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MOVABLE-WALL COKE OVEN TESTS AND RELATED ANALYSES OF
COAL BLEND SAMPLES FROM EWIN PASS SUBMITTED BY
CROWS NEST RESOURCES LIMITED

Project 03-3-1/11-5
(Job No. 3238R)

J.G. JORGENSEN, T.A. LLOYD AND W. GARDINER
COAL RESOURCE AND PROCESSING LABORATORY

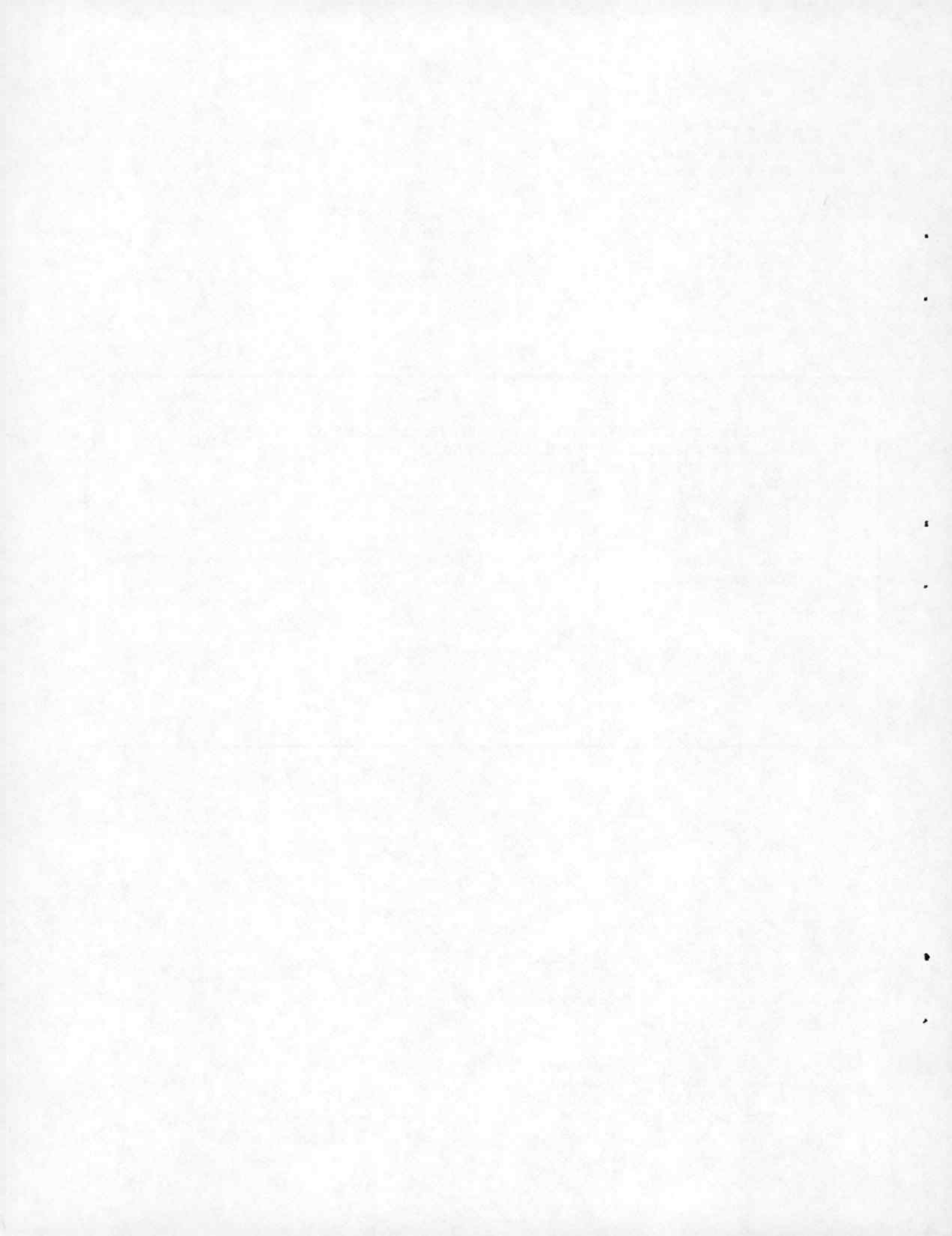
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by

