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James C. Currens

University of Kentucky, currens@uky.edu

Linda Jean Bragg

US Geological Survey

James C. Hower

University of Kentucky, james.hower@uky.edu

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KENTUCKY GEOLOGICAL SURVEY
UNIVERSITY OF KENTUCKY, LEXINGTON
Donald C. Haney
State Geologist and Director

**ANALYSIS OF COAL SAMPLES FROM THE
PRINCESS DISTRICT, KENTUCKY**

Boyd, Carter, Greenup, and Lawrence Counties
and Part of Lewis County



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ANALYSIS OF COAL SAMPLES FROM THE PRINCESS DISTRICT, KENTUCKY (Boyd, Carter, Greenup, and Lawrence Counties and Part of Lewis County)

James C. Currens¹, Linda Jean Bragg², and James C. Hower³

ABSTRACT

Chemical and petrographic data are presented for 42 samples of coal collected in the Princess 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, minor, and trace inorganic 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 Princess 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 Princess District, which includes Greenup, Boyd, Carter, and Lawrence Counties, and a small area in Lewis County.

Forty-two samples of coal were collected for chemical and petrographic analysis. Field-sampling data, proximate and ultimate analyses, heating value, forms of sulfur, free-swelling index, determinations of major, minor, 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 (1982) reported that 24 coal beds (Fig. 2) in the Princess District originally contained 3.4 billion tons of coal. Isopach maps (Brant, 1982) are published for the Princess No. 8, Princess No. 7, Princess No. 6, Princess No. 5 (upper zone), Princess No. 5 (lower zone), Princess No. 4, Princess No. 3, Hazard, Haddix, Hamlin, Fire Clay, Whitesburg, and Van Lear coal beds. When used together, these 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 Princess 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 dependent on the logistical constraints of the planned collection in eastern Kentucky of more than 600 individually sited coal samples distributed over a vertical section containing more than 30 major coal zones and an area including all or parts of 38 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 sampling sites was influenced by many factors. First, maintaining an even distribution of samples over a coal bed area, regardless of coal thickness, was important to delineate the regional characteristics of the coal bed. However, exposures of coal of mineable thickness were selected where possible to make the data economically relevant. Second, sites were chosen where many coals were exposed and easily accessible so that changes in 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 they might be mineable by themselves or in conjunction with overlying or underlying beds, or in areas of widespread occurrence.

The freshness of the exposed coal was also a major consideration in the choice of sampling sites. In general, a coal outcrop was not sampled if it had been exposed

¹Kentucky Geological Survey, Lexington, Kentucky.

²U.S. Geological Survey, Reston, Virginia.

³Kentucky Center for Energy Research Laboratory, Lexington, Kentucky.

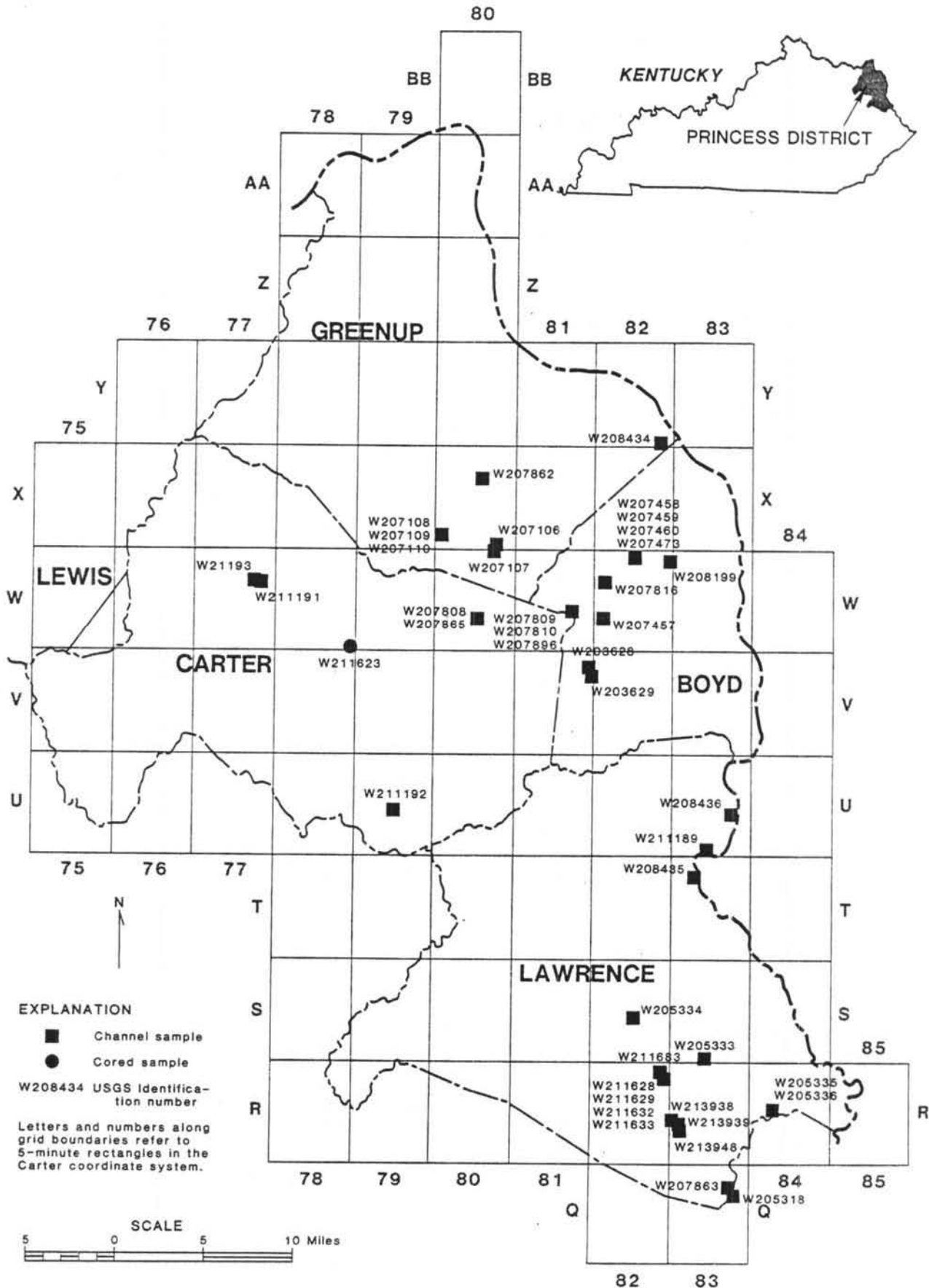
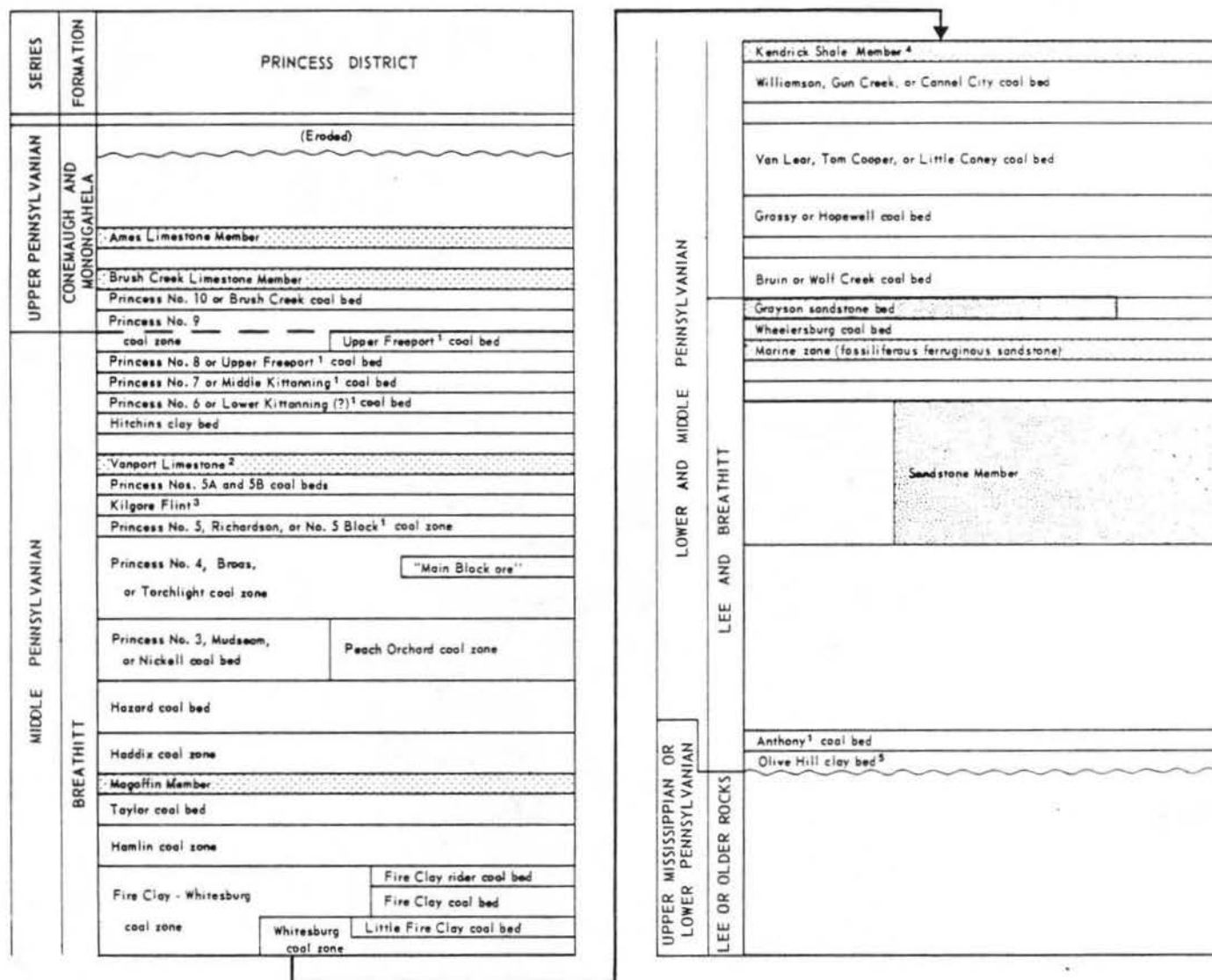


Figure 1. Locations of coal-sampling sites in the Princess District.



¹ Name used for coal bed in adjacent areas
² As used by Phalen (1912)
³ Of Cavaroc and Fern (1988)
⁴ Formerly Kendrick Shale of Jillaon (1920)
⁵ Of Orlder (1913)

Figure 2. Key stratigraphic units in the Princess District.

for more than 6 weeks. Exceptions were made if other opportunities to sample the coal bed were unlikely. A few samples from highly weathered roadcuts and abandoned surface mines were included because fresh exposures could not be found. The freshness of the exposures along highway construction projects ranged from a few months to several hours. Samples from surface mines and prospect openings were generally fresh, but a few samples were taken in areas where deeply weathered coals 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, and 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 dif-

ferences between coals at surface mines and roadcuts. Topographic maps were used to determine elevations in remote areas where other methods were not feasible.

Sampling Methods

Two sampling regimes were used. During the first 6 months 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 practice. These samples are described in Appendix I as having "thick partings included." The guidelines were also applied to core samples. The sampling guidelines for several samples collected before June 1979 are unknown.

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 inches in diameter.

Megascopic Description

The descriptive methods of Schopf (1960) were chosen as a basis for the megascopic descriptions, but modifica-

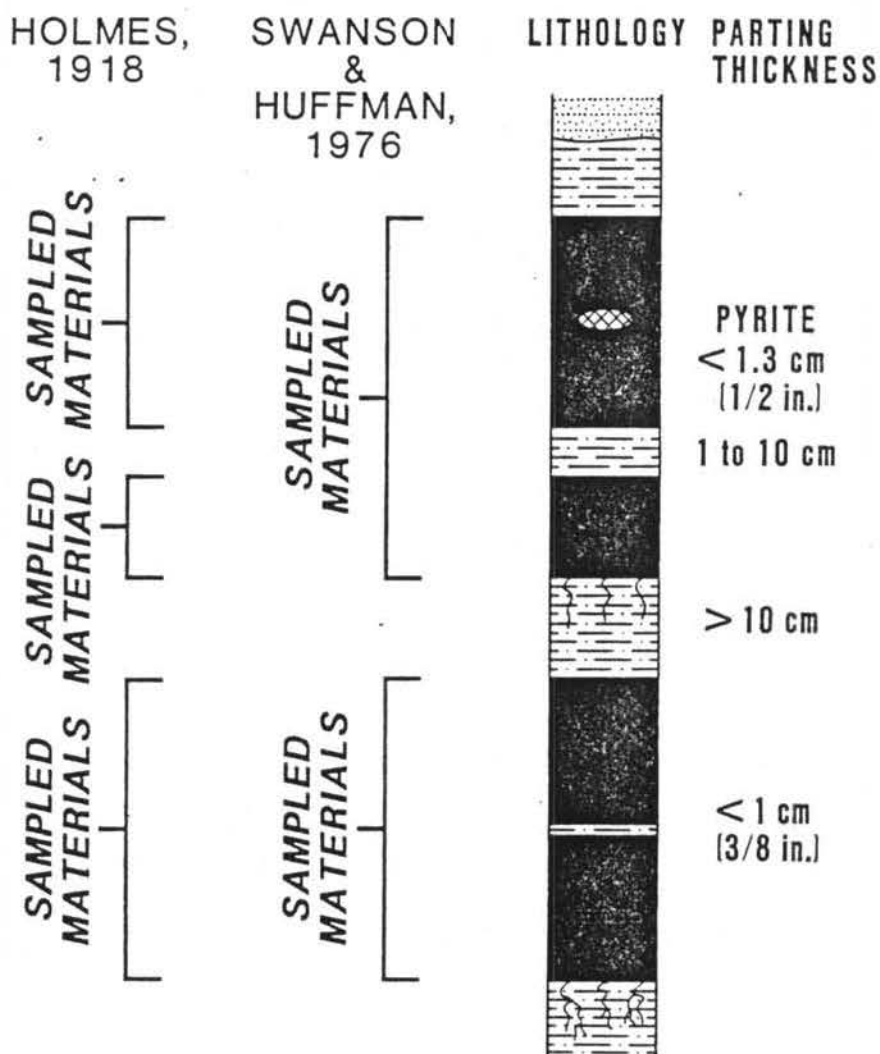


Figure 3. Diagrammatic column showing different criteria for excluding partings in the sampling methods of Holmes (1918) and Swanson and Huffman (1976).

tions 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 maximum size before splitting to minimize the possibility of contamination. Generally, three splits of each sample were prepared; 50 percent went to USGS, 25 percent went to IMMR for petrographic and other analyses, and the remainder is stored at the Kentucky Geological Survey's Well Sample and Core Library. Small samples were not split. The 0.5-inch (1.3 cm) samples were crushed to 0.1 in. (0.3 cm) by the USGS. The split for chemical analysis was crushed to minus 0.08 inch (0.177 mm). The pulverizer used for this 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 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. 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 (cleats) were seldom encountered during the sampling program. The dips of cleat surfaces were recorded if they were measurably different from vertical; this information is

available from the Kentucky Geological Survey (KGS). 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, many of the samples from the Princess 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 Princess 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 range between high volatile C and high volatile A bituminous coal, except sample KGS 033. This sample has an erroneous apparent rank of subbituminous A, as a result of its highly weathered condition. Vitrinite maximum reflectance suggests a high volatile A bituminous rank.

Chemical Analyses

Major, minor, and trace-element concentrations are reported for 42 coal samples from the Princess District. Table 2 (Appendix II) presents the results of analyses performed on coal ash, and Table 3 (Appendix II) contains the results of analyses for 23 trace elements in the whole coal. Table 4 (Appendix II) summarizes the results for all of the chemical species on a whole-coal basis. These data are reported as weight-percent or parts per million on both a coal-ash and a whole-coal basis. 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) were derived by wet chemical analysis, X-ray fluorescence, and optical emission spectrography.

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). A total of 65 elements was searched for,

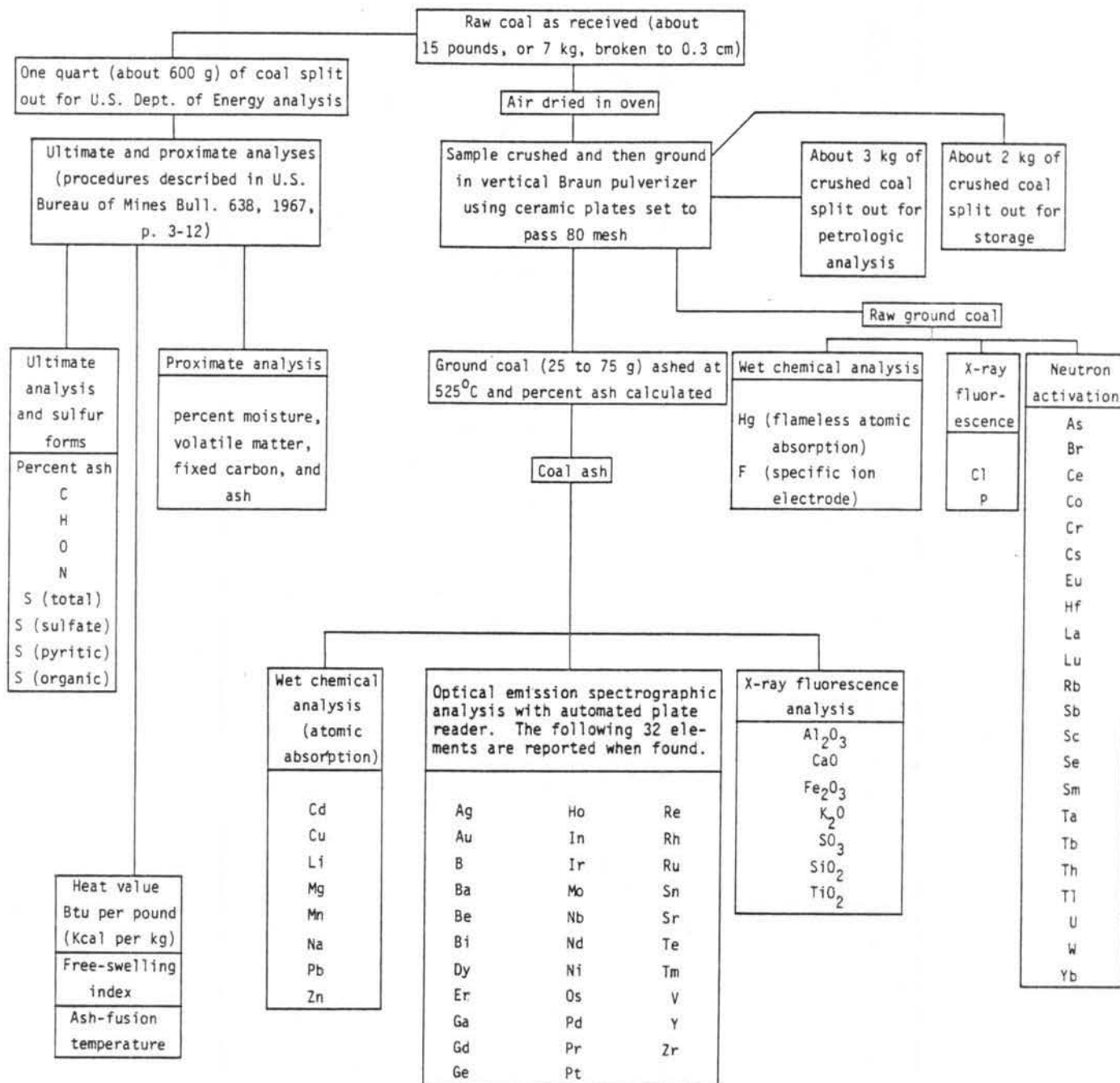


Figure 4. Flow diagram illustrating procedures used for coal-sample analysis.

and the following 10 elements were not found: Au, Ir, Os, Pd, Pt, Re, Rh, Ru, Te, and Tm.

Petrographic Analyses

Petrographic analyses were performed at the Kentucky Center for Energy Research Laboratory. This laboratory is currently 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) stan-

dards D-2797-72 (preparation), D-2796-81 and D-2799-72 (maceral analysis), and D-2798-79 (vitrinite reflectance). Results of the petrographic analyses 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 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 a 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 sampling 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: K89302 FIELD NO: KGS 001 U.S.G.S. NO: W203628
 SAMPLER: Casper AGENCY: KGS DATE: Jan/01/1978
 7.5' QUAD: Rush COUNTY: Boyd DISTRICT: Princess
 CARTER COORDINATE: SEC 1 ROW V TIER 81 700 FT FSL, 1700 FT FEL
 LATITUDE: 38 DEG 19 MIN 7 SEC LONGITUDE: 82 DEG 45 MIN 20 SEC
 ELEVATION (FT): 705.00, OF POINT AT unknown, USING altimeter

COMMENTARY:

REGIONAL COAL NAME: Princess No.7 GEO. MAP COAL NAME: Princess No.7
 REPORTED COAL NAME: Princess No.7 FORMATION OR MEMBER: Breathitt
 RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
 EXPOSURE: TYPE, surface mine; CONDITION, unknown
 SAMPLE CONDITION: unknown
 RECOVERY METHOD: channel SAMPLING REGIME: unknown
 SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): unknown
 THICKNESS (INCHES): SEAM HEIGHT 46.9, SAMPLE 46.9, COAL ONLY 46.9
 STRUCTURAL FEATURE: SEPARATION:
 STRIKE AZIMUTHS: SET 1 , SET 2 , SET 3

THE MEASURED SECTION IS REPORTED IN FEET

IN SAMPLE?	THICKNESS	STRATIGRAPHIC SECTION DESCRIPTION
N	5.91	Sandstone.
Y	3.90	Coal.
N		Clay, rooted.

COAL ANALYSIS REPORT

LABORATORY NO: K89302
LABORATORY: USBM

FIELD NO: KGS 001

U.S.G.S NO: W203628
REPORT DATE: Feb/15/1979

AIR DRIED LOSS: 4.90%

AS RECEIVED MOISTURE FREE MOISTURE/ASH FREE

PROXIMATE ANALYSIS:

TOTAL MOISTURE	7.80%		
VOLATILE MATTER	37.70%	40.89%	43.68%
FIXED CARBON	48.60%	52.71%	56.31%
ASH	5.90%	6.40%	

ULTIMATE ANALYSIS:

HYDROGEN	5.50%	5.02%	5.36%
CARBON	68.90%	74.73%	79.83%
NITROGEN	1.50%	1.63%	1.74%
TOTAL SULFUR	0.90%	0.98%	1.04%
OXYGEN	17.30%	11.24%	12.03%
ASH	5.90%	6.40%	

HEATING VALUE (BTU/LB):	12219	13253	14158
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SULFUR FORMS:

SULFATE	0.01%	0.01%	0.01%
PYRITIC	0.44%	0.48%	0.51%
ORGANIC	0.43%	0.47%	0.50%

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	01.5

ANALYSIS OF COAL SAMPLES FROM THE PRINCESS DISTRICT, KENTUCKY

COAL SAMPLING REPORT

LABORATORY NO: K89299 FIELD NO: KGS 004 U.S.G.S. NO: W203629
 SAMPLER: KGS AGENCY: KGS DATE: Jan/01/1978
 7.5' QUAD: Rush COUNTY: Boyd DISTRICT: Princess
 CARTER COORDINATE: SEC 10 ROW V TIER 81 5200 FT FSL, 600 FT FEL
 LATITUDE: 38 DEG 18 MIN 52 SEC LONGITUDE: 82 DEG 45 MIN 7 SEC
 ELEVATION (FT): 740.00, OF POINT AT unknown, USING altimeter
 COMMENTARY: On Fourmile Creek, RU-1.
 REGIONAL COAL NAME: Princess No.8 GEO. MAP COAL NAME: Princess No.8
 REPORTED COAL NAME: Princess No.8 FORMATION OR MEMBER: Breathitt
 RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
 EXPOSURE: TYPE, surface mine; CONDITION, unknown
 SAMPLE CONDITION: unknown
 RECOVERY METHOD: channel SAMPLING REGIME: unknown
 SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): unknown
 THICKNESS (INCHES): SEAM HEIGHT 54.3, SAMPLE 51.2, COAL ONLY 51.2
 STRUCTURAL FEATURE: SEPARATION:
 STRIKE AZIMUTHS: SET 1 , SET 2 , SET 3

THE MEASURED SECTION IS REPORTED IN FEET

IN SAMPLE?	THICKNESS	STRATIGRAPHIC SECTION DESCRIPTION
N	8.86	Shale, silty.
Y	0.26	Coal.
N	0.26	Shale.
Y	4.00	Coal.
N		Clay, rooted.

COAL ANALYSIS REPORT

LABORATORY NO: K89299
 LABORATORY: USBM

FIELD NO: KGS 004

U.S.G.S NO: W203629
 REPORT DATE: Feb/15/1979

AIR DRIED LOSS: 3.10%

AS RECEIVED MOISTURE FREE MOISTURE/ASH FREE

PROXIMATE ANALYSIS:

TOTAL MOISTURE	5.40%		
VOLATILE MATTER	33.40%	35.31%	43.15%
FIXED CARBON	44.00%	46.51%	56.85%
ASH	17.20%	18.18%	

ULTIMATE ANALYSIS:

HYDROGEN	4.90%	4.54%	5.55%
CARBON	60.30%	63.74%	77.91%
NITROGEN	1.20%	1.27%	1.55%
TOTAL SULFUR	2.30%	2.43%	2.97%
OXYGEN	14.10%	9.84%	12.02%
ASH	17.20%	18.18%	

HEATING VALUE (BTU/LB):	10762	11377	13905
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SULFUR FORMS:

SULFATE	0.01%	0.01%	0.01%
PYRITIC	1.72%	1.82%	2.22%
ORGANIC	0.54%	0.57%	0.70%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

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

FREE SWELLING INDEX	1.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	04.3

ANALYSIS OF COAL SAMPLES FROM THE PRINCESS DISTRICT, KENTUCKY

COAL SAMPLING REPORT

LABORATORY NO: K92636 FIELD NO: KGS 015 U.S.G.S. NO: W205318
 SAMPLER: Walker AGENCY: KGS DATE: Jan/01/1978
 7.5' QUAD: Milo COUNTY: Lawrence DISTRICT: Princess
 CARTER COORDINATE: SEC 10 ROW Q TIER 83 2500 FT FSL, 4600 FT FEL
 LATITUDE: 37 DEG 53 MIN 25 SEC LONGITUDE: 82 DEG 35 MIN 55 SEC
 ELEVATION (FT): 985.00, OF POINT AT unknown, USING altimeter
 COMMENTARY: Field ID M1-SM-1.
 REGIONAL COAL NAME: Broas zone GEO. MAP COAL NAME: Broas
 REPORTED COAL NAME: Broas, u rider FORMATION OR MEMBER: Breathitt
 RANGE SAMPLED (SPLITS, BENCHES, ETC.): upper rider
 EXPOSURE: TYPE, surface mine; CONDITION, unknown
 SAMPLE CONDITION: unknown
 RECOVERY METHOD: channel SAMPLING REGIME: unknown
 SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): unknown
 THICKNESS (INCHES): SEAM HEIGHT 44.1, SAMPLE 44.1, COAL ONLY 41.7
 STRUCTURAL FEATURE: SEPARATION:
 STRIKE AZIMUTHS: SET 1 , SET 2 , SET 3

THE MEASURED SECTION IS REPORTED IN FEET

IN SAMPLE?	THICKNESS	STRATIGRAPHIC SECTION	
			DESCRIPTION
N	1.74		Sandstone.
Y	0.20		Coal.
Y	1.74		Shale.
Y	0.43		Coal.
N			Underclay, rooted.

COAL ANALYSIS REPORT

LABORATORY NO: K92636
LABORATORY: USBM

FIELD NO: KGS 015

U.S.G.S NO: W205318
REPORT DATE: May/18/1979

AIR DRIED LOSS: 2.40%

AS RECEIVED MOISTURE FREE MOISTURE/ASH FREE

PROXIMATE ANALYSIS:

TOTAL MOISTURE	4.90%		
VOLATILE MATTER	36.00%	37.85%	41.10%
FIXED CARBON	51.60%	54.26%	58.91%
ASH	7.50%	7.89%	

ULTIMATE ANALYSIS:

HYDROGEN	5.50%	5.21%	5.65%
CARBON	70.70%	74.34%	80.71%
NITROGEN	1.60%	1.68%	1.83%
TOTAL SULFUR	0.60%	0.63%	0.68%
OXYGEN	14.10%	10.25%	11.13%
ASH	7.50%	7.89%	

HEATING VALUE (BTU/LB):	12665	13317	14458
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SULFUR FORMS:

SULFATE	0.01%	0.01%	0.01%
PYRITIC	0.07%	0.07%	0.08%
ORGANIC	0.50%	0.53%	0.57%

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	00.9

ANALYSIS OF COAL SAMPLES FROM THE PRINCESS DISTRICT, KENTUCKY

COAL SAMPLING REPORT

LABORATORY NO: K92902 FIELD NO: KGS 033 U.S.G.S. NO: W205333
 SAMPLER: KGS AGENCY: KGS DATE: Jan/01/1978
 7.5' QUAD: Adams COUNTY: Lawrence DISTRICT: Princess
 CARTER COORDINATE: SEC 23 ROW S TIER 83 1000 FT FSL, 4400 FT FEL
 LATITUDE: 38 DEG 0 MIN 10 SEC LONGITUDE: 82 DEG 37 MIN 53 SEC
 ELEVATION (FT): 782.00, OF POINT AT base of 33, USING altimeter
 COMMENTARY: Field note AD-SM-2.
 REGIONAL COAL NAME: Peach Orchard z GEO. MAP COAL NAME: Peach Orchard
 REPORTED COAL NAME: Peach Orchard FORMATION OR MEMBER: Breathitt
 RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
 EXPOSURE: TYPE, surface mine; CONDITION, abandoned
 SAMPLE CONDITION: highly oxidized
 RECOVERY METHOD: channel SAMPLING REGIME: unknown
 SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): unknown
 THICKNESS (INCHES): SEAM HEIGHT 18.9, SAMPLE 18.9, COAL ONLY 18.9
 STRUCTURAL FEATURE: SEPARATION:
 STRIKE AZIMUTHS: SET 1 , SET 2 , SET 3

THE MEASURED SECTION IS REPORTED IN FEET

IN SAMPLE?	THICKNESS	STRATIGRAPHIC SECTION DESCRIPTION
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IN SAMPLE?	THICKNESS	DESCRIPTION
N	16.01	Sandstone.
Y	1.58	Coal.
N	0.49	Underclay.

