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MOVABLE-WALL COKE OVEN TESTS AND RELATED ANALYSIS
OF SEVEN CLEANED COAL SAMPLES FROM THE
COAL CREEK EXPLORATION PROJECT
SUBMITTED BY WESTAR MINING LTD

Project No. 03-3-1/16-45 PART A
Job No. 3447R

J. G. Jorgensen and T. A. Lloyd
Energy Research Laboratories

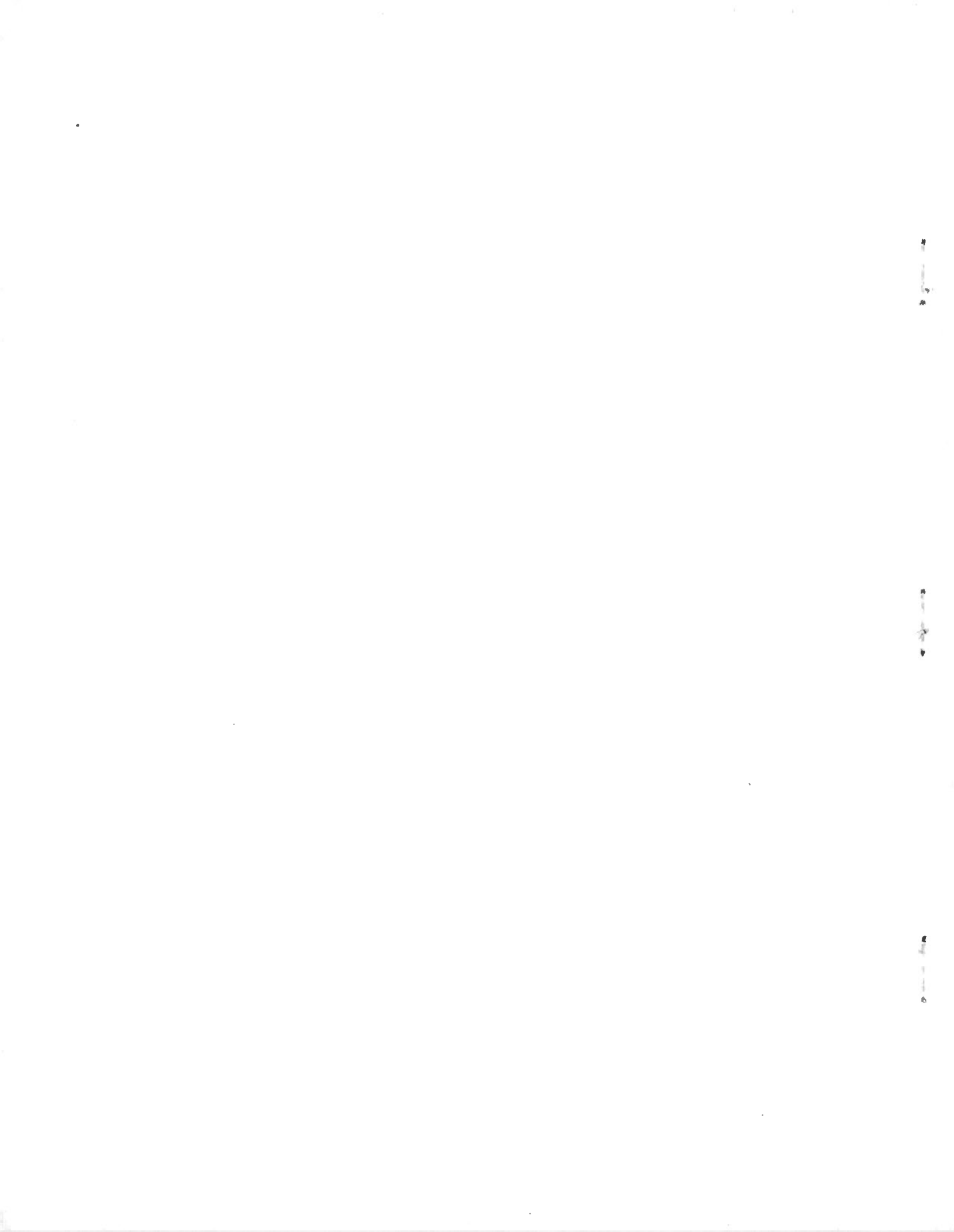
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by

J.G. Jorgensen* and T.A. Lloyd**

SUMMARY

The evaluation of coals for Westar Mining is a continuing divisional project in which periodic investigations are undertaken as requested by the company.

This investigation includes evaluation data on the following cleaned coal samples from the Coal Creek Exploration Project:

- | | | |
|----|--------|------------------|
| 1. | Adit 2 | No. 10 Seam |
| 2. | Adit 4 | No. 9 Seam North |
| 3. | Adit 5 | No. 9 L-3 Seam |
| 4. | Adit 6 | No. 9 U Seam |
| 5. | Adit 7 | No. 10 Seam |
| 6. | Adit 8 | No. 9 L-3 Seam |
| 7. | Adit 3 | No. 8 Seam |

The project was initiated in a letter dated October 4, 1983 from L.B. Samulson, P.Eng., Westar Mining Ltd. A copy of this letter appears in Appendix 1.

The cleaned coal samples received from Birtley Coal and Mineral Testing, Calgary, were crushed, blended and carbonized in the 310-mm wide CANMET movable-wall oven. Representative samples were taken for chemical, physical, thermal rheological and petrographical analyses. The results of the testing program are tabulated in Tables 1 to 12.

*Petrographer and **Head, Coal Treatment and Coke Processes, Combustion and Carbonization Research Laboratory, Energy Research Laboratories, CANMET, Energy, Mines and Resources Canada, Ottawa, K1A 0G1.