J.G. Jorgensen*, T.A. Lloyd*, and W. Gardiner*

INTRODUCTION

This investigation deals with the carbonization and related analyses of cleaned coal blend samples composed of Seam 4, Seam 8 and Seam 9 from Ewin Pass. Duplicate coking tests were conducted on a clean coal blend composed of 66.7% of Seam 8 and 33.3% of Seam 4. This sample was received on May 7, 1980. Duplicate coking tests were also conducted on a clean coal blend composed of 57.1% of Seam 8, 28.6% of Seam 4 and 14.3% of Seam 9.

The project was initiated by R. Crisafio, Senior Metallurgist, Crows Nest Resources Limited, Fernie, British Columbia in a letter dated November 15, 1979, which is reproduced in Appendix 1.

The cleaned bulk samples were carbonized in the 12-inch width movable-wall coke oven located at the CANMET Bells Corners Complex near Ottawa. Representative samples were taken and analysed for chemical analysis, thermal rheological and petrographical properties. The results of the testing and analyses are listed in Tables 1 to 6.

*Heads, Coal Petrography, Coal Treatment, and Carbonization Operations Sections, respectively, Coal Resource and Processing Laboratory, Energy Research Laboratories, CANMET, Department of Energy, Mines and Resources, Ottawa, Canada.

TABLE 1 Chemical Analyses of Component Coals

<u>Identification</u>	
Laboratory Number	3178-80
Description	Clean Coal Blend 66.7% Seam 8 33.3% Seam 4
<u>Classification</u>	
Rank (ASTM)	mvb
International System	533
Specific Volatile Index	177
Carbon (dmmfb)	89.0
<u>Proximate Analysis (db)</u>	
Ash	7.0
Volatile Matter	28.3
Fixed Carbon	64.7
<u>Gross Calorific Value (db)</u>	
Btu per pound	14270
<u>Ultimate Analysis (db)</u>	
Carbon	82.1
Hydrogen	5.0
Sulphur	0.43
Nitrogen	1.5
Ash	7.0
Oxygen (by difference)	4.0
<u>Ash Analysis (db)</u>	
SiO ₂	52.1
Al ₂ O ₃	29.9
Fe ₂ O ₃	7.8
TiO ₂	1.7
P ₂ O ₅	1.2
CaO	1.9
MgO	0.9
SO ₃	1.1
Na ₂ O	0.3
K ₂ O	0.9

TABLE 2 Physical Tests and Fusibility of Ash of Component Coals

<u>Identification</u>			3178-80	3212-80	3665-80
Laboratory Number			Clean Coal		
Description			Blend		
			Tests 776	Test 777	Test 790
			& 778		
	Seam #8		66.7%	57.1%	57.1%
<u>Coal Pulverization</u>	Seam #4		33.3%	28.6%	28.6%
	Seam #9			14.3%	14.3%
<u>Sieve Analysis</u>					
<u>Passing</u>		<u>Retained On</u>			
	1/4 in.	1/4 in.	%	0.1	0.1
	6 mesh	6 mesh	%	14.8	14.3
	12 mesh	12 mesh	%	20.8	20.8
	20 mesh	20 mesh	%	19.9	20.9
	%	44.4	43.9
Total Passing	6 mesh	6 mesh	%	85.1	85.6
<u>Grindability</u>					
Hardgrove Index					
<u>Fusibility of Ash</u>					
Initial Deformation Temp. ...		°F	2580		
Softening Temp. Spherical ...		°F	2680		
Softening Temp. Hemispherical		°F	2700+		
Fluid Temp.		°F	2700+		

