TABLE 6. - Description of coals and blends (Cont'd.)

Coal No.	Description
	High-volatile coals (Cont'd.)
a371A	Blend: 82.5 percent Thick Freeport (a371) and 17.5 percent Lower Kittanning (372).
b371A	Blend: 82.5 percent Thick Freeport (b371) and 17.5 percent Lower Kittanning (372).
c371A	Blend: 82.5 percent Thick Freeport (c371) and 17.5 percent Lower Kittanning (372).
d371A	Blend: 82.5 percent Thick Freeport (d371) and 17.5 percent Lower Kittanning (372).
e371A	Blend: 82.5 percent Thick Freeport (e371) and 17.5 percent Lower Kittanning (372).
f371A	Blend: 82.5 percent Thick Freeport (f371) and 17.5 percent Lower Kittanning (372).
373	Blend: 82.5 percent Thick Freeport, Harmar Mine (full seam) and 17.5 percent Lower Kittanning (372).
376	Upper Freeport bed, Sigley mine, Preston County, W. Va.
	Miscellaneous
354	J. & L. Blend: 80 percent Eagle beds and 20 percent Pocahontas No. 3.
	Standard blending coals
28	Pittsburgh bed, Warden mine, Allegheny County, Pa.
75	Pocahontas No. 3 bed, Kimball, McDowell County, W. Va.

The expanding properties of all coals and blends carbonized by the BM-AGA method (except those tested under cooperative agreement and the drilled sample) were determined. In addition to those listed in the preceding paragraph, expansion tests were made on three special samples of the Pocahontas No. 3 and No. 4 beds and on samples representing the following beds: Upper Freeport, Indiana County, Pa.; Upper Freeport, Preston County, Pa.; Thick Freeport, Allegheny County, Pa. (five samples); and Lower Kittanning, Somerset County, Pa. Eight blends of Thick Freeport and Lower Kittanning coals also were tested.

Methods of Testing

In the survey of reserves of coking coals, the experimental procedure followed heretofore[55] was modified as follows: (1) BM-AGA tests were made only in 18-inch standard retorts, (2) coals and blends were carbonized at 800° and 900° C., excepting a few samples that were too small, and (3) physical properties (table 8) of the cokes were determined by standard methods. Only three coals and one blend were carbonized in the 500-pound slot oven, for it has been shown that the physical properties of the coke from this oven are intermediate between those of 800° and 900° C. BM-AGA cokes. Expanding properties were determined largely by tests in the sole-heated oven; three coals and one blend were tested in the slot-type expansion oven. The plastic properties of all the separate coals and blends were determined by the Gieseler and Davis methods.

55/ Reynolds, D. A., and Holmes, C. R., Procedure and Apparatus for Determining Carbonizing Properties of American Coals by the Bureau of Mines - American Gas Association Method: Bureau of Mines Tech. Paper 685, 1946, 35 pp.

TABLE 7. - Analyses of coals, as-carbonized basis[1]

