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MINE SAMPLING AND CHEMICAL ANALYSES OF COALS

TESTED AT THE
UNITED STATES FUEL-TESTING PLANT
NORFOLK, VA.
IN 1907

BY
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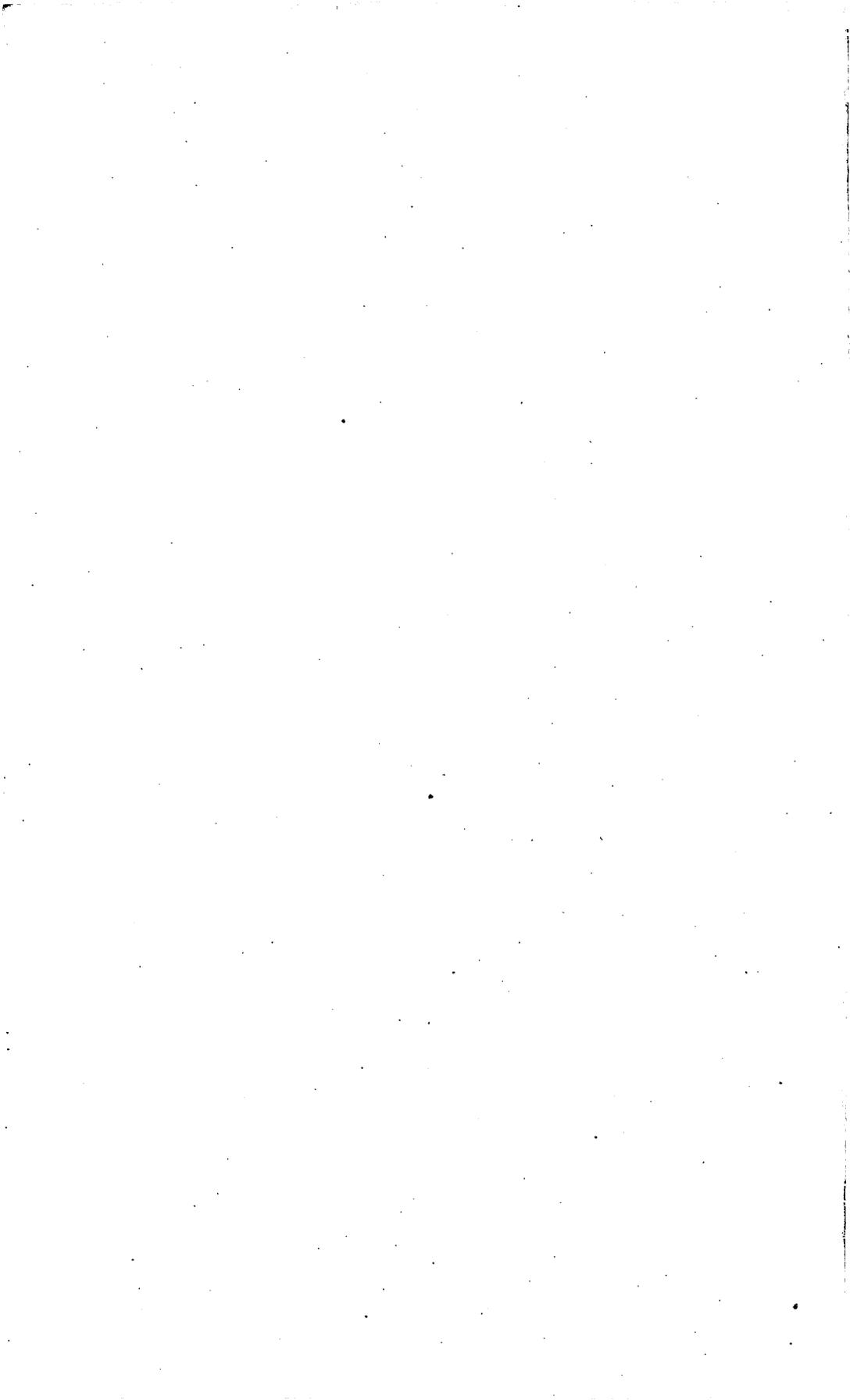


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MINE SAMPLING AND CHEMICAL ANALYSES OF COALS TESTED AT THE UNITED STATES FUEL-TESTING PLANT, NORFOLK, VA., IN 1907.

By JOHN SHOBER BURROWS.

INTRODUCTION.

In behalf of the United States Government, which is a large user of coal, the United States Geological Survey, in 1907, made a thorough investigation of the Pocahontas and New River coals. The tests were conducted at the Government plant on the grounds of the Jamestown Exposition, near Norfolk, Va., and their especial purpose was to determine the best methods of using the coals economically.

The New River field is situated in West Virginia; the Pocahontas in West Virginia and a small section of Virginia. From these fields the coals reach the tide-water shipping ports—Newport News and Norfolk—by two railways, the Chesapeake and Ohio and the Norfolk and Western, the former having docks at Newport News and the latter at Norfolk. Another road, the Virginian Railway, which extends into the territory of both the older lines and has docks at Norfolk, is now nearing completion and will soon be adding to the already enormous tonnage of the ports mentioned.

Pocahontas and New River coals are purchased by industrial plants along the Atlantic seaboard, are consumed by the United States Navy and the merchant marine, and are used by the Isthmian Canal Commission in digging the Panama Canal. Because of their extensive use by the public and the Government the determination of the best methods of utilizing these coals economically is a matter of much importance. The site selected for the investigation was chosen not only because of its accessibility to the New River and Pocahontas fields and its location near the shipping ports of Norfolk and Newport News, but also because of the facilities afforded by the Jamestown Exposition Company for temporarily housing the plant.

The equipment used in the tests came mainly from the St. Louis fuel-testing plant ^a of the Geological Survey. Some new equipment

^a See Bulletins 332 and 290 and Professional Paper 48 for description of equipment of St. Louis plant.

was added to that brought from the St. Louis plant, and the building erected was designed especially to meet the requirements of the work.

Three distinct lines of research were carried on with the coals received for test—use under boilers, use in gas producers, and adaptability to briquetting.

In the steaming investigations regular steaming tests were made and a large amount of research work was performed dealing with conditions in the combustion chamber, the temperature of the gases at various points, and the character of the flue gases. The results of this work are now being prepared for publication, and will appear in a forthcoming bulletin of the Survey.

The producer-gas tests, carried on after the general plan adopted at St. Louis, were made to determine the efficiency and economy of the particular coals as gas-producer fuels. The results of this work are being compiled for publication and will appear in a Survey bulletin.

