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FUEL RESEARCH INSTITUTE OF SOUTH AFRICA.

TECHNICAL MEMORANDUM NO. 18 OF 1963

FURTHER FULL SCALE COKING INVESTIGATION OF HLOBANE AND NORTHFIELD COALS ON BEHALF OF AMCOR AND THE NATAL NAVIGATION COLLIERIES & ESTATE COMPANY LIMITED.

BY:

DR. C.C.LA GRANGE

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FURTHER FULL SCALE COKING INVESTIGATION OF HLOBANE AND NORTHFIELD COALS ON BEHALF OF AMCOR AND THE NATAL NAVIGATION COLLIERIES & ESTATE COMPANY LIMITED.

The first series of tests in this programme was carried out in the latter half of 1962, and the results were communicated in F.R.I. Technical Memorandum No. 21 of 1962.

It was shown that the two coals Hlobane and Northfield, which are to be the main components of the blend to be coked by Amcor at Newcastle in the future, yielded cokes with satisfactory physical characteristics whether coked alone or in admixture. It was also possible to add different proportions of various other coals and even anthracites to the blend without undue deterioration in the quality of the coke.

However, a weakness in the test programme was the fact that the Hlobane and Northfield coals used in the tests represented the coking coals as produced for coking purposes by these collieries at that time. The coals were prepared from the relatively small size fractions (below about $\frac{3}{8}$") naturally arising at the two collieries and thus containing a concentration of the best coking constituents.

With the higher tonnage of coking coal to be supplied from the two collieries once coke production starts at Newcastle, it will be necessary to include larger sizes of coal in order to meet the demand and it could, therefore, not be assumed that coking coal characteristics will, under such circumstances, ipso facto, be satisfactory.

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Another factor which had to be borne in mind was the future mining policy at Hlobane. In order to extend the life of the mine by extracting the maximum available reserves, including seams and areas not previously worked, a rationalized mining procedure is to be introduced at the colliery.

With the above factors in mind it was decided to carry out a limited number of further full scale tests using Hlobane and Northfield coals representing as nearly as possible these products as they will be supplied on a long term in the future to Amcor and conforming to the minimum requirements of the specifications as laid down in the coking coal agreement between the colliery's company and Amcor.

In addition, two tests were included in which Alpha Anthracite duff was incorporated in the blend. The tests were done in April, 1963.

The Institute was not required to attend and report on the extraction and preparation of the two coking coals, but it is known that Amcor's representative attended to this and it must, therefore, be assumed that there was mutual agreement between the two interested parties that the coals supplied were in fact in accordance with what was required to be tested.

RESULTS AND DISCUSSION.

The results of the coking tests and analytical and other details of the blends and components used are given in Tables 1, 2 and 3.

As is normally done by the Institute with full scale testing, the coke samples were taken in duplicate to enable tests for physical characteristics to be carried out by both the British Standard methods (inches, square holes) and the Continental method (mm., round holes and Micum testing). It may be stated that the results obtained by the Continental method (see Table 1) largely confirm those

obtained .../

obtained by the other methods. Otherwise, no further notice need be taken for the present of these "metric" results.

In spite of the somewhat lower swelling numbers of the more recent Hlobane and Northfield coals, and contrary to what might have been anticipated, the cokes from tests Is.173 to Is. 176 are virtually of identical physical quality as the cokes made in the corresponding tests described in Technical Memorandum No. 21 of 1962. The only difference worth mentioning is the slightly smaller mean sizes of the cokes recently made. No explanation can be offered for this difference.

It will be observed that the B.S. Abrasion Indices of cokes from Tests Is. 177 and Is. 178 (15% and 8%, respectively, of Alpha Anthracite duff added) are somewhat lower than the corresponding indices obtained previously. This may mean that the coking coals (or rather the mixture used) have a lower capacity for accommodating an inert such as Alpha Anthracite. However, this is not necessarily the case as the grinding of the Alpha Anthracite in the latter series of tests (see Table 3) was not as fine as in the first series. (Finer grinding of the inert invariably results in better coke.) The grinding in the latter series was fairly similar to the grinding of the Elandsberg Anthracite also used in the previous series, and corresponding B.S. Abrasion Indices are in reasonably close agreement.

(SIGNED) C. C. la GRANGE.
CHIEF OF DIVISION.

PRETORIA.
15/5/63.

TABLE 1.

