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et de l'énergie


AN INVESTIGATION OF THE CAKING AND COKING PROPERTIES
OF SMOKY RIVER COAL SAMPLE NO. 1002-CM
SUBMITTED BY MCINTYRE MINES LIMITED

Project No. 03-5-1/20-8
Job No. 3370R

J. G. Jorgensen, T. A. Lloyd and A. B. Fung
Combustion and Carbonization Research Laboratory
Western Research Laboratory

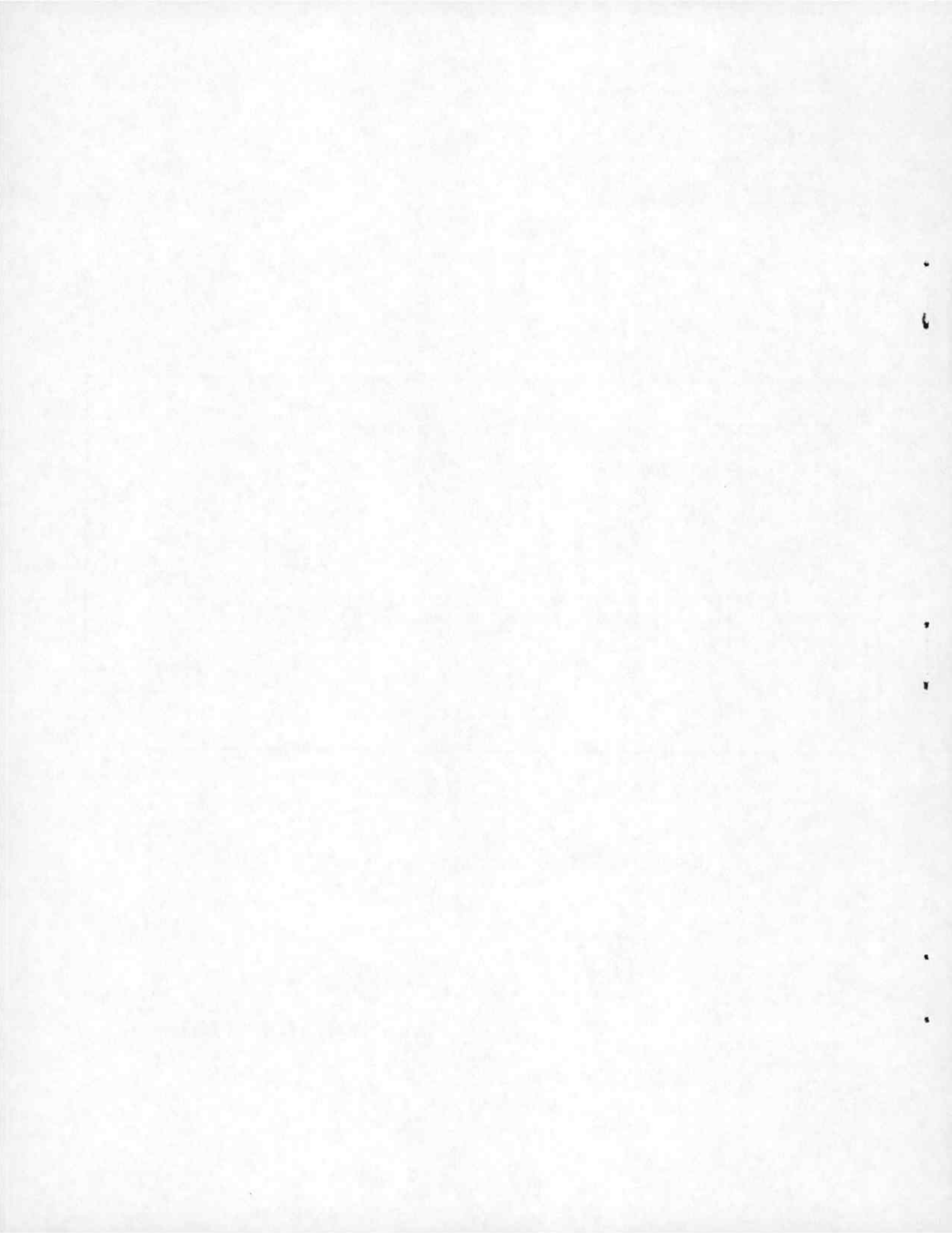
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An Investigation of the Caking and Coking
Properties of Smoky River Coal Sample No.
1002-CM Submitted by
McIntyre Mines Limited

Project 03-5-1/20-8
Job No. 3370R

by

J.G. Jorgensen*, T.A. Lloyd**, and A.B. Fung***

INTRODUCTION

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

This report includes evaluation data on a coal sample identified as No. 1002-CM from the Smoky River Property. The project was initiated by G. Grant Smith, Senior Staff Engineer, McIntyre Mines Limited in a letter dated October 19, 1981. A copy of this letter is included in Appendix 1.