Coal No.	Dry, mineral matter-free, fixed carbon percent	Proximate, percent: Moisture	Proximate, percent: Volatile matter	Proximate, percent: Fixed carbon	Ultimate, percent: Ash	Ultimate, percent: Hydrogen	Ultimate, percent: Carbon	Ultimate, percent: Nitrogen	Ultimate, percent: Oxygen	Ultimate, percent: Sulfur	Air drying loss, percent	Heating value, B.t.u. per lb.	Softening temperature of ash, °F.
Low-volatile coals													
345	79.8	1.7	19.1	72.2	7.0	4.7	82.5	1.4	3.5	0.9	0.9	14,290	2,620
347	81.1	1.4	17.9	73.4	7.3	4.3	82.8	1.3	3.5	.8	.7	14,310	2,680
357	84.0	1.1	15.5	78.3	5.1	4.3	85.1	1.2	3.6	.7	.6	14,650	2,420
a357	83.8	1.5	15.7	78.6	4.2	4.4	85.7	1.1	4.0	.6	1.0	14,820	-
b357	83.6	1.4	15.9	78.3	4.4	4.3	85.7	1.1	3.9	.6	.8	14,750	-
c357	84.2	1.8	15.2	78.2	4.8	4.4	85.1	1.1	3.8	.8	1.1	14,640	-
358	81.2	1.0	18.1	75.8	5.1	4.5	84.8	1.2	3.7	.7	.6	14,780	2,450
a358	82.3	1.4	17.1	77.3	4.2	4.5	85.5	1.1	4.1	.6	.8	14,830	-
b358	81.4	1.5	17.9	76.3	4.3	4.5	85.1	1.2	4.3	.6	.8	14,760	-
c358	81.6	1.3	17.7	75.9	5.1	4.5	84.3	1.2	4.3	.6	.7	14,630	-
369	81.4	4.1	17.0	69.9	9.0	4.5	78.4	1.2	6.1	.8	3.7	13,660	2,650
370	80.7	4.4	17.9	72.1	5.6	4.8	81.7	1.2	6.1	.6	3.9	14,220	2,540
372	82.5	2.3	16.5	73.1	8.1	4.5	80.7	1.3	4.0	1.4	1.9	14,010	-
Medium-volatile coals													
353	69.2	6.1	26.5	57.1	10.3	-	-	-	-	.8	5.2	12,840	2,730
374	76.8	1.7	21.9	69.7	6.7	4.8	81.6	1.3	3.8	1.8	1.3	14,430	2,340
375	73.9	1.1	24.8	68.1	6.0	5.0	82.3	1.5	4.3	.9	.6	14,510	2,780
378	76.9	2.8	21.7	70.3	5.2	4.9	82.7	1.4	5.0	.8	2.1	14,430	2,910
High-volatile coals													
b326	67.8	3.4	29.1	59.4	8.1	5.1	77.0	1.4	7.0	1.4	2.5	-	-
a331	67.8	3.6	29.0	59.2	8.2	5.2	76.5	1.4	7.8	.9	2.5	-	-
346	66.4	1.7	31.2	60.0	7.1	5.2	79.3	1.4	5.1	1.9	.8	14,110	2,450
348	64.0	2.6	32.8	56.6	8.0	5.2	76.0	1.6	8.2	1.0	1.3	13,580	2,650
352	57.6	2.2	39.5	52.8	5.5	5.6	76.6	1.7	10.0	.6	.7	13,730	2,420
356	61.8	3.0	35.8	57.0	4.2	5.6	78.0	1.6	9.6	1.0	1.3	13,910	2,840
361	60.9	6.4	34.4	52.3	6.9	5.4	71.2	1.6	13.2	1.7	3.3	12,680	2,160

TABLE 7. - Analyses of coals, as-carbonized basis[1] (Cont'd.)

Dry, miner-	Proximate, percent		Heat-	Soften-

TABLE 7. - Analyses of coals, as-carbonized basis[1] (Cont'd.)

Coal No.	Dry, mineral matter-free, fixed carbon percent	Proximate, percent			Ultimate, percent						Air drying loss, percent	Heating value, B.t.u. per lb.	Softening temperature of ash °F.
		Moisture	Volatile matter	Fixed carbon	Ash	Hydrogen	Carbon	Nitrogen	Oxygen	Sulfur			
					High-volatile coals - (Cont'd.)								
362	63.7	1.9	34.1	58.7	5.3	5.4	79.4	1.5	7.7	0.7	0.6	14,130	2,910
363	61.0	1.7	36.6	56.3	5.4	6.0	77.4	1.5	8.6	1.1	.8	14,070	2,780
364	59.5	4.9	34.8	49.2	11.1	5.1	69.4	1.3	11.7	1.4	1.2	12,270	2,730
366	57.7	4.4	36.4	47.7	11.5	5.2	68.3	1.3	11.6	2.1	1.7	12,320	2,700
371	62.4	2.4	32.4	51.1	14.1	4.9	70.0	1.3	7.9	1.8	1.0	-	-
b371	62.0	2.6	35.0	55.9	6.5	5.4	77.0	1.5	8.2	1.4	.9	-	-
c371	61.8	2.5	35.4	56.2	5.9	5.5	77.4	1.5	8.4	1.3	.9	-	-
d371	61.5	3.4	35.1	54.7	6.8	5.5	75.5	1.5	9.0	1.7	2.0	13,610	-
e371	62.0	4.1	33.6	53.1	9.2	5.3	73.2	1.4	9.4	1.5	2.9	13,170	-
f371	63.0	5.3	33.1	55.1	6.5	5.6	74.9	1.5	10.5	1.0	4.1	13,420	-
373	65.6	2.4	30.9	56.8	9.9	5.0	75.1	1.4	7.3	1.3	1.3	-	-
376	68.2	.8	28.2	57.3	13.7	4.7	73.8	1.3	5.2	1.3	.0	13,160	-
					Miscellaneous								
354	69.1	3.5	27.5	59.3	9.7	-	-	-	-	0.7	2.3	13,300	2,570
					Standard blending coals								
28	62.8	1.3	34.9	57.8	6.0	5.3	79.3	1.6	7.0	0.8	0.4	14,090	2,800
75	82.3	2.3	16.7	74.5	6.5	4.4	82.5	1.6	4.4	.6	1.8	14,240	2,350

1/ Analyses made under supervision of H. M. Cooper, chemist, Bureau of Mines.

