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FUEL RESEARCH INSTITUTE OF SOUTH AFRICA.

TECHNICAL MEMORANDUM NO. 9 OF 1957.

NUMBER 5-SEAM COAL FROM THE VENTILATION SHAFT
AT SPRINGBOK COLLIERY.

By:

C.C.la Grange.

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TION SHAFT AT SPRINGBOK COLLIERY

Subsequent to the issue of this Institute's Technical Memorandum No. 10 of 1955* the results of additional investigations carried out at the Institute on No. 5 Seam coal taken in the ventilation shaft, about 4500ft. north - north-east of Springbok Colliery's main hauling shaft, became available. These results are given in the present memorandum which should be regarded as an appendix to Technical Memorandum No. 10/1955.

A bulk sample of $4\frac{1}{2}$ tons was obtained for the tests. This was crushed in a hammer mill (with bars removed) to $-1\frac{1}{2}$ in. (nominal) and screened with $\frac{1}{4}$ in. and $1/16$ in. screens (sq. holes), respectively. Representative portions of the $+ 1/16$ in. size fractions were washed by the fractional method in zinc chloride solutions at a range of specific gravities. Prepared samples of the specific gravity fractions were used for reconstituting samples for analysis representing cumulative floats at the different specific gravities. The results of these investigations are given in Table 1 which is self-explanatory.

The washability results are shown graphically in Figure 1. Of special interest is perhaps the ± 0.1 s.g. distribution values which can be summarized as follows:-

S.G. of Separation.	± 0.1 S.G. Distribution (%)	
	$- 1\frac{1}{2} + \frac{1}{4}$ " Fraction.	$-\frac{1}{4} + 1/16$ " Fraction.
1.55	8	5
1.50	16	12
1.45	33	28

These/.....

* "Coking tests to determine the Suitability of coals from Springbok Colliery as blend coking coals" by C.C. la Grange, F.R.I.
Technical Memorandum No 10 of 1955 (Confidential.)

These figures signify that down to separation specific gravities of about 1.50, the coal could probably be washed reasonably satisfactorily in a Baum jig. Between 1.50 and 1.45 s.g. (and lower), however, the washability proposition becomes extremely difficult as the specific gravity is lowered and efficient separation cannot be expected in a jig under such conditions.

For the coking tests washed material was prepared by washing the $+\frac{1}{4}$ " coal (sample No. 55/112 A) in zinc chloride solution at a specific gravity of 1.40, to yield product 55/112 A_{1b} and $-\frac{1}{4}$ ", $+ 1/16$ " coal (sample No. 55/112 B) in the pilot cyclone washer at a specific gravity of about 1.42 to yield product 55/112 B_{1b}. These washed products were mixed in the proper ratio, and also with the correct amount of (unwashed) $-1/16$ " material to yield sample 55/112 X used in the coking tests. The details of these operations and the analysis of products appear in Table II.

Table III reflects the analyses of all the coals and blends used in the coking tests as well as the composition of the blends. Although the Springbok No. 5 Seam coal (sample 55/112 X) had a low ash content (9.9%) it should be remembered that it contained a high proportion (31.8%) of $-1/16$ " material that had not been washed at all. It will also be observed that the quantity of D.N.C. coal (sample No. 56/238) obtained in the first instance was insufficient to complete the series of tests and that a fresh quantity (sample No. 56/628) was later obtained for this purpose. This sample had an appreciably higher ash content than the first (14.7 and 11.7 per cent, respectively) but the coking properties, as judged by the swelling numbers (6 and $5\frac{1}{2}$, respectively) were fairly similar.

Table I/.....

TABLE I

RESULTS OF CRUSHING, SCREENING AND WASHING. ANALYSIS OF PRODUCTS (AIR-DRY BASIS.)