The cleaned coal sample received from Birtley Coal and Mineral Testing, Calgary, was crushed, blended and carbonized in the 18 inch width Carbolite movable-wall coke oven located at the Western Research Laboratory at Edmonton. Representative samples were taken for chemical, physical, thermal rheological, and petrographical analyses which were carried out at the Energy Research Laboratories located at the CANMET Bells Corners Complex near Ottawa. The results of the testing program are tabulated in Tables 1 to 6.

*Head, Petrographic Section, **Head, Conventional Cokemaking Section,
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***Carbonization Engineer, Western Research Laboratory, Coal Research
Laboratories, CANMET, Department of Energy, Mines and Resources, Ottawa,
Canada. K1A 0G1

TABLE 1 Chemical Analyses of Component Coals

<u>Identification</u>	
Laboratory Number	2193-82
Description	1002-CM
<u>Classification</u>	
Rank (ASTM)	1vb
International System	332
Specific Volatile Index	221
Carbon (dmmfb)	92.3
<u>Proximate Analysis (db)</u>	
Ash	7.2
Volatile Matter	17.3
Fixed Carbon	75.5
<u>Gross Calorific Value (db)</u>	
Btu per pound	14610
<u>Ultimate Analysis (db)</u>	
Carbon	85.0
Hydrogen	4.2
Sulphur	0.35
Nitrogen	1.1
Ash	7.2
Oxygen (by difference)	2.1
<u>Ash Analysis (db)</u>	
SiO ₂	51.8
Al ₂ O ₃	31.8
Fe ₂ O ₃	4.6
TiO ₂	1.6
P ₂ O ₅	1.3
CaO	3.5
MgO	0.4
SO ₃	1.9
Na ₂ O	0.9
K ₂ O	0.3

TABLE 2 Physical Tests and Fusibility of Ash of Component Coals

Identification

Laboratory Number 2193-82
 Description 1002-CM

Coal Pulverization

Sieve Analysis

Passing	Retained On		
	1/4 in.	%	3.0
1/4 in.	1/8 in.	%	10.9
1/8 in.	1/16 in.	%	22.6
1/16 in.	1/32 in.	%	20.4
1/32 in.	%	43.1
Total Passing	1/8 in.	%	86.1

Grindability

Hardgrove Index 89

Fusibility of Ash

Initial Deformation Temp. ...^oF 2700+
 Softening Temp. Spherical ...^oF 2700+
 Softening Temp. Hemispherical ...^oF 2700+
 Fluid Temp.^oF 2700+

TABLE 3 Thermal Rheological Properties of Component Coals

<u>Identification</u>	
Laboratory Number	2193-82
Description	1002-CM
<u>Linear Expansion</u>	
Bd. 52 lb/ft ³ at 2% moisture...%	
<u>Gieseler Plasticity</u>	
Start	°C 462
Fusion Temp.	°C -
Max. Fluid Temp.	°C 481
Final Fluid Temp.	°C 493
Solidification Temp.	°C 498
Melting Range	°C 31
Max. Fluidity	dd/m 2.8
Torque	g.in. 40
<u>Dilatation</u>	
Ti - Softening Temp.	°C 435
Tii - Max. Contraction Temp.	°C 474
Tiii - Max. Dilatation Temp.	°C 500
Contraction	% 26
Dilatation	% -7
<u>Free Swelling Index</u>	
F.S.I.	8

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TABLE 4 Petrographic Analysis of Component CoalsIdentification

Laboratory Number.....	2193-82
Description.....	1002-CM

Distribution of Vitrinite Types

V-6.....	%	
V-7.....	%	
V-8.....	%	
V-9.....	%	
V-10.....	%	
V-11.....	%	
V-12.....	%	
V-13.....	%	
V-14.....	%	2.6
V-15.....	%	25.6
V-16.....	%	35.9
V-17.....	%	
V-18.....	%	

