

CANADIAN CARBONIZATION RESEARCH ASSOCIATION

ANNUAL REPORT

Fiscal Year Ending July 31, 1978

ERP/ERL 78-88 (TR)

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Fiscal Year Ending July 31, 1978

ENERGY RESEARCH PROGRAM
ENERGY RESEARCH LABORATORIES
REPORT ERP/ERL 78-88 (TR)

FOREWORD

The Annual Report of the Canadian Carbonization Research Association for the fiscal year ending July 31, 1978 was prepared for the 27th Regular Meeting of the Board of Directors. The meeting was held in the Main Office, Dominion Foundries and Steel Limited, Hamilton, Ontario, September 28, 1978.

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ATTENDEES AT THE TWENTY-SEVENTH REGULAR MEETING OF THE BOARD OF DIRECTORS
CANADIAN CARBONIZATION RESEARCH ASSOCIATION

HAMILTON, ONTARIO

SEPTEMBER 28, 1978



Standing (L to R): *A.M. Cameron, D. Johnston, A.J. Lafreniere, G.A. Chapman, K.G. Dunlop, W.J. Riva, J.T. Collier, A.A. Johnson, R. Engler.*

Seated (L to R): *J.C. Campbell, B.I. Parsons, J.E. Ludberg, J.C. Botham, W.S. Wilson, J.C. Wilson.*

CANADIAN CARBONIZATION RESEARCH ASSOCIATION

BOARD OF DIRECTORS

OFFICERS

- Chairman - Mr. J.E. Ludberg,
Superintendent, Coke Plant,
Dominion Foundries and Steel Ltd.,
P.O. Box 460,
Hamilton, Ontario. L8N 3J5
(416) 544-3761 Ext. 3118
- Vice-Chairman - Mr. A.A. Johnson,
Chief Geologist,
Denison Coal Limited,
1500 444 5th Avenue S.W.,
Calgary, Alberta. T2P 2T8
(403) 269-4327
- Treasurer - Mr. G.A. Chapman,
Sr. Research Investigator,
The Steel Company of Canada,
Hamilton, Ont. L8N 3T1
(416) 528-2511
- Secretary - Mr. J.C. Botham,
CANMET,
Dept. of Energy, Mines & Resources,
555 Booth Street,
Ottawa, Ontario. K1A 0G1
(613) 996-4570 Ext. 191

CANADIAN CARBONIZATION RESEARCH ASSOCIATION

BOARD OF DIRECTORS

MEMBERS

The Canmore Mines Ltd.,
Canmore, Alberta.
MR. C.W. GREGORY
Executive Vice-President
(403) 678-5531

Fording Coal Ltd.,
Suite 206,
205-9th Ave. S.E.,
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(403) 264-1063
MR. P.J. URSO (Alternate)
Vice-Pres. (Operations Dev.)

Cape Breton Development Corp.,
P.O. Box 2500,
Sydney, N.S. B1P 6K9
MR. J.O. THOMAS
Vice-President, Coal Preparation
and Utilization Division.
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Sydney Steel Corporation,
P.O. Box 1450,
Sydney, N.S. B1P 6K5
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Manager, Coke Oven Department.
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Elco Mining Ltd.,
2800 Scotia Centre,
700 - 2nd Street S.W.,
Calgary, Alta. T2P 2W2
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Manager
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Domtar Chemical Ltd.,
Tar and Chemical Division,
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Hamilton, Ontario. L8H 5L3
MR. K.G. DUNLOP
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Luscar Limited,
800 Royal Trust Tower,
Edmonton Centre,
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The Steel Company of Canada Ltd.,
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Coke Ovens Department.
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Assistant Superintendent (Alternate)
Ext. 3352

Algoma Steel Corporation Ltd.,
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MR. A.M. CAMERON
Technical Manager,
Cokemaking Department.
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Kaiser Resources Ltd.,
P.O. Box 2000,
Sparwood, B.C. VOB 2G0
MR. W.J. RIVA,
Vice-President, Mining Operations.
(604) 425-8221

CANADIAN CARBONIZATION RESEARCH ASSOCIATION

AFFILIATE MEMBERS

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MR. J.J. CRABB

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Calgary, Alberta. T2P 2H5
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Senior Mining Engineer
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HONORARY MEMBERS

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Honorary Member,
706-1212 Pine Ave. W.,
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(514) 845-1875

TECHNICAL COMMITTEE

Chairman - MR. J.C. WILSON
Research Department,
Dominion Foundries and Steel Ltd.,
P.O. Box 460,
Hamilton, Ontario. L8N 3J5
(416) 544-3761, Ext. 3343

Secretary - DR. D.A. REEVE
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MR. N.R. FARKAS,
Gen. Foreman, By-Product
and Coal Handling,
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Sault Ste. Marie, Ontario.
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DOMTAR Chemicals Group,
DOMTAR Inc.,
395 de Maisonneuve Blvd. W.,
P.O. Box 7212,
Montreal, Quebec. H3C 3M3
(514) 282-5304

REVIEW OF THE YEAR

BY

CHAIRMAN, BOARD OF DIRECTORS

CANADIAN CARBONIZATION RESEARCH ASSOCIATION

(Fiscal Year Ending July 31, 1978)

It is a pleasure for DOFASCO to host the 27th Regular Meeting of the Association Board of Directors. It was exactly nine years ago that I chaired the Ninth Regular Meeting of the Board here in the DOFASCO main office. Today's occasion is therefore the beginning of my second time around to act as your Chairman.