ESSAIS EN FOUR À COKE À PAROIS MOBILES ET ANALYSES
SE RAPPORTANT À CES ESSAIS, CONDUITS SUR SEPT ÉCHANTILLONS DE
CHARBON ÉPURÉS, OBTENUS DANS LE CADRE DU PROJET D'EXPLORATION
DE COAL CREEK SOUMIS PAR LA WESTAR MINING LTD.

Projet N^o 03-3-1/16-45

Tâche N^o 3447R

par

J.G. Jorgensen* et T.A. Lloyd**

SOMMAIRE

L'évaluation de charbons à l'intention de la Westar Mining est un projet continu de la Division, au cours duquel on entreprend des enquêtes périodiques chaque fois que l'exige la compagnie.

Cette étude comprend les données de l'évaluation d'échantillons suivants de charbon épuré obtenus dans le cadre du projet d'exploration de Coal Creek.

*Pétrographe et **Chef, Traitement du charbon et du coke, Laboratoire de recherches sur la combustion et la carbonisation, Laboratoires de recherche sur l'énergie (CANMET), Energie, Mines et Ressources Canada, Ottawa K1A 0G1

1.	Fendue #2	Filon N ^o 10
2.	Fendue #4	Filon nord N ^o 9
3.	Fendue #5	Filon N ^o 9 L-3
4.	Fendue #6	Filon N ^o 9 U
5.	Fendue #7	Filon N ^o 10
6.	Fendue #8	Filon N ^o 9 L-3
7.	Fendue #3	Filon N ^o 8

Le projet a été entrepris à la suite de la réception d'une lettre datée du 4 octobre 1983 et rédigée par L.B. Samulson, ingénieur de la Westar Mining Ltd. Un exemplaire de cette lettre figure à l'annexe 1.

Les échantillons de charbon épuré expédiés par la Birtley Coal and Mineral Testing de Calgary ont été broyés, mélangés et carbonisés dans le four à parois mobiles de 310 mm de large, du CANMET. On a prélevé des échantillons représentatifs pour les soumettre à des analyses chimiques, physiques et pétrographiques et à des essais thermiques et rhéologiques. On présente sous forme de tableaux les résultats du programme expérimental (Tableaux 1 à 12)

CONTENTS

	<u>Page</u>
SUMMARY	1
SOMMAIRE.....	11
BIBLIOGRAPHY	17
APPENDIX 1	18

TABLES

<u>No.</u>		
1.	Chemical analysis of component coal	1
2.	Chemical analysis of component coal	2
3.	Physical tests and fusibility of ash of component coal	3
4.	Physical tests and fusibility of ash of component coal.	4
5.	Thermal rheological properties of component coal	5
6.	Thermal rheological properties of component coal	6
7.	Petrographic analysis of component coal ...	7
8.	Petrographic analysis of component coal ...	8
9.	Carbonization condition:	9
10.	Coke properties	10
11.	Carbonization conditions	11
12.	Coke properties	12

FIGURES

1.	Plot of the stability factors of the component coals from petrographic data.....	13
2.	Plot of the stability factors of the component coals from petrographic data.....	14
3.	Relationship between max. fluidity and mean reflectance	15
4.	Prediction of coke stability factors - regression results from CANMET data on Western Canadian coals	16

Table 1 - Chemical analyses of component coal

<u>Identification</u>					
Laboratory number.....	2196-84	2198-84	2199-84	2200-84	2201-84
Description.....	Adit 2 No. 10 Seam	Adit 4 No. 9 Seam North	Adit 5 No. 9 L-3 Seam	Adit 6 No. 9 U Seam	Adit 7 No. 10 Seam
<u>Classification</u>					
Rank (ASTM).....	mvb	mvb	mvb	mvb	mvb
International system.....	434	434	434	434	534
Specific volatile index....	199	198	199	191	192
Carbon (dmmfb).....%					
<u>Proximate analysis (db)</u>					
Ash.....%	6.7	6.6	6.2	5.7	9.8
Volatile matter.....%	23.6	23.5	23.3	26.3	27.4
Fixed carbon.....%	69.7	69.9	70.5	68.0	62.8
<u>Gross calorific value (db)</u>					
MJ/kg.....	34.13	34.08	34.25	34.34	32.89
Btu/per pound.....	14675	14650	14725	14765	14140
<u>Ultimate analysis (db)</u>					
Carbon.....%					
Hydrogen.....%					
Sulphur.....%	0.39	0.63	0.45	0.38	0.36
Nitrogen.....%					
Ash.....%					
Oxygen (by difference)....%					
<u>Ash analysis (db)</u>					
SiO ₂%	49.4	50.0	49.5	44.7	52.8
Al ₂ O ₃%	27.8	25.0	24.0	23.6	24.8
Fe ₂ O ₃%	4.4	3.9	4.8	8.3	3.8
TiO ₂%	1.7	1.5	1.8	1.4	1.5
P ₂ O ₅%	2.7	6.6	5.3	3.2	1.2
CaO.....%	4.5	6.8	6.2	7.1	4.7
MgO.....%	0.8	-	-	1.7	0.8
SO ₃%	3.7	2.0	2.8	5.9	4.7
Na ₂ O.....%	1.8	0.6	0.4	1.3	1.5
K ₂ O.....%	1.0	0.8	1.0	0.7	1.4

Table 2 - Chemical analyses of component coal.

