QUALITY CARBONIZATION PETROGRAPHY

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COAL QUALITY

COAL QUALITY

Quality of a coking coal includes two general categories: 1. The chemical composition of the coal and, 2. the coking aspects.

The capability of a coal to be used in blends with domestic Japanese coals, U.S. coals, Australian coals or others is of vital importance.

General Comments

Like the Michel area and other areas of the Crows Nest fields, the volatile content generally increases stratigraphically upward. In Line Creek Ridge there appears to be about a nine percent volatile spread (A.S.T.M.) in 1500 feet of measures.

Since there is no physical connection of the Upper Elk Coal Fields with the Fernie Basin, correlation of seams is based solely upon the position in the section.

Seams 10A, 10B, and 9 appear to lie within the same stratigraphic interval as the No. 10 (Balmer) seam at Michel. Positive correlation with one or all of these becomes academic in view of the more practical problem of establishing their quality. Tests run to date confirm that the bottom four seams are alike in lying on the low end of the medium volatile (A.S.T.M.) range.

Coking quality is as good or better than most other known seams in southeastern B. C. Seam 10B was reported by

Ottawa (M.R.E.C.) to have one of the highest coke stabilities of any Canadian coals that they have tested.

Crows Nest Industries maintains its own laboratory in Fernie. It is A.S.T.M. equipped to undertake proximate analysis, washability studies, sulphur determinations and calorific values. It is also equipped with coal washing apparatus to handle larger samples to be sent out for further testing. All small samples from adits, drill holes, pits, etc., are assayed here. Bulk samples are checked and some washed before forwarding for necessary carbonization or, other technical tests.

Between July 1968 and February 1971 the company lab processed about 3000 proximate and F.S.I. tests, 27 sulphur determinations, 520 D.H. and adit samples washed at S.G. 1.450. Twenty-one D.H. samples for 30 lb. oven tests and 8 bulk samples were prepared for Ottawa and Japanese testing.

Bulk samples of seams 8, 9, and 10B have been sent to Commercial Testing and Engineering Company in Chicago for washability and other studies. Similar tests for seams 10A on Line Creek and seam 7 on Horseshoe Ridge have been conducted by Cyclone Engineering Sales Ltd. in Edmonton.

The Metals Reduction and Energy Center of the Department of Energy, Mines and Resources at Ottawa has conducted all technical-scale coal and carbonization testing of seams on Line Creek Ridge, Horseshoe Ridge and Ewin Pass area.

Five-pound samples and drum samples left Vancouver for Tokyo on July 27th, 1970.

Outcrop coal from six seams and a sample from test pit 9 was evaluated for B.T.U. content. One-ton samples were screened at 1½" x 1/4" and 1/4" x 0. These samples were in turn rescreened at +1½", 1½" x 7/8", 7/8" x 1/4" and 1/4" x 0. Moisture, ash and volatile values were ascertained for each size fraction. Some calorific and ash fusion values were obtained from commercial labs and Department of Energy and Mines sources, while a few calorific values were ascertained in the C.N.I. labs.

Nearly all available results of the above tests are embodied in this report.

SAMPLING, TESTING AND EVALUATION OF LINE CREEK COAL AS OF 1 AUGUST 1970

GENERAL

The lower coal seams 8, 9, 10B and 10A on Line Creek Ridge can be ranked as being on the lower limits of the medium volatile bituminous range on a d.m.m.f. basis. The upper seams 5, 6 and 7 are M.V. and border on the upper limit but do NOT reach the H.V. category. Discounting the oxidized or low F.S.I. coal usually encountered on the perimeter - F.S.I. values range from four to eight. The F.S.I. four value being a reasonable average for the thickest No. 8 seam. The oxidized zone values range from less than 4 to 0. Raw ash values when sampled by hand methods from adits range from 17% to 20%, while sulfur values on Line Creek Ridge range from 0.40% to 0.60%. The B.T.U. content is greater than 15,000 calculated on d.m.m.f. basis for all lower seams.

Work done to date indicates the pattern for the coals on Horseshoe Ridge are similar. A greater variation in sulfur values has been encountered ranging from 0.23% to 0.74%.

SAMPLING

Coals have been sampled by three methods - drilling, adits and, test pits. Moveable wall bulk testsby Department

of Energy, Mines and Resources in Ottawa have in all cases been conducted on bulk samples taken from adits with one exception. This was a bulk test of No. 8 seam coal taken from Drill Hole No. 41 because test adit No. 7 in that seam could not be driven into the completely unoxidized zone. The test pits, except No. 9, also could not be dug deep enough to reach unoxidized coal and this work was not pursued extensively. Test Pit No. 9 was completed to unoxidized coal in October 1970. Samples were obtained and blended with seams 9, 10B, and 10A and the blends were tested by British Steel Corporation and by Stelco of Canada. The coke results can be found in the B.S.C. Report and in Table I.

Twenty-one drill hole samples were sent to the Department of Energy, Mines and Resources for tests in the 30-lb. test oven. Ottawa reports that correlation between the 30-lb. oven and the 12" M.W. oven are reasonably good with the 30 lb. oven showing a higher proportion of breeze than the 12" oven.

Four bulk samples taken from adits No. 4, No. 5, No. 7, and No. 10 representing seams 9, 10B, 8, and 10B respectively have been tested in the 12" oven. Samples from 8 seam and 9 seam were also blended at 30% with 70% Powellton, a H.V. Eastern U.S. coal.

The fifth bulk sample, as previously mentioned, was a bulk sample from 8 seam taken from D.H. 41. En route to the Department are bulk samples from Adit 12 (seam 10A),

Adit 15 (seam 6), Adit 16 (seam 7), on Line Creek Ridge and Adit 13 (seam 7), Adit 2 (seam7), Adit 14 (seam 8) on Horseshoe Ridge.

TESTING

Standard A.S.T.M. procedures were used for all proximate, F.S.I. and sulfur analysis on the coals.

DRILL HOLES

For the drill holes are samples were washed at 1.450 S.G. and proximates and F.S.I. done on the float fractions. Not too much emphasis was placed on raw values for drill hole samples for several reasons. The amount of extraneous material picked up by the reverse circulation drill can be considerable as it goes through the roof or floor. Consequently the raw ash values vary considerably and can be extremely high. Considering this, it is also apparent that yields are also meaningless. The size consist of the drill samples also varies considerably and in many cases the entire sample was minus 1/4" with a large percent being minus 30 mesh. Thus complete washabilities would not be meaningful in anticipating preparation plant performance while costs and labour involved would not be warranted.

With exception of the first six holes which were not subjected to the 1.450 S.G. split the washed results

for each seam are shown on Plate Nos. 4, 5, 6, 7, 8, 9, 10, 11 and 12 as plotted against the appropriate seam on the gamma ray-neutron log.

The series of tests on blends conducted on D.H. samples in the 30 lb. test oven is shown on Table II and II-A. All data pertaining to both coal and coke are shown on this table. It should be noted that when high F.S.I. (6 or better) coal is blended with low F.S.I. (1½) coal, an acceptable coke is produced as judged by 30 lb. oven tests. It is of interest to compare the D.H. No. 41 stability and hardness with results obtained from the same coal in the 12" oven. (See Table I.) Unfortunately J.I.S. 15 mm drum tests have not been conducted on the small oven tests as they were for the large.

ADITS

The results of bulk test done on adit samples and D.H. No. 41 are shown on Table I and I-A. Again all coal data is presented against resultant coke data.

There are several significant observations to be made on these tests.

a.) It is obviously erroneous to automatically discount a low F.S.I. coal as being unsuitable

for coking. The coal from adit No. 7, seam 8 was oxidized and shows an F.S.I. of 2 and an ash of 9.7%. The stability, hardness and J.I.S. 15 mm tests are, of course, not optimum but the coal coked much better than would be expected from an F.S.I. evaluation only. Moreover this coal when blended with 70% Powellton H.V. coal gave a coke with acceptable values for J.I.S. 15 mm test. Considering that the Japanese industry relies almost entirely on blends they would be denying themselves a substantial source of coal that would in fact suit their particular requirements. The F.S.I. was originally a criterion for the thermal rather than the metallurgical coal industry.

b.) The values for 10B seam from adits No. 5 and No. 10 are also significant. This coal at 7.5% ash gave the "highest stability values of any coal ever tested by the Department of Energy and Mines". The same coal at 9.8% ash also gave "exceptional" values for stability, hardness and J.I.S. 15 mm drum tests.

c.) Adit No. 4, seam 9, with F.S.I. 5 gave good coke with acceptable values in all categories.

d.) F.S.I. and ash results together with observations are shown for all adits on Table III.

TEST PITS

Except for Test Pit 9 seam 8, little of the coal recovered from the test pits showed much merit except for some good F.S.I. values obtained by air drill in Test Pit No. 2 seam 8. Coal from Test Pit 9 was obtained for testing by Stelco at M.R.E.C. in Ottawa and by British Steel Corporation in England as previously described under "sampling".

WASHABILITY

Washability studies performed by Commercial Testing of Chicago are shown in Appendix 1 for seams 8, 9, and 10B obtained from Adits NO. 7, No. 4 and No. 10. Similar studies for Seam 10A (Adit No. 12), Seam 10B (Adit No. 5), Seam 8 (Adit No. 8), Seam 9 (Adit No. 9), Seam 8 (Adit No. 7), Seam 9 (Adit No. 4), and Seam 10B (Adit No. 10) were conducted by Cyclone Engineering of Edmonton. These results are shown in Appendix II. A study of Seam 7 (Adit No. 13) Horseshoe Ridge is also shown.

Indications are that the coals will present some problems in cleaning and that cleaning much below a 10% ash level would result in substantial yield losses.

Five pound drill hole samples of coal from seams 8, 9, 10B were sent to Okura Trading Company in Tokyo and copies of their analysis have been received and are shown on Table IV. Presently en route are bulk 350 Kg. samples washed to about 10% ash from seams 8, 9, 10B and 10A.

CARONIZATION

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TABLE I

TEST RESULTS - E.M.R M.R.& E.C. OTTAWA

COAL DATA

Sample Location	% Seam 10A	% Seam 10B	% Seam 9	% Seam 8	% Seam 7	% Seam 6	% Seam 2	% Wharton	% Powellton	% Balmer 1	% Pocahontas	% Mathis	% S.H.V. Blend
A7				100									
A7				100									
A7				30					70				
D.H.41				100									
A4			100										
A4.			100										
A4			30						70				
A10		100											
A5		100											
12,5,4	15	21	24	40	(100% C.N.I. #2)								
T.P.9	4.5	6.3	7.2	12	(30% C.N.I. #2)						5	31	34
———										30	5	31	34
A12,5,4	6.7	9.5	10.8	18.0	(45% C.N.I. #2)						5	24	26
T.P.9	1.5	2.1	2.4	4.0	(10% C.N.I. #2)						10	10.7	69.3
———	6.7	9.5	10.8	18.0	(45% C.N.I. #2)						5	24	26
———	1.5	2.1	2.4	4.0	(10% C.N.I. #2)						10	10.7	69.3
A12,5	15.0	15.0									5	31	34
———	50	50											
A12,5,4	7.5	10.5	12.0								5	31	34
———	5.9	8.3	15.8								5	31	34
A12,5,4	4.5	6.3	7.2	12.0	(30% C.N.I. #2)						5	8.7	56.3
T.P.9	4.5	6.3	7.2	12.0	(" " ")							9.4	60.6
A12,5,4,7	4.5	6.3	7.2	12.0	(30% C.N.I. #1)						5	31	34
A12,5,4,T.P.9	4.5	6.3	7.2	12.0	(" " #2)			70					
A12,5,4,7	15	21	24	40	(100% C.N.I. #1)								
T.R.9				100									
A4			100										
A5		100											
A12	100												
										100			
											100		
												100	
													100

Sample Location	EMR Lab No	Classification: Rank	S.V.I.	Volatile dmmf %	Carbon dmmf %	Proximate (db): Ash %	Volatile %	Fixed Carbon %	Gross Cal Val dmmf BTU/lb	Ultimate Analysis (db) %: Carbon	Hydrogen	Sulphur	Nitrogen	Ash	Oxygen	Pulveriz % Pass 1/8"	Grind Hardgrove
A7		MV.b	194	23.6		7.9	21.2	70.9	15,650			0.36					
A7		LV.b	194			9.7	19.4	70.9	15,650	79.3	4.2	0.42	1.1	9.7	4.3		
A7						6.5	29.5	64.0				0.76					
D.H.41		M.Vb	197			8.6	21.7	69.7	15,690	81.3	4.4	0.40	1.1	8.6	4.2	52.1	80
A4		L.V.b	198	21.4		8.6	20.2	71.2	15,640			0.96					
A4.		LV.b	198			8.8	20.2	71.0	15,650	[illegible]	4.3	0.42	1.1	8.8	3.9		79
A4						6.2	31.1	62.7				0.77					
A10		MVb	197			7.5	22.3	70.2	15,788	82.6	5.0	0.46	1.2	7.5	3.2	50.7	114
A5		MVb	201			9.8	20.7	69.5	15,780	80.4	4.4	0.60	1.2	9.8	3.6	53.7	119
12,5,4		MVb	191	22.5	90.1	9.2	21.1	69.7	15,580	81.7	4.2	0.40	1.0	9.2	4.1		94
T.P.9																	
———																	
A12,5,4																	
T.P.9																	
———																	
———																	
A12,5																	
———																	
A12,5,4																	
———																	
A12,5,4																	
T.P.9																	
A12,5,4,7																	
A12,5,4,T.P.9																	
A12,5,4,7		MVb	193	22.4	90.2	11.4	20.6	68.0	15,570	79.0	4.3	0.45	1.1	11.4	3.3		84
T.R.9		MVb	188	23.6	89.6	9.9	21.7	68.4	15,800	79.8	4.2	0.28	1.0	9.9	4.9		96
A4		LVb	196	21.9	90.0	9.0	20.5	70.5	15,680	81.2	4.3	0.34	1.1	9.0	4.1		80
A5		MVb	199	22.4	90.4	9.5	21.1	69.4	15,710	80.8	4.4	0.60	1.1	9.5	3.6		104
A12		MVb	199	22.5	91.2	9.6	21.1	69.3	15,720	81.6	4.6	0.59	1.0	9.6	2.7		96
		LVb	200	21.9	90.8	10.2	20.4	69.4	15,710	80.7	4.3	0.36	1.1	10.2	3.4		89
		LVb	216	18.6	91.7	6.1	17.9	76.0	15,810	85.4	4.4	0.62	1.2	6.1	2.3		93
		HVb	164	38.2		7.2	36.1	56.7	15,210			1.55					58
		HVb	177	33.2		6.6	31.5	61.9	15,960			0.62					59

THERMAL RHEOLOGICAL PROPERTIES

Sample Location	Linear Exp % 52#/ft³ 2% Moist	Gieseler Plasticity Max ddm	Rhur Dil % Contraction	Rhur Dil % Dilatation	Aud - Arn % Contraction	Aud - Arn % Dilatation	F.S.I.	Ash Level	S.H.Q.	Ash Fusion	M.W. Test No
A7			14	14			4				
A7		0.9	8.5	-8.5	21.5	-21.5	2				573(1f)
A7											575(3f)
D.H.41		5.4	19	-19			4½				633(1f)
A4			20	-20			3½				
A4.		6	7	-7	7	-7	4				574(2f)
A4											576/592(US)
A10		54	29	14			7½				635(3f)
A5		36	20	34			8				634(2f)
12,5,4		2	28	-25			5½		-13.4		740
T.P.9									-15.6		741
———									-16.4		742
A12,5,4									-19.1		743
T.P.9									-16.4		744
———									-15.1		745
———									-15.0		746
A12,5									-13.9		747
———		150	29	18			8		-6.8		748
A12,5,4									-12.6		749
———									-16.7		750
A12,5,4									-9.8		751
T.P.9									-12.0		752
A12,5,4,7									-10.6		753
A12,5,4,T.P.9									-12.9		754
A12,5,4,7		3.3	24	-20			5½			[illegible]	
T.R.9		1.3	29	-23			3			—	
A4		1.0	27	-27			3				
A5		7.5	34	+7			8				
A12		6.4	26	+30			8				
		4.2	24	-14			7				
		2.4	22	+31			8½				
		26,000	30	+192			8				
		11,100	26	+164			8½				