TABLE 8. - Physical properties of coke (A. S. T. M. standard method)

Coal No.	Carbonizing temperature, °C.	True specific gravity	Apparent specific gravity	Cells, percent	Shatter test, cumulative percent upon - 2-inch screen	Shatter test 1-1/2-inch screen	Shatter test 1-inch screen	Shatter test 1/2-inch screen	Tumbler test, cumulative percent upon - 2-inch screen	Tumbler test 1-1/2-inch screen	Tumbler test 1-inch screen	Tumbler test 1/2-inch screen	Tumbler test 1/4-inch screen
					Low-volatile coals								
345A	800	1.85	0.85	54.1	64	85	91	92	6	29	56	63	64
345A	900	1.87	.86	54.0	50	82	95	98	0	9	49	64	66
347A	800	1.88	.85	54.8	81	94	97	98	9	38	56	61	61
347A	900	1.90	.88	53.7	53	82	95	98	5	16	52	64	65
357	800	1.83	.89	51.4	85	92	94	95	7	39	49	50	50
357	900	1.88	.90	52.1	57	83	96	97	1	16	53	61	62
358	800	1.84	.85	53.8	84	95	98	99	17	47	59	61	61
358	900	1.89	.86	54.5	58	87	97	99	1	20	56	65	66
369A	900	1.89	.83	56.1	54	86	96	98	1	22	54	63	65
370A	800	1.85	.82	55.7	86	94	97	98	15	44	57	61	61
370A	900	1.89	.82	56.6	56	84	96	98	1	17	53	62	64
					Medium-volatile coals								
353 1/	800	1.89	0.77	59.3	85	97	98	98	26	45	54	56	56
353 2/	800	-	.91	-	84	95	98	98	13	48	58	62	62
374	900	1.90	.83	56.3	61	89	96	98	3	32	56	62	63
374A	800	1.86	.86	53.8	76	90	96	98	4	29	52	62-	63
374A	900	1.88	.87	53.7	39	76	94	98	-	9	48	64	65
374B	800	1.86	.85	54.3	80	91	96	98	9	31	56	63	64
374B	900	1.87	.86	54.0	49	83	95	98	1	16	52	65	67
375	900	1.89	.82	56.6	65	87	97	98	6	27	57	63	64
375A	800	1.87	.87	53.5	72	89	95	97	4	24	48	61	63
375A	900	1.87	.88	52.9	37	77	96	98	-	11	50	63	65
375B	800	1.87	.84	55.1	78	91	96	98	7	30	52	62	63
375B	900	1.87	.87	53.5	43	77	96	98	-	13	50	64	65
378	900	1.89	.85	55.0	64	88	96	98	2	21	51	59	60
378A	800	1.86	.86	53.8	74	90	96	98	3	27	54	63	64
378A	900	1.88	.87	53.7	45	79	95	98	-	10	50	64	66
378B	900	1.88	.85	54.8	51	84	96	98	1	16	52	64	65

TABLE 8. - Physical properties of coke (A. S. T. M. standard method) (Cont'd.)