<u>Identification</u>		
Laboratory number.....	2202-84	2205-84
Description.....	Adit 8 No. 9L-3 Seam	Adit 3 No. 8 Seam
<u>Classification</u>		
Rank (ASTM).....	mvb	mvb
International system.....	434	434
Specific volatile index....	196	198
Carbon (dmmfb).....%		
<u>Proximate analysis (db)</u>		
Ash.....%	6.9	12.2
Volatile matter.....%	23.9	23.5
Fixed carbon.....%	69.2	64.3
<u>Gross calorific value (db)</u>		
MJ/kg.....	33.91	31.92
Btu/per pound.....	14580	13725
<u>Ultimate analysis (db)</u>		
Carbon.....%		
Hydrogen.....%		
Sulphur.....%	0.61	0.59
Nitrogen.....%		
Ash.....%		
Oxygen (by difference)....%		
<u>Ash analysis (db)</u>		
SiO ₂%	47.7	60.6
Al ₂ O ₃%	24.1	24.1
Fe ₂ O ₃%	7.8	1.9
TiO ₂%	1.4	1.9
P ₂ O ₅%	5.8	2.2
CaO.....%	5.7	2.5
MgO.....%	-	-
SO ₃%	2.2	2.2
Na ₂ O.....%	0.6	0.2
K ₂ O.....%	0.8	1.5

Table 3 - Physical tests and fusibility of ash of component coal

Identification

Laboratory number.....	2196-84	2198-84	2199-84	2200-84	2201-84
Description.....	Adit 2 No. 10 Seam	Adit 4 No. 9 Seam North	Adit 5 No. 9 L-3 Seam	Adit 6 No. 9 U Seam	Adit 7 No. 10 Seam

Coal Pulverization

Sieve analysis

<u>Passing</u>	<u>Retained On</u>						
	6.3 mm	%	0.1	0.1	0.1	0.1	0.1
6.3 mm	3.35 mm	%	10.3	13.1	10.8	10.7	10.4
3.35 mm	1.70 mm	%	15.1	17.8	18.9	16.8	15.5
1.70 mm	859 μm	%	16.0	18.6	21.5	18.8	17.2
850 μm	%	58.5	50.4	48.7	53.6	56.8
Total passing	3.35 mm	%	89.6	86.8	89.1	89.2	89.5

Grindability

Hardgrove index	115	101	93	79	91
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Fusibility of ash

Initial deformation temp	1249	1213	1185	1196	1268
Softening temp. spherical.....	1429	1277	1243	1221	1404
Softening temp. hemispherical...	1482+	1435	1382	1338	1457
Fluid temp	1482+	1474	1421	1377	1482

Table 4 - Physical tests and fusibility of ash of component coals

Identification

Laboratory number.....	2202-84	2205-84
Description.....	Adit 8	Adit 3
	No. 9L-3	No. 8
	Seam	Seam

Coal Pulverization

Sieve analysis

<u>Passing</u>	<u>Retained On</u>		
	6.3 mm	%	0.2
	3.35 mm	%	0.1
6.3 mm	3.35 mm	%	12.5
3.35 mm	1.70 mm	%	9.7
1.70 mm	859 μm	%	17.1
850 μm	%	17.9
			52.3
			59.5
Total passing	3.35 mm	%	87.3
			90.2

Grindability

Hardgrove index	91	112
-----------------------	----	-----

Fusibility of ash

Initial deformation temp	1177	1346
Softening temp. spherical.....	1232	1482+
Softening temp. hemispherical...	1377	1482+
Fluid temp	1407	1482+

Table 5 - Thermal rheological properties of component coal

Identification

Laboratory number.....	2196-84	2198-84	2199-84	2200-84	2201-84
Description.....	Adit 2 No. 10 Seam	Adit 4 No. 9 Seam North	Adit 5 No. 9 L-3 Seam	Adit 6 No. 9 U Seam	Adit 7 No. 10 Seam

Linear Expansion

833 kg/m³ at 2% moisture.....%

Gieseler plasticity

Start.....°C	424	428	425	419	412
Fusion temp°C	439	441	439	435	426
Max fluid temp°C	465	465	464	456	455
Final fluid temp°C	493	496	492	489	488
Solidification temp°C	498	501	495	493	493
Melting range°C	69	68	67	70	76
Max fluidity.....dd/m	230	310	215	510	1240

Dilatation

Ti - Softening temp°C	396	399	393	392	383
Tii - Max contraction temp...°C	444	444	444	439	432
Tiii - Max dilatation temp....°C	479	477	477	474	474
Contraction.....%	26	28	30	27	28
Dilatation%	86	102	74	109	135

Free swelling index

F.S.I.	9	9	9	8.5	8.5
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Table 6 - Thermal rheological properties of component coals

Identification

Laboratory number.....	2202-84	2205-84
Description.....	Adit 8	Adit 3
	No. 9L-3	No. 8
	Seam	Seam

Linear Expansion

Bd 833 kg/m³ at 2% moisture...%

Gieseler plasticity

Start.....°C	429	421
Fusion temp°C	443	435
Max fluid temp°C	465	468
Final fluid temp°C	493	496
Solidification temp°C	497	499
Melting range°C	64	75
Max fluidity.....dd/m	200	500

Dilatation

T _i - Softening temp°C	400	396
T _{ii} - Max contraction temp...°C	442	437
T _{iii} - Max dilatation temp....°C	477	477
Contraction.....%	24	23
Dilatation%	84	139

Free swelling index

F.S.I.	8.5	9
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Table 7 - Petrographic analysis of component coals

