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Analysis of Coal Samples from the Upper Cumberland District, Kentucky (Parts of Bell, Harlan, Letcher, and Whitley Counties)

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KENTUCKY GEOLOGICAL SURVEY
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ANALYSIS OF COAL SAMPLES FROM THE UPPER CUMBERLAND DISTRICT, KENTUCKY (Parts of Bell, Harlan, Letcher, and Whitley Counties)

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James C. Currens[1], Linda Jean Bragg[2], and James C. Hower[3]

ABSTRACT

Chemical and petrographic data are presented for 57 samples of coal collected in the Upper Cumberland District, eastern Kentucky. These data include sample-site locations, sampling conditions, stratigraphic position, megascopic description of the coal, air-drying loss, proximate and ultimate analyses, Btu content, forms of sulfur, initial deformation temperature, softening temperature, fluid temperature, free-swelling index, concentration of major- and minor-oxides and trace elements, and petrographic analyses.

INTRODUCTION

The Eastern Kentucky Coal Field has been subdivided into six reserve districts to facilitate the tabulation of coal-resource estimates. These districts are the Princess, Big Sandy, Licking River, Southwestern, Hazard, and Upper Cumberland. This report on the Upper Cumberland District (Fig. 1) is one in a series of coal-quality publications planned for each of the districts. This report provides easily accessible geological and analytical data describing the quality of coals in the Upper Cumberland District, which includes parts of Bell, Harlan, Letcher, and Whitley Counties.

Fifty-seven samples of coal were collected for chemical and petrographic analyses. Field-sampling data, proximate and ultimate analyses, Btu content, forms of sulfur, free-swelling index, determinations of major- and minor-oxides and trace elements, and petrographic analyses are contained in this report.

Brant (1982, 1983) and Brant and others (1983a-d) estimated the coal resources for each of the six districts in the Eastern Kentucky Coal Field. Brant and others (1983d) reported that 24 coal beds (Fig. 2) in the Upper Cumberland District originally contained 9.99 billion tons of coal. Isopach maps (Brant and others, 1983d) are published for the Harlan, Kellioka, and Wallins Creek coal beds. When used together, the coal-resource and coal-quality reports provide the essential tools for integrating the quantity and quality of eastern Kentucky coals on a regional basis.

METHODS

Although this report contains only the results for samples collected in the Upper Cumberland District, the methods of sampling were developed to determine coal quality for the entire Eastern Kentucky Coal Field. The choice of sampling sites and field techniques was largely determined by the logistical constraints associated with the collection of more than 600 coal samples distributed over a stratigraphic section containing more than 30 major coal zones and an area including all or parts of 38 eastern Kentucky counties. Therefore, expediency, uniform areal and stratigraphic distribution of sample sites, consistent sampling technique, and thorough sample documentation were major considerations in sample collection.

Sample Sites

The selection of sample sites was influenced by many factors. First, maintaining a consistent distribution of samples over a coal bed area, regardless of coal thickness, was important to delineate the regional characteristics of the coal beds. However, exposures of coal beds of mineable thickness were selected where possible to make the data economically relevant. Second, sites were chosen where many coal beds were exposed and easily accessible so that changes in coal-quality characteristics from one coal bed to another could be identified. Therefore, many of the samples are either from roadcuts along major highways that were under construction at the time of sampling or from surface mines. Third, thin coal beds were sampled in areas where the coals might be mineable by themselves or in conjunction with overlying or underlying beds, or in areas of widespread coal occurrence.

The freshness of the exposed coal was also a major consideration in the choice of sample sites. In general, a coal outcrop was not sampled if it had been exposed for more than 6 weeks. Exceptions were made if other opportunities to sample the coal bed were unlikely. The freshness of the exposures along highway construction projects ranged from a few months to several hours.

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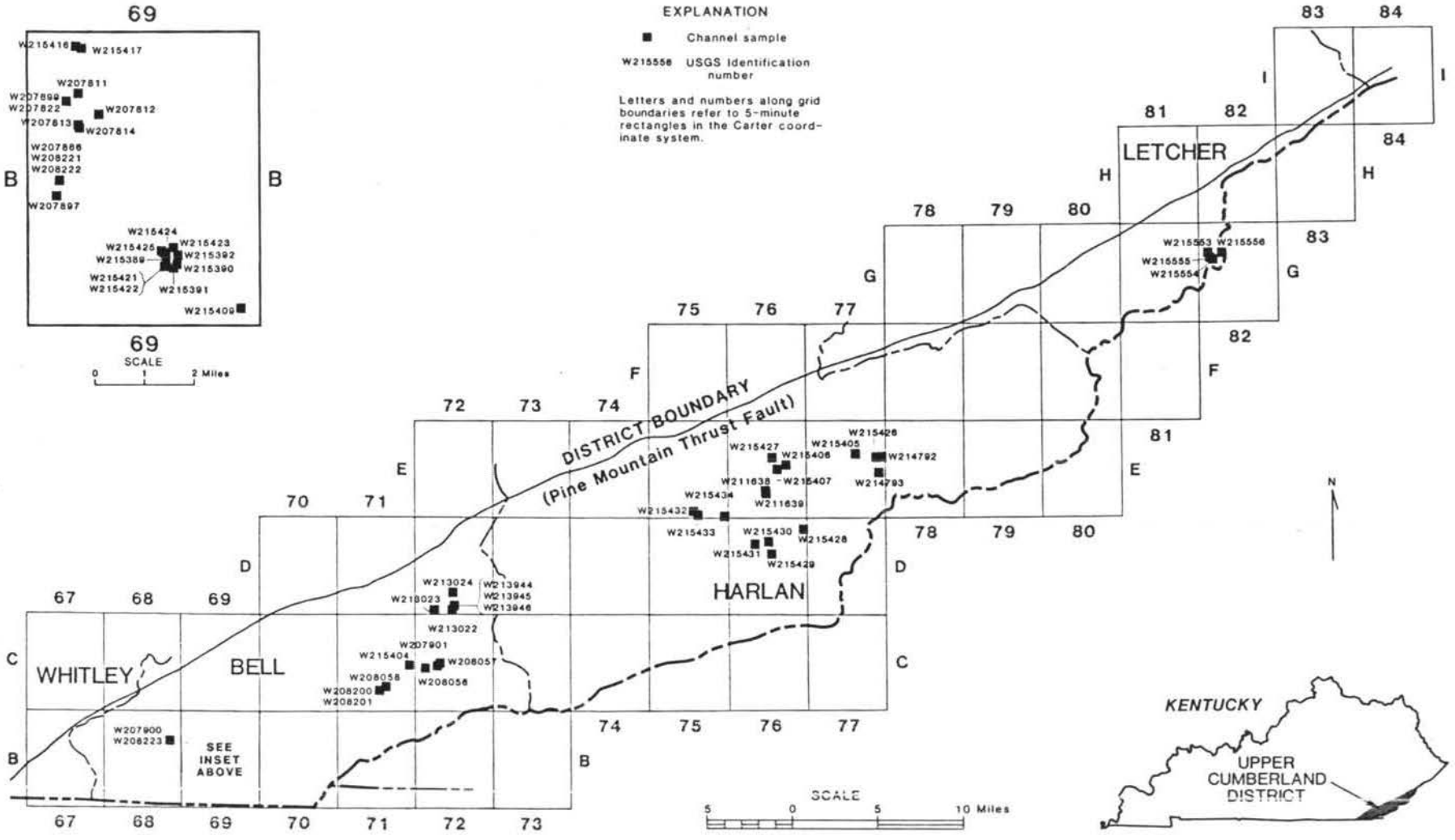
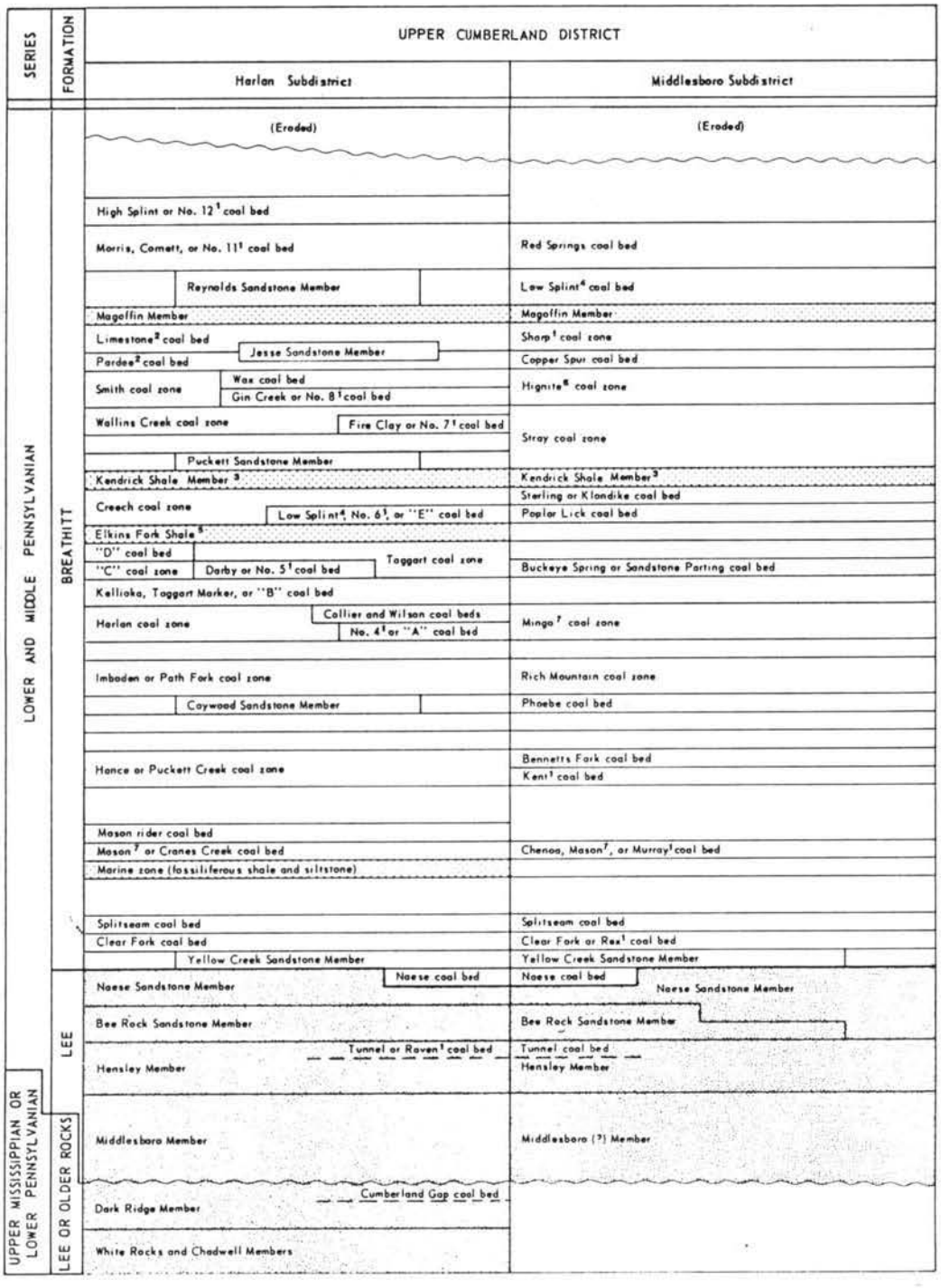


Figure 1. Locations of coal-sampling sites in the Upper Cumberland District.



[1] Name used for coal bed in adjacent areas

[2] The Limestone and Pardee coal beds locally come together to form a single coal bed where the Jesse Sandstone is not present

[3] Formerly Kendrick Shale of Jillson (1920)

[4] The name Low Splint is used for a coal bed in the lower part of the Creech coal zone in the Harlan subdistrict as well as for a coal bed above the Magoffin Member in the Middlesboro subdistrict

[5] Of Morse (1931)

[6] The Hignite coal bed has locally been called the Pewee coal bed in Tennessee; however, the Pewee is probably equivalent to the Red Springs coal bed of the Middlesboro subdistrict

[7] The name Mason is commonly used to identify the coal beds of the Mingo coal zone in the Middlesboro subdistrict

Figure 2. Key stratigraphic units in the Upper Cumberland District.

Samples from surface mines and prospect openings were generally fresh, but a few samples were taken in areas where deeply weathered coal beds were being mined. Underground mines generally provided the freshest samples, but because of the time and effort needed to travel to the working face, above-ground exposures were used where available. Nevertheless, more than 100 underground mines were sampled in eastern Kentucky. A few core samples were obtained for analysis; these samples were normally in excellent condition.

Elevations of sample sites were determined by several methods. A barometric altimeter was used for many determinations, and all two-way traverses from benchmark to sample site were adjusted for temperature changes and pressure fluctuations. Wherever possible, local leveling surveys were used to determine elevation. Underground elevations were typically determined from mine maps. Hand-leveling was used extensively to tie sample sites to benchmarks and to measure elevation differences between coal beds at surface mines and roadcuts. Topographic maps were used to estimate elevations in remote areas where other methods were not feasible.

Sampling Methods

Two sampling regimes were used. During the first 6 months of collection the guidelines of Swanson and Huffman (1976) were followed, and partings less than 10 cm (4 in.) thick were included in the sample (Fig. 3). The method of Holmes (1918) was adopted after the first field season and was used for the majority of the samples. The Holmes method is the standard method of the American Society for Testing and Materials (ASTM) for collecting channel samples for the determination of rank (ASTM, 1981). Under the Holmes method, all partings greater than 1 cm (3/8 in.) are excluded from the sample. The sampling regime is recorded in the Sampling Report (Appendix I). The guidelines for the exclusion of partings of either regime were exceeded at some exposures to make the samples conform to local mining

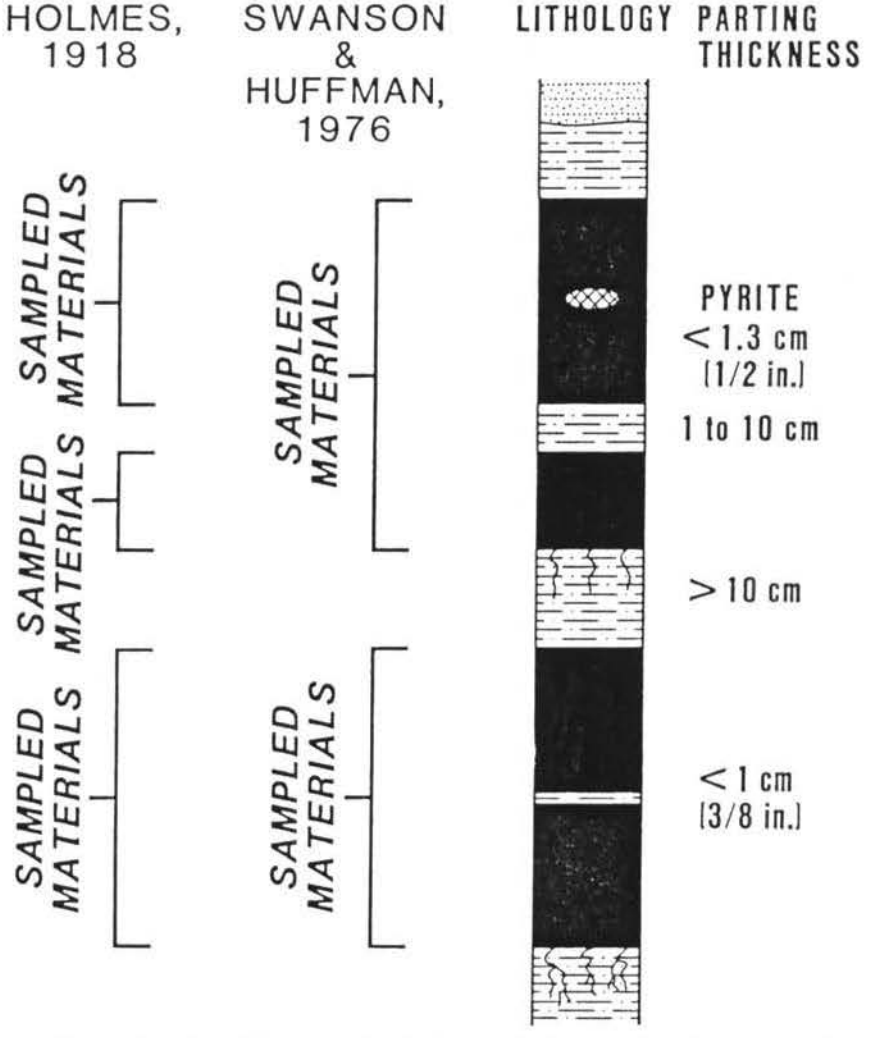


Figure 3. Diagrammatic column showing different criteria for excluding partings in the sampling methods of Holmes (1918) and Swanson and Huffman (1976).

practice. These samples are described in Appendix I as having "thick partings included." The same guidelines were also applied to core samples. The sampling guidelines for several samples collected before June 1979 are unknown and are so noted.

Dimensions of channel cuts were commonly adjusted to the thickness of the coal bed. The channels were typically 4 to 6 inches square (10 to 15 cm), and none was less than 3 inches (8 cm) square. In thick coal beds these channel cuts produced a large volume of sample, which was split in the field by coning and quartering. However, after the first 2 years of the sampling program, field splitting was discontinued. All of the core samples were 2.25 (6.4 cm) inches in diameter.

Megascopic Description

The descriptive methods of Schopf (1960) were chosen as a basis for the megascopic descriptions, but modifications were made in the terminology. Semiquantitative terms were chosen to reflect the thickness and abundance ranges defined by Schopf. The terms "bright attrital," "dull attrital," and "nonbanded" were replaced by "clarain," "durain," and "canneloid," respectively. Additional concentration categories were used; "scattered" was defined as 5 to 15 percent, and "sparse" was redefined as less than 5 percent. "Dominant" was changed to "very abundant," and "moderate" was changed to "common." The total seam thickness was measured and recorded separately from the megascopic description.

Sample Preparation

Samples with field-identification numbers higher than 063 were delivered to the University of Kentucky Institute for Mining and Minerals Research (IMMR) at the Kentucky Center for Energy Research Laboratory for drying, crushing, splitting, and repackaging. The samples were air-dried and crushed to 0.5-inch (1.3 cm) maximum size before splitting to minimize the possibility of contamination. Generally, three splits of each sample were prepared; 50 percent went to the U.S. Geological Survey (USGS), 25 percent went to IMMR for petrographic and other analyses, and the remainder is stored at the Kentucky Geological Survey's (KGS) Well Sample and Core Library. Small samples were not split. The 0.5-inch (1.3 cm) samples were crushed to 0.1 inch (0.3 cm) by the USGS. The split for chemical analysis was crushed to 0.08 inch (0.177 mm). The pulverizer used for the crushing was equipped with ceramic plates to minimize contamination.

PRESENTATION OF DATA

Field Notes and Laboratory Analyses

The coal-sampling reports (field notes) and the coal-analysis reports (laboratory analyses) for each sample are presented on facing pages in Appendix I. The field notes and analyses are arranged in numerical order by the USGS identification number. Most of the information in the field notes is self explanatory, but a few items need clarification. For example, the date on the sampling report is the day the sample was collected. However, samples KGS 001 through KGS 041, which were collected before the cooperative USGS/KGS sampling program began, have a sampling date of January 1, 1978, to indicate that the sample was collected sometime during that year. All thickness measurements except total seam thickness have been converted from meters to feet. The section in each sampling report on structural features applies primarily to cleat azimuths, which were measured for most exposures. Structural features other than jointing (cleat) were seldom encountered during the sampling program. The dips of cleat surfaces were recorded if the dips were measurably different from vertical; these data are available from the Kentucky Geological Survey. The "IN SAMPLE?" column indicates which units were included in the sample.

The laboratory analyses were performed by the U.S. Bureau of Mines (USBM) and Geochemical Testing, Inc. (Geo Test). The as-received values are shown as reported by the laboratory. The moisture-free and moisture- and ash-free values have been recalculated using standard formulas (ASTM, 1981) (ASTM D-3180-74). Other calculated values not shown on these analysis reports, such as volume-percent mineral matter and moist, mineral-matter-free Btu, are available from KGS. Specific gravity, Hardgrove grindability, washability, and similar tests were not performed. Most of the laboratory analyses were completed within 3 months after the samples were received by USGS. However, some of the samples from the Upper Cumberland District were stored for as long as a year, and these samples may have undergone some oxidation.

Table 1 of Appendix II shows the location, rank, and thickness of coal samples collected from the Upper Cumberland District. The apparent rank of each sample was calculated by using data in the coal-analysis reports (Appendix I) and the Parr formulas (ASTM, 1981) (ASTM D-388-77). Apparent ranks for these samples are high-volatile A and high-volatile B bituminous coal.

Chemical Analyses

Major- and minor-oxide and trace-element concentrations are reported for 56 coal samples and nine rock samples from the Upper Cumberland District. Table 2 (Appendix II) presents the results of analyses (in weight percent) performed on coal ash, and Table 3 (Appendix II) contains the results of analyses for 23 trace elements (in parts per million) in the whole coal. Table 4 (Appendix II) summarizes the results for all of the chemical species on a whole coal basis. A total of 65 elements

was searched for, and the following 12 elements were not found: Au, Bi, In, Ir, Os, Pd, Pt, Re, Rh, Ru, Te, and Zr. The whole-coal determinations were performed on air-dried coal (32°C) by wet chemical analysis, atomic absorption spectroscopy, X-ray fluorescence spectroscopy, and instrumental neutron activation analysis. The chemical composition of the ash (from coal ashed at 525°C) was determined by wet chemical analysis, X-ray fluorescence, and optical emission spectroscopy.

Figure 4 is a flow diagram that illustrates the various stages of preparation and analysis involved in processing coal samples. Analyses were performed by the USGS Branch of Analytical Chemistry. Analytical procedures used by the USGS were described by Swanson and Huffman (1976).

Petrographic Analyses

Petrographic analyses were performed at the Kentucky Center for Energy Research Laboratory. This laboratory is equipped with four Leitz petrographic microscopes, including one MPV-II and two MPV-Compact photometer systems for the determination of vitrinite maximum reflectance. Preparation and examination of the samples followed ASTM (1981) standards D-2797-72 (preparation),

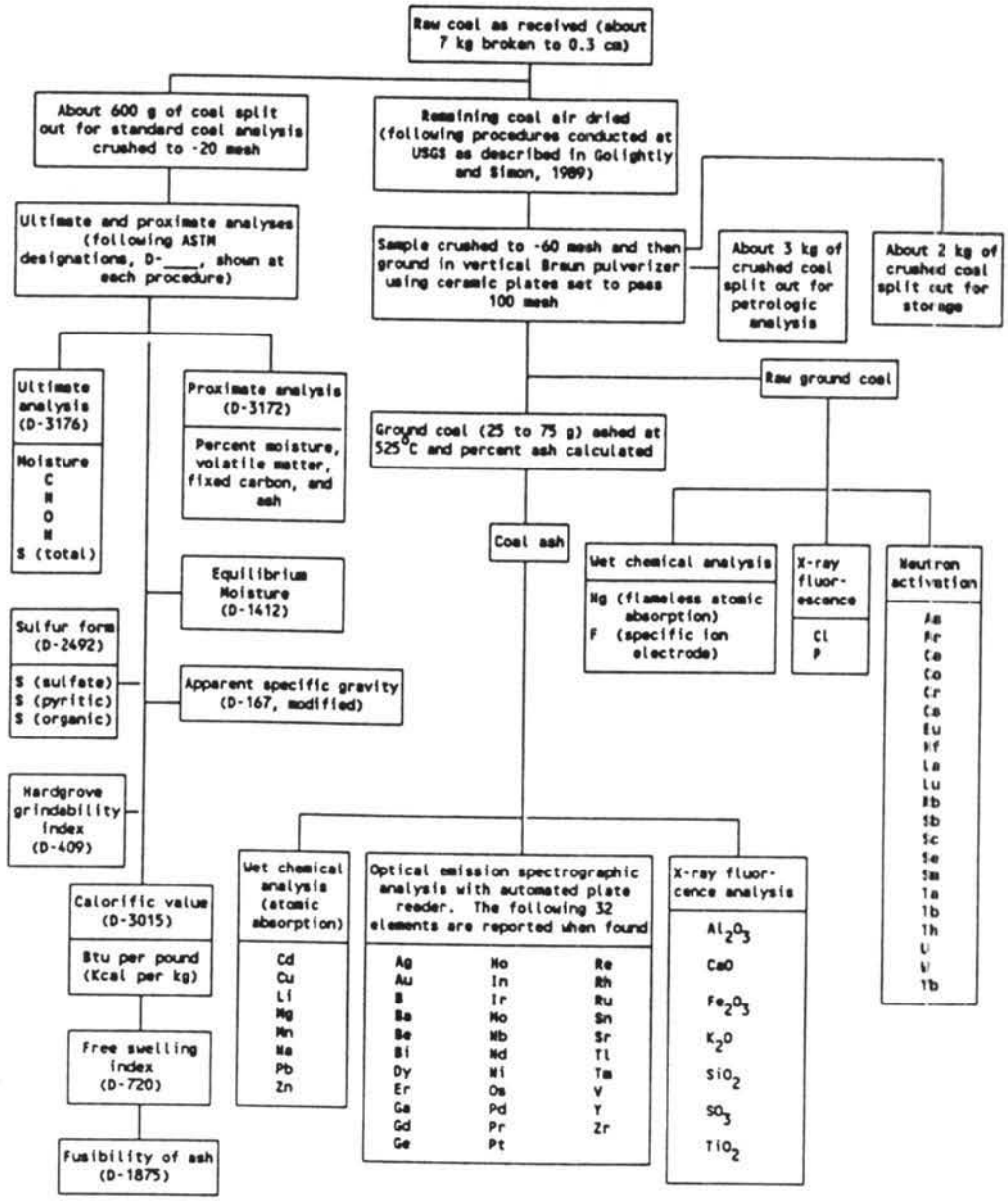


Figure 4. Flow diagram of procedures used for the analysis of coal samples collected. (ASTM—American Society for Testing and Materials—analyses performed by U.S. Bureau of Mines, U.S. Dept. of Energy, and Geochemical Testing Company; remaining analyses performed by the USGS—United States Geological Survey.)

D-2796-81 and D-2799-72 (maceral analysis), and D-2798-79 (vitrinite reflectance). Results of the petrographic analyses for 56 samples are shown in Appendix III.

ACKNOWLEDGMENTS

The field work, classification, and major- and minor-oxide and trace-element analyses were supported through grants from the USGS (U.S. Department of Interior, 14-08-0001-G 602 and 14-08-0001-A 0077). The support of the USGS, particularly the staff of the Branch of Coal Resources, is gratefully acknowledged. The assistance of Peter Zubovic during the early phase of the program is especially appreciated. Funding for petrographic analyses was provided by the Kentucky Energy Cabinet.

Collection of the coal samples would have been vastly more expensive and time consuming if it were not for the generous cooperation of the several hundred coal companies that allowed sampling in their mines. These companies are too numerous to acknowledge individually, but the authors extend sincere thanks to all of them.

Many individuals and agencies that were not directly involved in the research provided support for the program. The University of Kentucky IMMR provided sample preparation, proximate analyses, petrographic analyses, and an assistant during part of the project in exchange for splits of the coal samples. The authors also thank the personnel of the Kentucky Department of Mines and Minerals and the Department of Transportation for their help in locating prospective sample sites.

Finally, the entire staff of the Kentucky Geological Survey has been very supportive. Special thanks are due to Dr. James C. Cobb and Russell Brant for their helpful suggestions and to Kim R. Blackburn, Elizabeth K. Estes, and Douglas Hayes, student assistants, who contributed significantly both in the field and in the office.

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APPENDIX I:
COAL SAMPLING AND CLASSICAL ANALYSIS REPORTS

COAL SAMPLING REPORT

LABORATORY NO: K97577 FIELD NO: KGS 199 U.S.G.S. NO: W207811
SAMPLER: Currens & Kung AGENCY: KGS DATE: Aug/07/1979
7.5' QUAD: Kayjay COUNTY: Bell DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 7 ROW B TIER 69 5750 FT FSL, 4400 FT FEL
LATITUDE: 36 DEG 38 MIN 57 SEC LONGITUDE: 83 DEG 48 MIN 54 SEC
ELEVATION (FT): 2280.00, OF POINT AT base of 199, USING survey
COMMENTARY:
REGIONAL COAL NAME: Fire Clay GEO. MAP COAL NAME: Lower Hignite
REPORTED COAL NAME: Lower Hignite FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
EXPOSURE: TYPE, underground; CONDITION, active
SAMPLE CONDITION: fresh
RECOVERY METHOD: channel SAMPLING REGIME: Swanson & Huffman
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 49.8, SAMPLE 49.8, COAL ONLY 45.1
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 245, SET 2 155, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
N		Shale roof, carbonaceous.
Y	0.26	Clarain, with abundant vitrain.
Y	0.13	Siltstone, black, carbonaceous, nonlaminated (KGS 193, W211179).
Y	0.20	Clarain, with abundant vitrain.
Y	0.02	Fusain.
Y	0.13	Clarain.
Y	0.03	Fusain.
Y	0.92	Clarain, grading to durain at base.
Y	0.39	Clarain, grading to durain at base.
Y	0.46	Clarain, grading to durain at base.
Y	0.43	Clarain.
Y	0.03	Fusain.
Y	0.16	Clarain.
Y	0.02	Pyrite.
Y	0.13	Clarain, with vitrain.
Y	0.02	Pyrite.
Y	0.16	Clarain.
Y	0.23	Shale, medium-gray, carbonaceous, laminated, slickensided, coaly (KGS 196, W211180).
Y	0.43	Clarain, with abundant interlaminated durain, pyritic.
N	0.66	Underclay, slightly silty, rooted, slightly plastic (KGS 198, W211181).

COAL ANALYSIS REPORT

LABORATORY NO: K97577 FIELD NO: KGS 199 U.S.G.S. NO: W207811
LABORATORY: USBM REPORT DATE: Dec/13/1979

AIR DRIED LOSS: 1.20%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	3.00%		
VOLATILE MATTER	29.70%	30.62%	40.30%
FIXED CARBON	44.00%	45.36%	59.70%
ASH	23.30%	24.02%	
ULTIMATE ANALYSIS:			
HYDROGEN	4.50%	4.29%	5.65%
CARBON	60.20%	62.06%	81.69%
NITROGEN	1.40%	1.44%	1.90%
TOTAL SULFUR	1.20%	1.24%	1.63%
OXYGEN	9.40%	6.95%	9.13%
ASH	23.30%	24.02%	
HEATING VALUE (BTU/LB):	10745	11077	14580
SULFUR FORMS:			
SULFATE	0.01%	0.01%	0.01%
PYRITIC	0.56%	0.58%	0.76%
ORGANIC	0.60%	0.62%	0.81%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2550 deg F
SOFTENING TEMP.	2660 deg F
FLUID TEMP.	2780 deg F

FREE SWELLING INDEX	4.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	2.2

COAL SAMPLING REPORT

LABORATORY NO: K97578 FIELD NO: KGS 204 U.S.G.S. NO: W207812
SAMPLER: Currens & Kung AGENCY: KGS DATE: Aug/07/1979
7.5' QUAD: Kayjay COUNTY: Bell DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 7 ROW B TIER 69 3700 FT FSL, 2150 FT FEL
LATITUDE: 36 DEG 38 MIN 37 SEC LONGITUDE: 83 DEG 48 MIN 26 SEC
ELEVATION (FT): 2313.00, OF POINT AT base of 204, USING survey
COMMENTARY:
REGIONAL COAL NAME: Fire Clay GEO. MAP COAL NAME: Lower Hignite
REPORTED COAL NAME: Lower Hignite FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
EXPOSURE: TYPE, underground; CONDITION, active
SAMPLE CONDITION: fresh
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 36.2, SAMPLE 36.2, COAL ONLY 36.0
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 245, SET 2 155, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
N		Siltstone, dark-gray, laminated to bioturbated (KGS 203, W211183).
Y	0.20	Clarain, with calcite in cleat.
Y	0.02	Shale, dark-gray, carbonaceous.
Y	0.05	Durain.
Y	0.43	Clarain.
Y	0.03	Fusain.
Y	0.02	Vitrain and fusain.
Y	0.07	Vitrain.
Y	0.23	Clarain.
Y	0.30	Durain, interlaminated with clarain; scattered fusain.
Y	0.39	Clarain, with abundant durain.
Y	0.62	Clarain, with abundant vitrain.
Y	0.02	Fusain.
Y	0.66	Clarain.
N		Shale, silty, rooted, soft (KGS 202, W211182).

COAL ANALYSIS REPORT

LABORATORY NO: K97578 FIELD NO: KGS 204 U.S.G.S. NO: W207812
LABORATORY: USBM REPORT DATE: Dec/13/1979

AIR DRIED LOSS: 0.90%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	3.00%		
VOLATILE MATTER	36.00%	37.11%	38.92%
FIXED CARBON	56.50%	58.25%	61.08%
ASH	4.50%	4.64%	
ULTIMATE ANALYSIS:			
HYDROGEN	5.40%	5.22%	5.48%
CARBON	77.20%	79.59%	83.46%
NITROGEN	1.80%	1.86%	1.95%
TOTAL SULFUR	0.60%	0.62%	0.65%
OXYGEN	10.40%	8.07%	8.46%
ASH	4.50%	4.64%	
HEATING VALUE (BTU/LB):	13770	14196	14887
SULFUR FORMS:			
SULFATE	0.01%	0.01%	0.01%
PYRITIC	0.12%	0.12%	0.13%
ORGANIC	0.47%	0.48%	0.51%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2750 deg F
SOFTENING TEMP.	2800 deg F
FLUID TEMP.	2800 deg F

FREE SWELLING INDEX	5.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	0.9

COAL SAMPLING REPORT

LABORATORY NO: K97580 FIELD NO: KGS 224 U.S.G.S. NO: W207813
SAMPLER: Currens & Kung AGENCY: KGS DATE: Aug/08/1979
7.5' QUAD: Kayjay COUNTY: Bell DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 7 ROW B TIER 69 2500 FT FSL, 4200 FT FEL
LATITUDE: 36 DEG 38 MIN 25 SEC LONGITUDE: 83 DEG 48 MIN 52 SEC
ELEVATION (FT): 1977.00, OF POINT AT base of 224, USING survey
COMMENTARY: Portal of deep mine.
REGIONAL COAL NAME: Amburgy zone GEO. MAP COAL NAME: Poplar Lick
REPORTED COAL NAME: Poplar Lick FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
EXPOSURE: TYPE, mine portal; CONDITION, 9 months old, faced-up
SAMPLE CONDITION: clean, dry
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 29.5, SAMPLE 29.5, COAL ONLY 29.1
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 230, SET 2 315, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
N	13.12	Shale, black, carbonaceous, sideritic ("Kendrick").
Y	0.79	Clarain, with abundant durain.
Y	0.13	Vitrain.
Y	0.26	Clarain, with abundant vitrain.
Y	0.03	Shale, black, carbonaceous.
Y	0.30	Clarain.
Y	0.20	Durain.
Y	0.20	Clarain, with abundant durain.
Y	0.10	Fusain.
Y	0.16	Durain.
Y	0.23	Vitrain.
Y	0.07	Clarain.
N		Shale, dark-gray, rooted, silty.

COAL ANALYSIS REPORT

LABORATORY NO: K97580 FIELD NO: KGS 224 U.S.G.S. NO: W207813
LABORATORY: USBM REPORT DATE: Dec/13/1979

AIR DRIED LOSS: 1.00%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	2.80%		
VOLATILE MATTER	35.90%	36.93%	40.52%
FIXED CARBON	52.70%	54.22%	59.48%
ASH	8.60%	8.85%	
ULTIMATE ANALYSIS:			
HYDROGEN	5.30%	5.13%	5.63%
CARBON	73.80%	75.93%	83.30%
NITROGEN	1.90%	1.95%	2.14%
TOTAL SULFUR	0.70%	0.72%	0.79%
OXYGEN	9.80%	7.42%	8.14%
ASH	8.60%	8.85%	
HEATING VALUE (BTU/LB):	13253	13635	14959
SULFUR FORMS:			
SULFATE	0.01%	0.01%	0.01%
PYRITIC	0.23%	0.24%	0.26%
ORGANIC	0.49%	0.50%	0.55%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2800 deg F
SOFTENING TEMP.	2800 deg F
FLUID TEMP.	2800 deg F

FREE SWELLING INDEX	5.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	1.1

COAL SAMPLING REPORT

LABORATORY NO: K97563 FIELD NO: KGS 225 U.S.G.S. NO: W207814
SAMPLER: Currens & Kung AGENCY: KGS DATE: Aug/08/1979
7.5' QUAD: Kayjay COUNTY: Bell DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 7 ROW B TIER 69 2300 FT FSL, 4150 FT FEL
LATITUDE: 36 DEG 38 MIN 23 SEC LONGITUDE: 83 DEG 48 MIN 51 SEC
ELEVATION (FT): 1977.00, OF POINT AT base of 225, USING survey
COMMENTARY:
REGIONAL COAL NAME: Amburgy zone GEO. MAP COAL NAME: Poplar Lick
REPORTED COAL NAME: Poplar Lick FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
EXPOSURE: TYPE, underground; CONDITION, 9 months old, faced-up
SAMPLE CONDITION: slightly weathered
RECOVERY METHOD: channel SAMPLING REGIME: Swanson & Huffman
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 27.2, SAMPLE 27.2, COAL ONLY 26.4
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 230, SET 2 315, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
N	13.12	Shale, medium- to dark-gray, carbonaceous, silty.
Y	0.30	Clarain.
Y	0.03	Fusain.
Y	0.07	Vitrain.
Y	0.36	Clarain.
Y	0.33	Clarain, with durain.
Y	0.07	Shale, black.
Y	0.30	Clarain.
Y	0.26	Durain.
Y	0.56	Clarain.
N		Shale, dark-gray, rooted.

COAL ANALYSIS REPORT

LABORATORY NO: K97563 FIELD NO: KGS 225 U.S.G.S. NO: W207814
LABORATORY: USBM REPORT DATE: Dec/10/1979

AIR DRIED LOSS: 1.30%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	3.50%		
VOLATILE MATTER	35.40%	36.69%	39.91%
FIXED CARBON	53.30%	55.23%	60.09%
ASH	7.80%	8.08%	
ULTIMATE ANALYSIS:			
HYDROGEN	5.30%	5.09%	5.53%
CARBON	73.30%	75.96%	82.64%
NITROGEN	1.90%	1.97%	2.14%
TOTAL SULFUR	0.70%	0.73%	0.79%
OXYGEN	10.90%	8.17%	8.90%
ASH	7.80%	8.08%	
HEATING VALUE (BTU/LB):	13142	13619	14816
SULFUR FORMS:			
SULFATE	0.01%	0.01%	0.01%
PYRITIC	0.20%	0.21%	0.23%
ORGANIC	0.50%	0.52%	0.56%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2800 deg F
SOFTENING TEMP.	2800 deg F
FLUID TEMP.	2800 deg F

FREE SWELLING INDEX	3.5
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	1.1

COAL SAMPLING REPORT

LABORATORY NO: K97579 FIELD NO: KGS 218 U.S.G.S. NO: W207822
SAMPLER: Currens & Kung AGENCY: KGS DATE: Aug/08/1979
7.5' QUAD: Kayjay COUNTY: Bell DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 6 ROW B TIER 69 5050 FT FSL, 600 FT FEL
LATITUDE: 36 DEG 38 MIN 50 SEC LONGITUDE: 83 DEG 49 MIN 7 SEC
ELEVATION (FT): 2344.00, OF POINT AT base of 218, USING altimeter
COMMENTARY:
REGIONAL COAL NAME: Fire Clay GEO. MAP COAL NAME: Hignite
REPORTED COAL NAME: Hignite FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): bottom bench
EXPOSURE: TYPE, surface mine; CONDITION, abandoned, faced-up
SAMPLE CONDITION: slightly weathered
RECOVERY METHOD: channel SAMPLING REGIME: Swanson & Huffman
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 29.5, SAMPLE 29.5, COAL ONLY 27.8
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 70, SET 2 325, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
N	0.89	Horizon KGS 216.
N	0.10	Shale, black, carbonaceous, laminated.
Y	0.33	Clarain.
Y	0.72	Durain.
Y	0.03	Vitrain.
Y	0.08	Durain.
Y	0.05	Pyrite.
Y	0.03	Durain.
Y	0.10	Vitrain.
Y	0.13	Durain.
Y	0.56	Clarain, with abundant vitrain.
Y	0.03	Shale, dark-gray, carbonaceous.
Y	0.07	Clarain.
Y	0.07	Shale, dark-gray, carbonaceous.
Y	0.26	Clarain, pyritic.
N		Shale, dark-gray, slightly silty, carbonaceous, rooted, non-plastic (KGS 219, W211187).

