organic Sulfur	1.00	1.01	1.43	1.73
% Total Sulfur	3.45	3.46	4.88	5.94

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1930 °F	°F
Softening (H = W)	1970 °F	°F
Hemispherical (H = ½ W)	1980 °F	°F
Fluid	2180 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 16.06
HARDGROVE GRINDABILITY INDEX = 51 @ 15.52 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY = 1.29
* Insufficient Sample

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COAL-ANALYSIS REPORT

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DATE 11-7-88 LAB NO 880618 - 004

DRILL HOLE JK-11-2A SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS. W - 246499

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	31.21	33.17		
% Ash	6.63	6.44	9.64	
% Volatile	30.90	30.02	44.91	49.70
% Fixed Carbon	31.26	30.37	45.45	50.30
Btu	8255	8019	12000	13279
% Sulfur	1.64	1.60	2.39	2.65

lbs SUL/MM BTU = 2.00

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	47.54	46.19	69.12
Hydrogen	6.46	6.59	4.31
Nitrogen	0.96	0.94	1.40
Chlorine	0.04	0.04	0.06
Sulfur	1.64	1.60	2.39
Ash	6.63	6.44	9.64
Oxygen (diff)	36.73	38.20	13.08

SULFUR FORMS

% Pyritic Sulfur	0.95	0.92	1.38	1.52
% Sulfate Sulfur	0.07	0.07	0.10	0.11
% Organic Sulfur	0.62	0.61	0.91	1.02
% Total Sulfur	1.64	1.60	2.39	2.65

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos. pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1970 °F	°F
Softening (H = W)	2110 °F	°F
Hemispherical (H = ½ W)	2130 °F	°F
Fluid	2140 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 16.37
HARDGROVE GRINDABILITY INDEX = 65 @ 20.09 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY = 1.24

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COAL-ANALYSIS REPORT

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Reston, Virginia 22092

DATE 11-7-88 LAB. NO. 880618 - 005

DRILL HOLE JK-11-2B SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS: W - 246600

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	30.29	30.40		
% Ash	5.58	5.57	8.00	
% Volatile	32.89	32.84	47.18	51.29
% Fixed Carbon	31.24	31.19	44.82	48.71
Btu	8683	8669	12456	13539
% Sulfur	1.94	1.93	2.78	3.02

lbs SUL/MM BTU = 2.23

SULFUR FORMS				
% Pyritic Sulfur	1.19	1.18	1.70	1.85
% Sulfate Sulfur	0.05	0.05	0.08	0.08
% Organic Sulfur	0.70	0.70	1.00	1.09
% Total Sulfur	1.94	1.93	2.78	3.02

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2050 °F	°F
Softening (H = W)	2160 °F	°F
Hemispherical (H = ½ W)	2170 °F	°F
Fluid	2180 °F	°F

H is Cone Height
W is Cone Width

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	48.86	48.78	70.09
Hydrogen	6.59	6.59	4.59
Nitrogen	0.95	0.94	1.36
Chlorine	0.04	0.04	0.06
Sulfur	1.94	1.93	2.78
Ash	5.58	5.57	8.00
Oxygen (diff)	36.04	36.15	13.12

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos. pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

AIR DRYING LOSS = 10.93
HARDGROVE GRINDABILITY INDEX = 69 @ 21.86 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY = 1.25

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COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
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CA96

DATE 11-7-88 LAB NO 880618 - 006

DRILL HOLE JK-12-1 SEAM: PROJECT.

PROPERTY DEPTH: THICKNESS:

REMARKS. J - 12-1-6501

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	36.25	35.68		
% Ash	16.02	16.16	25.13	
% Volatile	35.77	36.08	56.10	74.93
% Fixed Carbon	11.96	12.08	18.77	25.07
Btu	5979	6032	9378	12525
% Sulfur	4.95	5.00	7.77	10.38

lbs SUL/MM BTU = 8.29

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	32.75	33.04	51.37
Hydrogen	6.39	6.35	3.66
Nitrogen	0.73	0.74	1.15
Chlorine	0.23	0.23	0.36
Sulfur	4.95	5.00	7.77
Ash	16.02	16.16	25.13
Oxygen (diff)	38.93	38.48	10.56

SULFUR FORMS

% Pyritic Sulfur	4.13	4.16	6.47	8.65
% Sulfate Sulfur	0.19	0.19	0.30	0.40
% Organic Sulfur	0.63	0.65	1.00	1.33
% Total Sulfur	4.95	5.00	7.77	10.38

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

MINERAL ANALYSIS	% Wt Ignited Basis
Phos. pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2050 °F	°F
Softening (H = W)	2100 °F	°F
Hemispherical (H = ½ W)	2160 °F	°F
Fluid	2200 °F	°F

H is Cone Height
W is Cone Width

AIR DRYING LOSS = 13.07
HARDGROVE GRINDABILITY INDEX = 72 @ 26.01 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY = 1.31

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COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

CR96

DATE 11-7-88 LAB NO 880618 - 019

DRILL HOLE JK-12-2 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS.

REMARKS. W-046502

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	28.89	26.25		
% Ash	41.51	43.05	58.38	
% Volatile	19.08	19.79	26.84	64.48
% Fixed Carbon	10.52	10.91	14.78	35.52
Btu	2799	2903	3937	9458
% Sulfur	7.08	7.34	9.95	23.91

lbs SUL/MM BTU = 25.28

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	15.77	16.35	22.17
Hydrogen	4.68	4.44	2.04
Nitrogen	0.35	0.36	0.49
Chlorine	0.11	0.11	0.16
Sulfur	7.08	7.34	9.95
Ash	41.51	43.05	58.38
Oxygen (diff)	30.50	28.35	6.81

SULFUR FORMS

% Pyritic Sulfur	6.27	6.50	8.82	21.19
% Sulfate Sulfur	0.31	0.32	0.43	1.03
% Organic Sulfur	0.50	0.52	0.70	1.69
% Total Sulfur	7.08	7.34	9.95	23.91

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2410 °F	°F
Softening (H = W)	2490 °F	°F
Hemispherical (H = ½ W)	2530 °F	°F
Fluid	2650 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 11.99
HARDGROVE GRINDABILITY INDEX = 117 @ 16.20 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY = 1.66

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COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-0466

COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE 11-7-88 LAB NO 880618 - 020

DRILL HOLE JK-12-3 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS. W-246503

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	29.76	31.38		
% Ash	23.06	22.53	32.83	
% Volatile	26.09	25.49	37.15	55.30
% Fixed Carbon	21.09	20.60	30.02	44.70
Btu	5706	5575	8124	12094
% Sulfur	11.96	11.68	17.02	25.34

lbs SUL/MM BTU = 20.95

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	28.79	28.13	40.99
Hydrogen	5.76	5.88	3.46
Nitrogen	0.58	0.57	0.83
Chlorine	0.08	0.08	0.12
Sulfur	11.96	11.68	17.02
Ash	23.06	22.53	32.83
Oxygen (diff)	29.77	31.13	4.75

SULFUR FORMS

% Pyritic Sulfur	11.74	11.47	16.72	24.89
% Sulfate Sulfur	0.19	0.18	0.27	0.40
% Organic Sulfur	0.03	0.03	0.03	0.05
% Total Sulfur	11.96	11.68	17.02	25.34

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1980 °F	°F
Softening (H = W)	1990 °F	°F
Hemispherical (H = ½ W)	2000 °F	°F
Fluid	2130 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 26.31
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY = 1.44
* Insufficient Sample

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COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE 11-7-88 LAB NO 880618 - 021

DRILL HOLE JK-12-4 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS. W - 246504

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	25.53	26.49		
% Ash	41.60	41.06	55.86	
% Volatile	22.48	22.19	30.19	68.40
% Fixed Carbon	10.39	10.26	13.95	31.60
Btu	3685	3637	4948	11210
% Sulfur	3.03	2.99	4.07	9.21

lbs SUL/MM BTU = 8.22

SULFUR FORMS				
% Pyritic Sulfur	2.26	2.24	3.04	6.89
% Sulfate Sulfur	0.02	0.02	0.02	0.05
% Organic Sulfur	0.75	0.73	1.01	2.27
% Total Sulfur	3.03	2.99	4.07	9.21

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2300 °F	°F
Softening (H = W)	2460 °F	°F
Hemispherical (H = ½ W)	2590 °F	°F
Fluid	2650 °F	°F

H is Cone Height / W is Cone Width

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	20.42	20.16	27.42
Hydrogen	4.90	4.98	2.74
Nitrogen	0.40	0.39	0.53
Chlorine	0.10	0.10	0.13
Sulfur	3.03	2.99	4.07
Ash	41.60	41.06	55.86
Oxygen (diff)	29.55	30.32	9.25

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

AIR DRYING LOSS = 19.88
HARDGROVE GRINDABILITY INDEX = 126 @ 8.25 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY = 1.57

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COAL-ANALYSIS REPORT

CA96

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE 12-15-88 LAB NO 880809 - 017

DRILL HOLE JK-12-5 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS: W-246505

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	35.46	35.15		
% Ash	10.43	10.48	16.17	
% Volatile	29.30	29.44	45.39	54.15
% Fixed Carbon	24.81	24.93	38.44	45.85
Btu	6815	6848	10559	12595
% Sulfur	3.49	3.50	5.40	6.44

lbs SUL/MM BTU = 5.11

SULFUR FORMS				
% Pyritic Sulfur	1.98	1.99	3.07	3.66
% Sulfate Sulfur	0.36	0.36	0.56	0.66
% Organic Sulfur	1.15	1.15	1.77	2.12
% Total Sulfur	3.49	3.50	5.40	6.44

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	39.66	39.85	61.45
Hydrogen	6.68	6.66	4.20
Nitrogen	1.01	1.01	1.56
Chlorine	0.09	0.09	0.14
Sulfur	3.49	3.50	5.40
Ash	10.43	10.48	16.17
Oxygen (diff)	38.64	38.41	11.08

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos. pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2010 °F	°F
Softening (H = W)	2040 °F	°F
Hemispherical (H = ½ W)	2050 °F	°F
Fluid	2300 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 18.16
HARDGROVE GRINDABILITY INDEX = 79 @ 20.76 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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Jerry Rollins
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COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE 12-15-88 LAB NO 880809 - 018

DRILL HOLE JK-12-6 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS: U.S. 246506

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	28.28	27.49		
% Ash	28.43	28.74	39.64	
% Volatile	28.49	28.80	39.72	65.80
% Fixed Carbon	14.80	14.97	20.64	34.20
Btu	5057	5113	7051	11681
% Sulfur	5.19	5.25	7.24	11.99

lbs SUL/MM BTU = 10.27

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	29.37	29.69	40.95
Hydrogen	5.47	5.41	3.21
Nitrogen	0.59	0.59	0.82
Chlorine	0.07	0.07	0.10
Sulfur	5.19	5.25	7.24
Ash	28.43	28.74	39.64
Oxygen (diff)	30.88	30.25	8.04

SULFUR FORMS				
% Pyritic Sulfur	3.61	3.65	5.03	8.34
% Sulfate Sulfur	0.63	0.63	0.87	1.45
% Organic Sulfur	0.95	0.97	1.34	2.20
% Total Sulfur	5.19	5.25	7.24	11.99

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2160 °F	°F
H is Cone Height / W is Cone Width — Softening (H = W)	2320 °F	°F
Hemispherical (H = ½ W)	2380 °F	°F
Fluid	2410 °F	°F

AIR DRYING LOSS = 18.88
HARDGROVE GRINDABILITY INDEX = 91 @ 10.62 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL-ANALYSIS REPORT

CH90

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE 12-15-88 LAB. NO 880809 - 019

DRILL HOLE JK-12-7 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS. W-246507

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	23.54	24.22		
% Ash	48.34	47.91	63.22	
% Volatile	18.46	18.29	24.14	65.63
% Fixed Carbon	9.66	9.58	12.64	34.37
Btu	2398	2376	3136	8526
% Sulfur	7.36	7.29	9.63	26.17

lbs SUL/MM BTU = 30.68

SULFUR FORMS				
% Pyritic Sulfur	5.91	5.86	7.73	21.02
% Sulfate Sulfur	0.63	0.62	0.82	2.23
% Organic Sulfur	0.82	0.81	1.08	2.92
% Total Sulfur	7.36	7.29	9.63	26.17

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	12.68	12.57	16.59
Hydrogen	4.14	4.20	1.97
Nitrogen	0.24	0.24	0.32
Chlorine	0.09	0.09	0.12
Sulfur	7.36	7.29	9.63
Ash	48.34	47.91	63.22
Oxygen (diff)	27.15	27.70	8.15

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2470 °F	°F
Softening (H = W)	2580 °F	°F
Hemispherical (H = ½ W)	>2700 °F	°F
Fluid	>2700 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 19.31
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

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COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE 12-15-88 LAB NO 880809 - 016

DRILL HOLE JK-12-8 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS. W-246508

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	34.32	36.02		
% Ash	4.48	4.36	6.82	
% Volatile	31.22	30.41	47.53	51.01
% Fixed Carbon	29.98	29.21	45.65	48.99
Btu	8071	7862	12289	13188
% Sulfur	0.26	0.26	0.40	0.43

lbs SUL/MM BTU = 0.33

SULFUR FORMS				
% Pyritic Sulfur	0.01	0.01	0.01	0.01
% Sulfate Sulfur	0.02	0.02	0.04	0.04
% Organic Sulfur	0.23	0.23	0.35	0.38
% Total Sulfur	0.26	0.26	0.40	0.43

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2000 °F	°F
Softening (H = W)	2090 °F	°F
Hemispherical (H = ½ W)	2100 °F	°F
Fluid	2150 °F	°F

H is Cone Height
W is Cone Width

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	47.78	46.55	72.75
Hydrogen	7.30	7.40	5.26
Nitrogen	0.59	0.58	0.90
Chlorine	0.09	0.09	0.13
Sulfur	0.26	0.26	0.40
Ash	4.48	4.36	6.82
Oxygen (diff)	39.50	40.76	13.74