<u>Identification</u>	2196-84	2198-84	2199-84	2200-84	2201-84
Laboratory number.....	Adit 2	Adit 4	Adit 5	Adit 6	Adit 7
Description	No. 10	No. 9	No. 9 L-3	No. 9 U	No. 10
	Seam	Seam	Seam	Seam	Seam
<u>Distribution of vitrinite types</u>					
V-6.....%					
V-7.....%					
V-8.....%					
V-9.....%		0.2		1.0	7.0
V-10.....%	1.2	0.5	0.2	28.1	41.1
V-11.....%	19.8	27.5	12.3	36.0	23.1
V-12.....%	45.2	38.1	56.0	3.8	0.9
V-13.....%	3.3	2.9	3.0		
V-14.....%					
V-15.....%					
V-16.....%					
V-17.....%					
V-18.....%					
<u>Reactive components</u>					
Total vitrinite.....%	69.7	69.2	71.7	68.8	72.0
Reactive semi-fusinite (1/3)....%					5.0
Reactive semi-fusinite (1/2)....%	10.4	10.2	9.9	10.8	
Exinite.....%	0.0	0.2	0.0	0.4	1.2
Total.....%	80.1	79.6	81.6	80.0	78.2
<u>Inert components</u>					
Inert semi-fusinite (2/3).....%					10.0
Inert semi-fusinite (1/2).....%	10.4	10.2	9.9	10.8	
Micrinite.....%	1.7	2.1	2.7	1.5	2.6
Fusinite.....%	4.1	4.4	2.4	4.6	3.7
Mineral matter.....%	3.7	3.7	3.4	3.1	5.5
Coke.....%					
Total.....%	19.9	20.4	18.4	20.0	21.8
<u>Petrographic indices</u>					
Mean reflectance.....%	1.22	1.21	1.23	1.11	1.07
Balance index.....	.95	.95	.90	.75	.78
Strength index.....	4.74	4.72	4.76	4.23	4.02
Stability index.....	62.1	62.0	62.3	58.0	55.1

Table 3 - Petrographic analysis of component coals

<u>Identification</u>		
Laboratory Number.....	2202-84	2205-84
Description	Adit 8	Adit 3
	No. 9L-3	No. 8
	Seam	Seam
<u>Distribution of Vitrinite Types</u>		
V-6.....%		
V-7.....%		
V-8.....%		
V-9.....%		
V-10.....%	2.0	0.8
V-11.....%	34.7	22.1
V-12.....%	34.2	53.9
V-13	0.7	2.8
V-14.....%		
V-15.....%		
V-16.....%		
V-17.....%		
V-18.....%		
<u>Reactive Components</u>		
Total Vitrinite.....%	71.6	79.6
Reactive Semi-fusinite (1/3)....%	6.2	3.5
Reactive Semi-fusinite (1/2)....%		
Exinite.....%	0.0	0.0
Total.....%	77.8	83.1
<u>Inert Components</u>		
Inert Semi-fusinite (2/3).....%	12.4	7.0
Inert Semi-fusinite (1/2).....%		
Micrinite.....%	2.0	0.7
Fusinite.....%	3.9	2.2
Mineral Matter.....%	3.9	7.0
Coke.....%		
Total.....%	22.2	16.9
<u>Petrographic Indices</u>		
Mean Reflectance.....%	1.19	1.22
Balance Index.....	1.02	.78
Strength Index.....	4.65	4.67
Stability Index.....	61.5	61.7

Table 9 - Carbonization conditions

Test identification number	1058	1070	1071	1069	1067
Date of test	15/12/83	31/1/84	1/2/84	26/1/84	24/1/84
Coke oven identification.....	12-71	12-71	12-71	12-71	12-71
Description.....	Adit 2 No. 10 Seam	Adit 4 No. 9 Seam	Adit 5 No. 9 L-3 Seam	Adit 6 No. 9 U Seam	Adit 7 No. 10 Seam

Charge Properties

Proximate analysis (db) Ash.....%	6.7	6.6	6.2	5.7	9.8
Volatile matter%	23.6	23.5	23.3	26.3	27.4
Fixed carbon.....%	69.7	69.9	70.5	68.0	62.8
Moisture in charge	2.8	3.3	3.2	3.0	2.9
Minus 3.35 mm	89.6	89.5	87.3	89.2	86.8
Other					
.....					

Carbonization conditions

Net weight of charge (wet).....kg	275.4	279.3	272.3	280.8	277.6
ASTM cone bulk density (wet).....kg/m ³	778.6	775.4	775.4	778.6	777.0
Calc. charge dry bulk density in oven... kg/m ³	812.2	820.2	801.0	826.6	818.6

Carbonization Results

Gross coking time (at Push).....h:min	10:25	10:25	10:25	10:20	9:53
Final centre temp.....°C	1045	1043	1049	1048	1050
Time to 900°C centre temp..... h:min	9:17	9:15	9:13	9:12	8:42
Time to 950°C centre temp..... h:min	9:32	9:32	9:29	9:27	8:55
Time to 1000°C centre temp..... h:min	9:52	9:52	9:49	9:45	9:15
Maximum wall pressure.....kPa	7.79	9.17	13.51	7.79	3:17
Coke yield actual	77.0	76.4	77.3	75.0	74.9

Table 10 - Coke properties

Test identification number.....	1058	1070	1071	1069	1067
<u>Screen analysis of coke</u> (cum. % retained on)					
100 mm sieve.....%	0.3	0.6	0.7	0.3	1.1
75 mm sieve.....%	5.5	7.1	7.2	6.8	10.6
50 mm sieve.....%	48.3	52.4	46.8	45.3	55.6
37.5 mm sieve.....%	78.3	81.4	76.1	75.8	78.9
25.0 mm sieve.....%	94.7	94.7	93.5	93.8	93.5
19.0 mm sieve.....%	95.7	96.0	95.6	95.8	95.6
12.5 mm sieve.....%	96.8	96.6	96.8	96.6	96.7
Total -12.5 mm (breeze).....%	3.2	3.1	3.2	3.4	3.3
Mean coke size.....mm	51.3	53.1	51.1	50.5	54.1
<u>Coke chemical analysis</u>					
Proximate analysis (db)					
Ash.....%	8.9	8.1	7.5	7.5	12.8
Volatile matter.....%	0.9	0.8	0.9	1.0	1.3
Fixed carbon.....%	90.2	91.9	91.6	91.5	85.9
Sulphur (db).....%	0.36	0.56	0.43	0.38	0.35
Coke apparent specific gravity.....	0.928	0.916	0.907	0.902	0.934
<u>ASTM coke tumbler test</u>					
Stability factor (cum. % + 25.0 mm).	58.4	53.2	52.7	52.4	45.5
Hardness factor (cum. % + 6.3 mm).	67.5	67.3	68.9	68.2	65.6
<u>JIS coke tumbler test</u> (cum. % retained on)					
30 revs: 50 mm sieve.....%	24.4	14.1	13.4	13.1	7.1
25 mm sieve.....%	90.5	87.6	85.5	85.7	81.6
15 mm sieve.....%	94.0	93.3	93.5	94.0	92.1
150 revs: 50 mm sieve.....%	4.5	0.0	0.8	1.7	0.0
25 mm sieve.....%	76.6	70.1	68.1	70.0	57.6
15 mm sieve.....%	83.3	82.1	83.7	83.3	78.4

