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FUEL RESEARCH INSTITUTE OF SOUTH AFRICA.

TECHNICAL MEMORANDUM NO. 10 OF 1968.

4500

RESEARCH WORK BY THE F.R.I. ON WITBANK DUFF COALS, AND CONCERNING MAINLY THEIR UPGRADING AND POSSIBLE UTILIZATION FOR COKING PURPOSES.

C. C. LA GRANGE.

1948: Report No. 8/1948. See Bulletin No. 30 of 1949.

" Report No.10/1948. See Bulletin No. 29 of 1949.

1949: Bulletin No. 29. "Recovery of the coking fraction from Witbank fine coal by means of the Cyclone washer."P.J.v.d.Walt, Jnl.S.A.Chem.Inst., June 1949.Vol.11, No. 1 pp.29-58.

" Bulletin No. 30. "The recovery of coking coal from small coal, produced in the Witbank coal-field." C.C.v.d.Merwe, S.B.Gass, P.A.M.Brink and A.J.Petrick. Jnl. Chem.Met.& Min.Soc.S.A., Oct. 1949, pp. 73-91.

" Bulletin No. 38. "Graphical method for assessing the relative suitabilities of coal washing processes from float and sink and relative data." P.J.v.d. Walt. Jnl.Chem.Met & Min.Soc.of S.A., Sept. 1949, pp. 45-62

1950: Bulletin No. 28. "A study of the operation of the Cyclone washer and its application to Witbank fine coal." P.J.v.d.Walt. Jnl.Chem.Met.& Min.Soc.of S.A., Aug., 1950, pp.19-101.

" Report No. 4/1950. See Bulletin No. 28 of 1950.

" Report No.14/1950. (Revised) See Bulletin No. 30 of 1949.

1951: Bulletin No. 33. "Investigations relating to the production of metallurgical coke from South African coals." T.D.Morgan, J.P.Bossert, J.F.Harris and C.C.la Grange. Jnl.Chem.Met.& Min.Soc.of S.A., Jan.1951, pp.219-238.

1952: Tech.Memo.No.8/1952.„Sifanalise van Witbankse Fynsteenkool." J.M.v.d.Merwe.

1952.../

1952: Report No. 2/1952. "Preliminary study of technical and economic aspects of washing a certain Witbank duff in a cyclone in order to recover the coking fraction." P.J.v.d. Walt.

1953: Report No.18/1953. "Preliminary investigation of coking properties of small coal from the newer Witbank collieries". W.H.D.Savage.

" Tech.Memo.No.18/1953. "Results of box tests carried out at Iscor in Aug.-Oct.1953".C.C.la Grange.

" Report No.23/1953. "The use of the Hydraulic Cyclone as a step in the dewatering of fine coal." P.J.v.d.Walt.

1955: Report No.15/1955. "Results of some washing and coking tests on selected No.2 Seam duff coals from the Witbank coal-field." C.C.la Grange.

" Tech.Memo.No.10/1955. "Coking tests to determine the suitability of coals from Springbok Collier, as blend coking coal." C.C.la Grange.

1958: Tech.Memo.No.12/1958. "Notes on tentative procedures visualised for the full scale coking investigation of Witbank duffs." C.C.la Grange.

" Tech.Memo.No.22/1958. Joint Iscor-Sasol-F.R.I. Research Project. "Investigation on Witbank No.2 Seam Duff". B.van Eck and W.H.D.Savage.

" Tech.Memo.No.26/1958. Joint Iscor-Sasol-F.R.I. Research Project. "Investigation on Witbank No.2 Seam Duff." B. Moodie.

1959: Tech.Memo.No.6/1959. Joint Iscor-Sasol-F.R.I. Research Project. "Investigation on Witbank No. 2 Seam Duff." Third Progress Report. C.C.la Grange.

" Tech.Memo.No.14/1959."Progress Report on Research on Coking Coals Carbonisation and Coke". C.C.la Grange.

1963: .../

1963: Tech. Memo. No.6/1963. "A report on the results obtained from the analysis of Witbank No.2 Seam pea-duff and the washing of bulk samples thereof in the Pilot Plant." S.F.Streicher.

