

MAINTENANCE OF THE COAL SAMPLE BANK AND DATABASE

Quarterly Technical Progress Report

Reporting Period: 7/01/97 - 9/30/97

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ABSTRACT

This project provides coal samples and accompanying analytical data for research by DOE contractors and others. All 56 samples have been purged with argon before storage, and the 33 samples in the DECS series are heat-sealed in foil laminate bags and stored under refrigeration. Eleven DECS samples have been collected under the current contract.

Basic characterization, standardized liquefaction analyses and organic geochemical analyses have been completed. Distribution of samples and data is continuing, with processing of samples being performed as needed. 133 samples, 291 data printouts, and individual data items from 4002 samples were distributed during the quarter.

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EXECUTIVE SUMMARY

Maintenance of the Coal Sample Bank and Database

Quarterly Technical Progress Report 7/01/97 - 9/30/97

The mission of the DOE Coal Sample Bank and Database is to provide a variety of well-characterized, high-quality coal samples for public and private coal research. Eleven coal samples collected under the current contract and 45 from previous contracts, along with analytical data, are distributed on a continuing basis to DOE contractors and others performing coal research. Additional analyses of liquefaction behavior and organic geochemical characteristics are performed under the contract. The samples are stored to minimize deterioration, and 10 samples are analyzed annually to monitor the effectiveness of the storage methods.

This report reflects the level of effort described in the revised work statement submitted to DOE on September 5, 1996, setting out a reduction in effort following a cut in the level of funding of the project.

Sample collection, basic analysis, liquefaction analysis and organic geochemistry analysis specified under the contract have been completed. The annual monitoring effort was completed early in the quarter.

An oral presentation on "Coal Sample Preservation in Foil Multilaminate Bags" was made at the joint meeting of The Society for Organic Petrology and the Eastern Section of the American Association for Petroleum Geologists in Lexington, Kentucky, on September 30.

INTRODUCTION

This five year project is intended to ensure the availability of well-characterized, high-quality coal samples for public and private coal research. It continues support of the DOE Coal Sample Bank and Database at The Pennsylvania State University. Eleven coal samples in the DECS- series have been collected, processed, packaged, and analyzed under the contract, and a resulting database is being maintained. These samples and data, as well as 45 samples collected under previous contracts, are distributed on a continuing basis to DOE contractors and others performing coal research.

Samples were chosen to maintain a sample bank of 56 coals representing the major U.S. coal fields and a variety of coal ranks and compositions. In addition to standard analyses, liquefaction tests have been performed, and organic geochemical analyses are being performed and are nearly completed. The samples are stored to minimize deterioration, and 10 samples are monitored annually by proximate, sulfur forms, and gaseous oxygen analysis to evaluate their condition. This year, additional monitoring was performed to evaluate the influence of various storage methods.

RESULTS AND DISCUSSION

Task 1B. Storage and Inventory of Samples

All samples supported by the contract are stored in containers purged with argon before sealing; container locations are tracked by a computer inventory program. PSOC-series samples are stored in drums or buckets at the Coal Sample Bank building, or in cans in the Coal and Organic Petrology Laboratories. All DECS-series samples are stored under refrigeration in foil laminate bags.

During the quarter, samples were distributed and inventory records were updated. Storage and inventory of sample containers is expected to continue routinely through the next quarter.

Task 1C. Monitoring of Sample Quality

It was planned that one 300 g (2/3 lb) bag of each DECS sample would be analyzed annually to monitor sample condition. This Task has been reduced in scope, to 10 samples per year, because of reduction in funding. Effort in the related study of liquefaction behavior (under Task 1F) over time has also been reduced.

For this year, some additional samples were included in the annual monitoring program in order to compare samples in the standard foil laminate bags with those exposed to air, and to compare the standard refrigerated storage to unrefrigerated storage. The program was completed early in the quarter, and results are included in the Appendix.

For the annual monitoring study, a 300g bag of each subject sample was taken from the stock of containers. A polarographic oxygen analyzer punctured the bag wall and measured the gaseous oxygen inside. The bag was opened and subsamples were taken for proximate, sulfur forms, ultimate (in some cases), Gieseler fluidity, and free-swelling index analyses.

Results are shown in Figures 1 and 2 for the 6 samples stored longer than 5 years. Gieseler fluid temperature range (Fig. 1) for the 5 bituminous samples was maintained with no significant decrease for 3 samples and with some decrease for the Lower Sunnyside and Blind Canyon samples. Sulfate sulfur (Fig. 2, shown by linear regression lines) showed no increasing trend for any sample (the vertical scale tends to exaggerate small random variations from a stable mean).