Table 11 - Carbonization conditions

Test identification number	1068	1072
Date of test	25/1/84	2/2/84
Coke oven identification.....	12-71	12-71
Description.....	Adit 8	Adit 3
	No. L-3	No. 8
	Seam	Seam

Charge Properties

Proximate analysis (db) Ash.....%	6.9	12.2
Volatile matter%	23.9	23.5
Fixed carbon.....%	69.2	64.3
Moisture in charge	3.1	3.1
Minus 3.35 mm	89.1	90.2
Other		
.....		

Carbonization conditions

Net weight of charge (wet).....kg	273.4	283.9
ASTM cone bulk density (wet).....kg/m ³	775.4	780.2
Calc. charge dry bulk density in oven... kg/m ³	804.6	834.6

Carbonization Results

Gross coking time (at Push).....h:min	10:40	11:15
Final centre temp.....°C	1055	1055
Time to 900°C centre temp..... h:min	9:23	9:59
Time to 950°C centre temp..... h:min	9:35	10:12
Time to 1000°C centre temp..... h:min	9:55	10:31
Maximum wall pressure.....kPa	18.41	14.69
Coke yield actual	76.2	76.6

Table 12 - Coke properties

Test identification number.....	1068	1072
<u>Screen analysis of coke</u> (cum. % retained on)		
100 mm sieve.....%	0.6	1.2
75 mm sieve.....%	7.6	14.8
50 mm sieve.....%	52.8	64.7
37.5 mm sieve.....%	81.6	82.8
25.0 mm sieve.....%	95.0	93.7
19.0 mm sieve.....%	96.3	95.6
12.5 mm sieve.....%	97.3	96.6
Total -12.5 mm (breeze).....%	2.7	3.4
Mean coke size.....mm	53.3	57.4
<u>Coke chemical analysis</u>		
Proximate analysis (db)		
Ash.....%	8.4	15.2
Volatile matter.....%	1.0	0.6
Fixed carbon.....%	90.6	84.2
Sulphur (db).....%	0.55	0.53
Coke apparent specific gravity.....	0.895	0.914
<u>ASTM coke tumbler test</u>		
Stability factor (cum. % + 25.0 mm).	56.7	47.7
Hardness factor (cum. % + 6.3 mm).	67.9	64.8
<u>JIS coke tumbler test</u> (cum. % retained on)		
30 revs: 50 mm sieve.....%	10.9	15.0
25 mm sieve.....%	90.0	83.2
15 mm sieve.....%	94.5	92.4
150 revs: 50 mm sieve.....%	2.0	0.0
25 mm sieve.....%	73.9	62.5
15 mm sieve.....%	83.0	79.2