" Tech.Memo.No.16/1963. "Some Pilot Plant coking tests to evaluate the smaller sizes of No. 2 Seam coal from the eastern Witbank coal-field." C.C.la Grange.

1965: Report No. 5/1965. "Investigation of samples of selected duff coals for Rand Mines Ltd., aimed at producing low ash products." C.C.la Grange.

" Tech.Memo.No.48/1965. "Report on washing and coking tests conducted on a bulk sample of Douglas duff coals for Rand Mines Ltd." P.J.F.Fourie, P.J.A.Beukes and C.C.la Grange.

B. The tables and notes appended represent information obtained from time to time during investigations concerned with the possible production of coking coal from Witbank duffs and other products of relatively small size.

(This Memorandum has been compiled by: C.C.la Grange.)

PRETORIA.
26/2/68.

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ESTIMATE OF ANNUAL DUFF PRODUCTION (WITBANK NO.2 SEAM)

JUNE, 1958.

(1) PROMISING:

Greenside	872,008	
Douglas	1,394,312	
Phoenix	1,034,685	
Landau	1,209,291	All sizes.
Springbok	974,509	
F.N.C.	741,009	
van Dykedrift	679,445	
Nolvesrand	1,373,507	
	8,274,766	

Duff, (say) 18% - 1,489,458

(2) NON-PROMISING:

Albion	568,716	
Koornfontein	659,494	
New Clydesdale	1,071,095	All sizes.
Tavistock	562,039	
T.U.C.	1,386,648	
	4,247,992	

Duff,(say) 18% - 764,639

Thus : Duff Production (1) 1,489,000
(2) 765,000
2,254,000 Raw, or only jig-washed.

2¼ million tons per annum
At 20 Years life - 45 million tons
At 30 Years life - 67½ " "

NOTE: New Schoongezicht, Coronation and Witbank South not included.

FUEL RESEARCH INSTITUTE OF SOUTH AFRICA.

JOINT ISCOR - SASOL - F.R.I. RESEARCH PROJECT.

RESULTS OF PRELIMINARY ASSESSMENT OF WITBANK DUFFS.

I. Transvaal Navigation Colliery Duff (Sampled:5/8/58).

1. SCREEN ANALYSIS.

Aperture	% Yield
-¼" sq. + 30 mesh	79.7
-30 mesh	20.3

2. WASHABILITY CHARACTERISTICS OF +30 MESH FRACTION.

Specific Gravity	Cumulative Yield %	Cumulative Ash %	Swelling Number
1.30	8.2	3.6	3½
1.32	17.4	4.0	4
1.34	25.9	4.6	4½
1.36	36.0	5.3	3½
1.38	44.2	5.9	2½
1.40	51.3	6.3	1½
1.42	60.3	6.9	1½
1.44	65.8	7.3	1Ag
1.46	71.4	7.7	1Ag
1.48	75.9	8.3	1Ag
1.50	79.3	8.7	1Ag
1.52	82.2	9.1	1Ag
Whole Coal	100.0	13.7	1Ag

3. -30 ..../

3. -30 MESH FRACTION.

Selective froth flotation tests indicated that a froth yield of approximately 55% with an ash content of 8.5% can be obtained. This material, however, has a swelling index of only 1Ag.

II. Douglas Colliery Baum Washed Duff. (Sampled: 5/8/58).

1. SCREEN ANALYSIS.

Aperture	% Yield.
+¼" sq.	3.0
-¼" +30 mesh	67.4
-30 mesh	29.6

2. WASHABILITY CHARACTERISTICS OF +30 MESH FRACTION.

Specific Gravity	Cumulative Yield %	Cumulative Ash %	Swelling Number
1.30	18.2	2.9	5
1.32	26.2	3.3	6
1.34	35.9	3.8	5½
1.36	45.6	4.4	4
1.38	54.9	4.9	3
1.40	64.1	5.4	2
1.42	72.3	6.0	1½
1.44	78.6	6.3	1Ag
1.46	82.2	6.8	1Ag
1.48	86.5	7.2	1Ag
1.50	88.8	7.5	1Ag
1.52	90.7	7.7	1Ag
Whole Coal	100.0	9.8	1Ag

3. -30 .../

3. -30 MESH FRACTION.