The investigations which seemed to attract more widespread interest than anything else at the plant were the briquetting tests. This work was most important, as it indicates a method by means of which Pocahontas and New River coals can be prepared for shipment to those distant receiving ports where consumers are apt to look for the firmness to which they have been familiar in European lump coals and briquets. The tests demonstrated that these coals could be formed into very satisfactory briquets suitable for locomotive and marine use and strong enough to be shipped long distances. The briquets were tried on locomotives, on torpedo boats, and on the U. S. S. *Connecticut*. The results of these locomotive-steaming tests are to be published separately as a Survey bulletin, and an account of the method of manufacture, the binders used, and the physical character and chemical composition of the briquets will appear in another bulletin.

Besides the coal investigations, tests of liquid fuels in internal-combustion engines were conducted at Norfolk in connection with work for the Navy Department. The results of this work are also being prepared for publication in a Survey bulletin.

ACKNOWLEDGMENTS.

The Norfolk tests were made possible through the hearty cooperation of the officials of the Chesapeake and Ohio Railway, the Norfolk and Western Railway, the Virginian Railway, and the coal operators. The railways named hauled all of the coal used in the tests, amounting to 38 carloads, free of cost, and the operators generously donated the coal and extended every facility to the inspector at the mine. To Mr. Neil Robinson, of Charleston, W. Va., is due credit for procuring the cooperation of the New River operators. Mr. Robinson personally visited many of the mine owners in the New River field and devoted

much of his time to making arrangements with them for furnishing coal.

One of the Survey inspectors, Mr. K. M. Way, to whom was assigned the task of sampling and shipping the coal, rendered most efficient service in the field and later prepared the chemical analyses and other details for this report.

COALS TESTED.

PRELIMINARY STATEMENT.

The table on page 8 briefly summarizes some data relating to the carload samples of coal tested at Norfolk in 1907. These were nearly all shipped under the supervision of an inspector of the technologic branch, who was at the mine while the car was being loaded and could therefore certify to its origin. The samples were designated consecutively Jamestown No. 1, Jamestown No. 2, etc., as they were shipped to distinguish them in the test records and to differentiate them from the samples received during the same period at the coking and washing plant operated at Denver, Colo., which were called Denver No. 1, Denver No. 2, etc.

At the time the inspector shipped the coal to the plant he thoroughly examined the coal in the mine and took small mine samples^a from the bed for chemical analysis to show the composition of the coal in its natural state before exposure to the weather and for the guidance of the engineers at the testing plant.

Detailed sections of the seams at the points where the mine samples were taken, showing the amount of clean coal and the partings of shale, bone coal, etc., together with chemical analyses of these samples and of the carload lots as they were received at the testing plant after exposure to the weather for various periods, are given on succeeding pages. The numbers used to designate the samples are those assigned in the chemical laboratory.

^a For method of taking mine samples, see Bull. U. S. Geol. Survey, No. 316, 1907, p. 486.

Coals tested at the Jamestown Exposition, 1907.

Field sample.	Kind of coal.	Name of bed.	Locality.	Railway.	Days exposed to weather.	Inspector.	Tests made.
Jamestown No.—							
1.	Bituminous run of mine, loaded in mine with forks.	Jaw Bone.....	Virginia City, Wise County, Va.	Norfolk and Western.	36	K. M. Way...	Steaming and producer gas.
2.	Semitbituminous run of mine.	Pocahontas No. 3.	Pocahontas, Tazewell County, Va.	.....do.....	a 33-43	.....do.....	Briquetting.
3.	.....do.....	Thin Vein Pocahontas.	Davy, McDowell County, W. Va.	.....do.....	37	.....do.....	Steaming, producer gas, and briquetting.
4.	.....do.....	Quinnimont (Fire Creek).	Rush Run, Fayette County, W. Va.	Chesapeake and Ohio.	24	.....do.....	Steaming and producer gas.
5.	.....do.....	.....do.....	1 mile east of Sewell, Fayette County, W. Va.	.....do.....	22, 28	.....do.....	Producer gas and briquetting.
6.	.....do.....	.....do.....	Red Star, Fayette County, W. Va.	.....do.....	20, 41	.....do.....	Steaming and briquetting.
7.	.....do.....	.....do.....	Derryhale, Fayette County, W. Va.	.....do.....	23, 32	.....do.....	Steaming, producer gas, and briquetting.
8.	.....do.....	Quinnimont (Fire Creek).	Lawton, Fayette County, W. Va.	.....do.....	27, 31	.....do.....	Briquetting.
9.	.....do.....	Sewell.	Winona, Fayette County, W. Va.	.....do.....	24	.....do.....	Steaming and briquetting.
10.	.....do.....	Beckley.	Stanaford, Raleigh County, W. Va.	.....do.....	23	.....do.....	Do.
11.	.....do.....	.....do.....	West Raleigh, Raleigh County, W. Va.	.....do.....	19, 23	.....do.....	Do.
12.	Bone coal.....	Pocahontas No. 3.	Svirchback, McDowell County, W. Va.	Norfolk and Western.	11	.....do.....	Briquetting.
13.	Semitbituminous run of mine.	.....do.....	Ennis, McDowell County, W. Va.	.....do.....	29, 37	.....do.....	Do.
14.	Semianthracite culm.	.....do.....	Merrimac, Montgomery County, Va.	.....do.....	37	Uninspected..	Do.
15.	Semitbituminous run of mine.	Fire Creek and Sewell.	Minden, Fayette County, W. Va.	Chesapeake and Ohio.	a 8-16	.....do.....	Do.
16.	.....do.....	.....do.....	.....do.....	.....do.....	.....do.....	.....do.....	Do.
17.	.....do.....	Pocahontas No. 3.	.....do.....	Norfolk and Western.	.....do.....	.....do.....	Do.

a Several cars taking various lengths of time in transit.

LOCATION OF COAL BEDS AND CHEMICAL ANALYSES.

JAMESTOWN No. 1.

This sample consisted of bituminous run-of-mine coal from a mine working the "Jaw Bone" bed at Virginia City, Wise County, Va., on the Norfolk and Western Railway. The coal was loaded with forks in the mine, and inspected by K. M. Way. It had been exposed to the weather for thirty-six days before use at the testing plant. It was used in making steaming and producer-gas tests, the results of which will appear in two bulletins now in course of preparation. Sections of the coal at the points in the mine where samples were taken are given below, as well as the analyses of the coal from these sections. Section A (No. 5235) was measured at a point 3,200 feet northwest of the opening of the mine, and section B (No. 5217) was measured at a point 2,400 feet northwest from the opening.

Sections of "Jaw Bone" bed at Virginia City, Va.

