ESTABLISHMENT AND MAINTENANCE OF A COAL SAMPLE BANK AND DATA BASE

Final Report

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by

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SUMMARY

This DOE contract continued support for the DOE Coal Sample Bank and Data Base at Penn State. Its objective was the maintenance of a set of 50 (later modified to 54) high-quality coal samples and related compositional data for the use of DOE contractors and grantees. Fresh samples have been collected to counteract problems arising from deterioration of older samples during storage. The five-year contract, a three-month no-cost extension, and a three-month unfunded period are covered in this report.

At the beginning of the contract, a new type of container was evaluated for long-term storage of coal samples ranging in quantity from a few grams to over 10 kg (22 lbs). Gieseler fluid behavior, oxidation of pyrite to sulfates, loss of heating value, and other properties were monitored over time. Based on preliminary results, these foil and polyethylene laminate bags were believed to be a significant improvement over the drums, buckets and cans previously used. Use of the bags was therefore instituted with DECS-1, the first sample collected under the contract. Monitoring of the condition of the DECS samples in foil bags and the older (PSOC-series) samples still supported by the contract has verified that the bags preserve the coal samples better than the other containers. All DECS samples, including the bulk reserves, have been stored under conditions where they are not subject to freezing or large temperature changes. Some splits of each DECS sample, and all of DECS-17, have been stored under refrigeration since 1991.

Twenty-two DECS samples were collected, ranging in rank from lignite to anthracite and representing the five most productive coal provinces of the U.S. Samples from the other two U.S. coal provinces (Pacific and Alaskan) are available from among the PSOC samples still supported by the contract. Over 6500 containers of DECS samples were created under the contract and 750 containers of 34 PSOC samples are supported by the contract. A new computer program used to track the sample container inventory was finalized.

Representative splits of the samples were distributed to DOE contractors, grantees, and other coal researchers. The standard package was approximately 300g (2/3 lb.) of coal at minus 20 mesh, but other quantities and mesh sizes were also available. One sample (DECS-17) was specially processed into 30g (1 oz) bags of minus 0.250 mm (-60 mesh) coal for use in dispersed catalyst liquefaction research. Distribution has included 932 samples (one or more containers of one sample sent to one recipient at one time) supported by this contract, plus 379 bags of DECS-17.

Each sample was characterized by proximate and ultimate analysis, petrographic (vitrinite reflectance and maceral) analysis, physical and thermoplastic testing, and inorganic element analysis. The resulting data, and geologic data on each sample, were entered in a data base which can be used to produce a formatted five-page or one-page printout for each sample. An interactively operated data base can be searched, sorted or summarized to produce tables of selected data or to identify samples meeting a requestor's criteria. During the period covered, 2,313 printouts, and 204 special data reports resulting in distribution of data on 34,086 samples, were provided on request.

STATEMENT OF OBJECTIVES

The objective of this project was the establishment, on a limited scale, of a coal sample bank and related data base activities at Penn State, including:

- (1) establishment of a sample bank of no more than fifty U.S. coal samples of proven value to process research personnel;
- (2) management of the sample bank to provide high quality coal samples and related compositional data;
- (3) provision of professional coal expertise for assistance in determining suitable sample specifications and in identifying specific samples to best fit the needs of an individual requestor's coal research;
- (4) distribution of samples and scientific data in response to requests from the coal research community; and
- (5) replenishment of depleted samples as required to assure adequate supply for future sample requests.

TASK I: COAL SAMPLE BANK OPERATION

TASK IA. BACKGROUND

Since 1967, Penn State has been involved with the maintenance of a set of coal samples from across the country, suitable for many aspects of coal research. Initially intended for use by various Penn State departments, its value was soon recognized by other research agencies. Provision of samples and data to other researchers has been supported by U.S. Department of the Interior's Office of Coal Research (1966-1975), U.S. Energy Research and Development Agency (1975-1980), and U.S. Department of Energy (1980-1993). Samples collected through the end of the previous contract had been identified by sequentially assigned numbers from PSOC (Penn State / Office of Coal Research) -1 through PSOC-1535.

These years encompassed a continuing program directed towards improvement in consistent sample collection, processing, distribution, analytical techniques, data computerization and container inventory operation. Thus, facilities for all of these aspects of the project were already in place when the contract began in April, 1988.

Distribution of samples and data continued uninterrupted from the previous contract. Table 1 shows the samples supported at the onset of the contract and the amounts of samples remaining at the conclusion of the reporting period.

Table 1. FSOC sample weights collected and remaining

PSOC Number	Approximate Sample Weights in Kilograms		
	Collected	Remaining 4/88	Remaining 8/93
1107	907	882	760
1442	260	214	201
1443	260	194	175
1444	326	323	306
1445	239	228	211
1446	321	319	306
1447	327	326	253
1448	316	305	288
1451	256	192	111
1461	365	363	339
1468	359	332	263
1469	320	304	289
1470	279	273	262
1471	302	287	252
1474	340	336	315
1475	419	390	290
1482	293	290	263
1485	300	293	256
1486	329	322	306
1487	385	383	349
1488	338	335	294
1489	335	328	315
1490	231	229	218
1491	252	249	235
1492	284	266	249
1493	332	283	134
1494	241	213	171
1495	259	252	244
1496	267	264	250
1497	245	243	234
1498	332	330	312
1499	406	403	383
1500	452	449	429
1501	286	283	270
1502	251	244	207
1503	339	319	275
1504	350	347	316
1506	267	248	235
1507	246	198	177
1508	586	579	547
1515	359	354	336
1516	327	300	254
1517	275	141	111
1518	252	244	193
1519	277	269	184
1520	339	305	218
1521	334	332	316
1522	264	261	246
1523	320	317	299
1524	323	315	260
1532	213	202	180
1533	161	154	143
1534	212	204	193
1535	194	183	167

TASK IB. STORAGE OF COAL SAMPLES

For the samples collected during the previous contract and supported by the subject contract, the processing procedure generally produced two 100 kg (220 lb) drums of minus 25 mm (-1") coal, one 50 kg (110 lb) drum of minus 6 mm (-1/4") coal, and three 12 kg (26 lb) buckets of minus 6 mm (-1/4") coal to be stored for future use and to meet requests for larger amounts of samples. The fourth bucket created was used to produce minus 0.85 mm (-20 mesh) coal, stored in number 2 size steel cans of at least 225 g (1/2 lb) net weight, for distribution and analysis.

Past experience of both DOE and Penn State had led to the belief that preservation of a sample's initial characteristics over long-term storage could be improved. Argon gas was already being used to displace air inside sample containers before sealing, but samples showed varying levels of change nonetheless.

In order to quantify these changes, the contract provided for a program to monitor the condition of all supported samples through time. The plan was to use a polarographic gaseous oxygen analyzer to test the atmosphere inside two drums of each sample (the instrument's probe pierces the drum lid, withdraws a sample, and the hole is sealed; the drum need not be opened). For each sample, one of the drums of minus 25 mm (-1") coal was to be tested every six months without the drum being opened. The drum of minus 6 mm (-1/4") coal was to be tested every year, and would then be opened in order to split out 2.3 kg (5 lb) of coal for chemical evaluation of the coal's condition. Moisture, ash, and total sulfur would indicate how well the subsample matched the subsample originally analyzed and other subsamples used for monitoring. Other analyses would indicate the extent of change from the coal's original condition. Gieseler fluid properties (maximum fluidity and fluid temperature range) are among the most sensitive indicators of deterioration during storage for bituminous coals; decreases in these parameters indicate deterioration. Another sensitive indicator, particularly in coals with abundant iron sulfide minerals, is the oxidation of sulfides to sulfates, which can be measured by the increase in sulfate sulfur level. Decreases in calorific value are less severe but also indicate deterioration. Alkali extraction was also to be performed in order to evaluate its application for such monitoring.

Analysis of Head Space Oxygen in Bulk Storage Containers

Ingold Polarographic Oxygen Analyzer

The head space oxygen contents of primary (113 liter, 30 gal.) coal storage containers as well as selected secondary (19 liter, 5 gal.) containers were measured. Tables 2 and 3 show the results of this effort, including comments on the physical appearance of the coals observed when selected containers were opened to obtain representative splits to document sample integrity.

Table 2. Headspace oxygen content of polyethylene drums sampled to evaluate the extent of coal deterioration; Fall, 1988

PSOC Number	Seam Name	Rank	% Head Oxygen	Comments*
1107	King Cannel	subA	--	Y, W sulfate, iron stain
1442	Darco	lig	3.2	moist
1443	unnamed	lig	3.8	moist
1444	unnamed	lig	1.4	moist, trace W sulfate
1445	Blue #1	hvCb	5.7	moist
1446	New Mexico #8	hvCb	12.3	
1447	Red	hvCb	13.0	
1448	York Canyon	hvAb	18.7	
1451	Pittsburgh	hvAb	--	
1461	Mammoth	an	19.7	
1468	Buck Mountain	an	17.8	
1469	Mary Lee	hvBb	15.0	
1470	Pratt	hvBb	8.6	moist, trace Y sulfate
1471	Pee Wee	hvAb	15.7	
1474	Splashdam	mvp	16.3	
1475	Elkhorn #3	hvAb	9.5	
1482	Hagel	lig	1.6	moist, trace Y, W sulfate
1485	Rosebud	subB	8.1	moist
1486	Big Dirty	subB	4.3	moist, trace Y sulfate
1487	Adaville #1	subA	13.4	trace Y sulfate
1488	Dietz	subB	3.4	moist
1489	Pust	lig	10.6	moist, trace Y, W sulfate
1490	Brazil Block	hvCb	16.4	moist
1491	Indiana #6	hvCb	15.0	moist
1492	Illinois #5	hvCb	16.1	
1493	Illinois #6	hvCb	3.0	moist, trace Y sulfate
1494	Kentucky #9	hvBb	13.7	iron stain
1495	Bevier-Wheeler	hvCb	15.8	
1496	Tebo	hvCb	12.8	trace W sulfate
1497	Illinois #2	hvCb	11.9	W sulfate
1498	Wadge	hvCb	15.6	
1499	Colorado B	hvBb	17.1	
1500	Basin B	mvp	19.7	moist
1501	Juanita C	hvBb	16.4	
1502	Hiawatha	hvCb	6.2	
1503	Blind Canyon	hvCb	16.9	
1504	U. Sunnyside	hvBb	18.7	
1506	Banner	hvAb	19.4	
1507	Beulah	lig	6.7	moist, trace Y, W sulfate
1508	Pocahontas #3	lvb	20.7	
1515	Pa. Anthracite	sa	19.8	moist
1516	L. Kittanning	lvb	20.5	
1517	L. Kittanning	hvBb	16.4	
1518	M. Kittanning	hvBb	18.5	large W sulfates
1519	Pittsburgh	hvBb	18.3	
1520	Smith-Roland	subC	--	
1521	L. Hartshorne	lvb	18.8	
1522	Sewell		19.1	
1523	#5 Block	hvAb		
1524	U. Kittanning	hvAb	20.3	
1532	#4 Usibelli	subC	15.7	moist
1533	#3 Usibelli	lig	17.2	moist
1534	Waterfall	subC	13.6	moist
1535	Deadfall Syn. #4	subA	20.8	moist

*KEY: Y = yellow

W = white

moist = visible condensation inside drum

Table 3. Comparison of head space oxygen in drums and buckets of PSOC samples after three years in storage

PSOC Number	Seam Name	Rank	% Head Oxygen in Drum	% Head Oxygen in bucket
1446	New Mexico #8	hvCb	12.3	20.6
1470	Pratt	hvBb	8.6	17.9
1488	Dietz	subB	3.4	18.0

Procedure

An Ingold 507 Head Space Oxygen Analyzer with a hard package sampling arm was used to measure the percentage of oxygen in the atmosphere within the containers. The hard package sampling arm allows a needle to puncture the container lid and about 3 cc of gas is drawn through the needle into a cuvette. A membrane in the cuvette allows gaseous oxygen to pass into an electrolyte gel where it is reduced to hydroxyl. The sensor generates a signal proportional to the hydroxyl concentration; the signal is displayed on a digital panel meter as percent oxygen. Calibration is achieved by sampling normal air and adjusting the signal to read 20.9 percent O_2 . The time required from intake of the sample until a stable reading is achieved is about 30 seconds. Accuracy is reported by the manufacturer to be plus or minus 0.25%. Increased accuracy at low oxygen levels may be achieved by calibration against a gas standard; this method was not employed.

Results

At the onset of the gas and coal sampling program a problem with the 19 liter (5 gal.) buckets was noted. The screw-top lids on about 20 percent of the containers had loosened. Head space oxygen analysis on the other 80 percent of the buckets revealed that many of them had also undergone leakage. Table 3 provides evidence of the susceptibility of these containers to atmospheric leakage. Because of the obvious inadequacy of the screw-top polyethylene buckets, further documentation of the gas content of these containers was not undertaken.

The oxygen contents of three primary containers were periodically measured over 36 days. Two drums of subbituminous coal (PSOC-1488) and one drum of anthracite (PSOC-1468) were opened and then resealed after flushing with argon. In order to achieve a still higher argon content, vacuum pumping followed by more argon introduction was then performed. Figure 1 shows how the oxygen contents of these drums changed during storage.

Figure 1. Changes in drum oxygen content with time (polarographic oxygen analyzer)

Gas Chromatograph

Three bituminous coal samples were selected from the Penn State Coal Sample Bank for container atmosphere analysis by gas chromatography. This study was undertaken entirely with support from non-DOE sources. The samples were chosen for their relative freshness and similarity in rank, storage time, composition, mesh size, and weight in the storage containers. Two (PSOC-1529 and 1531) were samples from the Pittsburgh seam and one (PSOC-1530) was from the Sewickley seam. All three had been collected over a period of two days in July, 1987. One 113 liter (30 gal.) polyethylene drum and one 19 liter (5 gal.) polyethylene bucket of each sample were used. No DOE samples met the requirements for similarity as well as the chosen samples, and no single sample was available in similar mesh size and quantity in three drums and three buckets.

Procedure

The gas chromatograph was calibrated for analysis of oxygen, nitrogen and argon. The results are expressed in mole percent of each gas. Before the coal sample containers were gassed, the argon from the argon tank to be used was analyzed. It was found to contain no measurable oxygen (the detection limit of the instrument was approximately 0.1 percent oxygen).

The six containers were moved to the gas chromatography lab and were fitted with gas sampling ports fabricated from tire valves and resealing membrane caps. After being opened for this procedure, argon gas was introduced into the six different containers by the following alternative methods:

for 113 liter (30-gal.) drums:

- 1) The lid was sealed, and the container was pumped with a small vacuum pump for approximately 2 minutes, then argon was introduced until a slight positive pressure was reached.
- 2) Same, except with large vacuum pump.
- 3) The lid was placed loosely over the container to allow the introduction of a stainless steel wand, through which argon was introduced to the bottom of the container. The wand was gradually withdrawn while the argon flowed for approximately 4 minutes.

for 19 liter (five-gal.) buckets:

- 1) The lid was sealed, and the container pumped with a small vacuum pump for approximately 30 seconds, until the bucket began to deform. Argon was introduced until a slight positive pressure was reached.
- 2) Same, except that the pumping and argon introduction were repeated after 3 hours.
- 3) A wand was used as in #3, under drums, above.

Gas samples were withdrawn through the membrane sampling ports with a 10-ml syringe and analyzed immediately for nitrogen, oxygen and argon with a Varian model 3700 gas chromatograph.

Results

Results of the analyses on gas samples taken approximately 30 seconds, 4 hours, 24 hours, 4 days, and 75 days after gassing are plotted in Figures 2, 3 and 4 using logarithmic scales for time. The three figures show levels of argon, oxygen and nitrogen respectively. The plotted argon levels at 0.01 hours (30 seconds) show the varying efficiency of the argon introduction methods. The initial argon content of the two vacuum-pumped drums was lower than that of the other four containers, but this would have been increased by longer pumping times.

The gas compositions after four hours probably reflect both diffusion into the interstices and pores of the coal samples and leakage of the containers. In the three containers treated once with a vacuum pump, gas samples were withdrawn approximately 10 cm from the argon introduction ports, and there was little time for diffusion before the first gas sampling. In comparison, the other three containers (treated with a wand or pumped twice) would have undergone more diffusion before the initial sampling. Their rate of argon level decrease at the sampling port over the first four hours would have been influenced less by diffusion and more by leakage.

Further drops in argon levels (1 day, 4 days and 75 days) are assumed to be related primarily to container leakage. The bucket treated with the wand, which appeared to leak the least over the first 4 hours, apparently developed a leak before 24 hours. By 75 days, the argon levels in all 6 containers had dropped below 2 mole percent.

Figure 3 shows that measured oxygen levels in all containers rose between the 30-second and 4-hour samples. This is likely to have been caused at least in part by movement of gases within the containers. Oxygen would have migrated out of pores in the coal into the free gas, where it was measured. In four of the six containers, oxygen levels subsequently declined, which is believed to reflect adsorption of oxygen onto the sample and oxidation of the coal in an atmosphere of limited oxygen. Since the argon levels show that all the containers leak, the oxygen levels are assumed to reflect an equilibrium between oxygen leakage and uptake rates. The four containers with final oxygen contents of less than 5% show oxygen uptake by the coal to have occurred faster than the oxygen leakage. In the two buckets with final oxygen levels of approximately 20%, the leakage rate was high enough that the gas composition was nearly that of air. Both final oxygen contents over 20 mole percent are assumed to be in error and should be 18.9 mole percent, the level of oxygen in atmospheric air.

The nitrogen levels (Fig. 4) reflect the leakage of air into the containers, with the coal depleting the atmosphere of oxygen in the four moderately tight containers, thereby enriching it in nitrogen.

Figure 2. Changes in container argon content with time (gas chromatograph)

Figure 3. Changes in container oxygen content with time (gas chromatograph)

Figure 4. Changes in container nitrogen content with time (gas chromatograph)

Conclusions

Data from two studies using different instruments indicated that atmospheric oxygen was leaking into the primary and secondary bulk storage containers of PSOC samples. The methods and containers tested cannot maintain an inert atmosphere over the long term. The actual percentage of oxygen in the containers is thought to be influenced by several factors:

- 1) Flushing with argon by any method only displaces part (50 to 80%) of the atmospheric air present in the container after it is filled with coal. Because the atmosphere may not be homogeneous, and because leakage may be a factor before it becomes homogeneous by diffusion, this fraction is difficult to determine by sampling and analysis.
- 2) The amount of air displaced depends upon the argon introduction method used and its duration. Methods which allow time for diffusion of air to an exit before argon introduction ends appear to be most effective.
- 3) After sealing the containers, oxygen in the container is consumed by the coal; the amount and rate of consumption are thought to be a function of coal rank.
- 4) Leakage of air into the container may replace some or all of the oxygen consumed by the coal.
- 5) Full containers generally exhibit lower head space oxygen contents.
- 6) The lid seals of the 19-liter (five-gal.) screw-top containers are unreliable.
- 7) The rate of leakage and the rate of oxygen consumption are likely to show disparate responses caused by seasonal temperature variation.

After the first year of polarographic and gas chromatographic research, it became apparent that the containers used did not exclude oxygen successfully for long-term storage. DOE agreed that the oxygen analyses had served their purpose and that they could be discontinued. The contractor's efforts were then concentrated on researching better types of containers for long-term storage.

Initial Studies of Foil Laminate Bags

Foil laminate bags had been shown to successfully preserve moisture in subbituminous coal samples for short-term storage (Sharp, 1986). Several types of laminate bags are available; military specification Mil B-131, the type used by Sharp, was also recommended by the distributor for its durability. A polyethylene inner layer allows heat-sealing and shields the contents from the middle aluminum foil layer which provides a barrier to gas transport and light. An outer spun-bonded polyethylene fiber layer resists tears and abrasions. Sealing may be accomplished by manual flushing with inert gas and a manually operated sealer, or an automated vacuum/inert gas sealer as used in the food industry.

Some of these bags and an appropriate manual heat-sealer were acquired and a program was planned to test their ability to preserve pyritic sulfur, Gieseler fluidity, calorific value, and an inert atmosphere for a bituminous coal sample. The work was performed with support from the Penn State Cooperative Program in Coal Research.

Medium volatile bituminous Lower Kittanning seam coal (PSOC-1536)

A run-of-mine sample of the medium volatile bituminous (mean-max. R_o 1.27%) Lower Kittanning seam was collected as PSOC-1536 and promptly processed. Gieseler fluidity, FSI, alkali extraction and preparation of petrographic pellets were accomplished within 32 hours after extraction of the coal from the mine face. A split was submitted for initial chemical analysis, and others were sealed for other studies.

Splits of the sample were packaged in several container types for the study: -6 mm (-1/4") coal in polyethylene buckets and foil laminate bags within buckets; -0.85 mm (-20 mesh) coal in steel cans, foil laminate bags and an open container exposed to the atmosphere. After 1, 4, 12, 22, and 27 months containers were opened and samples re-analyzed.

All re-analysis results for the various container types are shown in Table 4. Figure 5 shows that foil laminate bags maintained fluid range better than steel cans and much better than buckets. After storage for 12 months, the sample stored in the bucket had lost its thermoplastic character. However, the fluid range of the bagged -0.85 mm (-20 mesh) coal had dropped by only 5 percent (within the range of experimental error). Maximum fluidity and free-swelling index showed similar trends.

The initial analysis for the sample showed 5.88 percent total sulfur and 0.06 percent sulfate sulfur. Figure 6 shows that foil laminate bags avoided production of sulfates better than cans and much better than buckets. As with fluid range, the bucket sample was deteriorated even more than the sample exposed to the atmosphere. The bucket sample had much higher moisture than the exposed sample, perhaps caused by leakage, trapping of moist air, and subsequent condensation. Surface moisture would have accelerated the sulfide to sulfate reaction.

Figure 7 shows the change over time of the alkali extraction test, carbon content, and calorific value of the mvb sample over time of storage in foil bags as opposed to a sample left exposed to the laboratory atmosphere. All of these results show that the foil bags tended to preserve the initial condition of the coal, compared to the deterioration which occurs when the coal is exposed.

The foil laminate bags performed best at maintaining maximum Gieseler fluidity, fluid range and low sulfate sulfur (expressed as % of total sulfur to minimize effects of variability in the sulfate sulfur analysis). Coal at minus 6 mm (-1/4") in foil laminate bags within caulked buckets maintained maximum fluidity and low sulfate sulfur better than coal at minus 0.85 mm (-20 mesh) in

Table 4. Influence of container type on coal characteristics after storage, PSOC-1536 (mvb, Lower Kittanning seam), initially sealed in argon

Stability of coal in storage																	
Storage Time	Mesh Size	Ash, dry %	Moist-ure	Sulfur, % dry coal				% Oxygen in atmosphere		Alk. Extr. % trans.	Gieseler Fluidity						
				Total	Pyr-itic	Org-anic	Sulf-ate	Sulf. % of Tot.	inner bag		container	FSI	Max. Fl ddpmm	T Init.	T Max F	T Final	Fluid Range
Foil laminate bags, -20 mesh coal																	
original		21.37	1.34	5.88	4.54	1.28	0.06	1.0	-	100.0	9.0	1224	410	472	510	100	
4 weeks	20M	20.50	1.43	5.31	4.45	0.79	0.06	1.1	0.29	100.0	8.0	968	417	472	508	92	
16 weeks	20M	21.40	1.38	5.47	4.98	0.43	0.06	1.1	0.32	97.9	8.0	950	415	474	510	94	
52 weeks	20M	21.22	1.29	5.69	4.35	1.31	0.04	0.7		96.2	8.0	1937	410	470	505	95	
93 weeks	20M	21.46	1.08	5.35	4.63	0.68	0.03	0.6	0.47	98.9		1016	406	472	506	100	
116 weeks	20M	19.55	1.27	5.30	3.71	1.55	0.04	0.8		97.1		931	410	467	505	95	
Steel can with inner polyethylene bag, -20 mesh coal																	
original		21.37	1.34	5.88	4.54	1.28	0.06	1.0	-	100.0	9.0	1224	410	472	510	100	
4 weeks	20M	21.20	1.03	5.23	4.36	0.80	0.07	1.3	1.20	99.2	9.0	816	412	470	508	96	
16 weeks	20M	21.20	1.42	5.37	4.98	0.34	0.05	0.9	1.33	1.48	97.4	8.5	727	415	474	509	94
52 weeks	20M	21.35	1.63	5.71	4.23	1.19	0.20	3.5		0.60	94.9	8.0	205	417	471	500	83
Polyethylene bucket, -1/4" coal																	
original		21.37	1.34	5.88	4.54	1.28	0.06	1.0	-	100.0	9.0	1224	410	472	510	100	
4 weeks	1/4"	20.40	2.22	5.27	4.24	0.85	0.17	3.2	17.80	100.0	9.0	560	414	469	506	92	
16 weeks	1/4"	20.50	2.13	5.23	4.37	0.39	0.47	9.0	16.20	97.4	7.5	1	458	466	480	22	
52 weeks	1/4"	15.61	5.21	4.87	2.44	1.26	1.18	24.2	13.30	96.3	6.0	0					
Polyethylene bucket with caulked lid, -1/4" coal																	
original		21.37	1.34	5.88	4.54	1.28	0.06	1.0	-	100.0	9.0	1224	410	472	510	100	
20 weeks	1/4"	20.30	0.80	5.70	4.31	1.23	0.16	2.8	0.35	97.5	8.0	234	422	472	504	82	
Foil laminate bags within polyethylene bucket with caulked lid, -1/4" coal																	
original		21.37	1.34	5.88	4.54	1.28	0.06	1.0	-	100.0	9.0	1224	410	472	510	100	
4 weeks	1/4"	21.30	1.30	5.50	4.64	0.82	0.04	0.7	0.28	20.70	99.9	8.5	1173	409	472	508	99
16 weeks	1/4"	21.00	1.41	5.42	5.06	0.34	0.01	0.2	0.17	20.30	97.8	8.5	1169	417	474	508	91
Exposed to atmosphere, -20 mesh coal																	
original		21.37	1.34	5.88	4.54	1.28	0.06	1.0	-	100.0	9.0	1224	410	472	510	100	
4 weeks	20M	22.60	0.54	5.34	4.25	1.06	0.03	0.6	(20.9)	99.6	8.5	568	414	472	504	89	
16 weeks	20M	20.30	0.94	4.98	4.37	0.42	0.18	3.6	(20.9)	96.8	8.0	155	426	472	505	80	
52 weeks	20M	21.89	0.66	5.59	4.18	1.43	0.39	6.5	(20.9)	94.2	7.0	2	447	466	489	42	
116-9 wks	20M	20.60	1.34	5.34	2.30	1.95	1.09	20.4	(20.9)	93.0

Figure 5. Changes in Gieseler fluid range with time (PSOC-1536, mvb Lower Kittanning seam)

Figure 6. Changes in sulfate sulfur (as percent of total sulfur) with time (PSOC-1536, mvb Lower Kittanning seam)

Figure 7. Changes in calorific value, carbon, and alkali extraction with time (PSOC-1536, mvb Lower Kittanning seam sample)

foil laminate bags stored without enclosing buckets. Because the atmosphere in the buckets approached air in its oxygen content, it is assumed that the mesh size and not the enclosing bucket caused the difference in preservation. The four oxygen levels within foil bags were equivalent when the range of error of the oxygen analyzer at low oxygen levels is considered.

The next best container was the steel can with an inner polyethylene bag containing minus 0.85 mm (-20 mesh) coal. Values for sulfate sulfur as percent of total sulfur, oxygen, and maximum Gieseler fluidity were not as good as those from the foil bags. The steel can, not the polyethylene bag, provides the barrier to oxygen.

The polyethylene buckets and the open container ("exposed") performed poorly at maintaining low sulfate sulfur and high Gieseler fluidity. The polyethylene bucket with caulked lid performed poorly even though the oxygen level was low.

Other tests were performed on selected samples from the various container types. Figure 8 is a plot of the change in fluorescence intensity over time of irradiation and shows a negative alteration for telocollinite for this medium volatile coal. Moreover, there appears to be little difference in alteration for the different storage samples with the exception of the subsample stored for 16 weeks in a bucket, without the protection of a foil bag. For this sample, which also showed the greatest change in fluid properties, the initial alteration is again negative, but after about 8 minutes of alteration there is a slight increase in intensity. This increase may be the first indication of weathering effects in storage, although the pattern is inconclusive.

FTIR spectra were obtained on the fresh coal and that from foil bags and polyethylene buckets after 4 and 16 weeks; no definite changes in functional-group composition could be detected, either in the original spectra or the first derivatives.

Conclusions

The foil laminate bags performed best to maintain maximum Gieseler fluidity, fluid range, low sulfate sulfur, and other initial properties of the coal.

High volatile A bituminous Pittsburgh seam coal (DECS-12)

A sample with greater initial fluidity than PSOC-1536 might provide a more sensitive indication of deterioration in storage. When the hvAb Pittsburgh seam sample (DECS-12) was collected in July, 1990, it was designated for detailed monitoring in addition to the normal annual monitoring. Figure 9 shows how Gieseler fluid range decreased for a sample stored exposed to air, and was maintained near its initial value for samples stored in foil laminate bags.

The sample was also tested for liquefaction performance while fresh and again after 6 months in storage in foil bags and exposed to air. The conditions of hydrogenation were selected not to optimize conversion, but to emphasize minor

Figure 8. Fluorescence alteration of PSOC-1536 (muv):
Effect of storage

Figure 9. Changes in Gieseler fluid range with time (hvAb Pittsburgh seam sample)

compositional differences in the products derived from the two stored samples. Liquefaction runs were conducted at 350°C for 30 minutes, 1000 psig H₂, 2:1 tetralin: coal ratio. Table 5 shows that whereas the liquefaction response of the sample stored in the foil bag had not deteriorated in 6 months, there was a small but significant decrease in conversion of the exposed coal.

Table 5. Liquefaction data from DECS-12 (hvAb, Pittsburgh seam) after storage

	Initial	Exposed 5.5 months	Foil Bag 6 months
% Conversion	43.1 0.6	40.5	45.3
% Asphaltenes	41.2 0.7	42.5	41.7
% Oil + Gas	1.9 0.9	-2.0	3.6

Conclusions

The foil laminate bags performed well to maintain Gieseler fluid range and liquefaction behavior of the high volatile A bituminous coal.

Study Employing Argonne Premium Coals

At DOE's request, a further study of Gieseler fluid properties and alkali extraction tests was undertaken on six bituminous coal samples from the Argonne National Laboratory's (ANL) Premium Coal Sample Bank. ANL supplies coal samples in flame-sealed, nitrogen-filled glass ampoules (Vorres, 1990). The Gieseler fluidity test had not been undertaken at the time of collection for these coals. Therefore, the initial fluid range was assumed, using typical values reported for samples in the immediate geographic vicinity of the subject coals, and results reported by ANL after the sample had been stored. Evaluation of possible deterioration during storage was complicated by the fine size distribution of the nominal minus 0.85 mm (-20 mesh) samples provided by ANL (Table 6); size distributions finer than the -0.425 mm (-40 mesh) specified for the Gieseler test are known to increase the measured fluidity. It is possible that the true loss in fluid range might have been greater than that plotted.

The procedures and interim results of this study were reported by Glick, Mitchell and Davis (1991). Ten ampoules each of the six bituminous coals available from ANL were obtained. Four of each were placed in a nitrogen-filled glovebox where they were opened and the contents resealed in foil laminate bags. Of the six left unopened, two were used for initial analyses of Gieseler fluidity and alkali extraction. After eight months and again after two years, analyses comparing the coal resealed in foil laminate bags with that in the undisturbed ampoules were performed.

Table 6. Particle size distributions of some minus 20 mesh Argonne National Laboratory Premium Coal Samples

Mesh sizes	ANL-701 Lewiston-Stockton	ANL-101 Upper Freeport
+0.600 mm (+30 mesh)	1.0 %	0.2 %
-0.600 +0.425 mm (-30 +40 mesh)	6.1 %	0.5 %
-0.425 +0.250 mm (-40 +60 mesh)	30.3 %	3.2 %
-0.250 +0.150 mm (-60 +100 mesh)	62.6 %	11.5 %
-0.150 mm (-100 mesh)		84.6 %

Figure 10 shows that the samples repackaged in foil laminate bags and stored for two years compared well to those stored in their original ampoules. After two years, maximum fluidities of these pairs of samples matched within experimental error for all except ANL-701. Fluid ranges matched within experimental error for all except ANL-501 and -701. The variation in results for ANL-701 is probably caused by problems with the Gieseler plastometer. Dashed lines on the graphs for ANL-301, -401 and -601 indicate that the 8-month test could not be successfully completed on the amount of coal allocated because multiple repeat runs were required to meet the ASTM precision requirement.

Conclusions

Favorable comparison to Argonne National Laboratory's glass ampoules supports the use of foil laminate bags for long-term storage of samples in the DOE Coal Sample Bank.

Adoption of Foil Laminate Bags and Steel Drums for DECS Samples

The studies described above indicated that foil laminate bags are greatly superior to the polyethylene bulk storage containers, and somewhat superior to the steel cans, used previously for PSOC samples. Another study verified the preservation ability and showed the bags to be comparable to glass ampoules when sealed under the same circumstances. The availability of the bags in a variety of sizes also removed the problem of differences in preservation efficiency between bulk storage containers and smaller distribution containers (cans). The bags are available in a wide variety of sizes, and could therefore replace both 19 liter buckets and 560 ml cans. Samples for bulk storage would be split into lots no larger than 12 kg (26 lbs) so that the entire amount of each sample would be stored in only one type of container. Based on these considerations, DOE agreed that future samples should be stored in foil laminate bags.

However, these bags are not strong enough to survive rough handling when containing large blocks of coal, so they are not suitable for field collection.

Figure 10. Gieseler fluidity for Argonne Premium Coal Samples stored in foil laminate bags and original ampoules

Possibilities for field containers included the previously used polyethylene drums (in which the argon could be renewed daily before shipping, and which could be shipped by express service to minimize leakage) and 189 or 113 liter (55 or 30 gal.) steel drums with heavy duty closure bands and food-grade gaskets (Harvey and Kruse, 1988). Following some testing of the latter, they were adopted for use as described under Task IC (page 51).

Monitoring of Sample Condition

Appendix A shows the results of the analyses (including gaseous oxygen levels), performed in five annual programs over the five years of the contract. Monitoring of PSOC samples was performed on coal stored at minus 6mm (-1/4") in polyethylene drums in the Penn State Coal Sample Bank building (with no temperature control). Monitoring of DECS samples was performed on coal stored at minus 0.85 mm (-20 mesh) in foil laminate bags (nominally 300 g, 2/3 lb), the same bags distributed routinely to users. All DECS samples have been stored at controlled temperature, either at room temperature or under refrigeration.

For the PSOC-series samples collected under the previous contract (DE-AC22-84PC-70760, November 6, 1984 to April 5, 1988), the first column for each sample in Appendix A shows the initial analysis, performed as soon as possible after collection and processing. In some cases a second sample was also analyzed for verification of some results; these analyses are shown in the second column. At the beginning of the subject contract, a can of each coal at minus 0.85 mm (-20 mesh) which was a possible candidate for monitoring by Gieseler fluidity and/or alkali extraction was analyzed. The results were used to indicate the best possible condition of these samples at that time in their storage history (because the cans were the best containers for sample preservation then in use), and are shown in the next column.

In five successive programs, corresponding roughly to the five years of the contract, the drum of minus 6 mm (-1/4 inch) coal of each sample was opened and approximately 2.3 kg (5 lbs) was removed by a representative subsampling procedure using either a riffle splitter or a rotary turning-tube divider. Each drum was then resealed, purged with argon gas, and returned to storage. The subsamples were stage-ground to appropriate mesh sizes and subjected to analysis. Moisture, ash, total sulfur, forms of sulfur, and calorific value analyses were performed on all subsamples. Geiseler fluidity testing was performed on those samples in the bituminous rank range which had previously demonstrated thermoplastic behavior. Alkali extraction testing was initially performed on samples in the bituminous rank range, and was continued only for those samples (generally hvBb rank or higher) for which the results seemed to indicate that its use was appropriate (above approximately 80% transmittance). For PSOC samples, alkali extraction results were reported for a 10mm light path and were not corrected to the 17mm light path now adopted under ASTM D5263 as a standard condition (ASTM, 1993). The analytical results from these five programs are shown in the final columns for each sample in Appendix A. For samples which were superseded by newly collected samples during the contract, monitoring of the old sample was discontinued and monitoring of the new (DECS) sample was initiated.

The format of entries in Appendix A for DECS samples is similar to that for PSOC samples. There was not a major gap in coverage between collection and initial monitoring, and all DECS samples were stored in the same container type, so there is no equivalent to the cans of PSOC samples analyzed to determine the best possible condition for initial monitoring. For DECS samples, alkali extraction results were mathematically corrected to a 17 mm light path. Samples DECS-21 and DECS-22 were collected in the last year of the contract and were not monitored before the end of the contract.

Ash yield and total sulfur analyses show the degree to which the subsamples are representative of the total sample and the degree to which they match the initially analyzed subsample. Moisture analyses also show this, but could be influenced by storage conditions (temperature and humidity) as opposed to processing and subsampling conditions. Moisture, ash and sulfur levels are shown for DECS samples in Table 7. Variability between these subsamples is similar to that observed between subsamples analyzed for equivalence when the samples were first packaged.

Table 8 shows repeatability values (ASTM, 1993) applicable to the results presented in the various tables, figures and appendices. The results of duplicate analyses are expected to agree within the repeatability values shown if they are performed in the same laboratory by the same operator on the same equipment, and within the reproducibility values shown if performed in different laboratories. Samples in the monitoring studies were sent to the same laboratory, but over a period of years, so in some cases different operators would have been involved. Thus the expected tolerances for these tests may lie between the repeatability and reproducibility values shown. The random variation in ash between splits will also increase the variation in results.

Examination of monitoring results from PSOC samples (Appendix A) shows the problems associated with the bulk storage containers. Of the 29 PSOC samples which initially exhibited fluid properties with the Gieseler plastometer, only 7 maintained any fluidity through the monitoring project, and only one maintained more than 5 percent of its initial maximum fluidity. Each of the 7 did maintain at least half their fluid temperature range. Fluid temperature range is also less subject to variation between instrumental runs, and has therefore been used in this report as a more stable indicator of fluid behavior.

All samples except those lowest in total sulfur (PSOC-1447, 1468, 1498, 1499, 1501, 1502, 1503, 1504, 1508, and the four Alaskan samples, 1532-1535) showed significant increase in sulfate sulfur, indicating oxidation of sulfides. The Interior Province samples (PSOC-1490 through -1497) fared worst, with some increasing from below 0.05 % initial sulfate sulfur to over 2.5%, as much as half their total sulfur.

Monitoring results of samples DECS-1 through DECS-20 (Appendix A) are graphed in Figures 11 - 30. Each of these samples was a replacement for a PSOC sample with similar properties, usually collected from the same mine. These comparable PSOC samples were also monitored through time, and their conditions

Table 7. Moisture, ash and sulfur levels of DECS samples in foil laminate bags monitored through time

DECS sample	Monitoring Analyses: Moisture, percent coal					Equivalence Analyses	
	Year 1	Year 2	Year 3	mean	st. dev.	mean	st. dev.
1	28.20	29.00	29.30	28.83	0.57	29.49	0.52
2	10.30	10.10	9.80	10.07	0.25	10.18	0.16
3	0.87	0.82	0.72	0.80	0.08	0.99	0.08
4	15.00	14.80	--	14.90	0.14	15.05	0.13
5	7.30	7.10	--	7.20	0.14	7.29	0.18
6	4.35	4.06	4.45	4.29	0.20	4.51	0.13
7	16.80	17.00	--	16.90	0.14	17.02	0.25
8	28.30	28.60	--	28.45	0.21	28.22	0.31
9	23.80	24.80	--	24.30	0.71	24.44	0.17
10	21.10	22.40	--	21.75	0.92	21.88	0.87
11	32.50	32.90	--	32.70	0.28	32.79	0.56
12	2.47	2.99	1.98	2.48	0.51	2.35	0.03
13	1.80	1.50	--	1.65	0.21	1.73	0.18
14	1.70	1.40	--	1.55	0.21	1.68	0.17
15	2.90	2.60	--	2.75	0.21	3.03	0.18
16	4.90	5.00	--	4.95	0.07	5.13	0.12
17	4.00	3.60	--	3.80	0.28	3.93	0.11
18	7.30	--	--	7.30	--	7.47	0.39
19	0.80	--	--	0.80	--	0.96	0.06
20	2.70	--	--	2.70	--	2.92	0.09
Ash, percent dry coal							
1	16.20	15.20	16.40	15.93	0.64	16.08	0.42
2	16.10	16.20	15.90	16.07	0.15	16.08	0.16
3	5.24	5.26	5.52	5.34	0.16	5.27	0.16
4	6.20	6.20	--	6.20	0	6.27	0.09
5	8.70	8.70	--	8.70	0	8.68	0.22
6	5.96	5.92	6.00	5.96	0.04	5.92	0.13
7	4.30	4.30	--	4.30	0	4.22	0.04
8	12.80	13.10	--	12.95	0.21	13.31	0.41
9	6.70	6.50	--	6.60	0.14	6.33	0.14
10	13.00	13.10	--	13.05	0.07	12.67	0.34
11	10.40	9.50	--	9.95	0.64	9.63	0.28
12	11.05	10.35	9.52	10.31	0.77	10.12	0.32
13	4.30	4.60	--	4.45	0.21	4.70	0.31
14	10.30	10.60	--	10.45	0.21	10.76	0.32
15	10.10	9.80	--	9.95	0.21	9.09	1.61
16	15.20	15.70	--	15.45	0.35	15.74	1.82
17	6.50	6.50	--	6.50	0	6.69	0.09
18	11.30	--	--	11.30	--	11.85	0.68
19	5.50	--	--	5.50	--	5.92	0.79
20	5.20	--	--	5.20	--	5.17	0.20

Table 7. (continued)

DECS sample	Monitoring Analyses: Sulfur, percent dry coal					Equivalence Analyses	
	Year 1	Year 2	Year 3	mean	st. dev.	mean	st. dev.
1	1.03	0.97	1.07	1.02	0.05	1.06	0.05
2	4.33	4.54	4.50	4.46	0.11	4.41	0.08
3	0.65	0.67	0.64	0.65	0.02	0.66	0.03
4	0.57	0.54	--	0.55	0.02	0.57	0.09
5	0.63	0.67	--	0.65	0.03	0.64	0.05
6	0.43	0.35	0.43	0.40	0.05	0.43	0.02
7	0.99	1.04	--	1.02	0.04	1.02	0.03
8	0.77	0.81	--	0.79	0.03	0.80	0.04
9	0.42	0.44	--	0.43	0.01	0.45	0.03
10	1.14	1.33	--	1.24	0.13	1.09	0.10
11	0.74	0.74	--	0.74	0	0.76	0.02
12	1.18	1.16	1.17	1.17	0.01	1.16	0.03
13	0.62	0.65	--	0.64	0.02	0.64	0.03
14	1.71	1.80	--	1.76	0.06	1.76	0.04
15	1.75	1.62	--	1.69	0.09	1.35	0.36
16	0.48	0.46	--	0.47	0.01	0.47	0.01
17	0.44	0.43	--	0.44	0.01	0.42	0.02
18	3.91	--	--	3.91	--	4.00	0.13
19	0.78	--	--	0.78	--	0.76	0.02
20	0.96	--	--	0.96	--	0.98	0.01

Table 8. ASTM Repeatability and reproducibility values

ASTM Procedure	Repeatability	Reproducibility
Moisture, D3173-87		
coals < 5% moisture	0.2	0.3
coals > 5% moisture	0.3	0.5
Ash, D3174-89		
no carbonates present	0.2	0.3
carbonates present	0.3	0.5
coals with more than 12% ash containing carbonates and pyrite	0.5	1.0
Total Sulfur, D4239-93 method C (infrared)	$0.03 + 0.04\bar{x}$	$0.05 + 0.06\bar{x}$
BTU/lb (dry basis), D2015-93	50	100
Forms of Sulfur, D2492-90		
Sulfate	0.02	0.04
Pyritic	$0.08 + 0.09\bar{x}$	$0.15 + 0.27\bar{x}$
Gieseler Plastometer, D2639-90		
Temperature points, °C	5	not specified
Fluidity, ddpm	$0.1\bar{x}$	not specified

Figure 11. DECS-1 (Upper Wilcox Group, unnamed seam) condition over time, showing PSOC-1444 for comparison

Figure 12. DECS-2 (Illinois No. 6 seam) condition over time, showing PSOC-1493 for comparison

Figure 13. DECS-3 (Coal Basin M seam) condition over time, showing PSOC-1500 for comparison

Figure 14. DECS-4 (Blue seam) condition over time, showing PSOC-1445 for comparison

Figure 15. DECS-5 (Hiawatha seam) condition over time, showing PSOC-1502 for comparison

Figure 16. DECS-6 (Blind Canyon seam) condition over time, showing PSOC-1503 for comparison

Figure 17. DECS-7 (Adaville No. 1 seam) condition over time, showing PSOC-1487 for comparison

Figure 18. DECS-8 (Smith-Roland, "Wyodak" seam) condition over time, showing PSOC-1520 for comparison

Figure 19. DECS-9 (Dietz seam) condition over time, showing PSOC-1488 for comparison

Figure 20. DECS-10 (Rosebud seam) condition over time, showing PSOC-1485 for comparison

Figure 21. DECS-11 (Beulah seam) condition over time, showing PSOC-1507 for comparison

Figure 22. DECS-12 (Pittsburgh seam) condition over time, showing PSOC-1451 for comparison

Figure 23. DECS-13 (Sewell seam) condition over time, showing PSOC-1522 for comparison

Figure 24. DECS-14 (Upper Kittanning seam) condition over time, showing PSOC-1524 for comparison

Figure 25. DECS-15 (Lower Sunnyside seam) condition over time, showing PSOC-1504 for comparison

Figure 26. DECS-16 (Blind Canyon seam) condition over time, showing PSOC-1503 for comparison

Figure 27. DECS-17 (Blind Canyon seam, refrigerated sample) condition over time, showing PSOC-1503 for comparison. Analyses on samples stored at -0.25 mm (-60 mesh) except Gieseler fluidity on -0.85 mm (-20 mesh) sample.

Figure 28. DECS-18 (Kentucky No. 9 seam) condition over time, showing PSOC-1494 for comparison

Figure 29. DECS-19 (Pocahontas No. 3 seam) condition over time, showing PSOC-1508 for comparison

Figure 30. DECS-20 (Elkhorn No. 3 seam) condition over time, showing PSOC-1475 for comparison

are shown for comparison. Sulfate sulfur and calorific value graphs are shown for all samples, and Gieseler fluid range is shown for those bituminous samples which maintained fluid behavior after storage. In each case the initial values of the DECS and PSOC sample shown may differ; it is the trends or slopes of the lines and not their vertical position which show the difference in storage behavior. Some random variations in readings are present, and seem large where scales are expanded, so fluctuations must be interpreted cautiously. In general, DECS samples stored in foil laminate bags maintained their initial properties through time, whereas the bulk reserves of PSOC samples stored in polyethylene drums deteriorated.

DECS-2 (Figure 12), the Illinois No. 6 seam, shows such a difference between DECS and PSOC storage for a high-sulfur Interior province sample. Although the two samples were collected from different mines, they are similar in their total sulfur and initial sulfate sulfur, fluid range, and calorific value. DECS-18, the other Interior province sample, shows similar trends.

Eastern samples (DECS-12, -13, -14, -19, and -20) show similar trends, although sulfate sulfur is not as high. DECS-19 has decreased in calorific value more than PSOC-1508, but only one data point is available thus far.

Even several western samples with low total sulfur (DECS-4, -7, -8, -9, -10, and -11) showed a significant increase in sulfate sulfur when stored in drums, but not when stored in foil laminate bags. Utah samples (DECS-5, -6, -15, -16, -17) had low total sulfur and maintained low sulfate sulfur; slight differences are exaggerated by the scale of the graphs.

The abilities of the various container types to preserve sample characteristics through time are summarized in Figures 31, 32 and 33 using data from Appendix A. These are linear regression plots comparing initial properties of coal to properties after storage in drums, cans, and laminate bags for various time periods.

Gieseler fluid range (Figure 31) decreased significantly for samples stored in polyethylene drums. The graph shows a decrease for drums stored for 14-35 months, a slight increase for drums stored 36-51 months, and a greater decrease for drums stored more than 51 months. The inconsistency is believed to be an artifact of the particular samples measured in the different time periods; it was not observed with an interim data set using some of the same samples. The true trend seems to be a continuous decrease in fluid range with time. DECS samples stored in foil laminate bags show only a slight decrease in fluid range, less than that for cans and much less than that for drums of PSOC samples.

Production of sulfate sulfur from sulfides (Figure 32) was high for PSOC samples stored in either drums or cans, averaging as much as ten-fold for drums stored more than 68 months. DECS samples stored in foil bags maintained their initial sulfate sulfur levels much better, showing a very slight apparent decrease with time. This was probably an artifact caused by a few high initial sulfate sulfur data points.

Figure 31. Gieseler fluid range of bituminous PSOC and DECS samples after storage in drums and foil laminate bags: Linear regression on all appropriate samples

Figure 32. Sulfate sulfur levels of PSOC and DECS samples after storage in drums and foil laminate bags: Linear regression on all samples

Figure 33. Heating value of PSOC and DECS samples after storage in drums and foil laminate bags: Linear regression on all samples

Reduction in calorific value during storage was slight even for PSOC samples stored in drums; a graph showing the full range of values from 8000 to 16000 BTU/lb shows the regression lines for the various container types to be indistinguishable. When the scales are greatly expanded as in Figure 33, the expected trend of decrease over time can be seen. DECS samples lost about 60 BTU/lb while in storage for one to three years, about a third as much as PSOC samples stored in drums for the same time.