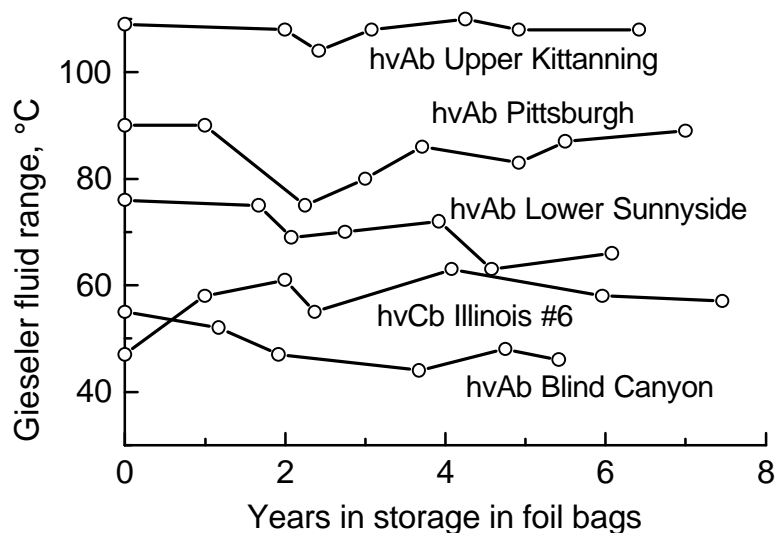


Figure 1. Gieseler fluid range after storage of samples in foil laminate bags.

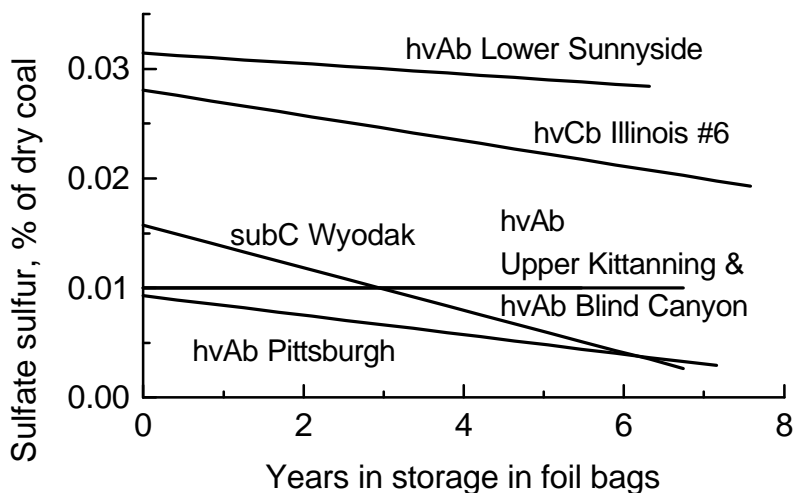


Figure 2. Sulfate sulfur after storage of samples in foil laminate bags (linear regression lines).

Coal samples stored in the bags also showed no decreasing trend in moisture, calorific value, or free swelling index. The gaseous oxygen level within the bags ranged from 0.00 to 0.08% for bituminous samples and was 0.13% for the subbituminous sample.

For six samples monitored over at least five years, all indicators of deterioration which were employed showed that foil multilaminar bags preserved the initial properties of pulverized coal samples very well in comparison to container types used in the past.

A paper entitled "Coal Sample Preservation in Foil Multilaminar Bags" was presented at the joint annual meetings of The Society for Organic Petrology and the Eastern Section of the American Association of Petroleum Geologists in Lexington, Kentucky, on September 30, 1997. A manuscript is being prepared for submission to the International Journal of Coal Geology.

Task 1D. Collection and Processing of Replacement Samples

Collection and processing of 11 samples, as described in the Revised Statement of Work (Sept. 6, 1996) has been completed. Portions of samples collected under a previous contract are being processed to minus 0.25 mm (minus 60 mesh). When the stock of 2.3 kg (5 lb) bags of a specific sample has been distributed, additional bags are split out from larger bulk storage bags.

Task 1E. Basic Characterization of Coal Samples

All basic characterization of samples planned for collection under the contract has been completed.

Task 1F. Liquefaction Testing

In this Task, appropriate samples will be subjected to a standardized liquefaction test using tetralin (1:1 coal:tetralin, 1000 psig H₂, 350°C, 30 min) and subsequent product workup. Work in this Task has been completed, although the total number of samples tested was reduced following a cut in the level of funding.