Some of you may also recall another meeting of the Association which was also held here at DOFASCO, namely the Association's Third Meeting on July 28, 1966. To my knowledge the only existing official picture of the CCRA Board was taken on that occasion by our Company photographer. From the photograph I note that the Company representatives have changed in many cases, but all of the charter member companies have remained with us. Indeed, it is encouraging to note that since then our active membership has increased from seven to twelve. This number will no doubt be greater after this meeting, as one of our duties today is to entertain recent applications for membership. In order to maintain the DOFASCO tradition, I have asked our Company photographer to once again capture our image for posterity, with the hope that CCRA will be active for a third photograph some years hence.

I have reviewed the Chairman's report which I presented to the Board at our last meeting here in 1969. In light of the changes which have occurred in the interim it might be appropriate to review some of the highlights of that report.

1. (1969 Report) *"The rapid expansion of the metallurgical coal industry was noted and it was forecasted that in excess of 15 million tons valued at \$180-200 million dollars would be exported in the early 1970's."*

(Comment) Actually, the export market is now of the order of 13 million tons but valued in excess of one-half billion dollars annually (i.e. about three times the estimated value). The lament of the CCRA Technical Committee in 1969 was the excessive oven time spent on resource

evaluation (i.e. 70 percent as compared to a current 10 percent). It is hoped that CCRA efforts on the resource evaluation contributed in some way to the development of this important market.

2. (1969 Report) *"Some of the members expressed their interest in the use of Western Canadian coals for cokemaking. Accordingly tests were carried out with a Western Canadian coking coal in a series of blends of interest to the steel company members. Although the low sulphur content was attractive, the ash level of this particular coal was considered too high for use as a major blend component."*

(Comment) The work has continued during the past year using coals which were not available in 1969. The Chairman of the Technical Committee will report on this work in the CCRA sponsored project dealing with self-sufficiency. Of course small tonnages of Western Canadian coal are now being used commercially by the steel industry in Central and Eastern Canada.

3. (1969 Report) *"It was announced in 1969 that Devco would open a new mine at Lingan to produce coal from the Harbour Seam."*

(Comment) We are all, of course, familiar with the development of this mine. Present production cannot satisfy the high demand for the Harbour Seam coal with its low ash contents of 4 percent or less. (The sulphur content is about 1 percent). The CCRA-sponsored project on Self-Sufficiency, just completed, used Harbour Seam coal as the base high volatile component in the evaluation of the medium and low volatile coal samples from Western Canada. High quality coke is currently being manufactured commercially at SYSCO from an all Canadian blend, namely a blend approximating 20 percent Smoky River coal and 80 percent Harbour Seam coal.

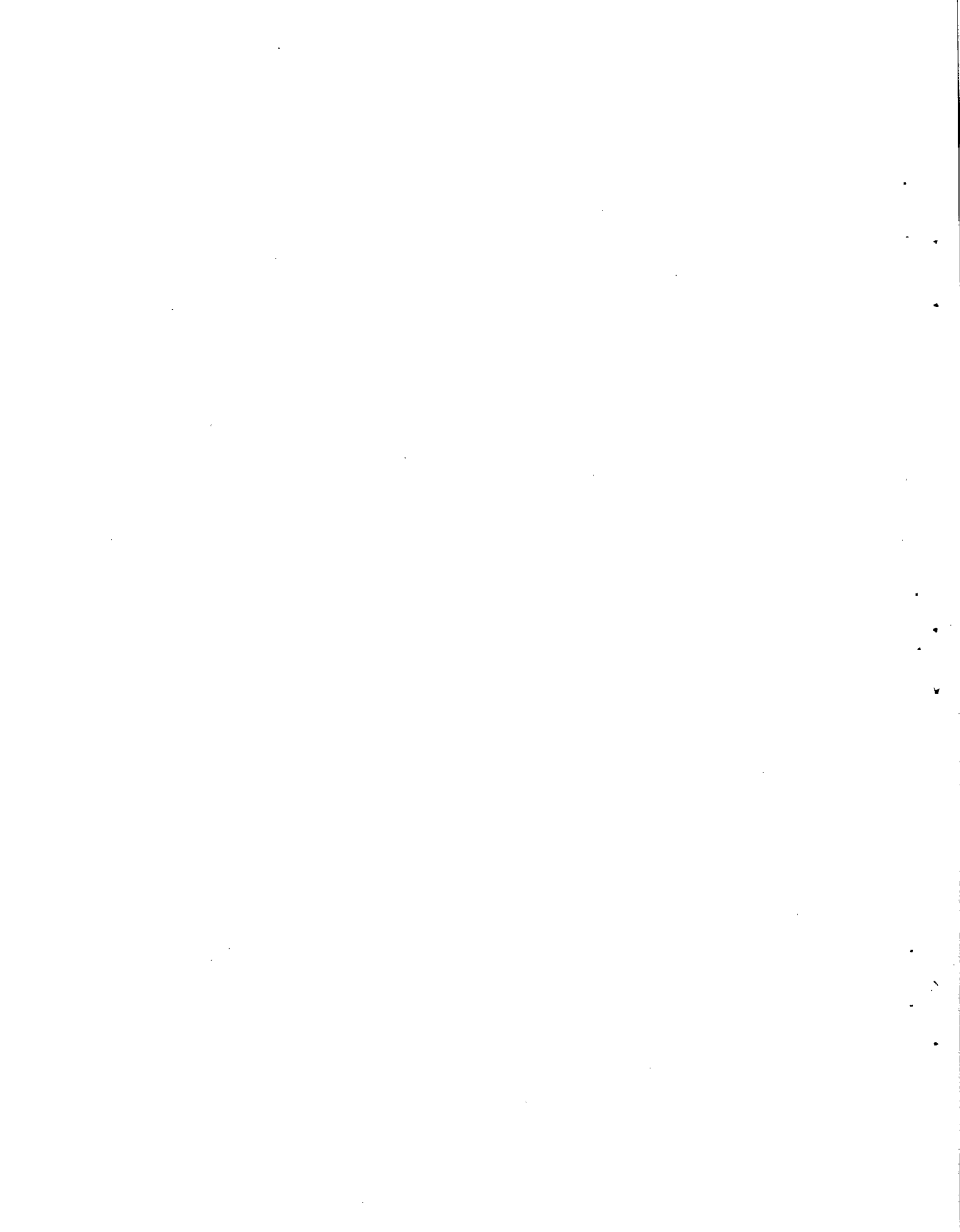
4. (1969 Report) *"Formed-coke studies were given a high priority rating on the agenda list of the 1969 meeting. Mr. R.G. Davies of the Broken Hill Proprietary Company in Australia was appointed CCRA research associate for studies in this field. He was the first of several research associates to follow."*

