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MOVABLE-WALL COKE OVEN TEST OF A COAL BLEND
SUBMITTED BY BETHLEHEM STEEL CORPORATION

Project No. 03-3-0/24-2
Job No. 3455R

J.G. Jorgensen and T.A. Lloyd
Combustion and Carbonization Research Laboratory

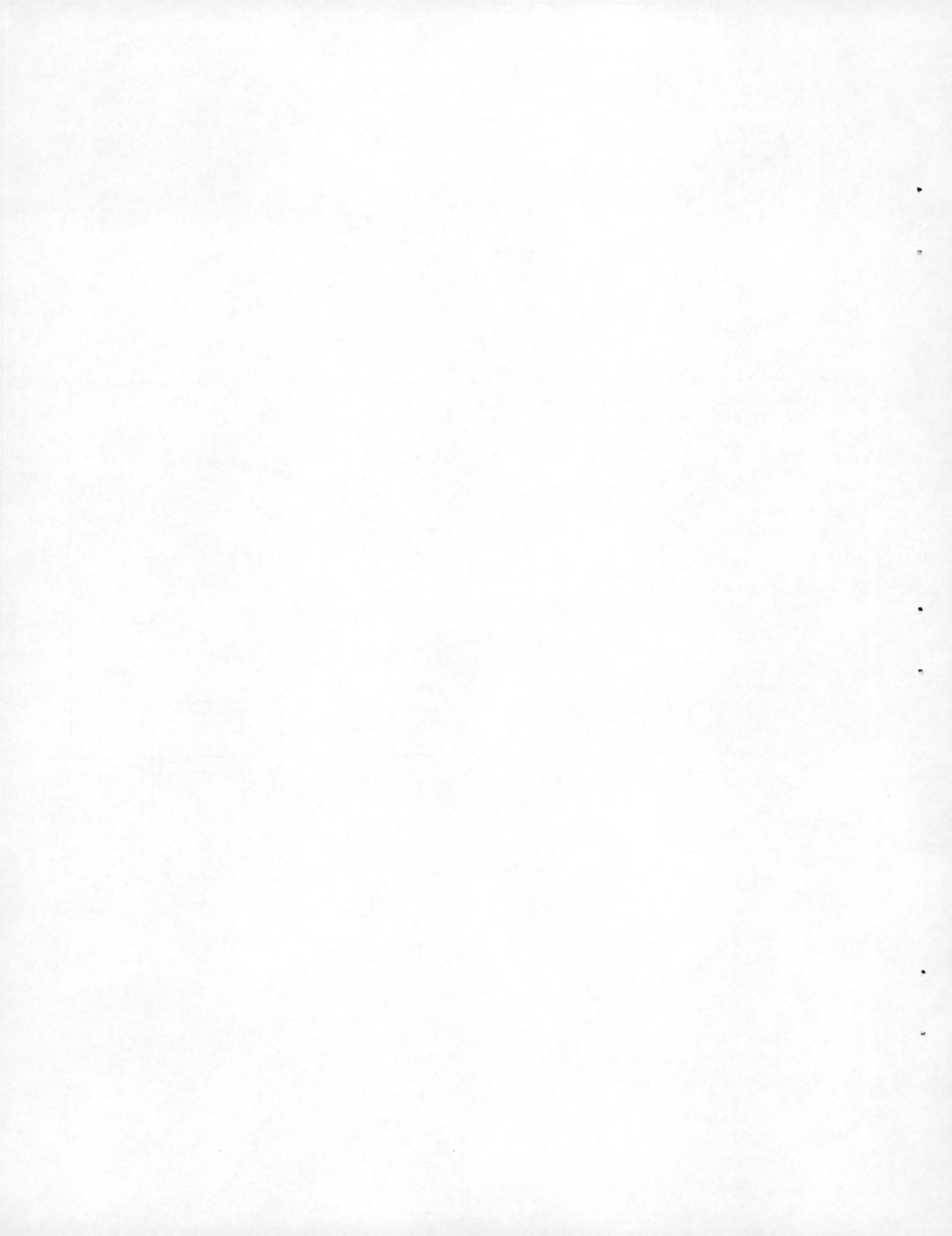
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by