Froth flotation tests indicated that a froth yield of approximately 70% with 1Ag swelling can be obtained.

III. Springbok Colliery No. 2-Seam Duff*. (Sampled: 13/8/58).

1. SCREEN ANALYSIS.

Aperture	% Yield
-¼" +30 mesh	83.9
-30 mesh	16.1

2. WASHABILITY CHARACTERISTICS OF -¼" +30 MESH FRACTION.

Specific Gravity	Cumulative Yield %	Cumulative Ash %	Swelling Number
1.30	10.7	3.8	6
1.32	22.1	4.6	5½
1.34	32.8	5.0	5
1.36	43.0	5.6	3½
1.38	51.7	6.0	2½
1.40	62.5	6.6	1½
1.42	71.0	7.0	1½
1.44	79.1	7.6	1Ag
1.46	83.8	7.9	1Ag
1.48	86.4	8.2	
1.50	88.9	8.5	
1.52	90.8	8.6	
Whole coal	100.0	12.9	

Albion ..../

*-¼" (sq.) fraction of pea-duff.

IV. Albion Colliery Duff*. (Sampled: 24/9/58).

1. SCREEN ANALYSIS.

Aperture	% Yield.
+30 mesh	79.8
-30 mesh	20.2

2. WASHABILITY CHARACTERISTICS OF -¼" sq. +30 MESH FRACTION.

Specific Gravity	Cumulative Yield %	Cumulative Ash %	Swelling Number
1.30	4.4	3.6	4 - 4½
1.32	8.0	4.2	4
1.34	13.6	4.9	3½- 4
1.36	21.0	5.7	2½
1.38	29.8	6.5	2
1.40	37.1	-	1
1.42	45.1	-	F
1.44	55.3	-	-
1.46	63.8	-	-
1.48	72.8	-	-
1.50	79.4	-	-
1.52	83.5	-	-
Whole coal		Not available	

New Clydesdale .../

*% +¼" in pea-duff: 48.1%.

V. New Clydesdale Colliery Duff*. (Sampled: 24/9/58).

1. SCREEN ANALYSIS.

Aperture	% Retained
30 mesh	79.3

2. WASHABILITY CHARACTERISTICS OF -¼" sq. +30 MESH FRACTION.

Specific Gravity	Cumulative Yield %	Cumulative Ash %	Swelling Number
1.30	9.8	3.9	3½
1.32	18.9	4.7	3½
1.34	29.5	5.3	3½-4
1.36	35.0	5.6	3½
1.38	43.9	6.2	3
1.40	52.1	6.7	2
1.42	57.5	-	1½
1.44	64.6	-	1
1.46	72.6	-	-
1.48	78.1	-	-
1.50	81.9	-	-
1.52	83.8	-	-
Whole coal		Not available.	

Van Dyksdrift .../

*% +¼" in pea-duff: 53.2%

VI. Van Dyksdrift Colliery Duff. (Sampled: 24/9/58).

1. SCREEN ANALYSIS.

Aperture	% Retained
30 mesh	81.7

2. WASHABILITY CHARACTERISTICS OF -¼" sq. +30 MESH SIZE FRATION.

Specific Gravity	Cumulative Yield %	Cumulative Ash %	Swelling Number.
1.30	11.5	3.2	4 - 4½
1.32	23.4	4.1	5½
1.34	34.2	4.7	4½
1.36	43.7	5.3	4
1.38	51.9	5.9	3 - 3½
1.40	58.3	6.4	3
1.42	67.1	6.9	2
1.44	73.4	-	-
1.46	79.9	-	-
1.48	83.2	-	-
1.50	86.1	-	-
1.52	87.7	-	-
Whole coal		Not available.	