TABLE 3 Thermal Rheological Properties of Component Coals

<u>Identification</u>				
Laboratory Number	3178-80	3212-80	3665-80	
Description	Tests 776 and 778	Test 777	Test 790	
	66.7% Seam 8	57.1% Seam 8	57.1% Seam 8	
	33.3% Seam 4	28.6% Seam 4	28.6% Seam 4	
		14.3% Seam 9	14.3% Seam 9	
<u>Linear Expansion</u>				
Bd. 52 lb/ft ³ at 2% moisture...%				
<u>Gieseler Plasticity</u>				
Start	°C 426	433	429	
Fusion Temp.	°C 438	447	445	
Max. Fluid Temp.	°C 460	464	460	
Final Fluid Temp.	°C 484	479	477	
Solidification Temp.	°C 487	483	481	
Melting Range	°C 58	46	68	
Max. Fluidity	dd/m 161.5	24.5	24	
Torque	g.in. 40	40	40	
<u>Dilatation</u>				
Ti - Softening Temp.	°C 397	402	399	
Tii - Max. Contraction Temp.	°C 442	448	447	
Tiii - Max. Dilatation Temp.	°C 470	474	470	
Contraction	% 27	25	26	
Dilatation	% 48	-4	-9	
<u>Free Swelling Index</u>				
F.S.I.	8	8	8	

TABLE 4 Petrographic Analysis of Component CoalsIdentification

Laboratory Number.....	3178-80
Description.....	Blend of
	66.7% Seam 8
	33.3% Seam 4

Distribution of Vitrinite Types

V-6.....%	
V-7.....%	
V-8.....%	
V-9.....%	0.7
V-10.....%	43.3
V-11.....%	26.7
V-12.....%	1.4
V-13.....%	
V-14.....%	
V-15.....%	
V-16.....%	
V-17.....%	
V-18.....%	

Reactive Components

Total Vitrinite.....%	72.2
Reactive Semi-fusinite (1/3).....%	4.8
Exinite.....%	1.5
Total.....%	78.5

Inert Components

Inert Semi-fusinite (2/3).....%	9.6
Micrinite.....%	1.8
Fusinite.....%	6.2
Mineral Matter.....%	3.9
Total.....%	21.5

Petrographic Indices

Mean Reflectance.....%	1.08
Balance Index.....	0.79
Strength Index.....	4.08
Stability Index.....	56.0

TABLE 5 - Carbonization Data

Test Identification Number.....	776	778	777	790				
Data of Test.....	13 May/80	21 May/80	15 May/80	9 July/80				
Laboratory Number.....								
Description.....								
Blend of Seam #8 ...	66.7%	66.7%	57.1%	57.1%				
Seam #4 ...	33.3%	33.3%	28.6%	28.6%				
Seam #9 ...			14.3%	14.3%				
<u>CARBONIZATION DATA</u>								
Net Weight of Charge (wet).....lb	556.0	551.5	567.0	555.2				
Moisture in Charge.....%	2.5	2.7	2.6	3.0				
ASTM Bulk Density (wet).....lb/ft ³								
Oven Bulk Density (db).....lb/ft ³	49.4	48.9	50.3	49.0				
<u>CARBONIZATION RESULTS</u>								
Gross Coking Time.....hr:min	9:05	9:10	8:55	9:05				
Maximum Wall Pressure.....lb/in ²	N.A.	1.22	2.02	1.16				
Coke Yield Actual.....%	75.6	75.6	76.7	75.8				
Mean Coke size.....in	1.93	1.93	1.90	1.87				
Apparent Specific Gravity.....	0.903	0.908	0.924	0.924				
<u>Screen Analysis of Coke</u> (cumulative percentage retained on)								
3 inch sieve.....	4.1	5.3	4.1	4.4				
2 inch sieve.....	41.2	40.1	40.0	36.0				
1 1/2 inch sieve.....	73.8	74.1	70.0	71.0				
1 inch sieve.....	93.8	94.0	93.3	93.5				
3/4 inch sieve.....	95.8	95.9	95.7	96.0				
1/2 inch sieve.....	96.9	97.0	96.7	96.7				
Percentage -1/2 inch (breeze).....	3.1	3.0	3.3	3.3				
<u>Tumbler Test (ASTM)</u>								
Stability Factor.....	49.5	51.1	48.6	50.5				
Hardness Factor.....	65.7	65.5	66.5	67.4				
<u>Japanese Drum Test (JIS)</u> (cumulative percentage retained on)								
	*	**	*	**	*	**	*	**
50 mm sieve.....	9.8	1.6	8.5	1.2	7.6	1.0	9.2	0.8
25 mm sieve.....	85.3	68.4	85.1	68.0	82.9	63.5	83.1	63.1
15 mm sieve.....	92.8	81.4	93.0	81.5	93.1	81.1	93.2	80.7
	*30 revs		**150 revs					