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

AIR DRYING LOSS = 21.79
HARDGROVE GRINDABILITY INDEX = 73 @ 18.20 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 001

Drill Hole : JK-13-1 Int : Thickness :

W250660

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	22.51	26.15		
% Ash	21.25	20.25	27.42	
% Volatile	32.11	30.60	41.43	57.09
% Fixed Carbon	24.13	23.00	31.15	42.91
Btu	7329	6985	9458	13032
% Sulfur	1.72	1.64	2.23	3.07

lbs SUL/MM BTU = 2.35

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	40.77	38.86	52.61
Hydrogen	6.16	6.40	4.70
Nitrogen	0.92	0.88	1.19
Chlorine	0.03	0.03	0.04
Sulfur	1.72	1.64	2.23
Ash	21.25	20.25	27.42
Oxygen (diff)	29.15	31.94	11.81

SULFUR FORMS				
% Pyritic Sulfur	1.20	1.15	1.55	2.14
% Sulfate Sulfur	0.15	0.15	0.20	0.27
% Organic Sulfur	0.37	0.34	0.48	0.66
% Total Sulfur	1.72	1.64	2.23	3.07

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH		Reducing	Oxidizing
	Initial Deformation	2480 °F	°F
H is Cone Height / W is Cone Width	Softening (H = W)	2510 °F	°F
	Hemispherical (H = ½ W)	2530 °F	°F
	Fluid	2550 °F	°F

AIR DRYING LOSS = 22.48
HARDGROVE GRINDABILITY INDEX = 52 @ 4.74 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 002

Drill Hole : JK-13-2- Int : Thickness :

W 250661

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	28.90	32.93		
% Ash	10.48	9.89	14.74	
% Volatile	28.94	27.30	40.70	47.74
% Fixed Carbon	31.68	29.88	44.56	52.26
Btu	7873	7426	11073	12987
% Sulfur	1.99	1.87	2.79	3.27

lbs SUL/MM BTU = 2.52

SULFUR FORMS				
% Pyritic Sulfur	1.19	1.13	1.68	1.97
% Sulfate Sulfur	0.15	0.14	0.20	0.24
% Organic Sulfur	0.65	0.60	0.91	1.06
% Total Sulfur	1.99	1.87	2.79	3.27

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	44.99	42.44	63.27
Hydrogen	6.27	6.55	4.27
Nitrogen	1.03	0.97	1.45
Chlorine	0.04	0.04	0.06
Sulfur	1.99	1.87	2.79
Ash	10.48	9.89	14.74
Oxygen (diff)	35.20	38.24	13.42

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2020 °F	°F
Softening (H = W)	2040 °F	°F
Hemispherical (H = ½ W)	2070 °F	°F
Fluid	2100 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 23.88
HARDGROVE GRINDABILITY INDEX = 64 @ 11.89 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL & OIL SHALE ANALYSTS
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COAL-ANALYSIS REPORT

CA 96

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE 6-21-88 LAB NO 880303 - 030

DRILL HOLE JK-14-A SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS: W- 246509

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	30.40	33.36		
% Ash	10.66	10.20	15.31	
% Volatile	31.57	30.23	45.36	53.56
% Fixed Carbon	27.37	26.21	39.33	46.44
Btu	7854	7520	11285	13325
% Sulfur	2.25	2.15	3.23	3.82

lbs SUL/MM BTU = 2.86

SULFUR FORMS				
% Pyritic Sulfur	1.94	1.86	2.79	3.30
% Sulfate Sulfur	0.04	0.04	0.05	0.06
% Organic Sulfur	0.27	0.25	0.39	0.46
% Total Sulfur	2.25	2.15	3.23	3.82

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	43.79	41.93	62.91
Hydrogen	6.66	6.86	4.69
Nitrogen	0.91	0.87	1.31
Chlorine	0.06	0.06	0.09
Sulfur	2.25	2.15	3.23
Ash	10.66	10.20	15.31
Oxygen (diff)	35.67	37.93	12.46

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos. pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1940 °F	°F
Softening (H = W)	1970 °F	°F
Hemispherical (H = ½ W)	1990 °F	°F
Fluid	2050 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 28.94
HARDGROVE GRINDABILITY INDEX = 50 @ 6.22 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL-ANALYSIS REPORT

CF96

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE 6-21-88 LAB NO 880303 - 031

DRILL HOLE JK-14-B1 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS W-246510

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	31.93	36.90		
% Ash	5.31	4.92	7.80	
% Volatile	30.81	28.56	45.26	49.08
% Fixed Carbon	31.95	29.62	46.94	50.92
Btu	8269	7665	12148	13175
% Sulfur	0.89	0.83	1.31	1.42

lbs SUL/MM BTU = 1.08

SULFUR FORMS				
% Pyritic Sulfur	0.43	0.40	0.63	0.69
% Sulfate Sulfur	0.03	0.03	0.04	0.05
% Organic Sulfur	0.43	0.40	0.64	0.68
% Total Sulfur	0.89	0.83	1.31	1.42

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	47.37	43.91	69.59
Hydrogen	6.95	7.26	4.96
Nitrogen	0.97	0.90	1.42
Chlorine	0.07	0.06	0.10
Sulfur	0.89	0.83	1.31
Ash	5.31	4.92	7.80
Oxygen (diff)	38.44	42.12	14.82

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos. pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1920 °F	°F
Softening (H = W)	2070 °F	°F
Hemispherical (H = ½ W)	2090 °F	°F
Fluid	2130 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 32.11
HARDGROVE GRINDABILITY INDEX = 61 @ 7.06 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

CF 96

DATE 11-7-88 LAB. NO 880618 - 024

DRILL HOLE JK-14-CS SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS: D - 2465'

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	26.59	26.88		
% Ash	40.02	39.87	54.52	
% Volatile	19.93	19.85	27.15	59.70
% Fixed Carbon	13.46	13.40	18.33	40.30
Btu	3464	3450	4718	10374
% Sulfur	3.99	3.97	5.43	11.94

lbs SUL/MM BTU = 11.51

SULFUR FORMS				
% Pyritic Sulfur	3.48	3.47	4.75	10.43
% Sulfate Sulfur	0.08	0.08	0.10	0.23
% Organic Sulfur	0.43	0.42	0.58	1.28
% Total Sulfur	3.99	3.97	5.43	11.94

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	20.63	20.54	28.10
Hydrogen	5.05	5.07	2.82
Nitrogen	0.42	0.42	0.57
Chlorine	0.05	0.05	0.07
Sulfur	3.99	3.97	5.43
Ash	40.02	39.87	54.52
Oxygen (diff)	29.84	30.08	8.49

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos. pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH

	Reducing	Oxidizing
Initial Deformation	2360 °F	°F
Softening (H = W)	2570 °F	°F
Hemispherical (H = ½ W)	2600 °F	°F
Fluid	2670 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 24.08
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY = 1.53
* Insufficient Sample

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DICKINSON LABORATORIES, INC.

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DICKINSON LABORATORIES, INC.
COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-9466

COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

CA96

DATE 11-7-88 LAB NO 880618 - 022

DRILL HOLE JK-14-B2 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS: W - 246512

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	34.71	37.53		
% Ash	3.58	3.43	5.49	
% Volatile	31.00	29.67	47.49	50.24
% Fixed Carbon	30.71	29.37	47.02	49.76
Btu	8188	7834	12541	13269
% Sulfur	0.58	0.56	0.89	0.94

lbs SUL/MM BTU = 0.71

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	51.17	48.96	78.38
Hydrogen	7.10	7.28	4.93
Nitrogen	0.95	0.90	1.45
Chlorine	0.06	0.06	0.10
Sulfur	0.58	0.56	0.89
Ash	3.58	3.43	5.49
Oxygen (diff)	36.56	38.81	8.76

SULFUR FORMS				
% Pyritic Sulfur	0.14	0.13	0.21	0.22
% Sulfate Sulfur	0.04	0.03	0.06	0.06
% Organic Sulfur	0.40	0.40	0.62	0.66
% Total Sulfur	0.58	0.56	0.89	0.94

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos. pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2180 °F	°F
Softening (H = W)	2200 °F	°F
Hemispherical (H = ½ W)	2210 °F	°F
Fluid	2240 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 13.03
RDGROVE GRINDABILITY INDEX = 76 @ 28.17 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY = 1.21

DICKINSON LABORATORIES, INC.
COAL & OIL SHALE ANALYSTS
P.O. BOX 12008 EL PASO, TEXAS 79913-0008 915/584-9406

Jerry Rollins
DICKINSON LABORATORIES, INC.

COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE 11-7-88 LAB NO 880618 - 023

DRILL HOLE JK-14-B3 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS. U - 34165 13

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	32.63	34.54		
% Ash	2.70	2.62	4.00	
% Volatile	13.41	13.03	19.90	20.73
% Fixed Carbon	51.26	49.81	76.10	79.27
Btu	8695	8448	12906	13444
% Sulfur	0.30	0.29	0.44	0.46

lbs SUL/MM BTU = 0.34

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	51.18	49.73	75.97
Hydrogen	6.91	7.03	4.84
Nitrogen	1.04	1.01	1.54
Chlorine	0.04	0.04	0.07
Sulfur	0.30	0.29	0.44
Ash	2.70	2.62	4.00
Oxygen (diff)	37.83	39.28	13.14

SULFUR FORMS				
% Pyritic Sulfur	0.01	0.01	0.01	0.01
% Sulfate Sulfur	0.14	0.14	0.21	0.22
% Organic Sulfur	0.15	0.14	0.22	0.23
% Total Sulfur	0.30	0.29	0.44	0.46

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2150 °F	°F
Softening (H = W)	2570 °F	°F
Hemispherical (H = ½ W)	2580 °F	°F
Fluid	2590 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 14.62
HARDGROVE GRINDABILITY INDEX = 66 @ 23.33 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY = 1.22

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DICKINSON LABORATORIES, INC.
COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-0466

COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 030

Drill Hole : JK-16.1 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	26.52	33.91		
% Ash	10.80	9.71	14.69	
% Volatile	30.65	27.57	41.71	48.90
% Fixed Carbon	32.03	28.81	43.60	51.10
Btu	8105	7290	11030	12930
% Sulfur	3.59	3.23	4.88	5.73

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	45.89	41.28	62.46
Hydrogen	6.32	6.81	4.56
Nitrogen	1.05	0.95	1.43
Chlorine	0.09	0.08	0.12
Sulfur	3.59	3.23	4.88
Ash	10.80	9.71	14.69
Oxygen (diff)	32.26	37.94	11.86

lbs SUL/MM BTU = 4.43

SULFUR FORMS
% Pyritic Sulfur *
% Sulfate Sulfur *
% Organic Sulfur
% Total Sulfur

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2020 °F	°F
Softening (H = W)	2050 °F	°F
Hemispherical (H = ½ W)	2070 °F	°F
Fluid	2090 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 29.37
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

Terry Rollins
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COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 031

Drill Hole : JK-16.2 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	28.30	34.00		
% Ash	6.26	5.76	8.73	
% Volatile	32.79	30.19	45.74	50.11
% Fixed Carbon	32.65	30.05	45.53	49.89
Btu	8740	8045	12190	13356
% Sulfur	1.43	1.31	1.99	2.18

lbs SUL/MM BTU = 1.63

SULFUR FORMS				
% Pyritic Sulfur	0.89	0.82	1.25	1.37
% Sulfate Sulfur	0.15	0.13	0.20	0.22
% Organic Sulfur	0.39	0.36	0.54	0.59
% Total Sulfur	1.43	1.31	1.99	2.18

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2190 °F	°F
Softening (H = W)	2210 °F	°F
Hemispherical (H = ½ W)	2220 °F	°F
Fluid	2230 °F	°F

H is Cone Height / W is Cone Width

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	49.58	45.63	69.14
Hydrogen	6.80	7.15	5.07
Nitrogen	1.25	1.15	1.74
Chlorine	0.07	0.06	0.10
Sulfur	1.43	1.31	1.99
Ash	6.26	5.76	8.73
Oxygen (diff)	34.61	38.94	13.23

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos. pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

AIR DRYING LOSS = 29.04
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

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COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 032

Drill Hole : JK-16.3 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	28.91	34.80		
% Ash	4.11	3.77	5.78	
% Volatile	32.90	30.18	46.29	49.13
% Fixed Carbon	34.08	31.25	47.93	50.87
Btu	8895	8158	12512	13280
% Sulfur	0.99	0.91	1.39	1.48

lbs SUL/MM BTU = 1.12

SULFUR FORMS				
% Pyritic Sulfur	0.41	0.37	0.57	0.61
% Sulfate Sulfur	0.12	0.11	0.16	0.17
% Organic Sulfur	0.46	0.43	0.66	0.70
% Total Sulfur	0.99	0.91	1.39	1.48

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	51.83	47.53	72.91
Hydrogen	6.74	7.11	4.93
Nitrogen	1.11	1.02	1.57
Chlorine	0.09	0.08	0.13
Sulfur	0.99	0.91	1.39
Ash	4.11	3.77	5.78
Oxygen (diff)	35.13	39.58	13.29

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2150 °F	°F
Softening (H = W)	2180 °F	°F
Hemispherical (H = ½ W)	2190 °F	°F
Fluid	2200 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 29.51
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

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COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 033

Drill Hole : JK-16.4 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	24.91	29.92		
% Ash	8.74	8.16	11.64	
% Volatile	34.77	32.45	46.31	52.41
% Fixed Carbon	31.58	29.47	42.05	47.59
Btu	9002	8401	11988	13567
% Sulfur	3.80	3.55	5.06	5.73

lbs SUL/MM BTU = 4.23

SULFUR FORMS				
% Pyritic Sulfur	2.79	2.60	3.71	4.20
% Sulfate Sulfur	0.09	0.08	0.12	0.13
% Organic Sulfur	0.92	0.87	1.23	1.40
% Total Sulfur	3.80	3.55	5.06	5.73

