FUEL RESEARCH INSTITUTE OF SOUTH AFRICA.

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PRODUCTION OF COKING COAL FROM THE OUTPUT OF NORTHFIELD COLLIERY.

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(Tentative Conclusions based on the results of washing tests done at the Colliery on samples taken on 3, 4 and 6th August, 1962 - Results sent to the Company's Head Office under a covering letter by the General Mines Manager dated 23rd August, 1962).

GENERAL CONSIDERATION OF ANALYTICAL RESULTS:

The float and sink analysis results obtained in these tests have been plotted as shown in Figure 1.

The "naturally arising" -⅜" and -1¼" + ⅜" size fractions have been shown to be rather superior to the similar size fractions obtained by crushing the "naturally arising" -4 + 1¼" coal to -1¼" i.e. the yields at comparable ash contents are very much lower on the "re-crushed" products.

Some 50% of the coal floats at S.G. 1.40 (in the case of 1½ x ⅜" coal the yield is lower due to a high percentage of "stone" S.G. over 1.70).

Specific gravity fractions above 1.50 carry over 20% ash and have correspondingly low calorific value.

However, the effect of the high percentage of float at S.G. 1.40 is such that cumulative floats up to 1.60 have a relatively low ash content and high swelling numbers.

A middling of say S.G. 1.60 - 1.70 even on coal of -⅜" size can be expected to have an ash content of some 36% at a calorific value of 9.0 lb/lb.

One is therefore inclined to conclude that by washing at a low gravity say 1.45 a very superior coking coal could be prepared but there is some doubt about the preparation of an acceptable middling product even when making the first cut at a low specific gravity.

According to information received the colliery's output is about 50,000 t.p.m. and the coking coal requirements may be of the order of 35,000 p.m.

In view of/.....2.

In view of this demand and the somewhat doubtful saleability of middlings one may consider Northfield as a producer of coking coal only and try to assess what product could be produced.

It will be assumed that the coal will all be crushed to -1½" as was done in the analysis done in August 1962.

In this case the coal was crushed first to -4" yielding size fractions -4" + 1¼", -1¼" + ⅜" and -⅜". The +1¼" coal was subsequently crushed to -1¼". The yield figures which will be used in this analysis were:

"Natural" -1¼" + ⅜" (from first screening) ...28.4% of raw coal.
"Natural" -⅜" (- do -) ...41. 1% "
-4" + 1¼" (- do -) ...30.5%
Yielding on recrushing -1¼"+⅜".... 54.1% or 16.5% of raw coal
-⅜".... 45.9% or 14.0% "

DETERMINATION OF THE "LOSS OF SALES" WHEN PRODUCING COKING COAL:

In order to have some basis of comparison, the position under which the coal is prepared for general sales may be considered.

Various methods of preparation might be considered but on the basis of the analytical results of the colliery's tests in August 1962 only the following three cases may be dealt with:

CASE I: The coal is crushed to -4";and +⅜" coal is washed at S.G. 1.70. The yield would be as follows:-

Size Fraction.	% of Raw Coal	S.G. of Sepn.	Yield %	Ash %	C.V. lb/lb	Yield as % of Raw coal
-4" + 1¼"	30.5	1.70	70.4	16.8	12.98	21.4
-1¼" + ⅜"	28.4	1.70	77.6	15.8	13.21	22.0
- ⅜"	41.1	Raw	100	15.6	13.17	41.1
	100			15.8		84.5

CASE II:/.....3.

CASE II: The coal is crushed to -1¼" and +⅜" coal is washed at S.G. 1.70. The yield would be:-

Size Fraction.	% of Raw Coal	S.G. of Sepn.	Yield %	Ash %	C.V. lb/lb	Yield as % of Raw coal
Natural -1¼+⅜"	28.4	1.70	77.6	15.8	13.21	22.0
-1¼"+ ⅜" ex +1¼"	16.5	1.70	61.1	18.4	12.66	10.1
	44.9			16.2		32.1
Natural -⅜"	41.1	raw	100	15.6	13.17	41.1
-⅜" ex +1¼"	14	raw	100	23.3	11.72	14.0
	55.1			17.4		55.1
					overall	87.2

CASE III:

Assuming that the -⅜" obtained from the +1¼" coal on re-crushing has too high an ash content, some clean up may be considered (as the S.G. analysis was stopped at S.G. 1.60 the values at 1.70 given below are only approximate - i.e. obtained by extrapolation from the plotted experimental results (Fig. 1))