SECTION A.		Ft. in.	SECTION B.		Ft. in.
Sandstone roof.			Sandstone roof.		
Coal.....		5	Coal.....		6½
Sandstone ".....		¼	Rash ".....		2
Coal.....		2	Coal.....		1 9½
Rash ".....		½	Bone coal.....		2
Coal.....		1 4½	Coal.....		1 5
Shale and coal ".....		7	Bone coal.....		2
Bone coal.....		3	Coal.....		4 ½
Coal.....		4 6	Shale floor.		7 3½
Shale floor.		7 4¼			

Chemical analysis.

		Mine samples.			
		5235.		5217.	
		As received.	Dried at 105° C.	As received.	Dried at 105° C.
Air-drying loss.....		1.80	.....	2.20	.....
Moisture.....		3.05	.....	3.37	.....
Prox.	Volatile matter.....	27.84	28.71	28.58	29.58
	Fixed carbon.....	54.17	55.88	53.09	54.94
	Ash.....	14.94	15.41	14.96	15.48
	Sulphur.....	1.24	1.28	1.18	1.22
Calorific value determined:					
Calories.....		6,896	7,113	6,916	7,157
British thermal units.....		12,413	12,803	12,449	12,883

^a Excluded from sample.

JAMESTOWN No. 2.

This sample consisted of several cars of semibituminous run-of-mine coal from a mine working the Pocahontas No. 3 bed, located at Pocahontas, Tazewell County, Va., on the Norfolk and Western Railway. It was loaded under the supervision of Inspector K. M. Way, the first car being exposed to the weather for thirty-three days, while the car longest in transit was exposed for forty-three days. The entire shipment of this coal was made into briquets and delivered to the U. S. S. *Connecticut* for trial tests under marine boilers. The test on the *Connecticut* was conducted in December, 1907, on a run from New York Harbor to Hampton Roads, Va.; the results will appear in a forthcoming bulletin of the Survey. Measured sections of the coal at the points in the mine where the samples were taken for chemical analysis, as well as the analyses of the coal as it was received at the testing plant, appear below.

Section A (No. 5268) was measured at a point 6,000 feet southwest of the drift mouth; section B (No. 5269) was measured at a point 6,700 feet southwest of the drift mouth.

Sections of Pocahontas No. 3 bed at Pocahontas, Va.

SECTION A.		SECTION B.	
	Ft. in.		Ft. in.
"Top coal" roof ^a	1 10	"Top coal" roof ^a	1 10
Coal.....	3 5	Coal.....	3
Bone coal ^a	4	Bone coal ^a	4½
Coal.....	4 6	Coal.....	3 8
Sulphur.....	¾	Bone coal ^a	3
Coal.....	1	Coal.....	1 9½
Shale floor.....		Sulphur.....	¼
	9 3¾	Coal.....	11
		Shale floor.....	
			10 ¼

Chemical analyses.

	Mine samples.				Car sample.	
	5268.		5269.		5456.	
	As received.	Dried at 105° C.	As received.	Dried at 105° C.	As received.	Dried at 105° C.
Air-drying loss.....	2.00		3.50		1.10	
Moisture.....	2.92		4.50		1.63	
Volatile matter.....	17.55	18.08	17.52	18.35	17.17	17.45
Fixed carbon.....	76.41	78.71	74.43	77.93	75.34	76.59
Ash.....	3.12	3.21	3.55	3.72	5.86	5.96
Sulphur.....	.61	.63	.80	.84	.75	.76
Hydrogen.....					4.58	4.47
Carbon.....					83.14	84.52
Nitrogen.....					1.02	1.04
Oxygen.....					4.65	3.25
Caloric value determined:						
Calories.....	8,301	8,551	8,142	8,526	8,151	8,286
British thermal units.....	14,942	15,392	14,656	15,347	14,672	14,915

^a Excluded from sample.

JAMESTOWN No. 3.

This sample consisted of two cars of semibituminous run-of-mine coal from a mine working the "Thin Vein" Pocahontas bed, located at Davy, McDowell County, W. Va., on the Norfolk and Western Railway. It was loaded under the supervision of Inspector K. M. Way, and was exposed to the weather thirty-seven days while in transit from the mine to the testing plant. It was used in making steaming, producer-gas, and briquetting tests, the results of which will appear in forthcoming bulletins of the Survey. Measured sections of the coal at the points where the samples were taken for chemical analysis, as well as the analyses of the mine and car samples, appear below. Section A (No. 5276) was measured 3,000 feet south of the drift mouth; section B (No. 5277) was measured 2,400 feet west of the drift mouth.

Sections of "Thin Vein" Pocahontas bed at Davy, W. Va.

SECTION A.		SECTION B.	
	Ft. in.		Ft. in.
Shale roof.		Shale roof.	
Coal.....	2 1	Coal.....	10 $\frac{3}{4}$
Mother coal.....	$\frac{1}{4}$	Mother coal.....	$\frac{1}{8}$
Coal.....	7	Bone coal.....	1
Mother coal.....	$\frac{3}{8}$	Coal.....	1 10 $\frac{1}{4}$
Coal.....	5 $\frac{1}{2}$	Mother coal and sulphur.....	$\frac{3}{4}$
Mother coal and sulphur.....	$\frac{1}{4}$	Coal.....	6
Coal.....	6	Shale floor.	
Shale floor.			3 8 $\frac{1}{2}$
	3 8 $\frac{3}{8}$		

Chemical analyses.

	Mine samples.				Car samples.			
	5276.		5277.		5334.		5459.	
	As received.	Dried at 105° C.	As received.	Dried at 105° C.	As received.	Dried at 105° C.	As received.	Dried at 105° C.
Air-drying loss.....	1.90	.....	2.70	.....	1.20	.....	0.90	.....
Moisture.....	2.87	.....	3.58	.....	1.92	.....	1.52	.....
Prox. Volatile matter.....	14.91	15.35	15.01	15.57	15.41	15.71	15.01	15.24
Fixed carbon.....	78.39	80.71	78.44	81.35	74.65	76.11	76.19	77.37
Ash.....	3.83	3.94	2.97	3.08	8.02	8.18	7.28	7.39
Sulphur.....	.81	.83	.62	.64	.68	.69	.62	.63
Hydrogen.....	.....	.....	.....	.....	4.77	4.65	4.55	4.45
Carbon.....	.....	.....	.....	.....	81.31	82.90	82.51	83.78
Nitrogen.....	.....	.....	.....	.....	1.26	1.28	1.12	1.14
Oxygen.....	.....	.....	.....	.....	3.96	2.30	3.92	2.61
Ult. Caloric value determined:								
Calories.....	8,227	8,470	8,235	8,540	7,931	8,086	8,024	8,148
British thermal units.....	14,809	15,246	14,823	15,372	14,276	14,555	14,443	14,666

JAMESTOWN No. 4.