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2110 °F	°F
Softening (H = W)	2120 °F	°F
Hemispherical (H = ½ W)	2140 °F	°F
Fluid	2160 °F	°F

H is Cone Height / W is Cone Width

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	51.06	47.65	67.99
Hydrogen	6.24	6.57	4.60
Nitrogen	1.08	1.01	1.44
Chlorine	0.09	0.08	0.12
Sulfur	3.80	3.55	5.06
Ash	8.74	8.16	11.64
Oxygen (diff)	28.99	32.98	9.15

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

AIR DRYING LOSS = 25.43
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

Jerry Rollins
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DICKINSON LABORATORIES, INC.
COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-0496

COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 034

Drill Hole : JK-16.5 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	25.09	28.47		
% Ash	25.18	24.04	33.61	
% Volatile	24.70	23.58	32.97	49.67
% Fixed Carbon	25.03	23.91	33.42	50.33
Btu	6094	5819	8136	12255
% Sulfur	6.42	6.13	8.56	12.90

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	34.10	32.56	45.52
Hydrogen	5.36	5.62	3.40
Nitrogen	0.73	0.70	0.98
Chlorine	0.09	0.08	0.12
Sulfur	6.42	6.13	8.56
Ash	25.18	24.04	33.61
Oxygen (diff)	28.12	30.87	7.81

lbs SUL/MM BTU = 10.53

SULFUR FORMS
% Pyritic Sulfur *
% Sulfate Sulfur *
% Organic Sulfur
% Total Sulfur

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1930 °F	°F
Softening (H = W)	1960 °F	°F
Hemispherical (H = ½ W)	1970 °F	°F
Fluid	1990 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 24.75
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = *
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

Terry Rollins
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DICKINSON LABORATORIES, INC.
COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-0466

COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 035

Drill Hole : JK-16.6 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	25.99	30.42		
% Ash	16.13	15.17	21.80	
% Volatile	29.25	27.50	39.53	50.54
% Fixed Carbon	28.63	26.91	38.67	49.46
Btu	7610	7155	10282	13148
% Sulfur	5.97	5.61	8.06	10.31

lbs SUL/MM BTU = 7.84

SULFUR FORMS				
% Pyritic Sulfur	4.86	4.57	6.56	8.39
% Sulfate Sulfur	0.01	0.01	0.01	0.01
% Organic Sulfur	1.10	1.03	1.49	1.91
% Total Sulfur	5.97	5.61	8.06	10.31

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1960 °F	°F
Softening (H = W)	1980 °F	°F
Hemispherical (H = ½ W)	1990 °F	°F
Fluid	2000 °F	°F

H is Cone Height / W is Cone Width

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	42.39	39.85	57.27
Hydrogen	5.89	6.21	4.03
Nitrogen	0.97	0.91	1.30
Chlorine	0.07	0.07	0.10
Sulfur	5.97	5.61	8.06
Ash	16.13	15.17	21.80
Oxygen (diff)	28.58	32.18	7.44

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	

BASE/ACID RATIO

AIR DRYING LOSS = 25.00
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

Terry Rollins
DICKINSON LABORATORIES, INC.

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DICKINSON LABORATORIES, INC.
COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-0466

COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 036

Drill Hole : JK-16.7 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	30.62	32.92		
% Ash	16.43	15.88	23.68	
% Volatile	26.83	25.94	38.67	50.66
% Fixed Carbon	26.12	25.26	37.65	49.34
Btu	6683	6461	9633	12621
% Sulfur	3.56	3.44	5.13	6.73

lbs SUL/MM BTU = 5.32

SULFUR FORMS				
% Pyritic Sulfur	2.48	2.39	3.57	4.68
% Sulfate Sulfur	0.04	0.04	0.05	0.07
% Organic Sulfur	1.04	1.01	1.51	1.98
% Total Sulfur	3.56	3.44	5.13	6.73

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	37.88	36.63	54.60
Hydrogen	6.47	6.62	4.38
Nitrogen	0.87	0.84	1.26
Chlorine	0.07	0.06	0.10
Sulfur	3.56	3.44	5.13
Ash	16.43	15.88	23.68
Oxygen (diff)	34.72	36.53	10.85

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2070 °F	°F
Softening (H = W)	2100 °F	°F
Hemispherical (H = ½ W)	2130 °F	°F
Fluid	2180 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 28.55
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

Terry Rollins
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DICKINSON LABORATORIES, INC.
COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-9496

COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 037

Drill Hole : JK-16.8 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	25.79	29.68		
% Ash	34.05	32.26	45.88	
% Volatile	21.54	20.41	29.02	53.63
% Fixed Carbon	18.62	17.65	25.10	46.37
Btu	4659	4415	6279	11602
% Sulfur	2.27	2.15	3.06	5.65

lbs SUL/MM BTU = 4.87

SULFUR FORMS				
% Pyritic Sulfur	1.62	1.54	2.19	4.04
% Sulfate Sulfur	0.04	0.04	0.05	0.10
% Organic Sulfur	0.61	0.57	0.82	1.51
% Total Sulfur	2.27	2.15	3.06	5.65

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	27.74	26.29	37.38
Hydrogen	5.28	5.59	3.23
Nitrogen	0.68	0.64	0.91
Chlorine	0.02	0.01	0.02
Sulfur	2.27	2.15	3.06
Ash	34.05	32.26	45.88
Oxygen (diff)	29.96	33.06	9.52

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	>2700 °F	°F
Softening (H = W)	>2700 °F	°F
Hemispherical (H = ½ W)	>2700 °F	°F
Fluid	>2700 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 25.38
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

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COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-0466

COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 038

Drill Hole : JK-16.9 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	30.73	32.01		
% Ash	12.28	12.05	17.72	
% Volatile	28.27	27.75	40.82	49.61
% Fixed Carbon	28.72	28.19	41.46	50.39
Btu	7445	7307	10747	13063
% Sulfur	2.34	2.29	3.37	4.10

lbs SUL/MM BTU = 3.13

SULFUR FORMS				
% Pyritic Sulfur	2.28	2.23	3.28	3.99
% Sulfate Sulfur	0.03	0.03	0.04	0.05
% Organic Sulfur	0.03	0.03	0.05	0.06
% Total Sulfur	2.34	2.29	3.37	4.10

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2000 °F	°F
Softening (H = W)	2010 °F	°F
Hemispherical (H = ½ W)	2020 °F	°F
Fluid	2060 °F	°F

H is Cone Height / W is Cone Width

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	42.77	41.98	61.74
Hydrogen	6.36	6.45	4.22
Nitrogen	0.87	0.85	1.26
Chlorine	0.04	0.04	0.06
Sulfur	2.34	2.29	3.37
Ash	12.28	12.05	17.72
Oxygen (diff)	35.34	36.34	11.63

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

AIR DRYING LOSS = 25.06
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

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COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-0496

COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 039

Drill Hole : JK-16.10 Int : Thickness :

W250658

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	26.66	29.83		
% Ash	5.97	5.71	8.14	
% Volatile	34.29	32.81	46.76	50.90
% Fixed Carbon	33.08	31.65	45.10	49.10
Btu	9205	8807	12552	13663
% Sulfur	1.16	1.11	1.58	1.72

lbs SUL/MM BTU = 1.26

ULTIMATE ANALYSIS	E.M basis	As received	Dry basis
Moisture			
Carbon	52.04	49.79	70.96
Hydrogen	6.43	6.64	4.70
Nitrogen	1.10	1.06	1.51
Chlorine	0.03	0.03	0.05
Sulfur	1.16	1.11	1.58
Ash	5.97	5.71	8.14
Oxygen (diff)	33.27	35.66	13.06

SULFUR FORMS				
% Pyritic Sulfur	0.63	0.60	0.85	0.93
% Sulfate Sulfur	0.01	0.01	0.01	0.01
% Organic Sulfur	0.52	0.50	0.72	0.78
% Total Sulfur	1.16	1.11	1.58	1.72

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

MINERAL ANALYSIS	% Wt Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1980 °F	°F
Softening (H = W)	1990 °F	°F
Hemispherical (H = ½ W)	2000 °F	°F
Fluid	2010 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 16.76
HARDGROVE GRINDABILITY INDEX = 51 @ 15.70 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

DICKINSON LABORATORIES, INC.
COAL & OIL SHALE ANALYSTS

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COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 040

Drill Hole : JK-16.11 Int : Thickness :

W250659

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	28.40	27.56		
% Ash	30.07	30.42	41.99	
% Volatile	22.87	23.14	31.94	55.06
% Fixed Carbon	18.66	18.88	26.07	44.94
Btu	5012	5071	7001	12068
% Sulfur	1.08	1.09	1.51	2.61

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	28.59	28.93	39.94
Hydrogen	5.63	5.56	3.42
Nitrogen	0.69	0.69	0.96
Chlorine	0.02	0.02	0.03
Sulfur	1.08	1.09	1.51
Ash	30.07	30.42	41.99
Oxygen (diff)	33.92	33.29	12.15

lbs SUL/MM BTU = 2.15

SULFUR FORMS
% Pyritic Sulfur *
% Sulfate Sulfur *
% Organic Sulfur
% Total Sulfur

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1960 °F	°F
Softening (H = W)	1980 °F	°F
Hemispherical (H = ½ W)	2000 °F	°F
Fluid	2010 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 22.89
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =
* Insufficient Sample

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COAL & OIL SHALE ANALYSTS
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COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 041

Drill Hole : JK-16.12 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	21.98	25.78		
% Ash	36.37	34.60	46.62	
% Volatile	20.76	19.75	26.61	49.85
% Fixed Carbon	20.89	19.87	26.77	50.15
Btu	4793	4560	6144	11509
% Sulfur	5.44	5.18	6.97	13.06

lbs SUL/MM BTU = 11.36

SULFUR FORMS				
% Pyritic Sulfur	4.40	4.19	5.64	10.56
% Sulfate Sulfur	0.14	0.13	0.18	0.33
% Organic Sulfur	0.90	0.86	1.15	2.17
% Total Sulfur	5.44	5.18	6.97	13.06

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	26.74	25.43	34.27
Hydrogen	4.52	4.85	2.64
Nitrogen	0.34	0.32	0.43
Chlorine	0.02	0.02	0.02
Sulfur	5.44	5.18	6.97
Ash	36.37	34.60	46.62
Oxygen (diff)	26.57	29.60	9.05

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos. pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2020 °F	°F
Softening (H = W)	2040 °F	°F
Hemispherical (H = ½ W)	2050 °F	°F
Fluid	2070 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 22.05
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

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COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 042

Drill Hole : JK-16.13 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	24.72	30.69		
% Ash	14.38	13.24	19.10	
% Volatile	30.37	27.96	40.34	49.86
% Fixed Carbon	30.53	28.11	40.56	50.14
Btu	7992	7358	10617	13122
% Sulfur	3.43	3.16	4.56	5.64

lbs SUL/MM BTU = 4.29

SULFUR FORMS				
% Pyritic Sulfur	1.97	1.81	2.62	3.24
% Sulfate Sulfur	0.14	0.13	0.18	0.22
% Organic Sulfur	1.32	1.22	1.76	2.18
% Total Sulfur	3.43	3.16	4.56	5.64

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2060 °F	°F
Softening (H = W)	2080 °F	°F
Hemispherical (H = ½ W)	2110 °F	°F
Fluid	2210 °F	°F

H is Cone Height / W is Cone Width

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	44.87	41.31	59.61
Hydrogen	6.21	6.61	4.58
Nitrogen	1.00	0.92	1.33
Chlorine	0.02	0.01	0.02
Sulfur	3.43	3.16	4.56
Ash	14.38	13.24	19.10
Oxygen (diff)	30.09	34.75	10.80

MINERAL ANALYSIS	% Wt Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania TiO_2	
Lime CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

AIR DRYING LOSS = 25.94
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

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COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-9466

COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 043

Drill Hole : JK-16.14 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	21.14	26.23		
% Ash	25.68	24.02	32.56	
% Volatile	26.80	25.07	33.99	50.40
% Fixed Carbon	26.38	24.68	33.45	49.60
Btu	6568	6237	8455	12538
% Sulfur	6.72	6.29	8.53	12.64

lbs SUL/MM BTU = 10.08

SULFUR FORMS				
% Pyritic Sulfur	5.35	5.01	6.79	10.06
% Sulfate Sulfur	0.06	0.05	0.07	0.11
% Organic Sulfur	1.31	1.23	1.67	2.47
% Total Sulfur	6.72	6.29	8.53	12.64

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1960 °F	°F
Softening (H = W)	1980 °F	°F
Hemispherical (H = ½ W)	2040 °F	°F
Fluid	2120 °F	°F

H is Cone Height / W is Cone Width

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	36.17	33.83	45.86
Hydrogen	5.35	5.72	3.78
Nitrogen	0.73	0.68	0.93
Chlorine	0.03	0.03	0.04
Sulfur	6.72	6.29	8.53
Ash	25.68	24.02	32.56
Oxygen (diff)	25.32	29.43	8.30

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

AIR DRYING LOSS = 22.26
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

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COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-0496

COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 044

Drill Hole : JK-16.15 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	21.54	27.40		
% Ash	17.31	16.02	22.07	
% Volatile	29.42	27.22	37.49	48.11
% Fixed Carbon	31.73	29.36	40.44	51.89
Btu	7952	7358	10136	13005
% Sulfur	4.55	4.21	5.80	7.45

lbs SUL/MM BTU = 5.72

SULFUR FORMS				
% Pyritic Sulfur	3.13	2.90	3.99	5.12
% Sulfate Sulfur	0.04	0.04	0.05	0.07
% Organic Sulfur	1.38	1.27	1.76	2.26
% Total Sulfur	4.55	4.21	5.80	7.45

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2010 °F	°F
Softening (H = W)	2020 °F	°F
Hemispherical (H = ½ W)	2030 °F	°F
Fluid	2110 °F	°F