COAL ANALYSIS REPORT

LABORATORY NO: K97579 FIELD NO: KGS 218 U.S.G.S. NO: W207822
LABORATORY: USBM REPORT DATE: Dec/13/1979

AIR DRIED LOSS: 1.40%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	3.50%		
VOLATILE MATTER	34.80%	36.06%	39.06%
FIXED CARBON	54.30%	56.27%	60.94%
ASH	7.40%	7.67%	
ULTIMATE ANALYSIS:			
HYDROGEN	5.20%	4.98%	5.40%
CARBON	73.70%	76.38%	82.71%
NITROGEN	1.60%	1.66%	1.80%
TOTAL SULFUR	1.30%	1.35%	1.46%
OXYGEN	10.70%	7.96%	8.63%
ASH	7.40%	7.67%	
HEATING VALUE (BTU/LB):	13052	13526	14648
SULFUR FORMS:			
SULFATE	0.01%	0.01%	0.01%
PYRITIC	0.59%	0.61%	0.66%
ORGANIC	0.73%	0.76%	0.82%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2210 deg F
SOFTENING TEMP.	2300 deg F
FLUID TEMP.	2420 deg F

FREE SWELLING INDEX	2.5
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	2.0

COAL SAMPLING REPORT

LABORATORY NO: K97849 FIELD NO: KGS 212 U.S.G.S. NO: W207866
SAMPLER: Currens & Kung AGENCY: KGS DATE: Aug/08/1979
7.5' QUAD: Fork Ridge COUNTY: Bell DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 15 ROW B TIER 69 2900 FT FSL, 1100 FT FEL
LATITUDE: 36 DEG 37 MIN 29 SEC LONGITUDE: 83 DEG 49 MIN 13 SEC
ELEVATION (FT): 1889.00, OF POINT AT base of 212, USING survey
COMMENTARY: Full channel at same location as KGS 209
REGIONAL COAL NAME: U Elkhorn No.3 GEO. MAP COAL NAME: Buckeye Spring
REPORTED COAL NAME: Buckeye Spring FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
EXPOSURE: TYPE, underground; CONDITION, active
SAMPLE CONDITION: very fresh
RECOVERY METHOD: channel SAMPLING REGIME: Swanson & Huffman
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 31.3, SAMPLE 31.3, COAL ONLY 29.7
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 250, SET 2 , SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
N		Shale, light-gray to brown, carbonaceous, with abundant plant fragments.
Y	0.23	Vitrain.
Y	0.21	Durain.
Y	0.66	Clarain.
Y	0.10	Vitrain.
Y	0.13	Durain.
Y	0.26	Clarain.
Y	0.13	Siltstone, black, arenaceous, carbonaceous, very hard.
Y	0.89	Clarain.
N		Seatrock.

COAL ANALYSIS REPORT

LABORATORY NO: K97849 FIELD NO: KGS 212 U.S.G.S. NO: W207866
LABORATORY: USBM REPORT DATE: Dec/26/1979

AIR DRIED LOSS: 1.30%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	2.50%		
9VOLATILE MATTER	33.10%	33.95%	38.76%
FIXED CARBON	52.30%	53.64%	61.24%
ASH	12.10%	12.41%	
ULTIMATE ANALYSIS:			
HYDROGEN	5.10%	4.94%	5.64%
CARBON	71.70%	73.54%	83.96%
NITROGEN	1.80%	1.85%	2.11%
TOTAL SULFUR	0.70%	0.72%	0.82%
OXYGEN	8.60%	6.54%	7.47%
ASH	12.10%	12.41%	
HEATING VALUE (BTU/LB):	12701	13026	14873
SULFUR FORMS:			
SULFATE	0.01%	0.01%	0.01%
PYRITIC	0.14%	0.14%	0.16%
ORGANIC	0.60%	0.62%	0.70%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2570 deg F
SOFTENING TEMP.	2700 deg F
FLUID TEMP.	2790 deg F

FREE SWELLING INDEX	4.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	1.1

COAL SAMPLING REPORT

LABORATORY NO: K97561 FIELD NO: KGS 208 U.S.G.S. NO: W207897
SAMPLER: Currens & Kung AGENCY: KGS DATE: Aug/07/1979
7.5' QUAD: Fork Ridge COUNTY: Bell DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 15 ROW B TIER 69 1150 FT FSL, 1300 FT FEL
LATITUDE: 36 DEG 37 MIN 11 SEC LONGITUDE: 83 DEG 49 MIN 16 SEC
ELEVATION (FT): 1912.00, OF POINT AT base of 208, USING survey
COMMENTARY:
REGIONAL COAL NAME: U Elkhorn No.3 GEO. MAP COAL NAME: Buckeye Spring
REPORTED COAL NAME: Buckeye Spring FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
EXPOSURE: TYPE, underground; CONDITION, active
SAMPLE CONDITION: very fresh
RECOVERY METHOD: channel SAMPLING REGIME: Swanson & Huffman
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 31.3, SAMPLE 31.3, COAL ONLY 28.1
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 240, SET 2 130, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
N		Shale, light to dark-gray, silty, carbonaceous, with abundant plant fragments.
Y	0.10	Vitrain.
Y	0.13	Clarain, pyritic.
Y	0.03	Shale, carbonaceous, laminated.
Y	0.49	Durain.
Y	0.02	Fusain.
Y	1.05	Clarain, with abundant durain.
Y	0.23	Siltstone, black, arenaceous, carbonaceous, nonlaminated, very hard.
Y	0.56	Clarain, pyritic.
N		Shale, light- to dark-gray, silty, rooted; full channel at KGS 205 site.

COAL ANALYSIS REPORT

LABORATORY NO: K97561 FIELD NO: KGS 208 U.S.G.S. NO: W207897
LABORATORY: USBM REPORT DATE: Dec/10/1979

AIR DRIED LOSS: 0.90%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	2.40%		
VOLATILE MATTER	30.70%	31.46%	40.40%
FIXED CARBON	45.30%	46.41%	59.61%
ASH	21.60%	22.13%	
ULTIMATE ANALYSIS:			
HYDROGEN	4.50%	4.34%	5.57%
CARBON	62.00%	63.53%	81.58%
NITROGEN	1.60%	1.64%	2.11%
TOTAL SULFUR	2.20%	2.25%	2.89%
OXYGEN	8.10%	6.11%	7.85%
ASH	21.60%	22.13%	
HEATING VALUE (BTU/LB):	11206	11482	14745
SULFUR FORMS:			
SULFATE	0.01%	0.01%	0.01%
PYRITIC	1.90%	1.95%	2.50%
ORGANIC	0.28%	0.29%	0.37%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2520 deg F
SOFTENING TEMP.	2630 deg F
FLUID TEMP.	2710 deg F

FREE SWELLING INDEX	5.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	3.9

COAL SAMPLING REPORT

LABORATORY NO: K97562 FIELD NO: KGS 220 U.S.G.S. NO: W207899
SAMPLER: Currens & Kung AGENCY: KGS DATE: Aug/08/1979
7.5' QUAD: Kayjay COUNTY: Bell DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 6 ROW B TIER 69 5050 FT FSL, 600 FT FEL
LATITUDE: 36 DEG 38 MIN 50 SEC LONGITUDE: 83 DEG 49 MIN 7 SEC
ELEVATION (FT): 2344.00, OF POINT AT base of 220, USING altimeter
COMMENTARY:
REGIONAL COAL NAME: Fire Clay GEO. MAP COAL NAME: Hignite
REPORTED COAL NAME: Hignite FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
EXPOSURE: TYPE, surface mine; CONDITION, abandoned, faced-up
SAMPLE CONDITION: slightly weathered
RECOVERY METHOD: channel SAMPLING REGIME: thick partings included
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 74.0, SAMPLE 73.8, COAL ONLY 57.1
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 70, SET 2 325, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
N	16.40	Sandstone, medium-gray, crossbedded to massive, carbonaceous, micaceous, feldspathic.
N	3.28	Shale, medium-gray, silty, carbonaceous, sideritic, bioturbated (KGS 213, W211184).
Y	0.26	Durain, with sparse thick-banded vitrain.
Y	1.28	Durain and clarain, interbedded, grading to clarain at base.
Y	0.26	Shale, dark-gray, slightly silty, rooted (KGS 215, W211185).
Y	0.89	Clarain, with abundant thin- to very thick-banded vitrain.
Y	0.89	Siltstone, dark-gray, carbonaceous, rooted (KGS 217, W211186).
Y	0.10	Shale, black, carbonaceous, laminated.
Y	0.33	Clarain.
Y	0.85	Durain, with sparse thick-banded vitrain.
Y	0.05	Pyrite.
Y	0.03	Durain.
Y	0.10	Vitrain.
Y	0.13	Durain.
Y	0.56	Clarain, with abundant vitrain.
Y	0.03	Shale, dark-gray, carbonaceous.
Y	0.07	Clarain.
Y	0.07	Shale, dark-gray, carbonaceous.
Y	0.26	Clarain, pyritic.
N		Shale, dark-gray, carbonaceous, slightly rooted, nonplastic (KGS 219, W211187).

COAL ANALYSIS REPORT

LABORATORY NO: K97562 FIELD NO: KGS 220 U.S.G.S. NO: W207899
LABORATORY: USBM REPORT DATE: Dec/10/1979

AIR DRIED LOSS: 1.00%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	2.80%		
VOLATILE MATTER	27.70%	28.50%	42.36%
FIXED CARBON	37.70%	38.79%	57.65%
ASH	31.80%	32.72%	
ULTIMATE ANALYSIS:			
HYDROGEN	4.00%	3.79%	5.64%
CARBON	52.30%	53.81%	79.97%
NITROGEN	1.30%	1.34%	1.99%
TOTAL SULFUR	0.80%	0.82%	1.22%
OXYGEN	9.70%	7.52%	11.18%
ASH	31.80%	32.72%	
HEATING VALUE (BTU/LB):	9382	9652	14346
SULFUR FORMS:			
SULFATE	0.01%	0.01%	0.02%
PYRITIC	0.23%	0.24%	0.35%
ORGANIC	0.59%	0.61%	0.90%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2790 deg F
SOFTENING TEMP.	2800 deg F
FLUID TEMP.	2800 deg F

FREE SWELLING INDEX	1.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	1.7

COAL SAMPLING REPORT

LABORATORY NO: K97564 FIELD NO: KGS 228 U.S.G.S. NO: W207900
SAMPLER: Currens & Kung AGENCY: KGS DATE: Aug/08/1979
7.5' QUAD: Kayjay COUNTY: Bell DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 10 ROW B TIER 68 2400 FT FSL, 3000 FT FEL
LATITUDE: 36 DEG 38 MIN 24 SEC LONGITUDE: 83 DEG 50 MIN 37 SEC
ELEVATION (FT): 2780.00, OF POINT AT base of 228, USING topo
COMMENTARY: Full channel at same location as KGS 226
REGIONAL COAL NAME: Hazard zone GEO. MAP COAL NAME: Red Springs
REPORTED COAL NAME: Red Springs FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
EXPOSURE: TYPE, underground; CONDITION, 2 months old, faced-up
SAMPLE CONDITION: slightly weathered, clean, damp
RECOVERY METHOD: channel SAMPLING REGIME: Swanson & Huffman
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 30.3, SAMPLE 30.3, COAL ONLY 25.0
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 245, SET 2 190, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
N	16.40	Sandstone, dark-gray to buff, very carbonaceous, with abundant plant fragments, crossbedded, feldspathic to micaceous.
Y	0.26	Durain, interlaminated with clarain.
Y	0.23	Clarain, with scattered vitrain.
Y	0.46	Durain, grading to clarain at base.
Y	0.10	Durain.
Y	0.66	Clarain, with abundant vitrain at base.
Y	0.10	Shale, medium-gray, rooted.
Y	0.20	Clarain, with abundant vitrain.
Y	0.20	Shale, medium-gray, silty, rooted.
Y	0.07	Vitrain.
Y	0.08	Shale, medium-gray, silty, rooted.
Y	0.08	Clarain.
Y	0.07	Shale, medium-gray, silty, rooted.
Y	0.03	Clarain.
N		Shale, medium-gray, plastic, silty, rooted, slightly carbonaceous.

COAL ANALYSIS REPORT

LABORATORY NO: K97564 FIELD NO: KGS 228 U.S.G.S. NO: W207900
LABORATORY: USBM REPORT DATE: Dec/11/1979

AIR DRIED LOSS: 1.50%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	3.60%		
VOLATILE MATTER	32.90%	34.13%	42.95%
FIXED CARBON	43.70%	45.33%	57.05%
ASH	19.80%	20.54%	
ULTIMATE ANALYSIS:			
HYDROGEN	4.70%	4.46%	5.61%
CARBON	62.70%	65.04%	81.85%
NITROGEN	1.30%	1.35%	1.70%
TOTAL SULFUR	0.60%	0.62%	0.78%
OXYGEN	11.00%	7.99%	10.06%
ASH	19.80%	20.54%	
HEATING VALUE (BTU/LB):	11206	11624	14629
SULFUR FORMS:			
SULFATE	0.01%	0.01%	0.01%
PYRITIC	0.12%	0.12%	0.16%
ORGANIC	0.45%	0.47%	0.59%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2800 deg F
SOFTENING TEMP.	2800 deg F
FLUID TEMP.	2800 deg F

FREE SWELLING INDEX	1.5
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	1.1

COAL SAMPLING REPORT

LABORATORY NO: K97565 FIELD NO: KGS 242 U.S.G.S. NO: W207901
SAMPLER: Currens & Pollock AGENCY: KGS DATE: Aug/20/1979
7.5' QUAD: Varilla COUNTY: Bell DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 15 ROW C TIER 72 1000 FT FSL, 1800 FT FEL
LATITUDE: 36 DEG 42 MIN 10 SEC LONGITUDE: 83 DEG 34 MIN 22 SEC
ELEVATION (FT): 1705.00, OF POINT AT base of 242, USING survey
COMMENTARY: The units in the upper part of the section were inaccessible; therefore, the thicknesses are estimated
REGIONAL COAL NAME: Manchester GEO. MAP COAL NAME: Hance
REPORTED COAL NAME: Hance FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): bottom split
EXPOSURE: TYPE, surface mine; CONDITION, 1 month old
SAMPLE CONDITION: fresh
RECOVERY METHOD: channel SAMPLING REGIME: Swanson & Huffman
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 36.6, SAMPLE 36.6, COAL ONLY 35.4
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 , SET 2 , SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
N	49.21	Siltstone.
N	3.28	Coal.
N	1.64	Siltstone, rooted.
N	3.28	Coal.
N	26.25	Siltstone, arenaceous.
N	1.64	Siltstone, medium- to dark-gray, sideritic.
Y	1.05	Clarain, with abundant vitrain.
Y	0.10	Shale, dark-gray, carbonaceous.
Y	0.10	Vitrain.
Y	0.39	Clarain.
Y	0.07	Vitrain.
Y	1.35	Clarain.
N		Siltstone, dark-gray, rooted.

COAL ANALYSIS REPORT

LABORATORY NO: K97565 FIELD NO: KGS 242 U.S.G.S. NO: W207901
LABORATORY: USBM REPORT DATE: Dec/10/1979

AIR DRIED LOSS: 0.80%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	2.40%		
VOLATILE MATTER	37.60%	38.52%	40.09%
FIXED CARBON	56.20%	57.58%	59.91%
ASH	3.80%	3.89%	
ULTIMATE ANALYSIS:			
HYDROGEN	5.60%	5.46%	5.68%
CARBON	79.20%	81.15%	84.44%
NITROGEN	2.10%	2.15%	2.24%
TOTAL SULFUR	0.70%	0.72%	0.75%
OXYGEN	8.60%	6.63%	6.89%
ASH	3.80%	3.89%	
HEATING VALUE (BTU/LB):	14268	14619	15211
SULFUR FORMS:			
SULFATE	0.01%	0.01%	0.01%
PYRITIC	0.17%	0.17%	0.18%
ORGANIC	0.54%	0.55%	0.58%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2640 deg F
SOFTENING TEMP.	2760 deg F
FLUID TEMP.	2800 deg F

FREE SWELLING INDEX	7.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	1.0

COAL SAMPLING REPORT

LABORATORY NO: K97868 FIELD NO: KGS 270 U.S.G.S. NO: W208056
SAMPLER: Currens, Pollock, Kung AGENCY: KGS DATE: Sep/27/1979
7.5' QUAD: Varilla COUNTY: Bell DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 16 ROW C TIER 72 1700 FT FSL, 3200 FT FEL
LATITUDE: 36 DEG 41 MIN 17 SEC LONGITUDE: 83 DEG 34 MIN 39 SEC
ELEVATION (FT): 1625.00, OF POINT AT base of 270, USING survey
COMMENTARY:
REGIONAL COAL NAME: Glamorgan zone GEO. MAP COAL NAME: Mason
REPORTED COAL NAME: Mason FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
EXPOSURE: TYPE, underground; CONDITION, active
SAMPLE CONDITION: fresh, clean, dry
RECOVERY METHOD: channel SAMPLING REGIME: Swanson & Huffman
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 45.5, SAMPLE 45.5, COAL ONLY 42.7
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 40, SET 2 113, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
N		Siltstone, black, laminated, carbonaceous, with with abundant plant fragments.
Y	0.20	Clarain.
Y	0.02	Fusain.
Y	0.28	Durain, with scattered thin- to medium-banded vitrain.
Y	0.02	Fusain.
Y	0.34	Clarain, with abundant thin- to medium-banded vitrain, scattered durain.
Y	0.85	Clarain, with abundant medium- to thick-banded vitrain, scattered thin durain, pyritic.
Y	0.23	Siltstone, black, coaly, laminated to partly bioturbated.
Y	0.08	Clarain, with 5-mm-thick pyrite nodule at base.
Y	1.77	Clarain, with abundant thin- to thick-banded vitrain, scattered thin-banded fusain, thin-banded pyrite; graphitic texture.
N		Shale, medium-gray, plastic, slickensided, rooted.

COAL ANALYSIS REPORT

LABORATORY NO: K97868 FIELD NO: KGS 270 U.S.G.S. NO: W208056
LABORATORY: USBM REPORT DATE: Dec/26/1979

AIR DRIED LOSS: 1.20%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	2.20%		
VOLATILE MATTER	34.40%	35.17%	43.27%
FIXED CARBON	45.10%	46.11%	56.73%
ASH	18.30%	18.71%	
ULTIMATE ANALYSIS:			
HYDROGEN	5.00%	4.86%	5.98%
CARBON	64.90%	66.36%	81.64%
NITROGEN	1.90%	1.94%	2.39%
TOTAL SULFUR	2.30%	2.35%	2.89%
OXYGEN	7.70%	5.78%	7.10%
ASH	18.30%	18.71%	
HEATING VALUE (BTU/LB):	11844	12111	14899
SULFUR FORMS:			
SULFATE	0.01%	0.01%	0.01%
PYRITIC	1.64%	1.68%	2.06%
ORGANIC	0.66%	0.67%	0.83%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2420 deg F
SOFTENING TEMP.	2510 deg F
FLUID TEMP.	2600 deg F

FREE SWELLING INDEX	6.5
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	3.9

COAL SAMPLING REPORT

LABORATORY NO: K97869 FIELD NO: KGS 271 U.S.G.S. NO: W208057
SAMPLER: Currens & Kung AGENCY: KGS DATE: Sep/27/1979
7.5' QUAD: Varilla COUNTY: Bell DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 16 ROW C TIER 72 1750 FT FSL, 2900 FT FEL
LATITUDE: 36 DEG 41 MIN 17 SEC LONGITUDE: 83 DEG 34 MIN 36 SEC
ELEVATION (FT): 1625.00, OF POINT AT base of 271, USING survey
COMMENTARY:
REGIONAL COAL NAME: Glamorgan zone GEO. MAP COAL NAME: Mason
REPORTED COAL NAME: Mason FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
EXPOSURE: TYPE, underground; CONDITION, active
SAMPLE CONDITION: fresh
RECOVERY METHOD: channel SAMPLING REGIME: Swanson & Huffman
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 42.3, SAMPLE 42.3, COAL ONLY 39.6
STRUCTURAL FEATURE: , SEPARATION:
STRIKE AZIMUTHS: SET 1 , SET 2 , SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
N		Siltstone, dark-gray to black, carbonaceous, with abundant plant fragments.
Y	0.07	Clarain.
Y	0.03	Vitrain.
Y	0.16	Fusain.
Y	0.52	Clarain, with abundant thin-banded vitrain, pyritic.
Y	0.02	Fusain.
Y	0.89	Clarain, with abundant thin- to thick-banded vitrain, scattered thin-banded fusain.
Y	0.23	Siltstone, medium-gray, micaceous.
Y	1.61	Clarain, with abundant thin-banded vitrain; bottom 20 cm slickensided, with graphitic texture; pyrite in cleat.
N		Siltstone, rooted.

COAL ANALYSIS REPORT

LABORATORY NO: K97869 FIELD NO: KGS 271 U.S.G.S. NO: W208057
LABORATORY: USBM REPORT DATE: Dec/26/1979

AIR DRIED LOSS: 1.20%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	2.20%		
VOLATILE MATTER	35.00%	35.79%	43.81%
FIXED CARBON	44.90%	45.91%	56.20%
ASH	17.90%	18.30%	
ULTIMATE ANALYSIS:			
HYDROGEN	4.90%	4.76%	5.82%
CARBON	64.90%	66.36%	81.23%
NITROGEN	1.90%	1.94%	2.38%
TOTAL SULFUR	2.60%	2.66%	3.25%
OXYGEN	7.80%	5.98%	7.32%
ASH	17.90%	18.30%	
HEATING VALUE (BTU/LB):	11932	12201	14934
SULFUR FORMS:			
SULFATE	0.08%	0.08%	0.10%
PYRITIC	1.93%	1.97%	2.42%
ORGANIC	0.55%	0.56%	0.69%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2260 deg F
SOFTENING TEMP.	2370 deg F
FLUID TEMP.	2480 deg F

FREE SWELLING INDEX	7.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	4.4

COAL SAMPLING REPORT

LABORATORY NO: K97870 FIELD NO: KGS 272 U.S.G.S. NO: W208058
SAMPLER: Currens, Pollock, Kung AGENCY: KGS DATE: Sep/27/1979
7.5' QUAD: Varilla COUNTY: Bell DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 19 ROW C TIER 71 1900 FT FSL, 4400 FT FEL
LATITUDE: 36 DEG 41 MIN 19 SEC LONGITUDE: 83 DEG 36 MIN 54 SEC
ELEVATION (FT): 1375.00, OF POINT AT base of 272, USING survey
COMMENTARY:
REGIONAL COAL NAME: Gray Hawk GEO. MAP COAL NAME: Splitseam
REPORTED COAL NAME: Splitseam FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
EXPOSURE: TYPE, underground; CONDITION, active
SAMPLE CONDITION: very fresh
RECOVERY METHOD: channel SAMPLING REGIME: thick partings included
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 49.6, SAMPLE 49.6, COAL ONLY 40.6
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 235, SET 2 285, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
N		Roof, black, laminated, carbonaceous.
Y	0.79	Clarain, with abundant thin- to medium-banded vitrain, scattered fusain.
Y	0.30	Durain.
Y	0.56	Clarain, with thin- to medium-banded vitrain, scattered fusain.
Y	0.43	Siltstone, medium- to dark-gray, nonlaminated, rooted, carbonaceous.
Y	0.03	Clarain.
Y	0.03	Shale.
Y	0.08	Clarain.
Y	0.05	Vitrain.
Y	0.49	Clarain, with abundant medium- to thick-banded vitrain.
Y	0.30	Siltstone, dark-gray, partially laminated, slickensided, rooted.
Y	0.36	Durain, with scattered thin-banded vitrain.
Y	0.72	Clarain, with abundant thin- to thick-banded vitrain; scattered fusain near base.
N		Seatrock.

COAL ANALYSIS REPORT

LABORATORY NO: K97870 FIELD NO: KGS 272 U.S.G.S. NO: W208058
LABORATORY: USBM REPORT DATE: Dec/26/1979

AIR DRIED LOSS: 1.30%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	2.20%		
VOLATILE MATTER	32.20%	32.92%	39.75%
FIXED CARBON	48.80%	49.90%	60.25%
ASH	16.80%	17.18%	
ULTIMATE ANALYSIS:			
HYDROGEN	4.90%	4.76%	5.75%
CARBON	67.90%	69.43%	83.83%
NITROGEN	1.80%	1.84%	2.22%
TOTAL SULFUR	1.10%	1.12%	1.36%
OXYGEN	7.40%	5.67%	6.84%
ASH	16.80%	17.18%	
HEATING VALUE (BTU/LB):	12224	12499	15092
SULFUR FORMS:			
SULFATE	0.01%	0.01%	0.01%
PYRITIC	0.62%	0.63%	0.77%
ORGANIC	0.48%	0.49%	0.59%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2660 deg F
SOFTENING TEMP.	2780 deg F
FLUID TEMP.	2800 deg F

FREE SWELLING INDEX	7.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	1.8

COAL SAMPLING REPORT

LABORATORY NO: K99439 FIELD NO: KGS 240 U.S.G.S. NO: W208200
SAMPLER: Currens & Pollock AGENCY: KGS DATE: Aug/20/1979
7.5' QUAD: Varilla COUNTY: Bell DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 18 ROW C TIER 71 1400 FT FSL, 900 FT FEL
LATITUDE: 36 DEG 41 MIN 14 SEC LONGITUDE: 83 DEG 37 MIN 11 SEC
ELEVATION (FT): 1688.60, OF POINT AT base of 240, USING survey
COMMENTARY:
REGIONAL COAL NAME: Manchester GEO. MAP COAL NAME: Hance
REPORTED COAL NAME: Hance FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): top split
EXPOSURE: TYPE, surface mine; CONDITION, 2 weeks old
SAMPLE CONDITION: fresh
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 16.5, SAMPLE 16.5, COAL ONLY 16.5
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 300, SET 2 40, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
N	32.81	Siltstone, medium- to dark-gray, laminated to partly bioturbated, carbonaceous, with abundant plant fragments.
Y	0.26	Clarain, with abundant vitrain.
Y	0.33	Clarain, with abundant fusain.
Y	0.79	Clarain.
		See KGS 241 for underlying strata.

COAL ANALYSIS REPORT

LABORATORY NO: K99439 FIELD NO: KGS 240 U.S.G.S. NO: W208200
LABORATORY: USBM REPORT DATE: Feb/13/1980

AIR DRIED LOSS: 1.00%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	2.20%		
VOLATILE MATTER	37.30%	38.14%	39.39%
FIXED CARBON	57.40%	58.69%	60.61%
ASH	3.10%	3.17%	
ULTIMATE ANALYSIS:			
HYDROGEN	5.60%	5.47%	5.65%
CARBON	79.80%	81.60%	84.27%
NITROGEN	2.20%	2.25%	2.32%
TOTAL SULFUR	0.70%	0.72%	0.74%
OXYGEN	8.60%	6.79%	7.02%
ASH	3.10%	3.17%	
HEATING VALUE (BTU/LB):	11425	11682	12065
SULFUR FORMS:			
SULFATE	0.01%	0.01%	0.01%
PYRITIC	0.10%	0.10%	0.11%
ORGANIC	0.63%	0.64%	0.67%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2330 deg F
SOFTENING TEMP.	2440 deg F
FLUID TEMP.	2550 deg F

FREE SWELLING INDEX	4.5
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	1.2

COAL SAMPLING REPORT

LABORATORY NO: K99437 FIELD NO: KGS 241 U.S.G.S. NO: W208201
SAMPLER: Currens & Pollock AGENCY: KGS DATE: Aug/20/1979
7.5' QUAD: Varilla COUNTY: Bell DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 18 ROW C TIER 71 1400 FT FSL, 900 FT FEL
LATITUDE: 36 DEG 41 MIN 14 SEC LONGITUDE: 83 DEG 37 MIN 11 SEC
ELEVATION (FT): 1680.00, OF POINT AT base of 241, USING survey
COMMENTARY:
REGIONAL COAL NAME: Manchester GEO. MAP COAL NAME: Hance
REPORTED COAL NAME: Hance FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): middle split
EXPOSURE: TYPE, surface mine; CONDITION, 2 weeks old
SAMPLE CONDITION: fresh
RECOVERY METHOD: channel SAMPLING REGIME: thick partings included
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 60.6, SAMPLE 60.6, COAL ONLY 53.5
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 300, SET 2 40, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
		Horizon KGS 240.
N	3.58	Shale, medium-gray, slickensided, carbonaceous, rooted, with scattered coal stringers.
Y	0.33	Clarain.
Y	0.72	Durain, interbedded with scattered clarain.
Y	0.43	Clarain.
Y	0.33	Vitrain.
Y	0.43	Clarain, with scattered fusain.
Y	0.62	Clarain.
Y	0.10	Vitrain.
Y	0.23	Clarain.
Y	0.59	Shale, dark-gray to black, silty, carbonaceous, rooted.
Y	0.95	Clarain.
Y	0.20	Durain.
Y	0.13	Clarain.
N		Siltstone, gray, rooted.

COAL ANALYSIS REPORT

LABORATORY NO: K99437 FIELD NO: KGS 241 U.S.G.S. NO: W208201
LABORATORY: USBM REPORT DATE: Feb/13/1980

AIR DRIED LOSS: 1.00%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	2.10%		
VOLATILE MATTER	31.10%	31.77%	40.76%
FIXED CARBON	45.20%	46.17%	59.24%
ASH	21.60%	22.06%	
ULTIMATE ANALYSIS:			
HYDROGEN	4.90%	4.77%	6.11%
CARBON	63.00%	64.35%	82.57%
NITROGEN	1.80%	1.84%	2.36%
TOTAL SULFUR	0.70%	0.72%	0.92%
OXYGEN	7.90%	6.26%	8.04%
ASH	21.60%	22.06%	
HEATING VALUE (BTU/LB):	11255	11497	14751
SULFUR FORMS:			
SULFATE	0.01%	0.01%	0.01%
PYRITIC	0.12%	0.12%	0.16%
ORGANIC	0.56%	0.57%	0.73%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2630 deg F
SOFTENING TEMP.	2740 deg F
FLUID TEMP.	2800 deg F

FREE SWELLING INDEX	5.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	1.2

COAL SAMPLING REPORT

LABORATORY NO: K99455 FIELD NO: KGS 209 U.S.G.S. NO: W208221
SAMPLER: Currens & Kung AGENCY: KGS DATE: Aug/08/1979
7.5' QUAD: Fork Ridge COUNTY: Bell DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 15 ROW B TIER 69 2900 FT FSL, 1100 FT FEL
LATITUDE: 36 DEG 37 MIN 29 SEC LONGITUDE: 83 DEG 49 MIN 13 SEC
ELEVATION (FT): 1890.00, OF POINT AT base of 209, USING survey
COMMENTARY:
REGIONAL COAL NAME: U Elkhorn No.3 GEO. MAP COAL NAME: Buckeye Spring
REPORTED COAL NAME: Buckeye Spring FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): top bench
EXPOSURE: TYPE, underground; CONDITION, active
SAMPLE CONDITION: very fresh
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 19.1, SAMPLE 19.1, COAL ONLY 19.1
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 250, SET 2 , SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
N		Shale, light-gray to brown, carbonaceous, with abundant plant fragments.
Y	0.23	Vitrain.
Y	0.21	Durain.
Y	0.66	Clarain.
Y	0.10	Vitrain.
Y	0.13	Durain.
Y	0.26	Clarain.
		See KGS 211 for underlying strata.

COAL ANALYSIS REPORT

LABORATORY NO: K99455 FIELD NO: KGS 209 U.S.G.S. NO: W208221
LABORATORY: USBM REPORT DATE: Feb/15/1980

AIR DRIED LOSS: 1.00%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	2.20%		
VOLATILE MATTER	34.70%	35.48%	39.34%
FIXED CARBON	53.50%	54.70%	60.66%
ASH	9.60%	9.82%	
ULTIMATE ANALYSIS:			
HYDROGEN	5.10%	4.96%	5.50%
CARBON	73.40%	75.05%	83.22%
NITROGEN	2.10%	2.15%	2.38%
TOTAL SULFUR	1.40%	1.43%	1.59%
OXYGEN	8.30%	6.59%	7.31%
ASH	9.60%	9.82%	
HEATING VALUE (BTU/LB):	13105	13400	14858
SULFUR FORMS:			
SULFATE	0.01%	0.01%	0.01%
PYRITIC	0.41%	0.42%	0.46%
ORGANIC	0.96%	0.98%	1.09%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2560 deg F
SOFTENING TEMP.	2640 deg F
FLUID TEMP.	2730 deg F

FREE SWELLING INDEX	6.5
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	2.1

COAL SAMPLING REPORT

LABORATORY NO: K99454 FIELD NO: KGS 211 U.S.G.S. NO: W208222
SAMPLER: Currens & Kung AGENCY: KGS DATE: Aug/08/1979
7.5' QUAD: Fork Ridge COUNTY: Bell DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 15 ROW B TIER 69 2900 FT FSL, 1100 FT FEL
LATITUDE: 36 DEG 37 MIN 29 SEC LONGITUDE: 83 DEG 49 MIN 13 SEC
ELEVATION (FT): 1889.00, OF POINT AT base of 211, USING survey
COMMENTARY:
REGIONAL COAL NAME: U Elkhorn No.3 GEO. MAP COAL NAME: Buckeye Spring
REPORTED COAL NAME: Buckeye Spring FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): bottom bench
EXPOSURE: TYPE, underground; CONDITION, very fresh
SAMPLE CONDITION: very fresh
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 10.6, SAMPLE 10.6, COAL ONLY 10.6
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 250, SET 2 , SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
		Horizon KGS 209.
N	0.13	Siltstone, black, arenaceous, very hard.
Y	0.89	Clarain.
N		Seatrock.

COAL ANALYSIS REPORT

LABORATORY NO: K99454 FIELD NO: KGS 211 U.S.G.S. NO: W208222
LABORATORY: USBM REPORT DATE: Feb/15/1980

AIR DRIED LOSS: 1.10%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	2.30%		
VOLATILE MATTER	37.20%	38.07%	40.17%
FIXED CARBON	55.40%	56.70%	59.83%
ASH	5.10%	5.22%	
ULTIMATE ANALYSIS:			
HYDROGEN	5.40%	5.26%	5.55%
CARBON	77.60%	79.42%	83.80%
NITROGEN	2.10%	2.15%	2.27%
TOTAL SULFUR	0.70%	0.72%	0.76%
OXYGEN	9.10%	7.23%	7.62%
ASH	5.10%	5.22%	
HEATING VALUE (BTU/LB):	13932	14259	15045
SULFUR FORMS:			
SULFATE	0.01%	0.01%	0.01%
PYRITIC	0.02%	0.02%	0.02%
ORGANIC	0.69%	0.71%	0.75%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2800 deg F
SOFTENING TEMP.	2800 deg F
FLUID TEMP.	2800 deg F

FREE SWELLING INDEX	6.5
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	1.0

COAL SAMPLING REPORT

LABORATORY NO: K99458 FIELD NO: KGS 226 U.S.G.S. NO: W208223
SAMPLER: Currens & Kung AGENCY: KGS DATE: Aug/08/1979
7.5' QUAD: Kayjay COUNTY: Bell DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 10 ROW B TIER 68 2400 FT FSL, 3000 FT FEL
LATITUDE: 36 DEG 38 MIN 24 SEC LONGITUDE: 83 DEG 50 MIN 37 SEC
ELEVATION (FT): 2780.00, OF POINT AT base of 226, USING topo
COMMENTARY:
REGIONAL COAL NAME: Hazard zone GEO. MAP COAL NAME: Red Springs
REPORTED COAL NAME: Red Springs FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): top bench
EXPOSURE: TYPE, underground; CONDITION, 2 months old, faced-up
SAMPLE CONDITION: slightly weathered, clean, damp
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 20.5, SAMPLE 20.5, COAL ONLY 20.5
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 245, SET 2 190, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
N		Sandstone, dark-gray to buff, crossbedded to thick-bedded, carbonaceous, with abundant plant fragments, feldspathic, micaceous.
Y	0.26	Durain, with abundant clarain.
Y	0.23	Clarain, with scattered vitrain.
Y	0.36	Durain, with clarain.
Y	0.10	Clarain.
Y	0.10	Durain.
Y	0.66	Clarain, with abundant vitrain at base.
N	0.10	Shale, medium-gray, rooted.
N	0.20	Clarain, with abundant vitrain (KGS 227).
N	0.20	Shale, medium-gray, silty, rooted.
N	0.07	Vitrain.
N	0.08	Shale, medium-gray, silty, rooted.
N	0.08	Clarain.
N	0.07	Shale, medium-gray, silty, rooted.
N	0.03	Clarain.
N		Shale, medium-gray, plastic, slightly carbonaceous.