STRENGTH INDEX

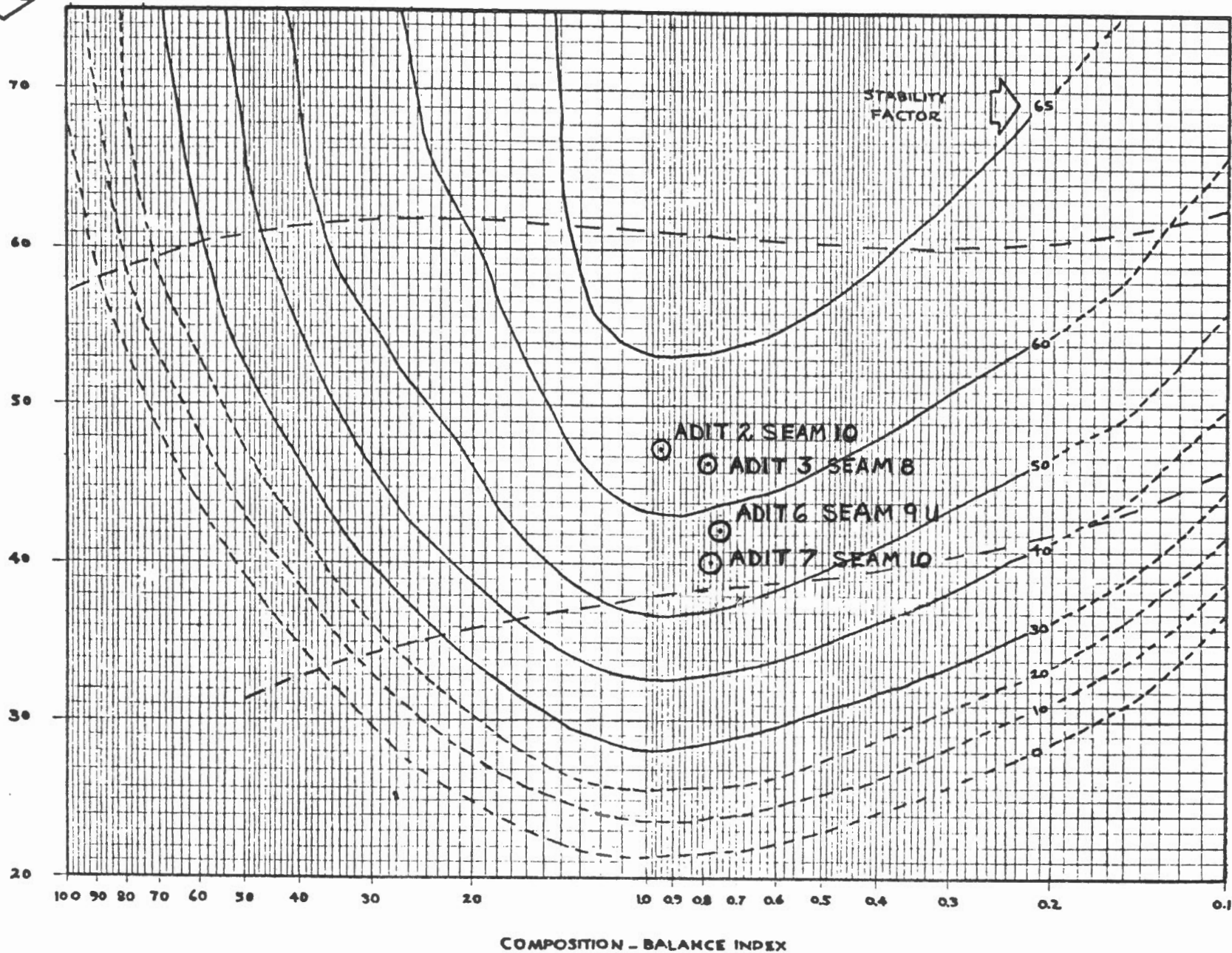


Fig. 1 - Plot of the stability factors of the component coals