CARBONIZATION DATA

Sample Location	Oven Feed Size	Net Wgt of Charge (wet)	Oven BD dry lbs/ft³	Moist in Charge %	Coking Time	Max. Wall Press. lb/in²	Yield %	Breeze (½") %	Mean Coke size (in)	Tumbler Test ASTM: Stability	Hardness	J.I.S. 15 MM	A.S.G.	Coke Analysis: Ash	Volatile	Fixed Carbon	Sulphur	Remarks
A7																		Advance Sample
A7		516.9	500	5.06	9:55	0.28	79.0	14.9	2.00	36.1	60.6	86.7	0.995	12.5	0.5	87.0	0.37	Partly Oxidized
A7		517.0	50.9	3.0	9:10	0.48	73.2	3.6	2.16	46.3	67.4	90.8	0.915	8.3	0.4	90.8	0.58	
D.H.41		518.0	51.1	3.5	9:45	0.51	79.6	11.7	1.84	52.4	72.9	92.0	1.015	11.0	0.7	88.3	0.46	
A4																		Advance Sample
A4.		517.0	50.6	3.6	9:40	0.46	80.6	4.6	2.14	49.2	71.8	91.8	0.849	10.7	0.3	89.0	0.42	
A4		517.3	50.9	3.2	9:50	0.59	73.7	4.8	2.09	49.2	69.3	91.7	0.887	8.6	0.5	90.9	0.63	
A10		517.9	50.6	3.8	10:25	4.84	79.1	4.7	2.26	62.2	71.3	93.3	0.902	9.3	0.4	90.3	0.45	
A5		515.0	50.7	3.1	10:20	2.51	79.9	9.8	2.15	58.2	69.9	93.7	0.927	11.6	0.6	87.8	0.49	
12,5,4	88%-⅛"	Average Charge 526#	51.3	3.0	10:30	0.39	80.3	14.2	1.84	48.8	69.1	91.0	1.001	12.2		86.2	0.40	
T.P.9	"		51.3	3.0	10:10	0.55	76.0	3.6	2.02	53.3	67.8	92.7	0.909	10.1		86.9	0.73	
———	"		51.4	3.2	10:30	0.50	77.5	3.5	2.02	53.4	69.6		0.934	10.2		86.8	0.73	
A12,5,4	"		51.9	3.0	10:20	0.53	79.9	3.8	2.00	56.6	69.7	91.4	0.935	10.6		86.9	0.66	
T.P.9	"		51.6	3.0	10:30	0.44	72.1	3.5	2.02	55.1	69.1	91.4	0.912	8.9		87.7	0.62	
———	100%		51.3	3.2	10:20	0.53	77.6	4.3	1.94	57.7	71.2	92.3	0.945	10.5		86.8	0.66	
———	-14M		51.5	3.0	10:30	0.48	75.9	3.8	2.00	55.1	69.0	92.3	0.902	9.9		87.7	0.62	
A12,5			51.4	3.1	10:14	0.71	77.9	3.5	2.04	55.7	68.5	91.4	0.943	10.0		86.9	0.77	
———			51.5	2.9	10:05	1.08	81.0	7.3	2.02	59.5	71.9	92.3	0.967	11.9		86.4	0.52	
A12,5,4			51.3	3.4	10:20	0.57	76.8	3.6	2.02	54.8	69.1	92.1	0.918					
———			51.5	3.0	10:13	0.47	76.1	3.8	2.04	54.7	68.7	92.1						
A12,5,4			51.6	2.9	10:15	0.59	76.8	3.7	2.00	55.0	70.4	92.9	0.939					
T.P.9			51.5	3.0	10:10	0.52	76.2	3.6	2.00	53.9	69.0	91.3	0.915					
A12,5,4,7			51.5	2.9	10:12	0.55	75.8	3.6	2.12	51.1	68.8	92.5	0.948					
A12,5,4,T.P.9			51.6	2.9	10:02	0.25	74.4	3.4	2.00	51.6	68.0	90.7	0.940					
A12,5,4,7																		
T.R.9																		
A4																		
A5																		
A12																		

TEST RESULTS - E.M.R. M.R.E.C. OTTAWA

12" OR 18" OVEN

COAL DATA

Sample Location	% Seam 10A-L.C.R.	% Seam 6-L.C.R.	% Seam 7-H.R.	% Seam 7-L.C.R.	% Seam 8-H.R.	% Ref. H.V.	E.M.R. Lab No	Classification: Rank	Classification: S.V.I.	Classification: Volatile D.M.M.F. %	Classification: Carbon D.M.M.F. %	Proximate (D.B.): Ash %	Proximate (D.B.): Volatile %	Proximate (D.B.): Carbon %	Gross Cal. Val. D.M.M.F. B.T.U./lb	Ultimate Analysis (D.B.) %: Carbon	Hydrogen	Sulphur	Nitrogen	Ash	Oxygen
A-12 L.C.R.	100						2238-71														
A-13 H.R.			100				2239-71														
A-13 H.R.			30			70															
A-2 H.R.			100				2136-71	M.V.	186	23.9	89.2	8.7	22.5	68.6	15,470	80.7	4.8	0.45	1.1	8.7	4.2
A-2 H.R.			30			70															
A-16 L.C.R.				100			2137-71	M.V.	182	25.4	89.6	10.1	23.6	66.3	15,450	79.6	4.4	0.61	1.1	10.1	4.2
A-16 L.C.R.				30		70															
A-15 L.C.R.		100																			
A-15 L.C.R.		30				70															

THERMAL RHEOLOGICAL PROPERTIES

Sample Location	Pulverize Pass 1/8" %	Grind Hardgrove	Linear Exp. 52#/FT.3 2% Moist to	Gieslar Plasticity Max. D.D.M.	Ruhr Dil. % Contraction	Ruhr Dil. % Dilatation	Aud. Arnu % Contraction	Aud. Arnu % Dilatation	F.S.I.	Ash Level	S.H.O.	Ash Fusion
A-12 L.C.R.			-16	54			24	-17	5			
A-13 H.R.				1.8			23	-23	3½			
A-13 H.R.												
A-2 H.R.		101	-12.7	61			26	2	6½			
A-2 H.R.			-16.0									
A-16 L.C.R.		82	-10.9	24			29	11	7			
A-16 L.C.R.			-18.2									
A-15 L.C.R.			-10.0									
A-15 L.C.R.			-16.7									

CARBONIZATION DATA

Sample Location	M.W. Test No	Oven Feed Size	Net Wt. of Charge	Oven B.D. lbs/ft.3 Wet / Dry	Moist. in Charge %	Coking Time	Max. Wall Press lbs/in.2	Yield %	Breeze ½" %	Mean Coke Size in.	Tumbler Test ASTM: Stability	Tumbler Test ASTM: Hardness	J.I.S. 15MM	A.S.G.	Coke Analysis: Ash	Volatile	Fixed Carbon	Sulphur	Remarks
A-12 L.C.R.	769		528.3	51.5	3.1	10:30	0.41	81.6	4.3	2.12	55.3	69.4	92.7	1.00					
A-13 H.R.	770		527.6	51.6	3.0	10:30	0.61	79.8	6.9	1.99	53.2	66.7	91.4	0.95					
A-13 H.R.	775		529.3	51.7	3.1	10:30	0.21	75.8	3.4	1.99	54.2	69.8	91.6	0.90					
A-2 H.R.	771		527.0	51.6	2.7	10:30	0.37	80.4	9.5	2.19	40.9	64.7	89.4	1.02					
A-2 H.R.	772		528.4	51.7	2.8	10:20	0.25	76.2	3.5	2.04	51.5	67.0	91.7	0.91					
A-16 L.C.R.	773		527.4	51.6	2.9	10:30	0.48	80.5	2.6	2.23	52.2	67.7	92.5	0.96					
A-16 L.C.R.	774		522.9	51.0	3.2	10:30	0.12	74.9	3.4	1.83	52.0	66.0	91.6	0.91					
A-15 L.C.R.	776		525.0	51.1	3.4	10:30	0.14	77.1	30.6	1.73	29.6	44.2	79.8	0.94					
A-15 L.C.R.	777		527.5	51.4	3.0	10:30	0.16	74.6	3.8	2.04	50.6	66.8	92.0	0.91					

TEST RESULTS - OTTAWA

TABLE II

SEAM NO.	ADIT OR DH NO.	THICKNESS	LOCATION	CMI SAMPLE NO.	MREC NO.	COAL DATA: PROXIMATE SVI	PROXIMATE ASH	PROXIMATE VOL.	PROXIMATE FC	ULTIMATE C	ULTIMATE H	ULTIMATE S	ULTIMATE N	ULTIMATE ASH	Q	BTU/LB.	PULV. %	CARBONIZATION DATA: GRIND.	FSI	PLAST. dd/m	CONTRA. %	DIL. %	MV TEST NO.	SHO TEST NO.	30 LB TEST NO.	CHARGE WGT. GMS.	MOIST. %	LBS/FT.3	30 POUND COKE OVEN: COKE TIME	FIELD %	BREEZE %	MEAN SIZE INS.	A.S.G.	STAB.	HARD.	JIS 15MM	MAX. WAL PRESS.	LIN. EXP.	COKE ANALYSIS: ASH	VOL.	FC	S	REMARKS
7	DH57	211-250 HR	1966			187	7.9	25.2	69.9	80.8	5.5	0.74	1.2	7.9	3.9	15,620	92.6	43	8	-	36	80			T132	13,792	1.1	46.8	2:26	77.4	6.1		0.775	56.7	63.0							
7	DH52	140-160 HR	2290	9		183	10.1	24.9	65.0	78.6	5.2	0.71	1.2	10.1	4.2	15,530	77.3	85	7½	5.2	29	17			T126	15,450	2.6	48.6	2:28	76.2	7.6	1.6	0.831	53.1	63.1							
8	DH57	640-676 HR	1978			195	10.6	21.2	68.2	79.2	4.9	0.57	1.1	10.6	3.6	15,650	75.8	139	3	1.9	30	-30			T134	14,711	1.5	49.9	2:54	78.1	23.5			42.8	55.3							
8	DH41		LCR	2140			197	8.6	21.7	69.7	81.3	4.4	0.40	1.1	8.6	4.2	15,690	56.1	80	4½	5.4	19	-19	633	70-227	T115	15,403	1.8	52.2	2:30	80.3	6.3			54.3	68.3		-12.4					
8	DH56	285-326 HR	1963			196	8.8	21.0	70.2	80.9	5.0	0.37	1.1	8.8	3.8		69.6	90	3½	0.8	30	-30			T129	15,017	1.3	50.9	2:57	77.6	24.3		0.908	46.6	57.8		-21.5					
8&9	DH53	624-683 HR	2297			199	10.5	22.8	66.7	78.0	5.0	0.35	1.1	10.5	3.0	15,820	73.6	113	6	46	12	12			T128	15,600	1.8	50.3	2:27	78.9	7.3	1.66	0.929	52.8	66.1		-17.6					
8&9	DH52	398-418 HR	2291	12		188	9.0	25.8	65.2	80.3	5.4	0.69	1.4	9.0	3.3	15,680	53.9	126	8½	235	24	122			T125	15,500	1.7	50.3	2:25	77.5	3.2	1.65	0.793	55.0	64.1							
8&9	DH52	434-447 HR	2292	10		189	8.6	24.4	67.0	81.5	5.3	0.65	1.3	8.6	3.6	15,650	52.2	111	8	278	27	72			T124	15,600	1.2	49.5	2:20	78.0	3.0	1.52	0.850	53.6	67.0							
8&9	DH53	551-584 HR	2299			192	11.2	22.0	66.8	78.7	4.8	0.23	1.0	11.2	4.1	15,620	69.8	111	2	2.2	27	-27			T130	14,863	1.8	50.4	2:34	79.1	14.0			46.2	60.3		-20.7					
85% 9 15% 8	DH37		LCR	2136 2134			197	9.4	20.9	69.7			0.44			15,600	50.0		6½ 5 12	3.6	24	-19		70-219	T106	15,089	1.7	51.1	2:30	80.7	13.8		0.951	50.4	65.4		-13.7					
90%10B	DH36		LCR	2135			197	10.3	20.8	68.9			0.51			15,670	70.6		7 5 11½	2.8	27	-16		70-220	T109	15,048	2.0	51.7	2:32	79.3	15.9		0.944	49.7	66.5		-14.9					
10% 9	DH36		LCR	2133																																						
10A	DH41		LCR	2143			201	9.9	21.2	68.9			0.56			15,760	48.6	88	7½	187	20	43			T113	14,905	0.8	50.5	2:18	82.0	3.0		0.934	54.2	69.0							
75% 8 25% 8	DH38 DH36		LCR LCR	2139 2132			197	8.0	20.7	71.3			0.40			15,630	72.9	81	5 3½ 3	1	27	-27		70-226	T114	15,186	1.1	51.5	2:30	79.5	12.1			48.0	67.3		-15.0					
10B	DH36		LCR	2135			202	10.2	21.2	68.6	?		0.49			15,790			7½	5.4	16	-2		70-218	T105	12,249	3.4	41.5	2:30	67.4							-27.1					
10B	A10		LCR				197	7.5	22.3	70.2	82.6	5.0	0.46	1.2	7.5	3.2	15720	50.7	114		5.4	79	14			T131	15,566	2.5	52.8	2:36	79.4	4.0		0.846	58.6	68.1							
9	DH57	740-798 HR	1977			201	8.1	20.7	71.2	82.6	5.1	0.54	1.1	8.1	2.6	15,720	71.0	131	4	1.3	30	-30			T134	14,583	1.7	49.8	2:34	78.5	17.3			51.4	64.1		-13.0					
10B	A5																									1.9	48.7		76.2	5.8	1.64	0.828	51.2	63.0							
10B	A10																									1.3	50.1		79.4	6.2	1.64	0.972	56.6	66.2							
7	DH74		EP		144																					1.4	51.2		75.7	7.1	1.55	0.811	48.6	62.3							
8	DH74		EP		145																																					
4	DH77		EP		156																		634		T116	15,800	1.8	52.2	2:25	79.6	8.0		0.877	54.8	67.7		- 4.8					
TYPICAL POCAHONTAS						164	5.0	36.8	58.2	80.6	5.4	0.70	1.6	5.0									635		T127	15,277	3.4	51.8	2:44	78.9	4.1		0.847	58.5	67.9		- 1.0					
															6.7	15,240		56	8	20.00	25	100																			

TEST RESULTS - E.M.R. M.R.E.C. OTTAWA

TABLE II A

30 lb. OVEN

COAL DATA

SAMPLE LOCATION	% SEAM 4 E.P.	% SEAM 5 E.P.	% SEAM 6 E.P.	% SEAM 7 E.P.	% SEAM 8 E.P.	% SEAM 7 H.R.	% SEAM 8 H.R.	% SEAM 6 L.C.R.	% SEAM 7 L.C.R.	% SEAM 10A L.C.R.	REF H.V. %
DH 74 EP				100.0							
DH 74 EP					100.0						
DH. 77 EP	100.0										
DH. 77 EP		100.0									
A- 12 LCR										100.0	
A- 13 H.R.						100.0					
A- 13 H.R.						30.0					70.0
A- 2 H.R.						100.0					
A- 2 H.R.						30.0					70.0
A-16 L.C.R.									100.0		
A-16 L.C.R.									30.0		70.0
A-15 L.C.R.								100.0			
A-15 L.C.R.								30.0			70.0

SAMPLE LOCATION	CLASSIFICATION: E.M.R. LAB No.	RANK	S.V.I.	VOLATILE D.M.M.F. %	CARBON D.M.M.F. %	ASH %	PROXIMATE (D.B.): VOLATILE %	FIXED CARBON %	GROSS CAL VAL D.M.M.F. BTU/LB.	ULTIMATE ANALYSIS (D.B.) %: CARBON	HYDROGEN	SULPHUR	NITROGEN	ASH	OXYGEN
DH 74 EP															
DH 74 EP															
DH. 77 EP															
DH. 77 EP	3378-70	M.V.	177	29.1	87.5	6.6	27.7	65.7	14,440	81.6	4.8	0.57	1.30	6.6	5.1
A- 12 LCR															
A- 13 H.R.	2239-71														
A- 13 H.R.															
A- 2 H.R.	2136-71	M.V.	186	23.9	89.2	8.7	22.5	68.8	1,470	80.7	4.8	0.45	1.1	8.7	4.2
A- 2 H.R.															
A-16 L.C.R.	2137-71	M.V.	182	25.4	89.6	10.1	23.6	66.3	1,450	79.6	4.4	0.61	1.1	10.1	4.2
A-16 L.C.R.															
A-15 L.C.R.															
A-15 L.C.R.															

THERMAL RHEOLOGICAL PROPERTIES

SAMPLE LOCATION	PULVERIZE PASS 1/8" %	GRIND HARDGROVE	LINEAR EXP. TO 52#/FT3 2% MOIST.	GIESLAR PLASTICITY MAX. D.D.M.	RHUR DIL. % CONTRACTION	RHUR DIL. % DILATATION	AUD. ARNU. % CONTRACTION	AUD. ARNU. % DILATATION	F.S.I.	ASH LEVEL	S.H.O.	ASH FUSION
DH 74 EP			-10.4									
DH 74 EP			-17.8									
DH. 77 EP												
DH. 77 EP		80		83			28	66	8			
A- 12 LCR												
A- 13 H.R.				1.8			23	-23	3½			
A- 13 H.R.												
A- 2 H.R.		101		6.1			26	2	6½			
A- 2 H.R.												
A-16 L.C.R.		82		2.4			29	11	7			
A-16 L.C.R.												
A-15 L.C.R.												
A-15 L.C.R.												