TASK IC. COLLECTION OF SAMPLES, SAMPLE HANDLING, AND PROCESSING

The contract called for the collection of twenty-four samples, to be selected based on depletion rates of the existing PSOC samples. However, the monitoring studies described above showed that deterioration needed to be considered as well. Therefore, arrangements were made to recollect those samples identified as being most important to DOE liquefaction projects as soon as possible. These included an Eastern Texas seam, the Illinois No. 6 seam, the Blind Canyon seam (Utah), the Smith-Roland or "Wyodak" seam (Wyoming), and the Pittsburgh seam (Pennsylvania).

Collection Methods

Steel Drums for Field Collection

As soon as DOE had agreed to the use of foil laminate bags for storage and steel drums with high-density gaskets for field collection, the first sampling trip was organized to test these methods. Two of the most needed samples, the Texas lignite and the Illinois No. 6 seam, were selected. Gaskets were fabricated from Tygon tubing, and laboratory tests showed the gaskets and hardware to be gas-tight. The samples were collected, sealed in the drums, and purged with argon. In the field, leaks were experienced in both the gaskets and the brass hardware affixed to the drum to introduce the argon. Argon was used to purge the drums as needed (daily) during transportation of the samples to Penn State to prevent introduction of air.

Prior to the next trip, the proper high-density gaskets were received. The hardware arrangement on the drum lids was changed to allow fewer connections and a lower profile of the hardware above the lid (Figure 34). This involved machining of valve bodies so that the valve body outside the drum lid and the O-ring sealing fixture inside the lid hold the sheet metal of the drum lid securely between them. Two such assemblies (inlet and outlet ports) are fitted to holes in the drum lid. The inlet port has a stainless steel tube extending through the coal to the bottom of the drum for argon introduction. The outlet port provides a valved hole for the air to escape at the opposite end of the container from the argon introduction tube. During purging, argon flows from the tube at the bottom of the drum up through the coal sample, displacing the lighter air and expelling it at the outlet port. The proper gaskets and the hardware modifications have successfully allowed 20 subsequent samples (40 drums) to be collected and transported without major leakage problems.

Figure 34. Apparatus for inert gas purging of samples in steel drums

After agreement with DOE, the minimum sample size was reduced from 270 kg (600 lb) to 180 kg (400 lb).

Sample Processing and Packaging

PSOC samples collected under previous contracts had been processed to provide approximately 32 steel cans (300g, 2/3 lb.) of coal at minus 0.85 mm (-20 mesh) for distribution to users. These cans preserved the coal well, but when the initial batch of cans was depleted, the coal in bulk storage designated to replenish the cans had deteriorated. There was also some risk that production of these small batches of cans over many years might introduce variations from differences in processing methods. Therefore a new processing scheme was devised which would create 256 containers for distribution (approximately half the amount collected). This requires much more work initially, but less effort subsequently and no concern over differences between batches of containers. The general scheme, which requires some adjustment for individual samples based on total amount collected, is shown in Figure 35. These adjustments vary the fraction of coal crushed to minus 0.85 mm (-20 mesh) in order to obtain the constant quantity (90 kg, 200 lbs) needed for the final splits.

The coal destined for the 256 bags is riffled into 8 splits, each of which is crushed to minus 0.85 mm (-20 mesh). Each split is then riffled into four, producing 32 splits of no more than 3 kg (6.6 lb). Each of these is divided into 8 final subsamples of nominally 300 g (2/3 lb) each using an 8-tube rotary divider. Each subsample is placed in a polyethylene bag; the bag's top is folded over once and it is placed in a labelled and numbered foil laminate bag. The inner unsealed bag prevents the sealing area of the foil bag, and the sealer apparatus, from being contaminated by coal particles. The bags are then placed in the chamber of a sealer which is programmed to evacuate the chamber (including the bag), introduce argon to near atmospheric pressure, and heat-seal the top of the foil bag. As the bags are removed from the sealer their weights are recorded. Five bags are removed from the run; one is the principal analytical sample and the other four are analyzed to evaluate equivalence to the principal sample. The first 36 bags of each sample are kept in the laboratory where they are readily accessible for distribution; the remainder are stored for later use.

Sample Container Inventory

Data (such as bag number, weight, mesh size, storage location, etc.) for every bag of every sample are entered in a computerized inventory program running on Penn State's research mainframe computer. This program was written under the previous contract to replace an older program on a minicomputer, and has been further improved under the subject contract. Data may be entered for individual containers or for groups of containers which differ only in their weights (the 256 final bags of each sample). The new program performs routine listings of containers for a specified sample about 100 times faster than the old one. When an order for samples is received, the inventory is queried and the locations, weights and particle sizes of the desired samples are shown. The list can be

Figure 35. Typical crushing and splitting steps for a DECS sample

printed out and used as a checklist while retrieving containers. The program is then used to remove the entry for each of those containers from the inventory list; it prompts the user to enter information about the recipient of a container, and that information along with the original data on the container is transferred to a separate file of transactions.

The program stores its files in the format of a commercial data management package, so both the main file and the transactions file can be examined and manipulated with a wide range of commands if the inventory program does not provide the functions required. This is also the format of the Coal Data Base, so although the inventory and the Data Base are normally completely separate, they can be merged if needed for specific tasks.

Samples and Sample Types Collected

The existing PSOC samples had been chosen to provide a range of ranks, chemical compositions, and geographic and geologic sources and to represent the output of major mining operations across the country. Samples to be recollected in the DECS series were chosen to meet current research needs, particularly for liquefaction. The specific mines were chosen based on their current exposure of coal of the desired composition. The same mines from which Argonne National Laboratory Premium Coal Samples had been sampled were chosen when feasible.

The 22 DECS samples collected under the contract are listed in Table 9. The goal for each sample is to collect a sample which represents the entire thickness of the seam. Whenever feasible this is achieved by collection of a channel sample of the full seam. For particularly thick seams, lack of access to the entire seam, coupled with the quantity per unit thickness required to achieve a representative sample, make a channel sample inappropriate. In these cases a run-of-mine sample is usually collected. For mines where only a part of the vertical extent of the seam is normally worked, a channel sample of that section (working-section channel sample) is taken. The ability to collect fresh coal is also considered when deciding on the location and type of sample to be collected. Samples collected as other than whole-seam channels are listed below.

DECS-5, Hiawatha seam, Utah: Only the bottom 80 percent of the seam was being mined; the upper 56 cm (22 in) was inaccessible in the mine roof. Our working section channel sample coincided with the normal extent of mining.

DECS-6, Blind Canyon seam, Utah: The lowest 15 cm (6 in) of coal was not mined at the sample site and was not included in our working-section channel sample.

DECS-8, Smith-Roland ("Wyodak") seam, Wyoming: The vertical pit wall over 30 meters (100 feet) high was not safely accessible. A run-of-mine sample was collected using the automatic sampler at the preparation plant; amounts taken while top and bottom sections were being mined were gauged to provide a representative sample of the whole seam.

Table 9. DECS samples collected under the contract

Sample Number	Replaces PSOC-	Seam name	Sample Type	County	State	Rank	Year
DECS-1	1444	unnamed	Chan-SEAM	Freestone	TX	subC	1989
DECS-2	1493	Illinois #6	Chan-SEAM	Randolph	IL	hvCb	1989
DECS-3	1500	Coal Basin M	Chan-SEAM	Pitkin	CO	mvb	1990
DECS-4	1445	Blue	Chan-SEAM	McKinley	NM	hvCb	1990
DECS-5	1502	Hiawatha	Chan-Work	Sevier	UT	hvCb	1990
DECS-6	1503	Blind Canyon	Chan-Work	Emery	UT	hvAb	1990
DECS-7	1487	Adaville #1	Chan-SEAM	Lincoln	WY	hvCb	1990
DECS-8	1520	Smith-Roland	Run-of-mine	Campbell	WY	subC	1990
DECS-9	1488	Dietz	Drill-SEAM	Bighorn	MT	subB	1990
DECS-10	1485	Rosebud	Chan-Work	Rosebud	MT	subB	1990
DECS-11	1507	Beulah	Chan-SEAM	Mercer	ND	lig	1990
DECS-12	1451	Pittsburgh	Chan-SEAM	Greene	PA	hvAb	1990
DECS-13	1522	Sewell	Chan-SEAM	Greenbrier	WV	mvb	1990
DECS-14	1524	Upper Kitt.	Chan-Work	Barbour	WV	hvAb	1990
DECS-15	1504	L. Sunnyside	Chan-SEAM	Carbon	UT	hvAb	1991
DECS-16	1503	Blind Canyon	Chan-Work	Emery	UT	hvAb	1991
DECS-17	1503	Blind Canyon	Chan-Sect	Emery	UT	hvAb	1991
DECS-18	1494	Kentucky #9	Chan-SEAM	Union	KY	hvBb	1991
DECS-19	1508	Pocahontas #3	Chan-SEAM	Buchanan	VA	lvb	1991
DECS-20	1475	Elkhorn #3	Chan-SEAM	Pike	KY	hvAb	1991
DECS-21	1461	Lykens V. #2	Chan-SEAM	Columbia	PA	an	1992
DECS-22	1107	Upper Kitt.	Chan-Lith	Armstrong	PA	hvAb	1993

DECS-9, Dietz seam, Montana: Only half of the 26 meter (84 foot) seam was freshly exposed at a time in the mining operation. The mine operators use an air rotary drill rig equipped with an automatic cyclonic sampler to take samples ahead of the mine face for quality prediction. They have studied their sampling process and report that the air drilling process does not significantly affect moisture content. The rig deposits about 450 kg (1000 lbs) of drill chips in a cone beside the hole. Opposite quarters of a cone from a freshly drilled hole were taken as our sample.

DECS-10, Rosebud seam, Montana: At least 15 cm (6 in) of material below the floor of the mine was a mixture of pyrite and coal and is not normally mined. Also, the top 1 meter (3 ft) of coal at the freshly exposed sample site was inaccessible from our ladder. These sections were excluded from our working section sample, which thus comprised approximately 84 percent of the seam.

DECS-14, Upper Kittanning seam, West Virginia: Neither the roof nor the floor of the coal seam were exposed in this underground mine. Our working-section channel was extended down to reach the bottom of the coal, but not up to reach the top.

DECS-16, Blind Canyon seam, Utah: Collected from the same mine as DECS-6, and the same situation prevailed. At least 25 cm (10 in) of coal below the mine floor was not included in the working-section channel sample.

DECS-17, Blind Canyon seam, Utah: This sample was required by DOE to be lower in ash than DECS-16, so a lithotype channel sample excluding two high-ash zones was taken (see discussion below).

DECS-22, Upper Kittanning seam (cannel), Pennsylvania: The upper 203 cm (80") of the 280 cm (110") seam thickness at the sample site was a cannel coal. To provide an unmixed cannel coal sample, the cannel coal section was taken as a lithotype channel sample. The lower section of banded coal was taken as another lithotype channel sample, PSOC-1560, which is not part of the DOE Sample Bank.

Special Sample for DOE Dispersed Catalyst Research

During the contract, a goal of DOE/PETC was to use a single coal for testing the comparative behaviors of dispersed catalysts. The initial criteria for selecting the coal were:

- 1) reasonably large reserves being actively mined,
- 2) high volatile bituminous rank,
- 3) high vitrinite content,
- 4) low pyritic sulfur,
- 5) low iron (to avoid the catalytic activity found in high pyrite coals such as the Illinois No. 6), and
- 6) low ash.

The Blind Canyon seam, Utah, was selected by DOE as the best candidate among several considered. Although sample DECS-6 has already been collected from this seam, it was not used because the proposed sample was to be stored entirely under refrigeration after processing to preserve its properties, and a larger amount of sample and special restrictions on distribution were to be used to keep the sample available for research over an extended time period.

A trip was made to Utah and 275 kg (600 lb) each of samples DECS-16, Blind Canyon seam, and DECS-15, Lower Sunnyside seam (as a possible alternate), were collected. The samples were returned to Penn State and promptly processed, analyzed, sealed, and stored under refrigeration. As expected, analyses showed DECS-16 to be more suitable than DECS-15. However, the ash yield of DECS-16 was higher than had been expected based on previous samples. In an effort to provide the best possible sample for the long-term catalyst research projects, another trip to Utah was undertaken and 275 kg (600 lb) of sample DECS-17, Blind Canyon seam, was collected. To reduce the amount of ash, two high-ash zones in the seam were excluded from the sample. This sample was also promptly treated and was accepted by DOE as the sample for the dispersed catalyst liquefaction research.

Reduction in Number of Samples Required

The collection effort planned under the contract had been intended to visit each region of the country only once to save travel time and costs. Unexpected costs were associated with the two additional trips to Utah, processing three larger than normal samples, and providing refrigerated storage for the special sample. As a result, DOE agreed in 1991 to reduce the number of samples required under the contract from 24 to 22.

TASK ID. CHARACTERIZATION OF COALS

All samples collected were subjected to characterization using the following routine compositional analyses and tests:

1. Proximate analysis
2. Ultimate analysis
3. Sulfur forms analysis
4. Calorific value determination
5. Maceral analysis
6. Vitrinite reflectance analysis
7. Ash fusion determination
8. Free swelling index determination
9. Hardgrove grindability index determination
10. Major inorganic elements analysis
11. Equilibrium moisture determination
12. Gieseler plasticity (for bituminous samples)
13. Carbon dioxide content
14. Chlorine content

The results of these analyses are shown in the individual Coal Data Base printouts included as Appendix B.

The alkali-extraction test (Lowenhaupt and Gray, 1980) for weathering of bituminous coals was applied to all samples in the appropriate range of ranks. For DECS samples, measurements from a 10 mm cuvette were mathematically corrected to a 17 mm light path per ASTM standard D-5263 (ASTM, 1993). Results are included in Appendix A.

Four additional subsamples of each DECS sample were submitted for ash, moisture, and total sulfur tests in order to evaluate the degree of variability among the subsamples distributed to researchers. Results of these tests for equivalence (Table 10) generally show low variability among subsamples. The table shows mean and standard deviation (S.D.) of each set of five analyses; however, because the means are not of similar magnitude, it is difficult to evaluate the variability using the standard deviations. The coefficient of variation (C.V.) is the standard deviation divided by the mean; coefficients of variation can be compared directly with each other to evaluate the variability within each set of analyses.

Table 10. Equivalence of moisture, ash and sulfur of splits of DECS samples

DECS sample	Equivalence Analyses: Moisture, percent					Statistics		
	Principal	1	2	3	4	Mean	S.D.	C.V.
1	30.00	29.57	29.56	29.71	28.61	29.49	0.52	0.018
2	10.43	10.22	10.10	10.03	10.11	10.18	0.16	0.015
3	1.10	0.90	1.05	0.92	0.99	0.99	0.08	0.085
4	15.13	15.08	15.21	14.90	14.93	15.05	0.13	0.009
5	7.54	7.27	7.38	7.09	7.18	7.29	0.18	0.024
6	4.73	4.48	4.51	4.38	4.45	4.51	0.13	0.029
7	17.34	16.90	17.19	16.69	16.99	17.02	0.25	0.015
8	28.42	28.29	28.53	27.74	28.11	28.22	0.31	0.011
9	24.68	24.46	24.32	24.25	24.51	24.44	0.17	0.007
10	21.58	23.40	21.21	21.47	21.72	21.88	0.87	0.040
11	33.38	31.95	33.23	32.65	32.74	32.79	0.56	0.017
12	2.40	2.36	2.37	2.32	2.32	2.35	0.03	0.015
13	1.45	1.79	1.81	1.67	1.93	1.73	0.18	0.105
14	1.46	1.61	1.92	1.71	1.68	1.68	0.17	0.100
15	2.71	3.07	3.13	3.10	3.12	3.03	0.18	0.059
16	5.20	4.95	5.26	5.09	5.15	5.13	0.12	0.023
17	3.74	4.01	3.92	3.99	3.99	3.93	0.11	0.028
18	6.81	7.51	7.51	7.67	7.85	7.47	0.39	0.053
19	1.01	1.02	0.93	0.87	0.99	0.96	0.06	0.065
20	2.79	2.90	2.98	2.90	3.01	2.92	0.09	0.029
21	3.99	4.10	4.09	3.97	3.96	4.02	0.07	0.017
22	0.91	0.93	0.95	1.01	0.96	0.95	0.04	0.040
Ash, percent dry coal								
1	15.81	16.51	16.55	15.91	15.63	16.08	0.42	0.026
2	16.16	16.31	16.02	15.89	16.02	16.08	0.16	0.010
3	5.37	5.01	5.44	5.27	5.26	5.27	0.16	0.031
4	6.23	6.41	6.33	6.19	6.20	6.27	0.09	0.015
5	8.54	8.47	8.98	8.55	8.85	8.68	0.22	0.026
6	5.84	6.13	5.85	5.83	5.94	5.92	0.13	0.021
7	4.17	4.24	4.22	4.27	4.22	4.22	0.04	0.009
8	13.83	13.48	12.70	13.30	13.25	13.31	0.41	0.031
9	6.37	6.41	6.50	6.16	6.21	6.33	0.14	0.022
10	12.56	12.24	12.76	13.17	12.62	12.67	0.34	0.027
11	9.56	10.12	9.52	9.49	9.46	9.63	0.28	0.029
12	10.25	10.36	9.57	10.13	10.29	10.12	0.32	0.031
13	4.22	4.54	4.95	4.90	4.89	4.70	0.31	0.067
14	10.52	11.27	10.51	10.62	10.88	10.76	0.32	0.030
15	10.13	10.19	10.46	7.37	7.29	9.09	1.61	0.177
16	13.89	15.19	16.83	14.46	18.32	15.74	1.82	0.115
17	6.57	6.68	6.81	6.65	6.75	6.69	0.09	0.014
18	12.25	11.31	11.04	11.97	12.70	11.85	0.68	0.057
19	4.60	6.39	5.76	6.49	6.34	5.92	0.79	0.133
20	5.47	5.10	4.93	5.23	5.13	5.17	0.20	0.038
21	11.15	11.34	11.15	10.97	11.18	11.16	0.13	0.012
22	23.27	23.20	23.17	22.91	22.93	23.10	0.16	0.007

Table 10. (continued)

DECS sample	Equivalence Analyses: Total sulfur, percent dry coal					Statistics		
	Principal	1	2	3	4	Mean	S.D.	C.V.
1	0.99	1.05	1.12	1.10	1.05	1.06	0.05	0.048
2	4.51	4.32	4.34	4.47	4.41	4.41	0.08	0.018
3	0.65	0.65	0.63	0.70	0.68	0.66	0.03	0.042
4	0.46	0.57	0.71	0.56	0.54	0.57	0.09	0.159
5	0.56	0.63	0.70	0.64	0.66	0.64	0.05	0.080
6	0.40	0.44	0.44	0.44	0.43	0.43	0.02	0.040
7	0.98	1.00	1.06	1.03	1.05	1.02	0.03	0.033
8	0.73	0.81	0.81	0.82	0.82	0.80	0.04	0.048
9	0.41	0.48	0.48	0.44	0.45	0.45	0.03	0.065
10	1.16	0.91	1.10	1.11	1.16	1.09	0.10	0.095
11	0.74	0.76	0.78	0.74	0.76	0.76	0.02	0.022
12	1.12	1.12	1.19	1.18	1.17	1.16	0.03	0.029
13	0.62	0.60	0.67	0.65	0.65	0.64	0.03	0.043
14	1.80	1.70	1.76	1.79	1.74	1.76	0.04	0.023
15	1.67	1.56	1.59	0.96	0.95	1.35	0.36	0.267
16	0.47	0.48	0.49	0.46	0.46	0.47	0.01	0.028
17	0.44	0.44	0.42	0.41	0.39	0.42	0.02	0.051
18	4.21	3.95	3.87	4.00	3.98	4.00	0.13	0.032
19	0.74	0.78	0.77	0.75	0.76	0.76	0.02	0.021
20	0.97	1.00	0.98	0.99	0.98	0.98	0.01	0.012
21	0.50	0.52	0.54	0.53	0.51	0.52	0.02	0.030
22	1.71	1.71	1.66	1.58	1.70	1.67	0.06	0.033

TASK IE. DISTRIBUTION OF COAL SAMPLES TO USERS

Distribution of samples took place under the conditions of the contract. Up to 1 kg (2 lbs) each of up to 15 samples per year per requestor were distributed to DOE contractors and grantees at no charge to the recipient. Requests for more than 4.5 kg (10 lbs) of a single PSOC coal were referred to the DOE Project Manager for approval. It was agreed with DOE that requests for more than 2.3 kg (5 lbs) of a single DECS coal would be referred to the Project Manager for approval.

A record of distribution of samples and data is shown in Table 11. For record-keeping under the contract, and this Table, a "sample" is any amount of one coal sample provided to one requestor at one time. Thus one 10 kg bucket of PSOC-1451 sent out is one "sample," but one 300 g bag each of DECS-1 and -2 sent every year for four years is 8 "samples." The exception is special sample DECS-17, for which each 30 g bag is counted individually. The bottom section of Table 10 shows the record of DECS-17 distributed. Over 1300 supported samples (379 bags of DECS-17 and 932 other DOE-supported samples) were distributed during the

Table 11. Samples and data distributed 4/09/88 to 9/28/93

Quarter ending	DOE samples (excl. DECS-17)			Other PSOC samples			Total spl's	Print outs	Special data req. limited info	
	Total	to DOE ctr	to others	Total	to DOE ctr	to others			#	on # spl's
7/88	21	0	21	49	0	49	70	144	5	3043
10/88	91	46	45	32	2	30	123	95	7	513
1/89	29	11	18	63	44	19	92	162	10	1631
4/89	46	20	26	93	43	50	139	88	7	2584
7/89	56	41	15	16	6	10	72	114	8	1259
10/89	55	32	23	58	15	43	113	125	10	1372
1/90	95	73	22	15	0	15	110	51	6	385
4/90	36	7	29	15	0	15	51	251	17	2989
7/90	14	6	8	11	3	8	25	42	7	2083
10/90	70	29	41	19	4	15	89	57	13	2138
1/91	44	19	25	23	15	8	67	65	10	4479
4/91	67	29	38	37	4	33	104	237	6	569
7/91	63	17	46	22	7	15	85	121	8	285
subtotal							1140			
10/91	25	8	17	16	0	16	41	28	7	553
1/92	44	7	37	31	0	31	75	113	6	312
4/92	41	30	11	15	5	10	56	121	14	2044
7/92	38	32	6	12	3	9	50	92	16	2331
10/92	30	12	18	50	2	48	80	188	15	1089
1/93	11	9	2	20	3	17	31	41	7	298
4/93	25	22	3	14	0	14	39	57	13	1130
TOTALS	901	450	451	611	156	455	1512	2192	192	31087
5 yr ctrct.										
6/30/93	12	11	1	6	4	2	18	60	5	2436
9/08/93	19	10	9	17	1	16	36	61	7	563
TOTALS	932	471	461	634	161	473	1566	2313	204	34086
overall										

Quarter ending	DECS-17		PSOC spl's	PSOC spl's + DECS-17 bags
	requests	30 g bags		
previous			1140	1140
10/91	9	90	41	131
1/92	6	65	75	140
4/92	5	48*	56	104
7/92	4	56	50	106
10/92	6	80	80	160
1/93	0	0	31	31
4/93	0	0	39	39
TOTALS	30	339	1512	1851
6/30/93	1	16	18	34
9/08/93	2	24	36	60
TOTALS	33	379	1566	1945

*incl. 8 300-gram bags

contract and following interim period. Over 600 other samples were also distributed for a total of over 1900 samples.

Requests for samples were received from a wide variety of agencies, classified as university, corporate, or government and as domestic or foreign. Appendix C lists the agencies receiving samples and/or data during the contract and the following interim period. Numbers in parentheses enumerate separate requests from the same agency. In total, 724 requests were received; most were for more than one sample or data printout. Table 12 summarizes the numbers of requests received from the various classes of agencies.

Table 12. Numbers of requests for samples and data by agency classification

Requesting Agency	Domestic	Foreign	Totals
University	433	25	458
Corporate	177	2	179
Government	76	11	87
Totals	686	38	724

A brochure describing the DOE Coal Sample Bank and Data Base, listing supported samples and conditions for distribution of samples to DOE contractors and grantees, was printed in April, 1988 and distributed. After two years of collection of DECS samples, a new version including information on 20 DECS samples was printed in July, 1992 and widely distributed. This version included not only the list of 54 supported samples but also their ash, sulfur, calorific value, carbon, and hydrogen analyses.

A booklet describing the DOE Coal Sample Bank and Data Base as well as the larger Penn State Coal Sample Bank and Data Base was also written. The first edition, printed in April, 1988, consisted of 83 pages and included a complete list of over 1400 samples by state. Three hundred copies were printed and distributed. When they had run out, a second edition was composed, adding a sample number -- state cross reference, and a discussion and list of DECS samples. The second edition condensed the booklet into 61 pages to reduce printing and postage costs. Four hundred copies were printed in October, 1990, and distributed over the next two years. Another 50 unbound copies of that booklet, with a separate up-to-date list of DECS samples, have been distributed in response to more recent requests.

TASK II: COAL DATA BASE

Data pertaining to the 22 DECS samples were entered into the Coal Data Base maintained on the Penn State research mainframe computer. The Data Base software accepts raw data as reported by the analyst and also recalculates the data to other bases of expression which are of value to researchers. Both the raw data and calculated data are checked for accuracy and consistency.

The Data Base may be interactively queried to identify samples matching requestor's criteria. When a list of samples has been produced, a table of data may be formatted and printed, or the list of samples may be used to specify that a one-page or five-page data printout be produced for each sample. Subsets of the Data Base or formatted tables may also be transmitted in electronic form. Appendix B includes a five-page printout for each of the 22 DECS samples collected and analyzed under the contract.

During the contract, the Data Base has been improved, new data fields have been added, and ancillary calculation programs have been written. The writing of an entirely new program for creation of standard data printouts is well under way. This was originally instigated in order to make the format of data printouts more easily modified as new types of analyses are incorporated in the Data Base, to create a vertical (portrait) format printout making use of modern printers, to improve readability, and to allow for new data fields (including those expressed in metric system units). It has recently become a necessity because the operating system under which the current printout program operates will be unavailable after April, 1994.

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APPENDIX A**Monitoring of DOE Sample Bank Coals****to Evaluate Sample Equivalence and****Sample Integrity**

Five annual programs completed August, 1993

DECS-1 unnamed seam lig collection date: 12/11/89				
Split ID	analysis	foil bag	foil bag	foil bag
size	sample	22 of 256	93 of 256	113 / 256
note		- 20 mesh	-20 mesh	-20 mesh
date sealed		8/14/90	8/14/90	8/14/90
date subsampled		1/25/91	10/01/92	6/02/93
PROXIMATE				
% moisture	30.0	28.2	29.0	29.3
% ash (dry)	15.8	16.2	15.2	16.4
analysis date	4/17/90	1/25/91	10/01/92	6/14/93
SULFUR FORMS (dry %)				
total sulfur	0.99	1.03	0.97	1.07
sulfate	0.01	0.06	0.00	0.00
pyritic	0.11	0.13	0.11	0.13
organic	0.86	0.85	0.86	0.94
analysis date	4/17/90	1/25/91	10/21/92	6/14/93
CALORIFIC VALUE (dry)				
BTU/lb	10956	10791	11023	10912
analysis date	4/17/90	1/25/91	10/21/92	6/14/93

DECS-2 Illinois #6 hvCb, Ro max = 0.524 collection date: 12/13/89				
Split ID	analysis sample	foil bag 21 of 256 - 20 mesh	foil bag 100 / 256 -20 mesh	foil bag 109 / 256 -20 mesh
size				
note				
date sealed		8/06/90	8/06/90	8/06/90
date subsampled		1/25/91	10/20/92	6/02/93
PROXIMATE				
% moisture	10.4	10.3	10.1	9.8
% ash (dry)	16.2	16.1	16.2	15.9
analysis date	2/28/90	1/25/91	11/27/92	6/14/93
GIESELER FLUIDITY				
max. ddpm	8	9	10	7
fluid range	47	58	61	55
analysis date	2/08/90	2/11/91	2/02/93	7/19/93
SULFUR FORMS (dry %)				
total sulfur	4.51	4.33	4.54	4.50
sulfate	0.01	0.06	0.01	0.03
pyritic	2.27	2.27	2.31	2.06
organic	2.24	2.00	2.22	2.41
analysis date	2/28/90	1/25/91	11/27/92	6/14/93
CALORIFIC VALUE (dry)				
BTU/lb	11880	11740	11814	11787
analysis date	2/28/90	1/25/91	11/27/92	6/14/93

DECS-3 Coal Basin M mwb, Ro max = 1.28 collection date: 5/31/90				
Split ID	analysis sample	foil bag 5 of 256 - 20 mesh	foil bag 13 of 256 -20 mesh	foil bag 31 of 256 -20 mesh
size				
note				
date sealed		8/24/91	8/24/91	8/24/91
date subsampled		1/25/91	10/01/92	6/03/93
PROXIMATE				
% moisture	1.10	0.87	0.82	0.72
% ash (dry)	5.37	5.24	5.26	5.52
analysis date	8/23/90	1/25/91	11/27/92	6/14/93
GIESELER FLUIDITY				
max. ddpm	9774	17 (a)	383 (b)	234
fluid range	100	79	94	94
analysis date	7/11/90	11/06/91	11/27/92	7/20/93
SULFUR FORMS (dry %)				
total sulfur	0.65	0.65	0.67	0.64
sulfate	0.01	0.05	0.01	0.05
pyritic	0.10	0.08	0.05	0.05
organic	0.54	0.52	0.61	0.55
analysis date	8/23/90	1/25/91	11/27/92	7/20/93
CALORIFIC VALUE (dry)				
BTU/lb	14889	14907	14797	14828
analysis date	8/23/90	1/25/91	11/27/92	6/14/92
ALKALI EXTRACTION*				
% transmission	96.3	98.5	99.3	98.1
analysis date	7/11/90	10/02/91	11/27/92	7/13/93

* calculated to 17mm light path

(a) erratic behavior during testing (3 runs performed)

(b) erratic behavior during testing (6 runs performed)

DECS-4 Blue hvCb, Ro max = 0.51 collection date: 6/04/90			
Split ID size note date sealed date subsampled	analysis sample	foil bag 6 of 256 -20 mesh 9/27/90 11/27/92	foil bag 16 of 256 -20 mesh 9/27/90 6/03/93
PROXIMATE % moisture % ash (dry) analysis date	15.1 6.2 10/29/90	15.0 6.2 11/27/92	14.8 6.2 6/14/93
GIESELER FLUIDITY max. ddpm fluid range analysis date	0 0 2/12/91	0 0 2/02/93	0 0 7/21/93
SULFUR FORMS (dry %) total sulfur sulfate pyritic organic analysis date	0.46 0.02 0.04 0.41 10/29/90	0.57 0.00 0.04 0.52 11/27/92	0.54 0.00 0.04 0.50 6/14/93
CALORIFIC VALUE (dry) BTU/lb analysis date	13000 10/29/90	12919 11/27/92	12964 6/14/93

DECS-5 Hiawatha hvCb, Ro max = 0.59 collection date: 6/06/90			
Split ID	analysis	foil bag	foil bag
size	sample	11 of 256	32 of 256
		- 20 mesh	-20 mesh
note			
date sealed		9/07/90	9/07/90
date subsampled		10/02/92	6/03/93
PROXIMATE			
% moisture	7.5	7.3	7.1
% ash (dry)	8.5	8.7	8.7
analysis date	10/29/90	10/02/92	6/14/93
SULFUR FORMS (dry %)			
total sulfur	0.56	0.63	0.67
sulfate	0.01	0.01	0.01
pyritic	0.27	0.26	0.24
organic	0.28	0.35	0.42
analysis date	10/29/90	10/02/92	6/14/93
CALORIFIC VALUE (dry)			
BTU/lb	12760	12681	12723
analysis date	10/29/90	10/02/92	6/14/93

DECS-6 Blind Canyon hvAb, Ro max = 0.66 collection date: 6/07/90				
Split ID	analysis	foil bag	foil bag	foil bag
size	sample	12 of 256	107 / 256	125 / 256
note		-20 mesh	-20 mesh	-20 mesh
date sealed		7/19/90	7/19/90	7/19/90
date subsampled		1/25/91	10/01/92	6/03/93
PROXIMATE				
% moisture	4.73	4.35	4.06	4.45
% ash (dry)	5.84	5.96	5.92	6.00
analysis date	8/23/90	1/25/91	10/21/92	6/23/93
GIESELER FLUIDITY				
max. ddpm	3	0	discon-	
fluid range	38	0	tinued	
analysis date	2/14/91	11/04/91		
SULFUR FORMS (dry %)				
total sulfur	0.40	0.43	0.35	0.43
sulfate	0.01	0.03	0.00	0.01
pyritic	0.02	0.02	0.02	0.02
organic	0.37	0.38	0.33	0.40
analysis date	8/23/90	1/25/91	10/21/92	6/23/93
CALORIFIC VALUE (dry)				
BTU/lb	13923	13828	13814	13874
analysis date	8/23/90	1/25/91	10/21/92	6/23/93
ALKALI EXTRACTION*				
% transmission		83.3	95.3	90.7
analysis date		11/04/91	10/01/92	7/13/93

* calculated to 17mm light path

DECS-7 Adaville No. 1 hvCb, Ro max = 0.45 collection date: 6/08/90			
Split ID	analysis	foil bag	foil bag
size	sample	21 of 256	26 of 256
note		-20 mesh	-20 mesh
date sealed		12/10/90	12/10/90
date subsampled		10/15/92	6/03/93
PROXIMATE			
% moisture	17.3	16.8	17.0
% ash (dry)	4.2	4.3	4.3
analysis date	1/16/91	10/15/92	6/15/93
SULFUR FORMS (dry %)			
total sulfur	0.98	0.99	1.04
sulfate	0.01	0.01	0.01
pyritic	0.10	0.08	0.08
organic	0.87	0.90	0.94
analysis date	1/16/91	10/15/92	6/15/93
CALORIFIC VALUE (dry)			
BTU/lb	13068	12898	12947
analysis date	1/16/91	10/15/92	6/15/93

DECS-8 Smith-Roland subC, Ro max = 0.37 collection date: 6/11/90			
Split ID	analysis	foil bag	foil bag
size	sample	27 of 256	127 / 256
note		-20 mesh	-20 mesh
date sealed		10/22/90	10/22/90
date subsampled		10/21/92	6/03/93
PROXIMATE			
% moisture	28.4	28.3	28.6
% ash (dry)	13.8	12.8	13.1
analysis date	10/30/90	10/21/92	6/15/93
SULFUR FORMS (dry %)			
total sulfur	0.73	0.77	0.81
sulfate	0.02	0.01	0.01
pyritic	0.28	0.20	0.22
organic	0.43	0.56	0.58
analysis date	10/30/90	10/21/92	6/15/93
CALORIFIC VALUE (dry)			
BTU/lb	11168	11275	11287
analysis date	10/30/90	10/21/92	6/15/93

DECS-9 Dietz subB, Ro max = 0.38 collection date: 6/12/90			
Split ID	analysis	foil bag	foil bag
size	sample	82 of 256	91 of 256
note		-20 mesh	-20 mesh
date sealed		1/10/91	1/10/91
date subsampled		10/21/92	6/03/93
PROXIMATE			
% moisture	24.7	23.8	24.8
% ash (dry)	6.4	6.7	6.5
analysis date	1/18/91	10/21/92	6/15/93
SULFUR FORMS (dry %)			
total sulfur	0.41	0.42	0.44
sulfate	0.02	0.03	0.03
pyritic	0.08	0.06	0.05
organic	0.31	0.33	0.35
analysis date	1/18/91	10/21/92	6/15/93
CALORIFIC VALUE (dry)			
BTU/lb	12330	12230	12401
analysis date	1/18/91	10/21/92	6/15/93

DECS-10 Rosebud subB, Ro max = 0.42 collection date: 6/13/90			
Split ID size note date sealed date subsampled	analysis sample	foil bag 8 of 256 -20 mesh 1/18/91 10/15/92	foil bag 27 of 256 -20 mesh 1/18/91 6/04/93
PROXIMATE % moisture % ash (dry) analysis date	21.6 12.6 1/28/91	21.1 13.0 10/15/92	22.4 13.1 6/15/93
SULFUR FORMS (dry %) total sulfur sulfate pyritic organic analysis date	1.16 0.02 0.68 0.47 1/28/91	1.14 0.02 0.69 0.43 10/15/92	1.33 0.02 0.61 0.70 6/15/93
CALORIFIC VALUE (dry) BTU/lb analysis date	11536 1/28/91	11383 10/15/92	11472 6/15/93

DECS-11 Beulah ligA, Ro max = 0.35 collection date: 6/15/90			
Split ID	analysis	foil bag	foil bag
size	sample	27 of 256	119 / 256
note		-20 mesh	-20 mesh
date sealed		1/25/91	1/25/91
date subsampled		10/21/92	6/04/93
PROXIMATE			
% moisture	33.4	32.5	32.9
% ash (dry)	9.6	10.4	9.5
analysis date	2/06/91	10/21/92	6/15/93
SULFUR FORMS (dry %)			
total sulfur	0.74	0.74	0.74
sulfate	0.03	0.04	0.03
pyritic	0.31	0.24	0.22
organic	0.39	0.46	0.49
analysis date	2/06/91	10/21/92	6/15/93
CALORIFIC VALUE (dry)			
BTU/lb	11062	10863	11012
analysis date	2/06/91	10/21/92	6/15/93

DECS-12 Pittsburgh hvAb, Ro max = 0.871 collection date: 7/25/90				
Split ID	analysis	foil bag	foil bag	foil bag
size	sample	86 of 256	117 / 256	120 / 256
note		-20 mesh	-20 mesh	-20 mesh
date sealed		7/30/90	7/30/90	7/30/90
date subsampled		7/31/91	10/23/92	6/04/93
PROXIMATE				
% moisture	2.40	2.47	2.99	1.98
% ash (dry)	10.25	11.05	10.35	9.52
analysis date	8/23/90	7/31/91	11/27/92	6/15/93
GIESELER FLUIDITY				
max. ddpm	20002	6458	4309	2173
fluid range	90	90	75	80
analysis date	7/27/90	7/24/91	10/27/92	7/21/93
SULFUR FORMS (dry %)				
total sulfur	1.12	1.18	1.16	1.17
sulfate	0.01	0.01	0.01	0.00
pyritic	0.38	0.29	0.17	0.35
organic	0.73	0.88	0.98	0.82
analysis date	8/23/90	7/31/91	11/27/92	6/15/93
CALORIFIC VALUE (dry)				
BTU/lb	13532	13337	13471	13563
analysis date	8/23/90	7/31/91	11/27/92	6/15/93
ALKALI EXTRACTION*				
% transmission	91.9	95.0	98.1	94.3
analysis date	7/27/90	7/24/91	10/23/92	8/18/93

* calculated to 17mm light path

DECS-13 Sewell mvb, Ro max = 1.35 collection date: 12/13/90			
Split ID	analysis	foil bag	foil bag
size	sample	7 of 256	23 of 256
note		-20 mesh	-20 mesh
date sealed		2/05/91	2/05/91
date subsampled		12/07/92	6/04/93
PROXIMATE			
% moisture	1.5	1.8	1.5
% ash (dry)	4.2	4.3	4.6
analysis date	2/18/91	12/07/92	6/15/93
GIESELER FLUIDITY			
max. ddpm	909	1294	915
fluid range	89	90	86
analysis date	2/18/91	2/03/93	7/23/93
SULFUR FORMS (dry %)			
total sulfur	0.62	0.62	0.65
sulfate	0.01	0.00	0.00
pyritic	0.07	0.07	0.08
organic	0.54	0.55	0.56
analysis date	2/15/91	12/07/92	6/15/93
CALORIFIC VALUE (dry)			
BTU/lb	14871	14827	14830
analysis date	2/15/91	12/07/92	6/15/93
ALKALI EXTRACTION*			
% transmission	96.0	95.0	95.3
analysis date	3/05/91	10/29/92	8/18/93

* calculated to 17mm light path

DECS-14 Upper Kittanning hvAb, Ro max = 1.07 collection date: 12/14/90			
Split ID	analysis	foil bag	foil bag
size	sample	6 of 256	20 of 256
note		-20 mesh	-20 mesh
date sealed		2/08/91	2/08/91
date subsampled		10/14/92	6/04/93
PROXIMATE			
% moisture	1.5	1.7	1.4
% ash (dry)	10.5	10.3	10.6
analysis date	2/15/91	11/27/92	6/15/93
GIESELER FLUIDITY			
max. cdpm	29930	27625	23619
fluid range	109	108	104
analysis date	2/19/91	2/04/93	7/23/93
SULFUR FORMS (dry %)			
total sulfur	1.80	1.71	1.80
sulfate	0.01	0.01	0.01
pyritic	0.94	0.03	1.02
organic	0.85	1.62	0.78
analysis date	2/15/91	11/27/92	6/15/93
CALORIFIC VALUE (dry)			
BTU/lb	13678	13723	13701
analysis date	2/15/91	11/27/92	6/15/93
ALKALI EXTRACTION*			
% transmission	91.0	99.5	94.1
analysis date	3/05/91	10/14/92	8/18/93

* calculated to 17mm light path

DECS-15 Lower Sunnyside hvAb, Ro max = 0.80 collection date: 5/06/91			
Split ID	analysis	foil bag	foil bag
size	sample	3 of 256	6 of 256
note		-20 mesh	-20 mesh
date sealed		10/15/92	10/15/92
date subsampled		10/26/92	6/04/93
PROXIMATE			
% moisture	2.9	2.9	2.6
% ash (dry)	10.0	10.1	9.8
analysis date	7/05/91	11/27/92	6/15/93
GIESELER FLUIDITY			
max. ddpm	959	258	170
fluid range	76	75	69
analysis date	6/13/91	2/05/93	7/26/93
SULFUR FORMS (dry %)			
total sulfur	1.65	1.75	1.62
sulfate	0.05	0.03	0.02
pyritic	0.61	0.94	0.69
organic	0.99	0.78	0.91
analysis date	7/05/91	11/27/92	6/15/93
CALORIFIC VALUE (dry)			
BTU/lb	13429	13275	13396
analysis date	7/05/91	11/27/92	6/15/93
ALKALI EXTRACTION*			
% transmission	95.5	91.8	91.0
analysis date	7/09/91	10/26/92	8/18/93

* calculated to 17mm light path

DECS-16 Blind Canyon hvAb, Ro max = 0.64 collection date: 5/07/91			
Split ID	analysis	foil bag	foil bag
size	sample	7 of 256	36 of 256
note		-20 mesh	-20 mesh
date sealed		8/25/92	8/25/92
date subsampled		10/31/92	6/04/93
PROXIMATE			
% moisture	5.4	4.9	5.0
% ash (dry)	13.9	15.2	15.7
analysis date	7/05/91	11/27/92	6/15/93
GIESELER FLUIDITY			
max. ddpn	6	3	2
fluid range	42	42	41
analysis date	6/14/91	2/08/93	7/26/93
SULFUR FORMS (dry %)			
total sulfur	0.47	0.48	0.46
sulfate	0.02	0.05	0.01
pyritic	0.06	0.07	0.06
organic	0.38	0.37	0.39
analysis date	7/05/91	11/27/92	6/15/93
CALORIFIC VALUE (dry)			
BTU/lb	12580	12253	12297
analysis date	7/05/91	11/27/92	6/15/93
ALKALI EXTRACTION*			
% transmission		79.9	83.4
analysis date		10/31/92	8/18/93

* calculated to 17mm light path

DECS-17 Blind Canyon, Refrig. hvAb, Ro max = 0.59 (standard -60 mesh package for distribution) collection date: 8/05/91			
Split ID	analysis sample	foil bag 60 of 512 -60 mesh	foil bag 61 of 512 -60 mesh
size			
note			
date sealed		12/04/91	12/04/91
date subsampled		4/16/93	6/07/93
PROXIMATE			
% moisture	3.7	4.0	3.6
% ash (dry)	6.6	6.5	6.5
analysis date	8/27/91	4/16/93	6/18/93
GIESELER FLUIDITY			
max. ddpm	5	not done	
fluid range	55	on -60	
analysis date	8/16/91	mesh	
SULFUR FORMS (dry %)			
total sulfur	0.44	0.44	0.43
sulfate	0.01	0.01	0.01
pyritic	0.02	0.03	0.04
organic	0.41	0.39	0.38
analysis date	8/27/91	4/16/93	6/18/93
CALORIFIC VALUE (dry)			
BTU/lb	13826	13919	13712
analysis date	8/27/91	4/16/93	6/18/93
ALKALI EXTRACTION*			
% transmission	86.0	93.8	93.1
analysis date	8/16/91	4/06/93	8/19/93

* calculated to 17mm light path

DECS-17 Blind Canyon, Refrig. hvAb, Ro max = 0.59 collection date: 8/05/91			
Split ID	analysis	foil bag	foil bag
size	sample	204 / 256	205 / 256
note		-20 mesh	-20 mesh
date sealed		12/04/91	12/04/91
date subsampled		10/28/92	6/07/93
PROXIMATE			
% moisture	3.7	3.9	3.8
% ash (dry)	6.6	6.6	6.7
analysis date	8/27/91	4/16/93	6/15/93
GIESELER FLUIDITY			
max. ddpm	5	4	2
fluid range	55	52	47
analysis date	8/16/91	10/28/92	7/27/93
SULFUR FORMS (dry %)			
total sulfur	0.44	0.43	0.42
sulfate	0.01	0.01	0.01
pyritic	0.02	0.03	0.05
organic	0.41	0.39	0.36
analysis date	8/27/91	4/16/93	6/15/93
CALORIFIC VALUE (dry)			
BTU/lb	13826	13869	13904
analysis date	8/27/91	4/16/93	6/15/93
ALKALI EXTRACTION*			
% transmission	86.0	90.0	94.1
analysis date	8/16/91	4/07/93	8/19/93

* calculated to 17mm light path

DECS-17 Blind Canyon, Unref. hvAb, Ro max = 0.59 collection date: 8/05/91			
Split ID	analysis sample	foil bag 7 of 16 -20 mesh	foil bag 15 of 16 -20 mesh
size			
note			
date sealed		8/15/91	8/15/91
date subsampled		10/28/92	6/07/93
PROXIMATE			
% moisture	3.7	3.9	3.7
% ash (dry)	6.6	6.4	6.5
analysis date	8/27/91	11/27/92	6/18/93
GIESELER FLUIDITY			
max. ddpm	5	5	2
fluid range	55	50	36
analysis date	8/16/91	10/28/92	7/28/93
SULFUR FORMS (dry %)			
total sulfur	0.44	0.44	0.43
sulfate	0.01	0.01	0.00
pyritic	0.02	0.03	0.05
organic	0.41	0.40	0.38
analysis date	8/27/91	11/27/92	6/18/93
CALORIFIC VALUE (dry)			
BTU/lb	13826	13858	13836
analysis date	8/27/91	11/27/92	6/18/93
ALKALI EXTRACTION*			
% transmission	86.0	88.9	92.1
analysis date	8/16/91	3/25/93	8/19/93

* calculated to 17mm light path

DECS-18 Kentucky #9 hv8b, Ro max = 0.56 collection date: 10/10/91			
Split ID size note date sealed date subsampled	analysis sample	foil bag 3 of 256 - 20 mesh 10/09/92 6/07/93	
PROXIMATE % moisture % ash (dry) analysis date	6.8 12.3 11/22/91	7.3 11.3 6/18/93	
GIESELER FLUIDITY max. dclpm fluid range analysis date	527 80 2/11/93	409 74 7/29/93	
SULFUR FORMS (dry %) total sulfur sulfate pyritic organic analysis date	4.21 0.01 2.37 1.83 11/22/91	3.91 0.04 1.78 2.10 6/18/93	
CALORIFIC VALUE (dry) BTU/lb analysis date	12687 11/22/91	12763 6/18/93	
ALKALI EXTRACTION* % transmission analysis date	92.5 3/26/93	97.5 8/19/93	

* calculated to 17mm light path

DECS-19 Pocahontas #3 lvb, Ro max = 1.71 collection date: 12/17/91			
Split ID size note date sealed date subsampled	analysis sample	foil bag 10 of 256 - 20 mesh 7/14/92 6/07/93	
PROXIMATE % moisture % ash (dry) analysis date	1.0 4.6 8/21/92	0.8 5.5 6/18/93	
GIESELER FLUIDITY max. ddpm fluid range analysis date	17 50 1/22/93	9 52 7/30/93	
SULFUR FORMS (dry %) total sulfur sulfate pyritic organic analysis date	0.74 0.00 0.21 0.52 8/21/92	0.78 0.00 0.24 0.53 6/18/93	
CALORIFIC VALUE (dry) BTU/lb analysis date	15006 8/21/92	14790 6/18/93	
ALKALI EXTRACTION* % transmission analysis date	86.9 7/29/92	89.0 8/19/93	

* calculated to 17mm light path

DECS-20 Elkhorn #3 hvAb, Ro max = 0.87 collection date: 12/18/91			
Split ID size note date sealed date subsampled	analysis sample	foil bag 16 of 256 -20 mesh 7/15/92 6/07/93	
PROXIMATE % moisture % ash (dry) analysis date	2.8 5.5 8/21/92	2.7 5.2 6/18/93	
GIESELER FLUIDITY max. ddpm fluid range analysis date	1612 66 1/19/93	1149 66 7/30/93	
SULFUR FORMS (dry %) total sulfur sulfate pyritic organic analysis date	0.97 0.00 0.21 0.75 8/21/92	0.96 0.00 0.17 0.78 6/18/93	
CALORIFIC VALUE (dry) BTU/lb analysis date	14244 8/21/92	14204 6/18/93	
ALKALI EXTRACTION* % transmission analysis date	94.2 3/30/93	91.6 8/19/93	

* calculated to 17mm light path

2 OF 3

DECS-21 Lykens Valley #2 an, Ro max = 5.19 collection date: 10/07/92			
Split ID size note date sealed date subsampled	analysis sample	foil bag of 256 -20 mesh	
PROXIMATE % moisture % ash (dry) analysis date	3.99 10.71 5/03/93		
SULFUR FORMS (dry %) total sulfur sulfate pyritic organic analysis date	0.50 0.00 0.06 0.43 5/03/93		
CALORIFIC VALUE (dry) BTU/lb analysis date	13284 5/03/93		

DECS-22 U. Kittanning cannel hvAb, Ro max = 0.77 collection date: 6/14/93			
Split ID size note date sealed date subsampled	analysis sample	foil bag of 256 -20 mesh	
PROXIMATE % moisture % ash (dry) analysis date	0.91 23.06 6/25/93		
GIESELER FLUIDITY max. ddpn fluid range analysis date	444 66 6/23/93		
SULFUR FORMS (dry %) total sulfur sulfate pyritic organic analysis date	1.71 0.03 1.15 0.53 6/25/93		
CALORIFIC VALUE (dry) BTU/lb analysis date	11786 6/25/93		
ALKALI EXTRACTION* % transmission analysis date	92.0 6/23/93		

* calculated to 17mm light path

PSOC-1107 KING CANNEL subA, Ro max = 0.55 collection date: 08/08/78							
Split ID	analysis sample 1	# 2 can 15 of 23 - 20mesh a 06/12/84	30 gal. 1 of 1 - 1/4" --- a	30 gal. 1 of 1 - 1/4" 18.6	30 gal. 1 of 1 - 1/4"	30 gal. 1 of 1 - 1/4"	30 gal. 2 of 2 - 1/4" c
size							
% oxygen							
note							
date sealed				9/18/89	11/14/91	10/22/92	5/10/93
date oxygen/subspl							
PROXIMATE							
% moisture	7.7	14.2	11.2	12.1	11.2	15.8	12.5
% ash (dry)	19.2	19.4	19.2	19.2	20.2	20.0	19.5
analysis date	11/04/83	06/13/88	3/07/89	10/16/89	11/22/91	11/27/92	5/27/93
SULFUR FORMS (dry %)						(b)	
total sulfur	2.16		1.71	1.85	2.08	1.96	1.96
sulfate	0.92		0.80	0.84	0.93	0.01	0.94
pyritic	0.43		0.45	0.42	0.56	0.23	0.50
organic	0.81		0.46	0.59	0.59	1.72	0.52
analysis date	11/04/83		3/07/89	10/16/89	11/22/91	11/27/92	5/27/93
CALORIFIC VALUE (dry)							
BTU/lb	10012		9736	9565	9513	9156	9364
analysis date	11/04/83		3/07/89	10/16/89	11/22/91	11/27/92	5/27/93
ALKALI EXTRACTION							
% transmission		0.2	discon-				
analysis date		06/13/88	tinued				

notes: a) Sample dry (dusty), visible yellow & white sulfates
iron stained, resealed in poly drum 11/16/88.

b) Sulfate sulfur value is questionable in view of previous results.

c) Sample dry (dusty), minor brown stains on a few particles.