RESULTS OF FULL SCALE COKING TESTS - AMCOR SERIES

TEST NO.				Is 173	Is 174	Is 175	Is 176	Is 177	Is 178
Nominal Composition of Charge % *				80 A.H. 20 A.N.	65 A.H. 35 A.N.	100 A.H.	100 A.N.	60 A.H. 25 A.N. 15 A.A.	63 A.H. 29 A.N. 8 A.A.
Characteristics of Coke.	Inches, square holes	Size Analysis % Retained on (in., sq.)	4"	13	12	10	8	12	15
			3"	42	35	36	32	38	46
			2"	78	72	73	72	72	79
			1"	94	94	94	93	92	95
			½"	96	96	96	97	94	96
		Mean Size, in.		2.82	2.67	2.67	2.57	2.67	2.86
		B.S. Shatter Index	2"	71	70	64	68	70	72
			1½"	88	87	86	87	86	87
			½"	97.4	97.6	97.9	98.2	96.9	97.4
		B.S. Abr. Index		79	79	80	81	73	75
		S.A.S.S. Value		41	39	40	41	35	37
	mm., round holes	Size Analysis % Retained on (mm. round)	125	8	5	8	3	9	8
			80	58	43	49	47	47	55
			60	78	68	72	74	70	75
			25	96	93	95	96	94	95
			10	97	95	96	97	96	97
		Mean Size, mm.		82.9	74.4	79.6	77.5	78.1	82.1
		Size of Coke used for Micum Test + 25 mm.	M'_{40}	69	69	72	74	65	66
			M_{20m}	89	90	89	91	84	86
			M_{10m}	10.1	8.6	10.1	8.1	13.9	11.9
			$MMSS_m$	56	58	57	61	53	53
			$CMTV_m$	62	63	65	68	56	58
		Size of Coke used for Micum Test + 60 mm.	M_{40}	74	72	72	74	67	67
			M_{10}	10.2	9.0	9.7	8.3	13.9	12.6
			MMSS	54	53	52	56	50	49
			CMTV	67	66	65	68	58	59

* Abbreviations used: A.H. - Hlobane) Coals specially
A.N. - Northfield) supplied for the
A.A. - Alpha Anthracite) second series of "Amcor Tests".

$CMTV = \frac{M_{40} \times (100 - M_{10})}{100}$

TABLE 2.

FULL SCALE COKING TESTS IN ISCOR'S OVENS - Is. - (AMCOR) - SERIES.

DETAILS OF BLENDS CHARGED AND OF CARBONISING CONDITIONS.

Test No.		Is 173	Is 174	Is 175	Is 176	Is 177	Is 178
Sample No.		63/391	63/392	63/393	63/394	63/396	63/395
Coal Charged.	Composition of Charge* %	80 AH 20 AN	65 AH 35 AN	100 AH	100 AN	60 AH 25 AN 15 AA	63 AH 29 AN 8 AA
	Prox. Anal. % (A.D. Basis) H_2O	1.0	1.0	1.0	0.9	1.0	1.1
	Ash	12.7	12.6	13.1	12.5	12.5	12.7
	V.M.	22.1	22.5	22.1	22.9	21.4	20.6
	F.C.	64.2	63.9	63.8	63.7	65.1	65.6
	Sw. No.	3	4½	3	6½	2½-3	2½
	Size Anal. % +⅛"	12.9	9.9	13.0	13.1	12.8	15.2
	⅛" x 1/16"	17.1	16.3	19.8	22.4	19.1	19.9
	1/16" x 22m	22.7	24.8	22.5	27.3	22.6	21.5
	22 x 100m	34.8	35.5	32.3	29.8	31.1	31.7
	-100m	12.5	13.5	12.4	7.4	14.4	11.7
Carbonisation Details.	Moist. as Charged %	7.0	5.2	7.2	3.8	6.0	5.4
	Date Charged	8/4/63	8/4/63	9/4/63	9/4/63	16/4/63	16/4/63
	Oven No.	137	127	152	142	122	112
	Mean Temp. °C	1327	1353	1295	1305	1354	1344
	Nett Coking Time, hrs.	15.9	15.9	15.5	15.5	15.6	15.5
Estimated (Dry basis)	Total Coke Yield %	80.9	80.6	80.9	80.3	81.5	82.2
	Ash in Coke %	15.9	15.8	16.4	15.7	15.5	15.6

*For Analytical details of Components used in Blends see Table 3.

Abbreviations used:- AH - Hlobane, AN - Northfield, AA - Alpha Anthracite } Coals specially supplied for the second series of "Amcor Tests.

TABLE 3.

FULL SCALE COKING TESTS IN ISCOR'S OVENS Is - (AMCOR) - SERIES.

ANALYTICAL DETAILS OF COMPONENTS USED IN BLENDS.