CARBONIZATION DATA

SAMPLE LOCATION	30 lb. TEST No.	OVEN FEED SIZE	NET WT. OF CHARGE WET	OVEN B.D. DRY lbs/FT.3	MOIST IN CHARGE %	COKING TIME	MAX. WALL PRESS. lbs./IN.2	YIELD %	BREEZE -½" %	MEAN COKE SIZE IN.	TUMBLER TEST: STABILITY	HARDNESS	J.I.S. 15 M.M.	A.S.G.	COKE ANALYSIS: ASH	VOLATILE	FIXED CARBON	SULPHUR	REMARKS
DH 74 EP	144			48.7	1.9			76.2	5.8	1.64	57.2	63.0							
DH 74 EP	145			50.1	1.3			79.4	6.2	1.64	56.6	66.2							
DH. 77 EP	156			51.2	1.4			75.7	7.1	1.55	48.6	62.3							
DH. 77 EP	187			48.7	1.5			77.7	10.0	1.41	44.5	56.5							
A- 12 LCR	188			48.5	2.1			84.3	4.1	1.78	52.0	63.8							
A- 13 H.R.	189			51.0	1.7			80.9	4.5	1.67	52.1	62.4							
A- 13 H.R.	201			49.8	1.5			73.1	3.9	1.47	47.5	61.6							
A- 2 H.R.	190			50.5	1.9			87.3	4.9	1.77	44.4	61.9							
A- 2 H.R.	198			50.5	1.4			72.9	4.4	1.53	47.9	60.3							
A-16 L.C.R.	199			49.4	1.5			80.7	5.7	1.62	45.6	58.8							
A-16 L.C.R.	200			49.4	1.7			73.3	4.8	1.55	45.0	58.8							
A-15 L.C.R.	202			49.2	2.4			78.7	9.2	1.70	46.3	57.0							
A-15 L.C.R.	203			49.8	2.2			73.5	4.2	1.50	44.0	59.0							

TABLE 3

ADIT	SEAM	LOCATION LATITUDE	LOCATION DEPARTURE	F.S.I.	ASH	REMARKS
2	7 HSR	51567	69687	*6	*9.8	Ottawa
3	8 LCR	53625	65369	1½	15.0%	Oxidized coal - not used for bulk tests
4	9	53440	65430	4	8.8%	Ottawa bulk sample analysis
5	10B	53210	65540	8	9.8%	Ottawa bulk sample analysis
6	10A	53050	65310	1	23.7%	Oxidized - very close to outcrop
7	8	54865	65950	2	9.7%	Ottawa bulk sample analysis (partly oxidized)
8	8	54560	64240	2	12.3%	Oxidized - not used for bulk tests
9	9	54780	63990	2½	10.7%	Oxidized - not used for bulk tests
10	10B	54860	63840	7½	7.5%	Ottawa bulk sample analysis
11	10A	54940	63860	1½	15.5%	Oxidized - not used for bulk tests
12	10A	53850	66050	*7	*8.4%	Bulk Sample to Ottawa
13	7 HSR **	53733	71551	*4½	*6.0%	Bulk Sample to Ottawa
14	8 HSR	53737	71719	*5½	*9.5	Bulk Sample to Ottawa
15	6 LCR***	56801	64892	*6	*7.3	Bulk Sample to Ottawa
16	7 LCR	55997	65312	*5½	*9.8	Bulk Sample to Ottawa

* Crows Nest Industries Limited Analysis
** Hosesehoe Ridge
*** Line Creek Ridge

Table 4

CABLE ADDRESS:
OKURA TOKYO
TELEX:
TK 2306, TK 2445
CODE USED:
A. B. C. 6TH, ACME
BENTLEY'S COMPLETE &
2ND PHRASE
TANNERS' COUNCIL, ETC.

Okura Trading Co., Ltd.

FOUNDED 1873
3-6, GINZA NICHOME, CHUO-KU
TOKYO 104, JAPAN

PHONE: 567-0411
561-2131
BRANCHES:
LONDON, DUESSELDORF, MILAN
NEW YORK, LOS ANGELES, PORTLAND
VANCOUVER, LIMA, SANTIAGO, SYDNEY
CALCUTTA, NEW DELHI, TAIPEI
HONG KONG, OSAKA, NAGOYA
YOKOHAMA, KOBE, ETC.

DATE May 4, 1970

In reply please quote OUR LETTER NO.
OUR REF.
YOUR REF.

MAY 11

Mr. Roy H. Inui
General Manager
Transpac Corporation
1107 Hoge Building
Seattle, Washington 98104
U. S. A.

Dear Mr. Inui,

I should like to advise you the result of analysis test of sample coal from Tornado Mountain property which were sent to us by Crows Nest Industries.

Sample Seam No.	36 10B	37 9	38 8
Moisture	1.93	1.04	1.26
Ash	10.27	9.29	7.14
V.M.	20.72	21.62	21.24
F.C.	67.08	68.05	70.36
Total Sulpher	0.41	0.39	0.38
Callorie	7,620	7,740	7,910
Cl	1.05	0.53	0.53
CBI	7.5	7	5.5

19

1 192

CABLE: OKURA VANCOUVER
TLX: 04-51342

PHONE: 688-2591

Kout — NKK

Okura & Co., Canada, Ltd.

STES. 623-625, 470 GRANVILLE ST.

VANCOUVER 2, B.C., CANADA

REFERENCE No. OVL-1960

December 30, 1970

CROWS NEST INDUSTRIES LIMITED RECEIVED JAN. 4 19

Crows Nest Industries Ltd.
Fernie, B.C.

Attention: Mr. J. J. Crabb

Dear Sirs,

40 Kgms/sample
Lead sent out

Re: Test Result of 8 drums Line Creek Coal Sample

We enclose herewith 2 copies of the report on testing the subject samples by Kokan Mining Company (subsidiary of NKK) at NKK's instruction.

80 kilo grams of the same samples were delivered to Nippon Steel, Sumitomo Metal, Kawasaki Steel and Kobe Steel, but due to extreme congestion of their laboratories test results are still not available.

NKK commented on the samples that 10 A and B seam may compare with Balmer Coal but coal from 8 and 9 seam is similar to Vicary Creek Coal or Australian Coal and may regarded as semi-hard coking coal or soft coking coal. They feel that ample consideration should be given to the ratio of 8 and 9 seams and 10 A and B seams at the time of mining.

Yours very truly,

OKURA & CO., CANADA, LTD.

I. Takamatsu

I. Takamatsu, Manager

WSM/yz
Encls.

20

1 193

T 194

CHARACTERISTIC TEST

(1)

	ASH	V.M. (d.b.)	T.S. (d.b.) *(1)	F.S.I.	K Cal/kg (d.b.)	V.M. (d.a.f.) *(2)
SEAM 8 (adit 7)	9.55	22.24	0.43	4	7,770	24.67
" 9 (adit 4)	9.79	21.24	0.41	3-1/2	7,510	23.54
" 10A (adit 12)	10.65	21.89	0.64	7-1/2	7,510	24.50
" 10B (adit 5)	10.37	21.07	0.54	7	7,830	23.51

* (1) After chloride adjustment.
* (2) dry ash free

(2)

	E.P. (kg/cm²)	G.I	Gieseler Fluidity S.T.	M.F.T.	F.T.	M.F. dd p.m.
SEAM 8	0.040	9	449°C	464°C	467°C	1.1
" 9	0.080	9	445	454	460	1.3
" 10A	0.140	18	420	444	450	6.9
" 10B	0.610	15	430	459	483	9.8

Remarkably similar to Ottawa

10.

Gieseler Test

	FLUIDITY	CARBONIZATION	DRUM INDEX TEST	
SEAM B	LOW	SIMILAR TO VICARY	SIMILAR TO AUSTRALIAN SOFT COKING COAL ?	Add #7 They were told were oxidized
" 9	1 "	"	" ?:	Possibly oxidized
" 10A	SIMILAR TO VICARY ?	"	SIMILAR TO BALMER ✓	
" 10B	" ?	"	" ✓	
BLENDED COAL (-25 mm)	-	-	SIMILAR TO AUSTRALIAN SEMI-HARD COKING COAL	
RE-WASHED COAL	-	-	NO EFFECT OF RE-WASHING	

Note - 1) Fluidity is adversely affected by perchlorethylene.
7.5.I " " " " " to some extent

2) Vicary should be higher fluidity (20 mm dd mm) 20% + margin of error in Gieseler test

3) What does carbonization test mean if not D.I.?
Does it refer to Coke yield?

4) What is diff. between "Soft" & "hard" coking coal. How is it defined?

HV LV.

6. PREPARATION OF BLENDED COAL SAMPLE

SAMPLE COAL WAS CRUSHED TO -25 MM AND -10 MM AND THEN SAMPLE FROM EACH SEAM WERE BLENDED BASED ON BELOW MENTIONED PROPORTION

-25 MM			-10 MM		
SEAM	8	45 %	SEAM	8	45 %
"	9	24	"	9	24
"	10A	13	"	10A	13
"	10B	18	"	10B	18

7.

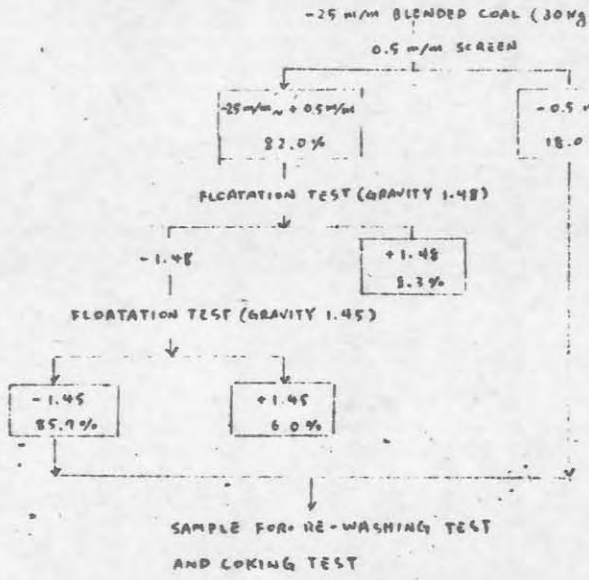
	SIZE (m/m)	M.C.	ASH	F.S.I.	ASH(dry base)
SEAM 8 -25 m/m	-0.5 x 0?	1.04	10.43	3-1/2	10.54
	+0.5 x 5	0.95	9.75	4	9.84
	+5 x 10	0.86	10.83	1-1/2	10.92
	+10 x 25	0.84	11.28	1	11.38

	SIZE (m/m)	M.C.	ASH	F.S.I.	ASH(dry base)
BLENDED COAL -25 m/m (-1")	-0.5	0.98	9.05	5-1/2	9.14
	+0.5	0.84	9.64	5	9.73
	5	0.96	11.20	2-1/2	11.29
	+10	0.94	11.47	1-1/2	11.56

5. FLOATATION TEST

(1) METHOD OF TEST.

FLOATATION TEST WAS MADE ON 30 KG OF -25 MM BLENDED COAL ACCORDING TO BELOW STATED MANNER AND THAT WASHED COAL WAS USED FOR SAMPLE OF COKING TEST. ZINC CHLORIDE WAS USED FOR MEDIUM.



(2) TEST RESULT

GRAVITY SIZE	(%)
- 0.5 m/m	18.0
0 ~ 1.45	70.29
1.45 ~ 1.48	4.92
+ 1.48	6.81
TOTAL	100

9 COKE DRUM TEST J.I.S. *1 meter drum?*

(1)

Do not agree with others.

	30 REVOLUTION		150 REVOLUTION	
	50 mm	15 mm	50 mm	15 mm
SEAM 8 (-10 m/m) (-½")	0.6	75.0 (86.7)	0	50.2
" 9 (-10 m/m)	0	74.9 (91.8)	0	50.3
" 10A (-10 m/m)	2.2	87.8	0.8	69.5
" 10B (-10 m/m)	0.6	89.4 (93.7)	0.4	72.7

(2)

		30 REVOLUTION		150 REVOLUTION	
		50 mm	15 mm	50 mm	15 mm
BLENDED COAL (-25 m/m) (-1")	1.	3.4	83.6	0	64.0
	2.	1.4	89.2	0.6	63.2

By calculation should be 79.25 ⟹

(3)

	30 REVOLUTION		150 REVOLUTION	
	50 mm	15 mm	50 mm	15 mm
RE-WASHED SAMPLE	3.0	82.6	0	63.6

30 Kg. sample -25 mm Avoid to?

NOTE COKES FOR DRUMS INDEX TEST WAS PRODUCED IN CW250 TYPE FURNACE

Description? *30 Kgm. (66 #)*

SIZE OF COAL	-3 m/m (⅛") 80%	+6 m/m. 0%	*feed to oven.*
MOISTURE	8 %		
BULK DENSITY	0.77		

REF. : DRUM INDEX TEST OF BALMER COAL AND NKK BLENDED COAL.

		30 REVOLUTION		190 REVOLUTION	
		50 mm	15 mm	50 mm	15 mm
BALMER COAL *UG or Pits?*		3.2	87.8	0.8	70.0
	A	1.8	88.4	0	72.8
NKK BLENDED COAL	B	1.0	87.8	0	69.0
(with Balmer as balance?)	C	5.6	89.8	0.6	72.9

— what advantage of American coal?

NKK BLENDED COAL	A	LV AMERICAN	22 %	MV AMERICAN	27 %
	B	"	13	"	13
	C	"	17	"	25

(3)

← note higher reactives yet low fluidity FSI. !

	SEAM 8	SEAM 9	SEAM 10A	SEAM 10B
VITRINITE	46.4	52.2	52.0	50.4
EXINITE	0	0.4	0	0.4
1/3 SEMI FUSINITE	6.7	6.7	6.1	4.6
TOTAL REACTIVES	53.1 (55.4)	59.3 (60.7)	58.1 (64.1)	55.4 (71.2)

	SEAM 8	SEAM 9	SEAM 10A	SEAM 10B
2/3 SEMI FUSINITE	13.4	13.4	12.3	9.1
FUSINITE	2.4	3.1	4.1	8.8
MICRINITE	25.7	18.8	19.6	21.0
MINERAL MATTER	5.4	5.4	5.9	5.7
TOTAL INERTS	46.9 (44.6)	40.7 (39.3)	41.9 (35.9)	44.6 (28.9)

	SEAM 8	SEAM 9	SEAM 10A	SEAM 10B
MEAN REFLECTANCE	1.34	1.43	1.45	1.46
OPTIMUM INERTS	11.29	9.38	8.99	11.60
C.B.I.	4.2	4.3	4.7	3.8 ?
S.I.	5.5	6.6	6.5	5.7 ?

REF. VICARY CREEK COAL	
MEAN REFLECTANCE	1.95
INERTS	28.9
V.M. (daf)	24.7
Kcal/kg (daf)	8,680
D.I. $^{30}_{15}$	91.8

note: 1) significant difference between 8 and others in Mean reflectance.

2) DI of Vicary Creek coal higher than Balmer?

COMMENTS ON JAPANESE DATA ON C.N.I. SAMPLES AS PER LETTER
J.J. CRABB TO J.C. BOTHAM DATED JANUARY 7, 1971

by

W. Gardiner

- - - - - -

From the "characteristic test" tables it will be seen that the seams 8 and 9 exhibit comparatively low F.S.I. and fluidity whilst 10A and 10B give much higher values in these respects, as was the case with our own results, as found in the present Stelco/C.N.I. test.

The total sulphurs in 8 and 9 are appreciably lower than those of 10A and 10B, as was also revealed by our tests in Ottawa in the same program.

With regard to the Gieseler results the following table gives a comparison of the Japanese figures with those obtained by ourselves. They agree well except for Seam 10A , our figure being 64 whilst the Japanese figure is 6.9. Our technician has suggested that the low M.F.T. reported by the Japanese in the case of 10A inclines him to the belief that the Japanese figure is incorrect possibly due to the point being inserted erroneously, the true figure being more likely to be 69.0. Perhaps this could be queried.

	Seam 8	Seam 9	Seam 10A	Seam 10B
Japanese Result	1.1	1.3	6.9	9.8
Ottawa Result	1.3	1.0	64.0	7.5

As mentioned in your letter the head sample of each seam was apparently split into 2 parts, one part being crushed to -25mm, whilst the other was taken down to -10mm. A little confusion arises here because it is reported that blends were made from the 4 individual seams with regard to the -25mm material, and also from the -10mm material. No results are given for tumbler tests of the blend of the -10mm material but only for each seam at this size, therefore one is left to conclude that in fact no blend was made up for this size.

1 78

201

In the case of the -25mm blended material, tumbler tests appertaining to the raw coal (presumably), and also to the fraction obtained from the sink-and-float experiment are given and these tests show that no positive improvement is obtained by this separation.

With regard to the actual results of the tumbler tests there is once again a marked improvement in the cases of Seams 10A and 10B as compared to Seams 8 and 9.

I would not care to comment on the lack of agreement between the Japanese figures and those you have obtained in the past from us. Obviously the type of oven and heating program could well differ from ours and without a knowledge of this area, comment is not valid.