PSOC-1442 DARCO ligA, Ro max = 0.44 collection date: 03/28/85						
Split ID	analysis	30 gal.	30 gal.	30 gal.	30 gal.	30 gal.
size	sample 1	3 of 3	3 of 3	3 of 3	3 of 3	3 of 3
% oxygen	- 20mesh	- 1/4"	- 1/4"	- 1/4"	- 1/4"	- 1/4"
note		3.16	10.6	18.8		
date sealed		a				b
date oxygen/subspl		8/17/88	9/18/89	11/16/90	11/19/91	4/19/93
PROXIMATE						
% moisture	32.6	30.5	34.1	35.8	34.7	33.7
% ash (dry)	11.3	9.4	10.9	10.6	9.5	10.4
analysis date	06/11/85	09/14/88	10/16/89	1/23/91	2/20/92	5/27/93
SULFUR FORMS (dry %)						
total sulfur	0.78	1.05	0.82	0.83	0.81	0.81
sulfate	0.02	0.11	0.08	0.13	0.07	0.11
pyritic	0.11	0.10	0.08	0.11	0.05	0.08
organic	0.65	0.84	0.66	0.60	0.70	0.63
analysis date	06/11/85	09/22/88	10/16/89	1/23/91	2/20/92	5/27/93
CALORIFIC VALUE (dry)						
BTU/lb	11375		11108	11005	10958	10903
analysis date	06/11/85		10/16/89	1/25/91	2/20/92	5/27/93

notes: a) Sample moist, good condition, container resealed 08/17/88.
 PSU MCL ash, moisture, sulfur forms.

b) Condensation on drum walls; no visible deterioration of coal.

PSOC-1443 UNNAMED (Lower Wilcox) ligA, Ro max = 0.44 collection date: 03/29/85						
Split ID	analysis sample 1	30 gal. 3 of 4	30 gal. 3 of 4	30 gal. 3 of 4	30 gal. 3 of 4	30 gal. 3 of 4
size	- 20mesh	-1"	-1/4"	- 1/4"	- 1/4"	- 1/4"
% head oxygen		3.84	6.8	16.7		
note		a				b
date sealed						
date oxygen/subspl		8/22/88	9/18/89	11/16/90	11/19/91	4/19/93
PROXIMATE						
% moisture	28.5	29.2	33.35	35.6	34.2	33.9
% ash (dry)	21.4	19.5	20.97	20.8	16.7	21.2
analysis date	06/11/85	09/14/88	10/16/89	1/23/91	2/20/92	5/27/93
SULFUR FORMS (dry %)						
total sulfur	0.75	0.99	6.83	0.83	0.90	0.82
sulfate	0.01	0.03	0.05	0.05	0.02	0.04
pyritic	0.09	0.02	0.02	0.02	0.02	0.03
organic	0.64	0.94	0.76	0.76	0.86	0.75
analysis date	06/11/85	09/22/88	10/16/89	1/23/91	2/20/92	5/27/93
CALORIFIC VALUE (dry)					c	
BTU/lb	9882		9673	9681	10175	9591
analysis date	06/11/85		10/16/89	1/25/91	2/20/92	5/27/93

notes: a) Good condition, moist, sample crushed to -1/4"
and resealed on 8/22/88. PSU MCL ash, moisture,
sulfur forms.

b) Sample moist, no visible deterioration.

c) High calorific value caused in part by low ash in this split.

PSOC-1444 UNNAMED (U. Calvert Bl.) ligA, Ro max = 0.45 collection date: 03/30/85				
Split ID	analysis sample 1	analysis sample 2	30 gal 3 of 3	30 gal 3 of 3
size	- 20mesh		-1"	-1/4"
% head oxygen			1.35	9.8
note			a	
date sealed				
date oxygen/subspl			8/18/88	9/19/89
PROXIMATE				
% moisture	31.2	31.9	28.2	32.6
% ash (dry)	16.5	16.8	16.1	16.9
analysis date	06/11/85	03/27/86	09/14/88	10/16/89
SULFUR FORMS (dry %)				
total sulfur	0.96	1.17	1.19	0.95
sulfate	0.01		0.07	0.13
pyritic	0.05		0.19	0.12
organic	0.90		0.93	0.70
analysis date	06/11/85	03/27/86	09/22/88	10/16/89
CALORIFIC VALUE (dry)				
BTU/lb	10694	10817		10463
analysis date	06/11/85	03/27/86		10/16/89

super-
seded
by
DECS-1

notes: a) Trace of visible sulfates, moist, sample was
crushed to -1/4" and resealed on 8/18/88.
PSU MCL ash, moisture, sulfur forms.

PSOC-1445					BLUE #1	hvCb, Ro max = 0.57				
collection date: 04/02/85										
Split ID		analysis	# 2 can	30 gal	30 gal	super- seded by DECS-4				
size		sample 1	15 of 19	2 of 3	2 of 3					
% head oxygen		- 20mesh	-20 mesh	-1"	-1/4"					
note				5.72	11.1					
date sealed			05/02/85	a						
date oxygen/subspl				8/22/88	9/19/89					
PROXIMATE										
% moisture		12.2	13.8	10.6	14.1					
% ash (dry)		4.6	4.2	4.8	5.1					
analysis date		06/11/85	06/13/88	09/14/88	10/16/89					
SULFUR FORMS (dry %)										
total sulfur		0.73		0.88	0.85					
sulfate		0.01		0.17	0.20					
pyritic		0.16		0.12	0.12					
organic		0.55		0.49	0.53					
analysis date		06/11/85		09/22/88	10/16/89					
CALORIFIC VALUE (dry)										
BTU/lb		13179			12837					
analysis date		06/11/85			10/16/89					
ALKALI EXTRACTION										
% transmission			15.7	16.1	discon-					
analysis date			06/13/88	09/22/88	tinued					

notes: a) Good condition, moist, sample crushed to -1/4" and
resealed on 08/22/88. PSU MCL ash, moisture, sulfur forms.

PSOC-1446 NEW MEXICO #8 hvCb, Ro max = 0.59 collection date: 04/03/85								
Split ID	analysis sample 1	# 2 can 15 of 22	30 gal. 3 of 3	5 gal. 3 of 3	30 gal. 3 of 3	30 gal. 3 of 3	30 gal. 3 of 3	30 gal. 3 of 3
size	- 20 mesh	-20 mesh	-1/4"	-1/4"	-1/4"	- 1/4"	- 1/4"	- 1/4"
% head oxygen			12.3	20.6	16.5	19.6		
note			a	b				c
date sealed		05/03/85						
date oxygen/subspl				8/23/88	9/19/89	11/16/90	11/19/91	4/19/93
PROXIMATE								
% moisture	11.2	12.9	9.7	9.2	12.2	13.6	12.2	12.6
% ash (dry)	20.8	19.9	20.9	21.2	20.5	20.5	20.1	21.0
analysis date	06/10/85	06/13/88	09/14/88	09/14/88	10/16/89	1/23/91	2/20/92	5/27/93
SULFUR FORMS (dry %)								
total sulfur	0.85		1.03	1.00	0.93	0.90	0.85	0.89
sulfate	0.01		0.18	0.17	0.21	0.25	0.18	0.25
pyritic	0.45		0.16	0.17	0.13	0.12	0.06	0.10
organic	0.39		0.69	0.66	0.60	0.54	0.61	0.54
analysis date	06/10/85		09/22/88	09/22/88	10/16/89	1/23/91	2/20/92	5/27/93
CALORIFIC VALUE (dry)								
BTU/lb	10940				10696	10619	10707	10537
analysis date	06/10/85				10/16/89	1/23/91	2/20/92	5/27/93
ALKALI EXTRACTION								
% transmission		38.3	37.1		discon-			
analysis date		06/14/88	09/22/88		tinued			

notes: a) Good condition, resealed 08/23/88 (split 1).
PSU MCL ash, moisture, sulfur forms.

b) White sulfate crystals visible on top surface.
Resealed on 08/23/88 (split 2). PSU MCL ash,
moisture, sulfur forms.

c) Sample dusty; some particles completely coated with yellow
deposits.

PSOC-1447 RED hvCb, Ro max = 0.54 collection date: 04/04/85							
Split ID	analysis sample 1	# 2 can 15 of 19	30 gal. 3 of 3	30 gal. 3 of 3	30 gal. 3 of 3	30 gal. 3 of 3	30 gal. 3 of 3
size	- 60mesh	-20 mesh	-1/4"	-1/4"	- 1/4"	- 1/4"	- 1/4"
% head oxygen			13.0		19.9		
note			a				b
date sealed		05/03/85					
date oxygen/subspl			9/01/88	9/19/89	11/16/90	11/19/91	4/19/93
PROXIMATE							
% moisture	10.1	12.3	10.1	12.2	12.8	11.8	12.4
% ash (dry)	5.7	5.1	5.8	6.1	5.9	6.1	5.7
analysis date	06/10/85	06/13/88	10/12/88	10/16/89	1/23/91	2/20/92	5/27/93
SULFUR FORMS (dry %)							
total sulfur	0.41		0.39	0.42	0.40	0.42	0.41
sulfate	0.01		0.01	0.02	0.03	0.01	0.02
pyritic	0.23		0.04	0.02	0.02	0.03	0.02
organic	0.17		0.34	0.38	0.35	0.38	0.37
analysis date	06/10/85		01/17/89	10/16/89	1/23/91	2/20/92	5/27/93
CALORIFIC VALUE (dry)							
BTU/lb	12983			12557	12595	12539	12537
analysis date	06/10/85			10/16/89	1/23/91	2/20/92	5/27/93
ALKALI EXTRACTION							
% transmission		5.6	4.5	discon-			
analysis date		06/14/88	10/05/88	tinued			

notes: a) Good condition, sample dry and dusty, lids loose on secondary buckets, sample resealed on 09/01/88.
 PSU MCL ash, moisture. PSU MCL sulfur forms (revised analysis report).

b) Sample dusty, no visible deterioration.

PSOC-1448 YORK CANYON hvAb, Ro max = 0.77 collection date: 04/08/85							
Split ID	analysis sample 1	# 2 can 8 of 29	30 gal. 3 of 3	30 gal. 3 of 3	30 gal. 3 of 3	30 gal. 3 of 3	30 gal. 3 of 3
size	- 20mesh	-20 mesh	-1/4"	-1/4"	- 1/4"	- 1/4"	- 1/4"
% head oxygen			18.7	19.5	20.7		
note			a				b
date sealed		05/07/85					
date oxygen/subspl			8/29/88	9/19/89	11/16/90	11/19/91	4/19/93
PROXIMATE							
% moisture	1.6	2.2	1.1	1.9	2.2	2.0	2.0
% ash (dry)	11.4	11.1	11.3	11.1	10.8	11.5	10.7
analysis date	06/10/85	04/04/88	09/19/88	10/16/89	10/03/91	2/20/92	5/27/93
GIESELER FLUIDITY							
max. ddpm	5632	2661	659	230	1	discon-	
fluid range	72	89	74	74	19	tinued	
analysis date	06/03/85	04/04/88	09/08/88	02/21/90	09/04/91		
SULFUR FORMS (dry %)							
total sulfur	0.46		0.49	0.46	0.48	0.44	0.44
sulfate	0.01		0.02	0.03	0.02	0.02	0.04
pyritic	0.04		0.05	0.03	0.07	0.04	0.04
organic	0.41		0.42	0.40	0.39	0.38	0.36
analysis date	06/10/85		01/17/89	10/16/89	10/03/91	2/20/92	5/27/93
CALORIFIC VALUE (dry)							
BTU/lb	13467			13198	13353	13229	13234
analysis date	06/10/85			10/16/89	10/03/91	2/20/92	5/27/93
ALKALI EXTRACTION							
% transmission		100.1	97.7		90.8	85.3	92.8
analysis date		06/01/88	09/23/88		9/04/91	9/02/92	7/01/93

notes: a) PSU MCL ash, moisture. PSU MCL sulfur forms (revised analysis report).

b) No visible deterioration.

PSOC-1451 PITTSBURGH hvAb, Ro max = 0.77 collection date: 05/01/85						
Split ID	analysis sample 1	analysis sample 2	analysis sample 3	# 2 can 1 of ?	5 gal.	30 gal.
size	-20 mesh	-20 mesh	-20 mesh	-20 mesh	-1/4"	1 of 3 -1/4"
% head oxygen						14.6
note					a	
date sealed				11/03/87		
date oxygen/subspl						9/20/89
PROXIMATE						
% moisture	2.6	2.5	2.5	3.6	1.8	discon-
% ash (dry)	14.2	13.7	13.9	13.9	13.4	tinued
analysis date	06/11/85	02/14/86	02/18/86	04/06/88	09/14/88	
GIESELER FLUIDITY						
max. ddpm	8525			59	225	to be
fluid range	80			62	63	resamp-
analysis date	05/29/85			04/06/88	08/17/88	led
SULFUR FORMS (dry %)						
total sulfur	1.36	1.37	1.38		1.39	
sulfate	0.01				0.15	
pyritic	0.82				0.40	
organic	0.53				0.84	
analysis date	06/10/85	02/12/86	02/18/86		09/22/88	
CALORIFIC VALUE (dry)						
BTU/lb	12863	12855	12893			
analysis date	06/10/85	02/12/86	02/18/86			
ALKALI EXTRACTION						
% transmission				99.5		
analysis date				06/02/88		

notes: a) Sample used for restocking. entire sample ground to
-20 mesh. PSU MCL ash, moisture, sulfur forms.

b) Superseded by DECS-12

PSOC-1461 MAMMOTH an, Ro max = 5.72 collection date: 05/24/85				
Split ID	analysis	30 gal.	30 gal.	30 gal.
size	sample 1	3 of 3	3 of 3	3 of 3
% head oxygen	- 60mesh	-1/4"	-1/4"	- 1/4"
note		19.7	19.9	20.6
date sealed		08/07/85		
date oxygen/subspl		9/23/88	9/19/89	11/16/90
PROXIMATE				
% moisture	3.1	3.0	3.5	3.8
% ash (dry)	24.2	21.6	23.3	24.8
analysis date	10/08/85	10/12/88	10/16/89	1/23/91
SULFUR FORMS (dry %)				
total sulfur	0.74	0.64	0.65	0.62
sulfate	0.02	0.04	0.02	0.06
pyritic	0.36	0.26	0.21	0.28
organic	0.37	0.34	0.42	0.29
analysis date	10/08/85	01/17/89	10/16/89	1/23/91
CALORIFIC VALUE (dry)				
BTU/lb	10860		10975	10718
analysis date	10/08/85		10/16/89	1/25/91

superseded
by DECS-21

notes: a) Good condition, sample dry. PSU MCL ash, moisture.
PSU MCL sulfur forms (revised analysis report).

PSUC-1468 BUCK MOUNTAIN an, Ro max = 5.45 collection date: 06/03/85						
Split ID	analysis	30 gal.	30 gal.	30 gal.	30 gal.	30 gal.
size	sample 1	1 of 3	1 of 3	1 of 3	3 of 3	3 of 3
% head oxygen	- 60mesh	-1/4"	-1/4"	- 1/4"	- 1/4"	- 1/4"
note		17.8	20.3	16.5		
date sealed		a				b
date oxygen/subspl		8/07/85				
		9/25/88	9/28/89	11/16/90	10/22/92	4/19/93
PROXIMATE						
% moisture	4.5	3.5	4.6	5.3	5.2	5.2
% ash (dry)	6.8	6.6	6.6	6.6	7.0	7.0
analysis date	10/08/85	10/12/88	12/14/89	1/23/91	11/27/92	5/27/93
SULFUR FORMS (dry %)						
total sulfur	0.49	0.43	0.39	0.41	0.41	0.38
sulfate	0.01	0.01	0.03	0.01	0.01	0.02
pyritic	0.11	0.07	0.06	0.05	0.07	0.05
organic	0.37	0.35	0.29	0.35	0.33	0.32
analysis date	10/08/85	01/17/89	12/14/89	1/23/91	11/27/92	5/27/93
CALORIFIC VALUE (dry)						
BTU/lb	13748		13671	13784	13596	13753
analysis date	10/08/85		12/14/89	1/25/91	11/27/92	5/27/93

notes: a) Sample dry, good condition. PSU MCL ash, moisture.
 PSU MCL sulfur forms (revised analysis report).

b) Sample dusty, no visible deterioration.

PSOC-1469 MARY LEE hvBb, Ro max = 1.12 collection date: 06/10/85							
Split ID	analysis	# 2 can	30 gal.	30 gal.	30 gal.	30 gal.	30 gal.
size	sample 1	26 of 31	3 of 3	3 of 3	3 of 3	3 of 3	3 of 3
% head oxygen	- 60mesh	-20 mesh	-1/4"	-1/4"	- 1/4"	- 1/4"	- 1/4"
note			15.0	18.1	19.9		
date sealed		10/01/85	a				b
date oxygen/subspl			8/29/88	9/28/89	11/16/90	11/20/91	5/06/93
PROXIMATE							
% moisture	1.9	1.9	1.3	2.3	2.3	2.2	2.5
% ash (dry)	21.0	21.1	20.7	20.8	20.8	25.5	20.8
analysis date	10/08/85	04/08/88	09/19/88	02/06/90	10/03/91	2/20/92	5/27/93
GIESELER FLUIDITY							
max. ddpmm	659	189	21	8	0	discon-	
fluid range	73	71	64	54	0	tinued	
analysis date	09/11/85	04/07/88	09/09/88	01/03/90	9/03/91		
SULFUR FORMS (dry %)							
total sulfur	0.80		0.84	0.78	0.77	0.70	0.77
sulfate	0.02		0.06	0.07	0.02	0.06	0.10
pyritic	0.26		0.14	0.13	0.07	0.12	0.13
organic	0.52		0.64	0.58	0.68	0.52	0.54
analysis date	10/08/85		01/17/89	02/06/90	10/03/91	2/20/92	5/27/93
CALORIFIC VALUE (dry)							
BTU/lb	11838			11742	11697	c	11635
analysis date	10/08/85			02/06/90	10/03/91	2/20/92	5/27/93
ALKALI EXTRACTION							
% transmission		99.8	95.5	94.4	94.6	86.2	95.1
analysis date		06/02/88	09/23/88	01/03/90	9/03/91	9/02/92	7/01/93

notes: a) Good condition, sample dry. PSU MCL ash, moisture.
 PSU MCL sulfur forms (revised analysis report).

b) No visible deterioration.

c) Low calorific value caused in part by high ash in this split.

PSOC-1470 PRATT hvBb, Ro max = 0.89 collection date: 06/12/85								
Split ID	analysis	# 2 can	30 gal.	5 gal.	30 gal.	30 gal.	30 gal.	30 gal.
size	sample 1	19 of 33	2 of 2	2 of 4	2 of 2	2 of 2	2 of 2	2 of 2
% head oxygen	- 60mesh	-20 mesh	-1"	-1/4"	-1/4"	- 1/4"	- 1/4"	- 1/4"
note			8.6	17.9	9.3	15.4		
date sealed		10/29/85		a	b			c
date oxygen/subspl				8/29/88	9/28/89	11/16/90	11/20/91	5/06/93
PROXIMATE								
% moisture	2.9	3.0	2.5	3.1	3.6	3.5	3.7	4.3
% ash (dry)	20.6	21.0	20.5	20.3	20.6	21.0	21.6	21.0
analysis date	10/08/85	04/14/88	09/19/88	09/19/88	2/28/90	10/03/91	2/20/92	5/27/93
GIESELER FLUIDITY								
max. ddpm	487	3	55		4	0	discon-	
fluid range	66	33	56		38	0	tinued	
analysis date	10/11/85	04/14/88	09/12/88		2/28/90	9/06/91		
SULFUR FORMS (dry %)								
total sulfur	2.50		2.56	2.58	2.48	2.36	2.40	2.41
sulfate	0.04		0.37	0.62	0.47	0.45	0.61	0.79
pyritic	1.88		1.16	0.96	1.11	1.00	0.50	0.74
organic	0.58		1.03	1.00	0.90	0.90	1.29	0.88
analysis date	10/08/85		01/17/89	01/17/89	2/28/90	10/03/91	2/20/92	5/27/93
CALORIFIC VALUE (dry)								
BTU/lb	11599				11458	11385	11185	11105
analysis date	10/08/85				2/28/90	10/03/91	2/20/92	5/27/93
ALKALI EXTRACTION								
% transmission		98.8	95.8		92.9	83.0	94.8	92.1
analysis date		06/03/88	09/32/88		2/22/90	9/06/91	9/03/92	7/02/93

notes: a) Sample moist, trace of yellow sulfate on top surface
 sample was crushed to -1" and then split,
 plastometer data fluid range estimated.
 PSU MCL ash, moisture. PSU MCL sulfur forms
 (revised analysis report).

b) white fibrous sulfate visible on surface.
 PSU MCL ash, moisture. PSU MCL sulfur forms
 (revised analysis report).

c) Occasional masses of white fibrous sulfates visible on surface.

PSOC-1471 PEE MEE hvAb, Ro max = 0.94 collection date: 06/13/85							
Split ID size % head oxygen note date sealed date oxygen/subspl	analysis sample 1 - 60mesh	# 2 can 20 of 37 -20 mesh 10/29/85	30 gal. 1 of 3 -1/4" 15.7 a 08/21/85 8/30/88	30 gal. 1 of 3 -1/4" 20.3 9/28/89	30 gal. 1 of 3 - 1/4" 20.4 12/20/90	30 gal. 1 of 3 - 1/4" 11/20/91	30 gal. 1 of 3 - 1/4" b 5/06/93
PROXIMATE % moisture % ash (dry) analysis date	2.5 8.0 10/08/85	2.7 7.7 04/15/88	2.2 7.9 10/12/88	3.0 8.0 4/17/90	2.1 8.9 10/03/91	2.9 6.5 2/20/92	3.1 7.9 5/27/93
GIESELER FLUIDITY max. ddpm fluid range analysis date	90 60 10/16/85	116 66 04/15/88	3 39 10/14/88	2 22 2/23/90	0 0 9/10/91	discon- tinued	
SULFUR FORMS (dry %) total sulfur sulfate pyritic organic analysis date	1.04 0.03 0.22 0.79 10/08/85		1.01 0.10 0.13 0.78 01/17/89	1.06 0.11 0.11 0.84 4/17/90	1.03 0.14 0.13 0.76 10/03/91	1.00 0.05 0.09 0.85 2/20/92	1.02 0.14 0.07 0.81 5/27/93
CALORIFIC VALUE (dry) BTU/lb analysis date	13715 10/08/85			13539 4/17/90	13370 10/03/91	13787 2/20/92	13516 5/27/93
ALKALI EXTRACTION % transmission analysis date		94.7 06/03/88	97.2 10/05/88	87.1 2/23/90	88.2 9/10/91	90.5 9/03/92	96.6 7/06/93

notes: a) Dry, good condition. PSU MCL ash, moisture.
 PSU MCL sulfur forms (revised analysis report).

b) Minor amounts of yellow coatings on some particles.

PSOC-1474 SPLASHDAM mvb, Ro max = 1.13 collection date: 06/27/85							
Split ID	analysis sample 1	# 2 can 26 of 33 - 60mesh	30 gal. 3 of 3 - 1/4"	30 gal. 3 of 3 - 1/4"	30 gal. 3 of 3 - 1/4"	30 gal. 3 of 3 - 1/4"	30 gal. 3 of 3 - 1/4"
size							
% head oxygen			16.3	16.3			
note			a				b
date sealed		10/29/85	08/27/85				
date oxygen/subspl			8/30/88	9/28/89	12/20/90	11/20/91	5/06/93
PROXIMATE							
% moisture	1.6	1.1	1.2	1.9	1.8	1.8	2.1
% ash (dry)	12.4	13.4	12.3	12.4	13.0	17.4	12.4
analysis date	10/22/85	04/18/88	10/12/88	2/28/90	10/03/91	2/21/92	5/26/93
GIESELER FLUIDITY							
max. ddpmm	14490	743	556	310	0	discon-	
fluid range	99	83	84	78	0	tinued	
analysis date	09/17/85	04/18/88	10/18/88	2/28/90	9/11/91		
SULFUR FORMS (dry %)							
total sulfur	0.73		0.70	0.68	0.68	0.61	0.66
sulfate	0.01		0.05	0.07	0.07	0.03	0.09
pyritic	0.16		0.11	0.07	0.10	0.04	0.06
organic	0.56		0.54	0.54	0.51	0.54	0.51
analysis date	10/22/85		01/17/89	4/17/90	10/03/91	2/21/92	5/27/93
CALORIFIC VALUE (dry)							
BTU/lb	13588			13428	13370	c 12642	13478
analysis date	10/22/85			4/17/90	10/03/91	2/21/92	5/27/93
ALKALI EXTRACTION							
% transmission		98.5	98.9	92.6	94.8	93.5	97.9
analysis date		06/03/88	10/05/88	2/28/90	9/11/91	9/03/92	7/07/93

notes: a) Dry, good condition. PSU MCL ash, moisture.
 PSU MCL sulfur forms (revised analysis report).

b) No visible deterioration.

c) Low calorific value caused in part by high ash in this split.

PSOC-1475 Elkhorn #3 hvAb, Ro max = 0.97 collection date: 06/18/85					
Split ID size % head oxygen note date sealed date oxygen/subspl	analysis sample 1 - 60mesh	# 2 can 27 of 33 -20 mesh 10/29/85	30 gal. 4 of 4 -1/4" 9.5 a 08/28/88 9/01/88	30 gal. 4 of 4 -1/4" 13.5 9/28/89	30 gal. 4 of 4 - 1/4" 12/20/90
PROXIMATE % moisture % ash (dry) analysis date	3.4 3.3 10/23/85	4.3 1.5 04/19/88	2.9 2.9 10/12/88	3.5 3.2 4/17/90	3.7 3.4 10/03/91
GIESELER FLUIDITY max. ddpm fluid range analysis date	177 59 09/18/85	15 59 04/19/88	3 33 10/20/88	2 30 3/02/90	1 2 9/12/91
SULFUR FORMS (dry %) total sulfur sulfate pyritic organic analysis date	0.98 0.02 3.32 0.64 10/23/85		0.93 0.06 0.22 0.65 01/17/89	0.87 0.08 0.20 0.59 4/17/90	0.92 0.10 0.22 0.61 10/03/91
CALORIFIC VALUE (dry) BTU/lb analysis date	14540 10/23/85			14392 4/17/90	14348 10/03/91
ALKALI EXTRACTION % transmission analysis date		95.9 06/03/88	97.4 10/05/88	92.1 3/02/90	92.5 9/12/91

superseded
by DECS-20

note: a) Sample discrepancy with ash analysis. PSU MCL ash,
moisture. PSU MCL sulfur forms (revised analysis report).

PSOC-1482 HAGEL ligA, Ro max = 0.39 collection date: 07/01/85							
Split ID	analysis sample 1	analysis sample 2	30 gal. 1 of 3	30 gal. 1 of 3	30 gal. 1 of 3	30 gal. 1 of 3	30 gal. 1 of 3
size	- 60mesh	-20 mesh	-1/4"	-1/4"	- 1/4"	- 1/4"	- 1/4"
% head oxygen			1.6	6.6			
note			a				b
date sealed			08/29/85				
date oxygen/subspl			9/23/88	9/28/89	12/20/90	11/20/91	5/06/93
PROXIMATE							
% moisture	34.7	34.5	32.9	34.4	36.4	34.4	35.6
% ash (dry)	9.0	8.5	7.4	9.2	9.0	6.9	9.1
analysis date	10/24/85	12/11/86	10/12/88	2/06/90	1/23/91	2/21/92	5/27/93
SULFUR FORMS (dry %)							
total sulfur	0.86	0.72	0.82	0.88	0.82	0.79	0.85
sulfate	0.02		0.14	0.17	0.18	0.11	0.25
pyritic	0.09		0.22	0.20	0.14	0.07	0.08
organic	0.75		0.46	0.51	0.51	0.61	0.53
analysis date	10/24/85	12/11/86	01/17/89	2/06/90	1/23/91	2/21/92	5/27/93
CALORIFIC VALUE (dry)							
BTU/lb	11118			10695	10783	10872	10583
analysis date	10/24/85			2/06/90	1/25/91	2/21/92	5/27/93

notes: a) Sample moist, trace yellow & white sulfates.
 PSU MCL ash, moisture. PSU MCL sulfur forms
 (revised analysis report).

b) Minor amounts of yellow coatings and white acicular crystals.

PSOC-1485					ROSEBUD	subB, Ro max = 0.51	
collection date: 07/05/86							
Split ID	analysis	% 2 can	30 gal.	30 gal.	super- seded by DECS-10		
size	sample 1	15 of 31	3 of 3	3 of 3			
% head oxygen	- 60mesh	-20 mesh	-1/4"	-1/4"			
note			8.1	10.4			
date sealed		04/01/86	03/25/86				
date oxygen/subspl			9/26/88	9/27/89			
PROXIMATE							
% moisture	25.4	25.0	21.9	25.1			
% ash (dry)	11.4	10.7	10.4	11.4			
analysis date	04/24/86	06/13/88	10/12/88	12/14/89			
SULFUR FORMS (dry %)							
total sulfur	0.88		0.86	0.77			
sulfate	0.00		0.08	0.13			
pyritic	0.02		0.23	0.24			
organic	0.86		0.55	0.40			
analysis date	04/24/86		01/17/89	12/14/89			
CALORIFIC VALUE (dry)							
BTU/lb	11620			11449			
analysis date	04/24/86			12/14/89			
ALKALI EXTRACTION							
% transmission		0.2	0.4	discon-			
analysis date		06/15/88	10/06/88	tinued			

notes: a) Sample moist, good condition. PSU MCL ash, moisture.
PSU MCL sulfur forms (revised analysis report).

PSOC-1486 BIG DIRTY subB, Ro max = 0.38 collection date: 07/09/85							
Split ID	analysis	# 2 can	30 gal.	30 gal.	30 gal.	30 gal.	30 gal.
size	sample 1	17 of 31	3 of 3	3 of 3	3 of 3	3 of 3	3 of 3
% head oxygen	- 60mesh	-20 mesh	-1/4"	-1/4"	- 1/4"	- 1/4"	- 1/4"
note			4.3	7.0			
date sealed		04/02/86	03/26/86				
date oxygen/subspl			9/26/88	9/29/89	12/20/90	11/20/91	5/06/93
PROXIMATE							
% moisture	20.1	18.8	17.3	19.5	20.6	18.7	19.4
% ash (dry)	19.4	18.7	17.2	19.3	20.1	14.1	19.1
analysis date	04/24/86	06/14/88	10/12/88	12/14/89	1/23/91	2/21/92	5/27/93
SULFUR FORMS (dry %)							
total sulfur	0.94		0.91	0.77	0.90	(b)	0.86
sulfate	0.01		0.17	0.27	0.28	0.03	0.27
pyritic	0.25		0.16	0.12	0.12	0.03	0.05
organic	0.68		0.58	0.38	0.50	0.61	0.54
analysis date	04/24/86		01/17/89	12/14/89	1/23/91	2/21/92	5/27/93
CALORIFIC VALUE (dry)							
BTU/lb	10447			10267	10116	d	10016
analysis date	04/24/86			12/14/89	1/23/91	2/21/92	5/27/93
ALKALI EXTRACTION							
% transmission		0.0	0.0	discon-			
analysis date		06/15/88	10/06/88	tinued			

notes: a) Sample dry, trace yellow sulfate. PSU MCL ash, moisture.
 PSU MCL sulfur forms (revised analysis report).

b) Sulfate analysis questionable in view of results from other years.

c) Traces of brown and yellow deposits on particles, particularly deeper in barrel. White streaks on barrel.

d) High calorific value caused in part by low ash in this split.

PSOC-1487 ADAVILLE #1 subA, Ro max = 0.48 collection date: 07/15/85					super- seded by DECS-7
Split ID	analysis	# 2 can	30 gal.	30 gal.	
size	sample 1	15 of 31	4 of 4	4 of 4	
% head oxygen	- 60mesh	-20 mesh	-1/4"	-1/4"	
note			13.4	17.1	
date sealed		04/03/86	03/26/86		
date oxygen/subspl			10/06/88	9/29/89	
PROXIMATE					
% moisture	19.0	18.1	11.5	18.3	
% ash (dry)	5.6	5.5	5.3	5.5	
analysis date	04/24/86	06/13/88	11/09/88	12/14/89	
SULFUR FORMS (dry %)					
total sulfur	1.31		1.37	1.21	
sulfate	0.01		0.18	0.27	
pyritic	0.03		0.08	0.06	
organic	1.27		1.11	0.94	
analysis date	04/24/86		01/17/89	12/14/89	
CALORIFIC VALUE (dry)					
BTU/lb	12589			12414	
analysis date	04/24/86			12/14/89	
ALKALI EXTRACTION					
% transmission		1.7	discon-		
analysis date		06/15/88	tinued		

notes: Sample dry, trace yellow sulfate. PSU MCL sulfur forms (revised analysis report).

PSOC-1488 DIETZ subB, Ro max = 0.47 collection date: 07/17/85				
Split ID	analysis	30 gal.	30 gal.	super- seded by DECS-9
size	sample 1	3 of 4	3 of 4	
% head oxygen	- 60mesh	-1/4"	-1/4"	
note		3.4	9.9	
date sealed		a		
date oxygen/subspl		3/27/86		
		10/03/88	10/03/89	
PROXIMATE				
% moisture	23.7	14.6	23.1	
% ash (dry)	5.4	4.6	5.2	
analysis date	04/25/86	11/09/88	12/14/89	
SULFUR FORMS (dry %)				
total sulfur	0.50	0.61	0.38	
sulfate	0.00	0.06	0.08	
pyritic	0.02	0.08	0.04	
organic	0.48	0.47	0.26	
analysis date	04/25/86	01/17/89	12/14/89	
CALORIFIC VALUE (dry)				
BTU/lb	12519		12387	
analysis date	04/25/86		12/14/89	

notes: a) Sample moist, good condition. PSU MCL sulfur forms (revised analysis report).

PSOC-1489 PUST ligA, Ro max = 0.34 collection date: 07/19/85						
Split ID	analysis	30 gal.	30 gal.	30 gal.	30 gal.	30 gal.
size	sample 1	4 of 4	4 of 4	4 of 4	4 of 4	4 of 4
% head oxygen	- 6" mesh	- 1/4"	- 1/4"	- 1/4"	- 1/4"	- 1/4"
note		10.6	14.3			
date sealed		a				c
date oxygen/subspl		10/06/88	9/29/89	12/20/90	11/20/91	5/06/93
PROXIMATE						
% moisture	37.2	20.1	34.8	37.4	34.9	34.2
% ash (dry)	11.0	10.5	10.9	10.1	6.5	9.8
analysis date	04/25/86	11/09/88	12/14/89	1/23/91	2/21/92	5/24/93
SULFUR FORMS (dry %)						
total sulfur	0.77	0.77	0.52	0.69	(b)	0.65
sulfate	0.00	0.26	0.32	0.26	0.38	0.31
pyritic	0.02	0.25	0.15	0.10	0.08	0.05
organic	0.75	0.26	0.04	0.33	0.03	0.05
analysis date	04/25/86	01/17/89	12/14/89	1/23/91	0.27	0.29
					2/21/92	5/27/93
CALORIFIC VALUE (dry)						
BTU/lb	10668		10515	10483	d	10328
analysis date	04/25/86		12/14/89	1/31/91	10556	5/27/93
					2/21/92	

notes: a) Sample moist, trace yellow and white sulfate.
 PSU MCL sulfur forms (revised analysis report).

b) Sulfate analysis questionable on view of results from other years.

c) Moderate amount of white coatings on particles.

d) High calorific value caused in part by low ash in this split.

PSOC-1490 BRAZIL BLOCK hvCb, Ro max = 0.45 collection date: 7/29 85								
Split ID	analysis sample 1	analysis sample 2	# 2 can 15 of 24	30 gal. 3 of 3	30 gal. 3 of 3	30 gal. 3 of 3	30 gal. 3 of 3	30 gal. 3 of 3
size	- 60mesh	- 60mesh	-20 mesh	-1/4"	-1/4"	- 1/4"	- 1/4"	- 1/4"
% head oxygen				16.4	16.8			
note				a				b
date sealed			10/30/85	10/22/85				
date oxygen/subspl				10/06/85	9/29/89	12/20/90	11/20/91	5/06/93
PROXIMATE								
% moisture	15.1	15.2	15.5	9.1	16.5	18.7	15.7	17.2
% ash (dry)	5.4	5.3	5.2	5.2	5.3	5.1	3.9	5.2
analysis date	12/23/85	05/30/86	06/14/88	11/09/88	12/14/89	1/23/91	2/21/91	5/27/93
SULFUR FORMS								
total sulfur	0.71	0.73		0.76	0.67	0.76	0.75	0.70
sulfate	0.01			0.03	0.10	0.06	0.06	0.07
pyritic	0.09			0.11	0.06	0.07	0.02	0.04
organic	0.61			0.62	0.51	0.62	0.66	0.59
analysis date	12/23/85	05/30/86		01/17/89	12/14/89	1/23/91	2/21/92	5/27/93
CALORIFIC VALUE (dry)								
BTU/lb	13960	13966			13692	13715	13847	13602
analysis date	12/23/85	05/30/86			12/14/89	1/31/91	2/21/92	5/27/93
ALKALI EXTRACTION								
% transmission			95.9		77.8	71.8	72.8	86.3
analysis date			06/15/88		1/10/90	6/03/91	9/09/92	7/07/93

notes: a) Sample moist, good condition. PSU MCL sulfur forms
(revised analysis report).

b) No visible deterioration.

PSOC-1491 INDIANA # 6 hvCb, Ro max = 0.43 collection date: 07/29/85								
Split ID	analysis sample 1	analysis sample 2	# 2 can 10 of 29	30 gal. 1 of 3	30 gal. 1 of 3	30 gal. 1 of 3	30 gal. 1 of 3	30 gal. 1 of 3
size	- 60mesh		- 20mesh	- 1/4"	- 1/4"	- 1/4"	- 1/4"	- 1/4"
% head oxygen				15.0	16.4			
note				?				b
date sealed			10/30/85					
date oxygen/subspl				10/14/88	10/03/89	12/20/90	11/20/91	5/06/93
PROXIMATE								
% moisture (a.d)	11.5	11.5	9.9	9.6	11.3	12.8	11.1	11.7
% ash (dry)	15.8	15.2	14.2	14.9	15.2	15.1	10.7	15.2
analysis date	05/28/86	05/30/86	3/10/88	02/01/89	12/14/89	1/23/91	2/21/92	5/28/93
GIESELER FLUIDITY								
max. ddpm	28		0	0	discon-			
fluid range	61		0	0	tinued			
analysis date	11/27/85		3/21/88	11/21/88				
SULFUR FORMS (dry)								
total sulfur	2.82	2.85			2.56	2.78	2.56	2.80
sulfate	0.02				1.30	1.37	1.03	1.52
pyritic	2.22				0.60	0.53	0.26	0.42
organic	0.57				0.66	0.88	1.27	0.85
analysis date	12/23/85	05/30/86			12/14/89	1/23/91	2/21/92	5/28/93
CALORIFIC VALUE (dry)							c	
BTU/lb	12134	12292			11613	11505	12229	11320
analysis date	12/23/85	05/30/86			12/14/89	1/23/91	2/21/92	5/28/93
ALKALI EXTRACTION								
% transmission			95.1	93.6	97.3	88.5	86.7	90.3
analysis date			06/07/88	12/09/88	1/08/90	6/03/91	9/16/92	7/07/93

notes: a) Sample moist, good condition. PSU MCL ash, moisture;
S forms (revised)

b) Trace of white acicular crystals.

c) High calorific value caused in aprt by low ash in this split.

PSOC-1492 ILLINOIS #5 hvCb, Ro max = 0.62 collection date: 08/01/85								
Split ID	analysis sample 1	analysis sample 2	# 2 can 31 of 31	30 gal. 1 of 3	30 gal. 1 of 3	30 gal. 1 of 3	30 gal. 1 of 3	30 gal. 1 of 3
size	- 60mesh		- 20mesh	- 1/4"	- 1/4"	- 1/4"	- 1/4 "	- 1/4"
% head oxygen				16.1	18.3			
note				a				b
date sealed			11/14/85					
date oxygen/subspl				10/14/88	10/02/89	12/21/90	11/20/91	5/06/93
PROXIMATE								
% moisture (a.d)	9.6	9.5	9.2	8.0	9.8	10.9	9.6	9.9
% ash (dry)	10.6	10.5	9.9	10.2	10.5	10.6	9.0	10.6
analysis date	12/23/85	05/29/86	03/14/88	02/01/89	02/06/90	1/23/91	2/21/92	5/28/93
GIESELER FLUIDITY								
max. ddpm	6		5	0	discon-			
fluid range	56		58	0	tinued			
analysis date	11/29/85		03/14/88	11/21/88				
SULFUR FORMS (dry)								
total sulfur (3.90)	3.90	4.35		4.10	3.90	3.77	3.35	3.74
sulfate (0.03)	0.03			0.91	0.94	0.98	0.65	1.16
pyritic (1.82)	1.82			0.76	0.62	0.59	0.23	0.54
organic (2.05)	2.05			2.43	2.34	2.20	2.47	2.04
analysis date	12/23/85	05/29/86		2/12/90	02/06/90	1/23/91	2/21/92	5/28/93
CALORIFIC VALUE (dry)								
BTU/lb	12758	12722			12237	12246	12462	12026
analysis date	12/23/85	05/29/86			02/06/90	1/23/91	2/21/92	5/28/93
ALKALI EXTRACTION								
% transmission			86.9	93.4	86.2		79.4	83.3
analysis date			06/07/88	12/09/88	01/11/90		9/21/92	7/07/93

notes: a) Sample dry, good condition. PSU MCL ash, moisture;
S forms (revised).

b) Trace of brown powdery coatings.

PSOC-1493 ILLINOIS #6 hvCb, Ro max = 0.53 collection date: 08/01/85					
split ID size % head oxygen note date sealed date oxygen/subspl	analysis sample 1 - 60mesh	analysis sample 2	# 2 can 19 of 31 - 20mesh 11/19/85	30 gal. 2 of 4 - 1/4" 3.0 a 10/14/88	30 gal. 2 of 4 -1/4" 15.4 10/03/89
PROXIMATE % moisture % ash (dry) analysis date	9.5 15.2 12/23/85	9.4 15.2 05/29/86	9.8 14.3 03/17/88	8.8 14.6 02/01/89	10.2 14.4 02/06/90
GIESELER FLUIDITY max. ddpm fluid range analysis date	6 47 12/05/85		6 51 03/17/88	0 0 11/23/88	discon- tinued
SULFUR FORMS (dry) total sulfur sulfate pyritic organic analysis date	4.23 0.04 2.61 1.57 12/23/85	4.98 05/29/86		4.51 0.68 1.40 2.43 02/12/90	4.07 1.04 1.02 2.01 02/06/90
CALORIFIC VALUE (dry) BTU/lb analysis date	11989 12/23/85	11963 05/29/86			11746 02/06/90
ALKALI EXTRACTION % transmission analysis date			93.2 06/08/88	94.5 12/12/88	89.3 01/09/90

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by
DECS-2

notes: a) Sample moist, trace yellow sulfate. PSU MCL ash,
moisture; S forms (revised).

PSOC-1494 KENTUCKY #9 hvBb, Ro max = 0.61 collection date: 08/02/85					
split ID	analysis	# 2 can	30 gal.	30 gal.	30 gal.
size	sample 1	8 of 31	1 of 3	1 of 3	1 of 3
% head oxygen	- 60mesh	- 20mesh	- 1/4"	- 1/4"	- 1/4"
note			13.7	18.1	
date sealed		11/19/85	a		
date oxygen/subspl			10/14/88	10/03/89	12/21/90
PROXIMATE					
% moisture (a.d)	7.1	7.1	6.7	8.1	8.5
% ash (dry)	11.8	11.4	10.7	11.4	10.9
analysis date	12/23/85	03/21/88	02/01/89	02/06/90	1/23/91
GIESELER FLUIDITY					
max. ddpm	48	175	0	discon-	
fluid range	60	84	0	tinued	
analysis date	12/03/85	03/21/88	11/30/88		
SULFUR FORMS (dry)					
total sulfur	4.85		5.45	5.15	4.94
sulfate	0.02		1.21	1.21	1.36
pyritic	3.14		1.63	1.75	1.63
organic	1.69		2.61	2.19	1.96
analysis date	12/23/85		02/12/90	02/06/90	1/23/91
CALORIFIC VALUE (dry)					
BTU/lb	12851			12287	12217
analysis date	12/23/85			02/06/90	1/23/91
ALKALI EXTRACTION					
% transmission		98.4	94.7	94.8	95.5
analysis date		06/08/88	12/12/88	01/11/90	8/20/91

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by
DECS-18

notes: a) Sample dry, iron stained. PSU MCL ash, moisture; S forms (revised).

PSOC-1495 BEVIER-WHEELER hvCb, Ro max = 0.62 collection date: 08/05/85								
split ID	analysis sample 1 - 60mesh	analysis sample 2 - 60mesh	# 2 can 23 of 31 - 20mesh	30 gal. 3 of 3 -1"	30 gal. 1 of 3 -1/4"	30 gal. 1 of 3 - 1/4"	30 gal. 1 of 3 - 1/4"	30 gal. 1 of 3 - 1/4"
size				15.8	17.9			
% head oxygen				a				b
note			11/21/85					
date sealed				10/14/88	10/11/89	12/21/90	11/20/91	5/06/93
date oxygen/subspl								
PROXIMATE								
% moisture (a.d)	13.4	13.3	10.2	11.0	13.0	14.4	13.4	13.3
% ash (dry)	16.1	16.1	14.9	15.1	15.8	15.3	11.2	15.9
analysis date	12/30/85	05/30/86	03/22/88	02/01/89	02/06/90	1/23/91	2/21/92	5/28/93
GIESELER FLUIDITY								
max. ddpm	2		0	0	discon-			
fluid range	45		0	0	tinued			
analysis date	12/04/85		03/22/88	12/02/88				
SULFUR FORMS (dry)								
total sulfur	6.04	7.02		6.47	6.05	5.92	6.21	5.96
sulfate	0.03	0.22		1.89	1.97	2.15	1.15	2.35
pyritic	3.77	3.43		1.49	1.59	0.08	1.47	0.61
organic	2.24	3.37		3.09	2.49	3.68	3.59	3.00
analysis date	12/30/85	06/18/86		02/12/90	02/06/90	1/23/91	2/21/92	5/28/93
CALORIFIC VALUE (dry)							c	
BTU/lb	11879				11085	11097	12172	10841
analysis date	12/20/85				02/06/90	1/31/91	2/21/92	5/28/93
ALKALI EXTRACTION								
% transmission			87.4	93.0	94.6	85.0	97.1	90.6
analysis date			06/07/88	12/12/88	01/12/90	2/20/91	9/21/92	7/08/93

notes: a) PSU MCL ash, moisture; S forms (revised).

b) Abundant white acicular crystals and some yellow/brown coatings.

c) High calorific value caused in part by low ash in this split.