COAL ANALYSIS REPORT

LABORATORY NO: K99458 FIELD NO: KGS 226 U.S.G.S. NO: W208223
LABORATORY: USBM REPORT DATE: Feb/15/1980

AIR DRIED LOSS: 1.60%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	3.10%		
VOLATILE MATTER	38.70%	39.94%	41.48%
FIXED CARBON	54.60%	56.35%	58.52%
ASH	3.60%	3.72%	
ULTIMATE ANALYSIS:			
HYDROGEN	5.60%	5.42%	5.63%
CARBON	78.00%	80.50%	83.60%
NITROGEN	1.90%	1.96%	2.04%
TOTAL SULFUR	0.70%	0.72%	0.75%
OXYGEN	10.40%	7.68%	7.98%
ASH	3.60%	3.72%	
HEATING VALUE (BTU/LB):	13897	14342	14895
SULFUR FORMS:			
SULFATE	0.01%	0.01%	0.01%
PYRITIC	0.03%	0.03%	0.03%
ORGANIC	0.61%	0.63%	0.65%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2800 deg F
SOFTENING TEMP.	2800 deg F
FLUID TEMP.	2800 deg F

FREE SWELLING INDEX	4.5
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	1.0

COAL SAMPLING REPORT

LABORATORY NO: U10043 FIELD NO: KGS 397 U.S.G.S. NO: W211638
SAMPLER: Currens AGENCY: KGS DATE: Sep/14/1980
7.5' QUAD: Evarts COUNTY: Harlan DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 18 ROW E TIER 76 2500 FT FSL, 3150 FT FEL
LATITUDE: 36 DEG 51 MIN 25 SEC LONGITUDE: 83 DEG 12 MIN 39 SEC
ELEVATION (FT): 1340.00, OF POINT AT base of 397, USING topo
COMMENTARY:
REGIONAL COAL NAME: L Elkhorn GEO. MAP COAL NAME: L Path Fork
REPORTED COAL NAME: L Path Fork FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
EXPOSURE: TYPE, underground; CONDITION, 6 weeks old, faced-up
SAMPLE CONDITION: fresh, dry
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 26.9, SAMPLE 26.9, COAL ONLY 26.9
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 350, SET 2 , SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
		See KGS 398 for overlying strata.
N	10.17	Siltstone, interbedded with fine- to medium-grained sandstone, light-gray; low-angle, longitudinal crossbeds; top 1.5 foot rooted claystone.
Y	0.10	Clarain.
Y	0.02	Fusain.
Y	0.13	Clarain, with very abundant thin-banded vitrain, scattered medium-banded fusain.
Y	0.02	Fusain.
Y	0.26	Clarain, with abundant medium-banded vitrain, scattered medium-banded fusain.
Y	0.02	Fusain.
Y	0.36	Durain, with scattered medium-banded vitrain.
Y	1.21	Clarain, with abundant medium-banded vitrain, slightly pyritic.
Y	0.13	Fusain, interlaminated with thin-banded vitrain, argillaceous.
N		Siltstone, medium-gray, plastic when wet.

COAL ANALYSIS REPORT

LABORATORY NO: U10043 FIELD NO: KGS 397 U.S.G.S. NO: W211638
LABORATORY: Geo Test REPORT DATE: Nov/11/1981

AIR DRIED LOSS: 0.19%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	1.85%		
VOLATILE MATTER	33.10%	33.72%	39.83%
FIXED CARBON	50.00%	50.94%	60.17%
ASH	15.05%	15.33%	
ULTIMATE ANALYSIS:			
HYDROGEN	4.87%	4.75%	5.61%
CARBON	69.69%	71.00%	83.86%
NITROGEN	1.61%	1.64%	1.94%
TOTAL SULFUR	0.56%	0.57%	0.67%
OXYGEN	8.22%	6.71%	7.92%
ASH	15.05%	15.33%	
HEATING VALUE (BTU/LB):	12263	12494	14757
SULFUR FORMS:			
SULFATE	0.00%	0.00%	0.00%
PYRITIC	0.04%	0.04%	0.05%
ORGANIC	0.52%	0.53%	0.63%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2800 deg F
SOFTENING TEMP.	2800 deg F
FLUID TEMP.	2800 deg F

FREE SWELLING INDEX	2.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	0.9

COAL SAMPLING REPORT

LABORATORY NO: U10044 FIELD NO: KGS 398 U.S.G.S. NO: W211639
SAMPLER: Currens AGENCY: KGS DATE: Aug/14/1980
7.5' QUAD: Evarts COUNTY: Harlan DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 18 ROW E TIER 76 2300 FT FSL, 3150 FT FEL
LATITUDE: 36 DEG 51 MIN 23 SEC LONGITUDE: 83 DEG 12 MIN 39 SEC
ELEVATION (FT): 1350.00, OF POINT AT base of 398, USING topo
COMMENTARY:
REGIONAL COAL NAME: L Elkhorn GEO. MAP COAL NAME: Path Fork
REPORTED COAL NAME: Path Fork FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
EXPOSURE: TYPE, underground; CONDITION, active
SAMPLE CONDITION: fresh, dry
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 27.6, SAMPLE 24.8, COAL ONLY 24.4
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 95, SET 2 320, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
N	7.87	Siltstone, medium-gray, sideritic.
N	0.49	Coal.
N	5.91	Siltstone, medium-gray, intensively rooted, sideritic.
N	0.26	Siltstone, highly carbonaceous, laminated; roof failure surface.
N	4.92	Siltstone, medium-gray, sideritic arenaceous at top, laminated.
Y	0.33	Clarain.
Y	0.26	Durain.
Y	0.03	Vitrain.
Y	0.20	Durain.
Y	0.20	Clarain.
Y	0.03	Pyrite.
Y	0.75	Clarain, with abundant thin-banded vitrain.
N	0.23	Siltstone, dark-grayish-brown, carbonaceous, rooted.
Y	0.26	Clarain.
N	0.43	Claystone, medium-gray, rooted, plastic when wet.
N	0.10	Clarain.
		See KGS 397 for underlying strata.

COAL ANALYSIS REPORT

LABORATORY NO: U10044 FIELD NO: KGS 398 U.S.G.S. NO: W211639
LABORATORY: Geo Test REPORT DATE: Nov/11/1981

AIR DRIED LOSS: 0.13%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	1.54%		
VOLATILE MATTER	35.62%	36.18%	41.70%
FIXED CARBON	49.79%	50.57%	58.29%
ASH	13.05%	13.25%	
ULTIMATE ANALYSIS:			
HYDROGEN	4.98%	4.88%	5.63%
CARBON	70.98%	72.09%	83.10%
NITROGEN	1.56%	1.58%	1.83%
TOTAL SULFUR	2.60%	2.64%	3.04%
OXYGEN	6.83%	5.56%	6.40%
ASH	13.05%	13.25%	
HEATING VALUE (BTU/LB):	12706	12904	14876
SULFUR FORMS:			
SULFATE	0.03%	0.03%	0.04%
PYRITIC	1.88%	1.91%	2.20%
ORGANIC	0.69%	0.70%	0.81%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2140 deg F
SOFTENING TEMP.	2490 deg F
FLUID TEMP.	2540 deg F

FREE SWELLING INDEX	6.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	4.1

COAL SAMPLING REPORT

LABORATORY NO: U10268 FIELD NO: KGS 482 U.S.G.S. NO: W213022
SAMPLER: Currens AGENCY: KGS DATE: Mar/03/1981
7.5' QUAD: Balkan COUNTY: Bell DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 23 ROW D TIER 72 1900 FT FSL, 2400 FT FEL
LATITUDE: 36 DEG 45 MIN 19 SEC LONGITUDE: 83 DEG 32 MIN 29 SEC
ELEVATION (FT): 1372.60, OF POINT AT base of 482, USING altimeter
COMMENTARY:
REGIONAL COAL NAME: Manchester GEO. MAP COAL NAME: Hance
REPORTED COAL NAME: Hance FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): top split
EXPOSURE: TYPE, surface mine; CONDITION, active
SAMPLE CONDITION: fresh, dry
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 48.4, SAMPLE 40.2, COAL ONLY 40.2
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 120, SET 2 185, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
N	16.40	Sandstone, light-gray, coarse-grained, carbonaceous, crossbedded(?) (disturbed by blasting).
N	0.07	Shale, black, carbonaceous.
N	8.20	Siltstone, medium-gray, arenaceous, sideritic; rooted at top; discontinuous.
Y	0.56	Clarain, with abundant medium-banded vitrain.
N	0.49	Siltstone (to 3 cm thick), light-gray to tan, grading to black at base, soft, carbonaceous, rooted.
Y	0.16	Clarain.
N	0.10	Siltstone, dark-gray to brown, hard, arenaceous.
Y	1.02	Clarain, with abundant medium- to thick-banded vitrain; scattered thin-banded fusain at 15 cm above base.
N	0.10	Claystone, dark-gray, soft, probably rooted.
Y	1.61	Clarain, with abundant medium- to thin-banded vitrain, scattered thin-banded fusain, slightly pyritic; argillaceous at base.
N		Siltstone(?), medium-gray, rooted (ganister?); underlain by three more splits of Hance Also see KGS 498, 499, 500 (W213944, W213945, W213946).

COAL ANALYSIS REPORT

LABORATORY NO: U10268 FIELD NO: KGS 482 U.S.G.S. NO: W213022
LABORATORY: Geo Test REPORT DATE: Jan/25/1982

AIR DRIED LOSS: 0.19%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	1.99%		
VOLATILE MATTER	36.94%	37.69%	40.30%
FIXED CARBON	54.72%	55.83%	59.70%
ASH	6.35%	6.48%	
ULTIMATE ANALYSIS:			
HYDROGEN	5.38%	5.26%	5.63%
CARBON	77.25%	78.82%	84.28%
NITROGEN	1.90%	1.94%	2.07%
TOTAL SULFUR	1.94%	1.98%	2.12%
OXYGEN	7.18%	5.52%	5.90%
ASH	6.35%	6.48%	
HEATING VALUE (BTU/LB):	13845	14126	15105
SULFUR FORMS:			
SULFATE	0.05%	0.05%	0.05%
PYRITIC	1.07%	1.09%	1.17%
ORGANIC	0.82%	0.84%	0.89%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2140 deg F
SOFTENING TEMP.	2330 deg F
FLUID TEMP.	2510 deg F

FREE SWELLING INDEX	7.5
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	2.8

COAL SAMPLING REPORT

LABORATORY NO: U10277 FIELD NO: KGS 483 U.S.G.S. NO: W213023
SAMPLER: Currens AGENCY: KGS DATE: Mar/03/1981
7.5' QUAD: Balkan COUNTY: Bell DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 24 ROW D TIER 72 1000 FT FSL, 3700 FT FEL
LATITUDE: 36 DEG 45 MIN 10 SEC LONGITUDE: 83 DEG 33 MIN 45 SEC
ELEVATION (FT): 1187.80, OF POINT AT base of 483, USING altimeter
COMMENTARY:
REGIONAL COAL NAME: Glamorgan zone GEO. MAP COAL NAME: Mason
REPORTED COAL NAME: Mason FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
EXPOSURE: TYPE, construction site; CONDITION, 3 weeks old
SAMPLE CONDITION: fresh
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 34.8, SAMPLE 34.8, COAL ONLY 34.8
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 215, SET 2 135, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
N	13.12	Siltstone, medium- to dark-gray, sideritic, laminated.
Y	0.13	Vitrain.
Y	0.02	Fusain.
Y	0.20	Vitrain, with laminae 1 to 3 cm thick.
Y	1.05	Clarain, with abundant medium- to thick-banded vitrain.
Y	0.49	Vitrain, with laminae 1 to 3 cm thick.
Y	1.02	Clarain, with abundant medium- to thick-banded vitrain.
N	1.64	Siltstone, medium-gray, intensively rooted, plastic at top, sideritic.
N	0.72	Shale, black, silty, highly carbonaceous; canneloid in center; with abundant plant fossils, but no marine fossils observed.
N	3.97	Siltstone, medium-gray, highly arenaceous, carbonaceous, sideritic, rooted(?).
N	0.52	Clarain, with 3-cm parting.
N	0.07	Shale, plastic, light-gray, rooted.
N	2.30	Siltstone, medium-gray, arenaceous, rooted.

COAL ANALYSIS REPORT

LABORATORY NO: U10277 FIELD NO: KGS 483 U.S.G.S. NO: W213023
LABORATORY: Geo Test REPORT DATE: Jan/25/1982

AIR DRIED LOSS: 0.19%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	2.00%		
VOLATILE MATTER	38.58%	39.37%	40.71%
FIXED CARBON	56.20%	57.35%	59.30%
ASH	3.22%	3.29%	
ULTIMATE ANALYSIS:			
HYDROGEN	5.56%	5.45%	5.63%
CARBON	79.69%	81.32%	84.08%
NITROGEN	2.41%	2.46%	2.54%
TOTAL SULFUR	1.56%	1.59%	1.65%
OXYGEN	7.56%	5.89%	6.10%
ASH	3.22%	3.29%	
HEATING VALUE (BTU/LB):	14377	14670	15169
SULFUR FORMS:			
SULFATE	0.05%	0.05%	0.05%
PYRITIC	0.42%	0.43%	0.44%
ORGANIC	1.09%	1.11%	1.15%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2140 deg F
SOFTENING TEMP.	2210 deg F
FLUID TEMP.	2330 deg F

FREE SWELLING INDEX	8.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	2.2

COAL SAMPLING REPORT

LABORATORY NO: U10269 FIELD NO: KGS 484 U.S.G.S. NO: W213024
SAMPLER: Currens AGENCY: KGS DATE: Mar/03/1981
7.5' QUAD: Balkan COUNTY: Bell DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 18 ROW D TIER 72 600 FT FSL, 2500 FT FEL
LATITUDE: 36 DEG 46 MIN 6 SEC LONGITUDE: 83 DEG 32 MIN 31 SEC
ELEVATION (FT): 1659.21, OF POINT AT base of 484, USING survey
COMMENTARY:
REGIONAL COAL NAME: L Elkhorn GEO. MAP COAL NAME: Path Fork
REPORTED COAL NAME: Path Fork FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
EXPOSURE: TYPE, underground; CONDITION, active
SAMPLE CONDITION: fresh, dry
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 33.9, SAMPLE 30.7, COAL ONLY 30.7
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 235, SET 2 , SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
N		Siltstone, arenaceous, or fine-grained sandstone, with abundant plant fragments.
Y	0.66	Clarain, with scattered medium- to thin-banded vitrain.
N	0.13	Siltstone, carbonaceous, hard, brittle.
Y	0.30	Canneloid coal, metallic (dull) gray, very hard, with conchoidal fracture.
Y	0.98	Clarain, grading to durain, with abundant thin-banded vitrain at top, abundant thin- to thick-banded at base.
N	0.13	Shale, dark-gray to brown, carbonaceous.
Y	0.62	Clarain, with abundant medium- to thick-banded vitrain, pyritic.
N		Siltstone, light-gray, rooted.

COAL ANALYSIS REPORT

LABORATORY NO: U10269 FIELD NO: KGS 484 U.S.G.S. NO: W213024
LABORATORY: Geo Test REPORT DATE: Jan/25/1982

AIR DRIED LOSS: 0.17%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	1.82%		
VOLATILE MATTER	36.03%	36.70%	43.57%
FIXED CARBON	46.67%	47.53%	56.43%
ASH	15.48%	15.77%	
ULTIMATE ANALYSIS:			
HYDROGEN	4.94%	4.82%	5.73%
CARBON	68.90%	70.17%	83.31%
NITROGEN	1.64%	1.67%	1.98%
TOTAL SULFUR	1.54%	1.57%	1.86%
OXYGEN	7.50%	6.00%	7.12%
ASH	15.48%	15.77%	
HEATING VALUE (BTU/LB):	12364	12593	14951
SULFUR FORMS:			
SULFATE	0.03%	0.03%	0.04%
PYRITIC	0.80%	0.81%	0.97%
ORGANIC	0.71%	0.72%	0.86%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2390 deg F
SOFTENING TEMP.	2720 deg F
FLUID TEMP.	2800 deg F

FREE SWELLING INDEX	6.5
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	2.5

COAL SAMPLING REPORT

LABORATORY NO: U10280 FIELD NO: KGS 498 U.S.G.S. NO: W213944
SAMPLER: Currens AGENCY: KGS DATE: Apr/02/1981
7.5' QUAD: Balkan COUNTY: Bell DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 23 ROW D TIER 72 2250 FT FSL, 2300 FT FEL
LATITUDE: 36 DEG 45 MIN 22 SEC LONGITUDE: 83 DEG 32 MIN 28 SEC
ELEVATION (FT): 1341.00, OF POINT AT base of 498, USING altimeter
COMMENTARY:
REGIONAL COAL NAME: Manchester GEO. MAP COAL NAME: Hance
REPORTED COAL NAME: Hance FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): third split from bottom
EXPOSURE: TYPE, surface mine; CONDITION, active
SAMPLE CONDITION: fresh, wet
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 19.3, SAMPLE 19.3, COAL ONLY 19.3
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 25, SET 2 125, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
		Horizon KGS 482 (W213022).
N	6.89	Siltstone, light-gray, sideritic; arenaceous toward top; intensively rooted at top.
Y	1.38	Clarain, largely obscured; with abundant medium-banded vitrain(?), scattered thick-banded fusain; pyritic.
Y	0.23	Durain.
		See KGS 499 for underlying strata.

COAL ANALYSIS REPORT

LABORATORY NO: U10280 FIELD NO: KGS 498 U.S.G.S. NO: W213944
LABORATORY: Geo Test REPORT DATE: Jan/25/1982

AIR DRIED LOSS: 1.86%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	3.60%		
VOLATILE MATTER	37.30%	38.69%	40.19%
FIXED CARBON	55.50%	57.57%	59.81%
ASH	3.60%	3.73%	
ULTIMATE ANALYSIS:			
HYDROGEN	5.55%	5.34%	5.55%
CARBON	78.83%	81.77%	84.95%
NITROGEN	1.92%	1.99%	2.07%
TOTAL SULFUR	0.91%	0.94%	0.98%
OXYGEN	9.19%	6.23%	6.45%
ASH	3.60%	3.73%	
HEATING VALUE (BTU/LB):	14009	14532	15096
SULFUR FORMS:			
SULFATE	0.13%	0.13%	0.14%
PYRITIC	0.07%	0.07%	0.08%
ORGANIC	0.71%	0.74%	0.77%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2350 deg F
SOFTENING TEMP.	2570 deg F
FLUID TEMP.	2700 deg F

FREE SWELLING INDEX	6.5
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	1.3

COAL SAMPLING REPORT

LABORATORY NO: U10281 FIELD NO: KGS 499 U.S.G.S. NO: W213945
SAMPLER: Currens AGENCY: KGS DATE: Apr/02/1981
7.5' QUAD: Balkan COUNTY: Bell DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 23 ROW D TIER 72 2250 FT FSL, 2300 FT FEL
LATITUDE: 36 DEG 45 MIN 22 SEC LONGITUDE: 83 DEG 32 MIN 28 SEC
ELEVATION (FT): 1339.90, OF POINT AT base of 499, USING altimeter
COMMENTARY:
REGIONAL COAL NAME: Manchester GEO. MAP COAL NAME: Hance
REPORTED COAL NAME: Hance FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): second split from bottom
EXPOSURE: TYPE, surface mine; CONDITION, active
SAMPLE CONDITION: fresh, dry
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 16.1, SAMPLE 13.0, COAL ONLY 13.0
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 310, SET 2 50, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
		Horizon KGS 498.
N	1.15	Siltstone, arenaceous, carbonaceous, rooted.
Y	0.20	Canneloid coal, argillaceous, with scattered thin-banded vitrain.
N	0.26	Shale, black, carbonaceous, rooted, silty.
Y	0.56	Clarain, with scattered thin-banded vitrain, scattered thin-banded fusain.
Y	0.03	Fusain.
Y	0.30	Clarain, with abundant medium- to thick-banded vitrain.
		See KGS 500 for underlying strata.

COAL ANALYSIS REPORT

LABORATORY NO: U10281 FIELD NO: KGS 499 U.S.G.S. NO: W213945
LABORATORY: Geo Test REPORT DATE: Jan/25/1982

AIR DRIED LOSS: 0.26%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	1.86%		
VOLATILE MATTER	33.28%	33.91%	39.32%
FIXED CARBON	51.36%	52.34%	60.68%
ASH	13.50%	13.76%	
ULTIMATE ANALYSIS:			
HYDROGEN	4.93%	4.81%	5.58%
CARBON	71.82%	73.18%	84.86%
NITROGEN	1.80%	1.83%	2.13%
TOTAL SULFUR	0.76%	0.77%	0.90%
OXYGEN	7.19%	5.65%	6.53%
ASH	13.50%	13.76%	
HEATING VALUE (BTU/LB):	12793	13036	15115
SULFUR FORMS:			
SULFATE	0.05%	0.05%	0.06%
PYRITIC	0.10%	0.10%	0.12%
ORGANIC	0.61%	0.62%	0.72%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2500 deg F
SOFTENING TEMP.	2800 deg F
FLUID TEMP.	2800 deg F

FREE SWELLING INDEX	7.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	1.2

COAL SAMPLING REPORT

LABORATORY NO: U10402 FIELD NO: KGS 500 U.S.G.S. NO: W213946
SAMPLER: Currens AGENCY: KGS DATE: Apr/02/1981
7.5' QUAD: Balkan COUNTY: Bell DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 23 ROW D TIER 72 2250 FT FSL, 2300 FT FEL
LATITUDE: 36 DEG 45 MIN 22 SEC LONGITUDE: 83 DEG 32 MIN 28 SEC
ELEVATION (FT): 1331.40, OF POINT AT base of 500, USING altimeter
COMMENTARY:
REGIONAL COAL NAME: Manchester GEO. MAP COAL NAME: Hance
REPORTED COAL NAME: Hance FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): bottom split
EXPOSURE: TYPE, surface mine; CONDITION, active
SAMPLE CONDITION: fresh, dry
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 20.1, SAMPLE 20.1, COAL ONLY 20.1
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 50, SET 2 , SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
		Horizon KGS 499.
N	9.51	Siltstone, medium-gray, laminated, with some small ripple bedding, sparsely sideritic; arenaceous at base; top meter intensively rooted.
Y	0.46	Clarain, with abundant thick-banded vitrain, scattered thin-banded fusain.
Y	0.23	Vitrain, with medium to thick laminae.
Y	0.98	Clarain, with abundant medium- to thick-banded vitrain, pyritic.
N		Siltstone, light-gray, rooted.

COAL ANALYSIS REPORT

LABORATORY NO: U10402 FIELD NO: KGS 500 U.S.G.S. NO: W213946
LABORATORY: Geo Test REPORT DATE: Feb/22/1982

AIR DRIED LOSS: 0.14%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	1.64%		
VOLATILE MATTER	38.00%	38.63%	39.67%
FIXED CARBON	57.79%	58.76%	60.33%
ASH	2.57%	2.61%	
ULTIMATE ANALYSIS:			
HYDROGEN	5.56%	5.47%	5.61%
CARBON	80.66%	82.01%	84.21%
NITROGEN	2.17%	2.21%	2.27%
TOTAL SULFUR	1.21%	1.23%	1.26%
OXYGEN	7.83%	6.47%	6.65%
ASH	2.57%	2.61%	
HEATING VALUE (BTU/LB):	14526	14769	15165
SULFUR FORMS:			
SULFATE	0.04%	0.04%	0.04%
PYRITIC	0.22%	0.22%	0.23%
ORGANIC	0.95%	0.97%	0.99%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2250 deg F
SOFTENING TEMP.	2450 deg F
FLUID TEMP.	2500 deg F

FREE SWELLING INDEX	5.5
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	1.7

COAL SAMPLING REPORT

LABORATORY NO: U10245 FIELD NO: KGS 554 U.S.G.S. NO: W214792
SAMPLER: Currens AGENCY: KGS DATE: Aug/13/1981
7.5' QUAD: Louellen COUNTY: Harlan DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 10 ROW E TIER 77 1150 FT FSL, 150 FT FEL
LATITUDE: 36 DEG 53 MIN 11 SEC LONGITUDE: 83 DEG 5 MIN 2 SEC
ELEVATION (FT): 2972.00, OF POINT AT base of 554, USING survey
COMMENTARY: Highsplint mine, No.4 entry.
REGIONAL COAL NAME: Hazard zone GEO. MAP COAL NAME: High Splint
REPORTED COAL NAME: High Splint FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
EXPOSURE: TYPE, underground; CONDITION,
SAMPLE CONDITION: clean, dry
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 57.1, SAMPLE 55.9, COAL ONLY 55.9
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 265, SET 2 180, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
N	16.40	Sandstone, coarse-grained, massive.
N	4.92	Siltstone, dark-gray, laminated.
N	0.33	Coal.
N	2.95	Siltstone, carbonaceous, laminated.
Y	0.23	Durain.
Y	2.72	Clarain, with common thin- to thick-banded vitrain, scattered thin-banded fusain; locally contains coal balls and pyrite.
Y	0.23	Durain, with scattered thin-banded vitrain.
Y	0.72	Clarain, with abundant medium-banded vitrain, scattered medium-banded fusain.
N	0.10	Siltstone, dark-brown, brittle.
Y	0.75	Clarain, with scattered thin-banded vitrain, interbedded with durain.
N		Siltstone, dark-gray, rooted.

COAL ANALYSIS REPORT

LABORATORY NO: U10245 FIELD NO: KGS 554 U.S.G.S. NO: W214792
LABORATORY: Geo Test REPORT DATE: Dec/31/1981

AIR DRIED LOSS: 1.47%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	3.94%		
VOLATILE MATTER	35.88%	37.35%	40.97%
FIXED CARBON	51.69%	53.81%	59.02%
ASH	8.49%	8.84%	
ULTIMATE ANALYSIS:			
HYDROGEN	5.28%	5.04%	5.53%
CARBON	72.65%	75.63%	82.96%
NITROGEN	1.41%	1.47%	1.61%
TOTAL SULFUR	0.90%	0.94%	1.03%
OXYGEN	11.27%	8.08%	8.87%
ASH	8.49%	8.84%	
HEATING VALUE (BTU/LB):	12816	13342	14635
SULFUR FORMS:			
SULFATE	0.02%	0.02%	0.02%
PYRITIC	0.31%	0.32%	0.35%
ORGANIC	0.57%	0.59%	0.65%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2600 deg F
SOFTENING TEMP.	2720 deg F
FLUID TEMP.	2800 deg F

FREE SWELLING INDEX	3.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	1.4

COAL SAMPLING REPORT

LABORATORY NO: U10311 FIELD NO: KGS 555 U.S.G.S. NO: W214793
SAMPLER: Currens AGENCY: KGS DATE: Aug/13/1981
7.5' QUAD: Pennington Gap COUNTY: Harlan DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 11 ROW E TIER 77 2900 FT FSL, 1700 FT FEL
LATITUDE: 36 DEG 52 MIN 29 SEC LONGITUDE: 83 DEG 5 MIN 21 SEC
ELEVATION (FT): 2892.00, OF POINT AT base of 555, USING altimeter
COMMENTARY: Reported elevation is 80 feet below KGS 554 location, by altimeter.
REGIONAL COAL NAME: Haddix zone GEO. MAP COAL NAME: Morris
REPORTED COAL NAME: Morris FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
EXPOSURE: TYPE, prospect; CONDITION, few weeks old, "outcroppy"
SAMPLE CONDITION: slightly weathered, clean, dry
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 31.5, SAMPLE 31.5, COAL ONLY 31.5
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 80, SET 2 220, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
		Abandoned surface mine in the High Splint.
N	32.81	Covered.
N	0.98	Coal.
N	29.53	Siltstone, medium-gray, arenaceous; laminated in bottom 4.5 m; dark-gray and sideritic in top half; rooted at top.
Y	2.62	Clarain, with very abundant thin- to thick-banded vitrain, scattered thin-banded fusain; very homogenous, no pyrite observed, slightly weathered.
N		Siltstone, dark-gray, plastic when wet, rooted.

COAL ANALYSIS REPORT

LABORATORY NO: U10311 FIELD NO: KGS 555 U.S.G.S. NO: W214793
LABORATORY: Geo Test REPORT DATE: Jan/25/1982

AIR DRIED LOSS: 1.34%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	4.04%		
VOLATILE MATTER	38.83%	40.46%	41.52%
FIXED CARBON	54.69%	56.99%	58.48%
ASH	2.44%	2.54%	
ULTIMATE ANALYSIS:			
HYDROGEN	5.62%	5.39%	5.53%
CARBON	76.82%	80.05%	82.14%
NITROGEN	1.67%	1.74%	1.79%
TOTAL SULFUR	0.76%	0.79%	0.81%
OXYGEN	12.69%	9.49%	9.73%
ASH	2.44%	2.54%	
HEATING VALUE (BTU/LB):	13507	14076	14443
SULFUR FORMS:			
SULFATE	0.00%	0.00%	0.00%
PYRITIC	0.11%	0.11%	0.12%
ORGANIC	0.65%	0.68%	0.70%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2410 deg F
SOFTENING TEMP.	2470 deg F
FLUID TEMP.	2570 deg F

FREE SWELLING INDEX	2.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	1.1

COAL SAMPLING REPORT

LABORATORY NO: U10575 FIELD NO: KGS 583 U.S.G.S. NO: W215389
SAMPLER: Currens AGENCY: KGS DATE: Oct/06/1981
7.5' QUAD: Fork Ridge COUNTY: Bell DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 18 ROW B TIER 69 600 FT FSL, 0 FT FEL
LATITUDE: 36 DEG 36 MIN 6 SEC LONGITUDE: 83 DEG 47 MIN 0 SEC
ELEVATION (FT): 2403.30, OF POINT AT base of 583, USING altimeter
COMMENTARY:
REGIONAL COAL NAME: Fire Clay GEO. MAP COAL NAME: Hignite
REPORTED COAL NAME: Hignite FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
EXPOSURE: TYPE, surface mine; CONDITION, a few weeks old, faced-up
SAMPLE CONDITION: clean, dry
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 34.3, SAMPLE 34.3, COAL ONLY 34.3
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 80, SET 2 155, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
		Horizon KGS 576 (W215421).
N	13.12	Siltstone, light-gray, rooted.
N	1.64	Coal.
N	16.40	Siltstone, medium-gray, sandy.
N	0.98	Coal.
N	19.69	Shale, dark-gray, laminated, sideritic, coaly; rooted at top.
N	1.31	Sandstone, dark-gray, coarse-grained, crossbedded, carbonaceous.
N	1.64	Covered.
N	0.98	Siltstone, dark-gray, coaly.
Y	0.66	Clarain, with abundant thin-banded vitrain, common thin-banded fusain.
Y	0.03	Fusain.
Y	1.48	Clarain, with abundant thin- to thick-banded vitrain, scattered medium-banded fusain, scattered, interlaminated durain to 1 cm thick.
Y	0.03	Fusain.
Y	0.66	Clarain, with abundant thick-banded vitrain.
N		Siltstone, medium-gray, rooted.

COAL ANALYSIS REPORT

LABORATORY NO: U10575 FIELD NO: KGS 583 U.S.G.S. NO: W215389
LABORATORY: Geo Test REPORT DATE: Mar/31/1982

AIR DRIED LOSS: 0.62%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	2.51%		
VOLATILE MATTER	34.74%	35.63%	36.98%
FIXED CARBON	59.21%	60.73%	63.02%
ASH	3.54%		
ULTIMATE ANALYSIS			
HYDROGEN	5.49%	5.34%	5.54%
CARBON	78.06%	80.07%	83.09%
NITROGEN	1.77%	1.82%	1.88%
TOTAL SULFUR	0.77%	0.79%	0.82%
OXYGEN	10.37%	8.35%	8.67%
ASH	3.54%	3.63%	
VALUE (BTU/LB):	14105	14468	15013
SULFUR FORMS:			
SULFATE	0.02%	0.02%	0.02%
PYRITIC	0.08%	0.08%	0.09%
ORGANIC	0.67%	0.69%	0.71%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2580 deg F
SOFTENING TEMP.	2720 deg F
FLUID TEMP.	2750 deg F

FREE SWELLING INDEX	4.5
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	1.1

COAL SAMPLING REPORT

LABORATORY NO: U10576 FIELD NO: KGS 584 U.S.G.S. NO: W215390
SAMPLER: Currens AGENCY: KGS DATE: Oct/06/1981
7.5' QUAD: Fork Ridge COUNTY: Bell DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 19 ROW B TIER 69 150 FT FSL, 3900 FT FEL
LATITUDE: 36 DEG 36 MIN 1 SEC LONGITUDE: 83 DEG 46 MIN 48 SEC
ELEVATION (FT): 2218.90, OF POINT AT base of 584, USING altimeter
COMMENTARY:
REGIONAL COAL NAME: Whitesburg zone GEO. MAP COAL NAME: Stray
REPORTED COAL NAME: Stray FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): first split from bottom
EXPOSURE: TYPE, surface mine; CONDITION, active
SAMPLE CONDITION: fresh, clean, dry
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 20.9, SAMPLE 20.9, COAL ONLY 20.9
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 310, SET 2 50, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
		Horizon KGS 578 (W215423); locally cut out.
N	6.56	Shale, dark-gray.
N	14.76	Siltstone, dark-gray, sideritic, laminated.
N	1.64	Siltstone, dark-gray, coaly.
Y	1.74	Clarain, with abundant thin- to medium-banded vitrain, scattered thin-banded fusain; pyritic near top; hard, blocky.
N		?

COAL ANALYSIS REPORT

LABORATORY NO: U10576 FIELD NO: KGS 584 U.S.G.S. NO: W215390
LABORATORY: Geo Test REPORT DATE: Mar/31/1982

AIR DRIED LOSS: 0.13%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	1.77%		
VOLATILE MATTER	37.39%	38.06%	39.38%
FIXED CARBON	57.56%	58.60%	60.62%
ASH	3.28%	3.34%	
ULTIMATE ANALYSIS:			
HYDROGEN	5.63%	5.53%	5.72%
CARBON	80.36%	81.81%	84.64%
NITROGEN	1.89%	1.92%	1.99%
TOTAL SULFUR	0.65%	0.66%	0.68%
OXYGEN	8.19%	6.74%	6.97%
ASH	3.28%	3.34%	
HEATING VALUE (BTU/LB):	14598	14861	15375
SULFUR FORMS:			
SULFATE	0.01%	0.01%	0.01%
PYRITIC	0.04%	0.04%	0.04%
ORGANIC	0.60%	0.61%	0.63%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2600 deg F
SOFTENING TEMP.	2690 deg F
FLUID TEMP.	2730 deg F

FREE SWELLING INDEX	6.5
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	0.9

COAL SAMPLING REPORT

LABORATORY NO: U10577 FIELD NO: KGS 585 U.S.G.S. NO: W215391
SAMPLER: Currens AGENCY: KGS DATE: Oct/06/1981
7.5' QUAD: Fork Ridge COUNTY: Bell DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 19 ROW B TIER 69 0 FT FSL, 4050 FT FEL
LATITUDE: 36 DEG 36 MIN 0 SEC LONGITUDE: 83 DEG 46 MIN 50 SEC
ELEVATION (FT): 2312.40, OF POINT AT base of 585, USING altimeter
COMMENTARY:
REGIONAL COAL NAME: Whitesburg zone GEO. MAP COAL NAME: Stray
REPORTED COAL NAME: Stray FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): sixth split from bottom
EXPOSURE: TYPE, surface mine; CONDITION, several months old, faced-up
SAMPLE CONDITION: clean, dry
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 24.6, SAMPLE 21.3, COAL ONLY 21.3
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 220, SET 2 160, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
		Hignite coal bed (horizon KGS 583) (W215389).
N	49.21	Sandstone, massive, rooted at top.
N	32.81	Siltstone, medium-gray, interlaminated with thin, fine-grained sandstone; arenaceous at top; light-gray, sideritic, plant fossils near base.
Y	0.39	Clarain, with common medium-banded vitrain, pyritic, slightly weathered.
N	0.16	Shale, black, carbonaceous.
Y	0.43	Clarain, with abundant thin- to thick-banded vitrain.
N	0.07	Shale, medium-gray.
Y	0.82	Clarain, with abundant thin- to thick-banded vitrain, scattered thin-banded fusain; highly pyritic at base.
N	0.05	Shale, light-gray.
Y	0.13	Clarain.
		See KGS 580 (W215425) for underlying strata.

COAL ANALYSIS REPORT

LABORATORY NO: U10577 FIELD NO: KGS 585 U.S.G.S. NO: W215391
LABORATORY: Geo Test REPORT DATE: Mar/31/1982

AIR DRIED LOSS: 0.29%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	1.79%		
VOLATILE MATTER	37.09%	37.77%	42.43%
FIXED CARBON	50.33%	51.25%	57.57%
ASH	10.79%	10.99%	
ULTIMATE ANALYSIS:			
HYDROGEN	5.26%	5.15%	5.79%
CARBON	72.00%	73.31%	82.36%
NITROGEN	1.69%	1.72%	1.93%
TOTAL SULFUR	2.50%	2.55%	2.86%
OXYGEN	7.76%	6.28%	7.06%
ASH	10.79%	10.99%	
HEATING VALUE (BTU/LB):	13079	13317	14961
SULFUR FORMS:			
SULFATE	0.04%	0.04%	0.05%
PYRITIC	1.59%	1.62%	1.82%
ORGANIC	0.87%	0.89%	1.00%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2190 deg F
SOFTENING TEMP.	2280 deg F
FLUID TEMP.	2370 deg F

FREE SWELLING INDEX	5.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	3.8

COAL SAMPLING REPORT

LABORATORY NO: U10578 FIELD NO: KGS 586 U.S.G.S. NO: W215392
SAMPLER: Currens AGENCY: KGS DATE: Oct/06/1981
7.5' QUAD: Fork Ridge COUNTY: Bell DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 19 ROW B TIER 69 1000 FT FSL, 4500 FT FEL
LATITUDE: 36 DEG 36 MIN 10 SEC LONGITUDE: 83 DEG 46 MIN 55 SEC
ELEVATION (FT): 2240.30, OF POINT AT base of 586, USING altimeter
COMMENTARY:
REGIONAL COAL NAME: Whitesburg zone GEO. MAP COAL NAME: Stray
REPORTED COAL NAME: Stray FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): third split from bottom
EXPOSURE: TYPE surface mine; CONDITION, active
SAMPLE CONDITION: fresh, clean, dry
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 13.0, SAMPLE 13.0, COAL ONLY 13.0
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 50, SET 2 15, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
		Horizon KGS 579.
N	9.84	Shale, dark-gray to black, sideritic; rooted at top.
N	12.47	Siltstone, medium-gray, dark-gray at base, carbonaceous, micaceous; calcareous nodules 0.1 to 1 m thick by 2 to 5 m long near top.
Y	1.08	Clarain, with highly abundant medium- to thick-banded vitrain, common medium-banded fusain. See KGS 578 for underlying strata.

COAL ANALYSIS REPORT

LABORATORY NO: U10578 FIELD NO: KGS 586 U.S.G.S. NO: W215392
LABORATORY: Geo Test REPORT DATE: Mar/31/1982

AIR DRIED LOSS: 0.39%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	2.28%		
VOLATILE MATTER	37.62%	38.50%	40.54%
FIXED CARBON	55.18%	56.47%	59.46%
ASH	4.92%	5.03%	
ULTIMATE ANALYSIS:			
HYDROGEN	5.51%	5.38%	5.66%
CARBON	78.03%	79.85%	84.09%
NITROGEN	1.97%	2.02%	2.12%
TOTAL SULFUR	1.22%	1.25%	1.31%
OXYGEN	8.35%	6.47%	6.82%
ASH	4.92%	5.03%	
HEATING VALUE (BTU/LB):	14009	14335	15096
SULFUR FORMS:			
SULFATE	0.06%	0.06%	0.06%
PYRITIC	0.35%	0.36%	0.38%
ORGANIC	0.81%	0.83%	0.87%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2450 deg F
SOFTENING TEMP.	2540 deg F
FLUID TEMP.	2580 deg F

FREE SWELLING INDEX	6.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	1.7

COAL SAMPLING REPORT

LABORATORY NO: U10590 FIELD NO: KGS 563 U.S.G.S. NO: W215404
SAMPLER: Currens AGENCY: KGS DATE: Sep/03/1981
7.5' QUAD: Kayjay COUNTY: Bell DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 11 ROW C TIER 69 2500 FT FSL, 1600 FT FEL
LATITUDE: 36 DEG 42 MIN 25 SEC LONGITUDE: 83 DEG 45 MIN 20 SEC
ELEVATION (FT): 1553.30, OF POINT AT base of 563, USING altimeter
COMMENTARY:
REGIONAL COAL NAME: U Elkhorn No.1 GEO. MAP COAL NAME: Mingo
REPORTED COAL NAME: Mingo FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
EXPOSURE: TYPE, surface mine; CONDITION, active
SAMPLE CONDITION: fresh, clean, dry
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 32.1, SAMPLE 32.1, COAL ONLY 32.1
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 220, SET 2 290, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
N		Covered.
N	32.81	Sandstone, medium-gray to red-brown, coarse-grained.
N	16.40	Siltstone, medium- to dark-gray, laminated, sideritic, slightly carbonaceous.
Y	0.30	Durain, with sparse thin-banded vitrain, abundant calcite in cleat.
Y	0.02	Fusain.
Y	0.03	Vitrain.
Y	0.03	Fusain.
Y	1.38	Clarain, with abundant medium- to thick-banded vitrain, scattered thin-banded fusain, scattered pyrite nodules up to 3 x 10 cm.
Y	0.07	Fusain.
Y	0.85	Clarain, with abundant thick-banded vitrain, scattered thin-banded fusain.
N	2.62	Shale, medium-gray; rooted at top; slightly carbonaceous.