One point that appears in the figures is that the moisture in the charges was fixed at 8% which is much higher than the value we employ. It may also be remarked that the Japanese do not specifically state that the tests reported are in fact J.I.S. They give the screen percentages on 50mm and 15mm but do not mention 25mm which is included in the standard J.I.S. method.

Finally, in the last paragraph of your letter you remark "that the drum index tests show little or no improvement by blending Balmer coal with U.S. coals". Either the tables you have sent to us are incomplete or you are mistaken. A drum index test is reported for Balmer alone and 3 tests A, B, and C, are reported for N.K.K. blended with American coals, but there is no mention of Balmer being blended with American coals.

CANADA

N° à rappeler

Metals Reduction and Energy Centre,
562 Booth Street,
Ottawa, Ontario.

5 January, 1971.

Mr. R. Crisafio,
Assayer,
Crows Nest Industries Limited,
Fernie, B.C.

Dear Bob:

Re: Project 03-3-0/14-10

I would like to apologize for my tardiness in replying to your letter of December 7th, 1970. My main excuse is the difficulties associated with the Christmas and the New Year activities.

The following comments are made in response to the questions in your letter:

1. The sample of CNI coal cleaned at the Coleman plant has been crushed and sampled and is now ready for testing. I know your reactions concerning the release of information from testing this coal. In discussions with Henry Paulencu he is cognizant of the adverse conditions during the cleaning of this particular sample but would like the information anyway as this particular coal, being high in ash content, would indicate the affect of the mineral-matter in the coal on the resulting coke properties.

2. All the samples of coal required for the Stelco-CNI project have been prepared and are now in the course of carbonization tests. These coals include CNI Seam Nos. 8, 9, 10B and 10A, Balmer No. 1, Pocahontas, Mathies, Southern high volatile and our reference hv coal. The analysis and MW oven tests required are

/2

specified in Tables 1 and 2 prepared by Stelco December 14th, 1970. I have enclosed copies of these two tables in case you have not received your copies. You will note in Table 2 that the tests in the MW oven are listed in chronological order based on their importance. Henry Paulencu has requested that we complete test Nos. 1 to 7 inclusive by mid-January. The dates for carbonizing these coals and blends are handwritten under each test number. Stelco was kind enough to send Rick Griggs and two helpers prior to Christmas to assist in the coal crushing, blending and sampling. We are very appreciative of this assistance. Rick has returned to our laboratory, today, to observe progress in the project.

3. Bulk sample from 10A Seam, Adit No. 12, comprising two drums is on hand but not prepared.

4. Bulk sample from Adit No. 13, Horseshoe Ridge, Seam No. 7, comprising two drums is on hand but not prepared.

5. Bulk sample from Adit No. 15, Seam 6, comprising four drums has been prepared and is ready for carbonization. Incidentally, is the identification of this sample, as given here, correct?

6. Bulk sample from Adit No. 14, Seam No. 8, Horseshoe Ridge, is on hand but not prepared.

Due to the urgent request to expedite the CNI-Stelco project the testing of the adit samples will be deferred unless requested to the contrary.

With regard to the 30 lb. oven tests the following is the present status:

1. DH No. 77, Seam 8, Ewin Pass, is complete
2. DH No. 77, Seam 4, Ewin Pass, is prepared and ready to carbonize immediately.
3. DH No. 74, Seam 7, Ewin Pass, is complete.
4. DH No. 74, Seam 8, Ewin Pass, is complete.

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Now that we are back on stream we will endeavour to carry out 30 lb. oven tests on the same samples processed in the MW oven. With regard to the testing of the bulk samples in the MW oven we will consider including blend tests with our reference hv coal after completion of the Stelco-CNI project.

Jack Crabb is scheduled to telephone us tomorrow and we will relay, to him, all the information available on your coals.

Best regards.

Yours truly,

J.C. Botham,
Group Leader,
Metallurgical Fuel Engineering Group.

JCB/cm

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TELEX

Ottawa, Ontario.

2:45 p.m.

SEPT 21-4-70

Mr. R. Crisafio,
Assayer,
Crows Nest Industries,
Fernie, B.C.

RECEIVED THREE HUNDRED POUND SAMPLES TODAY TWO IDENTIFIED AS DH53 S2297 AND S2299 THIRD DRUM NOT IDENTIFIED. IS THIS THIRD DRUM DH56 S1963. THIRD MOVEABLE WALL TEST CARRIED OUT WEDNESDAY. THIS SAMPLE FROM CHICAGO AND IDENTIFIED AS FERNIE 10 BULK SAMPLE 1.41 COULD YOU PROVIDE SAMPLE NUMBER AND IDENTITY. RESULTS OF THIS TEST ARE AS FOLLOWS COKE YIELD 79.1 WALL PRESSURE 4.9 LBS PER SQUARE INCH BREEZE 4.7 PERCENT MEAN COKE SIZE 2.26 APPARENT SPECIFIC GRAVITY 0.902 STABILITY 62.2 HARDNESS 71.3 JIS DRUM 15 93.3. THIS IS EXCEPTIONALLY GOOD COKE AND REPRESENTS THE HIGHEST STABILITY VALUE WE HAVE ENCOUNTERED IN TEST WORK IN OTTAWA TO DATE. THE HIGH CARBONIZATION PRESSURE PRECLUDES USE AS A SINGLE COMPONENT CHARGE BUT OBVIOUSLY THIS IS A VERY FINE LOW VOLATILE BLENDING COAL. BEST REGARDS.

E. W. Montgomery,
Mines Branch.

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CANADA

Department of Energy, Mines and Resources
Ministère de l'Énergie, des Mines et des Ressources

Mines Branch
Direction des mines

File Number
N° à rappeler

Metals Reduction and Energy Centre,
562 Booth Street,
Ottawa, Ontario,
K1A 0G1.

April 13, 1971.

Mr. R. Crisafio,
Assayer,
Crows Nest Industries,
Fernie, B.C.

Dear Bob:

Re: Project No. 03-3-0/11-3 (Continued)

In Jack's letter to you of 31st March, he mentioned that I would be sending you the results to date of our tests on the various samples we have received from you.

We have carried on the existing project number which we were using for similar investigations for you in the recent past, and have added the word "continued" to signify that these results apply to the latest samples.

Referring to your letter of 7th December 1970 to Jack the complete list of samples at that time was as follows:

BULK SAMPLES
(a) Adit 12 - Seam 10A
(b) Adit 13 - Horseshoe Ridge - Seam 7
(c) Adit 15 - Seam 6
(d) Adit 14 - Horseshoe Ridge - Seam 7? - 8 Seam

SMALL SAMPLES FOR 30 LB. OVEN
(e) DH No. 77 - Seam 5 - Ewin Pass
(f) DH No. 77 - Seam 4 - Ewin Pass
(g) DH No. 74 - Seam 7 - Ewin Pass
(h) DH No. 74 - Seam 8 - Ewin Pass

We subsequently received two further bulk samples towards the end of January, 1971.

(i) Adit 16 - Line Creek Ridge - Seam 7
(j) Adit 2 - Horseshoe Ridge - Seam 7

/2

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This list comprises the total number of samples discussed in this letter. It should be mentioned at this point that we had an unfortunate experience in the case of the Adit 14 sample. This sample was misplaced, and has been only partly recovered. This was due in some degree to the change over of operations to Corkstown Road and also to the winter conditions obliterating barrel markings. There are therefore no results included herewith for that particular sample, but we hope to carry out the possible tests in the next few days.

The results reported are as follows:

Table 1 - 30 lb. oven results and Expansion/Contraction results for DH samples.

Table 2 - 12-inch MW oven results and Expansion/Contraction results for bulk samples.

Table 3 - 30 lb. oven results for the same samples as are given in Table 2.

Table 4 - Analytical results now available.

Table 5 - Bench-scale results now available.

I trust that the above information will be helpful to you in the meantime. When our results are complete we will furnish you with the final report.

Yours faithfully,

William Gardiner

W. Gardiner,
Head,
Carbonization Operations.

WG/cm

c.c. Mr. J.C. Botham

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TABLE 1

30 lb. Oven and Expansion/Contraction Results Drill Hole Samples
- Project No. 03-3-0/11-3 -
Project Short Title: Crows Nest Industries Drill Hole and Adit Samples

Test Identification Number.....	144	145	156	187
Date of Test.....	15/9/70	15/9/70	8/10/70	1/2/71
Laboratory Number (refer for analysis of charge).....				
COMPONENT COALS IN CHARGE (% by wt. on db)	100% D.H. 74 Seam 7	100% D.H. 74 Seam 8	100% D.H. 77 Seam 4	100% D.H. 77 Seam 5
CARBONIZATION DATA				
Net Weight of Charge (wet).....lb				
Moisture in Charge.....%	1.9	1.3	1.4	1.5
ASTM Bulk Density (wet).....lb/ft^3				
Oven Bulk Density (db).....lb/ft^3	48.7	50.1	51.2	48.7
CARBONIZATION RESULTS				
Gross Coking Time.....hr:min				
Maximum Wall Pressure.....lb/in^2				
Coke Yield Actual.....%	76.2	79.4	75.7	77.7
Mean Coke size.....in	1.64	1.64	1.55	1.41
Apparent Specific Gravity.....	-	-	-	-
Screen Analysis of Coke (cumulative percentage retained on)				
3 inch sieve.....	-	-	-	-
2 inch sieve.....	19.9	27.8	18.9	12.6
1 1/2 inch sieve.....	58.0	56.2	53.2	44.5
1 inch sieve.....	86.1	84.5	84.9	75.6
3/4 inch sieve.....	91.8	91.6	91.1	87.8
1/2 inch sieve.....	94.2	93.8	92.9	90.0
Percentage -1/2 inch (breeze).....	5.8	6.2	7.1	10.0
Tumbler Test (ASTM)				
Stability Factor.....	51.2	56.6	48.6	44.5
Hardness Factor.....	63.0	66.2	62.3	56.5
Japanese Tumbler Test (JIS) (cumulative percentage retained on)				
50 mm sieve.....				
25 mm sieve.....				
15 mm sieve.....				
Linear Expansion at B.D. of 52 lb/ft^3 at 2% moisture	-10.4	-17.8	-	-

12-Inch MW Oven and Expansion/Contraction Results for Adit Samples

- Project No. [illegible]-3-0/11-3 -

Project Short Title: Crows Nest [illegible]eries Drill Hole and Adit Samples

Test Identification Number Date of Test Laboratory Number (refer for analysis of charge)	769 9/3/71	770 10/3/71	771 17/3/71	772 18/3/71	773 23/3/71	774 24/3/71	775 25/3/71	776 30/3/71	777 31/3/71
COMPONENT COALS IN CHARGE (% by wt. on db)	Adit 12 100% Seam 10A	Adit 13 100% Seam 7	Adit 2 Seam 7 100%	30% Adit 2 Seam 7 70% hv Reference	Adit 16 100% Seam 7	Adit 16 Seam 7 30% hv Reference 70%	Adit 13 30% hv Reference 70%	Adit 15 Seam 6 100%	Adit 15 Seam 6 hv Reference 70%
CARBONIZATION DATA									
Net Weight of Charge (wet) ..... lb	528.3	527.6	527.0	528.4	527.4	522.9	529.3	525.0	527.5
Moisture in Charge ..... %	3.1	3.0	2.7	2.8	2.9	3.2	3.1	3.4	3.0
ASTM Bulk Density (wet) ..... lb/ft^3	48.7	48.7	48.7	48.6	48.6	48.5	48.5	48.5	48.5
Oven Bulk Density (db) ..... lb/ft^3	51.5	51.6	51.6	51.7	51.6	51.0	51.7	51.1	51.4
CARBONIZATION RESULTS									
Gross Coking Time ..... hr:min	10:30	10:30	10:30	10:20	10:30	10:30	10:30	10:30	10:30
Maximum Wall Pressure ..... lb/in^2	0.41	0.61	0.37	0.25	0.48	0.12	0.21	0.14	0.16
Coke Yield Actual ..... %	81.6	79.8	80.4	76.2	80.5	74.9	75.8	77.1	74.6
Mean Coke size ..... in	2.12	1.99	2.19	2.04	2.23	1.83	1.99	1.73	2.04
Apparent Specific Gravity	1.00	0.95	1.02	0.91	0.96	0.91	0.90	0.94	0.91
Screen Analysis of Coke (cumulative percentage retained on)									
3 inch sieve	11.7	7.2	17.6	5.6	12.0	6.2	4.6	12.8	6.6
2 inch sieve	54.3	48.0	60.4	50.0	61.1	52.2	46.5	47.3	49.9
1 1/2 inch sieve	79.3	77.2	80.0	80.1	85.5	80.3	78.0	61.3	79.6
1 inch sieve	93.5	91.1	88.6	94.1	95.4	93.8	93.8	67.8	93.9
3/4 inch sieve	95.2	92.5	90.1	95.8	96.9	95.6	95.8	68.9	95.6
1/2 inch sieve	95.7	93.1	90.5	96.5	97.4	96.6	96.6	69.4	96.4
Percentage -1/2 inch (breeze)	4.3	6.9	9.5	3.5	2.6	3.4	3.4	30.6	3.6
Tumbler Test (ASTM)									
Stability Factor	55.3	53.2	40.9	51.5	52.2	52.0	54.2	29.6	50.6
Hardness Factor	69.4	66.7	64.7	67.0	67.7	66.0	69.8	44.7	66.8
Japanese Tumbler Test (JIS) (cumulative percentage retained on)									
50 mm sieve	23.8	20.0	8.6	25.0	21.8	22.2	16.4	13.4	16.5
25 mm sieve	88.5	84.3	79.9	86.0	84.2	85.7	83.4	71.6	86.0
15 mm sieve	92.7	91.4	89.4	91.7	92.5	91.6	91.6	79.8	92.0
Linear Expansion at B.D. of 52 lb/ft^3 at 2% moisture	-16.0*	-	-	-16.0	-10.9	-18.7	-12.7	-10.0	-16.7

30 Lb. Oven Resul for Adit Samples
- Project [illegible]-3-0/11-3 -
Project Short Title: Crows Nest [illegible]stries Drill Hole and Adit Samples

Test Identification Number	188	189	190	198	199	200	201	202	203
Date of Test	3/2/71	4/2/71	10/2/71	18/3/71	23/3/71	24/3/71	26/3/71	30/3/71	31/3/71
Laboratory Number (refer for analysis of charge)									
COMPONENT COALS IN CHARGE (% by wt. on db)	100% Adit 12 Seam 10A	100% Adit 13 Seam 7	100% Adit 2 Seam 7	30% Adit 2 Seam 7 70% hv Reference	100% Adit 16 Seam 7	30% Adit 16 Seam 7 70% hv Reference	30% Adit 13 70% hv Reference	100% Adit 15 Seam 6	30% Adit 15 Seam 6 70% hv Reference
CARBONIZATION DATA									
Net Weight of Charge (wet)....lb									
Moisture in Charge....%	2.1	1.7	1.9	1.4	1.5	1.7	1.5	2.4	2.2
ASTM Bulk Density (wet)....lb/Ft^3									
Oven Bulk Density (db)....lb/ft^3	48.5	51.0	50.5	50.5	49.4	49.4	49.8	49.2	49.8
CARBONIZATION RESULTS									
Gross Coking Time....hr:min									
Maximum Wall Pressure....lb/in^2									
Coke Yield *Actual....%	84.3	80.9	87.3	72.9	80.7	73.3	73.1	78.7	73.5
Mean Coke size....in	1.78	1.67	1.77	1.53	1.62	1.55	1.47	1.70	1.50
Apparent Specific Gravity....									
Screen Analysis of Coke (cumulative percentage retained on)									
3 inch sieve....	-	-	-	-	-	-	-	-	-
2 inch sieve....	34.6	26.3	35.9	16.1	22.2	17.7	8.0	32.7	12.6
1 1/2 inch sieve....	66.7	60.5	66.0	50.0	59.0	53.0	49.9	63.2	46.1
1 inch sieve....	90.0	87.2	88.3	84.4	84.8	84.1	84.6	85.3	86.2
3/4 inch sieve....	94.4	93.4	93.2	93.3	92.3	92.8	93.6	89.4	93.3
1/2 inch sieve....	95.9	95.5	95.1	95.6	94.3	95.2	96.1	90.8	95.8
Percentage -1/2 inch (breeze)....	4.1	4.5	4.9	4.4	5.7	4.8	3.9	9.2	4.2
Tumbler Test (ASTM)									
Stability Factor....	52.0	52.1	44.4	47.9	45.6	45.0	47.5	46.3	44.4
Hardness Factor....	63.8	62.4	61.9	60.3	58.8	58.8	61.6	57.0	59.0
Japanese Tumbler Test (JIS) (cumulative percentage retained on)									
50 mm sieve....									
25 mm sieve....									
15 mm sieve....									