Coal No.	Carbonizing temperature, °C.	True specific gravity	Apparent specific gravity	Cells, percent	Shatter test, cumulative percent upon - 2-inch screen	Shatter test, cumulative percent upon - 1-1/2-inch screen	Shatter test, cumulative percent upon - 1-inch screen	Shatter test, cumulative percent upon - 1/2-inch screen	Tumbler test, cumulative percent upon - 2-inch screen	Tumbler test, cumulative percent upon - 1-1/2-inch screen	Tumbler test, cumulative percent upon - 1-inch screen	Tumbler test, cumulative percent upon - 1/2-inch screen	Tumbler test, cumulative percent upon - 1/4-inch screen
					High-volatile coals								
346 3/	900	1.89	0.84	55.6	56	85	95	-	2	21	52	61	63
346A 3/	900	1.87	.86	54.0	48	77	94	-	0	11	39	57	59
346B 3/	900	1.89	.84	55.6	52	81	95	-	0	14	47	58	61
348 3/	800	1.88	.90	52.1	62	84	93	-	4	35	56	-	67
348 3/	900	1.92	.88	54.2	43	76	93	-	1	23	55	-	68
348 3/	1000	1.92	.85	55.7	14	56	87	-	0	7	44	-	69
352 4/	900	1.91	.74	61.3	-	23	72	94	-	6	53	81	-
356	800	1.84	.77	58.2	56	76	89	96	-	8	24	53	62
356	900	1.84	.78	57.6	33	68	91	97	-	3	34	63	67
356 5/	870-1,010	1.86	.80	57.0	51	76	91	97	-	5	25	56	62
356A	800	1.87	.81	55.5	79	90	96	97	3	28	48	58	60
356A	900	1.87	.80	57.2	43	77	95	98	-	9	45	63	65
361	800	1.87	.77	58.8	51	73	89	97	0	4	22	56	66
361	900	1.91	.78	59.2	31	65	91	97	-	3	31	63	68
361 5/	870-1,010	1.90	.80	57.9	42	71	91	97	1	5	29	61	68
361A	800	1.87	.81	56.7	83	93	97	98	10	36	55	60	61
361A	900	1.90	.77	59.5	45	79	95	98	-	11	50	63	65
361A 5/	870-1,010	1.90	.79	58.4	69	89	98	100	7	21	52	59	61
362	800	1.84	.78	57.6	73	87	94	97	3	20	42	53	61
362	900	1.86	.82	55.9	43	77	94	97	0	9	52	66	68
362A	800	1.84	.82	55.4	84	95	97	98	14	46	60	63	63
362A	900	1.89	.83	56.1	42	83	96	98	0	16	56	67	68
362B	800	1.86	.84	54.8	82	95	98	98	12	46	61	64	64
362B	900	1.88	.86	54.3	42	81	96	98	1	16	55	68	69
362C	800	1.86	.84	54.8	83	95	97	98	9	44	59	62	62
362C	900	1.88	.83	55.9	47	81	96	98	0	13	52	66	67
362D	800	1.86	.82	55.9	83	94	97	98	6	43	61	65	65
362D	900	1.89	.83	56.1	44	79	96	98	1	13	55	67	69
362F	800	1.86	.81	56.5	84	93	93	94	8	42	61	63	64
362F	900	1.89	.80	57.7	38	78	96	98	-	14	54	67	69
363	800	1.86	.83	55.4	68	84	92	96	1	12	34	54	59

TABLE 8. - Physical properties of coke (A. S. T. M. standard method) (Cont'd.)

Coal No.	Carbonizing temperature, °C.	True specific gravity	Apparent specific gravity	Cells, percent	Shatter test, cumulative percent upon - 2-inch screen	1-1/2-inch screen	1-inch screen	1/2-inch screen	Tumbler test, cumulative percent upon - 2-inch screen	1-1/2-inch screen	1-inch screen	1/2-inch screen	1/4-inch screen
					High-volatile coals (Cont'd.)								
363	900	1.86	0.86	53.8	36	72	93	97	0	3	31	54	58
363 5/	870-1,010	1.88	.87	53.7	59	83	94	97	0	10	38	55	59
363A	900	1.86	.84	54.8	44	80	96	98	1	15	53	65	67
364	800	1.89	.83	56.1	65	80	87	91	-	5	19	39	49
364	900	1.94	.82	57.7	58	81	91	95	-	4	24	44	52
364	1,000	1.90	.83	56.3	37	68	90	96	-	3	27	52	58
366	800	1.90	.77	59.5	76	84	90	93	2	9	23	41	48
366	900	1.96	.82	58.2	65	84	92	95	-	9	34	48	53
366	1,000	1.89	.82	56.6	42	75	92	96	-	5	33	55	59

1/ Moisture in coal, 6.1 percent.
2/ Moisture in coal, 1.4 percent.
3/ Cokes tested by Bureau of Mines method.
4/ Cokes tested by Columbia Steel Co. method.
5/ Carbonized in 500-pound slot oven.

In analyzing the results of laboratory carbonization tests, the physical properties of the cokes and expansion of the coals are stressed, because these factors are of prime importance in commercial plants. Yields, which are of secondary importance, are given in table 9.