COAL ANALYSIS REPORT

LABORATORY NO: K92902
 LABORATORY: USBM

FIELD NO: KGS 033

U.S.G.S NO: W205333
 REPORT DATE: MAY/25/1979

AIR DRIED LOSS: 10.10%

AS RECEIVED MOISTURE FREE MOISTURE/ASH FREE

PROXIMATE ANALYSIS:

TOTAL MOISTURE	15.90%		
VOLATILE MATTER	32.00%	38.05%	41.67%
FIXED CARBON	44.80%	53.27%	58.33%
ASH	7.30%	8.68%	

ULTIMATE ANALYSIS:

HYDROGEN	5.90%	4.90%	5.37%
CARBON	59.40%	70.63%	77.34%
NITROGEN	1.40%	1.66%	1.82%
TOTAL SULFUR	0.70%	0.83%	0.91%
OXYGEN	25.40%	13.30%	14.56%
ASH	7.30%	8.68%	

HEATING VALUE (BTU/LB):	10145	12063	13210
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SULFUR FORMS:

SULFATE	0.01%	0.01%	0.01%
PYRITIC	0.29%	0.34%	0.38%
ORGANIC	0.40%	0.48%	0.52%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2255 deg F
SOFTENING TEMP.	2360 deg F
FLUID TEMP.	2455 deg F

FREE SWELLING INDEX

POUNDS OF SULFUR DIOXIDE PER MILLION BTU 01.4

COAL ANALYSIS REPORT

LABORATORY NO: K92903
LABORATORY: USBM

FIELD NO: KGS 034

U.S.G.S NO: W205334
REPORT DATE: MAY/25/1979

AIR DRIED LOSS: 4.00%

AS RECEIVED MOISTURE FREE MOISTURE/ASH FREE

PROXIMATE ANALYSIS:

TOTAL MOISTURE	7.40%		
VOLATILE MATTER	32.50%	35.10%	39.83%
FIXED CARBON	49.10%	53.02%	60.17%
ASH	11.00%	11.88%	

ULTIMATE ANALYSIS:

HYDROGEN	5.50%	5.05%	5.73%
CARBON	67.10%	72.46%	82.23%
NITROGEN	1.40%	1.51%	1.72%
TOTAL SULFUR	0.70%	0.76%	0.86%
OXYGEN	14.30%	8.34%	9.46%
ASH	11.00%	11.88%	

HEATING VALUE (BTU/LB):	11724	12661	14368
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SULFUR FORMS:

SULFATE	0.01%	0.01%	0.01%
PYRITIC	0.22%	0.24%	0.27%
ORGANIC	0.49%	0.53%	0.60%

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	01.2

ANALYSIS OF COAL SAMPLES FROM THE PRINCESS DISTRICT, KENTUCKY

COAL SAMPLING REPORT

LABORATORY NO: K92904 FIELD NO: KGS 35-8 U.S.G.S. NO: W205335
 SAMPLER: Walker AGENCY: KGS DATE: Jan/01/1978
 7.5' QUAD: Milo COUNTY: Lawrence DISTRICT: Princess
 CARTER COORDINATE: SEC 14 ROW R TIER 84 4400 FT FSL, 2900 FT FEL
 LATITUDE: 37 DEG 57 MIN 44 SEC LONGITUDE: 82 DEG 33 MIN 35 SEC
 ELEVATION (FT): 807.00, OF POINT AT base of 35-8, USING altimeter

COMMENTARY:

REGIONAL COAL NAME: Peach Orchard z GEO. MAP COAL NAME: Peach Orchard
 REPORTED COAL NAME: Peach Orch, 1 b FORMATION OR MEMBER: Breathitt
 RANGE SAMPLED (SPLITS, BENCHES, ETC.): bottom bench
 EXPOSURE: TYPE, surface mine; CONDITION, unknown
 SAMPLE CONDITION: unknown
 RECOVERY METHOD: unknown SAMPLING REGIME: unknown
 SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): unknown
 THICKNESS (INCHES): SEAM HEIGHT 7.9, SAMPLE 7.9, COAL ONLY 7.9
 STRUCTURAL FEATURE: SEPARATION:
 STRIKE AZIMUTHS: SET 1 , SET 2 , SET 3

THE MEASURED SECTION IS REPORTED IN FEET

		STRATIGRAPHIC SECTION	
IN SAMPLE?	THICKNESS	DESCRIPTION	
		Horizon KGS 35-13.	
N	0.33	Shale.	
Y	0.66	Coal.	
N	0.23	Underclay.	

COAL ANALYSIS REPORT

LABORATORY NO: K92904
LABORATORY: USBM

FIELD NO: KGS 35-8

U.S.G.S NO: W205335
REPORT DATE: May/25/1979

AIR DRIED LOSS: 2.20%

AS RECEIVED MOISTURE FREE MOISTURE/ASH FREE

PROXIMATE ANALYSIS:

TOTAL MOISTURE	5.20%		
VOLATILE MATTER	34.60%	36.50%	41.99%
FIXED CARBON	47.80%	50.42%	58.01%
ASH	12.40%	13.08%	

ULTIMATE ANALYSIS:

HYDROGEN	5.40%	5.08%	5.85%
CARBON	67.00%	70.68%	81.31%
NITROGEN	1.50%	1.58%	1.82%
TOTAL SULFUR	1.80%	1.90%	2.18%
OXYGEN	11.80%	7.68%	8.84%
ASH	12.40%	13.08%	

HEATING VALUE (BTU/LB):	11952	12608	14505
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SULFUR FORMS:

SULFATE	0.03%	0.03%	0.04%
PYRITIC	1.29%	1.36%	1.57%
ORGANIC	0.47%	0.50%	0.57%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

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

FREE SWELLING INDEX	1.5
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	03.0

ANALYSIS OF COAL SAMPLES FROM THE PRINCESS DISTRICT, KENTUCKY

COAL SAMPLING REPORT

LABORATORY NO: K92905 FIELD NO: KGS 35-13 U.S.G.S. NO: W205336
 SAMPLER: Walker AGENCY: KGS DATE: Jan/01/1978
 7.5' QUAD: Milo COUNTY: Lawrence DISTRICT: Princess
 CARTER COORDINATE: SEC 14 ROW R TIER 84 4400 FT FSL, 2900 FT FEL
 LATITUDE: 37 DEG 57 MIN 44 SEC LONGITUDE: 82 DEG 33 MIN 35 SEC
 ELEVATION (FT): 808.00, OF POINT AT base of 35-13, USING altimeter

COMMENTARY:

REGIONAL COAL NAME: Peach Orchard z GEO. MAP COAL NAME: Peach Orchard
 REPORTED COAL NAME: Peach Orch, u b FORMATION OR MEMBER: Breathitt
 RANGE SAMPLED (SPLITS, BENCHES, ETC.): top bench
 EXPOSURE: TYPE, surface mine; CONDITION, unknown
 SAMPLE CONDITION: unknown
 RECOVERY METHOD: unknown SAMPLING REGIME: unknown
 SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): unknown
 THICKNESS (INCHES): SEAM HEIGHT 13.0, SAMPLE 13.0, COAL ONLY 13.0
 STRUCTURAL FEATURE: SEPARATION:
 STRIKE AZIMUTHS: SET 1 , SET 2 , SET 3

THE MEASURED SECTION IS REPORTED IN FEET

IN SAMPLE?	THICKNESS	STRATIGRAPHIC SECTION
		DESCRIPTION
N	49.21	Sandstone and claystone, rooted.
N	0.43	Coal.
N	0.49	Shale.
N	0.26	Coal.
N	0.43	Shale.
Y	1.08	Coal.
See KGS 35-8 for underlying strata.		

COAL ANALYSIS REPORT

LABORATORY NO: K92905
 LABORATORY: USBM

FIELD NO: KGS 35-13

U.S.G.S NO: W205336
 REPORT DATE: May/30/1979

AIR DRIED LOSS: 2.80%

AS RECEIVED MOISTURE FREE MOISTURE/ASH FREE

PROXIMATE ANALYSIS:

TOTAL MOISTURE	6.20%		
VOLATILE MATTER	35.60%	37.95%	40.96%
FIXED CARBON	51.30%	54.69%	59.03%
ASH	6.90%	7.36%	

ULTIMATE ANALYSIS:

HYDROGEN	5.80%	5.44%	5.88%
CARBON	70.70%	75.37%	81.35%
NITROGEN	1.60%	1.71%	1.84%
TOTAL SULFUR	0.70%	0.75%	0.81%
OXYGEN	14.40%	9.37%	10.12%
ASH	6.90%	7.36%	

HEATING VALUE (BTU/LB):	12696	13535	14609
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SULFUR FORMS:

SULFATE	0.02%	0.02%	0.02%
PYRITIC	0.51%	0.54%	0.59%
ORGANIC	0.16%	0.17%	0.18%

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	01.1

ANALYSIS OF COAL SAMPLES FROM THE PRINCESS DISTRICT, KENTUCKY

COAL SAMPLING REPORT

LABORATORY NO: K96801 FIELD NO: KGS 064 U.S.G.S. NO: W207106
 SAMPLER: Currens AGENCY: KGS DATE: Jun/26/1979
 7.5' QUAD: Argillite COUNTY: Greenup DISTRICT: Princess
 CARTER COORDINATE: SEC 22 ROW X TIER 80 1000 FT FSL, 500 FT FEL
 LATITUDE: 38 DEG 25 MIN 10 SEC LONGITUDE: 82 DEG 51 MIN 7 SEC
 ELEVATION (FT): 731.00, OF POINT AT base of 064, USING topo

COMMENTARY:

REGIONAL COAL NAME: Peach Orchard z GEO. MAP COAL NAME: Princess No. 3
 REPORTED COAL NAME: Princess No. 3 FORMATION OR MEMBER: Breathitt
 RANGE SAMPLED (SPLITS, BENCHES, ETC.): top split
 EXPOSURE: TYPE, surface mine; 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 13.0, SAMPLE 13.0, COAL ONLY 11.8
 STRUCTURAL FEATURE: cleat, SEPARATION:
 STRIKE AZIMUTHS: SET 1 20, SET 2 280, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

IN SAMPLE?	THICKNESS	STRATIGRAPHIC SECTION	
			DESCRIPTION
N	0.98	Shale, medium-gray, sideritic, bioturbated.	
Y	0.08	Clarain, with vitrain.	
Y	0.13	Durain.	
Y	0.12	Clarain, with very abundant vitrain.	
Y	0.36	Durain, with scattered clarain.	
Y	0.10	Shale, carbonaceous, pyritic.	
Y	0.30	Durain, with clarain.	
		See KGS 65 for underlying strata.	

COAL ANALYSIS REPORT

LABORATORY NO: K96801
 LABORATORY: USBM

FIELD NO: KGS 064

U.S.G.S NO: W207106
 REPORT DATE: Nov/15/1979

AIR DRIED LOSS: 2.50%

AS RECEIVED MOISTURE FREE MOISTURE/ASH FREE

PROXIMATE ANALYSIS:

TOTAL MOISTURE	4.70%		
VOLATILE MATTER	37.00%	38.82%	50.14%
FIXED CARBON	36.80%	38.61%	49.86%
ASH	21.50%	22.56	

ULTIMATE ANALYSIS:

HYDROGEN	4.80%	4.48%	5.79%
CARBON	57.10%	59.92%	77.37%
NITROGEN	1.10%	1.15%	1.49%
TOTAL SULFUR	3.50%	3.67%	4.74%
OXYGEN	12.00%	8.22%	10.61%
ASH	21.50%	22.56%	

HEATING VALUE (BTU/LB):	10401	10914	14093
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SULFUR FORMS:

SULFATE	0.02%	0.02%	0.03%
PYRITIC	2.79%	2.93%	3.78%
ORGANIC	0.73%	0.77%	0.99%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2340 deg F
SOFTENING TEMP.	2470 deg F
FLUID TEMP.	2550 deg F

FREE SWELLING INDEX	2.5
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	06.7

ANALYSIS OF COAL SAMPLES FROM THE PRINCESS DISTRICT, KENTUCKY

COAL SAMPLING REPORT

LABORATORY NO: K96802 FIELD NO: KGS 065 U.S.G.S. NO: W207107
 SAMPLER: Currens AGENCY: KGS DATE: Jun/26/1979
 7.5' QUAD: Argillite COUNTY: Greenup DISTRICT: Princess
 CARTER COORDINATE: SEC 22 ROW X TIER 80 0 FT FSL, 600 FT FEL
 LATITUDE: 38 DEG 25 MIN 1 SEC LONGITUDE: 82 DEG 51 MIN 8 SEC
 ELEVATION (FT): 720.00, OF POINT AT base of 065, USING topo

COMMENTARY:

REGIONAL COAL NAME: Peach Orchard z GEO. MAP COAL NAME: Princess No.3
 REPORTED COAL NAME: Princess No.3 FORMATION OR MEMBER: Breathitt
 RANGE SAMPLED (SPLITS, BENCHES, ETC.): bottom split
 EXPOSURE: TYPE, surface mine; CONDITION, active
 SAMPLE CONDITION: croppy
 RECOVERY METHOD: channel SAMPLING REGIME: Holmes
 SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
 THICKNESS (INCHES): SEAM HEIGHT 19.7, SAMPLE 19.7, COAL ONLY 19.7
 STRUCTURAL FEATURE: SEPARATION:
 STRIKE AZIMUTHS: SET 1 , SET 2 , SET 3

THE MEASURED SECTION IS REPORTED IN FEET

IN SAMPLE?	THICKNESS	STRATIGRAPHIC SECTION DESCRIPTION
		Horizon KGS 64.
N	9.84	Sandstone, medium-gray, rooted, carbonaceous, micaceous; clayey at top; poor exposure.
Y	1.18	Clarain, with vitrain.
Y	0.46	Clarain, with abundant vitrain.
N		Claystone, rooted.

COAL ANALYSIS REPORT

LABORATORY NO: K96802
 LABORATORY: USBM

FIELD NO: KGS 065

U.S.G.S NO: W207107
 REPORT DATE: Nov/21/1979

AIR DRIED LOSS: 6.20%

AS RECEIVED MOISTURE FREE MOISTURE/ASH FREE

PROXIMATE ANALYSIS:

TOTAL MOISTURE	10.10%		
VOLATILE MATTER	36.00%	40.04%	42.06%
FIXED CARBON	49.60%	55.17%	57.94%
ASH	4.30%	4.78%	

ULTIMATE ANALYSIS:

HYDROGEN	5.50%	4.86%	5.10%
CARBON	65.60%	72.97%	76.63%
NITROGEN	1.50%	1.67%	1.75%
TOTAL SULFUR	0.80%	0.89%	0.93%
OXYGEN	22.40%	14.83%	15.59%
ASH	4.30%	4.78%	

HEATING VALUE (BTU/LB):	12084	13441	14117
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SULFUR FORMS:

SULFATE	0.01%	0.01%	0.01%
PYRITIC	0.35%	0.39%	0.41%
ORGANIC	0.45%	0.50%	0.53%

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	01.3

COAL SAMPLING REPORT

LABORATORY NO: K96803 FIELD NO: KGS 066 U.S.G.S. NO: W207108
 SAMPLER: Currens AGENCY: KGS DATE: Jun/26/1979
 7.5' QUAD: Oldtown COUNTY: Greenup DISTRICT: Princess
 CARTER COORDINATE: SEC 25 ROW X TIER 80 4900 FT FSL, 2900 FT FEL
 LATITUDE: 38 DEG 25 MIN 48 SEC LONGITUDE: 82 DEG 54 MIN 37 SEC
 ELEVATION (FT): 849.00, OF POINT AT base of 66, USING topo
 COMMENTARY: Also see KGS 67 and KGS 68.
 REGIONAL COAL NAME: Broas zone GEO. MAP COAL NAME: Princess No.4
 REPORTED COAL NAME: Princess No.4 FORMATION OR MEMBER: Breathitt
 RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
 EXPOSURE: TYPE, surface mine; CONDITION, active
 SAMPLE CONDITION: slightly weathered
 RECOVERY METHOD: channel SAMPLING REGIME: Holmes
 SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
 THICKNESS (INCHES): SEAM HEIGHT 8.7, SAMPLE 8.7, COAL ONLY 8.7
 STRUCTURAL FEATURE: cleat, SEPARATION:
 STRIKE AZIMUTHS: SET 1 110, SET 2 170, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

IN SAMPLE?	THICKNESS	STRATIGRAPHIC SECTION DESCRIPTION
N		Sandstone, light-gray, fine-grained, argillaceous, ripple-bedded.
Y	0.26	Durain, with vitrain.
Y	0.36	Clarain.
Y	0.10	Durain, with vitrain. See KGS 67 for underlying strata.

COAL ANALYSIS REPORT

LABORATORY NO: K96803
 LABORATORY: USBM

FIELD NO: KGS 066

U.S.G.S NO: W207108
 REPORT DATE: Nov/15/1979

AIR DRIED LOSS: 3.20%

AS RECEIVED MOISTURE FREE MOISTURE/ASH FREE

PROXIMATE ANALYSIS:

TOTAL MOISTURE	5.90%		
VOLATILE MATTER	39.20%	41.66%	48.27%
FIXED CARBON	42.00%	44.63%	51.72%
ASH	12.90%	13.71%	

ULTIMATE ANALYSIS:

HYDROGEN	5.30%	4.93%	5.71%
CARBON	62.30%	66.21%	76.72%
NITROGEN	1.30%	1.38%	1.60%
TOTAL SULFUR	5.50%	5.84%	6.77%
OXYGEN	12.80%	7.93%	9.20%
ASH	12.90%	13.71%	

HEATING VALUE (BTU/LB):	11572	12298	14251
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SULFUR FORMS:

SULFATE	0.14%	0.15%	0.17%
PYRITIC	4.85%	5.15%	5.97%
ORGANIC	0.47%	0.50%	0.58%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	1910 deg F
SOFTENING TEMP.	2000 deg F
FLUID TEMP.	2100 deg F

FREE SWELLING INDEX	1.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	09.5

COAL SAMPLING REPORT

LABORATORY NO: K96804 FIELD NO: KGS 067 U.S.G.S. NO: W207109
 SAMPLER: Currens AGENCY: KGS DATE: Jun/26/1979
 7.5' QUAD: Oldtown COUNTY: Greenup DISTRICT: Princess
 CARTER COORDINATE: SEC 25 ROW X TIER 80 4900 FT FSL, 2900 FT FEL
 LATITUDE: 38 DEG 25 MIN 48 SEC LONGITUDE: 82 DEG 54 MIN 37 SEC
 ELEVATION (FT): 837.00, OF POINT AT base of 67, USING topo

COMMENTARY:

REGIONAL COAL NAME: Peach Orchard z GEO. MAP COAL NAME: Princess No.3
 REPORTED COAL NAME: Princess No.3 FORMATION OR MEMBER: Breathitt
 RANGE SAMPLED (SPLITS, BENCHES, ETC.): top split
 EXPOSURE: TYPE, surface mine; 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 14.2, SAMPLE 14.2, COAL ONLY 11.0
 STRUCTURAL FEATURE: cleat, SEPARATION:
 STRIKE AZIMUTHS: SET 1 250, SET 2 340, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

IN SAMPLE?	THICKNESS	STRATIGRAPHIC SECTION DESCRIPTION
N	11.52	Horizon KGS 66. Sandstone, argillaceous, micaceous, feldspathic, bioturbated (very rooted at top).
Y	0.23	Durain.
Y	0.20	Vitrain, with clarain; pyrite parting, 3 mm thick.
Y	0.26	Shale, very carbonaceous.
Y	0.49	Clarain, with abundant vitrain. See KGS 68 for underlying strata.

COAL ANALYSIS REPORT

LABORATORY NO: K96804
 LABORATORY: USBM

FIELD NO: KGS 067

U.S.G.S NO: W207109
 REPORT DATE: Nov/15/1979

AIR DRIED LOSS: 3.70%

AS RECEIVED MOISTURE FREE MOISTURE/ASH FREE

PROXIMATE ANALYSIS:

TOTAL MOISTURE	6.00%		
VOLATILE MATTER	31.90%	33.94%	46.70%
FIXED CARBON	36.40%	38.72%	53.29%
ASH	25.70%	27.34%	

ULTIMATE ANALYSIS:

HYDROGEN	4.40%	3.97%	5.46%
CARBON	52.10%	55.42%	76.28%
NITROGEN	1.00%	1.06%	1.46%
TOTAL SULFUR	4.70%	5.00%	6.88%
OXYGEN	12.20%	7.21%	9.92%
ASH	25.70%	27.34%	

HEATING VALUE (BTU/LB):	09445	10048	13828
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SULFUR FORMS:

SULFATE	0.35%	0.37%	0.51%
PYRITIC	3.99%	4.24%	5.84%
ORGANIC	0.33%	0.35%	0.48%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2360 deg F
SOFTENING TEMP.	2440 deg F
FLUID TEMP.	2550 deg F

FREE SWELLING INDEX	1.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	10.0

ANALYSIS OF COAL SAMPLES FROM THE PRINCESS DISTRICT, KENTUCKY

COAL SAMPLING REPORT

LABORATORY NO: K96805 FIELD NO: KGS 068 U.S.G.S. NO: W207110
 SAMPLER: Currens AGENCY: KGS DATE: Jun/26/1979
 7.5' QUAD: Oldtown COUNTY: Greenup DISTRICT: Princess
 CARTER COORDINATE: SEC 25 ROW X TIER 80 4900 FT FSL, 2900 FT FEL
 LATITUDE: 38 DEG 25 MIN 48 SEC LONGITUDE: 82 DEG 54 MIN 37 SEC
 ELEVATION (FT): 830.00, OF POINT AT base of 068, USING topo

COMMENTARY:

REGIONAL COAL NAME: Peach Orchard z GEO. MAP COAL NAME: Princess No.3
 REPORTED COAL NAME: Princess No.3 FORMATION OR MEMBER: Breathitt
 RANGE SAMPLED (SPLITS, BENCHES, ETC.): bottom split
 EXPOSURE: TYPE, surface mine; 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 15.0, SAMPLE 15.0, COAL ONLY 15.0
 STRUCTURAL FEATURE: cleat, SEPARATION:
 STRIKE AZIMUTHS: SET 1 20, SET 2 280, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

IN SAMPLE?	THICKNESS	STRATIGRAPHIC SECTION	
			DESCRIPTION
		Horizon KGS 67.	
N	1.25	Shale, clayey, rooted, carbonaceous.	
N	4.92	Shale and sandstone, interbedded, medium-gray, rooted; very carbonaceous at base.	
Y	0.49	Durain, with scattered vitrain.	
Y	0.72	Clarain.	
Y	0.03	Clarain, with abundant vitrain.	
N		Siltstone, medium-gray, rooted.	

COAL ANALYSIS REPORT

LABORATORY NO: K96805
 LABORATORY: USBM

FIELD NO: KGS 068

U.S.G.S NO: W207110
 REPORT DATE: Nov/15/1979

AIR DRIED LOSS: 5.00%

AS RECEIVED MOISTURE FREE MOISTURE/ASH FREE

PROXIMATE ANALYSIS:

TOTAL MOISTURE	7.80%		
VOLATILE MATTER	36.00%	39.05%	43.16%
FIXED CARBON	47.40%	51.41%	56.83%
ASH	8.80%	9.54%	

ULTIMATE ANALYSIS:

HYDROGEN	4.90%	4.37%	4.83%
CARBON	67.10%	72.78%	80.45%
NITROGEN	1.40%	1.52%	1.68%
TOTAL SULFUR	0.90%	0.98%	1.08%
OXYGEN	17.00%	10.81%	11.96%
ASH	8.80%	9.54%	

HEATING VALUE (BTU/LB):	11988	13002	14374
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SULFUR FORMS:

SULFATE	0.01%	0.01%	0.01%
PYRITIC	0.38%	0.41%	0.46%
ORGANIC	0.49%	0.53%	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	01.5

COAL SAMPLING REPORT

LABORATORY NO: K96940 FIELD NO: KGS 150 U.S.G.S. NO: W207457
 SAMPLER: Anderson & Wonderly AGENCY: KGS DATE: Jul/18/1979
 7.5' QUAD: Boltsfork COUNTY: Boyd DISTRICT: Princess
 CARTER COORDINATE: SEC 16 ROW W TIER 82 4700 FT FSL, 2450 FT FEL
 LATITUDE: 38 DEG 21 MIN 47 SEC LONGITUDE: 82 DEG 44 MIN 31 SEC
 ELEVATION (FT): 700.00, OF POINT AT base of 150, USING unknown

COMMENTARY:

REGIONAL COAL NAME: Princess No.7 GEO. MAP COAL NAME: Princess No.7
 REPORTED COAL NAME: Princess No.7 FORMATION OR MEMBER: Breathitt
 RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
 EXPOSURE: TYPE, surface mine; CONDITION, several years old
 SAMPLE CONDITION: weathered
 RECOVERY METHOD: channel SAMPLING REGIME: TK partings included
 SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): unknown
 THICKNESS (INCHES): SEAM HEIGHT 46.5, SAMPLE 46.5, COAL ONLY 36.6
 STRUCTURAL FEATURE: SEPARATION:
 STRIKE AZIMUTHS: SET 1 , SET 2 , SET 3

THE MEASURED SECTION IS REPORTED IN FEET

IN SAMPLE?	THICKNESS	STRATIGRAPHIC SECTION
		DESCRIPTION
N	7.87	Shale, light-gray, weathers to greenish-orange, limy; siderite stains, very fine-grained; bottom 4 inches black carbonaceous shale (bone).
Y	0.36	Shale, hard, carbonaceous, dense.
Y	0.98	Vitrain, with some fusain bands.
Y	0.39	Clay, very dark-gray.
Y	1.80	Vitrain, with very fine fusain stringers; fusain more abundant than above.
Y	0.07	Clay, very dark-gray.
Y	0.13	Fusain, 50 percent; vitrain, 50 percent.
Y	0.13	Vitrain, laminated clarain, and vitrain, 25 percent.

COAL ANALYSIS REPORT

LABORATORY NO: K96940
LABORATORY: USBM

FIELD NO: KGS 150

U.S.G.S NO: W207457
REPORT DATE: Nov/23/1979

AIR DRIED LOSS: 5.60%

AS RECEIVED MOISTURE FREE MOISTURE/ASH FREE

PROXIMATE ANALYSIS:

TOTAL MOISTURE	9.10%		
VOLATILE MATTER	31.80%	34.98%	42.57%
FIXED CARBON	42.90%	47.19%	57.43%
ASH	16.20%	17.82%	

ULTIMATE ANALYSIS:

HYDROGEN	4.60%	3.94%	4.79%
CARBON	57.60%	63.37%	77.11%
NITROGEN	1.20%	1.32%	1.61%
TOTAL SULFUR	0.70%	0.77%	0.94%
OXYGEN	19.70%	12.78%	15.55%
ASH	16.20%	17.82%	

HEATING VALUE (BTU/LB):	10094	11104	13513
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SULFUR FORMS:

SULFATE	0.01%	0.01%	0.01%
PYRITIC	0.38%	0.42%	0.51%
ORGANIC	0.33%	0.36%	0.44%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

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

FREE SWELLING INDEX	1.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	01.4

ANALYSIS OF COAL SAMPLES FROM THE PRINCESS DISTRICT, KENTUCKY

COAL SAMPLING REPORT

LABORATORY NO: K96941 FIELD NO: KGS 151 U.S.G.S. NO: W207458
 SAMPLER: Anderson & Wonderly AGENCY: KGS DATE: Jul/18/1979
 7.5' QUAD: Ashland COUNTY: Boyd DISTRICT: Princess
 CARTER COORDINATE: SEC 3 ROW W TIER 82 4800 FT FSL, 2700 FT FEL
 LATITUDE: 38 DEG 24 MIN 47 SEC LONGITUDE: 82 DEG 42 MIN 34 SEC
 ELEVATION (FT): 604.00, OF POINT AT base of 151, USING topo

COMMENTARY:

REGIONAL COAL NAME: Richardson zone GEO. MAP COAL NAME: Princess No.5
 REPORTED COAL NAME: Princess No.5 FORMATION OR MEMBER: Breathitt
 RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
 EXPOSURE: TYPE, roadcut; CONDITION, several years old
 SAMPLE CONDITION: weathered
 RECOVERY METHOD: channel SAMPLING REGIME: TK partings included
 SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): unknown
 THICKNESS (INCHES): SEAM HEIGHT 20.5, SAMPLE 20.5, COAL ONLY 16.1
 STRUCTURAL FEATURE: SEPARATION:
 STRIKE AZIMUTHS: SET 1 , SET 2 , SET 3

THE MEASURED SECTION IS REPORTED IN FEET

IN SAMPLE?	THICKNESS	STRATIGRAPHIC SECTION	
			DESCRIPTION
		Horizon KGS 152.	
N	2.00		Underclay, medium- to light-gray, rooted, semi-plastic; becomes more carbonaceous near top.
N	22.97		Siltstone, interbedded with ironstone.
Y	0.20		Vitrain.
Y	0.26		Sulfide lenses; grade laterally into coal.
Y	0.26		Vitrain, 90 percent; clarain, 10 percent.
Y	0.59		Clarain, with abundant vitrain and fusain stringers.
Y	0.10		Clay, light-gray, semi-plastic.
Y	0.30		Durain, 80 percent; fusain, 20 percent.
N	5.91		Shale, medium- to dark-gray.