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

SUMMARY

This report includes coke oven evaluation data of one coal blend (No. 3) sample from Bethlehem Steel Corporation. The project was initiated by J.A. Augstadt, Supervisor, Raw Materials and Chemical Processes, Bethlehem Steel Corporation in a letter dated February 10, 1984. A copy of this letter is given in Appendix 1.

The crushed coal blend was thoroughly mixed and carbonized in the 460-mm wide CANMET movable-wall coke oven. Representative samples were taken for chemical and thermal rheological analysis. The results of the testing program are tabulated in Tables 1 to 3.

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

TEST D'UN MÉLANGE DE CHARBON DANS UN FOUR À COKE À PAROIS MOBILES,
PROPOSÉ PAR LA BETHLEHEM STEEL CORPORATION

Projet N° 03-3-0/24-2
Activité N° 3455R

par

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

SOMMAIRE

Ce rapport comprend les données qui concernent l'évaluation, par carbonisation dans un four à coke, d'un échantillon du mélange de charbon N° 3 provenant de la Bethlehem Steel Corporation. Le projet a été proposé par J.A. Augstadt, Superviseur de la section des matières premières et des procédés chimiques à la Bethlehem Steel Corporation, dans une lettre datée du 10 février 1984. Une copie de cette lettre est présentée dans l'annexe 1.

Le mélange de charbon broyé a été complètement lié et carbonisé dans le four à coke à parois mobiles d'une largeur de 460 mm que possède CANMET. Des échantillons types ont été prélevés aux fins d'analyse rhéologique par voies chimique et thermique. Les résultats du programme d'essai sont compilés dans les tableaux 1 à 3.

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

CONTENTS

	<u>Page</u>
SUMMARY	i
SOMMAIRE	ii
INTRODUCTION	1
BIBLIOGRAPHY	4
APPENDIX 1	6

TABLES

<u>No.</u>		
1.	Carbonization conditions	1
2.	Coke properties	2
3.	Thermal rheological properties of component coal	3