(Comment) Considerable time and effort was devoted to formed-coke studies during the past nine-years. Laboratory and pilot-scale equipment was developed to evaluate the potentials of coals and carbons for the production of formed coke; selected coal samples of interest to the Canadian steel and coal industries were sent to Europe for assessment by such processes as the BBF (Germany) and HBNPC (France); and visits were arranged for members of the Association to inspect well-known formed coke plants in Europe. On the advice of the Technical Committee and NACMR, activities in this field have now been curtailed in favour of other activities.

As for the present, conventional coke-making in slot-type ovens is alive and with us for at least the next two decades. Formed coke is not expected to make any serious inroads during this time. The cost of conventional coke oven plants has increased substantially during the past decade, but of necessity new batteries are continuing to be built. We hope to show you our new battery following this meeting. Therefore, for the immediate future, our R & D efforts should be concentrated on innovations to the conventional mode of producing coke in such areas as: increasing oven productivity; broadening the range of coals for cokemaking; improving coke quality; reducing air and water pollution; increasing the overall thermal efficiency of the process; applying various additives to improve coke structure from poorly caking coals; assessment of coke oven by-products in light of process changes and world energy patterns, etc. I leave these matters to the Technical Committee.

My remarks are intended as an introduction to the Technical Committee Report on the Association's progress in CCRA-sponsored research projects during the year and the Treasurer's report on our financial status. Their reports will now follow for your consideration.