COAL ANALYSIS REPORT

LABORATORY NO: K96941
 LABORATORY: USBM

FIELD NO: KGS 151

U.S.G.S NO: W207458
 REPORT DATE: Nov/23/1979

AIR DRIED LOSS: 2.90%

AS RECEIVED MOISTURE FREE MOISTURE/ASH FREE

PROXIMATE ANALYSIS:

TOTAL MOISTURE	5.20%		
VOLATILE MATTER	28.60%	30.17%	43.53%
FIXED CARBON	37.10%	39.14%	56.47%
ASH	29.10%	30.70%	

ULTIMATE ANALYSIS:

HYDROGEN	4.20%	3.82%	5.51%
CARBON	51.50%	54.33%	78.39%
NITROGEN	1.10%	1.16%	1.67%
TOTAL SULFUR	2.60%	2.74%	3.96%
OXYGEN	11.50%	7.25%	10.47%
ASH	29.10%	30.70%	

HEATING VALUE (BTU/LB):	09267	09776	14105
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SULFUR FORMS:

SULFATE	0.04%	0.04%	0.06%
PYRITIC	2.00%	2.11%	3.04%
ORGANIC	0.57%	0.60%	0.87%

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	05.6

COAL SAMPLING REPORT

LABORATORY NO: K96942 FIELD NO: KGS 153 U.S.G.S. NO: W207459
 SAMPLER: Anderson & Wonderly AGENCY: KGS DATE: Jul/19/1979
 7.5' QUAD: Ashland COUNTY: Boyd DISTRICT: Princess
 CARTER COORDINATE: SEC 3 ROW W TIER 82 4800 FT FSL, 2700 FT FEL
 LATITUDE: 38 DEG 24 MIN 47 SEC LONGITUDE: 82 DEG 42 MIN 34 SEC
 ELEVATION (FT): 666.50, OF POINT AT base of 153, USING topo

COMMENTARY:

REGIONAL COAL NAME: Princess No.6 GEO. MAP COAL NAME: Princess No.6
 REPORTED COAL NAME: Princess No.6 FORMATION OR MEMBER: Breathitt
 RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
 EXPOSURE: TYPE, roadcut; CONDITION, several years old
 SAMPLE CONDITION: weathered
 RECOVERY METHOD: channel SAMPLING REGIME: TK partings included
 SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): unknown
 THICKNESS (INCHES): SEAM HEIGHT 17.7, SAMPLE 17.7, COAL ONLY 8.3
 STRUCTURAL FEATURE: SEPARATION:
 STRIKE AZIMUTHS: SET 1 , SET 2 , SET 3

THE MEASURED SECTION IS REPORTED IN FEET

IN SAMPLE?	THICKNESS	STRATIGRAPHIC SECTION	
			DESCRIPTION
		Horizon KGS 154.	
N	2.99		Claystone, abundant roots, iron stained.
N	10.50		Shale, weathers greenish, iron stained.
Y	0.39		Clarain, with more abundant vitrain than below, several dominant fusain bands (50 percent).
Y	0.79		Claystone, brown, dense, breaks conchoidally.
Y	0.30		Clarain, with few vitrain bands.
			See KGS 152 for underlying strata.

COAL ANALYSIS REPORT

LABORATORY NO: K96942
LABORATORY: USBM

FIELD NO: KGS 153

U.S.G.S NO: W207459
REPORT DATE: Nov/23/1979

AIR DRIED LOSS: 2.80%

AS RECEIVED MOISTURE FREE MOISTURE/ASH FREE

PROXIMATE ANALYSIS:

TOTAL MOISTURE	5.20%		
VOLATILE MATTER	33.70%	35.55%	47.40%
FIXED CARBON	37.40%	39.45%	52.60%
ASH	23.70%	25.00%	

ULTIMATE ANALYSIS:

HYDROGEN	4.50%	4.13%	5.51%
CARBON	52.20%	55.07%	73.42%
NITROGEN	1.10%	1.16%	1.55%
TOTAL SULFUR	5.10%	5.38%	7.17%
OXYGEN	13.40%	9.26%	12.35%
ASH	23.70%	25.00%	

HEATING VALUE (BTU/LB):	09576	10102	13469
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SULFUR FORMS:

SULFATE	0.28%	0.30%	0.40%
PYRITIC	3.72%	3.92%	5.23%
ORGANIC	1.13%	1.19%	1.59%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2380 deg F
SOFTENING TEMP.	2470 deg F
FLUID TEMP.	2560 deg F

FREE SWELLING INDEX

POUNDS OF SULFUR DIOXIDE PER MILLION BTU 10.7

ANALYSIS OF COAL SAMPLES FROM THE PRINCESS DISTRICT, KENTUCKY

COAL SAMPLING REPORT

LABORATORY NO: K96943 FIELD NO: KGS 154 U.S.G.S. NO: W207460
 SAMPLER: Anderson & Wonderly AGENCY: KGS DATE: Jul/19/1979
 7.5' QUAD: Ashland COUNTY: Boyd DISTRICT: Princess
 CARTER COORDINATE: SEC 3 ROW W TIER 82 4800 FT FSL, 2700 FT FEL
 LATITUDE: 38 DEG 24 MIN 47 SEC LONGITUDE: 82 DEG 42 MIN 34 SEC
 ELEVATION (FT): 678.50, OF POINT AT base of 154, USING topo

COMMENTARY:

REGIONAL COAL NAME: Princess No.7 GEO. MAP COAL NAME: Princess No.7
 REPORTED COAL NAME: Princess No.7 FORMATION OR MEMBER: Breathitt
 RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
 EXPOSURE: TYPE, roadcut; CONDITION, several years old
 SAMPLE CONDITION: weathered
 RECOVERY METHOD: channel SAMPLING REGIME: Holmes
 SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): unknown
 THICKNESS (INCHES): SEAM HEIGHT 13.8, SAMPLE 13.8, COAL ONLY 13.8
 STRUCTURAL FEATURE: SEPARATION:
 STRIKE AZIMUTHS: SET 1 , SET 2 , SET 3

THE MEASURED SECTION IS REPORTED IN FEET

IN SAMPLE?	THICKNESS	STRATIGRAPHIC SECTION	
			DESCRIPTION
		Covered.	
N	4.00	Shale, dark-gray, weathers light-gray, very fissile, carbonaceous.	
Y	1.15	Vitrain, with 10 percent durain, several fusain stringers; thin pyrite band near top. See KGS 153 for underlying strata.	

COAL ANALYSIS REPORT

LABORATORY NO: K96943
LABORATORY: USBM

FIELD NO: KGS 154

U.S.G.S NO: W207460
REPORT DATE: Nov/30/1979

AIR DRIED LOSS: 3.00%

AS RECEIVED MOISTURE FREE MOISTURE/ASH FREE

PROXIMATE ANALYSIS:

TOTAL MOISTURE	5.70%		
VOLATILE MATTER	37.30%	39.55%	46.16%
FIXED CARBON	43.50%	46.13%	53.84%
ASH	13.50%	14.32%	

ULTIMATE ANALYSIS:

HYDROGEN	4.60%	4.20%	4.90%
CARBON	61.20%	64.90%	75.74%
NITROGEN	1.30%	1.38%	1.61%
TOTAL SULFUR	7.10%	7.53%	8.79%
OXYGEN	12.40%	7.67%	8.96%
ASH	13.50%	14.32%	

HEATING VALUE (BTU/LB):	11313	11996	14001
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SULFUR FORMS:

SULFATE	0.11%	0.12%	0.14%
PYRITIC	5.86%	6.21%	7.25%
ORGANIC	1.08%	1.15%	1.34%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2110 deg F
SOFTENING TEMP.	2180 deg F
FLUID TEMP.	2260 deg F

FREE SWELLING INDEX	3.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	12.6

COAL SAMPLING REPORT

LABORATORY NO: K96955 FIELD NO: KGS 152 U.S.G.S. NO: W207473
 SAMPLER: Anderson & Wonderly AGENCY: KGS DATE: Jul/19/1979
 7.5' QUAD: Ashland COUNTY: Boyd DISTRICT: Princess
 CARTER COORDINATE: SEC 3 ROW W TIER 82 4800 FT FSL, 2700 FT FEL
 LATITUDE: 38 DEG 24 MIN 47 SEC LONGITUDE: 82 DEG 42 MIN 34 SEC
 ELEVATION (FT): 635.00, OF POINT AT base of 152, USING topo

COMMENTARY:

REGIONAL COAL NAME: uncorrelated GEO. MAP COAL NAME: unnamed
 REPORTED COAL NAME: unnamed FORMATION OR MEMBER: Breathitt
 RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
 EXPOSURE: TYPE, roadcut; CONDITION, several years old
 SAMPLE CONDITION: weathered
 RECOVERY METHOD: channel SAMPLING REGIME: Swanson & Huffman
 SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): unknown
 THICKNESS (INCHES): SEAM HEIGHT 13.0, SAMPLE 13.0, COAL ONLY 11.4
 STRUCTURAL FEATURE: SEPARATION:
 STRIKE AZIMUTHS: SET 1 , SET 2 , SET 3

THE MEASURED SECTION IS REPORTED IN FEET

IN SAMPLE?	THICKNESS	STRATIGRAPHIC SECTION DESCRIPTION
		Horizon KGS 153.
N	0.36	Underclay, dark-gray, rooted.
N	8.96	Claystone, light-gray, weathers buff.
N	1.68	Sandstone, light-green; thin beds, poor sorting; large quartz crystals, limonitic; beds 5 inches to 1 foot; burrowed, friable, micaceous.
N	13.71	Shale, medium- to light-gray, weathers olive-green, very fine-grained; becomes siltier and more micaceous toward top.
Y	0.66	Vitrain; 1/4 inch bands prominent; with clarain, fusain partings.
Y	0.13	Clay, dark-gray.
Y	0.30	Coal, extremely dense durain, with few vitrain stringers, hard.
		See KGS 151 for underlying strata.

COAL ANALYSIS REPORT

LABORATORY NO: K96955
LABORATORY: USBM

FIELD NO: KGS 152

U.S.G.S NO: W207473
REPORT DATE: Nov/30/1979

AIR DRIED LOSS: 3.10%

AS RECEIVED MOISTURE FREE MOISTURE/ASH FREE

PROXIMATE ANALYSIS:

TOTAL MOISTURE	5.10%		
VOLATILE MATTER	22.70%	23.92%	44.86%
FIXED CARBON	27.90%	29.40%	55.14%
ASH	44.30%	46.68%	

ULTIMATE ANALYSIS:

HYDROGEN	3.50%	3.09%	5.79%
CARBON	37.50%	39.51%	74.11%
NITROGEN	0.70%	0.74%	1.38%
TOTAL SULFUR	1.40%	1.48%	2.77%
OXYGEN	12.60%	8.50%	15.95%
ASH	44.30%	46.68%	

HEATING VALUE (BTU/LB):	06382	06725	12613
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SULFUR FORMS:

SULFATE	0.05%	0.05%	0.10%
PYRITIC	0.86%	0.91%	1.70%
ORGANIC	0.54%	0.57%	1.07%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

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

FREE SWELLING INDEX

POUNDS OF SULFUR DIOXIDE PER MILLION BTU 04.4

COAL SAMPLING REPORT

LABORATORY NO: K97571 FIELD NO: KGS 155 U.S.G.S. NO: W207808
 SAMPLER: Wonderly AGENCY: KGS DATE: Jul/31/1979
 7.5' QUAD: Rush COUNTY: CARTER DISTRICT: Princess
 CARTER COORDINATE: SEC 18 ROW W TIER 80 3200 FT FSL, 900 FT FEL
 LATITUDE: 38 DEG 21 MIN 32 SEC LONGITUDE: 82 DEG 52 MIN 24 SEC
 ELEVATION (FT): 715.00, OF POINT AT base of 155, USING topo

COMMENTARY:

REGIONAL COAL NAME: Peach Orchard z GEO. MAP COAL NAME: Princess No.3
 REPORTED COAL NAME: Princess No.3 FORMATION OR MEMBER: Breathitt
 RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
 EXPOSURE: TYPE, roadcut; CONDITION, several years old
 SAMPLE CONDITION: weathered
 RECOVERY METHOD: channel SAMPLING REGIME: Holmes
 SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): unknown
 THICKNESS (INCHES): SEAM HEIGHT 14.2, SAMPLE 14.2, COAL ONLY 13.8
 STRUCTURAL FEATURE: cleat, SEPARATION:
 STRIKE AZIMUTHS: SET 1 32, SET 2 282, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

IN SAMPLE?	THICKNESS	STRATIGRAPHIC SECTION	
			DESCRIPTION
N	2.00		Shale, dark-gray to black, highly carbonaceous; scattered nodules of siderite or ironstone.
Y	0.56		Coal, 80 percent vitrain, 15 percent clarain, 5 percent durain, very hard.
Y	0.03		Shale, carbonaceous, coaly.
Y	0.59		Coal, 80 percent vitrain, 15 percent clarain, 5 percent durain, very hard.
N	0.30		Shale, dark-gray to black, highly carbonaceous (bone).
N	0.20		Clay, light-gray, weathers orange, very plastic (underclay), rooted.
N	9.94		Shale, medium- to light-gray, highly weathered.

COAL ANALYSIS REPORT

LABORATORY NO: K97571
 LABORATORY: USBM

FIELD NO: KGS 155

U.S.G.S NO: W207808
 REPORT DATE: Dec/10/1979

AIR DRIED LOSS: 4.00%

AS RECEIVED MOISTURE FREE MOISTURE/ASH FREE

PROXIMATE ANALYSIS:

TOTAL MOISTURE	7.00%		
VOLATILE MATTER	41.40%	44.52%	46.41%
FIXED CARBON	47.80%	51.40%	53.59%
ASH	3.80%	4.09%	

ULTIMATE ANALYSIS:

HYDROGEN	5.90%	5.50%	5.74%
CARBON	70.60%	75.92%	79.15%
NITROGEN	1.60%	1.72%	1.79%
TOTAL SULFUR	2.00%	2.15%	2.24%
OXYGEN	16.10%	10.62%	11.08%
ASH	3.80%	4.09%	

HEATING VALUE (BTU/LB):	12923	13896	14488
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SULFUR FORMS:

SULFATE	0.01%	0.01%	0.01%
PYRITIC	1.27%	1.37%	1.42%
ORGANIC	0.78%	0.84%	0.87%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	1990 deg F
SOFTENING TEMP.	2080 deg F
FLUID TEMP.	2170 deg F

FREE SWELLING INDEX	4.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	03.1

COAL SAMPLING REPORT

LABORATORY NO: K97572 FIELD NO: KGS 158 U.S.G.S. NO: W207809
 SAMPLER: Wonderly AGENCY: KGS DATE: Aug/02/1979
 7.5' QUAD: Rush COUNTY: Boyd DISTRICT: Princess
 CARTER COORDINATE: SEC 12 ROW W TIER 81 100 FT FSL, 2300 FT FEL
 LATITUDE: 38 DEG 22 MIN 9 SEC LONGITUDE: 82 DEG 47 MIN 29 SEC
 ELEVATION (FT): 652.50, OF POINT AT base of 158, USING altimeter

COMMENTARY:

REGIONAL COAL NAME: Richardson zone GEO. MAP COAL NAME: Princess No.5
 REPORTED COAL NAME: Princess No.5 FORMATION OR MEMBER: Breathitt
 RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
 EXPOSURE: TYPE, roadcut; CONDITION, several years old
 SAMPLE CONDITION: weathered
 RECOVERY METHOD: channel SAMPLING REGIME: Swanson & Huffman
 SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): unknown
 THICKNESS (INCHES): SEAM HEIGHT 42.1, SAMPLE 10.8, COAL ONLY 10.8
 STRUCTURAL FEATURE: SEPARATION:
 STRIKE AZIMUTHS: SET 1 , SET 2 , SET 3

THE MEASURED SECTION IS REPORTED IN FEET

IN SAMPLE?	THICKNESS	STRATIGRAPHIC SECTION	
			DESCRIPTION
		Horizon KGS 159.	
N	2.20		Claystone, medium-gray; rooted near top.
Y	0.59		Clarain, with few vitrain stringers, highly weathered; 1/4-inch clay parting in center.
N	0.49		Clay, medium-gray; few bands of shaly coal or coaly shale near base.
N	0.46		Shale, black, carbonaceous; interbedded coal (grades into durain).
N	0.20		Shale, black, carbonaceous; plant fragments.
N	1.25		Claystone, medium- to light-gray; plant fragments, few coal fragments.
N	0.03		Shale, dark-gray, carbonaceous; coal fragments.
N	0.20		Clay, light-gray, very plastic.
Y	0.30		Coal, dominantly vitrain, with lesser clarain and fusain; vitrain bands 1/4 inch, blocky.
N	0.61		Clay, light-tannish-gray; upper 3 inches rooted, semi-plastic.

COAL ANALYSIS REPORT

LABORATORY NO: K97572
LABORATORY: USBM

FIELD NO: KGS 158

U.S.G.S NO: W207809
REPORT DATE: Dec/13/1979

AIR DRIED LOSS: 3.80%

AS RECEIVED MOISTURE FREE MOISTURE/ASH FREE

PROXIMATE ANALYSIS:

TOTAL MOISTURE	7.10%		
VOLATILE MATTER	33.60%	36.17%	43.52%
FIXED CARBON	43.60%	46.93%	56.48%
ASH	15.70%	16.90%	

ULTIMATE ANALYSIS:

HYDROGEN	5.00%	4.53%	5.45%
CARBON	60.20%	64.80%	77.98%
NITROGEN	1.30%	1.40%	1.68%
TOTAL SULFUR	1.70%	1.83%	2.20%
OXYGEN	16.00%	10.54%	12.69%
ASH	15.70%	16.90%	

HEATING VALUE (BTU/LB):	10766	11589	13945
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SULFUR FORMS:

SULFATE	0.01%	0.01%	0.01%
PYRITIC	1.08%	1.16%	1.40%
ORGANIC	0.66%	0.71%	0.85%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2650 deg F
SOFTENING TEMP.	2770 deg F
FLUID TEMP.	2800 deg F

FREE SWELLING INDEX	1.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	03.2

COAL SAMPLING REPORT

LABORATORY NO: K97573 FIELD NO: KGS 159 U.S.G.S. NO: W207810
 SAMPLER: Wonderly AGENCY: KGS DATE: Aug/02/1979
 7.5' QUAD: Rush COUNTY: Boyd DISTRICT: Princess
 CARTER COORDINATE: SEC 12 ROW W TIER 81 100 FT FSL, 2300 FT FEL
 LATITUDE: 38 DEG 22 MIN 9 SEC LONGITUDE: 82 DEG 47 MIN 29 SEC
 ELEVATION (FT): 658.24, OF POINT AT base of 159, USING altimeter

COMMENTARY:

REGIONAL COAL NAME: Richardson zone GEO. MAP COAL NAME: Princess No.5
 REPORTED COAL NAME: Princess No.5 FORMATION OR MEMBER: Breathitt
 RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
 EXPOSURE: TYPE, roadcut; CONDITION, several years old
 SAMPLE CONDITION: weathered
 RECOVERY METHOD: channel SAMPLING REGIME: Holmes
 SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): unknown
 THICKNESS (INCHES): SEAM HEIGHT 64.6, SAMPLE 38.2, COAL ONLY 38.2
 STRUCTURAL FEATURE: cleat, SEPARATION:
 STRIKE AZIMUTHS: SET 1 19, SET 2 80, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

IN SAMPLE?	THICKNESS	STRATIGRAPHIC SECTION DESCRIPTION
N	10.40	Covered. Siltstone, light-bluish-gray to iron-gray, weathers to light-orange, massive, silicified, fossils (brachiopods, gastropods); sandy toward top.
Y	0.07	Coal, dominantly vitrain.
N	0.46	Claystone, light-gray, semi-plastic.
Y	0.30	Coal, mostly clarain, blocky.
N	0.79	Shale, medium-gray; abundant plant fragments.
Y	1.12	Coal, dominantly vitrain, lesser clarain, blocky.
N	0.39	Clay, medium- to light-gray, plastic, rooted.
N	0.16	Shale, black, very hard, carbonaceous.
Y	0.49	Coal, vitrain, lesser durain; very hard and weathered, sulfurous.
N	0.39	Clay, medium- to dark-gray, rooted.
Y	1.21	Coal, very hard; vitrain 70 percent, fusain 5 percent, clarain 25 percent; few 1/8-inch partings. See KGS 158 for underlying strata.

COAL ANALYSIS REPORT

LABORATORY NO: K97573
LABORATORY: USBM

FIELD NO: KGS 159

U.S.G.S NO: W207810
REPORT DATE: Dec/13/1979

AIR DRIED LOSS: 4.00%

AS RECEIVED MOISTURE FREE MOISTURE/ASH FREE

PROXIMATE ANALYSIS:

TOTAL MOISTURE	7.30%		
VOLATILE MATTER	37.10%	40.02%	45.63%
FIXED CARBON	44.20%	47.68%	54.37%
ASH	11.40%	12.30%	

ULTIMATE ANALYSIS:

HYDROGEN	5.30%	4.84%	5.51%
CARBON	63.90%	68.93%	78.60%
NITROGEN	1.20%	1.29%	1.48%
TOTAL SULFUR	2.00%	2.16%	2.46%
OXYGEN	16.10%	10.48%	11.95%
ASH	11.40%	12.30%	

HEATING VALUE (BTU/LB):	11353	12247	13964
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SULFUR FORMS:

SULFATE	0.01%	0.01%	0.01%
PYRITIC	1.10%	1.19%	1.35%
ORGANIC	0.91%	0.98%	1.12%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2550 deg F
SOFTENING TEMP.	2640 deg F
FLUID TEMP.	2710 deg F

FREE SWELLING INDEX	1.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	03.5

ANALYSIS OF COAL SAMPLES FROM THE PRINCESS DISTRICT, KENTUCKY

COAL SAMPLING REPORT

LABORATORY NO: K97574 FIELD NO: KGS 162 U.S.G.S. NO: W207816
 SAMPLER: Wonderly AGENCY: KGS DATE: Aug/03/1979
 7.5' QUAD: Ashland COUNTY: Boyd DISTRICT: Princess
 CARTER COORDINATE: SEC 6 ROW W TIER 82 2900 FT FSL, 1250 FT FEL
 LATITUDE: 38 DEG 23 MIN 28 SEC LONGITUDE: 82 DEG 44 MIN 17 SEC
 ELEVATION (FT): 766.00, OF POINT AT base of 162, USING altimeter

COMMENTARY:

REGIONAL COAL NAME: Princess No.7 GEO. MAP COAL NAME: Princess No.7
 REPORTED COAL NAME: Princess No.7 FORMATION OR MEMBER: Breathitt
 RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
 EXPOSURE: TYPE, surface mine; CONDITION, active
 SAMPLE CONDITION: unknown
 RECOVERY METHOD: channel SAMPLING REGIME: Holmes
 SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): unknown
 THICKNESS (INCHES): SEAM HEIGHT 49.2, SAMPLE 48.0, COAL ONLY 48.0
 STRUCTURAL FEATURE: SEPARATION:
 STRIKE AZIMUTHS: SET 1 , SET 2 , SET 3

THE MEASURED SECTION IS REPORTED IN FEET

IN SAMPLE?	THICKNESS	STRATIGRAPHIC SECTION
		DESCRIPTION
N		Siltstone, dark-green, very hard; highwall is 95 feet high.
N	0.10	Shale, black, very hard, carbonaceous (bone).
N	0.69	Clay, medium- to dark-gray, rooted.
N	0.30	Shale, black, carbonaceous; plant fragments.
Y	0.49	Coal, dominantly vitrain bands (1/4-1/2 inch), with lesser attrital coal; very blocky.
Y	1.21	Coal.
N	0.10	Clay.
Y	1.51	Coal, vitrain, lesser fusain.
Y	0.79	Coal.
N		Underclay.

COAL ANALYSIS REPORT

LABORATORY NO: K97574
LABORATORY: USBM

FIELD NO: KGS 162

U.S.G.S NO: W207816
REPORT DATE: Dec/13/1979

AIR DRIED LOSS: 4.60%

AS RECEIVED MOISTURE FREE MOISTURE/ASH FREE

PROXIMATE ANALYSIS:

TOTAL MOISTURE	7.60%		
VOLATILE MATTER	35.30%	38.21%	44.13%
FIXED CARBON	44.70%	48.38%	55.88%
ASH	12.40%	13.42%	

ULTIMATE ANALYSIS:

HYDROGEN	5.30%	4.82%	5.56%
CARBON	62.70%	67.86%	78.38%
NITROGEN	1.30%	1.41%	1.63%
TOTAL SULFUR	2.20%	2.38%	2.75%
OXYGEN	16.10%	10.11%	11.68%
ASH	12.40%	13.42%	

HEATING VALUE (BTU/LB):	11385	12322	14231
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SULFUR FORMS:

SULFATE	0.01%	0.01%	0.01%
PYRITIC	1.86%	2.01%	2.33%
ORGANIC	0.38%	0.41%	0.48%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2460 deg F
SOFTENING TEMP.	2580 deg F
FLUID TEMP.	2690 deg F

FREE SWELLING INDEX	2.5
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	03.9

ANALYSIS OF COAL SAMPLES FROM THE PRINCESS DISTRICT, KENTUCKY

COAL SAMPLING REPORT

LABORATORY NO: K97848 FIELD NO: KGS 157 U.S.G.S. NO: W207862
 SAMPLER: Wonderly AGENCY: KGS DATE: Aug/01/1979
 7.5' QUAD: Argillite COUNTY: Greenup DISTRICT: Princess
 CARTER COORDINATE: SEC 8 ROW X TIER 80 3900 FT FSL, 700 FT FEL
 LATITUDE: 38 DEG 28 MIN 39 SEC LONGITUDE: 82 DEG 52 MIN 8 SEC
 ELEVATION (FT): 770.00, OF POINT AT base of 157, USING topo

COMMENTARY:

REGIONAL COAL NAME: Peach Orchard z GEO. MAP COAL NAME: Princess No.3
 REPORTED COAL NAME: Princess No.3 FORMATION OR MEMBER: Breathitt
 RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
 EXPOSURE: TYPE, roadcut; CONDITION, several years old
 SAMPLE CONDITION: highly weathered
 RECOVERY METHOD: channel SAMPLING REGIME: Holmes
 SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): unknown
 THICKNESS (INCHES): SEAM HEIGHT 14.6, SAMPLE 14.6, COAL ONLY 14.6
 STRUCTURAL FEATURE: cleat, SEPARATION:
 STRIKE AZIMUTHS: SET 1 6, SET 2 280, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

IN SAMPLE?	THICKNESS	STRATIGRAPHIC SECTION DESCRIPTION
		Covered.
N	8.50	Sandstone, light-gray, weathers orange, massively bedded to laminated, poorly sorted.
N	10.50	Shale, medium-bluish-gray, silty, very few ironstone concretions.
Y	1.21	Coal, dominantly durain, with abundant vitrain stringers, lesser fusain; more vitrain and harder toward top; highly weathered.
N	0.16	Clay, dark-gray, rooted.
N	12.60	Shale, silty; grades to shaly sandstone, medium- to light-gray.
N	0.59	Shale, silty; alternating with siltstone (1/4-inch beds) and coal fragments.
N	0.49	Clay (underclay), plastic, rooted.
N	2.00	Claystone, medium-gray, highly weathered.