Phoenix .../

VII. Phoenix Duff Samples.* (Sampled: 24/9/58).

1. SCREEN ANALYSES.

Sample	Aperture	% Yield
A	+30 mesh	79.7
	-30 mesh	20.3
B**	+30 mesh	80.8
	-30 mesh	19.2
C	+30 mesh	84.1
	-30 mesh	15.9
D	+30 mesh	82.4
	-30 mesh	17.6

* Samples had to be taken at four different points at the plant. The production at the individual points is not known.

** Duff washed at Colliery.(Duff at other points is not washed.)

2. WASHABILITY CHARACTERISTICS.

Sample	Specific Gravity	Cumulative Yield %	Cumulative Ash %	Swelling Number.
A	F. 1.30	11.7	2.9	4½
	1.32	21.0	3.8	4½
	1.34	28.5	4.4	4½
	1.36	35.1	5.1	4½
	1.38	41.8	5.7	4
	1.40	48.3	6.4	3½
	1.42	51.7	6.9	3
	1.44	57.9	7.3	2½
	1.46	63.0	-	1½
	1.48	66.6	-	1½
	1.50	70.3	-	1½
	1.52	73.5	-	1½

B ..../

2. WASHABILITY CHARACTERISTICS (Continued).

Sample	Specific Gravity	Cumulative Yield %	Cumulative Ash %	Swelling Number.
B*	F. 1.30	11.7	3.1	4½
	1.32	23.3	4.1	4½
	1.34	34.5	4.9	4½
	1.36	44.4	5.6	4½
	1.38	52.4	6.2	4
	1.40	61.4	6.8	2½
	1.42	64.6	7.1	2½
	1.44	70.9	7.7	2
	1.46	75.1	8.0	2
	1.48	78.6	-	1½
	1.50	82.9	-	1½
	1.52	86.1	-	1½
C	F. 1.30	10.6	3.0	4½-5
	1.32	19.0	3.9	5
	1.34	26.7	4.7	3½
	1.36	32.6	5.4	3½-4
	1.38	39.7	6.2	4
	1.40	45.2	6.7	3
	1.42	48.9	7.1	3
	1.44	54.1	-	1½
	1.46	59.0	-	1½
	1.48	61.9	-	1½
	1.50	65.9	-	1 -1½
	1.52	67.9	-	1
D	F. 1.30	8.6	3.2	3 -3½
	1.32	18.0	4.1	4½
	1.34	26.0	4.7	3½
	1.36	32.1	5.2	3
	1.38	41.6	5.7	2½
	1.40	47.4	-	1
	1.42	52.8	-	1½
	1.44	57.5	-	1
	1.46	61.8	-	1½
	1.48	66.0	-	1
	1.50	68.9	-	1
	1.52	71.9	-	1

*Duff washed at Colliery. (Duff at other points is not washed.)

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FUEL RESEARCH INSTITUTE OF SOUTH AFRICA.

JOINT ISCOR-SASOL-F.R.I.
RESEARCH PROJECT.

NOTE ON COKING INVESTIGATION OF WITBANK NO. 2 SEAM DUFF.

The general impression gained from the results of coking tests tabulated in the 1st and 2nd Progress reports is that the coking properties of the duff, washed at the lower s.g. are somewhat inferior to those of Navigation and Springbok, but are not inferior to those of Blesbok, and may, in fact, be slightly better. Washed at the higher s.g., coking properties are possibly slightly inferior to those of Blesbok, but if blended in a relatively low percentage (20% or less) the difference will hardly be noticeable, and there would, therefore, be little object in practice to wash at the lower specific gravity and to sacrifice 10 - 15 percent of the yield (based on feed to cyclone washer).

The low ash contents (6 - 8 per cent) of the washed duffs (combined with volatiles which are not appreciably higher than those of the other blend coking coals, and in some instances even lower) are a decided advantage. A few sulphur contents on washed duffs have been determined. The values range from 0.5 to 0.7 per cent.

The tendency for cokes from blends containing duff to be smaller than normal may be due to the low ash (i.e. inert) content of the duff. This tendency should not be considered serious, provided there is no increase in the breeze production*. There is no evidence in the results that the use of duff will materially increase breeze production.

A factor which/.....