PSOC-1496 TEBO hvCb, Ro max = 0.57 collection date: 08/05/85							
Split ID	analysis sample 1	# 2 Can 13 of 30	30 gal. 3 of 3	30 gal. 3 of 3	30 gal. 3 of 3	30 gal. 3 of 3	30 gal. 3 of 3
size	- 60mesh	- 20mesh	- 1/4"	- 1/4"	- 1/4"	- 1/4"	- 1/4"
% head oxygen			12.8	19.0			
note			a				b
date sealed		11/27/85					
date oxygen/subspl			10/14/88	10/11/89	12/21/90	11/21/91	5/06/93
PROXIMATE							
% moisture (a.d)	7.9	7.3	6.3	8.3	8.8	6.1	8.5
% ash (dry)	29.4	29.5	27.4	28.5	28.0	27.3	28.8
analysis date	12/23/85	03/28/88	02/01/89	02/06/90	1/23/91	2/21/92	6/14/93
GIESELER FLUIDITY							
max. ddpm	6	6	0	discon-			
fluid range	44	39	0	tinued			
analysis date	12/04/85	03/28/88	12/02/88				
SULFUR FORMS (dry %)							
total sulfur	6.04		6.23	5.74	5.78	5.73	6.09
sulfate	0.03		2.09	2.02	2.22	1.26	2.68
pyritic	3.31		1.75	1.93	2.14	1.19	1.35
organic	2.69		2.39	1.79	1.42	3.28	2.06
analysis date	12/23/85		02/12/90	02/06/90	1/23/91	2/21/92	6/14/93
CALORIFIC VALUE (dry)							
BTU/lb	9881			9619	9498	9912	9199
analysis date	12/23/85			02/06/90	1/23/91	2/21/92	6/14/93
ALKALI EXTRACTION							
% transmission		94.4	94.7	80.9	95.6	97.2	97.5
analysis date		06/30/88	12/12/88	01/12/90	8/22/91	9/21/92	7/08/93

notes: a) Sample dry, trace white sulfate. PSU MCL ash,
 moisture (low ash may be due to lab not sample split);
 S forms (revised).

b) Abundant white acicular crystals and some yellow/brown coatings.

PSOC-1497 ILLINOIS #2 hvCb, Ro max = 0.40 collection date: 08/08/85								
Split ID size % head oxygen note date sealed date oxygen/subspl	analysis sample 1 - 60mesh	analysis sample 2	# 2 can 13 of 30 - 20mesh 12/03/85	30 gal. 1 of 3 - 1/4" 11.9 a 10/14/88	30 gal. 1 of 3 - 1/4" 16.0 10/04/89	30 gal. 1 of 3 - 1/4" 12/21/90	30 gal. 1 of 3 - 1/4" 11/21/91	30 gal. 1 of 3 - 1/4" b 5/06/93
PROXIMATE % moisture (a.d) % ash (dry) analysis date	13.5 12.0 12/23/85	13.4 11.7 05/30/86	14.6 12.3 03/29/88	12.1 10.8 02/01/88	13.2 11.5 02/06/90	13.9 11.8 1/23/91	12.3 6.8 2/21/92	13.4 11.5 6/14/93
GIESELER FLUIDITY max. ddpm fluid range analysis date	83 65 12/06/85		146 87 03/29/88	0 0 12/05/88	discon- tinued			
SULFUR FORMS (dry %) total sulfur sulfate pyritic organic analysis date	5.04 0.02 4.00 1.02 12/23/85	5.93 0.35 3.51 2.06 06/18/86		5.33 2.20 1.21 1.92 02/12/90	4.96 2.16 1.43 1.37 02/06/90	5.13 2.41 1.17 1.55 1/23/91	4.24 1.92 0.54 1.79 2/21/92	5.02 2.51 0.96 1.56 6/14/93
CALORIFIC VALUE (dry) BTU/lb analysis date	12823 12/23/85	12778 05/30/86			11748 02/06/90	11633 1/23/91	12628 2/21/92	11421 6/14/93
ALKALI EXTRACTION % transmission analysis date			96.3 06/08/88	93.5 12/14/88	88.9 01/23/90	89.1 8/23/91	95.4 9/22/92	89.9 7/08/93

notes: a) Sample dry, visible white sulfate. PSU MCL ash, moisture;
 S forms (revised).

b) Trace of brown and white coatings.

PSOC-1498 MADGE hr/Cb, Ro max = 0.60 collection date: 09/24/85							
Split ID	analysis	# 2 Can	30 gal.	30 gal.	30 gal.	30 gal.	30 gal.
size	sample 1	15 of 31	3 of 3	3 of 3	3 of 3	3 of 3	3 of 3
% head oxygen	- 60mesh	- 20mesh	- 1/4"	- 1/4"	- 1/4"	- 1/4"	- 1/4"
note			15.6	17.1			
date sealed		12/13/85	a				b
date oxygen/subspl			10/14/88	10/04/89	12/21/90	11/21/91	5/06/93
PROXIMATE							
% moisture	9.6	9.6	9.8	11.1	11.9	10.8	11.5
% ash (dry)	7.1	7.3	6.6	7.1	7.2	7.6	7.3
analysis date	03/13/86	06/14/88	02/01/89	02/06/90	1/23/91	2/21/92	6/14/93
SULFUR FORMS (dry %)							
total sulfur	0.52		0.55	0.46	0.51	0.53	0.47
sulfate	0.00		0.02	0.01	0.01	0.02	0.01
pyritic	0.03		0.04	0.02	0.03	0.03	0.02
organic	0.48		0.49	0.43	0.47	0.48	0.44
analysis date	03/13/86		02/12/90	02/06/90	1/23/91	2/21/92	6/14/93
CALORIFIC VALUE (dry)							
BTU/lb	12762			12520	12438	12429	12368
analysis date	03/13/86			02/06/90	1/31/91	2/21/92	6/14/93
ALKALI EXTRACTION							
% transmission		23.5	38.8	discon-			
analysis date		06/16/88	12/14/88	tinued			

notes: a) Sample dry (dusty), good condition. PSU MCL ash, moisture;
S forms (revised).

b) No visible deterioration.

PSOC-1499 COLORADO B hv8b, Ro max = 0.75 collection date: 09/26/85							
Split ID	analysis sample 1	# 2 can	30 gal.	30 gal.	30 gal.	30 gal.	30 gal.
size	- 60mesh	15 of 31	3 of 4	3 of 4	3 of 4	3 of 4	3 of 4
% head oxygen		- 20mesh	- 1/4"	- 1/4"	- 1/4"	- 1/4"	- 1/4"
note			17.1	18.3			
date sealed		12/17/85	a				b
date oxygen/subspl			10/14/88	10/11/89	12/21/90	11/21/91	6/05/93
PROXIMATE							
% moisture	3.4	4.2	3.7	4.4	4.8	4.1	4.7
% ash (dry)	5.9	4.4	5.3	5.7	6.0	7.2	5.9
analysis date	03/13/86	04/22/88	02/03/89	02/28/90	10/03/91	10/14/92	6/14/93
GIESELER FLUIDITY							
max. ddpm	4	4	2	1	1	0	discon-
fluid range	43	44	36	18	34	0	tinued
analysis date	12/17/85	04/22/88	12/05/88	02/01/90	8/21/91	9/24/92	
SULFUR FORMS (dry %)							
total sulfur	0.67		0.74	0.64	0.65	0.64	0.66
sulfate	0.00		0.04	0.01	0.01	0.02	0.01
pyritic	0.02		0.04	0.02	0.05	0.04	0.03
organic	0.65		0.66	0.61	0.59	0.58	0.62
analysis date	03/13/86		02/12/90	02/28/90	10/03/91	10/14/92	6/14/93
CALORIFIC VALUE (dry)							
BTU/lb	13780			13597	13519	13320	13415
analysis date	03/13/86			02/28/90	10/03/91	10/14/92	6/14/93
ALKALI EXTRACTION							
% transmission		98.7		91.8	93.9	89.8	96.6
analysis date		06/06/88		02/01/90	8/21/91	9/24/92	7/08/93

notes: a) Sample dry (dusty), good condition. PSU MCL ash, moisture;
S forms (revised).

b) No visible deterioration.

PSOC-1500		BASIN B		mvb, Ro max = 1.45	
collection date: 09/26/85					
Split ID	analysis sample 1	# 2 can	30 gal.	30 gal.	super- seded by DECS-3
size	- 60mesh	15 of 31	2 of 4	2 of 4	
% head oxygen		- 20mesh	- 1/4"	- 1/4"	
note			19.7	19.4	
date sealed		02/11/86	a		
date oxygen/subspl			10/19/88	10/11/89	
PROXIMATE					
% moisture	4.4	2.2	1.6	2.8	
% ash (dry)	23.4	21.8	24.2	22.8	
analysis date	03/13/86	04/25/88	02/03/89	03/01/90	
GIESELER FLUIDITY					
max. ddpm	267	284	30	23	
fluid range	83	84	70	66	
analysis date	03/13/86	04/25/88	01/17/89	02/02/90	
SULFUR FORMS (dry %)					
total sulfur	0.76		0.84	0.74	
sulfate	0.00		0.13	0.08	
pyritic	0.32		0.17	0.19	
organic	0.44		0.54	0.47	
analysis date	03/13/86		02/12/89	03/01/90	
CALORIFIC VALUE (dry)					
BTU/lb	11986			12005	
analysis date	03/13/86			03/01/90	
ALKALI EXTRACTION					
% transmission		99.0		99.1	
analysis date		06/06/88		02/02/90	

notes: a) Sample moist, good condition. PSU MCL ash, moisture;
S forms (revised).

PSOC-1501 JUANITA C hv8b, Ro max = 0.73 collection date: 09/27/85							
Split ID	analysis sample 1	# 2 can 16 of 29	30 gal. 3 of 3	30 gal. 3 of 3	30 gal. 3 of 3	30 gal. 3 of 3	30 gal. 3 of 3
size	- 60mesh	- 20mesh	- 1/4"	- 1/4"	- 1/4"	- 1/4"	- 1/4"
% head oxygen			16.4	17.7			
note							a
date sealed		03/03/86					
date oxygen/subspl			10/19/88	10/12/89	2/05/91	11/21/91	5/06/93
PROXIMATE							
% moisture	5.8	6.8	6.0	6.5	7.6	6.5	6.4
% ash (dry)	5.6	5.4	5.5	5.6	5.7	5.8	5.5
analysis date	03/13/86	04/26/88	02/10/89	02/06/90	2/08/91	2/21/92	6/14/93
GIESELER FLUIDITY							
max. ddp	1	1	0	discon-			
fluid range	24	25	0	tinued			
analysis date	03/20/86	04/26/88	02/02/89				
SULFUR FORMS (dry %)							
total sulfur	0.64		0.57	0.61	0.63	0.63	0.62
sulfate	0.00		0.02	0.01	0.01	0.01	0.01
pyritic	0.02		0.03	0.03	0.03	0.02	0.02
organic	0.62		0.53	0.57	0.59	0.60	0.60
analysis date	03/13/86		02/10/89	02/06/90	2/08/91	2/21/92	6/14/93
CALORIFIC VALUE (dry)							
BTU/lb	13579		13368	13342	13317	13257	13286
analysis date	03/13/86		02/10/89	02/06/90	2/15/91	2/21/92	6/14/93
ALKALI EXTRACTION							
% transmission		94.3	90.9	92.0	89.8	90.5	92.7
analysis date		06/06/88	02/10/89	01/23/90	8/26/91	9/22/92	7/09/93

notes: a) No visible deterioration.

PSOC-1502 HIAMATHA hvCb, Ro max = 0.54 collection date: 09/30/85				
Split ID size % head oxygen note date sealed date oxygen/subspl	analysis sample 1 - 60mesh	# 2 Can 14 of 29 - 20mesh 03/03/86	30 gal. 2 of 4 -1" 6.2 10/19/88	30 gal. 2 of 4 -1/4" 9.6 10/12/89
super-seded by DECS-5				
PROXIMATE % moisture % ash (dry) analysis date	8.7 9.0 03/13/86	8.4 8.9 06/14/88	8.4 9.0 02/10/89	8.9 9.1 02/06/90
GIESELER FLUIDITY max. ddpm fluid range analysis date	0 0 03/21/86	discon- tinued		
SULFUR FORMS (dry %) total sulfur sulfate pyritic organic analysis date	0.51 0.00 0.15 0.35 03/13/86		0.43 0.02 0.13 0.28 02/10/89	0.42 0.01 0.11 0.29 02/06/90
CALORIFIC VALUE (dry) BTU/lb analysis date	12650 03/13/86		12576 02/10/89	12574 02/06/90
ALKALI EXTRACTION % transmission analysis date		54.6 06/15/88	80.6 11/10/89	58.8 01/23/90

PSOC-1503 BLIND CANYON hvCb, Ro max = 0.62 collection date: 10/01/85				
Split ID	analysis sample 1	# 2 can 15 of 31	30 gal. 3 of 4	30 gal. 3 of 4
size	- 60mesh	- 20mesh	-1"	-1/4"
% head oxygen			16.9	16.6
note				
date sealed		03/20/86		
date oxygen/subspl			10/19/88	10/12/89
PROXIMATE				
% moisture	10.4	5.1	5.2	5.6
% ash (dry)	3.9	4.0	4.0	4.1
analysis date	04/25/86	04/26/88	02/10/89	02/06/90
GIESELER FLUIDITY				
max. ddpw	2	0	discon-	
fluid range	39	0	tinued	
analysis date	03/24/86	04/26/88		
SULFUR FORMS (dry %)				
total sulfur	0.54		0.47	0.48
sulfate	0.00		0.01	0.02
pyritic	0.02		0.17	0.02
organic	0.52		0.29	0.44
analysis date	04/25/86		02/10/89	02/06/90
CALORIFIC VALUE (dry)				
BTU/lb	14069		13984	13832
analysis date	04/25/86		02/10/89	02/06/90
ALKALI EXTRACTION				
% transmission		94.5	86.1	84.6
analysis date		06/06/88	02/10/89	01/24/90

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DECS-6,
DECS-16,
DECS-17

PSOC-1504 UPPER SUNNYSIDE hv8b, Ro max = 0.80 collection date: 10/02/85					
Split ID	analysis sample 1	# 2 can 15 of 31	30 gal. 4 of 4	30 gal. 4 of 4	30 gal. 4 of 4
size	- 60mesh	- 20mesh	- 1/4"	- 1/4"	- 1/4"
% head oxygen			18.7	19.2	
note			a		
date sealed		03/21/86	03/18/86		
date oxygen/subspl			10/28/88	10/12/89	2/05/91
PROXIMATE					
% moisture	3.4	2.8	2.6	3.0	3.9
% ash (dry)	7.5	7.9	7.3	7.7	7.6
analysis date	04/25/86	05/04/88	02/10/89	02/06/90	2/08/91
GIESELER FLUIDITY					
max. ddpw	17	13	0	discon-	
fluid range	51	58	0	tinued	
analysis date	03/24/86	05/04/88	02/02/89		
SULFUR FORMS (dry %)					
total sulfur	0.77		0.82	0.73	0.75
sulfate	0.02		0.02	0.02	0.02
pyritic	0.04		0.03	0.02	0.03
organic	0.71		0.77	0.70	0.71
analysis date	04/24/86		02/12/90	02/06/90	2/08/91
CALORIFIC VALUE (dry)					
BTU/lb	13640		13612	13218	13519
analysis date	04/24/86		02/10/89	02/06/90	2/15/91
ALKALI EXTRACTION					
% transmission		97.2	91.8	87.4	94.4
analysis date		06/07/88	02/10/89	01/24/90	8/26/91

superseded
by DECS-15

notes: a) Sample dry, good condition. PSU S forms (revised).

PSOC-1506 BANNER hvAb, Ro max = 0.96 collection date: 06/14/85							
Split ID	analysis sample 1	# 2 can 15 of 31	30 gal. 3 of 3	30 gal. 3 of 3	30 gal. 3 of 3	30 gal. 3 of 3	30 gal. 3 of 3
size	- 60mesh	- 20mesh	- 1/4"	- 1/4"	- 1/4"	- 1/4"	- 1/4"
% head oxygen			19.4	19.8			
note			a				b
date sealed		04/24/86	04/22/86				
date oxygen/subspl			10/28/88	10/13/89	2/05/91	11/21/91	4/13/93
PROXIMATE							
% moisture	1.3	1.8	1.1	1.5	1.6	1.6	1.5
% ash (dry)	13.6	14.0	14.7	14.5	15.0	14.5	14.3
analysis date	10/04/85	05/05/88	02/10/89	03/01/90	10/03/91	10/21/92	6/14/93
GIESELER FLUIDITY							
max. ddpm	29881	6645	4889	2870	782	1426	1446
fluid range	90	89	79	81	78	76	75
analysis date	04/25/86	05/05/88	02/02/89	02/09/90	6/26/91	2/19/93	7/01/93
SULFUR FORMS (dry %)							
total sulfur	0.70		0.72	0.65	0.66	0.63	0.65
sulfate	0.02		0.05	0.06	0.09	0.09	0.08
pyritic	0.14		0.07	0.08	0.09	0.05	0.04
organic	0.54		0.60	0.51	0.48	0.49	0.54
analysis date	10/05/85		02/12/90	03/01/90	10/03/91	10/21/92	6/14/93
CALORIFIC VALUE							
BTU/lb dry	13325		13024	13095	12991	13033	13048
analysis date	10/05/85		02/10/89	03/01/90	10/03/91	10/21/92	6/14/93
ALKALI EXTRACTION							
% transmission		98.8	95.4	98.9	99.2	99.1	97.3
analysis date		06/08/88	02/13/89	02/09/90	6/26/91	9/25/92	7/09/93

notes: a) Sample dry, good condition; PSU S forms (revised).

b) Sample dry, no visible deterioration.

PSOC-1507 BEULAH ligA, Ro max = 0.37 collection date: 07/02/85				
Split ID	analysis	30 gal.	30 gal.	super- seded by DECS-11
size	sample 1	1 of 3	1 of 3	
% head oxygen	- 60mesh	-1"	-1/4"	
note		6.7	7.1	
date sealed		a		
date oxygen/subspl		04/10/86		
		10/28/88	10/13/89	
PROXIMATE				
% moisture	35.6	32.8	31.9	
% ash (dry)	12.5	12.5	13.3	
analysis date	04/24/86	02/10/89	02/06/90	
SULFUR FORMS (dry %)				
total sulfur	1.43	1.41	1.23	
sulfate	0.01	0.19	0.16	
pyritic	0.02	0.48	0.51	
organic	1.40	0.74	0.56	
analysis date	04/24/86	02/12/90	02/06/90	
CALORIFIC VALUE (dry)				
BTU/lb	10627	10585	10420	
analysis date	04/24/86	02/10/89	02/06/90	

notes: a) Sample moist, trace white and yellow sulfate.
 PSU S forms (revised).

PSOC-1508 POCAHONTAS #3 lvb, Ro max = 1.85 collection date: 11/05/85					
Split ID	analysis sample 1	# 2 can	30 gal.	30 gal.	30 gal.
size	- 60mesh	15 of 31	6 of 6	6 of 6	6 of 6
% head oxygen		- 20mesh	- 1/4"	- 1/4"	- 1/4"
note			20.7	20.9	
date sealed		12/04/85	a		
date oxygen/subspl			11/14/85		
			10/28/88	10/13/89	2/05/91
PROXIMATE					
% moisture	1.1	1.9	1.4	1.3	2.4
% ash (dry)	7.4	7.1	7.4	7.5	7.2
analysis date	12/23/85	05/06/88	02/10/89	02/06/90	2/15/91
GIESELER FLUIDITY					
max. cldpm	10	3	0	discon-	
fluid range	44	41	0	tinued	
analysis date	12/07/85	05/06/88	02/02/89		
SULFUR FORMS (dry %)					
total sulfur	0.64		0.57	0.61	0.60
sulfate	0.00		0.02	0.03	0.02
pyritic	0.14		0.24	0.07	0.07
organic	0.50		0.31	0.51	0.51
analysis date	12/23/85		02/10/89	02/06/90	2/15/91
CALORIFIC VALUE (dry)					
BTU/lb	14542		14489	14345	14410
analysis date	12/23/85		02/10/89	02/06/90	2/15/91
ALKALI EXTRACTION					
% transmission		100.2	96.9	97.7	95.8
analysis date		06/09/88	02/13/89	01/25/90	8/27/91

superseded
by DECS-19

notes: a) Sample dry, good condition.

PSOC-1515 PENNSYLVANIA C sa, Ro max = 2.80 collection date: 05/08/86						
Split ID	analysis	30 gal.	30 gal.	30 gal.	30 gal.	30 gal.
size	sample 1	4 of 4	4 of 4	4 of 4	4 of 4	4 of 4
% head oxygen	- 60mesh	- 1/4"	- 1/4"	- 1/4"	- 1/4"	- 1/4"
note		19.8	20.3			
date sealed		a				b
date oxygen/subspl		08/08/86				
		10/28/88	10/13/89	2/05/91	11/21/91	5/06/93
PROXIMATE						
% moisture	2.4	2.2	2.1	3.5	2.1	2.4
% ash (dry)	29.2	28.3	28.3	30.0	33.1	29.7
analysis date	09/25/86	02/10/89	02/06/90	2/08/91	2/21/92	6/14/93
SULFUR FORMS (dry %)						
total sulfur	0.58	0.63	0.59	0.60	0.53	0.60
sulfate	0.00	0.13	0.10	0.10	0.06	0.10
pyritic	0.10	0.04	0.06	0.06	0.03	0.04
organic	0.49	0.46	0.43	0.44	0.44	0.46
analysis date	09/25/86	02/12/90	02/06/90	2/08/91	2/21/92	6/14/93
CALORIFIC VALUE (dry)						
BTU/lb	10642	10677	10657	10360	9812	10386
analysis date	09/16/86	02/10/89	02/06/90	2/15/91	2/21/92	6/14/93

notes: a) Sample moist, good condition. PSU S forms (revised).

b) No visible deterioration.

PSOC-1516 LOWER KITTANNING lvb, Ro max = 1.73 collection date: 05/29/86							
Split ID	analysis sample 1	# 2 can 15 of 31 - 60mesh	30 gal. 4 of 4 - 1/4"	30 gal. 4 of 4 - 1/4"		30 gal. 4 of 4 - 1/4"	30 gal. 4 of 4 - 1/4"
size							
% head oxygen			20.5	20.6			
note			a		b		c
date sealed		08/20/86	08/08/86				
date oxygen/subspl			10/28/88	10/13/89		11/21/91	5/06/93
PROXIMATE							
% moisture	2.0	2.1	2.1	1.9		1.9	2.5
% ash (dry)	10.3	9.4	10.3	10.5		15.4	10.5
analysis date	09/25/86	05/09/88	02/10/89	2/28/90		2/21/92	6/15/93
GIESELER FLUIDITY							
max. ddpm	53	2	2	0		discon-	
fluid range	69	25	nd	0		tinued	
analysis date	08/20/86	05/09/88	02/06/89				
SULFUR FORMS (dry %)							
total sulfur	1.40		1.33	1.44		1.56	1.39
sulfate	0.01		0.01	0.29		0.22	0.37
pyritic	0.61		0.81	0.36		0.38	0.29
organic	0.78		0.50	0.79		0.96	0.74
analysis date	09/25/86		02/10/89	02/28/90		2/21/92	6/15/93
CALORIFIC VALUE (dry)							
BTU/lb	14025		13822	13752		12915	13708
analysis date	09/25/86		02/10/89	02/28/90		2/21/92	6/15/93
ALKALI EXTRACTION							
% transmission		99.9	95.9	98.8		96.9	99.7
analysis date		06/08/88	02/15/89	02/12/90		9/22/92	7/09/93

notes: a) Sample dry, good condition.

b) quality monitoring not performed - recollection was planned
at the time quality monitoring splitting was performed.

c) Trace of yellow coatings.

PSOC-1517 OHIO #5 hv8b, Ro max = 0.86 collection date: 06/09/86							
Split ID	analysis sample 1	# 2 can 16 of 31 - 60mesh	30 gal. 2 of 3 - 1"	30 gal. 2 of 3 - 1/4"	30 gal. 2 of 3 - 1/4"	30 gal. 2 of 3 - 1/4"	30 gal. 2 of 3 - 1/4"
size	- 60mesh	- 20mesh	- 1"	- 1/4"	- 1/4"	- 1/4"	- 1/4"
% head oxygen			16.4	18.7			
note			a				c
date sealed		08/22/86	08/07/86				
date oxygen/subspl			10/28/88	10/13/89	2/05/91	11/25/91	5/06/93
PROXIMATE							
% moisture	4.2	4.0	4.3	4.5	5.3	4.1	5.4
% ash (dry)	4.8	4.7	5.8	5.7	5.6	3.2	5.9
analysis date	09/25/86	05/10/88	02/10/89	02/28/90	10/03/91	2/21/92	6/14/93
GIESELER FLUIDITY							
max. ddpm	1509	13	77	18	1 (b)	discon-	
fluid range	75	50	60	52	2	tinued	
analysis date	09/03/86	05/10/88	02/06/89	02/13/90	8/26/91		
SULFUR FORMS (dry %)							
total sulfur	1.92		2.09	2.19	2.08	1.40	2.30
sulfate	0.01		0.01	0.32	0.43	0.13	0.51
pyritic	0.70		0.98	1.17	0.97	0.39	0.97
organic	1.21		1.10	0.70	0.68	0.88	0.82
analysis date	09/25/86		02/10/89	02/28/90	10/23/91	2/21/92	6/14/93
CALORIFIC VALUE (dry)							
BTU/lb	14258		13933	13841	13814	14320	13663
analysis date	09/25/86		02/10/89	02/28/90	10/03/91	2/21/92	6/14/93
ALKALI EXTRACTION							
% transmission		98.0	98.1	87.0	96.4	97.1	98.2
analysis date		06/09/88	02/15/89	02/13/90	8/26/91	9/23/92	7/12/93

notes: a) Sample dry, good condition.

b) No consecutive readings with fluidity.

c) No visible deterioration.

PSOC-1518 M. KITTANNING (OHIO #6) hv8b, Ro max = 0.69 collection date: 06/10/86							
Split ID	analysis sample 1	# 2 can 15 of 31	30 gal. 3 of 3	30 gal. 3 of 3	30 gal. 3 of 3	30 gal. 3 of 3	30 gal. 3 of 3
size	- 60mesh	- 20mesh	- 1/4"	- 1/4"	- 1/4"	- 1/4"	- 1/4"
% head oxygen			18.5	19.1			
note			a				b
date sealed		08/26/86	08/07/86				
date oxygen/subspl			10/28/88	10/16/89	2/05/91	11/25/91	5/10/93
PROXIMATE							
% moisture	5.3	5.0	5.8	5.9	6.8	4.3	6.2
% ash (dry)	9.9	9.3	9.6	9.5	9.8	8.4	9.6
analysis date	09/25/86	05/11/88	03/07/89	02/06/90	2/08/91	2/21/92	6/14/93
GIESELER FLUIDITY							
max. ddpm	113	118	1	discon-			
fluid range	62	66	3	tinued			
analysis date	09/04/86	05/11/88	3/03/89				
SULFUR FORMS (dry %)							
total sulfur	3.86		3.44	3.77	3.62	2.98	3.67
sulfate	0.12		0.91	1.06	1.16	0.46	1.30
pyritic	2.26		1.05	0.88	0.55	0.35	0.49
organic	1.48		1.48	1.83	1.91	2.17	1.88
analysis date	09/25/86		03/07/89	02/06/90	1/23/91	2/21/92	6/14/93
CALORIFIC VALUE (dry)							
BTU/lb	13074		12258	12538	12434	12902	12352
analysis date	09/25/86		03/07/89	02/06/90	2/15/91	2/21/92	6/14/93
ALKALI EXTRACTION							
% transmission		97.4	94.8	92.4	91.2	88.5	94.9
analysis date		06/09/88	03/06/89	01/25/90	8/17/91	9/23/92	7/12/93

notes: a) Sample dry, large visible white sulfate crystals.

b) White encrustations and brown coatings on some particles.

PSOC-1519 PITTSBURGH hv8b, Ro max = 0.87 collection date: 06/19/86							
Split ID	analysis sample 1	# 2 can	30 gal.	30 gal.		30 gal.	30 gal.
size	- 60mesh	15 of 31	1 of 3	1 of 3		1 of 3	1 of 3
% head oxygen		-20 mesh	-1/4"	-1/4"		- 1/4"	- 1/4"
note			18.3	18.4			
date sealed		08/29/86	a		b		c
date oxygen/subspl			8/06/86				
			9/24/88	10/16/89		11/25/91	4/13/93
PROXIMATE							
% moisture	3.1	3.5	1.5	3.3		5.6	4.5
% ash (dry)	10.5	9.8	10.2	11.7		13.7	11.8
analysis date	09/25/86	05/12/88	10/12/88	02/28/90		10/15/92	6/14/93
GIESELER FLUIDITY							
max. dcpm	3548	1409	800	17		3	81
fluid range	77	80	67	39		27	53
analysis date	12/15/86	05/12/88	10/21/88	02/14/90		9/18/92	7/02/93
SULFUR FORMS (dry %)							
total sulfur	1.94		1.93	1.97		2.62	2.02
sulfate	0.10		0.47	0.55		1.16	0.73
pyritic	0.02		0.60	0.42		0.51	0.29
organic	1.82		0.86	1.00		0.95	1.00
analysis date	09/25/86		09/17/89	02/28/90		10/15/92	6/14/93
CALORIFIC VALUE (dry)							
BTU/lb	13382			12959		12221	12825
analysis date	09/25/86			02/28/90		10/15/92	6/14/93
ALKALI EXTRACTION							
% transmission		81.4	85.0	70.7		70.6	77.2
analysis date		06/09/88	10/06/88	02/28/90		9/18/92	7/02/93

notes: a) PSU MCL ash, moisture.

b) Quality monitoring not performed - recollection was planned
at the time quality monitoring splitting was performed.

c) No visible deterioration.

PSOC-1520 SMITH ROLAND subC, Ro max = 0.43				
collection date: 08/18/86				
Split ID	analysis sample 1	analysis sample 2	5 gal.	30 gal.
size	- 60mesh	-60 mesh	-1/4"	4 of 5
% head oxygen				-1"
note			a	12.1
date sealed				
date oxygen/subspl				10/16/89
PROXIMATE				
% moisture	29.7	26.7	24.8	27.3
% ash (dry)	12.4	12.6	10.5	12.7
analysis date	09/16/86	10/05/87	09/14/88	02/06/90
SULFUR FORMS (dry %)				
total sulfur	1.21	1.22	1.24	1.18
sulfate	0.01		0.34	0.24
pyritic	0.05		0.14	0.23
organic	1.15		0.76	0.71
analysis date	09/16/86	10/05/87	09/22/88	02/06/90
CALORIFIC VALUE (dry)				
BTU/lb	11291			11006
analysis date	09/16/86			02/06/90

super-
seded
by
DECS-8

notes: a) Entire sample used for restocking #2 cans.
PSU MCL ash, moisture, sulfur forms.

PSOC-1521 L. HARTSHORNE 1vb, Ro max = 1.61 collection date: 08/22/86							
Split ID	analysis sample 1	# 2 can 15 of 31	30 gal. 3 of 3	30 gal. 3 of 3	30 gal. 3 of 3	30 gal. 3 of 3	30 gal. 3 of 3
size	- 60mesh	- 20mesh	- 1/4"	- 1/4"	- 1/4"	- 1/4"	- 1/4"
% head oxygen			18.8	19.7			
note			a				b
date sealed		08/29/86	08/07/86				
date oxygen/subspl			10/28/88	10/23/89	2/05/91	11/25/91	5/10/93
PROXIMATE							
% moisture	2.7	2.1	2.5	2.6	4.6	2.3	3.4
% ash (dry)	11.2	10.0	11.4	10.0	11.5	18.5	11.5
analysis date	09/26/86	05/13/88	03/07/89	02/06/90	2/08/91	2/21/92	6/15/93
GIESELER FLUIDITY							
max. ddpw	4	0	discon-				
fluid range	38	0	tinued				
analysis date	09/15/86	05/13/88					
SULFUR FORMS (dry %)							
total sulfur	0.80		0.79	0.85	0.84	0.67	0.81
sulfate	0.00		0.19	0.18	0.22	0.10	0.21
pyritic	0.02		0.16	0.15	0.19	0.14	0.09
organic	0.77		0.43	0.52	0.43	0.42	0.50
analysis date	09/26/86		03/07/89	02/06/90	2/08/91	2/21/92	6/15/93
CALORIFIC VALUE (dry)						c	
BTU/lb	13612		13538	13825	13493	11953	13512
analysis date	09/26/86		03/07/89	02/06/90	2/15/91	2/21/92	6/15/93
ALKALI EXTRACTION							
% transmission		99.5	96.1	96.8	99.0	98.0	99.6
analysis date		06/10/88	03/06/89	01/25/90	8/27/91	9/23/92	7/12/93

notes: a) Sample moist, good condition.

b) No visible deterioration.

c) Low calorific value caused in part by high ash in this split.

PSOC-1522		SEMELL		mvb, Ro max = 1.28	
collection date: 08/05/86					
Split ID	analysis sample 1	# 2 can	30 gal.	30 gal.	super-seeded by DECS-13
size	- 60mesh	15 of 31 - 20mesh	3 of 3 - 1/4"	3 of 3 - 1/4"	
% head oxygen			19.1	20.3	
note			a		
date sealed		09/06/86	08/11/86		
date oxygen/subspl			10/28/88	10/23/89	
PROXIMATE					
% moisture	2.5	1.3	2.4	3.5	
% ash (dry)	18.8	18.9	17.9	18.3	
analysis date	09/16/86	05/25/88	03/07/89	03/01/90	
GIESELER FLUIDITY					
max. ddpm	223	6	4	0	
fluid range	72	50	45	0	
analysis date	09/17/86	05/25/88	03/03/89		
SULFUR FORMS (dry %)					
total sulfur	1.17		1.05	1.19	
sulfate	0.10		0.43	0.40	
pyritic	0.42		0.16	0.16	
organic	0.66		0.45	0.63	
analysis date	09/17/86		03/07/89	03/01/90	
CALORIFIC VALUE (dry)					
BTU/lb	12355		12229	12258	
analysis date	09/17/86		03/07/89	03/01/90	
ALKALI EXTRACTION					
% transmission		98.2	98.9	95.8	
analysis date		06/10/88	03/06/89	02/15/90	

notes: a) Sample dry, good condition.

PSOC-1523 #5 BLOCK hvBb, Ro max = 0.92 collection date: 08/06/86							
Split ID	analysis	# 2 can	30 gal.	30 gal.	30 gal.	30 gal.	30 gal.
size	sample 1	15 of 31	3 of 3	3 of 3	3 of 3	3 of 3	3 of 3
% head oxygen	- 60mesh	- 20mesh	- 1/4"	- 1/4"	- 1/4"	- 1/4"	- 1/4"
note			20.1	20.4			
date sealed		09/08/86	a				b
date oxygen/subspl			11/16/88	10/23/89	2/05/91	9/15/92	5/10/93
PROXIMATE							
% moisture	2.6	2.7	2.5	2.9	3.2	3.2	3.2
% ash (dry)	16.1	14.5	15.6	15.9	15.9	16.1	15.8
analysis date	09/25/86	05/26/88	03/07/89	02/28/90	10/03/91	10/14/92	6/14/93
GIESELER FLUIDITY							
max. ddpm	415	10	5	3	2	0	2
fluid range	58	49	33	30	6	0	36
analysis date	09/18/86	05/26/88	03/01/89	02/16/90	8/19/91	9/16/92	8/02/93
SULFUR FORMS (dry %)							
total sulfur	0.71		0.68	0.72	0.71	0.70	0.71
sulfate	0.00		0.06	0.06	0.05	0.09	0.06
pyritic	0.02		0.04	0.03	0.05	0.05	0.02
organic	0.69		0.57	0.63	0.62	0.57	0.63
analysis date	09/25/86		03/07/89	02/28/90	10/03/91	10/14/92	6/14/93
CALORIFIC VALUE (dry)							
BTU/lb	12425		12391	12340	12345	12248	12299
analysis date	09/25/86		03/07/89	02/28/90	10/03/91	10/14/92	6/14/93
ALKALI EXTRACTION							
% transmission		96.3	95.5	90.0	94.6	76.8	93.9
analysis date		06/10/88	03/06/89	02/16/90	8/19/91	9/16/92	8/27/93

notes: a) Sample dry, good condition.

b) No visible deterioration.

PSOC-1524 UPPER KITTANNING hvAb, Ro max = 1.06 collection date: 10/23/86					super- seded by DECS-14
Split ID	analysis	# 2 Can	30 gal.	30 gal.	
size	sample 1	15 of 30	3 of 3	3 of 3	
% head oxygen	- 60mesh	- 20mesh	- 1/4"	-1/4"	
note			20.3	20.4	
date sealed		11/04/86	a		
date oxygen/subspl			11/16/88	10/24/89	
PROXIMATE					
% moisture	1.6	1.5	1.8	2.0	
% ash (dry)	11.0	11.5	10.9	11.5	
analysis date	11/25/86	05/31/88	03/07/89	02/28/90	
GIESELER FLUIDITY					
max. ddpm	30000	4589	3907	752	
fluid range	110	91	88	82	
analysis date	03/17/87	05/31/88	03/03/89	02/19/90	
SULFUR FORMS (dry %)					
total sulfur	1.85		1.76	2.01	
sulfate	0.02		0.18	0.25	
pyritic	1.39		1.08	0.93	
organic	0.44		0.51	0.83	
analysis date	11/25/86		03/07/89	02/28/90	
CALORIFIC VALUE (dry)					
BTU/lb	13656		13469	13378	
analysis date	11/17/86		03/07/89	02/23/90	
ALKALI EXTRACTION					
% transmission		98.3	98.2	93.5	
analysis date		06/10/88	03/08/89	02/19/90	

notes: a) Sample dry, good condition.

PSOC-1532 #4 (Usibelli) subC, Ro max = 0.33 collection date: 09/11/87						
Split ID	analysis sample 1	30 gal. 2 of 2	30 gal. 2 of 2	30 gal. 2 of 2	30 gal. 2 of 2	30 gal. 2 of 2
size	- 60mesh	- 1/4"	- 1/4"	- 1/4"	- 1/4"	- 1/4"
% head oxygen		15.7	17.6			
note		a				b
date sealed						
date oxygen/subspl		11/16/88	10/24/89	2/05/91	11/25/91	5/10/93
PROXIMATE						
% moisture	23.7	24.3	25.8	26.9	25.3	26.2
% ash (dry)	9.5	9.2	10.7	9.6	7.9	10.1
analysis date	11/12/87	03/08/89	02/06/90	2/08/91	2/21/92	6/14/93
SULFUR FORMS (dry %)						
total sulfur	0.22	0.17	0.18	0.23	0.20	(c) 0.20
sulfate	0.02	0.01	0.01	0.01	0.00	0.02
pyritic	0.05	0.03	0.04	0.02	0.01	0.03
organic	0.16	0.13	0.13	0.20	0.18	0.15
analysis date	11/12/87	03/08/89	02/06/90	2/08/91	2/21/92	6/14/93
CALORIFIC VALUE (dry)						
BTU/lb	10867	10705	10589	10530	10599	10444
analysis date	11/12/87	03/08/89	02/06/90	2/15/91	2/21/92	6/14/93

notes: a) Sample moist, good condition

b) Sample moist at bottom of barrel; trace white coatings.

c) Changed from reported total S value of 1.96% which was 10 times too high.

PSOC-1533 #3 (Usibelli) ligA, Ro max = 0.35 collection date: 09/11/87						
Split ID	analysis	30 gal.	30 gal.	30 gal.	30 gal.	30 gal.
size	sample 1	2 of 2	2 of 2	2 of 2	2 of 2	2 of 2
% head oxygen	- 60mesh	- 1/4"	- 1/4"	- 1/4"	- 1/4"	- 1/4"
note		17.2	18.6			
date sealed		a				b
date oxygen/subspl		11/16/88	10/24/89	2/05/91	11/25/91	5/10/93
PROXIMATE						
% moisture	26.4	26.4	28.3	29.8	27.9	28.8
% ash (dry)	8.3	8.3	9.1	8.2	7.5	8.6
analysis date	12/11/87	03/07/89	02/06/90	2/08/91	2/21/92	6/14/93
SULFUR FORMS (dry %)						
total sulfur	0.16	0.10	0.10	0.16	0.11	(c)
sulfate	0.02	0.01	0.02	0.01	0.01	0.02
pyritic	0.05	0.03	0.04	0.02	0.02	0.04
organic	0.09	0.05	0.04	0.12	0.08	0.08
analysis date	12/11/87	03/07/89	02/06/90	2/08/91	2/21/92	6/14/93
CALORIFIC VALUE (dry)						
BTU/lb	10620	10523	10466	10434	10426	10388
analysis date	12/11/87	03/07/89	02/06/90	2/15/91	2/21/92	6/14/93

notes: a) Sample moist, good condition.

b) Sample dry at top of barrel, moist below; trace brown coatings

c) Changed from reported total S value of 1.36% which was 10 times too high.

PSOC-1534 WATERFALL subC, Ro max = 0.28 collection date: 09/14/87						
Split ID	analysis	30 gal.	30 gal.	30 gal.	30 gal.	30 gal.
size	sample 1	2 of 2	2 of 2	2 of 2	2 of 2	2 of 2
% head oxygen	- 60mesh	- 1/4"	- 1/4"	- 1/4"	- 1/4"	- 1/4"
note		13.6	15.2			
date sealed		a				b
date oxygen/subspl		11/16/88	10/24/89	2/05/91	11/25/91	5/10/93
PROXIMATE						
% moisture	21.8	23.1	23.8	24.9	23.7	23.8
% ash (dry)	11.1	10.8	11.4	11.5	8.3	11.5
analysis date	11/12/87	03/07/89	02/06/90	2/08/91	2/21/92	5/10/93
SULFUR FORMS (dry %)						
total sulfur	0.15	0.13	0.12	0.17	0.16	0.14
sulfate	0.01	0.02	0.01	0.01	0.01	0.01
pyritic	0.05	0.01	0.01	0.02	0.01	0.01
organic	0.09	0.10	0.09	0.14	0.14	0.13
analysis date	11/12/87	03/07/89	02/06/90	2/08/91	2/21/92	5/10/93
CALORIFIC VALUE (dry)						
BTU/lb	11082	10965	10832	10753	10979	10657
analysis date	11/12/87	03/07/89	02/06/90	2/15/91	2/21/92	6/14/93

notes: a) Sample moist, good condition.

b) Sample moist at bottom of barrel; trace white crystals and brown coatings.

PSOC-1535 DEADFALL SYNCLINE #4 subA, Ro max = 0.73 collection date: 10/08/87							
Split ID	analysis sample 1	# 2 Can	30 gal.	30 gal.	30 gal.	30 gal.	30 gal.
size	- 60mesh	- 20mesh	2 of 2	2 of 2	2 of 2	2 of 2	2 of 2
% head oxygen			- 1/4"	- 1/4"	- 1/4"	- 1/4"	- 1/4"
note			20.8	19.2			
date sealed		12/14/87	a				c
date oxygen/subspl			11/16/88	10/25/89	2/05/91	11/25/91	5/10/93
PROXIMATE							
% moisture	10.1	10.2	10.1	10.6	11.5	10.4	10.1
% ash (dry)	3.3	3.4	3.4	3.7	3.5	3.4	3.4
analysis date	12/23/87	06/14/88	03/07/89	02/06/90	2/08/91	2/21/92	5/10/93
GIESELER FLUIDITY							
max. ddpm	0	discon-					
fluid range	0	tinued					
analysis date							
SULFUR FORMS (dry %)	(b)						
total sulfur	0.15		0.16	0.13	0.16	0.23	0.17
sulfate	0.02		0.01	0.01	0.01	0.01	0.00
pyritic	0.01		0.01	0.01	0.04	0.02	0.01
organic	0.18		0.14	0.12	0.11	0.21	0.16
analysis date	12/23/87		03/07/89	02/06/90	2/08/91	2/21/92	5/10/93
CALORIFIC VALUE (dry)							
BTU/lb	12107		12085	12074	12050	12069	11978
analysis date	12/23/87		03/07/89	02/06/90	2/15/91	2/21/92	5/10/93
ALKALI EXTRACTION							
% transmission		0.1	discon-				
analysis date		06/16/88	tinued				

notes: a) Sample dry, good condition.

b) Changed from reported total S value of 1.46 which
was 10 times too high.

c) Trace white acicular crystals.

APPENDIX B

**Coal Data Base Printouts of
DECS Samples**

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-1
SEAM NAME -> BOTTOM
ALTERNATE SEAM NAME ->
APPARENT RANK -> SUBBIT C

SAMPLE HISTORY:

SAMPLING DATE & AGENCY -> 12/11/89 ; PSU

SAMPLE TYPE -> CHANNEL-WHOLE SEAM

ADDITIONAL INFORMATION ->

MINE INFORMATION:

RESERVES ->

ANNUAL PRODUCTION -> 5500 THOUSAND TONS

SAMPLE LOCATION:

COUNTRY -> USA
STATE -> TEXAS
COUNTY -> FREESTONE
TOWNSHIP ->
CITY -> FAIRFIELD

COAL PROVINCE-> GULF
REGION ->

MAP REFERENCE: LATITUDE -> 31 D 51 M 10 S
LONGITUDE -> 96 D 3 M 59 S
QUADRANGLE-> YOUNG (7.5')

** PENN STATE COAL DATA BASE **

**
** DECS-1 **
**
** 11/16/93 **
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SEAM INFORMATION:

AGE OF SEAM -> EOCENE
GROUP -> Upper Wilcox
FORMATION -> Upper Calvert Bluff
SEAM THICKNESS -> 9 FT. 6 IN.

** SEAM PROFILE **

ROOF -> gr. siltstone
2 IN. -> dull, brown, fibrous
41 IN. -> moderately bright, black
1 IN. -> dull, brown, thickness varies
68 IN. -> moderately bright, black
2 IN. -> dull, brown, fibrous
FLOOR -> brown shale w/coaly stringers

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-1
SEAM NAME -> BOTTOM
ALTERNATE SEAM NAME ->
APPARENT RANK -> SUBBIT C

SAMPLE LOCATION:

COUNTRY -> USA
STATE -> TEXAS

** PENN STATE COAL DATA BASE **

**
** DECS-1 **
**
** 11/16/93 **
** PAGE 2 **

* * * * * C H E M I C A L D A T A * * * * *

PROXIMATE ANALYSIS	AS REC'D	DRY	DAF	DMMF(PARR)
% MOISTURE	30.00			
% ASH	11.07	15.81		
% VOLATILE	33.18	47.40	56.30	55.52
% FIXED CARBON	25.75	36.79	43.70	44.48

% EQUILIBRIUM MOISTURE = 31.47
MM-FREE = 35.89

ULTIMATE ANALYSIS	AS REC'D	DRY	DAF	DMMF(PARR)	ELEMENTAL ANALYSIS	DRY	DMMF(MOD.P)	DMMF(DIR.)
% ASH	11.07	15.81		(17.62%MM)			(17.97%MM)	(%MM)
% CARBON	43.77	62.53	74.27	75.90	% CARBON	62.45	76.13	
% HYDROGEN	3.32 (*)	4.75	5.64	5.77	% HYDROGEN	4.55	5.54	
% NITROGEN	0.86	1.23	1.46	1.49	% NITROGEN	1.23	1.50	
% TOTAL SULFUR	0.69	0.99	1.18		% ORGANIC SULFUR	0.86	1.05	
% OXYGEN(DIFF)	10.28 (*)	14.69	17.45	16.84	% OXYGEN(DIFF)	12.94	15.78	
					% MINERAL MATTER (INCL. 0.21% FES2)	17.97		

(*)-EXCLUDES MOISTURE

SULFUR FORMS	% PYRITIC	% SULFATIC	% ORGANIC	% TOTAL
DRY	0.11	0.01	0.86	0.99
DAF	0.13	0.01	1.02	1.18

DRY % CHLORINE = 0.11 DRY % CO2 = 0.29
MOTT-SPOONER DIFFERENCE = -115.

CALORIFIC VALUE (GROSS, BTU/LB)	DRY	AS REC'D MOIST.	EQUIL. MOIST.	ATOM RATIOS (DMMF)	PARR	MOD.PARR	DIRECT
MM-CONTAINING	10956.	7669.	7508.	ATOMIC H/C	0.9124	0.8744	
MM-FREE (PARR)	13239.	8709.	8501.	ATOMIC O/C	0.1665	0.1556	
MM-FREE (MOD. P)	13349.	8768.	8558.				
NET CV, DMMF BTU/LB	12812.						