TABLE 6

Analyses of Coke Oven Charges and Resultant Cokes

<u>Identification</u>				
Test Number.....	776	778	777	790
Date Charged.....	13/5/80	21/5/80	14/5/80	5/7/80
Description.....				
Blend of Seam #8	66.7	66.7	57.1	57.1
Seam #4	33.3	33.3	28.6	28.6
Seam #9			14.3	14.3
<u>Coke Oven Charge</u>				
Laboratory Number.....	3178-80	3178-80	3212-80	3665-80
Proximate Analysis (db)				
Ash.....%	7.0	7.0	7.0	7.4
Volatile Matter.....%	28.3	28.3	27.0	27.3
Fixed Carbon	64.7	64.7	66.0	65.3
Sulphur (db).....%	0.43	0.43	0.33	0.35
<u>Resultant Coke</u>				
Laboratory Number.....	3230-80	3557-80	3231-80	3815-80
Proximate Analysis (db)				
Ash.....%	9.0	9.0	9.3	9.6
Volatile Matter.....%	1.2	1.7	1.3	1.1
Fixed Carbon.....%	89.8	89.3	89.4	89.3
Sulphur (db).....%	0.32	0.28	0.31	0.29

STRENGTH INDEX

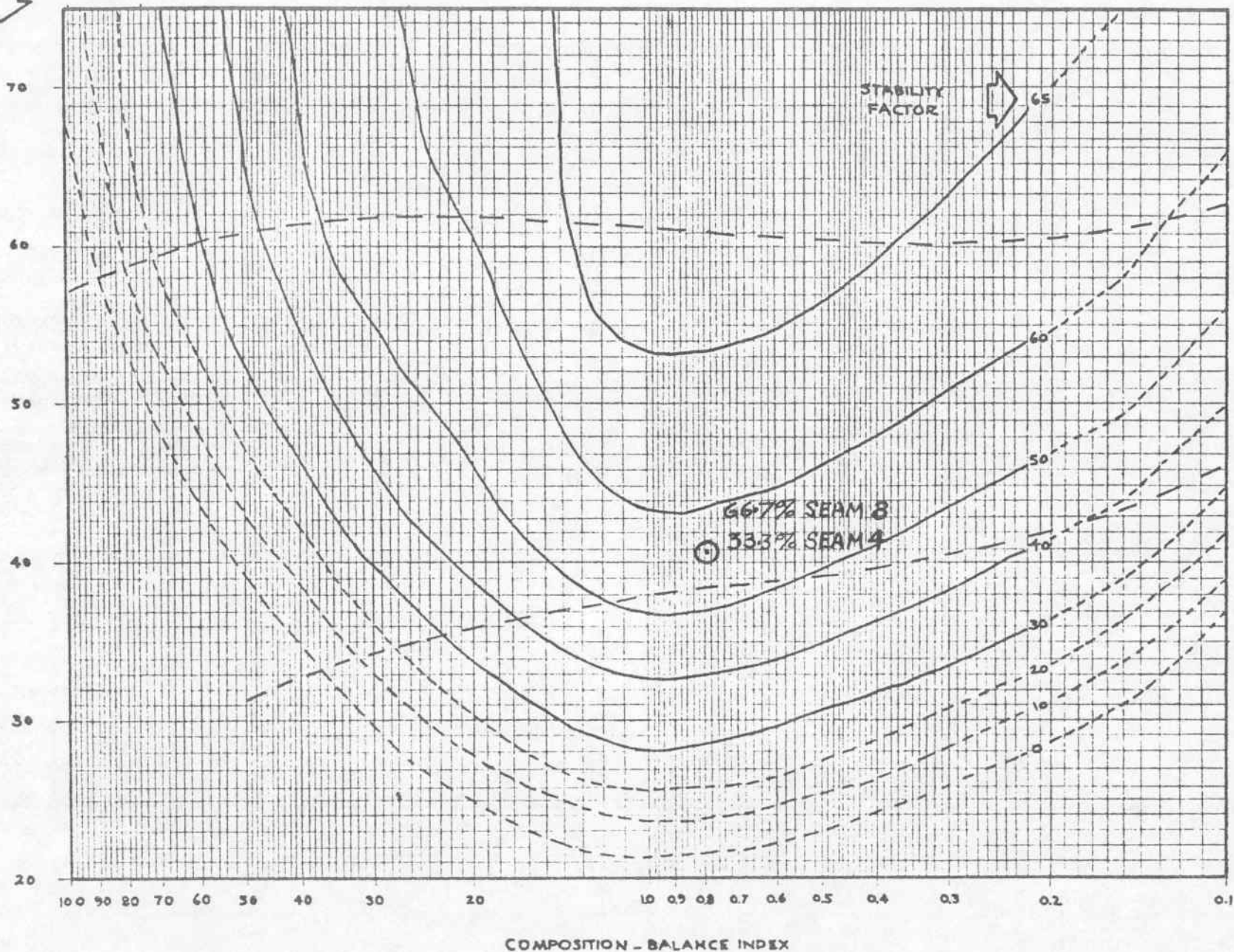
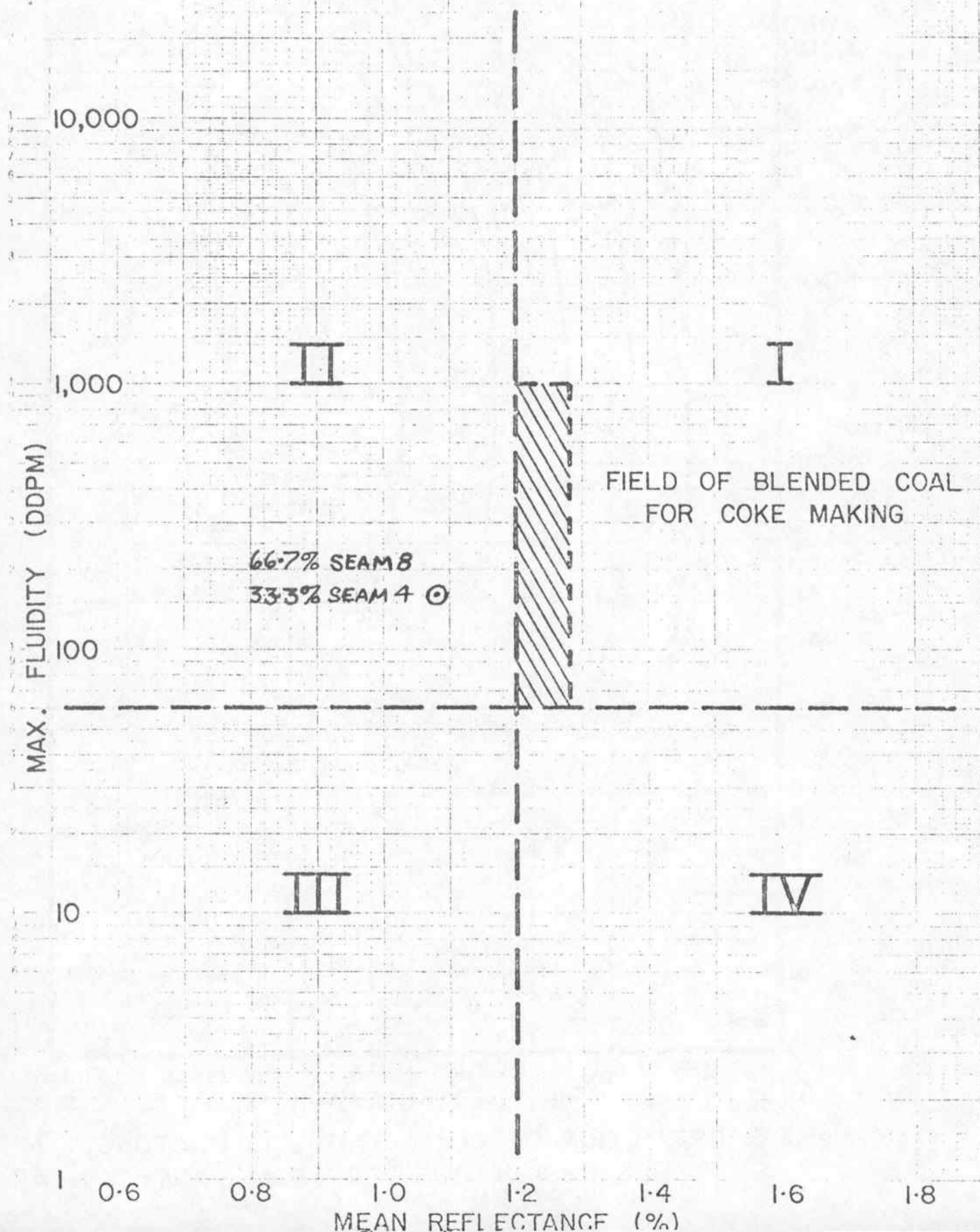