Review and synthesis of data generated in this Task and Task 1H (organic Geochemistry) was ongoing during the quarter. Bivariate plots were produced and evaluated. It is planned that a page showing the liquefaction and organic geochemistry results will be created for each of the DECS samples analyzed. These will be available for distribution along with the standard four-page-per-sample analytical printouts.

Task 1G. Investigation of Changes in Surface Chemistry During Storage

This Task has been discontinued.

Task 1H. Organic Geochemistry

Pyrolysis - Gas Chromatography - Mass Spectrometry

These measurements have been completed. Runs were performed at a flash pyrolysis temperature of 610°C with a heating rate of 10°C/ms and a pyrolysis time of 10 s (for further discussion see the Quarterly Technical Progress Report for 7/01/94-9/30/94).

Nuclear Magnetic Resonance (NMR) Spectroscopy

Dried powdered samples of coal were placed in the bullet-type rotor of a Chemagnetics, Inc. M-100 NMR spectrometer and analyzed according to the cross-polarization, magic-angle spinning (CPMAS) and dipolar dephasing with magic angle spinning (DDMAS) procedures outlined by Hatcher (1988). Approximately 10,000 transients having a contact time of 1 ms and a cycle time of 1 s were acquired in 0.5K of data, zero-filled to 4K. The chemical shifts were referenced to hexamethylbenzene. For DDMAS, approximately 8000 transients with a cycle time of 1 s were used at each of 10 dephasing times.

CPMAS, DDMAS and Bloch decay analyses planned for this contract have been completed and presented in prior reports. Review and synthesis of all data generated in this Task is under way (see discussion under Task 1F)..

Task 1I. Distribution of Coal Samples to Users

During the period 7/01/97 - 9/30/97 a total of 133 samples (27 DOE Sample Bank samples and 106 other Penn State samples) of various sizes in 143 containers were distributed. See Task 2C for a list of sample and data recipients. This task will continue in the same manner through the next quarter.

Task 2A. Programming

Consideration of database programs for future use is ongoing. Some minor programming was undertaken during the quarter. See also the discussion of the world wide web site under 'Distribution of Data to Users.'

Task 2B. Data Entry

Entry of basic characterization data for the 11 samples collected under the contract has been completed.

Task 2C. Distribution of Data to Users

During the quarter a total of 291 data printouts were distributed. In addition, 15 special data requests were filled by database searches and printed output or creation of a data disk, resulting in distribution of information on 4002 samples. In August, a new edition of the brochure

describing the DOE Coal Sample Bank and Database project was created. It was distributed at the Coal Liquefaction and Solid Fuels Contractors Review Conference in September, and also will be distributed by mail. Requests for general Sample Bank and Database information were filled during the quarter. This task will continue in the same manner through the next quarter.

Organizations supplied with coal samples and/or data include:

Brown University, Division of Engineering
CSIRO (Australia)
Eco-Systems
Goldman-Sachs
Kentucky Geological Survey
Pennsylvania State University, Geosciences Department
Pennsylvania State University, Fuel Science Department (5)
Silogran Trading Ltd. (Switzerland)
Southern Illinois University, Mining Engineering Department
Stanford University, Geosciences Department
Université Pierre et Marie Curie, Lab. Géochemie et Métallogénie (France)
University of Delaware, Chemical Engineering Department
University of Kentucky, Consortium for Fossil Fuel Liquefaction Science
University of Maryland
University of South Carolina, Biology Department (2)

The numbers in parentheses represent multiple requests which were separately processed.

Additional clients have received information via a world wide web site (<http://www.ems.psu.edu/COPL/>). It includes a table of basic data for the 56 samples supported under the current contract, and a searchable database of those and 522 other samples from the Penn State Coal Database.

CONCLUSIONS

The coal samples and data supported under this project are being used on an ongoing basis by DOE contractors and others performing coal research. Samples collected under the current contract are stored in argon under refrigeration in multilaminate bags which have demonstrated an ability to preserve the properties of the fresh coal. Samples and data continue to be distributed from the DOE Coal Sample Bank and Database to other DOE contractors.

The annual monitoring program evaluated the condition of coal samples which have been in storage for as long as seven years. The refrigerated foil multilaminate bags continue to preserve samples very well.