TABLE 4

Analyses of Component Coals (available at present)
(Project No. 03-3-0/11-3)
Project Short Title: Crows Nest Industries Drill Hole and Adit Samples

Identification			
Laboratory Number	3378-70	2136-71	2137-71
Description	DH 77 Seam 5	Adit 2 Seam 7	Adit 16 Seam 7
Classification			
Rank (ASTM)			
Specific Volatile Index	177	186	182
Volatile Matter (dmmfb)....%	29.1	23.9	25.4
Carbon (dmmfb)....%	87.5	89.2	89.6
Proximate Analysis (db)			
Ash....%	6.6	8.7	10.1
Volatile Matter....%	27.7	22.5	23.6
Fixed Carbon....%	65.7	68.6	66.3
Gross Calorific Value (dmmfb)			
Btu per pound	15,440	15,470	15,450
Ultimate Analysis (db)			
Carbon....%	81.6	80.7	79.6
Hydrogen....%	4.8	4.8	4.4
Sulphur....%	0.57	0.45	0.61
Nitrogen....%	1.30	1.1	1.1
Ash....%	6.6	8.7	10.1
Oxygen (by difference)....%	5.1	4.2	4.2
Screen Analysis			
Laboratory Number	3378-70	2136-71	2137-71
Description	DH 77 Seam 5	Adit 2 Seam 7	Adit 16 Seam 7
Retained 4 mesh	0.5	0.0	1.0
4 mesh - 6 mesh	1.2	5.5	9.8
6 mesh - 8 mesh	2.5	9.8	10.6
8 mesh - 12 mesh	4.2	9.9	10.9
12 mesh - 20 mesh	14.7	19.7	21.6
- 20 mesh	76.9	55.1	46.1
Grindability			
Hardgrove Index	80	101	82
Coal Pulverization			
Total Passing 1/8 in....%			

TABLE 5

Thermal Rheological Properties (available at present)
(Project No. 03-3-0/11-3)
Project Short Title: Crows Nest Industries Drill Hole and Adit Samples

Identification					
Laboratory Number.....	3378-70	2136-71	2137-71	2238-71	2239-71
Description.....	DH 77 Seam 5	Adit 2 Seam 7	Adit 16 Seam 7	Adit 12 Seam 10A	Adit 13 Seam 7
Linear Expansion					
Bd. 52 lb/ft^3 at 2% moisture.....%					
Gieseler Plasticity					
Start.....°C	420	440	433	444	456
Fusion Temp.....°C	434	459	448	470	-
Max. Fluid Temp.....°C	456	464	466	470	466
Final Fluid Temp.....°C	478	482	488	491	486
Solidification Temp.....°C	488	493	489	493	490
Melting Range.....°C	58	42	55	47	30
Max. Fluidity.....dd/m	83	6.1	24	5.4	1.8
Total.....dd	538	53.	178	47	16
Dilatation					
Ti - Softening Temp.....°C	404	421	406	407	416
Tii - Max. Contraction Temp.....°C	446	460	452	458	467
Tiii - Max. Dilatation Temp.....°C	476	484	479	482	447
Contraction.....%	28	26	29	24	23
Dilatation.....%	66	2	11	-17	-23
Free Swelling Index	8+	6 1/2	7	5	3 1/2

BRITISH STEEL

1 268

TELEPHONE: 01-387 9333
TELEX: 265123
TELEGRAMS: BRISTEELEX LONDON TELEX

BRITISH STEEL CORPORATION
151, GOWER STREET
LONDON W.C.1

YOUR REF:
OUR REF: GED/ET

25th January, 1971

Mr. W. R. Prentice,
Crows Nest Industries Ltd.,
FERNIE,
B.C., Canada.

Dear Bill,

I thought you would be interested to have a copy of the first results obtained on the sample of your coal which you sent to us last month. When Dr. Pinchbeck returns from Australia he will, no doubt, write in more detail.

It was a great pleasure to meet you and all your colleagues during our visit to Fernie in December and we very much appreciated your excellent hospitality. We look forward to seeing you again before too long.

Best wishes for the New Year,

Yours sincerely,

George Davies
G. E. DAVIES

Enc.

cc. Dr. P. Pinchbeck,
Stavely Works,
Chesterfield, England.

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THE BRITISH COKE RESEARCH ASSOCIATION

FILE
CROW'S NEST

CHESTERFIELD
DERBYSHIRE

SECRETARY
E. T. S. WRAITH, F.C.I.S.

TELEPHONE
CHESTERFIELD 76621

COPIES ① K. Wardell
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③ E.W. VOICE.

WJP/KW

18th January, 1971.

20 JAN 1971

W. N. Menzies-Wilson, Esq.,
The British Steel Corporation,
151 Gower Street,
London W.C.1.

Dear Mr. Menzies-Wilson,

Dr. Pinchbeck before his departure to Australia has suggested that you might be interested to have, as early as possible, the results obtained at the Coke Research Centre using specially washed sample of Crows Nest Canadian coal.

The enclosed summaries of analytical, petrographic and test results show that although the swelling number of Crows Nest is about 6, this coal showed no fluidity or expansion i.e. it is apparently deficient in caking properties (see Table 1). Our sample of Crows Nest, even after washing in carbon tetrachloride most probably under laboratory conditions, has comparatively high ash content with finely disseminated mineral matter. The petrographic analysis (see Table 1) agrees with the findings of the analysis and shows exceptionally high content of inertinite likely to depress fluidity which could cause a decrease to the resistance of coke to abrasion.

When Crows Nest coal is carbonised alone in the movable-wall oven (250 kg) the parameters indicating physical resistance of coke to breakage ($1\frac{1}{2}$ in shatter and M_{40} micum indices) are reasonably high. Resistance is defined by M_{10} micum index and make of breeze is comparatively low, (see Table 2). Nevertheless as shown in Table 3 when 30 per cent of Crows Nest is blended with 70 per cent of Ravenscraig blend its effect is beneficial i.e. all the parameters of coke strength improve including the resistance of coke to abrasion and the breeze make, this improvement being practically comparable with that obtained when adding Peak Down Australian coal. I would like to stress, however, that as only single results are available at each condition these observations would need confirmation.

W. N. Menzies-Wilson, Esq. 18th January, 1971.

Unfortunately it is not possible to give a British coal which could be compared directly with Crows Nest except possibly a coal similar to that of, say, Marine (from South Wales coal field) but even then the Marine coal would have artifically increased level of Duraine.

I hope the above information will be of use.

Yours sincerely,

W. J. Pater

Enc.

TABLE I

Chemical & Petrographic analyses.

Sample Chemical analysis

Crow's Nest Coal

Results of the comprehensive analysis are given below.

	W	A	V	S	C	H	N	O
Air dried	1.54	10.02	19.98	0.46	78.62	4.22	0.93	-
Dry, mineral matter free	-	-	21.68	-	89.90	4.72	0.96	4.42

Other analyses

Pyritic sulphur	0.02%
Sulphate sulphur	0.01%
Organic sulphur	0.43%
Carbon dioxide	0.25 per cent
Phosphorus	0.024%

Calorific Value (Btu/lb. 13650 a.d.; 15610 d.m.m.f.)

Caking and Swelling Tests

B.S. Swelling Number 6½ → 5½

Ruhr dilatometer

Softening temperature	408°C
Contraction	21%
Dilatation	-21%

Gieseler Test

No fluidity

International Classification 432. (306)

Petrographic analysis

Maceral analysis vol/vol mineral matter free basis

Vitrinite	62
Exinite	Nil
Inertinite	38

Reflectance measurements

Reflectance group (random) in oil of R.I. 1.518

0.8 - 0.9	0.8 per cent
0.9 - 1.0	1.6 per cent
1.0 - 1.1	6.9 per cent
1.1 - 1.2	29.0 per cent
1.2 - 1.3	34.1 per cent
1.3 - 1.4	18.4 per cent
1.4 - 1.5	6.9
1.5 - 1.6	Nil
1.6 - 1.7	2.3
Mean rando- reflectance	1.24 per cent

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TABLE 2

5111/10

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THE BRITISH COKE RESEARCH ASSOCIATION

TEST PLANT - MOVABLE WALL TEST OVEN

SUMMARY OF TEST RESULTS ON BEHALF OF .....

Date tested ..7:1:71.....

A. COALS CROW'S NEST (CANADA)

Chemical analysis

Moisture (air dry)	%	...1.54....
Volatile matter (d.b.)	%	...20.3....
Ash (d.b.)	%	...18.18....
Volatile matter (d.a.f.b.)	%	...22.35....
B.S. swelling number		...6½....
Sulphur (d.b.)	%	...0.47....
Carbon (d.a.f.b.)	%	...88.76....
Hydrogen (d.a.f.b.)	%	...4.76....
Moisture (as charged)	%	...3.1....

Size analysis

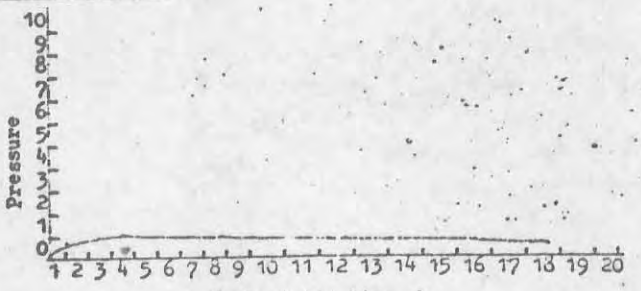
+ ¼in	%	.....
+ ⅛in	%	.....
+ ⅛in	%	.....
+ 1/16in	%	.....
+ 16 B.S.	%	.....
+ 30 B.S.	%	.....
+ 72 B.S.	%	.....
+120 B.S.	%	.....

B. OPERATING CONDITIONS

Charge bulk density (wet) 53.7 lb/ft³. Carbonising rate to 900°C 0.33in/h

(dry) 52.0 lb/ft³. gross 0.33in/h

C. COKING PRESSURES



Maximum wall pressure ..1.2 lb/in²..

Maximum internal pressure ..Nil.....

Final pressure at discharge ..0.8 lb/in²....

D. COKE

Size analysis

+ 200 mm	%	...2.2....
+ 180 mm	%	...6.3....
+ 160 mm	%	...12.2....
+ 140 mm	%	...24.6....
+ 120 mm	%	...37.5....
+ 100 mm	%	...53.3....
+ 80 mm	%	...66.4....
+ 60 mm	%	...77.2....
+ 40 mm	%	...92.8....
+ 30 mm	%	...94.3....
+ 20 mm	%	...97.6....
+ 10 mm	%	...98.2....
- 10 mm	%	.....

Mean coke size mm 33.9

Shatter indices

+ 2 in	67.5
+ 1½in	86.4
- ½in	2.3

Micum indices

+ 40 mm	73.5
+ 30 mm	91.3
+ 20 mm	98.8
- 10 mm	1.4.8

Chemical analysis

Carbon (d.a.f.b.)	%	.....
Hydrogen (d.a.f.b.)	%	.....
Ash (d.b.)	%	.....
Sulphur (d.b.)	%	.....
Phosphorus (d.b.)	%	.....

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TABLE 3

THE BRITISH COKE RESEARCH ASSOCIATION

Summary of test data - moveable-wall test oven

Blend composition								
Ravenscraig blend	%	100	70	70	Nil	Nil	Nil	Nil
Easington coal	%	Nil	Nil	Nil	100	70	90	Nil
Cross Nest coal	%	Nil	30	Nil	Nil	Nil	Nil	100
Peak Downs coal	%	Nil	Nil	30	Nil	30	Nil	Nil
Gunnedah coal	%	Nil	Nil	Nil	Nil	Nil	10	Nil
Total moisture	%	5.1	5.1	5.6	4.1	4.3	4.1	3.1
Bulk density, wet	lb/ft³	53.5	52.1	51.4	51.1	50.8	51.9	53.7
Bulk density, d.b.	lb/ft³	50.7	49.5	48.4	49.0	48.7	49.8	52.0
Carbonising rate to 900°C	in/h	1.07	1.07	1.07	1.10	1.13	1.10	0.99
Carbonising rate to push	in/h	1.00	1.01	1.00	1.03	1.05	1.03	0.93
Size-analysis								
+ 200 mm	%	-	2.3	4.1	-	-	-	2.2
+ 180 mm	%	3.7	3.0	6.2	-	0.9	-	6.5
+ 160 mm	%	8.0	8.6	11.8	1.5	4.0	4.9	12.2
+ 140 mm	%	19.5	14.7	23.3	14.5	11.8	17.7	24.6
+ 120 mm	%	39.7	33.4	37.2	31.7	30.4	34.5	37.5
+ 100 mm	%	58.5	53.4	58.9	52.5	52.3	57.0	53.9
+ 80 mm	%	76.5	75.0	77.3	74.2	76.4	77.0	66.4
+ 60 mm	%	87.5	87.2	89.2	88.0	89.7	88.2	77.2
+ 40 mm	%	93.9	93.6	94.8	94.6	96.0	94.7	82.8
+ 30 mm	%	95.5	94.9	95.8	96.4	97.4	96.3	84.3
+ 20 mm	%	96.8	95.7	96.6	97.6	97.8	97.4	84.6
+ 10 mm	%	97.9	96.8	97.6	98.5	98.5	98.4	85.2
Mean size	mm	107	103	110	101	102	104	99
Shatter indices								
3 in.		65.2	70.7	79.6	64.2	73.4	70.0	67.5
1½ in.		83.2	87.6	91.7	85.3	91.2	84.6	86.4
Micum indices								
M_{40}		60.2	73.1	76.6	58.0	78.0	59.4	73.5
M_{30}		74.2	84.2	84.4	72.2	85.6	73.2	81.3
M_{10}		12.0	9.8	10.3	12.7	9.6	12.9	14.0

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British Steel Corporation
Head Office
P.O. Box 142, 151 Gower Street, London WC1E 6BB
Telephone 01-387-9333 Telex 265123

Your Ref. JJC/sb
Our Ref. GED/ET

22nd April, 1971

Mr. J. J. Crabb,
Crows Nest Industries Ltd.,
Fernie, B.C.,
Canada.

Dear Mr. Crabb,

Thank you for your letter of March 11th, enclosing your invoices for shipment of coal samples. These have been passed to our Accounts Department for payment.

The attached sheet gives analytical data on your coal sample. Coking tests were carried out on your coal and a number of other coals in the 250 kg movable wall oven at the British Coke Research Association test laboratories. The following oven test procedure was adopted:-

1. Charges were crushed to 85% minus $\frac{1}{8}$ in.

2. Carbonised in the oven (width 16.5 in.) at charge bulk density (d.b.) of 48-50 lb/ft^3, and at a mean flue temperature of 1100° C.

3. The oven was pushed one hour after the charge-centre temperature had reached 900° C., equivalent to a carbonizing rate of 0.1 in.per hour.

4. The coke was sized and subjected to shatter and micum tests.

Up to 30 per cent of Crows Nest coal was added to a series of base blends which represent the type of domestic coking coal blends used in various parts of this country. As you will note, there is a significant improvement in physical properties over those of coke made from the base blends.

Base Blend	% addition	% VM (db) of blend	1½" shatter	Micum Indices M40	Micum Indices M10
Ravenscraig	Nil	33.5	83	60	12.0
	15	31.5	86	71	10.3
	30	29.5	88	73	9.8
Appleby-Frodingham	Nil	34.5	84	62	11.5
	30	30.2	89	78	10.2
Easington	Nil	36.3	85	58	12.7
	30	31.5	89	75	10.0

You will appreciate that we are still carrying out similar tests on coals from many parts of the world. Nevertheless, these results are indicative of the properties which one may expect from the use of this coal under our conditions.

Kind regards,

Yours sincerely,

George Davies

G. E. DAVIES

Enc.

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4.2.3. Crow's Nest. Origin: Canada. 2000 lb sample received by B.C.R.A.

Analysis

	Moisture	Ash	Volatile matter	Sulphur	Carbon	Hydrogen	Nitrogen	Oxygen
r-dried basis %	1.5	10.0	20.0	0.46	78.6	4.22	0.93	-
y-mineral-tter-free sis %	-	-	21.7	-	89.9	4.72	0.96	4.4+

+ By difference

Pyritic sulphur a.d.	%	0.02
Sulphate sulphur a.d.	%	0.01
Organic sulphur a.d.	%	0.43
Carbon dioxide a.d.	%	0.25
Phosphorus a.d.	%	0.026
Calorific value a.d.	Btu/lb	13650
Colorific value d.m.m.f.	Btu/lb	15610

Caking and swelling tests

B.S. swelling number $6\frac{1}{2}$

Ruhr dilatometer

Softening temperature	°C	408
Contraction	%	21
Dilatation	%	-21

Gieseler test

No fluidity

International classification 432

N.C.B. classification 302 or 303

Petrographic analysis

Mineral-matter-free basis

Vitrinite	%	66.4
Exinite	%	Nil
Inertinite	%	33.6
Mean random reflectance		1.24

PETROGRAPHY

Department of Energy, Mines and Resources
Ministère de l'Énergie, des Mines et des Ressources
CANADA

Mines Branch
Direction des mines

File Number
N° à rappeler

Metals Reduction and Energy Centre,
562 Booth Street,
Ottawa, Ontario.

25 January, 1971.

Mr. J.J. Crabb,
Exploration Manager,
Crows Nest Industries Limited,
Fernie, B.C.

Dear Jack:

Further to your letter of January 7th I have asked Bill Gardiner and John Jorgensen to review the Japanese data which you sent to us. Their comments are attached to this letter. Bill has concentrated on the carbonization aspects and John on the petrography.