Figure 1. Predicted Stability Factor from Petrographic Data of a Clean Coal Blend of Seam 8 and Seam 4.

Figure 2 . RELATIONSHIP BETWEEN MAX. FLUIDITY AND MEAN REFLECTANCE .



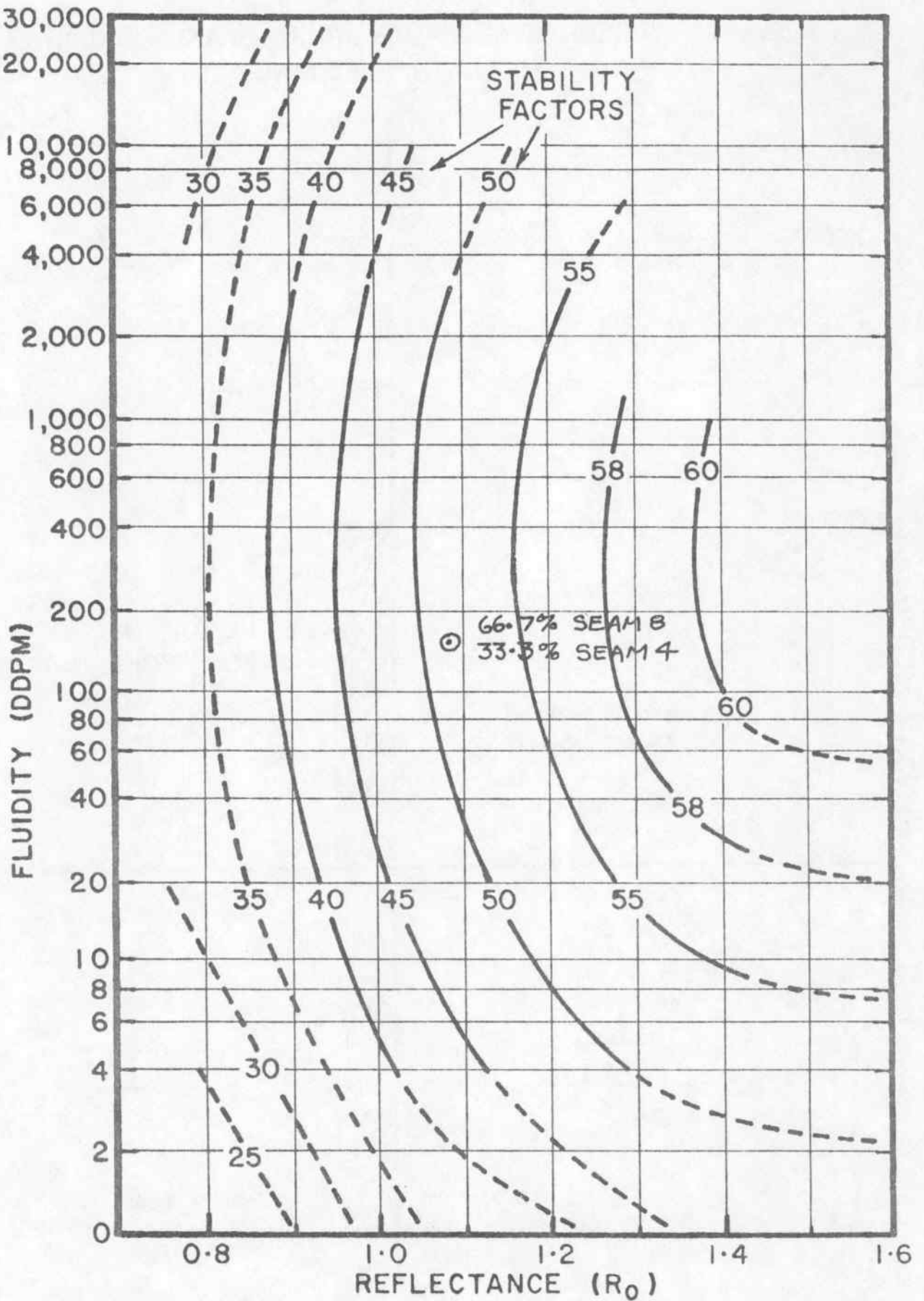


Figure 3. PREDICTION OF COKE STABILITY FACTORS.
- REGRESSION RESULTS FROM CANMET DATA
ON WESTERN CANADIAN COALS.

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Letter dated November 15, 1979 from R. Crisafio, Senior Metallurgist, Crows Nest Resources Limited.



Crows Nest Resources

P.O. Box 250, Fernie, British Columbia V0B 1M0 (604) 423-4464

LIMITED

November 15, 1979

Dr. W.R. Leeder
Western Research Lab
C/O Alberta Research Council Bldg.
Highway 10 East
Clover Bar
Edmonton, Alberta

Dear Dr. Leeder:

Relative to our phone conversation 15 November, 1979, you will receive from Birtley Coal Testing the following samples from "Ewin Pass" in the Upper Elk Coal Fields.

Adit 1, Adit 2, Adit 3 - 4 drums from each

I would request a complete set of tests to be conducted such as proximate, ultimate, ash analysis, B.T.U., rheology, carbonization drum tests, sole heated oven, hardgrove and such other data, as screen analysis, as may be derived during the testing procedures

I would also request a confidentiality period of two years because of possible marketing implications.

The need for this information is not pressing, so that you can schedule the tests at your earliest convenience.

Yours truly,

R. Crisafio
Metallurgist

PC: J. Jorgensen - Head Petrographer
E.M.R. Ottawa
J.J. Crabb
D. Riva

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