from petrographic data

STRENGTH INDEX

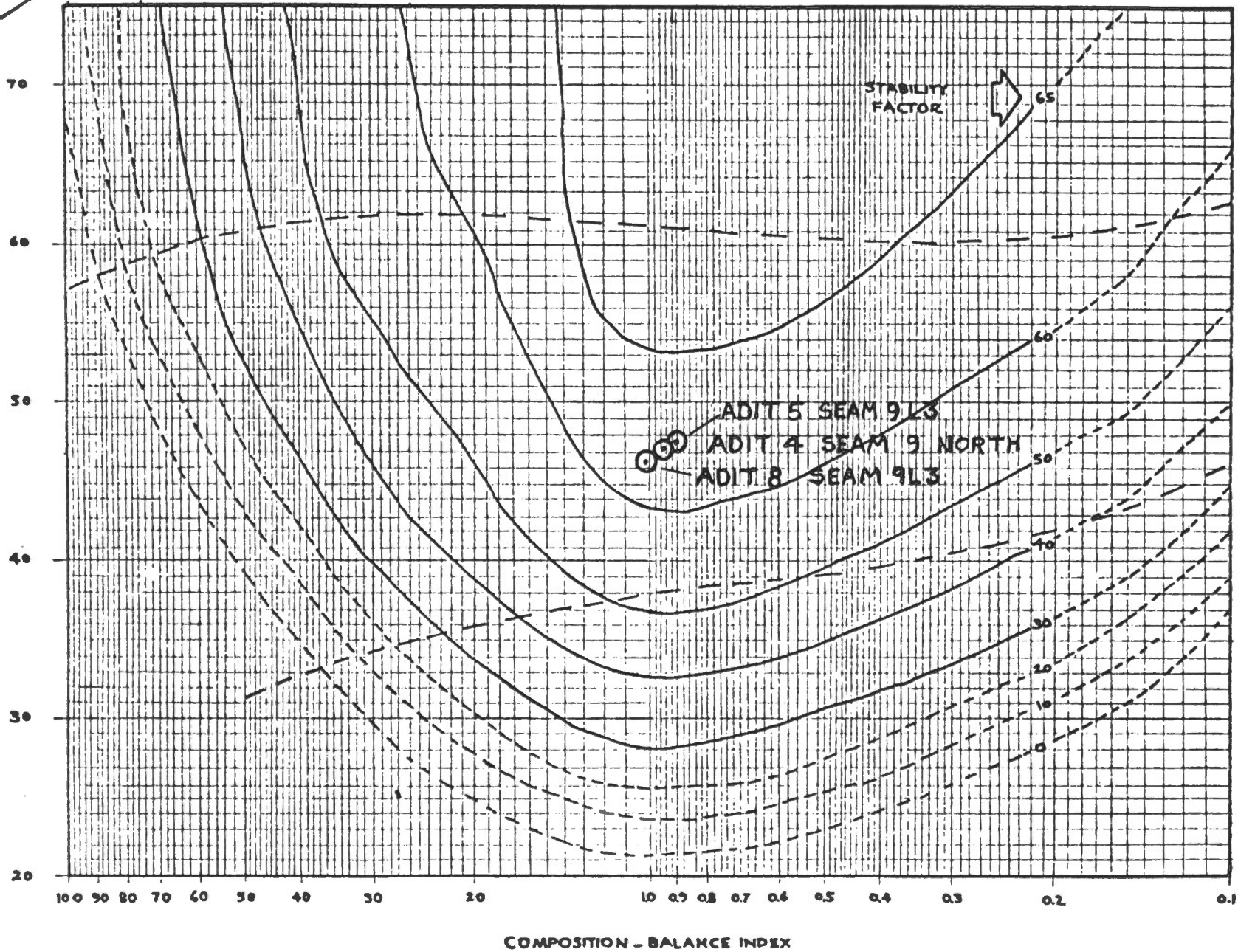
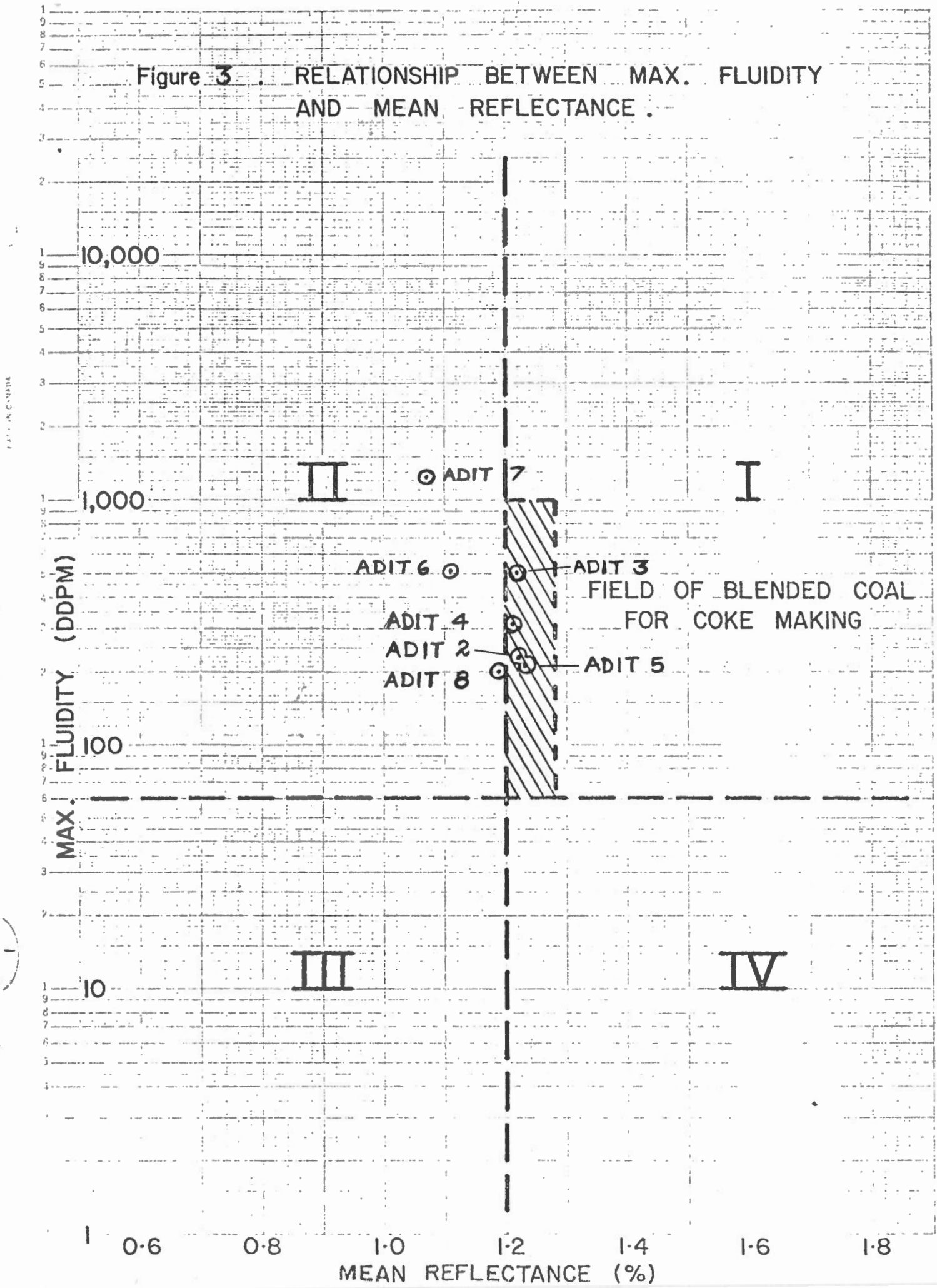