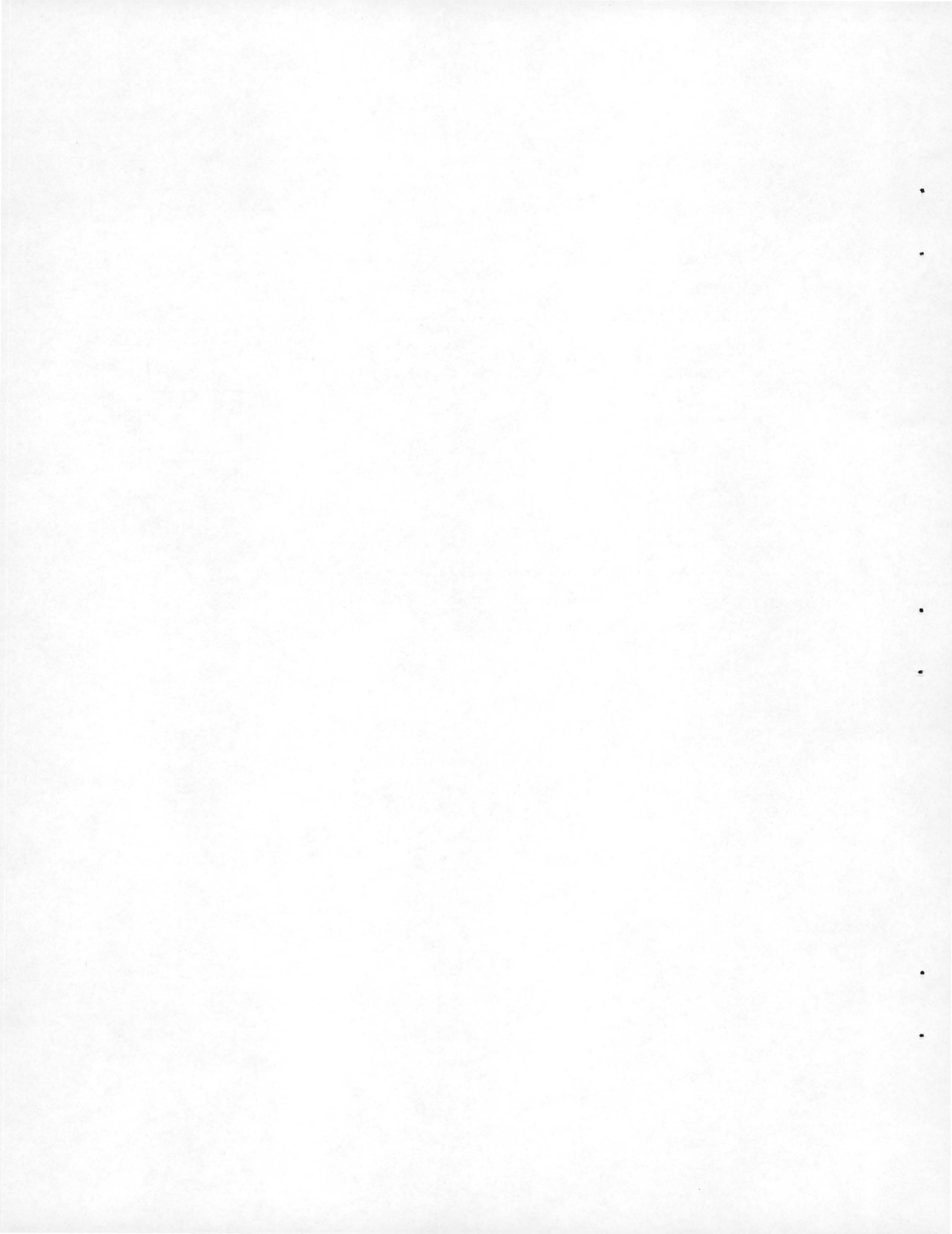


Table 1 - Carbonization conditions

Test Identification Number	741
Date of Test	April 9/84
Coke Oven Identification.....	Bethlehem
Description.....	Blend No. 3

Charge Properties

Proximate Analysis (db) Ash.....%	6.1
Volatile Matter%	30.0
Fixed Carbon.....%	63.9
Moisture in Charge	7.4
Minus 3.35 mm	82.5
Other .. Sulphur	0.88
.....	

Carbonization Conditions

Net Weight of Charge (wet).....kg	317.2
ASTM Cone Bulk Density (wet).....kg/m ³	656.0
Calc. Charge Dry Bulk Density in Oven... kg/m ³	728.0 (45.5 lb/ft ³)

Carbonization Results

Gross Coking Time (at Push).....h:min	18.00
Final Centre Temp.....°C	1140.
Time to 900°C Centre Temp.....h:min	12:26
Time to 950°C Centre Temp.....h:min	12:48
Time to 1000°C Centre Temp.....h:min	13:20
Maximum Wall Pressure.....kPa	2.4 (0.35 psi)
Coke Yield Actual	71.8
Maximum Gas Pressure at centre.....kPa	9.37 (1.36 psi)

Table 2 - Coke properties

Test Identification Number.....	741
<u>Screen Analysis of Coke</u>	
(cum. % retained on)	
100 mm sieve.....%	1.5
75 mm sieve.....%	12.5
50 mm sieve.....%	49.1
37.5 mm sieve.....%	75.5
25.0 mm sieve.....%	92.7
19.0 mm sieve.....%	94.8
12.5 mm sieve.....%	95.9
Total -12.5 mm (breeze).....%	4.1
Mean Coke Size.....mm	52.8 (2.08 in)