I received the map display cabinet which you were kind enough to send to us. Our carpenter shop has offered to make slight modifications and staining-compatibility with our room decor. This item will provide a useful role in keeping track of our projects in relation to their geography.

Yours truly,

J.C. Botham,
Group Leader,
Metallurgical Fuel Engineering Group.

Jack

JCB/cm

With regard to DDH 11 Seam 5 this sample has been run in Sollovet but results not available at time of writing.

Enclosures

c.c. J.G. Jorgensen
W. Gardiner.

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COMMENTS ON JAPANESE DATA ON C.N.I. SAMPLES AS PER LETTER
J.J. CRABB TO J.C. BOTHAM DATED JANUARY 7, 1971

by

J.G. Jorgensen

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Comparison of Analysis-Petrography

	Japanese Seam 8	MREC Seam 8	Japanese Seam 9	MREC Seam 9
Vitrinite	46.4	40.5	52.2	47.7
Exinite	0.0	0.0	0.4	0.0
1/3 Semi-Fusinite	6.7	14.9	6.7	13.0
Total Reactives	53.1	55.4	59.3	60.7
2/3 Semi-Fusinite	13.4	29.7	13.4	26.0
Fusinite	2.4	9.3	3.1	7.7
Micrinite	25.7	0.0	18.8	0.5
Mineral Matter	5.4	5.6	5.4	5.1
Total Inerts	46.9	44.6	40.7	39.3
Mean Reflectance	1.34	1.27	1.43	1.36
Optimum Inerts	11.29	- 12.80	9.38	11.03
Strength Index	5.5	4.65	6.6	5.67

Comparing results from the same seams there appears to be a fundamental difference in interpreting semi-fusinite, fusinite and micronoid which I cannot explain.

Optimum Inerts is a petrographic term indicating the relative amount of inert material the vitrinite of a particular reflectance group can bond to give the best coke.

C.B.I = Composition-Balance Index - indicates the relative ratio of reactives to inerts with the balance point of one. (i.e. values greater than one indicate an excess of inerts, and values less than one indicate an excess of reactives).

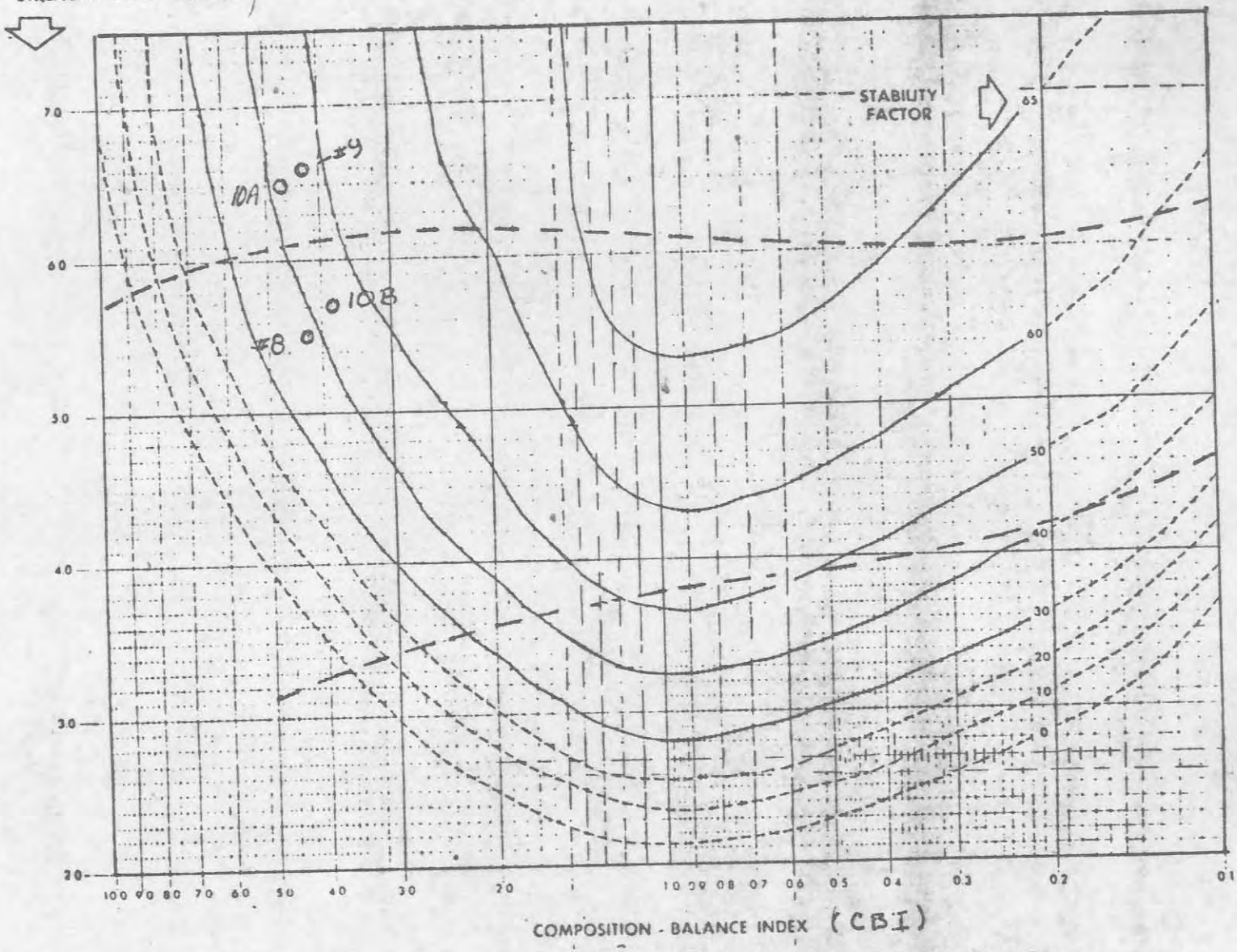
S.I. = Strength Index - vitrinoid of each reflectance group will produce coke of a relative strength depending on amount of inert material added or present.

Strength Index = $\frac{(\text{Reactives} \times \text{Strength Factor})}{\text{Total Reactives}}$ for each vitrinoid reflectance type.

Stability Factor is determined from a plot of the strength index versus the composition index.

Based on the Japanese values of CBI and SI the calculated potential stability factor is listed below. The values obtained from petrographic analysis at MREC for the same seams are also listed for comparison.

Seam No.	Japanese Stability Factor	MREC Stability Factor
8	38	35
9	46	46
10A	42	51
10B	43	57



STABILITY POTENTIAL OF CNIL SEAMS 8, 9, 10A, 10B BASED ON JAPANESE STROGRAPHIC VALUES.

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(3)

← note higher reactives yet low fluidity FSI. !!

	SEAM 8	SEAM 9	SEAM 10A	SEAM 10B
VITRINITE	46.4	52.2	52.0	50.4
EXINITE	0	0.4	0	0.4
1/3 SEMI FUSINITE	6.7	6.7	6.1	4.6
TOTAL REACTIVES	53.1 (55.4)	59.3 (60.7)	58.1 (64.1)	55.4 (71.2)

	SEAM 8	SEAM 9	SEAM 10A	SEAM 10B
2/3 SEMI FUSINITE	13.4	13.4	12.3	9.1
FUSINITE	2.4	3.1	4.1	8.8
MICRINITE	25.7	18.8	19.6	21.0
MINERAL MATTER	5.4	5.4	5.9	5.7
TOTAL INERTS	46.9 (44.6)	40.7 (39.3)	41.9 (35.9)	44.6 (28.8)

	SEAM 8	SEAM 9	SEAM 10A	SEAM 10B
MEAN REFLECTANCE	1.34	1.43	1.45	1.46
OPTIMUM INERTS	11.29	9.38	8.99	11.60
C. B. I.	4.2	4.3	4.7	3.8 ?
S. I.	5.5	6.6	6.5	5.7 ?

REF. VICARY CREEK COAL

MEAN REFLECTANCE	1.45
INERTS	28.9
V.M. (daf)	24.7
K cal / Kg (daf)	8.680
D.I. $^{30}_{15}$	91.8

note: 1) Significant difference between 8 and others in Mean reflectance.

2) DI of Vicary Creek coal higher than Balmer?

Department of Energy, Mines and Resources
Ministère de l'Énergie, des Mines et des Ressources

CANADA

Mines Branch
Direction des mines

File Number
N° à rappeler

Metals Reduction and Energy Centre,
562 Booth Street,
Ottawa, Ontario.

10 March, 1971.

Mr. J.J. Crabb,
Exploration Manager,
Crows Nest Industries Limited,
Fernie, B.C.

Dear Jack:

Re: Project No. 3-2-1/11-3

Please find enclosed three copies of our Divisional Report MREC 71/18, prepared by J.G. Jorgensen and R.C. Guenette.

This report deals, in the main, with the analyses of your exploration samples from Line Creek Ridge and Horseshoe Ridge.

Yours truly,

J.C. Botham,
Group Leader,
Metallurgical Fuel Engineering Group.

JCB/cm

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Confidential

CANADA

DEPARTMENT OF ENERGY, MINES AND RESOURCES

MINES BRANCH

OTTAWA

METALS REDUCTION AND ENERGY CENTRE
DIVISIONAL REPORT MREC 71/18

PETROGRAPHIC EVALUATION OF EXPLORATION COAL SAMPLES FROM LINE CREEK RIDGE AND HORSESHOE RIDGE COAL MEASURES, CROWS NEST INDUSTRIES, LTD., FERNIE, B.C.

- Project No. 3-2-1/11-3 -

by

J.G. Jorgensen and R.C. Guenette

February 1971

PETROGRAPHIC EVALUATION OF EXPLORATION COAL SAMPLES FROM LINE CREEK RIDGE AND HORSESHOE RIDGE COAL MEASURES, CROWS NEST INDUSTRIES, LTD., FERNIE, B.C.

- Project No. 3-2-1/11-3 -

by

J.G. Jorgensen* and R.C. Guenette**

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INTRODUCTION

This report deals with the petrographic analyses of exploration samples listed in Table 1. Included in this group are samples of coal from Line Creek Ridge and Horseshoe Ridge.

The samples were prepared for analyses according to ASTM Tentative Standard D-2797 (1). The maceral composition and mean maximum reflectance were determined according to ASTM Tentative Standards D-2798-T(2) and D-2799-69T(3). From the petrographic results the potential stability factors were calculated.

---

*Head, Laboratory Services, **Technician, Metals Reduction and Energy Centre, Department of Energy, Mines and Resources, Ottawa, Canada.

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TABLE 1

A List of Samples Submitted for Petrographic Analyses

Laboratory No.	Mark	Description
2226-70	2140	Line Creek Ridge, Seam 8, DH No. 41
2302-70		Seam 10B, Adit 5
2393-70	2290	DH No. 52, Level 140' - 160'
2394-70	2291	DH No. 52, Level 398' - 418'
2395-70	2292	DH No. 52, Level 434' - 445'
2433-70		Fernie No. 10, Adit 29, Float 141
2435-70	S2299	DH No. 53, Level 551' - 584'
2436-70	S2297	DH No. 53, Level 624' - 683'
2437-70	S1963	DH No. 56
2514-70	S1966	Horseshoe Ridge, DH No. 57, Level 211' - 250'
2515-70	S1978	Horseshoe Ridge, DH No. 57, Level 640' - 676'
2516-70	S1977	Horseshoe Ridge, DH No. 57, Level 740' - 798'

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PETROGRAPHIC AND ALLIED DATA ON: Crows Nest Industries, Limited, Line Creek Ridge - Seam #8 - Drill Hole #41.

Project No. 3-2-1/11-3 Sample No. 2226-70 Pellet No. J-74

I Petrographic Composition

Reactive Components

Distribution of Vitrinoid Types

Type	Percent
10	5.0
11	17.2
12	11.7
13	1.7
14	0.8

	%
Total Vitrinoid	36.4
Reactive Semi-fusinoid (1/3)	16.2
Exinoid + Resinoid	0.0
Total Reactive Components	52.6

Inert Components

Inert Semi-fusinoids (2/3)	32.4
Micrinoids	0.4
Fusinoids	9.8
Mineral Matter	4.8
Total Inert Components	47.4

II Petrographic Indices

Mean Reflectance	1.18
Balance Index	3.13
Strength Index	4.08
Stability Index	30

III Chemical and Physical Analyses

	%		
Moisture	1.1	Free Swelling Index	4 1/2
Ash, db	8.6	Grindability	80
Volatile Matter, db	21.7		
Fixed Carbon, db	69.7		
Sulphur, db	0.40		
BTU/lb, db	14,200		

PETROGRAPHIC AND ALLIED DATA ON: Crows Nest Industries, Limited, Line Creek Ridge - Seam #10B - Adit 5.

Project No. 3-2-1/11-3 Sample No. 2302-70 Pellet No. J-75

I Petrographic Composition

Reactive Components

Distribution of Vitrinoid Types

Type	Percent
10	1.4
11	5.0
12	27.3
13	15.8
14	2.9

	%
Total Vitrinoid	52.4
Reactive Semi-fusinoid (1/3)	11.0
Exinoid + Resinoid	0.1
Total Reactive Components	63.5

Inert Components

Inert Semi-fusinoids (2/3)	22.1
Micrinoids	0.7
Fusinoids	8.1
Mineral Matter	5.6
Total Inert Components	36.5

II Petrographic Indices

Mean Reflectance	1.28
Balance Index	2.49
Strength Index	4.97
Stability Index	49

III Chemical and Physical Analyses

	%
Moisture	1.2
Ash, db	9.8
Volatile Matter, db	20.8
Fixed Carbon, db	69.4
Sulphur, db	0.60
BTU/lb, db	14,040

Free Swelling Index	8
Grindability	119

PETROGRAPHIC AND ALLIED DATA ON: Crows Nest Industries, Limited, #2290 - DH No. 52 - 140' to 160'

Project No. 3-2-1/11-3 Sample No. 2393-70 Pellet No. J-87

I Petrographic Composition

Reactive Components

Distribution of Vitrinoid Types

Type	Percent
8	0.7
9	6.0
10	41.5
11	9.4

	%
Total Vitrinoid	57.6
Reactive Semi-fusinoid (1/3)	10.3
Exinoid + Resinoid	0.6
Total Reactive Components	68.5

Inert Components

Inert Semi-fusinoids (2/3)	20.7
Micrinoids	0.8
Fusinoids	4.2
Mineral Matter	5.8
Total Inert Components	31.5

II Petrographic Indices

Mean Reflectance	1.05
Balance Index	1.25
Strength Index	3.89
Stability Index	51

III Chemical and Physical Analyses

	%		
Moisture	1.3	Free Swelling Index	7 1/2
Ash, db	10.1	Grindability	85
Volatile Matter, db	24.9		
Fixed Carbon, db	65.0		
Sulphur, db	0.71		
BTU/lb, db	13,800		

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PETROGRAPHIC AND ALLIED DATA ON: Crows Nest Industries, Limited, #2291 - DH No. 52 - 398' to 418'

Project No. 3-2-1/11-3 Sample No. 2394-70 Pellet No. J-88

I Petrographic Composition

Reactive Components

Distribution of Vitrinoid Types

Type	Percent
9	1.8
10	18.5
11	36.9
12	4.4

	%
Total Vitrinoid	61.5
Reactive Semi-fusinoid (1/3)	9.4
Exinoid + Resinoid	0.7
Total Reactive Components	71.6
Inert Components	
Inert Semi-fusinoids (2/3)	18.9
Micrinoids	0.4
Fusinoids	4.0
Mineral Matter	5.1
Total Inert Components	28.4

II Petrographic Indices

Mean Reflectance	1.12
Balance Index	1.21
Strength Index	4.30
Stability Index	57

III Chemical and Physical Analyses

	%
Moisture	1.0
Ash, db	9.0
Volatile Matter, db	25.8
Fixed Carbon, db	65.2
Sulphur, db	0.69
BTU/lb, db	14,120

Free Swelling Index	8 1/2
Grindability	126

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PETROGRAPHIC AND ALLIED DATA ON: Crows Nest Industries, Limited, #2292 - DH No. 52 - 434' to 445'

Project No. 3-2-1/11-3 Sample No. 2395-70 Pellet No. J-89

I Petrographic Composition

Reactive Components

Distribution of Vitrinoid Types

Type	Percent
9	1.9
10	30.1
11	10.7
12	1.2

	%
Total Vitrinoid	49.3
Reactive Semi-fusinoid (1/3)	14.4
Exinoid + Resinoid	0.0
Total Reactive Components	58.3

Inert Components

Inert Semi-fusinoids (2/3)	28.9
Micrinoids	0.8
Fusinoids	7.1
Mineral Matter	4.9
Total Inert Components	41.7

II Petrographic Indices

Mean Reflectance	1.07
Balance Index	2.01
Strength Index	3.73
Stability Index	37

III Chemical and Physical Analyses

	%		
Moisture	1.2	Free Swelling Index	8
Ash, db	8.6	Grindability	111
Volatile Matter, db	24.4		
Fixed Carbon, db	67.0		
Sulphur, db	0.65		
BTU/lb, db	14,160		

65

I 237

PETROGRAPHIC AND ALLIED DATA ON: Crows Nest Industries, Limited,
Fernie #10 - Float 1.41 - Adit 29.