This sample consisted of two cars of semibituminous run-of-mine coal from a mine working the Quinimont (Fire Creek) bed, located at Rush Run, Fayette County, W. Va., on the Chesapeake and Ohio

Railway. It was loaded under the supervision of Inspector K. M. Way, and was exposed twenty-four days to the weather before being tested. Steaming and producer-gas tests were made on this coal, the results of which will appear in forthcoming bulletins of the Survey. Measured sections of the coal at the points in the mine where the samples were taken for chemical analysis, as well as the analyses of the coal as it was received at the testing plant, appear below. Section A (No. 5328) was measured 4,500 feet southwest of the drift mouth; section B (No. 5327) was measured 5,700 feet south of the drift mouth.

Sections of Quinnimont (Fire Creek) bed at Rush Run, W. Va.

SECTION B.		SECTION A.	
	Ft. in.		Ft. in.
Sandstone roof.		Sandstone roof.	
Coal.....	4½	Coal.....	4¼
Bone coal ^a	½	Bone coal.....	1½
Coal.....	4 8	Coal.....	4 3
Shale floor.		Mother coal.....	¼
	5 1	Coal.....	5
		Shale floor.	
			5 2½

Chemical analyses.

	Mine samples.				Car samples.			
	5327.		5328.		5436.		5438.	
	As received.	Dried at 105° C.	As received.	Dried at 105° C.	As received.	Dried at 105° C.	As received.	Dried at 105° C.
Air-drying loss.....	2.10	.....	1.90	.....	1.50	.....	1.50	.....
Prox. Moisture.....	3.35	.....	2.97	.....	2.04	.....	2.05	.....
Volatil matter.....	18.65	19.30	18.96	19.54	18.96	19.35	18.63	19.02
Fixed carbon.....	73.69	76.24	74.60	76.88	71.75	73.25	73.52	75.06
Ash.....	4.31	4.46	3.47	3.58	7.25	7.40	5.80	5.92
Ult. Sulphur.....	.51	.53	.60	.62	.75	.77	.57	.58
Hydrogen.....	.....	.....	.....	.....	4.80	4.67	4.86	4.73
Carbon.....	.....	.....	.....	.....	80.83	82.51	81.58	83.29
Nitrogen.....	.....	.....	.....	.....	1.49	1.52	1.43	1.46
Oxygen.....	.....	.....	.....	.....	4.88	3.13	5.76	4.02
Calorific value determined:								
Calories.....	8,237	8,523	8,321	8,576	7,919	8,084	8,066	8,235
British thermal units.....	14,827	15,341	14,978	15,437	14,254	14,551	14,519	14,823

JAMESTOWN No. 5.

This sample consisted of two cars of semibituminous run-of-mine coal from a mine working the Sewell bed, located 1 mile east of Sewell, Fayette County, W. Va., on the Chesapeake and Ohio Railway. It was loaded under the supervision of Inspector K. M. Way, one car being exposed to the weather for twenty-two days and the other twenty-eight days before arriving at the testing plant. Producer-gas and briquetting tests were made on this shipment. The results will be published in forthcoming bulletins of the Survey. Measured

^aExcluded from sample.

sections of coal at the points in the mine where the samples were taken for chemical analysis, as well as the analyses of the mine and car samples, appear below. Section A (No. 5329) was measured 3,000 feet east of the drift mouth; section B (No. 5432) was measured 1,500 feet west of the drift mouth.

Sections of Sewell bed 1 mile east of Sewell, W. Va.

SECTION A.		SECTION B.	
	Ft. in.		Ft. in.
Sandstone roof.		Sandstone roof.	
Coal.....	10½	Coal.....	9¼
Hard coal.....	3	Hard coal.....	3
Coal.....	2 10	Coal.....	1 6½
Fire clay floor.		Mother coal.....	¼
	3 11½	Coal.....	10
		Mother coal.....	¼
		Coal.....	7
		Fire clay floor.	
			4

Chemical analyses.

	Mine samples.				Car samples.			
	5329.		5432.		5453.		5480.	
	As received.	Dried at 105° C.	As received.	Dried at 105° C.	As received.	Dried at 105° C.	As received.	Dried at 105° C.
Air-drying loss.....	2.60		2.50		2.60		1.70	
(Moisture.....)	3.83		3.20		3.37		2.52	
Volatile matter.....	20.27	21.08	21.82	22.54	21.80	22.56	21.28	21.83
Fixed carbon.....	74.04	70.99	72.83	75.24	70.74	73.21	68.20	69.96
Ash.....	1.86	1.93	2.15	2.22	4.09	4.23	8.00	8.21
Sulphur.....	.53	.55	.51	.53	.58	.60	.68	.70
Hydrogen.....					5.06	4.85	4.73	4.57
Carbon.....					82.19	85.06	78.71	80.74
Nitrogen.....					1.34	1.39	1.31	1.34
Oxygen.....					6.74	3.87	6.57	4.44
Calorific value determined:								
Calories.....	8,335	8,667	8,308	8,583	8,068	8,349	7,776	7,977
British thermal units.....	15,003	15,601	14,954	15,449	14,522	15,028	13,997	14,359

JAMESTOWN No. 6.

This sample consisted of two cars of semibituminous run-of-mine coal from a mine working the Sewell bed, located at Red Star, Fayette County, W. Va., on the Chesapeake and Ohio Railway. It was loaded under the supervision of Inspector K. M. Way, one car being exposed to the weather for twenty days, the other for forty-one days, before arriving at the testing plant. Steaming and briquetting tests were made on this shipment of coal, the results of which will be given in Survey bulletins. The following sections are typical of the coal bed in this mine and were measured at the places where samples were taken for chemical analysis. The analyses of the mine samples, as well as of the coal as it was received at the testing plant, are

given below. Section A (No. 5396) was measured 7,600 feet southwest of the drift mouth; section B (No. 5397) was measured 6,700 feet southwest of the drift mouth.

Section of Sewell bed at Red Star, W. Va.

SECTION A.		Ft. in.	SECTION B.		Ft. in.
Shale roof.			Shale roof.		
Coal and shale		2	Soft coal.....		5½
Coal.....		1 3¼	Hard coal.....		3
Hard coal.....		10½	Soft coal.....		10½
Coal.....		3½	Coal.....		2 6
Sulphur.....		¼	Sulphur.....		¼
Coal.....		5½	Coal.....		1 2½
Mother coal.....		⅛	Shale floor.		
Coal.....		8			5 3½
Shale floor.					
		3 8⅞			

Chemical analyses.