APPENDIX. Monitoring of DOE Sample Bank Coals to Evaluate Sample Condition after Storage

DECS-2	Illinois #6 seam	hvCb			Ro max= 0.52 %			
FOIL BAG	original analysis	21 of 256	100 of 256	109 of 256	114 of 256 115 of 256	136 of 256	138 of 256	152 of 256
particle size stored		-20 mesh	-20 mesh	-20 mesh	-20 mesh	-20 mesh	-20 mesh	-20 mesh
note								
date sealed		8/ 06/ 90	8/ 06/ 90	8/ 06/ 90	8/ 06/ 90	8/ 06/ 90	8/ 06/ 90	8/ 06/ 90
date analyzed	2/ 28/ 90	1/ 25/ 91	11/ 27/ 92	6/ 14/ 93	3/ 23/ 94	5/ 23/ 95	2/ 13/ 96	7/ 31/ 97
PROXIMATE								
% moisture	10.4	10.3	10.1	9.8	9.6	10.2	10.0	10.2
% ash (dry basis)	16.2	16.1	16.2	15.9	16.1	15.9	16.0	16.1
SULFUR FORMS (dry %)								
total sulfur	4.51	4.33	4.54	4.50	4.64	4.62	4.59	4.63
sulfate	0.01	0.06	0.01	0.03	0.01	0.04	0.01	0.07
pyritic	2.27	2.27	2.31	2.06	1.92	2.06	2.27	2.35
organic	2.24	2.00	2.22	2.41	2.72	2.51	2.30	2.21
CALORIFIC VALUE (dry)								
Btu/lb	11880	11740	11814	11787	11895	11833	11813	11794
GIESELER FLUIDITY								
maximum fluidity, ddpm	8	9	10	7	8	11	9	6
fluid range, °C	47	58	61	55	63	64	58	57
date analyzed	2/ 08/ 90	2/ 11/ 91	2/ 02/ 93	7/ 19/ 93	3/ 07/ 94	5/ 09/ 95	1/ 23/ 96	7/ 22/ 97
FREE SWELLING INDEX	3.5				3.5	3.5	2.5	3
GASEOUS OXYGEN								
% in bag atmosphere					0.12	0.00	0.17	0.08
date analyzed					3/ 08/ 94	5/ 09/ 95	1/ 18/ 96	7/ 21/ 97

APPENDIX. Monitoring of DOE Sample Bank Coals to Evaluate Sample Condition after Storage

DECS-8	Smith-Roland seam	subC		Ro max= 0.37 %			
FOIL BAG	original analysis	27 of 256	127 of 256	138 of 256	144 of 256	159 of 256	65 of 256
particle size stored		-20 mesh	-20 mesh	-20 mesh	-20 mesh	-20 mesh	-20 mesh
note							
date sealed		10/ 22/ 90	10/ 22/ 90	10/ 22/ 90	10/ 22/ 90	10/ 22/ 96	10/ 22/ 90
date analyzed	10/ 30/ 90	10/ 21/ 92	6/ 03/ 93	3/ 23/ 94	5/ 09/ 95	2/ 13/ 96	8/ 01/ 97
PROXIMATE							
% moisture	28.4	28.3	28.6	28.1	28.6	28.7	28.6
% ash (dry basis)	13.8	12.8	13.1	13.0	13.6	13.0	13.1
SULFUR FORMS (dry %)							
total sulfur	0.73	0.77	0.81	0.95	0.87	0.80	0.78
sulfate	0.02	0.01	0.01	0.00	0.01	0.01	0.00
pyritic	0.28	0.20	0.22	0.22	0.27	0.25	0.31
organic	0.43	0.56	0.58	0.72	0.58	0.54	0.47
CALORIFIC VALUE (dry)						(a)	
Btu/lb	11168	11275	11287	11244	11210	11263	11223
GASEOUS OXYGEN							
% in bag atmosphere				0.08	0.14	0.28	0.13
date analyzed				3/ 08/ 94	5/ 09/ 95	1/ 18/ 96	7/ 21/ 97

(a) result from repeat analysis 4/29/96, change from Quarterly Technical Progress Report dated 4/25/96.