Fig. 2 - Plot of the stability factors of the component coals from petrographic data

Figure 3 . RELATIONSHIP BETWEEN MAX. FLUIDITY AND MEAN REFLECTANCE .



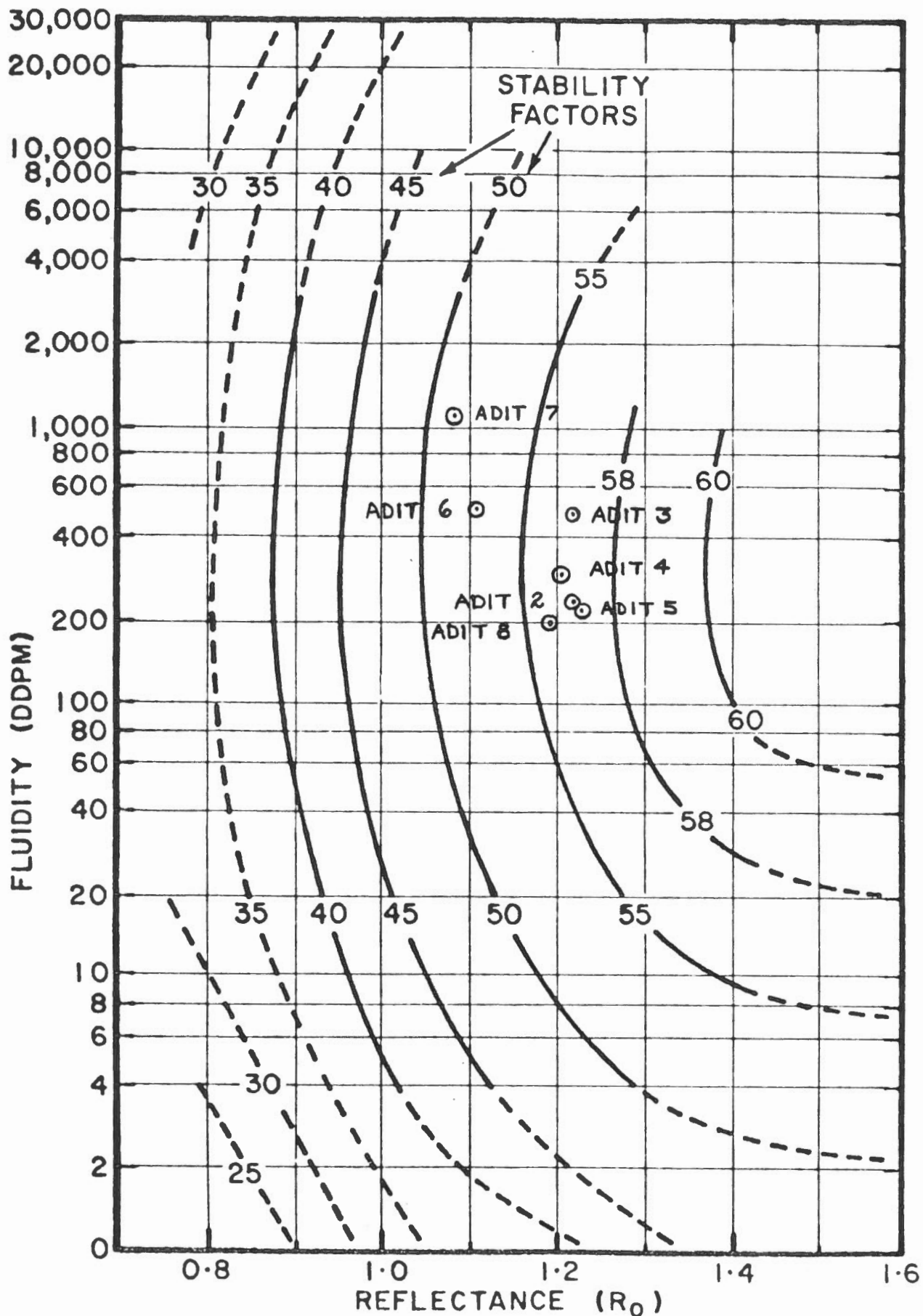


Figure 4. PREDICTION OF COKE STABILITY FACTORS.

- REGRESSION RESULTS FROM CANMET DATA
ON WESTERN CANADIAN COALS.

BIBLIOGRAPHY

1. Eddinger, R. Tracy and Mitchell, John "Pilot-scale ovens - development and operation"; Proc of Blast Furnace, Coke Oven and Raw Materials Committee; AIME 15:148-163; 1956.
2. ASTM Designation: D388-66; "Classification of coals by rank".
3. ASTM Designation: D720-67; "Free swelling index of coal".
4. ASTM Designation: D2639-74; "Plastic properties of coal by the constant-torque Gieseler plastometer".
5. Burrough, E.J. "Specific volatile index"; Fuels Division Memorandum 97/58-CG; Fuels and Mining Practice Division, Mines Branch, Dept of M. and T.S.; Ottawa, Canada; 1958.
6. ASTM Designation: D409-71; "Grindability of coal by the Hardgrove - machine method".
7. ASTM "Proposed method of test for measuring the coking pressures of coals by a movable-wall slot oven"; (presently under consideration for adoption as a standard method of test by Sub-Committee XV of ASTM Committee D-5).
8. ASTM Designation: D291-60; "Cubic foot weight of crushed bituminous coal"; Procedure A - Cone Procedure for Uncompacted Cubic Foot Weight.
9. ASTM Designation: D293-69; "Sieve analysis of coke".
10. ASTM Designation: D3402-76; "Tumbler test for coke".
11. "Japanese drum test for coke"; Designated as J.I.S. (Japanese Industrial Standard) K2151-1972; pp 12-16.
12. Burrough, E.J., Strong, R.A. and Swartzman, E. "Report of investigation on the method now in use at the Fuels Research Laboratories for determination of the apparent specific gravity of coke"; R.I. C.S. 35; Division of Fuel Testing; Department of Mines; August 24, 1934.
13. ASTM Designation: D2014-71; "Expansion or contraction of coal by the sole-heated oven".
14. German Industrial Specification No. DIN 51739/March 1951.

15. ASTM Designation: D2797-72; "Preparing coal samples for microscopical analysis by reflected light".
16. ASTM Designation: D-2798-72; "Microscopical determination of the reflectance of the organic components in a polished specimen of coal".
17. ASTM Designation: D-2799-72; "Microscopical determination of volume percent of physical components of coal".
18. Schapiro, N., Gray, R.J. "Petrographic classification applicable to coals of all ranks"; Proc Illinois Min Inst 68;83-97; 1960.
19. Hoffman, H. and Hoehne, K. Brenstoff Chemie, 35:202:236:269:298; 1954.

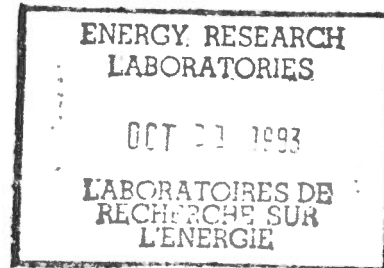


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Telex 041-45136

October 4, 1983



Dr. B. I. Parsons, Director,
Energy Research Laboratory,
CANMET
555 Booth Street,
Ottawa, Ontario K1A 0G1

Dear Dr. Parsons:

RE: COAL CREEK EXPLORATION PROJECT

In conjunction with our Coal Creek exploration project we will require carbonization tests on the following samples:

- 1) Adit # 2 No. 10 Seam
- 2) Adit # 4 No. 9 Seam North
- 3) Adit # 5 No. 9 Seam
- 4) Adit # 6 No. 9 Seam
- 5) Adit # 7 No. 10 Seam
- 6) Adit # 8 No. 8 Seam
- 7) Adit # 9 No. 10 Seam North

Approximately 300 to 400 KG of clean coal from each of the above Adits will be shipped to the Bells Corner Lab, Ottawa from Birtley Coal and Mineral Testing, Calgary.

Along with the carbonization tests please perform the following tests:

Proximate Analysis
% Sulphur
FSI
Dilation (Ruhr)
Dilation (Adudibut-Arnu)
Giesler Plasticity
Petrographic Analysis
Ash Fusion temps.
Chemical Analysis of ash
Hardgrove Grindability Index

Please bill us for this test work as per the CCRA member rates.

Respectfully,

L. B. Samulson

L. B. Samulson, P. Eng.,

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