COAL ANALYSIS REPORT

LABORATORY NO: K97848
 LABORATORY: USBM

FIELD NO: KGS 157

U.S.G.S NO: W207862
 REPORT DATE: Dec/26/1979

AIR DRIED LOSS: 3.10%

AS RECEIVED MOISTURE FREE MOISTURE/ASH FREE

PROXIMATE ANALYSIS:

TOTAL MOISTURE	5.20%		
VOLATILE MATTER	43.90%	46.31%	49.66%
FIXED CARBON	44.50%	46.94%	50.34%
ASH	6.40%	6.75%	

ULTIMATE ANALYSIS:

HYDROGEN	6.00%	5.72%	6.13%
CARBON	70.40%	74.26%	79.64%
NITROGEN	1.40%	1.48%	1.58%
TOTAL SULFUR	1.90%	2.00%	2.15%
OXYGEN	13.90%	9.79%	10.50%
ASH	6.40%	6.75%	

HEATING VALUE (BTU/LB):	12815	13519	14496
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SULFUR FORMS:

SULFATE	0.01%	0.01%	0.01%
PYRITIC	0.86%	0.91%	0.97%
ORGANIC	1.06%	1.12%	1.20%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	1950 deg F
SOFTENING TEMP.	2040 deg F
FLUID TEMP.	2120 deg F

FREE SWELLING INDEX	3.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	03.0

ANALYSIS OF COAL SAMPLES FROM THE PRINCESS DISTRICT, KENTUCKY

COAL SAMPLING REPORT

LABORATORY NO: K97850 FIELD NO: KGS 236 U.S.G.S. NO: W207863
 SAMPLER: Currens & Kung AGENCY: KGS DATE: Aug/15/1979
 7.5' QUAD: Milo COUNTY: Lawrence DISTRICT: Princess
 CARTER COORDINATE: SEC 9 ROW Q TIER 83 5100 FT FSL, 2700 FT FEL
 LATITUDE: 37 DEG 53 MIN 50 SEC LONGITUDE: 82 DEG 36 MIN 33 SEC
 ELEVATION (FT): 925.70, OF POINT AT base of 236, USING survey

COMMENTARY:

REGIONAL COAL NAME: Richardson zone GEO. MAP COAL NAME: Richardson
 REPORTED COAL NAME: Richardson FORMATION OR MEMBER: Breathitt
 RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
 EXPOSURE: TYPE, surface mine; CONDITION, active
 SAMPLE CONDITION: clean, fresh
 RECOVERY METHOD: channel SAMPLING REGIME: Swanson & Huffman
 SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
 THICKNESS (INCHES): SEAM HEIGHT 76.1, SAMPLE 76.1, COAL ONLY 66.4
 STRUCTURAL FEATURE: cleat, SEPARATION:
 STRIKE AZIMUTHS: SET 1 150, SET 2 45, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

IN SAMPLE?	THICKNESS	STRATIGRAPHIC SECTION	
			DESCRIPTION
Y	0.20	Clarain,	with abundant durain at base.
Y	0.02	Pyrite.	
Y	0.23	Clarain,	with abundant durain, pyritic.
Y	0.20	Durain,	intermixed with clarain.
Y	0.23	Siltstone,	black, hard, nonlaminated.
Y	0.20	Durain,	with clarain, pyritic.
Y	0.38	Clarain,	with scattered durain, very pyritic.
Y	0.07	Vitrain.	
Y	0.43	Clarain,	pyritic.
Y	0.33	Shale,	dark-gray to black, silty, carbonaceous, rooted; coaly at base, pyritic.
Y	0.39	Clarain.	
Y	0.43	Durain,	with scattered clarain; large pyrite nodule.
Y	0.39	Vitrain.	
Y	0.16	Durain.	
Y	0.23	Sandstone,	very dark-gray to black, fine- grained, argillaceous, carbonaceous, rooted.
Y	0.30	Clarain.	
Y	0.49	Durain,	with scattered clarain at top.
Y	0.20	Clarain,	with scattered fusain.
Y	0.98	Durain,	with scattered clarain; abundant clarain at base.
Y	0.49	Clarain.	

COAL ANALYSIS REPORT

LABORATORY NO: K97850
 LABORATORY: USBM

FIELD NO: KGS 236

U.S.G.S NO: W207863
 REPORT DATE: Dec/26/1979

AIR DRIED LOSS: 3.50%

AS RECEIVED MOISTURE FREE MOISTURE/ASH FREE

PROXIMATE ANALYSIS:

TOTAL MOISTURE	5.00%		
VOLATILE MATTER	31.70%	33.37%	41.88%
FIXED CARBON	44.00%	46.31%	58.12%
ASH	19.30%	20.32%	

ULTIMATE ANALYSIS:

HYDROGEN	4.80%	4.46%	5.60%
CARBON	60.60%	63.79%	80.05%
NITROGEN	1.20%	1.26	1.59%
TOTAL SULFUR	2.50%	2.63%	3.30%
OXYGEN	11.70%	7.54%	9.46%
ASH	19.30%	20.32%	

HEATING VALUE (BTU/LB):	10741	11306	14189
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SULFUR FORMS:

SULFATE	0.01%	0.01%	0.01%
PYRITIC	2.05%	2.16%	2.71%
ORGANIC	0.46%	0.48%	0.61%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2500 deg F
SOFTENING TEMP.	2620 deg F
FLUID TEMP.	2710 deg F

FREE SWELLING INDEX	1.5
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	04.7

ANALYSIS OF COAL SAMPLES FROM THE PRINCESS DISTRICT, KENTUCKY

COAL SAMPLING REPORT

LABORATORY NO: K97847 FIELD NO: KGS 156 U.S.G.S. NO: W207865
 SAMPLER: Wonderly AGENCY: KGS DATE: Jul/31/1979
 7.5' QUAD: Rush COUNTY: Carter DISTRICT: Princess
 CARTER COORDINATE: SEC 18 ROW W TIER 80 3200 FT FSL, 900 FT FEL
 LATITUDE: 38 DEG 21 MIN 32 SEC LONGITUDE: 82 DEG 52 MIN 24 SEC
 ELEVATION (FT): 717.00, OF POINT AT base of 156, USING topo

COMMENTARY:

REGIONAL COAL NAME: Peach Orchard z GEO. MAP COAL NAME: Princess No.3
 REPORTED COAL NAME: Princess No.3 r FORMATION OR MEMBER: Breathitt
 RANGE SAMPLED (SPLITS, BENCHES, ETC.): rider
 EXPOSURE: TYPE, roadcut; CONDITION, several years old
 SAMPLE CONDITION: weathered
 RECOVERY METHOD: channel SAMPLING REGIME: Holmes
 SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): unknown
 THICKNESS (INCHES): SEAM HEIGHT 7.9, SAMPLE 7.9, COAL ONLY 7.9
 STRUCTURAL FEATURE: cleat, SEPARATION:
 STRIKE AZIMUTHS: SET 1 12, SET 2 271, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

IN SAMPLE?	THICKNESS	STRATIGRAPHIC SECTION
		DESCRIPTION
		Covered.
N	6.99	Shale, black, highly carbonaceous, some coal spar.
Y	0.66	Coal, vitrain 70 percent, durain 30 percent; very hard; top 3 inches of vitrain with small amount of fusain; this coal not continuous laterally; thins to 4 inches along roadcut.

COAL ANALYSIS REPORT

LABORATORY NO: K97847
 LABORATORY: USBM

FIELD NO: KGS 156

U.S.G.S NO: W207865
 REPORT DATE: Dec/26/1979

AIR DRIED LOSS: 4.60%

AS RECEIVED MOISTURE FREE MOISTURE/ASH FREE

PROXIMATE ANALYSIS:

TOTAL MOISTURE	6.50%		
VOLATILE MATTER	38.70%	41.39%	44.90%
FIXED CARBON	47.50%	50.80%	55.10%
ASH	7.30%	7.81%	

ULTIMATE ANALYSIS:

HYDROGEN	5.80%	5.43%	5.88%
CARBON	68.50%	73.26%	79.47%
NITROGEN	1.40%	1.50%	1.62%
TOTAL SULFUR	2.90%	3.10%	3.36%
OXYGEN	14.20%	8.90%	9.67%
ASH	7.30%	7.81%	

HEATING VALUE (BTU/LB):	12317	13173	14289
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SULFUR FORMS:

SULFATE	0.01%	0.01%	0.01%
PYRITIC	2.05%	2.19%	2.38%
ORGANIC	0.87%	0.93%	1.01%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	1910 deg F
SOFTENING TEMP.	2000 deg F
FLUID TEMP.	2100 deg F

FREE SWELLING INDEX	1.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	04.7

COAL SAMPLING REPORT

LABORATORY NO: K97559 FIELD NO: KGS 160 U.S.G.S. NO: W207896
 SAMPLER: Wonderly AGENCY: KGS DATE: Aug/02/1979
 7.5' QUAD: Rush COUNTY: Boyd DISTRICT: Princess
 CARTER COORDINATE: SEC 12 ROW W TIER 81 100 FT FSL, 2300 FT FEL
 LATITUDE: 38 DEG 22 MIN 9 SEC LONGITUDE: 82 DEG 47 MIN 29 SEC
 ELEVATION (FT): 689.60, OF POINT AT base of 160, USING altimeter

COMMENTARY:

REGIONAL COAL NAME: uncorrelated GEO. MAP COAL NAME: unnamed
 REPORTED COAL NAME: unnamed FORMATION OR MEMBER: Breathitt
 RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
 EXPOSURE: TYPE, roadcut; CONDITION, several years old
 SAMPLE CONDITION: weathered
 RECOVERY METHOD: channel SAMPLING REGIME: Holmes
 SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): unknown
 THICKNESS (INCHES): SEAM HEIGHT 8.3, SAMPLE 8.3, COAL ONLY 8.3
 STRUCTURAL FEATURE: SEPARATION:
 STRIKE AZIMUTHS: SET 1 , SET 2 , SET 3

THE MEASURED SECTION IS REPORTED IN FEET

IN SAMPLE?	THICKNESS	STRATIGRAPHIC SECTION
		DESCRIPTION
		Covered.
N	4.00	Sandstone, dark-gray, massive to laminated, poorly sorted, very micaceous, abundant plant fragments, friable.
N	6.99	Shale, alternating with siltstone, with few ironstone bands; sequence coarsens upward.
N	6.00	Shale, dark-gray, very well indurated; alternates with ironstone bands 1/4 to 1 inch thick.
N	0.69	Clay, medium-gray, rooted, semi-plastic.
Y	0.69	Coal, vitrain, very hard, extremely weathered, few pyrite stringers.
N	5.18	Claystone, light- to medium-gray, silty, semi-plastic; upper 2 inches rooted.

COAL ANALYSIS REPORT

LABORATORY NO: K97559
 LABORATORY: USBM

FIELD NO: KGS 160

U.S.G.S NO: W207896
 REPORT DATE: Dec/10/1979

AIR DRIED LOSS: 3.80%

AS RECEIVED MOISTURE FREE MOISTURE/ASH FREE

PROXIMATE ANALYSIS:

TOTAL MOISTURE	6.90%		
VOLATILE MATTER	38.00%	40.82%	47.80%
FIXED CARBON	41.50%	44.58%	52.20%
ASH	13.60%	14.61%	

ULTIMATE ANALYSIS:

HYDROGEN	5.00%	4.54%	5.32%
CARBON	57.50%	61.76%	72.33%
NITROGEN	1.20%	1.29%	1.51%
TOTAL SULFUR	7.30%	7.84%	9.18
OXYGEN	15.40%	9.96%	11.66%
ASH	13.60%	14.61%	

HEATING VALUE (BTU/LB):	11070	11890	13925
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SULFUR FORMS:

SULFATE	0.04%	0.04%	0.05%
PYRITIC	5.22%	5.61%	6.57%
ORGANIC	2.01%	2.16%	2.53%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2010 deg F
SOFTENING TEMP.	2100 deg F
FLUID TEMP.	2180 deg F

FREE SWELLING INDEX	4.5
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	13.2

ANALYSIS OF COAL SAMPLES FROM THE PRINCESS DISTRICT, KENTUCKY

COAL SAMPLING REPORT

LABORATORY NO: K99444 FIELD NO: KGS 161 U.S.G.S. NO: W208199
 SAMPLER: Wonderly AGENCY: KGS DATE: Aug/02/1979
 7.5' QUAD: Ashland COUNTY: Boyd DISTRICT: Princess
 CARTER COORDINATE: SEC 1 ROW W TIER 82 3950 FT FSL, 1000 FT FEL
 LATITUDE: 38 DEG 24 MIN 39 SEC LONGITUDE: 82 DEG 40 MIN 13 SEC
 ELEVATION (FT): 654.00, OF POINT AT base of 161, USING topo

COMMENTARY:

REGIONAL COAL NAME: Princess No.6 GEO. MAP COAL NAME: Princess No.6
 REPORTED COAL NAME: Princess No.6 FORMATION OR MEMBER: Breathitt
 RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
 EXPOSURE: TYPE, roadcut; CONDITION, several years old
 SAMPLE CONDITION: weathered
 RECOVERY METHOD: channel SAMPLING REGIME: Holmes
 SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): unknown
 THICKNESS (INCHES): SEAM HEIGHT 15.8, SAMPLE 15.8, COAL ONLY 15.8
 STRUCTURAL FEATURE: cleat, SEPARATION:
 STRIKE AZIMUTHS: SET 1 140, SET 2 40, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

IN SAMPLE?	THICKNESS	STRATIGRAPHIC SECTION DESCRIPTION
		Covered.
N	10.99	Sandstone, weathers orange, massive, poorly sorted, micaceous, plant fragments; siderite nodules and coal spar at base; friable.
N	0.30	Clay, dark-gray, semi-plastic.
N	0.10	Shale, black, extremely carbonaceous.
Y	0.69	Coal, as below, but with more vitrain; very brittle.
Y	0.03	Fusain.
Y	0.59	Coal, dominantly vitrain (bands 1/4 to 1/2 inch thick), lesser dull attrital coal, with subordinate fusain.
N	0.49	Clay, light-gray, plastic, rooted.

COAL ANALYSIS REPORT

LABORATORY NO: K99444
LABORATORY: USBM

FIELD NO: KGS 161

U.S.G.S NO: W208199
REPORT DATE: Feb/15/1980

AIR DRIED LOSS: 5.10%

AS RECEIVED MOISTURE FREE MOISTURE/ASH FREE

PROXIMATE ANALYSIS:

TOTAL MOISTURE	7.70%		
VOLATILE MATTER	4.30%	43.66%	46.75%
FIXED CARBON	45.90%	49.73%	53.25%
ASH	6.10%	6.61%	

ULTIMATE ANALYSIS:

HYDROGEN	5.60%	5.13%	5.50%
CARBON	68.00%	73.67%	78.89%
NITROGEN	1.40%	1.52%	1.62%
TOTAL SULFUR	2.60%	2.82%	3.02%
OXYGEN	16.20%	10.25%	10.97%
ASH	6.10%	6.61%	

HEATING VALUE (BTU/LB):	12229	13249	14187
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SULFUR FORMS:

SULFATE	0.21%	0.23%	0.24%
PYRITIC	1.28%	1.39%	1.48%
ORGANIC	1.12%	1.21%	1.30%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2540 deg F
SOFTENING TEMP.	2620 deg F
FLUID TEMP.	2690 deg F

FREE SWELLING INDEX	3.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	04.3

COAL SAMPLING REPORT

LABORATORY NO: K99265 FIELD NO: KGS 131 U.S.G.S. NO: W208434
 SAMPLER: Currens & Kung AGENCY: KGS DATE: Nov/07/1979
 7.5' QUAD: Ironton COUNTY: Greenup DISTRICT: Princess
 CARTER COORDINATE: SEC 21 ROW Y TIER 82 1400 FT FSL, 4450 FT FEL
 LATITUDE: 38 DEG 30 MIN 14 SEC LONGITUDE: 82 DEG 40 MIN 55 SEC
 ELEVATION (FT): 580.00, OF POINT AT base of 131, USING topo

COMMENTARY:

REGIONAL COAL NAME: Richardson zone GEO. MAP COAL NAME: Princess No.5
 REPORTED COAL NAME: Princess No.5 FORMATION OR MEMBER: Breathitt
 RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
 EXPOSURE: TYPE, surface mine; CONDITION, weathered
 SAMPLE CONDITION: faced-up with hand tools
 RECOVERY METHOD: channel SAMPLING REGIME: Swanson & Huffman
 SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
 THICKNESS (INCHES): SEAM HEIGHT 28.0, SAMPLE 28.0, COAL ONLY 26.0
 STRUCTURAL FEATURE: SEPARATION:
 STRIKE AZIMUTHS: SET 1 , SET 2 , SET 3

THE MEASURED SECTION IS REPORTED IN FEET

IN SAMPLE?	THICKNESS	STRATIGRAPHIC SECTION DESCRIPTION
N	6.56	Siltstone, medium-gray; weathered dark-gray to black at base; sandy lenses, sideritic.
Y	1.48	Clarain, with scattered medium-banded vitrain.
Y	0.23	Durain, with scattered thin-banded vitrain.
Y	0.16	Shale, dark-gray, carbonaceous.
Y	0.46	Clarain, interbedded with scattered durain.
N	0.98	Shale, medium-gray, silty, rooted.

COAL ANALYSIS REPORT

LABORATORY NO: K99265
LABORATORY: USBM

FIELD NO: KGS 131

U.S.G.S NO: W208434
REPORT DATE: Feb/08/1980

AIR DRIED LOSS: 4.20%

AS RECEIVED MOISTURE FREE MOISTURE/ASH FREE

PROXIMATE ANALYSIS:

TOTAL MOISTURE	6.00%		
VOLATILE MATTER	31.50%	33.51%	39.62%
FIXED CARBON	48.00%	51.06%	60.38%
ASH	14.50%	15.43%	

ULTIMATE ANALYSIS:

HYDROGEN	5.00%	4.60%	5.44%
CARBON	64.00%	68.08%	80.51%
NITROGEN	1.40%	1.49%	1.76%
TOTAL SULFUR	0.80%	0.85%	1.01%
OXYGEN	14.30%	9.55%	11.28%
ASH	14.50%	15.43%	

HEATING VALUE (BTU/LB):	11247	11965	14148
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SULFUR FORMS:

SULFATE	0.01%	0.01%	0.01%
PYRITIC	0.10%	0.11%	0.13%
ORGANIC	0.66%	0.70%	0.83%

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	01.4

COAL SAMPLING REPORT

LABORATORY NO: K99266 FIELD NO: KGS 132 U.S.G.S. NO: W208435
 SAMPLER: Currens & Kung AGENCY: KGS DATE: Nov/07/1979
 7.5' QUAD: Fallsburg COUNTY: Lawrence DISTRICT: Princess
 CARTER COORDINATE: SEC 4 ROW T TIER 83 400 FT FSL, 2100 FT FEL
 LATITUDE: 38 DEG 9 MIN 4 SEC LONGITUDE: 82 DEG 38 MIN 26 SEC
 ELEVATION (FT): 600.00, OF POINT AT base of 132, USING topo

COMMENTARY:

REGIONAL COAL NAME: Princess No.7 GEO. MAP COAL NAME: Princess No.7
 REPORTED COAL NAME: Princess No.7 FORMATION OR MEMBER: Breathitt
 RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
 EXPOSURE: TYPE, roadcut; CONDITION, less than 6 months old
 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 20.1, SAMPLE 20.1, COAL ONLY 19.3
 STRUCTURAL FEATURE: SEPARATION:
 STRIKE AZIMUTHS: SET 1 , SET 2 , SET 3

THE MEASURED SECTION IS REPORTED IN FEET

IN SAMPLE?	THICKNESS	STRATIGRAPHIC SECTION	
			DESCRIPTION
N	16.40		Sandstone, medium-gray, medium-grained, micaceous, feldspathic, crossbedded.
N	0.53		Siltstone, medium-gray, laminated to partly bioturbated, sideritic.
Y	0.85		Clarain, with abundant medium- to thick-banded vitrain and scattered pyrite to 3 mm thick (very pyritic).
Y	0.07		Pyrite and siderite in semicontinuous horizon, 0.5 to 3.0 cm thick.
Y	0.49		Clarain, with abundant thick vitrain near base.
Y	0.26		Durain, with scattered clarain and medium-banded vitrain, pyritic.
N	0.66		Shale, dark-gray, silty, rooted.

COAL ANALYSIS REPORT

LABORATORY NO: K99266
LABORATORY: USBM

FIELD NO: KGS 132

U.S.G.S NO: W208435
REPORT DATE: Feb/08/1980

AIR DRIED LOSS: 2.40%

AS RECEIVED MOISTURE FREE MOISTURE/ASH FREE

PROXIMATE ANALYSIS:

TOTAL MOISTURE	4.20%		
VOLATILE MATTER	41.70%	43.53%	48.88%
FIXED CARBON	43.60%	45.51%	51.11%
ASH	10.50%	10.96%	

ULTIMATE ANALYSIS:

HYDROGEN	5.30%	5.04%	5.66%
CARBON	67.00%	69.93%	78.54%
NITROGEN	1.50%	1.57%	1.76%
TOTAL SULFUR	3.60%	3.76%	4.22%
OXYGEN	12.20%	8.74%	9.82%
ASH	10.50%	10.96%	

HEATING VALUE (BTU/LB):	12318	12858	14440
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SULFUR FORMS:

SULFATE	0.01%	0.01%	0.01%
PYRITIC	2.92%	3.05%	3.42%
ORGANIC	0.63%	0.66%	0.74%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	1900 deg F
SOFTENING TEMP.	2010 deg F
FLUID TEMP.	2080 deg F

FREE SWELLING INDEX	4.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	05.8

COAL SAMPLING REPORT

LABORATORY NO: K99267 FIELD NO: KGS 133 U.S.G.S. NO: W208436
 SAMPLER: Currens & Kung AGENCY: KGS DATE: Nov/07/1979
 7.5' QUAD: Prichard COUNTY: Lawrence DISTRICT: Princess
 CARTER COORDINATE: SEC 12 ROW U TIER 83 1150 FT FSL, 1000 FT FEL
 LATITUDE: 38 DEG 12 MIN 12 SEC LONGITUDE: 82 DEG 36 MIN 13 SEC
 ELEVATION (FT): 580.00, OF POINT AT base of 133, USING topo

COMMENTARY:

REGIONAL COAL NAME: Princess No.7 GEO. MAP COAL NAME: Princess No.7
 REPORTED COAL NAME: Princess No.7 FORMATION OR MEMBER: Breathitt
 RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
 EXPOSURE: TYPE, roadcut; CONDITION, 2-3 months old, faced-up by hand
 SAMPLE CONDITION: slightly weathered
 RECOVERY METHOD: channel SAMPLING REGIME: Holmes
 SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
 THICKNESS (INCHES): SEAM HEIGHT 11.8, SAMPLE 11.8, COAL ONLY 11.8
 STRUCTURAL FEATURE: cleat, SEPARATION:
 STRIKE AZIMUTHS: SET 1 315, SET 2 235, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

IN SAMPLE?	THICKNESS	STRATIGRAPHIC SECTION	
			DESCRIPTION
N	32.81		Siltstone, medium-gray, sideritic, arenaceous, bioturbated to laminated (scattered lenticular bedding).
N	0.33		Siltstone, dark-gray, carbonaceous, abundant plant fragments.
Y	0.26		Clarain, pyritic.
Y	0.16		Clarain, mixed with durain.
Y	0.56		Clarain, with scattered thin- to medium-banded vitrain.
N	1.31		Siltstone, medium-gray, rooted.
N	9.84		Siltstone, medium-gray, sideritic, arenaceous, laminated to slightly bioturbated.

COAL ANALYSIS REPORT

LABORATORY NO: K99267
 LABORATORY: USBM

FIELD NO: KGS 133

U.S.G.S NO: W208436
 REPORT DATE: Feb/08/1980

AIR DRIED LOSS: 3.60%

AS RECEIVED MOISTURE FREE MOISTURE/ASH FREE

PROXIMATE ANALYSIS:

TOTAL MOISTURE	5.50%		
VOLATILE MATTER	36.50%	38.62%	42.20%
FIXED CARBON	50.00%	52.91%	57.81%
ASH	8.00%	8.47%	

ULTIMATE ANALYSIS:

HYDROGEN	5.40%	5.06%	5.53%
CARBON	68.80%	72.80%	79.54%
NITROGEN	1.50%	1.59%	1.73%
TOTAL SULFUR	3.50%	3.70%	4.05%
OXYGEN	12.80%	8.38%	9.15%
ASH	8.00%	8.47%	

HEATING VALUE (BTU/LB):	12497	13224	14448
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SULFUR FORMS:

SULFATE	0.01%	0.01%	0.01%
PYRITIC	2.74%	2.90%	3.17%
ORGANIC	0.72%	0.76%	0.83%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	1930 deg F
SOFTENING TEMP.	2020 deg F
FLUID TEMP.	2090 deg F

FREE SWELLING INDEX	4.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	05.6

COAL SAMPLING REPORT

LABORATORY NO: U10056 FIELD NO: KGS 335 U.S.G.S. NO: W211189
 SAMPLER: Currens AGENCY: KGS DATE: May/01/1980
 7.5' QUAD: Fallsburg COUNTY: Lawrence DISTRICT: Princess
 CARTER COORDINATE: SEC 23 ROW U TIER 83 1900 FT FSL, 4200 FT FEL
 LATITUDE: 38 DEG 10 MIN 17 SEC LONGITUDE: 82 DEG 37 MIN 53 SEC
 ELEVATION (FT): 660.00, OF POINT AT base of 335, USING topo
 COMMENTARY: U.S. Highway 23 improvement, top of second bench above
 road level.

REGIONAL COAL NAME: Princess No.8 GEO. MAP COAL NAME: Princess No.8
 REPORTED COAL NAME: Princess No.8 FORMATION OR MEMBER: Breathitt
 RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
 EXPOSURE: TYPE, roadcut; CONDITION, 9 months old
 SAMPLE CONDITION: slightly weathered, damp
 RECOVERY METHOD: channel SAMPLING REGIME: Holmes
 SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
 THICKNESS (INCHES): SEAM HEIGHT 5.9, SAMPLE 5.9, COAL ONLY 5.9
 STRUCTURAL FEATURE: SEPARATION:
 STRIKE AZIMUTHS: SET 1 , SET 2 , SET 3

THE MEASURED SECTION IS REPORTED IN FEET

IN SAMPLE?	THICKNESS	STRATIGRAPHIC SECTION DESCRIPTION
N	9.84	Siltstone, medium- to dark-gray, sideritic, ripple-bedded, with fine-grained sandstone lenses.
N	4.92	Sandstone, medium-gray, coarse-grained, micaceous, large-scale trough crossbeds of variable thickness.
N	1.08	Siltstone, black, very coaly (predominantly vitrain, some durain); grades to coal at base; very pyritic.
Y	0.49	Clairain predominant in top 12 cm; bottom 3 cm durain; highly argillaceous, highly pyritic, possibly allocthonous.
N	32.81	Siltstone, dark-gray, laminated, carbonaceous, with abundant plant fragments (rooting at top?). Horizon of Princess No. 7 coal bed.

COAL ANALYSIS REPORT

LABORATORY NO: U10056
 LABORATORY: Geo Test

FIELD NO: KGS 335

U.S.G.S NO: W211189
 REPORT DATE: Nov/20/1981

AIR DRIED LOSS: 1.95%

AS RECEIVED MOISTURE FREE MOISTURE/ASH FREE

PROXIMATE ANALYSIS:

TOTAL MOISTURE	4.58%		
VOLATILE MATTER	29.18%	30.58%	45.26%
FIXED CARBON	35.29%	36.98%	54.74%
ASH	30.95%	32.44%	

ULTIMATE ANALYSIS:

HYDROGEN	4.04%	3.70%	5.47%
CARBON	46.13%	48.34%	71.55%
NITROGEN	1.02%	1.07%	1.58%
TOTAL SULFUR	5.94%	6.23%	9.21%
OXYGEN	11.92%	8.22%	12.19%
ASH	30.95%	32.44%	

HEATING VALUE (BTU/LB):	08502	08910	13188
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SULFUR FORMS:

SULFATE	0.44%	0.46%	0.68%
PYRITIC	4.39%	4.60%	6.81%
ORGANIC	1.11%	1.16%	1.72%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2180 deg F
SOFTENING TEMP.	2240 deg F
FLUID TEMP.	2480 deg F

FREE SWELLING INDEX	1.5
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	14.0

COAL SAMPLING REPORT

LABORATORY NO: U10058 FIELD NO: KGS 378 U.S.G.S. NO: W211191
 SAMPLER: Currens AGENCY: KGS DATE: Jul/15/1980
 7.5' QUAD: Tygarts Valley COUNTY: Carter DISTRICT: Princess
 CARTER COORDINATE: SEC 10 ROW W TIER 77 2400 FT FSL, 4700 FT FEL
 LATITUDE: 38 DEG 23 MIN 23 SEC LONGITUDE: 83 DEG 5 MIN 59 SEC
 ELEVATION (FT): 1020.00, OF POINT AT base of 378, USING topo

COMMENTARY: Because no coal is mapped below the "Tom Cooper," but mining reveals a coal 15' lower, the geologist concluded that the "Tom Cooper" is the Gun Creek and the lower coal is the Tom Cooper.

REGIONAL COAL NAME: Amburgy zone GEO. MAP COAL NAME: Gun Creek
 REPORTED COAL NAME: Tom Cooper FORMATION OR MEMBER: Breathitt
 RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
 EXPOSURE: TYPE, surface mine; CONDITION, active
 SAMPLE CONDITION: fresh, dry (some mud in cleats)
 RECOVERY METHOD: channel SAMPLING REGIME: Holmes
 SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
 THICKNESS (INCHES): SEAM HEIGHT 16.0, SAMPLE 15.8, COAL ONLY 15.8
 STRUCTURAL FEATURE: SEPARATION:
 STRIKE AZIMUTHS: SET 1 110, SET 2 200, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

IN SAMPLE?	THICKNESS	STRATIGRAPHIC SECTION DESCRIPTION
N	32.81	Siltstone, carbonaceous at base; highly sideritic.
Y	0.43	Clarain, very pyritic.
Y	0.66	Durain; scattered thick zones of clarain.
Y	0.23	Durain, highly pyritic.