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-1
 SEAM NAME -> BOTTOM
 ALTERNATE SEAM NAME ->
 APPARENT RANK -> SUBBIT C

SAMPLE LOCATION:

COUNTRY -> USA
 STATE -> TEXAS

** PENN STATE COAL DATA BASE **
 ** DECS-1 **
 ** 11/16/93 **
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***** RANK CALCULATIONS *****

APPARENT RANK (AS REC'D MOIST.) -> SUBBIT C INTERNATIONAL RANK :
 AS REC'D MOIST. ->
 ASTM RANK (EQUIL. MOIST.) -> SUBBIT C EQUIL. MOIST. ->
 REFLECTANCE RANK CATEGORY -> REPORTED RANK : -> LIGNITE

***** PETROGRAPHIC DATA *****

MACERAL COMPOSITION (WHITE LIGHT AND FLUORESCENCE ANALYSIS)

	TEXT- INITE	ULM- INITE	HUMO- DETRINITE	GEL- INITE	CORPO- HUMINITE	SPOR- INITE	CUT- INITE	RES- INITE	ALG- INITE	FUS- INITE	SEMI- FUSINITE	MAC- RINITE	SCLERO- TINITE	
DMMF VOL. %	0.0	25.4	45.5	0.4	7.1	13.2	0.2	1.5	0.0	1.3	1.8	2.9	0.7	
DRY WT. %	0.0	20.9	37.5	0.3	5.8	10.9	0.2	1.2	0.0	1.1	1.5	2.4	0.6	17.6 % MM.
DMMF VOL % HUMINITE = 78.4														

ULMINITE REFLECTANCE DATA: HIGH: 0.51 LOW: 0.20 MEAN-MAX: 0.35

***** C A K I N G A N D M E C H A N I C A L P R O P E R T I E S *****

GIESELER COAL PLASTOMETER:

INIT. SOFTENING TEMP

TEMP. MAX. FLUIDITY

SOLIDIFICATION TEMP.

FLUID TEMP. RANGE

MAXIMUM FLUIDITY

WASHABILITY DATA AVAILABLE? NO

GRAY-KING COKE TYPE

HARDGROVE GRINDABILITY 68.2

FREE SWELLING INDEX 1.0

VICKERS HARDNESS NUMBER

SAMPLE IDENTIFICATION:

 PSU NUMBER -> DECS-1
 SEAM NAME -> BOTTOM
 ALTERNATE SEAM NAME ->
 APPARENT RANK -> SUBBIT C

SAMPLE LOCATION:

 COUNTRY -> USA
 STATE -> TEXAS

** PENN STATE COAL DATA BASE **

 ** DECS-1 **
 **
 ** 11/16/93 **
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MAJOR ELEMENT ANALYSIS

% HTA = 17.14

	SI02	AL203	TI02	FE203	MGO	CAO	NA2O	K2O	P2O5	S03
OXIDE % OF HTA	45.6	17.0	1.26	4.18	2.68	5.50	0.42	0.60	0.23	12.7
ELEMENT % OF TOTAL DRY COAL	SI	AL	TI	FE	MG	CA	NA	K	P	S
	3.7	1.5	0.13	0.50	0.28	0.67	0.05	0.09	0.02	1.0

TRACE ELEMENT ANALYSIS

% HTA = 17.14

	PPM HTA	PPM TOTAL COAL		PPM HTA	PPM TOTAL COAL		PPM HTA	PPM TOTAL COAL	VOLATILES -----	PPM TOTAL COAL
AG			GE			SN			AS	
B			LA			SR	2960.	507.	BR	
BA	1344.	230.	LI			TH			CD	
BE	5.0	0.9	MN	1239.	212.	U			CL	1100.
BI			MO			V	35.	6.	F	
CE			NB			Y			HG	
CO			NI	< 25.	< 4.	YB			SB	
CR	95.	16.	PB			ZN	50.	9.	SE	
CU	130.	22.	RB	30.	5.	ZR	270.	46.		
GA			SC							

SAMPLE IDENTIFICATION:

 PSU NUMBER -> DECS-1
 SEAM NAME -> BOTTOM
 ALTERNATE SEAM NAME ->
 APPARENT RANK -> SUBBIT C

SAMPLE LOCATION:

 COUNTRY -> USA
 STATE -> TEXAS

** PENN STATE COAL DATA BASE **
 ** DECS-1 **
 ** 11/16/93 **
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ASH FUSION TEMPERATURES (ALL TEMPERATURES IN DEGREES F)

	REDUCING	OXIDIZING
INITIAL DEFORMATION	1840.	2120.
SOFTENING	2000.	2220.
HEMISPHERICAL	2060.	2280.
FLUID	2100.	2330.

SAMPLE IDENTIFICATION:

 PSU NUMBER -> DECS-2
 SEAM NAME -> ILLINOIS #6
 ALTERNATE SEAM NAME -> HERRIN
 APPARENT RANK -> HVC

SAMPLE LOCATION:

 COUNTRY -> USA
 STATE -> ILLINOIS
 COUNTY -> RANDOLPH
 TOWNSHIP ->
 CITY -> SPARTA
 COAL PROVINCE -> INTERIOR
 REGION -> EASTERN

** PENN STATE COAL DATA BASE **

**
 ** DECS-2 **
 **
 ** 11/16/93 **
 ** PAGE 1 **

SAMPLE HISTORY:

 SAMPLING DATE & AGENCY -> 12/13/89 ; PSU

SAMPLE TYPE -> CHANNEL-WHOLE SEAM

ADDITIONAL INFORMATION -> Bright clarain except 4 pyritic bands not sampled

MAP REFERENCE: LATITUDE -> 38 D 9 M 27 S
 LONGITUDE -> 89 D 43 M 19 S
 QUADRANGLE -> Tilden (7.5')

MINE INFORMATION:

 RESERVES ->

ANNUAL PRODUCTION ->

LIFE EXPECTANCY ->

MINING METHOD -> STRIP

SEAM INFORMATION:

 AGE OF SEAM -> PENNSYL.

GROUP -> Kewanee

FORMATION -> Carbondale

SEAM THICKNESS -> 6 FT. 3 IN.

SAMPLE IDENTIFICATION:

SAMPLE LOCATION:

** PENN STATE COAL DATA BASE **

PSU NUMBER -> DECS-2
 SEAM NAME -> ILLINOIS #6
 ALTERNATE SEAM NAME -> HERRIN
 APPARENT RANK -> HVC

COUNTRY -> USA
 STATE -> ILLINOIS

** DECS-2 **
 ** 11/16/93 **
 ** PAGE 2 **

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* * * * * C H E M I C A L D A T A * * * * *

PROXIMATE ANALYSIS	AS REC'D	DRY	DAF	DMMF(PARR)
% MOISTURE	10.43			% EQUILIBRIUM MOISTURE = 11.51
% ASH	14.47	16.16		MM-FREE = 13.89
% VOLATILE	34.16	38.14	45.49	43.77
% FIXED CARBON	40.93	45.70	54.51	56.23

ULTIMATE ANALYSIS	AS REC'D	DRY	DAF	DMMF(PARR)	ELEMENTAL ANALYSIS	DRY	DMMF(MOD.P)	DMMF(DIR.)
% ASH	14.47	16.16		(19.94%MM)			(19.39%MM)	(%MM)
% CARBON	58.66	65.49	78.11	81.80	% CARBON	65.31	81.02	
% HYDROGEN	4.08 (*)	4.56	5.44	5.70	% HYDROGEN	4.40	5.45	
% NITROGEN	0.99	1.11	1.32	1.39	% NITROGEN	1.11	1.38	
% TOTAL SULFUR	4.05	4.52	5.39		% ORGANIC SULFUR	2.24	2.78	
% OXYGEN(DIFF)	7.31 (*)	8.16	9.73	11.12	% OXYGEN(DIFF)	7.56	9.37	
(*)-EXCLUDES MOISTURE					% MINERAL MATTER	19.39		
					(INCL. 4.25% FES2)			

SULFUR FORMS	% PYRITIC	% SULFATIC	% ORGANIC	% TOTAL
DRY	2.27	0.01	2.24	4.52
DAF	2.71	0.01	2.67	5.39

DRY % CHLORINE = 0.12 DRY % CO2 = 0.66
 MOTT-SPOONER DIFFERENCE = 24.

CALORIFIC VALUE (GROSS, BTU/LB)	DRY	AS REC'D MOIST.	EQUIL. MOIST.	ATOM RATIOS (DMMF)	PARR	MOD.PARR	DIRECT
MM-CONTAINING	11880.	10641.	10513.	ATOMIC H/C	0.8363	0.8083	
MM-FREE (PARR)	14556.	12708.	12522.	ATOMIC O/C	0.1020	0.0869	
MM-FREE (MOD. P)	14585.	12744.	12559.				
NET CV, DMMF BTU/LB	14061.						

SAMPLE IDENTIFICATION:

SAMPLE LOCATION:

** PENN STATE COAL DATA BASE **

PSU NUMBER -> DECS-2
 SEAM NAME -> ILLINOIS #6
 ALTERNATE SEAM NAME -> HERRIN
 APPARENT RANK -> HVC

COUNTRY -> USA
 STATE -> ILLINOIS

**
 ** DECS-2 **
 **
 ** 11/16/93 **
 ** PAGE 3 **

***** RANK CALCULATIONS *****

APPARENT RANK (AS REC'D MOIST.) -> HVC
 ASTM RANK (EQUIL. MOIST.) -> HVC
 REFLECTANCE RANK CATEGORY -> HVC

INTERNATIONAL RANK :
 AS REC'D MOIST. ->
 EQUIL. MOIST. ->

REPORTED RANK : -> HVC

***** PETROGRAPHIC DATA *****

MACERAL COMPOSITION (WHITE LIGHT AND FLUORESCENCE ANALYSIS)

	VITRINITE	PSEUDO-VITRINITE	FUSINITE	SEMI-FUSINITE	MACRINITE	MICRINITE	SCLERO-TINITE	SPORINITE	RESINITE	ALGINITE	CUTINITE
DMMF VOL. %	86.7	0.0	1.1	2.2	1.7	0.2	0.0	6.9	0.2	0.1	0.8
DRY VOL. %	77.4	0.0	1.0	2.0	1.5	0.2	0.0	6.2	0.2	0.1	10.7 % MM
DRY WT. %	70.0	0.0	1.0	1.9	1.5	0.2	0.0	4.7	0.1	0.1	19.9 % MM

REFLECTANCE DATA

VITRINITE :

HIGH: 0.65 LOW: 0.42 MEAN-MAX: 0.52

VITRINITE TYPES

V 4 V 5 V 6

PERCENT 33.0 62.0 5.0

***** CAKING AND MECHANICAL PROPERTIES *****

GIESELER COAL PLASTOMETER:

GRAY-KING COKE TYPE

INIT. SOFTENING TEMP 385

HARDGROVE GRINDABILITY 57.8

TEMP. MAX. FLUIDITY 411

FREE SWELLING INDEX 3.5

SOLIDIFICATION TEMP. 432

VICKERS HARDNESS NUMBER

FLUID TEMP. RANGE 47

MAXIMUM FLUIDITY 8

WASHABILITY DATA AVAILABLE? NO

SAMPLE IDENTIFICATION:

 PSJ NUMBER -> DECS-2
 SEAM NAME -> ILLINOIS #6
 ALTERNATE SEAM NAME -> HERRIN
 APPARENT RANK -> HVC

SAMPLE LOCATION:

 COUNTRY -> USA
 STATE -> ILLINOIS

** PENN STATE COAL DATA BASE **

**
 ** DECS-2 **
 **
 ** 11/16/93 **
 ** PAGE 4 **

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MAJOR ELEMENT ANALYSIS

% HTA = 15.97

	SI02	AL203	TI02	FE203	MGO	CAO	NA2O	K2O	P2O5	SO3
OXIDE % OF HTA	49.2	19.1	0.89	20.4	0.82	5.18	0.71	1.87	0.17	1.60
	SI	AL	TI	FE	MG	CA	NA	K	P	S
ELEMENT % OF TOTAL DRY COAL	3.7	1.6	0.09	2.3	0.08	0.59	0.08	0.25	0.01	4.52

TRACE ELEMENT ANALYSIS

% HTA = 15.97

	PPM HTA	PPM TOTAL COAL		PPM HTA	PPM TOTAL COAL		PPM HTA	PPM TOTAL COAL	VOLATILES -----	PPM TOTAL COAL
AG			GE			SN			AS	
B			LA			SR	254.	41.	BR	
BA	269.	43.	LI			TH			CD	
BE	8.0	1.3	MN	387.	62.	U			CL	1200.
BI			MO			V	20.	3.	F	
CE			NB			Y			HG	
CO			NI	85.	14.	YB			SB	
CR	130.	21.	PB			ZN	610.	97.	SE	
CU	60.	10.	RB	90.	14.	ZR	160.	26.		
GA			SC							

SAMPLE IDENTIFICATION:

 PSU NUMBER -> DECS-2
 SEAM NAME -> ILLINOIS #6
 ALTERNATE SEAM NAME -> HERRIN
 APPARENT RANK -> HVC

SAMPLE LOCATION:

 COUNTRY -> USA
 STATE -> ILLINOIS

** PENN STATE COAL DATA BASE **

**
 ** DECS-2 **
 **
 ** 11/16/93 **
 ** PAGE 5 **

ASH FUSION TEMPERATURES (ALL TEMPERATURES IN DEGREES F)

	REDUCING	OXIDIZING
INITIAL DEFORMATION	1900.	2240.
SOFTENING	2035.	2340.
HEMISPHERICAL	2100.	2400.
FLUID	2180.	2450.

SAMPLE IDENTIFICATION:

 PSU NUMBER -> DECS-3
 SEAM NAME -> COAL BASIN M
 ALTERNATE SEAM NAME -> DUTCH CREEK
 APPARENT RANK -> MED VOL

SAMPLE HISTORY:

 SAMPLING DATE & AGENCY -> 5/31/90 ;

SAMPLE TYPE -> CHANNEL-WHOLE SEAM

ADDITIONAL INFORMATION ->

MINE INFORMATION:

 RESERVES ->

ANNUAL PRODUCTION ->

SEAM INFORMATION:

 AGE OF SEAM -> U. CRET.
 GROUP -> MESAVERDE
 FORMATION -> WILLIAMS FORK
 SEAM THICKNESS -> 9 FT. 0 IN.

SAMPLE LOCATION:

 COUNTRY -> USA

STATE -> COLORADO

COUNTY -> GUNNISON

TOWNSHIP ->

CITY -> REDSTONE

COAL PROVINCE-> ROCKY MOUNTAIN
 REGION -> UINTA

MAP REFERENCE: LATITUDE -> 39 D 11 M 13 S
 LONGITUDE -> 107 D 22 M 7 S
 QUADRANGLE-> PLACITA (7.5')

LIFE EXPECTANCY ->

MINING METHOD -> UNDERGROUND

** PENN STATE COAL DATA BASE **

 ** DECS-3 **
 **
 ** 11/16/93 **
 ** PAGE 1 **

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-3
SEAM NAME -> COAL BASIN M
ALTERNATE SEAM NAME -> DUTCH CREEK
APPARENT RANK -> MED VOL

SAMPLE LOCATION:

COUNTRY -> USA
STATE -> COLORADO

** PENN STATE COAL DATA BASE **
** DECS-3 **
** 11/16/93 **
** PAGE 2 **

* * * * * C H E M I C A L D A T A * * * * *

<u>PROXIMATE ANALYSIS</u>	<u>AS REC'D</u>	<u>DRY</u>	<u>DAF</u>	<u>DMMF(PARR)</u>
% MOISTURE	1.10			
% ASH	5.31	5.37		
% VOLATILE	26.89	27.19	28.73	28.24
% FIXED CARBON	66.70	67.44	71.27	71.76

% EQUILIBRIUM MOISTURE = 1.53
MM-FREE = 1.63

<u>ULTIMATE ANALYSIS</u>	<u>AS REC'D</u>	<u>DRY</u>	<u>DAF</u>	<u>DMMF(PARR)</u>	<u>ELEMENTAL ANALYSIS</u>	<u>DRY</u>	<u>DMMF(MOD.P)</u>	<u>DMMF(DIR.)</u>
% ASH	5.31	5.37		(6.16%MM)			(6.15%MM)	(%MM)
% CARBON	81.77	82.68	87.37	88.10	% CARBON	82.39	87.78	
% HYDROGEN	5.50 (*)	5.56	5.88	5.92	% HYDROGEN	5.49	5.85	
% NITROGEN	1.63	1.65	1.74	1.76	% NITROGEN	1.65	1.76	
% TOTAL SULFUR	0.64	0.65	0.69		% ORGANIC SULFUR	0.54	0.58	
% OXYGEN(DIFF)	4.05 (*)	4.09	4.32	4.21	% OXYGEN(DIFF)	3.78	4.03	
(*)-EXCLUDES MOISTURE					% MINERAL MATTER (INCL. 0.19% FES2)	6.15		

<u>SULFUR FORMS</u>	<u>% PYRITIC</u>	<u>% SULFATIC</u>	<u>% ORGANIC</u>	<u>% TOTAL</u>
DRY	0.10	0.01	0.54	0.65
DAF	0.11	0.01	0.57	0.69

DRY % CHLORINE = 0.07 DRY % CO2 = 1.08
MOTT-SPOONER DIFFERENCE = -168.

<u>CALORIFIC VALUE</u> (GROSS, BTU/LB)	<u>DRY</u>	<u>AS REC'D</u> <u>MOIST.</u>	<u>EQUIL.</u> <u>MOIST.</u>	<u>ATOM RATIOS (DMMF)</u>	<u>PARR</u>	<u>MOD.PARR</u>	<u>DIRECT</u>
MM-CONTAINING	14889.	14725.	14661.	ATOMIC H/C	0.8077	0.8007	
MM-FREE (PARR)	15831.	15646.	15573.	ATOMIC O/C	0.0359	0.0345	
MM-FREE (MOD. P)	15859.	15673.	15601.				
NET CV, DMMF BTU/LB	15310.						

SAMPLE IDENTIFICATION:

SAMPLE LOCATION:

** PENN STATE COAL DATA BASE **

PSU NUMBER -> DECS-3
 SEAM NAME -> COAL BASIN M
 ALTERNATE SEAM NAME -> DUTCH CREEK
 APPARENT RANK -> MED VOL

COUNTRY -> USA
 STATE -> COLORADO

** **
 ** DECS-3 **
 ** **
 ** 11/16/93 **
 ** PAGE 3 **

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***** RANK CALCULATIONS *****

APPARENT RANK (AS REC'D MOIST.) -> MED VOL INTERNATIONAL RANK :
 AS REC'D MOIST. ->
 ASTM RANK (EQUIL. MOIST.) -> MED VOL EQUIL. MOIST. ->
 REFLECTANCE RANK CATEGORY -> MED VOL REPORTED RANK : -> MED VOL

***** PETROGRAPHIC DATA *****

MACERAL COMPOSITION (WHITE LIGHT ANALYSIS)

	VITRINITE	PSEUDO-VITRINITE	FUSINITE	SEMI-FUSINITE	MACRINITE	MICRINITE	SCLERO-TINITE	SPOR-INITE	RESINITE	ALGINITE	CUTINITE	
DMMF VOL. %	94.4	0.0	1.2	2.0	2.2	0.0	0.0	0.0	0.2	0.0	0.0	
DRY VOL. %	91.5	0.0	1.2	1.9	2.1	0.0	0.0	0.0	0.2	0.0	0.0	3.1 % MM
DRY WT. %	88.1	0.0	1.3	2.0	2.2	0.0	0.0	0.0	0.2	0.0	0.0	6.2 % MM

REFLECTANCE DATA

VITRINITE :

HIGH: 1.38 LOW: 1.19 MEAN-MAX: 1.28

VITRINITE TYPES

V11 V12 V13

PERCENT

1.0 72.0 27.0

***** CAKING AND MECHANICAL PROPERTIES *****

GIESELER COAL PLASTOMETER:

INIT. SOFTENING TEMP 399
 TEMP. MAX. FLUIDITY 461
 SOLIDIFICATION TEMP. 499
 FLUID TEMP. RANGE 100
 MAXIMUM FLUIDITY 9774
 WASHABILITY DATA AVAILABLE? NO

GRAY-KING COKE TYPE

HARDGROVE GRINDABILITY 103.0
 FREE SWELLING INDEX 9.0
 VICKERS HARDNESS NUMBER

SAMPLE IDENTIFICATION:

SAMPLE LOCATION:

** PENN STATE COAL DATA BASE **

PSU NUMBER -> DECS-3
SEAM NAME -> COAL BASIN M
ALTERNATE SEAM NAME -> DUTCH CREEK
APPARENT RANK -> MED VOL

COUNTRY -> USA
STATE -> COLORADO

**
** DECS-3
**
** 11/16/93
** PAGE 4
**

MAJOR ELEMENT ANALYSIS

% HTA = 5.26

	SI02	AL203	TI02	FE203	MGO	CAO	NA2O	K2O	P2O5	SO3
OXIDE % OF HTA	24.8	22.7	0.82	10.8	3.52	9.40	2.84	0.33	0.90	13.7
ELEMENT % OF TOTAL DRY COAL	SI	AL	TI	FE	MG	CA	NA	K	P	S
	0.6	0.6	0.03	0.4	0.11	0.35	0.11	0.01	0.02	0.6

TRACE ELEMENT ANALYSIS

% HTA = 5.26

	PPM HTA	PPM TOTAL COAL		PPM HTA	PPM TOTAL COAL		PPM HTA	PPM TOTAL COAL	VOLATILES -----	PPM TOTAL COAL
AG			GE			SN			AS	
B			LA			SR	3805.	200.	BR	
BA	5464.	287.	LI			TH			CD	
BE	4.0	0.2	MN	310.	16.	U			CL	700.
BI			MO			V	110.	6.	F	
CE			NB			Y			HG	
CO			NI	< 25.	< 1.	YB			SB	
CR	60.	3.	PB			ZN	65.	3.	SE	
CU	110.	6.	RB	20.	1.	ZR	150.	8.		
GA			SC							

SAMPLE IDENTIFICATION:

 PSU NUMBER -> DECS-3
 SEAM NAME -> COAL BASIN M
 ALTERNATE SEAM NAME -> DUTCH CREEK
 APPARENT RANK -> MED VOL

SAMPLE LOCATION:

 COUNTRY -> USA
 STATE -> COLORADO

** PENN STATE COAL DATA BASE **

**
 ** DECS-3 **
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 ** 11/16/93 **
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ASH FUSION TEMPERATURES (ALL TEMPERATURES IN DEGREES F)

 REDUCING OXIDIZING
 INITIAL DEFORMATION 2020. 2270.
 SOFTENING 2130. 2365.
 HEMISPHERICAL 2200. 2420.
 FLUID 2250. 2460.

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-4
SEAM NAME -> BLUE
ALTERNATE SEAM NAME -> #1
APPARENT RANK -> HVC

SAMPLE HISTORY:

SAMPLING DATE & AGENCY -> 6/ 4/90 ; PSU

SAMPLE TYPE -> CHANNEL-WHOLE SEAM

ADDITIONAL INFORMATION ->

MINE INFORMATION:

RESERVES ->

ANNUAL PRODUCTION ->

SAMPLE LOCATION:

COUNTRY -> USA
STATE -> NEW MEXICO
COUNTY -> MCKINLEY
TOWNSHIP ->
CITY -> WINDOW ROCK, AZ

COAL PROVINCE -> ROCKY MOUNTAIN
REGION -> SAN JUAN RIVER

MAP REFERENCE: LATITUDE -> 35 D 42 M 53 S
LONGITUDE -> 108 D 55 M 22 S
QUADRANGLE -> TSE BONITA SCHOOL (7.5')

** PENN STATE COAL DATA BASE **

** DECS-4 **
** 11/16/93 **
** PAGE 1 **

LIFE EXPECTANCY ->

MINING METHOD -> STRIP

SEAM INFORMATION:

AGE OF SEAM -> CRET.
GROUP -> MESAVERDE
FORMATION -> GALLUP SANDSTONE
SEAM THICKNESS -> 4 FT. 5 IN.

** SEAM PROFILE **

ROOF -> finely bedded med.-gray siltst
8 IN. -> bright clarain
0 IN. -> 1/2" blk silty mudstn SAMPLED
21 IN. -> bright clarain, resin visible
10 IN. -> bright clarain
14 IN. -> bright clarain, wht cleat min.
FLOOR -> brn-dark gray mudstone & coal

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-4
SEAM NAME -> BLUE
ALTERNATE SEAM NAME -> #1
APPARENT RANK -> HVC

SAMPLE LOCATION:

COUNTRY -> USA
STATE -> NEW MEXICO

** PENN STATE COAL DATA BASE **

** DECS-4 **
** 11/16/93 **
** PAGE 2 **

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* * * * * C H E M I C A L D A T A * * * * *

PROXIMATE ANALYSIS AS REC'D DRY DAF DMMF(PARR)

% MOISTURE	15.13				% EQUILIBRIUM MOISTURE = 15.61
% ASH	5.29	6.23			MM-FREE = 16.60
% VOLATILE	38.56	45.43	48.45	48.11	
% FIXED CARBON	41.03	48.34	51.55	51.89	

ULTIMATE ANALYSIS AS REC'D DRY DAF DMMF(PARR) ELEMENTAL ANALYSIS DRY DMMF(MOD.P.) DMMF(DIR.)

% ASH	5.29	6.23		(6.98%MM)	% CARBON	73.12	78.69	(7.08%MM) (%MM)
% CARBON	62.29	73.40	78.28	78.91	% HYDROGEN	5.33	5.74	
% HYDROGEN	4.59 (*)	5.41	5.77	5.82	% NITROGEN	1.20	1.29	
% NITROGEN	1.02	1.20	1.28	1.29	% ORGANIC SULFUR	0.41	0.44	
% TOTAL SULFUR	0.39	0.46	0.49		% OXYGEN(DIFF)	12.86	13.84	
% OXYGEN(DIFF)	11.29 (*)	13.30	14.18	13.99	% MINERAL MATTER (INCL. 0.07% FES2)	7.08		

(*)-EXCLUDES MOISTURE

SULFUR FORMS % PYRITIC % SULFATIC % ORGANIC % TOTAL

DRY	0.04	0.02	0.41	0.46
DAF	0.04	0.02	0.44	0.49

DRY % CHLORINE = 0.04 DRY % CO2 = 1.01

MOTT-SPOONER DIFFERENCE = -37.

CALORIFIC VALUE
(GROSS, BTU/LB)

DRY AS REC'D
MOIST. MOIST.

ATOM RATIOS (DMMF) PARR MOD.PARR DIRECT

MM-CONTAINING	13000.	11033.	10971.
MM-FREE (PARR)	13951.	11707.	11637.
MM-FREE (MOD. P)	13988.	11736.	11666.
NET CV, DMMF BTU/LB	13448.		

ATOMIC H/C	0.8853	0.8754
ATOMIC O/C	0.1331	0.1320

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-4
SEAM NAME -> BLUE
ALTERNATE SEAM NAME -> #1
APPARENT RANK -> HVC

SAMPLE LOCATION:

COUNTRY -> USA
STATE -> NEW MEXICO

** PENN STATE COAL DATA BASE **

** DECS-4 **
** 11/16/93 **
** PAGE 3 **

***** RANK CALCULATIONS *****

APPARENT RANK (AS REC'D MOIST.) -> HVC
ASTM RANK (EQUIL. MOIST.) -> HVC
REFLECTANCE RANK CATEGORY -> HVC
INTERNATIONAL RANK :
AS REC'D MOIST. ->
EQUIL. MOIST. ->
REPORTED RANK : -> HVC

***** PETROGRAPHIC DATA *****

MACERAL COMPOSITION (WHITE LIGHT AND FLUORESCENCE ANALYSIS)

	VITRINITE	PSEUDO-VITRINITE	FUSINITE	SEMI-FUSINITE	MACRINITE	MICRINITE	SCLEROTINITE	SPORINITE	RESINITE	ALGINITE	CUTINITE
DMMF VOL. %	87.7	0.0	1.5	3.5	2.5	0.0	0.0	4.5	0.3	0.0	0.0
DRY VOL. %	84.6	0.0	1.4	3.4	2.4	0.0	0.0	4.3	0.3	0.0	3.5 % MM
DRY WT. %	81.7	0.0	1.6	3.5	2.5	0.0	0.0	3.6	0.2	0.0	7.0 % MM

REFLECTANCE DATA

VITRINITE : HIGH: 0.62 LOW: 0.43 MEAN-MAX: 0.51

VITRINITE TYPES V 4 V 5 V 6
PERCENT 37.0 62.0 1.0

***** CAKING AND MECHANICAL PROPERTIES *****

GIESELER COAL PLASTOMETER:

INIT. SOFTENING TEMP
TEMP. MAX. FLUIDITY
SOLIDIFICATION TEMP.
FLUID TEMP. RANGE

GRAY-KING COKE TYPE

HARDGROVE GRINDABILITY 42.6
FREE SWELLING INDEX 0.5
VICKERS HARDNESS NUMBER

MAXIMUM FLUIDITY
WASHABILITY DATA AVAILABLE? NO

```
PSU NUMBER          -> DECS-4
SEAM NAME            -> BLUE
ALTERNATE SEAM NAME  -> #1
APPARENT RANK        -> HVC
```

100 100 200 400 600 800 1000 1200 1400 1600 1800 2000 2200 2400 2600 2800 3000 3200 3400 3600 3800 4000 4200 4400 4600 4800 5000 5200 5400 5600 5800 6000 6200 6400 6600 6800 7000 7200 7400 7600 7800 8000 8200 8400 8600 8800 9000 9200 9400 9600 9800 10000

COUNTRY -> USA
STATE -> NEW MEXICO

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1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050 2051 2052 2053 2054 2055 2056 2057 2058 2059 2060 2061 2062 2063 2064 2065 2066 2067 2068 2069 2070 2071 2072 2073 2074 2075 2076 2077 2078 2079 2080 2081 2082 2083 2084 2085 2086 2087 2088 2089 2090 2091 2092 2093 2094 2095 2096 2097 2098 2099 2100 2101 2102 2103 2104 2105 2106 2107 2108 2109 2110 2111 2112 2113 2114 2115 2116 2117 2118 2119 2120 2121 2122 2123 2124 2125 2126 2127 2128 2129 2130 2131 2132 2133 2134 2135 2136 2137 2138 2139 2140 2141 2142 2143 2144 2145 2146 2147 2148 2149 2150 2151 2152 2153 2154 2155 2156 2157 2158 2159 2160 2161 2162 2163 2164 2165 2166 2167 2168 2169 2170 2171 2172 2173 2174 2175 2176 2177 2178 2179 2180 2181 2182 2183 2184 2185 2186 2187 2188 2189 2190 2191 2192 2193 2194 2195 2196 2197 2198 2199 2200 2201 2202 2203 2204 2205 2206 2207 2208 2209 2210 2211 2212 2213 2214 2215 2216 2217 2218 2219 2220 2221 2222 2223 2224 2225 2226 2227 2228 2229 2230 2231 2232 2233 2234 2235 2236 2237 2238 2239 2240 2241 2242 2243 2244 2245 2246 2247 2248 2249 2250 2251 2252 2253 2254 2255 2256 2257 2258 2259 2260 2261 2262 2263 2264 2265 2266 2267 2268 2269 2270 2271 2272 2273 2274 2275 2276 2277 2278 2279 2280 2281 2282 2283 2284 2285 2286 2287 2288 2289 2290 2291 2292 2293 2294 2295 2296 2297 2298 2299 2300 2301 2302 2303 2304 2305 2306 2307 2308 2309 2310 2311 2312 2313 2314 2315 2316 2317 2318 2319 2320 2321 2322 2323 2324 2325 2326 2327 2328 2329 2330 2331 2332 2333 2334 2335 2336 2337 2338 2339 2340 2341 2342 2343 2344 2345 2346 2347 2348 2349 2350 2351 2352 2353 2354 2355 2356 2357 2358 2359 2360 2361 2362 2363 2364 2365 2366 2367 2368 2369 2370 2371 2372 2373 2374 2375 2376 2377 2378 2379 2380 2381 2382 2383 2384 2385 2386 2387 2388 2389 2390 2391 2392 2393 2394 2395 2396 2397 2398 2399 2400 2401 2402 2403 2404 2405 2406 2407 2408 2409 2410 2411 2412 2413 2414 2415 2416 2417 2418 2419 2420 2421 2422 2423 2424 2425 2426 2427 2428 2429 2430 2431 2432 2433 2434 2435 2436 2437 2438 2439 2440 2441 2442 2443 2444 2445 2446 2447 2448 2449 2450 2451 2452 2453 2454 2455 2456 2457 2458 2459 2460 2461 2462 2463 2464 2465 2466 2467 2468 2469 2470 2471 2472 2473 2474 2475 2476 2477 2478 2479 2480 2481 2482 2483 2484 2485 2486 2487 2488 2489 2490 2491 2492 2493 2494 2495 2496 2497 2498 2499 2500 2501 2502 2503 2504 2505 2506 2507 2508 2509 2510 2511 2512 2513 2514 2515 2516 2517 2518 2519 2520 2521 2522 2523 2524 2525 2526 2527 2528 2529 2530 2531 2532 2533 2534 2535 2536 2537 2538 2539 2540 2541 2542 2543 2544 2545 2546 2547 2548 2549 2550 2551 2552 2553 2554 2555 2556 2557 2558 2559 2560 2561 2562 2563 2564 2565 2566 2567 2568 2569 2570 2571 2572 2573 2574 2575 2576 2577 2578 2579 2580 2581 2582 2583 2584 2585 2586 2587 2588 2589 2590 2591 2592 2593 2594 2595 2596 2597 2598 2599 2600 2601 2602 2603 2604 2605 2606 2607 2608 2609 2610 2611 2612 2613 2614 2615 2616 2617 2618 2619 2620 2621 2622 2623 2624 2625 2626 2627 2628 2629 2630 2631 2632 2633 2634 2635 2636 2637 2638 2639 2640 2641 2642 2643 2644 2645 2646 2647 2648 2649 2650 2651 2652 2653 2654 2655 2656 2657 2658 2659 2660 2661 2662 2663 2664 2665 2666 2667 2668 2669 2670 2671 2672 2673 2674 2675 2676 2677 2678 2679 2680 2681 2682 2683 2684 2685 2686 2687 2688 2689 2690 2691 2692 2693 2694 2695 2696 2697 2698 2699 2700 2701 2702 2703 2704 2705 2706 2707 2708 2709 2710 2711 2712 2713 2714 2715 2716 2717 2718 2719 2720 2721 2722 2723 2724 2725 2726 2727 2728 2729 2730 2731 2732 2733 2734 2735 2736 2737 2738 2739 2740 2741 2742 2743 2744 2745 2746 2747 2748 2749 2750 2751 2752 2753 2754 2755 2756 2757 2758 2759 2760 2761 2762 2763 2764 2765 2766 2767 2768 2769 2770 2771 2772 2773 2774 2775 2776 2777 2778 2779 2780 2781 2782 2783 2784 2785 2786 2787 2788 2789 2790 2791 2792 2793 2794 2795 2796 2797 2798 2799 2800 2801 2802 2803 2804 2805 2806 2807 2808 2809 2810 2811 2812 2813 2814 2

	SI02	AL203	Ti02	FE203	MGO	CA0	NA2O	K2O	P2O5	S03
OXIDE % OF HTA	57.4	21.7	1.29	6.08	1.88	7.14	0.79	0.79	0.14	2.10
	SI	AL	TI	FE	MG	CA	NA	K	P	S
ELEMENT % OF TOTAL DRY COAL	1.6	0.7	0.05	0.26	0.07	0.31	0.04	0.04	0.004	0.46

[illegible]

	PPM HTA	PPM TOTAL COAL		PPM HTA	PPM TOTAL COAL		PPM HTA	PPM TOTAL COAL	VOLATILES -----	PPM TOTAL COAL
AG			GE			SN			AS	
B			LA			SR	1776.	107.	BR	
BA	1344.	81.	LI			TH			CD	
BE	17.	1.	MN	310.	19.	U			CL	400.
BI			MO			V	25.	2.	F	
CE			NB			Y			HG	
CO			NI	< 25.	< 2.	YB			SB	
CR	110.	7.	PB			ZN	70.	4.	SE	
CU	90.	5.	RB	40.	2.	ZR	380.	23.		
GA			SC							

SAMPLE IDENTIFICATION:

 PSU NUMBER -> DECS-4
 SEAM NAME -> BLUE
 ALTERNATE SEAM NAME -> #1
 APPARENT RANK -> HVC

SAMPLE LOCATION:

 COUNTRY -> USA
 STATE -> NEW MEXICO

** PENN STATE COAL DATA BASE **
 ** **
 ** DECS-4 **
 ** **
 ** 11/16/93 **
 ** PAGE 5 **

ASH FUSION TEMPERATURES (ALL TEMPERATURES IN DEGREES F)

 REDUCING OXIDIZING
 INITIAL DEFORMATION 2100. 2250.
 SOFTENING 2210. 2300.
 HEMISPHERICAL 2265. 2345.
 FLUID 2300. 2390. *

SAMPLE IDENTIFICATION:

 PSU NUMBER -> DECS-5
 SEAM NAME -> HIAWATHA
 ALTERNATE SEAM NAME ->
 APPARENT RANK -> HVC

SAMPLE LOCATION:

 COUNTRY -> USA
 STATE -> UTAH
 COUNTY -> SEVIER
 TOWNSHIP ->
 CITY -> EMERY

** PENN STATE COAL DATA BASE **

**
 ** DECS-5 **
 **
 ** 11/16/93 **
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SAMPLE HISTORY:

 SAMPLING DATE & AGENCY -> 6/ 6/90 ; PSU

COAL PROVINCE-> ROCKY MOUNTAIN
 REGION -> UINTA

SAMPLE TYPE -> CHANNEL-WORKING SECTION

MAP REFERENCE: LATITUDE -> 38 D 57 M 55 S
 LONGITUDE -> 111 D 23 M 15 S
 QUADRANGLE-> ACORD LAKES (7.5')

ADDITIONAL INFORMATION -> sample is bottom 88" of 110" seam

MINE INFORMATION:

 RESERVES ->

LIFE EXPECTANCY ->

ANNUAL PRODUCTION ->

MINING METHOD -> UNDERGROUND

SEAM INFORMATION:

 AGE OF SEAM -> U. CRET.
 GROUP -> MESAVERDE
 FORMATION -> BLACKHAWK
 SEAM THICKNESS -> 9 FT. 2 IN.

** SEAM PROFILE **

ROOF -> not accessible
 22 IN. -> coal in mine roof NOT SAMPLED
 16 IN. -> coal
 4 IN. -> zone of discont. 5mm partings
 68 IN. -> coal
 FLOOR -> gray silty mudstone

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-5
SEAM NAME -> HIAWATHA
ALTERNATE SEAM NAME ->
APPARENT RANK -> HVC

SAMPLE LOCATION:

COUNTRY -> USA
STATE -> UTAH

** PENN STATE COAL DATA BASE **

** DECS-5 **
** 11/16/93 **
** PAGE 2 **

* * * * * C H E M I C A L D A T A * * * * *

PROXIMATE ANALYSIS AS REC'D DRY DAF DMMF(PARR)

% MOISTURE	7.54				% EQUILIBRIUM MOISTURE = 7.88
% ASH	7.90	8.54			MM-FREE = 8.66
% VOLATILE	37.29	40.33	44.10	43.58	
% FIXED CARBON	47.27	51.13	55.90	56.42	

ULTIMATE ANALYSIS AS REC'D DRY DAF DMMF(PARR) ELEMENTAL ANALYSIS DRY DMMF(MOD.P) DMMF(DIR.)

% ASH	7.90	8.54		(9.53%MM)			(9.80%MM)	(%MM)
% CARBON	67.22	72.70	79.49	80.36	% CARBON	72.40	80.27	
% HYDROGEN	4.58 (*)	4.95	5.41	5.47	% HYDROGEN	4.84	5.37	
% NITROGEN	1.05	1.14	1.25	1.26	% NITROGEN	1.14	1.26	
% TOTAL SULFUR	0.52	0.56	0.61		% ORGANIC SULFUR	0.28	0.31	
% OXYGEN(DIFF)	11.20 (*)	12.11	13.24	12.91	% OXYGEN(DIFF)	11.53	12.78	
					% MINERAL MATTER (INCL. 0.51% FES2)	9.80		

(*)-EXCLUDES MOISTURE

SULFUR FORMS % PYRITIC % SULFATIC % ORGANIC % TOTAL

DRY	0.27	0.01	0.28	0.56
DAF	0.30	0.01	0.31	0.61

DRY % CHLORINE = 0.05 DRY % CO2 = 1.09

MOTT-SPOONER DIFFERENCE = 40.

CALORIFIC VALUE
(GROSS, BTU/LB)

DRYAS REC'D
MOIST.EQUIL.
MOIST.ATOM RATIOS (DMMF)PARRMOD. PARRDIRECT

MM-CONTAINING	12760.	11798.	11755.	ATOMIC H/C	0.8178	0.8036
MM-FREE (PARR)	14073.	12910.	12858.	ATOMIC O/C	0.1206	0.1196
MM-FREE (MOD. P)	14131.	12959.	12906.			
NET CV, DMMF BTU/LB	13622.					

SAMPLE IDENTIFICATION:

SAMPLE LOCATION:

** PENN STATE COAL DATA BASE **

 PSU NUMBER -> DECS-5
 SEAM NAME -> HIAWATHA
 ALTERNATE SEAM NAME ->
 APPARENT RANK -> HVC

 COUNTRY -> USA
 STATE -> UTAH

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***** RANK CALCULATIONS *****

APPARENT RANK (AS REC'D MOIST.) -> HVC INTERNATIONAL RANK :
 AS REC'D MOIST. ->
 ASTM RANK (EQUIL. MOIST.) -> HVC EQUIL. MOIST. ->
 REFLECTANCE RANK CATEGORY -> HVB REPORTED RANK : -> HVC

***** PETROGRAPHIC DATA *****

MACERAL COMPOSITION (WHITE LIGHT AND FLUORESCENCE ANALYSIS)

	VITRINITE	PSEUDO-VITRINITE	FUSINITE	SEMI-FUSINITE	MACRINITE	MICRINITE	SCLERO-TINITE	SPORINITE	RESINITE	ALGINITE	CUTINITE	
DMMF VOL. %	65.5	0.0	3.7	9.7	5.5	0.8	0.0	11.8	2.2	0.3	0.5	
DRY VOL. %	62.3	0.0	3.5	9.2	5.2	0.8	0.0	11.2	2.1	0.3	0.5	4.8 % MM
DRY WT. %	59.6	0.0	3.7	9.5	5.4	0.8	0.0	9.1	1.7	0.2	0.4	9.5 % MM

REFLECTANCE DATA

VITRINITE :

HIGH: 0.68 LOW: 0.48 MEAN-MAX: 0.59

VITRINITE TYPES

V 4 V 5 V 6

PERCENT

2.0 56.0 42.0

***** CAKING AND MECHANICAL PROPERTIES *****

GIESELER COAL PLASTOMETER:

GRAY-KING COKE TYPE

INIT. SOFTENING TEMP

HARDGROVE GRINDABILITY 43.1

TEMP. MAX. FLUIDITY

FREE SWELLING INDEX 1.0

SOLIDIFICATION TEMP.

VICKERS HARDNESS NUMBER

FLUID TEMP. RANGE

MAXIMUM FLUIDITY
 WASHABILITY DATA AVAILABLE? NO

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-5
SEAM NAME -> HIAWATHA
ALTERNATE SEAM NAME ->
APPARENT RANK -> HVC

SAMPLE LOCATION:

COUNTRY -> USA
STATE -> UTAH

** PENN STATE COAL DATA BASE **

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** DECS-5 **
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MAJOR ELEMENT ANALYSIS

% HTA = 8.61

	SI02	AL203	TIO2	FE203	MGO	CAO	NA2O	K2O	P2O5	SO3
OXIDE % OF HTA	44.1	11.0	0.84	8.10	1.73	8.40	4.29	0.15	0.41	10.2
ELEMENT % OF TOTAL DRY COAL	SI	AL	TI	FE	MG	CA	NA	K	P	S
	1.8	0.5	0.04	0.49	0.09	0.52	0.27	0.01	0.02	0.6

TRACE ELEMENT ANALYSIS

% HTA = 8.61

	PPM HTA	PPM TOTAL COAL		PPM HTA	PPM TOTAL COAL		PPM HTA	PPM TOTAL COAL	VOLATILES -----	PPM TOTAL COAL
AG			GE			SN			AS	
B			LA			SR	1691.	146.	BR	
BA	806.	69.	LI			TH			CD	
BE	< 3.0	< 0.3	MN	465.	40.	U			CL	500.
BI			MO			V	110.	9.	F	
CE			NB			Y			HG	
CO			NI	35.	3.	YB			SB	
CR	85.	7.	PB			ZN	80.	7	SE	
CU	150.	13.	RB	15.	1.	ZR	310.	27.		
GA			SC							

SAMPLE IDENTIFICATION:

 PSU NUMBER -> DECS-5
 SEAM NAME -> HIAWATHA
 ALTERNATE SEAM NAME ->
 APPARENT RANK -> HVC

SAMPLE LOCATION:

 COUNTRY -> USA
 STATE -> UTAH

** PENN STATE COAL DATA BASE **

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ASH FUSION TEMPERATURES (ALL TEMPERATURES IN DEGREES F)

	REDUCING	OXIDIZING
INITIAL DEFORMATION	1920.	2150.
SOFTENING	2045.	2205.
HEMISPHERICAL	2100.	2245.
FLUID	2170.	2300.

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-6
SEAM NAME -> Blind Canyon
ALTERNATE SEAM NAME ->
APPARENT RANK -> HVA

SAMPLE HISTORY:

SAMPLING DATE & AGENCY -> 6/ 7/90 ; PSU

SAMPLE TYPE -> CHANNEL-WORKING SECTION

ADDITIONAL INFORMATION -> TOP 8' OF 8' 6" SEAM

MINE INFORMATION:

RESERVES ->

ANNUAL PRODUCTION ->

SAMPLE LOCATION:

COUNTRY -> USA

STATE -> UTAH

COUNTY -> Emery

TOWNSHIP ->

CITY -> Huntington

COAL PROVINCE-> ROCKY MOUNTAIN
REGION -> UINTA

MAP REFERENCE: LATITUDE -> 39 D 21 M 44 S
LONGITUDE -> 111 D 10 M 4 S
QUADRANGLE-> Mahogany Point (7.5')

** PENN STATE COAL DATA BASE **
** DECS-6 **
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LIFE EXPECTANCY ->

MINING METHOD -> UNDERGROUND

SEAM INFORMATION:

AGE OF SEAM -> U. CRET.

GROUP -> Mesaverde

FORMATION -> Blackhawk

SEAM THICKNESS -> 8 FT. 6 IN.

** SEAM PROFILE **

ROOF ->
5 IN. -> coal
2 IN. -> high ash (30-40 %) lithotype
89 IN. -> coal with abundant resin
6 IN. -> below mine floor NOT SAMPLED
FLOOR -> not accessible

SAMPLE IDENTIFICATION:

SAMPLE LOCATION:

** PENN STATE COAL DATA BASE **

PSU NUMBER -> DECS-6
SEAM NAME -> Blind Canyon
ALTERNATE SEAM NAME ->
APPARENT RANK -> HVA

COUNTRY -> USA
STATE -> UTAH

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* * * * * C H E M I C A L D A T A * * * * *

PROXIMATE ANALYSIS AS REC'D DRY DAF DMMF(PARR)

% MOISTURE	4.73				% EQUILIBRIUM MOISTURE = 4.85
% ASH	5.56	5.84			MM-FREE = 5.18
% VOLATILE	42.40	44.50	47.26	46.94	
% FIXED CARBON	47.31	49.66	52.74	53.06	

ULTIMATE ANALYSIS AS REC'D DRY DAF DMMF(PARR) ELEMENTAL ANALYSIS DRY DMMF(MOD.P) DMMF(DIR.)

% ASH	5.56	5.84		(6.53%MM)			(6.67%MM)	(%MM)
% CARBON	72.91	76.53	81.28	81.87	% CARBON	76.27	81.72	
% HYDROGEN	5.60 (*)	5.88	6.24	6.29	% HYDROGEN	5.80	6.22	
% NITROGEN	1.39	1.46	1.55	1.56	% NITROGEN	1.46	1.56	
% TOTAL SULFUR	0.38	0.40	0.42		% ORGANIC SULFUR	0.37	0.40	
% OXYGEN(DIFF)	9.42 (*)	9.89	10.50	10.27	% OXYGEN(DIFF)	9.43	10.10	
(*) -EXCLUDES MOISTURE					% MINERAL MATTER	6.67		
					(INCL. 0.04% FES2)			

SULFUR FORMS % PYRITIC % SULFATIC % ORGANIC % TOTAL

DRY	0.02	0.01	0.37	0.40
DAF	0.02	0.01	0.39	0.42

DRY % CHLORINE = 0.12 DRY % CO2 = 0.96

MOTT-SPOONER DIFFERENCE = -72.