COAL ANALYSIS REPORT

LABORATORY NO: U10590 FIELD NO: KGS 563 U.S.G.S. NO: W215404
LABORATORY: Geo Test REPORT DATE: Mar/31/1982

AIR DRIED LOSS: 0.30%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	2.14%		
VOLATILE MATTER	35.83%	36.61%	37.37%
FIXED CARBON	60.04%	61.35%	62.63%
ASH	1.99%	2.03%	
ULTIMATE ANALYSIS:			
HYDROGEN	5.46%	5.33%	5.45%
CARBON	81.43%	83.21%	84.94%
NITROGEN	1.95%	1.99%	2.03%
TOTAL SULFUR	0.72%	0.74%	0.75%
OXYGEN	8.45%	6.70%	6.83%
ASH	1.99%	2.03%	
HEATING VALUE (BTU/LB):	14378	14693	14998
SULFUR FORMS:			
SULFATE	0.01%	0.01%	0.01%
PYRITIC	0.10%	0.10%	0.10%
ORGANIC	0.61%	0.62%	0.64%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2290 deg F
SOFTENING TEMP.	2400 deg F
FLUID TEMP.	2500 deg F

FREE SWELLING INDEX	4.5
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	1.0

COAL SAMPLING REPORT

LABORATORY NO: U10591 FIELD NO: KGS 564 U.S.G.S. NO: W215405
SAMPLER: Currens AGENCY: KGS DATE: Sep/09/1981
7.5' QUAD: Louellen COUNTY: Harlan DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 9 ROW E TIER 77 2150 FT FSL, 4400 FT FEL
LATITUDE: 36 DEG 53 MIN 21 SEC LONGITUDE: 83 DEG 6 MIN 54 SEC
ELEVATION (FT): 1453.70, OF POINT AT base of 564, USING survey
COMMENTARY:
REGIONAL COAL NAME: U Elkhorn No.1 GEO. MAP COAL NAME: Harlan
REPORTED COAL NAME: Harlan FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
EXPOSURE: TYPE, underground; CONDITION, active
SAMPLE CONDITION: fresh, clean, dry
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 41.1, SAMPLE 38.8, COAL ONLY 38.8
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 255, SET 2 335, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
N		Shale, medium- to dark-gray, slightly silty, laminated to bioturbated, carbonaceous, with abundant plant fragments, coaly.
N	0.13	Clarain.
N	0.13	Shale, medium- to dark-gray, slightly silty, laminated to bioturbated, carbonaceous, with abundant plant fragments, coaly.
Y	0.03	Durain.
Y	1.51	Clarain, with abundant thin- to thick-banded vitrain, scattered thin-banded fusain.
Y	0.02	Fusain.
Y	0.33	Clarain, with abundant thick-banded vitrain.
N	0.20	Claystone, dark-gray to black, coaly.
Y	1.35	Clarain, with abundant medium- to thick-banded vitrain, common thin-banded fusain; pyritic at base.
N		Shale, light-gray, silty, rooted, hard.

COAL ANALYSIS REPORT

LABORATORY NO: U10591 FIELD NO: KGS 564 U.S.G.S. NO: W215405
LABORATORY: Geo Test REPORT DATE: Mar/31/1982

AIR DRIED LOSS: 0.23%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	1.79%		
VOLATILE MATTER	37.33%	38.01%	39.99%
FIXED CARBON	56.02%	57.04%	60.01%
ASH	4.86%	4.95%	
ULTIMATE ANALYSIS:			
HYDROGEN	5.46%	5.36%	5.63%
CARBON	78.86%	80.30%	84.47%
NITROGEN	1.64%	1.67%	1.76%
TOTAL SULFUR	1.12%	1.14%	1.20%
OXYGEN	8.06%	6.58%	6.94%
ASH	4.86%	4.95%	
HEATING VALUE (BTU/LB):	14060	14316	15061
SULFUR FORMS:			
SULFATE	0.01%	0.01%	0.01%
PYRITIC	0.26%	0.26%	0.28%
ORGANIC	0.85%	0.87%	0.91%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2690 deg F
SOFTENING TEMP.	2800 deg F
FLUID TEMP.	2800 deg F

FREE SWELLING INDEX	6.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	1.6

COAL SAMPLING REPORT

LABORATORY NO: U10592 FIELD NO: KGS 565 U.S.G.S. NO: W215406
SAMPLER: Currens AGENCY: KGS DATE: Sep/10/1981
7.5' QUAD: Nolansburg COUNTY: Harlan DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 12 ROW E TIER 76 4900 FT FSL, 1000 FT FEL
LATITUDE: 36 DEG 52 MIN 48 SEC LONGITUDE: 83 DEG 11 MIN 12 SEC
ELEVATION (FT): 1460.00, OF POINT AT base of 565, USING topo
COMMENTARY:
REGIONAL COAL NAME: U Elkhorn No.1 GEO. MAP COAL NAME: Harlan
REPORTED COAL NAME: Harlan FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
EXPOSURE: TYPE, underground; CONDITION, active
SAMPLE CONDITION: fresh, clean, dry
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 41.7, SAMPLE 37.0, COAL ONLY 37.0
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 245, SET 2 335, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
N		Siltstone, dark-gray, carbonaceous, with scattered plant fragments.
N	0.10	Clarain.
N	0.20	Siltstone, dark-gray, arenaceous, rooted.
Y	0.46	Durain, with scattered thin-banded vitrain.
Y	0.39	Clarain, with abundant medium-banded vitrain.
N	0.26	Siltstone, dark-brown to black, carbonaceous; coaly at base.
Y	0.10	Clarain, with abundant thin-banded vitrain, pyritic.
Y	0.03	Fusain.
Y	0.89	Clarain, with abundant thin- to medium-banded vitrain, scattered thin-banded fusain, scattered, interlaminated durain, up to 1 cm thick.
Y	0.10	Durain.
Y	0.13	Clarain.
N	0.13	Siltstone, dark-brown to black, coaly, laminated.
Y	0.98	Clarain, with thin- to thick-banded vitrain, scattered thin-banded fusain.
N		Siltstone, light-gray, hard, rooted.

COAL ANALYSIS REPORT

LABORATORY NO: U10592 FIELD NO: KGS 565 U.S.G.S. NO: W215406
LABORATORY: Geo Test REPORT DATE: Mar/31/1982

AIR DRIED LOSS: 0.20%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	1.71%		
VOLATILE MATTER	34.91%	35.52%	39.44%
FIXED CARBON	53.59%	54.52%	60.55%
ASH	9.79%	9.96%	
ULTIMATE ANALYSIS:			
HYDROGEN	5.05%	4.94%	5.49%
CARBON	74.38%	75.67%	84.04%
NITROGEN	1.60%	1.63%	1.81%
TOTAL SULFUR	0.87%	0.89%	0.98%
OXYGEN	8.31%	6.91%	7.68%
ASH	9.79%	9.96%	
HEATING VALUE (BTU/LB):	13312	13544	15041
SULFUR FORMS:			
SULFATE	0.01%	0.01%	0.01%
PYRITIC	0.14%	0.14%	0.16%
ORGANIC	0.72%	0.73%	0.81%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2800 deg F
SOFTENING TEMP.	2800 deg F
FLUID TEMP.	2800 deg F

FREE SWELLING INDEX	6.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	1.3

COAL SAMPLING REPORT

LABORATORY NO: U10593 FIELD NO: KGS 566 U.S.G.S. NO: W215407
SAMPLER: Currens AGENCY: KGS DATE: Sep/10/1981
7.5' QUAD: Nolansburg COUNTY: Harlan DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 12 ROW E TIER 76 3800 FT FSL, 4300 FT FEL
LATITUDE: 36 DEG 52 MIN 38 SEC LONGITUDE: 83 DEG 11 MIN 53 SEC
ELEVATION (FT): 1693.00, OF POINT AT base of 566, USING topo
COMMENTARY:
REGIONAL COAL NAME: U Elkhorn No.3 GEO. MAP COAL NAME: Darby
REPORTED COAL NAME: Darby FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
EXPOSURE: TYPE, underground; CONDITION, active
SAMPLE CONDITION: fresh, clean, dry
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 44.1, SAMPLE 37.8, COAL ONLY 37.8
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 60, SET 2 335, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
N	1.64	Sandstone, dark-gray, coarse-grained, carbonaceous, micaceous; locally cuts out darby, reported thickness 80 to 100 feet.
N	1.05	Shale and thin coal (to 1 cm, largely vitrain), slickensided.
N	0.49	Shale, dark-gray, rooted, with abundant plant fragments.
N	0.07	Clarain.
N	0.23	Shale, dark-gray, carbonaceous.
N	0.10	Durain, highly argillaceous.
Y	0.20	Durain, argillaceous, with scattered thin-banded vitrain.
Y	0.56	Clarain, with abundant thin- to thick-banded vitrain, common fusain.
N	0.36	Shale, dark-gray, carbonaceous, rooted.
N	0.10	Shale, black, highly carbonaceous, grades into units above and below.
N	0.07	Durain, highly argillaceous.
Y	1.38	Clarain, with abundant thin- to medium-banded vitrain, common medium-banded fusain, scattered durain up to 1 cm thick.
Y	0.03	Fusain.
Y	0.98	Clarain, with scattered to abundant thin-banded vitrain, scattered thin-banded fusain.
N	0.33	Siltstone, dark-gray, rooted.

COAL ANALYSIS REPORT

LABORATORY NO: U10593 FIELD NO: KGS 566 U.S.G.S. NO: W215407
LABORATORY: Geo Test REPORT DATE: Mar/31/1982

AIR DRIED LOSS: 0.27%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	1.97%		
VOLATILE MATTER	35.47%	36.18%	39.39%
FIXED CARBON	54.57%	55.67%	60.61%
ASH	7.99%	8.15%	
ULTIMATE ANALYSIS:			
HYDROGEN	5.23%	5.11%	5.56%
CARBON	75.67%	77.19%	84.04%
NITROGEN	1.49%	1.52%	1.65%
TOTAL SULFUR	0.70%	0.71%	0.78%
OXYGEN	8.92%	7.32%	7.97%
ASH	7.99%	8.15%	
HEATING VALUE (BTU/LB):	13515	13787	15010
SULFUR FORMS:			
SULFATE			
PYRITIC	0.05%	0.05%	0.06%
ORGANIC	0.65%	0.66%	0.72%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2680 deg F
SOFTENING TEMP.	2760 deg F
FLUID TEMP.	2800 deg F

FREE SWELLING INDEX	4.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	1.0

COAL SAMPLING REPORT

LABORATORY NO: U10595 FIELD NO: KGS 568 U.S.G.S. NO: W215409
SAMPLER: Currens AGENCY: KGS DATE: Sep/17/1981
7.5' QUAD: Fork Ridge COUNTY: Bell DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 21 ROW B TIER 69 1550 FT FSL, 1900 FT FEL
LATITUDE: 36 DEG 35 MIN 15 SEC LONGITUDE: 83 DEG 45 MIN 23 SEC
ELEVATION (FT): 2298.30, OF POINT AT base of 568, USING altimeter
COMMENTARY:
REGIONAL COAL NAME: Amburgy zone GEO. MAP COAL NAME: Sterling
REPORTED COAL NAME: Sterling FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
EXPOSURE: TYPE, surface mine; CONDITION, active
SAMPLE CONDITION: fresh, clean, wet
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 39.8, SAMPLE 38.2, COAL ONLY 38.2
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 225, SET 2 180, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
N	32.81	Siltstone and shale, dark-gray; carbonaceous at base; no fossils observed.
Y	0.59	Clarain, with abundant medium- to thick-banded vitrain; pyritic.
Y	0.49	Clarain, with common thin-banded vitrain.
N	0.13	Siltstone, black to dark-brown, highly carbonaceous, hard, brittle.
Y	2.10	Clarain, with abundant thick-banded vitrain, common medium-banded fusain; large pyrite nodules at base.
N		Siltstone, light-gray, rooted.
N		Sandstone, coarse-grained.

COAL ANALYSIS REPORT

LABORATORY NO: U10595 FIELD NO: KGS 568 U.S.G.S. NO: W215409
LABORATORY: Geo Test REPORT DATE: Mar/31/1982

AIR DRIED LOSS: 0.23%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	1.88%		
VOLATILE MATTER	36.65%	37.35%	40.44%
FIXED CARBON	53.99%	55.03%	59.57%
ASH	7.48%	7.62%	
ULTIMATE ANALYSIS			
HYDROGEN	5.18%	5.07%	5.48%
CARBON	75.59%	77.04%	83.40%
NITROGEN	1.91%	1.95%	2.11%
TOTAL SULFUR	0.80%	0.82%	0.88%
OXYGEN	9.04%	7.50%	8.13%
ASH	7.48%	7.62%	
HEATING VALUE (BTU/LB):	13468	13727	14859
SULFUR FORMS:			
SULFATE	0.04%	0.04%	0.04%
PYRITIC	0.13%	0.13%	0.14%
ORGANIC	0.63%	0.64%	0.70%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2590 deg F
SOFTENING TEMP.	2680 deg F
FLUID TEMP.	2740 deg F

FREE SWELLING INDEX	4.5
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	1.2

COAL SAMPLING REPORT

LABORATORY NO: U10553 FIELD NO: KGS 571 U.S.G.S. NO: W215416
SAMPLER: Currens & Blackburn AGENCY: KGS DATE: Sep/22/1981
7.5' QUAD: Kayjay COUNTY: Bell DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 4 ROW B TIER 69 4900 FT FSL, 4450 FT FEL
LATITUDE: 36 DEG 39 MIN 48 SEC LONGITUDE: 83 DEG 48 MIN 55 SEC
ELEVATION (FT): 2640.00, OF POINT AT base of 571, USING altimeter
COMMENTARY:
REGIONAL COAL NAME: Haddix zone GEO. MAP COAL NAME: Low Splint
REPORTED COAL NAME: No.6 FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): bottom split
EXPOSURE: TYPE, surface mine; CONDITION, active
SAMPLE CONDITION: fresh, clean, dry
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 24.0, SAMPLE 24.0, COAL ONLY 24.0
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 80, SET 2 170, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
		Horizon KGS 572.
N	13.12	Shale, dark-gray, coaly, rooted, sideritic.
N	11.48	Shale, dark-gray, laminated, sideritic, interbedded with fine-grained sandstone up to 0.1 m thick; grades into underlying unit.
N	0.52	Canneloid coal, very argillaceous.
N	0.62	Coal, obscured; predominatly clarain.
N	0.52	Claystone, light-gray, rooted.
Y	0.30	Clarain, with abundant medium-banded vitrain, scattered medium-banded fusain.
Y	0.16	Durain, with sparse medium-banded vitrain.
Y	0.89	Clarain, with abundant medium-banded vitrain.
Y	0.03	Fusain.
Y	0.62	Clarain, with abundant medium-banded vitrain.

COAL ANALYSIS REPORT

LABORATORY NO: U10553 FIELD NO: KGS 571 U.S.G.S. NO: W215416
LABORATORY: Geo Test REPORT DATE: Mar/31/1982

AIR DRIED LOSS: 0.52%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	2.54%		
VOLATILE MATTER	36.84%	37.80%	38.90%
FIXED CARBON	57.86%	59.37%	61.10%
ASH	2.76%	2.83%	
ULTIMATE ANALYSIS:			
HYDROGEN	5.58%	5.43%	5.59%
CARBON	79.20%	81.27%	83.64%
NITROGEN	1.66%	1.70%	1.75%
TOTAL SULFUR	0.86%	0.88%	0.91%
OXYGEN	9.94%	7.89%	8.11%
ASH	2.76%	2.83%	
HEATING VALUE (BTU/LB):	14154	14523	14947
SULFUR FORMS:			
SULFATE	0.03%	0.03%	0.03%
PYRITIC	0.17%	0.17%	0.18%
ORGANIC	0.66%	0.68%	0.70%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2690 deg F
SOFTENING TEMP.	2770 deg F
FLUID TEMP.	2800 deg F

FREE SWELLING INDEX	3.5
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	1.2

COAL SAMPLING REPORT

LABORATORY NO: U10554 FIELD NO: KGS 572 U.S.G.S. NO: W215417
SAMPLER: Currens & Blackburn AGENCY: KGS DATE: Sep/22/1981
7.5' QUAD: Kayjay COUNTY: Bell DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 4 ROW B TIER 69 4800 FT FSL, 4100 FT FEL
LATITUDE: 36 DEG 39 MIN 47 SEC LONGITUDE: 83 DEG 48 MIN 50 SEC
ELEVATION (FT): 2680.00, OF POINT AT base of 572, USING altimeter
COMMENTARY:
REGIONAL COAL NAME: Haddix zone GEO. MAP COAL NAME: Low Splint
REPORTED COAL NAME: No.5 FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): top split
EXPOSURE: TYPE, surface mine; CONDITION, few weeks old
SAMPLE CONDITION: dry
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 55.5, SAMPLE 55.5, COAL ONLY 55.1
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 50, SET 2 125, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
N	16.40	Siltstone, medium-gray, with limestone nodules (2 x 10 m in diameter).
N	1.64	Coal.
N	1.64	Shale, rooted.
N	1.64	Coal.
N	13.12	Siltstone, medium-gray; rooted at top.
N	6.56	Shale, medium-gray, sideritic.
Y	1.35	Clarain, with abundant thin- to thick-banded vitrain, scattered thin-banded fusain.
Y	0.23	Durain, with scattered medium-banded vitrain.
Y	0.03	Siltstone, black, highly carbonaceous.
Y	0.46	Clarain, with abundant thin-banded vitrain.
Y	0.23	Clarain, with abundant medium- to thick-banded vitrain.
Y	0.33	Durain, with sparse thin-banded vitrain.
Y	0.56	Clarain, with scattered thin-banded vitrain.
Y	1.44	Clarain, with abundant medium- to thick-banded vitrain, scattered thin-banded fusain; pyritic at base.

See KGS 571 for underlying strata.

COAL ANALYSIS REPORT

LABORATORY NO: U10554 FIELD NO: KGS 572 U.S.G.S. NO: W215417
LABORATORY: Geo Test REPORT DATE: Mar/31/1982

AIR DRIED LOSS: 0.33%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	2.36%		
VOLATILE MATTER	37.05%	37.95%	40.26%
FIXED CARBON	54.97%	56.30%	59.74%
ASH	5.62%	5.76%	
ULTIMATE ANALYSIS:			
HYDROGEN	5.39%	5.25%	5.57%
CARBON	76.92%	78.78%	83.59%
NITROGEN	1.73%	1.77%	1.88%
TOTAL SULFUR	0.75%	0.77%	0.82%
OXYGEN	9.59%	7.67%	8.14%
ASH	5.62%	5.76%	
HEATING VALUE (BTU/LB):	13689	14020	14876
SULFUR FORMS:			
SULFATE	0.00%	0.00%	0.00%
PYRITIC	0.10%	0.10%	0.11%
ORGANIC	0.65%	0.67%	0.71%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2800 deg F
SOFTENING TEMP.	2800 deg F
FLUID TEMP.	2800 deg F

FREE SWELLING INDEX	4.5
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	1.1

COAL SAMPLING REPORT

LABORATORY NO: U10558 FIELD NO: KGS 576 U.S.G.S. NO: W215421
SAMPLER: Currens & Blackburn AGENCY: KGS DATE: Sep/29/1981
7.5' QUAD: Fork Ridge COUNTY: Bell DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 18 ROW B TIER 69 300 FT FSL, 100 FT FEL
LATITUDE: 36 DEG 36 MIN 3 SEC LONGITUDE: 83 DEG 47 MIN 1 SEC
ELEVATION (FT): 2554.80, OF POINT AT base of 576, USING altimeter
COMMENTARY: KGS 576 is approximately 70 feet above the Hignite seam
REGIONAL COAL NAME: uncorrelated GEO. MAP COAL NAME: unmapped
REPORTED COAL NAME: No.2 FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
EXPOSURE: TYPE, surface mine; CONDITION, active, "croppy"
SAMPLE CONDITION: clean, dry, slightly weathered
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 4.7, SAMPLE 4.7, COAL ONLY 4.7
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 50, SET 2 310, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
		Horizon KGS 577.
N	4.59	Sandstone, dark-gray, fine-grained, argillaceous; silty, rooted at top; sideritic (fining-upward sequence).
Y	0.39	Clarain, with abundant medium-banded vitrain; abundant pyrite in cleat.
		See KGS 583 (W215389) for underlying strata.

COAL ANALYSIS REPORT

LABORATORY NO: U10558 FIELD NO: KGS 576 U.S.G.S. NO: W215421
LABORATORY: Geo Test REPORT DATE: Mar/31/1982

AIR DRIED LOSS: 0.39%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	2.12%		
VOLATILE MATTER	27.70%	28.30%	46.74%
FIXED CARBON	31.56%	32.24%	53.26%
ASH	38.62%	39.46%	
ULTIMATE ANALYSIS:			
HYDROGEN	3.84%	3.68%	6.08%
CARBON	46.79%	47.81%	78.96%
NITROGEN	1.14%	1.16%	1.92%
TOTAL SULFUR	0.92%	0.94%	1.55%
OXYGEN	8.79%	6.95%	11.49%
ASH	38.62%	39.46%	
HEATING VALUE (BTU/LB):	8298	8478	14003
SULFUR FORMS:			
SULFATE	0.02%	0.02%	0.03%
PYRITIC	0.45%	0.46%	0.76%
ORGANIC	0.45%	0.46%	0.76%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2800 deg F
SOFTENING TEMP.	2800 deg F
FLUID TEMP.	2800 deg F

FREE SWELLING INDEX	1.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	2.2

COAL SAMPLING REPORT

LABORATORY NO: U10559 FIELD NO: KGS 577 U.S.G.S. NO: W215422
SAMPLER: Currens & Blackburn AGENCY: KGS DATE: Sep/29/1981
7.5' QUAD: Fork Ridge COUNTY: Bell DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 18 ROW B TIER 69 300 FT FSL, 100 FT FEL
LATITUDE: 36 DEG 36 MIN 3 SEC LONGITUDE: 83 DEG 47 MIN 1 SEC
ELEVATION (FT): 2559.80, OF POINT AT base of 577, USING altimeter
COMMENTARY: KGS 577 is approximately 75 feet above the Hignite seam
REGIONAL COAL NAME: uncorrelated GEO. MAP COAL NAME: unmapped
REPORTED COAL NAME: No.3 FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
EXPOSURE: TYPE, surface mine; CONDITION, active, "croppy"
SAMPLE CONDITION: clean, dry, slightly weathered
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 20.9, SAMPLE 20.9, COAL ONLY 20.9
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 230, SET 2 340, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
		Soil.
N	16.40	Siltstone, light-gray, sideritic, laminated to slightly bioturbated, with common fine-grained sand lenses.
N	0.85	Shale, black, laminated.
Y	1.74	Canneloid coal, with scattered thin-banded vitrain near base, slightly argillaceous, hard, with conchoidal fracture.
		See KGS 576 for underlying strata.

COAL ANALYSIS REPORT

LABORATORY NO: U10559 FIELD NO: KGS 577 U.S.G.S. NO: W215422
LABORATORY: Geo Test REPORT DATE: Mar/31/1982

AIR DRIED LOSS: 0.37%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	1.41%		
VOLATILE MATTER	18.70%	18.97%	56.86%
FIXED CARBON	14.19%	14.39%	43.14%
ASH	65.70%	66.64%	
ULTIMATE ANALYSIS:			
HYDROGEN	2.18%	2.05%	6.15%
CARBON	24.00%	24.34%	72.97%
NITROGEN	0.45%	0.46%	1.37%
TOTAL SULFUR	0.40%	0.41%	1.22%
OXYGEN	7.27%	6.10%	18.29%
ASH	65.70%	66.64%	
HEATING VALUE (BTU/LB):	4029	4087	12250
SULFUR FORMS:			
SULFATE	0.01%	0.01%	0.03%
PYRITIC	0.24%	0.24%	0.73%
ORGANIC	0.15%	0.15%	0.46%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2460 deg F
SOFTENING TEMP.	2540 deg F
FLUID TEMP.	2600 deg F

FREE SWELLING INDEX
POUNDS OF SULFUR DIOXIDE PER MILLION BTU 2.0

COAL SAMPLING REPORT

LABORATORY NO: U10560 FIELD NO: KGS 578 U.S.G.S. NO: W215423
SAMPLER: Currens & Blackburn AGENCY: KGS DATE: Sep/29/1981
7.5' QUAD: Fork Ridge COUNTY: Bell DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 19 ROW B TIER 69 1450 FT FSL, 4800 FT FEL
LATITUDE: 36 DEG 36 MIN 14 SEC LONGITUDE: 83 DEG 46 MIN 59 SEC
ELEVATION (FT): 2215.20, OF POINT AT base of 578, USING altimeter
COMMENTARY:
REGIONAL COAL NAME: Whitesburg zone GEO. MAP COAL NAME: Stray
REPORTED COAL NAME: Stray FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): second split from bottom
EXPOSURE: TYPE, surface mine; CONDITION, active
SAMPLE CONDITION: fresh, clean
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 31.9, SAMPLE 29.5, COAL ONLY 29.5
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 50, SET 2 150, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
		Horizon KGS 586 (W215392).
N	21.98	Siltstone, medium-gray, sideritic; rooted at top; rolling.
Y	1.12	Clarain, with abundant thin- to thick-banded vitrain, scattered thin-banded fusain.
Y	0.16	Durain, with scattered thin-banded vitrain.
N	0.07	Siltstone.
Y	0.52	Clarain, interlaminated with durain, with scattered thin-banded vitrain; argillaceous, pyritic.
N	0.13	Shale, dark-gray.
Y	0.66	Clarain, with abundant thick-banded vitrain, thin (up to 1 cm thick) shale, and scattered thin-banded fusain.
		See KGS 584 (W215390) for underlying strata.

COAL ANALYSIS REPORT

LABORATORY NO: U10560 FIELD NO: KGS 578 U.S.G.S. NO: W215423
LABORATORY: Geo Test REPORT DATE: Mar/31/1982

AIR DRIED LOSS: 0.38%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	1.89%		
VOLATILE MATTER	32.99%	33.63%	39.73%
FIXED CARBON	50.04%	51.01%	60.27%
ASH	15.08%	15.37%	
ULTIMATE ANALYSIS:			
HYDROGEN	4.68%	4.55%	5.38%
CARBON	68.30%	69.62%	82.26%
NITROGEN	1.73%	1.76%	2.08%
TOTAL SULFUR	2.16%	2.20%	2.60%
OXYGEN	8.05%	6.50%	7.68%
ASH	15.08%	15.37%	
HEATING VALUE (BTU/LB):	12256	12493	14761
SULFUR FORMS:			
SULFATE	0.03%	0.03%	0.04%
PYRITIC	1.26%	1.28%	1.52%
ORGANIC	0.87%	0.89%	1.05%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2340 deg F
SOFTENING TEMP.	2480 deg F
FLUID TEMP.	2550 deg F

FREE SWELLING INDEX	3.5
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	3.5

COAL SAMPLING REPORT

LABORATORY NO: U10561 FIELD NO: KGS 579 U.S.G.S. NO: W215424
SAMPLER: Currens & Blackburn AGENCY: KGS DATE: Sep/29/1981
7.5' QUAD: Fork Ridge COUNTY: Bell DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 18 ROW B TIER 69 1450 FT FSL, 200 FT FEL
LATITUDE: 36 DEG 36 MIN 14 SEC LONGITUDE: 83 DEG 47 MIN 2 SEC
ELEVATION (FT): 2263.10, OF POINT AT base of 579, USING altimeter
COMMENTARY:
REGIONAL COAL NAME: Whitesburg zone GEO. MAP COAL NAME: Stray
REPORTED COAL NAME: Stray FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): fourth split from bottom
EXPOSURE: TYPE, surface mine; CONDITION, active
SAMPLE CONDITION: fresh, clean, dry
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
thick-NESS (INCHES): SEAM HEIGHT 12.2, SAMPLE 12.2, COAL ONLY 12.2
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 225, SET 2 145, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
		Horizon KGS 580 (W215425).
N	11.81	Siltstone, medium-gray, arenaceous; rooted at top.
N	0.49	Coal.
N	9.84	Shale, medium-gray(?); rooted at top; obscured by dust.
Y	1.02	Clarain, with abundant thick-banded vitrain, scattered thin-banded fusain.
		See KGS 586 (W215392) for underlying strata.

COAL ANALYSIS REPORT

LABORATORY NO: U10561 FIELD NO: KGS 579 U.S.G.S. NO: W215424
LABORATORY: Geo Test REPORT DATE: Mar/31/1982

AIR DRIED LOSS: 0.26%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	1.83%		
VOLATILE MATTER	38.86%	39.58%	41.09%
FIXED CARBON	55.72%	56.76%	58.91%
ASH	3.59%	3.66%	
ULTIMATE ANALYSIS:			
HYDROGEN	5.67%	5.57%	5.78%
CARBON	78.57%	80.03%	83.07%
NITROGEN	1.97%	2.01%	2.08%
TOTAL SULFUR	0.68%	0.69%	0.72%
OXYGEN	9.52%	8.04%	8.35%
ASH	3.59%	3.66%	
HEATING VALUE (BTU/LB):	14267	14532	15085
SULFUR FORMS:			
SULFATE	0.01%	0.01%	0.01%
PYRITIC	0.02%	0.02%	0.02%
ORGANIC	0.65%	0.66%	0.69%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2650 deg F
SOFTENING TEMP.	2720 deg F
FLUID TEMP.	2760 deg F

FREE SWELLING INDEX	4.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	1.0

COAL SAMPLING REPORT

LABORATORY NO: U10562 FIELD NO: KGS 580 U.S.G.S. NO: W215425
SAMPLER: Currens & Blackburn AGENCY: KGS DATE: Sep/29/1981
7.5' QUAD: Fork Ridge COUNTY: Bell DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 18 ROW B TIER 69 1500 FT FSL, 350 FT FEL
LATITUDE: 36 DEG 36 MIN 15 SEC LONGITUDE: 83 DEG 47 MIN 4 SEC
ELEVATION (FT): 2282.10, OF POINT AT base of 580, USING altimeter
COMMENTARY:
REGIONAL COAL NAME: Whitesburg zone GEO. MAP COAL NAME: Stray
REPORTED COAL NAME: Stray FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): fifth split from bottom
EXPOSURE: TYPE, surface mine; CONDITION, active, "croppy"
SAMPLE CONDITION: clean, dry, slightly weathered
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
thick-NESS (INCHES): SEAM HEIGHT 24.4, SAMPLE 21.3, COAL ONLY 21.3
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 210, SET 2 310, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
		Horizon KGS 585 (W215391).
N	3.48	Siltstone, medium-gray, weathers red-brown, rooted.
N	0.20	Clarain, pyritic.
N	0.43	Shale, medium-gray, silty, rooted.
Y	0.85	Clarain, with abundant medium- to thick-banded vitrain, scattered thin-banded fusain; some durain near top.
N	0.26	Shale, medium-gray, rooted.
Y	0.92	Clarain, with abundant thin-banded vitrain, scattered thin-banded fusain.
		See KGS 579 (W215424) for underlying strata.

COAL ANALYSIS REPORT

LABORATORY NO: U10562 FIELD NO: KGS 580 U.S.G.S. NO: W215425
LABORATORY: Geo Test REPORT DATE: Mar/31/1982

AIR DRIED LOSS: 0.44%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	2.33%		
VOLATILE MATTER	36.39%	37.26%	39.25%
FIXED CARBON	56.33%	57.68%	60.75%
ASH	4.95%	5.07%	
ULTIMATE ANALYSIS:			
HYDROGEN	5.43%	5.29%	5.58%
CARBON	76.89%	78.73%	82.93%
NITROGEN	1.89%	1.94%	2.04%
TOTAL SULFUR	1.40%	1.43%	1.51%
OXYGEN	9.44%	7.54%	7.94%
ASH	4.95%	5.07%	
HEATING VALUE (BTU/LB):	13862	14193	14950
SULFUR FORMS:			
SULFATE	0.01%	0.01%	0.01%
PYRITIC	0.65%	0.67%	0.70%
ORGANIC	0.74%	0.76%	0.80%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	1990 deg F
SOFTENING TEMP.	2150 deg F
FLUID TEMP.	2240 deg F

FREE SWELLING INDEX	2.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	2.0

COAL SAMPLING REPORT

LABORATORY NO: U10563 FIELD NO: KGS 581 U.S.G.S. NO: W215426
SAMPLER: Currens & Blackburn AGENCY: KGS DATE: Sep/30/1981
7.5' QUAD: Louellen COUNTY: Harlan DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 10 ROW E TIER 77 1150 FT FSL, 2100 FT FEL
LATITUDE: 36 DEG 53 MIN 11 SEC LONGITUDE: 83 DEG 5 MIN 26 SEC
ELEVATION (FT): 1669.50, OF POINT AT base of 581, USING survey
COMMENTARY:
REGIONAL COAL NAME: U Elkhorn No.3 GEO. MAP COAL NAME: Darby
REPORTED COAL NAME: Darby FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
EXPOSURE: TYPE, underground; CONDITION, active
SAMPLE CONDITION: clean, dry
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
thick-NESS (INCHES): SEAM HEIGHT 53.5, SAMPLE 48.8, COAL ONLY 48.8
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 105, SET 2 330, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
N		Sandstone, massive.
N	3.28	Shale, dark-gray.
N	0.26	Durain, with scattered thin-banded vitrain.
N	1.48	Siltstone, dark-gray, rooted.
Y	0.30	Durain, highly argillaceous, with scattered thin-banded vitrain.
Y	0.49	Clarain, with common medium-banded vitrain; pyritic.
N	0.39	Siltstone, dark-gray, coaly.
Y	0.46	Clarain, with scattered thin-banded vitrain.
Y	0.23	Clarain, with common thick-banded vitrain.
Y	1.05	Clarain, with common thin- to medium-banded vitrain, scattered thin-banded fusain; pyritic.
Y	0.07	Fusain.
Y	0.56	Clarain, with common thin- to medium-banded vitrain.
Y	0.03	Fusain.
Y	0.89	Clarain, with abundant medium- to thick-banded vitrain, common thin-banded fusain.
N		Siltstone.

COAL ANALYSIS REPORT

LABORATORY NO: U10563 FIELD NO: KGS 581 U.S.G.S. NO: W215426
LABORATORY: Geo Test REPORT DATE: Mar/31/1982

AIR DRIED LOSS: 0.28%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	1.78%		
VOLATILE MATTER	34.07%	34.69%	38.65%
FIXED CARBON	54.08%	55.06%	61.35%
ASH	10.07%	10.25%	
ULTIMATE ANALYSIS:			
HYDROGEN	4.98%	4.87%	5.42%
CARBON	73.48%	74.81%	83.36%
NITROGEN	1.44%	1.47%	1.63%
TOTAL SULFUR	0.65%	0.66%	0.74%
OXYGEN	9.38%	7.94%	8.85%
ASH	10.07%	10.25%	
HEATING VALUE (BTU/LB):	13247	13487	15027
SULFUR FORMS:			
SULFATE	0.01%	0.01%	0.01%
PYRITIC	0.12%	0.12%	0.14%
ORGANIC	0.52%	0.53%	0.59%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2570 deg F
SOFTENING TEMP.	2660 deg F
FLUID TEMP.	2720 deg F

FREE SWELLING INDEX	4.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	1.0

COAL SAMPLING REPORT

LABORATORY NO: U10564 FIELD NO: KGS 582 U.S.G.S. NO: W215427
SAMPLER: Currens & Blackburn AGENCY: KGS DATE: Sep/30/1981
7.5' QUAD: Nolansburg COUNTY: Harlan DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 8 ROW E TIER 76 500 FT FSL, 150 FT FEL
LATITUDE: 36 DEG 53 MIN 5 SEC LONGITUDE: 83 DEG 12 MIN 2 SEC
ELEVATION (FT): 1890.00, OF POINT AT base of 582, USING survey
COMMENTARY:
REGIONAL COAL NAME: Amburgy zone GEO. MAP COAL NAME: Creech
REPORTED COAL NAME: Creech FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
EXPOSURE: TYPE, mine portal; CONDITION, active, a few weeks old
SAMPLE CONDITION: fresh, clean, dry
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
thick-NESS (INCHES): SEAM HEIGHT 29.9, SAMPLE 28.8, COAL ONLY 28.8
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 235, SET 2 33, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
N	9.84	Sandstone.
N	3.28	Siltstone(?).
N	0.66	Coal.
N	3.28	Siltstone(?), rooted.
N	32.81	Sandstone, light-gray, weathers red-brown, medium-grained, thin- to thick-bedded, argillaceous, carbonaceous, micaceous, feldspathic.
N	0.98	Shale, medium-gray, laminated.
Y	0.23	Clarain, with abundant thin- to medium-banded vitrain; pyritic.
N	0.10	Durain, argillaceous; laterally grades to black claystone.
Y	0.23	Clarain, with common thin-banded vitrain.
Y	0.20	Durain, with scattered thin-banded vitrain.
Y	1.74	Clarain, with abundant thin- to medium-banded fusain at base.
N		Claystone, medium-gray, coaly, rooted.