	Mine samples.				Car samples.			
	5396.		5397.		5489.		5574.	
	As received.	Dried at 105° C.	As received.	Dried at 105° C.	As received.	Dried at 105° C.	As received.	Dried at 105° C.
Air-drying loss.....	1.90	.....	1.30	.....	1.50	.....	1.80	.....
Moisture.....	2.79	.....	2.27	.....	2.09	.....	2.36	.....
Volatile matter.....	18.82	19.36	20.52	21.00	19.39	19.80	18.76	19.21
Fixed carbon.....	75.46	77.63	71.75	73.41	74.63	76.23	73.74	75.53
Ash.....	2.93	3.01	5.46	5.59	3.89	3.97	5.14	5.26
Sulphur.....	.70	.72	.60	.61	.89	.91	.76	.78
Hydrogen.....					4.88	4.74	4.88	4.73
Carbon.....					79.61	81.31	82.53	84.52
Nitrogen.....					1.33	1.36	1.40	1.43
Oxygen.....					9.40	7.71	5.29	3.28
Caloric value determined:								
Calories.....	8,308	8,546	8,146	8,335	8,213	8,388	8,109	8,305
British thermal units.....	14,954	15,383	14,663	15,003	14,783	15,098	14,596	14,949

JAMESTOWN No. 7.

This sample consisted of three cars of semibituminous run-of-mine coal from a mine working the Sewell bed, located at Derryhale, Fayette County, W. Va., on the Chesapeake and Ohio Railway. It was loaded under the supervision of Inspector K. M. Way, the first two cars shipped being exposed to the weather for twenty-three days, while the other car was exposed forty-one days, before arriving at the testing plant. Steaming and briquetting tests were made on this shipment of coal, the results of which will appear in forthcoming bulletins of the Survey. The following sections are typical of the coal bed in this mine and were measured at the places where samples were taken for chemical analysis. The analyses of the mine samples, as well as of the coal as it was received at the testing plant, are given below. Section A (No. 5404) was measured 3,500 feet northwest of

^a Excluded from sample.

the drift mouth; section B (No. 5431) was measured 3,000 feet southeast of the drift mouth.

Sections of Sewell bed at Derryhale, W. Va.

SECTION A.		Ft. in.	SECTION B.		Ft. in.
Shale roof.			Shale roof.		
Hard coal.....		8	Coal.....		2½
Soft coal.....		1 8½	Mother coal and sulphur.....		¼
Hard coal.....		1 9½	Coal.....		2½
Mother coal.....		¼	Mother coal and sulphur.....		½
Coal.....		4¼	Hard coal.....		5½
Mother coal.....		¼	Soft coal.....		8
Coal.....		3¾	Coal.....		11
Shale floor.			Hard coal.....		7½
		4 10½	Mother coal.....		¼
			Coal.....		11½
			Mother coal.....		¼
			Coal.....		1¼
			Mother coal.....		½
			Coal.....		4
			Shale floor.		
					4 6½

Chemical analyses.

	Mine samples.				Car sample.	
	5404.		5431.		5501.	
	As re- ceived.	Dried at 105° C.	As re- ceived.	Dried at 105° C.	As re- ceived.	Dried at 105° C.
Air-drying loss.....	2.80		2.50		1.40	
Moisture.....	3.71		3.26		2.00	
Prox. Volatile matter.....	18.47	19.18	19.52	20.18	17.57	17.93
Fixed carbon.....	75.05	77.94	74.55	77.06	74.10	75.61
Prox. Ash.....	2.77	2.88	2.67	2.76	6.33	6.46
Sulphur.....	.47	.49	.59	.61	.91	.93
Ult. Hydrogen.....					4.75	4.59
Carbon.....					81.37	83.03
Nitrogen.....					1.28	1.31
Oxygen.....					5.36	3.68
Calorific value determined:						
Calorific.....	8,219	8,536	8,311	8,591	8,036	8,200
British thermal units.....	14,794	15,365	14,960	15,464	14,465	14,760

JAMESTOWN No. 8.

This sample consisted of two cars of semibituminous run-of-mine coal from a mine working the Quinnimont (Fire Creek) bed, located at Lawton, Fayette County, W. Va., on the Chesapeake and Ohio Railway. It was loaded under the supervision of Inspector K. M. Way, one car being exposed to the weather for twenty-seven days and the other car for thirty-one days before being tested. Briquetting tests were made on this shipment of coal, the results of which will appear in a forthcoming bulletin of the Survey. Measured sections of the coal as it appeared in the mine where the samples were taken for chemical analysis, as well as the analyses of these

samples and of the coal as it was received at the plant, are given below. Section A (No. 5419) was measured at a point 1,600 feet northwest of the drift mouth; section B (No. 5420) was measured at a point 900 feet east of the drift mouth.

Sections of Quinnimont (Fire Creek) bed at Lawton, W. Va.

SECTION A.		SECTION B.	
	Ft. in.		Ft. in.
Shale roof.		Shale roof.	
Soft coal	8½	Soft coal	1
Mother coal.....	¼	Mother coal.....	⅛
Soft coal	5½	Coal	1½
Coal	1 7¼	Mother coal.....	⅛
Mother coal.....	¼	Coal	1 6½
Coal	5½	Mother coal.....	¼
Mother coal and sulphur	⅜	Coal	1 1½
Coal	7½	Shale floor.	
Shale floor.			3 11
	3 11½		

Chemical analyses.

	Mine samples.				Car sample.	
	5419.		5420.		5575.	
	As received.	Dried at 105° C.	As received.	Dried at 105° C.	As received.	Dried at 105° C.
Air-drying loss.....	2.40	.....	3.10	.....	2.20	.....
Moisture.....	2.96	.....	3.79	.....	2.80	.....
Volatile matter.....	17.47	18.00	16.44	17.09	17.10	17.59
Fixed carbon.....	73.57	75.82	73.40	76.29	74.80	76.96
Ash.....	6.00	6.18	6.37	6.62	5.30	5.45
Sulphur.....	1.08	1.11	.76	.79	.86	.88
Ult. Hydrogen.....	.....	.....	.....	.....	4.97	4.75
Carbon.....	.....	.....	.....	.....	82.68	85.07
Nitrogen.....	.....	.....	.....	.....	1.40	1.44
Oxygen.....	.....	.....	.....	.....	4.79	2.41
Calorific value determined:						
Calories.....	8,004	8,248	7,921	8,233	8,167	8,402
British thermal units.....	14,407	14,846	14,258	14,819	14,701	15,124

JAMESTOWN No. 9.

This sample consisted of two cars of semibituminous run-of-mine coal from a mine working the Sewell bed, located at Winona, Fayette County, W. Va., on the Chesapeake and Ohio Railway. It was loaded under the supervision of Inspector K. M. Way, and was used in making steaming and briquetting tests, the results of which will appear in forthcoming bulletins of the Survey. Twenty-four days elapsed before the shipment of the coal and its use at the testing plant, during which period the coal was exposed to the weather. Measured sections of the coal as it appeared in the mine where the samples were taken, and the analyses of these samples and of the coal as it was received at the plant, are given. Section A (No. 5467) was measured at a point 1,800 feet southeast of the drift mouth;

section B (No. 5468) was measured at a point 2,500 feet south of the drift mouth.