* See: B.C.R.A. 6th Conference (1953), p.21.

A factor which should be borne in mind is that with at least some of the duff tests the duff probably suffered more exposure (i.e. oxidation) than would be expected in normal practice. This was especially the case with tests containing high percentages of duff.

When the tests were started (late in August, 1958), very little time was lost between the time of mining and the time of coking - not more than one or two weeks. This delay has gradually been increasing and is now probably three to four weeks.

PRETORIA.
16/2/1959.

CONCLUSIONS BASED ON RESULTS OF INVESTIGATION OF WITBANK NO. 2 SEAM DUFF COALS, MAINLY AS REPORTED IN THE FIRST, SECOND AND THIRD PROGRESS REPORTS.

by

Dr. J.H. Scholtz, Iscor.

and

C.C. la Grange, F.R.I.

---oOo---

1. The washing of duff (+30 mesh fraction) in the cyclone washer in relatively large quantities proceeded satisfactorily.

2. Froth flotation - applied on -30 mesh material with one of the batches of duff investigated - was not entirely satisfactory and the test should be repeated.

It appears that froth flotation, as applied in the case mentioned, resulted in a reduction in the ash of the product but did not produce a concentration of coal with otherwise improved coking qualities.

3. The relatively large proportion of discards and fines (mixed back with peas?) could conceivably be used as power station fuel. If this is not the case the duff scheme would appear to be rather unattractive, economically.

4. There is a tendency for cokes from blends containing duff to be smaller than normal Iscor coke.

5. There is some evidence that substitution of the present Iscor blend coking coal mixture by washed duff will result in a slight increase in breeze production.

6. Generally speaking, the appearance of cokes from blends containing duff was not as good as that of the present Iscor coke.

7. It should be borne in mind that with at least some of the duff tests the duff probably suffered more exposure (i.e. oxidation) than would be expected in normal practice. This was especially the case with tests in which high percentages

of/....

of duff were used.

8. The duffs tested would probably be usable as blend coking coal without causing appreciable deterioration in the physical characteristics of the resultant coke, provided they are adequately washed and are incorporated in the blend in moderate proportions.

9. The low ash contents (6-8 per cent) of the washed duffs, - combined with volatiles which are not appreciably higher than those of the other blend coking coals, and in some instances even lower - are a decided advantage. Sulphur contents of the washed duffs generally vary between 0.5 and 0.7 per cent.

10. Although it appears from the physical test results obtained on the cokes that a swelling number of 2 for the blend coking coal may be adequate (e.g. Springbok No. 2 Seam duff and Blesbok coal) this needs corroboration by extensive blast furnace trials.

11. It would appear that finer crushing has a marked beneficial effect on coke strength (compare, for example, Tests 33, 39 and 46).

12. The progressive substitution of D.N.C. by Northfield (up to 17½ per cent Northfield in the blend - tests 49, 50 and 51) appears to improve coke quantity.

PRETORIA.

1st April, 1959.

FUEL RESEARCH INSTITUTE OF SOUTH AFRICA.

POTENTIAL LOW ASH COAL AND POWER STATION COAL FROM SOME WITBANK DUFFS.

Specific Gravity of Product		Raw	Float 1.40			Middlings 1.4-1.6		Sink 1.60		Sink 1.40	
Colliery and Year		Ash %	Yield %	Ash %	Sw.No.	Yield %	Ash %	Yield %	Ash %	Yield %	Ash %
Douglas*	1961	9.2	63.2	5.4	1½	34.2	14.2	2.6	35.4	36.8	15.7
Douglas	1962	9.1	67.8	5.9	1½	30.2	14.7	2.0	33.6	32.2	15.8
Springbok	1961	12.0	55.1	6.4	2	38.1	14.0	6.8	46.3	44.9	18.9
Springbok	1962	12.3	52.9	6.7	1½	40.7	13.8	6.4	48.9	47.1	18.6
T.N.C.	1961	13.2	56.4	6.0	1½	33.6	15.4	10.0	46.5	43.6	22.5
T.N.C.	1962	14.7	47.8	6.7	1	39.2	15.1	13.0	42.8	52.2	22.0
Van Dyks Drift	1961	13.3	50.1	6.2	1½	40.9	14.7	9.0	46.7	49.9	20.4
Van Dyke Drift	1962	13.5	53.0	6.7	1½	38.2	15.3	8.8	46.7	47.0	21.2

*¼" x ⅛" mm size fractions only.