CALORIFIC VALUE
(GROSS, BTU/LB)DRYAS REC'D
MOIST.EQUIL.
MOIST.ATOM RATIOS (DMMF)PARRMOD. PARRDIRECT

MM-CONTAINING	13923.	13264.	13248.	ATOMIC H/C	0.9228	0.9141
MM-FREE (PARR)	14874.	14124.	14105.	ATOMIC O/C	0.0942	0.0928
MM-FREE (MOD. P)	14917.	14163.	14144.			
NET CV, DMMF BTU/LB	14333.					

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-6
SEAM NAME -> Blind Canyon
ALTERNATE SEAM NAME ->
APPARENT RANK -> HVA

SAMPLE LOCATION:

COUNTRY -> USA
STATE -> UTAH

** PENN STATE COAL DATA BASE **
** DECS-6 **
** 11/16/93 **
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***** RANK CALCULATIONS *****

APPARENT RANK (AS REC'D MOIST.) -> HVA INTERNATIONAL RANK ;
ASTM RANK (EQUIL. MOIST.) -> HVA AS REC'D MOIST. ->
REFLECTANCE RANK CATEGORY -> HVB EQUIL. MOIST. ->
REPORTED RANK : ->

***** PETROGRAPHIC DATA *****

MACERAL COMPOSITION (WHITE LIGHT AND FLUORESCENCE ANALYSIS)

	VITRINITE	PSEUDO-VITRINITE	FUSINITE	SEMI-FUSINITE	MACRINITE	MICRINITE	SCLERO-TINITE	SPOR-INITE	RESINITE	ALGINITE	CUTINITE
DMMF VOL. %	69.1	0.0	1.8	5.6	5.3	0.9	0.0	11.1	5.0	0.4	0.8
DRY VOL. %	66.8	0.0	1.7	5.4	5.1	0.9	0.0	10.7	4.8	0.4	0.8 3.3 % MM
DRY WT. %	64.5	0.0	1.9	5.6	5.3	0.9	0.0	9.7	4.4	0.4	0.7 6.5 % MM

REFLECTANCE DATA

VITRINITE : HIGH: 0.82 LOW: 0.58 MEAN-MAX: 0.66

VITRINITE TYPES

	V 5	V 6	V 7	V 8
PERCENT	3.0	77.0	19.0	1.0

***** C A K I N G A N D M E C H A N I C A L P R O P E R T I E S *****

GIESELER COAL PLASTOMETER:

INIT. SOFTENING TEMP 400
TEMP. MAX. FLUIDITY 419
SOLIDIFICATION TEMP. 438
FLUID TEMP. RANGE 38
MAXIMUM FLUIDITY 3
WASHABILITY DATA AVAILABLE? NO

GRAY-KING COKE TYPE

HARDGROVE GRINDABILITY 44.5
FREE SWELLING INDEX 2.0
VICKERS HARDNESS NUMBER

SAMPLE IDENTIFICATION:

SAMPLE LOCATION:

** PENN STATE COAL DATA BASE **

PSU NUMBER -> DECS-6
SEAM NAME -> Blind Canyon
ALTERNATE SEAM NAME ->
APPARENT RANK -> HVA

COUNTRY -> USA
STATE -> UTAH

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MAJOR ELEMENT ANALYSIS

% HTA = 6.26

	SI02	AL203	TI02	FE203	MGO	CAO	NA2O	K2O	P2O5	S03
OXIDE % OF HTA	50.3	15.3	0.96	6.88	1.26	12.0	6.91	0.59	0.38	4.80
ELEMENT % OF TOTAL DRY COAL	SI	AL	TI	FE	MG	CA	NA	K	P	S
	1.5	0.5	0.04	0.30	0.05	0.5	0.32	0.03	0.01	0.40

TRACE ELEMENT ANALYSIS

% HTA = 6.26

	PPM HTA	PPM TOTAL COAL		PPM HTA	PPM TOTAL COAL		PPM HTA	PPM TOTAL COAL	VOLATILES -----	PPM TOTAL COAL
AG			GE			SN			AS	
B			LA			SR	1353.	85.	BR	
BA	1433.	90.	LI			TH			CD	
BE	4.0	0.3	MN	155.	10.	U			CL	1200.
BI			MO			V	140.	9.	F	
CE			NB			Y			HG	
CO			NI	< 25.	< 2.	YB			SB	
CR	95.	6.	PB			ZN	70.	4.	SE	
CU	150.	9.	RB	25.	2.	ZR	470.	29.		
GA			SC							

SAMPLE IDENTIFICATION:

 PSU NUMBER -> DECS-6
 SEAM NAME -> Blind Canyon
 ALTERNATE SEAM NAME ->
 APPARENT RANK -> HVA

SAMPLE LOCATION:

 COUNTRY -> USA
 STATE -> UTAH

** PENN STATE COAL DATA BASE **

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 ** DECS-6 **
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ASH FUSION TEMPERATURES (ALL TEMPERATURES IN DEGREES F)

	REDUCING	OXIDIZING
INITIAL DEFORMATION	1900.	2250.
SOFTENING	2020.	2345.
HEMISPHERICAL	2090.	2400.
FLUID	2240.	2440.

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-7
SEAM NAME -> ADAVILLE #1
ALTERNATE SEAM NAME ->
APPARENT RANK -> HVC

SAMPLE HISTORY:

SAMPLING DATE & AGENCY -> 6/ 8/90 ; PSU

SAMPLE TYPE -> CHANNEL-WHOLE SEAM

ADDITIONAL INFORMATION -> channel sample taken as 257' trench on pit floor

MINE INFORMATION:

RESERVES ->

ANNUAL PRODUCTION ->

SAMPLE LOCATION:

COUNTRY -> USA

STATE -> WYOMING

COUNTY -> LINCOLN

TOWNSHIP ->

CITY -> KEMMERER

COAL PROVINCE-> ROCKY MOUNTAIN

REGION -> HAMS FORK

MAP REFERENCE: LATITUDE -> 41 D 47 M 23 S

LONGITUDE -> 110 D 36 M 32 S

QUADRANGLE-> KEMMERER (7.5')

** PENN STATE COAL DATA BASE **

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SEAM INFORMATION:

AGE OF SEAM -> U. CRET.

GROUP ->

FORMATION -> ADAVILLE

SEAM THICKNESS -> 120 FT. 0 IN.

LIFE EXPECTANCY ->

MINING METHOD -> STRIP

SAMPLE IDENTIFICATION:

 PSU NUMBER -> DECS-7
 SEAM NAME -> ADAVILLE #1
 ALTERNATE SEAM NAME ->
 APPARENT RANK -> HVC

SAMPLE LOCATION:

 COUNTRY -> USA
 STATE -> WYOMING

** PENN STATE COAL DATA BASE **
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 ** DECS-7 **
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* * * * * C H E M I C A L D A T A * * * * *

<u>PROXIMATE ANALYSIS</u>	<u>AS REC'D</u>	<u>DRY</u>	<u>DAF</u>	<u>DMMF(PARR)</u>
% MOISTURE	17.34			
% ASH	3.45	4.17		
% VOLATILE	38.11	46.10	48.11	47.78
% FIXED CARBON	41.11	49.73	51.89	52.22

% EQUILIBRIUM MOISTURE = 18.40
 MM-FREE = 19.15

<u>ULTIMATE ANALYSIS</u>	<u>AS REC'D</u>	<u>DRY</u>	<u>DAF</u>	<u>DMMF(PARR)</u>
% ASH	3.45	4.17		(5.04%MM)
% CARBON	61.09	73.90	77.12	77.82
% HYDROGEN	4.38 (*)	5.30	5.53	5.58
% NITROGEN	0.82	0.99	1.03	1.04
% TOTAL SULFUR	0.81	0.98	1.02	
% OXYGEN(DIFF)	12.12 (*)	14.66	15.30	15.55

(*)-EXCLUDES MOISTURE

<u>ELEMENTAL ANALYSIS</u>	<u>DRY</u>	<u>DMMF(MOD.P)</u>	<u>DMMF(DIR.)</u>
% CARBON	73.74	77.45	(4.79%MM) (%MM)
% HYDROGEN	5.25	5.51	
% NITROGEN	0.99	1.04	
% ORGANIC SULFUR	0.87	0.91	
% OXYGEN(DIFF)	14.37	15.09	
% MINERAL MATTER (INCL. 0.19% FES2)	4.79		

<u>SULFUR FORMS</u>	<u>% PYRITIC</u>	<u>% SULFATIC</u>	<u>% ORGANIC</u>	<u>% TOTAL</u>
DRY	0.10	0.01	0.87	0.98
DAF	0.10	0.01	0.91	1.02

DRY % CHLORINE = 0.06 DRY % CO2 = 0.60
 MOTT-SPOONER DIFFERENCE = 52.

<u>CALORIFIC VALUE (GROSS, BTU/LB)</u>	<u>DRY</u>	<u>AS REC'D MOIST.</u>	<u>EQUIL. MOIST.</u>
MM-CONTAINING	13068.	10802.	10663.
MM-FREE (PARR)	13710.	11230.	11079.
MM-FREE (MOD. P)	13720.	11243.	11093.
NET CV, DMMF BTU/LB	13204.		

<u>ATOM RATIOS (DMMF)</u>	<u>PARR</u>	<u>MOD.PARR</u>	<u>DIRECT</u>
ATOMIC H/C	0.8614	0.8548	
ATOMIC O/C	0.1500	0.1463	

SAMPLE IDENTIFICATION:

SAMPLE LOCATION:

** PENN STATE COAL DATA BASE **

PSU NUMBER -> DECS-7
 SEAM NAME -> ADAVILLE #1
 ALTERNATE SEAM NAME ->
 APPARENT RANK -> HVC

COUNTRY -> USA
 STATE -> WYOMING

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***** RANK CALCULATIONS *****

APPARENT RANK (AS REC'D MOIST.) -> HVC INTERNATIONAL RANK :
 AS REC'D MOIST. ->
 ASTM RANK (EQUIL. MOIST.) -> HVC EQUIL. MOIST. ->
 REFLECTANCE RANK CATEGORY -> REPORTED RANK : -> HVC

***** PETROGRAPHIC DATA *****

MACERAL COMPOSITION (WHITE LIGHT AND FLUORESCENCE ANALYSIS)

	TEXT- INITE	ULM- INITE	HUMO- DETRINITE	GEL- INITE	CORPO- HUMINITE	SPOR- INITE	CUT- INITE	RES- INITE	ALG- INITE	FUS- INITE	SEMI- FUSINITE	MAC- RINITE	SCLERO- TINITE
DMMF VOL. %	0.0	32.5	52.9	1.3	7.9	3.1	0.0	0.1	0.0	0.3	0.5	0.9	0.5
DRY WT. %	0.0	30.9	50.2	1.2	7.5	2.9	0.0	0.1	0.0	0.3	0.5	0.9	0.5
DMMF VOL % HUMINITE = 94.6													

5.0 % MM.

ULMINITE REFLECTANCE DATA: HIGH: 0.56 LOW: 0.27 MEAN-MAX: 0.45

***** CAKING AND MECHANICAL PROPERTIES *****

GIESELER COAL PLASTOMETER:

GRAY-KING COKE TYPE

INIT. SOFTENING TEMP

HARDGROVE GRINDABILITY 49.3

TEMP. MAX. FLUIDITY

FREE SWELLING INDEX 1.0

SOLIDIFICATION TEMP.

VICKERS HARDNESS NUMBER

FLUID TEMP. RANGE

MAXIMUM FLUIDITY

WASHABILITY DATA AVAILABLE? NO

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-7
SEAM NAME -> ADAVILLE #1
ALTERNATE SEAM NAME ->
APPARENT RANK -> HVC

SAMPLE LOCATION:

COUNTRY -> USA
STATE -> WYOMING

** PENN STATE COAL DATA BASE **

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MAJOR ELEMENT ANALYSIS

% HTA = 4.43

	SI02	AL203	Ti02	FE203	MGO	CAO	NA2O	K2O	P2O5	S03
OXIDE % OF HTA	50.2	18.7	0.68	4.49	3.41	8.76	0.38	0.41	0.18	10.5
ELEMENT % OF TOTAL DRY COAL	SI	AL	TI	FE	MG	CA	NA	K	P	S
	1.0	0.4	0.02	0.14	0.09	0.28	0.01	0.02	0.003	1.0

TRACE ELEMENT ANALYSIS

% HTA = 4.43

	PPM HTA	PPM TOTAL COAL		PPM HTA	PPM TOTAL COAL		PPM HTA	PPM TOTAL COAL	VOLATILES -----	PPM TOTAL COAL
AG			GE			SN			AS	
B			LA			SR	1945.	86.	BR	
BA	2060.	91.	LI			TH			CD	
BE	< 3.0	< 0.1	MN	465.	21.	U			CL	600.
BI			MO			V	< 10.	< 0.4	F	
CE			NB			Y			HG	
CO			NI	< 25.	< 1.	YB			SB	
CR	85.	4.	PB			ZN	95.	4.	SE	
CU	85.	4.	RB	20.	1.	ZR	380.	17.		
GA			SC							

SAMPLE IDENTIFICATION:

 PSU NUMBER -> DECS-7
 SEAM NAME -> ADAVILLE #1
 ALTERNATE SEAM NAME ->
 APPARENT RANK -> HVC

SAMPLE LOCATION:

 COUNTRY -> USA
 STATE -> WYOMING

** PENN STATE COAL DATA BASE **
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ASH FUSION TEMPERATURES (ALL TEMPERATURES IN DEGREES F)

	REDUCING	OXIDIZING
INITIAL DEFORMATION	2120.	2200.
SOFTENING	2200.	2300.
HEMISPHERICAL	2260.	2345.
FLUID	2330.	2390.

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-8
SEAM NAME -> SMITH-ROLAND
ALTERNATE SEAM NAME -> WYODAK
APPARENT RANK -> SUBBIT C

SAMPLE LOCATION:

COUNTRY -> USA
STATE -> WYOMING
COUNTY -> CAMPBELL
TOWNSHIP ->
CITY -> GILLETTE

** PENN STATE COAL DATA BASE **

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SAMPLE HISTORY:

SAMPLING DATE & AGENCY -> 6/11/90 ; PSU

SAMPLE TYPE -> RUN OF MINE

ADDITIONAL INFORMATION -> COLLECTED FROM AUTOMATIC SAMPLER

COAL PROVINCE-> NORTHERN GREAT PLAINS
REGION -> FORT UNION

MAP REFERENCE: LATITUDE -> 44 D 16 M 40 S
LONGITUDE -> 105 D 23 M 36 S
QUADRANGLE-> GILLETTE EAST (7.5')

MINE INFORMATION:

RESERVES ->

ANNUAL PRODUCTION ->

LIFE EXPECTANCY ->

MINING METHOD -> STRIP

SEAM INFORMATION:

AGE OF SEAM -> PALEO.

GROUP ->

FORMATION -> FORT UNION

SEAM THICKNESS -> 90 FT. 8 IN.

** SEAM PROFILE **

ROOF ->
480 IN. -> 40' coal (Roland seam)
240 IN. -> 20' coal (Roland seam)
0 IN. -> parting, thickness unspecified
120 IN. -> 10' coal (Smith seam)
8 IN. -> parting
240 IN. -> 20' coal (Smith seam)
FLOOR ->

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-8
SEAM NAME -> SMITH-ROLAND
ALTERNATE SEAM NAME -> WYODAK
APPARENT RANK -> SUBBIT C

SAMPLE LOCATION:

COUNTRY -> USA
STATE -> WYOMING

** PENN STATE COAL DATA BASE **

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* * * * * C H E M I C A L D A T A * * * * *

PROXIMATE ANALYSIS	AS REC'D	DRY	DAF	DMMF(PARR)	
% MOISTURE	28.42				% EQUILIBRIUM MOISTURE = 28.41
% ASH	9.90	13.83			MM-FREE = 32.03
% VOLATILE	32.38	45.23	52.49	51.77	
% FIXED CARBON	29.30	40.94	47.51	48.23	

ULTIMATE ANALYSIS	AS REC'D	DRY	DAF	DMMF(PARR)	ELEMENTAL ANALYSIS	DRY	DMMF(MOD.P)	DMMF(DIR.)
% ASH	9.90	13.83		(15.34%MM)			(15.78%MM)	(%MM)
% CARBON	45.91	64.14	74.43	75.76	% CARBON	63.87	75.84	
% HYDROGEN	3.23 (*)	4.51	5.23	5.33	% HYDROGEN	4.34	5.15	
% NITROGEN	0.62	0.86	1.00	1.02	% NITROGEN	0.86	1.02	
% TOTAL SULFUR	0.52	0.73	0.85		% ORGANIC SULFUR	0.43	0.51	
% OXYGEN(DIFF)	11.40 (*)	15.93	18.49	17.90	% OXYGEN(DIFF)	14.72	17.48	
(*)-EXCLUDES MOISTURE					% MINERAL MATTER (INCL. 0.52% FES2)	15.78		

SULFUR FORMS	% PYRITIC	% SULFATIC	% ORGANIC	% TOTAL	DRY % CHLORINE = 0.05	DRY % CO2 = 0.98
DRY	0.28	0.02	0.43	0.73	MOTT-SPOONER DIFFERENCE = 178.	
DAF	0.32	0.02	0.50	0.85		

CALORIFIC VALUE (GROSS, BTU/LB)	DRY	AS REC'D MOIST.	EQUIL. MOIST.	ATOM RATIOS (DMMF)	PARR	MOD. PARR	DIRECT
MM-CONTAINING	11168.	7994.	7995.	ATOMIC H/C	0.8446	0.8153	
MM-FREE (PARR)	13148.	8951.	8952.	ATOMIC O/C	0.1773	0.1730	
MM-FREE (MOD. P)	13243.	9000.	9002.				
NET CV, DMMF BTU/LB	12747.						

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-8
SEAM NAME -> SMITH-ROLAND
ALTERNATE SEAM NAME -> WYODAK
APPARENT RANK -> SUBBIT C

SAMPLE LOCATION:

COUNTRY -> USA
STATE -> WYOMING

** PENN STATE COAL DATA BASE **

**
** DECS-8
**
** 11/16/93
** PAGE 3 **

***** RANK CALCULATIONS *****

APPARENT RANK (AS REC'D MOIST.) -> SUBBIT C
ASTM RANK (EQUIL. MOIST.) -> SUBBIT C
REFLECTANCE RANK CATEGORY ->
INTERNATIONAL RANK :
AS REC'D MOIST. ->
EQUIL. MOIST. ->
REPORTED RANK : -> SUBBIT C

***** PETROGRAPHIC DATA *****

MACERAL COMPOSITION (WHITE LIGHT AND FLUORESCENCE ANALYSIS)

	TEXT- INITE	ULM- INITE	HUMO- DETRINITE	GEL- INITE	CORPO- HUMINITE	SPOR- INITE	CUT- INITE	RES- INITE	ALG- INITE	FUS- INITE	SEMI- FUSINITE	MAC- RINITE	SCLERO- TINITE	
DMMF VOL. %	0.0	32.6	34.3	8.0	4.0	11.3	0.1	0.3	0.1	2.6	3.6	3.0	0.1	
DRY WT. %	0.0	27.6	29.0	6.8	3.4	9.6	0.1	0.3	0.1	2.2	3.0	2.5	0.1	15.3 % MM.
DMMF VOL % HUMINITE = 78.9														

ULMINITE REFLECTANCE DATA: HIGH: 0.45 LOW: 0.26 MEAN-MAX: 0.37

***** C A K I N G A N D M E C H A N I C A L P R O P E R T I E S *****

GIESELER COAL PLASTOMETER:

INIT. SOFTENING TEMP
TEMP. MAX. FLUIDITY
SOLIDIFICATION TEMP.
FLUID TEMP. RANGE

GRAY-KING COKE TYPE

HARDGROVE GRINDABILITY 55.3
FREE SWELLING INDEX 0.0
VICKERS HARDNESS NUMBER

MAXIMUM FLUIDITY
WASHABILITY DATA AVAILABLE? NO

OF

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-8
SEAM NAME -> SMITH-ROLAND
ALTERNATE SEAM NAME -> WYODAK
APPARENT RANK -> SUBBIT C

SAMPLE LOCATION:

COUNTRY -> USA
STATE -> WYOMING

** PENN STATE COAL DATA BASE **
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MAJOR ELEMENT ANALYSIS

% HTA = 13.19

	SI02	AL203	TI02	FE203	MG0	CA0	NA20	K20	P205	SO3
OXIDE % OF HTA	40.7	21.8	1.05	6.23	3.56	13.3	0.86	0.77	0.85	10.9
	SI	AL	TI	FE	MG	CA	NA	K	P	S
ELEMENT % OF TOTAL DRY COAL	2.5	1.5	0.08	0.57	0.28	1.3	0.08	0.09	0.05	0.7

TRACE ELEMENT ANALYSIS

% HTA = 13.19

	PPM HTA	PPM TOTAL COAL		PPM HTA	PPM TOTAL COAL		PPM HTA	PPM TOTAL COAL	VOLATILES	PPM TOTAL COAL

AG			GE			SN			AS	
B			LA			SR	2537.	335.	BR	
BA	3851.	508.	LI			TH			CD	
BE	4.0	0.5	MN	155.	20.	U			CL	500.
BI			MO			V	160.	21.	F	
CE			NB			Y			HG	
CO			NI	55.	7.	YB			SB	
CR	120.	16.	PB			ZN	160.	21.	SE	
CU	150.	20.	RB	45.	6.	ZR	140.	18.		
GA			SC							

SAMPLE IDENTIFICATION:

 PSU NUMBER -> DECS-8
 SEAM NAME -> SMITH-ROLAND
 ALTERNATE SEAM NAME -> WYODAK
 APPARENT RANK -> SUBBIT C

SAMPLE LOCATION:

 COUNTRY -> USA
 STATE -> WYOMING

** PENN STATE COAL DATA BASE **

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 ** DECS-8 **
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ASH FUSION TEMPERATURES (ALL TEMPERATURES IN DEGREES F)

	REDUCING	OXIDIZING
INITIAL DEFORMATION	2000.	2200.
SOFTENING	2100.	2260.
HEMISPHERICAL	2145.	2300.
FLUID	2210.	2345.

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-9
SEAM NAME -> DIETZ
ALTERNATE SEAM NAME ->
APPARENT RANK -> SUBBIT B

SAMPLE HISTORY:

SAMPLING DATE & AGENCY -> 6/12/90 ; PSU

SAMPLE TYPE ->

ADDITIONAL INFORMATION -> AIR ROTARY DRILL CUTTINGS, WHOLE SEAM

MINE INFORMATION:

RESERVES ->

ANNUAL PRODUCTION ->

SAMPLE LOCATION:

COUNTRY -> USA

STATE -> MONTANA

COUNTY -> BIGHORN

TOWNSHIP ->

CITY -> DECKER

COAL PROVINCE-> NORTHERN GREAT PLAINS

REGION -> FORT UNION

MAP REFERENCE: LATITUDE -> 45 D 6 M 41 S
LONGITUDE -> 106 D 53 M 53 S
QUADRANGLE-> PEARL SCHOOL (7.5')

** PENN STATE COAL DATA BASE **

**

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SEAM INFORMATION:

AGE OF SEAM -> PALEO.

GROUP ->

FORMATION -> FORT UNION

SEAM THICKNESS -> 83 FT. 8 IN.

LIFE EXPECTANCY ->

MINING METHOD -> STRIP

SAMPLE IDENTIFICATION:

SAMPLE LOCATION:

** PENN STATE COAL DATA BASE **

PSU NUMBER -> DECS-9
SEAM NAME -> DIETZ
ALTERNATE SEAM NAME ->
APPARENT RANK -> SUBBIT B

COUNTRY -> USA
STATE -> MONTANA

**
** DECS-9
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* * * * * C H E M I C A L D A T A * * * * *

PROXIMATE ANALYSIS	AS REC'D	DRY	DAF	DMMF(PARR)
% MOISTURE	24.68			% EQUILIBRIUM MOISTURE = 24.57
% ASH	4.80	6.37		MM-FREE = 26.00
% VOLATILE	33.46	44.43	47.45	47.10
% FIXED CARBON	37.06	49.20	52.55	52.90

ULTIMATE ANALYSIS	AS REC'D	DRY	DAF	DMMF(PARR)	ELEMENTAL ANALYSIS	DRY	DMMF(MOD.P)	DMMF(DIR.)
% ASH	4.80	6.37		(7.11%MM)			(7.28%MM)	(%MM)
% CARBON	53.27	70.73	75.54	76.14	% CARBON	70.57	76.11	
% HYDROGEN	3.65 (*)	4.85	5.18	5.22	% HYDROGEN	4.77	5.14	
% NITROGEN	0.63	0.84	0.90	0.90	% NITROGEN	0.84	0.91	
% TOTAL SULFUR	0.31	0.41	0.44		% ORGANIC SULFUR	0.31	0.33	
% OXYGEN(DIFF)	12.65 (*)	16.80	17.94	17.74	% OXYGEN(DIFF)	16.23	17.50	
(*) -EXCLUDES MOISTURE					% MINERAL MATTER	7.28		
					(INCL. 0.15% FES2)			

SULFUR FORMS	% PYRITIC	% SULFATIC	% ORGANIC	% TOTAL
DRY	0.08	0.02	0.31	0.41
DAF	0.09	0.02	0.33	0.44

DRY % CHLORINE = 0.09 DRY % CO2 = 0.58
MOTT-SPOONER DIFFERENCE = 201.

CALORIFIC VALUE (GROSS, BTU/LB)	DRY	AS REC'D MOIST.	EQUIL. MOIST.	ATOM RATIOS (DMMF)	PARR	MOD. PARR	DIRECT
MM-CONTAINING	12330.	9287.	9301.	ATOMIC H/C	0.8236	0.8116	
MM-FREE (PARR)	13251.	9796.	9811.	ATOMIC O/C	0.1749	0.1726	
MM-FREE (MOD. P)	13294.	9822.	9838.				
NET CV, DMMF BTU/LB	12809.						

SAMPLE IDENTIFICATION:

SAMPLE LOCATION:

** PENN STATE COAL DATA BASE **

PSU NUMBER -> DECS-9
 SEAM NAME -> DIETZ
 ALTERNATE SEAM NAME ->
 APPARENT RANK -> SUBBIT B

COUNTRY -> USA
 STATE -> MONTANA

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***** RANK CALCULATIONS *****

APPARENT RANK (AS REC'D MOIST.) -> SUBBIT B INTERNATIONAL RANK :
 AS REC'D MOIST. ->
 ASTM RANK (EQUIL. MOIST.) -> SUBBIT B EQUIL. MOIST. ->
 REFLECTANCE RANK CATEGORY -> REPORTED RANK : -> SUBBIT B

***** PETROGRAPHIC DATA *****

MACERAL COMPOSITION (WHITE LIGHT AND FLUORESCENCE ANALYSIS)

	TEXT- INITE	ULM- INITE	HUMO- DETRINITE	GEL- INITE	CORPO- HUMINITE	SPOR- INITE	CUT- INITE	RES- INITE	ALG- INITE	FUS- INITE	SEMI- FUSINITE	MAC- RINITE	SCLERO- TINITE	
DMMF VOL. %	0.0	43.4	42.0	1.5	0.8	5.1	0.2	0.0	0.0	2.3	2.3	1.7	0.7	
DRY WT. %	0.0	40.3	39.0	1.4	0.7	4.7	0.2	0.0	0.0	2.1	2.1	1.6	0.7	7.1 % MM.
DMMF VOL % HUMINITE = 87.7														

ULMINITE REFLECTANCE DATA: HIGH: 0.47 LOW: 0.27 MEAN-MAX: 0.38

***** C A K I N G A N D M E C H A N I C A L P R O P E R T I E S *****

GIESELER COAL PLASTOMETER:

GRAY-KING COKE TYPE

INIT. SOFTENING TEMP

HARDGROVE GRINDABILITY 40.8

TEMP. MAX. FLUIDITY

FREE SWELLING INDEX 0.0

SOLIDIFICATION TEMP.

VICKERS HARDNESS NUMBER

FLUID TEMP. RANGE

MAXIMUM FLUIDITY

WASHABILITY DATA AVAILABLE? NO

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-9
SEAM NAME -> DIETZ
ALTERNATE SEAM NAME ->
APPARENT RANK -> SUBBIT B

SAMPLE LOCATION:

COUNTRY -> USA
STATE -> MONTANA

*** PENN STATE COAL DATA BASE ***

** DECS-9 **
**
** 11/16/93 **
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MAJOR ELEMENT ANALYSIS

% HTA = 5.96

	SI02	AL203	TI02	FE203	MGO	CAO	NA2O	K2O	P2O5	SO3
OXIDE % OF HTA	36.2	18.1	1.20	4.90	4.52	13.5	5.55	1.01	0.36	13.4
ELEMENT % OF TOTAL DRY COAL	SI	AL	TI	FE	MG	CA	NA	K	P	S
	1.0	0.6	0.04	0.20	0.16	0.6	0.25	0.05	0.01	0.4

TRACE ELEMENT ANALYSIS

% HTA = 5.96

	PPM HTA	PPM TOTAL COAL		PPM HTA	PPM TOTAL COAL		PPM HTA	PPM TOTAL COAL	VOLATILES -----	PPM TOTAL COAL
AG			GE			SN			AS	
B			LA			SR	5835.	348.	BR	
BA	11644.	694.	LI			TH			CD	
BE	4.0	0.2	MN	310.	18.	U			CL	900.
BI			MO			V	250.	15.	F	
CE			NB			Y			HG	
CO			NI	< 25.	< 1.	YB			SB	
CR	85.	5.	PB			ZN	130.	8.	SE	
CU	210.	13.	RB	40.	2.	ZR	370.	22.		
GA			SC							

SAMPLE IDENTIFICATION:

 PSU NUMBER -> DECS-9
 SEAM NAME -> DIETZ
 ALTEPNATE SEAM NAME ->
 APPARENT RANK -> SUBBIT B

SAMPLE LOCATION:

 COUNTRY -> USA
 STATE -> MONTANA

** PENN STATE COAL DATA BASE **

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 ** DECS-9 **
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 ** 11/16/93 **
 ** PAGE 5 **

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ASH FUSION TEMPERATURES (ALL TEMPERATURES IN DEGREES F)

	REDUCING	OXIDIZING
INITIAL DEFORMATION	1910.	2050.
SOFTENING	1990.	2145.
HEMISPHERICAL	2040.	2210.
FLUID	2090.	2240.

SAMPLE IDENTIFICATION:

 PSU NUMBER -> DECS-10
 SEAM NAME -> ROSEBUD
 ALTERNATE SEAM NAME ->
 APPARENT RANK -> SUBBIT B

SAMPLE LOCATION:

 COUNTRY -> USA
 STATE -> MONTANA
 COUNTY -> ROSEBUD
 TOWNSHIP ->
 CITY -> COLSTRIP

** PENN STATE COAL DATA BASE **

**
 ** DECS-10 **
 **
 ** 11/16/93 **
 ** PAGE 1 **

SAMPLE HISTORY:

 SAMPLING DATE & AGENCY -> 6/13/90 ; PSU

COAL PROVINCE-> NORTHERN GREAT PLAINS
 REGION -> FORT UNION

SAMPLE TYPE -> CHANNEL-WORKING SECTION

MAP REFERENCE: LATITUDE -> 45 D 48 M 30 S
 LONGITUDE -> 106 D 39 M 30 S
 QUADRANGLE-> COLSTRIP SW (7.5')

ADDITIONAL INFORMATION -> >6" high pyrite coal below pit floor not sampled

MINE INFORMATION:

RESERVES ->

LIFE EXPECTANCY ->

ANNUAL PRODUCTION ->

MINING METHOD -> STRIP

SEAM INFORMATION:

AGE OF SEAM -> PALEO.

GROUP ->

FORMATION -> FORT UNION

SEAM THICKNESS -> 22 FT. 2 IN.

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-10
SEAM NAME -> ROSEBUD
ALTERNATE SEAM NAME ->
APPARENT RANK -> SUBBIT B

SAMPLE LOCATION:

COUNTRY -> USA
STATE -> MONTANA

** PENN STATE COAL DATA BASE **

**
** DECS-10
**
** 11/16/93
** PAGE 2

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* * * * * C H E M I C A L D A T A * * * * *

PROXIMATE ANALYSIS AS REC'D DRY DAF DMMF(PARR)

% EQUILIBRIUM MOISTURE = 23.98

% MOISTURE 21.58

% ASH 9.85 12.56

MM-FREE = 26.96

% VOLATILE 32.68 41.67 47.66 46.86

% FIXED CARBON 35.89 45.77 52.34 53.14

ULTIMATE ANALYSIS AS REC'D DRY DAF DMMF(PARR) ELEMENTAL ANALYSIS DRY DMMF(MOD,P) DMMF(DIR.)

% ASH 9.85 12.56 (14.20%MM) (14.55%MM) (%MM)

% CARBON 53.62 68.37 78.19 79.69 % CARBON 68.12 79.72

% HYDROGEN 2.89 (*) 3.69 4.22 4.30 % HYDROGEN 3.54 4.14

% NITROGEN 0.72 0.92 1.05 1.07 % NITROGEN 0.92 1.08

% TOTAL SULFUR 0.91 1.16 1.33 % ORGANIC SULFUR 0.47 0.55

% OXYGEN(DIFF) 10.43 (*) 13.30 15.21 14.94 % OXYGEN(DIFF) 12.40 14.51

(*)-EXCLUDES MOISTURE

% MINERAL MATTER 14.55
(INCL. 1.27% FES2)

SULFUR FORMS % PYRITIC % SULFATIC % ORGANIC % TOTAL

DRY % CHLORINE = 0.07 DRY % CO2 = 0.91

DRY 0.68 0.02 0.47 1.16

MOTT-SPOONER DIFFERENCE = 294.

DAF 0.78 0.02 0.54 1.33

CALORIFIC VALUE
(GROSS, BTU/LB)

DRY AS REC'D
MOIST. MOIST.

EQUIL.
MOIST.

ATOM RATIOS (DMMF) PARR MOD.PARR DIRECT

MM-CONTAINING 11536. 9047. 8770.

ATOMIC H/C 0.6482 0.6242

MM-FREE (PARR) 13378. 10129. 9782.

ATOMIC O/C 0.1407 0.1367

MM-FREE (MOD. P) 13457. 10179. 9829.

NET CV, DMMF BTU/LB 13057.

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-10
SEAM NAME -> ROSEBUD
ALTERNATE SEAM NAME ->
APPARENT RANK -> SUBBIT B

SAMPLE LOCATION:

COUNTRY -> USA
STATE -> MONTANA

** PENN STATE COAL DATA BASE **

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** DECS-10 **
**
** 11/16/93 **
** PAGE 3 **

***** RANK CALCULATIONS *****

APPARENT RANK (AS REC'D MOIST.) -> SUBBIT B
ASTM RANK (EQUIL. MOIST.) -> SUBBIT B
REFLECTANCE RANK CATEGORY ->
INTERNATIONAL RANK :
AS REC'D MOIST. ->
EQUIL. MOIST. ->
REPORTED RANK : -> SUBBIT B

***** PETROGRAPHIC DATA *****

MACERAL COMPOSITION (WHITE LIGHT AND FLUORESCENCE ANALYSIS)

	TEXT- INITE	ULM- INITE	HUMO- DETRINITE	GEL- INITE	CORPO- HUMINITE	SPOR- INITE	CUT- INITE	RES- INITE	ALG- INITE	FUS- INITE	SEMI- FUSINITE	MAC- RINITE	SCLERO- TINITE	
DMMF VOL. %	0.0	34.8	37.4	0.6	0.7	9.7	0.0	0.4	0.0	4.6	6.6	5.1	0.1	
DRY WT. %	0.0	29.9	32.1	0.5	0.6	8.3	0.0	0.3	0.0	3.9	5.7	4.4	0.1	14.2 % MM.
DMMF VOL % HUMINITE = 73.5														

ULMINITE REFLECTANCE DATA: HIGH: 0.49 LOW: 0.33 MEAN-MAX: 0.42

***** C A K I N G A N D M E C H A N I C A L P R O P E R T I E S *****

GIESELER COAL PLASTOMETER:

INIT. SOFTENING TEMP
TEMP. MAX. FLUIDITY
SOLIDIFICATION TEMP.
FLUID TEMP. RANGE

GRAY-KING COKE TYPE

HARDGROVE GRINDABILITY 45.5
FREE SWELLING INDEX 0.0
VICKERS HARDNESS NUMBER

MAXIMUM FLUIDITY
WASHABILITY DATA AVAILABLE? NO

Abstract

```
-> DECS-10
-> ROSEBUD
->
-> SUBBIT B
```

Figure 1

-> USA

-> MONTANA

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 14
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SI02	AL203	TI02	FE203	MGO	CAO	NA2O	K2O	P2O5	S03
37.0	17.9	0.76	9.14	3.31	13.2	1.17	0.48	0.31	16.2
SI	AL	TI	FE	MG	CA	NA	K	P	S
2.3	1.3	0.06	0.85	0.26	1.3	0.12	0.05	0.02	1.2

[illegible]

	PPM HTA	PPM TOTAL COAL		PPM HTA	PPM TOTAL COAL		PPM HTA	PPM TOTAL COAL	VOLATILES -----	PPM TOTAL COAL
AG			GE			SN			AS	
B			LA			SR	4059.	538.	BR	
BA	6628.	879.	LI			TH			CD	
BE	4.0	0.5	MN	1162.	154.	U			CL	700.
BI			MO			V	15.	2.	F	
CE			NB			Y			HG	
CO			NI	< 25.	< 3.	YB			SB	
CR	50.	7.	PB			ZN	35.	5.	SE	
CU	70.	9.	RB	25.	3.	ZR	290.	38.		
GA			SC							

SAMPLE IDENTIFICATION:

 PSU NUMBER -> DECS-10
 SEAM NAME -> ROSEBUD
 ALTERNATE SEAM NAME ->
 APPARENT RANK -> SUBBIT B

SAMPLE LOCATION:

 COUNTRY -> USA
 STATE -> MONTANA

** PENN STATE COAL DATA BASE **

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 ** DECS-10 **
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 ** 11/16/93 **
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ASH FUSION TEMPERATURES (ALL TEMPERATURES IN DEGREES F)

	REDUCING	OXIDIZING
INITIAL DEFORMATION	2080.	2200.
SOFTENING	2155.	2260.
HEMISPHERICAL	2200.	2300.
FLUID	2250.	2345.

SAMPLE IDENTIFICATION:

 PSU NUMBER -> DECS-11
 SEAM NAME -> BEULAH
 ALTERNATE SEAM NAME ->
 APPARENT RANK -> LIGNITE

SAMPLE HISTORY:

 SAMPLING DATE & AGENCY -> 6/15/90 ; PSU

SAMPLE TYPE -> CHANNEL-WHOLE SEAM

ADDITIONAL INFORMATION -> Face loosened by blasting; no description.

MINE INFORMATION:

RESERVES ->
 ANNUAL PRODUCTION -> 9999 THOUSAND TONS

SAMPLE LOCATION:

 COUNTRY -> USA
 STATE -> NORTH DAKOTA
 COUNTY -> MERCER
 TOWNSHIP ->
 CITY -> BEULAH

COAL PROVINCE -> NORTHERN GREAT PLAINS
 REGION -> FORT UNION

MAP REFERENCE: LATITUDE -> 47 D 23 M 29 S
 LONGITUDE -> 101 D 47 M 59 S
 QUADRANGLE -> BEULAH NE (7.5')

LIFE EXPECTANCY -> 50 YEARS
 MINING METHOD -> STRIP

** PENN STATE COAL DATA BASE **

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 ** DECS-11 **
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 ** PAGE 1 **

SEAM INFORMATION:

AGE OF SEAM -> PALEO.
 GROUP ->
 FORMATION -> FORT UNION
 SEAM THICKNESS -> 17 FT. 0 IN.

SAMPLE IDENTIFICATION:

SAMPLE LOCATION:

** PENN STATE COAL DATA BASE **

PSU NUMBER -> DECS-11
SEAM NAME -> BEULAH
ALTERNATE SEAM NAME ->
APPARENT RANK -> LIGNITE

COUNTRY -> USA
STATE -> NORTH DAKOTA

**
** DECS-11
**
** 11/16/93
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* * * * * C H E M I C A L D A T A * * * * *

PROXIMATE ANALYSIS AS REC'D DRY DAF DMMF(PARR)

% MOISTURE	33.38				% EQUILIBRIUM MOISTURE = 35.22
% ASH	6.37	9.56			MM-FREE = 37.92
% VOLATILE	37.36	56.08	62.01	61.63	
% FIXED CARBON	22.89	34.36	37.99	38.37	

ULTIMATE ANALYSIS AS REC'D DRY DAF DMMF(PARR) ELEMENTAL ANALYSIS DRY DMMF(MOD.P) DMMF(DIR.)

% ASH	6.37	9.56		(10.73%MM)			(10.99%MM)	(%MM)
% CARBON	44.07	66.15	73.14	74.10	% CARBON	66.05	74.20	
% HYDROGEN	2.68 (*)	4.03	4.46	4.51	% HYDROGEN	3.91	4.39	
% NITROGEN	0.60	0.90	1.00	1.01	% NITROGEN	0.90	1.01	
% TOTAL SULFUR	0.49	0.74	0.82		% ORGANIC SULFUR	0.39	0.44	
% OXYGEN(DIFF)	12.40 (*)	18.62	20.59	20.37	% OXYGEN(DIFF)	17.76	19.96	
(*)-EXCLUDES MOISTURE					% MINERAL MATTER	10.99		
					(INCL. 0.58% FES2)			

SULFUR FORMS % PYRITIC % SULFATIC % ORGANIC % TOTAL

DRY	0.31	0.03	0.39	0.74
DAF	0.34	0.03	0.43	0.82

DRY % CHLORINE = 0.08 DRY % CO2 = 0.38

MOTT-SPOONER DIFFERENCE = 179.

CALORIFIC VALUE DRY AS REC'D EQUIL. ATOM RATIOS (DMMF) PARR MOD. PARR DIRECT
(GROSS, BTU/LB) MOIST. MOIST.

MM-CONTAINING	11062.	7370.	7166.	ATOMIC H/C	0.7317	0.7114	
MM-FREE (PARR)	12350.	7910.	7676.	ATOMIC O/C	0.2064	0.2019	
MM-FREE (MOD. P)	12409.	7940.	7703.				
NET CV, DMMF BTU/LB	11989.						

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-11
SEAM NAME -> BEULAH
ALTERNATE SEAM NAME ->
APPARENT RANK -> LIGNITE

SAMPLE LOCATION:

COUNTRY -> USA
STATE -> NORTH DAKOTA

** PENN STATE COAL DATA BASE **
** DECS-11 **
** 11/16/93 **
** PAGE 3 **

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***** RANK CALCULATIONS *****

APPARENT RANK (AS REC'D MOIST.) -> LIGNITE
ASTM RANK (EQUIL. MOIST.) -> LIGNITE
REFLECTANCE RANK CATEGORY ->
INTERNATIONAL RANK :
AS REC'D MOIST. ->
EQUIL. MOIST. ->
REPORTED RANK : -> LIGNITE

***** PETROGRAPHIC DATA *****

MACERAL COMPOSITION (WHITE LIGHT AND FLUORESCENCE ANALYSIS)

	TEXT- INITE	ULM- INITE	HUMO- DETRINITE	GEL- INITE	CORPO- HUMINITE	SPOR- INITE	CUT- INITE	RES- INITE	ALG- INITE	FUS- INITE	SEMI- FUSINITE	MAC- RINITE	SCLERO- TINITE	
DMMF VOL. %	0.0	41.7	28.4	1.2	2.5	5.8	0.4	0.5	0.0	4.6	9.2	5.4	0.3	
DRY WT. %	0.0	37.2	25.4	1.1	2.2	5.2	0.4	0.4	0.0	4.1	8.2	4.8	0.3	10.7 % MM.
DMMF VOL % HUMINITE = 73.8														

ULMINITE REFLECTANCE DATA: HIGH: 0.47 LOW: 0.25 MEAN-MAX: 0.35

***** C A K I N G A N D M E C H A N I C A L P R O P E R T I E S *****

GIESELER COAL PLASTOMETER:

INIT. SOFTENING TEMP
TEMP. MAX. FLUIDITY
SOLIDIFICATION TEMP.
FLUID TEMP. RANGE

GRAY-KING COKE TYPE

HARDGROVE GRINDABILITY 56.7
FREE SWELLING INDEX 0.0
VICKERS HARDNESS NUMBER

MAXIMUM FLUIDITY
WASHABILITY DATA AVAILABLE? NO

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-11
SEAM NAME -> BEULAH
ALTERNATE SEAM NAME ->
APPARENT RANK -> LIGNITE

SAMPLE LOCATION:

COUNTRY -> USA
STATE -> NORTH DAKOTA

*** PENN STATE COAL DATA BASE ***

*** DECS-11 ***

*** 11/16/93 ***
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MAJOR ELEMENT ANALYSIS

% HTA = 9.41

	SI02	AL203	TI02	FE203	MGO	CAO	NA2O	K2O	P2O5	S03
OXIDE % OF HTA	11.5	11.1	0.57	9.29	9.94	27.4	9.39	0.59	0.49	18.2
	SI	AL	TI	FE	MG	CA	NA	K	P	S
ELEMENT % OF TOTAL DRY COAL	0.5	0.6	0.03	0.61	0.56	1.8	0.66	0.05	0.02	0.7

TRACE ELEMENT ANALYSIS

% HTA = 9.41

	PPM HTA	PPM TOTAL COAL		PPM HTA	PPM TOTAL COAL		PPM HTA	PPM TOTAL COAL	VOLATILES -----	PPM TOTAL COAL
AG			GE			SN			AS	
B			LA			SR	8202.	772.	BR	
BA	9225.	868.	LI			TH			CD	
BE	7.0	0.7	MN	620.	58.	U			CL	800.
BI			MO			V	145.	14.	F	
CE			NB			Y			HG	
CO			NI	< 25.	< 2.	YB			SB	
CR	55.	5.	PB			ZN	120.	11.	SE	
CU	95.	9.	RB	25.	2.	ZR	160.	15.		
GA			SC							

SAMPLE IDENTIFICATION:

 PSU NUMBER -> DECS-11
 SEAM NAME -> BEULAH
 ALTERNATE SEAM NAME ->
 APPARENT RANK -> LIGNITE

SAMPLE LOCATION:

 COUNTRY -> USA
 STATE -> NORTH DAKOTA

** PENN STATE COAL DATA BASE **

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ASH FUSION TEMPERATURES (ALL TEMPERATURES IN DEGREES F)

	REDUCING	OXIDIZING
INITIAL DEFORMATION	2000.	2200.
SOFTENING	2070.	2270.
HEMISPHERICAL	2100.	2330.
FLUID	2140.	2380.

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-12
SEAM NAME -> PITTSBURGH
ALTERNATE SEAM NAME -> #8
APPARENT RANK -> HVA

SAMPLE HISTORY:

SAMPLING DATE & AGENCY -> 7/25/90 ; PSU

SAMPLE TYPE -> CHANNEL-WHOLE SEAM

ADDITIONAL INFORMATION ->

MINE INFORMATION:

RESERVES ->

ANNUAL PRODUCTION ->

SAMPLE LOCATION:

COUNTRY -> USA
STATE -> PENNSYLVANIA
COUNTY -> GREENE

TOWNSHIP ->
CITY -> GRAYSVILLE

COAL PROVINCE -> EASTERN
REGION -> APPALACHIAN

MAP REFERENCE: LATITUDE -> 39 D 55 M 58 S
LONGITUDE -> 80 D 23 M 59 S
QUADRANGLE -> WIND RIDGE (7.5')

** PENN STATE COAL DATA BASE **

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SEAM INFORMATION:

AGE OF SEAM -> PENNSYL.

GROUP -> MONONGAHELA

FORMATION ->

SEAM THICKNESS -> 6 FT. 6 IN.

** SEAM PROFILE **

ROOF -> hard gray mudstone
15 IN. -> rider: bright clarain & shale
26 IN. -> bright clarain w/ occ. vitrain
2 IN. -> shale parting & vitrain
35 IN. -> bright clarain w/ occ. vitrain
FLOOR -> hard gray mudstone, clay

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-12
SEAM NAME -> PITTSBURGH
ALTERNATE SEAM NAME -> #8
APPARENT RANK -> HVA

SAMPLE LOCATION:

COUNTRY -> USA
STATE -> PENNSYLVANIA

** PENN STATE COAL DATA BASE **

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* * * * * C H E M I C A L D A T A * * * * *

PROXIMATE ANALYSIS	AS REC'D	DRY	DAF	DMMF(PARR)	
% MOISTURE	2.40				% EQUILIBRIUM MOISTURE = 2.88
% ASH	10.00	10.25			MM-FREE = 3.26
% VOLATILE	35.16	36.02	40.13	39.35	
% FIXED CARBON	52.44	53.73	59.87	60.65	

ULTIMATE ANALYSIS	AS REC'D	DRY	DAF	DMMF(PARR)	ELEMENTAL ANALYSIS	DRY	DMMF(MOD. P)	DMMF(DIR.)
% ASH	10.00	10.25		(11.69%MM)			(11.88%MM)	(%MM)
% CARBON	72.99	74.78	83.32	84.68	% CARBON	74.69	84.75	
% HYDROGEN	4.99 (*)	5.11	5.69	5.79	% HYDROGEN	4.98	5.66	
% NITROGEN	1.20	1.23	1.37	1.39	% NITROGEN	1.23	1.40	
% TOTAL SULFUR	1.09	1.12	1.25		% ORGANIC SULFUR	0.73	0.83	
% OXYGEN(DIFF)	7.33 (*)	7.51	8.37	8.15	% OXYGEN(DIFF)	6.49	7.37	
(*) -EXCLUDES MOISTURE					% MINERAL MATTER	11.88		
					(INCL. 0.71% FES2)			

SULFUR FORMS	% PYRITIC	% SULFATIC	% ORGANIC	% TOTAL	
DRY	0.38	0.01	0.73	1.12	DRY % CHLORINE = 0.23 DRY % CO2 = 0.34
DAF	0.42	0.01	0.81	1.25	MOTT-SPOONER DIFFERENCE = 61.