COAL ANALYSIS REPORT

LABORATORY NO: U10058
 LABORATORY: Geo Test

FIELD NO: KGS 378

U.S.G.S NO: W211191
 REPORT DATE: Nov/20/1981

AIR DRIED LOSS: 1.46%

AS RECEIVED MOISTURE FREE MOISTURE/ASH FREE

PROXIMATE ANALYSIS:

TOTAL MOISTURE	4.60%		
VOLATILE MATTER	38.41%	40.26%	45.70%
FIXED CARBON	45.64%	47.84%	54.30%
ASH	11.35%	11.90%	

ULTIMATE ANALYSIS:

HYDROGEN	5.06%	4.76%	5.41%
CARBON	64.31%	67.41%	76.52%
NITROGEN	1.51%	1.58%	1.80%
TOTAL SULFUR	5.80%	6.08%	6.90%
OXYGEN	11.97%	8.27%	9.37%
ASH	11.35%	11.90%	

HEATING VALUE (BTU/LB):	11709	12273	13931
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SULFUR FORMS:

SULFATE	0.25%	0.26%	0.30%
PYRITIC	4.18%	4.38%	4.97%
ORGANIC	1.37%	1.44%	1.63%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2070 deg F
SOFTENING TEMP.	2100 deg F
FLUID TEMP.	2140 deg F

FREE SWELLING INDEX	1.5
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	09.9

COAL SAMPLING REPORT

LABORATORY NO: U10059 FIELD NO: KGS 379 U.S.G.S. NO: W211192
 SAMPLER: Currens AGENCY: KGS DATE: Jul/16/1980
 7.5' QUAD: Willard COUNTY: Carter DISTRICT: Princess
 CARTER COORDINATE: SEC 13 ROW U TIER 79 1800 FT FSL, 2400 FT FEL
 LATITUDE: 38 DEG 12 MIN 18 SEC LONGITUDE: 82 DEG 57 MIN 30 SEC
 ELEVATION (FT): 869.00, OF POINT AT base of 379, USING altimeter

COMMENTARY:

REGIONAL COAL NAME: Richardson zone GEO. MAP COAL NAME: Princess No.5
 REPORTED COAL NAME: Princess No.5 FORMATION OR MEMBER: Breathitt
 RANGE SAMPLED (SPLITS, BENCHES, ETC.): top and middle 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 37.8, SAMPLE 22.9, COAL ONLY 22.9
 STRUCTURAL FEATURE: cleat, SEPARATION:
 STRIKE AZIMUTHS: SET 1 140, SET 2 230, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

IN SAMPLE?	THICKNESS	STRATIGRAPHIC SECTION DESCRIPTION
N	9.84	Siltstone, dark-gray, arenaceous.
N	0.33	Coal.
N	9.84	Sandstone, medium- to coarse-grained, flaser-bedded, fines upward; contains upright tree trunks, which extend to thin coal.
N	5.91	Shale, plastic in lower third; thin (0.05 m) coal at top.
Y	0.59	Clarain.
N	1.25	Siltstone, very carbonaceous, laminated to rooted.
Y	0.23	Durain, highly argillaceous.
Y	1.08	Clarain, slightly pyritic.
N		Siltstone, carbonaceous.

COAL ANALYSIS REPORT

LABORATORY NO: U10059
 LABORATORY: Geo Test

FIELD NO: KGS 379

U.S.G.S NO: W211192
 REPORT DATE: Nov/20/1981

AIR DRIED LOSS: 1.22%

AS RECEIVED MOISTURE FREE MOISTURE/ASH FREE

PROXIMATE ANALYSIS:

TOTAL MOISTURE	3.75%		
VOLATILE MATTER	37.33%	38.79%	43.18%
FIXED CARBON	49.12%	51.04%	56.82%
ASH	9.80%	10.18%	

ULTIMATE ANALYSIS:

HYDROGEN	5.33%	5.10%	5.68%
CARBON	70.04%	72.77%	81.02%
NITROGEN	1.54%	1.60%	1.78%
TOTAL SULFUR	0.80%	0.83%	0.93%
OXYGEN	12.49%	9.52%	10.59%
ASH	9.80%	10.18%	

HEATING VALUE (BTU/LB):	12445	12930	14395
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SULFUR FORMS:

SULFATE	0.01%	0.01%	0.01%
PYRITIC	0.22%	0.23%	0.25%
ORGANIC	0.57%	0.59%	0.66%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

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

FREE SWELLING INDEX	1.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	01.3

COAL SAMPLING REPORT

LABORATORY NO: U10060 FIELD NO: KGS 380 U.S.G.S. NO: W211193
 SAMPLER: Currens AGENCY: KGS DATE: Jul/16/1980
 7.5' QUAD: Tygarts Valley COUNTY: Carter DISTRICT: Princess
 CARTER COORDINATE: SEC 9 ROW W TIER 77 2500 FT FSL, 500 FT FEL
 LATITUDE: 38 DEG 23 MIN 24 SEC LONGITUDE: 83 DEG 6 MIN 7 SEC
 ELEVATION (FT): 995.90, OF POINT AT base of 380, USING altimeter

COMMENTARY:

REGIONAL COAL NAME: Up Elkhorn No.3 GEO. MAP COAL NAME: Tom Cooper
 REPORTED COAL NAME: Tom Cooper FORMATION OR MEMBER: Breathitt
 RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
 EXPOSURE: TYPE, surface mine; CONDITION, active
 SAMPLE CONDITION: fresh, wet (some mud in cleats)
 RECOVERY METHOD: channel SAMPLING REGIME: Holmes
 SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
 THICKNESS (INCHES): SEAM HEIGHT 17.0, SAMPLE 16.9, COAL ONLY 16.9
 STRUCTURAL FEATURE: cleat, SEPARATION:
 STRIKE AZIMUTHS: SET 1 280, SET 2 10, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

IN SAMPLE?	THICKNESS	STRATIGRAPHIC SECTION	
			DESCRIPTION
		Horizon KGS 378	
N	10.83	Siltstone, light- to medium-gray; arenaceous at base; sideritic; rooted at top.	
Y	0.89	Clarain; abundant thick vitrain at top.	
Y	0.03	Fusain.	
Y	0.49	Clarain.	
N		Siltstone, light-gray-brown, rooted.	

COAL ANALYSIS REPORT

LABORATORY NO: U10060
LABORATORY: Geo Test

FIELD NO: KGS 380

U.S.G.S NO: W211193
REPORT DATE: Nov/20/1981

AIR DRIED LOSS: 2.44%

AS RECEIVED MOISTURE FREE MOISTURE/ASH FREE

PROXIMATE ANALYSIS:

TOTAL MOISTURE	6.57%		
VOLATILE MATTER	36.17%	38.71%	40.92%
FIXED CARBON	52.22%	55.89%	59.08%
ASH	5.04%	5.39%	

ULTIMATE ANALYSIS:

HYDROGEN	5.47%	5.07%	5.36%
CARBON	71.61%	76.64%	81.01%
NITROGEN	1.55%	1.66%	1.75%
TOTAL SULFUR	0.71%	0.76%	0.80%
OXYGEN	15.62%	10.48%	11.08%
ASH	5.04%	5.39%	

HEATING VALUE (BTU/LB):	12593	13478	14247
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SULFUR FORMS:

SULFATE	0.01%	0.01%	0.01%
PYRITIC	0.09%	0.10%	0.10%
ORGANIC	0.61%	0.65%	0.69%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2610 deg F
SOFTENING TEMP.	2800 deg F
FLUID TEMP.	2800 deg F

FREE SWELLING INDEX	1.5
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	01.1

COAL SAMPLING REPORT

LABORATORY NO: U10023 FIELD NO: KGS 381 U.S.G.S. NO: W211623
 SAMPLER: Currens AGENCY: KGS DATE: Jul/16/1980
 7.5' QUAD: Grahn COUNTY: Carter DISTRICT: Princess
 CARTER COORDINATE: SEC 21 ROW W TIER 78 350 FT FSL, 700 FT FEL
 LATITUDE: 38 DEG 20 MIN 4 SEC LONGITUDE: 83 DEG 0 MIN 8 SEC
 ELEVATION (FT): 750.00, OF POINT AT base of 381, USING topo

COMMENTARY:

REGIONAL COAL NAME: Up Elkhorn No.3 GEO. MAP COAL NAME: Little Caney
 REPORTED COAL NAME: Little Caney FORMATION OR MEMBER: Breathitt
 RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
 EXPOSURE: TYPE, drill hole; CONDITION, 2 mos. old, wrapped in plastic
 SAMPLE CONDITION: clean, dry
 RECOVERY METHOD: core SAMPLING REGIME: Holmes
 SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 2.25 in.
 THICKNESS (INCHES): SEAM HEIGHT 38.6, SAMPLE 29.7, COAL ONLY 29.7
 STRUCTURAL FEATURE: SEPARATION:
 STRIKE AZIMUTHS: SET 1 , SET 2 , SET 3

THE MEASURED SECTION IS REPORTED IN FEET

IN SAMPLE?	THICKNESS	STRATIGRAPHIC SECTION DESCRIPTION
		Depth 51.6 feet.
N	1.41	Siltstone, black, laminated, carbonaceous, with abundant plant fragments, pyritic.
Y	1.15	Clarain; abundant thin-banded vitrain and scattered thin-banded fusain near base.
Y	0.16	Durain.
Y	0.02	Fusain.
Y	0.10	Clarain.
N	0.16	Siltstone, black, laminated, carbonaceous, thin-banded vitrain layers.
Y	0.23	Clarain.
N	0.15	Siltstone, black, laminated, carbonaceous.
Y	0.26	Clarain, abundant thin-banded vitrain and scattered thin-banded fusain, pyritic.
N	0.43	Siltstone, black, laminated, carbonaceous, with abundant plant fragments.
Y	0.56	Clarain, abundant thin- to thick-banded vitrain and scattered medium-banded fusain.
N	0.39	Siltstone, medium-gray, slightly arenaceous, rooted.
		Depth 54.9 feet.

COAL ANALYSIS REPORT

LABORATORY NO: U10023
LABORATORY: Geo Test

FIELD NO: KGS 381

U.S.G.S NO: W211623
REPORT DATE: Nov/11/1981

AIR DRIED LOSS: 1.59%

AS RECEIVED MOISTURE FREE MOISTURE/ASH FREE

PROXIMATE ANALYSIS:

TOTAL MOISTURE	4.11%		
VOLATILE MATTER	38.36%	40.01%	45.16%
FIXED CARBON	46.58%	48.58%	54.84%
ASH	10.95%	11.42%	

ULTIMATE ANALYSIS:

HYDROGEN	5.14%	4.88%	5.51%
CARBON	66.55%	69.40%	78.35%
NITROGEN	1.62%	1.69%	1.91%
TOTAL SULFUR	2.90%	3.02%	3.41%
OXYGEN	12.84%	9.59%	10.82%
ASH	10.95%	11.42%	

HEATING VALUE (BTU/LB):	12010	12525	14139
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SULFUR FORMS:

SULFATE	0.14%	0.15%	0.16%
PYRITIC	1.66%	1.73%	1.95%
ORGANIC	1.10%	1.15%	1.30%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2110 deg F
SOFTENING TEMP.	2220 deg F
FLUID TEMP.	2540 deg F

FREE SWELLING INDEX	1.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	04.8

COAL SAMPLING REPORT

LABORATORY NO: U10035 FIELD NO: KGS 390 U.S.G.S. NO: W211628
 SAMPLER: Currens AGENCY: KGS DATE: Aug/05/1980
 7.5' QUAD: Richardson COUNTY: Lawrence DISTRICT: Princess
 CARTER COORDINATE: SEC 1 ROW R TIER 82 1800 FT FSL, 3300 FT FEL
 LATITUDE: 37 DEG 59 MIN 17 SEC LONGITUDE: 82 DEG 40 MIN 41 SEC
 ELEVATION (FT): 846.00, OF POINT AT base of 390, USING altimeter
 COMMENTARY: Barometric elevation not adjusted for pressure or
 temperature changes.

REGIONAL COAL NAME: Up Peach Orch GEO. MAP COAL NAME: Up Peach Orch
 REPORTED COAL NAME: Peach Orch,us,ub FORMATION OR MEMBER: Breathitt
 RANGE SAMPLED (SPLITS, BENCHES, ETC.): top bench
 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 29.3, SAMPLE 29.3, COAL ONLY 29.3
 STRUCTURAL FEATURE: cleat, SEPARATION:
 STRIKE AZIMUTHS: SET 1 320, SET 2 40, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

IN SAMPLE?	THICKNESS	STRATIGRAPHIC SECTION	
			DESCRIPTION
N	32.81		Sandstone, light-gray, coarse-grained, massive.
N	1.97		Siltstone, dark-gray, carbonaceous; coaly at top.
Y	0.33		Clarain; argillaceous at top.
Y	0.49		Canneloid coal, indistinct layering, conchoidal fracture.
Y	0.36		Clarain, with abundant thin-banded vitrain.
Y	0.03		Fusain, prominent, laterally continuous, argillaceous.
Y	0.85		Clarain, with abundant thin- to medium-banded vitrain.
Y	0.02		Fusain.
Y	0.36		Clarain, with scattered thick vitrain. See KGS 391 for underlying strata.

COAL ANALYSIS REPORT

LABORATORY NO: U10035
 LABORATORY: Geo Test

FIELD NO: KGS 390

U.S.G.S NO: W211628
 REPORT DATE: Nov/11/1981

AIR DRIED LOSS: 0.53%

AS RECEIVED MOISTURE FREE MOISTURE/ASH FREE

PROXIMATE ANALYSIS:

TOTAL MOISTURE	3.52%		
VOLATILE MATTER	40.14%	41.61%	44.56%
FIXED CARBON	49.95%	51.77%	55.44%
ASH	6.39%	6.62%	

ULTIMATE ANALYSIS:

HYDROGEN	5.71%	5.51%	5.90%
CARBON	73.98%	76.68%	82.12%
NITROGEN	1.68%	1.74%	1.86%
TOTAL SULFUR	0.89%	0.92%	0.99%
OXYGEN	11.35%	8.53%	9.13%
ASH	6.39%	6.62%	

HEATING VALUE (BTU/LB):	13265	13749	14724
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SULFUR FORMS:

SULFATE	0.01%	0.01%	0.01%
PYRITIC	0.22%	0.23%	0.24%
ORGANIC	0.66%	0.68%	0.73%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

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

FREE SWELLING INDEX	1.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	01.3

ANALYSIS OF COAL SAMPLES FROM THE PRINCESS DISTRICT, KENTUCKY

COAL SAMPLING REPORT

LABORATORY NO: U10025 FIELD NO: KGS 391 U.S.G.S. NO: W211629
 SAMPLER: Currens AGENCY: KGS DATE: Aug/05/1980
 7.5' QUAD: Richardson COUNTY: Lawrence DISTRICT: Princess
 CARTER COORDINATE: SEC 1 ROW R TIER 82 1800 FT FSL, 3300 FT FEL
 LATITUDE: 37 DEG 59 MIN 17 SEC LONGITUDE: 82 DEG 40 MIN 41 SEC
 ELEVATION (FT): 845.00, OF POINT AT base of 391, USING altimeter
 COMMENTARY: Barometric elevation not adjusted for pressure or
 temperature changes.

REGIONAL COAL NAME: Up Peach Orch GEO. MAP COAL NAME: Up Peach Orch
 REPORTED COAL NAME: Peach Orch,us,1b FORMATION OR MEMBER: Breathitt
 RANGE SAMPLED (SPLITS, BENCHES, ETC.): bottom bench
 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 7.1, SAMPLE 7.1, COAL ONLY 7.1
 STRUCTURAL FEATURE: cleat, SEPARATION:
 STRIKE AZIMUTHS: SET 1 330, SET 2 40, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

		STRATIGRAPHIC SECTION
IN SAMPLE?	THICKNESS	DESCRIPTION
		Horizon KGS 390.
N	0.59	Siltstone, medium-gray, arenaceous, rooted.
Y	0.59	Clarain, pyritic, with abundant medium-banded vitrain.
		See KGS 394 for underlying strata.

COAL ANALYSIS REPORT

LABORATORY NO: U10025
 LABORATORY: Geo Test

FIELD NO: KGS 391

U.S.G.S NO: W211629
 REPORT DATE: Nov/11/1981

AIR DRIED LOSS: 1.22%

AS RECEIVED MOISTURE FREE MOISTURE/ASH FREE

PROXIMATE ANALYSIS:

TOTAL MOISTURE	3.83%		
VOLATILE MATTER	35.79%	37.21%	42.04%
FIXED CARBON	49.34%	51.30%	57.96%
ASH	11.04%	11.48%	

ULTIMATE ANALYSIS:

HYDROGEN	5.03%	4.78%	5.41%
CARBON	68.22%	70.94%	80.14%
NITROGEN	1.64%	1.71%	1.93%
TOTAL SULFUR	1.53%	1.59%	1.80%
OXYGEN	12.54%	9.50%	10.72%
ASH	11.04%	11.48%	

HEATING VALUE (BTU/LB):	12043	12522	14147
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SULFUR FORMS:

SULFATE	0.06%	0.06%	0.07%
PYRITIC	0.80%	0.83%	0.94%
ORGANIC	0.67%	0.70%	0.79%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2550 deg F
SOFTENING TEMP.	2620 deg F
FLUID TEMP.	2680 deg F

FREE SWELLING INDEX	1.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	02.5

COAL ANALYSIS REPORT

LABORATORY NO: U10037
LABORATORY: Geo Test

FIELD NO: KGS 394

U.S.G.S NO: W211632
REPORT DATE: Nov/11/1981

AIR DRIED LOSS: 0.61%

AS RECEIVED MOISTURE FREE MOISTURE/ASH FREE

PROXIMATE ANALYSIS:

TOTAL MOISTURE	3.23%		
VOLATILE MATTER	35.41%	36.59%	42.81%
FIXED CARBON	47.31%	48.89%	57.19%
ASH	14.05%	14.52%	

ULTIMATE ANALYSIS:

HYDROGEN	4.93%	4.72%	5.52%
CARBON	67.68%	69.94%	81.82%
NITROGEN	1.60%	1.65%	1.93%
TOTAL SULFUR	0.62%	0.64%	0.75%
OXYGEN	11.12%	8.53%	9.98%
ASH	14.05%	14.52%	

HEATING VALUE (BTU/LB):	11876	12273	14357
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SULFUR FORMS:

SULFATE	0.01%	0.01%	0.01%
PYRITIC	0.04%	0.04%	0.05%
ORGANIC	0.57%	0.59%	0.69%

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	01.0

COAL ANALYSIS REPORT

LABORATORY NO: U10038
LABORATORY: Geo Test

FIELD NO: KGS 395

U.S.G.S NO: W211633
REPORT DATE: Nov/11/1981

AIR DRIED LOSS: 0.64%

AS RECEIVED MOISTURE FREE MOISTURE/ASH FREE

PROXIMATE ANALYSIS:

TOTAL MOISTURE	3.89%		
VOLATILE MATTER	37.62%	39.14%	41.89%
FIXED CARBON	52.18%	54.29%	58.11%
ASH	6.31%	6.57%	

ULTIMATE ANALYSIS:

HYDROGEN	5.45%	5.22%	5.58%
CARBON	72.61%	75.55%	80.86%
NITROGEN	1.68%	1.75%	1.87%
TOTAL SULFUR	0.95%	0.99%	1.06%
OXYGEN	13.00%	9.92%	10.63%
ASH	6.31%	6.57%	

HEATING VALUE (BTU/LB):	12906	13429	14372
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SULFUR FORMS:

SULFATE	0.01%	0.01%	0.01%
PYRITIC	0.20%	0.21%	0.22%
ORGANIC	0.74%	0.77%	0.82%

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	01.5

COAL SAMPLING REPORT

LABORATORY NO: U10027 FIELD NO: KGS 412 U.S.G.S. NO: W211683
 SAMPLER: Currens AGENCY: KGS DATE: Sep/02/1980
 7.5' QUAD: Richardson COUNTY: Lawrence DISTRICT: Princess
 CARTER COORDINATE: SEC 1 ROW R TIER 82 2000 FT FSL, 3400 FT FEL
 LATITUDE: 37 DEG 59 MIN 19 SEC LONGITUDE: 82 DEG 40 MIN 43 SEC
 ELEVATION (FT): 850.00, OF POINT AT base of 412, USING topo

COMMENTARY:

REGIONAL COAL NAME: Peach Orch z GEO. MAP COAL NAME: Low Peach Orch
 REPORTED COAL NAME: Peach Orch, l s 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 18.1, SAMPLE 18.1, COAL ONLY 18.1
 STRUCTURAL FEATURE: cleat, SEPARATION:
 STRIKE AZIMUTHS: SET 1 140, SET 2 250, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

		STRATIGRAPHIC SECTION	
IN SAMPLE?	THICKNESS	DESCRIPTION	
		Horizon KGS 395.	
N	2.26	Siltstone, medium- to dark-gray, rooted at top.	
Y	0.43	Clarain.	
Y	0.07	Fusain, thickness varies.	
Y	0.26	Clarain.	
Y	0.07	Fusain.	
Y	0.30	Clarain.	
Y	0.39	Durain.	
N		Siltstone, dark-gray, rooted.	

COAL ANALYSIS REPORT

LABORATORY NO: U10027
 LABORATORY: Geo Test

FIELD NO: KGS 412

U.S.G.S NO: W211683
 REPORT DATE: Nov/11/1981

AIR DRIED LOSS: 1.46%

AS RECEIVED MOISTURE FREE MOISTURE/ASH FREE

PROXIMATE ANALYSIS:

TOTAL MOISTURE	4.51%		
VOLATILE MATTER	34.22%	35.84%	37.67%
FIXED CARBON	56.62%	59.29%	62.33%
ASH	4.65%	4.87%	

ULTIMATE ANALYSIS:

HYDROGEN	4.96%	4.67%	4.90%
CARBON	74.84%	78.37%	82.38%
NITROGEN	1.50%	1.57%	1.65%
TOTAL SULFUR	0.65%	0.68%	0.72%
OXYGEN	13.40%	9.84%	10.35%
ASH	4.65%	4.87%	

HEATING VALUE (BTU/LB):	13102	13720	14423
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SULFUR FORMS:

SULFATE	0.02%	0.02%	0.02%
PYRITIC	0.05%	0.05%	0.06%
ORGANIC	0.58%	0.61%	0.64%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

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

FREE SWELLING INDEX	1.0
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	01.0

ANALYSIS OF COAL SAMPLES FROM THE PRINCESS DISTRICT, KENTUCKY

COAL SAMPLING REPORT

LABORATORY NO: U10283 FIELD NO: KGS 502 U.S.G.S. NO: W213948
 SAMPLER: Currens AGENCY: KGS DATE: Apr/14/1981
 7.5' QUAD: Richardson COUNTY: Lawrence DISTRICT: Princess
 CARTER COORDINATE: SEC 16 ROW R TIER 83 4400 FT FSL, 2100 FT FEL
 LATITUDE: 37 DEG 56 MIN 44 SEC LONGITUDE: 82 DEG 39 MIN 25 SEC
 ELEVATION (FT): 755.00, OF POINT AT base of 502, USING topo
 COMMENTARY: Kentucky Highway 581 improvement, elevation determined
 from engineering core holes, accuracy plus or minus 3
 feet.

REGIONAL COAL NAME: Peach Orchard z GEO. MAP COAL NAME: Peach Orchard
 REPORTED COAL NAME: Peach Orch t s FORMATION OR MEMBER: Breathitt
 RANGE SAMPLED (SPLITS, BENCHES, ETC.): top split
 EXPOSURE: TYPE, roadcut; CONDITION, 6 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.
 THICKNESS (INCHES): SEAM HEIGHT 27.6, SAMPLE 15.7, COAL ONLY 15.4
 STRUCTURAL FEATURE: cleat, SEPARATION:
 STRIKE AZIMUTHS: SET 1 145, SET 2 50, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

IN SAMPLE?	THICKNESS	STRATIGRAPHIC SECTION	
			DESCRIPTION
N	16.40		Sandstone, buff, coarse-grained, massive, no lag gravel at base.
Y	0.16		Clarain, with abundant thin-banded vitrain.
N	0.36		Shale, black, highly carbonaceous, with scattered medium-banded vitrain.
N	0.62		Siltstone, light-gray, carbonaceous.
Y	0.16		Clarain, with scattered vitrain.
Y	0.79		Clarain, with abundant medium-banded vitrain.
N	0.03		Clay, light-brown.
Y	0.16		Clarain.
N	0.66		Shale, medium-gray, slightly silty, slightly carbonaceous, rooted.

COAL ANALYSIS REPORT

LABORATORY NO: U10283
 LABORATORY: Geo Test

FIELD NO: KGS 502

U.S.G.S NO: W213948
 REPORT DATE: Jan/25/1982

AIR DRIED LOSS: 1.79%

AS RECEIVED MOISTURE FREE MOISTURE/ASH FREE

PROXIMATE ANALYSIS:

TOTAL MOISTURE	5.06%		
VOLATILE MATTER	35.65%	37.55%	44.33%
FIXED CARBON	44.76%	47.15%	55.66%
ASH	14.53%	15.30%	

ULTIMATE ANALYSIS:

HYDROGEN	5.25%	4.93%	5.82%
CARBON	65.28%	68.76%	81.18%
NITROGEN	1.45%	1.53%	1.80%
TOTAL SULFUR	1.05%	1.11%	1.31%
OXYGEN	12.44%	8.37%	9.89%
ASH	14.53%	15.30%	

HEATING VALUE (BTU/LB):	11579	12196	14400
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SULFUR FORMS:

SULFATE	0.07%	0.07%	0.09%
PYRITIC	0.36%	0.38%	0.45%
ORGANIC	0.62%	0.65%	0.77%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2530 deg F
SOFTENING TEMP.	2800 deg F
FLUID TEMP.	2800 deg F

FREE SWELLING INDEX	1.5
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	01.8

COAL SAMPLING REPORT

LABORATORY NO: U10318 FIELD NO: KGS 516 U.S.G.S. NO: W213938
 SAMPLER: Currens AGENCY: KGS DATE: Apr/30/1981
 7.5' QUAD: Richardson COUNTY: Lawrence DISTRICT: Princess
 CARTER COORDINATE: SEC 15 ROW R TIER 83 400 FT FSL, 4500 FT FEL
 LATITUDE: 37 DEG 57 MIN 3 SEC LONGITUDE: 82 DEG 39 MIN 56 SEC
 ELEVATION (FT): 600.00, OF POINT AT base of 516, USING topo

COMMENTARY:

REGIONAL COAL NAME: Fire Clay GEO. MAP COAL NAME: Fire Clay
 REPORTED COAL NAME: Fire Clay FORMATION OR MEMBER: Breathitt
 RANGE SAMPLED (SPLITS, BENCHES, ETC.): full thickness
 EXPOSURE: TYPE, roadcut; CONDITION, about 8 weeks old, faced-up
 SAMPLE CONDITION: damp
 RECOVERY METHOD: channel SAMPLING REGIME: Holmes
 SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
 THICKNESS (INCHES): SEAM HEIGHT 12.2, SAMPLE 9.4, COAL ONLY 9.4
 STRUCTURAL FEATURE: cleat, SEPARATION:
 STRIKE AZIMUTHS: SET 1 310, SET 2 30, SET 3

THE MEASURED SECTION IS REPORTED IN FEET

IN SAMPLE?	THICKNESS	STRATIGRAPHIC SECTION DESCRIPTION
N	6.56	Sandstone.
N	9.84	Siltstone, dark-gray, arenaceous.
N	13.12	Sandstone, coarse-grained, crossbedded, carbonaceous, micaceous; lag gravel (abundant siderite) at base.
N	0.98	Shale, dark-gray to black, laminated; locally cut out; scattered pelecypods(?), abundant plant fragments.
N	0.92	Canneloid coal.
N	0.30	Durain.
N	0.26	Siltstone, carbonaceous.
N	0.53	Canneloid coal.
N	1.71	Siltstone, gray-brown, intensively rooted, soft.
N	3.45	Siltstone, medium- to dark-gray; arenaceous at base; intensively rooted, sideritic (rooted also).
Y	0.33	Clarain, with abundant thin-banded vitrain.
Y	0.16	Durain, with scattered thin-banded vitrain.
N	0.23	Siltstone, black to dark-gray-brown, brittle, highly carbonaceous, hard (flint clay).
Y	0.30	Durain, highly argillaceous, with scattered thin-banded vitrain.
N	1.64	Shale, medium-gray, intensively rooted.