**Washed with other products in the colliery's washer.

FUEL RESEARCH INSTITUTE OF SOUTH AFRICA.

WITBANK NO. 2 SEAM DUFF INVESTIGATION.

WASHABILITY CHARACTERISTICS OF SAMPLES TAKEN DURING 1961 AND 1962.

YEAR	S.G.	DOUGLAS			SPRINGBOK			T.N.C.			VAN DYKSDRIFT.		
		CUM. YIELD %	CUM. ASH %	SWELLING NO.	CUM. YIELD %	CUM. ASH %	SWELLING NO.	CUM. YIELD %	CUM. ASH %	SWELLING NO.	CUM. YIELD %	CUM. ASH %	SWELLING NO.
1961	F 1.40	63.2	5.4	1½	55.1	6.4	2	56.4	6.0	1½	50.1	6.2	1½
	1.45	81.7	6.7	1	77.1	7.7	1	72.3	7.3	1	71.6	7.7	1
	1.50	90.7	7.5	1	89.1	8.8	1	82.3	8.3	1	82.1	8.7	1
	1.55	95.7	8.2		91.5	9.2		87.3	9.2		88.6	9.5	
	1.60	97.4	8.5		93.2	9.5		90.0	9.5		91.0	10.0	
	S 1.60	100.0	9.2		100.0	12.0		[illegible]0	13.2		100.0	13.3	
1962	F 1.40	67.8	5.9	1½	52.9	6.7	1½	47.8	6.7	1	53.0	6.7	1½
	1.45	86.7	7.2	1	78.7	8.2	1	62.5	7.8	1	72.5	8.1	1
	1.50	93.0	7.8	1	87.8	9.0	1	74.1	8.9	1	84.2	9.2	1
	1.55	96.4	8.3		91.8	9.5		82.3	9.8		89.7	10.0	
	1.60	98.0	8.6		93.6	9.8		87.0	10.5		91.2	10.3	
	S 1.60	100.0	9.1		100.0	12.3		100.0	14.7		100.0	13.5	

FUEL RESEARCH INSTITUTE OF SOUTH AFRICA.

PRODUCTION OF PEAS, PEA-DUFF AND DUFF AT SELECTED WITBANK COLLIERIES DURING 1960*.

COLLIERY **	PEAS	PEA-DUFF	DUFF	TOTAL
Springbok	-	342,365	-	342,365
Van Dyks Drift	-	189,865	-	189,865
Douglas	355,508	9,550	254,408	619,466
T. N. C.	7,248	287,709	82,217	377,174
(crushed)	—	17,472	—	17,472
Greenside	267,678	1,013	233,093	501,784
Sub-Total	630,434	847,974	569,718	2,048,126
Koornfontein	103,172	-	158,058	261,230
Clydesdale	-	493,199	-	493,199
Phoenix **	227,036	-	302,178	529,214
Sub-Total	330,208	493,199	460,236	1,283,643
GRAND TOTAL	960,642	1,341,173	1,029,954	3,331,769

* Latest figures available at the F.R.I.

** Figures for Phoenix (and possibly some other collieries) abnormally high during 1960, due to the Coalbrook mine disaster.

FUEL RESEARCH INSTITUTE OF SOUTH AFRICA.

PRELIMINARY RESULTS OF FULL SCALE COKING TESTS.