H is Cone Height / W is Cone Width

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	46.31	42.85	59.03
Hydrogen	5.57	5.99	4.03
Nitrogen	1.00	0.93	1.28
Chlorine	0.02	0.02	0.02
Sulfur	4.55	4.21	5.80
Ash	17.31	16.02	22.07
Oxygen (diff)	25.24	29.98	7.77

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

AIR DRYING LOSS = 22.53
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

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COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 045

Drill Hole : JK-16.16 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	29.28	28.95		
% Ash	11.10	11.15	15.70	
% Volatile	29.43	29.56	41.61	49.36
% Fixed Carbon	30.19	30.34	42.69	50.64
Btu	7912	7949	11188	13270
% Sulfur	4.08	4.10	5.77	6.84

lbs SUL/MM BTU = 5.16

SULFUR FORMS				
% Pyritic Sulfur	2.77	2.78	3.91	4.64
% Sulfate Sulfur	0.10	0.10	0.14	0.16
% Organic Sulfur	1.21	1.22	1.72	2.04
% Total Sulfur	4.08	4.10	5.77	6.84

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1990 °F	°F
Softening (H = W)	2000 °F	°F
Hemispherical (H = ½ W)	2010 °F	°F
Fluid	2050 °F	°F

H is Cone Height / W is Cone Width

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	44.13	44.33	62.40
Hydrogen	6.46	6.43	4.50
Nitrogen	0.90	0.90	1.27
Chlorine	0.05	0.05	0.07
Sulfur	4.08	4.10	5.77
Ash	11.10	11.15	15.70
Oxygen (diff)	33.28	33.04	10.29

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

AIR DRYING LOSS = 18.72
HARDGROVE GRINDABILITY INDEX = 58 @ 12.59 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 046

Drill Hole : JK-18.1 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	35.74	36.33		
% Ash	15.29	15.15	23.79	
% Volatile	25.08	24.85	39.03	51.22
% Fixed Carbon	23.89	23.67	37.18	48.78
Btu	6256	6198	9735	12774
% Sulfur	7.73	7.66	12.03	15.78

lbs SUL/MM BTU = 12.36

SULFUR FORMS				
% Pyritic Sulfur	5.69	5.64	8.86	11.62
% Sulfate Sulfur	0.15	0.14	0.23	0.30
% Organic Sulfur	1.89	1.88	2.94	3.86
% Total Sulfur	7.73	7.66	12.03	15.78

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2420 °F	°F
Softening (H = W)	2450 °F	°F
Hemispherical (H = ½ W)	2460 °F	°F
Fluid	2470 °F	°F

H is Cone Height / W is Cone Width

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	33.56	33.25	52.23
Hydrogen	6.46	6.50	3.83
Nitrogen	0.79	0.78	1.22
Chlorine	0.03	0.03	0.05
Sulfur	7.73	7.66	12.03
Ash	15.29	15.15	23.79
Oxygen (diff)	36.14	36.63	6.85

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos. pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

AIR DRYING LOSS = 27.90
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =
* Insufficient Sample

Terry Rollins
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DICKINSON LABORATORIES, INC.
COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-9466

COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 051

Drill Hole : JK-18.2 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A tree basis
% Moisture	34.15	36.28		
% Ash	14.76	14.28	22.42	
% Volatile	24.76	23.96	37.60	48.47
% Fixed Carbon	26.33	25.48	39.98	51.53
Btu	6366	6160	9667	12460
% Sulfur	5.63	5.45	8.56	11.03

lbs SUL/MM BTU = 8.85

SULFUR FORMS				
% Pyritic Sulfur	3.98	3.85	6.04	7.79
% Sulfate Sulfur	0.04	0.04	0.06	0.07
% Organic Sulfur	1.61	1.56	2.46	3.17
% Total Sulfur	5.63	5.45	8.56	11.03

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2070 °F	°F
Softening (H = W)	2100 °F	°F
Hemispherical (H = ½ W)	2130 °F	°F
Fluid	2170 °F	°F

H is Cone Height / W is Cone Width

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	35.48	34.33	53.88
Hydrogen	6.27	6.43	3.72
Nitrogen	0.58	0.56	0.88
Chlorine	0.10	0.10	0.16
Sulfur	5.63	5.45	8.56
Ash	14.76	14.28	22.42
Oxygen (diff)	37.18	38.85	10.38

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

AIR DRYING LOSS = 27.79
HARDGROVE GRINDABILITY INDEX = 70 @ 11.76 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 052

Drill Hole : JK-18.3 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	27.71	29.36		
% Ash	35.18	34.37	48.66	
% Volatile	20.29	19.83	28.07	54.68
% Fixed Carbon	16.82	16.44	23.27	45.32
Btu	4270	4172	5906	11504
% Sulfur	4.46	4.36	6.17	12.01

lbs SUL/MM BTU = 10.45

SULFUR FORMS				
% Pyritic Sulfur	3.99	3.90	5.53	10.76
% Sulfate Sulfur	0.45	0.44	0.62	1.21
% Organic Sulfur	0.02	0.02	0.02	0.04
% Total Sulfur	4.46	4.36	6.17	12.01

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2020 °F	°F
Softening (H = W)	2060 °F	°F
Hemispherical (H = ½ W)	2140 °F	°F
Fluid	2260 °F	°F

H is Cone Height / W is Cone Width

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	23.83	23.29	32.97
Hydrogen	5.08	5.22	2.73
Nitrogen	0.62	0.60	0.85
Chlorine	0.17	0.17	0.24
Sulfur	4.46	4.36	6.17
Ash	35.18	34.37	48.66
Oxygen (diff)	30.66	31.99	8.38

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

AIR DRYING LOSS = 25.79
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =
* Insufficient Sample

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COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-0496

COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 053

Drill Hole : JK-18.4 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	26.19	33.00		
% Ash	22.33	20.27	30.26	
% Volatile	26.02	23.62	35.26	50.55
% Fixed Carbon	25.46	23.11	34.48	49.45
Btu	6298	5717	8533	12235
% Sulfur	4.95	4.49	6.70	9.61

lbs SUL/MM BTU = 7.85

SULFUR FORMS				
% Pyritic Sulfur	3.84	3.49	5.20	7.46
% Sulfate Sulfur	0.11	0.10	0.15	0.21
% Organic Sulfur	1.00	0.90	1.35	1.94
% Total Sulfur	4.95	4.49	6.70	9.61

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2060 °F	°F
H is Cone Height / W is Cone Width — Softening (H = W)	2080 °F	°F
Hemispherical (H = ½ W)	2160 °F	°F
Fluid	2250 °F	°F

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	34.96	31.74	47.37
Hydrogen	5.74	6.24	3.80
Nitrogen	0.83	0.75	1.12
Chlorine	0.18	0.16	0.25
Sulfur	4.95	4.49	6.70
Ash	22.33	20.27	30.26
Oxygen (diff)	31.01	36.35	10.50

MINERAL ANALYSIS	% Wt Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

AIR DRYING LOSS = 28.27
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =
* Insufficient Sample

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COAL & OIL SHALE ANALYSTS
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COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 054

Drill Hole : JK-18.5 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	31.17	31.88		
% Ash	19.70	19.50	28.62	
% Volatile	24.35	24.10	35.38	49.56
% Fixed Carbon	24.78	24.52	36.00	50.44
Btu	6069	6006	8817	12352
% Sulfur	4.23	4.18	6.14	8.60

lbs SUL/MM BTU = 6.96

SULFUR FORMS				
% Pyritic Sulfur	2.97	2.94	4.32	6.06
% Sulfate Sulfur	0.18	0.18	0.27	0.37
% Organic Sulfur	1.08	1.06	1.55	2.17
% Total Sulfur	4.23	4.18	6.14	8.60

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2000 °F	°F
Softening (H = W)	2020 °F	°F
Hemispherical (H = ½ W)	2030 °F	°F
Fluid	2150 °F	°F

H is Cone Height / W is Cone Width

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	33.95	33.60	49.33
Hydrogen	6.11	6.16	3.81
Nitrogen	0.76	0.75	1.10
Chlorine	0.17	0.17	0.24
Sulfur	4.23	4.18	6.14
Ash	19.70	19.50	28.62
Oxygen (diff)	35.08	35.64	10.76

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

AIR DRYING LOSS = 21.07
HARDGROVE GRINDABILITY INDEX = 71 @ 13.70 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 047

Drill Hole : JK-18.6 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	25.88	25.08		
% Ash	40.87	41.31	55.14	
% Volatile	17.47	17.66	23.57	52.53
% Fixed Carbon	15.78	15.95	21.29	47.47
Btu	3408	3445	4598	10248
% Sulfur	6.74	6.81	9.10	20.27

lbs SUL/MM BTU = 19.77

SULFUR FORMS				
% Pyritic Sulfur	5.41	5.47	7.30	16.28
% Sulfate Sulfur	0.15	0.16	0.21	0.46
% Organic Sulfur	1.18	1.18	1.59	3.53
% Total Sulfur	6.74	6.81	9.10	20.27

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2490 °F	°F
Softening (H = W)	2530 °F	°F
Hemispherical (H = ½ W)	2550 °F	°F
Fluid	2570 °F	°F

H is Cone Height / W is Cone Width

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	19.11	19.31	25.78
Hydrogen	4.58	4.51	2.27
Nitrogen	0.45	0.45	0.60
Chlorine	0.11	0.11	0.15
Sulfur	6.74	6.81	9.10
Ash	40.87	41.31	55.14
Oxygen (diff)	28.14	27.50	6.96

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

AIR DRYING LOSS = 21.94
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

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COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-9496

COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 055

Drill Hole : JK-18.7 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	35.76	32.11		
% Ash	21.59	22.81	33.60	
% Volatile	21.03	22.23	32.74	49.31
% Fixed Carbon	21.62	22.85	33.66	50.69
Btu	5430	5739	8453	12730
% Sulfur	4.57	4.83	7.11	10.71

lbs SUL/MM BTU = 8.42

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	*		
Hydrogen	*		
Nitrogen	*		
Chlorine	*		
Sulfur	*		
Ash	*		
Oxygen (diff)			

SULFUR FORMS

% Pyritic Sulfur	*
% Sulfate Sulfur	*
% Organic Sulfur	
% Total Sulfur	

WATER SOLUBLE ALKALIES

% Na_2O =	
% K_2O =	

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1970 °F	°F
Softening (H = W)	1990 °F	°F
Hemispherical (H = ½ W)	2000 °F	°F
Fluid	2010 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 27.85
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = *
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

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COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-9496

COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 056

Drill Hole : JK-18.8 Int : Thickness :

W250656

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	28.82	32.05		
% Ash	21.87	20.88	30.73	
% Volatile	26.10	24.92	36.67	52.94
% Fixed Carbon	23.21	22.15	32.60	47.06
Btu	6153	5873	8644	12479
% Sulfur	4.68	4.47	6.57	9.49

lbs SUL/MM BTU = 7.61

SULFUR FORMS				
% Pyritic Sulfur	3.45	3.29	4.84	6.99
% Sulfate Sulfur	0.09	0.09	0.13	0.19
% Organic Sulfur	1.14	1.09	1.60	2.31
% Total Sulfur	4.68	4.47	6.57	9.49

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	34.05	32.50	47.84
Hydrogen	5.88	6.12	3.73
Nitrogen	0.72	0.69	1.01
Chlorine	0.14	0.13	0.20
Sulfur	4.68	4.47	6.57
Ash	21.87	20.88	30.73
Oxygen (diff)	32.66	35.21	9.92

MINERAL ANALYSIS	% Wt Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2080 °F	°F
Softening (H = W)	2110 °F	°F
Hemispherical (H = ½ W)	2160 °F	°F
Fluid	2240 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 25.92
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

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COAL & OIL SHALE ANALYSTS
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COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 057

Drill Hole : JK-18.9 Int : Thickness :

W250657

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	33.76	35.17		
% Ash	7.39	7.24	11.16	
% Volatile	28.18	27.58	42.54	47.89
% Fixed Carbon	30.67	30.01	46.30	52.11
Btu	7728	7563	11666	13132
% Sulfur	2.60	2.54	3.92	4.41

lbs SUL/MM BTU = 3.36

SULFUR FORMS				
% Pyritic Sulfur	1.64	1.60	2.47	2.78
% Sulfate Sulfur	0.14	0.14	0.21	0.24
% Organic Sulfur	0.82	0.80	1.24	1.39
% Total Sulfur	2.60	2.54	3.92	4.41

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1950 °F	°F
Softening (H = W)	1960 °F	°F
Hemispherical (H = ½ W)	1970 °F	°F
Fluid	2030 °F	°F

H is Cone Height / W is Cone Width

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	44.84	43.88	67.69
Hydrogen	6.52	6.62	4.13
Nitrogen	1.01	0.98	1.52
Chlorine	0.15	0.15	0.23
Sulfur	2.60	2.54	3.92
Ash	7.39	7.24	11.16
Oxygen (diff)	37.49	38.59	11.35

MINERAL ANALYSIS	% Wt Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina Al_2O_3	
Titania, TiO_2	
Lime CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

AIR DRYING LOSS = 18.59
HARDGROVE GRINDABILITY INDEX = 69 @ 20.36 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 048

Drill Hole : JK-18.10 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	23.42	26.65		
% Ash	26.78	25.65	34.97	
% Volatile	27.05	25.91	35.32	54.31
% Fixed Carbon	22.75	21.79	29.71	45.69
Btu	6567	6290	8575	13186
% Sulfur	1.89	1.81	2.46	3.79

lbs SUL/MM BTU = 2.88

SULFUR FORMS				
% Pyritic Sulfur	1.60	1.53	2.09	3.21
% Sulfate Sulfur	0.17	0.16	0.22	0.33
% Organic Sulfur	0.12	0.12	0.15	0.25
% Total Sulfur	1.89	1.81	2.46	3.79