Reactive Components

Total Vitrinite.....	%	64.1
Reactive Semi-fusinite (1/3)...	%	12.2
Exinite.....	%	0.0
Total.....	%	76.3

Inert Components

Inert Semi-fusinite (2/3).....	%	12.1
Micrinite.....	%	2.6
Fusinite.....	%	5.0
Mineral Matter.....	%	4.0
Total.....	%	23.7

Petrographic Indices

Mean Reflectance.....	%	1.60
Balance Index.....		3.34
Strength Index.....		7.20
Stability Index.....		54.3

TABLE 5 - Carbonization Conditions

Test Identification Number.....	C-126
Date of Test.....	Jan. 14/82
Coke Oven Identification.....	
Description.....	1002-CM

CHARGE PROPERTIES

Proximate Analysis (db) Ash.....%	7.2
Volatile Matter.....%	17.3
Fixed Carbon.....%	75.5
Moisture in Charge.....%	2.6
Minus 1/8 in. (6 mesh).....%	86.1
Other:.....	
.....	

CARBONIZATION CONDITIONS

Net Weight of Charge (wet).....lb	652.6
ASTM Cone Bulk Density (wet).....lb/ft ³	48.8
Calc. Charge Dry Bulk Density in Oven...lb/ft ³	51.3
Flue Temp Control.....	

Charge Push (Centre Temp:Soak Time).....°C:hr	950:3
Quenched Coke Conditioning Drop.....ft	10

CARBONIZATION RESULTS

Gross Coking Time (at Push).....hr:min	19:11
Final Centre Temp.....°C	1064
Time to 900°C Centre Temp.....hr:min	15:49
Time to 950°C Centre Temp.....hr:min	16:11
Time to 1000°C Centre Temp.....hr:min	16:27
Maximum Wall Pressure.....lb/in ²	6.81
Coke Yield Actual.....%	78.6

TABLE 6 - Coke Properties

Test Identification Number..... C-126

SCREEN ANALYSIS OF COKE

(cum % retained on)

4 inch sieve.....	0.7
3 inch sieve.....	17.7
2 inch sieve.....	68.6
1½ inch sieve.....	85.2
1 inch sieve.....	92.8
¾ inch sieve.....	94.0
½ inch sieve.....	95.0
Percentage -½ inch (breeze).....	5.0
Mean Coke Size.....in.	2.28

COKE CHEMICAL ANALYSIS

Proximate Analysis (db)

Ash.....%	8.4
Volatile Matter.....%	0.9
Fixed Carbon.....%	90.7
Sulphur (db).....%	0.35

COKE APPARENT SPECIFIC GRAVITY..... 0.92

ASTM COKE TUMBLER TEST

Stability Factor.(cum % + 1 in.).....	57.7
Hardness Factor.(cum % + 1/4 in.).....	64.8

JIS COKE TUMBLE TEST

(cum % retained on)

30 revs:	50 mm sieve.....	28.2
	25 mm sieve.....	90.9
	15 mm sieve.....	94.1
150 revs:	50 mm sieve.....	5.3
	25 mm sieve.....	76.9
	15 mm sieve.....	82.1