Sections of Sewell bed at Winona, W. Va.

SECTION A.		Ft. in.	SECTION B.		Ft. in.
Shale roof.			Shale roof.		
Coal	1	5	Coal	1	4
Hard coal		1½	Hard coal		1½
Coal		11½	Coal		9½
Mother coal		½	Mother coal		¼
Coal		6	Coal		3
Mother coal		¼	Mother coal		¾
Coal		10	Coal		4½
Shale floor.			Mother coal		½
		3 10¼	Coal		10
			Shale floor.		
					3 9¼

Chemical analyses.

	Mine samples.				Car samples.			
	5467.		5468.		5709.		5711.	
	As received.	Dried at 105° C.	As received.	Dried at 105° C.	As received.	Dried at 105° C.	As received.	Dried at 105° C.
Air-drying loss	2.40	.....	2.40	.....	3.00	.....	3.90	.....
Moisture	3.22	.....	3.34	.....	3.98	.....	4.71	.....
Volatile matter	23.53	24.31	23.67	24.49	23.21	24.17	23.80	24.98
Fixed carbon	71.16	73.53	71.15	73.61	67.41	70.21	66.18	69.45
Ash	2.09	2.16	1.84	1.90	5.40	5.62	5.31	5.57
Sulphur .....	.57	.59	.56	.58	.66	.69	.68	.71
Hydrogen					5.31	5.01	5.09	4.80
Carbon					79.56	82.85	78.53	82.41
Nitrogen					1.34	1.40	1.37	1.44
Oxygen					7.73	4.43	9.02	5.07
Calorific value determined:								
Calories	8,211	8,484	8,185	8,468	7,910	8,238	7,836	8,223
British thermal units	14,780	15,271	14,733	15,242	14,238	14,828	14,105	14,801

JAMESTOWN No. 10.

This sample consisted of two cars of semibituminous run-of-mine coal from a mine working the Beckley bed, located at Stanaford, Raleigh County, W. Va., on the Chesapeake and Ohio Railway. It was loaded under the supervision of Inspector K. M. Way, and was used in making steaming and briquetting tests, the results of which will be published in forthcoming bulletins of the Survey. Twenty-three days elapsed before the shipment of the coal and its use at the testing plant, during which period the coal was exposed to the weather. Measured sections of the coal at the points in the mine where the samples were taken for chemical analysis, the analyses of these samples, and the analyses of the coal as it was received at the plant are given below. Section A (No. 5502) was measured at a point 2,700 feet southwest of the drift mouth; section B (No. 5503) was measured at a point 2,700 feet west of the drift mouth.

Sections of Beckley bed at Stanford, W. Va.

SECTION A.		SECTION B.	
	Ft. in.		Ft. in.
Shale roof.		Shale roof.	
Coal.....	1 5 $\frac{1}{4}$	Coal.....	4
Bone and shale ^a	11 $\frac{1}{4}$	Sulphur ^a	$\frac{3}{4}$
Coal.....	2 $\frac{3}{4}$	Coal.....	5 $\frac{1}{4}$
Sulphur ^a	$\frac{1}{2}$	Mother coal.....	$\frac{1}{4}$
Coal.....	1 11 $\frac{1}{4}$	Coal.....	4 $\frac{1}{4}$
Mother coal.....	$\frac{1}{4}$	Bone and shale ^a	10 $\frac{1}{4}$
Coal.....	1 9	Coal.....	9
Shale floor.		Sulphur.....	$\frac{1}{2}$
	6 5 $\frac{1}{4}$	Coal.....	2 6 $\frac{1}{4}$
		Shale floor.	
			5 4 $\frac{1}{4}$

Chemical analyses.

	Mine samples.				Car samples.			
	5502.		5503.		5719.		5720.	
	As received.	Dried at 105° C.	As received.	Dried at 105° C.	As received.	Dried at 105° C.	As received.	Dried at 105° C.
Air-drying loss.....	1.50		1.70		1.40		1.90	
Moisture.....	2.19		2.28		2.14		2.56	
Volatile matter.....	17.09	17.47	16.81	17.20	16.83	17.20	16.08	16.50
Fixed carbon.....	76.99	78.72	77.37	79.18	71.91	73.48	72.87	74.79
Ash.....	3.73	3.81	3.54	3.62	9.12	9.32	8.49	8.71
Sulphur.....	.64	.65	.79	.81	1.20	1.23	.85	.87
Hydrogen.....					4.74	4.57	4.75	4.55
Carbon.....					79.60	81.34	79.85	81.94
Nitrogen.....					1.41	1.44	1.34	1.38
Oxygen.....					3.93	2.10	4.72	2.55
Caloric value determined:								
Calories.....	8,254	8,439	8,241	8,433	7,791	7,961	7,802	8,007
British thermal units.....	14,857	15,190	14,834	15,179	14,024	14,330	14,044	14,413

JAMESTOWN No. 11.

This sample consisted of two cars of semibituminous run-of-mine coal from a mine working the Beckley bed, located at West Raleigh, Raleigh County, W. Va., on the Chesapeake and Ohio Railway. It was loaded under the supervision of Inspector K. M. Way, and was used in making steaming and briquetting tests, the results of which will appear in forthcoming bulletins of the Survey. One car was exposed to the weather for nineteen days and the other for twenty-three days before being tested. Measured sections of the coal as it appeared in the mine where the samples were taken for chemical analysis, as well as the analyses of the mine and the car samples, are given below. Section A (No. 5547) was taken at a point 1,800 feet northeast of the drift mouth; section B (No. 5548) was measured at a point 3,150 feet northwest of the drift mouth.

^a Excluded from sample.

Sections of Beckley bed at West Raleigh, W. Va.

SECTION A.		SECTION B.	
	Ft. in.		Ft. in.
Shale roof.		Shale roof.	
Bone coal and shale ^a	2½	Bone coal and shale ^a	1½
Coal.....	3	Coal.....	1 4½
Bone coal.....	¾	Sulphur.....	¼
Coal.....	11½	Coal.....	1 7½
Mother coal.....	½	Bone coal.....	¾
Coal.....	1	Coal.....	5¼
Mother coal.....	¼	Mother coal.....	⅛
Coal.....	3	Coal.....	2½
Shale floor.		Mother coal.....	¼
	5 1½	Coal.....	11½
		Shale floor.	
			4 10

Chemical analyses.