Project No. 3-2-1/11-3 Sample No. 2433-70 Pellet No. 91

I Petrographic Composition

Reactive Components

Distribution of Vitrinoid Types

Type	Percent
10	0.8
11	6.7
12	48.6
13	10.7

	%
Total Vitrinoid	62.9
Reactive Semi-fusinoid (1/3)	8.9
Exinoid + Resinoid	0.0
Total Reactive Components	71.8

Inert Components

Inert Semi-fusinoids (2/3)	17.9
Micrinoids	0.0
Fusinoids	6.0
Mineral Matter	4.3
Total Inert Components	28.2

II Petrographic Indices

Mean Reflectance	1.25
Balance Index	1.59
Strength Index	4.45
Stability Index	53.0

III Chemical and Physical Analyses

	%
Moisture	1.4
Ash, db	7.5
Volatile Matter, db	22.3
Fixed Carbon, db	70.2
Sulphur, db	0.46
BTU/lb, db	14,410

Free Swelling Index	7 1/2
Grindability	114

bb

PETROGRAPHIC AND ALLIED DATA ON: Crows Nest Industries, Limited, S-2299 - DH No. 53 - Level 551' - 584'

Project No. 3-2-1/11-3 Sample No. 2435-70 Pellet No. 92

I Petrographic Composition

Reactive Components

Distribution of Vitrinoid Types

Type	Percent
10	2.3
11	17.4
12	18.8
13	2.7
14	1.3

	%
Total Vitrinoid	42.5
Reactive Semi-fusinoid (1/3)	14.1
Exinoid + Resinoid	0.5
Total Reactive Components	57.1

Inert Components

Inert Semi-fusinoids (2/3)	28.1
Micrinoids	0.0
Fusinoids	8.5
Mineral Matter	6.3
Total Inert Components	42.9

II Petrographic Indices

Mean Reflectance	1.21
Balance Index	2.76
Strength Index	4.36
Stability Index	39.0

III Chemical and Physical Analyses

	%
Moisture	1.6
Ash, db	11.2
Volatile Matter, db	22.0
Fixed Carbon, db	66.8
Sulphur, db	0.23
BTU/lb, db	13,700

Free Swelling Index	2
Grindability	111

67

PETROGRAPHIC AND ALLIED DATA ON: Crows Nest Industries, Limited, S2297 - DH No. 53 - Level 624' - 683'.

Project No. 3-2-1/11-3 Sample No. 2436-70 Pellet No. 93

I Petrographic Composition

Reactive Components

Distribution of Vitrinoid Types

Type	Percent
9	0.6
10	8.7
11	22.7
12	15.7
13	2.4

	%
Total Vitrinoid	50.1
Reactive Semi-fusinoid (1/3)	12.0
Exinoid + Resinoid	0.0
Total Reactive Components	62.1
Inert Components	
Inert Semi-fusinoids (2/3)	23.9
Micrinoids	0.8
Fusinoids	7.3
Mineral Matter	5.9
Total Inert Components	37.9

II Petrographic Indices

Mean Reflectance	1.05
Balance Index	2.06
Strength Index	4.31
Stability Index	45.0

III Chemical and Physical Analyses

	%
Moisture	1.7
Ash, db	10.5
Volatile Matter, db	22.8
Fixed Carbon, db	66.7
Sulphur, db	0.35
BTU/lb, db	13,990

Free Swelling Index	6
Grindability	113

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I 240

PETROGRAPHIC AND ALLIED DATA ON: Crows Nest Industries, Limited, S1963 - DH No. 56

Project No. 3-2-1/11-3 Sample No. 2437-70 Pellet No. 94

I Petrographic Composition

Reactive Components

Distribution of Vitrinoid Types

Type	Percent
11	4.6
12	29.9
13	5.8

	%
Total Vitrinoid	40.3
Reactive Semi-fusinoid (1/3)	14.1
Exinoid + Resinoid	0.0
Total Reactive Components	54.4

Inert Components

Inert Semi-fusinoids (2/3)	28.1
Micrinoids	0.0
Fusinoids	12.6
Mineral Matter	4.9
Total Inert Components	45.6

II Petrographic Indices

Mean Reflectance	1.25
Balance Index	3.44
Strength Index	4.43
Stability Index	32.5

III Chemical and Physical Analyses

	%		
Moisture	1.5	Free Swelling Index	3 1/2
Ash, db	8.8	Grindability	90
Volatile Matter, db	21.0		
Fixed Carbon, db	70.2		
Sulphur, db	0.37		
BTU/lb, db	14,110		

PETROGRAPHIC AND ALLIED DATA ON: Crows Nest Industries, Limited, S1966 - Horseshoe Ridge - DH No. 57 - Level 211' - 250'

Project No. 3-2-1/11-3 Sample No. 2514-70 Pellet No. 99

I Petrographic Composition

Reactive Components

Distribution of Vitrinoid Types

Type	Percent
10	2.5
11	21.2
12	48.2
13	3.2

	%
Total Vitrinoid	75.1
Reactive Semi-fusinoid (1/3)	5.0
Exinoid + Resinoid	0.0
Total Reactive Components	80.1

Inert Components

Inert Semi-fusinoids (2/3)	10.1
Micrinoids	0.0
Fusinoids	5.3
Mineral Matter	4.5
Total Inert Components	19.9

II Petrographic Indices

Mean Reflectance	1.22
Balance Index	0.94
Strength Index	4.71
Stability Index	62.0

III Chemical and Physical Analyses

	%		
Moisture	2.0	Free Swelling Index	8
Ash, db	7.9	Grindability	143
Volatile Matter, db	25.2		
Fixed Carbon, db	66.9		
Sulphur, db	0.74		
BTU/lb, db	14,250		

70

PETROGRAPHIC AND ALLIED DATA ON: Crows Nest Industries, Limited, D1978 - Horseshoe Ridge - DH No. 57 - Level 640' - 676'

Project No. 3-2-1/11-3 Sample No. 2515-70 Pellet No. 100

I Petrographic Composition

Reactive Components

Distribution of Vitrinoid Types

Type	Percent
10	1.0
11	2.0
12	26.2
13	16.2

	%
Total Vitrinoid	45.4
Reactive Semi-fusinoid (1/3)	13.0
Exinoid + Resinoid	0.0
Total Reactive Components	58.4

Inert Components

Inert Semi-fusinoids (2/3)	26.1
Micrinoids	0.0
Fusinoids	9.5
Mineral Matter	6.0
Total Inert Components	41.6

II Petrographic Indices

Mean Reflectance	1.28
Balance Index	3.11
Strength Index	4.79
Stability Index	41.0

III Chemical and Physical Analyses

	%		
Moisture	2.1	Free Swelling Index	3
Ash, db	10.6	Grindability	139
Volatile Matter, db	21.3		
Fixed Carbon, db	68.1		
Sulphur, db	0.57		
BTU/lb, db	13,820		

7/

1 243

PETROGRAPHIC AND ALLIED DATA ON: Crows Nest Industries, Limited, S1977 - Horseshoe Ridge - DH No. 57 - Level 740' - 798'

Project No. 3-2-1/11-3 Sample No. 2516-70 Pellet No. 101

I Petrographic Composition

Reactive Components

Distribution of Vitrinoid Types

Type	Percent
12	11.2
13	26.4
14	5.3
15	0.7

	%
Total Vitrinoid	43.6
Reactive Semi-fusinoid (1/3)	14.2
Exinoid + Resinoid	0.0
Total Reactive Components	57.8

Inert Components

Inert Semi-fusinoids (2/3)	28.3
Micrinoids	0.0
Fusinoids	9.3
Mineral Matter	4.6
Total Inert Components	42.2

II Petrographic Indices

Mean Reflectance	1.34
Balance Index	3.78
Strength Index	5.38
Stability Index	41.0

III Chemical and Physical Analyses

	%
Moisture	3.1
Ash, db	8.1
Volatile Matter, db	20.7
Fixed Carbon, db	71.2
Sulphur, db	0.54
BTU/lb, db	14,320

Free Swelling Index	4
Grindability	131

72

COMMENTS

These coal samples taken from many locations exhibit a wide variation in maceral composition resulting in stability index values ranging from 30 to 62. The low stability index results are mainly due to a excess of inert material, especially semi-fusinoid which is assumed to be two thirds inert. The high percentage of total inerts cannot be properly bonded due to a insufficient amount of reactive material such as vitrinoid. Coke from these coals can be strengthened by blending with coals such as high volatile A bituminous containing a excess of reactive macerals.

ACKNOWLEDGEMENT

The author is grateful to the Fuels Research Centre for the chemical analyses of the coal samples.

REFERENCES

1. ASTM Designation: D-2797-69T, "Tentative Method of Preparing Coal Samples for Microscopical Analysis by Reflected Light".

2. ASTM Designation: D-2798-69T, "Tentative Method for Determining Microscopically the Reflectance of the Organic Components in a Polished Specimen of Coal".

3. ASTM Designation: D-2799-69T, "Tentative Method of Microscopical Determination of Volume Percent of Physical Components of Coal".

* * * * * *

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JGJ:RCG/cm

CANADA

Department of Energy, Mines and Resources
Ministère de l'Énergie, des Mines et des Ressources

Mines Branch
Direction des mines

File Number
N° à rappeler

Metals Reduction and Energy Centre,
562 Booth Street,
Ottawa, Ontario.

10 March, 1971.

Mr. J.J. Crabb,
Exploration Manager,
Crows Nest Industries Limited,
Fernie, B.C.

Dear Jack:

Re: Project No. 3-2-1/11-3

Please find enclosed three copies of our Divisional Report MREC 71/18, prepared by J.G. Jorgensen and R.C. Guenette.

This report deals, in the main, with the analyses of your exploration samples from Line Creek Ridge and Horseshoe Ridge.

Yours truly,

J.C. Botham,
Group Leader,
Metallurgical Fuel Engineering Group.

JCB/cm

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CANADA

DEPARTMENT OF ENERGY, MINES AND RESOURCES

MINES BRANCH

OTTAWA

METALS REDUCTION AND ENERGY CENTRE
DIVISIONAL REPORT MREC 72/45

PETROGRAPHIC AND RELATED ANALYSES OF TEN EXPLORATION COAL SAMPLES SUBMITTED BY CROW'S NEST INDUSTRIES, LTD., FERNIE, B.C.

by

J.G. Jorgensen, C.H. Glaude, R.C. Guenette and A.B. Fung

May, 1972

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PETROGRAPHIC AND RELATED ANALYSES OF TEN EXPLORATION COAL SAMPLES SUBMITTED BY CROW'S NEST INDUSTRIES, LTD., FERNIE, B.C.

Project 03-3-1/11-3

by

J.G. Jorgensen*, C.H. Glaude**, R.C. Guenette*** and A.B. Fung****

INTRODUCTION

This report deals with the petrographic and related analyses of Drill Hole and Adit coal samples listed in the Table of Contents, page i. The carbonization, chemical, and rheological properties relating to these samples have been reported earlier by mail or telephone.

The samples were prepared for petrographic analyses according to ASTM Tentative Standard D-2797-69T[1]. The maceral composition and mean maximum reflectance were determined according to ASTM Tentative Standards D-2798-69T[2] and D-2799-69T[3]. From the petrographic data the potential stability factor was calculated according to a modification of a method proposed by N. Schapiro and R.J. Gray[4]. The petrographic results are listed in Tables 1 to Table 10. The potential stability factors are plotted in Figures 1 and 2.

The chemical analyses and physical tests conducted on the samples include proximate analyses, ultimate analyses, ash analysis, calorific value, Hardgrove grindability and size consist. These results are listed in Table 11.

The rheological properties were characterized by Gieseler plasticity, Ruhr dilatation and the Free Swelling Index. These results are listed in Table 12.

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*Head, Laboratory Services Section, ** and ***, Coal Technologists, ****Student, Waterloo University Program, Metals Reduction and Energy Centre, Department of Energy, Mines and Resources, Mines Branch, Ottawa, Canada.

TABLE 1

PETROGRAPHIC DATA ON: D.H. No. 74, Seam 7, Ewin Pass

Project No. 03-3-1/11-3 Sample No. 3139-70 Pellet No. 137

I Petrographic Composition

Reactive Components

Distribution of Vitrinoid Types

Type	Percent
9	0.8
10	19.0
11	32.3
12	6.6
13	0.9

	%
Total Vitrinoid	59.6
Reactive Semi-fusinoid (1/3)	6.4
Exinoid + Resinoid	1.2
Total Reactive Components	67.2
Inert Components	
Inert Semi-fusinoids (2/3)	12.7
Micrinoids	4.0
Fusinoids	11.3
Mineral Matter	4.8
Total Inert Components	32.8

II Petrographic Indices

Mean Reflectance	1.13
Balance Index	1.51
Strength Index	4.25
Stability Index	52.1

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TABLE 2

PETROGRAPHIC DATA ON: D.H. No. 74, Seam 8, Ewin Pass

Project No. 03-3-1/11-3 **Sample No.** 3140-70 **Pellet No.** 140

I Petrographic Composition

Reactive Components

Distribution of Vitrinoid Types

Type	Percent
10	4.7
11	32.2
12	13.4
13	1.4

	%
Total Vitrinoid	51.7
Reactive Semi-fusinoid (1/3)	7.9
Exinoid + Resinoid	1.5
Total Reactive Components	61.1
Inert Components	
Inert Semi-fusinoids (2/3)	15.7
Micrinoids	4.2
Fusinoids	13.3
Mineral Matter	5.7
Total Inert Components	38.9

II Petrographic Indices

Mean Reflectance	1.17
Balance Index	2.15
Strength Index	4.29
Stability Index	44.0

71

1 C2

TABLE 3

PETROGRAPHIC DATA ON: D.H. No. 77, Seam 4, Ewin Pass

Project No. 03-3-1/11-3 Sample No. 3199-70 Pellet No. 141

I Petrographic Composition

Reactive Components

Distribution of Vitrinoid Types

Type	Percent
9	8.8
10	41.7
11	11.3
12	1.5

	%
Total Vitrinoid	63.3
Reactive Semi-fusinoid (1/3)	6.2
Exinoid + Resinoid	2.7
Total Reactive Components	72.2
Inert Components	
Inert Semi-fusinoids (2/3)	12.5
Micrinoids	4.0
Fusinoids	7.3
Mineral Matter	4.0
Total Inert Components	27.8

II Petrographic Indices

Mean Reflectance	1.06
Balance Index	1.05
Strength Index	3.98
Stability Index	54.4

80

1 252

TABLE 4

PETROGRAPHIC DATA ON: D.H. No. 77, Seam 5, Ewin Pass

Project No. 03-3-1/11-3 **Sample No.** 3378-70 **Pellet No.** 153

I Petrographic Composition

Reactive Components

Distribution of Vitrinoid Types

Type	Percent
7	0.9
8	0.9
9	7.0
10	45.6
11	11.4
12	1.7

	%
Total Vitrinoid	67.5
Reactive Semi-fusinoid (1/3)	5.7
Exinoid + Resinoid	1.5
Total Reactive Components	74.7
Inert Components	
Inert Semi-fusinoids (2/3)	11.3
Micrinoids	2.6
Fusinoids	7.7
Mineral Matter	3.7
Total Inert Components	25.3

II Petrographic Indices

Mean Reflectance	1.06
Balance Index	0.93
Strength Index	3.95
Stability Index	54.4

TABLE 5

PETROGRAPHIC DATA ON: Adit No. 16, Seam 7, Line Creek Ridge

Project No. 03-3-1/11-3 Sample No. 2137-71 Pellet No. 176

I Petrographic Composition

Reactive Components

Distribution of Vitrinoid Types

Type	Percent
10	1.3
11	11.0
12	36.8
13	5.1

	%
Total Vitrinoid	54.2
Reactive Semi-fusinoid (1/3)	9.0
Exinoid + Resinoid	0.0
Total Reactive Components	63.2
Inert Components	
Inert Semi-fusinoids (2/3)	18.1
Micrinoids	2.2
Fusinoids	10.8
Mineral Matter	5.7
Total Inert Components	36.8

II Petrographic Indices

Mean Reflectance	1.23
Balance Index	2.28
Strength Index	4.58
Stability Index	46.3

82

254

TABLE 6

PETROGRAPHIC DATA ON: Adit No. 12, Seam 10A

Project No. 03-3-1/11-3 Sample No. 2238-71 Pellet No. 179

I Petrographic Composition

Reactive Components

Distribution of Vitrinoid Types

Type	Percent
11	0.6
12	9.0
13	30.7
14	12.8
15	0.6

	%
Total Vitrinoid	53.7
Reactive Semi-fusinoid (1/3)	9.8
Exinoid + Resinoid	0.0
Total Reactive Components	63.5
Inert Components	
Inert Semi-fusinoids (2/3)	19.7
Micrinoids	2.4
Fusinoids	7.2
Mineral Matter	7.2
Total Inert Components	36.5