CALORIFIC VALUE (GROSS, BTU/LB)	DRY	AS REC'D MOIST.	EQUIL. MOIST.	ATOM RATIOS (DMMF)	PARR	MOD. PARR	DIRECT
MM-CONTAINING	13532.	13207.	13142.	ATOMIC H/C	0.8208	0.8016	
MM-FREE (PARR)	15259.	14846.	14763.	ATOMIC O/C	0.0722	0.0653	
MM-FREE (MOD. P)	15332.	14916.	14833.				
NET CV, DMMF BTU/LB	14795.						

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-12
SEAM NAME -> PITTSBURGH
ALTERNATE SEAM NAME -> #8
APPARENT RANK -> HVA

SAMPLE LOCATION:

COUNTRY -> USA
STATE -> PENNSYLVANIA

** PENN STATE COAL DATA BASE **
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***** RANK CALCULATIONS *****

APPARENT RANK (AS REC'D MOIST.) -> HVA
ASTM RANK (EQUIL. MOIST.) -> HVA
REFLECTANCE RANK CATEGORY -> HVA
INTERNATIONAL RANK :
AS REC'D MOIST. ->
EQUIL. MOIST. ->
REPORTED RANK : -> HVA

***** PETROGRAPHIC DATA *****

MACERAL COMPOSITION (WHITE LIGHT ANALYSIS)

	VITRINITE	PSEUDO-VITRINITE	FUSINITE	SEMI-FUSINITE	MACRINITE	MICRINITE	SCLERO-TINITE	SPOR-INITE	RESINITE	ALGINITE	CUTINITE
DMMF VOL. %	83.0	0.0	2.7	4.0	1.4	0.8	0.0	7.1	1.0	0.0	0.0
DRY VOL. %	78.0	0.0	2.5	3.8	1.3	0.8	0.0	6.7	0.9	0.0	6.0 % MM
DRY WT. %	73.0	0.0	2.7	3.8	1.3	0.8	0.0	5.9	0.8	0.0	11.7 % MM

REFLECTANCE DATA

VITRINITE : HIGH: 0.99 LOW: 0.68 MEAN-MAX: 0.87

VITRINITE TYPES

V 6	V 7	V 8	V 9
1.0	6.0	60.0	33.0

***** CAKING AND MECHANICAL PROPERTIES *****

GIESELER COAL PLASTOMETER:

INIT. SOFTENING TEMP 387
TEMP. MAX. FLUIDITY 440
SOLIDIFICATION TEMP. 477
FLUID TEMP. RANGE 90

GRAY-KING COKE TYPE

HARDGROVE GRINDABILITY 56.4
FREE SWELLING INDEX 7.5
VICKERS HARDNESS NUMBER

MAXIMUM FLUIDITY 20002
WASHABILITY DATA AVAILABLE? NO

SAMPLE IDENTIFICATION:

 PSU NUMBER -> DECS-12
 SEAM NAME -> PITTSBURGH
 ALTERNATE SEAM NAME -> #8
 APPARENT RANK -> HVA

SAMPLE LOCATION:

 COUNTRY -> USA
 STATE -> PENNSYLVANIA

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MAJOR ELEMENT ANALYSIS

% HTA = 11.89

	SI02	AL203	TI02	FE203	MGO	CAO	NA2O	K2O	P2O5	S03
OXIDE % OF HTA	55.8	25.8	1.21	6.37	0.91	3.20	0.49	2.19	0.56	2.10
	SI	AL	TI	FE	MG	CA	NA	K	P	S
ELEMENT % OF TOTAL DRY COAL	3.1	1.6	0.09	0.53	0.07	0.27	0.04	0.22	0.03	1.12

TRACE ELEMENT ANALYSIS

% HTA = 11.89

	PPM HTA	PPM TOTAL COAL		PPM HTA	PPM TOTAL COAL		PPM HTA	PPM TOTAL COAL	VOLATILES -----	PPM TOTAL COAL
AG			GE			SN			AS	
B			LA			SR	930.	111.	BR	
BA	717.	85.	LI			TH			CD	
BE	8.0	1.0	MN	155.	18.	U			CL	2300.
BI			MO			V	60.	7.	F	
CE			NB			Y			HG	
CO			NI	95.	11.	YB			SB	
CR	180.	21.	PB			ZN	130.	15.	SE	
CU	75.	9.	RB	100.	12.	ZR	200.	24.		
GA			SC							

SAMPLE IDENTIFICATION:

 PSU NUMBER -> DECS-12
 SEAM NAME -> PITTSBURGH
 ALTERNATE SEAM NAME -> #8
 APPARENT RANK -> HVA

SAMPLE LOCATION:

 COUNTRY -> USA
 STATE -> PENNSYLVANIA

** PENN STATE COAL DATA BASE **
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ASH FUSION TEMPERATURES (ALL TEMPERATURES IN DEGREES F)

	REDUCING	OXIDIZING
INITIAL DEFORMATION	2225.	2420.
SOFTENING	2330.	2510.
HEMISPHERICAL	2390.	2565.
FLUID	2445.	2600.

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-13
SEAM NAME -> SEWELL
ALTERNATE SEAM NAME ->
APPARENT RANK -> MED VOL

SAMPLE HISTORY:

SAMPLING DATE & AGENCY -> 12/13/90 ; PSU

SAMPLE TYPE -> CHANNEL-WHOLE SEAM

ADDITIONAL INFORMATION ->

MINE INFORMATION:

RESERVES ->

ANNUAL PRODUCTION ->

SAMPLE LOCATION:

COUNTRY -> USA
STATE -> WEST VIRGINIA
COUNTY -> GREENBRIER
TOWNSHIP -> NEW HAVEN
CITY -> BELLBURN

COAL PROVINCE -> EASTERN
REGION -> APPALACHIAN

MAP REFERENCE: LATITUDE -> 38 D 1 M 29 S
LONGITUDE -> 80 D 46 M 30 S
QUADRANGLE -> CORLISS (7.5')

** PENN STATE COAL DATA BASE **

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LIFE EXPECTANCY ->

MINING METHOD ->

SEAM INFORMATION:

AGE OF SEAM -> PENNSYL.

GROUP -> POTTSVILLE

FORMATION -> NEW RIVER

SEAM THICKNESS -> 1 FT. 8 IN.

** SEAM PROFILE **

ROOF -> hard gray mudstone
20 IN. -> bright clarain, shale lenses
FLOOR -> gray shale & coal (gradational)

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-13
SEAM NAME -> SEWELL
ALTERNATE SEAM NAME ->
APPARENT RANK -> MED VOL

SAMPLE LOCATION:

COUNTRY -> USA
STATE -> WEST VIRGINIA

** PENN STATE COAL DATA BASE **
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***** CHEMICAL DATA *****

PROXIMATE ANALYSIS	AS REC'D	DRY	DAF	DMMF(PARR)
% MOISTURE	1.45			
% ASH	4.16	4.22		
% VOLATILE	24.62	24.98	26.08	25.65
% FIXED CARBON	69.77	70.80	73.92	74.35

% EQUILIBRIUM MOISTURE = 1.89
MM-FREE = 1.99

ULTIMATE ANALYSIS	AS REC'D	DRY	DAF	DMMF(PARR)	ELEMENTAL ANALYSIS	DRY	DMMF(MOD. P)	DMMF(DIR.)
% ASH	4.16	4.22		(4.90%MM)			(4.93%MM)	(%MM)
% CARBON	83.25	84.47	88.19	88.82	% CARBON	84.39	88.77	
% HYDROGEN	4.67 (*)	4.74	4.95	4.98	% HYDROGEN	4.69	4.93	
% NITROGEN	1.42	1.44	1.50	1.51	% NITROGEN	1.44	1.51	
% TOTAL SULFUR	0.61	0.62	0.65		% ORGANIC SULFUR	0.54	0.57	
% OXYGEN(DIFF)	4.44 (*)	4.51	4.71	4.68	% OXYGEN(DIFF)	4.01	4.22	
					% MINERAL MATTER (INCL. 0.13% FES2)	4.93		

(*)-EXCLUDES MOISTURE

SULFUR FORMS	% PYRITIC	% SULFATIC	% ORGANIC	% TOTAL
DRY	0.07	0.01	0.54	0.62
DAF	0.07	0.01	0.56	0.65

DRY % CHLORINE = 0.26 DRY % CO2 = 0.30
MOTT-SPOONER DIFFERENCE = 44.

CALORIFIC VALUE (GROSS, BTU/LB)	DRY	AS REC'D MOIST.	EQUIL. MOIST.	ATOM RATIOS (DMMF)	PARR	MOD. PARR	DIRECT
MM-CONTAINING	14871.	14655.	14590.	ATOMIC H/C	0.6740	0.6670	
MM-FREE (PARR)	15604.	15367.	15295.	ATOMIC O/C	0.0396	0.0357	
MM-FREE (MOD. P)	15638.	15400.	15328.				
NET CV, DMMF BTU/LB	15176.						

SAMPLE IDENTIFICATION:

SAMPLE LOCATION:

** PENN STATE COAL DATA BASE **

PSU NUMBER -> DECS-13
 SEAM NAME -> SEWELL
 ALTERNATE SEAM NAME ->
 APPARENT RANK -> MED VOL

COUNTRY -> USA
 STATE -> WEST VIRGINIA

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***** RANK CALCULATIONS *****

APPARENT RANK (AS REC'D MOIST.) -> MED VOL INTERNATIONAL RANK :
 AS REC'D MOIST. ->
 ASTM RANK (EQUIL. MOIST.) -> MED VOL EQUIL. MOIST. ->
 REFLECTANCE RANK CATEGORY -> MED VOL REPORTED RANK : -> MED VOL

***** PETROGRAPHIC DATA *****

MACERAL COMPOSITION (WHITE LIGHT ANALYSIS)

	VITRINITE	PSEUDO-VITRINITE	FUSINITE	SEMI-FUSINITE	MACRINITE	MICRINITE	SCLERO-TINITE	SPOR-INITE	RESINITE	ALGINITE	CUTINITE	
DMMF VOL. %	77.2	0.0	5.2	7.4	4.5	0.9	0.0	3.1	1.4	0.0	0.3	
DRY VOL. %	75.3	0.0	5.1	7.2	4.4	0.9	0.0	3.0	1.4	0.0	0.3	2.4 % MM
DRY WT. %	72.3	0.0	5.6	7.5	4.5	0.9	0.0	2.8	1.3	0.0	0.3	4.9 % MM

REFLECTANCE DATA

VITRINITE :

HIGH: 1.48 LOW: 1.22 MEAN-MAX: 1.35

VITRINITE TYPES

V12 V13 V14

PERCENT

14.0 75.0 11.0

***** CAKING AND MECHANICAL PROPERTIES *****

GIESELER COAL PLASTOMETER:

GRAY-KING COKE TYPE

INIT. SOFTENING TEMP 404
 TEMP. MAX. FLUIDITY 456
 SOLIDIFICATION TEMP. 493
 FLUID TEMP. RANGE 89
 MAXIMUM FLUIDITY 909
 WASHABILITY DATA AVAILABLE? NO

HARDGROVE GRINDABILITY 82.1
 FREE SWELLING INDEX 8.0
 VICKERS HARDNESS NUMBER

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-13
SEAM NAME -> SEWELL
ALTERNATE SEAM NAME ->
APPARENT RANK -> MED VOL

SAMPLE LOCATION:

COUNTRY -> USA
STATE -> WEST VIRGINIA

** PENN STATE COAL DATA BASE **

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MAJOR ELEMENT ANALYSIS

% HTA = 4.23

	SI02	AL203	T102	FE203	MGO	CAO	NA2O	K2O	P2O5	S03
OXIDE % OF HTA	52.8	33.3	1.02	4.59	0.97	1.78	0.70	2.29	1.16	0.20
ELEMENT % OF TOTAL DRY COAL	SI	AL	TI	FE	MG	CA	NA	K	P	S
	1.0	0.7	0.03	0.14	0.02	0.05	0.02	0.08	0.02	0.62

TRACE ELEMENT ANALYSIS

% HTA = 4.23

	PPM HTA	PPM TOTAL COAL		PPM HTA	PPM TOTAL COAL		PPM HTA	PPM TOTAL COAL	VOLATILES -----	PPM TOTAL COAL
AG			GE			SN			AS	
B			LA			SR	2452.	104.	BR	
BA	2597.	110.	LI			TH			CD	
BE	24.	1.	MN	77.	3.	U			CL	2600.
BI			MO			V	270.	11.	F	
CE			NB			Y			HG	
CO			NI	270.	11.	YB			SB	
CR	260.	11.	PB			ZN	150.	6.	SE	
CU	260.	11.	RB	95.	4.	ZR	130.	6.		
GA			SC							

SAMPLE IDENTIFICATION:

 PSU NUMBER -> DECS-13
 SEAM NAME -> SEWELL
 ALTERNATE SEAM NAME ->
 APPARENT RANK -> MED VOL

SAMPLE LOCATION:

 COUNTRY -> USA
 STATE -> WEST VIRGINIA

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ASH FUSION TEMPERATURES (ALL TEMPERATURES IN DEGREES F)

	REDUCING	OXIDIZING
INITIAL DEFORMATION	2750.+	2800.+
SOFTENING	2800.+	2800.+
HEMISPHERICAL	2800.+	2800.+
FLUID	2800.+	2800.+

SAMPLE IDENTIFICATION:

 PSU NUMBER -> DECS-14
 SEAM NAME -> UPPER KITTANNING
 ALTERNATE SEAM NAME ->
 APPARENT RANK -> HVA

SAMPLE HISTORY:

 SAMPLING DATE & AGENCY -> 12/14/90 ; PSU

 SAMPLE TYPE -> CHANNEL-WORKING SECTION
 ADDITIONAL INFORMATION -> Bottom 38" of seam

MINE INFORMATION:

 RESERVES ->
 ANNUAL PRODUCTION ->

SEAM INFORMATION:

 AGE OF SEAM -> PENNSYL.
 GROUP -> ALLEGHENY
 FORMATION ->
 SEAM THICKNESS ->

SAMPLE LOCATION:

 COUNTRY -> USA
 STATE -> WEST VIRGINIA
 COUNTY -> BARBOUR
 TOWNSHIP -> PLEASANT
 CITY -> PHILIPPI

COAL PROVINCE -> EASTERN
 REGION -> APPALACHIAN

MAP REFERENCE: LATITUDE -> 39 D 8 M 18 S
 LONGITUDE -> 80 D 3 M 13 S
 QUADRANGLE -> PHILIPPI (7.5')

** PENN STATE COAL DATA BASE **

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SAMPLE IDENTIFICATION:

SAMPLE LOCATION:

** PENN STATE COAL DATA BASE **

PSU NUMBER -> DECS-14
SEAM NAME -> UPPER KITTANNING
ALTERNATE SEAM NAME ->
APPARENT RANK -> HVA

COUNTRY -> USA
STATE -> WEST VIRGINIA

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* * * * * C H E M I C A L D A T A * * * * *

PROXIMATE ANALYSIS AS REC'D DRY DAF DMMF(PARR)

% MOISTURE	1.46				% EQUILIBRIUM MOISTURE = 1.86
% ASH	10.37	10.52			MM-FREE = 2.12
% VOLATILE	32.11	32.59	36.42	35.40	
% FIXED CARBON	56.06	56.89	63.58	64.60	

ULTIMATE ANALYSIS AS REC'D DRY DAF DMMF(PARR) ELEMENTAL ANALYSIS DRY DMMF(MOD.P) DMMF(DIR.)

% ASH	10.37	10.52		(12.35%MM)			(12.51%MM)	(%MM)
% CARBON	75.13	76.24	85.20	86.98	% CARBON	76.19	87.08	
% HYDROGEN	4.82 (*)	4.89	5.46	5.58	% HYDROGEN	4.77	5.45	
% NITROGEN	1.28	1.30	1.45	1.48	% NITROGEN	1.30	1.49	
% TOTAL SULFUR	1.77	1.80	2.01		% ORGANIC SULFUR	0.85	0.97	
% OXYGEN(DIFF)	5.17 (*)	5.25	5.87	5.95	% OXYGEN(DIFF)	4.38	5.00	
(*)-EXCLUDES MOISTURE					% MINERAL MATTER	12.51		
					(INCL. 1.76% FES2)			

SULFUR FORMS % PYRITIC % SULFATIC % ORGANIC % TOTAL

DRY	0.94	0.01	0.85	1.80
DAF	1.05	0.01	0.95	2.01

DRY % CHLORINE = 0.37 DRY % CO2 = 0.20
MOTT-SPOONER DIFFERENCE = -62.

CALORIFIC VALUE
(GROSS, BTU/LB)

DRYAS REC'D
MOIST.EQUIL.
MOIST.ATOM RATIOS (DMMF)PARRMOD. PARRDIRECT

MM-CONTAINING	13678.	13478.	13424.
MM-FREE (PARR)	15503.	15245.	15175.
MM-FREE (MOD. P)	15577.	15317.	15246.
NET CV, DMMF BTU/LB	15058.		

ATOMIC H/C	0.7704	0.7523
ATOMIC O/C	0.0514	0.0431

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-14
SEAM NAME -> UPPER KITTANNING
ALTERNATE SEAM NAME ->
APPARENT RANK -> HVA

SAMPLE LOCATION:

COUNTRY -> USA
STATE -> WEST VIRGINIA

** PENN STATE COAL DATA BASE **

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* * * * * R A N K C A L C U L A T I O N S * * * * *

APPARENT RANK (AS REC'D MOIST.) -> HVA INTERNATIONAL RANK :
ASTM RANK (EQUIL. MOIST.) -> HVA AS REC'D MOIST. ->
REFLECTANCE RANK CATEGORY -> HVA EQUIL. MOIST. ->
REPORTED RANK : -> HVA

* * * * * P E T R O G R A P H I C D A T A * * * * *

MACERAL COMPOSITION (WHITE LIGHT ANALYSIS)

	VITRINITE	PSEUDO-VITRINITE	FUSINITE	SEMI-FUSINITE	MACRINITE	MICRINITE	SCLERO-TINITE	SPOR-INITE	RESINITE	ALGINITE	CUTINITE	
DMMF VOL. %	89.0	0.0	1.8	2.3	2.2	1.3	0.0	2.3	1.0	0.0	0.1	
DRY VOL. %	83.3	0.0	1.7	2.2	2.1	1.2	0.0	2.2	0.9	0.0	0.1	6.4 % MM
DRY WT. %	77.6	0.0	1.8	2.2	2.1	1.2	0.0	1.9	0.8	0.0	0.1	12.4 % MM

REFLECTANCE DATA

VITRINITE : HIGH: 1.34 LOW: 0.92 MEAN-MAX: 1.07

VITRINITE TYPES	V 9	V10	V11	V12	V13
PERCENT	14.0	62.0	21.0	0.0	3.0

* * * * * C A K I N G A N D M E C H A N I C A L P R O P E R T I E S * * * * *

GIESELER COAL PLASTOMETER:

INIT. SOFTENING TEMP 376
TEMP. MAX. FLUIDITY 446
SOLIDIFICATION TEMP. 485
FLUID TEMP. RANGE 109

GRAY-KING COKE TYPE

HARDGROVE GRINDABILITY 68.9
FREE SWELLING INDEX 8.0
VICKERS HARDNESS NUMBER

MAXIMUM FLUIDITY 29930
WASHABILITY DATA AVAILABLE? NO

APPARENT RANK

-> HVA

EDUCATION.

-> WEST VIRGINIA

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$$\% \text{ HTA} = 10.55$$

	SI02	AL203	TI02	FE203	MGO	CAO	NA2O	K2O	P2O5	SO3
OXIDE % OF HTA	46.1	29.5	1.28	15.0	0.82	2.59	0.24	1.87	0.21	1.30
	SI	AL	TI	FE	MG	CA	NA	K	P	S
ELEMENT % OF TOTAL DRY COAL	2.3	1.6	0.08	1.1	0.05	0.20	0.02	0.16	0.01	1.80

— — — — —

$$\% \text{ HTA} = 10.55$$

	PPM HTA	PPM TOTAL COAL		PPM HTA	PPM TOTAL COAL		PPM HTA	PPM TOTAL COAL	VOLATILES -----	PPM TOTAL COAL
AG			GE			SN				
B			LA			SR	592.	62.	AS	
BA	448.	47.	LI			TH			BR	
BE	10.	1.	MN	77.	8.	U			CD	
BI			MO			V	70.	7.	CL	3700.
CE			NB			Y			F	
CO			NI	55.	6.	YB			HG	
CR	170.	18.	PB			ZN	190.	20.	SB	
CU	95.	10.	RB	100.	11.	ZR	220.	23.	SE	
GA			SC							

SAMPLE IDENTIFICATION:

 PSU NUMBER -> DECS-14
 SEAM NAME -> UPPER KITTANNING
 ALTERNATE SEAM NAME ->
 APPARENT RANK -> HVA

SAMPLE LOCATION:

 COUNTRY -> USA
 STATE -> WEST VIRGINIA

** PENN STATE COAL DATA BASE **

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ASH FUSION TEMPERATURES (ALL TEMPERATURES IN DEGREES F)

	REDUCING	OXIDIZING
INITIAL DEFORMATION	2310.	2520.
SOFTENING	2400.	2600.
HEMISPHERICAL	2460.	2640.
FLUID	2510.	2685.

SAMPLE IDENTIFICATION:

 PSU NUMBER -> DECS-15
 SEAM NAME -> Lower Sunnyside
 ALTERNATE SEAM NAME ->
 APPARENT RANK -> HVA

SAMPLE HISTORY:

 SAMPLING DATE & AGENCY -> 5/ 6/91 ; PSU

SAMPLE TYPE -> CHANNEL-WHOLE SEAM

ADDITIONAL INFORMATION -> upper split of Lower Sunnyside seam

MINE INFORMATION:

 RESERVES ->

ANNUAL PRODUCTION ->

SAMPLE LOCATION:

 COUNTRY -> USA
 STATE -> UTAH
 COUNTY -> Carbon
 TOWNSHIP ->
 CITY -> Sunnyside

COAL PROVINCE-> ROCKY MOUNTAIN
 REGION -> UINTA

MAP REFERENCE: LATITUDE -> 39 D 35 M 30 S
 LONGITUDE -> 110 D 21 M 26 S
 QUADRANGLE-> Patmos Head (7.5')

** PENN STATE COAL DATA BASE **

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LIFE EXPECTANCY ->

MINING METHOD -> UNDERGROUND

SEAM INFORMATION:

 AGE OF SEAM -> U. CRET.
 GROUP -> Mesaverde
 FORMATION -> Blackhawk
 SEAM THICKNESS -> 4 FT. 7 IN.

** SEAM PROFILE **

ROOF -> gray mudstone
 34 IN. -> clarain with some vitrain
 12 IN. -> clarain, abundant resin
 2 IN. -> discount. gray shale parting
 7 IN. -> clarain
 FLOOR -> gray/black laminated mudstone

SAMPLE IDENTIFICATION:

SAMPLE LOCATION:

** PENN STATE COAL DATA BASE **

PSU NUMBER -> DECS-15
 SEAM NAME -> Lower Sunnyside
 ALTERNATE SEAM NAME ->
 APPARENT RANK -> HVA

COUNTRY -> USA
 STATE -> UTAH

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* * * * * C H E M I C A L D A T A * * * * *

PROXIMATE ANALYSIS	AS REC'D	DRY	DAF	DMMF(PARR)	
% MOISTURE	2.71				% EQUILIBRIUM MOISTURE = 3.15
% ASH	9.86	10.13			MM-FREE = 3.56
% VOLATILE	36.86	37.89	42.16	41.31	
% FIXED CARBON	50.57	51.98	57.84	58.69	

ANALYSIS	AS REC'D	DRY	DAF	DMMF(PARR)	ELEMENTAL ANALYSIS	DRY	DMMF(MOD. P.)	DMMF(DIR.)
	9.86	10.13		(11.86%MM)			(11.92%MM)	(%MM)
% CARBON	72.28	74.29	82.66	84.29	% CARBON	74.17	84.21	
% HYDROGEN	4.85 (*)	4.99	5.55	5.66	% HYDROGEN	4.87	5.53	
% NITROGEN	1.55	1.59	1.77	1.80	% NITROGEN	1.59	1.81	
% TOTAL SULFUR	1.62	1.67	1.86		% ORGANIC SULFUR	0.83	0.94	
% OXYGEN(DIFF)	7.13 (*)	7.33	8.16	8.25	% OXYGEN(DIFF)	6.62	7.51	
(*)-EXCLUDES MOISTURE					% MINERAL MATTER	11.92		
					(INCL. 1.55% FES2)			

SULFUR FORMS	% PYRITIC	% SULFATIC	% ORGANIC	% TOTAL
DRY	0.83	0.01	0.83	1.67
DAF	0.92	0.01	0.92	1.86

DRY % CHLORINE = 0.16 DRY % CO2 = 0.43
 MOTT-SPOONER DIFFERENCE = -93.

CALORIFIC VALUE (GROSS, BTU/LB)	DRY	AS REC'D MOIST.	EQUIL. MOIST.	ATOM RATIOS (DMMF)	PARR	MOD. PARR	DIRECT
MM-CONTAINING	13276.	12916.	12858.	ATOMIC H/C	0.8068	0.7894	
MM-FREE (PARR)	14967.	14509.	14435.	ATOMIC O/C	0.0735	0.0670	
MM-FREE (MOD. P)	15021.	14561.	14486.				
NET CV, DMMF BTU/LB	14496.						

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-15
SEAM NAME -> Lower Sunnyside
ALTERNATE SEAM NAME ->
APPARENT RANK -> HVA

SAMPLE LOCATION:

COUNTRY -> USA
STATE -> UTAH

** PENN STATE COAL DATA BASE **
** DECS-15 **
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* * * * * R A N K C A L C U L A T I O N S * * * * *

APPARENT RANK (AS REC'D MOIST.) -> HVA
ASTM RANK (EQUIL. MOIST.) -> HVA
REFLECTANCE RANK CATEGORY -> HVA
INTERNATIONAL RANK :
AS REC'D MOIST. ->
EQUIL. MOIST. ->
REPORTED RANK : ->

* * * * * P E T R O G R A P H I C D A T A * * * * *

MACERAL COMPOSITION (WHITE LIGHT AND FLUORESCENCE ANALYSIS)

	VITRINITE	PSEUDO-VITRINITE	FUSINITE	SEMI-FUSINITE	MACRINITE	MICRINITE	SCLEROTINITE	SPORINITE	RESINITE	ALGINITE	CUTINITE
DMMF VOL. %	76.7	0.0	2.3	4.1	2.8	0.0	0.0	11.3	1.5	0.0	1.3
DRY VOL. %	72.0	0.0	2.2	3.9	2.6	0.0	0.0	10.6	1.4	0.0	1.2 6.1 % MM
DRY WT. %	67.6	0.0	2.3	3.9	2.7	0.0	0.0	9.3	1.2	0.0	1.1 11.9 % MM

REFLECTANCE DATA

VITRINITE : HIGH: 0.95 LOW: 0.68 MEAN-MAX: 0.80

VITRINITE TYPES V 6 V 7 V 8 V 9
PERCENT 1.0 56.0 40.0 3.0

* * * * * C A K I N G A N D M E C H A N I C A L P R O P E R T I E S * * * * *

GIESELER COAL PLASTOMETER:

INIT. SOFTENING TEMP 402
TEMP. MAX. FLUIDITY 442
SOLIDIFICATION TEMP. 478
FLUID TEMP. RANGE 76
MAXIMUM FLUIDITY 959
WASHABILITY DATA AVAILABLE? NO

GRAY-KING COKE TYPE

HARDGROVE GRINDABILITY 54.2
FREE SWELLING INDEX 4.5
VICKERS HARDNESS NUMBER

SAMPLE IDENTIFICATION:

SAMPLE LOCATION:

** PENN STATE COAL DATA BASE **

PSU NUMBER -> DECS-15
SEAM NAME -> Lower Sunnyside
ALTERNATE SEAM NAME ->
APPARENT RANK -> HVA

COUNTRY -> USA
STATE -> UTAH

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MAJOR ELEMENT ANALYSIS

% HTA = 10.08

	SI02	AL203	TIO2	FE203	MGO	CAO	NA2O	K2O	P2O5	SO3
OXIDE % OF HTA	58.9	22.7	1.03	11.6	0.55	1.34	0.78	0.94	0.12	1.10
ELEMENT % OF TOTAL DRY COAL	SI	AL	TI	FE	MG	CA	NA	K	P	S
	2.8	1.2	0.06	0.8	0.03	0.10	0.06	0.08	0.01	1.67

TRACE ELEMENT ANALYSIS

% HTA = 10.08

	PPM HTA	PPM TOTAL COAL		PPM HTA	PPM TOTAL COAL		PPM HTA	PPM TOTAL COAL	VOLATILES -----	PPM TOTAL COAL
AG			GE			SN			AS	
B			LA			SR	179.	18.	BR	
BA			LI			TH			CD	
BE	7.0	0.7	MN	232.	23.	U			CL	1600.
BI			MO			V	50.	5.	F	
CE			NB			Y			HG	
CO			NI	45.	5.	YB			SB	
CR	90.	9.	PB			ZN	160.	16.	SE	
CU	65.	7.	RB	40.	4.	ZR	370.	37.		
GA			SC							

SAMPLE IDENTIFICATION:

 PSU NUMBER -> DECS-15
 SEAM NAME -> Lower Sunnyside
 ALTERNATE SEAM NAME ->
 APPARENT RANK -> HVA

SAMPLE LOCATION:

 COUNTRY -> USA
 STATE -> UTAH

** PENN STATE COAL DATA BASE **

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ASH FUSION TEMPERATURES (ALL TEMPERATURES IN DEGREES F)

	REDUCING	OXIDIZING
INITIAL DEFORMATION	2415.	2655.
SOFTENING	2480.	2695.
HEMISPHERICAL	2560.	2700.+
FLUID	2635.	2700.+

SAMPLE IDENTIFICATION:

 PSU NUMBER -> DECS-16
 SEAM NAME -> Blind Canyon
 ALTERNATE SEAM NAME ->
 APPARENT RANK -> HVB

SAMPLE HISTORY:

 SAMPLING DATE & AGENCY -> 5/ 7/91 ; PSU

SAMPLE TYPE -> CHANNEL-WORKING SECTION

ADDITIONAL INFORMATION ->

MINE INFORMATION:

 RESERVES ->

ANNUAL PRODUCTION ->

SAMPLE LOCATION:

 COUNTRY -> USA

STATE -> UTAH

COUNTY -> Emery

TOWNSHIP ->

CITY -> Huntington

COAL PROVINCE-> ROCKY MOUNTAIN

REGION -> UINTA

MAP REFERENCE: LATITUDE -> 39 D 21 M 2 S
 LONGITUDE -> 111 D 10 M 0 S
 QUADRANGLE-> Mahogany Point (7.5')

** PENN STATE COAL DATA BASE **

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 ** DECS-16 **
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SEAM INFORMATION:

 AGE OF SEAM -> U. CRET.

GROUP -> Mesaverde

FORMATION -> Blackhawk

SEAM THICKNESS -> 7 FT. 6 IN.

** SEAM PROFILE **

ROOF -> gray to black mudstone
 4 IN. -> mudstone w/ vitrain stringers
 13 IN. -> hard bright clarain, resin
 63 IN. -> bright clarain, abund. resin
 10 IN. -> coal below floor NOT SAMPLED
 FLOOR -> not exposed

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-16
SEAM NAME -> Blind Canyon
ALTERNATE SEAM NAME ->
APPARENT RANK -> HVB

SAMPLE LOCATION:

COUNTRY -> USA
STATE -> UTAH

** PENN STATE COAL DATA BASE **

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* * * * * C H E M I C A L D A T A * * * * *

PROXIMATE ANALYSIS	AS REC'D	DRY	DAF	DMMF (PARR)	
% MOISTURE	5.20				% EQUILIBRIUM MOISTURE = 4.88
% ASH	13.17	13.89			MM-FREE = 5.74
% VOLATILE	39.23	41.38	48.05	47.30	
% FIXED CARBON	42.40	44.73	51.95	52.70	

ULTIMATE ANALYSIS	AS REC'D	DRY	DAF	DMMF (PARR)	ELEMENTAL ANALYSIS	DRY	DMMF (MOD. P)	DMMF (DIR.)
% ASH	13.17	13.89		(15.26%MM)			(15.76%MM)	(%MM)
% CARBON	66.15	69.78	81.04	82.35	% CARBON	69.57	82.59	
% HYDROGEN	4.80 (*)	5.06	5.88	5.97	% HYDROGEN	4.88	5.79	
% NITROGEN	1.21	1.28	1.49	1.51	% NITROGEN	1.28	1.52	
% TOTAL SULFUR	0.45	0.47	0.55		% ORGANIC SULFUR	0.40	0.47	
% OXYGEN (DIFF)	9.02 (*)	9.52	11.06	10.17	% OXYGEN (DIFF)	8.11	9.62	
(*) - EXCLUDES MOISTURE					% MINERAL MATTER (INCL. 0.11% FES ₂)	15.76		

SULFUR FORMS	% PYRITIC	% SULFATIC	% ORGANIC	% TOTAL
DRY	0.06	0.01	0.40	0.47
DAF	0.07	0.01	0.46	0.55

DRY % CHLORINE = 0.07 DRY % CO₂ = 0.76
MOTT-SPOONER DIFFERENCE = -27.

CALORIFIC VALUE (GROSS, BTU/LB)	DRY	AS REC'D MOIST.	EQUIL. MOIST.	ATOM RATIOS (DMMF)	PARR	MOD. PARR	DIRECT
MM-CONTAINING	12522.	11871.	11911.	ATOMIC H/C	0.8710	0.8426	
MM-FREE (PARR)	14749.	13853.	13907.	ATOMIC O/C	0.0927	0.0875	
MM-FREE (MOD. P)	14861.	13952.	14008.				
NET CV, DMMF BTU/LB	14304.						

SAMPLE IDENTIFICATION:

SAMPLE LOCATION:

** PENN STATE COAL DATA BASE **

 PSU NUMBER -> DECS-16
 SEAM NAME -> Blind Canyon
 ALTERNATE SEAM NAME ->
 APPARENT RANK -> HVB

 COUNTRY -> USA
 STATE -> UTAH

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***** RANK CALCULATIONS *****

APPARENT RANK (AS REC'D MOIST.) -> HVB INTERNATIONAL RANK :
 AS REC'D MOIST. ->
 ASTM RANK (EQUIL. MOIST.) -> HVB EQUIL. MOIST. ->
 REFLECTANCE RANK CATEGORY -> HVB REPORTED RANK : -> HVA

***** PETROGRAPHIC DATA *****

MACERAL COMPOSITION (WHITE LIGHT AND FLUORESCENCE ANALYSIS)

	VITRINITE	PSEUDO-VITRINITE	FUSINITE	SEMI-FUSINITE	MACRINITE	MICRINITE	SCLERO-TINITE	SPOR-INITE	RESINITE	ALGINITE	CUTINITE	
DMMF VOL. %	76.7	0.0	1.1	4.7	3.0	0.6	0.0	8.2	5.1	0.0	0.8	
DRY VOL. %	70.6	0.0	1.0	4.3	2.8	0.6	0.0	7.5	4.7	0.0	0.7	8.0 % MM
DRY WT. %	65.0	0.0	1.1	4.3	2.7	0.5	0.0	6.4	4.0	0.0	0.6	15.3 % MM

REFLECTANCE DATA

VITRINITE :

HIGH: 0.73 LOW: 0.52 MEAN-MAX: 0.64

VITRINITE TYPES

V 5 V 6 V 7

PERCENT

26.0 61.0 13.0

***** C A K I N G A N D M E C H A N I C A L P R O P E R T I E S *****

GIESELER COAL PLASTOMETER:

INIT. SOFTENING TEMP 396

TEMP. MAX. FLUIDITY 420

SOLIDIFICATION TEMP. 438

FLUID TEMP. RANGE 42

MAXIMUM FLUIDITY 6

WASHABILITY DATA AVAILABLE? NO

GRAY-KING COKE TYPE

HARDGROVE GRINDABILITY 46.6

FREE SWELLING INDEX 2.0

VICKERS HARDNESS NUMBER

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-16
SEAM NAME -> Blind Canyon
ALTERNATE SEAM NAME ->
APPARENT RANK -> HVB

SAMPLE LOCATION:

COUNTRY -> USA
STATE -> UTAH

** PENN STATE COAL DATA BASE **

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MAJOR ELEMENT ANALYSIS

% HTA = 13.45

	SI02	AL203	T102	FE203	MGO	CAO	NA2O	K2O	P2O5	SO3
OXIDE % OF HTA	62.1	21.5	1.01	3.83	1.11	4.21	2.35	1.51	0.17	2.30
ELEMENT % OF TOTAL DRY COAL	SI	AL	TI	FE	MG	CA	NA	K	P	S
	3.9	1.5	0.08	0.36	0.09	0.40	0.23	0.17	0.01	0.47

TRACE ELEMENT ANALYSIS

% HTA = 13.45

	PPM HTA	PPM TOTAL COAL		PPM HTA	PPM TOTAL COAL		PPM HTA	PPM TOTAL COAL	VOLATILES -----	PPM TOTAL COAL
AG			GE			SN			AS	
B			LA			SR	338.	45.	BR	
BA			LI			TH			CD	
BE	4.0	0.5	MN	77.	10.	U			CL	700.
BI			MO			V	90.	12.	F	
CE			NB			Y			HG	
CO			NI	80.	11.	YB			SB	
CR	130.	17.	PB			ZN	105.	14.	SE	
CU	70.	9.	RB	65.	9.	ZR	370.	50.		
GA			SC							

SAMPLE IDENTIFICATION:

 PSU NUMBER -> DECS-16
 SEAM NAME -> Blind Canyon
 ALTERNATE SEAM NAME ->
 APPARENT RANK -> HVB

SAMPLE LOCATION:

 COUNTRY -> USA
 STATE -> UTAH

** PENN STATE COAL DATA BASE **

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ASH FUSION TEMPERATURES (ALL TEMPERATURES IN DEGREES F)

	REDUCING	OXIDIZING
INITIAL DEFORMATION	2280.	2385.
SOFTENING	2315.	2425.
HEMISPHERICAL	2360.	2485.
FLUID	2420.	2660.

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-17
SEAM NAME -> Blind Canyon
ALTERNATE SEAM NAME ->
APPARENT RANK -> HVA

SAMPLE HISTORY:

SAMPLING DATE & AGENCY -> 8/ 5/91 ; PSU

SAMPLE TYPE -> CHANNEL-SUBSECTION

ADDITIONAL INFORMATION ->

MINE INFORMATION:

RESERVES ->

ANNUAL PRODUCTION ->

SAMPLE LOCATION:

COUNTRY -> USA

STATE -> UTAH

COUNTY -> Emery

TOWNSHIP ->

CITY -> Huntington

COAL PROVINCE-> ROCKY MOUNTAIN

REGION -> UINTA

MAP REFERENCE: LATITUDE -> 39 D 21 M 2 S
LONGITUDE -> 111 D 10 M 37 S
QUADRANGLE-> Mahogany Point (7.5')

** PENN STATE COAL DATA BASE **

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LIFE EXPECTANCY ->

MINING METHOD -> UNDERGROUND

SEAM INFORMATION:

AGE OF SEAM -> U. CRET.

GROUP -> Mesaverde

FORMATION -> Blackhawk

SEAM THICKNESS -> 8 FT. 4 IN.

** SEAM PROFILE **

ROOF ->
20 IN. -> Clarain & mudstone NOT SAMPLED
25 IN. -> Bright clarain INCL IN DECS-17
3 IN. -> Discont. bony lyr. NOT SAMPLED
32 IN. -> Bright clarain INCL IN DECS-17
20 IN. -> Clarain NOT SAMPLED
FLOOR ->

SAMPLE IDENTIFICATION:

SAMPLE LOCATION:

** PENN STATE COAL DATA BASE **

PSU NUMBER -> DECS-17
SEAM NAME -> Blind Canyon
ALTERNATE SEAM NAME ->
APPARENT RANK -> HVA

COUNTRY -> USA
STATE -> UTAH

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* * * * * C H E M I C A L D A T A * * * * *

PROXIMATE ANALYSIS AS REC'D DRY DAF DMMF(PARR)

% MOISTURE	3.74				% EQUILIBRIUM MOISTURE = 4.32
% ASH	6.32	6.57			MM-FREE = 4.65
% VOLATILE	45.00	46.75	50.04	49.69	
% FIXED CARBON	44.93	46.68	49.96	50.31	

ULTIMATE ANALYSIS AS REC'D DRY DAF DMMF(PARR) ELEMENTAL ANALYSIS DRY DMMF(MOD.P) DMMF(DIR.)

% ASH	6.32	6.57		(7.34%MM)			(7.49%MM)	(%MM)
% CARBON	73.40	76.25	81.61	82.29	% CARBON	75.90	82.05	
% HYDROGEN	5.58 (*)	5.80	6.21	6.26	% HYDROGEN	5.71	6.18	
% NITROGEN	1.24	1.29	1.38	1.39	% NITROGEN	1.29	1.39	
% TOTAL SULFUR	0.42	0.44	0.47		% ORGANIC SULFUR	0.41	0.44	
% OXYGEN(DIFF)	9.29 (*)	9.65	10.33	10.06	% OXYGEN(DIFF)	9.19	9.94	
					% MINERAL MATTER (INCL. 0.04% FES2)	7.49		

(*)-EXCLUDES MOISTURE

SULFUR FORMS % PYRITIC % SULFATIC % ORGANIC % TOTAL

DRY	0.02	0.01	0.41	0.44
DAF	0.02	0.01	0.44	0.47

DRY % CHLORINE = 0.11 DRY % CO2 = 1.27

MOTT-SPOONER DIFFERENCE = -79.

CALORIFIC VALUE
(GROSS, BTU/LB)

DRY AS REC'D
MOIST.

EQUIL.
MOIST.

ATOM RATIOS (DMMF)PARRMOD. PARRDIRECT

MM-CONTAINING	13826.	13309.	13229.
MM-FREE (PARR)	14897.	14298.	14205.
MM-FREE (MOD. P)	14944.	14342.	14249.
NET CV, DMMF BTU/LB	14363.		

ATOMIC H/C	0.9136	0.9043
ATOMIC O/C	0.0918	0.0909

SAMPLE IDENTIFICATION:

 PSU NUMBER -> DECS-17
 SEAM NAME -> Blind Canyon
 ALTERNATE SEAM NAME ->
 APPARENT RANK -> HVA

SAMPLE LOCATION:

 COUNTRY -> USA
 STATE -> UTAH

** PE'N STATE COAL DATA BASE **
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***** RANK CALCULATIONS *****

APPARENT RANK (AS REC'D MOIST.) -> HVA
 ASTM RANK (EQUIL. MOIST.) -> HVA
 REFLECTANCE RANK CATEGORY -> HVB

INTERNATIONAL RANK :
 AS REC'D MOIST. ->
 EQUIL. MOIST. ->
 REPORTED RANK : -> HVA

***** PETROGRAPHIC DATA *****

MACERAL COMPOSITION (WHITE LIGHT AND FLUORESCENCE ANALYSIS)

	VITRINITE	PSEUDO-VITRINITE	FUSINITE	SEMI-FUSINITE	MACRINITE	MICRINITE	SCLERO-TINITE	SPOR-INITE	RESINITE	ALGINITE	CUTINITE	
DMMF VOL. %	79.7	0.0	1.2	4.8	1.8	0.2	0.1	7.8	3.8	0.3	0.3	
DRY VOL. %	76.8	0.0	1.2	4.6	1.7	0.2	0.1	7.5	3.7	0.3	0.3	3.7 % MM
DRY WT. %	73.9	0.0	1.3	4.8	1.8	0.2	0.1	6.8	3.3	0.3	0.3	7.3 % MM

REFLECTANCE DATA

VITRINITE :

HIGH: 0.65 LOW: 0.52 MEAN-MAX: 0.59

 VITRINITE TYPES V 5 V 6

 PERCENT 56.0 44.0

***** C A K I N G A N D M E C H A N I C A L P R O P E R T I E S *****

GIESELER COAL PLASTOMETER:

INIT. SOFTENING TEMP 387
 TEMP. MAX. FLUIDITY 420
 SOLIDIFICATION TEMP. 442
 FLUID TEMP. RANGE 55
 MAXIMUM FLUIDITY 5
 WASHABILITY DATA AVAILABLE? NO

GRAY-KING COKE TYPE

HARDGROVE GRINDABILITY 46.6
 FREE SWELLING INDEX 2.0
 VICKERS HARDNESS NUMBER

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-17
SEAM NAME -> Blind Canyon
ALTERNATE SEAM NAME ->
APPARENT RANK -> HVA

SAMPLE LOCATION:

COUNTRY -> USA
STATE -> UTAH

** PENN STATE COAL DATA BASE **

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MAJOR ELEMENT ANALYSIS

% HTA = 6.44

	SI02	AL203	TI02	FE203	MG0	CA0	NA20	K20	P205	S03
OXIDE % OF HTA	47.6	9.23	0.76	7.92	1.96	4.80	6.36	0.49	0.13	10.9
ELEMENT % OF TOTAL DRY COAL	SI	AL	TI	FE	MG	CA	NA	K	P	S
	1.4	0.31	0.03	0.36	0.08	0.22	0.30	0.03	0.004	0.4

TRACE ELEMENT ANALYSIS

% HTA = 6.44

	PPM HTA	PPM TOTAL COAL		PPM HTA	PPM TOTAL COAL		PPM HTA	PPM TOTAL COAL	VOLATILES -----	PPM TOTAL COAL
AG			GE			SN			AS	
B			LA			SR			BR	
BA			LI			TH			CD	
BE	< 3.0	< 0.2	MN	155.	10.	U			CL	1100.
BI			MO			V	140.	9.	F	
CE			NB			Y			HG	
CO			NI	< 25.	< 2.	YB			SB	
CR	95.	6.	PB			ZN	50.	3.	SE	
CU	135.	9.	RB	20.	1.	ZR	440.	28.		
GA			SC							

SAMPLE IDENTIFICATION:

 PSU NUMBER -> DECS-17
 SEAM NAME -> Blind Canyon
 ALTERNATE SEAM NAME ->
 APPARENT RANK -> HVA

SAMPLE LOCATION:

 COUNTRY -> USA
 STATE -> UTAH

** PENN STATE COAL DATA BASE **

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ASH FUSION TEMPERATURES (ALL TEMPERATURES IN DEGREES F)

	REDUCING	OXIDIZING
INITIAL DEFORMATION	1800.	2100.
SOFTENING	1900.	2200.
HEMISPHERICAL	1965.	2245.
FLUID	2020.	2290.

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-18
SEAM NAME -> Kentucky #9
ALTERNATE SEAM NAME ->
APPARENT RANK -> HVB

SAMPLE HISTORY:

SAMPLING DATE & AGENCY -> 10/10/91 ; PSU

SAMPLE TYPE -> CHANNEL-WHOLE SEAM

ADDITIONAL INFORMATION ->

MINE INFORMATION:

RESERVES ->

ANNUAL PRODUCTION ->

SAMPLE LOCATION:

COUNTRY -> USA
STATE -> KENTUCKY
COUNTY -> Union
TOWNSHIP ->
CITY -> Waverly

COAL PROVINCE-> INTERIOR
REGION -> EASTERN

MAP REFERENCE: LATITUDE -> 37 D 38 M 48 S
LONGITUDE -> 87 D 48 M 37 S
QUADRANGLE-> Waverly (7.5')

LIFE EXPECTANCY ->

MINING METHOD -> UNDERGROUND

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SEAM INFORMATION:

AGE OF SEAM -> PENNSYL.

GROUP ->

FORMATION -> Carbondale

SEAM THICKNESS -> 5 FT. 2 IN.

** SEAM PROFILE **

ROOF -> gray mudstone, coal stringers
6 IN. -> brt clarain, 1-3mm pyrite btm
27 IN. -> brt clarain, calcite on cleat
19 IN. -> 1cm ptg; brt clarain, vitrain
2 IN. -> pyrite zone NOT SAMPLED
8 IN. -> brt clarain, vitrain, parting
FLOOR -> dk gray mudstone, slickensides

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-18
SEAM NAME -> Kentucky #9
ALTERNATE SEAM NAME ->
APPARENT RANK -> HVB

SAMPLE LOCATION:

COUNTRY -> USA
STATE -> KENTUCKY

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* * * * * C H E M I C A L D A T A * * * * *

PROXIMATE ANALYSIS	AS REC'D	DRY	DAF	DMMF(PARR)
% MOISTURE	6.81			
% ASH	11.42	12.25		
% VOLATILE	38.38	41.18	46.93	45.61
% FIXED CARBON	43.40	46.57	53.07	54.39

% EQUILIBRIUM MOISTURE = 7.84
MM-FREE = 9.10

ULTIMATE ANALYSIS	AS REC'D	DRY	DAF	DMMF(PARR)	ELEMENTAL ANALYSIS	DRY	DMMF(MOD.P)	DMMF(DIR.)
% ASH	11.42	12.25		(15.55%MM)			(15.04%MM)	(%MM)
% CARBON	64.66	69.39	79.08	82.16	% CARBON	69.09	81.32	
% HYDROGEN	4.74 (*)	5.09	5.80	6.03	% HYDROGEN	4.98	5.86	
% NITROGEN	1.17	1.26	1.44	1.49	% NITROGEN	1.26	1.48	
% TOTAL SULFUR	3.92	4.21	4.80		% ORGANIC SULFUR	1.83	2.15	
% OXYGEN(DIFF)	7.27 (*)	7.80	8.89	10.32	% OXYGEN(DIFF)	7.80	9.18	
					% MINERAL MATTER (INCL. 4.43% FES2)	15.04		

(*)-EXCLUDES MOISTURE

SULFUR FORMS	% PYRITIC	% SULFATIC	% ORGANIC	% TOTAL
DRY	2.37	0.01	1.83	4.21
DAF	2.70	0.01	2.09	4.80

DRY % CHLORINE = 0.16 DRY % CO2 = 1.09
MOTT-SPOONER DIFFERENCE = -58.