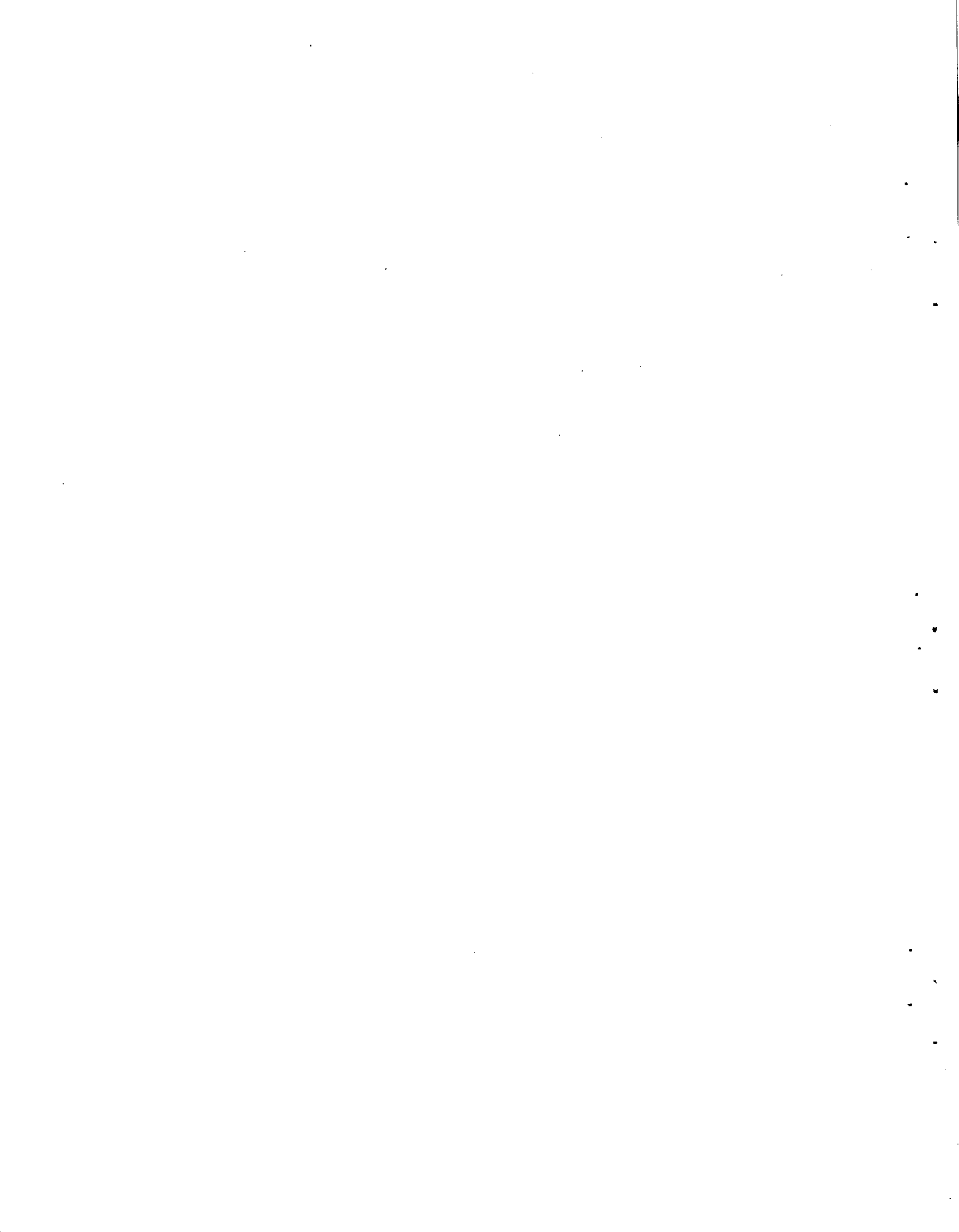
J. E. Ludberg



CANADIAN CARBONIZATION RESEARCH ASSOCIATION

REPORT OF THE TECHNICAL COMMITTEE

1977 - 1978



REPORT OF THE TECHNICAL COMMITTEE OF THE CANADIAN
CARBONIZATION RESEARCH ASSOCIATION

1977-1978

INTRODUCTION

During the period under review, no major developments have taken place within the Technical Committee. Occasional attendance of the meetings, by non-member groups; i.e. McMaster University, Great Canadian Oil Sands, has continued and has allowed for more thorough discussions during the meetings. An attempt to increase attendance by member western Canadian coal producers was made by holding a meeting in Calgary in June, 1978, with a follow-up tour of Kaiser Resources mining operations.

Research studies continued into selective pulverization, partial briquetting of the coke oven charge, self-sufficiency, the use of specially prepared bitumens in cokemaking, hot strength testing of coke and oven correlation.

MEETINGS

Five technical committee meetings were held during the period under review. The meetings were as follows:

<u>Technical Committee Meeting Number</u>	<u>Location</u>	<u>Dates</u>
67	Ottawa	Sept. 8, 9, 1977
68	Ottawa	Nov. 9, 10, 1977
69	Ottawa	Jan. 12, 13, 1978
70	Ottawa	March 16, 17, 1978
71	Calgary	June 19, 1978

The 71st CCRA Technical Committee meeting was held in Calgary rather than Ottawa to try and get more participation from the member western coal producers. All CCRA members were notified of the meeting and of the eight western coal producers, only three attended the meeting

From the poor attendance and the lack of response to program proposals from the western members in the past, it will be very difficult to justify future meetings in western Canada.

PERSONNEL

Representation on the Technical Committee has been increased by the addition of Mr. P. Ahara from Domtar. No other changes in official representation have taken place from other companies.

Dr. W. R. Leeder has been appointed since his return from England as Manager of the Western Research Laboratory.

PRODUCTIVITY

In the year August 1, 1977 - July 31, 1978, the tests carried out in the test ovens are as follows:

<u>Category</u>	<u>18"</u>	<u>12"</u>	<u>Koppers</u>
Self-sufficiency	31	21	8
Partial Briquetting	42	3	0
Confidential (Steel Co.)	0	9	13
(Coal Co.)	0	7	0
Correlation	15	11	1
Resource Evaluation	0	16	14
Research	0	11	26
Other	3	5	0
	<u>91</u>	<u>83</u>	<u>62</u>

RESEARCH STUDIES

- a) Standardization and correlation studies: 18" Moveable wall oven.

The work on the sensitivity of the 18" MWO and the correlation with the 12" MWO has been completed. The main conclusions are:

- a) The 18" MWO reflects changes in coal preparation and oven operating conditions to changes in coke quality.
- b) Results from the 18" oven are on the average two stability points higher than the results from the 12" oven.

A complete report, issued jointly by J. F. Gransden and W. R. Leeder has been circulated.

One area which did not show good agreement was the correlation between the technical scale oven and the industrial ovens. Generally, the industrial scale ovens showed a higher stability (5-10 points) than the test ovens which in some instances can be explained by sample location. However, in an attempt to get a better correlation, a follow-up proposal for further tests is attached for your approval.

b) Selective pulverization

Phase II of the work is complete. The results of Phase II indicate that increasing coal blend pulverization from 65% to 100% -6 m will increase stability 9 points. With Phase II complete, the work on the project is now complete. An interim report from Phase I has been issued and a final report incorporating the results from Phase II is forthcoming.

The main conclusion from the work is that selective pulverization shows no improvement over conventional pulverization at increasing coke quality. The overriding factor is the overall blend pulverization.

c) Briquette addition to the coke oven charge.
(From a progress report - J. Price)

Summary of Phase I - Series 1.