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	37.21	35.64	48.58
Hydrogen	5.73	5.96	4.06
Nitrogen	0.80	0.77	1.05
Chlorine	0.07	0.07	0.10
Sulfur	1.89	1.81	2.46
Ash	26.78	25.65	34.97
Oxygen (diff)	27.52	30.10	8.78

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2190 °F	°F
H is Cone Height / W is Cone Width — Softening (H = W)	2230 °F	°F
Hemispherical (H = ½ W)	2280 °F	°F
Fluid	2330 °F	°F

AIR DRYING LOSS = 20.72
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

Terry Rollins
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COAL & OIL SHALE ANALYSTS
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COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 058

Drill Hole : JK-18.11 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	28.82	33.18		
% Ash	15.22	14.29	21.39	
% Volatile	28.09	26.37	39.47	50.20
% Fixed Carbon	27.87	26.16	39.14	49.80
Btu	7227	6785	10154	12916
% Sulfur	2.82	2.65	3.97	5.04

lbs SUL/MM BTU = 3.91

SULFUR FORMS				
% Pyritic Sulfur	2.00	1.87	2.81	3.57
% Sulfate Sulfur	0.23	0.21	0.32	0.41
% Organic Sulfur	0.59	0.57	0.84	1.06
% Total Sulfur	2.82	2.65	3.97	5.04

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2090 °F	°F
Softening (H = W)	2120 °F	°F
Hemispherical (H = ½ W)	2170 °F	°F
Fluid	2260 °F	°F

H is Cone Height / W is Cone Width

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	41.07	38.55	57.69
Hydrogen	6.39	6.69	4.45
Nitrogen	0.81	0.76	1.14
Chlorine	0.13	0.12	0.18
Sulfur	2.82	2.65	3.97
Ash	15.22	14.29	21.39
Oxygen (diff)	33.56	36.94	11.18

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

AIR DRYING LOSS = 26.19
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =
* Insufficient Sample

Terry Rollins
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COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-9496

COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 059

Drill Hole : JK-18.12 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	23.40	29.72		
% Ash	25.36	23.27	33.11	
% Volatile	28.09	25.77	36.67	54.82
% Fixed Carbon	23.15	21.24	30.22	45.18
Btu	6455	5923	8427	12599
% Sulfur	1.04	0.95	1.36	2.03

lbs SUL/MM BTU = 1.60

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	36.66	33.64	47.86
Hydrogen	5.78	6.22	4.12
Nitrogen	0.76	0.70	0.99
Chlorine	0.13	0.12	0.17
Sulfur	1.04	0.95	1.36
Ash	25.36	23.27	33.11
Oxygen (diff)	30.27	35.10	12.39

SULFUR FORMS
% Pyritic Sulfur *
% Sulfate Sulfur *
% Organic Sulfur
% Total Sulfur

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	>2700 °F	°F
Softening (H = W)	>2700 °F	°F
Hemispherical (H = ½ W)	>2700 °F	°F
Fluid	>2700 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 24.87
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =
* Insufficient Sample

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COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 060

Drill Hole : JK-18.13 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	27.13	30.35		
% Ash	10.62	10.15	14.57	
% Volatile	34.02	32.52	46.68	54.64
% Fixed Carbon	28.23	26.98	38.75	45.36
Btu	8510	8134	11678	13669
% Sulfur	1.99	1.90	2.73	3.20

lbs SUL/MM BTU = 2.34

SULFUR FORMS				
% Pyritic Sulfur	1.39	1.33	1.91	2.24
% Sulfate Sulfur	0.05	0.05	0.07	0.09
% Organic Sulfur	0.55	0.52	0.75	0.87
% Total Sulfur	1.99	1.90	2.73	3.20

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1960 °F	°F
Softening (H = W)	1980 °F	°F
Hemispherical (H = ½ W)	1990 °F	°F
Fluid	2010 °F	°F

H is Cone Height
W is Cone Width

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	47.32	45.23	64.94
Hydrogen	6.84	7.03	5.22
Nitrogen	0.95	0.91	1.30
Chlorine	0.11	0.10	0.15
Sulfur	1.99	1.90	2.73
Ash	10.62	10.15	14.57
Oxygen (diff)	32.17	34.68	11.09

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos. pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

AIR DRYING LOSS = 25.61
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

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COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 061

Drill Hole : JK-18.14 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	35.41	38.13		
% Ash	4.17	3.99	6.45	
% Volatile	28.16	26.98	43.60	46.61
% Fixed Carbon	32.26	30.90	49.95	53.39
Btu	7960	7625	12324	13174
% Sulfur	2.10	2.02	3.26	3.48

lbs SUL/MM BTU = 2.65

SULFUR FORMS				
% Pyritic Sulfur	0.30	0.29	0.46	0.50
% Sulfate Sulfur	0.41	0.39	0.63	0.68
% Organic Sulfur	1.39	1.34	2.17	2.30
% Total Sulfur	2.10	2.02	3.26	3.48

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	46.73	44.76	72.34
Hydrogen	7.08	7.26	4.83
Nitrogen	1.00	0.96	1.55
Chlorine	0.17	0.16	0.26
Sulfur	2.10	2.02	3.26
Ash	4.17	3.99	6.45
Oxygen (diff)	38.75	40.85	11.31

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1990 °F	°F
Softening (H = W)	2000 °F	°F
Hemispherical (H = ½ W)	2010 °F	°F
Fluid	2030 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 24.52
HARDGROVE GRINDABILITY INDEX = 65 @ 18.03 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 062

Drill Hole : JK-18.15 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	31.21	31.77		
% Ash	10.76	10.67	15.64	
% Volatile	28.68	28.45	41.69	49.42
% Fixed Carbon	29.35	29.11	42.67	50.58
Btu	7663	7600	11139	13203
% Sulfur	3.31	3.28	4.81	5.71

lbs SUL/MM BTU = 4.32

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	42.95	42.61	62.44
Hydrogen	6.77	6.81	4.76
Nitrogen	0.92	0.91	1.33
Chlorine	0.13	0.13	0.19
Sulfur	3.31	3.28	4.81
Ash	10.76	10.67	15.64
Oxygen (diff)	35.16	35.59	10.83

SULFUR FORMS

% Pyritic Sulfur	*
% Sulfate Sulfur	*
% Organic Sulfur	
% Total Sulfur	

WATER SOLUBLE ALKALIES

% Na_2O =	
% K_2O =	

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos. pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2030 °F	°F
Softening (H = W)	2050 °F	°F
Hemispherical (H = ½ W)	2080 °F	°F
Fluid	2100 °F	°F

H is Cone Height
W is Cone Width

AIR DRYING LOSS = 26.68
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

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COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 063

Drill Hole : JK-18.16 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	30.59	33.38		
% Ash	6.80	6.53	9.80	
% Volatile	32.02	30.74	46.14	51.15
% Fixed Carbon	30.59	29.35	44.06	48.85
Btu	8442	8103	12163	13485
% Sulfur	1.28	1.23	1.85	2.05

lbs SUL/MM BTU = 1.52

SULFUR FORMS				
% Pyritic Sulfur	0.58	0.55	0.83	0.92
% Sulfate Sulfur	0.26	0.25	0.38	0.42
% Organic Sulfur	0.44	0.43	0.64	0.71
% Total Sulfur	1.28	1.23	1.85	2.05

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	48.13	46.20	69.35
Hydrogen	6.96	7.13	5.09
Nitrogen	0.99	0.95	1.42
Chlorine	0.13	0.13	0.19
Sulfur	1.28	1.23	1.85
Ash	6.80	6.53	9.80
Oxygen (diff)	35.71	37.83	12.30

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1930 °F	°F
Softening (H = W)	1950 °F	°F
Hemispherical (H = ½ W)	1960 °F	°F
Fluid	1980 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 24.05
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

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COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 064

Drill Hole : JK-18.17 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	25.32	30.46		
% Ash	18.37	17.11	24.60	
% Volatile	29.14	27.14	39.02	51.75
% Fixed Carbon	27.17	25.29	36.38	48.25
Btu	7279	6778	9747	12927
% Sulfur	3.23	3.01	4.33	5.74

lbs SUL/MM BTU = 4.44

SULFUR FORMS				
% Pyritic Sulfur	2.13	1.98	2.85	3.78
% Sulfate Sulfur	0.21	0.20	0.29	0.38
% Organic Sulfur	0.89	0.83	1.19	1.58
% Total Sulfur	3.23	3.01	4.33	5.74

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	40.53	37.74	54.27
Hydrogen	6.10	6.45	4.38
Nitrogen	0.82	0.76	1.10
Chlorine	0.11	0.10	0.15
Sulfur	3.23	3.01	4.33
Ash	18.37	17.11	24.60
Oxygen (diff)	30.84	34.83	11.17

MINERAL ANALYSIS	% Wt.** Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1940 °F	°F
Softening (H = W)	1980 °F	°F
Hemispherical (H = ½ W)	1990 °F	°F
Fluid	2110 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 25.86
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

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COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 049

Drill Hole : JK-18.18 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	29.88	26.13		
% Ash	31.95	33.66	45.56	
% Volatile	19.76	20.82	28.18	51.77
% Fixed Carbon	18.41	19.39	26.26	48.23
Btu	4144	4365	5909	10855
% Sulfur	8.63	9.09	12.31	22.61

lbs SUL/MM BTU = 20.82

SULFUR FORMS				
% Pyritic Sulfur	6.47	6.82	9.23	16.95
% Sulfate Sulfur	0.20	0.21	0.28	0.52
% Organic Sulfur	1.96	2.06	2.80	5.14
% Total Sulfur	8.63	9.09	12.31	22.61

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	22.13	23.32	31.57
Hydrogen	5.29	4.98	2.78
Nitrogen	0.47	0.49	0.67
Chlorine	0.03	0.03	0.04
Sulfur	8.63	9.09	12.31
Ash	31.95	33.66	45.56
Oxygen (diff)	31.50	28.43	7.07

MINERAL ANALYSIS	% Wt Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2200 °F	°F
Softening (H = W)	2250 °F	°F
Hemispherical (H = ½ W)	2270 °F	°F
Fluid	2350 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 22.89
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

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P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-9496

COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 065

Drill Hole : JK-18.19 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	31.77	34.39		
% Ash	8.38	8.06	12.28	
% Volatile	29.31	28.19	42.96	48.98
% Fixed Carbon	30.54	29.36	44.76	51.02
Btu	7959	7653	11664	13297
% Sulfur	2.94	2.82	4.31	4.91

lbs SUL/MM BTU = 3.68

SULFUR FORMS				
% Pyritic Sulfur	1.78	1.72	2.61	2.98
% Sulfate Sulfur	0.10	0.09	0.14	0.16
% Organic Sulfur	1.06	1.01	1.56	1.77
% Total Sulfur	2.94	2.82	4.31	4.91

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2060 °F	°F
Softening (H = W)	2090 °F	°F
Hemispherical (H = ½ W)	2110 °F	°F
Fluid	2120 °F	°F

H is Cone Height / W is Cone Width

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	45.76	44.00	67.07
Hydrogen	6.74	6.91	4.67
Nitrogen	0.90	0.87	1.32
Chlorine	0.12	0.12	0.18
Sulfur	2.94	2.82	4.31
Ash	8.38	8.06	12.28
Oxygen (diff)	35.16	37.22	10.17

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos. pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

AIR DRYING LOSS = 22.39
HARDGROVE GRINDABILITY INDEX = 66 @ 15.46 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 050

Drill Hole : JK-18.20 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	25.41	24.30		
% Ash	38.51	39.08	51.63	
% Volatile	19.25	19.53	25.80	53.34
% Fixed Carbon	16.83	17.09	22.57	46.66
Btu	4145	4207	5557	11488
% Sulfur	5.18	5.26	6.95	14.36

lbs SUL/MM BTU = 12.50

SULFUR FORMS				
% Pyritic Sulfur	3.86	3.92	5.17	10.69
% Sulfate Sulfur	0.05	0.06	0.07	0.15
% Organic Sulfur	1.27	1.28	1.71	3.52
% Total Sulfur	5.18	5.26	6.95	14.36

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	23.70	24.05	31.77
Hydrogen	4.70	4.61	2.49
Nitrogen	0.48	0.49	0.65
Chlorine	0.05	0.05	0.06
Sulfur	5.18	5.26	6.95
Ash	38.51	39.08	51.63
Oxygen (diff)	27.38	26.46	6.45

MINERAL ANALYSIS	% Wt Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2340 °F	°F
H is Cone Height / W is Cone Width — Softening (H = W)	2370 °F	°F
Hemispherical (H = ½ W)	2390 °F	°F
Fluid	2400 °F	°F

AIR DRYING LOSS = 21.05
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =
* Insufficient Sample

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COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-0466

COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 003

Drill Hole : JK-19-19.1 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	21.24	22.45		
% Ash	56.56	55.69	71.82	
% Volatile	16.15	15.90	20.51	72.76
% Fixed Carbon	6.05	5.96	7.67	27.24
Btu	1756	1729	2230	7911
% Sulfur	0.42	0.41	0.53	1.87

lbs SUL/MM BTU = 2.37

SULFUR FORMS				
% Pyritic Sulfur	0.23	0.22	0.29	1.03
% Sulfate Sulfur	0.06	0.06	0.07	0.26
% Organic Sulfur	0.13	0.13	0.17	0.58
% Total Sulfur	0.42	0.41	0.53	1.87

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	11.59	11.41	14.71
Hydrogen	3.90	4.02	1.94
Nitrogen	0.30	0.30	0.38
Chlorine	0.06	0.06	0.07
Sulfur	0.42	0.41	0.53
Ash	56.56	55.69	71.82
Oxygen (diff)	27.17	28.11	10.55

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania TiO_2	
Lime CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	>2700 °F	°F
Softening (H = W)	>2700 °F	°F
Hemispherical (H = ½ W)	>2700 °F	°F
Fluid	>2700 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 19.76
HARDGROVE GRINDABILITY INDEX = 157 @ 3.35 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-9496

COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 004

Drill Hole : JK-19-19.2 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	23.43	23.44		
% Ash	51.80	51.79	67.65	
% Volatile	16.09	16.09	21.02	64.97
% Fixed Carbon	8.68	8.68	11.33	35.03
Btu	2003	2003	2616	8088
% Sulfur	0.40	0.40	0.52	1.62

lbs SUL/MM BTU = 2.00

SULFUR FORMS				
% Pyritic Sulfur	0.15	0.15	0.20	0.61
% Sulfate Sulfur	0.06	0.06	0.08	0.24
% Organic Sulfur	0.19	0.19	0.24	0.77
% Total Sulfur	0.40	0.40	0.52	1.62

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	13.24	13.24	17.30
Hydrogen	4.31	4.31	2.20
Nitrogen	0.33	0.33	0.44
Chlorine	0.08	0.08	0.10
Sulfur	0.40	0.40	0.52
Ash	51.80	51.79	67.65
Oxygen (diff)	29.84	29.85	11.79

MINERAL ANALYSIS	% Wt Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	>2700 °F	°F
Softening (H = W)	>2700 °F	°F
Hemispherical (H = ½ W)	>2700 °F	°F
Fluid	>2700 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 16.50
HARDGROVE GRINDABILITY INDEX = 123 @ 8.31 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 005

Drill Hole : JK-19-19.3 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	35.24	34.72		
% Ash	21.34	21.51	32.95	
% Volatile	21.55	21.73	33.28	49.64
% Fixed Carbon	21.87	22.04	33.77	50.36
Btu	5068	5109	7826	11672
% Sulfur	3.58	3.61	5.53	8.24

lbs SUL/MM BTU = 7.07

SULFUR FORMS				
% Pyritic Sulfur	2.51	2.53	3.87	5.78
% Sulfate Sulfur	0.28	0.28	0.43	0.65
% Organic Sulfur	0.79	0.80	1.23	1.81
% Total Sulfur	3.58	3.61	5.53	8.24

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2080 °F	°F
Softening (H = W)	2100 °F	°F
Hemispherical (H = ½ W)	2140 °F	°F
Fluid	2150 °F	°F

H is Cone Height / W is Cone Width

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	28.72	28.96	44.36
Hydrogen	6.26	6.22	3.57
Nitrogen	0.64	0.64	0.99
Chlorine	0.06	0.06	0.10
Sulfur	3.58	3.61	5.53
Ash	21.34	21.51	32.95
Oxygen (diff)	39.40	39.00	12.50

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

AIR DRYING LOSS = 30.75
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =
* Insufficient Sample

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COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 006

Drill Hole : JK-19-19.4 Int : Thickness :

W250662

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	29.67	31.45		
% Ash	12.90	12.57	18.34	
% Volatile	28.92	28.19	41.12	50.36
% Fixed Carbon	28.51	27.79	40.54	49.64
Btu	7342	7156	10439	12783
% Sulfur	3.01	2.93	4.27	5.23

lbs SUL/MM BTU = 4.09

SULFUR FORMS				
% Pyritic Sulfur	1.95	1.90	2.77	3.39
% Sulfate Sulfur	0.17	0.17	0.24	0.30
% Organic Sulfur	0.89	0.86	1.26	1.54
% Total Sulfur	3.01	2.93	4.27	5.23

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M basis	As received	Dry basis
Moisture			
Carbon	41.57	40.52	59.11
Hydrogen	6.41	6.53	4.39
Nitrogen	0.93	0.91	1.33
Chlorine	0.03	0.03	0.04
Sulfur	3.01	2.93	4.27
Ash	12.90	12.57	18.34
Oxygen (diff)	35.15	36.51	12.52

MINERAL ANALYSIS	% Wt Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1900 °F	°F
Softening (H = W)	1920 °F	°F
Hemispherical (H = ½ W)	1930 °F	°F
Fluid	1940 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 27.31
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

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COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 007

Drill Hole : JK-19-19.5 Int : Thickness :

W250663

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	35.27	27.15		
% Ash	10.85	12.21	16.76	
% Volatile	27.18	30.59	41.99	50.44
% Fixed Carbon	26.70	30.05	41.25	49.56
Btu	6310	7101	9748	11711
% Sulfur	4.17	4.69	6.44	7.73

lbs SUL/MM BTU = 6.60

SULFUR FORMS				
% Pyritic Sulfur	1.90	2.14	2.94	3.53
% Sulfate Sulfur	1.41	1.59	2.18	2.62
% Organic Sulfur	0.86	0.96	1.32	1.58
% Total Sulfur	4.17	4.69	6.44	7.73

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2320 °F	°F
Softening (H = W)	2360 °F	°F
Hemispherical (H = ½ W)	2440 °F	°F
Fluid	2450 °F	°F

H is Cone Height / W is Cone Width

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	34.76	39.12	53.70
Hydrogen	6.73	6.17	4.30
Nitrogen	0.70	0.79	1.08
Chlorine	0.05	0.05	0.07
Sulfur	4.17	4.69	6.44
Ash	10.85	12.21	16.76
Oxygen (diff)	42.74	36.97	17.65

MINERAL ANALYSIS	% Wt Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

AIR DRYING LOSS = 22.23
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = *
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =
* Insufficient Sample

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COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 008

Drill Hole : JK-19-19.6 Int : Thickness :

W 250664

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	31.36	31.57		
% Ash	14.48	14.43	21.09	
% Volatile	28.55	28.47	41.60	52.72
% Fixed Carbon	25.61	25.53	37.31	47.28
Btu	6926	6905	10091	12788
% Sulfur	1.84	1.84	2.69	3.41

lbs SUL/MM BTU = 2.66

SULFUR FORMS				
% Pyritic Sulfur	1.01	1.01	1.47	1.86
% Sulfate Sulfur	0.15	0.14	0.21	0.27
% Organic Sulfur	0.68	0.69	1.01	1.28
% Total Sulfur	1.84	1.84	2.69	3.41

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2150 °F	°F
Softening (H = W)	2170 °F	°F
Hemispherical (H = ½ W)	2190 °F	°F
Fluid	2200 °F	°F

H is Cone Height / W is Cone Width

ULTIMATE ANALYSIS	E.M basis	As received	Dry basis
Moisture			
Carbon	39.56	39.44	57.63
Hydrogen	6.56	6.57	4.44
Nitrogen	0.83	0.83	1.21
Chlorine	0.05	0.05	0.07
Sulfur	1.84	1.84	2.69
Ash	14.48	14.43	21.09
Oxygen (diff)	36.68	36.84	12.87

MINERAL ANALYSIS	% Wt Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

AIR DRYING LOSS = 27.59
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

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COAL & OIL SHALE ANALYSTS
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COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 009

Drill Hole : JK-19-19.7 Int : Thickness :

W250665

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	31.03	35.15		
% Ash	6.96	6.55	10.10	
% Volatile	30.14	28.34	43.70	48.61
% Fixed Carbon	31.87	29.96	46.20	51.39
Btu	8032	7553	11646	12954
% Sulfur	2.00	1.88	2.91	3.23

lbs SUL/MM BTU = 2.49

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	46.63	43.85	67.61
Hydrogen	6.65	6.92	4.61
Nitrogen	0.94	0.88	1.36
Chlorine	0.07	0.06	0.10
Sulfur	2.00	1.88	2.91
Ash	6.96	6.55	10.10
Oxygen (diff)	36.75	39.86	13.31

SULFUR FORMS				
% Pyritic Sulfur	1.02	0.96	1.48	1.65
% Sulfate Sulfur	0.18	0.17	0.26	0.29
% Organic Sulfur	0.80	0.75	1.17	1.29
% Total Sulfur	2.00	1.88	2.91	3.23

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

MINERAL ANALYSIS	% Wt Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1860 °F	°F
Softening (H = W)	1880 °F	°F
Hemispherical (H = ½ W)	1890 °F	°F
Fluid	1900 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 30.72
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = *
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

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COAL & OIL SHALE ANALYSTS
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COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 010

Drill Hole : JK-19-19.8 Int : Thickness :

W250666

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	41.33	37.21		
% Ash	4.55	4.87	7.75	
% Volatile	24.98	26.74	42.58	46.16
% Fixed Carbon	29.14	31.18	49.67	53.84
Btu	7063	7559	12038	13050
% Sulfur	1.60	1.71	2.72	2.95

lbs SUL/MM BTU = 2.26

SULFUR FORMS				
% Pyritic Sulfur	0.83	0.88	1.41	1.53
% Sulfate Sulfur	0.08	0.09	0.14	0.16
% Organic Sulfur	0.69	0.74	1.17	1.26
% Total Sulfur	1.60	1.71	2.72	2.95

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2020 °F	°F
Softening (H = W)	2040 °F	°F
Hemispherical (H = ½ W)	2060 °F	°F
Fluid	2090 °F	°F

H is Cone Height / W is Cone Width

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	41.18	44.07	70.19
Hydrogen	7.43	7.17	4.78
Nitrogen	0.87	0.93	1.48
Chlorine	0.05	0.06	0.09
Sulfur	1.60	1.71	2.72
Ash	4.55	4.87	7.75
Oxygen (diff)	44.32	41.19	12.99

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

AIR DRYING LOSS = 30.86
HARDGROVE GRINDABILITY INDEX = 60 @ 9.18 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL & OIL SHALE ANALYSTS
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COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 011

Drill Hole : JK-19-19.9 Int : Thickness :

W250667

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	32.49	37.20		
% Ash	3.46	3.22	5.12	
% Volatile	28.74	26.73	42.57	44.87
% Fixed Carbon	35.31	32.85	52.31	55.13
Btu	8437	7849	12498	13173
% Sulfur	0.76	0.71	1.13	1.19

lbs SUL/MM BTU = 0.90

SULFUR FORMS				
% Pyritic Sulfur	0.18	0.17	0.27	0.28
% Sulfate Sulfur	0.02	0.02	0.03	0.03
% Organic Sulfur	0.56	0.52	0.83	0.88
% Total Sulfur	0.76	0.71	1.13	1.19

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	48.95	45.53	72.51
Hydrogen	6.95	7.24	4.90
Nitrogen	1.08	1.01	1.60
Chlorine	0.04	0.03	0.06
Sulfur	0.76	0.71	1.13
Ash	3.46	3.22	5.12
Oxygen (diff)	38.76	42.26	14.68

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2190 °F	°F
Softening (H = W)	2250 °F	°F
Hemispherical (H = ½ W)	2470 °F	°F
Fluid	2490 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 30.49
HARDGROVE GRINDABILITY INDEX = 66 @ 9.65 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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DICKINSON LABORATORIES, INC.
COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-9466

COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 012

Drill Hole : JK-19-19.10 Int : Thickness :

W250668

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	33.62	33.35		
% Ash	10.02	10.06	15.10	
% Volatile	26.82	26.93	40.40	47.59
% Fixed Carbon	29.54	29.66	44.50	52.41
Btu	6997	7025	10540	12414
% Sulfur	3.87	3.88	5.83	6.86

lbs SUL/MM BTU = 5.52

SULFUR FORMS				
% Pyritic Sulfur	1.65	1.66	2.49	2.93
% Sulfate Sulfur	0.53	0.54	0.81	0.95
% Organic Sulfur	1.69	1.68	2.53	2.98
% Total Sulfur	3.87	3.88	5.83	6.86

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	40.01	40.17	60.28
Hydrogen	6.47	6.45	4.08
Nitrogen	0.73	0.73	1.10
Chlorine	0.04	0.04	0.05
Sulfur	3.87	3.88	5.83
Ash	10.02	10.06	15.10
Oxygen (diff)	38.86	38.67	13.56

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2010 °F	°F
Softening (H = W)	2040 °F	°F
Hemispherical (H = ½ W)	2080 °F	°F
Fluid	2100 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 29.40
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =
* Insufficient Sample

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COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-9498

COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 014

Drill Hole : JK-19-19.11 Int : Thickness :

W 250669

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	31.44	36.74		
% Ash	4.17	3.85	6.08	
% Volatile	29.76	27.46	43.40	46.21
% Fixed Carbon	34.63	31.95	50.52	53.79
Btu	8491	7835	12385	13187
% Sulfur	1.02	0.94	1.49	1.58

lbs SUL/MM BTU = 1.20

SULFUR FORMS				
% Pyritic Sulfur	0.21	0.19	0.31	0.33
% Sulfate Sulfur	0.03	0.03	0.05	0.05
% Organic Sulfur	0.78	0.72	1.13	1.20
% Total Sulfur	1.02	0.94	1.49	1.58

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1940 °F	°F
Softening (H = W)	1990 °F	°F
Hemispherical (H = ½ W)	2070 °F	°F
Fluid	2180 °F	°F

H is Cone Height / W is Cone Width

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	50.34	46.45	73.42
Hydrogen	6.52	6.88	4.37
Nitrogen	0.52	0.48	0.76
Chlorine	0.09	0.09	0.14
Sulfur	1.02	0.94	1.49
Ash	4.17	3.85	6.08
Oxygen (diff)	37.34	41.31	13.74

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

AIR DRYING LOSS = 28.12
HARDGROVE GRINDABILITY INDEX = 72 @ 11.99 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 015

Drill Hole : JK-19-19.12 Int : . Thickness :

W 250670

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	31.10	34.30		
% Ash	4.56	4.35	6.62	
% Volatile	30.87	29.43	44.80	47.97
% Fixed Carbon	33.47	31.92	48.58	52.03
Btu	8518	8122	12362	13238
% Sulfur	1.32	1.26	1.92	2.05

lbs SUL/MM BTU = 1.55

SULFUR FORMS				
% Pyritic Sulfur	0.52	0.50	0.76	0.81
% Sulfate Sulfur	0.09	0.09	0.13	0.14
% Organic Sulfur	0.71	0.67	1.03	1.10
% Total Sulfur	1.32	1.26	1.92	2.05