II Petrographic Indices

Mean Reflectance	1.36
Balance Index	3.12
Strength Index	5.73
Stability Index	50.6

83

1 255

TABLE 7

PETROGRAPHIC DATA ON: Adit No. 13, Seam 7, Horseshoe Ridge

Project No. 03-3-1/11-3 Sample No. 2239-71 Pellet No. 178

I Petrographic Composition

Reactive Components

Distribution of Vitrinoid Types

Type	Percent
11	3.2
12	27.0
13	23.1
14	2.5

	%
Total Vitrinoid	55.8
Reactive Semi-fusinoid (1/3)	9.1
Exinoid + Resinoid	0.1
Total Reactive Components	65.0
Inert Components	
Inert Semi-fusinoids (2/3)	18.3
Micrinoids	3.0
Fusinoids	9.3
Mineral Matter	4.4
Total Inert Components	35.0

II Petrographic Indices

Mean Reflectance	1.29
Balance Index	2.67
Strength Index	5.14
Stability Index	48.9

84

TABLE 8

PETROGRAPHIC DATA ON: Adit No. 15, Seam 6

Project No. 03-3-1/11-3 Sample No. 2372-71 Pellet No. 182

I Petrographic Composition

Reactive Components

Distribution of Vitrinoid Types

Type	Percent
10	1.1
11	9.5
12	29.6
13	7.3

	%
Total Vitrinoid	47.5
Reactive Semi-fusinoid (1/3)	9.8
Exinoid + Resinoid	0.0
Total Reactive Components	57.3
Inert Components	
Inert Semi-fusinoids (2/3)	19.6
Micrinoids	3.7
Fusinoids	14.8
Mineral Matter	4.6
Total Inert Components	42.7

II Petrographic Indices

Mean Reflectance	1.24
Balance Index	2.96
Strength Index	4.47
Stability Index	38.0

TABLE 9

PETROGRAPHIC DATA ON: Adit No. 14, Seam 8, Horseshoe Ridge

Project No. 03-3-1/11-3 Sample No. 2396-71 Pellet No. 187

I Petrographic Composition

Reactive Components

Distribution of Vitrinoid Types

Type	Percent
12	11.0
13	31.1
14	6.9

	%
Total Vitrinoid	49.0
Reactive Semi-fusinoid (1/3)	10.5
Exinoid + Resinoid	0.0
Total Reactive Components	59.5
Inert Components	
Inert Semi-fusinoids (2/3)	20.9
Micrinoids	5.0
Fusinoids	8.8
Mineral Matter	5.8
Total Inert Components	40.5

II Petrographic Indices

Mean Reflectance	1.34
Balance Index	3.55
Strength Index	5.45
Stability Index	44.0

ab

TABLE 10

PETROGRAPHIC DATA ON: Adit No. 2, Seam 7, Horseshoe Ridge

Project No. 03-3-1/11-3 Sample No. 2460-71 Pellet No. 190

I Petrographic Composition

Reactive Components

Distribution of Vitrinoid Types

Type	Percent
12	10.2
13	30.0
14	7.3
16	1.1
17	0.6

	%
Total Vitrinoid	49.2
Reactive Semi-fusinoid (1/3)	8.8
Exinoid + Resinoid	0.0
Total Reactive Components	58.0
Inert Components	
Inert Semi-fusinoids (2/3)	17.5
Micrinoids	2.9
Fusinoids	15.4
Mineral Matter	6.2
Total Inert Components	42.0

II Petrographic Indices

Mean Reflectance	1.36
Balance Index	3.89
Strength Index	5.49
Stability Index	41.1

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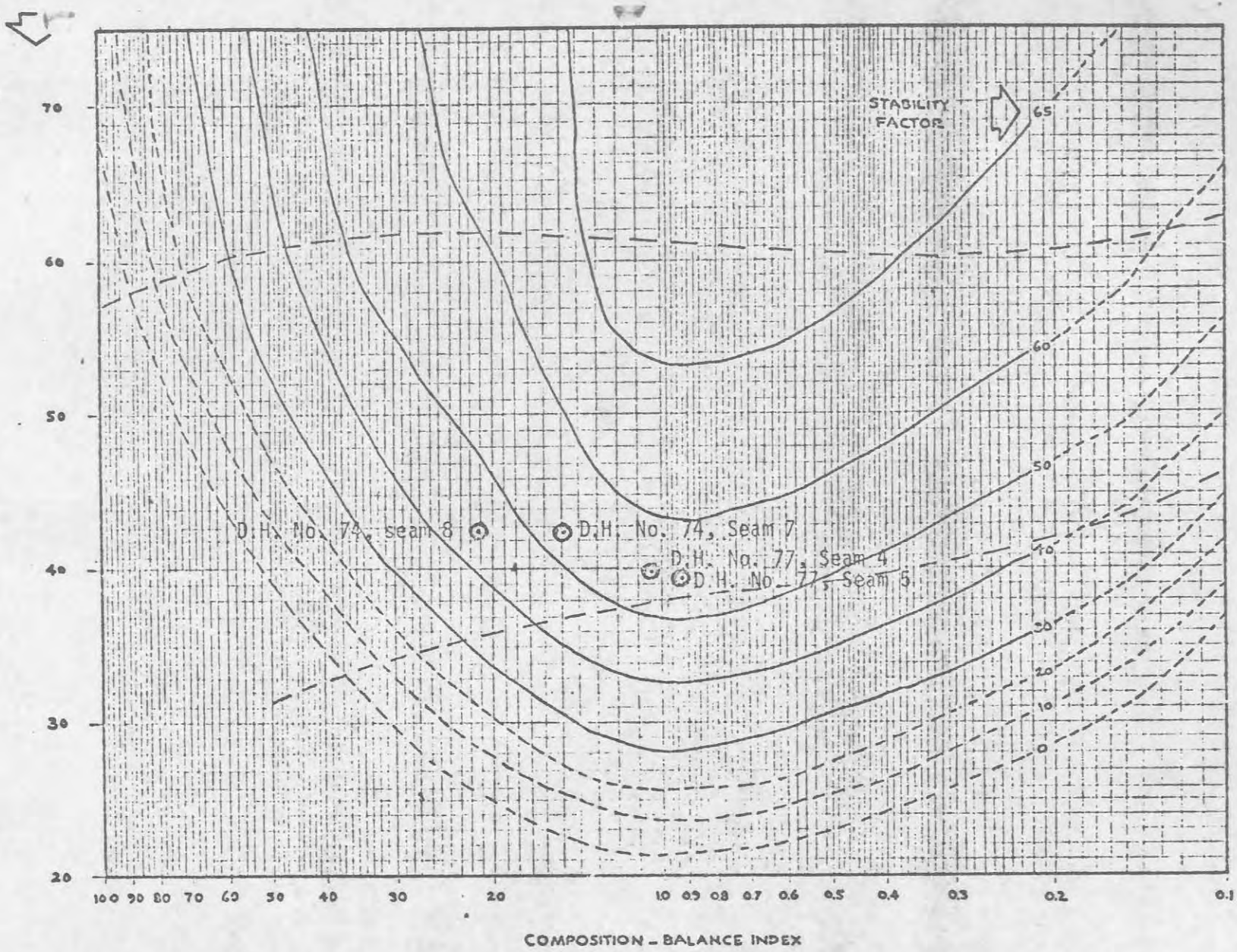

FIGURE 1. Potential Stability Factors of Coals from D.H. 74, Seam 7, D.H. No. 74, Seam 8, D.H. No. 77, Seam 4, and D.H. No. 77, Seam 5.

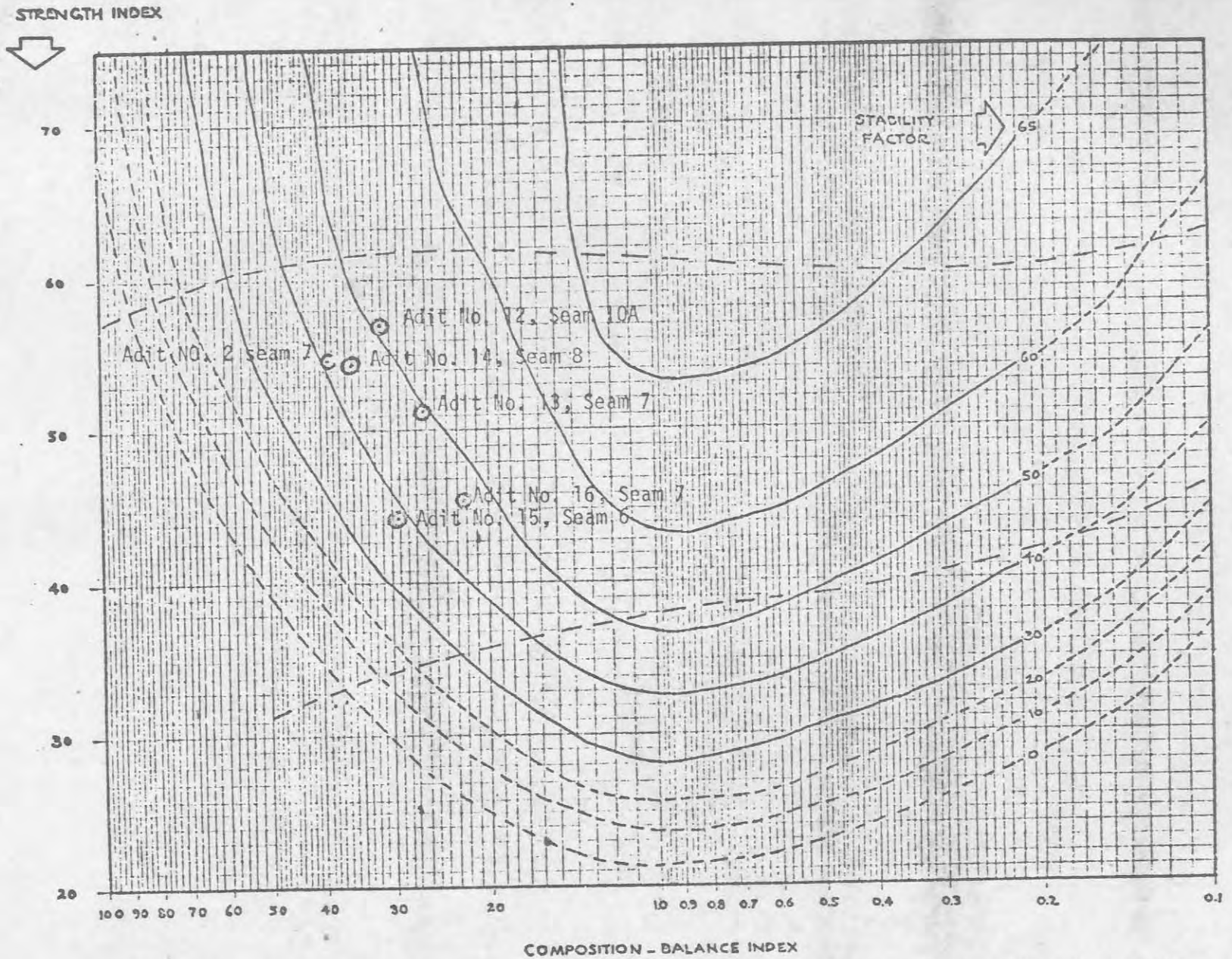

FIGURE 2. Potential Stability Factors of coals from Adit No. 16, Seam 7, Adit No. 12 Seam 10A Adit No. 13 Seam 7, Adit 15 Seam 6, Adit No. 14 Seam 8 and Adit No. 2 Seam 7

TABLE 11

Analyses of Component Coals
(Project No. 03-3-1/11-3)

Identification										
Laboratory Number	3139-70	3140-70	3199-70	3378-70	2137-71	2238-71	2239-71	2372-71	2396-71	2460-71
Description	D.H. No 74 Seam 7	D.H. No 74 Seam 8	D.H. No 77 Seam 4	D.H. No 77 Seam 5	Adit No 16 Seam 7	Adit No 12 Seam 1A	Adit No 13 Seam 7	Adit No 15 Seam 6	Adit No 14 Seam 8	Adit No 2 Seam 7
Classification										
Rank (ASTM)	mvb	mvb	mvb	mvb	mvb	mvb	mvb	mvb	mvb	mvb
Specific Volatile Index	178	185	180	177	182	196	189	180	184	183
Volatile Matter (dmmfb)..%	28.6	24.7	29.1	29.1	25.4	22.9	23.9	24.8	23.4	24.1
Carbon (dmmfb)..%	87.5	89.3	87.9	87.5	89.6	90.6	89.9	88.0	89.6	88.9
Proximate Analysis (db)										
Ash..%	8.5	10.2	7.3	6.6	10.1	12.6	7.8	8.1	10.2	11.0
Volatile Matter..%	26.8	22.9	27.5	27.7	23.6	21.0	22.7	23.5	21.8	22.3
Fixed Carbon..%	64.7	66.9	65.2	65.7	66.3	66.4	69.5	68.4	68.0	66.7
Gross Calorific Value (db)										
Btu per pound	15,450	15,500	15,550	15,440	15,450	15,671	15,541	15,375	15,421	15,412
Ultimate Analysis (db)										
Carbon..%	79.3	79.4	80.9	81.6	79.6	78.1	82.1	80.0	79.6	78.2
Hydrogen..%	4.5	4.3	4.8	4.8	4.4	4.2	4.5	4.4	4.3	4.3
Sulphur..%	0.52	0.23	0.30	0.57	0.61	0.62	0.51	0.77	0.58	0.48
Nitrogen..%	1.2	1.1	1.3	1.3	1.1	0.8	1.4	1.2	1.0	0.04
Ash..%	8.5	10.2	7.3	6.6	10.1	12.6	7.8	8.1	10.2	11.0
Oxygen (by difference)..%	6.0	4.8	5.4	5.1	4.2	3.7	3.7	5.5	4.3	6.1
Ash Analysis (db)										
SiO_2..%	57.5			55.0	54.1	59.2		53.8	55.2	53.7
Al_2O_3..%	35.0			32.7	35.9	36.0		35.7	35.0	37.3
Fe_2O_3..%	2.1			2.4	3.4	1.9		5.9	2.8	1.3
TiO_2..%	1.2			1.6	1.7	1.7		1.3	1.3	1.4
P_2O_5..%	1.2			3.1	2.5	0.2		0.8	2.5	2.1
CaO..%	2.1			2.9	2.3	1.1		0.5	2.4	2.2
MgO..%	0.7			2.0	0.1	0.0		0.5	0.0	0.0
SO_3..%	0.0			-	0.4	0.7		0.8	0.8	0.5
Na_2O..%	0.3			0.1	0.4	0.2		0.4	0.5	0.2
K_2O..%	1.6			0.3	0.4	0.4		0.5	0.6	0.1
Grindability										
Hardgrove Index	87	77	78	80	82	93	85	77	76	77
Coal Pulverization										
Total Passing 1/8 in..%	97.3	91.4	92.9	98.3	89.2	92.3	77.1	90.0	82.5	89.7

TABLE 12

Thermal Rheological Properties
(Project No. 03-3-1/11-3)

Identification										
Laboratory Number	3139-70	3140-70	3199-70	3378-70	2137-71	2238-71	2239-71	2372-71	2396-71	2460-71
Description	D.H. No 74 Seam 7	D.H. No 74 Seam 8	D.H. No 77 Seam 4	D.H. No 77 Seam 5	Adit No 16 Seam 7	Adit No 12 Seam 10A	Adit No 13 Seam 7	Adit No 15 Seam 6	Adit No 14 Seam 8	Adit No 2 Seam 7
Linear Expansion										
Bd. 52 lb/ft³ at 2% moisture....%	-10.4	-14.8	-	-	-10.9	-	-	-10.0	-	-14.0
Gieseler Plasticity										
Start....°C	421	444	419	420	433	444	456	-	457	449
Fusion Temp....°C	435	-	434	434	448	470	-	-	-	-
Max. Fluid Temp....°C	452	460	454	456	466	470	466	460	465	460
Final Fluid Temp....°C	480	466	479	478	488	491	486	-	475	470
Solidification Temp....°C	485	483	481	488	489	493	490	480	489	486
Melting Range....°C	43	1.9	68	83	24	5.4	1.8	0.9	1.5	1.7
Max. Fluidity....dd/m	59	22	60	58	55	47	30	-	18	21
Total....dd	263	16	428	538	178	47	16	9	13	17
Dilatation										
Ti - Softening Temp....°C	386	414	412	404	406	407	416	425	434	422
Tii - Max. Contraction Temp....°C	429	459	417	446	452	458	467	509	500	464
Tiii - Max. Dilatation Temp....°C	467	459	476	476	479	482	467	509	500	464
Contraction....%	30	28	30	28	29	24	23	21	23	22
Dilatation....%	47	NIL	46	66	11	-17	NIL	NIL	NIL	NIL
Free Swelling Index	8	4½	8	8+	7	5	3½	3½	3½	4

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The authors are grateful to the Fuels Research Centre for the chemical analyses of the coal sample.

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