COAL ANALYSIS REPORT

LABORATORY NO: U10564 FIELD NO: KGS 582 U.S.G.S. NO: W215427
LABORATORY: Geo Test REPORT DATE: Mar/31/1982

AIR DRIED LOSS: 0.43%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	2.00%		
VOLATILE MATTER	38.08%	38.86%	41.82%
FIXED CARBON	52.98%	54.06%	58.18%
ASH	6.94%	7.08%	
ULTIMATE ANALYSIS:			
HYDROGEN	5.51%	5.39%	5.81%
CARBON	75.84%	77.39%	83.29%
NITROGEN	1.63%	1.66%	1.79%
TOTAL SULFUR	2.56%	2.61%	2.81%
OXYGEN	7.52%	5.87%	6.30%
ASH	6.94%	7.08%	
HEATING VALUE (BTU/LB):	13696	13975	15041
SULFUR FORMS:			
SULFATE	0.03%	0.03%	0.03%
PYRITIC	1.62%	1.65%	1.78%
ORGANIC	0.91%	0.93%	1.00%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	1960 deg F
SOFTENING TEMP.	2080 deg F
FLUID TEMP.	2230 deg F

FREE SWELLING INDEX	4.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	3.7

100 ANALYSIS OF COAL SAMPLES FROM THE UPPER CUMBERLAND DISTRICT

COAL SAMPLING REPORT

LABORATORY NO: U10714 FIELD NO: KGS 591 U.S.G.S. NO: W215428
SAMPLER: Currens AGENCY: KGS DATE: Oct/13/1981
7.5' QUAD: Evarts COUNTY: Harlan DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 1 ROW D TIER 76 3400 FT FSL, 600 FT FEL
LATITUDE: 36 DEG 49 MIN 34 SEC LONGITUDE: 83 DEG 10 MIN 7 SEC
ELEVATION (FT): 2717.00, OF POINT AT base of 591, USING survey
COMMENTARY:
REGIONAL COAL NAME: Taylor GEO. MAP COAL NAME: Limestone
REPORTED COAL NAME: Limestone FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
EXPOSURE: TYPE, underground; CONDITION, active
SAMPLE CONDITION: fresh, clean, dry
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
thick-NESS (INCHES): SEAM HEIGHT 46.1, SAMPLE 40.9, COAL ONLY 40.9
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 10, SET 2 150, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
N	0.66	Siltstone, dark-gray, sideritic, with abundant plant fragments, kettle bottoms.
Y	11.18	Clarain, with abundant medium-banded vitrain, scattered thin-banded fusain; hard.
N	0.16	Siltstone, light-gray, rooted, soft.
Y	0.26	Clarain, with abundant thin-banded vitrain, scattered thin-banded fusain.
Y	0.46	Durain, with scattered thin-banded vitrain.
Y	1.31	Clarain, with scattered thin-banded vitrain; sparse thick-banded vitrain near top.
N	0.26	Siltstone, dark-gray, hard.
Y	0.20	Clarain, with scattered thin-banded vitrain.
N		?

COAL ANALYSIS REPORT

LABORATORY NO: U10714 FIELD NO: KGS 591 U.S.G.S. NO: W215428
LABORATORY: Geo Test REPORT DATE: Apr/29/1982

AIR DRIED LOSS: 0.54%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	2.62%		
VOLATILE MATTER	33.36%	34.26%	39.67%
FIXED CARBON	50.74%	52.10%	60.33%
ASH	13.28%	13.64%	
ULTIMATE ANALYSIS:			
HYDROGEN	4.88%	4.71%	5.45%
CARBON	69.38%	71.25%	82.50%
NITROGEN	1.56%	1.60%	1.85%
TOTAL SULFUR	0.98%	1.01%	1.17%
OXYGEN	9.92%	7.79%	9.03%
ASH	13.28%	13.64%	
HEATING VALUE (BTU/LB):	12271	12601	14591
SULFUR FORMS:			
SULFATE	0.00%	0.00%	0.00%
PYRITIC	0.20%	0.21%	0.24%
ORGANIC	0.78%	0.80%	0.93%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2390 deg F
SOFTENING TEMP.	2500 deg F
FLUID TEMP.	2540 deg F

FREE SWELLING INDEX	2.5
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	1.6

COAL SAMPLING REPORT

LABORATORY NO: U10715 FIELD NO: KGS 592 U.S.G.S. NO: W215429
SAMPLER: Currens AGENCY: KGS DATE: Oct/13/1981
7.5' QUAD: Evarts COUNTY: Harlan DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 8 ROW D TIER 76 650 FT FSL, 950 FT FEL
LATITUDE: 36 DEG 48 MIN 6 SEC LONGITUDE: 83 DEG 12 MIN 12 SEC
ELEVATION (FT): 1540.00, OF POINT AT base of 592, USING topo
COMMENTARY:
REGIONAL COAL NAME: U Elkhorn No.1 GEO. MAP COAL NAME: Harlan
REPORTED COAL NAME: Harlan FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
EXPOSURE: TYPE, underground; CONDITION, active
SAMPLE CONDITION: fresh, clean, dry
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
thick-NESS (INCHES): SEAM HEIGHT 58.7, SAMPLE 45.3, COAL ONLY 45.3
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 255, SET 2 360, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
N		Shale, black, carbonaceous, laminated, coaly, with abundant plant fragments.
Y	0.52	Clarain, with very abundant thin- to thick-banded vitrain, common thin-banded fusain.
N	0.16	Shale, dark-gray, coaly, rooted, soft.
Y	0.43	Clarain, with abundant thin- to thick-banded vitrain.
Y	0.03	Fusain, thinning laterally, pyritic.
Y	1.44	Clarain, with abundant thin- to medium-banded vitrain, common thin-banded fusain.
N	0.95	Claystone, dark-gray, slightly silty, rooted.
Y	1.35	Clarain, with abundant thin- to medium-banded vitrain, sparse thin-banded fusain; pyritic.
N		Shale, light-gray, rooted, plastic when wet.

COAL ANALYSIS REPORT

LABORATORY NO: U10715 FIELD NO: KGS 592 U.S.G.S. NO: W215429
LABORATORY: Geo Test REPORT DATE: Apr/29/1982

AIR DRIED LOSS: 0.22%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	2.03%		
VOLATILE MATTER	35.38%	36.11%	38.91%
FIXED CARBON	55.55%	56.70%	61.09%
ASH	7.04%	7.19%	
ULTIMATE ANALYSIS:			
HYDROGEN	5.26%	5.14%	5.53%
CARBON	76.14%	77.72%	83.73%
NITROGEN	1.71%	1.75%	1.88%
TOTAL SULFUR	1.12%	1.14%	1.23%
OXYGEN	8.73%	7.06%	7.63%
ASH	7.04%	7.19%	
HEATING VALUE (BTU/LB):	13689	13972	15054
SULFUR FORMS:			
SULFATE	0.00%	0.00%	0.00%
PYRITIC	0.32%	0.33%	0.35%
ORGANIC	0.80%	0.82%	0.88%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2450 deg F
SOFTENING TEMP.	2550 deg F
FLUID TEMP.	2590 deg F

FREE SWELLING INDEX	3.5
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	1.6

104 ANALYSIS OF COAL SAMPLES FROM THE UPPER CUMBERLAND DISTRICT

COAL SAMPLING REPORT

LABORATORY NO: U10716 FIELD NO: KGS 593 U.S.G.S. NO: W215430
SAMPLER: Currens AGENCY: KGS DATE: Oct/13/1981
7.5' QUAD: Evarts COUNTY: Harlan DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 8 ROW D TIER 76 4600 FT FSL, 1700 FT FEL
LATITUDE: 36 DEG 48 MIN 45 SEC LONGITUDE: 83 DEG 12 MIN 21 SEC
ELEVATION (FT): 1739.70, OF POINT AT base of 593, USING hand level
COMMENTARY:
REGIONAL COAL NAME: U Elkhorn No.3 GEO. MAP COAL NAME: Kellioka
REPORTED COAL NAME: Kellioka FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
EXPOSURE: TYPE, mine portal; CONDITION, 3 months old, faced-up
SAMPLE CONDITION: clean, dry
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
thick-NESS (INCHES): SEAM HEIGHT 24.2, SAMPLE 24.2, COAL ONLY 24.0
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 250, SET 2 350, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
N	16.40	Soil and regolith.
N	22.97	Siltstone, medium-gray, sideritic, largely laminated, partly bioturbated, with thin sand lenses; small-scale ripple beds in upper part.
Y	1.77	Clarain, with abundant medium-banded vitrain, sparse thin- to medium-banded fusain.
Y	0.02	Shale, carbonaceous.
Y	0.23	Clarain, with abundant thin-banded vitrain, pyritic.
N		Siltstone, medium-gray, rooted, arenaceous.

COAL ANALYSIS REPORT

LABORATORY NO: U10716 FIELD NO: KGS 593 U.S.G.S. NO: W215430
LABORATORY: Geo Test REPORT DATE: Apr/29/1982

AIR DRIED LOSS: 0.19%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	1.98%		
VOLATILE MATTER	40.53%	41.35%	43.65%
FIXED CARBON	52.31%	53.37%	56.34%
ASH	5.18%	5.28%	
ULTIMATE ANALYSIS:			
HYDROGEN	5.48%	5.36%	5.66%
CARBON	77.33%	78.89%	83.29%
NITROGEN	1.71%	1.74%	1.84%
TOTAL SULFUR	2.14%	2.18%	2.30%
OXYGEN	8.16%	6.55%	6.91%
ASH	5.18%	5.28%	
HEATING VALUE (BTU/LB):	13931	14212	15005
SULFUR FORMS:			
SULFATE	0.03%	0.03%	0.03%
PYRITIC	1.09%	1.11%	1.17%
ORGANIC	1.02%	1.04%	1.10%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2010 deg F
SOFTENING TEMP.	2160 deg F
FLUID TEMP.	2240 deg F

FREE SWELLING INDEX	3.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	3.1

COAL SAMPLING REPORT

LABORATORY NO: U10717 FIELD NO: KGS 594 U.S.G.S. NO: W215431
SAMPLER: Currens AGENCY: KGS DATE: Oct/13/1981
7.5' QUAD: Evarts COUNTY: Harlan DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 7 ROW D TIER 76 4050 FT FSL, 950 FT FEL
LATITUDE: 36 DEG 48 MIN 40 SEC LONGITUDE: 83 DEG 13 MIN 12 SEC
ELEVATION (FT): 2034.00, OF POINT AT base of 594, USING survey
COMMENTARY:
REGIONAL COAL NAME: Amburgy zone GEO. MAP COAL NAME: Creech
REPORTED COAL NAME: Creech FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
EXPOSURE: TYPE, underground; CONDITION, active
SAMPLE CONDITION: fresh, clean, dry
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
thick-NESS (INCHES): SEAM HEIGHT 41.3, SAMPLE 39.4, COAL ONLY 39.4
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 250, SET 2 , SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
N		Shale, obscured.
Y	0.20	Clarain, with scattered thin-banded vitrain, highly pyritic.
N	0.16	Shale, black, carbonaceous, with scattered thin-banded vitrain.
Y	0.82	Clarain, with very abundant medium-banded vitrain, scattered thin-banded fusain.
Y	0.16	Durain; argillaceous near top.
Y	0.46	Clarain, with abundant thin-banded vitrain.
Y	0.03	Fusain.
Y	1.61	Clarain, with abundant thin- to medium-banded vitrain, scattered thin-banded fusain; durain up to 1 cm thick, 2 cm from top.
N		Siltstone, rooted.

COAL ANALYSIS REPORT

LABORATORY NO: U10717 FIELD NO: KGS 594 U.S.G.S. NO: W215431
LABORATORY: Geo Test REPORT DATE: Apr/29/1982

AIR DRIED LOSS: 0.02%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	1.72%		
VOLATILE MATTER	33.81%	34.40%	40.20%
FIXED CARBON	50.29%	51.17%	59.80%
ASH	14.18%	14.43%	
ULTIMATE ANALYSIS:			
HYDROGEN	4.86%	4.75%	5.55%
CARBON	69.35%	70.56%	82.46%
NITROGEN	1.81%	1.84%	2.15%
TOTAL SULFUR	1.89%	1.92%	2.25%
OXYGEN	7.91%	6.50%	7.59%
ASH	14.18%	14.43%	
HEATING VALUE (BTU/LB):	12367	12583	14706
SULFUR FORMS:			
SULFATE	0.04%	0.04%	0.05%
PYRITIC	1.27%	1.29%	1.51%
ORGANIC	0.58%	0.59%	0.69%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2290 deg F
SOFTENING TEMP.	2550 deg F
FLUID TEMP.	2630 deg F

FREE SWELLING INDEX	3.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	3.1

COAL SAMPLING REPORT

LABORATORY NO: U10718 FIELD NO: KGS 595 U.S.G.S. NO: W215432
SAMPLER: Currens AGENCY: KGS DATE: Oct/15/1981
7.5' QUAD: Harlan COUNTY: Harlan DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 23 ROW E TIER 75 1900 FT FSL, 450 FT FEL
LATITUDE: 36 DEG 50 MIN 19 SEC LONGITUDE: 83 DEG 17 MIN 6 SEC
ELEVATION (FT): 2476.80, OF POINT AT base of 595, USING survey
COMMENTARY: KGS 595 site is on outby rib of third right break outby end of track.
REGIONAL COAL NAME: Fire Clay rider GEO. MAP COAL NAME: Smith
REPORTED COAL NAME: Smith FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
EXPOSURE: TYPE, underground; CONDITION, 6 weeks old, faced-up
SAMPLE CONDITION: fresh, dry
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
thick-NESS (INCHES): SEAM HEIGHT 45.1, SAMPLE 45.1, COAL ONLY 44.9
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 250, SET 2 , SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
N		Sandstone; reported to locally cutout Smith coal.
N	1.64	Shale, dark-gray, laminated, sideritic, with abundant slickensided and rotated slump blocks.
Y	0.23	Clarain, with common medium-banded vitrain.
Y	0.20	Durain, argillaceous.
Y	0.52	Clarain, with common medium-banded vitrain, scattered thick-banded durain, interbedded.
Y	0.39	Durain, grading to clarain at base; finely fractured.
Y	0.02	Siltstone, black, carbonaceous.
Y	0.95	Clarain, with common thin- to thick-banded vitrain, scattered thin-banded fusain.
Y	0.36	Durain, finely fractured.
Y	1.08	Clarain, with abundant thick-banded vitrain, scattered thin-banded fusain.
N		Siltstone, dark-gray, arenaceous, rooted.

COAL ANALYSIS REPORT

LABORATORY NO: U10718 FIELD NO: KGS 595 U.S.G.S. NO: W215432
LABORATORY: Geo Test REPORT DATE: Apr/29/1982

AIR DRIED LOSS: 0.55%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	2.34%		
VOLATILE MATTER	30.83%	31.57%	36.50%
FIXED CARBON	53.64%	54.93%	63.50%
ASH	13.19%	13.51%	
ULTIMATE ANALYSIS:			
HYDROGEN	4.72%	4.57%	5.28%
CARBON	71.29%	73.00%	84.40%
NITROGEN	1.66%	1.70%	1.97%
TOTAL SULFUR	0.72%	0.74%	0.85%
OXYGEN	8.42%	6.48%	7.50%
ASH	13.19%	13.51%	
HEATING VALUE (BTU/LB):	12512	12812	14813
SULFUR FORMS:			
SULFATE	0.02%	0.02%	0.02%
PYRITIC	0.08%	0.08%	0.09%
ORGANIC	0.62%	0.63%	0.73%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2760 deg F
SOFTENING TEMP.	2800 deg F
FLUID TEMP.	2800 deg F

FREE SWELLING INDEX	3.5
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	1.2

COAL SAMPLING REPORT

LABORATORY NO: U10719 FIELD NO: KGS 596 U.S.G.S. NO: W215433
SAMPLER: Currens AGENCY: KGS DATE: Oct/15/1981
7.5' QUAD: Harlan COUNTY: Harlan DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 22 ROW E TIER 75 1550 FT FSL, 4800 FT FEL
LATITUDE: 36 DEG 50 MIN 15 SEC LONGITUDE: 83 DEG 16 MIN 59 SEC
ELEVATION (FT): 2413.80, OF POINT AT base of 596, USING survey
COMMENTARY:
REGIONAL COAL NAME: Fire Clay GEO. MAP COAL NAME: Wallins Creek
REPORTED COAL NAME: Wallins Creek FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
EXPOSURE: TYPE, underground; CONDITION, active
SAMPLE CONDITION: fresh, clean, dry
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 56.3, SAMPLE 52.0, COAL ONLY 52.0
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 145, SET 2 230, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
N		Sandstone and arenaceous siltstone, interbedded.
Y	2.99	Clarain, with abundant thin- to thick-banded vitrain, common medium-banded fusain; pyritic at top; pyrite nodules up to 1 cm thick, 10 cm long, near base.
Y	0.39	Clarain and durain, interbedded with medium to thick bands of carbonaceous shale.
N	0.36	Claystone (flint clay), dark-gray, brittle, rooted, with conchoidal fracture.
Y	0.62	Clarain, with scattered thin-banded vitrain, scattered thick-banded vitrain, medium-banded fusain.
Y	0.33	Durain, with scattered thin-banded vitrain.
N		Siltstone, dark-gray, rooted.

COAL ANALYSIS REPORT

LABORATORY NO: U10719 FIELD NO: KGS 596 U.S.G.S. NO: W215433
LABORATORY: Geo Test REPORT DATE: Apr/29/1982

AIR DRIED LOSS: 0.29%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	2.09%		
VOLATILE MATTER	34.84%	35.58%	38.95%
FIXED CARBON	54.60%	55.76%	61.05%
ASH	8.47%	8.65%	
ULTIMATE ANALYSIS:			
HYDROGEN	5.20%	5.07%	5.55%
CARBON	74.52%	76.11%	83.32%
NITROGEN	2.01%	2.05%	2.25%
TOTAL SULFUR	1.41%	1.44%	1.58%
OXYGEN	8.39%	6.68%	7.30%
ASH	8.47%	8.65%	
HEATING VALUE (BTU/LB):	13320	13604	14893
SULFUR FORMS:			
SULFATE	0.02%	0.02%	0.02%
PYRITIC	0.57%	0.58%	0.64%
ORGANIC	0.82%	0.84%	0.92%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2580 deg F
SOFTENING TEMP.	2720 deg F
FLUID TEMP.	2780 deg F

FREE SWELLING INDEX	4.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	2.1

COAL SAMPLING REPORT

LABORATORY NO: U10720 FIELD NO: KGS 597 U.S.G.S. NO: W215434
SAMPLER: Currens AGENCY: KGS DATE: Oct/15/1981
7.5' QUAD: Harlan COUNTY: Harlan DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 21 ROW E TIER 75 600 FT FSL, 600 FT FEL
LATITUDE: 36 DEG 50 MIN 6 SEC LONGITUDE: 83 DEG 15 MIN 7 SEC
ELEVATION (FT): 2980.00, OF POINT AT base of 597, USING survey
COMMENTARY:
REGIONAL COAL NAME: Haddix zone GEO. MAP COAL NAME: Morris
REPORTED COAL NAME: Morris FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
EXPOSURE: TYPE, underground; CONDITION, active
SAMPLE CONDITION: fresh, clean, dry
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 72.8, SAMPLE 67.3, COAL ONLY 67.3
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 55, SET 2 160, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
N	16.40	Sandstone, crossbedded to massive.
N	1.64	Shale, dark-gray, carbonaceous, with abundant plant fragments; locally cut out.
Y	0.36	Durain.
Y	0.13	Clarain.
Y	0.30	Durain, with sparse thin-banded vitrain.
Y	1.12	Clarain, with scattered to common, thin-banded vitrain.
Y	0.89	Clarain, with abundant thin-banded vitrain, common thin-banded fusain.
N	0.10	Siltstone, dark-gray, carbonaceous.
Y	0.26	Clarain, with abundant medium-banded vitrain; pyritic.
N	0.26	Siltstone, dark-gray, carbonaceous, coaly.
Y	0.56	Clarain, with abundant thin-banded vitrain; pyritic at top.
N	0.10	Siltstone, dark-gray, carbonaceous.
Y	2.00	Clarain, with abundant thin- to medium-banded vitrain, common thin-banded fusain; pyritic at top.
N		Siltstone(?).

COAL ANALYSIS REPORT

LABORATORY NO: U10720 FIELD NO: KGS 597 U.S.G.S. NO: W215434
LABORATORY: Geo Test REPORT DATE: Apr/29/1982

AIR DRIED LOSS: 0.82%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	2.91%		
VOLATILE MATTER	33.60%	34.61%	37.80%
FIXED CARBON	55.28%	56.94%	62.20%
ASH	8.21%	8.46%	
ULTIMATE ANALYSIS:			
HYDROGEN	5.03%	4.85%	5.29%
CARBON	74.03%	76.25%	83.29%
NITROGEN	1.54%	1.59%	1.73%
TOTAL SULFUR	1.40%	1.44%	1.58%
OXYGEN	9.79%	7.41%	8.11%
ASH	8.21%	8.46%	
HEATING VALUE (BTU/LB):	13062	13454	14696
SULFUR FORMS:			
SULFATE	0.03%	0.03%	0.03%
PYRITIC	0.60%	0.62%	0.68%
ORGANIC	0.77%	0.79%	0.87%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2580 deg F
SOFTENING TEMP.	2690 deg F
FLUID TEMP.	2760 deg F

FREE SWELLING INDEX	2.5
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	2.1

COAL SAMPLING REPORT

LABORATORY NO: U10774 FIELD NO: KGS 612 U.S.G.S. NO: W215553
SAMPLER: Currens AGENCY: KGS DATE: Nov/11/1981
7.5' QUAD: Flat Gap COUNTY: Letcher DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 6 ROW G TIER 82 3000 FT FSL, 2000 FT FEL
LATITUDE: 37 DEG 3 MIN 30 SEC LONGITUDE: 82 DEG 44 MIN 25 SEC
ELEVATION (FT): 2072.50, OF POINT AT base of 612, USING altimeter
COMMENTARY: KGS 612, 613, & 614 are probably splits of the Imboden
REGIONAL COAL NAME: uncorrelated GEO. MAP COAL NAME: unmapped
REPORTED COAL NAME: A seam, bot split FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): bottom split
EXPOSURE: TYPE, surface mine; CONDITION, slightly croppy
SAMPLE CONDITION: clean to muddy, damp
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 59.4, SAMPLE 52.0, COAL ONLY 52.0
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 90, SET 2 360, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
		Horizon KGS 613.
N	19.69	Sandstone, medium-gray, crossbedded, coarse-grained; unconformable contact with coal below; carbonaceous, micaceous, may fine upward; obscured.
Y	1.05	Clarain, with very abundant, medium- to thick-banded vitrain, common medium-banded fusain; mud in cleats.
Y	0.03	Fusain.
Y	1.02	Clarain, with abundant thin- to medium-banded vitrain, common medium-banded fusain; pyritic at base; mud in cleats.
N	0.13	Siltstone, black, carbonaceous.
Y	0.30	Clarain, with common medium-banded vitrain, scattered thin-banded fusain.
N	0.46	Siltstone, dark-gray, rooted.
Y	0.33	Clarain, with scattered thin- to medium-banded vitrain.
N	0.03	Claystone, medium-gray.
Y	1.61	Clarain, with scattered thin-banded vitrain, sparse thin-banded fusain; scattered small pyrite nodules; thick fusain at base.
N		Claystone, medium-gray, rooted.

COAL ANALYSIS REPORT

LABORATORY NO: U10774 FIELD NO: KGS 612 U.S.G.S. NO: W215553
LABORATORY: Geo Test REPORT DATE: May/07/1982

AIR DRIED LOSS: 1.35%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	2.64%		
VOLATILE MATTER	32.89%	33.78%	38.28%
FIXED CARBON	53.02%	54.46%	61.72%
ASH	11.45%	11.76%	
ULTIMATE ANALYSIS:			
HYDROGEN	5.11%	4.95%	5.60%
CARBON	72.65%	74.62%	84.56%
NITROGEN	1.59%	1.63%	1.85%
TOTAL SULFUR	1.54%	1.58%	1.79%
OXYGEN	7.66%	5.46%	6.20%
ASH	11.45%	11.76%	
HEATING VALUE (BTU/LB):	12998	13350	15130
SULFUR FORMS:			
SULFATE	0.02%	0.02%	0.02%
PYRITIC	0.75%	0.77%	0.87%
ORGANIC	0.77%	0.79%	0.90%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2610 deg F
SOFTENING TEMP.	2740 deg F
FLUID TEMP.	2790 deg F

FREE SWELLING INDEX	7.5
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	2.4

COAL SAMPLING REPORT

LABORATORY NO: U10775 FIELD NO: KGS 613 U.S.G.S. NO: W215554
SAMPLER: Currens AGENCY: KGS DATE: Nov/11/1981
7.5' QUAD: Flat Gap COUNTY: Letcher DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 6 ROW G TIER 82 2700 FT FSL, 1600 FT FEL
LATITUDE: 37 DEG 3 MIN 27 SEC LONGITUDE: 82 DEG 44 MIN 20 SEC
ELEVATION (FT): 2089.00, OF POINT AT base of 613, USING altimeter
COMMENTARY: KGS 612, 613, & 614 are probably splits of the Imboden
REGIONAL COAL NAME: uncorrelated GEO. MAP COAL NAME: unmapped
REPORTED COAL NAME: A seam, mid split FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): first split from bottom
EXPOSURE: TYPE, surface mine; CONDITION, active
SAMPLE CONDITION: fresh, clean, dry
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 42.9, SAMPLE 35.8, COAL ONLY 35.4
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 90, SET 2 70, SET 3 360

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
		Horizon KGS 614.
N	7.22	Siltstone, medium-gray, arenaceous, sideritic; rooted at top.
Y	0.30	Clarain, with very abundant medium- to thick-banded vitrain, common thin-banded fusain; argillaceous.
N	0.49	Siltstone, dark-gray to black, carbonaceous.
Y	0.03	Vitrain, medium- to thick-banded, pyritic.
Y	0.02	Claystone, black, carbonaceous (argillaceous fusain).
Y	0.52	Clarain, with abundant thin- to medium-banded vitrain, scattered thin-banded fusain.
N	0.07	Siltstone, carbonaceous.
Y	0.16	Clarain, with common medium-banded vitrain.
Y	0.02	Siltstone, carbonaceous.
Y	0.46	Clarain, with common medium-banded vitrain.
Y	0.30	Clarain, with very abundant vitrain, argillaceous, slickensided.
N	0.03	Siltstone, dark-gray.
Y	1.18	Clarain, with very abundant thin- to thick-banded vitrain, common medium-banded vitrain, common medium-banded fusain; pyritic; cleats closely spaced, 2 to 5 cm apart. See KGS 612 for underlying strata.

COAL ANALYSIS REPORT

LABORATORY NO: U10775 FIELD NO: KGS 613 U.S.G.S. NO: W215554
LABORATORY: Geo Test REPORT DATE: May/07/1982

AIR DRIED LOSS: 1.38%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	2.67%		
VOLATILE MATTER	32.67%	33.57%	38.79%
FIXED CARBON	51.55%	52.96%	61.21%
ASH	13.11%	13.47%	
ULTIMATE ANALYSIS:			
HYDROGEN	5.03%	4.86%	5.62%
CARBON	71.44%	73.40%	84.83%
NITROGEN	1.45%	1.49%	1.72%
TOTAL SULFUR	1.00%	1.03%	1.19%
OXYGEN	7.97%	5.75%	6.64%
ASH	13.11%	13.47%	
HEATING VALUE (BTU/LB):	12774	13124	15168
SULFUR FORMS:			
SULFATE	0.03%	0.03%	0.04%
PYRITIC	0.15%	0.15%	0.18%
ORGANIC	0.82%	0.84%	0.97%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2800 deg F
SOFTENING TEMP.	2800 deg F
FLUID TEMP.	2800 deg F

FREE SWELLING INDEX	7.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	1.6

COAL SAMPLING REPORT

LABORATORY NO: U10776 FIELD NO: KGS 614 U.S.G.S. NO: W215555
SAMPLER: Currens AGENCY: KGS DATE: Nov/11/1981
7.5' QUAD: Flat Gap COUNTY: Letcher DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 6 ROW G TIER 82 2800 FT FSL, 1650 FT FEL
LATITUDE: 37 DEG 3 MIN 28 SEC LONGITUDE: 82 DEG 44 MIN 20 SEC
ELEVATION (FT): 2100.00, OF POINT AT base of 614, USING altimeter
COMMENTARY: KGS 612, 613, & 614 are probably splits of the Imboden. The top split is approximately 0.5 m thick at an inaccessible location.
REGIONAL COAL NAME: uncorrelated GEO. MAP COAL NAME: unmapped
REPORTED COAL NAME: A seam, mid sp, rdr FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): second split from bottom
EXPOSURE: TYPE, surface mine; CONDITION, active
SAMPLE CONDITION: fresh, clean, dry
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 14.4, SAMPLE 14.4, COAL ONLY 14.4
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 75, SET 2 360, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
N	13.12	Sandstone, massive.
N	3.28	Siltstone, light-gray.
N	1.31	Coal (middle split rider No.2).
N	9.84	Sandstone, light-gray, fine-grained, argillaceous; rooted at top.
N	2.30	Siltstone, medium-gray, sideritic; arenaceous at top.
Y	0.46	Clarain, with abundant medium-banded vitrain.
Y	0.03	Fusain, argillaceous.
Y	0.46	Clarain, with abundant thin- to thick-banded vitrain.
Y	0.02	Fusain, argillaceous.
Y	0.23	Clarain, with abundant medium-banded vitrain. See KGS 613 for underlying strata.

COAL ANALYSIS REPORT

LABORATORY NO: U10776 FIELD NO: KGS 614 U.S.G.S. NO: W215555
LABORATORY: Geo Test REPORT DATE: May/07/1982

AIR DRIED LOSS: 1.11%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	2.30%		
VOLATILE MATTER	32.35%	33.11%	39.12%
FIXED CARBON	50.34%	51.52%	60.88%
ASH	15.01%	15.36%	
ULTIMATE ANALYSIS:			
HYDROGEN	4.91%	4.76%	5.63%
CARBON	69.77%	71.41%	84.37%
NITROGEN	1.47%	1.50%	1.78%
TOTAL SULFUR	1.37%	1.40%	1.66%
OXYGEN	7.47%	5.57%	6.56%
ASH	15.01%	15.36%	
HEATING VALUE (BTU/LB):	12450	12743	15056
SULFUR FORMS:			
SULFATE	0.00%	0.00%	0.00%
PYRITIC	0.48%	0.49%	0.58%
ORGANIC	0.89%	0.91%	1.08%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2650 deg F
SOFTENING TEMP.	2760 deg F
FLUID TEMP.	2800 deg F

FREE SWELLING INDEX	7.5
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	2.2

120 ANALYSIS OF COAL SAMPLES FROM THE UPPER CUMBERLAND DISTRICT

COAL SAMPLING REPORT

LABORATORY NO: U10777 FIELD NO: KGS 615 U.S.G.S. NO: W215556
SAMPLER: Currens AGENCY: KGS DATE: Nov/11/1981
7.5' QUAD: Flat Gap COUNTY: Letcher DISTRICT: Upper Cumberland
CARTER COORDINATE: SEC 7 ROW G TIER 82 3150 FT FSL, 2950 FT FEL
LATITUDE: 37 DEG 3 MIN 31 SEC LONGITUDE: 82 DEG 43 MIN 36 SEC
ELEVATION (FT): 2225.30, OF POINT AT base of 615, USING survey
COMMENTARY:
REGIONAL COAL NAME: U Elkhorn No.2 GEO. MAP COAL NAME: Collier
REPORTED COAL NAME: Collier FORMATION OR MEMBER: Breathitt
RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
EXPOSURE: TYPE, underground; CONDITION, active
SAMPLE CONDITION: fresh, clean, dry
RECOVERY METHOD: channel SAMPLING REGIME: Holmes
SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
THICKNESS (INCHES): SEAM HEIGHT 37.0, SAMPLE 37.0, COAL ONLY 37.0
STRUCTURAL FEATURE: cleat, SEPARATION:
STRIKE AZIMUTHS: SET 1 250, SET 2 330, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

STRATIGRAPHIC SECTION

IN SAMPLE?	THICKNESS	DESCRIPTION
N	13.12	Sandstone, coarse-grained, crossbedded; locally cuts underlying siltstone.
N	4.92	Siltstone, dark-gray, rooted in part, coaly.
Y	0.69	Clarain, with abundant thin-banded vitrain, pyritic; scattered thin-banded fusain.
Y	0.03	Fusain.
Y	2.36	Clarain, with common medium-banded vitrain, scattered thin-banded fusain.
N		Siltstone.

COAL ANALYSIS REPORT

LABORATORY NO: U10777 FIELD NO: KGS 615 U.S.G.S. NO: W215556
LABORATORY: Geo Test REPORT DATE: May/07/1982

AIR DRIED LOSS: 1.27%

	AS RECEIVED	MOISTURE FREE	MOISTURE/ASH FREE
PROXIMATE ANALYSIS:			
TOTAL MOISTURE	2.38%		
VOLATILE MATTER	33.55%	34.37%	37.20%
FIXED CARBON	56.63%	58.01%	62.80%
ASH	7.44%	7.62%	
ULTIMATE ANALYSIS:			
HYDROGEN	5.17%	5.02%	5.44%
CARBON	77.03%	78.91%	85.42%
NITROGEN	1.38%	1.41%	1.53%
TOTAL SULFUR	1.27%	1.30%	1.41%
OXYGEN	7.71%	5.74%	6.20%
ASH	7.44%	7.62%	
HEATING VALUE (BTU/LB):	13754	14090	15252
SULFUR FORMS:			
SULFATE	0.04%	0.04%	0.04%
PYRITIC	0.52%	0.53%	0.58%
ORGANIC	0.71%	0.73%	0.79%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2570 deg F
SOFTENING TEMP.	2660 deg F
FLUID TEMP.	2730 deg F

FREE SWELLING INDEX	7.5
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	1.8

Table 1.--Descriptions and Locations for 57 Bituminous Coal Samples and 9 rock samples from the Upper Cumberland District, Eastern Kentucky.

Sample No.	Field No.	County	Latitude	Longitude	Formation	Coal Bed	Estimated Rank	Sample Thickness (inches)
W214792	KGS 554	Harlan	365311n	830502w	Breathitt	High Splint	High Volatile A Bit	55.9
W214793	KGS 555	Harlan	365229n	830521w	Breathitt	Morris	High Volatile B Bit	31.5 *
W215434	KGS 597	Harlan	365006n	831507w	Breathitt	Morris	High Volatile A Bit	67.3
W208223	KGS 226	Bell	363824n	835037w	Breathitt	Red Springs	High Volatile A Bit	20.5
W207900	KGS 228	Bell	363824n	835037w	Breathitt	Red Springs	High Volatile A Bit	30.3
W215416	KGS 571	Bell	363948n	834855w	Breathitt	Low Splint	High Volatile A Bit	24.0
W215417	KGS 572	Bell	363947n	834850w	Breathitt	Low Splint	High Volatile A Bit	55.5
W215428	KGS 591	Harlan	364934n	831007w	Breathitt	Limestone	High Volatile A Bit	40.9
W215432	KGS 595	Harlan	365019n	831706w	Breathitt	Smith	High Volatile A Bit	45.1
W207822	KGS 218	Bell	363850n	834907w	Breathitt	Hignite	High Volatile A Bit	29.5
W207899	KGS 220	Bell	363850n	834907w	Breathitt	Hignite	High Volatile A Bit	73.8
W215389	KGS 583	Bell	363606n	834700w	Breathitt	Hignite	High Volatile A Bit	34.3
W207811	KGS 199	Bell	363857n	834854w	Breathitt	Lower Hignite	High Volatile A Bit	49.8
W207812	KGS 204	Bell	363837n	834826w	Breathitt	Lower Hignite	High Volatile A Bit	36.2
W215433	KGS 596	Harlan	365015n	831659w	Breathitt	Wallins Creek	High Volatile A Bit	52.0
W215427	KGS 582	Harlan	365305n	831202w	Breathitt	Creech	High Volatile A Bit	28.8
W215431	KGS 594	Harlan	364840n	831312w	Breathitt	Creech	High Volatile A Bit	39.4
W215423	KGS 578	Bell	363614n	834659w	Breathitt	Stray	High Volatile A Bit	29.5
W215424	KGS 579	Bell	363614n	834702w	Breathitt	Stray	High Volatile A Bit	12.2
W215425	KGS 580	Bell	363615n	834704w	Breathitt	Stray	High Volatile A Bit	21.3
W215390	KGS 584	Bell	363601n	834648w	Breathitt	Stray	High Volatile A Bit	20.9
W215391	KGS 585	Bell	363600n	834650w	Breathitt	Stray	High Volatile A Bit	21.3
W215392	KGS 586	Bell	363610n	834655w	Breathitt	Stray	High Volatile A Bit	13.0
W215409	KGS 568	Bell	363515n	834523w	Breathitt	Sterling	High Volatile A Bit	38.2
W207813	KGS 224	Bell	363825n	834852w	Breathitt	Poplar Lick	High Volatile A Bit	29.5
W207814	KGS 225	Bell	363823n	834851w	Breathitt	Poplar Lick	High Volatile A Bit	27.2
W207897	KGS 208	Bell	363711n	834916w	Breathitt	Buckeye Springs	High Volatile A Bit	31.3
W208221	KGS 209	Bell	363729n	834913w	Breathitt	Buckeye Springs	High Volatile A Bit	19.1
W208222	KGS 211	Bell	363729n	834913w	Breathitt	Buckeye Springs	High Volatile A Bit	10.6
W207866	KGS 212	Bell	363729n	834913w	Breathitt	Buckeye Springs	High Volatile A Bit	31.3

Table 1.--Descriptions and Locations for 57 Bituminous Coal Samples and 9 rock samples from the Upper Cumberland District, Eastern Kentucky--Continued.

Sample No.	Field No.	County	Latitude	Longitude	Formation	Coal Bed	Estimated Rank	Sample Thickness (inches)
W215407	KGS 566	Harlan	365238n	831153w	Breathitt	Darby	High Volatile A Bit	37.8
W215426	KGS 581	Harlan	365311n	830526w	Breathitt	Darby	High Volatile A Bit	48.8
W215430	KGS 593	Harlan	364845n	831221w	Breathitt	Kellioka	High Volatile A Bit	24.2
W215405	KGS 564	Harlan	365321n	830654w	Breathitt	Harlan	High Volatile A Bit	38.8
W215406	KGS 565	Harlan	365248n	831112w	Breathitt	Harlan	High Volatile A Bit	37.0
W215429	KGS 592	Harlan	364806n	831212w	Breathitt	Harlan	High Volatile A Bit	45.3
W215556	KGS 615	Letcher	370331n	824336w	Breathitt	Harlan	High Volatile A Bit	37.0
W215404	KGS 563	Bell	364225n	834520w	Breathitt	Mingo	High Volatile A Bit	32.1
W211639	KGS 398	Harlan	365123n	831239w	Breathitt	Path Fork	High Volatile A Bit	24.8
W213024	KGS 484	Bell	364606n	833231w	Breathitt	Path Fork	High Volatile A Bit	30.7
W211638	KGS 397	Harlan	365125n	831239w	Breathitt	Lower Path Fork	High Volatile A Bit	26.9
W208200	KGS 240	Bell	364114n	833711w	Breathitt	Hance	High Volatile A Bit	16.5
W208201	KGS 241	Bell	364114n	833711w	Breathitt	Hance	High Volatile A Bit	60.6
W207901	KGS 242	Bell	364210n	833422w	Breathitt	Hance	High Volatile A Bit	36.6
W213022	KGS 482	Bell	364519n	833229w	Breathitt	Hance Split, ts	High Volatile A Bit	40.2
W213944	KGS 498	Bell	364522n	833228w	Breathitt	Hance Split, 3 ms	High Volatile A Bit	19.3
W213945	KGS 499	Bell	364522n	833228w	Breathitt	Hance Split, 2 ms	High Volatile A Bit	13.0
W213946	KGS 500	Bell	364522n	833228w	Breathitt	Hance Split, bs	High Volatile A Bit	20.1
W208056	KGS 270	Bell	364117n	833439w	Breathitt	Mason	High Volatile A Bit	45.5
W208057	KGS 271	Bell	364117n	833436w	Breathitt	Mason	High Volatile A Bit	42.3
W213023	KGS 483	Bell	364510n	833345w	Breathitt	Mason	High Volatile A Bit	34.8
W208058	KGS 272	Bell	364119n	833654w	Breathitt	Splitseam	High Volatile A Bit	49.6
W215421	KGS 576	Bell	363603n	834701w	Breathitt	Unnamed	High Volatile A Bit	4.7
W215422	KGS 577	Bell	363603n	834701w	Breathitt	Unnamed	High Volatile B Bit	20.9
W215553	KGS 612	Letcher	370330n	824425w	Breathitt	Unnamed	High Volatile A Bit	52.0
W215554	KGS 613	Letcher	370327n	824420w	Breathitt	Unnamed	High Volatile A Bit	35.8
W215555	KGS 614	Letcher	370328n	824420w	Breathitt	Unnamed	High Volatile A Bit	14.4

Table 1.--Descriptions and Locations for 57 Bituminous Coal Samples and 9 rock samples from the Upper Cumberland District, Eastern Kentucky-- Continued.