Screen sizes and yields (after crushing.)	"Fractional" Results			"Cumulative" Results							Sw. No.	
	S.G. Fraction.	Yield %	Sw. No.	Sample No.	Floats at S.G.	Yield %	Moist %	Ash %	Vol. Mat. %	Fixed Carb. %		
Sample No. 55/112 A Size Fr.: -1 1/2", + 1/4" = 54.9% of original.	Fl. 1.35	56.6	3 1/2-4	55/112 A1	1.35	56.6	2.3	7.5	36.2	54.0	3 1/2-4	
	1.35-1.40	18.2	1AG	A2	1.40	74.8	2.3	8.6	35.2	53.9	3 1/2	
	1.40-1.45	9.0	1AG	A3	1.45	83.8	2.3	9.3	34.6	53.8	3	
	1.45-1.50	3.6	1AG	A4	1.50	87.4	2.4	9.7	34.5	53.4	3	
	1.50-1.55	1.8	1AG	A5	1.55	89.2	2.2	10.0	34.3	53.5	2 1/2	
	1.55-1.60	1.2	F	A6	1.60	90.4	2.2	10.4	34.2	53.2	2 1/2	
	1.60-1.65	1.1	F	A7	1.65	91.5	2.4	10.8	34.1	52.7	2 1/2	
	Sk. 1.65	8.5*	-	A	Un-washed	100.0	2.2	14.4	32.8	50.6	2 1/2	
	Sample No. 55/112 B Size Fr.: -1/4" + 1/16" = 18.7% of original	Fl. 1.35	61.4	5 1/2	55/112 B1	1.35	61.4	2.3	5.6	36.6	55.4	5 1/2
		1.35-1.40	18.0	1AG	B2	1.40	79.4	2.4	7.0	35.2	55.4	4 1/2
1.40-1.45		6.7	1AG	B3	1.45	86.1	2.2	7.7	34.9	55.2	4 1/2	
1.45-1.50		2.4	1AG	B4	1.50	88.5	2.5	8.0	34.4	55.1	4 1/2	
1.50-1.55		1.2	F	B5	1.55	89.7	2.4	8.3	34.2	55.1	3 1/2-4	
1.55-1.60		1.2	F	B6	1.60	90.9	2.7	8.6	34.1	54.6	3 1/2	
1.60-1.65		0.4**	F	B7	1.65	91.3	2.4	8.7	33.9	55.0	3 1/2	
Sk. 1.65		8.7**	-	B	Un-washed	100.0	2.3	12.7	33.1	51.9	2 1/2	
Sample No. 55/112 C -1/16" Fr. = 26.4% of original		NOT WASHED			55/112 C	Unwashed	100.0	2.6	13.4	32.3	51.7	2-2 1/2

* Ash content = 51.6%

** Ash content = 55.6%

Table II/.....

TABLE II.

DETAILS OF THE PREPARATION OF SPRINGBOX NO. 5 SEAM COAL FOR COKING TESTS.

Before Washing		After Washing									
Sample No.	Size Fraction	% of Original	Float Yield on Washing for Coking Tests (%)		Weight ratio for mixing for coking	Sample No.	Analysis (air-dry basis)				
			Of Size Fraction	Of Original.			Moist. %	Ash %	V.M. %	F.C. %	Sw. No.
55/112 A	1½"x¼"	54.9	75.0	41.2	49.7	55/112 A _{1b}	2.4	8.5	35.4	53.7	4½
55/112 B	¼"x1/16"	18.7	81.8	15.3	18.5	55/112 B _{1b}	2.2	7.4	35.2	55.2	5
55/112 C [‡]	-1/16" [‡]	26.4	100.0 [‡]	26.4 [‡]	31.8 [‡]	55/112 C [‡]	2.6	13.4	32.3	51.7	2-2½
TOTAL.		100.0	-	82.9	100.0	55/112 X	2.4 ^{‡‡}	9.9 ^{‡‡}	34.4 ^{‡‡}	53.3 ^{‡‡}	3

‡ Not washed.

‡‡ Calculated analysis.

Table III/.....

TABLE III

COMPOSITION AND ANALYSIS OF COALS AND BLENDS.