COAL ANALYSIS REPORT

LABORATORY NO: U10318
LABORATORY: Geo Test

FIELD NO: KGS 516

U.S.G.S NO: W213938
REPORT DATE: Jan/25/1982

AIR DRIED LOSS: 1.80%

AS RECEIVED MOISTURE FREE MOISTURE/ASH FREE

PROXIMATE ANALYSIS:

TOTAL MOISTURE	4.32%		
VOLATILE MATTER	30.25%	31.62%	42.50%
FIXED CARBON	40.93%	42.78%	57.50%
ASH	24.50%	25.61%	

ULTIMATE ANALYSIS:

HYDROGEN	4.48%	4.18%	5.61%
CARBON	57.30%	59.89%	80.50%
NITROGEN	1.21%	1.26%	1.70%
TOTAL SULFUR	0.56%	0.59%	0.79%
OXYGEN	11.95%	8.47%	11.40%
ASH	24.50%	25.61%	

HEATING VALUE (BTU/LB):	10015	10468	14070
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SULFUR FORMS:

SULFATE	0.02%	0.02%	0.03%
PYRITIC	0.07%	0.07%	0.10%
ORGANIC	0.47%	0.49%	0.66%

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	01.1

COAL SAMPLING REPORT

LABORATORY NO: U10366 FIELD NO: KGS 517 U.S.G.S. NO: W213939
 SAMPLER: Currens AGENCY: KGS DATE: Apr/30/1981
 7.5' QUAD: Richardson COUNTY: Lawrence DISTRICT: Princess
 CARTER COORDINATE: SEC 16 ROW R TIER 83 5500 FT FSL, 2900 FT FEL
 LATITUDE: 37 DEG 56 MIN 54 SEC LONGITUDE: 82 DEG 39 MIN 35 SEC
 ELEVATION (FT): 727.00, OF POINT AT base of 517, USING topo

COMMENTARY:

REGIONAL COAL NAME: Peach Orch z GEO. MAP COAL NAME: Peach Orchard
 REPORTED COAL NAME: Peach Orch, b s FORMATION OR MEMBER: Breathitt
 RANGE SAMPLED (SPLITS, BENCHES, ETC.): bottom split
 EXPOSURE: TYPE, roadcut; CONDITION, 8 weeks old, faced-up by hand
 SAMPLE CONDITION: fresh, damp
 RECOVERY METHOD: channel SAMPLING REGIME: Holmes
 SAMPLE SIZE (CORE DIA., CHANNEL SIZE, OR LBS.): 3 x 3 in.
 THICKNESS (INCHES): SEAM HEIGHT 9.5, SAMPLE 9.4, COAL ONLY 9.4
 STRUCTURAL FEATURE: cleat, SEPARATION: 0
 STRIKE AZIMUTHS: SET 1 320, SET 2 360, SET 3 230

THE MEASURED SECTION IS REPORTED IN FEET

IN SAMPLE?	THICKNESS	STRATIGRAPHIC SECTION	
			DESCRIPTION
		Horizon KGS 502.	
N	0.66	Ganister.	
N	2.95	Sandstone, white to light-gray, fine-grained, intensively rooted, carbonaceous, micaceous.	
N	9.19	Siltstone, interbedded with fine-grained sandstone in 0.5-cm beds, light- to medium-gray; coarsens upward; plant fragments, carbonaceous, micaceous, laminated.	
N	0.16	Shale, black, laminated, sideritic.	
N	0.33	Durain, highly argillaceous.	
N	0.39	Clarain; third from bottom split of Peach Orchard.	
N	4.27	Shale, medium-gray; laminated to rooted at top.	
N	0.69	Siltstone, black, laminated, with arenaceous laminations to 3 cm thick.	
N	0.43	Clarain; second from bottom split of Peach Orchard.	
N	2.30	Shale, medium-gray, rooted.	
N	5.58	Shale, medium-gray, sideritic, laminated to partly bioturbated.	
Y	0.79	Clarain, with abundant medium- to thick-banded vitrain and abundant medium-banded fusain.	
N	0.85	Siltstone, light-gray, rooted.	
N	18.05	Sandstone, light-gray to buff, coarse-grained, fines upward; argillaceous at top (rooted at top); micaceous, trough crossbeds.	

COAL ANALYSIS REPORT

LABORATORY NO: U10366
LABORATORY: Geo Test

FIELD NO: KGS 517

U.S.G.S NO: W213939
REPORT DATE: Feb/11/1982

AIR DRIED LOSS: 4.68%

AS RECEIVED MOISTURE FREE MOISTURE/ASH FREE

PROXIMATE ANALYSIS:

TOTAL MOISTURE	8.51%		
VOLATILE MATTER	32.88%	35.94%	37.21%
FIXED CARBON	55.48%	60.64%	62.79%
ASH	3.13%	3.42%	

ULTIMATE ANALYSIS:

HYDROGEN	5.30%	4.75%	4.92%
CARBON	73.40%	80.23%	83.07%
NITROGEN	1.40%	1.53%	1.58%
TOTAL SULFUR	0.60%	0.66%	0.68%
OXYGEN	16.17%	9.41%	9.75%
ASH	3.13%	3.42%	

HEATING VALUE (BTU/LB):	12927	14129	14630
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SULFUR FORMS:

SULFATE	0.03%	0.03%	0.03%
PYRITIC	0.10%	0.11%	0.11%
ORGANIC	0.47%	0.51%	0.53%

ASH FUSION TEMPERATURE (REDUCING ATMOSPHERE)

INITIAL DEFORMATION	2050 deg F
SOFTENING TEMP.	2110 deg F
FLUID TEMP.	2190 deg F

FREE SWELLING INDEX	1.5
POUNDS OF SULFUR DIOXIDE PER MILLION BTU	00.9

**APPENDIX II:
CHEMICAL ANALYSES**

Table 1.--Descriptions and Locations for 42 Coal Samples from the Princess District, Eastern Kentucky.

Sample No.	Field No.	County	Latitude	Longitude	Formation	Coal Bed	Estimated Rank	Sample Thickness (inches)
W203629	KGS 4	Boyd	381852n	824507w	Breathitt	Princess No.8	High Volatile B Bit	51.0
W211189	KGS 335	Lawrence	381017n	823753w	Breathitt	Princess No.8	High Volatile C Bit	6.0 *
W203628	KGS 1	Boyd	381907n	824520w	Breathitt	Princess No.7	High Volatile B Bit	47.0
W207457	KGS 150	Boyd	382147n	824431w	Breathitt	Princess No.7	High Volatile C Bit	46.0 **
W207460	KGS 154	Boyd	382447n	824234w	Breathitt	Princess No.7	High Volatile B Bit	14.0 **
W207816	KGS 162	Boyd	382328n	824417w	Breathitt	Princess No.7	High Volatile B Bit	48.0
W208435	KGS 132	Lawrence	380904n	823826w	Breathitt	Princess No.7	High Volatile A Bit	20.0 *
W208436	KGS 133	Lawrence	381212n	823613w	Breathitt	Princess No.7	High Volatile B Bit	12.0 *
W207459	KGS 153	Boyd	382447n	824234w	Breathitt	Princess No.6	High Volatile B Bit	18.0 **
W208199	KGS 161	Boyd	382439n	824013w	Breathitt	Princess No.6	High Volatile B Bit	16.0 **
W207863	KGS 236	Lawrence	375350n	823633w	Breathitt	Richardson	High Volatile B Bit	76.0
W207458	KGS 151	Boyd	382447n	824234w	Breathitt	Princess No.5	High Volatile B Bit	21.0 **
W207809	KGS 158	Boyd	382209n	824729w	Breathitt	Princess No.5	High Volatile B Bit	11.0 **
W207810	KGS 159	Boyd	382209n	824729w	Breathitt	Princess No.5	High Volatile C Bit	38.0 **
W211192	KGS 379	Carter	381218n	825730w	Breathitt	Princess No.5	High Volatile B Bit	23.0
W208434	KGS 131	Greenup	383014n	824055w	Breathitt	Princess No.5	High Volatile B Bit	28.0 **
W205318	KGS 15	Lawrence	375325n	823555w	Breathitt	Broas Upper Rider	High Volatile B Bit	44.0
W207108	KGS 66	Greenup	382548n	825437w	Breathitt	Princess No.4	High Volatile B Bit	9.0 *
W207865	KGS 156	Carter	382132n	825224w	Breathitt	Princess No.3 Rider	High Volatile B Bit	8.0 **
W211628	KGS 390	Lawrence	375917n	824041w	Breathitt	Upper Peach Orchard	High Volatile A Bit	29.0
W211629	KGS 391	Lawrence	375917n	824041w	Breathitt	Upper Peach Orchard	High Volatile B Bit	7.0
W211632	KGS 394	Lawrence	375917n	824041w	Breathitt	Middle Peach Orchard	High Volatile A Bit	8.0
W211633	KGS 395	Lawrence	375917n	824041w	Breathitt	Middle Peach Orchard	High Volatile B Bit	19.0
W205333	KGS 33	Lawrence	380010n	823753w	Breathitt	Peach Orchard	Subbituminous A	19.0 ***
W205334	KGS 34	Lawrence	380217n	824219w	Breathitt	Peach Orchard	High Volatile B Bit	13.0
W205335	KGS 35-8	Lawrence	375744n	823335w	Breathitt	Peach Orchard	High Volatile B Bit	8.0
W205336	KGS 35-13	Lawrence	375744n	823335w	Breathitt	Peach Orchard	High Volatile B Bit	13.0
W211683	KGS 412	Lawrence	375919n	824043w	Breathitt	Peach Orchard	High Volatile B Bit	18.0
W213939	KGS 517	Lawrence	375654n	823935w	Breathitt	Peach Orchard	High Volatile B Bit	9.0
W213948	KGS 502	Lawrence	375644n	823925w	Breathitt	Peach Orchard	High Volatile B Bit	16.0
W207808	KGS 155	Carter	382132n	825224w	Breathitt	Princess No.3	High Volatile B Bit	14.0 **
W207106	KGS 64	Greenup	382510n	825107w	Breathitt	Princess No.3	High Volatile B Bit	12.0

Table 1.--Descriptions and Locations for 42 Coal Samples from the Princess District, Eastern Kentucky--Continued.

Sample No.	Field No.	County	Latitude	Longitude	Formation	Coal Bed	Estimated Rank	Sample Thickness (inches)
W207107	KGS 65	Greenup	382501n	825108w	Breathitt	Princess No.3	High Volatile C Bit	20.0
W207109	KGS 67	Greenup	382548n	825437w	Breathitt	Princess No.3	High Volatile B Bit	14.0
W207110	KGS 68	Greenup	382548n	825437w	Breathitt	Princess No.3	High Volatile B Bit	15.0
W207862	KGS 157	Greenup	382839n	825208w	Breathitt	Princess No.3	High Volatile B Bit	15.0 ***
W213938	KGS 516	Lawrence	375703n	823956w	Breathitt	Fire Clay	High Volatile B Bit	9.0
W211191	KGS 378	Carter	382323n	830559w	Breathitt	Gun Creek	High Volatile B Bit	16.0
W211193	KGS 380	Carter	382324n	830607w	Breathitt	Tom Cooper	High Volatile B Bit	17.0
W211623	KGS 381	Carter	382004n	830008w	Breathitt	Little Caney	High Volatile B Bit	30.0
W207473	KGS 152	Boyd	382447n	824234w	Breathitt	Unnamed	High Volatile C Bit	13.0 **
W207896	KGS 160	Boyd	382209n	824729w	Breathitt	Unnamed	High Volatile B Bit	8.0 **

* This sample was slightly weathered.

** This sample was weathered.

*** This sample was very weathered.

Table 2.--Major- and Minor- Oxides and Trace-Element Concentrations in the Laboratory Ash of 42 Bituminous Coal Samples from the Princess Reserve District, Eastern Kentucky.

[Values in percent or parts per million. Coal ashed at 525^oC. L means less than the value shown; H, interference for an element that 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 spectrographic 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 ₂ O ₃ (PERCENT)	CaO (PERCENT)	MgO (PERCENT)	Na ₂ O (PERCENT)	K ₂ O (PERCENT)	Fe ₂ O ₃ (PERCENT)	TiO ₂ (PERCENT)	P ₂ O ₅ (PERCENT)	SAMPLE NUMBER
W203628	5.8	44	34	1.4	0.50	0.12	1.2	13	1.0	0.29	W203628
W203629	17.2	42	33	1.1	.43	.15	1.2	14	1.9	.87	W203629
W205318	7.7	52	35	.88	.50	.14	1.9	3.4	1.6	.06L	W205318
W205333	8.9	39	27	5.0	2.5	.28	3.0	7.4	.84	.06	W205333
W205334	11.3	52	33	1.5	.63	.11	1.5	2.3	2.0	.04L	W205334
W205335	13.3	50	26	.80	.88	.23	2.9	14	1.2	.04L	W205335
W205336	7.8	52	29	1.1	1.1	.27	2.8	5.3	1.1	.06L	W205336
W207106	21.6	47	25	.73	.60	.18	1.7	21	1.6	.02L	W207106
W207107	4.9	42	33	3.3	.86	.12	.91	9.1	.63	.22	W207107
W207108	14.1	34	13	.97	.60	.15	1.6	46	.65	.04L	W207108
W207109	25.8	48	24	.56	.65	.14	2.0	19	1.4	.02L	W207109
W207110	8.9	50	34	.83	.76	.16	2.1	7.0	1.1	.06L	W207110
W207457	16.6	60	24	.50	.48	.08	1.5	7.2	2.5	.06L	W207457
W207458	29.0	77	8.5	.31	.12	.03	.44	9.3	.43	.03L	W207458
W207459	24.0	44	26	.52	.35	.08	1.3	23	.80	.04L	W207459
W207460	14.1	22	13	.77	.32	.08	1.0	58	.52	.07L	W207460
W207473	43.1	57	28	.28	.58	.12	1.8	8.3	1.9	.02L	W207473
W207808	4.0	31	18	2.4	.58	.16	.91	42	.57	.25L	W207808
W207809	19.0	55	26	.69	.66	.20	2.6	12	1.0	.05L	W207809
W207810	12.5	47	26	1.5	.65	.23	1.7	17	1.6	.08L	W207810

Table 2.--Major- and Minor-Oxides and Trace-Element Concentrations in the Laboratory Ash of 42 Bituminous Coal Samples from the Princess District, Eastern Kentucky--Continued.

SAMPLE NUMBER	SO ₃ (PERCENT)	AG-S PPM	B-S PPM	BA-S PPM	BE-S PPM	BI-S PPM	CD PPM	CE PPM	CO PPM	CR PPM	SAMPLE NUMBER
W203628	1.4	0.66	1,200	280	27	15L	0.85	160	110	190	W203628
W203629	.75	.20	500	400	11	15L	1.3	330	40	220	W203629
W205318	1.3	.15	1,500	360	23	10L	.07	250	25	190	W205318
W205333	9.8	.30	500	770	12	10L	.26	180	140	150	W205333
W205334	2.0	.23	570	360	15	10L	.19	130	47	200	W205334
W205335	1.0	.38	500	420	13	10L	1.1	180	24	90	W205335
W205336	1.0	.49	2,000	540	14	10L	.23	150	100	130	W205336
W207106	1.3	.43	360	230	22	10L	.34	120	30	140	W207106
W207107	5.3	.37	800	460	74	10L	1.6	340	180	220	W207107
W207108	2.0	.53	400	240	35	10L	2.9	82	110	79	W207108
W207109	1.2	.29	250	250	15	10	.67	100	40	130	W207109
W207110	.95	.59	750	300	55	10L	.66	300	180	200	W207110
W207457	.77	.10L	410	250	8.5	10L	.12	150	17	170	W207457
W207458	.50	.10L	280	460	15	10L	.40	14L	23	67	W207458
W207459	1.2	.40	300	1,300	29	10L	1.4	430	63	280	W207459
W207460	1.5	.52	250	460	25	10L	.58	28L	23	100	W207460
W207473	.50	.42	230	2,200	9.5	10L	.11	170	9.3	230	W207473
W207808	2.8	.45	480	340	84	10L	.46	100	61	130	W207808
W207809	1.2	.29	400	370	21	10L	.57	190	57	240	W207809
W207810	2.2	.27	480	420	21	10L	.35	230	34	260	W207810

Table 2.--Major- and Minor- Oxides and Trace-Element Concentrations in the Laboratory Ash of 42 Bituminous Coal Samples from the Princess District, Eastern Kentucky.

SAMPLE NUMBER	CS PPM	CU PPM	DY-S PPM	ER-S PPM	EU PPM	GA-S PPM	GD-S PPM	GE-S PPM	HF PPM	HO-S PPM	SAMPLE NUMBER
W203628	5.2	150	22L	10L	4.0	71	15L	54	5.2	6.8L	W203628
W203629	3.8	180	22L	10L	5.3	56	15L	3.0	8.1	6.8L	W203629
W205318	7.8	140	22L	10L	4.5	41	15L	4.6	7.8	6.8L	W205318
W205333	10	150	22L	10L	4.2	28	15L	4.3	4.5	6.8L	W205333
W205334	4.4	140	22L	10L	3.8	66	15L	8.0	8.0	6.8L	W205334
W205335	5.3	220	22L	11	3.4	46	15L	7.0	6.0	6.8L	W205335
W205336	9.0	170	22L	10L	4.1	40	15L	4.6	5.1	6.8L	W205336
W207106	7.2	130	22L	10L	2.3	39	15L	23	6.9	6.8L	W207106
W207107	5.1	170	28	10L	7.1	110	15L	140	6.1	6.8L	W207107
W207108	9.6	110	22L	10L	2.3	72	15L	85	3.2	6.8L	W207108
W207109	8.1	100	22L	10L	1.9	38	15L	15	6.2	6.8L	W207109
W207110	6.7	150	22L	10L	5.7	91	15L	58	5.6	6.8L	W207110
W207457	6.0	64	22L	10L	2.5	26	15L	7.1	12	6.8L	W207457
W207458	1.7	66	22L	10L	1.2	15	15L	9.2	2.1	6.8L	W207458
W207459	6.3	71	26	12	6.3	70	26	110	21	8.7	W207459
W207460	3.5	150	22	11	2.9	71	22	77	2.8	6.8L	W207460
W207473	6.0	72	22L	10L	2.4	49	15L	13	8.4	6.8L	W207473
W207808	3.8	170	46L	10L	5.7	100	46L	68	5.0	6.8L	W207808
W207809	10	280	22L	10L	3.9	43	46L	26	5.3	6.8L	W207809
W207810	7.2	210	22L	10L	4.6	37	46L	9.4	8.0	6.8L	W207810

Table 2.--Major- and Minor-Oxides and Trace-Element Concentrations in the Laboratory Ash of 42 Bituminous Coal Samples from the Princess Reserve District, Eastern Kentucky--Continued.

SAMPLE NUMBER	IN-S PPM	LA PPM	LI PPM	LU PPM	MN PPM	MO-S PPM	NB-S PPM	ND-S PPM	NI-S PPM	PB PPM	SAMPLE NUMBER
W203628	6.8L	52	240	1.4	63	32	9	87	340	150	W203628
W203629	6.8L	190	420	1.5	46	7.7	12	100	71	140	W203629
W205318	6.8L	130	190	1.7	40	9.6	21	130	62	70	W205318
W205333	6.8L	79	140	1.5	130	29	11	79	180	65	W205333
W205334	6.8L	62	240	1.5	100	11	35	92	140	100	W205334
W205335	6.8L	98	130	1.0	91	40	12	41	350	120	W205335
W205336	6.8L	77	180	1.8	250	32	14	78	200	98	W205336
W207106	6.8L	65	230	1.4	110	5.8	23	58	62	83	W207106
W207107	6.8L	220	150	3.0	370	55	9	110	700	200	W207107
W207108	6.8L	35	55	1.8	200	94	21	42	430	130	W207108
W207109	6.8L	58	200	1.0	190	3.5	7	32L	84	92	W207109
W207110	6.8L	150	220	2.0	84	8.6	8	94	380	110	W207110
W207457	6.8L	84	210	1.3	55	4.3	24	32L	40	77	W207457
W207458	6.8L	0.0B	45	0.0B	43	9.7	7	32L	68	51	W207458
W207459	6.8L	180	110	5.8	60	42	20	90	110	200	W207459
W207460	6.8L	0.0B	59	0.0B	240	120	13	33	61	60	W207460
W207473	6.8L	90	140	.9	42	8.4	28	91	56	58	W207473
W207808	6.8L	25	73	5.6	170	74	12	67	170	91	W207808
W207809	6.8L	95	100	2.1	45	30	21	79	170	160	W207809
W207810	6.8L	120	150	2.0	95	11	19	80	94	92	W207810

Table 2.--Major- and Minor-Oxides and Trace-Element Concentrations in the Laboratory Ash of 42 Bituminous Coal Samples from the Princess District, Eastern Kentucky--Continued.

SAMPLE NUMBER	PR-S PPM	RB PPM	SC PPM	SM PPM	SN-S PPM	SR-S PPM	TA PPM	TB PPM	TH PPM	TL-S PPM	SAMPLE NUMBER
W203628	68L	140L	44	17	1.5L	690	3.4L	2.8	26	3.2L	W203628
W203629	70	76	53	27	1.5L	1,800	2.6	3.8	51	3.2L	W203629
W205318	68L	780L	38	23	10	480	3.9L	3.0	30	11	W205318
W205333	68L	670L	27	22	3.0	750	3.4L	3.1	21	4.6L	W205333
W205334	68L	440L	36	19	12	340	2.8	3.4	35	8.1	W205334
W205335	68L	450L	23	19	3.6	390	1.9	2.6	20	28	W205335
W205336	68L	640L	36	22	4.5	670	2.6L	3.7	26	4.6L	W205336
W207106	68L	88	38	11	1.5L	340	2.2	1.8	24	4.6L	W207106
W207107	68L	610L	100	28	2.5	1,900	8.2L	6.7	23	4.6L	W207107
W207108	68L	130	39	9.2	0.0H	350	3.5L	2.4	11	4.6L	W207108
W207109	68L	150	30	9.5	1.5L	200	2.1	1.8	22	4.6L	W207109
W207110	68L	340L	62	26	3.1	330	2.2	3.8	21	4.6L	W207110
W207457	68L	110	30	9.6	4.2	260	2.5	1.8	31	4.6L	W207457
W207458	68L	0.0B	15	0.0B	1.5L	120	.59	.62	9.0	4.6L	W207458
W207459	68L	92	76	45	1.5L	270	2.2	9.0	54	4.6L	W207459
W207460	68L	0.0B	35	0.0B	0.0H	240	2.8L	3.2	13	4.6L	W207460
W207473	68L	110	39	13	10	320	2.1	1.4	39	4.6L	W207473
W207808	68L	750L	75	19	0.0H	720	2.5L	6.4	15	4.6L	W207808
W207809	68L	170	75	19	3.9	270	1.3	2.5	33	4.6L	W207809
W207810	68L	400L	56	22	1.5L	440	1.8	3.8	38	4.6L	W207810

Table 2.--Major- and Minor-Oxides and Trace-Element Concentrations in the Laboratory Ash of 42 Bituminous Coal Samples from the Princess Reserve District, Eastern Kentucky--Continued.

SAMPLE NUMBER	U PPM	V-S PPM	W PPM	Y-S PPM	YB PPM	ZN PPM	ZR-S PPM	SAMPLE NUMBER
W203628	19	230	5.2	61	10	210	82	W203628
W203629	16	220	5.5	55	10	110	80	W203629
W205318	6.9	230	10L	74	10	49	170	W205318
W205333	5.8	220	4.5	70	7.9	120	120	W205333
W205334	18	250	5.3	62	8.8	67	260	W205334
W205335	12	260	3.8	65	7.5	640	110	W205335
W205336	12	260	6.4	80	9.0	120	170	W205336
W207106	8.8	120	5.1	47	7.9	48	150	W207106
W207107	11	230	21	98	17	280	99	W207107
W207108	7.6	130	7.8	58	9.6	1,300	120	W207108
W207109	6.3	110	4.3	19	5.8	110	68	W207109
W207110	7.1	210	10	58	12	260	92	W207110
W207457	13	110	4.2	21	7.8	48	92	W207457
W207458	8.0	81	0.0B	28	0.0B	170	79	W207458
W207459	59	180	6.7	89	35	310	200	W207459
W207460	54	140	0.0B	61	0.0B	120	63	W207460
W207473	10	230	3.5	40	5.8	55	180	W207473
W207808	7.7L	160	32	160	31	360	100	W207808
W207809	27	250	5.5	64	13	130	140	W207809
W207810	14	200	8.8	56	12	140	110	W207810

Table 2.--Major- and Minor-Oxides and Trace-Element Concentrations in the Laboratory Ash of 42 Bituminous Coal Samples from the Princess Reserve District, Eastern Kentucky--Continued.

SAMPLE NUMBER	ASH (PERCENT)	SiO ₂ (PERCENT)	Al ₂ O ₃ (PERCENT)	CaO (PERCENT)	MgO (PERCENT)	Na ₂ O (PERCENT)	K ₂ O (PERCENT)	Fe ₂ O ₃ (PERCENT)	TiO ₂ (PERCENT)	P ₂ O ₅ (PERCENT)	SAMPLE NUMBER
W207816	14.1	45	25	.83	.66	.14	1.7	23	1.8	.07L	W207816
W207862	6.7	34	17	3.1	.60	.45	1.3	36	1.1	.15L	W207862
W207863	19.0	52	27	.50	.55	.13	1.8	15	2.1	.05L	W207863
W207865	7.4	35	18	.92	.71	.14	2.0	39	.78	.14L	W207865
W207896	14.7	25	14	.92	.53	.18	1.2	53	.58	.07L	W207896
W208199	6.3	29	20	2.7	.48	.27	.94	40	.67	.16L	W208199
W208434	19.0	52	37	.32	.76	.30	1.9	3.2	1.4	.05L	W208434
W208435	5.0	21	14	1.6	.55	.19	1.2	56	.43	.20L	W208435
W208436	13.2	25	16	1.2	.41	.16	1.1	51	.58	.08L	W208436
W211683	5.1	55	28	1.6	1.2	.26	3.2	3.6	1.4	.20L	W211683
W211189	37.4	38	26	.49	.73	.14	2.5	26	1.0	.03L	W211189
W211191	9.4	19	11	1.3	.40	.07	.77	55	.50	1.0	W211191
W211192	9.7	55	29	.83	.91	.16	3.1	5.2	1.2	.10L	W211192
W211193	4.9	53	28	1.8	.66	.15	1.6	5.4	2.3	.20L	W211193
W211623	11.4	39	25	1.4	.90	.28	3.0	23	.84	1.3	W211623
W211628	6.5	48	33	1.8	.98	.32	2.7	7.2	1.2	.15L	W211628
W211629	11.8	52	27	.83	.85	.20	2.6	12	1.3	.08L	W211629
W211632	14.3	53	37	.56	.66	.18	2.2	1.5	2.0	.07L	W211632
W211633	6.6	46	39	1.4	.63	.71	1.5	5.3	.75	.15L	W211633
W213938	25.5	55	37	.53	.35	.19	1.0	1.1	2.0	.08	W213938
W213939	3.2	26	14	3.8	1.3	0.36	1.3	40	0.68	0.31L	W213939
W213948	16.0	51	31	.90	1.1	.30	3.8	.65	1.2	.08	W213948

Table 2.--Major- and Minor-Oxides and Trace-Element Concentrations in the Laboratory Ash of 42 Bituminous Coal Samples from the Princess Reserve District, Eastern Kentucky--Continued.

SAMPLE NUMBER	SO ₃ (PERCENT)	AG-S PPM	B-S PPM	BA-S PPM	BE-S PPM	BI-S PPM	CD PPM	CE PPM	CO PPM	CR PPM	SAMPLE NUMBER
W207816	1.0	.13	400	300	8.4	10L	.38	130	24	140	W207816
W207862	3.5	.85	700	690	110	10L	.35	100	33	100	W207862
W207863	.80	.34	250	320	13	10L	.38	200	37	170	W207863
W207865	1.1	.71	500	350	50	10L	.72	110	43	190	W207865
W207896	1.9	.62	300	240	18	10L	1.6	61	28	68	W207896
W208199	2.9	2.5	600	880	150	10L	1.6	140	79	170	W208199
W208434	.57	.34	600	320	12	10L	.20	220	64	150	W208434
W208435	2.2	1.6	600	260	81	10L	.30	180	280	190	W208435
W208436	1.0	5.2	500	1,600	59	10L	1.8	68	100	80	W208436
W211683	1.9	1.5	1,000	580	88	10L	4.5	160	160	200	W211683
W211189	1.4	.36	220	340	20	13	.14	94	28	120	W211189
W211191	1.6	.79	680	480	34	150	.40	280	110	120	W211191
W211192	1.4	.36	320	380	32	10L	1.6	200	64	580	W211192
W211193	2.4	1.0	220	370	140	10L	.38	260	210	270	W211193
W211623	1.8	.63	550	830	14	10L	.80	260	36	120	W211623
W211628	1.4	.55	680	630	19	10L	.82	200	180	170	W211628
W211629	.80	.80	600	990	37	10L	1.8	140	200	210	W211629
W211632	.30	.10L	370	250	21	10L	.36	150	60	240	W211632
W211633	1.2	.22	850	480	33	10L	2.0	200	230	180	W211633
W213938	.43	.27	210	300	24	10L	1.0	320	21	110	W213938
W213939	5.4	1.1	460	410	230	10L	0.59	130	660	160	W213939
W213948	1.3	.18	210	610	57	10L	.88	140	120	160	W213948

APPENDIX II: CHEMICAL ANALYSES

Table 2.--Major- and Minor-Oxides and Trace-Element Concentrations in the Laboratory Ash of 42 Bituminous Coal Samples from the Princess District, Eastern Kentucky--Continued.

