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DEPARTMENT OF MINES AND TECHNICAL SURVEYS
MINES BRANCH

OTTAWA

FUELS DIVISION

TECHNICAL MEMORANDUM 171/58-PREP

EVALUATION OF THE COKING CHARACTERISTICS
OF A SAMPLE OF COAL FROM THE
NORDEGG AREA, ALBERTA

by

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INTRODUCTION

The reviving interest in the coking coals of Western Canada prompted an industrial group in the west to request a determination of the coking characteristics of a coal deposit which they were contemplating leasing. This request was made to Professor Donald Quon, Research Engineer, Dept. of Chemical and Petroleum Engineering, University of Alberta and passed on to the Fuels Division on Feb. 8, 1958. As this comes under the Division's continuing project of evaluating Canada's coking coal resources the study was made.

The coal seam in question, the Division was advised, is exposed on the south bank of the Big Horn River, some 200 yards above Crescent Falls, approximately 18 miles southwest of Mordegg, Alberta. The seam, considered to be medium volatile bituminous coal, was said to be about six feet thick with a 30° dip. Details regarding the opening from which the sample was taken were not given. However, Professor Quon was cautioned by the Division to take the sample across the seam at least 20 ft. from the outcrop, as a sample from an exposure at the surface could be seriously oxidized thus deleteriously affecting the coking properties.

A sample of coal was received August, 1958, with a covering letter from D. Quon dated July 29, 1958 in which it was requested that a copy of the report be sent to: Mr. K. Schmidt, 10266 - 124 Street, North Surrey, B.C.

In addition to determining the chemical and physical characteristics of the coal the coking properties were evaluated by means of the Swelling Index, Gieseler plasticity and the small scale Bethlehem coke oven. The test data and comments were transmitted by letter to Prof. Quon and Mr. Schmidt on August 26, 1958.

SUMMARY OF RESULTS

The detailed test data are presented in Tables 1 to 4. Within the scope of the tests conducted and the limitations of the sample obtained the data indicate that this medium volatile bituminous coking coal is of high grade and would be an excellent blending coal and might under certain conditions be suitable for coking alone.

The analyses of the coal are presented in Table 1. The ash and sulphur are low. The volatile matter is also low by American standards for a coking coal for processing alone but would be acceptable as a valuable blending coal for admixture with high volatile coking coals.

Table 2 presents the probable physical properties of coke made from the sample of coal when processed in standard by-product ovens. This data is predicted from the F.R.L. Swelling Index and the volatile matter of the coal evolved at 600°C and is based upon the results from a large number of coke oven tests made from similar coals of the same rank (1).

In table 3 are presented the operating data for the carbonization test as it was conducted in the Bethlehem Expansion tester.

Evaluation of the physical properties of the coke produced in the Bethlehem coke oven as presented in Table 4, indicate a product of good strength and resistance to abrasion.

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(1) Mines Branch publication No. 737-2, "A Laboratory Test on Coals for Predicting the Physical Properties of the Resultant By-Product Coke". E. Swartzman, E.J. Burrough and R.A. Strong (1933).

DETAILS OF RESULTS

TABLE I

Analysis of Sample of Coal

Laboratory No.	2668-58	
	As Received Basis	Dry Basis
Proximate Analysis		
Moisture.....%	1.4	0.0
Ash.....%	5.4	5.5
Volatile Matter.....%	23.1	23.4
Fixed Carbon.....%	70.1	71.1
Sulphur.....%	0.3	0.3
Calorific Value.....Btu./lb.	14,348	14,544
Ash Softening Temp.°F		2638
Bulk Density.....Lb./cu. ft.		46.0
Grindability Index (Hardgrove).....	-	123

Mineral Matter Free		
Calorific Value.....Btu./lb.	-	15,490
Volatile Matter.....%	-	24.4

Coking Properties		
ASTM Swelling Index.....	-	7.5
FRL Swelling:		
Index.....	-	1102
Volatile at 600°C.....%	-	16.8
Gieseler Plasticity:		
Maximum Fluidity.....DDM	-	16
Temp. of Max. Fluidity.....°F	-	440
Solidification Temp.....°F	-	470

Specific Volatile Index		186

Rank:		
From Specific Volatile Index.....	Ortho-Bituminous	
ASTM Classification.....	Medium Volatile Bituminous	

TABLE 2

Predicted Approximate Quality of Oven Coke

FRL Swelling	
Index.....	1102
Volatile at 600°C.....	16.8
Group.....	II
Size on Wharf	
On 3 in.%	25 - 40
1/2 in. x 0 (Breeze)%	1.0 - 2.5
Shatter Test	
Plus 2 in. Index.....%	55 - 65
1/2 in. x 0 (Breeze).....%	2.0 - 3.0
Abrasion	
Plus 1-1/2 in. Index.....%	85 - 95
10 Mesh x 0 (Dust).....%	2.5 - 3.5
Density	
Apparent Specific Gravity.....	0.85- 0.95
Bulk Density.....lb./cu. ft.	24 - 26
Transverse Shrinkage.....	Fair (Difficult to Discharge)
Appearance of Natural Surface.....	Steel Grey and Smooth
Shape.....	Square
Strength.....	Hard
Cross Fracture.....	Med. to Large Amount, Straight
Longitudinal Fracture.....	Small to Medium Amount
Cell Structure.....	Dense
Sponge.....	Very Little
Pebbly Seam.....	None

TABLE 3

Carbonization Data and Visual Characteristics of Coke
From Bethlehem Expansion Tester

Operating Data		
Weight of Charge.....	Lb.	25
Size of Coal Charged (-1/8 in.).....	%	83.1
Depth of Charge in Oven.....	in.	5.25
Bulk Density (Charged).....	Lb./cu. Ft.	55.6
Temperature of Oven Sole:		
Initial.....	°F	1350
Final.....	°F	1820
Top Temperature.... Final	°F	1220
Expansion Data		
Corrected* Expansion		
Maximum.....	%	+ 1.4
Final.....	%	- 0.14
Coke Yield.....	%	76.7
Visual Characteristics of Coke		
Appearance.....		Dull to Steel Gray
Shape and Size.....		Medium; Blocky
Cross Fracture.....		Med. Amt. Sl. Steppy
Longitudinal Fracture.....		Med. Amt.
Cell Structure.....		Dense
Sponge.....		None
Pebbliness.....		Slight Amt.

* Method of calculation presented in U.S. Bureau of Mines Report of Investigations, R.I. 3403.