OTHER

STRENGTH INDEX

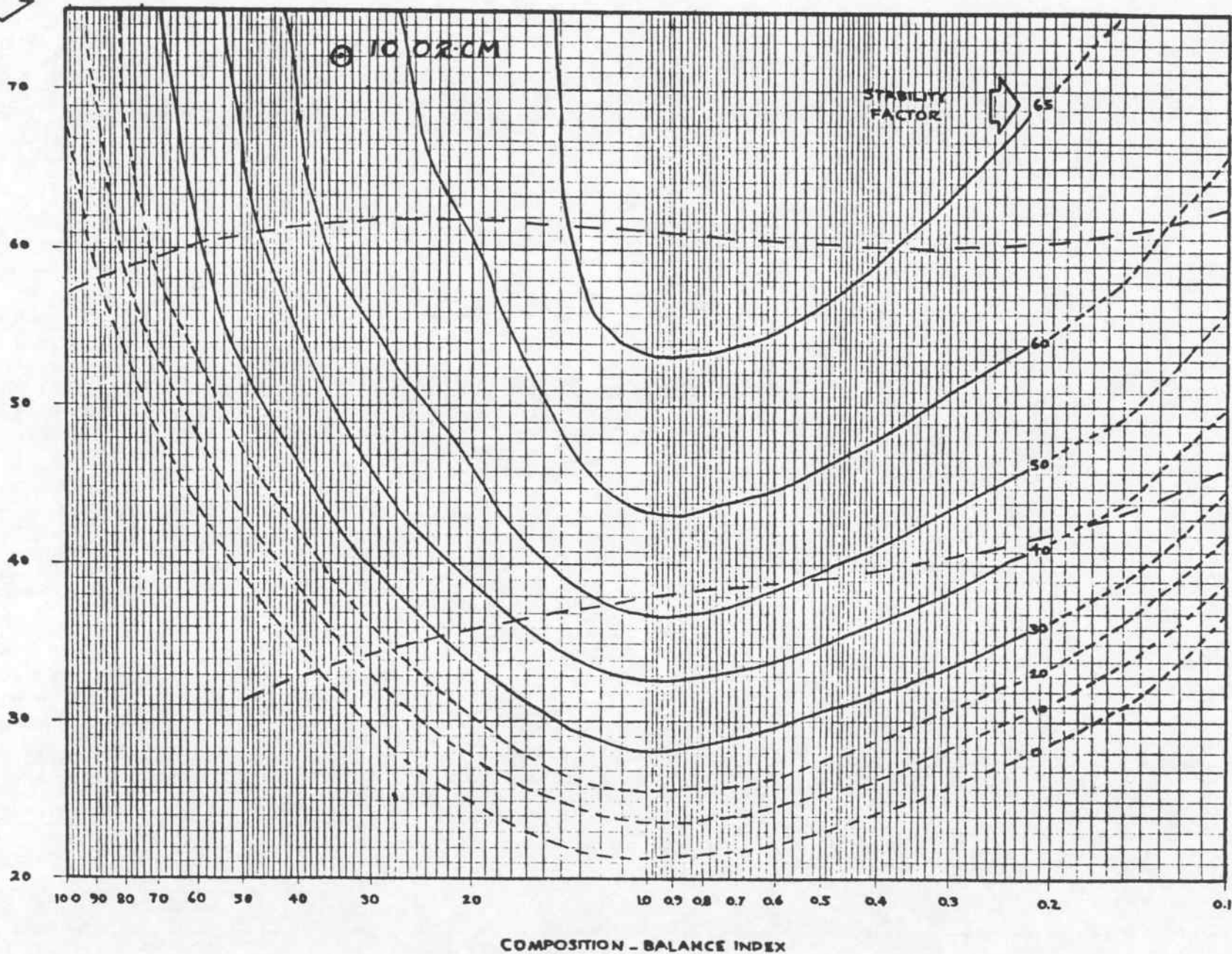
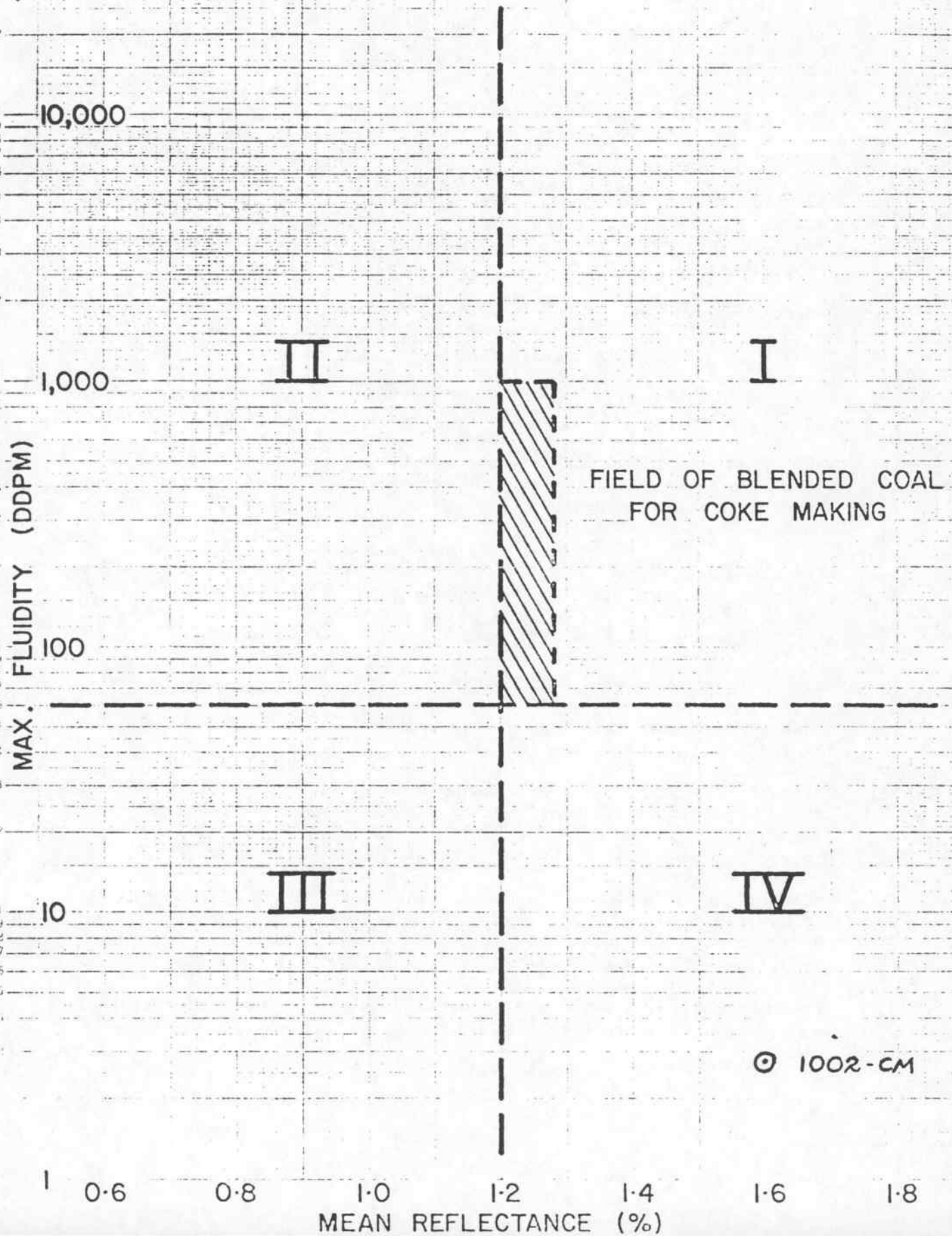