Partial briquetting of the reference coal blends of four steel companies was undertaken as the initial phase in this program to determine what improvement (if any) in present coke quality could be expected by using this technology.

Oven tests were carried out in the 18-in. oven on the four reference blends, on the blends 30% briquetted, and on reconstituted blends consisting of 30% crushed briquets and 70% reference blend. The briquets were made after the coal blends were crushed to 90% minus 14 mesh and mixed with Gulf #2 roofing asphalt binder.

Results indicated partial briquetting improved ASTM and JIS tumbler drum indices for all reference blends. Maximum coke improvement was found for the Dofasco blend with the ASTM stability increasing by 6.7 units (averaged result) while the least improvement (2.8 units) was found for the Algoma blend. Mean coke size decreased by approximately 0.04 in. for three of the reference blends, but increased by approximately 0.02 in. for the Dofasco blend. Oven pressures generally increased slightly, with partial briquetting, to values between 0.4 and 0.7 psi. All results were within safe limits; the maximum wall pressure for any test was 0.74 psi.

A comparison of test results between charges 30% briquetted and charges made of 30% crushed briquets (similar bulk densities) showed that the former charges gave cokes of slightly better quality. However, addition of pitch and finer crushing of the coal (in charges containing crushed briquets) improved coke quality by approximately 1.7 stability units from that of the loose reference blends.

Phase I - Series 2, reducing the amount of low volatile coal while maintaining coke quality by partial briquetting is currently underway as is the addition of non-coking coals to the standard reference blends.

d) Self-sufficiency

This work is complete and a final report will be issued. The project has documented the presently mined Canadian coals and their properties, individually and blended with other coals. In most cases, the predicted stabilities were higher than either the 18" or 12" oven test results.

e) Hot strength testing of coke

Progress has been slow on this project due to manpower allocation to other higher priority projects. Work has been completed on the sensitivity of the test and based on eight tests to date, the results are as follows:

<u>Test</u>	<u>Std. Deviation</u>
Reactivity	1.30
Strength-after-reaction	3.49

If small changes are to be detected, considerable repetitive testing would be required. Contact is being made with others using the test to check whether this considerable variation is a function of the test or whether the equipment being used is non-standard.

f) Formed coke

The pilot scale (100 lbs./hour) formed coke facility at CANMET will be dismantled. The equipment is not presently operating and would require 1.5 man years to put into shape, and, at best, would not be able to produce a better product than the smaller bench scale equipment.

There is no program at present for formed coke, and until such time as more interest is generated within the CCRA membership, formed coke will stay at the current awareness level.

POINTS FOR REVIEW BY THE BOARD

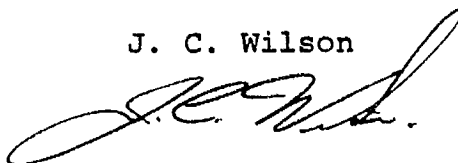
As indicated in section "Research Studies" (a), attached is a proposal for a program to correlate the moveable wall ovens with the commercial scale ovens.

CONCLUDING REMARKS

Past attendance at the Technical Committee, as well as the Board of Director's meetings, has traditionally been dominated by the integrated steel producers. This has also been reflected in the types and direction of projects which have been handled by the technical committee. Attempts by the Board and the Technical Committee to involve the member coal producers has not been successful as demonstrated by the attendance at the Technical Committee meeting held in Calgary.