Sample No.	Field No.	County	Latitude	Longitude	Formation	Coal Bed	Estimated Rank	Sample Thickness (inches)
W211184	KGS 213	Bell	363850n	834907w	Breathitt	Hignite	Shale, roof	39.4
W211185	KGS 215	Bell	363850n	834907w	Breathitt	Hignite	Shale, parting	3.1
W211186	KGS 217	Bell	363850n	834907w	Breathitt	Hignite	Siltstone, parting	11.8
W211187	KGS 219	Bell	363850n	834907w	Breathitt	Hignite	Shale, floor	
W211179	KGS 193	Bell	363857n	834854w	Breathitt	Lower Hignite	Siltstone, parting	1.6
W211180	KGS 196	Bell	363857n	834854w	Breathitt	Lower Hignite	Shale, parting	2.8
W211181	KGS 198	Bell	363857n	834854w	Breathitt	Lower Hignite	Clay, floor	
W211182	KGS 202	Bell	363837n	834826w	Breathitt	Lower Hignite	Shale, floor	
W211183	KGS 203	Bell	363837n	834826w	Breathitt	Lower Hignite	Siltstone, roof	

* This sample is slightly weathered.

Table 2.--Major- and Minor-Oxide and Trace-Element Concentrations in the Laboratory Ash of 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland River District, Eastern Kentucky.

[Values in percent or parts-per-million. Coal ashed at 525°C. L means less than the value shown; H, interference for an element which cannot be resolved by any routine method; G, greater than; B, not determined; S, after element title, indicates determinations by automatic plate reading computer assisted, emission spectographic analyses. The standard deviation of any single answer should be taken as plus 50% and minus 35%. Sample number is laboratory number.]

SAMPLE NUMBER	ASH (PERCENT)	SIO_2 (PERCENT)	AL_2O_3 (PERCENT)	CAO (PERCENT)	MGO (PERCENT)	NA_2O (PERCENT)	K_2O (PERCENT)	FE_2O_3 (PERCENT)	TIO_2 (PERCENT)	P_2O_5 (PERCENT)	SAMPLE NUMBER
W207811	24.3	55	26	.60	1.4	.28	4.6	7.9	1.2	.04L	W207811
W207812	4.6	53	29	1.7	.86	.45	2.4	6.1	1.4	.22L	W207812
W207813	9.8	52	30	2.3	.75	.26	2.1	3.9	1.4	1.8	W207813
W207814	8.0	53	32	1.8	.75	.30	2.1	3.9	1.4	1.3	W207814
W207866	12.5	61	25	3.3	.53	.23	1.7	2.9	1.8	2.5	W207866
W207897	2 .8	62	22	1.1	.60	.20	1.8	9.1	1.8	.63	W207897
W207899	32.9	58	27	.62	1.3	.27	4.0	5.1	1.4	.11	W207899
W207900	19.7	54	32	.81	1.5	.22	4.4	3.7	1.5	.05L	W207900
W207901	3.7	45	33	2.4	1.2	.40	3.0	8.5	1.5	.27L	W207901
W208056	19.1	47	26	.80	1.5	.35	3.6	15	.94	.15	W208056
W208057	18.4	45	25	.99	1.5	.34	3.3	19	.90	.05L	W208057
W208058	2 .0	57	26	.50	1.8	.39	4.0	7.2	1.2	.05L	W208058
W208200	3.6	44	29	2.4	1.1	.80	2.4	11	1.0	.28L	W208200
W208201	21.6	55	27	.64	1.3	.30	4.2	7.6	1.1	.07	W208201
W208221	1 .4	48	29	4.6	.51	.27	1.5	10	1.7	3.7	W208221
W208222	4.9	56	33	1.4	.48	.27	1.5	2.8	1.5	.47	W208222
W208223	3.9	48	35	3.0	.86	.22	1.7	3.8	2.3	.26L	W208223
W211179	77.7	60	26	.32	1.3	.26	4.5	3.6	1.2	.01L	W211179
W211180	65.6	52	27	.35	1.4	.16	5.3	8.3	1.1	.02L	W211180
W211181	87.1	57	28	.36	1.3	.16	4.7	4.5	1.1	.01L	W211181

Table 2.--Major- and Minor-Oxide and Trace-Element Concentrations in the Laboratory Ash of 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland River District, Eastern Kentucky--Continued.

SAMPLE NUMBER	SO_3 (PERCENT)	AG-S PPM	B-S PPM	BA-S PPM	BE-S PPM	CD PPM	CE PPM	CO PPM	CR PPM	CS PPM	SAMPLE NUMBER
W207811	1.1	.10L	160	1,000	6.6	.62	150	30	130	12	W207811
W207812	2.8	.34	400	2,200	23	1.4	200	74	150	6.5	W207812
W207813	1.3	.15	310	1,000	11	.78	180	26	120	10	W207813
W207814	1.4	.19	320	920	16	.88	180	36	120	7.5	W207814
W207866	.55	.38	280	1,200	22	.28	220	19	120	4.0	W207866
W207897	.63	.12	150	670	6.8	.33	240	13	99	6.3	W207897
W207899	.50	.10	140	870	4.7	.43	140	18	110	8.2	W207899
W207900	.63	.15	140	620	8.5	.59	180	50	150	10	W207900
W207901	2.4	.47	600	1,000	7.6	1.1	220	41	170	8.1	W207901
W208056	1.5	.18	290	640	7.0	.77	190	31	130	11	W208056
W208057	1.7	.24	300	620	6.2	.82	170	26	110	10	W208057
W208058	.82	.22	210	690	8.8	.37	130	39	94	7.0	W208058
W208200	2.9	1.3	500	1,700	54	.50	470	86	200	8.3	W208200
W208201	1.1	.10L	330	840	7.4	.30	140	30	130	8.8	W208201
W208221	.88	.25	200	900	13	.54	240	25	130	4.8	W208221
W208222	.88	.17	450	460	44	.93	330	53	170	4.1	W208222
W208223	2.8	.34	270	300	56	1.1	310	140	210	7.7	W208223
W211179	.77	.10L	100	580	4.0	.38	120	7.4	96	9.5	W211179
W211180	1.6	.10L	150	840	4.4	.40	140	30	120	11	W211180
W211181	.85	.10L	100	580	4.5	.14	120	14	110	11	W211181

Table 2.--Major- and Minor-Oxide and Trace-Element Concentrations in the Laboratory Ash of 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland River District, Eastern Kentucky--Continued.

SAMPLE NUMBER	CU PPM	DY-S PPM	ER-S PPM	EU PPM	GA-S PPM	GD-S PPM	GE-S PPM	HF PPM	HO-S PPM	LA PPM	SAMPLE NUMBER
W207811	84	22L	10L	2.8	27	15L	4.1	5.3	6.8L	86	W207811
W207812	210	22L	10L	4.3	37	15L	38	6.5	6.8L	110	W207812
W207813	120	22L	10L	3.7	32	15L	5.8	10	6.8L	110	W207813
W207814	140	22L	10L	2.9	40	15L	18	10	6.8L	88	W207814
W207866	130	22L	10L	3.0	41	15L	25	11	6.8L	130	W207866
W207897	110	22L	10L	2.8	34	15L	7.4	16	6.8L	130	W207897
W207899	66	22L	10L	2.2	31	15L	1.5L	7.0	6.8L	76	W207899
W207900	80	30	10L	2.9	41	61	6.9	6.1	6.8L	96	W207900
W207901	220	29	10L	4.1	36	24	21	8.1	6.8L	110	W207901
W208056	190	22L	10L	4.1	43	15L	3.6	5.8	6.8L	120	W208056
W208057	200	22L	10L	3.5	39	15L	5.3	4.9	6.8L	100	W208057
W208058	93	22L	10L	2.3	38	15L	22	4.0	6.8L	70	W208058
W208200	410	51	29	11	70	47	37	8.3	6.8L	250	W208200
W208201	80	22L	10L	2.7	47	15L	10	4.6	6.8L	83	W208201
W208221	160	22L	10L	3.8	33	15L	19	11	6.8L	130	W208221
W208222	300	24	15	8.2	35	15L	21	8.2	6.8L	140	W208222
W208223	290	22L	17	9.2	34	15L	22	10	6.8L	180	W208223
W211179	37	22L	10L	2.0	26	15L	1.5L	4.9	6.8L	69	W211179
W211180	73	22L	10L	2.3	31	15L	1.5L	4.3	6.8L	76	W211180
W211181	36	22L	10L	1.6	33	15L	1.5	3.8	6.8L	62	W211181

Table 2.--Major- and Minor-Oxide and Trace-Element Concentrations in the Laboratory Ash of 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland River District, Eastern Kentucky--Continued.

SAMPLE NUMBER	LI PPM	LU PPM	MN PPM	MO-S PPM	NB-S PPM	ND-S PPM	NI-S PPM	PB PPM	PR-S PPM	RB PPM	SAMPLE NUMBER
W207811	210	.9	140	4.6	19	79	65	41	68L	260	W207811
W207812	250	2.0	110	15	18	81	110	62	68L	870L	W207812
W207813	240	1.9	110	3.5	17	78	47	64	68L	410L	W207813
W207814	270	1.8	210	7.4	34	100	69	64	68L	350	W207814
W207866	240	1.6L	70	5.9	56	140	62	61	68L	320L	W207866
W207897	240	1.3	87	8.0	21	54	41	51	68L	370	W207897
W207899	170	.9	250	1.1	21	32L	45	38	68L	180	W207899
W207900	180	1.3	130	1.0L	27	77	120	48	68L	230	W207900
W207901	150	1.9	180	19	10	61	77	63	68L	810L	W207901
W208056	120	1.6	300	26	12	66	93	54	68L	210	W208056
W208057	120	1.3	370	14	9	71	81	51	68L	170	W208057
W208058	140	.8	200	13	19	82	79	41	68L	140	W208058
W208200	160	3.6	130	45	22	290	190	100	89	560L	W208200
W208201	150	.8	360	3.6	19	61	72	66	68L	190	W208201
W208221	270	1.1	99	7.1	20	67	61	73	68L	87	W208221
W208222	270	3.5	85	3.5	12	110	55	63	68L	410L	W208222
W208223	180	2.8	220	13	33	160	280	97	68L	260L	W208223
W211179	110	.5	95	1.0L	24	38	22	26	68L	170	W211179
W211180	92	.5	83	2.1	14	40	76	14	68L	180	W211180
W211181	93	.5	120	1.0L	22	42	44	13	68L	200	W211181

Table 2.--Major- and Minor-Oxide and Trace-Element Concentrations in the Laboratory Ash of 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland River District, Eastern Kentucky--Continued.

SAMPLE NUMBER	SC PPM	SM PPM	SN-S PPM	SR-S PPM	TA PPM	TB PPM	TH PPM	TL-S PPM	TM PPM	U PPM	SAMPLE NUMBER
W207811	28	12	3.7	290	1.6	1.3	23	4.6L	4.6L	7.2	W207811
W207812	46	20	3.9	820	1.5	3.3	24	4.6L	4.6L	11	W207812
W207813	42	16	9.7	3,000	2.2	2.8	34	4.6L	4.6L	9.6	W207813
W207814	44	14	9.9	1,700	2.3	2.1	22	4.6L	4.6L	7.6	W207814
W207866	37	21	14	2,400	3.0	2.2	38	4.6L	4.6L	13	W207866
W207897	28	17	6.3	1,000	3.7	2.0	48	12	4.6L	17	W207897
W207899	24	11	2.4	440	1.5	.88	21	4.6L	4.6L	6.6	W207899
W207900	32	14	4.5	260	1.7	1.3	26	4.6L	4.6L	9.0	W207900
W207901	49	22	4.9	680	1.9	2.7	27	4.6L	4.6L	8.6L	W207901
W208056	29	21	9.9	670	1.4	3.1	30	4.6L	4.6L	13	W208056
W208057	26	18	1.5L	540	1.1	1.6	26	4.6L	4.6L	13	W208057
W208058	25	12	5.0	460	1.1	1.6	18	4.6L	4.6L	7.8	W208058
W208200	89	47	3.4	1,200	2.2	13	31	4.6L	4.6L	42	W208200
W208201	29	12	5.1	430	1.6	2.3	22	4.6L	4.6L	8.2	W208201
W208221	37	19	14	1,700	4.7	3.8	42	4.6L	4.6L	19	W208221
W208222	86	33	5.9	1,100	2.0	11	27	4.6L	4.6L	12	W208222
W208223	58	38	15	440	4.1	12	38	4.6L	4.6L	11	W208223
W211179	19	7.8	7.2	230	1.7	1.2	18	4.6L	4.6L	4.6	W211179
W211180	22	9.0	4.7	300	1.5	1.3	21	4.6L	4.6L	7.2	W211180
W211181	21	6.7	8.2	250	1.5	1.0	19	4.6L	4.6L	5.4	W211181

Table 2.--Major- and Minor-Oxide and Trace-Element Concentrations in the Laboratory Ash of 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland River District, Eastern Kentucky--Continued.

SAMPLE NUMBER	V-S PPM	W PPM	Y-S PPM	YB PPM	ZN PPM	ZR-S PPM	SAMPLE NUMBER
W207811	160	3.3	36	6.2	140	140	W207811
W207812	150	6.5	57	13	64	90	W207812
W207813	110	9.2	41	12	82	120	W207813
W207814	160	11	55	11	150	250	W207814
W207866	170	9.6	64	10	41	520	W207866
W207897	100	5.8	19	7.7	52	170	W207897
W207899	120	2.1	17	5.5	130	140	W207899
W207900	170	3.0	35	7.1	130	280	W207900
W207901	150	5.4	41	11	140	120	W207901
W208056	130	3.7	24	8.9	210	62	W208056
W208057	140	2.7	31	7.6	210	74	W208057
W208058	160	17	38	5.0	140	140	W208058
W208200	300	8.3	160	31	210	200	W208200
W208201	180	2.3	20	6.5	140	100	W208201
W208221	140	.0B	41	8.7	52	200	W208221
W208222	170	.0B	82	24	38	110	W208222
W208223	210	.0B	130	21	170	290	W208223
W211179	130	1.8	27	4.4	98	130	W211179
W211180	180	2.0	25	4.4	91	110	W211180
W211181	150	1.7	25	4.2	89	130	W211181

Table 2.--Major- and Minor-Oxide and Trace-Element Concentrations in the Laboratory Ash of 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland River District, Eastern Kentucky--Continued.

SAMPLE NUMBER	ASH (PERCENT)	SiO_2 (PERCENT)	Al_2O_3 (PERCENT)	CaO (PERCENT)	MgO (PERCENT)	Na_2O (PERCENT)	K_2O (PERCENT)	Fe_2O_3 (PERCENT)	TiO_2 (PERCENT)	P_2O_5 (PERCENT)	SAMPLE NUMBER
W211182	92.0	60	25	.34	1.5	.18	4.7	4.6	1.1	.01L	W211182
W211183	91.7	59	26	.38	1.6	.19	5.0	4.1	1.0	.01	W211183
W211184	88.6	58	26	.35	1.8	.23	5.1	4.9	1.0	.02	W211184
W211185	9 .9	57	27	.48	1.8	.26	5.1	4.8	1.2	.06	W211185
W211186	91.8	68	21	.24	1.2	.14	3.2	2.8	1.3	.01L	W211186
W211187	77.8	54	31	.32	1.4	.22	5.3	3.7	1.1	.01	W211187
W211638	15.9	54	34	.56	.93	.24	3.6	2.2	2.1	.06L	W211638
W211639	12.7	46	25	1.3	.46	.20	1.4	20	1.9	1.0	W211639
W213022	6.6	42	26	2.0	.85	.35	1.9	20	1.6	1.2	W213022
W213023	3.6	39	24	1.9	1.4	.59	2.9	22	.92	.28L	W213023
W213024	16.9	50	29	1.1	1.0	.61	3.4	10	1.3	1.1	W213024
W213944	4.1	43	29	1.8	1.3	.53	2.8	15	1.1	.24	W213944
W213945	13.3	58	27	.59	1.1	.28	3.0	4.4	1.5	.17	W213945
W213946	2.1	44	30	2.1	1.0	.66	2.7	12	1.2	.48L	W213946
W214792	3.5	46	31	1.9	1.0	.20	3.1	9.0	1.2	.57	W214792
W214793	9.0	34	28	7.0	1.5	.45	1.9	13	1.0	.11L	W214793
W215389	3.6	45	30	2.8	.90	.19	2.2	7.7	1.5	.28L	W215389
W215390	3.4	45	32	5.2	.86	.27	.73	5.9	1.5	2.1	W215390
W215391	11.6	44	26	1.4	.80	.19	2.8	20	1.2	.78	W215391
W215392	4.9	50	26	1.5	.90	.19	2.3	13	1.4	.61	W215392
W215404	1.4	45	25	2.2	.73	1.2	1.7	15	1.4	.86	W215404
W215405	5.0	45	33	2.0	.63	.67	1.8	11	1.3	.20L	W215405
W215406	1 .0	53	32	.78	.70	.43	3.0	4.3	1.6	.24	W215406
W215407	9.0	51	31	.88	1.1	.67	4.3	4.6	1.1	.11	W215407
W215409	8.0	49	29	4.3	.53	.14	1.3	6.4	1.6	3.0	W215409

Table 2.--Major- and Minor-Oxide and Trace-Element Concentrations in the Laboratory Ash of 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland River District, Eastern Kentucky--Continued.

SAMPLE NUMBER	SO_3 (PERCENT)	AG-S PPM	B-S PPM	BA-S PPM	BE-S PPM	CD PPM	CE PPM	CO PPM	CR PPM	CS PPM	SAMPLE NUMBER
W211182	.73	.10L	99	570	3.8	.38	100	16	110	9.9	W211182
W211183	.75	.10L	110	610	4.1	.24	98	9.6	91	8.6	W211183
W211184	.88	.10L	130	730	4.5	.50	120	21	110	9.6	W211184
W211185	.77	.10L	120	690	3.0	.40	130	19	120	12	W211185
W211186	.70	.10L	93	470	2.9	.38	130	5.6	81	6.5	W211186
W211187	.90	.10L	150	570	4.1	.50	160	20	130	11	W211187
W211638	.47	.10L	180	640	11	.48	150	30	170	11	W211638
W211639	1.1	.40	220	760	10	1.5	210	68	170	3.1	W211639
W213022	1.7	.36	360	1,100	19	.97	320	67	220	6.1	W213022
W213023	2.5	1.0	300	1,400	12	1.3	170	39	160	14	W213023
W213024	.93	.37	280	940	7.1	.77	200	40	150	8.3	W213024
W213944	2.7	.89	250	710	13	2.0	290	180	180	7.3	W213944
W213945	.80	.44	220	680	40	.88	220	160	180	7.5	W213945
W213946	3.0	1.6	310	830	110	1.8	290	210	190	14	W213946
W214792	1.9	.50	220	470	13	.72	540	150	440	29	W214792
W214793	9.5	1.8	320	1,500	70	.81	67	48	48	1.1	W214793
W215389	3.5	.88	500	2,600	38	1.1	290	140	170	5.6	W215389
W215390	3.3	.79	400	1,800	38	.96	320	68	170	2.9	W215390
W215391	1.3	.56	250	670	8.9	.92	200	24	120	10	W215391
W215392	2.0	.76	320	1,800	1.0L	1.1	200	180	140	14	W215392
W215404	3.3	1.5	400	3,100	74	.60	290	250	210	.0B	W215404
W215405	1.7	.83	320	900	34	.60	260	150	150	6.0	W215405
W215406	.95	.53	290	840	17	.72	270	55	160	8.0	W215406
W215407	1.2	.49	290	1,100	14	.92	270	57	140	21	W215407
W215409	1.6	.37	250	770	20	.92	390	27	120	6.3	W215409

Table 2.--Major- and Minor-Oxide and Trace-Element Concentrations in the Laboratory Ash of 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland River District, Eastern Kentucky--Continued.

SAMPLE NUMBER	CU PPM	DY-S PPM	ER-S PPM	EU PPM	GA-S PPM	GD-S PPM	GE-S PPM	HF PPM	HO-S PPM	LA PPM	SAMPLE NUMBER
W211182	33	22L	10L	1.5	30	15L	1.5L	4.2	6.8L	55	W211182
W211183	31	22L	10L	1.5	28	15L	1.5L	3.9	6.8L	55	W211183
W211184	45	22L	10L	2.0	28	15L	1.5L	4.0	6.8L	67	W211184
W211185	40	22L	10L	1.7	31	15L	1.5L	4.7	6.8L	73	W211185
W211186	19	22L	10L	1.9	22	15L	1.5L	9.6	6.8L	62	W211186
W211187	66	22L	10L	2.7	30	15L	1.5L	4.4	6.8L	89	W211187
W211638	120	22L	10L	3.0	47	15L	14	6.3	6.8L	88	W211638
W211639	240	22L	10L	4.6	42	15L	7.7	6.3	6.8L	120	W211639
W213022	260	22L	10L	6.4	56	69	17	11	6.8L	170	W213022
W213023	300	22L	10L	3.9	55	15L	46	5.6	6.8L	83	W213023
W213024	150	22L	10	3.6	46	15L	10	5.9	6.8L	110	W213024
W213944	490	22L	10L	7.3	46	15L	20	7.3	6.8L	150	W213944
W213945	230	22L	18	5.6	51	15L	31	9.0	6.8L	110	W213945
W213946	570	22L	10L	8.1	90	27	280	9.5	6.8L	140	W213946
W214792	180	22L	10L	11	45	15L	5.8	14	6.8L	310	W214792
W214793	36	22L	10L	1.6	82	15L	41	1.1	6.8L	33	W214793
W215389	240	22L	20	6.7	46	16	22	8.3	7.3	170	W215389
W215390	230	19	23	9.7	37	36	28	8.8	8.5	180	W215390
W215391	110	22L	10L	4.1	52	15	17	6.0	6.8L	110	W215391
W215392	290	22L	10L	5.3	54	15L	60	8.2	6.8L	100	W215392
W215404	650	22L	10L	7.1	90	15L	160	7.1	6.8L	140	W215404
W215405	380	22L	10L	6.8	48	15L	9.0	8.0	6.8L	120	W215405
W215406	270	22L	14	5.5	61	27	18	8.0	6.8L	130	W215406
W215407	210	22L	10L	5.7	50	15L	2.6	4.4	6.8L	120	W215407
W215409	210	22L	18	4.4	50	15L	5.0	15	6.8L	210	W215409

Table 2.--Major- and Minor-Oxide and Trace-Element Concentrations in the Laboratory Ash of 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland River District, Eastern Kentucky--Continued.

SAMPLE NUMBER	LI PPM	LU PPM	MN PPM	MO-S PPM	NB-S PPM	ND-S PPM	NI-S PPM	PB PPM	PR-S PPM	RB PPM	SAMPLE NUMBER
W211182	85	.5	130	1.0L	23	42	47	37	68L	160	W211182
W211183	93	.4	95	1.0L	25	50	44	31	68L	160	W211183
W211184	75	.5	130	1.0L	17	38	57	33	68L	180	W211184
W211185	110	.5	160	1.0L	15	32L	34	44	68L	200	W211185
W211186	92	.6	100	1.0L	22	32	23	61	68L	120	W211186
W211187	110	.6	76	1.0L	19	62	57	7.0	68L	190	W211187
W211638	270	1.1	98	1.0L	20	72	48	55	68L	160	W211638
W211639	270	1.4	120	9.2	20	66	110	78	68L	47	W211639
W213022	150	2.0	210	39	32	150	200	70	69	140	W213022
W213023	140	1.1	130	130	15	82	180	49	75	140	W213023
W213024	280	1.1	54	8.7	23	120	74	52	68L	120	W213024
W213944	62	2.4	150	18	13	97	250	78	68L	730L	W213944
W213945	76	2.2	120	9.1	30	120	230	92	68L	90	W213945
W213946	51	3.3	140	89	39	110	370	120	68L	950L	W213946
W214792	120	2.3	110	27	23	150	160	50	68L	460	W214792
W214793	43	.8	190	43	9	98	350	67	68L	56L	W214793
W215389	110	2.8	82	35	23	130	290	50	68L	560L	W215389
W215390	130	2.6	96	22	28	200	180	40	68L	590L	W215390
W215391	140	1.0	62	24	8	49	76	32	68L	150	W215391
W215392	110	2.9	76	32	17	77	260	80	68L	410L	W215392
W215404	88	2.9	240	51	17	43	280	80	68L	1,400L	W215404
W215405	140	2.4	88	55	15	120	240	80	68L	600L	W215405
W215406	160	1.8	68	15	11	140	130	120	68L	190	W215406
W215407	140	1.6	100	11	8	110	130	100	68L	260	W215407
W215409	190	2.1	72	15	25	180	68	90	69	250L	W215409

Table 2.--Major- and Minor-Oxide and Trace-Element Concentrations in the Laboratory Ash of 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland River District, Eastern Kentucky--Continued.

SAMPLE NUMBER	SC PPM	SM PPM	SN-S PPM	SR-S PPM	TA PPM	TB PPM	TH PPM	TL-S PPM	TM PPM	U PPM	SAMPLE NUMBER
W211182	20	6.1	2.0	230	1.5	1.1	17	4.6L	4.6L	4.5	W211182
W211183	18	5.6	6.4	280	1.6	1.1	16	4.6L	4.6L	5.3	W211183
W211184	21	7.9	3.1	270	1.5	1.2	18	4.6L	4.6L	6.2	W211184
W211185	23	7.2	3.5	240	1.8	.97	19	4.6L	4.6L	4.2	W211185
W211186	16	8.1	5.5	150	2.0	1.4	18	4.6L	4.6L	4.6	W211186
W211187	24	10	6.1	270	1.7	1.6	24	4.6L	4.6L	6.6	W211187
W211638	39	12	9.3	470	2.7	1.9	26	4.6L	4.6L	7.5	W211638
W211639	45	19	1.5L	2,000	2.9	3.5	33	4.6L	4.6L	15	W211639
W213022	63	24	1.5L	1,600	2.6	4.7	36	4.6L	4.6L	30	W213022
W213023	38	17	1.5L	800	1.4	2.5	28	4.6L	4.6L	31	W213023
W213024	38	15	5.7	2,800	2.0	1.8	25	4.6L	4.6L	11	W213024
W213944	49	29	6.3	440	1.7	5.4	32	4.6L	4.6L	21	W213944
W213945	80	20	6.7	350	2.5	4.0	31	4.6L	4.6L	20	W213945
W213946	140	29	3.7	490	3.3	8.6	33	4.6L	4.6L	37	W213946
W214792	83	46	5.1	560	4.6	7.1	80	4.6L	4.6L	32	W214792
W214793	14	5.6	2.3	1,700	.44	1.3	8.9	4.6L	4.6L	3.0L	W214793
W215389	56	28	5.5	1,100	2.2	7.1	32	4.6L	4.6L	9.2	W215389
W215390	64	41	4.4	2,100	1.5	8.8	35	4.6L	4.6L	7.4L	W215390
W215391	32	18	1.5L	1,200	1.5	4.0	25	4.6L	4.6L	28	W215391
W215392	82	18	1.5L	840	2.0	5.1	24	25	4.6L	12	W215392
W215404	100	29	1.5L	420	16	7.1	21	4.6L	4.6L	21L	W215404
W215405	48	28	5.9	1,600	2.6	6.0	36	26	4.6L	25	W215405
W215406	47	23	4.2	1,200	2.5	4.3	38	4.6L	4.6L	18	W215406
W215407	43	22	2.1	1,200	1.8	4.9	29	4.6L	4.6L	14	W215407
W215409	43	30	11	2,400	3.6	5.9	40	4.6L	4.6L	26	W215409

Table 2.--Major- and Minor-Oxide and Trace-Element Concentrations in the Laboratory Ash of 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland River District, Eastern Kentucky--Continued.

SAMPLE NUMBER	V-S PPM	W PPM	Y-S PPM	YB PPM	ZN PPM	ZR-S PPM	SAMPLE NUMBER
W211182	150	1.6	26	4.0	110	160	W211182
W211183	150	1.5	27	3.5	100	190	W211183
W211184	140	1.7	24	4.2	130	92	W211184
W211185	130	2.0	19	4.3	120	81	W211185
W211186	85	2.3	25	5.0	53	170	W211186
W211187	170	2.1	31	5.0	92	120	W211187
W211638	170	6.3	41	7.5	54	120	W211638
W211639	150	6.3	34	9.4	46	99	W211639
W213022	360	12L	120	15	140	350	W213022
W213023	290	11	71	8.3	510	170	W213023
W213024	200	5.9L	50	7.7	77	150	W213024
W213944	200	7.3	56	17	440	110	W213944
W213945	400	7.5	110	17	190	250	W213945
W213946	270	33	120	24	340	250	W213946
W214792	240	29L	74	23	170	200	W214792
W214793	230	7.8L	120	5.6	210	140	W214793
W215389	260	14L	140	19	300	210	W215389
W215390	250	5.9	170	24	110	230	W215390
W215391	160	3.4	28	10	180	61	W215391
W215392	170	8.2	82	18	260	180	W215392
W215404	250	29	76	29	190	120	W215404
W215405	320	12	98	18	88	170	W215405
W215406	270	11	75	15	110	120	W215406
W215407	250	6.7	61	12	110	74	W215407
W215409	180	7.5	100	16	94	340	W215409

Table 2.--Major- and Minor-Oxide and Trace-Element Concentrations in the Laboratory Ash of 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland River District, Eastern Kentucky--Continued.

SAMPLE NUMBER	ASH (PERCENT)	SiO_2 (PERCENT)	Al_2O_3 (PERCENT)	CAO (PERCENT)	MGO (PERCENT)	Na_2O (PERCENT)	K_2O (PERCENT)	Fe_2O_3 (PERCENT)	TiO_2 (PERCENT)	P_2O_5 (PERCENT)	SAMPLE NUMBER
W215416	2.6	41	33	3.5	.73	.14	.80	11	1.1	1.3	W215416
W215417	5.6	52	33	1.5	.86	.49	2.6	5.1	1.6	.43	W215417
W215421	4 .0	54	31	.39	1.1	.14	4.0	4.6	1.6	.13	W215421
W215422	68.4	56	23	.85	1.2	.11	3.4	10	1.2	.26	W215422
W215423	15.6	48	26	1.0	1.0	.16	3.5	15	1.1	.46	W215423
W215424	6.4	47	29	3.2	.93	.32	1.2	4.7	1.2	.38	W215424
W215425	5.2	42	27	2.5	.83	.11	2.0	20	1.1	.96	W215425
W215426	12.0	55	27	.69	1.6	.57	4.2	6.3	1.1	.08	W215426
W215427	7.5	39	23	1.3	.63	.38	2.0	29	1.1	.13L	W215427
W215428	13.9	49	27	4.5	.91	.78	1.6	6.0	1.1	.14	W215428
W215429	7.3	46	29	1.4	.71	.67	1.7	14	1.1	.25	W215429
W215430	5.3	30	20	3.1	.80	.62	2.4	32	.82	.40	W215430
W215431	13.6	51	27	.63	.76	.63	2.9	14	1.1	.15	W215431
W215432	13.8	61	26	.63	.41	.42	2.5	2.4	1.8	.51	W215432
W215433	8.4	55	25	.88	.35	.42	1.6	12	1.5	.20	W215433
W215434	8.5	49	29	1.7	.46	.31	1.9	14	1.4	.45	W215434
W215553	12.8	47	29	.64	.85	.35	3.1	7.8	1.4	.23	W215553
W215554	14.0	51	30	.94	1.1	.34	3.4	7.9	1.5	.43	W215554
W215555	16.0	48	30	.77	1.0	.36	5.3	16	1.1	.44	W215555
W215556	7.6	49	27	.88	.71	.28	2.7	5.8	1.4	.26	W215556

Table 2.--Major- and Minor-Oxide and Trace-Element Concentrations in the Laboratory Ash of 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland River District, Eastern Kentucky--Continued.

SAMPLE NUMBER	SO_3 (PERCENT)	AG-S PPM	B-S PPM	BA-S PPM	BE-S PPM	CD PPM	CE PPM	CO PPM	CR PPM	CS PPM	SAMPLE NUMBER
W215416	4.0	1.6	460	930	45	.96	690	340	350	.0B	W215416
W215417	1.2	1.0	410	520	20	.52	230	55	200	7.1	W215417
W215421	.53	.10L	99	470	10	.40	150	22	150	11	W215421
W215422	.77	.10L	74	450	4.0	.52	110	22	100	8.8	W215422
W215423	.85	.27	220	870	8.6	.52	190	24	160	10	W215423
W215424	3.8	.65	600	3,000	62	.52	270	61	310L	3.1	W215424
W215425	2.8	.86	320	1,400	41	1.5	290	190	270	9.6	W215425
W215426	.85	.32	230	770	18	.40	180	71	130	16	W215426
W215427	1.6	.47	300	640	23	.48	170	49	150	6.7	W215427
W215428	2.8	.10L	170	550	15	.52	140	66	130	9.4	W215428
W215429	1.9	.60	310	950	16	.68	180	67	120	11	W215429
W215430	4.8	.58	250	1,200	7.6	.64	150	68	120	9.4	W215430
W215431	1.2	.35	220	390	13	.40	130	37	100	11	W215431
W215432	.77	.26	150	530	11	.70	170	22	160	5.1	W215432
W215433	1.2	.53	260	680	33	.74	430	25	140	8.3	W215433
W215434	1.5	.49	170	430	13	.22	190	46	140	5.9	W215434
W215553	1.2	.52	180	580	32	1.0	230	49	170	12	W215553
W215554	1.3	.18	150	890	8.8	.79	180	34	170	16	W215554
W215555	1.4	.42	170	1,200	16	.82	180	77	180	15	W215555
W215556	1.4	.30	140	520	31	.60	170	51	170	13	W215556

Table 2.--Major- and Minor-Oxide and Trace-Element Concentrations in the Laboratory Ash of 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland River District, Eastern Kentucky--Continued.

SAMPLE NUMBER	CU PPM	DY-S PPM	ER-S PPM	EU PPM	GA-S PPM	GD-S PPM	GE-S PPM	HF PPM	HO-S PPM	LA PPM	SAMPLE NUMBER
W215416	490	60	32	15	46	71	14	23L	13	350	W215416
W215417	230	22L	18	5.2	41	15L	6.7	7.1	6.8L	160	W215417
W215421	110	22L	10L	2.6	40	15L	21	6.0	6.8L	88	W215421
W215422	78	22L	10L	2.3	26	15L	1.5L	5.0	6.8L	67	W215422
W215423	190	22L	10L	3.7	45	15L	7.7	5.8	6.8L	120	W215423
W215424	280	22L	36	6.7	50	33	92	11L	9.5	140	W215424
W215425	270	22L	10L	7.7	56	29	60	5.8	11	130	W215425
W215426	220	22L	10L	3.9	43	15L	9.6	4.2	6.8L	100	W215426
W215427	190	22L	10L	3.7	48	15L	12	6.7	6.8L	110	W215427
W215428	140	22L	10L	3.1	39	15L	18	5.0	6.8L	79	W215428
W215429	340	22L	10L	5.6	46	15L	4.6L	27L	6.8L	96	W215429
W215430	350	22L	10L	3.8	32	15L	6.1	9.4L	6.8L	94	W215430
W215431	210	22L	10L	2.9	44	15L	39	5.9	6.8L	81	W215431
W215432	160	22L	10L	3.3	35	15L	2.7	8.0	6.8L	100	W215432
W215433	120	22L	17	4.0	46	23	12	18	7.0	240	W215433
W215434	220	22L	10L	3.8	39	15L	9.1	7.1	6.8L	94	W215434
W215553	210	22L	10L	4.5	52	16	18	5.5	6.8L	130	W215553
W215554	120	22L	10L	3.6	51	15L	7.4	5.7	6.8L	100	W215554
W215555	160	22L	11	3.6	49	23	23	5.0	6.8L	88	W215555
W215556	160	22L	10L	3.6	43	15L	12	5.3	6.8L	92	W215556

Table 2.--Major- and Minor-Oxide and Trace-Element Concentrations in the Laboratory Ash of 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland River District, Eastern Kentucky--Continued.

SAMPLE NUMBER	LI PPM	LU PPM	MN PPM	MO-S PPM	NB-S PPM	ND-S PPM	NI-S PPM	PB PPM	PR-S PPM	RB PPM	SAMPLE NUMBER
W215416	110	4.2	84	69	30	350	880	110	110	1,500L	W215416
W215417	130	2.5	54	24	25	150	200	88	68L	710L	W215417
W215421	210	1.1	64	1.5	23	61	72	64	68L	180	W215421
W215422	160	.9	1,000	1.0L	11	32L	41	56	68L	120	W215422
W215423	180	1.6	58	21	16	65	78	98	68L	380L	W215423
W215424	94	3.1	240	21	26	210	190	100	68L	630L	W215424
W215425	110	2.7	640	57	28	160	410	100	87	770L	W215425
W215426	140	1.6	200	9.4	11	95	140	110	68L	200	W215426
W215427	120	1.5	170	8.1	20	82	110	48	68L	670L	W215427
W215428	120	1.0	640	4.8	14	32L	110	53	68L	360L	W215428
W215429	140	1.6	150	40	11	87	150	88	68L	550L	W215429
W215430	94	.9	160	38	13	79	130	37	68L	750L	W215430
W215431	120	1.0	150	11	12	32L	87	70	68L	370L	W215431
W215432	270	1.4	38	6.1	30	71	73	47	68L	360L	W215432
W215433	48	2.7	41	17	29	180	73	71	68L	600L	W215433
W215434	100	1.2	58	22	15	45	100	69	68L	470L	W215434
W215553	110	1.3	83	18	23	130	110	78	68L	110	W215553
W215554	150	.9	55	11	17	49	73	54	68L	130	W215554
W215555	86	1.0	53	15	12	81	120	59	68L	190	W215555
W215556	85	1.4	43	7.7	17	48	87	53	68L	260L	W215556

Table 2.--Major- and Minor-Oxide and Trace-Element Concentrations in the Laboratory Ash of 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland River District, Eastern Kentucky--Continued.