Figure 1. Plot of the Predicted Stability Factor of Component Coal from Petrographic Data.

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



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APPENDIX 1

Letter dated October 19, 1981 from G. Grant Smith, Senior Staff Officer, McIntyre Mines Limited.

MCINTYRE MINES

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October 19, 1981

Department of Energy, Mines & Resources
Western Research Laboratory
P.O. Box 3294
Sherwood Park, Alberta
T8A 2A6

Attention: Ms. Jackie Picard

Dear Ms. Picard:

McIntyre is currently extensively evaluating four (4) bulk samples of Smoky River coals. The sampling/testing program was previously discussed with Dr. Ross Leader and more recently (October 6, 1981), in telephone conversation with Mr. A. Fung. Two (2) bulk samples have been dispatched to Birtley Coal & Mineral Testing for washing and testing, (refer to attached letter). Two (2) additional samples will be delivered to Birtley within the next few weeks.

When suitable clean coal is available, McIntyre wishes to proceed with a complete carbonization analysis of each sample. Could you please advise us of the disposition of your Western Research Laboratory to conduct a comprehensive analysis of these four (4) samples in a manner similar to that of your project 03-5-1/20-7 - for our coal sample from Mine 9A-4 at Smoky River, (refer to attached report ERP/ERL 81-11 (CT)). Please arrange carbonization testing and costing for this project in accordance with our association with the Canadian Carbonization Research Association.

Upon your advice, I shall arrange to have the drums of clean coal delivered to the Western Research Laboratory. Furthermore, I shall forward all test reports provided by Birtley in accordance with the attached letter.

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Ms. J. Picard
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October 19, 1981

We are anxious to expedite this coal evaluation program and would appreciate if you would telephone me (267-4534) if further clarification is required.

Yours truly,

A handwritten signature in dark ink, appearing to read "G. Grant Smith". The signature is written in a cursive style with a large initial "G".

G. Grant Smith
Senior Staff Engineer

cc: J.G. Jorgensen,
CANMET

A.B. Fung,
Dept. of Energy, Mines & Resources

GGS/sds
Attachments

5
>
3

4
2

4
2