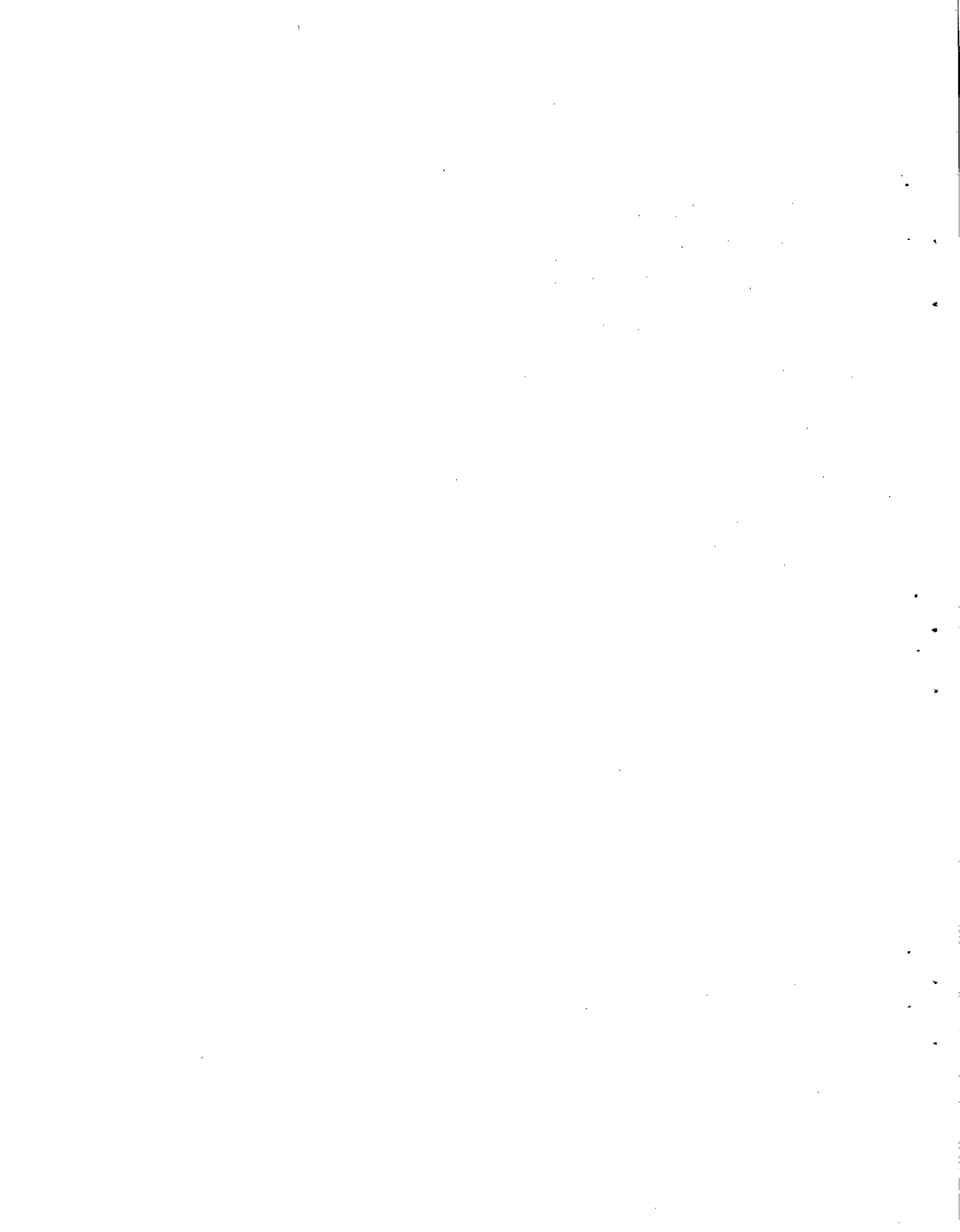
In order to make the CCRA work, we must have input from both the producers and users. I believe the future of the CCRA depends upon this input.

J. C. Wilson



Attach.

September 27, 1978



PROPOSAL

Correlation of Industrial - CANMET Coke Ovens

Part 2

Background:

BACKGROUND

Differences in ASTM tumble test results and sizing have been observed between coke produced industrially and (now the CANMET 18-in. oven operated at standard conditions of a dry oven bulk density of 46.5 lb/ft³ and a flue temperature of 1125°C equivalent to a coking rate of 1 inch/hr to a charge centre temperature of 1000°C) - Table 1. These conditions were based on a CCRA TC estimated industrial oven bulk density of 46-47 lb/ft³. This CANMET 18-in. oven coke is larger, but has lower ASTM stabilities and hardnesses. The 18-in. oven coke hardnesses, a factor primarily influenced by the oven bulk density, e.g. coke ASG, were consistently lower than observed for industrial skip coke. Tests of the ASG of two industrial cokes, seen in Table 2, and the use of Figure 1, suggest that perhaps the test oven should be charged to a higher bulk density. However the influence of the testing point on the quality of industrial coke clouds this picture.

Objective:

To determine coking conditions for the 18-in. test ovens to produce similar coke sizing, ASG, stability and hardness as industrial wharf coke.

Method:

The method would be to sample coal and wharf coke from one battery at one or more companies, test the coke both at the company and in Ottawa, then prepare coke in Ottawa with the coal and test its properties. The influence of differences in testing procedures and equipment, company coke sampling point and Ottawa oven parameters could then be taken into account to standardize the Ottawa 18-in. oven operations to produce coke similar to a company's wharf coke.

Suggest do tests with one company to determine how closely Ottawa can produce a wharf coke, before testing with other possible companies.

TABLE 1

	Company A Blend 1	Technical-Scale Oven			Average	Difference
Stability	54.7	50.6	49.8	49.9	50.1	- 4.6
Hardness	67.3	57.5	57.8	56.7	57.3	-10.0
Mean Coke Size	2.9	2.95	3.19	3.18	3.10	+ 0.2
ASTM Bulk Density	43.1	43.5	43.0	42.8	43.1	-
	Company B Blend 2					
Stability	54.2	51.7	50.9	50.2	50.9	- 3.3
Hardness	69.4	61.7	61.0	61.5	61.4	- 8.0
Mean Coke Size	2.55	2.62	2.50	2.51	2.54	- 0.01
ASTM Bulk Density	42.6	43.0	43.0	43.0	43.0	+ 0.4
	Company B					
Stability	54.7	46.8	48.9	50.2	48.6	- 6.1
Hardness	67.0	59.9	62.0	62.5	61.5	- 5.5
Mean Coke Size	1.81	2.37	2.53	2.41	2.44	+ 0.63
	Company C					
Stability	58.1	45.0	49.8	50.6	48.5	- 9.6
Hardness	65.6	57.2	60.0	60.5	59.2	- 6.4
+ 2-in. coke	35.8	67.7	67.2	71.5	68.8	+33.0