	Mine samples.				Car samples.			
	5547.		5548.		5718.		5740.	
	As received.	Dried at 105° C.	As received.	Dried at 105° C.	As received.	Dried at 105° C.	As received.	Dried at 105° C.
Air-drying loss.....	1.80		1.80		1.50		3.60	
Prox. { Moisture.....	2.28		2.32		2.15		4.26	
Volatile matter.....	15.84	16.21	16.18	16.56	15.06	15.39	16.25	16.97
Fixed carbon.....	78.80	80.64	78.42	80.29	75.46	77.12	73.45	76.72
Uit. { Ash.....	3.08	3.15	3.08	3.15	7.33	7.49	6.04	6.31
Sulphur.....	.96	.98	.65	.67	.90	.92	.78	.81
Hydrogen.....					4.72	4.58	4.83	4.49
Carbon.....					82.27	84.09	81.37	84.99
Nitrogen.....					1.55	1.58	1.49	1.56
Oxygen.....					3.23	1.34	5.49	1.84
Calorific value determined:								
Calories.....	8,300	8,494	8,316	8,514	7,995	8,171	7,933	8,286
British thermal units...	14,940	15,289	14,969	15,325	14,391	14,708	14,279	14,915

JAMESTOWN No. 12.

This sample consisted of one car of bone coal from a mine working the Pocahontas No. 3 bed, located at Switchback, McDowell County, W. Va., on the Norfolk and Western Railway. It was shipped, without inspection, by the operator and was used in making briquetting tests, the results of which will be published in a Survey bulletin. One mine sample, the chemical analyses of which and a section of the seam appear below, was taken in order to make a comparison between the coal regularly shipped and the bone coal. The section was measured at a point 5,200 feet from the drift mouth.

Section of Pocahontas No. 3 bed at Switchback, W. Va.

	Ft. in.		Ft. in.
Shale roof.		Mother coal.....	½
Coal.....	1 8¾	Coal.....	7¼
Mother coal.....	½	Bone coal ^a	3
Coal.....	3	Coal.....	5 6½
Mother coal.....	¾	Shale floor.	
Coal.....	2¾		8 8½

^a Excluded from sample.

Chemical analyses.

	Mine sample (5706).	
	As received.	Dried at 150° C.
Air-drying loss.....	2.40	.....
Proximate:		
Moisture.....	3.01	.....
Volatile matter.....	15.94	16.43
Fixed carbon.....	76.31	78.68
Ash.....	4.74	4.89
Sulphur.....	.44	.45
Caloric value determined:		
Calories.....	8,175	8,429
British thermal units.....	14,715	15,172

JAMESTOWN No. 13.

This sample consisted of three cars of semibituminous run-of-mine coal from a mine working the Pocahontas No. 3 bed, located at Ennis, McDowell County, W. Va., on the Norfolk and Western Railway. It was loaded under the supervision of Inspector K. M. Way. Two cars were exposed to the weather for twenty-nine days and the other for thirty-seven days before being tested. The entire shipment was made into briquets and delivered to the Seaboard Air Line for several tests under locomotive boilers. The results of these tests will appear in a forthcoming bulletin of the Survey. Measured sections of the coal as it appeared in the mine where the samples were taken for chemical analysis, as well as the analyses of the coal as it was received at the testing plant, are given below. Section A (No. 5789) was measured at a point 8,000 feet northeast from the drift mouth; section B (No. 5790), at a point 8,100 feet northeast of the drift mouth.

Sections of Pocahontas No. 3 bed at Ennis, W. Va.

SECTION A.		SECTION B.	
	Ft. in.		Ft. in.
Shale roof.		Shale roof.	
Coal.....	11½	Coal.....	2½
Sulphur band ^a	2¼	Mother coal.....	¼
Coal.....	10½	Coal.....	1 3½
Mother coal.....	½	Bone coal ^a	4
Coal.....	2½	Coal.....	1 8
Mother coal.....	¼	Bone coal ^a	3
Coal.....	8¼	Coal.....	1 2¾
Bone coal ^a	3¾	Mother coal.....	¼
Coal.....	1 11	Coal.....	1 5
Bone coal ^a	2	Shale floor.	
Coal.....	1 3¼		6 5¼
Mother coal.....	½		
Coal.....	1 4		
Shale floor.			
	8 ¾		

^a Excluded from sample.

Chemical analyses.

	Mine samples.				Car samples.					
	5789.		5790.		5829.		5830.		5831.	
	As received.	Dried at 105° C.	As received.	Dried at 105° C.	As received.	Dried at 105° C.	As received.	Dried at 105° C.	As received.	Dried at 105° C.
Air-drying loss.....	2.80	.....	2.10	.....	2.80	.....	3.10	.....	4.00	.....
Moisture.....	3.27	.....	2.58	.....	3.67	.....	3.96	.....	4.52	.....
Volatile matter.....	15.51	16.03	16.04	16.46	15.09	15.66	15.60	16.24	15.04	15.75
Fixed carbon.....	77.67	80.30	77.48	79.54	74.69	77.54	74.51	77.59	74.07	77.58
Ash.....	3.55	3.67	3.90	4.00	6.55	6.80	5.93	6.17	6.37	6.67
Sulphur.....	.47	.49	.36	.37	.46	.48	.43	.45	.41	.43
Hydrogen.....	.....	.....	.....	.....	4.32	4.06	.....	.....	.....	.....
Carbon.....	.....	.....	.....	.....	81.73	84.84	.....	.....	.....	.....
Nitrogen.....	.....	.....	.....	.....	.94	.98	.....	.....	.....	.....
Oxygen.....	.....	.....	.....	.....	6.00	2.84	.....	.....	.....	.....
Caloric value determined:	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Calories.....	8,215	8,493	8,249	8,467	7,939	8,241	7,985	8,314	7,881	8,254
British thermal units.....	14,787	15,287	14,848	15,241	14,290	14,834	14,373	14,965	14,186	14,857

JAMESTOWN No. 14.

This sample consisted of a car of Virginia semianthracite culm from a mine working the "Big Vein" at Merrimac, Montgomery County, Va., on the Virginia Anthracite Railway, which makes connections with the Norfolk and Western Railway at Christiansburg, Va. It was shipped, uninspected, by the operator and was used in making briquets after being exposed to the weather for thirty-seven days from the time it was shipped until the tests were made. The results of these tests will appear in a forthcoming bulletin of the Survey.

JAMESTOWN No. 15.

This sample consisted of several cars of semibituminous run-of-mine coal from a mine working the Fire Creek and Sewell beds at Minden, Fayette County, W. Va., on the Chesapeake and Ohio Railway. It was loaded, uninspected, by the operator and the entire shipment was made into briquets and delivered to the Chesapeake and Ohio Railway for trial under locomotive boilers. The results of the tests will appear in a forthcoming bulletin of the Survey. No mine samples were taken. The analyses of the coal as it was received at the testing plant are given on page 22.