APPENDIX. Monitoring of DOE Sample Bank Coals to Evaluate Sample Condition after Storage

DECS- 12	Pittsburgh seam	hvAb			Ro max= 0.87 %			
FOIL BAG	original analysis	86 of 256	117 of 256	120 of 256	132 of 256	142 of 256	155 of 256	173 of 256
particle size stored		-20 mesh	-20 mesh	-20 mesh	-20 mesh	-20 mesh	-20 mesh	-20 mesh
note								
date sealed		7/ 30/ 90	7/ 30/ 90	7/ 30/ 90	7/ 30/ 90	7/ 30/ 90	7/ 30/ 90	7/ 30/ 90
date analyzed	8/ 23/ 90	7/ 31/ 91	10/ 23/ 92	6/ 04/ 93	3/ 23/ 94	5/ 23/ 95	2/ 13/ 96	7/ 30/ 97
PROXIMATE								
% moisture	2.40	2.47	2.99	1.98	2.35	2.46	2.23	2.41
% ash (dry basis)	10.25	11.05	10.35	9.52	9.86*	9.69	9.34	10.12
SULFUR FORMS (dry %)								
total sulfur	1.12	1.18	1.16	1.17	1.16	1.16	1.16	1.26
sulfate	0.01	0.01	0.01	0.00	0.00	0.01	0.01	0.00
pyritic	0.38	0.29	0.17	0.35	0.35	0.39	0.40	0.53
organic	0.73	0.88	0.98	0.82	0.81	0.76	0.74	0.73
CALORIFIC VALUE (dry)								
Btu/lb	13532	13337	13471	13563	13534	13603	13646	13481
GIESELER FLUIDITY					(a)			
maximum fluidity, ddpm	20002	6458	4309	2173	7866	6986	17800	20489
fluid range, °C	90	90	75	80	86	83	87	89
date analyzed	7/ 27/ 90	7/ 24/ 91	10/ 27/ 92	7/ 21/ 92	3/ 09/ 94	5/ 10/ 95	1/ 24/ 96	7/ 18/ 97
FREE SWELLING INDEX	7.5				8	8	8	9
GASEOUS OXYGEN								
% in bag atmosphere					0.01	0.04	0.00	0.04
date analyzed					3/ 08/ 94	5/ 10/ 95	1/ 18/ 96	7/ 18/ 97

(a) based on two of three runs which agreed within ASTM limits

* correction of Quarterly Technical Progress Report dated 10/14/94

APPENDIX. Monitoring of DOE Sample Bank Coals to Evaluate Sample Condition after Storage

DECS- 14	Upper Kittanning seam						
		hvAb		Ro max= 1.07 %			
FOIL BAG	original analysis	6 of 256	20 of 256	11 of 256	16 of 256	23 of 256	24 of 256
particle size stored		-20 mesh	-20 mesh	-20 mesh	-20 mesh	-20 mesh	-20 mesh
note							
date sealed		2/ 08/ 91	2/ 08/ 91	2/ 08/ 91	2/ 08/ 91	2/ 08/ 91	2/ 08/ 91
date analyzed	2/ 15/ 91	11/ 27/ 92	6/ 15/ 93	3/ 24/ 94	5/ 23/ 95	2/ 13/ 96	7/ 31/ 97
PROXIMATE							
% moisture	1.5	1.7	1.4	1.8	1.7	1.6	1.7
% ash (dry basis)	10.5	10.3	10.6	10.5	10.7	10.3	10.8
SULFUR FORMS (dry %)							
total sulfur	1.80	1.71	1.80	1.79	1.86	1.90	1.96
sulfate	0.01	0.01	0.01	0.01	0.01	0.01	0.01
pyritic	0.94	0.08	1.02	1.01	1.03	1.15	1.25
organic	0.85	1.62	0.78	0.77	0.82	0.74	0.71
CALORIFIC VALUE (dry)							
Btu/lb	13678	13723	13701	13803	13602	13739	13621
GIESELER FLUIDITY							
maximum fluidity, ddpm	29930	27625	23619	29836	29945	29953	28578
fluid range, °C	109	108	104	108	110	108	108
date analyzed	2/ 19/ 91	2/ 04/ 93	7/ 23/ 93	3/ 10/ 94	5/ 16/ 95	1/ 24/ 96	7/ 23/ 97
FREE SWELLING INDEX	8			7.5	8	7.5	9.0
GASEOUS OXYGEN					(a)		
% in bag atmosphere				0.04	0	0.08	0.06
date analyzed				3/ 08/ 94	5/ 15/ 95	1/ 18/ 96	7/ 22/ 97

(a) less than usual accuracy but definitely no significant oxygen

APPENDIX. Monitoring of DOE Sample Bank Coals to Evaluate Sample Condition after Storage