			TEST NO.	Is 307	Is 308	Is 309
			Nominal Composition of Charge %)*	70 DD 30 DNC	70 DD 30 DNC (Charged Dry)	100 DD (Charged Dry)
			Oven No.	200	102	99
Characteristics of Coke	Inches, square holes	Size Analysis % Retained on (in., sq.)	(4"	18	14	16
			(3"	46	42	47
			(2"	77	73	78
			(1"	93	95	96
			(½"	95	97	97
		Mean Size, in.		2.89	2.77	3.00
		B.S. Shatter Index	(1½"	86	84	86
			(½"	96.0	97.6	97.1
		B.S. Abr. Index		73	79	77
		S.A.S.S. Value		35	37	36
	mm., round holes	Size Analysis % Retained on (mm. round)	(125	15	9	7
			(80	59	49	51
			(60	77	70	74
			(25	94	95	96
			(10	96	97	97
		Mean Size, mm.		86.3	80.0	80.7
		Size of Coke used for Micum Test + 25 mm.	M'_{40}	64	65	64
			M_{20m}	83	87	86
			M_{10m}	14.7	10.7	11.8
			$MMSS_m$	51	53	53
			$CMTV_m$	55	58	56
		Size of Coke used for Micum Test + 60 mm.	M_{40}	65	63	65
			M_{10}	15.3	11.2	12.3
			MMSS	47	48	49
			CMTV	55	56	57

* Abbreviations used: DD - Douglas Duff (low ash).
DNC - Durban Navigation Colliery.

FUEL RESEARCH INSTITUTE OF SOUTH AFRICA.

TABLE C27.

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

DETAILS OF BLENDS CHARGED AND OF CARBONISING CONDITIONS.

	Test No.		Is 307	Is 308	Is 309
	Sample No. 65/		1346	1424	1425
Coal Charged	Composition of Charge* %		70 DD 30 DNC	70 DD 30 DNC	100 DD
	Proximate Analysis % (A.D. Basis)	H_2O	1.9	1.8	1.9
		Ash	8.6	8.3	6.3
		V.M.	31.4	31.7	32.6
		F.C.	58.1	58.2	59.2
	Swelling No.		3½-4	3-3½	3½
	Size Analysis %	+⅛"	19.0	25.2	13.1
		⅛" x 1/16"	22.8	28.1	23.0
		1/16" x 22m	26.2	24.2	28.0
		22m x 100m	23.9	18.9	29.5
		-100m	8.1	3.6	6.4
Carbonisation Details	Moist. as Charged %		5.4	1.5	1.7
	Date Charged 1965		23/8	24/8	25/8
	Oven No.		200	102	99
	Mean Temp. °C		1284	1307	1297
	Nett Coking Time, hrs.		15.8	15.6	16.0
Estimated (Dry basis)	Total Coke Yield %		72.8	72.6	71.8
	Ash in Coke %		12.0	11.6	8.9

*Abbreviations used:-

DNC - Durban Navigation Colliery.
DD - Douglas duff (washed at F.R.I. Pilot Plant).

For Analytical details of Components used in Blends see Table D27.

FUEL RESEARCH INSTITUTE OF SOUTH AFRICA.

TABLE D27.

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

ANALYTICAL DETAILS OF COMPONENTS USED IN BLENDS.

Test No.	Is 307		Is 308		Is 309
Sample No. 65/	1346		1424		1425
Component	C	D	C	D	C
Identification*	DD	DNC	DD	DNC	DD
Proximate Analysis (%) (Air-dry) H_2O	2.2	1.3	2.2	1.3	2.1
Proximate Analysis (%) (Air-dry) Ash	6.5	12.4	6.5	12.9	6.4
Proximate Analysis (%) (Air-dry) V.M.	31.9	30.3	32.1	30.2	32.1
Proximate Analysis (%) (Air-dry) F.C.	59.4	56.0	59.2	55.6	59.4
Swelling No.	3	4½-5	3	4½-5	3-3½

*Abbreviations used:-

DNC - Durban Navigation Colliery.
DD - Douglas duff (washed at F.R.I. Pilot Plant).

FUEL RESEARCH INSTITUTE OF SOUTH AFRICA.

RESULTS (AIR-DRY BASIS) OF INVESTIGATION OF DUFF SAMPLES FOR RAND MINES LTD.

DOUGLAS WASHED DUFF (Sample No. 65/299).