SAMPLE NUMBER	SC PPM	SM PPM	SN-S PPM	SR-S PPM	TA PPM	TB PPM	TH PPM	TL-S PPM	TM PPM	U PPM	SAMPLE NUMBER
W215416	58	69	3.6	1,800	7.7L	11	42	4.6L	4.6L	11L	W215416
W215417	37	23	6.2	640	1.8	4.3	36	4.6L	4.6L	14	W215417
W215421	31	11	4.4	500	2.2	1.8	22	4.6L	4.6L	6.3	W215421
W215422	21	9.6	3.2	440	1.8	2.1	18	4.6L	4.6L	5.4	W215422
W215423	32	18	1.5L	430	1.9	3.3	28	4.6L	4.6L	19	W215423
W215424	59	30	2.7	1,600	1.3	6.4	19	4.6L	5.0	4.5L	W215424
W215425	84	31	1.5L	1,400	5.8L	6.7	29	4.6L	4.6L	12	W215425
W215426	34	18	3.5	890	2.1	3.0	28	4.6L	4.6L	13	W215426
W215427	31	17	1.5L	780	2.1	3.1	24	4.6L	4.6L	4.3L	W215427
W215428	31	13	5.9	470	2.0	2.2	27	4.6L	4.6L	12	W215428
W215429	39	18	1.5L	1,200	1.2	4.1	25	4.6L	4.6L	29	W215429
W215430	23	13	1.5L	1,900	3.8L	2.8	25	60	4.6L	19	W215430
W215431	37	12	5.6	420	1.8	3.5	25	4.6L	4.6L	13	W215431
W215432	40	14	11	1,200	3.3	2.9	28	4.6L	4.6L	7.8	W215432
W215433	41	36	7.6	670	3.0	7.3	62	37	4.6L	27	W215433
W215434	30	15	7.5	520	2.5	3.8	28	26	4.6L	10	W215434
W215553	36	20	1.5L	760	1.8	4.8	32	4.6L	4.6L	21	W215553
W215554	35	14	3.0	1,600	2.1	4.1	26	4.6L	4.6L	17	W215554
W215555	38	14	5.2	1,400	1.8	4.1	31	4.6L	4.6L	14	W215555
W215556	35	13	1.5L	830	2.0	2.5	22	27	4.6L	11	W215556

Table 2.--Major- and Minor-Oxide and Trace-Element Concentrations in the Laboratory Ash of 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland River District, Eastern Kentucky--Continued.

SAMPLE NUMBER	V-S PPM	W PPM	Y-S PPM	YB PPM	ZN PPM	ZR-S PPM	SAMPLE NUMBER
W215416	330	31L	310	31	280	270	W215416
W215417	260	5.4	98	16	140	190	W215417
W215421	180	4.0	53	6.7	84	160	W215421
W215422	98	3.5	18	4.7	230	75	W215422
W215423	190	4.5	40	11	140	120	W215423
W215424	420	9.4	200	20	100	240	W215424
W215425	470	38L	150	19	340	370	W215425
W215426	230	5.8	58	10	140	88	W215426
W215427	150	8.0	63	12	100	160	W215427
W215428	160	3.6	53	7.9	110	100	W215428
W215429	250	8.9	61	12	110	110	W215429
W215430	170	17L	43	9.4	110	100	W215430
W215431	160	4.4	28	7.4	92	110	W215431
W215432	160	14L	56	9.4	33	190	W215432
W215433	140	6.0	100	20	100	450	W215433
W215434	130	11L	33	9.4	140	84	W215434
W215553	240	5.5	76	10	230	200	W215553
W215554	190	5.0	30	7.9	83	98	W215554
W215555	250	6.3	44	9.4	66	88	W215555
W215556	210	12	43	9.2	44	120	W215556

Table 3.--Content of 23 Trace Elements in 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland District, Eastern Kentucky.

[Analysis performed on whole-coal. Values in parts-per-million (ppm). L, less than the value shown; B, not determined.]

SAMPLE NUMBER	AS PPM	CE PPM	CL PPM	CO PPM	CR PPM	CS PPM	EU PPM	F PPM	HF PPM	HG PPM	SAMPLE NUMBER
W207811	32.6	37	50L	7.4	32	2.9	.67	200	1.3	.25	W207811
W207812	1.6	9.0	160	3.4	6.9	.3	.20	20L	.3	.030	W207812
W207813	1.9	18	190	2.5	11	1.0	.36	150	1.0	.030	W207813
W207814	2.7	14	140	2.9	9.6	.6	.23	60	.8	.020	W207814
W207866	7.6	28	190	2.4	15	.5	.38	180	1.4	.046	W207866
W207897	64.6	49	50L	2.7	21	1.3	.58	120	3.4	.18	W207897
W207899	3.4	45	50L	5.8	37	2.7	.72	160	2.3	.045	W207899
W207900	4.0	35	110	9.9	30	2.0	.58	120	1.2	.032	W207900
W207901	3.8	8.0	60	1.5	6.4	.3	.15	30	.3	.030	W207901
W208056	76.5	37	50L	5.9	26	2.1	.78	110	1.1	.27	W208056
W208057	97.2	31	50L	4.7	21	1.9	.64	120	.9	.15	W208057
W208058	58.7	26	50L	7.9	19	1.4	.46	100	.8	.15	W208058
W208200	2.7	17	80	3.1	7.2	.3	.41	30	.3	.19	W208200
W208201	7.3	31	50L	6.4	27	1.9	.59	150	1.0	.13	W208201
W208221	44.5	25	120	2.6	13	.5	.39	220	1.1	.16	W208221
W208222	.8	16	120	2.6	8.5	.2	.40	40	.4	.055	W208222
W208223	1.8	12	240	5.4	8.3	.3	.36	40	.4	.060	W208223
W211179	2.4	96	100L	5.8	75	7.4	1.5	550	3.8	.050	W211179
W211180	18.4	91	100L	19	80	7.5	1.5	500	2.8	.040	W211180
W211181	5.1	100	100L	12	99	9.6	1.4	450	3.3	.050	W211181

Table 3.--Content of 23 Trace Elements in 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland District, Eastern Kentucky.--Continued.

SAMPLE NUMBER	LA PPM	LU PPM	NA PPM	P PPM	RB PPM	SB PPM	SC PPM	SE PPM	SM PPM	TB PPM	SAMPLE NUMBER
W207811	21	.2	510	44L	62	.80	6.8	5.4	3.0	.3	W207811
W207812	5	.1	150	44L	40L	.50	2.1	2.4	.90	.2	W207812
W207813	11	.2	190	770	40L	.40	4.1	2.0	1.6	.3	W207813
W207814	7	.1	180	470	28	.40	3.5	1.8	1.1	.2	W207814
W207866	16	.2L	210	1,400	40L	.50	4.7	3.0	2.6	.3	W207866
W207897	27	.3	310	580	77	1.3	5.8	7.3	3.5	.4	W207897
W207899	25	.3	660	150	58	.50	7.9	2.8	3.6	.3	W207899
W207900	19	.3	320	44L	45	.60	6.4	4.7	2.8	.3	W207900
W207901	4	.1	110	44L	30L	.60	1.8	2.3	.80	.1	W207901
W208056	22	.3	500	130	41	1.7	5.6	2.5	4.0	.6	W208056
W208057	19	.2	460	44L	32	1.7	4.7	2.0	3.3	.3	W208057
W208058	14	.2	580	44L	28	1.1	5.1	2.2	2.3	.3	W208058
W208200	9	.1	210	44L	20L	.70	3.2	.8	1.7	.5	W208200
W208201	18	.2	480	66	41	.40	6.3	2.7	2.5	.5	W208201
W208221	13	.1	210	1,700	9	1.1	3.9	6.8	2.0	.4	W208221
W208222	7	.2	98	100	20L	.30	4.2	2.6	1.6	.5	W208222
W208223	7	.1	62	44L	10L	.40	2.3	4.2	1.5	.5	W208223
W211179	54	.4	1,500	44L	130	1.7	15	4.5	6.1	1	W211179
W211180	50	.3	790	44L	120	1.9	14	3.3	5.9	.9	W211180
W211181	54	.4	1,000	44L	170	1.7	18	1.0	5.8	.9	W211181

Table 3.--Content of 23 Trace Elements in 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland District, Eastern Kentucky.--Continued.

SAMPLE NUMBER	TH PPM	U PPM	YB PPM
W207811	5.6	1.8	1.5
W207812	1.1	.52	.6
W207813	3.3	.94	1.2
W207814	1.8	.61	.9
W207866	4.7	1.6	1.3
W207897	9.9	3.5	1.6
W207899	6.9	2.2	1.8
W207900	5.1	1.8	1.4
W207901	1.0	.32L	.4
W208056	5.8	2.4	1.7
W208057	4.8	2.5	1.4
W208058	3.6	1.6	1.0
W208200	1.1	1.5	1.1
W208201	4.8	1.8	1.4
W208221	4.4	2.0	.9
W208222	1.3	.59	1.2
W208223	1.5	.44	.8
W211179	14	3.6	3.4
W211180	14	4.7	2.9
W211181	16	4.7	3.7

Table 3.--Content of 23 Trace Elements in 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland District, Eastern Kentucky.--Continued.

SAMPLE NUMBER	AS PPM	CE PPM	CL PPM	CO PPM	CR PPM	CS PPM	EU PPM	F PPM	HF PPM	HG PPM	SAMPLE NUMBER
W211182	3.7	96	100L	15	98	9.1	1.4	600	3.9	.050	W211182
W211183	3.2	90	100L	8.8	83	7.9	1.4	630	3.6	.050	W211183
W211184	9.1	110	100L	18	99	8.5	1.7	740	3.5	.060	W211184
W211185	9.3	120	100L	17	110	11	1.5	450	4.3	.050	W211185
W211186	3.0	120	100L	5.1	74	6.0	1.8	460	8.8	.060	W211186
W211187	9.7	130	100L	16	100	8.7	2.1	390	3.4	.060	W211187
W211638	2.0	24	100L	4.8	27	1.8	.48	70	1.0	.058	W211638
W211639	33.8	27	330	8.6	22	.4	.58	140	.8	.075	W211639
W213022	1 .8	21	110	4.4	15	.4	.42	50	.7	.18	W213022
W213023	24.6	6.0	120	1.4	5.9	.5	.14	20	.2	.075	W213023
W213024	4.3	33	120	6.7	25	1.4	.60	130	1.0	.049	W213024
W213944	12.4	12	130	7.5	7.4	.3	.30	110	.3	.12	W213944
W213945	3.1	29	130	21	25	1.0	.74	150	1.2	.090	W213945
W213946	6.1	6.0	100L	4.4	3.9	.3	.17	40	.2	.050	W213946
W214792	5.8	19	100L	5.2	15	1.0	.37	50	.5	.030	W214792
W214793	5.7	6.0	100L	4.3	4.3	.1	.14	70	.1	.020	W214793
W215389	3.3	11	350	4.9	6.3	.2	.24	70	.3	.050	W215389
W215390	.9	11	500	2.3	5.7	.1	.33	90	.3	.072	W215390
W215391	39.7	23	250	2.8	14	1.2	.48	120	.7	.065	W215391
W215392	12.9	10	260	8.6	6.8	.7	.26	70	.4	.050	W215392
W215404	1.4	4.0	890	3.5	2.9	.08	.10	70	.1	.17	W215404
W215405	19.7	13	130	7.5	7.6	.3	.34	90	.4	.13	W215405
W215406	3.4	27	180	5.5	16	.8	.55	170	.8	.10	W215406
W215407	1.6	24	250	5.1	13	1.9	.51	170	.4	.12	W215407
W215409	11.4	31	330	2.2	9.4	.5	.35	320	1.2	.26	W215409

Table 3.--Content of 23 Trace Elements in 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland District, Eastern Kentucky.--Continued.

SAMPLE NUMBER	LA PPM	LU PPM	NA PPM	P PPM	RB PPM	SB PPM	SC PPM	SE PPM	SM PPM	TB PPM	SAMPLE NUMBER
W211182	51	.5	1,200	44L	150	1.5	19	.9	5.6	1	W211182
W211183	50	.4	1,300	44	150	.90	16	2.0	5.1	1	W211183
W211184	59	.5	1,500	87	160	1.2	19	2.3	7.0	1	W211184
W211185	66	.5	1,700	220	180	1.7	21	4.0	6.5	.9	W211185
W211186	57	.6	920	44L	110	1.4	15	1.0	7.4	1	W211186
W211187	69	.5	1,200	44	150	1.5	18	4.3	8.1	1	W211187
W211638	14	.2	290	44L	26	1.1	6.2	5.6	1.9	.3	W211638
W211639	15	.2	190	550	6	1.0	5.7	4.4	2.4	.4	W211639
W213022	11	.1	170	340	9	.70	4.1	3.1	1.6	.3	W213022
W213023	3	.1L	160	44L	5	1.0	1.4	2.4	.60	.1	W213023
W213024	19	.2	760	830	20	.30	6.4	4.9	2.5	.3	W213024
W213944	6	.1	160	44	30L	.20	2.0	2.4	1.2	.2	W213944
W213945	15	.3	280	100	12	1.0	11	4.5	2.7	.5	W213945
W213946	3	.1	100	44L	20L	.70	3.0	1.9	.60	.2	W213946
W214792	11	.1	52	87	16	.50	2.9	6.0	1.6	.3	W214792
W214793	3	.1	300	44L	5L	.80	1.3	2.4	.50	.1	W214793
W215389	6	.1	50	44L	20L	.30	2.0	2.8	1.0	.3	W215389
W215390	6	.1	68	310	20L	.20	2.2	4.0	1.4	.3	W215390
W215391	13	.1	160	390	17	1.4	3.8	3.8	2.1	.5	W215391
W215392	5	.1	69	130	20L	.60	4.0	2.3	.90	.3	W215392
W215404	2	.1L	130	52	20L	.50	1.4	.9	.40	.1	W215404
W215405	6	.1	250	44L	30L	.80	2.4	3.3	1.4	.3	W215405
W215406	13	.2	320	100	19	1.1	4.7	4.0	2.3	.4	W215406
W215407	11	.1	450	44	23	.70	3.8	4.6	2.0	.4	W215407
W215409	17	.2	80	1,000	20L	.40	3.4	2.4	2.4	.5	W215409

Table 3.--Content of 23 Trace Elements in 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland District, Eastern Kentucky.--Continued.

SAMPLE NUMBER	TH PPM	U PPM	YB PPM
W211182	16	4.1	3.7
W211183	14	4.9	3.2
W211184	16	5.5	3.7
W211185	17	3.9	3.9
W211186	17	4.3	4.6
W211187	19	5.1	3.9
W211638	4.2	1.2	1.2
W211639	4.2	1.9	1.2
W213022	2.4	2.0	1.0
W213023	1.0	1.1	.3
W213024	4.2	1.8	1.3
W213944	1.3	.86	.7
W213945	4.1	2.6	2.2
W213946	.7	.78	.5
W214792	2.8	1.1	.8
W214793	.8	.27L	.5
W215389	1.2	.33	.7
W215390	1.2	.25L	.8
W215391	2.9	3.3	1.2
W215392	1.2	.58	.9
W215404	.3	.30L	.4
W215405	1.8	1.2	.9
W215406	3.8	1.8	1.5
W215407	2.6	1.3	1.1
W215409	3.2	2.1	1.3

Table 3.--Content of 23 Trace Elements in 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland District, Eastern Kentucky.--Continued.

SAMPLE NUMBER	AS PPM	CE PPM	CL PPM	CO PPM	CR PPM	CS PPM	EU PPM	F PPM	HF PPM	HG PPM	SAMPLE NUMBER
W215416	7.5	18	270	8.8	9.2	.0B	.38	60	.6L	.17	W215416
W215417	5.0	13	180	3.1	11	.4	.29	80	.4	.22	W215417
W215421	7.8	60	100L	8.8	62	4.5	1.0	390	2.4	.14	W215421
W215422	15.3	77	100L	15	70	6.0	1.5	660	3.4	.25	W215422
W215423	118	30	100L	3.8	25	1.6	.58	220	.9	.29	W215423
W215424	2.1	17	100L	3.9	20L	.2	.43	90	.7L	.27	W215424
W215425	6.9	15	100L	9.8	14	.5	.40	40	.3	.24	W215425
W215426	5.2	22	170	8.5	16	1.9	.47	120	.5	.16	W215426
W215427	73.1	13	400	3.7	11	.5	.28	70	.5	.24	W215427
W215428	4.3	20	130	9.2	18	1.3	.43	150	.7	.18	W215428
W215429	12.8	13	180	4.9	8.7	.8	.41	90	2.0L	.14	W215429
W215430	77.1	8.0	150	3.6	6.2	.5	.20	70	.5L	.11	W215430
W215431	100	18	390	5.1	14	1.5	.40	40	.8	.21	W215431
W215432	2.2	24	190	3.0	22	.7	.45	180	1.1	.25	W215432
W215433	23.6	36	200	2.1	12	.7	.34	70	1.5	.23	W215433
W215434	27.0	16	130	3.9	12	.5	.32	100	.6	.22	W215434
W215553	16.8	29	200	6.3	22	1.5	.58	100	.7	.14	W215553
W215554	93.0	25	200	4.7	24	2.3	.50	180	.8	.27	W215554
W215555	39.1	28	400	12	28	2.4	.57	310	.8	.50	W215555
W215556	1 .9	13	600	3.9	13	1.0	.27	60	.4	.44	W215556

Table 3.--Content of 23 Trace Elements in 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland District, Eastern Kentucky.--Continued.

SAMPLE NUMBER	LA PPM	LU PPM	NA PPM	P PPM	RB PPM	SB PPM	SC PPM	SE PPM	SM PPM	TB PPM	SAMPLE NUMBER
W215416	9	.1	26	150	40L	.50	1.5	2.7	1.8	.3	W215416
W215417	9	.1	200	100	40L	.70	2.1	4.0	1.3	.2	W215417
W215421	35	.5	400	230	73	2.1	13	6.0	4.4	.7	W215421
W215422	46	.6	550	790	84	1.4	14	5.3	6.6	1	W215422
W215423	19	.3	190	310	60L	2.3	5.0	5.1	2.8	.5	W215423
W215424	9	.2	150	100	40L	.50	3.8	1.9	1.9	.4	W215424
W215425	7	.1	42	220	40L	.80	4.4	2.4	1.6	.4	W215425
W215426	12	.2	500	44	24	1.1	4.1	4.2	2.2	.4	W215426
W215427	8	.1	210	44L	50L	1.1	2.3	3.5	1.3	.2	W215427
W215428	11	.1	810	83	50L	1.0	4.3	2.0	1.8	.3	W215428
W215429	7	.1	360	79	40L	1.2	2.8	3.7	1.4	.3	W215429
W215430	5	.1	240	92	40L	1.1	1.2	2.4	.70	.2	W215430
W215431	11	.1	640	87	50L	2.1	5.0	4.3	1.7	.5	W215431
W215432	14	.2	430	310	50L	.50	5.6	3.6	1.9	.4	W215432
W215433	20	.2	260	74	50L	.60	3.5	2.3	3.0	.6	W215433
W215434	8	.1	200	170	40L	.70	2.6	5.7	1.3	.3	W215434
W215553	17	.2	330	130	14	.80	4.6	5.3	2.5	.6	W215553
W215554	14	.1	350	260	18	1.1	4.9	7.0	2.0	.6	W215554
W215555	14	.2	430	310	31	1.7	6.0	4.2	2.3	.7	W215555
W215556	7	.1	160	87	20L	.80	2.6	6.1	1.0	.2	W215556

Table 3.--Content of 23 Trace Elements in 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland District, Eastern Kentucky.--Continued.

SAMPLE NUMBER	TH PPM	U PPM	YB PPM
W215416	1.1	.28L	.8
W215417	2.0	.77	.9
W215421	8.9	2.5	2.7
W215422	12	3.7	3.2
W215423	4.3	3.0	1.7
W215424	1.2	.29L	1.3
W215425	1.5	.64	1.0
W215426	3.4	1.6	1.2
W215427	1.8	.32L	.9
W215428	3.7	1.7	1.1
W215429	1.8	2.1	.9
W215430	1.3	1.0	.5
W215431	3.4	1.7	1.0
W215432	3.9	1.1	1.3
W215433	5.2	2.3	1.7
W215434	2.4	.86	.8
W215553	4.1	2.7	1.3
W215554	3.6	2.5	1.1
W215555	4.9	2.3	1.5
W215556	1.7	.83	.7

Table 4.--Major-, Minor-, and Trace-Element Concentrations of 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland District, Eastern Kentucky.

[Values in percent or parts-per-million. 23 elements are from direct determinations on whole coal: all other elements calculated from analyses of ash. S means analysis by emission spectography; L, less than the value shown; H, interference for an element which cannot be resolved by any routine method; B, not determined; G, greater than. Sample number is laboratory sample number.]

SAMPLE NUMBER	SI (PERCENT)	AL (PERCENT)	CA (PERCENT)	MG (PERCENT)	NA (PERCENT)	K (PERCENT)	FE (PERCENT)	TI (PERCENT)	AG-S PPM	AS PPM	SAMPLE NUMBER
W207811	6.2	3.3	.10	.21	.051	.93	1.3	.17	.024L	33	W207811
W207812	1.1	.70	.056	.024	.015	.091	.20	.039	.016	1.6	W207812
W207813	2.4	1.6	.16	.044	.019	.17	.27	.080	.015	1.9	W207813
W207814	2.0	1.3	.10	.036	.018	.14	.22	.068	.015	2.7	W207814
W207866	3.6	1.7	.30	.040	.021	.17	.26	.14	.048	7.6	W207866
W207897	6.0	2.4	.16	.075	.031	.31	1.3	.23	.025	65	W207897
W207899	8.8	4.7	.15	.25	.066	1.1	1.2	.27	.033	3.4	W207899
W207900	5.0	3.3	.11	.17	.032	.72	.51	.18	.030	4.0	W207900
W207901	.78	.65	.063	.026	.011	.093	.22	.033	.017	3.8	W207901
W208056	4.2	2.6	.11	.17	.050	.58	2.0	.11	.034	77	W208056
W208057	3.8	2.4	.13	.16	.046	.50	2.4	.099	.044	97	W208057
W208058	5.3	2.7	.071	.22	.058	.67	1.0	.14	.044	59	W208058
W208200	.73	.55	.062	.023	.021	.073	.27	.022	.047	2.7	W208200
W208201	5.5	3.1	.099	.17	.048	.75	1.1	.14	.022L	7.3	W208201
W208221	2.3	1.6	.35	.032	.021	.13	.73	.11	.026	45	W208221
W208222	1.3	.86	.048	.014	.010	.060	.095	.043	.008	.80	W208222
W208223	.88	.73	.084	.020	.006	.056	.10	.054	.013	1.8	W208223
W211179	22	10	.18	.62	.15	2.9	1.9	.54	.078L	2.4	W211179
W211180	16	9.4	.16	.54	.079	2.9	3.8	.41	.066L	18	W211180
W211181	23	13	.22	.70	.10	3.4	2.7	.56	.087L	5.1	W211181

Table 4.--Major-, Minor-, and Trace-Element Concentrations of 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland District, Eastern Kentucky--Continued.

SAMPLE NUMBER	B-S PPM	BA-S PPM	BE-S PPM	BR PPM	CD PPM	CE PPM	CL PPM	CO PPM	CR PPM	CS PPM	SAMPLE NUMBER
W207811	39	240	2	1.4	.15	37	50L	7.4	32	2.9	W207811
W207812	18	100	1	1.0	.06	9.0	160	3.4	6.9	.3	W207812
W207813	30	98	1	2.3	.08	18	190	2.5	11	1.0	W207813
W207814	26	74	1	2.1	.07	14	140	2.9	9.6	.6	W207814
W207866	35	150	3	3.4	.04	28	190	2.4	15	.5	W207866
W207897	31	140	1	2.4	.07	49	50L	2.7	21	1.3	W207897
W207899	46	290	2	1.1	.14	45	50L	5.8	37	2.7	W207899
W207900	28	120	2	1.2	.12	35	110	9.9	30	2.0	W207900
W207901	22	37	1L	1.6	.04	8.0	60	1.5	6.4	.3	W207901
W208056	55	120	1	1.4	.15	37	50L	5.9	26	2.1	W208056
W208057	55	110	1	1.0	.15	31	50L	4.7	21	1.9	W208057
W208058	42	140	2	2.0	.07	26	50L	7.9	19	1.4	W208058
W208200	18	61	2	1.2	.02	17	80	3.1	7.2	.3	W208200
W208201	71	180	2	1.1	.06	31	50L	6.4	27	1.9	W208201
W208221	21	94	1	3.5	.06	25	120	2.6	13	.5	W208221
W208222	22	23	2	3.9	.05	16	120	2.6	8.5	.2	W208222
W208223	11	12	2	1.8	.04	12	240	5.4	8.3	.3	W208223
W211179	78	450	3	2.3	.30	96	100L	5.8	75	7.4	W211179
W211180	98	550	3	1.9	.26	91	100L	19	80	7.5	W211180
W211181	87	510	4	1.9	.12	100	100L	12	99	9.6	W211181

Table 4.--Major-, Minor-, and Trace-Element Concentrations of 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland District, Eastern Kentucky--Continued.

SAMPLE NUMBER	CU PPM	DY-S PPM	ER-S PPM	EU PPM	F PPM	GA-S PPM	GD-S PPM	GE-S PPM	HF PPM	HG PPM	SAMPLE NUMBER
W207811	20	5.3L	2.4L	.67	200	6.6	3.6L	1.0	1.3	.25	W207811
W207812	9.7	1.0L	.5L	.20	20L	1.7	.69L	1.7	.3	.030	W207812
W207813	12	2.2L	1.0L	.36	150	3.1	1.5L	.57	1.0	.030	W207813
W207814	11	1.8L	.8L	.23	60	3.2	1.2L	1.4	.8	.020	W207814
W207866	16	2.8L	1.3L	.38	180	5.1	1.9L	3.1	1.4	.046	W207866
W207897	23	4.6L	2.1L	.58	120	7.1	3.1L	1.5	3.4	.18	W207897
W207899	22	7.2L	3.3L	.72	160	10	4.9L	.49L	2.3	.045	W207899
W207900	16	5.9	2.0L	.58	120	8.1	12	1.4	1.2	.032	W207900
W207901	8.1	1.1	.4L	.15	30	1.3	.89	.78	.3	.030	W207901
W208056	36	4.2L	1.9L	.78	110	8.2	2.9L	.69	1.1	.27	W208056
W208057	37	4.0L	1.8L	.64	120	7.2	2.8L	.98	.9	.15	W208057
W208058	19	4.4L	2.0L	.46	100	7.6	3.0L	4.4	.8	.15	W208058
W208200	15	1.8	1.0	.41	30	2.5	1.7	1.3	.3	.19	W208200
W208201	17	4.8L	2.2L	.59	150	10	3.2L	2.2	1.0	.13	W208201
W208221	17	2.3L	1.0L	.39	220	3.4	1.6L	2.0	1.1	.16	W208221
W208222	15	1.2	.7	.40	40	1.7	.74L	1.0	.4	.055	W208222
W208223	11	.9L	.7	.36	40	1.3	.59L	.86	.4	.060	W208223
W211179	29	17L	7.8L	1.5	550	20	12L	1.2L	3.8	.050	W211179
W211180	48	14L	6.6L	1.5	500	20	9.8L	.98L	2.8	.040	W211180
W211181	31	19L	8.7L	1.4	450	29	13L	1.3	3.3	.050	W211181

Table 4.--Major-, Minor-, and Trace-Element Concentrations of 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland District, Eastern Kentucky--Continued.

SAMPLE NUMBER	HO-S PPM	LA PPM	LI PPM	LU PPM	MN PPM	MO-S PPM	NB-S PPM	ND-S PPM	NI-S PPM	P PPM	SAMPLE NUMBER
W207811	1.7L	21	51	.2	34	1.1	4.6	19	16	44L	W207811
W207812	.31L	5	12	.1	5.1	.69	.83	3.7	5.1	44L	W207812
W207813	.67L	11	24	.2	11	.34	1.7	7.6	4.6	770	W207813
W207814	.54L	7	22	.1	17	.59	2.7	8.0	5.5	470	W207814
W207866	.85L	16	30	.2L	8.8	.74	7.0	18	7.8	1,400	W207866
W207897	1.4L	27	50	.3	18	1.7	4.4	11	8.5	580	W207897
W207899	2.2L	25	56	.3	82	.36	6.9	11L	15	150	W207899
W207900	1.3L	19	35	.3	26	.20L	5.3	15	24	44L	W207900
W207901	.25L	4	5.6	.1	6.7	.70	.35	2.3	2.8	44L	W207901
W208056	1.3L	22	23	.3	57	5.0	2.3	13	18	130	W208056
W208057	1.3L	19	22	.2	68	2.6	1.6	13	15	44L	W208057
W208058	1.4L	14	28	.2	40	2.6	3.8	16	16	44L	W208058
W208200	.24L	9	5.8	.1	4.7	1.6	.79	10	6.8	44L	W208200
W208201	1.5L	18	32	.2	78	.78	4.1	13	16	66	W208201
W208221	.71L	13	28	.1	10	.74	2.1	7.0	6.3	1,700	W208221
W208222	.33L	7	13	.2	4.2	.17	.59	5.4	2.7	100	W208222
W208223	.27L	7	7.0	.1	8.6	.51	1.3	6.2	11	44L	W208223
W211179	5.3L	54	85	.4	74	.78L	19	30	17	44L	W211179
W211180	4.5L	50	60	.3	54	1.4	9.2	26	50	44L	W211180
W211181	5.9L	54	81	.4	100	.87L	19	37	38	44L	W211181

Table 4.--Major-, Minor-, and Trace-Element Concentrations of 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland District, Eastern Kentucky--Continued.

SAMPLE NUMBER	PB PPM	PR-S PPM	RB PPM	SB PPM	SC PPM	SE PPM	SM PPM	SN-S PPM	SR-S PPM	TA PPM	SAMPLE NUMBER
W207811	10	17L	62	.80	6.8	5.4	3.0	.90	70	.39	W207811
W207812	2.9	3.1L	40L	.50	2.1	2.4	.90	.18	38	.07	W207812
W207813	6.3	6.7L	40L	.40	4.1	2.0	1.6	.95	290	.22	W207813
W207814	5.1	5.4L	28	.40	3.5	1.8	1.1	.79	140	.18	W207814
W207866	7.6	8.5L	40L	.50	4.7	3.0	2.6	1.8	300	.37	W207866
W207897	11	14L	77	1.3	5.8	7.3	3.5	1.3	210	.77	W207897
W207899	13	22L	58	.50	7.9	2.8	3.6	.79	140	.50	W207899
W207900	9.5	13L	45	.60	6.4	4.7	2.8	.89	51	.34	W207900
W207901	2.3	2.5L	30L	.60	1.8	2.3	.80	.18	25	.07	W207901
W208056	10	13L	41	1.7	5.6	2.5	4.0	1.9	130	.26	W208056
W208057	9.4	13L	32	1.7	4.7	2.0	3.3	.28L	99	.21	W208057
W208058	8.2	14L	28	1.1	5.1	2.2	2.3	1.0	92	.21	W208058
W208200	3.6	3.2	20L	.70	3.2	.8	1.7	.12	43	.08	W208200
W208201	14	15L	41	.40	6.3	2.7	2.5	1.1	93	.34	W208201
W208221	7.6	7.1L	9	1.1	3.9	6.8	2.0	1.5	180	.49	W208221
W208222	3.1	3.3L	20L	.30	4.2	2.6	1.6	.29	54	.10	W208222
W208223	3.8	2.7L	10L	.40	2.3	4.2	1.5	.59	17	.16	W208223
W211179	20	53L	130	1.7	15	4.5	6.1	5.6	180	1.3	W211179
W211180	9.2	45L	120	1.9	14	3.3	5.9	3.1	200	.96	W211180
W211181	11	59L	170	1.7	18	1.0	5.8	7.1	220	1.3	W211181

Table 4.--Major-, Minor-, and Trace-Element Concentrations of 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland District, Eastern Kentucky--Continued.

SAMPLE NUMBER	TB PPM	TH PPM	TL-S PPM	TM-S PPM	U PPM	V-S PPM	W PPM	Y-S PPM	YB PPM	ZN PPM	SAMPLE NUMBER
W207811	.31	5.6	1.1L	1.1L	1.8	39	.80	8.7	1.5	34	W207811
W207812	.15	1.1	.21L	.21L	.52	6.9	.30	2.6	.6	2.9	W207812
W207813	.27	3.3	.45L	.45L	.94	11	.90	4.0	1.2	8.0	W207813
W207814	.17	1.8	.37L	.37L	.61	13	.90	4.4	.9	12	W207814
W207866	.27	4.7	.58L	.58L	1.6	21	1.2	8.0	1.3	5.1	W207866
W207897	.42	9.9	2.5	.96L	3.5	21	1.2	4.0	1.6	11	W207897
W207899	.29	6.9	1.5L	1.5L	2.2	39	.70	5.6	1.8	43	W207899
W207900	.25	5.1	.91L	.91L	1.8	33	.60	6.9	1.4	26	W207900
W207901	.10	1.0	.17L	.17L	.32L	5.6	.20	1.5	.4	5.2	W207901
W208056	.60	5.8	.88L	.88L	2.4	25	.70	4.6	1.7	40	W208056
W208057	.30	4.8	.85L	.85L	2.5	26	.50	5.7	1.4	39	W208057
W208058	.32	3.6	.92L	.92L	1.6	32	3.3	7.6	1.0	28	W208058
W208200	.48	1.1	.17L	.17L	1.5	11	.30	5.8	1.1	7.6	W208200
W208201	.49	4.8	.99L	.99L	1.8	39	.50	4.3	1.4	30	W208201
W208221	.40	4.4	.48L	.48L	2.0	15	.0B	4.3	.9	5.4	W208221
W208222	.53	1.3	.23L	.23L	.59	8.3	.0B	4.0	1.2	1.9	W208222
W208223	.46	1.5	.18L	.18L	.44	8.2	.0B	5.1	.8	6.6	W208223
W211179	.95	14	3.6L	3.6L	3.6	100	1.4	21	3.4	76	W211179
W211180	.87	14	3.0L	3.0L	4.7	120	1.3	16	2.9	60	W211180
W211181	.89	16	4.0L	4.0L	4.7	130	1.5	22	3.7	78	W211181

Table 4.--Major-, Minor-, and Trace-Element Concentrations of 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland District, Eastern Kentucky--Continued.

SAMPLE NUMBER	ZR-S PPM
W207811	34
W207812	4.1
W207813	12
W207814	20
W207866	65
W207897	35
W207899	46
W207900	55
W207901	4.4
W208056	12
W208057	14
W208058	28
W208200	7.2
W208201	22
W208221	21
W208222	5.4
W208223	11
W211179	100
W211180	72
W211181	110

Table 4.--Major-, Minor-, and Trace-Element Concentrations of 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland District, Eastern Kentucky--Continued.

SAMPLE NUMBER	SI (PERCENT)	AL (PERCENT)	CA (PERCENT)	MG (PERCENT)	NA (PERCENT)	K (PERCENT)	FE (PERCENT)	TI (PERCENT)	AG-S PPM	AS PPM	SAMPLE NUMBER
W211182	26	12	.22	.84	.12	3.6	3.0	.61	.092L	3.7	W211182
W211183	25	12	.25	.86	.13	3.8	2.6	.56	.092L	3.2	W211183
W211184	24	12	.22	.97	.15	3.8	3.0	.53	.089L	9.1	W211184
W211185	24	13	.31	1.0	.17	3.9	3.0	.65	.091L	9.3	W211185
W211186	29	10	.16	.64	.092	2.5	1.8	.74	.092L	3.0	W211186
W211187	19	13	.18	.65	.12	3.5	2.0	.51	.078L	9.7	W211187
W211638	4.0	2.8	.064	.089	.029	.47	.24	.20	.016L	2.0	W211638
W211639	2.7	1.7	.12	.035	.019	.14	1.8	.14	.051	34	W211639
W213022	1.3	.90	.094	.034	.017	.11	.92	.062	.024	11	W213022
W213023	.66	.46	.049	.030	.016	.088	.56	.020	.036	25	W213023
W213024	4.0	2.6	.14	.10	.076	.49	1.2	.13	.063	4.3	W213024
W213944	.83	.63	.052	.032	.016	.097	.42	.027	.036	12	W213944
W213945	3.6	1.9	.056	.086	.028	.33	.41	.12	.059	3.1	W213945
W213946	.43	.33	.032	.013	.010	.048	.18	.015	.034	6.1	W213946
W214792	.75	.58	.048	.022	.005	.089	.22	.025	.018	5.8	W214792
W214793	1.4	1.3	.45	.083	.030	.14	.83	.055	.16	5.7	W214793
W215389	.76	.58	.072	.019	.005	.065	.19	.033	.032	3.3	W215389
W215390	.72	.58	.13	.018	.007	.021	.14	.031	.027	.90	W215390
W215391	2.4	1.6	.12	.056	.016	.27	1.6	.081	.065	40	W215391
W215392	1.2	.67	.054	.026	.007	.093	.45	.042	.037	13	W215392
W215404	.30	.18	.022	.006	.013	.020	.15	.011	.021	1.4	W215404
W215405	1.1	.88	.070	.019	.025	.075	.38	.040	.042	20	W215405
W215406	2.5	1.7	.056	.042	.032	.25	.30	.096	.053	3.4	W215406
W215407	2.1	1.5	.057	.061	.045	.32	.29	.061	.044	1.6	W215407
W215409	1.8	1.2	.25	.026	.008	.088	.36	.076	.030	11	W215409

Table 4.--Major-, Minor-, and Trace-Element Concentrations of 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland District, Eastern Kentucky--Continued.

SAMPLE NUMBER	B-S PPM	BA-S PPM	BE-S PPM	BR PPM	CD PPM	CE PPM	CL PPM	CO PPM	CR PPM	CS PPM	SAMPLE NUMBER
W211182	91	520	3	1.5	.35	96	100L	15	98	9.1	W211182
W211183	100	560	4	1.0	.22	90	100L	8.8	83	7.9	W211183
W211184	120	650	4	1.0	.44	110	100L	18	99	8.5	W211184
W211185	110	630	3	1.6	.36	120	100L	17	110	11	W211185
W211186	85	430	3	1.8	.35	120	100L	5.1	74	6.0	W211186
W211187	120	440	3	1.7	.39	130	100L	16	100	8.7	W211187
W211638	29	100	2	1.9	.08	24	100L	4.8	27	1.8	W211638
W211639	28	97	1	1.3	.19	27	330	8.6	22	.4	W211639
W213022	24	73	1	1.0L	.06	21	110	4.4	15	.4	W213022
W213023	11	50	1L	2.0L	.05	6.0	120	1.4	5.9	.5	W213023
W213024	47	160	1	1.0L	.13	33	120	6.7	25	1.4	W213024
W213944	10	29	1	.5L	.08	12	130	7.5	7.4	.3	W213944
W213945	29	90	5	.5L	.12	29	130	21	25	1.0	W213945
W213946	6.5	17	2	.5L	.04	6.0	100L	4.4	3.9	.3	W213946
W214792	7.7	16	1L	3.4	.03	19	100L	5.2	15	1.0	W214792
W214793	29	130	6	4.1	.07	6.0	100L	4.3	4.3	.1	W214793
W215389	18	94	1	4.5	.04	11	350	4.9	6.3	.2	W215389
W215390	14	61	1	5.3	.03	11	500	2.3	5.7	.1	W215390
W215391	29	78	1	3.9	.11	23	250	2.8	14	1.2	W215391
W215392	16	88	1L	5.5	.05	10	260	8.6	6.8	.7	W215392
W215404	5.6	43	1	5.3	.01	4.0	890	3.5	2.9	.0B	W215404
W215405	16	45	2	3.5	.03	13	130	7.5	7.6	.3	W215405
W215406	29	84	2	3.7	.07	27	180	5.5	16	.8	W215406
W215407	26	99	1	3.1	.08	24	250	5.1	13	1.9	W215407
W215409	20	62	2	2.7	.07	31	330	2.2	9.4	.5	W215409

Table 4.--Major-, Minor-, and Trace-Element Concentrations of 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland District, Eastern Kentucky--Continued.