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	50.16	47.83	72.80
Hydrogen	6.57	6.79	4.49
Nitrogen	0.87	0.83	1.27
Chlorine	0.08	0.08	0.12
Sulfur	1.32	1.26	1.92
Ash	4.56	4.35	6.62
Oxygen (diff)	36.44	38.86	12.78

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2180 °F	°F
Softening (H = W)	2210 °F	°F
Hemispherical (H = ½ W)	2340 °F	°F
Fluid	2480 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 27.68
HARDGROVE GRINDABILITY INDEX = 64 @ 9.15 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 016

Drill Hole : JK-19-19.13 Int : Thickness :

W250671

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	30.59	34.14		
% Ash	7.47	7.09	10.76	
% Volatile	30.95	29.37	44.60	49.98
% Fixed Carbon	30.99	29.40	44.64	50.02
Btu	8241	7820	11873	13305
% Sulfur	1.53	1.45	2.20	2.47

lbs SUL/MM BTU = 1.85

SULFUR FORMS				
% Pyritic Sulfur	0.83	0.78	1.19	1.33
% Sulfate Sulfur	0.08	0.08	0.12	0.14
% Organic Sulfur	0.62	0.59	0.89	1.00
% Total Sulfur	1.53	1.45	2.20	2.47

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	46.44	44.06	66.91
Hydrogen	6.93	7.15	5.06
Nitrogen	1.38	1.31	1.99
Chlorine	0.08	0.08	0.12
Sulfur	1.53	1.45	2.20
Ash	7.47	7.09	10.76
Oxygen (diff)	36.17	38.86	12.96

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1920 °F	°F
Softening (H = W)	1940 °F	°F
Hemispherical (H = ½ W)	1950 °F	°F
Fluid	1960 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 27.52
HARDGROVE GRINDABILITY INDEX = 52 @ 9.14 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL & OIL SHALE ANALYSTS
P.O. BOX 12008 EL PASO, TEXAS 79913-0008 915/584-0496

COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 017

Drill Hole : JK-19-19.14 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	26.93	32.88		
% Ash	13.73	12.61	18.79	
% Volatile	27.95	25.67	38.25	47.10
% Fixed Carbon	31.39	28.84	42.96	52.90
Btu	7585	7059	10517	12950
% Sulfur	0.47	0.43	0.64	0.78

lbs SUL/MM BTU = 0.61

SULFUR FORMS				
% Pyritic Sulfur	0.05	0.04	0.06	0.08
% Sulfate Sulfur	0.03	0.03	0.04	0.05
% Organic Sulfur	0.39	0.36	0.54	0.65
% Total Sulfur	0.47	0.43	0.64	0.78

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2310 °F	°F
Softening (H = W)	2330 °F	°F
Hemispherical (H = ½ W)	2340 °F	°F
Fluid	2350 °F	°F

H is Cone Height / W is Cone Width

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	47.84	43.95	65.48
Hydrogen	6.82	7.18	5.21
Nitrogen	0.89	0.82	1.22
Chlorine	0.11	0.10	0.15
Sulfur	0.47	0.43	0.64
Ash	13.73	12.61	18.79
Oxygen (diff)	30.14	34.91	8.51

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

AIR DRYING LOSS = 28.75
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =
* Insufficient Sample

Terry Rollins
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DICKINSON LABORATORIES, INC.
COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-0496

COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 018

Drill Hole : JK-19-19.15 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	28.89	32.76		
% Ash	18.50	17.49	26.02	
% Volatile	26.86	25.40	37.77	51.06
% Fixed Carbon	25.75	24.35	36.21	48.94
Btu	6598	6239	9278	12541
% Sulfur	2.07	1.96	2.91	3.94

lbs SUL/MM BTU = 3.14

SULFUR FORMS				
% Pyritic Sulfur	1.02	0.97	1.44	1.94
% Sulfate Sulfur	0.18	0.17	0.25	0.34
% Organic Sulfur	0.87	0.82	1.22	1.66
% Total Sulfur	2.07	1.96	2.91	3.94

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2170 °F	°F
H is Cone Height / W is Cone Width — Softening (H = W)	2200 °F	°F
Hemispherical (H = ½ W)	2220 °F	°F
Fluid	2240 °F	°F

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	38.04	35.97	53.50
Hydrogen	5.91	6.19	3.76
Nitrogen	0.76	0.72	1.07
Chlorine	0.04	0.04	0.05
Sulfur	2.07	1.96	2.91
Ash	18.50	17.49	26.02
Oxygen (diff)	34.68	37.63	12.69

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

AIR DRYING LOSS = 29.03
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

Jerry Rollins
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DICKINSON LABORATORIES, INC.
COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-9496

COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 019

Drill Hole : JK-19-19.16 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	27.39	30.91		
% Ash	30.93	29.43	42.60	
% Volatile	22.06	20.99	30.38	52.93
% Fixed Carbon	19.62	18.67	27.02	47.07
Btu	4866	4630	6701	11675
% Sulfur	0.82	0.78	1.12	1.96

lbs SUL/MM BTU = 1.68

SULFUR FORMS				
% Pyritic Sulfur	0.46	0.44	0.63	1.10
% Sulfate Sulfur	0.05	0.05	0.07	0.13
% Organic Sulfur	0.31	0.29	0.42	0.73
% Total Sulfur	0.82	0.78	1.12	1.96

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M basis	As received	Dry basis
Moisture			
Carbon	28.32	26.95	39.01
Hydrogen	5.58	5.85	3.46
Nitrogen	0.66	0.63	0.91
Chlorine	0.05	0.05	0.07
Sulfur	0.82	0.78	1.12
Ash	30.93	29.43	42.60
Oxygen (diff)	33.64	36.31	12.83

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina Al_2O_3	
Titania TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	>2700 °F	°F
Softening (H = W)	>2700 °F	°F
Hemispherical (H = ½ W)	>2700 °F	°F
Fluid	>2700 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 27.42
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

Terry Rollins
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COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-9496

COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 020

Drill Hole : JK-19-19.17 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	29.05	34.34		
% Ash	8.17	7.56	11.52	
% Volatile	31.13	28.80	43.87	49.58
% Fixed Carbon	31.65	29.30	44.61	50.42
Btu	8318	7698	11724	13250
% Sulfur	1.65	1.52	2.32	2.62

lbs SUL/MM BTU = 1.97

SULFUR FORMS				
% Pyritic Sulfur	0.67	0.62	0.95	1.07
% Sulfate Sulfur	0.08	0.08	0.12	0.13
% Organic Sulfur	0.90	0.82	1.25	1.42
% Total Sulfur	1.65	1.52	2.32	2.62

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	47.17	43.65	66.48
Hydrogen	6.81	7.13	5.01
Nitrogen	1.11	1.03	1.56
Chlorine	0.08	0.08	0.12
Sulfur	1.65	1.52	2.32
Ash	8.17	7.56	11.52
Oxygen (diff)	35.01	39.03	12.99

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1990 °F	°F
Softening (H = W)	2000 °F	°F
Hemispherical (H = ½ W)	2020 °F	°F
Fluid	2030 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 29.19
HARDGROVE GRINDABILITY INDEX = 50 @ 7.27 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-9496

Jerry Rollins
DICKINSON LABORATORIES, INC.

COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 021

Drill Hole : JK-19-19.18 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	30.81	30.25		
% Ash	26.00	26.21	37.58	
% Volatile	21.51	21.69	31.10	49.82
% Fixed Carbon	21.68	21.85	31.32	50.18
Btu	4925	4965	7118	11403
% Sulfur	4.38	4.41	6.33	10.13

lbs SUL/MM BTU = 8.88

SULFUR FORMS				
% Pyritic Sulfur	2.83	2.85	4.08	6.54
% Sulfate Sulfur	0.38	0.39	0.56	0.89
% Organic Sulfur	1.17	1.17	1.69	2.70
% Total Sulfur	4.38	4.41	6.33	10.13

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2020 °F	°F
Softening (H = W)	2040 °F	°F
Hemispherical (H = ½ W)	2090 °F	°F
Fluid	2190 °F	°F

H is Cone Height / W is Cone Width

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	27.89	28.12	40.31
Hydrogen	5.79	5.75	3.39
Nitrogen	0.60	0.61	0.87
Chlorine	0.07	0.07	0.09
Sulfur	4.38	4.41	6.33
Ash	26.00	26.21	37.58
Oxygen (diff)	35.27	34.83	11.43

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos. pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

AIR DRYING LOSS = 26.95
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =
* Insufficient Sample

Terry Rollins
DICKINSON LABORATORIES, INC.

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COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-9496

COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 022

Drill Hole : JK-19-19.19 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	36.45	30.17		
% Ash	20.79	22.84	32.71	
% Volatile	20.62	22.66	32.45	48.22
% Fixed Carbon	22.14	24.33	34.84	51.78
Btu	4723	5190	7432	11044
% Sulfur	4.73	5.20	7.45	11.07

lbs SUL/MM BTU = 10.02

SULFUR FORMS				
% Pyritic Sulfur	2.59	2.84	4.07	6.05
% Sulfate Sulfur	0.87	0.96	1.37	2.04
% Organic Sulfur	1.27	1.40	2.01	2.98
% Total Sulfur	4.73	5.20	7.45	11.07

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	27.08	29.75	42.61
Hydrogen	6.26	5.77	3.43
Nitrogen	0.60	0.66	0.95
Chlorine	0.06	0.07	0.09
Sulfur	4.73	5.20	7.45
Ash	20.79	22.84	32.71
Oxygen (diff)	40.48	35.71	12.76

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2430 °F	°F
Softening (H = W)	2450 °F	°F
Hemispherical (H = ½ W)	2490 °F	°F
Fluid	2540 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 26.32
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

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P.O. BOX 12008 EL PASO, TEXAS 79913-0008 915/584-9496

COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 023

Drill Hole : JK-19-19.20 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	27.74	28.32		
% Ash	13.16	13.05	18.21	
% Volatile	54.11	53.67	74.88	91.54
% Fixed Carbon	4.99	4.96	6.91	8.46
Btu	7752	7690	10728	13116
% Sulfur	4.83	4.79	6.69	8.17

lbs SUL/MM BTU = 6.23

SULFUR FORMS				
% Pyritic Sulfur	1.56	1.55	2.16	2.64
% Sulfate Sulfur	0.37	0.37	0.52	0.63
% Organic Sulfur	2.90	2.87	4.01	4.90
% Total Sulfur	4.83	4.79	6.69	8.17

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1920 °F	°F
Softening (H = W)	1940 °F	°F
Hemispherical (H = ½ W)	1950 °F	°F
Fluid	1970 °F	°F

H is Cone Height / W is Cone Width

ULTIMATE ANALYSIS	E.M basis	As received	Dry basis
Moisture			
Carbon	42.99	42.65	59.49
Hydrogen	6.50	6.54	4.71
Nitrogen	1.11	1.10	1.53
Chlorine	0.08	0.08	0.12
Sulfur	4.83	4.79	6.69
Ash	13.16	13.05	18.21
Oxygen (diff)	31.33	31.79	9.25

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos. pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

AIR DRYING LOSS = 24.17
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = *
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =
* Insufficient Sample

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COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 024

Drill Hole : JK-19-19.21 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	28.21	32.50		
% Ash	10.90	10.24	15.18	
% Volatile	29.24	27.49	40.73	48.02
% Fixed Carbon	31.65	29.77	44.09	51.98
Btu	7551	7100	10518	12400
% Sulfur	3.65	3.43	5.08	5.99

lbs SUL/MM BTU = 4.83

SULFUR FORMS				
% Pyritic Sulfur	1.72	1.62	2.40	2.83
% Sulfate Sulfur	0.67	0.63	0.94	1.11
% Organic Sulfur	1.26	1.18	1.74	2.05
% Total Sulfur	3.65	3.43	5.08	5.99

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2000 °F	°F
Softening (H = W)	2020 °F	°F
Hemispherical (H = ½ W)	2040 °F	°F
Fluid	2060 °F	°F

H is Cone Height / W is Cone Width

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	42.30	39.77	58.93
Hydrogen	6.49	6.77	4.65
Nitrogen	0.80	0.76	1.12
Chlorine	0.08	0.07	0.11
Sulfur	3.65	3.43	5.08
Ash	10.90	10.24	15.18
Oxygen (diff)	35.78	38.96	14.93

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

AIR DRYING LOSS = 28.06
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = *
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =
* Insufficient Sample

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COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-0466

COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 025

Drill Hole : JK-19-19.22 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	30.83	32.61		
% Ash	8.56	8.34	12.38	
% Volatile	30.80	30.00	44.52	50.81
% Fixed Carbon	29.81	29.05	43.10	49.19
Btu	7905	7702	11429	13043
% Sulfur	3.29	3.21	4.76	5.43

lbs SUL/MM BTU = 4.17

SULFUR FORMS				
% Pyritic Sulfur	1.80	1.75	2.60	2.97
% Sulfate Sulfur	0.21	0.21	0.31	0.35
% Organic Sulfur	1.28	1.25	1.85	2.11
% Total Sulfur	3.29	3.21	4.76	5.43

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	44.18	43.05	63.87
Hydrogen	6.84	6.95	4.90
Nitrogen	1.00	0.97	1.44
Chlorine	0.08	0.08	0.12
Sulfur	3.29	3.21	4.76
Ash	8.56	8.34	12.38
Oxygen (diff)	36.05	37.40	12.53

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide. P_2O_5	
Silica. SiO_2	
Ferric oxide. Fe_2O_3	
Alumina. Al_2O_3	
Titania. TiO_2	
Lime. CaO	
Magnesia. MgO	
Sulfur trioxide. SO_3	
Potassium oxide. K_2O	
Sodium oxide. Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2010 °F	°F
Softening (H = W)	2030 °F	°F
Hemispherical (H = ½ W)	2050 °F	°F
Fluid	2070 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 28.10
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 4.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

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COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-0496

COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 026

Drill Hole : JK-19-19.23 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	25.90	31.52		
% Ash	21.77	20.12	29.38	
% Volatile	26.60	24.58	35.90	50.83
% Fixed Carbon	25.73	23.78	34.72	49.17
Btu	6437	5949	8687	12302
% Sulfur	2.73	2.52	3.69	5.22

lbs SUL/MM BTU = 4.24

SULFUR FORMS				
% Pyritic Sulfur	1.72	1.59	2.33	3.29
% Sulfate Sulfur	0.10	0.09	0.14	0.20
% Organic Sulfur	0.91	0.84	1.22	1.73
% Total Sulfur	2.73	2.52	3.69	5.22

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2370 °F	°F
Softening (H = W)	2390 °F	°F
Hemispherical (H = ½ W)	2420 °F	°F
Fluid	2430 °F	°F

H is Cone Height / W is Cone Width

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	36.18	33.44	48.83
Hydrogen	5.87	6.27	4.01
Nitrogen	0.85	0.79	1.15
Chlorine	0.09	0.08	0.12
Sulfur	2.73	2.52	3.69
Ash	21.77	20.12	29.38
Oxygen (diff)	32.51	36.78	12.82

MINERAL ANALYSIS	% Wt Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

AIR DRYING LOSS = 27.25
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = *
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =
* Insufficient Sample

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P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-6466

COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 013

Drill Hole : JK-19-19.24 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	23.31	25.18		
% Ash	41.90	40.88	54.63	
% Volatile	20.45	19.96	26.67	58.79
% Fixed Carbon	14.34	13.98	18.70	41.21
Btu	3572	3582	4788	10554
% Sulfur	1.42	1.38	1.85	4.07

lbs SUL/MM BTU = 3.85

SULFUR FORMS				
% Pyritic Sulfur	0.66	0.65	0.87	1.91
% Sulfate Sulfur	0.15	0.15	0.20	0.44
% Organic Sulfur	0.61	0.58	0.78	1.72
% Total Sulfur	1.42	1.38	1.85	4.07

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	21.25	20.74	27.71
Hydrogen	4.90	5.05	2.98
Nitrogen	0.70	0.68	0.91
Chlorine	0.07	0.07	0.09
Sulfur	1.42	1.38	1.85
Ash	41.90	40.88	54.63
Oxygen (diff)	29.76	31.20	11.83

MINERAL ANALYSIS	% Wt Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2320 °F	°F
H is Cone Height / W is Cone Width — Softening (H = W)	2350 °F	°F
Hemispherical (H = ½ W)	2370 °F	°F
Fluid	2390 °F	°F

AIR DRYING LOSS = 21.99
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =
* Insufficient Sample

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COAL & OIL SHALE ANALYSTS
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COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 027

Drill Hole : JK-19-19.25 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	27.44	29.19		
% Ash	23.06	22.51	31.79	
% Volatile	24.52	23.93	33.80	49.55
% Fixed Carbon	24.98	24.37	34.41	50.45
Btu	5890	5748	8118	11900
% Sulfur	4.72	4.61	6.51	9.54

lbs SUL/MM BTU = 8.02

SULFUR FORMS				
% Pyritic Sulfur	3.06	2.99	4.22	6.18
% Sulfate Sulfur	0.48	0.47	0.66	0.97
% Organic Sulfur	1.18	1.15	1.63	2.39
% Total Sulfur	4.72	4.61	6.51	9.54

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M basis	As received	Dry basis
Moisture			
Carbon	33.36	32.55	45.97
Hydrogen	5.67	5.81	3.59
Nitrogen	0.66	0.64	0.91
Chlorine	0.07	0.07	0.10
Sulfur	4.72	4.61	6.51
Ash	23.06	22.51	31.79
Oxygen (diff)	32.46	33.81	11.13

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2090 °F	°F
Softening (H = W)	2120 °F	°F
Hemispherical (H = ½ W)	2170 °F	°F
Fluid	2250 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 23.44
HARDGROVE GRINDABILITY INDEX = 84 @ 7.51 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-0496

COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 028

Drill Hole : JK-19-19.26 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	31.18	34.05		
% Ash	4.82	4.62	7.00	
% Volatile	30.20	28.94	43.89	47.19
% Fixed Carbon	33.80	32.39	49.11	52.81
Btu	8481	8127	12323	13251
% Sulfur	1.36	1.30	1.98	2.13

lbs SUL/MM BTU = 1.60

SULFUR FORMS				
% Pyritic Sulfur	0.56	0.54	0.82	0.88
% Sulfate Sulfur	0.14	0.13	0.20	0.21
% Organic Sulfur	0.66	0.63	0.96	1.04
% Total Sulfur	1.36	1.30	1.98	2.13

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	51.75	49.59	75.20
Hydrogen	6.34	6.54	4.14
Nitrogen	1.03	0.99	1.49
Chlorine	0.08	0.07	0.11
Sulfur	1.36	1.30	1.98
Ash	4.82	4.62	7.00
Oxygen (diff)	34.62	36.89	10.08

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2080 °F	°F
Softening (H = W)	2100 °F	°F
Hemispherical (H = ½ W)	2130 °F	°F
Fluid	2140 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 18.54
HARDGROVE GRINDABILITY INDEX = 67 @ 19.04 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

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COAL-ANALYSIS REPORT

UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE : 11-1-89 LAB NUMBER : 890483 - 029

Drill Hole : JK-19-19.27 Int : Thickness :

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	24.59	29.41		
% Ash	6.43	6.01	8.52	
% Volatile	38.37	35.92	50.89	55.63
% Fixed Carbon	30.61	28.66	40.59	44.37
Btu	9511	8997	12745	13932
% Sulfur	1.67	1.57	2.22	2.43

lbs SUL/MM BTU = 1.75

SULFUR FORMS				
% Pyritic Sulfur	0.95	0.89	1.26	1.38
% Sulfate Sulfur	0.17	0.16	0.22	0.24
% Organic Sulfur	0.55	0.52	0.74	0.81
% Total Sulfur	1.67	1.57	2.22	2.43

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	53.87	50.42	71.43
Hydrogen	6.92	7.19	5.53
Nitrogen	1.03	0.96	1.36
Chlorine	0.06	0.05	0.07
Sulfur	1.67	1.57	2.22
Ash	6.43	6.01	8.52
Oxygen (diff)	30.02	33.80	10.87

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2140 °F	°F
Softening (H = W)	2160 °F	°F
Hemispherical (H = ½ W)	2180 °F	°F
Fluid	2200 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 25.01
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

DICKINSON LABORATORIES, INC.
COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-0466

Terry Rollins
DICKINSON LABORATORIES, INC.

COAL-ANALYSIS REPORT

CH96

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE 12-15-88 LAB. NO: 880809 - 020

DRILL HOLE JK-20-1 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS: W-246514

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	35.36	36.93		
% Ash	10.76	10.50	16.65	
% Volatile	28.28	27.59	43.75	52.49
% Fixed Carbon	25.60	24.98	39.60	47.51
Btu	7039	6868	10889	13064
% Sulfur	4.03	3.93	6.24	7.48

lbs SUL/MM BTU = 5.72

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	39.48	38.52	61.07
Hydrogen	6.87	6.98	4.51
Nitrogen	0.81	0.79	1.25
Chlorine	0.08	0.08	0.13
Sulfur	4.03	3.93	6.24
Ash	10.76	10.50	16.65
Oxygen (diff)	37.97	39.20	10.15

SULFUR FORMS				
% Pyritic Sulfur	2.64	2.57	4.08	4.90
% Sulfate Sulfur	0.07	0.06	0.10	0.12
% Organic Sulfur	1.32	1.30	2.06	2.46
% Total Sulfur	4.03	3.93	6.24	7.48

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1960 °F	°F
Softening (H = W)	2000 °F	°F
Hemispherical (H = ½ W)	2040 °F	°F
Fluid	2340 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 28.09
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

DICKINSON LABORATORIES, INC.
COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-0466

Jerry Rollins
DICKINSON LABORATORIES, INC.

COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

cf 96

DATE 12-15-88 LAB NO 880809 - 021

DRILL HOLE JK-20-2AP SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS: W-246515

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	26.08	27.46		
% Ash	36.79	36.10	49.77	
% Volatile	22.81	22.39	30.86	61.44
% Fixed Carbon	14.32	14.05	19.37	38.56
Btu	4160	4082	5628	11204
% Sulfur	6.24	6.13	8.44	16.81

lbs SUL/MM BTU = 15.02

SULFUR FORMS				
% Pyritic Sulfur	5.27	5.17	7.13	14.19
% Sulfate Sulfur	0.15	0.15	0.21	0.42
% Organic Sulfur	0.82	0.81	1.10	2.20
% Total Sulfur	6.24	6.13	8.44	16.81

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2120 °F	°F
Softening (H = W)	2470 °F	°F
Hemispherical (H = ½ W)	2570 °F	°F
Fluid	2630 °F	°F

H is Cone Height / W is Cone Width

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	22.19	21.78	30.02
Hydrogen	3.97	4.11	1.43
Nitrogen	0.44	0.43	0.60
Chlorine	0.05	0.05	0.07
Sulfur	6.24	6.13	8.44
Ash	36.79	36.10	49.77
Oxygen (diff)	30.32	31.40	9.67

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos. pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

AIR DRYING LOSS = 24.09
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

Terry Rollins
DICKINSON LABORATORIES, INC.

DICKINSON LABORATORIES, INC.
COAL & OIL SHALE ANALYSTS
P.O. BOX 12008 EL PASO, TEXAS 79913-0008 915/584-9466

COAL-ANALYSIS REPORT

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

CA 96

DATE 12-15-88 LAB. NO 880809 - 022

DRILL HOLE. JK-20-2BC SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS: W-246576

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	33.59	34.45		
% Ash	7.93	7.82	11.93	
% Volatile	30.60	30.21	46.08	52.32
% Fixed Carbon	27.88	27.52	41.99	47.68
Btu	7766	7665	11694	13278
% Sulfur	2.35	2.32	3.53	4.01

lbs SUL/MM BTU = 3.03

SULFUR FORMS				
% Pyritic Sulfur	1.39	1.37	2.09	2.37
% Sulfate Sulfur	0.16	0.15	0.24	0.27
% Organic Sulfur	0.80	0.80	1.20	1.37
% Total Sulfur	2.35	2.32	3.53	4.01

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	44.51	43.93	67.02
Hydrogen	6.69	6.75	4.42
Nitrogen	0.87	0.86	1.31
Chlorine	0.07	0.07	0.11
Sulfur	2.35	2.32	3.53
Ash	7.93	7.82	11.93
Oxygen (diff)	37.58	38.25	11.68

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos. pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	1910 °F	°F
H is Cone Height / W is Cone Width — Softening (H = W)	2000 °F	°F
Hemispherical (H = ½ W)	2010 °F	°F
Fluid	2200 °F	°F

AIR DRYING LOSS = 18.43
HARDGROVE GRINDABILITY INDEX = 82 @ 19.64 % Moisture
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

DICKINSON LABORATORIES, INC.
COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-0466

Terry Rollins
DICKINSON LABORATORIES, INC.

COAL-ANALYSIS REPORT

CF 96

TO: UNITED STATES GEOLOGICAL SURVEY
National Center
Mail Stop 956
Reston, Virginia 22092

DATE 12-15-88 LAB NO: 880809 - 023

DRILL HOLE JK-20-3 SEAM: PROJECT:

PROPERTY DEPTH: THICKNESS:

REMARKS: W-246517

PROXIMATE ANALYSIS	E.M. basis	As received	Dry basis	M&A free basis
% Moisture	33.66	35.56		
% Ash	8.19	7.96	12.35	
% Volatile	30.21	29.34	45.53	51.94
% Fixed Carbon	27.94	27.14	42.12	48.06
Btu	7699	7478	11605	13240
% Sulfur	0.61	0.59	0.92	1.05

lbs SUL/MM BTU = 0.79

SULFUR FORMS				
% Pyritic Sulfur	0.01	0.01	0.01	0.01
% Sulfate Sulfur	0.01	0.01	0.02	0.03
% Organic Sulfur	0.59	0.57	0.89	1.01
% Total Sulfur	0.61	0.59	0.92	1.05

WATER SOLUBLE ALKALIES
% Na_2O =
% K_2O =

ULTIMATE ANALYSIS	E.M. basis	As received	Dry basis
Moisture			
Carbon	43.19	41.95	65.10
Hydrogen	7.28	7.40	5.30
Nitrogen	0.83	0.81	1.25
Chlorine	0.07	0.06	0.10
Sulfur	0.61	0.59	0.92
Ash	8.19	7.96	12.35
Oxygen (diff)	39.83	41.23	14.98

MINERAL ANALYSIS	% Wt. Ignited Basis
Phos. pentoxide, P_2O_5	
Silica, SiO_2	
Ferric oxide, Fe_2O_3	
Alumina, Al_2O_3	
Titania, TiO_2	
Lime, CaO	
Magnesia, MgO	
Sulfur trioxide, SO_3	
Potassium oxide, K_2O	
Sodium oxide, Na_2O	
Undetermined	
BASE/ACID RATIO	

FUSION TEMPERATURE OF ASH	Reducing	Oxidizing
Initial Deformation	2030 °F	°F
Softening (H = W)	2230 °F	°F
Hemispherical (H = ½ W)	2380 °F	°F
Fluid	2500 °F	°F

H is Cone Height / W is Cone Width

AIR DRYING LOSS = 29.35
HARDGROVE GRINDABILITY INDEX = *
FREE SWELLING INDEX = 0.0
WATER SOLUBLE CHLORINE =
APPARENT SPECIFIC GRAVITY =

* Insufficient Sample

Jerry Rollins
DICKINSON LABORATORIES, INC.

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DICKINSON LABORATORIES, INC.
COAL & OIL SHALE ANALYSTS
P.O. BOX 12006 EL PASO, TEXAS 79913-0006 915/584-9466