Chemical analyses.

	Car samples.							
	5774.		5775.		5776.		5777.	
	As received.	Dried at 105° C.	As received.	Dried at 105° C.	As received.	Dried at 105° C.	As received.	Dried at 105° C.
Air-drying loss.....	3.00		2.90		4.90		5.10	
Prox. (Moisture.....)	3.80		3.73		5.70		5.90	
(Volatile matter.....)	21.32	22.16	20.29	21.08	20.48	21.72	20.85	22.16
Fixed carbon.....	67.30	69.96	70.09	72.80	67.31	71.38	69.81	74.18
(Ash.....)	7.58	7.88	5.89	6.12	6.51	6.90	3.44	3.66
(Sulphur.....)	.58	.60	.58	.60	.54	.57	.52	.55
(Hydrogen.....)	4.81	4.56	5.18	4.96	5.18	4.83	5.21	4.83
Ult. Carbon.....	79.02	82.14	80.86	83.99	79.95	84.78	80.45	85.49
Nitrogen.....	1.31	1.36	1.39	1.44	1.28	1.36	1.38	1.47
Oxygen.....	6.70	3.46	6.10	2.89	6.54	1.56	9.00	4.00
Caloric value determined:								
Calories.....	7,783	8,091	7,940	8,247	7,676	8,139	7,995	8,496
British thermal units.....	14,009	14,564	14,292	14,845	13,817	14,650	14,391	15,293

JAMESTOWN No. 16.

This sample consisted of semibituminous run-of-mine coal from West Virginia, shipped without inspection. It was all made into briquets and delivered to the Atlantic Coast Line Railway for locomotive tests, coal from the same locality being regularly used by the engines on this road. The results of these tests will appear in a forthcoming bulletin of the Survey. The following analyses were made of the coal as it was received at the testing plant:

Chemical analyses.

	Car samples.			
	5828.		5793.	
	As received.	Dried at 105° C.	As received.	Dried at 105° C.
Air-drying loss.....	3.40		4.80	
Prox. (Moisture.....)	4.89		6.25	
(Volatile matter.....)	29.63	31.15	28.50	30.40
Fixed carbon.....	57.74	60.71	52.50	56.01
(Ash.....)	7.74	8.14	12.75	13.59
(Sulphur.....)	.72	.76	.72	.77
(Hydrogen.....)	5.00	4.69	5.15	4.76
Ult. Carbon.....	73.83	77.63	68.66	73.24
Nitrogen.....	1.21	1.27	1.07	1.14
Oxygen.....	11.50	7.51	11.65	6.50
Caloric value determined:				
Calories.....	7,489	7,874	6,811	7,265
British thermal units.....	13,480	14,173	12,260	13,077

JAMESTOWN No. 17.

This sample consisted of semibituminous run-of-mine coal from the Pocahontas No. 3 bed of West Virginia. It was not inspected at the mines, as it was furnished by one of the navy coal contractors at Norfolk, Va., to be made into briquets for marine boiler tests on the U. S. S. *Connecticut*, flagship of the Atlantic fleet. The briquets were used on the battle ship during the first part of the cruise

of the fleet from Hampton Roads to the Pacific. The results of these tests will appear in a Survey bulletin. The following analyses were made of the coal as it was received at the testing plant:

Chemical analyses.

	Car samples.			
	5832.		5833.	
	As re- ceived.	Dried at 105° C.	As re- ceived.	Dried at 105° C.
Air-drying loss.....	2.80	.....	2.20	.....
Moisture.....	3.16	.....	2.71	.....
Volatile matter.....	15.90	16.42	16.23	16.68
Fixed carbon.....	76.63	79.13	76.47	78.60
Prox. { Ash.....	4.31	4.45	4.59	4.72
{ Sulphur.....	.52	.54	.50	.51
Ult. { Hydrogen.....	4.49	4.28	.....	.....
{ Carbon.....	84.26	87.01	.....	.....
{ Nitrogen.....	.97	1.00	.....	.....
{ Oxygen.....	5.45	2.72	.....	.....
Calorific value determined:				
Calories.....	8,192	8,459	8,264	8,494
British thermal units.....	14,746	15,226	14,875	15,289

SURVEY PUBLICATIONS ON FUEL TESTING.

The following publications, except those to which a price is affixed, can be obtained free by applying to the Director, Geological Survey, Washington, D. C. The priced publications can be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C.

BULLETIN 261. Preliminary report on the operations of the coal-testing plant of the United States Geological Survey at the Louisiana Purchase Exposition; in St. Louis, Mo., 1904; E. W. Parker, J. A. Holmes, M. R. Campbell, committee in charge. 1905. 172 pp. 10 cents.

PROFESSIONAL PAPER 48. Report on the operations of the coal-testing plant of the United States Geological Survey at the Louisiana Purchase Exposition, St. Louis, Mo., 1904; E. W. Parker, J. A. Holmes, M. R. Campbell, committee in charge. 1906. In three parts. 1492 pp., 13 pls. \$1.50.

BULLETIN 290. Preliminary report on the operations of the fuel-testing plant of the United States Geological Survey at St. Louis, Mo., 1905, by J. A. Holmes. 1906. 240 pp. 20 cents.

BULLETIN 323. Experimental work conducted in the chemical laboratory of the United States fuel-testing plant at St. Louis, Mo., January 1, 1905, to July 31, 1906, by N. W. Lord. 1907. 49 pp.

BULLETIN 325. A study of four hundred steaming tests, made at the fuel-testing plant, St. Louis, Mo., 1904, 1905, and 1906, by L. P. Breckenridge. 1907. 196 pp.

BULLETIN 332. Report of the United States fuel-testing plant at St. Louis, Mo., January 1, 1906, to June 30, 1907; J. A. Holmes, in charge. 1908. 299 pp.

BULLETIN 334. The burning of coal without smoke in boiler plants; a preliminary report, by D. T. Randall. 1908. 26 pp.

BULLETIN 336. Washing and coking tests of coal and cupola tests of coke, by Richard Moldenke, A. W. Belden, and G. R. Delamater. 1908. 76 pp.

BULLETIN 339. The purchase of coal under Government and commercial specifications on the basis of its heating value, with analyses of coal delivered under Government contracts, by D. T. Randall. 1908. 27 pp.

BULLETIN 343. Binders for coal briquets, by J. E. Mills. 1908. 56 pp.

BULLETIN 363. Comparative tests of run-of-mine and briquetted coal on locomotives, by W. F. M. Goss. 1908. 57 pp.