SAMPLE NUMBER	CU PPM	DY-S PPM	ER-S PPM	EU PPM	F PPM	GA-S PPM	GD-S PPM	GE-S PPM	HF PPM	HG PPM	SAMPLE NUMBER
W211182	30	20L	9.2L	1.4	600	28	14L	1.4L	3.9	.050	W211182
W211183	28	20L	9.2L	1.4	630	26	14L	1.4L	3.6	.050	W211183
W211184	40	19L	8.9L	1.7	740	25	13L	1.3L	3.5	.060	W211184
W211185	36	20L	9.1L	1.5	450	28	14L	1.4L	4.3	.050	W211185
W211186	17	20L	9.2L	1.8	460	20	14L	1.4L	8.8	.060	W211186
W211187	51	17L	7.8L	2.1	390	23	12L	1.2L	3.4	.060	W211187
W211638	19	3.5L	1.6L	.48	70	7.5	2.4L	2.2	1.0	.058	W211638
W211639	30	2.8L	1.3L	.58	140	5.3	1.9L	.98	.8	.075	W211639
W213022	17	1.5L	.7L	.42	50	3.7	4.6	1.1	.7	.18	W213022
W213023	11	.8L	.4L	.14	20	2.0	.54L	1.7	.2	.075	W213023
W213024	25	3.7L	1.7	.60	130	7.8	2.5L	1.7	1.0	.049	W213024
W213944	20	.9L	.4L	.30	110	1.9	.62L	.82	.3	.12	W213944
W213945	31	2.9L	2.4	.74	150	6.8	2.0L	4.1	1.2	.090	W213945
W213946	12	.5L	.2L	.17	40	1.9	.57	5.9	.2	.050	W213946
W214792	6.3	.8L	.4L	.37	50	1.6	.53L	.20	.5	.030	W214792
W214793	3.2	2.0L	.9L	.14	70	7.4	1.4L	3.7	.1	.020	W214793
W215389	8.6	.8L	.7	.24	70	1.7	.58	.79	.3	.050	W215389
W215390	7.8	.6	.8	.33	90	1.3	1.2	.95	.3	.072	W215390
W215391	13	2.6L	1.2L	.48	120	6.0	1.7	2.0	.7	.065	W215391
W215392	14	1.1L	.5L	.26	70	2.6	.74L	2.9	.4	.050	W215392
W215404	9.1	.3L	.1L	.10	70	1.3	.21L	2.2	.1	.17	W215404
W215405	19	1.1L	.5L	.34	90	2.4	.75L	.45	.4	.13	W215405
W215406	27	2.2L	1.4	.55	170	6.1	2.7	1.8	.8	.10	W215406
W215407	19	2.0L	.9L	.51	170	4.5	1.4L	.23	.4	.12	W215407
W215409	17	1.8L	1.4	.35	320	4.0	1.2L	.40	1.2	.26	W215409

Table 4.--Major-, Minor-, and Trace-Element Concentrations of 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland District, Eastern Kentucky--Continued.

SAMPLE NUMBER	HO-S PPM	LA PPM	LI PPM	LU PPM	MN PPM	MO-S PPM	NB-S PPM	ND-S PPM	NI-S PPM	P PPM	SAMPLE NUMBER
W211182	6.3L	51	78	.5	120	.92L	21	39	43	44L	W211182
W211183	6.2L	50	85	.4	87	.92L	23	46	40	44	W211183
W211184	6.0L	59	66	.5	120	.89L	15	34	51	87	W211184
W211185	6.2L	66	100	.5	150	.91L	14	29L	31	220	W211185
W211186	6.2L	57	84	.6	92	.92L	20	29	21	44L	W211186
W211187	5.3L	69	86	.5	59	.78L	15	48	44	44	W211187
W211638	1.1L	14	43	.2	16	.16L	3.2	11	7.6	44L	W211638
W211639	.86L	15	34	.2	15	1.2	2.5	8.4	14	550	W211639
W213022	.45L	11	9.9	.1	14	2.6	2.1	9.9	13	340	W213022
W213023	.24L	3	5.0	.1L	4.7	4.7	.54	3.0	6.5	44L	W213023
W213024	1.1L	19	47	.2	9.1	1.5	3.9	20	13	830	W213024
W213944	.28L	6	2.5	.1	6.2	.74	.53	4.0	10	44	W213944
W213945	.90L	15	10	.3	16	1.2	4.0	16	31	100	W213945
W213946	.14L	3	1.1	.1	2.9	1.9	.82	2.3	7.8	44L	W213946
W214792	.24L	11	4.2	.1	3.9	.95	.81	5.3	5.6	87	W214792
W214793	.61L	3	3.9	.1	17	3.9	.79	8.8	31	44L	W214793
W215389	.26	6	4.0	.1	3.0	1.3	.83	4.7	10	44L	W215389
W215390	.29	6	4.4	.1	3.3	.75	.95	6.8	6.1	310	W215390
W215391	.79L	13	16	.1	7.2	2.8	.97	5.7	8.8	390	W215391
W215392	.33L	5	5.4	.1	3.7	1.6	.83	3.8	13	130	W215392
W215404	.10L	2	1.2	.1L	3.4	.71	.24	.6	3.9	52	W215404
W215405	.34L	6	7.0	.1	4.4	2.8	.75	6.0	12	44L	W215405
W215406	.68L	13	16	.2	6.8	1.5	1.1	14	13	100	W215406
W215407	.61L	11	13	.1	9.0	.99	.68	9.9	12	44	W215407
W215409	.54L	17	15	.2	5.8	1.2	2.0	14	5.4	1,000	W215409

Table 4.--Major-, Minor-, and Trace-Element Concentrations of 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland District, Eastern Kentucky--Continued.

SAMPLE NUMBER	PB PPM	PR-S PPM	RB PPM	SB PPM	SC PPM	SE PPM	SM PPM	SN-S PPM	SR-S PPM	TA PPM	SAMPLE NUMBER
W211182	34	63L	150	1.5	19	.9	5.6	1.8	210	1.4	W211182
W211183	28	62L	150	.90	16	2.0	5.1	5.9	260	1.4	W211183
W211184	29	60L	160	1.2	19	2.3	7.0	2.7	240	1.3	W211184
W211185	40	62L	180	1.7	21	4.0	6.5	3.2	220	1.7	W211185
W211186	56	62L	110	1.4	15	1.0	7.4	5.0	140	1.8	W211186
W211187	5.4	53L	150	1.5	18	4.3	8.1	4.7	210	1.3	W211187
W211638	8.7	11L	26	1.1	6.2	5.6	1.9	1.5	75	.43	W211638
W211639	9.9	8.6L	6	1.0	5.7	4.4	2.4	.19L	250	.37	W211639
W213022	4.6	4.6	9	.70	4.1	3.1	1.6	.10L	110	.17	W213022
W213023	1.8	2.7	5	1.0	1.4	2.4	.60	.05L	29	.05	W213023
W213024	8.8	11L	20	.30	6.4	4.9	2.5	.96	470	.34	W213024
W213944	3.2	2.8L	30L	.20	2.0	2.4	1.2	.26	18	.07	W213944
W213945	12	9.0L	12	1.0	11	4.5	2.7	.89	47	.33	W213945
W213946	2.5	1.4L	20L	.70	3.0	1.9	.60	.08	10	.07	W213946
W214792	1.8	2.4L	16	.50	2.9	6.0	1.6	.18	20	.16	W214792
W214793	6.0	6.1L	5L	.80	1.3	2.4	.50	.21	150	.04	W214793
W215389	1.8	2.4L	20L	.30	2.0	2.8	1.0	.20	40	.08	W215389
W215390	1.4	2.3L	20L	.20	2.2	4.0	1.4	.15	71	.05	W215390
W215391	3.7	7.9L	17	1.4	3.8	3.8	2.1	.17L	140	.17	W215391
W215392	3.9	3.3L	20L	.60	4.0	2.3	.90	.07L	41	.10	W215392
W215404	1.1	1.0L	20L	.50	1.4	.9	.40	.02L	5.9	.23	W215404
W215405	4.0	3.4L	30L	.80	2.4	3.3	1.4	.30	80	.13	W215405
W215406	12	6.8L	19	1.1	4.7	4.0	2.3	.42	120	.25	W215406
W215407	9.0	6.1L	23	.70	3.8	4.6	2.0	.19	110	.16	W215407
W215409	7.2	5.5	20L	.40	3.4	2.4	2.4	.88	190	.29	W215409

Table 4.--Major-, Minor-, and Trace-Element Concentrations of 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland District, Eastern Kentucky--Continued.

SAMPLE NUMBER	TB PPM	TH PPM	TL-S PPM	TM-S PPM	U PPM	V-S PPM	W PPM	Y-S PPM	YB PPM	ZN PPM	SAMPLE NUMBER
W211182	1.0	16	4.2L	4.2L	4.1	140	1.5	24	3.7	100	W211182
W211183	.98	14	4.2L	4.2L	4.9	140	1.4	25	3.2	92	W211183
W211184	1.1	16	4.1L	4.1L	5.5	120	1.5	21	3.7	120	W211184
W211185	.88	17	4.2L	4.2L	3.9	120	1.8	17	3.9	110	W211185
W211186	1.3	17	4.2L	4.2L	4.3	78	2.1	23	4.6	49	W211186
W211187	1.2	19	3.6L	3.6L	5.1	130	1.6	24	3.9	72	W211187
W211638	.31	4.2	.73L	.73L	1.2	27	1.0	6.5	1.2	8.6	W211638
W211639	.44	4.2	.58L	.58L	1.9	19	.80	4.3	1.2	5.8	W211639
W213022	.31	2.4	.30L	.30L	2.0	24	.80L	7.9	1.0	9.2	W213022
W213023	.09	1.0	.17L	.17L	1.1	10	.40	2.6	.3	18	W213023
W213024	.30	4.2	.78L	.78L	1.8	34	1.0L	8.5	1.3	13	W213024
W213944	.22	1.3	.19L	.19L	.86	8.2	.30	2.3	.7	18	W213944
W213945	.53	4.1	.61L	.61L	2.6	53	1.0	15	2.2	25	W213945
W213946	.18	.70	.10L	.10L	.78	5.7	.70	2.5	.5	7.1	W213946
W214792	.25	2.8	.16L	.16L	1.1	8.4	1.0L	2.6	.8	6.0	W214792
W214793	.12	.80	.41L	.41L	.27L	21	.70L	11	.5	19	W214793
W215389	.26	1.2	.17L	.17L	.33	9.4	.50L	5.0	.7	11	W215389
W215390	.30	1.2	.16L	.16L	.25L	8.5	.20	5.8	.8	3.7	W215390
W215391	.46	2.9	.53L	.53L	3.3	19	.40	3.2	1.2	21	W215391
W215392	.25	1.2	1.2	.23L	.58	8.3	.40	4.0	.9	13	W215392
W215404	.10	.30	.06L	.06L	.30L	3.5	.40	1.1	.4	2.7	W215404
W215405	.30	1.8	1.3	.23L	1.2	16	.60	4.9	.9	4.4	W215405
W215406	.43	3.8	.46L	.46L	1.8	27	1.1	7.5	1.5	11	W215406
W215407	.44	2.6	.41L	.41L	1.3	23	.60	5.5	1.1	9.9	W215407
W215409	.47	3.2	.37L	.37L	2.1	14	.60	8.0	1.3	7.5	W215409

Table 4.--Major-, Minor-, and Trace-Element Concentrations of 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland District, Eastern Kentucky--Continued.

SAMPLE NUMBER	ZR-S PPM
W211182	150
W211183	170
W211184	82
W211185	74
W211186	160
W211187	93
W211638	19
W211639	13
W213022	23
W213023	6.1
W213024	25
W213944	4.5
W213945	33
W213946	5.3
W214792	7.0
W214793	13
W215389	7.6
W215390	7.8
W215391	7.1
W215392	8.8
W215404	1.7
W215405	8.5
W215406	12
W215407	6.7
W215409	27

Table 4.--Major-, Minor-, and Trace-Element Concentrations of 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland District, Eastern Kentucky--Continued.

SAMPLE NUMBER	SI (PERCENT)	AL (PERCENT)	CA (PERCENT)	MG (PERCENT)	NA (PERCENT)	K (PERCENT)	FE (PERCENT)	TI (PERCENT)	AG-S PPM	AS PPM	SAMPLE NUMBER
W215416	.50	.45	.065	.011	.003	.017	.20	.017	.042	7.5	W215416
W215417	1.3	.96	.062	.029	.020	.12	.20	.055	.056	5.0	W215417
W215421	10	6.6	.11	.27	.040	1.3	1.3	.38	.040L	7.8	W215421
W215422	18	8.3	.42	.49	.055	1.9	4.9	.48	.068L	15	W215422
W215423	3.5	2.2	.12	.093	.019	.45	1.6	.10	.042	120	W215423
W215424	1.4	.99	.15	.036	.015	.064	.21	.046	.042	2.1	W215424
W215425	1.0	.75	.094	.026	.004	.088	.74	.033	.045	6.9	W215425
W215426	3.1	1.7	.059	.12	.050	.42	.53	.077	.038	5.2	W215426
W215427	1.4	.92	.072	.028	.021	.13	1.5	.051	.035	73	W215427
W215428	3.2	2.0	.44	.076	.081	.18	.58	.092	.014L	4.3	W215428
W215429	1.6	1.1	.071	.031	.036	.10	.73	.048	.044	13	W215429
W215430	.75	.56	.12	.025	.024	.11	1.2	.026	.031	77	W215430
W215431	3.2	1.9	.061	.062	.064	.33	1.3	.091	.048	100	W215431
W215432	3.9	1.9	.062	.034	.043	.29	.23	.15	.036	2.2	W215432
W215433	2.2	1.1	.053	.018	.026	.11	.69	.075	.045	24	W215433
W215434	2.0	1.3	.10	.024	.020	.14	.82	.071	.042	27	W215434
W215553	2.8	1.9	.058	.065	.033	.34	.69	.10	.067	17	W215553
W215554	3.3	2.2	.094	.091	.035	.40	.78	.12	.025	93	W215554
W215555	3.6	2.6	.088	.096	.043	.71	1.7	.11	.067	39	W215555
W215556	1.7	1.1	.048	.033	.016	.17	.31	.062	.023	11	W215556

Table 4.--Major-, Minor-, and Trace-Element Concentrations of 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland District, Eastern Kentucky--Continued.

SAMPLE NUMBER	B-S PPM	BA-S PPM	BE-S PPM	BR PPM	CD PPM	CE PPM	CL PPM	CO PPM	CR PPM	CS PPM	SAMPLE NUMBER
W215416	12	24	1	2.1	.02	18	270	8.8	9.2	.0B	W215416
W215417	23	29	1	1.4	.03	13	180	3.1	11	.4	W215417
W215421	40	190	4	1.3	.16	60	100L	8.8	62	4.5	W215421
W215422	51	310	3	1.2	.36	77	100L	15	70	6.0	W215422
W215423	34	140	1	2.9	.08	30	100L	3.8	25	1.6	W215423
W215424	38	190	4	2.0	.03	17	100L	3.9	20L	.2	W215424
W215425	17	73	2	2.2	.08	15	100L	9.8	14	.5	W215425
W215426	28	92	2	1.1	.05	22	170	8.5	16	1.9	W215426
W215427	23	48	2	2.6	.04	13	400	3.7	11	.5	W215427
W215428	24	76	2	.7	.07	20	130	9.2	18	1.3	W215428
W215429	23	69	1	1.0	.05	13	180	4.9	8.7	.8	W215429
W215430	13	64	1L	1.6	.03	8.0	150	3.6	6.2	.5	W215430
W215431	30	53	2	1.9	.05	18	390	5.1	14	1.5	W215431
W215432	21	73	2	1.2	.10	24	190	3.0	22	.7	W215432
W215433	22	57	3	1.4	.06	36	200	2.1	12	.7	W215433
W215434	14	37	1	1.2	.02	16	130	3.9	12	.5	W215434
W215553	23	74	4	1.7	.13	29	200	6.3	22	1.5	W215553
W215554	21	120	1	3.2	.11	25	200	4.7	24	2.3	W215554
W215555	27	190	3	4.8	.13	28	400	12	28	2.4	W215555
W215556	11	40	2	5.9	.05	13	600	3.9	13	1.0	W215556

Table 4.--Major-, Minor-, and Trace-Element Concentrations of 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland District, Eastern Kentucky--Continued.

SAMPLE NUMBER	CU PPM	DY-S PPM	ER-S PPM	EU PPM	F PPM	GA-S PPM	GD-S PPM	GE-S PPM	HF PPM	HG PPM	SAMPLE NUMBER
W215416	13	1.6	.8	.38	60	1.2	1.8	.36	.6L	.17	W215416
W215417	13	1.2L	1.0	.29	80	2.3	.84L	.38	.4	.22	W215417
W215421	44	8.8L	4.0L	1.0	390	16	6.0L	8.4	2.4	.14	W215421
W215422	53	15L	6.8L	1.5	660	18	10L	1.0L	3.4	.25	W215422
W215423	30	3.4L	1.6L	.58	220	7.0	2.3L	1.2	.9	.29	W215423
W215424	18	1.4L	2.3	.43	90	3.2	2.1	5.9	.7L	.27	W215424
W215425	14	1.1L	.5L	.40	40	2.9	1.5	3.1	.3	.24	W215425
W215426	26	2.6L	1.2L	.47	120	5.2	1.8L	1.2	.5	.16	W215426
W215427	14	1.7L	.8L	.28	70	3.6	1.1L	.90	.5	.24	W215427
W215428	19	3.1L	1.4L	.43	150	5.4	2.1L	2.5	.7	.18	W215428
W215429	25	1.6L	.7L	.41	90	3.4	1.1L	.34L	2.0L	.14	W215429
W215430	19	1.2L	.5L	.20	70	1.7	.80L	.32	.5L	.11	W215430
W215431	29	3.0L	1.4L	.40	40	6.0	2.0L	5.3	.8	.21	W215431
W215432	22	3.0L	1.4L	.45	180	4.8	2.1L	.37	1.1	.25	W215432
W215433	10	1.8L	1.4	.34	70	3.9	1.9	1.0	1.5	.23	W215433
W215434	19	1.9L	.9L	.32	100	3.3	1.3L	.77	.6	.22	W215434
W215553	27	2.8L	1.3L	.58	100	6.7	2.0	2.3	.7	.14	W215553
W215554	17	3.1L	1.4L	.50	180	7.1	2.1L	1.0	.8	.27	W215554
W215555	26	3.5L	1.8	.57	310	7.8	3.7	3.7	.8	.50	W215555
W215556	12	1.7L	.8L	.27	60	3.3	1.1L	.91	.4	.44	W215556

Table 4.--Major-, Minor-, and Trace-Element Concentrations of 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland District, Eastern Kentucky--Continued.

SAMPLE NUMBER	HO-S PPM	LA PPM	LI PPM	LU PPM	MN PPM	MO-S PPM	NB-S PPM	ND-S PPM	NI-S PPM	P PPM	SAMPLE NUMBER
W215416	.34	9	2.9	.1	2.2	1.8	.78	9.1	23	150	W215416
W215417	.38L	9	7.3	.1	3.0	1.3	1.4	8.4	11	100	W215417
W215421	2.7L	35	84	.5	26	.60	9.2	24	29	230	W215421
W215422	4.7L	46	110	.6	700	.68L	7.5	22L	28	790	W215422
W215423	1.1L	19	28	.3	9.0	3.3	2.5	10	12	310	W215423
W215424	.61	9	6.0	.2	15	1.3	1.7	13	12	100	W215424
W215425	.57	7	5.7	.1	33	3.0	1.5	8.3	21	220	W215425
W215426	.82L	12	17	.2	24	1.1	1.3	11	17	44	W215426
W215427	.51L	8	9.0	.1	13	.61	1.5	6.2	8.3	44L	W215427
W215428	.95L	11	17	.1	89	.67	1.9	4.4L	15	83	W215428
W215429	.50L	7	10	.1	11	2.9	.80	6.4	11	79	W215429
W215430	.36L	5	5.0	.1	8.5	2.0	.69	4.2	6.9	92	W215430
W215431	.92L	11	16	.1	20	1.5	1.6	4.4L	12	87	W215431
W215432	.94L	14	37	.2	5.2	.84	4.1	9.8	10	310	W215432
W215433	.59	20	4.0	.2	3.4	1.4	2.4	15	6.1	74	W215433
W215434	.58L	8	8.5	.1	4.9	1.9	1.3	3.8	8.5	170	W215434
W215553	.87L	17	14	.2	11	2.3	2.9	17	14	130	W215553
W215554	.95L	14	21	.1	7.7	1.5	2.4	6.9	10	260	W215554
W215555	1.1L	14	14	.2	8.5	2.4	1.9	13	19	310	W215555
W215556	.52L	7	6.5	.1	3.3	.59	1.3	3.6	6.6	87	W215556

Table 4.--Major-, Minor-, and Trace-Element Concentrations of 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland District, Eastern Kentucky--Continued.

SAMPLE NUMBER	PB PPM	PR-S PPM	RB PPM	SB PPM	SC PPM	SE PPM	SM PPM	SN-S PPM	SR-S PPM	TA PPM	SAMPLE NUMBER
W215416	2.9	2.9	40L	.50	1.5	2.7	1.8	.09	47	.20L	W215416
W215417	4.9	3.8L	40L	.70	2.1	4.0	1.3	.35	36	.10	W215417
W215421	26	27L	73	2.1	13	6.0	4.4	1.8	200	.88	W215421
W215422	38	47L	84	1.4	14	5.3	6.6	2.2	300	1.2	W215422
W215423	15	11L	60L	2.3	5.0	5.1	2.8	.23L	67	.30	W215423
W215424	6.4	4.4L	40L	.50	3.8	1.9	1.9	.17	100	.08	W215424
W215425	5.2	4.5	40L	.80	4.4	2.4	1.6	.08L	73	.30L	W215425
W215426	13	8.2L	24	1.1	4.1	4.2	2.2	.42	110	.25	W215426
W215427	3.6	5.1L	50L	1.1	2.3	3.5	1.3	.11L	58	.16	W215427
W215428	7.4	9.5L	50L	1.0	4.3	2.0	1.8	.82	65	.28	W215428
W215429	6.4	5.0L	40L	1.2	2.8	3.7	1.4	.11L	88	.09	W215429
W215430	2.0	3.6L	40L	1.1	1.2	2.4	.70	.08L	100	.20L	W215430
W215431	9.5	9.2L	50L	2.1	5.0	4.3	1.7	.76	57	.25	W215431
W215432	6.5	9.4L	50L	.50	5.6	3.6	1.9	1.5	170	.46	W215432
W215433	6.0	5.7L	50L	.60	3.5	2.3	3.0	.64	56	.25	W215433
W215434	5.9	5.8L	40L	.70	2.6	5.7	1.3	.64	44	.21	W215434
W215553	10	8.7L	14	.80	4.6	5.3	2.5	.19L	97	.23	W215553
W215554	7.6	9.5L	18	1.1	4.9	7.0	2.0	.42	220	.30	W215554
W215555	9.4	11L	31	1.7	6.0	4.2	2.3	.83	220	.28	W215555
W215556	4.0	5.2L	20L	.80	2.6	6.1	1.0	.11L	63	.15	W215556

Table 4.--Major-, Minor-, and Trace-Element Concentrations of 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland District, Eastern Kentucky--Continued.

SAMPLE NUMBER	TB PPM	TH PPM	TL-S PPM	TM-S PPM	U PPM	V-S PPM	W PPM	Y-S PPM	YB PPM	ZN PPM	SAMPLE NUMBER
W215416	.28	1.1	.12L	.12L	.28L	8.6	.80L	8.1	.8	7.3	W215416
W215417	.24	2.0	.26L	.26L	.77	15	.30	5.5	.9	7.8	W215417
W215421	.70	8.9	1.8L	1.8L	2.5	72	1.6	21	2.7	34	W215421
W215422	1.4	12	3.1L	3.1L	3.7	67	2.4	12	3.2	160	W215422
W215423	.51	4.3	.72L	.72L	3.0	30	.70	6.2	1.7	22	W215423
W215424	.41	1.2	.29L	.32	.29L	27	.60	13	1.3	6.4	W215424
W215425	.35	1.5	.24L	.24L	.64	24	2.0L	7.8	1.0	18	W215425
W215426	.36	3.4	.55L	.55L	1.6	28	.70	7.0	1.2	17	W215426
W215427	.23	1.8	.35L	.35L	.32L	11	.60	4.7	.9	7.5	W215427
W215428	.30	3.7	.64L	.64L	1.7	22	.50	7.4	1.1	15	W215428
W215429	.30	1.8	.34L	.34L	2.1	18	.65	4.5	.9	8.0	W215429
W215430	.15	1.3	3.2	.24L	1.0	9.0	.90L	2.3	.5	5.8	W215430
W215431	.47	3.4	.63L	.63L	1.7	22	.60	3.8	1.0	13	W215431
W215432	.40	3.9	.63L	.63L	1.1	22	2.0L	7.7	1.3	4.6	W215432
W215433	.61	5.2	3.1	.39L	2.3	12	.50	8.4	1.7	8.4	W215433
W215434	.32	2.4	2.2	.39L	.86	11	.90L	2.8	.8	12	W215434
W215553	.61	4.1	.59L	.59L	2.7	31	.70	9.7	1.3	29	W215553
W215554	.57	3.6	.64L	.64L	2.5	27	.70	4.2	1.1	12	W215554
W215555	.66	4.9	.74L	.74L	2.3	40	1.0	7.0	1.5	11	W215555
W215556	.19	1.7	2.1	.35L	.83	16	.90	3.3	.7	3.3	W215556

Table 4.--Major-, Minor-, and Trace-Element Concentrations of 56 Bituminous Coal Samples and Nine Rock Samples from the Upper Cumberland District, Eastern Kentucky--Continued.

SAMPLE NUMBER	ZR-S PPM
W215416	7.0
W215417	11
W215421	64
W215422	51
W215423	19
W215424	15
W215425	19
W215426	11
W215427	12
W215428	14
W215429	8.0
W215430	5.3
W215431	15
W215432	26
W215433	38
W215434	7.1
W215553	26
W215554	14
W215555	14
W215556	9.1

APPENDIX III:
PETROGRAPHIC ANALYSES

Maceral Composition and Vitrinite Reflectance
of Upper Cumberland River District Coals

VIT - Vitrinite
PVT - Pseudovitrinite
FUS - Fusinite
SFS - Semifusinite
MIC - Micrinite
MAC - Macrinite
EX - Exinite
RES - Resinite
Rmax - Vitrinite maximum reflectance (Oil immersion: 546 nm)
S/D - Standard deviation
Rmn - Vitrinite mean reflectance (Oil immersion: 546 nm)

USGS# W-	KCER#	VIT	PVT	FUS	SFS	MIC	MAC	EX	RES	Rmax	S/D	Rmn	S/D
207811	6008	70.9	9.8	6.0	2.8	3.6	.1	6.4	.4	.85	.04	.80	.05
207812	6001	44.4	32.6	4.5	2.9	7.0	.4	8.0	.2	.82	.09	.75	.09
207813	6004	58.0	18.5	9.9	2.3	4.9		6.1	.3	.83	.09	.76	.09
207814	6005	73.2	7.2	3.9	3.8	3.1	.1	8.7		.85	.04	.79	.06
207822	6023	58.6	3.2	13.6	6.7	9.6		8.4		.75	.04	.70	.05
207866	6018	65.3	4.3	12.3	4.2	5.6		7.7	.6	.93	.03	.88	.06
207897	6029	65.2	4.0	9.9	10.1	3.3	.4	6.5	.6	.83	.05	.77	.07
207899	6024	66.8	6.4	11.6	5.3	4.6		5.3		.88	.04	.82	.06
207900	6026	62.3	3.9	9.8	9.2	7.5	.5	5.9	.9	.79	.04	.73	.06
207901	6028	69.3	11.1	7.7	3.1	2.6	.1	5.7	.4	.76	.04	.71	.06
208056	6036	78.8	9.3	2.1	1.1	4.1		4.5	.1	.83	.04	.78	.05
208057	6037	77.9	8.8	2.4	.7	5.6		4.6		.76	.04	.72	.05
208058	6038	64.1	10.1	5.2	4.3	8.5		7.1	.7	.83	.04	.79	.05
208200	6019	81.3	5.8	4.2	1.2	3.2		4.4		.95	.04	.91	.05
208201	6027	62.4	12.1	4.9	4.8	7.5	.9	7.2	.2	.88	.05	.84	.05
208221	6011	64.3	4.3	8.3	9.4	6.2	.3	6.6	.6	.86	.05	.79	.07
208223	6006	55.0	5.0	9.8	10.9	7.7	.3	9.9	1.4	.78	.04	.71	.06
211638	6039	62.6	10.6	9.7	5.9	2.5		7.9	.8	.95	.04	.90	.06
211639	6040	52.7	6.6	10.1	9.6	8.1	.5	9.9	2.5	.78	.04	.74	.06
213022	6041	64.5	7.1	6.0	6.8	4.7	1.4	7.8	1.7	.88	.04	.84	.09
213023	6042	82.9	4.1	2.2	1.3	4.2	.2	3.9	1.2	.88	.05	.84	.06
213024	6043	52.0	4.5	8.4	5.6	18.1		9.8	1.6	.83	.05	.79	.06
213944	6044	67.6	14.4	4.7	3.3	3.6	.2	5.0	1.2	.86	.04	.80	.05
213945	6045	63.6	4.0	9.6	7.7	3.5	1.7	7.7	2.2	.92	.04	.88	.05
213946	6046	70.6	14.1	2.4	1.6	5.0	.1	5.2	1.0	.93	.05	.86	.07
214792	6047	59.8	9.8	6.3	4.0	8.6		10.5	1.0	.77	.05	.72	.07
214793	6048	64.0	16.8	2.1	1.3	5.9		9.0	.9	.82	.04	.76	.06
215389	6063	65.9	11.2	3.9	6.5	5.3		5.6	1.6	.90	.04	.84	.06
215390	6064	54.5	4.3	4.2	15.1	8.0	.2	9.2	4.5	.90	.04	.85	.06
215391	6065	74.4	8.4	2.4	3.6	4.3		5.8	1.1	.82	.04	.78	.05

USGS# W-	KCER#	VIT	PVT	FUS	SFS	MIC	MAC	EX	RES	Rmax	S/D	Rmn	S/D
215392	6066	65.5	11.8	4.4	3.3	1.7		11.3	1.8	.80	.04	.76	.05
215404	6049	67.7	17.9	3.0	3.1	3.0	.1	4.4	.8	.92	.04	.87	.06
215405	6050	67.2	11.1	4.8	4.7	2.7	.1	7.0	2.4	.85	.03	.80	.05
215406	6051	60.2	8.0	3.4	11.2	5.9	.3	8.0	3.0	.91	.03	.87	.06
215407	6052	59.8	16.3	4.5	5.9	4.2	.2	6.4	2.6	.90	.04	.85	.05
215409	6053	59.8	6.4	3.7	11.9	8.1	.3	8.3	1.5	.84	.04	.79	.06
215416	6054	61.1	15.2	4.2	3.7	7.1	.2	7.5	1.0	.85	.03	.81	.05
215417	6055	56.9	3.7	5.2	16.3	6.1	.7	8.0	3.1	.80	.04	.75	.05
215421	6056	64.7	12.3	5.3	6.0	1.3	.4	8.5	1.5	.78	.04	.74	.06
215422	6057	6.8	.2	3.8	7.2	62.5	.2	19.0	.3				
215423	6058	68.3	7.6	4.0	7.5	4.6	.2	5.9	1.9	.85	.04	.80	.05
215424	6059	67.6	10.8	3.2	4.9	4.2	.1	6.5	2.7	.84	.03	.79	.05
215425	6060	66.2	9.9	3.9	5.2	5.4	.1	7.6	1.7	.84	.03	.80	.05
215426	6061	54.9	13.3	4.6	11.7	4.7	.2	6.7	3.8	.89	.05	.83	.05
215427	6062	67.9	11.1	3.7	3.3	3.4	.3	9.1	1.2	.84	.04	.79	.06
215428	6067	61.6	7.4	8.7	5.6	8.2	.3	5.9	2.3	.77	.04	.74	.05
215429	6068	64.8	14.2	4.5	2.2	4.5		7.9	1.9	.84	.05	.79	.06
215430	6069	74.0	7.0	5.3	1.1	3.9	.2	6.7	1.8	.74	.04	.71	.04
215431	6070	66.4	6.6	6.6	5.0	6.6	.3	6.8	1.7	.79	.05	.74	.06
215432	6071	54.8	4.2	8.7	12.1	9.6	.9	8.6	1.1	.78	.05	.74	.05
215433	6072	62.6	6.5	6.4	7.1	8.0		7.8	1.6	.84	.04	.78	.05
215434	6073	50.5	4.1	9.9	14.6	8.5	.8	9.5	2.2	.82	.06	.77	.07
215553	6074	68.4	9.5	7.7	4.3	3.1	.1	6.5	.4	.92	.04	.87	.06
215554	6075	64.1	14.4	7.2	2.7	2.2		8.9	.7	.94	.04	.89	.05
215555	6076	74.5	12.4	1.1	1.5	2.6		5.9	2.0	.95	.04	.90	.06
215556	6077	59.4	13.3	6.2	8.4	3.2	.5	6.2	2.9	.94	.04	.89	.06

INDEX OF COAL SAMPLES BY COUNTY, SORTED BY QUADRANGLE

COUNTY	7 1/2' QUADRANGLE	COAL NAME USED ON GQ	USGS ID NUMBER
Bell	Balkan	Hance	W213022
Bell	Balkan	Mason	W213023
Bell	Balkan	Path Fork	W213024
Bell	Balkan	Hance	W213944
Bell	Balkan	Hance	W213945
Bell	Balkan	Hance	W213946
Bell	Fork Ridge	Buckeye Spring	W207866
Bell	Fork Ridge	Buckeye Spring	W207897
Bell	Fork Ridge	Buckeye Spring	W208221
Bell	Fork Ridge	Buckeye Spring	W208222
Bell	Fork Ridge	Hignite	W215389
Bell	Fork Ridge	Stray	W215390
Bell	Fork Ridge	Stray	W215391
Bell	Fork Ridge	Stray	W215392
Bell	Fork Ridge	Sterling	W215409
Bell	Fork Ridge	unmapped	W215421
Bell	Fork Ridge	unmapped	W215422
Bell	Fork Ridge	Stray	W215423
Bell	Fork Ridge	Stray	W215424
Bell	Fork Ridge	Stray	W215425
Bell	Kayjay	Lower Hignite	W207811
Bell	Kayjay	Lower Hignite	W207812
Bell	Kayjay	Poplar Lick	W207813
Bell	Kayjay	Poplar Lick	W207814
Bell	Kayjay	Hignite	W207822
Bell	Kayjay	Hignite	W207899
Bell	Kayjay	Red Springs	W207900
Bell	Kayjay	Red Springs	W208223
Bell	Kayjay	Mingo	W215404
Bell	Kayjay	Low Splint	W215416
Bell	Kayjay	Low Splint	W215417
Bell	Varilla	Hance	W207901
Bell	Varilla	Mason	W208056
Bell	Varilla	Mason	W208057
Bell	Varilla	Splitseam	W208058
Bell	Varilla	Hance	W208200
Bell	Varilla	Hance	W208201
Harlan	Evarts	Lower Path Fork	W211638
Harlan	Evarts	Path Fork	W211639
Harlan	Evarts	Limestone	W215428
Harlan	Evarts	Harlan	W215429
Harlan	Evarts	Kellioka	W215430

COUNTY	7 1/2' QUADRANGLE	COAL NAME USED ON GQ	USGS ID NUMBER
Harlan	Evarts	Creech	W215431
Harlan	Harlan	Smith	W215432
Harlan	Harlan	Wallins Creek	W215433
Harlan	Harlan	Morris	W215434
Harlan	Louellen	High Splint	W214792
Harlan	Louellen	Harlan	W215405
Harlan	Louellen	Darby	W215426
Harlan	Nolansburg	Harlan	W215406
Harlan	Nolansburg	Darby	W215407
Harlan	Nolansburg	Creech	W215427
Harlan	Pennington Gap	Morris	W214793
Letcher	Flat Gap	unmapped	W215553
Letcher	Flat Gap	unmapped	W215554
Letcher	Flat Gap	unmapped	W215555
Letcher	Flat Gap	Collier	W215556

INDEX OF COAL SAMPLES BY BED NAME, WITH SAMPLED INTERVAL AND SAMPLING REGIME

COAL NAME USED ON GQ	INTERVAL SAMPLED	SAMPLING REGIME	USGS ID NUMBER
Buckeye Spring	bottom bench	Holmes	W208222
Buckeye Spring	full thickness	Swanson & Huffman	W207866
Buckeye Spring	full thickness	Swanson & Huffman	W207897
Buckeye Spring	top bench	Holmes	W208221
Collier	full thickness	Holmes	W215556
Creech	full thickness	Holmes	W215427
Creech	full thickness	Holmes	W215431
Darby	full thickness	Holmes	W215407
Darby	full thickness	Holmes	W215426
Hance	top split	Holmes	W213022
Hance	3d split f bot	Holmes	W213944
Hance	2d split f bot	Holmes	W213945
Hance	bottom split	Holmes	W213946
Hance	bottom split	Swanson & Huffman	W207901
Hance	middle split	thick partings included	W208201
Hance	top split	Holmes	W208200
Harlan	full thickness	Holmes	W215405
Harlan	full thickness	Holmes	W215406
Harlan	full thickness	Holmes	W215429
High Splint	full thickness	Holmes	W214792
Hignite	bottom bench	Swanson & Huffman	W207822
Hignite	full thickness	thick partings included	W207899
Hignite	full thickness	Holmes	W215389
Kellioka	full thickness	Holmes	W215430
Limestone	full thickness	Holmes	W215428
Low Splint	bottom split	Holmes	W215416
Low Splint	top split	Holmes	W215417
Lower Hignite	full thickness	Swanson & Huffman	W207811
Lower Hignite	full thickness	Holmes	W207812
Lower Path Fork	full thickness	Holmes	W211638
Mason	full thickness	Swanson & Huffman	W208056
Mason	full thickness	Swanson & Huffman	W208057
Mason	full thickness	Holmes	W213023
Mingo	full thickness	Holmes	W215404
Morris	full thickness	Holmes	W214793
Morris	full thickness	Holmes	W215434
Path Fork	full thickness	Holmes	W211639
Path Fork	full thickness	Holmes	W213024
Poplar Lick	full thickness	Holmes	W207813
Poplar Lick	full thickness	Swanson & Huffman	W207814

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COAL NAME USED ON GQ	INTERVAL SAMPLED	SAMPLING REGIME	USGS ID NUMBER
Red Springs	full thickness	Swanson & Huffman	W207900
Red Springs	top bench	Holmes	W208223
Smith	full thickness	Holmes	W215432
Splitseam	full thickness	thick partings included	W208058
Sterling	full thickness	Holmes	W215409
Stray	1st split f bot	Holmes	W215390
Stray	2nd split f bot	Holmes	W215423
Stray	3rd split f bot	Holmes	W215392
Stray	4th split f bot	Holmes	W215424
Stray	5th split f bot	Holmes	W215425
Stray	6th split f bot	Holmes	W215391
Unmapped	1st split f bot	Holmes	W215554
Unmapped	2nd split f bot	Holmes	W215555
Unmapped	bottom split	Holmes	W215553
Unmapped	full thickness	Holmes	W215421
Unmapped	full thickness	Holmes	W215422
Wallins Creek	full thickness	Holmes	W215433