TABLE 2

ASG of Company Cokes

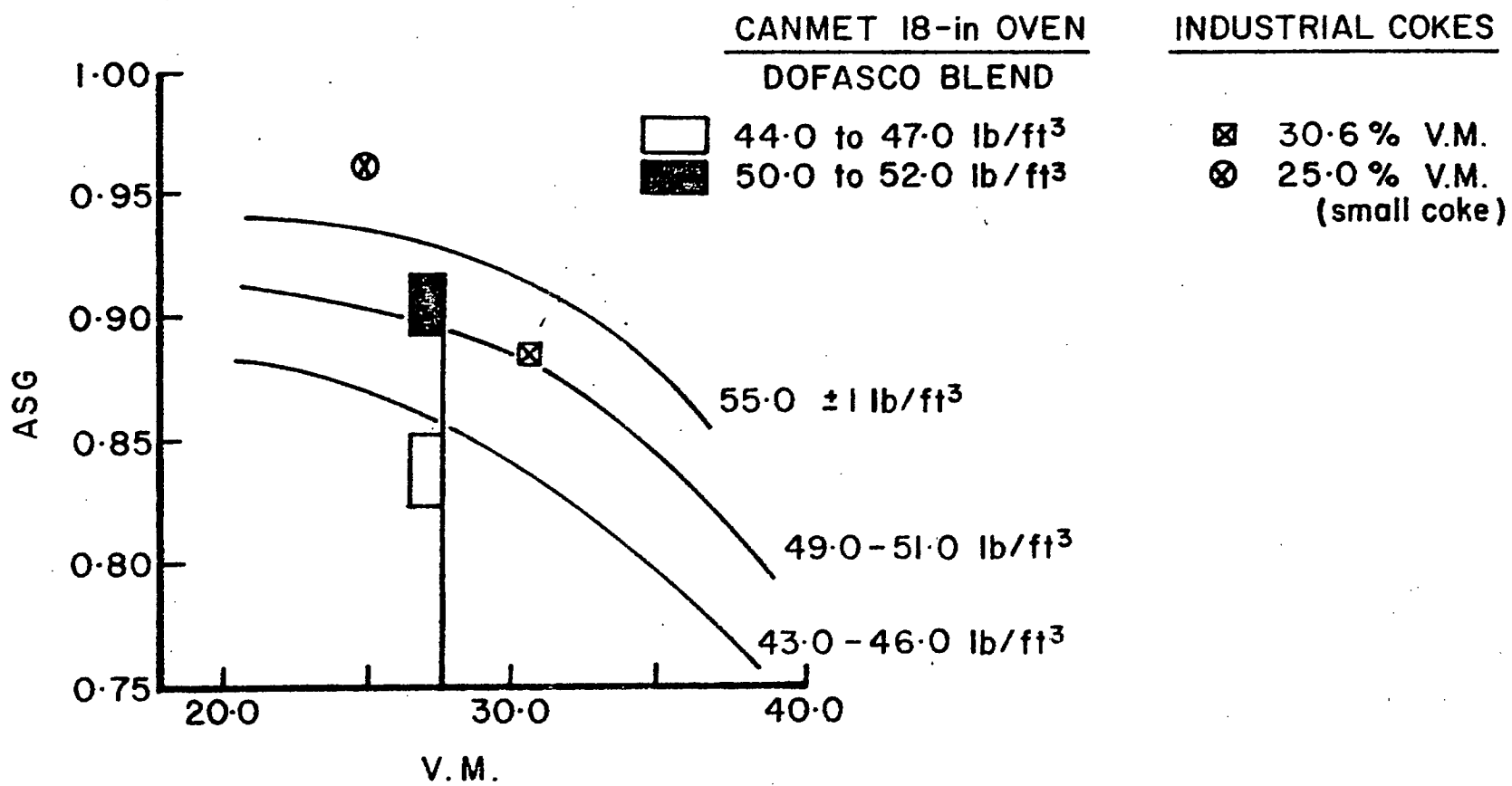
1. Company A: Blend V.M. \approx 30.6 \pm 1%