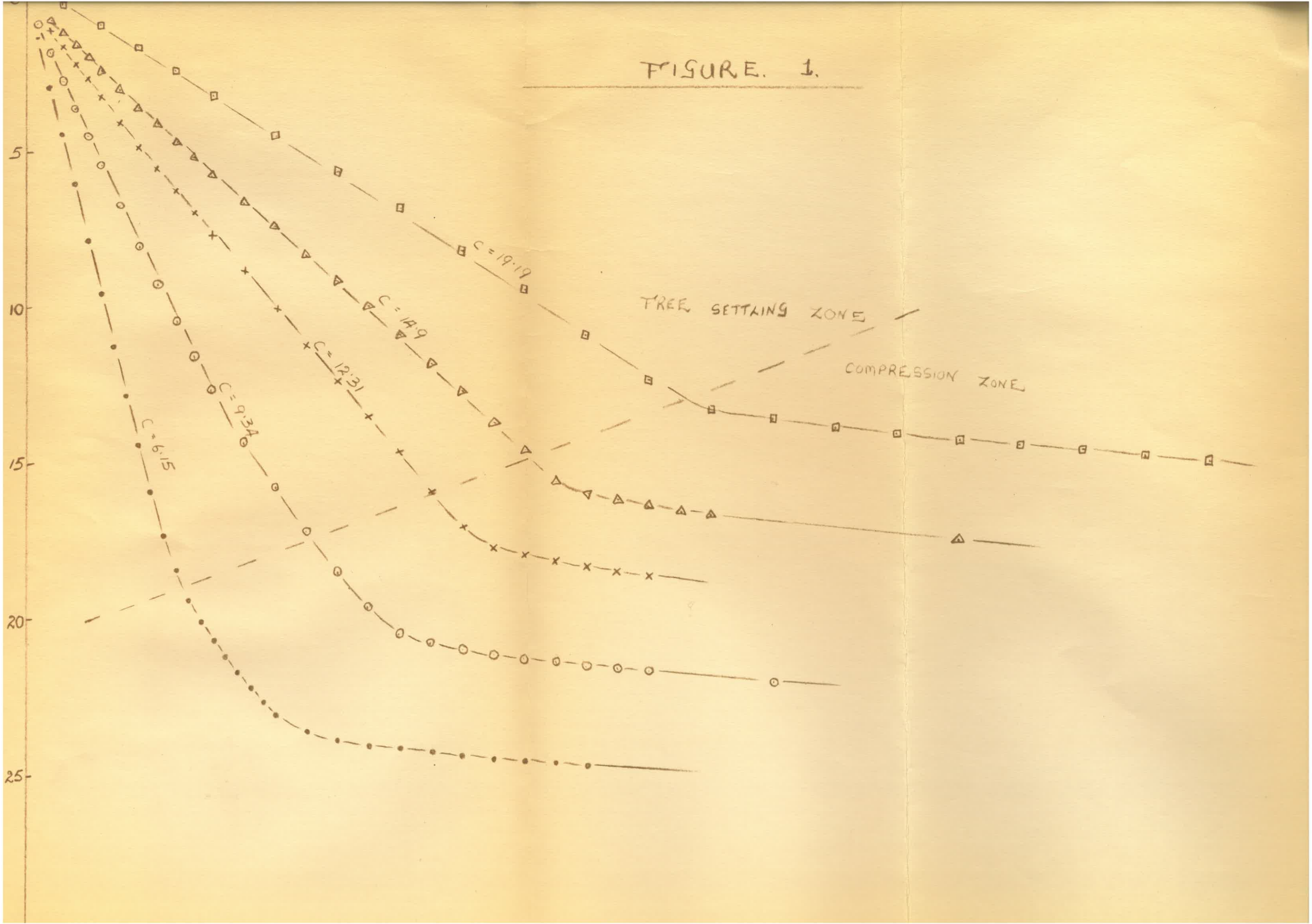
Test No.	Is 173		Is 174		Is 175	Is 176	Is 177			Is 178		
Sample No.	63/391		63/392		63/393	63/394	63/396			63/395		
& Identification	C	D	C	D	C	C	C	D	E	C	D	E
Component*	AH	AN	AH	AN	AH	AN	AH	AN	AA	AH	AN	AA
Prox. Anal. (Air dry basis) % H_2O	1.0	0.9	1.0	0.9	1.0	1.0	1.0	1.2	1.5	1.1	1.1	1.3
Ash	12.8	12.3	12.8	12.5	13.1	12.4	12.9	12.2	11.3	13.2	12.3	11.4
V.M.	22.0	22.3	22.2	22.7	21.9	22.8	22.0	23.8	10.6	22.0	23.5	10.9
F.C.	64.2	64.5	64.0	63.9	64.0	63.8	64.1	62.8	76.6	63.7	63.1	76.4
Sw. No.	3	6	2½	6½	3	6½-7	2½	4½-5	-	3	5½-6	-
S, %	-	-	-	-	0.82	1.38	-	-	-	-	-	-

SIZE ANALYSIS OF ALPHA ANTHRACITE AFTER GRINDING IN ISCOR'S ROD MILL AND USED FOR BLENDING IN TESTS Is 177 & Is 178.

Size Anal. %	+⅛"	0.4
	⅛" x 1/16"	9.4
	1/16" x 22m	43.1
	22m x 100m	33.0
	-100m	14.1

*Abbreviations used: AH - Hlobane, AN - Northfield, AA - Alpha Anthracite } Coals specially supplied for the second series of "Amcor Tests".

FIGURE. 1.


-1
5
10
15
20
25
C = 19·19
C = 14·9
C = 12·31
C = 9·34
C = 6·15
TREE SETTLING ZONE
COMPRESSION ZONE