TABLE 9. - Yields of carbonization products, as-carbonized basis

Coal No.	Carbonizing temperature, °C.	Coke, percent	Yields per ton of coal[1/]: Gas, cubic feet	Tar, gallons	Light oil, gal.: In gas	Light oil, gal.: Tar to 170° C.	$(NH_4)_2SO_4$, pounds
			Low-volatile coals				
345A	800	72.3	8,700	14.5	2.00	0.84	27.1
345A	900	71.7	10,100	-	2.61	-	24.1
347A	800	72.3	9,100	15.0	1.83	.81	26.2
347A	900	71.9	10,400	12.6	2.78	.47	23.5
357	800	83.9	8,950	3.1	1.02	.09	12.6
357	900	84.1	10,450	2.8	1.14	.04	7.8
358	800	83.1	9,100	5.1	1.29	.23	17.4
358	900	82.6	10,200	5.2	1.36	.12	12.1
369A	900	71.9	10,000	12.4	2.43	.82	23.5
370A	800	71.7	8,850	15.4	2.28	1.16	25.6
370A	900	71.5	10,100	12.9	2.58	.81	22.5
			Medium-volatile coals				
353[2/]	800	71.5	8,550	11.9	-	0.50	29.8
353[3/]	800	75.0	9,100	12.0	-	.49	29.2
374	900	78.1	10,400	8.4	1.97	.29	17.1
374A	800	71.2	9,350	15.3	2.44	1.16	26.6
374A	900	71.1	10,550	13.4	2.98	.70	23.9
374B	800	72.6	9,000	15.1	2.67	1.09	23.8
374B	900	72.2	10,550	12.8	2.83	.68	23.1
375	900	76.9	10,700	10.1	2.06	.41	19.6
375A	800	71.0	9,400	15.4	2.50	.94	25.3
375A	900	70.7	10,550	14.3	3.09	.73	25.4
375B	800	72.1	9,100	15.2	2.63	.90	29.8
375B	900	71.8	10,200	13.2	3.04	.57	23.2
378	900	78.1	10,300	7.9	2.14	-	20.3
378A	800	71.2	9,050	15.5	2.76	-	28.2
378A	900	71.0	10,350	12.9	3.24	-	24.9
378B	900	72.1	10,300	13.0	3.13	-	23.9
			High-volatile coals				
346	900	71.8	10,450	14.0	2.50	0.46	18.7
346A	900	70.0	10,500	14.5	2.63	.55	22.7
346B	900	70.7	10,500	13.8	2.59	.53	19.2
348	800	69.5	9,050	15.5	2.08	.72	27.4
348	900	69.4	10,200	13.8	2.80	.46	23.3
348	1,000	69.3	11,400	11.9	2.74	.29	18.0
352	900	64.3	10,750	14.7	2.70	.68	25.0
356	800	67.4	8,900	17.1	1.57	1.10	26.4
356	900	67.0	10,300	14.6	2.15	.90	25.7
356[4/]	870-1,010	67.1	10,200	11.6	1.60	.59	26.0

TABLE 9. - Yields of carbonization products, as-carbonized basis (Cont'd.)

Coal No.	Carbonizing temperature, °C.	Coke, percent	Yields per ton of coal[1]				
			Gas, cubic feet	Tar, gallons	Light oil, gal. In gas	Light oil, gal. Tar to 170° C.	$(NH_4)_2SO_4$, pounds
			High-volatile coals				
356A	800	71.3	8,850	13.8	2.33	1.10	26.6
356A	900	70.7	10,250	12.7	2.08	.61	22.7
361	800	65.4	8,650	15.4	1.66	1.20	32.1
361	900	64.7	9,950	12.0	1.89	.65	28.7
361[4]	870-1,010	65.7	9,250	9.0	1.80	.69	28.1
361A	800	69.7	8,950	10.2	1.73	.62	29.0
361A	900	68.2	9,450	11.4	2.05	.59	26.1
361A[4]	870-1,010	70.8	9,350	8.4	1.73	.45	25.6
362	800	69.1	8,900	17.9	2.82	1.74	22.0
362	900	69.2	10,200	14.8	2.88	1.22	19.5
362A	800	72.8	8,800	15.3	2.56	1.45	20.9
362A	900	72.4	10,100	13.2	2.79	.99	20.0
362B	800	74.4	9,050	13.6	2.16	1.10	21.1
362B	900	74.1	10,350	11.3	2.39	.70	19.0
362C	800	72.7	9,000	14.8	2.49	1.17	22.6
362C	900	72.3	10,200	14.1	2.74	.89	19.1
362D	800	72.8	8,800	12.9	2.57	.71	22.9
362D	900	72.4	10,100	12.6	2.67	.89	17.4
362F	800	72.5	8,800	14.1	2.69	.90	22.2
362F	900	72.0	10,100	12.5	2.76	.84	17.9
363	800	68.4	9,200	18.5	2.60	1.47	24.3
363	900	68.2	10,500	15.9	2.97	1.19	21.7
363[4]	870-1,010	67.4	10,150	13.3	1.97	.96	22.4
363A	900	72.2	10,000	13.2	3.00	.66	22.7
364	800	66.6	8,800	12.5	2.62	.80	31.2
364	900	66.1	9,900	10.4	2.69	.71	23.2
364	1,000	66.0	11,300	7.9	3.01	.38	14.1
366	800	66.4	8,750	14.7	2.64	1.29	25.8
366	900	65.7	10,100	11.8	3.37	.90	22.1
366	1,000	65.6	11,000	10.1	3.35	.40	19.1