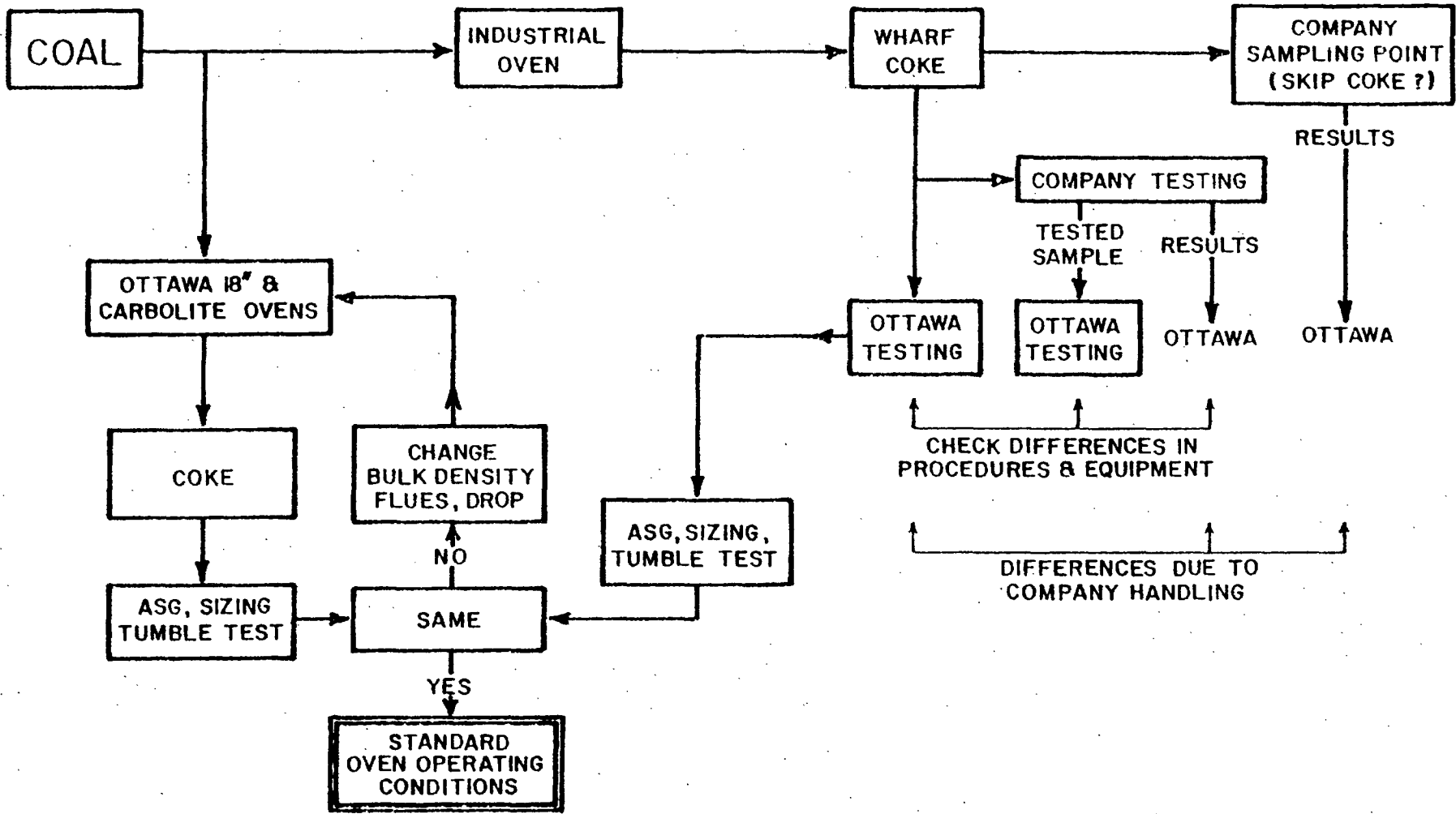
ASG: 0.891 (2 x 3" coke)
0.887
0.886
0.879
0.883
0.884
0.883
0.891
0.876
0.868
0.897
0.881

Avg 0.883

2. Company B: Blend V.M. \approx 25 \pm 0.5%

ASG: Sample A - 0.974 (coke small in size, may have
Sample B - 0.951 increased ASG)





THE CANADIAN CARBONIZATION RESEARCH ASSOCIATION

HAMILTON, ONTARIO

F I N A N C I A L S T A T E M E N T S

JULY 31, 1978

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AUDITORS' REPORT

To the Members of The Canadian Carbonization Research Association

We have examined the balance sheet of The Canadian Carbonization Research Association as at July 31, 1978 and the statement of revenue and unappropriated surplus for the year then ended. Our examination was made in accordance with generally accepted auditing standards, and accordingly included such tests and other procedures as we considered necessary in the circumstances.

In our opinion these financial statements present fairly the financial position of the association as at July 31, 1978 and the results of its operations for the year then ended in accordance with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

Toronto, Ontario
September 25, 1978

H.R. Doane And Company
Chartered Accountants

THE CANADIAN CARBONIZATION RESEARCH ASSOCIATION

BALANCE SHEET

AS AT JULY 31, 1978

	<u>1978</u>	<u>1977</u>
<u>ASSETS</u>		
Current		
Cash	\$ 32,197	\$ 27,239
Term deposits	65,000	62,000
Accounts receivable	24,892	
Accrued interest receivable	<u>1,427</u>	<u>2,131</u>
	<u>\$ 123,516</u>	<u>\$ 91,370</u>

<u>LIABILITIES</u>		
Current		
Accounts payable		
Due to The Department of Energy, Mines and Resources (Canmet)	\$ 26,892	
Professional fees	175	
Membership fees paid in advance	<u>12,000</u>	<u>30,000</u>
	<u>39,067</u>	<u>30,000</u>

<u>MEMBERS' EQUITY</u>		
Unappropriated surplus	84,449	61,370
	<u>\$ 123,516</u>	<u>\$ 91,370</u>

THE CANADIAN CARBONIZATION RESEARCH ASSOCIATION

STATEMENT OF REVENUE AND UNAPPROPRIATED SURPLUS

YEAR ENDED JULY 31, 1978

	<u>1978</u>	<u>1977</u>
Revenue		
Membership fees	\$ 105,000	\$ 96,000
Test revenue	85,965	14,256
Interest income	6,236	7,088
	<u>197,201</u>	<u>117,344</u>
Expenses		
Canmet membership fees	105,000	93,000
NKK		128
Office supplies' expense	701	148
Oven tests	68,096	14,256
Professional fees	325	250
	<u>174,122</u>	<u>107,782</u>
Excess of revenues over expenses	23,079	9,562
Unappropriated surplus, beginning of year	<u>61,370</u>	<u>51,808</u>
Unappropriated surplus, end of year	\$ <u>84,449</u>	\$ <u>61,370</u>