Size (Mesh)	Sp. Gr. Fraction	Yield %	Moist. %	Ash %	Vol. Mat. %	Fixed Carb. %	Sw. No.	Cumul. Sw. No.
-30	*	19.7	2.1	13.5	28.1	56.3	1	-
+30	Float 1.30	14.3	2.2	3.4	38.8	55.6	6½	6½
	1.30-1.35	25.7	2.1	6.2	32.4	59.3	2	4-4½
	1.35-1.40	29.4	2.0	8.9	26.3	62.8	½-1	1½
	1.40-1.45	13.6	2.1	12.2	24.3	61.4	½	1
	1.45-1.50	7.4	1.9	16.5	23.0	58.6	-	-
	1.50-1.55	3.7	2.0	20.7	22.1	55.2	-	-
	1.55-1.60	2.4	1.9	24.0	21.8	52.3	-	-
	1.60-1.65	1.4	1.7	26.6	22.3	49.4	-	-
	1.65-1.70	1.1	1.7	30.3	22.1	45.9	-	-
	Sink 1.70	1.0	1.7	33.0	22.9	42.4	-	-

VAN DYKS DRIFT DUFF (Sample No. 65/300).

-30	*	18.8	2.1	13.7	28.3	55.9	1	-
+30	Float 1.30	12.0	2.4	3.1	37.0	57.5	5	5
	1.30-1.35	21.0	2.2	5.9	31.7	60.2	1-1½	3-3½
	1.35-1.40	19.9	2.2	8.4	26.7	62.7	½-1½	1-1½
	1.40-1.45	19.4	2.2	11.3	23.1	63.4	½	1
	1.45-1.50	11.8	2.1	15.2	22.5	60.2	-	-
	1.50-1.55	4.5	2.2	19.6	21.6	56.6	-	-
	1.55-1.60	2.6	2.0	22.9	22.0	53.1	-	-
	1.60-1.65	2.0	1.9	26.8	22.3	49.0	-	-
	1.65-1.70	1.6	1.7	32.8	23.3	42.2	-	-
	Sink 1.70	5.2	1.0	52.1	27.8	19.1	-	-

WOLVEKRANS WASHED DUFF (Sample No. 65/301).

-30	*	18.2	2.1	16.7	24.2	57.0	1	-
+30	Float 1.30	7.9	2.3	3.4	37.2	57.1	5-5½	5-5½
	1.30-1.35	12.8	2.2	6.0	32.4	59.4	2	4
	1.35-1.40	19.8	2.1	8.6	26.5	62.8	½-1	1
	1.40-1.45	23.7	2.2	11.5	22.6	63.7	½	½
	1.45-1.50	16.0	2.1	15.7	21.4	60.8	-	-
	1.50-1.55	8.0	2.1	20.5	20.6	56.8	-	-
	1.55-1.60	4.5	1.9	25.1	20.6	52.4	-	-
	1.60-1.65	2.7	1.9	28.9	20.6	48.6	-	-
	1.65-1.70	2.1	1.7	33.4	20.6	44.3	-	-
	Sink 1.70	2.5	1.4	45.4	21.3	31.9	-	-

UTRECHT DUFF (Sample No. 65/302).

-30	*	15.7	1.7	20.5	25.1	52.7	½	-
+30	Float 1.30	8.2	1.5	4.8	33.2	60.5	7	7
	1.30-1.35	31.4	1.6	6.7	31.5	60.2	5	5½
	1.35-1.40	13.1	1.7	9.9	27.9	60.5	1½-2	4-4½
	1.40-1.45	8.9	1.7	13.0	24.7	60.6	½	3
	1.45-1.50	7.6	1.7	16.9	22.7	58.7	-	-
	1.50-1.55	6.6	1.9	21.1	20.5	56.5	-	-
	1.55-1.60	5.1	1.8	25.4	19.6	53.2	-	-
	1.60-1.65	4.4	1.7	29.5	18.6	50.2	-	-
	1.65-1.70	4.4	1.8	34.4	18.5	45.3	-	-
	Sink 1.70	10.3	1.4	51.5	20.1	27.0	-	-

*Not subjected to float and sink analysis.