SAMPLE NUMBER	CS PPM	CU PPM	DY-S PPM	ER-S PPM	EU PPM	GA-S PPM	GD-S PPM	GE-S PPM	HF PPM	HO-S PPM	SAMPLE NUMBER
W207816	8.5	72	22L	10L	2.4	23	15L	6.8	7.1	6.8L	W207816
W207862	4.5	200	22L	10L	2.8	110	15L	50	6.0	6.8L	W207862
W207863	6.3	110	22L	10L	3.1	54	15L	6.1	10	6.8L	W207863
W207865	6.8	150	22L	10L	3.5	110	15L	110	4.1	6.8L	W207865
W207896	6.1	170	22L	10L	1.4	49	15L	88	2.7	6.8L	W207896
W208199	4.0	95	55	30	6.7	110	36	260	3.2	6.8L	W208199
W208434	5.3	170	22L	13	3.5	54	15L	34	4.7	6.8L	W208434
W208435	12	150	22L	10L	5.6	39	15L	30	6.0	6.8L	W208435
W208436	1.5	220	28	15	2.3	57	17	290	2.3	6.8L	W208436
W211683	17	620	22L	32L	6.2	74	15L	69	5.9	15L	W211683
W211189	7.2	120	22L	10L	1.8	37	15L	23	2.9	6.8L	W211189
W211191	4.3	140	36	10L	5.7	41	15L	48	2.1	6.8L	W211191
W211192	13	110	22L	10L	5.3	43	15L	36	5.2	6.8L	W211192
W211193	7.1	110	22L	32L	6.9	100	15L	190	10	6.8L	W211193
W211623	12	280	22L	10L	5.3	44	15L	11	3.5	6.8L	W211623
W211628	9.2	190	22L	10L	4.9	39	15L	10	4.6	6.8L	W211628
W211629	16	300	22L	32L	3.7	64	15L	66	5.5	6.8L	W211629
W211632	9.1	140	32L	10L	4.1	57	15L	52	6.3	6.8L	W211632
W211633	4.5	180	22L	10L	6.4	43	32L	20	4.5	6.8L	W211633
W213938	2.7	150	22L	13	3.6	43	15L	24	16	6.8L	W213938
W213939	9.4	410	30	10L	6.2	60	15L	120	3.1	6.8L	W213939
W213948	17	140	22L	10L	3.3	57	15L	41	5.0	6.8L	W213948

Table 2.--Major- and Minor-Oxides and Trace-Element Concentrations in the Laboratory Ash of 42 Bituminous Coal Samples from the Princess Reserve District, Eastern Kentucky--Continued.

SAMPLE NUMBER	IN-S PPM	LA PPM	LI PPM	LU PPM	MN PPM	MO-S PPM	NB-S PPM	ND-S PPM	NI-S PPM	PB PPM	SAMPLE NUMBER
W207816	6.8L	71	270	.9	55	21	30	62	51	41	W207816
W207862	6.8L	60	42	4.5L	170	29	12	44	55	32	W207862
W207863	6.8L	120	130	1.6L	61	6.5	44	85	97	55	W207863
W207865	6.8L	54	51	2.7L	240	74	15	67	130	59	W207865
W207896	6.8L	34	39	.9	270	86	9	32L	170	150	W207896
W208199	6.8L	48	96	3.3	360	110	16	95	200	220	W208199
W208434	6.8L	120	440	1.3	36	12	12	100	180	100	W208434
W208435	6.8L	80	52	4.2	2,800	16	15	49	200	150	W208435
W208436	6.8L	23	44	1.5	160	150	10	100	400	540	W208436
W211683	6.8L	78	130	4.1	160	42	21	130	220	120	W211683
W211189	6.8L	59	110	.7	52	19	12	32L	94	3.0	W211189
W211191	6.8L	160	58	1.6	78	9.4	14	97	220	78	W211191
W211192	6.8L	100	77	1.9	75	12	13	110	180	73	W211192
W211193	6.8L	120	100	2.7	76	25	34	140	450	170	W211193
W211623	6.8L	140	180	1.6	130	20	13	92	90	110	W211623
W211628	6.8L	100	190	1.5	150	36	27	110	250	70	W211628
W211629	6.8L	68	140	2.6	100	28	19	56	210	96	W211629
W211632	16	84	220	1.6	43	8.0	3L	49	120	120	W211632
W211633	6.8L	76	210	1.7	96	49	16	130	230	86	W211633
W213938	6.8L	160	210	2.1	32	1.0L	22	110	52	150	W213938
W213939	6.8L	63	67	4.1	1,100	56	10	34	520	170	W213939
W213948	6.8L	81	55	1.4	97	14	17	62	230	82	W213948

Table 2.--Major- and Minor-Oxides and Trace-Element Concentrations in the Laboratory Ash of 42 Bituminous Coal Samples from the Princess District, Eastern Kentucky--Continued.

SAMPLE NUMBER	PR-S PPM	RB PPM	SC PPM	SM PPM	SN-S PPM	SR-S PPM	TA PPM	TB PPM	TH PPM	TL-S PPM	SAMPLE NUMBER
W207816	68L	280L	25	11	1.5L	320	2.3	1.5	23	4.6L	W207816
W207862	68L	600L	26	16	0.0H	1,400	1.2	3.0	15	4.6L	W207862
W207863	68L	260L	33	16	1.5L	480	2.6	2.1	31	4.6L	W207863
W207865	68L	410L	64	16	0.0H	380	1.4	3.1	18	4.6L	W207865
W207896	68L	340L	28	4.8	0.0H	260	.88	1.2	8.8	4.6L	W207896
W208199	170	320L	50	25	0.0H	1,000	1.1	10	13	130	W208199
W208434	68L	100	34	19	7.2	240	1.1	1.8	21	4.6L	W208434
W208435	68L	600L	53	18	0.0H	440	1.6	4.0	36	130	W208435
W208436	68L	230L	23	11	0.0H	320	1.5L	2.3	7.6	4.6L	W208436
W211683	68L	590L	65	21	8.4	820	1.5	5.6	25	4.6L	W211683
W211189	68L	78	25	8.3	1.5L	290	1.0	.99	18	50	W211189
W211191	68L	320L	47	22	0.0H	1,800	.96	6.6	13	4.6L	W211191
W211192	68L	120	38	19	10	460	1.6	5.4	23	10L	W211192
W211193	68L	410L	78	27	5.9	730	3.7	6.5	42	4.6L	W211193
W211623	68L	130	43	22	1.5L	2,900	1.3	3.6	23	4.6L	W211623
W211628	68L	170	40	18	5.6	910	1.8	3.7	25	4.6L	W211628
W211629	68L	230	75	12	4.5	420	1.8	3.5	22	4.6L	W211629
W211632	68L	130	54	15	8.4	280	3.1	3.6	33	4.6L	W211632
W211633	68L	76	44	23	5.6	670	1.5	3.6	18	4.6L	W211633
W213938	68L	160L	40	26	16	220	3.6	7.2	87	4.6L	W213938
W213939	68L	630L	46	19	1.5L	740	6.2L	8.8	13	4.6L	W213939
W213948	68L	170	35	13	3.8	350	2.0	2.4	27	17	W213948

Table 2.--Major- and Minor-Oxides and Trace-Element Concentrations in the Laboratory Ash of 42 Bituminous Coal Samples from the Princess Reserve District, Eastern Kentucky--Continued.

SAMPLE NUMBER	U PPM	V-S PPM	W PPM	Y-S PPM	YB PPM	ZN PPM	ZR-S PPM	SAMPLE NUMBER
W207816	4.8	120	3.5	40	5.7	94	190	W207816
W207862	5.8	120	19	90	15	260	140	W207862
W207863	8.7	150	5.8	39	8.4	91	440	W207863
W207865	24	240	18	64	19	230	110	W207865
W207896	11	100	4.1	19	5.4	110	46	W207896
W208199	51	170	17	150	25	640	110	W208199
W208434	8.3	160	4.2	45	7.4	98	130	W208434
W208435	15	92	20	58	22	250	68	W208435
W208436	14	99	11	95	9.8	580	84	W208436
W211683	35	440	17	160	24	1,100	170	W211683
W211189	10	180	2.1	28	4.5	84	110	W211189
W211191	8.1	140	14	89	9.6	60	96	W211191
W211192	7.7	200	6.2	110	12	220	140	W211192
W211193	25	500	27	180	17	150	390	W211193
W211623	22	180	12	47	10	100	59	W211623
W211628	10	190	7.7	86	10	170	210	W211628
W211629	15	180	7.6	80	17	890	140	W211629
W211632	23	170	5.6	58	11	93	110	W211632
W211633	8.3	180	9.1	95	12	260	150	W211633
W213938	32	120	5.5	93	16	47	290	W213938
W213939	10	110	25	200	28	610	130	W213939
W213948	8.9	210	5.6	51	9.4	190	90	W213948

Table 3.--Content of 22 Trace Elements in 42 Coal Samples from the Princess 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
W203628	6.3	9.0	160	6.4	11	0.3	0.23	58	0.3	0.11	W203628
W203629	31.3	57	140	6.9	39	.7	.92	11	1.4	.14	W203629
W205318	3.7	19	120	1.9	15	.6	.35	88	.6	.062	W205318
W205333	4.8	16	410	12	13	.9	.37	68	.4	.080	W205333
W205334	3.2	15	100	5.3	23	.5	.43	42	.9	.090	W205334
W205335	1.4	24	500	3.2	12	.7	.45	56	.8	.40	W205335
W205336	4.0	12	870	7.9	10	.7	.32	42	.4	.053	W205336
W207106	24.9	26	230	6.5	31	1.6	.50	90	1.5	.20	W207106
W207107	3.1	17	170	8.6	11	.3	.35	60	.3	.36	W207107
W207108	59.5	12	200	16	11	1.4	.33	60	.5	.19	W207108
W207109	35.8	26	90	10	33	2.1	.50	160	1.6	.26	W207109
W207110	2.3	27	140	16	18	.6	.51	130	.5	.17	W207110
W207457	23.5	25	50L	2.9	28	1.0	.42	130	2.0	.29	W207457
W207458	0.0B	4.0L	70	6.8	19	.5	.35	70	.6	.36	W207458
W207459	37.6	100	160	15	68	1.5	1.5	120	5.1	.41	W207459
W207460	0.0B	4.0L	260	3.3	14	.5	.41	130	.4	.59	W207460
W207473	31.4	72	130	4.0	98	2.6	1.0	160	3.6	.23	W207473
W207808	3.5	4.0	260	2.5	5.4	.2	.23	30	.2	.070	W207808
W207809	13.3	37	50L	11	45	2.0	.74	80	1.0	.17	W207809
W207810	8.9	29	300	4.3	32	.9	.58	160	1.0	.35	W207810

Table 3.--Content of 22 Trace Elements in 42 Coal Samples from the Princess 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
W203628	3	0.1	50	74	8L	0.60	2.6	3.6	1.0	0.2	W203628
W203629	32	.3	190	660	13	.75	9.2	14	4.6	.7	W203629
W205318	10	.1	77	22L	60L	.30	2.9	6.1	1.8	.2	W205318
W205333	7	.1	190	22	60L	.60	2.4	5.1	2.0	.3	W205333
W205334	7	.2	95	22L	50L	.80	4.1	5.2	2.2	.4	W205334
W205335	13	.1	230	22L	60L	.20	3.1	4.7	2.5	.4	W205335
W205336	6	.1	160	22L	50L	.60	2.8	3.6	1.7	.3	W205336
W207106	14	.3	280	22L	19	1.1	8.3	6.6	2.4	.4	W207106
W207107	11	.1	44	48	30L	1.9	4.9	3.5	1.4	.3	W207107
W207108	5	.3	150	22L	19	2.2	5.5	7.6	1.3	.3	W207108
W207109	15	.3	260	22L	39	1.2	7.8	5.3	2.5	.5	W207109
W207110	13	.2	110	22L	30L	1.3	5.5	4.0	2.3	.3	W207110
W207457	14	.2	100	44L	18	1.0	5.0	4.7	1.6	.3	W207457
W207458	0.0B	0.0B	58	44L	0.0B	1.4	4.3	.6L	0.0B	.2	W207458
W207459	43	1	140	44L	22	5.6	18	8.2	11	2	W207459
W207460	0.0B	0.0B	85	44L	0B	3.9	4.9	4.0L	0.0B	.5	W207460
W207473	39	.4	400	44L	48	1.5	17	14	5.5	.6	W207473
W207808	1	.2	48	44L	30L	.45	3.0	3.2	.75	.3	W207808
W207809	18	.4	280	44L	33	4.6	14	10	3.7	.5	W207809
W207810	15	.3	210	44L	50L	1.0	7.1	11	2.7	.5	W207810

Table 3.--Content of 22 Trace Elements in 42 Coal Samples from the Princess District, Eastern Kentucky--Continued.

SAMPLE NUMBER	TH PPM	U PPM	YB PPM
W203628	1.5	1.1	0.6
W203629	8.8	2.7	1.8
W205318	2.3	.53	.8
W205333	1.9	.52	.7
W205334	3.9	2.0	1.0
W205335	2.6	1.6	1.0
W205336	2.0	.90	.7
W207106	5.1	1.9	1.7
W207107	1.1	.52	.9
W207108	1.6	1.1	1.4
W207109	5.6	1.6	1.5
W207110	1.9	.63	1.1
W207457	5.1	2.2	1.3
W207458	2.6	2.3	0.0B
W207459	13	14	8.3
W207460	1.9	7.6	0.0B
W207473	17	4.4	2.5
W207808	.6	.31L	1.3
W207809	6.3	5.2	2.5
W207810	4.7	1.7	1.5

Table 3.--Content of 22 Trace Elements in 42 Coal Samples from the Princess District, Eastern Kentucky.

SAMPLE NUMBER	AS PPM	CE PPM	CL PPM	CO PPM	CR PPM	CS PPM	EU PPM	F PPM	HF PPM	HG PPM	SAMPLE NUMBER
W207816	68.7	18	50L	3.4	19	1.2	.34	60	1.0	.48	W207816
W207862	54.2	7.0	1,500	2.2	7.0	.3	.19	40	.4	.14	W207862
W207863	40.7	38	180	7.1	32	1.2	.58	50	1.9	.39	W207863
W207865	13.6	8.0	220	3.2	14	.5	.26	30	.3	.052	W207865
W207896	85.1	9.0	200	4.1	10	.9	.21	20	.4	.35	W207896
W208199	39.5	9.0	610	5.0	11	.3	.43	20	.2	.51	W208199
W208434	7.1	42	210	12	28	1.0	.67	170	.9	.52	W208434
W208435	111	9.0	640	14	9.7	.6	.28	60	.3	1.0	W208435
W208436	160	9.0	200	14	11	.2	.31	70	.3	1.0	W208436
W211683	2.0	8.0	520	8.1	10	.9	.32	50	.3	.11	W211683
W211189	170	35	100L	11	44	2.7	.68	150	1.1	.16	W211189
W211191	174	26	270	10	11	.4	.54	50	.2	.068	W211191
W211192	9.0	19	440	6.2	56	1.3	.51	150	.5	.10	W211192
W211193	3.3	13	360	10	13	.4	.34	50	.5	.095	W211193
W211623	34.5	30	970	4.1	14	1.4	.60	50	.4	.21	W211623
W211628	3.6	13	1,100	12	11	.6	.32	50	.3	.068	W211628
W211629	17.4	17	680	24	25	1.9	.44	70	.7	.25	W211629
W211632	1.1	21	390	8.6	34	1.3	.58	140	.9	.055	W211632
W211633	3.3	13	870	15	12	.3	.42	160	.3	.13	W211633
W213938	1.3	81	600	5.3	28	.7	.92	180	4.2	.080	W213938
W213939	3.9	4.0	680	21	5.1	0.3	0.20	70	0.1	0.020	W213939
W213948	13.7	23	590	19	25	2.7	.52	260	.8	.19	W213948

Table 3.--Content of 22 Trace Elements in 42 Coal Samples from the Princess 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
W207816	10	.1	140	44L	40L	.90	3.6	2.6	1.6	.2	W207816
W207862	4	.3L	220	44L	40L	.70	1.8	2.4	1.1	.2	W207862
W207863	22	.3L	180	44L	50L	.90	6.3	13	3.0	.4	W207863
W207865	4	.2L	74	44L	30L	.70	4.8	4.9	1.2	.2	W207865
W207896	5	.1	190	44L	50L	1.8	4.2	8.0	.70	.2	W207896
W208199	3	.2	130	44L	20L	2.1	3.1	6.8	1.6	.6	W208199
W208434	22	.3	420	44L	19	1.9	6.4	6.3	3.7	.4	W208434
W208435	4	.2	70	44L	30L	1.6	2.7	2.4	.90	.2	W208435
W208436	3	.2	160	44L	30L	12	3.0	1.6	1.4	.3	W208436
W211683	4	.2	97	44L	30L	2.6	3.3	3.5	1.1	.3	W211683
W211189	22	.3	370	44L	29	1.0	9.5	11	3.1	.4	W211189
W211191	15	.2	51	430	30L	1.7	4.4	4.8	2.1	.6	W211191
W211192	10	.2	120	44L	12	1.0L	3.7	7.2	1.8	.5	W211192
W211193	6	.1	54	44L	20L	2.2	3.8	2.8	1.3	.3	W211193
W211623	17	.2	240	640	15	1.7	4.9	2.7	2.6	.4	W211623
W211628	7	.1	160	44L	11	.75	2.6	5.1	1.2	.2	W211628
W211629	8	.3	180	44L	27	2.9	8.9	3.6	1.5	.4	W211629
W211632	12	.2	190	44L	19	2.3	7.8	4.5	2.1	.5	W211632
W211633	5	.1	350	44L	5	1.0	2.9	3.9	1.5	.2	W211633
W213938	41	.5	360	87	40L	1.0	10	7.6	6.6	2	W213938
W213939	2	0.1	86	44L	20L	0.80	1.5	2.0	0.60	0.3	W213939
W213948	13	.2	350	57	27	1.7	5.6	5.0	2.1	.4	W213948

Table 3.--Content of 22 Trace Elements in 42 Coal Samples from the Princess District, Eastern Kentucky--Continued.

SAMPLE NUMBER	TH PPM	U PPM	YB PPM
W207816	3.2	.68	.8
W207862	1.0	.39	1.0
W207863	5.9	1.7	1.6
W207865	1.3	1.8	1.4
W207896	1.3	1.6	.8
W208199	.8	3.2	1.6
W208434	4.0	1.6	1.4
W208435	1.8	.76	1.1
W208436	1.0	1.8	1.3
W211683	1.3	1.8	1.2
W211189	6.9	3.8	1.7
W211191	1.2	.76	.9
W211192	2.2	.75	1.2
W211193	2.1	1.2	.9
W211623	2.6	2.5	1.2
W211628	1.6	.67	.7
W211629	2.6	1.8	2.0
W211632	4.7	3.3	1.6
W211633	1.2	.55	.8
W213938	22	8.2	4.2
W213939	0.4	0.32	0.9
W213948	4.3	1.4	1.5

Table 4.--Major-, Minor-, and Trace-Element Concentrations of 42 Bituminous Coal Samples from the Princess Reserve District, Eastern Kentucky.

[Values in percent or parts-per-million. 22 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
W203628	1.2	1.0	0.058	0.017	0.005	0.060	0.54	0.035	0.038	6.3	W203628
W203629	3.3	3.0	.13	.045	.019	.17	1.7	.20	.034	31	W203629
W205318	1.9	1.4	.048	.023	.008	.12	.18	.074	.012	3.7	W205318
W205333	1.6	1.3	.32	.13	.019	.23	.46	.045	.027	4.8	W205333
W205334	2.8	2.0	.12	.043	.009	.14	.18	.13	.026	3.2	W205334
W205335	3.1	1.8	.076	.070	.023	.32	1.3	.092	.051	1.4	W205335
W205336	1.9	1.2	.063	.050	.016	.18	.29	.051	.038	4.0	W205336
W207106	4.7	2.8	.11	.078	.028	.31	3.1	.21	.093	25	W207106
W207107	.97	.86	.12	.025	.004	.037	.31	.018	.018	3.1	W207107
W207108	2.2	.98	.098	.051	.015	.19	4.5	.055	.075	60	W207108
W207109	5.8	3.3	.10	.10	.026	.43	3.4	.22	.075	36	W207109
W207110	2.1	1.6	.053	.041	.011	.15	.43	.057	.053	2.3	W207110
W207457	4.6	2.1	.059	.048	.010	.20	.83	.25	.017L	24	W207457
W207458	10	1.3	.064	.020	.006	.11	1.9	.075	.029L	0.0B	W207458
W207459	4.9	3.3	.089	.050	.014	.25	3.9	.12	.096	38	W207459
W207460	1.5	1.0	.078	.027	.008	.12	5.8	.044	.073	0.0B	W207460
W207473	11	6.4	.086	.15	.040	.65	2.5	.49	.18	31	W207473
W207808	.58	.39	.069	.014	.005	.030	1.2	.014	.018	3.5	W207808
W207809	4.9	2.6	.094	.076	.028	.41	1.6	.12	.055	13	W207809
W207810	2.7	1.7	.14	.049	.021	.17	1.4	.12	.034	8.9	W207810

Table 4.--Major-, Minor-, and Trace-Element Concentrations of 42 Bituminous Coal Samples from the Princess Reserve District, Eastern Kentucky--Continued.

SAMPLE NUMBER	B-S PPM	BA-S PPM	BE-S PPM	BI-S PPM	BR PPM	CD PPM	CE PPM	CL PPM	CO PPM	CR PPM	SAMPLE NUMBER
W203628	70	16	2	0.9L	5.6	0.05	9.0	160	6.4	11	W203628
W203629	86	69	2	2.6L	2.9	.22	57	140	6.9	39	W203629
W205318	120	28	2	.8L	4.3	.01	19	120	1.9	15	W205318
W205333	44	69	1	.9L	21	.02	16	410	12	13	W205333
W205334	64	41	2	1.1L	6.2	.02	15	100	5.3	23	W205334
W205335	66	56	2	1.3L	17	.15	24	500	3.2	12	W205335
W205336	160	42	1	.8L	22	.02	12	870	7.9	10	W205336
W207106	78	50	5	2.2L	8.8	.07	26	230	6.5	31	W207106
W207107	39	23	4	.5L	4.6	.08	17	170	8.6	11	W207107
W207108	56	34	5	1.4L	9.3	.41	12	200	16	11	W207108
W207109	64	64	4	2.6	6.5	.17	26	90	10	33	W207109
W207110	67	27	5	.9L	6.6	.06	27	140	16	18	W207110
W207457	68	41	1	1.7L	2.8	.02	25	50L	2.9	28	W207457
W207458	81	130	4	2.9L	0.0B	.12	4.0L	70	6.8	19	W207458
W207459	72	310	7	2.4L	7.2	.34	100	160	15	68	W207459
W207460	35	65	4	1.4L	0.0B	.08	4.0L	260	3.3	14	W207460
W207473	99	950	4	4.3L	6.6	.05	72	130	4.0	98	W207473
W207808	19	14	3	.4L	10	.02	4.0	260	2.5	5.4	W207808
W207809	76	70	4	1.9L	4.1	.11	37	50L	11	45	W207809
W207810	60	53	3	1.3L	9.2	.04	29	300	4.3	32	W207810

Table 4.--Major-, Minor-, and Trace-Element Concentrations of 42 Bituminous Coal Samples from the Princess Reserve District, Eastern Kentucky--Continued.

SAMPLE NUMBER	CS PPM	CU PPM	DY-S PPM	ER-S PPM	EU PPM	F PPM	GA-S PPM	GD-S PPM	GE-S PPM	HF PPM	SAMPLE NUMBER
W203628	0.3	8.7	1.3L	0.6L	0.23	58	4.1	0.87L	3.1	0.3	W203628
W203629	.7	31	3.8L	1.7L	.92	11	9.6	2.6L	.52	1.4	W203629
W205318	.6	11	1.7L	.8L	.35	88	3.2	1.2L	.35	.6	W205318
W205333	.9	13	2.0L	.9L	.37	68	2.5	1.3L	.38	.4	W205333
W205334	.5	16	2.5L	1.1L	.43	42	7.5	1.7L	.90	.9	W205334
W205335	.7	29	2.9L	1.5	.45	56	6.1	2.0L	.93	.8	W205335
W205336	.7	13	1.7L	.8L	.32	42	3.1	1.2L	.36	.4	W205336
W207106	1.6	28	4.8L	2.2L	.50	90	8.4	3.2L	5.0	1.5	W207106
W207107	.3	8.3	1.4	.5L	.35	60	5.4	.74L	6.9	.3	W207107
W207108	1.4	16	3.1L	1.4L	.33	60	10	2.1L	12	.5	W207108
W207109	2.1	26	5.7L	2.6L	.50	160	9.8	3.9L	3.9	1.6	W207109
W207110	.6	13	2.0L	.9L	.51	130	8.1	1.3L	5.2	.5	W207110
W207457	1.0	11	3.7L	1.7L	.42	130	4.3	2.5L	1.2	2.0	W207457
W207458	.5	19	6.4L	2.9L	.35	70	4.4	4.4L	2.7	.6	W207458
W207459	1.5	17	6.2	2.9	1.5	120	17	6.2	26	5.1	W207459
W207460	.5	21	3.1	1.6	.41	130	10	3.1	11	.4	W207460
W207473	2.6	31	9.5L	4.3L	1.0	160	21	6.5L	5.6	3.6	W207473
W207808	.2	6.8	1.8L	.4L	.23	30	4.0	1.8L	2.7	.2	W207808
W207809	2.0	53	4.2L	1.9L	.74	80	8.2	8.7L	4.9	1.0	W207809
W207810	.9	26	2.8L	1.3L	.58	160	4.6	5.8L	1.2	1.0	W207810

Table 4.--Major-, Minor-, and Trace-Element Concentrations of 42 Bituminous Coal Samples from the Princess Reserve District, Eastern Kentucky--Continued.

SAMPLE NUMBER	HG PPM	HO-S PPM	IN-S PPM	LA PPM	LI PPM	LU PPM	MN PPM	MO-S PPM	NB-S PPM	ND-S PPM	SAMPLE NUMBER
W203628	0.11	0.39L	0.39L	3	14	0.1	3.7	1.9	0.51	5.0	W203628
W203629	.14	1.2L	1.2L	32	72	.3	7.9	1.3	2.1	17	W203629
W205318	.062	.52L	.52L	10	15	.1	3.1	.74	1.6	10	W205318
W205333	.080	.61L	.61L	7	12	.1	12	2.6	.98	7.0	W205333
W205334	.090	.77L	.77L	7	27	.2	11	1.2	4.0	10	W205334
W205335	.40	.90L	.90L	13	17	.1	12	5.3	1.6	5.5	W205335
W205336	.053	.53L	.53L	6	14	.1	19	2.5	1.1	6.1	W205336
W207106	.20	1.5L	1.5L	14	50	.3	24	1.3	5.0	13	W207106
W207107	.36	.33L	.33L	11	7.4	.1	18	2.7	.44	5.4	W207107
W207108	.19	.96L	.96L	5	7.8	.3	28	13	3.0	5.9	W207108
W207109	.26	1.8L	1.8L	15	52	.3	49	.90	1.9	8.3L	W207109
W207110	.17	.61L	.61L	13	20	.2	7.5	.77	.67	8.4	W207110
W207457	.29	1.1L	1.1L	14	35	.2	9.1	.71	4.0	5.3L	W207457
W207458	.36	2.0L	2.0L	0.0B	13	0.0B	12	2.8	1.9	9.3L	W207458
W207459	.41	2.1	1.6L	43	26	1	14	10	4.8	22	W207459
W207460	.59	.96L	.96L	0.0B	8.3	0.0B	34	17	1.8	4.7	W207460
W207473	.23	2.9L	2.9L	39	60	.4	18	3.6	12	39	W207473
W207808	.070	.27L	.27L	1	2.9	.2	6.8	3.0	.48	2.7	W207808
W207809	.17	1.3L	1.3L	18	19	.4	8.6	5.7	4.0	15	W207809
W207810	.35	.85L	.85L	15	19	.3	12	1.4	2.4	10	W207810

Table 4.--Major-, Minor-, and Trace-Element Concentrations of 42 Bituminous Coal Samples from the Princess Reserve District, Eastern Kentucky--Continued.