DECS-15	Lower Sunnyside seam		hvAb	Ro max= 0.80 %			
FOIL BAG	original analysis	3 of 256	6 of 256	5 of 256	8 of 256	10 of 256	11 of 256
particle size stored		-20 mesh	-20 mesh	-20 mesh	-20 mesh	-20 mesh	-20 mesh
note							
date sealed	7/ 05/ 91	10/ 15/ 92	10/ 15/ 92	10/ 15/ 92	10/ 15/ 92	10/ 15/ 92	10/ 15/ 92
date analyzed		11/ 27/ 92	6/ 15/ 93	3/ 24/ 94	5/ 23/ 95	2/ 13/ 96	7/ 31/ 97
PROXIMATE							
% moisture	2.9	2.9	2.6	3.1	3.0	3.0	3.2
% ash (dry basis)	10.0	10.1	9.8	9.8	10.0	10.1	10.4
SULFUR FORMS (dry %)							
total sulfur	1.65	1.75	1.62	1.64	1.66	1.58	1.65
sulfate	0.05	0.03	0.02	0.02	0.02	0.05	0.05
pyritic	0.61	0.94	0.69	0.76	0.70	0.77	0.76
organic	0.99	0.78	0.91	0.87	0.94	0.76	0.83
CALORIFIC VALUE (dry)							
Btu/lb	13429	13275	13396	13553	13415	13295	13180
GIESELER FLUIDITY							
maximum fluidity, ddpm	959	258	170	215	246	60	68
fluid range, °C	76	75	69	70	72	63	66
date analyzed	6/ 13/ 91	2/ 05/ 93	7/ 26/ 93	3/ 11/ 94	5/ 11/ 95	1/ 25/ 96	7/ 23/ 97
FREE SWELLING INDEX	4.5			4	4.5	3.5	5.5
GASEOUS OXYGEN					(a)		
% in bag atmosphere				0.04	0	0.18	0.01
date analyzed				3/ 08/ 94	5/ 11/ 95	1/ 18/ 96	7/ 22/ 97

(a) less than usual accuracy but definitely no significant oxygen

APPENDIX. Monitoring of DOE Sample Bank Coals to Evaluate Sample Condition after Storage

DECS-17 Blind Canyon seam hvAb Ro max=0.59 % REFRIGERATED, -20 MESH							
FOIL BAG	original analysis	204 of 256	205 of 256	17 of 256	10 of 256	11 of 256	12 of 256
particle size stored		-20 mesh	-20 mesh	-20 mesh	-20 mesh	-20 mesh	-20 mesh
note							
date sealed		12/ 04/ 91	12/ 04/ 91	12/ 04/ 91	12/ 04/ 91	12/ 04/ 91	12/ 04/ 91
date analyzed	8/ 27/ 91	4/ 16/ 93	6/ 15/ 93	4/ 26/ 94	5/ 23/ 95	2/ 13/ 96	7/ 31/ 97
PROXIMATE							
% moisture	3.7	3.9	3.8	3.9	4.1	4.0	4.1
% ash (dry basis)	6.6	6.6	6.7	6.4	6.5	6.7	6.7
SULFUR FORMS (dry %)							
total sulfur	0.44	0.43	0.42	0.47	0.44	0.43	0.43
sulfate	0.01	0.01	0.01	0.01	0.01	0.01	0.00
pyritic	0.02	0.03	0.05	0.04	0.04	0.04	0.06
organic	0.41	0.39	0.36	0.43	0.39	0.38	0.37
CALORIFIC VALUE (dry)							
Btu/lb	13826	13869	13904	13926	13745	13942	13861
GIESELER FLUIDITY							
maximum fluidity, ddpm	5	4	2	2	2	2	3
fluid range, °C	55	52	47	44	48	46	48
date analyzed	8/ 16/ 91	10/ 28/ 92	7/ 27/ 93	4/ 20/ 94	5/ 16/ 95	1/ 26/ 96	7/ 24/ 97
FREE SWELLING INDEX	2			2	2.5	1.5	2
GASEOUS OXYGEN					(a)		
% in bag atmosphere				0.00	0	0.10	0.00
date analyzed				4/ 20/ 94	5/ 16/ 95	1/ 18/ 96	7/ 22/ 97

(a) less than usual accuracy but definitely no significant oxygen

APPENDIX. Monitoring of DOE Sample Bank Coals to Evaluate Sample Condition after Storage