CALORIFIC VALUE (GROSS, BTU/LB)	DRY	AS REC'D MOIST.	EQUIL. MOIST.	ATOM RATIOS (DMMF)	PARR	MOD. PARR	DIRECT
MM-CONTAINING	12687.	11823.	11692.	ATOMIC H/C	0.8810	0.8654	
MM-FREE (PARR)	14773.	13597.	13421.	ATOMIC O/C	0.0943	0.0848	
MM-FREE (MOD. P)	14782.	13611.	13436.				
NET CV, DMMF BTU/LB	14226.						

SAMPLE IDENTIFICATION:

SAMPLE LOCATION:

** PENN STATE COAL DATA BASE **

PSU NUMBER -> DECS-18
SEAM NAME -> Kentucky #9
ALTERNATE SEAM NAME ->
APPARENT RANK -> HVB

COUNTRY -> USA
STATE -> KENTUCKY

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* * * * * R A N K C A L C U L A T I O N S * * * * *

APPARENT RANK (AS REC'D MOIST.) -> HVB INTERNATIONAL RANK :
ASTM RANK (EQUIL. MOIST.) -> HVB AS REC'D MOIST. ->
REFLECTANCE RANK CATEGORY -> HVC EQUIL. MOIST. ->
REPORTED RANK : ->

* * * * * P E T R O G R A P H I C D A T A * * * * *

MACERAL COMPOSITION (WHITE LIGHT AND FLUORESCENCE ANALYSIS)

	VITRINITE	%SEUDO-VITRINITE	FUSINITE	SEMI-FUSINITE	MACRINITE	MICRINITE	SCLERO-TINITE	SPOR-INITE	RESINITE	ALGINITE	CUTINITE	
DMMF VOL. %	85.7	0.0	1.9	2.2	1.7	0.8	0.0	6.0	0.0	0.5	1.2	
DRY VOL. %	78.7	0.0	1.7	2.0	1.6	0.7	0.0	5.5	0.0	0.5	1.1	8.2 % MM
DRY WT. %	72.3	0.0	1.9	2.0	1.5	0.7	0.0	4.7	0.0	0.4	0.9	15.5 % MM

REFLECTANCE DATA VITRINITE : HIGH: 0.67 LOW: 0.44 MEAN-MAX: 0.56

VITRINITE TYPES V 4 V 5 V 6
PERCENT 10.0 67.0 23.0

* * * * * C A K I N G A N D M E C H A N I C A L P R O P E R T I E S * * * * *

GIESELER COAL PLASTOMETER:

INIT. SOFTENING TEMP 376
TEMP. MAX. FLUIDITY 421
SOLIDIFICATION TEMP. 456
FLUID TEMP. RANGE 80
MAXIMUM FLUIDITY 527
WASHABILITY DATA AVAILABLE? NO

GRAY-KING COKE TYPE

HARDGROVE GRINDABILITY 56.3
FREE SWELLING INDEX 2.0
VICKERS HARDNESS NUMBER

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-18
SEAM NAME -> Kentucky #9
ALTERNATE SEAM NAME ->
APPARENT RANK -> HVB

SAMPLE LOCATION:

COUNTRY -> USA
STATE -> KENTUCKY

** PENN STATE COAL DATA BASE **

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MAJOR ELEMENT ANALYSIS

% HTA = 12.55

	SI02	AL203	TIO2	FE203	MGO	CAO	NA2O	K2O	P2O5	SO3
OXIDE % OF HTA	41.2	15.6	0.75	22.0	0.70	8.08	0.66	1.89	0.04	9.40
	SI	AL	TI	FE	MG	CA	NA	K	P	S
ELEMENT % OF TOTAL DRY COAL	2.4	1.0	0.06	1.9	0.05	0.73	0.06	0.20	0.002	4.21

TRACE ELEMENT ANALYSIS

% HTA = 12.55

	PPM HTA	PPM TOTAL COAL		PPM HTA	PPM TOTAL COAL		PPM HTA	PPM TOTAL COAL	VOLATILES -----	PPM TOTAL COAL
AG			GE			SN			AS	
B			LA			SR	169.	21.	BR	
BA	806.	101.	LI			TH			CD	
BE	15.	2.	MN	387.	49.	U			CL	1600.
BI			MO			V	150.	19.	F	
CE			NB			Y			HG	
CO			NI	60.	8.	YB			SB	
CR	180.	23.	PB			ZN	400.	50.	SE	
CU	80.	10.	RB	75.	9.	ZR	150.	19.		
GA			SC							

SAMPLE IDENTIFICATION:

 PSU NUMBER -> DECS-18
 SEAM NAME -> Kentucky #9
 ALTERNATE SEAM NAME ->
 APPARENT RANK -> HVB

SAMPLE LOCATION:

 COUNTRY -> USA
 STATE -> KENTUCKY

** PENN STATE COAL DATA BASE **

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ASH FUSION TEMPERATURES (ALL TEMPERATURES IN DEGREES F)

	REDUCING	OXIDIZING
INITIAL DEFORMATION	1755.	2100.
SOFTENING	1900.	2200.
HEMISPHERICAL	2000.	2260.
FLUID	2040.	2310.

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-19
SEAM NAME -> Pocahontas #3
ALTERNATE SEAM NAME ->
APPARENT RANK -> LOW VOL

SAMPLE HISTORY:

SAMPLING DATE & AGENCY -> 12/17/91 ; PSU

SAMPLE TYPE -> CHANNEL-WHOLE SEAM

ADDITIONAL INFORMATION ->

MINE INFORMATION:

RESERVES ->

ANNUAL PRODUCTION -> 1855 THOUSAND TONS

SAMPLE LOCATION:

COUNTRY -> USA

STATE -> VIRGINIA

COUNTY -> Buchanan

TOWNSHIP ->

CITY -> Oakwood

COAL PROVINCE-> EASTERN

REGION -> APPALACHIAN

MAP REFERENCE: LATITUDE -> 37 D 12 M 45 S
LONGITUDE -> 82 D 2 M 30 S
QUADRANGLE-> Vansant (7.5')

** PENN STATE COAL DATA BASE **

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LIFE EXPECTANCY -> 1 YEARS

MINING METHOD -> UNDERGROUND

SEAM INFORMATION:

AGE OF SEAM -> PENNSYL.

GROUP -> Pottsville

FORMATION -> Pocahontas

SEAM THICKNESS -> 4 FT. 10 IN.

** SEAM PROFILE **

ROOF -> gray mudstone
4 IN. -> bright clarain with vitrain
0 IN. -> gray mudstone < 1/2"
14 IN. -> clarain
1 IN. -> gray mudstone NOT SAMPLED
25 IN. -> bright clarain, friable
14 IN. -> clarain w/ ptgs, less friable
FLOOR -> gray mudstone

SAMPLE IDENTIFICATION:

SAMPLE LOCATION:

** PENN STATE COAL DATA BASE **

 PSU NUMBER -> DECS-19
 SEAM NAME -> Pocahontas #3
 ALTERNATE SEAM NAME ->
 APPARENT RANK -> LOW VOL

 COUNTRY -> USA
 STATE -> VIRGINIA

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* * * * * C H E M I C A L D A T A * * * * *

PROXIMATE ANALYSIS AS REC'D DRY DAF DMMF(PARR)

% EQUILIBRIUM MOISTURE = 4.87

% MOISTURE 1.01

% ASH 4.55 4.60

MM-FREE = 5.14

% VOLATILE 18.13 18.31 19.19 18.65

% FIXED CARBON 76.31 77.09 80.81 81.35

ULTIMATE ANALYSIS AS REC'D DRY DAF DMMF(PARR) ELEMENTAL ANALYSIS DRY DMMF(MOD.P) DMMF(DIR.)

% ASH 4.55 4.60 (5.37%MM) (5.44%MM) (%MM)

% CARBON 84.87 85.74 89.87 90.61 % CARBON 85.58 90.50

% HYDROGEN 4.62 (*) 4.67 4.90 4.94 % HYDROGEN 4.61 4.88

% NITROGEN 1.08 1.09 1.14 1.15 % NITROGEN 1.09 1.15

% TOTAL SULFUR 0.73 0.74 0.78 % ORGANIC SULFUR 0.52 0.55

% OXYGEN(DIFF) 3.13 (*) 3.16 3.31 3.30 % OXYGEN(DIFF) 2.76 2.92

(*)-EXCLUDES MOISTURE

% MINERAL MATTER 5.44
 (INCL. 0.39% FES2)

SULFUR FORMS % PYRITIC % SULFATIC % ORGANIC % TOTAL

DRY % CHLORINE = 0.28 DRY % CO2 = 0.59

DRY 0.21 0.00 0.52 0.74

MOTT-SPOONER DIFFERENCE = -38.

DAF 0.22 0.00 0.55 0.78

CALORIFIC VALUE
 (GROSS, BTU/LB)

DRY

AS REC'D
MOIST.

EQUIL.
MOIST.

ATOM RATIOS (DMMF)PARRMOD. PARRDIRECT

MM-CONTAINING 15006. 14854. 14275.

ATOMIC H/C 0.6542 0.6476

MM-FREE (PARR) 15819. 15651. 15007.

ATOMIC O/C 0.0274 0.0242

MM-FREE (MOD. P) 15857. 15687. 15042.

NET CV, DMMF BTU/LB 15399.

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-19
SEAM NAME -> Pocahontas #3
ALTERNATE SEAM NAME ->
APPARENT RANK -> LOW VOL

SAMPLE LOCATION:

COUNTRY -> USA
STATE -> VIRGINIA

** PENN STATE COAL DATA BASE **

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***** RANK CALCULATIONS *****

APPARENT RANK (AS REC'D MOIST.) -> LOW VOL
ASTM RANK (EQUIL. MOIST.) -> LOW VOL
REFLECTANCE RANK CATEGORY -> LOW VOL
INTERNATIONAL RANK :
AS REC'D MOIST. ->
EQUIL. MOIST. ->
REPORTED RANK : -> LOW VOL

***** PETROGRAPHIC DATA *****

MACERAL COMPOSITION (WHITE LIGHT ANALYSIS)

	VITRINITE	PSEUDO-VITRINITE	FUSINITE	SEMI-FUSINITE	MACRINITE	MICRINITE	SCLEROTINITE	SPORINITE	RESINITE	ALGINITE	CUTINITE
DMMF VOL. %	89.3	0.0	3.3	3.1	2.5	1.2	0.1	0.5	0.0	0.0	0.0
DRY VOL. %	86.9	0.0	3.2	3.0	2.4	1.2	0.1	0.5	0.0	0.0	2.7 % MM
DRY WT. %	83.9	0.0	3.5	3.1	2.5	1.2	0.1	0.4	0.0	0.0	5.4 % MM

REFLECTANCE DATA

VITRINITE : HIGH: 1.83 LOW: 1.57 MEAN-MAX: 1.71

VITRINITE TYPES

V15	V16	V17	V18
1.0	42.0	50.0	7.0

***** C A K I N G A N D M E C H A N I C A L P R O P E R T I E S *****

GIESELER COAL PLASTOMETER:

INIT. SOFTENING TEMP 458
TEMP. MAX. FLUIDITY 483
SOLIDIFICATION TEMP. 508
FLUID TEMP. RANGE 50
MAXIMUM FLUIDITY 17
WASHABILITY DATA AVAILABLE? NO

GRAY-KING COKE TYPE

HARDGROVE GRINDABILITY 101.6
FREE SWELLING INDEX 6.0
VICKERS HARDNESS NUMBER

SAMPLE IDENTIFICATION:

SAMPLE LOCATION:

** PENN STATE COAL DATA BASE **

PSU NUMBER -> DECS-19
SEAM NAME -> Pocahontas #3
ALTERNATE SEAM NAME ->
APPARENT RANK -> LOW VOL

COUNTRY -> USA
STATE -> VIRGINIA

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MAJOR ELEMENT ANALYSIS

% HTA = 5.52

	SI02	AL203	TI02	FE203	MGO	CAO	NA2O	K2O	P2O5	S03
OXIDE % OF HTA	28.6	19.6	0.95	17.0	2.49	15.2	1.14	0.83	0.04	13.0
ELEMENT % OF TOTAL DRY COAL	SI	AL	TI	FE	MG	CA	NA	K	P	S
	0.7	0.6	0.03	0.7	0.08	0.6	0.05	0.04	0.001	0.7

TRACE ELEMENT ANALYSIS

% HTA = 5.52

	PPM HTA	PPM TOTAL COAL		PPM HTA	PPM TOTAL COAL		PPM HTA	PPM TOTAL COAL	VOLATILES -----	PPM TOTAL COAL
AG			GE			SN			AS	
B			LA			SR	2452.	135.	BR	
BA	3493.	193.	LI			TH			CD	
BE	25.	1.	MN	387.	21.	U			CL	2800.
BI			MO			V	160.	9.	F	
CE			NB			Y			HG	
CO			NI	130.	7.	YB			SB	
CR	180.	10.	PB			ZN	110.	6.	SE	
CU	260.	14.	RB	35.	2.	ZR	210.	12.		
GA			SC							

SAMPLE IDENTIFICATION:

 PSU NUMBER -> DECS-19
 SEAM NAME -> Pocahontas #3
 ALTERNATE SEAM NAME ->
 APPARENT RANK -> LOW VOL

SAMPLE LOCATION:

 COUNTRY -> USA
 STATE -> VIRGINIA

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ASH FUSION TEMPERATURES (ALL TEMPERATURES IN DEGREES F)

	REDUCING	OXIDIZING
INITIAL DEFORMATION	1910.	2300.
SOFTENING	2030.	2380.
HEMISPHERICAL	2090.	2440.
FLUID	2140.	2475.

SAMPLE IDENTIFICATION:

 PSU NUMBER -> DECS-20
 SEAM NAME -> Elkhorn #3
 ALTERNATE SEAM NAME ->
 APPARENT RANK -> HVA

SAMPLE HISTORY:

 SAMPLING DATE & AGENCY -> 12/18/91 ; PSU

SAMPLE TYPE -> CHANNEL-WHOLE SEAM

ADDITIONAL INFORMATION ->

MINE INFORMATION:

 RESERVES ->

ANNUAL PRODUCTION ->

SAMPLE LOCATION:

 COUNTRY -> USA
 STATE -> KENTUCKY
 COUNTY -> Floyd

TOWNSHIP ->
 CITY -> Teaberry

COAL PROVINCE -> EASTERN
 REGION -> APPALACHIAN

MAP REFERENCE: LATITUDE -> 37 D 25 M 33 S
 LONGITUDE -> 82 D 36 M 43 S
 QUADRANGLE -> Pikeville (7.5')

** PENN STATE COAL DATA BASE **

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SEAM INFORMATION:

 AGE OF SEAM -> PENNSYL.
 GROUP ->
 FORMATION -> Breathitt
 SEAM THICKNESS -> 5 FT. 4 IN.

** SEAM PROFILE **

ROOF -> gray laminated mudstone
 30 IN. -> clarain, occ. pyrite on cleat
 9 IN. -> gray mudstone ptg NOT SAMPLED
 1 IN. -> mudstone & clarain NOT SAMPLED
 24 IN. -> clarain, occ. 5 mm partings
 FLOOR -> gray mudstone

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-20
SEAM NAME -> Elkhorn #3
ALTERNATE SEAM NAME ->
APPARENT RANK -> HVA

SAMPLE LOCATION:

COUNTRY -> USA
STATE -> KENTUCKY

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* * * * * C H E M I C A L D A T A * * * * *

PROXIMATE ANALYSIS	AS REC'D	DRY	DAF	DMMF(PARR)	
% MOISTURE	2.79				% EQUILIBRIUM MOISTURE = 2.97
% ASH	5.32	5.47			MM-FREE = 3.17
% VOLATILE	36.48	37.53	39.70	39.23	
% FIXED CARBON	55.41	57.00	60.30	60.77	

ULTIMATE ANALYSIS	AS REC'D	DRY	DAF	DMMF(PARR)	ELEMENTAL ANALYSIS	DRY	DMMF(MOD. P)	DMMF(DIR.)
% ASH	5.32	5.47		(6.44%MM)			(6.39%MM)	(%MM)
% CARBON	77.33	79.55	84.15	85.03	% CARBON	79.52	84.95	
% HYDROGEN	5.37 (*)	5.52	5.84	5.90	% HYDROGEN	5.45	5.83	
% NITROGEN	1.33	1.37	1.45	1.46	% NITROGEN	1.37	1.46	
% TOTAL SULFUR	0.94	0.97	1.03		% ORGANIC SULFUR	0.75	0.80	
% OXYGEN(DIFF)	6.92 (*)	7.12	7.53	7.61	% OXYGEN(DIFF)	6.51	6.96	
(*)-EXCLUDES MOISTURE					% MINERAL MATTER	6.39		
					(INCL. 0.39% FES2)			

SULFUR FORMS	% PYRITIC	% SULFATIC	% ORGANIC	% TOTAL	
DRY	0.21	0.00	0.75	0.97	DRY % CHLORINE = 0.22 DRY % CO2 = 0.10
DAF	0.22	0.00	0.79	1.03	MOTT-SPOONER DIFFERENCE = -224.

CALORIFIC VALUE (GROSS, BTU/LB)	DRY	AS REC'D MOIST.	EQUIL. MOIST.	ATOM RATIOS (DMMF)	PARR	MOD. PARR	DIRECT
MM-CONTAINING	14244.	13847.	13821.	ATOMIC H/C	0.8334	0.8236	
MM-FREE (PARR)	15173.	14721.	14692.	ATOMIC O/C	0.0672	0.0615	
MM-FREE (MOD. P)	15204.	14752.	14723.				
NET CV, DMMF BTU/LB	14658.						

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-20
 SEAM NAME -> Elkhorn #3
 ALTERNATE SEAM NAME ->
 APPARENT RANK -> HVA

SAMPLE LOCATION:

COUNTRY -> USA
 STATE -> KENTUCKY

** PENN STATE COAL DATA BASE **

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* * * * * R A N K C A L C U L A T I O N S * * * * *

APPARENT RANK (AS REC'D MOIST.) -> HVA INTERNATIONAL RANK :
 AS REC'D MOIST. ->
 ASTM RANK (EQUIL. MOIST.) -> HVA EQUIL. MOIST. ->
 REFLECTANCE RANK CATEGORY -> HVA REPORTED RANK : -> HVA

* * * * * P E T R O G R A P H I C D A T A * * * * *

MACERAL COMPOSITION (WHITE LIGHT AND FLUORESCENCE ANALYSIS)

	VITRINITE	PSEUDO-VITRINITE	FUSINITE	SEMI-FUSINITE	MACRINITE	MICRINITE	SCLERO-TINITE	SPORINITE	RESINITE	ALGINITE	CUTINITE	
DMMF VOL. %	77.7	0.0	1.8	4.6	4.2	1.3	0.1	9.2	0.1	0.0	1.0	
DRY VOL. %	75.2	0.0	1.7	4.5	4.1	1.3	0.1	8.9	0.1	0.0	1.0	3.2 % MM
DRY WT. %	72.4	0.0	1.9	4.6	4.2	1.3	0.1	8.0	0.1	0.0	0.9	6.4 % MM

REFLECTANCE DATA

VITRINITE :

HIGH: 1.03 LOW: 0.73 MEAN-MAX: 0.87

VITRINITE TYPES

V 7 V 8 V 9 V10

PERCENT 10.0 57.0 31.0 2.0

* * * * * C A K I N G A N D M E C H A N I C A L P R O P E R T I E S * * * * *

GIESELER COAL PLASTOMETER:

INIT. SOFTENING TEMP 403
 TEMP. MAX. FLUIDITY 439
 SOLIDIFICATION TEMP. 469
 FLUID TEMP. RANGE 66
 MAXIMUM FLUIDITY 1612
 WASHABILITY DATA AVAILABLE? NO

GRAY-KING COKE TYPE

HARDGROVE GRINDABILITY 52.1
 FREE SWELLING INDEX 4.0
 VICKERS HARDNESS NUMBER

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-20
SEAM NAME -> Elkhorn #3
ALTERNATE SEAM NAME ->
APPARENT RANK -> HVA

SAMPLE LOCATION:

COUNTRY -> USA
STATE -> KENTUCKY

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MAJOR ELEMENT ANALYSIS

% HTA = 5.68

	SI02	AL203	TIO2	FE203	MGO	CAO	NA2O	K2O	P2O5	SO3
OXIDE % OF HTA	47.8	31.3	1.15	9.20	1.24	3.26	1.16	2.72	0.04	1.80
ELEMENT % OF TOTAL DRY COAL	SI	AL	TI	FE	MG	CA	NA	K	P	S
	1.3	0.9	0.04	0.37	0.04	0.13	0.05	0.13	0.001	0.97

TRACE ELEMENT ANALYSIS

% HTA = 5.68

	PPM HTA	PPM TOTAL COAL		PPM HTA	PPM TOTAL COAL		PPM HTA	PPM TOTAL COAL	VOLATILES -----	PPM TOTAL COAL
AG			GE			SN			AS	
B			LA			SR	2368.	134.	BR	
BA	2239.	127.	LI			TH			CD	
BE	55.	3.	MN	232.	13.	U			CL	2200.
BI			MO			V	290.	16.	F	
CE			NB			Y			HG	
CO			NI	220.	12.	YB			SB	
CR	170.	10.	PB			ZN	240.	14.	SE	
CU	300.	17.	RB	95.	5.	ZR	170.	10.		
GA			SC							

SAMPLE IDENTIFICATION:

 PSU NUMBER -> DECS-20
 SEAM NAME -> Elkhorn #3
 ALTERNATE SEAM NAME ->
 APPARENT RANK -> HVA

SAMPLE LOCATION:

 COUNTRY -> USA
 STATE -> KENTUCKY

** PENN STATE COAL DATA BASE **

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ASH FUSION TEMPERATURES (ALL TEMPERATURES IN DEGREES F)

--- -----

	REDUCING	OXIDIZING
INITIAL DEFORMATION	2180.	2370.
SOFTENING	2300.	2460.
HEMISPHERICAL	2355.	2505.
FLUID	2420.	2550.

SAMPLE IDENTIFICATION:

 PSU NUMBER -> DECS-21
 SEAM NAME -> Lykens Valley #2
 ALTERNATE SEAM NAME -> Lykens #2
 APPARENT RANK -> AN

SAMPLE HISTORY:

 SAMPLING DATE & AGENCY -> 10/ 7/92 ; PSU

 SAMPLE TYPE -> CHANNEL-WHOLE SEAM
 ADDITIONAL INFORMATION -> Coal fractured by blasting

MINE INFORMATION:

 RESERVES ->
 ANNUAL PRODUCTION ->
 LIFE EXPECTANCY ->
 MINING METHOD -> UNDERGROUND

SAMPLE LOCATION:

 COUNTRY -> USA
 STATE -> PENNSYLVANIA
 COUNTY -> Columbia
 TOWNSHIP -> Conygham
 CITY -> Mount Carmel
 COAL PROVINCE -> EASTERN
 REGION -> ANTHRACITE

MAP REFERENCE: LATITUDE -> 40 D 46 M 34 S
 LONGITUDE -> 76 D 22 M 43 S
 QUADRANGLE -> Mount Carmel (7.5')

** PENN STATE COAL DATA BASE **

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SEAM INFORMATION:

 AGE OF SEAM -> PENNSYL.
 GROUP -> Pottsville
 FORMATION ->
 SEAM THICKNESS -> 6 FT. 6 IN.

** SEAM PROFILE **

ROOF -> Coarse-grained sandstone
 18 IN. -> Blocky bright clarain
 45 IN. -> Fractured bright clarain
 4 IN. -> Dull coal "middlings"
 11 IN. -> Bright clarain, less fractured
 FLOOR -> Laminated dark gray shale

SAMPLE IDENTIFICATION:

SAMPLE LOCATION:

** PENN STATE COAL DATA BASE **

PSU NUMBER -> DECS-21
SEAM NAME -> Lykens Valley #2
ALTERNATE SEAM NAME -> Lykens #2
APPARENT RANK -> AN

COUNTRY -> USA
STATE -> PENNSYLVANIA

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* * * * * C H E M I C A L D A T A * * * * *

PROXIMATE ANALYSIS	AS REC'D	DRY	DAF	DMMF(PARR)	
% MOISTURE	3.99				% EQUILIBRIUM MOISTURE = 2.10
% ASH	10.71	11.15			MM-FREE = 2.40
% VOLATILE	4.33	4.51	5.08	3.90	
% FIXED CARBON	80.97	84.34	94.92	96.10	

ULTIMATE ANALYSIS	AS REC'D	DRY	DAF	DMMF(PARR)	ELEMENTAL ANALYSIS	DRY	DMMF(MOD. P)	DMMF(DIR.)
% ASH	10.71	11.15		(12.32%MM)			(12.65%MM)	(%MM)
% CARBON	77.06	80.26	90.33	91.53	% CARBON	80.25	91.87	
% HYDROGEN	3.42 (*)	3.56	4.01	4.06	% HYDROGEN	3.42	3.91	
% NITROGEN	0.68	0.71	0.80	0.81	% NITROGEN	0.71	0.81	
% TOTAL SULFUR	0.48	0.50	0.56		% ORGANIC SULFUR	0.43	0.49	
% OXYGEN(DIFF)	3.67 (*)	3.82	4.30	3.60	% OXYGEN(DIFF)	2.55	2.92	
					% MINERAL MATTER	12.65		
					(INCL. 0.11% FES2)			

(*)-EXCLUDES MOISTURE

SULFUR FORMS	% PYRITIC	% SULFATIC	% ORGANIC	% TOTAL	
DRY	0.06	0.00	0.43	0.50	DRY % CHLORINE = 0.04 DRY % CO2 = 0.05
DAF	0.07	0.00	0.48	0.56	MOTT-SPOONER DIFFERENCE = -295.

CALORIFIC VALUE (GROSS, BTU/LB)	DRY	AS REC'D MOIST.	EQUIL. MOIST.	ATOM RATIOS (DMMF)	PARR	MOD. PARR	DIRECT
MM-CONTAINING	13284.	12754.	13005.	ATOMIC H/C	0.5328	0.5113	
MM-FREE (PARR)	15122.	14437.	14760.	ATOMIC O/C	0.0295	0.0239	
MM-FREE (MOD. P)	15204.	14513.	14839.				
NET CV, DMMF BTU/LB	14826.						

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-21
SEAM NAME -> Lykens Valley #2
ALTERNATE SEAM NAME -> Lykens #2
APPARENT RANK -> AN

SAMPLE LOCATION:

COUNTRY -> USA
STATE -> PENNSYLVANIA

** PENN STATE COAL DATA BASE **

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* * * * * R A N K C A L C U L A T I O N S * * * * *

APPARENT RANK (AS REC'D MOIST.) -> AN
ASTM RANK (EQUIL. MOIST.) -> AN
REFLECTANCE RANK CATEGORY -> AN
INTERNATIONAL RANK :
AS REC'D MOIST. ->
EQUIL. MOIST. ->
REPORTED RANK : -> AN

* * * * * P E T R O G R A P H I C D A T A * * * * *

MACERAL COMPOSITION (WHITE LIGHT ANALYSIS)

	VITRINITE	PSEUDO-VITRINITE	FUSINITE	SEMI-FUSINITE	MACRINITE	MICRINITE	SCLERO-TINITE	SPOR-INITE	RESINITE	ALGINITE	CUTINITE
DMMF VOL. %	87.1	0.0	2.5	8.3	2.0	0.1	0.0	0.0	0.0	0.0	0.0
DRY VOL. %	81.6	0.0	2.3	7.8	1.9	0.1	0.0	0.0	0.0	0.0	6.3 % MM
DRY WT. %	75.9	0.0	2.4	7.5	1.8	0.1	0.0	0.0	0.0	0.0	12.3 % MM

REFLECTANCE DATA VITRINITE : HIGH: 5.94 LOW: 4.26 MEAN-MAX: 5.19

***** NUMBER OF V-TYPES IS GREATER THAN 10; CONSULT ORIGINAL DATA FOR INFORMATION *****

* * * * * C A K I N G A N D M E C H A N I C A L P R O P E R T I E S * * * * *

GIESELER COAL PLASTOMETER:

INIT. SOFTENING TEMP
TEMP. MAX. FLUIDITY
SOLIDIFICATION TEMP.
FLUID TEMP. RANGE

GRAY-KING COKE TYPE

HARDGROVE GRINDABILITY 31.6
FREE SWELLING INDEX 0.0
VICKERS HARDNESS NUMBER

MAXIMUM FLUIDITY
WASHABILITY DATA AVAILABLE? NO

SAMPLE IDENTIFICATION:

SAMPLE LOCATION:

** PENN STATE COAL DATA BASE **

PSU NUMBER -> DECS-21
SEAM NAME -> Lykens Valley #2
ALTERNATE SEAM NAME -> Lykens #2
APPARENT RANK -> AN

COUNTRY -> USA
STATE -> PENNSYLVANIA

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MAJOR ELEMENT ANALYSIS

% HTA = 11.14

	SI02	AL203	TI02	FE203	MGO	CAO	NA2O	K2O	P2O5	SO3
OXIDE % OF HTA	55.1	30.7	2.27	4.24	0.88	0.56	0.22	4.93	0.04	0.20
ELEMENT % OF TOTAL DRY COAL	SI	AL	TI	FE	MG	CA	NA	K	P	S
	2.9	1.8	0.15	0.33	0.06	0.04	0.02	0.46	0.002	0.50

TRACE ELEMENT ANALYSIS

% HTA = 11.14

PPM HTA	PPM TOTAL COAL	PPM HTA	PPM TOTAL COAL	PPM HTA	PPM TOTAL COAL	VOLATILES -----	PPM TOTAL COAL
AG		GE		SN		AS	
B		LA		SR	169.	BR	
BA	1164.	LI		TH		CD	
BE	45.	MN	465.	U		CL	400.
BI		MO		V	190.	F	
CE		NB		Y		HG	
CO		NI	150.	YB		SB	
CR	210.	PB		ZN	130.	SE	
CU	220.	RB	200.	ZR	500.		
GA		SC					

SAMPLE IDENTIFICATION:

 PSU NUMBER -> DECS-21
 SEAM NAME -> Lykens Valley #2
 ALTERNATE SEAM NAME -> Lykens #2
 APPARENT RANK -> AN

SAMPLE LOCATION:

 COUNTRY -> USA
 STATE -> PENNSYLVANIA

** PENN STATE COAL DATA BASE **

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ASH FUSION TEMPERATURES (ALL TEMPERATURES IN DEGREES F)

	REDUCING	OXIDIZING
INITIAL DEFORMATION	2730.+	2800.+
SOFTENING	2800.+	2800.+
HEMISPHERICAL	2800.+	2800.+
FLUID	2800.+	2800.+

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-22
SEAM NAME -> Upper Kittanning
ALTERNATE SEAM NAME ->
APPARENT RANK -> HVA

SAMPLE LOCATION:

COUNTRY -> USA
STATE -> PENNSYLVANIA
COUNTY -> Armstrong
TOWNSHIP -> Mahoning
CITY -> Distant
COAL PROVINCE -> EASTERN
REGION -> APPALACHIAN

** PENN STATE COAL DATA BASE **

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SAMPLE HISTORY:

SAMPLING DATE & AGENCY -> 6/14/93 ; PSU

SAMPLE TYPE -> CHANNEL-LITHOTYPE

ADDITIONAL INFORMATION -> Cannel coal, pod shaped deposit; see PSOC-1560 Ro

MAP REFERENCE: LATITUDE -> 40 D 58 M 21 S
LONGITUDE -> 79 D 18 M 23 S
QUADRANGLE -> Distant (7.5')

MINE INFORMATION:

RESERVES ->
ANNUAL PRODUCTION ->

LIFE EXPECTANCY ->
MINING METHOD -> UNDERGROUND

SEAM INFORMATION:

AGE OF SEAM -> PENNSYL.
GROUP -> Allegheny
FORMATION ->
SEAM THICKNESS -> 9 FT. 2 IN.

** SEAM PROFILE **

ROOF -> Irregular contact
16 IN. -> Blocky, few bands DECS-22
29 IN. -> Very blocky DECS-22
27 IN. -> Blocky, some partings DECS-22
8 IN. -> Blocky, not fractured DECS-22
30 IN. -> Clarain, well banded PSOC-1560
FLOOR ->

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-22
SEAM NAME -> Upper Kittanning
ALTERNATE SEAM NAME ->
APPARENT RANK -> HVA

SAMPLE LOCATION:

COUNTRY -> USA
STATE -> PENNSYLVANIA

** PENN STATE COAL DATA BASE **
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* * * * * C H E M I C A L D A T A * * * * *

PROXIMATE ANALYSIS	AS REC'D	DRY	DAF	DMMF (PARR)
% MOISTURE	0.91			
% ASH	23.06	23.27		
% VOLATILE	30.17	30.45	39.68	37.75
% FIXED CARBON	45.86	46.28	60.32	62.25

% EQUILIBRIUM MOISTURE = 1.32
MM-FREE = 1.80

ULTIMATE ANALYSIS	AS REC'D	DRY	DAF	DMMF (PARR)	ELEMENTAL ANALYSIS	DRY	DMMF (MOD. P)	DMMF (DIR.)
% ASH	23.06	23.27		(26.07%MM)			(26.91%MM)	(%MM)
% CARBON	64.30	64.89	84.57	87.77	% CARBON	64.79	88.64	
% HYDROGEN	4.44 (*)	4.48	5.84	6.06	% HYDROGEN	4.20	5.75	
% NITROGEN	1.35	1.36	1.77	1.84	% NITROGEN	1.36	1.86	
% TOTAL SULFUR	1.69	1.71	2.23		% ORGANIC SULFUR	0.53	0.73	
% OXYGEN (DIFF)	4.25 (*)	4.29	5.59	4.33	% OXYGEN (DIFF)	2.21	3.03	
					% MINERAL MATTER (INCL. 2.15% FES ₂)	26.91		

(*) -EXCLUDES MOISTURE

SULFUR FORMS	% PYRITIC	% SULFATIC	% ORGANIC	% TOTAL
DRY	1.15	0.03	0.53	1.71
DAF	1.50	0.04	0.69	2.23

DRY % CHLORINE = 0.14 DRY % CO₂ = 0.36
MOTT-SPOONER DIFFERENCE = -116.

CALORIFIC VALUE (GROSS, BTU/LB)	DRY	AS REC'D MOIST.	EQUIL. MOIST.	ATOM RATIOS (DMMF)	PARR	MOD. PARR	DIRECT
MM-CONTAINING	11786.	11679.	11630.	ATOMIC H/C	0.8292	0.7787	
MM-FREE (PARR)	15827.	15633.	15546.	ATOMIC O/C	0.0370	0.0256	
MM-FREE (MOD. P)	16039.	15840.	15751.				
NET CV, DMMF BTU/LB	15471.						

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-22
 SEAM NAME -> Upper Kittanning
 ALTERNATE SEAM NAME ->
 APPARENT RANK -> HVA

SAMPLE LOCATION:

COUNTRY -> USA
 STATE -> PENNSYLVANIA

** PENN STATE COAL DATA BASE **

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***** RANK CALCULATIONS *****

APPARENT RANK (AS REC'D MOIST.) -> HVA INTERNATIONAL RANK :
 AS REC'D MOIST. ->
 ASTM RANK (EQUIL. MOIST.) -> HVA EQUIL. MOIST. ->
 REFLECTANCE RANK CATEGORY -> HVA REPORTED RANK : -> HVA

***** PETROGRAPHIC DATA *****

MACERAL COMPOSITION (WHITE LIGHT AND FLUORESCENCE ANALYSIS)

	VITRINITE	PSEUDO-VITRINITE	FUSINITE	SEMI-FUSINITE	MACRINITE	MICRINITE	SCLEROTINITE	SPORINITE	RESINITE	ALGINITE	CUTINITE	
DMMF VOL. %	29.5	0.0	0.5	17.2	0.2	20.8	0.0	30.2	0.5	0.4	0.7	
DRY VOL. %	25.2	0.0	0.4	14.7	0.2	17.8	0.0	25.8	0.4	0.3	0.6	14.5 % MM
DRY WT. %	21.6	0.0	0.4	13.6	0.2	16.4	0.0	20.7	0.3	0.3	0.5	26.1 % MM

REFLECTANCE DATA

VITRINITE : HIGH: 0.92 LOW: 0.65 MEAN-MAX: 0.77

VITRINITE TYPES

V 6 V 7 V 8 V 9

PERCENT

8.0 68.0 20.0 4.0

***** C A K I N G A N D M E C H A N I C A L P R O P E R T I E S *****

GIESELER COAL PLASTOMETER:

INIT. SOFTENING TEMP 416
 TEMP. MAX. FLUIDITY 444
 SOLIDIFICATION TEMP. 482
 FLUID TEMP. RANGE 66

MAXIMUM FLUIDITY 11719
 WASHABILITY DATA AVAILABLE? NO

GRAY-KING COKE TYPE

HARDGROVE GRINDABILITY 31.0
 FREE SWELLING INDEX 1.0
 VICKERS HARDNESS NUMBER

SAMPLE IDENTIFICATION:

PSU NUMBER -> DECS-22
SEAM NAME -> Upper Kittanning
ALTERNATE SEAM NAME ->
APPARENT RANK -> HVA

SAMPLE LOCATION:

COUNTRY -> USA
STATE -> PENNSYLVANIA

** PENN STATE COAL DATA BASE **

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MAJOR ELEMENT ANALYSIS

% HTA = 22.81

	SI02	AL203	TI02	FE203	MGO	CAO	NA2O	K2O	P2O5	S03
OXIDE % OF HTA	62.0	23.2	1.49	8.71	1.01	0.53	0.28	2.74	0.04	0.10
ELEMENT % OF TOTAL DRY COAL	SI	AL	TI	FE	MG	CA	NA	K	P	S
	6.6	2.8	0.20	1.39	0.14	0.09	0.05	0.52	0.004	1.71

TRACE ELEMENT ANALYSIS

% HTA = 22.81

	PPM HTA	PPM TOTAL COAL		PPM HTA	PPM TOTAL COAL		PPM HTA	PPM TOTAL COAL	VOLATILES -----	PPM TOTAL COAL
AG			GE			SN			AS	
B			LA			SR	169.	39.	BR	
BA	358.	82.	LI			TH			CD	
BE	10.	2.	MN	77.	18.	U			CL	1400.
BI			MO			V	110.	25.	F	
CE			NB			Y			HG	
CO			NI	70.	16.	YB			SB	
CR	180.	41.	PB			ZN	320.	73.	SE	
CU	150.	34.	RB	95.	22.	ZR	240.	55.		
GA			SC							

SAMPLE IDENTIFICATION:

 PSU NUMBER -> DECS-22
 SEAM NAME -> Upper Kittanning
 ALTERNATE SEAM NAME ->
 APPARENT RANK -> HVA

SAMPLE LOCATION:

 COUNTRY -> USA
 STATE -> PENNSYLVANIA

** PENN STATE COAL DATA BASE **

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ASH FUSION TEMPERATURES (ALL TEMPERATURES IN DEGREES F)

	REDUCING	OXIDIZING
INITIAL DEFORMATION	2600.	2725.+
SOFTENING	2645.	2765.+
HEMISPHERICAL	2680.	2780.+
FLUID	2740.+	2800.+

APPENDIX C**List of Agencies Supplied with****Coal Samples and/or Data****4/08/88 through 9/07/93**

Numbers in parentheses are multiple requests which were separately processed.

Abilene Christian University (4)
Advanced Fuel Research (8)
AGL
Air Products Corporation
Akita University (Japan)
Akita University, Chemical Eng. for Resources Dept. (Japan)
Alcoa Research Lab
Alcon Coal and Land Co.
Allied Coal Testing
Amax Coal Company Research and Development Center (3)
American Lignite Co. (2)
Amoco Oil Company, Research & Development Division (15)
Anthracite Industries Co.
ARCO
ARCO Coal Company
ARCO Oil and Gas Co.
Argonne National Laboratory
Arizona State University, Chemistry and Biochemistry Dept.
Arizona State University, Geology Department
Arizona State University, Mechanical & Aerospace Engineering Department
Arkansas Tech University, Arkansas Mining Institute
Asea Brown Boveri Ltd. (Switzerland)
Atlas Powder Co.
Auburn University, Chemical Engineering Department (5)
Babcock & Wilcox Co. (2)
BCR National Laboratories (6)
Boarshead Resource Development Co.
Borden Chemical Co.
Brigham Young University (5)
Brigham Young University, College of Engineering Technology
Brookhaven National Laboratory (2)
Brown University
Brown University, Engineering Div.
Bruce MacDonald, Consultant
Buckeye Industrial Mining Co. (2)
Cal Tech
Calgon Carbon Corporation (2)
California Institute of Technology
CANMET Energy Mines & Resources (Canada) (3)
Carnegie-Mellon University, Metallurgical Eng. & Materials Science Dept.
Central Research Institute, Electric Power Industry (Japan) (2)
Centre Lime & Stone
Chalmers University of Technology (Sweden)
Chemroll Enterprises
Chevron Oilfield Research Co. (6)
City College of New York, Chemical Engineering Department (2)
Clark Atlanta University, Chemistry Department (6)
Clarke Rajchel Engineering (2)
Coal Cleaning Test Facility, Homer City, PA

Coal Technology Corp. (2)
Colorado School of Mines, Chemical Engineering Department (3)
CONOCO Research Center
Consolidation Coal Company
Consortium for Fossil Fuel Liquefaction Science (3)
Davis Coal Co.
Decision Focus Co.
Dow Chemical/DESTEC
Duke University Medical Center
EFH Coal Co.
EG & G Idaho
Electrochem, Inc.
Emory University, Chemistry Department
Encyclopedia Britannica
Energy Ventures Analysis Inc.
Engineering Resources
ENSR Consultants and Engineers
ERM Inc.
Exxon Production Research Co. (3)
Exxon Research & Development Co. (5)
Fossil Energy Research Company
Foster-Wheeler Development Corp.
Franklin & Marshall College, Geology Department
Gannon University
Gas Research Institute
Genesis Research Corp. (2)
General Electric Co.
Geological Survey of Denmark
Geological Survey of Wyoming
Gould Energy, Warner Labs Division
Grambling State University, Chemistry Department (7)
Hacettepe University, Chemistry Department (Turkey) (2)
Hampton University, Engineering Department
Hess and Fisher Engineers
Howard University, Chemistry Department (2)
Idea, Inc.
Idemitsu Kosan Co., Ltd. (Japan)
Illinois State Geological Survey
Indianapolis Power & Light Co. (4)
Industrial Mining Co. (2)
Industrial Quimica del Nalon (Spain)
Institute of Gas Technology (4)
Instituto Nacional del Carbon (Spain)
Interpower of Pennsylvania
J.K. Research (4)
Jet Propulsion Laboratory
Juniata College
Kansai University, Chemical Engineering Dept.
Dr. J. Kelly, Mining Engineer

Kentucky Center for Applied Energy Research (2)
Korea Advanced Institute of Science and Technology
Lehigh University, Chemistry Department (2)
Louisiana State University, Chemical Engineering Department
Louisiana Tech
Martin Marietta Energy Systems
Michigan Biotechnology Institute
Michigan State University
Missouri Geological Survey
Monash University, Chemistry Department (Australia) (2)
MPR Associates
National Refractories and Minerals Corporation
National University of Colombia
New Energy and Development Org.
New York State Electric & Gas
New York University, Chemistry Department
New York University, Medical Center
NIOSH (2)
NIR Systems (2)
NKK America, Inc.
Northeastern University (3)
Northern Indiana Public Service Co.
Notre Dame University, Geology Department
Oak Ridge National Laboratory (7)
Ohio Coal Development Office
Ohio Coal Research Board
Ohio State University, Chemistry Department
Ohio University, Geological Sciences Department
Ohio University, Chemical Engineering Department (5)
Pacific Northwest Laboratory
Peabody Development Co.
PEN Coal Corp.
Pendencygraft & Plews, Attorneys
Pennsylvania Department of Environmental Resources
Pennsylvania Geological Survey
Pennsylvania State University, Architectural Engineering Department
Pennsylvania State University, Chemical Engineering Dept.
Pennsylvania State University, Dust Control Center (3)
Pennsylvania State University, Energy and Fuels Research Center (4)
Pennsylvania State University, Fuel Science Department (125)
Pennsylvania State University, Geography Department
Pennsylvania State University, Geosciences Department (26)
Pennsylvania State University, Materials Research Lab (2)
Pennsylvania State University, Mineral Processing Section (44)
Pennsylvania State University, Mining Engineering Department (4)
Pennsylvania State University, Nuclear Engineering Department
Pennsylvania State University, Polymer Science Department (17)
Perfect View, Inc. (5)
Physical Science Inc.

Potomac Electric Power Company
Praxis Engineers Inc.
PSI Technology Co. (3)
Ralph Gray Services
RDI, Inc.
Research Triangle Institute
RLN Co.
Rochester and Pittsburgh Coal Co. (2)
Russian Academy of Sciences, Kemerovo Scientific Centre
Sandia National Laboratory (3)
Science Applications International Co. (2)
Science Ventures, Inc. (3)
Scott Paper Co.
Sekei University, Industrial Chemistry Department (Japan) (2)
Seoul National University, Chemical Engineering Dept. (Korea)
Shell Development Co. (5)
Solar Energy Research Institute
Solar Sources, Inc.
Southern Illinois University, Coal Research Center
Southern Illinois University, Geology Department (7)
Southern Illinois University, Mechanical Engineering Department (5)
Southern Illinois University, Dept. of Mechanical Eng. & Energy Processes
Southern Research Institute
Spackman, W., consultant
Standard Laboratories
Stanford University (4)
Stanford University, Mechanical Engineering Dept. (2)
State University of New York at Binghamton, Chemistry Department (2)
State University of New York at Buffalo (2)
Stock Equipment Company (2)
Stone and Webster Engineering (2)
Superior Adsorbents, Inc.
TA Instruments
Technical Research Centre of Finland
Technical University of Denmark
Technology and Management Services, Inc.
Tennessee Valley Authority
Texaco Research Center (2)
Texas A & M University (2)
Texas A & M University, Mechanical Engineering Dept. (2)
Textron Defense Systems
Tohoku University, Institute for Chemical Reaction Science (2) (Japan)
TRW Corp.
Tuskegee University, Chemical Engineering Dept. (2)
University of Alabama, Geology Department (2)
University of Alaska, Mineral Industries Research Lab
University of Arkansas, Engineering Research Center (2)
University of British Columbia, Geological Sciences Department (Canada)
University of California at Berkeley, Materials Science and Mineral Eng. Dept. (2)

University of California at Davis, Chemical Engineering Department (4)
 University of Canterbury (New Zealand) (2)
 University of Chicago, Chemistry Department
 University of Chicago, Geophysical Sciences Department
 University of Cincinnati, Chemical Engineering Department
 University of Delaware
 University of Delaware, Chemical Engineering Department
 University of Hartford, Biology Dept.
 University of Illinois
 University of Illinois, Mechanical & Industrial Engineering Department (7)
 University of Kentucky (4)
 University of Kentucky, Center for Applied Energy Research
 University of Kentucky, Consortium for Fossil Fuel Liquefaction Science (6)
 University of Kentucky, Geology Department (2)
 University of Kentucky, Mechanical Engineering Department
 University of Kentucky, School of Biological Sciences
 University of London, Chemistry Department (England)
 University of Lund, Analytical Chemistry Dept. (Sweden)
 University of New Hampshire
 University of New Hampshire, Dept. of Chemical Engineering
 University of New South Wales, Applied Geology Department (Australia)
 University of North Dakota
 University of North Dakota, Energy and Environmental Research Center (10)
 University of Pierre and Marie Curie (France)
 University of Pittsburgh
 University of Pittsburgh, Chemical Engineering Department (3)
 University of South Carolina (2)
 University of Southern Mississippi, Chemistry & Biochemistry Dept. (2)
 University of Texas at Arlington, Chemistry Department (2)
 University of Toledo, Geology Dept.
 University of Toronto (2)
 University of Utah (5)
 University of Utah, Center for Microanalysis (3)
 University of Utah, Chemistry Dept. (3)
 University of Utah, Fuels Engineering Department (11)
 University of Utah, Metallurgy & Metallurgical Engineering Department (4)
 University of Wisconsin, Anthropology Dept.
 Unocal Science and Technology Division (8)
 U.S. Bureau of Mines (4)
 U.S. Department of Energy
 U.S. Department of Energy, Morgantown (9)
 U.S. Department of Energy, Pittsburgh (21)
 U.S. Geological Survey (6)
 Usibelli Mining Co.
 USSR Academy of Sciences
 Viking Systems International (5)
 West Virginia University, Chemical Engineering Dept. (4)
 West Virginia University, Chemistry Department
 West Virginia University, Geology and Geography Department

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