SAMPLE NUMBER	NI-S PPM	P PPM	PB PPM	PR-S PPM	RB PPM	SB PPM	SC PPM	SE PPM	SM PPM	SN-S PPM	SAMPLE NUMBER
W203628	20	74	8.7	3.9L	8L	0.60	2.6	3.6	1.0	0.09L	W203628
W203629	12	660	24	12	13	.75	9.2	14	4.6	.26L	W203629
W205318	4.8	22L	5.4	5.2L	60L	.30	2.9	6.1	1.8	.77	W205318
W205333	16	22	5.8	6.1L	60L	.60	2.4	5.1	2.0	.27	W205333
W205334	16	22L	11	7.7L	50L	.80	4.1	5.2	2.2	1.4	W205334
W205335	47	22L	16	9.0L	60L	.20	3.1	4.7	2.5	.48	W205335
W205336	16	22L	7.6	5.3L	50L	.60	2.8	3.6	1.7	.35	W205336
W207106	13	22L	18	15L	19	1.1	8.3	6.6	2.4	.32L	W207106
W207107	34	48	9.8	3.3L	30L	1.9	4.9	3.5	1.4	.12	W207107
W207108	61	22L	18	9.6L	19	2.2	5.5	7.6	1.3	0.0H	W207108
W207109	22	22L	24	18L	39	1.2	7.8	5.3	2.5	.39L	W207109
W207110	34	22L	9.8	6.1L	30L	1.3	5.5	4.0	2.3	.28	W207110
W207457	6.6	44L	13	11L	18	1.0	5.0	4.7	1.6	.70	W207457
W207458	20	44L	15	20L	0.0B	1.4	4.3	.6L	0.0B	.44L	W207458
W207459	26	44L	48	16L	22	5.6	18	8.2	11	.36L	W207459
W207460	8.6	44L	8.5	9.6L	0.0B	3.9	4.9	4.0L	0.0B	0.0H	W207460
W207473	24	44L	25	29L	48	1.5	17	14	5.5	4.3	W207473
W207808	6.8	44L	3.6	2.7L	30L	.45	3.0	3.2	.75	0.0H	W207808
W207809	32	44L	30	13L	33	4.6	14	10	3.7	.74	W207809
W207810	12	44L	12	8.5L	50L	1.0	7.1	11	2.7	.19L	W207810

Table 4.--Major-, Minor-, and Trace-Element Concentrations of 42 Bituminous Coal Samples from the Princess Reserve District, Eastern Kentucky--Continued.

SAMPLE NUMBER	SR-S PPM	TA PPM	TB PPM	TH PPM	TL-S PPM	U PPM	V-S PPM	W PPM	Y-S PPM	YB PPM	SAMPLE NUMBER
W203628	40	0.20L	0.16	1.5	0.19L	1.1	13	0.30	3.5	0.6	W203628
W203629	310	.45	.66	8.8	.55L	2.7	38	.95	9.5	1.8	W203629
W205318	37	.30L	.23	2.3	.85	.53	18	.80L	5.7	.8	W205318
W205333	67	.30L	.28	1.9	.41L	.52	20	.40	6.2	.7	W205333
W205334	38	.32	.38	3.9	.92	2.0	28	.60	7.0	1.0	W205334
W205335	52	.25	.35	2.6	3.7	1.6	35	.50	8.6	1.0	W205335
W205336	52	.20L	.29	2.0	.36L	.90	20	.50	6.2	.7	W205336
W207106	73	.47	.39	5.1	.99L	1.9	26	1.1	10	1.7	W207106
W207107	93	.40L	.33	1.1	.23L	.52	11	1.1	4.8	.9	W207107
W207108	49	.50L	.34	1.6	.65L	1.1	18	1.1	8.2	1.4	W207108
W207109	52	.54	.46	5.6	1.2L	1.6	28	1.1	4.9	1.5	W207109
W207110	29	.20	.34	1.9	.41L	.63	19	.90	5.2	1.1	W207110
W207457	43	.42	.30	5.1	.76L	2.2	18	.70	3.5	1.3	W207457
W207458	35	.17	.18	2.6	1.3L	2.3	23	0.0B	8.1	0.0B	W207458
W207459	65	.52	2.2	13	1.1L	14	43	1.6	21	8.3	W207459
W207460	34	.40L	.45	1.9	.65L	7.6	20	0.0B	8.6	0.0B	W207460
W207473	140	.90	.59	17	2.0L	4.4	99	1.5	17	2.5	W207473
W207808	29	.10L	.26	.60	.18L	.31L	6.4	1.3	6.4	1.3	W207808
W207809	51	.25	.48	6.3	.87L	5.2	47	1.1	12	2.5	W207809
W207810	55	.22	.48	4.7	.58L	1.7	25	1.1	7.0	1.5	W207810

Table 4.--Major-, Minor-, and Trace-Element Concentrations of 42 Bituminous Coal Samples from the Princess Reserve District, Eastern Kentucky--Continued.

SAMPLE NUMBER	ZN PPM	ZR-S PPM
W203628	12	4.8
W203629	19	14
W205318	3.8	13
W205333	11	11
W205334	7.6	29
W205335	85	15
W205336	9.4	13
W207106	10	32
W207107	14	4.9
W207108	180	17
W207109	28	18
W207110	23	8.2
W207457	8.0	15
W207458	49	23
W207459	74	48
W207460	17	8.9
W207473	24	78
W207808	14	4.0
W207809	25	27
W207810	18	14

Table 4.--Major-, Minor-, and Trace-Element Concentrations of 42 Bituminous Coal Samples from the Princess Reserve 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
W207816	3.0	1.8	.084	.056	.014	.20	2.2	.15	.018	69	W207816
W207862	1.1	.61	.15	.024	.022	.072	1.7	.043	.057	54	W207862
W207863	4.6	2.7	.068	.063	.018	.28	1.9	.24	.065	41	W207863
W207865	1.2	.72	.049	.032	.007	.12	2.0	.035	.053	14	W207865
W207896	1.7	1.1	.097	.047	.019	.14	5.5	.051	.091	85	W207896
W208199	.85	.65	.12	.018	.013	.049	1.7	.025	.16	40	W208199
W208434	4.6	3.7	.043	.087	.042	.30	.42	.16	.065	7.1	W208434
W208435	.49	.36	.058	.016	.007	.048	1.9	.013	.080	110	W208435
W208436	1.5	1.1	.11	.033	.016	.12	4.7	.046	.69	160	W208436
W211683	1.3	.77	.058	.036	.010	.14	.13	.042	.077	2.0	W211683
W211189	6.7	5.2	.13	.16	.037	.78	6.7	.23	.13	170	W211189
W211191	.84	.57	.090	.023	.005	.060	3.6	.028	.074	170	W211191
W211192	2.5	1.5	.057	.053	.012	.25	.35	.069	.035	9.0	W211192
W211193	1.2	.74	.062	.020	.005	.065	.18	.068	.049	3.3	W211193
W211623	2.1	1.5	.12	.061	.024	.28	1.8	.057	.072	35	W211623
W211628	1.5	1.1	.084	.038	.016	.15	.33	.045	.036	3.6	W211628
W211629	2.9	1.7	.070	.060	.018	.26	.97	.090	.094	17	W211629
W211632	3.5	2.8	.057	.057	.019	.26	.15	.17	.014L	1.1	W211632
W211633	1.4	1.4	.065	.025	.035	.082	.24	.030	.015	3.3	W211633
W213938	6.5	4.9	.097	.053	.036	.22	.20	.30	.069	1.3	W213938
W213939	0.39	0.24	0.087	0.026	0.009	0.034	0.89	0.013	0.035	3.9	W213939
W213948	3.8	2.6	.10	.11	.035	.51	.07	.12	.029	14	W213948

Table 4.--Major-, Minor-, and Trace-Element Concentrations of 42 Bituminous Coal Samples from the Princess Reserve District, Eastern Kentucky--Continued.

SAMPLE NUMBER	B-S PPM	BA-S PPM	BE-S PPM	BI-S PPM	BR PPM	CD PPM	CE PPM	CL PPM	CO PPM	CR PPM	SAMPLE NUMBER
W207816	56	42	1	1.4L	3.2	.05	18	50L	3.4	19	W207816
W207862	47	46	7	.7L	28	.02	7.0	1,500	2.2	7.0	W207862
W207863	47	61	2	1.9L	7.7	.07	38	180	7.1	32	W207863
W207865	37	26	4	.7L	7.5	.05	8.0	220	3.2	14	W207865
W207896	44	35	3	1.5L	7.0	.24	9.0	200	4.1	10	W207896
W208199	38	55	9	.6L	12	.10	9.0	610	5.0	11	W208199
W208434	110	61	2	1.9L	11	.04	42	210	12	28	W208434
W208435	30	13	4	.5L	15	.02	9.0	640	14	9.7	W208435
W208436	66	210	8	1.3L	8.9	.24	9.0	200	14	11	W208436
W211683	51	30	4	.5L	15	.23	8.0	520	8.1	10	W211683
W211189	82	130	7	4.9	2.0	.05	35	100L	11	44	W211189
W211191	64	45	3	14	5.9	.04	26	270	10	11	W211191
W211192	31	37	3	1.0L	8.6	.16	19	440	6.2	56	W211192
W211193	11	18	7	.5L	5.3	.02	13	360	10	13	W211193
W211623	63	95	2	1.1L	21	.09	30	970	4.1	14	W211623
W211628	44	41	1	.7L	17	.05	13	1,100	12	11	W211628
W211629	71	120	4	1.2L	13	.21	17	680	24	25	W211629
W211632	53	36	3	1.4L	7.9	.05	21	390	8.6	34	W211632
W211633	56	32	2	.7L	16	.13	13	870	15	12	W211633
W213938	54	76	6	2.6L	14	.26	81	600	5.3	28	W213938
W213939	15	13	7	0.3L	14	0.02	4.0	680	21	5.1	W213939
W213948	34	98	9	1.6L	15	.14	23	590	19	25	W213948

Table 4.--Major-, Minor-, and Trace-Element Concentrations of 42 Bituminous Coal Samples from the Princess Reserve District, Eastern Kentucky--Continued.

SAMPLE NUMBER	CS PPM	CU PPM	DY-S PPM	ER-S PPM	EU PPM	F PPM	GA-S PPM	GD-S PPM	GE-S PPM	HF PPM	SAMPLE NUMBER
W207816	1.2	10	3.1L	1.4L	.34	60	3.2	2.1L	.96	1.0	W207816
W207862	.3	13	1.5L	.7L	.19	40	7.4	1.0L	3.4	.4	W207862
W207863	1.2	21	4.2L	1.9L	.58	50	10	2.9L	1.2	1.9	W207863
W207865	.5	11	1.6L	.7L	.26	30	8.1	1.1L	8.1	.3	W207865
W207896	.9	25	3.2L	1.5L	.21	20	7.2	2.2L	13	.4	W207896
W208199	.3	6.0	3.5	1.9	.43	20	6.9	2.3	16	.2	W208199
W208434	1.0	32	4.2L	2.5	.67	170	10	2.9L	6.5	.9	W208434
W208435	.6	7.5	1.1L	.5L	.28	60	2.0	.75L	1.5	.3	W208435
W208436	.2	29	3.7	2.0	.31	70	7.5	2.2	38	.3	W208436
W211683	.9	32	1.1L	1.6L	.32	50	3.8	.77L	3.5	.3	W211683
W211189	2.7	45	8.2L	3.7L	.68	150	14	5.6L	8.6	1.1	W211189
W211191	.4	13	3.4	.9L	.54	50	3.9	1.4L	4.5	.2	W211191
W211192	1.3	11	2.1L	1.0L	.51	150	4.2	1.5L	3.5	.5	W211192
W211193	.4	5.4	1.1L	1.6L	.34	50	4.9	.74L	9.3	.5	W211193
W211623	1.4	32	2.5L	1.1L	.60	50	5.0	1.7L	1.3	.4	W211623
W211628	.6	12	1.4L	.7L	.32	50	2.5	.98L	.65	.3	W211628
W211629	1.9	35	2.6L	3.8L	.44	70	7.6	1.8L	7.8	.7	W211629
W211632	1.3	20	4.6L	1.4L	.58	140	8.2	2.1L	7.4	.9	W211632
W211633	.3	12	1.5L	.7L	.42	160	2.8	2.1L	1.3	.3	W211633
W213938	.7	38	5.6L	3.3	.92	180	11	3.8L	6.1	4.2	W213938
W213939	0.3	13	1.0	0.3L	0.20	70	1.9	0.48L	3.8	0.1	W213939
W213948	2.7	22	3.5L	1.6L	.52	260	9.1	2.4L	6.6	.8	W213948

Table 4.--Major-, Minor-, and Trace-Element Concentrations of 42 Bituminous Coal Samples from the Princess Reserve District, Eastern Kentucky--Continued.

SAMPLE NUMBER	HG PPM	HO-S PPM	IN-S PPM	LA PPM	LI PPM	LU PPM	MN PPM	MO-S PPM	NB-S PPM	ND-S PPM	SAMPLE NUMBER
W207816	.48	.96L	.96L	10	38	.1	7.8	3.0	4.2	8.7	W207816
W207862	.14	.46L	.46L	4	2.8	.3L	11	1.9	.80	2.9	W207862
W207863	.39	1.3L	1.3L	22	25	.3L	12	1.2	8.4	16	W207863
W207865	.052	.50L	.50L	4	3.8	.2L	18	5.5	1.1	5.0	W207865
W207896	.35	1.0L	1.0L	5	5.7	.1	40	13	1.3	4.7L	W207896
W208199	.51	.43L	.43L	3	6.0	.2	23	6.9	1.0	6.0	W208199
W208434	.52	1.3L	1.3L	22	84	.3	6.8	2.3	2.3	19	W208434
W208435	1.0	.34L	.34L	4	2.6	.2	140	.80	.75	2.5	W208435
W208436	1.0	.90L	.90L	3	5.8	.2	21	20	1.3	13	W208436
W211683	.11	.77L	.35L	4	6.6	.2	8.2	2.1	1.1	6.6	W211683
W211189	.16	2.5L	2.5L	22	41	.3	19	7.1	4.5	12L	W211189
W211191	.068	.64L	.64L	15	5.5	.2	7.3	.88	1.3	9.1	W211191
W211192	.10	.66L	.66L	10	7.5	.2	7.3	1.2	1.3	11	W211192
W211193	.095	.33L	.33L	6	4.9	.1	3.7	1.2	1.7	6.9	W211193
W211623	.21	.78L	.78L	17	21	.2	15	2.3	1.5	10	W211623
W211628	.068	.44L	.44L	7	12	.1	9.8	2.3	1.8	7.2	W211628
W211629	.25	.80L	.80L	8	17	.3	12	3.3	2.2	6.6	W211629
W211632	.055	.97L	2.3	12	31	.2	6.1	1.1	.46L	7.0	W211632
W211633	.13	.45L	.45L	5	14	.1	6.3	3.2	1.1	8.6	W211633
W213938	.080	1.7L	1.7L	41	54	.5	8.2	.26L	5.6	28	W213938
W213939	0.020	0.22L	0.22L	2	2.1	0.1	35	1.8	0.32	1.1	W213939
W213948	.19	1.1L	1.1L	13	8.8	.2	16	2.2	2.7	9.9	W213948

Table 4.--Major-, Minor-, and Trace-Element Concentrations of 42 Bituminous Coal Samples from the Princess Reserve District, Eastern Kentucky--Continued.

SAMPLE NUMBER	NI-S PPM	P PPM	PB PPM	PR-S PPM	RB PPM	SB PPM	SC PPM	SE PPM	SM PPM	SN-S PPM	SAMPLE NUMBER
W207816	7.2	44L	5.8	9.6L	40L	.90	3.6	2.6	1.6	.21L	W207816
W207862	3.7	44L	2.1	4.6L	40L	.70	1.8	2.4	1.1	0.0H	W207862
W207863	18	44L	10	13L	50L	.90	6.3	13	3.0	.29L	W207863
W207865	9.6	44L	4.4	5.0L	30L	.70	4.8	4.9	1.2	0.0H	W207865
W207896	25	44L	22	10L	50L	1.8	4.2	8.0	.70	0.0H	W207896
W208199	13	44L	14	11	20L	2.1	3.1	6.8	1.6	0.0H	W208199
W208434	34	44L	19	13L	19	1.9	6.4	6.3	3.7	1.4	W208434
W208435	10	44L	7.5	3.4L	30L	1.6	2.7	2.4	.90	0.0H	W208435
W208436	53	44L	71	9.0L	30L	12	3.0	1.6	1.4	0.0H	W208436
W211683	11	44L	6.1	3.5L	30L	2.6	3.3	3.5	1.1	.43	W211683
W211189	35	44L	1.1	25L	29	1.0	9.5	11	3.1	.56L	W211189
W211191	21	430	7.3	6.4L	30L	1.7	4.4	4.8	2.1	0.0H	W211191
W211192	17	44L	7.1	6.6L	12	1.0L	3.7	7.2	1.8	.97	W211192
W211193	22	44L	8.3	3.3L	20L	2.2	3.8	2.8	1.3	.29	W211193
W211623	10	640	13	7.8L	15	1.7	4.9	2.7	2.6	.17L	W211623
W211628	16	44L	4.6	4.4L	11	.75	2.6	5.1	1.2	.36	W211628
W211629	25	44L	11	8.0L	27	2.9	8.9	3.6	1.5	.53	W211629
W211632	17	44L	17	9.7L	19	2.3	7.8	4.5	2.1	1.2	W211632
W211633	15	44L	5.7	4.5L	5	1.0	2.9	3.9	1.5	.37	W211633
W213938	13	87	38	17L	40L	1.0	10	7.6	6.6	4.1	W213938
W213939	17	44L	5.4	2.2L	20L	0.80	1.5	2.0	0.60	0.05L	W213939
W213948	37	57	13	11L	27	1.7	5.6	5.0	2.1	.61	W213948

Table 4.--Major-, Minor-, and Trace-Element Concentrations of 42 Bituminous Coal Samples from the Princess Reserve District, Eastern Kentucky--Continued.

SAMPLE NUMBER	SR-S PPM	TA PPM	TB PPM	TH PPM	TL-S PPM	U PPM	V-S PPM	W PPM	Y-S PPM	YB PPM	SAMPLE NUMBER
W207816	45	.32	.21	3.2	.65L	.68	17	.50	5.6	.8	W207816
W207862	94	.08	.20	1.0	.31L	.39	8.0	1.3	6.0	1.0	W207862
W207863	91	.49	.39	5.9	.87L	1.7	29	1.1	7.4	1.6	W207863
W207865	28	.10	.23	1.3	.34L	1.8	18	1.3	4.7	1.4	W207865
W207896	38	.13	.17	1.3	.68L	1.6	15	.60	2.8	.8	W207896
W208199	63	.07	.65	.80	8.2	3.2	11	1.1	9.5	1.6	W208199
W208434	46	.21	.35	4.0	.87L	1.6	30	.80	8.6	1.4	W208434
W208435	22	.08	.20	1.8	6.5	.76	4.6	1.0	2.9	1.1	W208435
W208436	42	.20L	.30	1.0	.61L	1.8	13	1.5	13	1.3	W208436
W211683	42	.08	.29	1.3	.23L	1.8	22	.85	8.2	1.2	W211683
W211189	110	.39	.37	6.9	19	3.8	67	.80	10	1.7	W211189
W211191	170	.09	.62	1.2	.43L	.76	13	1.3	8.4	.9	W211191
W211192	45	.16	.52	2.2	.97L	.75	19	.60	11	1.2	W211192
W211193	36	.18	.32	2.1	.23L	1.2	25	1.3	8.8	.9	W211193
W211623	330	.15	.41	2.6	.52L	2.5	21	1.4	5.4	1.2	W211623
W211628	59	.12	.24	1.6	.30L	.67	12	.50	5.6	.7	W211628
W211629	50	.21	.42	2.6	.54L	1.8	21	.90	9.4	2.0	W211629
W211632	40	.45	.52	4.7	.66L	3.3	24	.80	8.3	1.6	W211632
W211633	44	.10	.24	1.2	.30L	.55	12	.60	6.3	.8	W211633
W213938	56	.92	1.8	22	1.2L	8.2	31	1.4	24	4.2	W213938
W213939	24	0.20L	0.28	0.40	0.15L	0.32	3.5	0.80	6.4	0.9	W213939
W213948	56	.32	.39	4.3	2.7	1.4	34	.90	8.2	1.5	W213948

Table 4.--Major-, Minor-, and Trace-Element Concentrations of 42 Bituminous Coal Samples from the Princess Reserve District, Eastern Kentucky--Continued.

SAMPLE NUMBER	ZN PPM	ZR-S PPM
W207816	13	27
W207862	17	9.4
W207863	17	84
W207865	17	8.1
W207896	16	6.8
W208199	40	6.9
W208434	19	25
W208435	13	3.4
W208436	77	11
W211683	56	8.7
W211189	31	41
W211191	5.6	9.0
W211192	21	14
W211193	7.4	19
W211623	11	6.7
W211628	11	14
W211629	110	17
W211632	13	16
W211633	17	9.9
W213938	12	74
W213939	20	4.2
W213948	30	14

**APPENDIX III:
PETROGRAPHIC ANALYSES**

Maceral Composition and Vitrinite Reflectance
of Princess District Coals

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

USGS#	KCER#	VIT	PVT	FUS	SFS	MIC	MAC	EX	RES	Rmax	S/D	Rmn	S/D
203628	1121	80.0	7.5	1.4	1.9	1.6	0.0	6.3	1.3	.68	.03	.64	.05
203628	1122	58.4	2.5	6.3	17.3	4.2	.4	9.6	1.3	.62	.04	.59	.05
205318	1070	51.1	13.7	17.7	5.7	4.5	.4	6.8	.1	.68	.07	.62	.08
205333	1071	58.7	16.1	6.7	1.8	2.4	.4	13.7	.2	.79	.04	.73	.06
205334	1072	63.8	19.2	7.3	1.6	2.1	0.0	5.9	.1	.68	.05	.62	.06
205336	1123	76.8	2.5	3.8	2.5	4.6	.5	7.6	1.5	.78	.03	.73	.05
207106	1076	41.6	8.8	6.1	18.4	8.2	2.1	14.8	0.0	.47	.03	.43	.04
207107	1075	59.2	8.0	6.5	12.2	4.4	.1	9.6	0.0	.61	.06	.54	.06
207108	1073	57.6	10.7	11.0	5.8	5.6	.3	8.9	.1	.49	.04	.45	.04
207109	1074	36.8	6.1	12.2	21.9	7.3	1.6	14.1	0.0	.51	.04	.47	.05
207110	1077	55.6	9.6	6.3	10.6	4.3	.1	13.4	.1	.61	.04	.56	.05
207457	1081	58.3	13.8	5.5	7.7	5.2	.4	9.1	0.0	.61	.05	.56	.05
207458	1082	63.5	9.7	7.0	7.6	4.9	.3	6.9	.1	.61	.04	.56	.05
207459	1079	61.4	10.0	7.6	4.4	4.4	.3	11.3	.6	.58	.05	.54	.05
207460	1080	72.1	10.8	5.5	4.7	2.7	0.0	4.3	0.0	.53	.03	.48	.05
207473	1078	46.2	10.7	7.9	24.6	1.6	.7	8.3	0.0	.55	.04	.51	.05
207808	1086	58.0	15.1	4.5	3.1	6.5	.3	12.4	.1	.56	.04	.51	.05
207809	1084	80.1	0.0	3.9	2.0	5.1	.1	8.5	.3	.64	.04	.61	.05
207810	1085	78.4	1.0	4.9	4.4	3.0	.1	6.8	1.4	.58	.04	.56	.04
207816	1083	66.9	13.4	4.7	2.3	2.1	0.0	10.3	.3	.57	.06	.52	.07
207862	1088	68.3	6.4	4.5	4.9	5.4	.4	8.8	1.3	.52	.03	.49	.04
207863	1092	48.8	14.4	12.0	6.5	5.8	.3	11.9	.4	.69	.05	.65	.06
207865	1087	59.7	3.7	2.6	10.1	6.0	.7	13.5	3.7	.62	.03	.57	.05
207896	1120	78.4	3.4	3.1	6.7	1.3	.3	6.0	.8	.55	.03	.52	.04
208199	1089	58.2	14.6	12.8	3.9	6.1	.3	4.1	0.0	.53	.03	.49	.04
208434	1099	68.1	10.4	8.7	2.0	4.6	.2	5.5	.5	.59	.04	.53	.05
208435	1100	70.9	10.4	5.2	1.3	4.7	.2	7.2	.1	.54	.03	.50	.04
208436	1101	72.6	11.8	2.9	1.5	3.0	.1	7.8	.3	.63	.04	.58	.05
211191	1104	74.0	4.6	3.8	2.0	6.5	.3	8.2	.6	.57	.04	.53	.04
211192	1105	53.9	11.1	4.3	7.2	7.4	.6	14.0	1.5	.68	.05	.63	.06
211193	1106	69.8	5.2	6.4	4.6	5.4	.6	7.5	.5	.60	.03	.56	.04
211623	1111	70.0	9.8	4.1	3.2	4.4	0.0	8.0	.5	.68	.03	.61	.05
211628	1112	64.6	6.0	5.0	4.1	8.8	.4	10.4	.7	.77	.04	.71	.05
211629	1113	67.7	15.9	4.7	3.5	2.1	.1	5.4	.6	.75	.04	.69	.06
211632	1114	45.2	2.5	12.6	11.8	16.4	0.0	10.7	.8	.72	.04	.67	.06
211633	1115	78.4	6.5	3.8	2.0	4.2	.3	4.5	.3	.72	.04	.67	.05

INDEX OF COAL SAMPLES BY COUNTY, SORTED BY QUADRANGLE

COUNTY	7 1/2' QUADRANGLE	COAL NAME USED ON THE GEOLOGIC QUADRANGLE	USGS ID No.
Boyd	Ashland	Princess No.7	W207460
Boyd	Ashland	Princess No.6	W208199
Boyd	Ashland	Princess No.6	W207459
Boyd	Ashland	unnamed	W207473
Boyd	Ashland	Princess No.7	W207816
Boyd	Ashland	Princess No.5	W207458
Boyd	Boltsfork	Princess No.7	W207457
Boyd	Rush	Princess No.5	W207809
Boyd	Rush	Princess No.7	W203628
Boyd	Rush	unnamed	W207896
Boyd	Rush	Princess No.8	W203629
Boyd	Rush	Princess No.5	W207810
Carter	Grahn	Little Caney	W211623
Carter	Rush	Princess No.3	W207808
Carter	Rush	Princess No.3	W207865
Carter	Tygarts Valley	Tom Cooper	W211193
Carter	Tygarts Valley	Gun Creek	W211191
Carter	Willard	Princess No.5	W211192
Greenup	Argillite	Princess No.3	W207107
Greenup	Argillite	Princess No.3	W207106
Greenup	Argillite	Princess No.3	W207862
Greenup	Ironton	Princess No.5	W208434
Greenup	Oldtown	Princess No.3	W207109
Greenup	Oldtown	Princess No.3	W207110
Greenup	Oldtown	Princess No.4	W207108
Lawrence	Adams	Peach Orchard	W205333
Lawrence	Adams	Peach Orchard	W205334
Lawrence	Fallsburg	Princess No.7	W208435
Lawrence	Fallsburg	Princess No.8	W211189
Lawrence	Milo	Richardson	W207863
Lawrence	Milo	Peach Orchard	W205335
Lawrence	Milo	Peach Orchard	W205336
Lawrence	Milo	Broas	W205318
Lawrence	Prichard	Princess No.7	W208436
Lawrence	Richardson	Fire Clay	W213938
Lawrence	Richardson	U Peach Orchard	W211629
Lawrence	Richardson	M Peach Orchard	W211633
Lawrence	Richardson	Peach Orchard	W213939
Lawrence	Richardson	Peach Orchard	W213948
Lawrence	Richardson	M Peach Orchard	W211632
Lawrence	Richardson	U Peach Orchard	W211628
Lawrence	Richardson	L Peach Orchard	W211683

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

COAL NAME USED ON GEOLOGIC QUAD	INTERVAL SAMPLED	SAMPLING REGIME	USGS ID No.
Broas	Upper rider	unknown	W205318
Fire Clay	full thickness	Holmes	W213938
Gun Creek	full thickness	Holmes	W211191
Little Caney	full thickness	Holmes	W211623
L Peach Orchard	bottom split	Holmes	W211683
M Peach Orchard	bottom bench	Holmes	W211633
M Peach Orchard	top bench	Holmes	W211632
Peach Orchard	bottom bench	unknown	W205335
Peach Orchard	bottom split	unknown	W205334
Peach Orchard	bottom split	Holmes	W213939
Peach Orchard	full thickness	unknown	W205333
Peach Orchard	top bench	unknown	W205336
Peach Orchard	top split	Holmes	W213948
Princess No.3	bottom split	Holmes	W207107
Princess No.3	bottom split	Holmes	W207110
Princess No.3	full thickness	Holmes	W207862
Princess No.3	full thickness	Holmes	W207808
Princess No.3	rider	Holmes	W207865
Princess No.3	top split	Holmes	W207106
Princess No.3	top split	Swanson & Huffman	W207109
Princess No.4	full thickness	Holmes	W207108
Princess No.5	full thickness	Swanson & Huffman	W208434
Princess No.5	full thickness	TK partings included	W207458
Princess No.5	full thickness	Swanson & Huffman	W207809
Princess No.5	full thickness	Holmes	W207810
Princess No.5	top & mid split	Holmes	W211192
Princess No.6	full thickness	TK partings included	W207459
Princess No.6	full thickness	Holmes	W208199
Princess No.7	full thickness	Holmes	W207460
Princess No.7	full thickness	Holmes	W208436
Princess No.7	full thickness	Swanson & Huffman	W208435
Princess No.7	full thickness	TK partings included	W207457
Princess No.7	full thickness	unknown	W203628
Princess No.7	full thickness	Holmes	W207816
Princess No.8	full thickness	Holmes	W211189
Princess No.8	full thickness	unknown	W203629
Richardson	full thickness	Swanson & Huffman	W207863
Tom Cooper	full thickness	Holmes	W211193
unnamed	full thickness	Swanson & Huffman	W207473
unnamed	full thickness	Holmes	W207896
U Peach Orchard	bottom bench	Holmes	W211629
U Peach Orchard	top bench	Holmes	W211628