DECS-17 Blind Canyon seam hvAb Ro max= 0.59 % UNREFRIGERATED, -20 MESH							
FOIL BAG	original analysis	7 of 16	15 of 16	8 of 16	10 of 16	9 of 16	11 of 16
particle size stored		-20 mesh	-20 mesh	-20 mesh	-20 mesh	-20 mesh	-20 mesh
note							
date sealed		8/ 15/ 91	8/ 15/ 91	8/ 15/ 91	8/ 15/ 91	8/ 15/ 91	8/ 15/ 91
date analyzed	8/ 27/ 91	11/ 27/ 92	6/ 18/ 93	4/ 26/ 94	5/ 23/ 95	2/ 13/ 96	7/ 31/ 97
PROXIMATE							
% moisture	3.7	3.9	3.7	3.9	3.9	3.5	4.0
% ash (dry basis)	6.6	6.4	6.5	6.4	6.6	6.6	6.6
SULFUR FORMS (dry %)							
total sulfur	0.44	0.44	0.43	0.47	0.43	0.42	0.43
sulfate	0.01	0.01	0.00	0.01	0.00	0.01	0.01
pyritic	0.02	0.03	0.05	0.04	0.04	0.04	0.09
organic	0.41	0.40	0.38	0.43	0.39	0.38	0.33
CALORIFIC VALUE (dry)							
Btu/lb	13826	13858	13836	13862	13801	13925	13882
GIESELER FLUIDITY							
maximum fluidity, ddpm	5	5	2	2	2	2	2
fluid range, °C	55	50	36	46	42	44	43
date analyzed	8/ 16/ 91	10/ 28/ 92	7/ 28/ 93	3/ 16/ 94	5/ 12/ 95	1/ 26/ 96	7/ 24/ 97
FREE SWELLING INDEX	2			2	2	2	2.5
GASEOUS OXYGEN					(a)		
% in bag atmosphere				0.05	0	0.16	0.00
date analyzed				3/ 16/ 94	5/ 12/ 95	1/ 18/ 96	7/ 22/ 97

(a) less than usual accuracy but definitely no significant oxygen

APPENDIX. Monitoring of DOE Sample Bank Coals to Evaluate Sample Condition after Storage

DECS-23	Pittsburgh seam	hvAb	Ro max= 0.73 %	
FOIL BAG	original analysis	17 of 256	18 of 256	19 of 256
particle size stored		-20 mesh	-20 mesh	-20 mesh
note				
date sealed		2/ 11/ 94	2/ 11/ 94	2/ 11/ 94
date analyzed	2/ 21/ 94	2/ 08/ 95	11/ 30/ 95	7/ 30/ 97
PROXIMATE				
% moisture	2.00	2.03	2.09	2.13
% ash (dry basis)	9.44	9.64	9.67	9.61
SULFUR FORMS (dry %)				
total sulfur	3.87	3.79	3.66	3.89
sulfate	0.01	0.01	0.00	0.00
pyritic	2.23	2.42	2.45	2.73
organic	1.63	1.36	1.20	1.16
CALORIFIC VALUE (dry)				
Btu/lb	13614	13553	13565	13487
GIESELER FLUIDITY				
maximum fluidity, ddpm	30000	30000	30000	30002
fluid range, °C	97	106	100	104
date analyzed	2/ 07/ 94	1/ 23/ 95	11/ 28/ 95	7/ 15/ 97
FREE SWELLING INDEX	7.5	7	7.5	9
GASEOUS OXYGEN		(a)		
% in bag atmosphere		0	not	0.00
date analyzed		5/ 16/ 95	determined	7/ 15/ 97

(a) less than usual accuracy but definitely no significant oxygen

APPENDIX. Monitoring of DOE Sample Bank Coals to Evaluate Sample Condition after Storage

DECS-24	Illinois #6 seam	hvBb	Ro max= 0.49 %	
FOIL BAG	original analysis	105 of 328	106 of 328	107 of 256
particle size stored		-20 mesh	-20 mesh	-20 mesh
note				
date sealed		7/ 19/ 94	7/ 19/ 94	7/ 19/ 94
date analyzed	9/ 07/ 94	2/ 08/ 95	11/ 29/ 95	7/ 30/ 97
PROXIMATE				
% moisture	13.2	13.4	13.4	13.4
% ash (dry basis)	13.4	13.5	13.6	13.5
SULFUR FORMS (dry %)				
total sulfur	5.53	5.92	5.76	5.75
sulfate	0.25	0.01	0.01	0.06
pyritic	2.64	2.86	2.77	2.96
organic	2.64	3.05	2.98	2.73
CALORIFIC VALUE (dry)				
Btu/lb	12162	12074	12242	12203
GIESELER FLUIDITY				
maximum fluidity, ddpm	49	55	53	54
fluid range, °C	78	82	82	74
date analyzed	6/ 14/ 94	1/ 24/ 95	11/ 29/ 95	7/ 16/ 97
FREE SWELLING INDEX	3	3.5	3.5	6
GASEOUS OXYGEN		(a)		
% in bag atmosphere		0	not determined	0.00
date analyzed		5/ 16/ 95		7/ 15/ 97