1/ Coke, tar, ammonia, and light oil are reported moisture-free; gas is reported as stripped of light oil and saturated with water vapor at 60° F. and under a pressure of 30 inches of mercury.
2/ Moisture in coal, 6.1 percent.
3/ Moisture in coal, 1.4 percent.
4/ Carbonized in 500-pound slot oven.

Low-Volatile Bituminous Coals

The carbonizing properties of low-volatile coals from four beds in West Virginia were determined.

Davy Sewell-bed coal (345) from Twin Branch mine, McDowell County, was blended with 80 percent Pittsburgh-bed coal, and the blend (345A) yielded 72.3 and 71.7

percent coke at 800° and 900° C., respectively. This low-volatile coal expanded 11.2 percent in the sole-heated oven, and its blend contracted 3.7 percent. These results indicate that the coal is suitable for blending with high-volatile coals for the production of metallurgical coke.

Pocahontas No. 3 (357) from Lake Superior No. 3 mine, McDowell County, coked strongly at 900° C., either singly or when blended with 80 percent Eagle (362) or No. 2 Gas (363). This coal contained 84.0 percent fixed carbon on the dry, mineral matter-free basis, and it ranks rather high, therefore, in the low-volatile classification. It coked less strongly at 800° C. than other samples from the same bed, probably because of its high rank. It expanded 10.9 percent in the sole-heated oven. Three channel samples from the same mine (a357, b357, and c357) expanded 10.2 to 13.1 percent.

Pocahontas No. 4 (358) from Lake Superior No. 4 mine, McDowell County, coked strongly at 800° and 900° C. Its blend (362F) with 80 percent Eagle (362) yielded coke of metallurgical grade, although it should be carbonized commercially at moderate charge densities because it expanded 3.8 percent. The carbonization sample expanded 16.2 percent, whereas three samples (a358, b358, and c358) from different parts of the mine expanded 20.4 and 25.3 percent in the sole-heated oven. A mixture of equal parts of these two Pocahontas coals proved satisfactory for blending with 70 and 80 percent of mixed high-volatile Eagle and No. 2 Gas coals.

Three samples of Pocahontas No. 6 coal - two (347 and 369) from the Black Eagle mine, Wyoming County, and one (370) from the Louisville mine, Mercer County - coked strongly when blended with 80 percent Pittsburgh coal. Samples from the two mines expanded 5.7 and 6.4 in the sole-heated oven, and their blends with Pittsburgh coal contracted 4.0 and 4.8 percent. These results indicate that the blends containing Pocahontas No. 6 from either mine could be carbonized safely in commercial ovens, and that the coke would be suitable for blast-furnace use.

Medium-Volatile Bituminous Coals

Two medium-volatile coals, both from Clearfield County, Pa., were carbonized singly at 900° C. and in blends with 70 and 80 percent Pittsburgh at 800° and 900° C.

Lower Kittanning or B Miller (374), coal from Springfield No. 4 mine yielded strong coke when carbonized singly, and its blends also coked strongly. It expanded 6.7 percent in the sole-heated oven, and its blends with 80 and 70 percent Pittsburgh contracted 4.3 and 0.7 percent, respectively.

Upper Kittanning (375) or "C" coal from Springfield No. 6 mine and its blends with Pittsburgh coal coked similarly to Lower Kittanning (374) and its blends. The upper bed, however, expanded much more - 18.4 percent in the sole-heated oven, although its blends, containing 20 and 30 percent Pittsburgh, contracted more (5.6 and 2.0 percent) than the corresponding blends of the lower bed.

Both of these Kittanning coals could be blended with lower-rank coals for the production of metallurgical coke.