Coke Chemical Analysis

Proximate Analysis (db)	
Ash.....%	8.3
Volatile Matter.....%	0.7
Fixed Carbon.....%	91.0
Sulphur (db).....%	0.69
Coke Apparent Specific Gravity.....	0.792

ASTM Coke Tumbler Test

Stability Factor (cum. % + 25.0 mm).	56.5
Hardness Factor (cum. % + 6.3 mm).	64.9

JIS Coke Tumbler Test

(cum. % retained on)

30 revs:	50 mm sieve.....%
	25 mm sieve.....%
	15 mm sieve.....%
150 revs:	50 mm sieve.....%
	25 mm sieve.....%
	15 mm sieve.....%

Table 3 - Thermal rheological properties of component coal

Identification

Laboratory number.....	
Description.....	2757-84
	BETHLEHEM
	BLEND NO. 3

Linear Expansion

833 kg/m³ at 2% moisture.....%

Gieseler plasticity

Start.....°C	410
Fusion temp°C	422
Max fluid temp°C	442
Final fluid temp°C	464
Solidification temp°C	470
Melting range°C	54
Max fluidity.....dd/m	80

3

Dilatation

Ti - Softening temp°C	
Tii - Max contraction temp...°C	
Tiii - Max dilatation temp....°C	
Contraction.....%	
Dilatation%	

Free swelling index

F.S.I.	6.5
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Appendix 1. Letter initiating project

Bethlehem Steel Corporation

BETHLEHEM, PA 18016

J. E. WERNER
DIRECTOR OF RESEARCH



February 10, 1984

R505-E2-A025
1009-3

Dr. Basil Parsons
Director, Energy Research Lab.
CANMET
c/o 555 Booth Street
Ottawa, Canada K1A0G1

Dear Dr. Parsons:

A purchase order for a single carbonization test of our Test Blend No. 3 in your 18" moveable wall test oven has been issued and will be sent under a separate cover. As per our recent correspondence, we would like to have this coal blend carbonized under the following test conditions:

- | | |
|------------------------------------------------------------------|------------------------|
| o Oven bulk density (wet basis) | - 50 lb/cu ft |
| o Coal moisture | - 7.5% |
| o Pulverization level | - As received |
| o Oven flue temperature | - 1275 C (if possible) |
| o Gross coking time | - 18 hours |
| o Measurement of peak wall pressure and center-line gas pressure | |
| o Wet quenching of coke | |

As per my phone conversation with Dr. John Price on February 8, 1984 I understand that flue temperatures of 1275 C are at the upper limit of your oven's temperature capabilities and are not routinely run. If possible, we would appreciate this single carbonization test to be run at an oven flue temperature of 1275 C.

Bethlehem Steel Corporation

Dr. Basil Parsons

-2-

February 10, 1984

In addition, we would like to have the following chemical and physical tests performed (please use ASTM test methods where applicable):

Coal Analyses

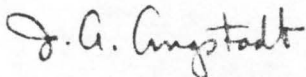
- o Coal size analyses (1/4", 1/8", 1/16", 1/32")
- o Coal fluidity (Constant-Torque Gieseler Plastometer)
- o Coal free swelling index
- o Coal proximate analyses (volatile matter, ash, and sulfur)

Coke Analyses

- o ASTM tumbler test (stability and hardness)
- o Coke size analyses
- o Coke proximate analyses (volatile matter, ash, and sulfur)

We will be shipping 3-55-gallon drums (approximately 1,000 lb) of our Test Blend No. 3 to your Bells Corners complex within the next few days. If you have any scheduling problems or other questions please contact A. D. Strauss at 215-694-6854.

Sincerely yours,



J. A. Angstadt
Supervisor
Raw Materials and Chemical Processes

ADStrauss:djj