Sample/ Test No.	COAL OR BLEND.	Analysis (Air-dry basis)				Screen analysis after crushing for coking (%)		
		Moist %	Ash %	V.M. %	F.C. %	Sw. No.	+1/8" + 22 mesh	
55/112 X	Springbok No. 5 Seam, prepared for coking	2.4	9.9	34.4	53.3	3	4.6	60.8
56/238	D.N.C. ex Iscor	1.6	11.7	32.2	54.5	6	14.4	60.9
56/627	Blesbok ex Iscor	2.6	9.9	32.2	55.3	3-3½	5.8	66.0
56/628	D.N.C. ex Iscor	1.4	14.7	29.9	54.0	5½	16.2	58.5
189	100% Springbok No. 5 (55/112 X)			as above				
188	80% Springbok No. 5 (55/112 X) + 20% D.N.C. (56/238)	2.2	10.3	34.0	53.5	3½	6.6	60.8
186	70% Springbok No. 5 (55/112 X) + 30% D.N.C. (56/238)	2.2	10.4	33.7	53.7	4	7.5	60.8
198	35% Springbok No. 5 (55/112 X) + 35% Blesbok (56/627) + 30% D.N.C. (56/628)	2.2	11.3	32.3	54.2	3½-4	8.5	61.9

* Calculated analyses.

A description/.....

A description of the cokes obtained appears in Table IV and their physical characteristics are recorded in Table V.

REMARKS ON TESTS.

Although the Springbok No. 5 seam coal used in the tests described in this memorandum was really only a "spot" sample, enough evidence has been obtained to be able to state that the coal should constitute a very useful source of blend coking coal, to augment other sources like Blesbok.

Provided the usual percentage (about 30) of D.N.C. coal is incorporated in the blend "fairly good coke" can be made. The distinct tendency for the coke to be fingery can probably best be counteracted by also incorporating Witbank No. 2 seam coal which is standard Iscor practice at present.

From Table V one might be inclined to conclude that Springbok No. 5 is somewhat inferior to Blesbok, but this is not necessarily the case. It should be remembered that although every possible precaution is taken at the Institute during the preparation of samples for coking tests, to reduce oxidation of the coal to a minimum, it is hardly likely that the Springbok coal was quite as fresh as the Blesbok coal obtained from Iscor. Another point which may be mentioned is that the cover of the seam in the ventilation shaft is only about 50'. Instances have been observed where a coal seam at much greater depth than this had suffered "in situ" weathering. No generalization about this type of weathering can, however, be made as the nature of the overlying strata and other factors are too variable. There was no indication in the present case, either from the appearance and nature of the coal, or from the analyses, that the seam had suffered underground weathering.

(Sgd.) C.C. la Grange.

PRINCIPAL TECHNICAL OFFICER.

PRETORIA.

15th April, 1957.

TABLE IV.

DESCRIPTION OF EXPERIMENTAL COKES.

Test No.	189	188	186
Composition of charge)	100% Springbok No. 5.	80% Springbok No. 5, 20% D.N.C.	70% Springbok No. 5 30% D.N.C.
Flue Temp. °C	1000	1000	1000
Colour	Dark grey to grey.	Dark grey	Grey
Size	Medium to small	Medium	Medium
Shape.	Irregular; inclined to be fingery	Inclined to be fingery.	Blocky, inclined to be fingery.
Longitudinal) Fissures.)	Large amount	Large amount	Fair amount
Transverse) Fissures.)	Fair to large amount	Fair amount	Fair amount
Cell Structure.	Fair	Fair to good	Good
Spongy Ends.	Small amount	Fair amount	Small amount
Cauliflower) Ends.)	Overdeveloped	Well to over-developed	Well to over-developed.
Ring.	Poor to fair	Fair to good	Good.
Pebbly Material.	Fairly large amount.	Fair amount.	Fair amount.
Remarks.	Probably requires D.N.C. to yield a better coke.	Fair coke	Fairly good coke.

TABLE IV (Contd.)

Test No.	198
Composition of Charge)	35% Springbok No. 5 35% Blesbok 30% D.N.C.
Flue Temp (°C)	1000
Colour	Dark grey.
Size	Medium
Shape.	Blocky, slightly fingery.
Longitudinal Fissures)	Large amount.
Transverse Fissures.)	Large amount.
Cell Structure.	Fair to good.
Spongy Ends.	Small amount.
Cauliflower Ends.)	Well to over- developed.
Ring	Good.
Pebbly Material	Large amount.
Remarks.	Fairly good coke.

Table V/.....