(a) less than usual accuracy but definitely no significant oxygen

APPENDIX. Monitoring of DOE Sample Bank Coals to Evaluate Sample Condition after Storage

DECS-30 Splash Dam seam mvb Ro max= 1.16 %			
FOIL BAG	original analysis	35 of 280	
particle size stored		-20 mesh	
note			
date sealed		7/ 11/ 95	
date analyzed	8/ 15/ 95	8/ 01/ 97	
PROXIMATE			
% moisture	2.06	1.59	
% ash (dry basis)	3.89	3.99	
SULFUR FORMS (dry %)			
total sulfur	0.79	0.80	
sulfate	0.00	0.00	
pyritic	0.14	0.20	
organic	0.65	0.60	
CALORIFIC VALUE (dry)			
Btu/lb	15060	14967	
GIESELER FLUIDITY			
maximum fluidity, ddpm	28188	19182	
fluid range, °C	117	110	
date analyzed	6/ 30/ 95	7/ 31/ 97	
FREE SWELLING INDEX	8	9	
GASEOUS OXYGEN			
% in bag atmosphere		0.00	
date analyzed		7/ 25/ 97	

APPENDIX. Monitoring of DOE Sample Bank Coals to Evaluate Sample Condition after Storage

DECS-31	Pond Creek seam	hvAb	Ro max= 0.99 %
FOIL BAG	original analysis	35 of 280	
particle size stored		-20 mesh	
note			
date sealed		7/ 12/ 95	
date analyzed	8/ 14/ 95	8/ 01/ 97	
PROXIMATE			
% moisture	2.32	1.94	
% ash (dry basis)	10.89	11.46	
SULFUR FORMS (dry %)			
total sulfur	0.60	0.63	
sulfate	0.01	0.01	
pyritic	0.11	0.17	
organic	0.49	0.46	
CALORIFIC VALUE (dry)			
Btu/lb	13689	13467	
GIESELER FLUIDITY			
maximum fluidity, ddpm	3634	3472	
fluid range, °C	79	74	
date analyzed	6/ 28/ 95	7/ 28/ 97	
FREE SWELLING INDEX	8	9	
GASEOUS OXYGEN			
% in bag atmosphere		0.00	
date analyzed		7/ 28/ 97	

APPENDIX. Monitoring of DOE Sample Bank Coals to Evaluate Sample Condition after Storage

DECS-32 Stockton-Lewiston seam hvAb Ro max= 1.16 %			
FOIL BAG	original analysis	35 of 280	
particle size stored		-20 mesh	
note			
date sealed		7/ 13/ 95	
date analyzed	8/ 14/ 95	8/ 01/ 95	
PROXIMATE			
% moisture	2.64	2.42	
% ash (dry basis)	20.30	20.88	
SULFUR FORMS (dry %)			
total sulfur	0.73	0.73	
sulfate	0.01	0.00	
pyritic	0.10	0.17	
organic	0.62	0.55	
CALORIFIC VALUE (dry)			
Btu/lb	11853	11685	
GIESELER FLUIDITY			
maximum fluidity, ddpm	450	472	
fluid range, °C	67	64	
date analyzed	6/ 27/ 95	7/ 29/ 97	
FREE SWELLING INDEX	5	5.5	
GASEOUS OXYGEN			
% in bag atmosphere		0.00	
date analyzed		7/ 28/ 97	

APPENDIX. Monitoring of DOE Sample Bank Coals to Evaluate Sample Condition after Storage

DECS-33	Ohio #4A seam	hvBb	Ro max= 0.51 %	
FOIL BAG	original analysis	35 of 280		
particle size stored		-20 mesh		
note				
date sealed		8/ 02/ 95		
date analyzed	8/ 16/ 95	8/ 01/ 97		
PROXIMATE				
% moisture	5.97	5.86		
% ash (dry basis)	12.02	12.06		
SULFUR FORMS (dry %)				
total sulfur	3.74	3.76		
sulfate	0.01	0.01		
pyritic	1.41	1.84		
organic	2.32	1.92		
CALORIFIC VALUE (dry)				
Btu/lb	12617	12662		
GIESELER FLUIDITY				
maximum fluidity, ddpm	86	116		
fluid range, °C	75	66		
date analyzed	7/ 28/ 95	7/ 30/ 97		
FREE SWELLING INDEX	4	5		
GASEOUS OXYGEN				
% in bag atmosphere		0.00		
date analyzed		7/ 28/ 97		