TABLE V

PHYSICAL CHARACTERISTICS OF EXPERIMENTAL COKES.

Test No.	Composition of Charge	Resistance to Shatter			Resistance to Abrasion		R.S.A. Value.	* Bulk Dens. (Dry basis) lb/cu ft.		
		Mean Size in.	Shatter Ind.		S.S.S.*	B.S. Cochr. Abr. Ind.			A.S.S.*	
			2"	1 1/2"						1"
189	100% Springbok No. 5	2.84	60	81	95.3	75	71	41	31	24.6
188	80% Springbok No. 5 + 20% D.N.C.	3.06	60	82	95.3	75	70	43	32	22.9
186	70% Springbok No. 5 + 30% D.N.C.	3.11	64	83	96.0	78	71	46	36	24.4
198	35% Springbok No. 5 + 35% Blesbok + 30% D.N.C.	3.29	69	85	96.2	81	69	47	38	26.4

* For an explanation of these indices see J. Chem. Met. Soc. S. Afr., Nov., 1952, 53, 130/2.

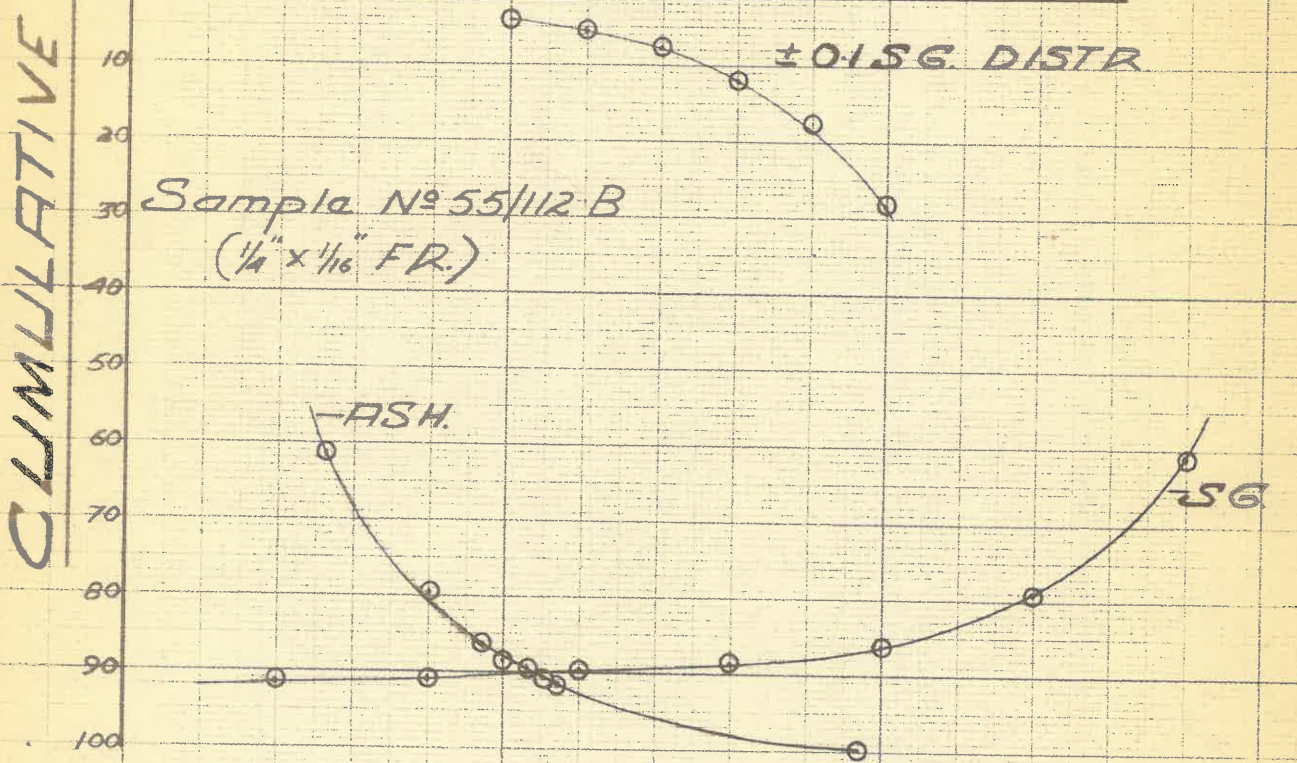
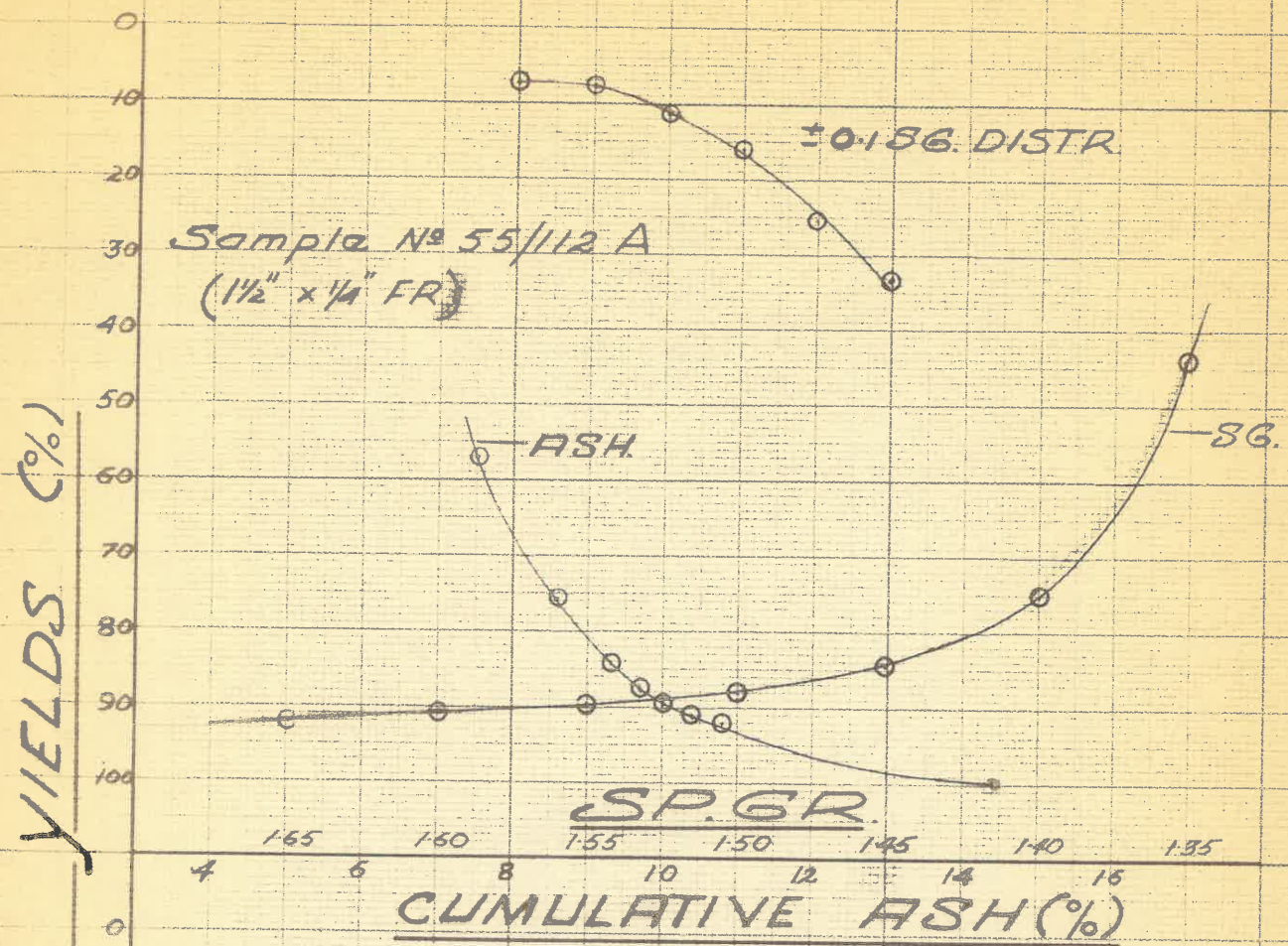


FIG. 1