Assuming then that the +⅜" coal is treated as in Case II but that the -⅜" coal derived from recrushing is also washed at S.G. 1.70, the yields may be:

Size Fraction	% of Raw Coal	S.G. of Sepn.	Yield %	Ash %	C.V. lb/lb	Yield as % of Raw Coal.
+ ⅜" coal (as in Case II)	44.9	1.70		16.2		32.1
Natural -⅜"	41.1	raw	100	15.6	13.17	41.1
-⅜" ex+1¼"	14	1.70	75 (guess)	12.0 (guess)		10.5
						51.6
			Overall yield:			83.7

Accepting case I as the most realistic but considering the two others also, it appears reasonable to assume that the yield of saleable coal would be of the order of 84% i.e. that a discard of 16% on the raw coal is unavoidable.

In the following/.....4.

In the following assessment, this discard of 16% will be accepted as unavoidable loss - to be deducted from subsequent "washing discards" to find the "loss in vend".

POSSIBLE YIELDS OF COKING COAL:

1. The result of washing the total output, crushed to -1¼" at S.G. 1.60 is given in Table 1.

   The loss of vend would be of the order of 13% and some 35,000 t.p.m. of excellent coking coal could be produced. It appears doubtful that a saleable middling could be produced even in this case.

   In practice, unless an efficient washer is used, it may be found that the ash content of the product is somewhat higher, the yield might also be higher but there is a possibility of loss of coal to the discard in an inefficient washer.

   The tonnage of coking coal is approximately that which the colliery is to produce.

2. An alternative procedure is sketched in Table 2. Here it is assumed that the +⅜" coal is washed at S.G. 1.65 and the -⅜" coal at 1.70. As before, the yield and ash content of -⅜" coal washed at 1.70 were obtained by extrapolation and the result is only approximate.

   It would appear that under these circumstances the theoretical ash content of the product may be about 12% with a swelling number of about 6 (or better?) while the loss of vend is now theoretically about 6%.

   The monthly tonnage production may be 38,000 tons giving an excess that might be made available to coke producers in preference to supplying Hlobane coking coal(?)

3. Table 3 gives a final alternative where all the coal is washed at S.G. 1.70. The swelling number of the product might still be acceptable but efficient washing would be necessary to maintain an ash content of not more than about 13%.

The loss of/.....5.

The loss of vend is only 3.3% and the tonnage production exceeds the visualized requirement appreciably. Nevertheless, the coking coal so produced may still be better than that from Hlobane and the excess could be used to replace demand from Hlobane.
It may be difficult to get those consumers who only want Northfield coking coal to agree to take this 13% ash coking coal.

4. The above analysis was based on production of coal for general sales i.e. as regards the relative "loss of vend".

Alternatively, considering Northfield as a producer of coking coal only, the results of Table 3 might be used as basis of comparison i.e. considering that if coking coal only is to be produced from Northfield, the minimum "unavoidable discard" would be 19.6% on raw coal or say 20% on raw coal when producing what might be termed a "usable coking coal".

Higher grade coking coal can then only be produced at a price which includes compensation for loss of vend (of, on this basis, 3% in the case of Table 2 product and 10% in the case of the Table 1 product) as well as for the commensurate effect of such greater loss on the life of the reserves.

A.J. PETRICK.

17TH OCTOBER, 1962.
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TABLE I

PRODUCTION OF COKING COAL BY WASHING AT S.G. 1.60

CUTTING AT S.G. 1.60

Size Fraction.	% of Raw Feed	Product			
		Ash %	S.W. No.	% Yield on Fraction	% Yield on Raw Feed
Natural -1¼"x⅜"	28.4	12.4	7	67.1	19
-1¼x⅜ ex Natural +1¼	16.5	12.7	6	47.4	7.8
Natural -⅜"	41.1	9.5	9	85.1	35
-⅜" ex Natural +1¼"	14.0	10.7	7½	67.2	9.4
	100				71.2
Product:	Approxim.	10.8	ca.7 - 8		71.2
				Discard	28.8 %

Loss of vend ca. 13% of Raw feed

on 50,000 raw feed ca.35,000 t.p.m. of coking coal.

plus ⅜" middlings (S.G.1.60-1.70 ca.36% ash, C.V. 9.0 lb/lb.

TABLE 2

PRODUCTION OF COKING COAL WASHING +⅜" COAL AT 1.65 & -⅜" COAL AT 1.70

Size Fraction	% of Raw Feed	Product. Sepn. S.G.	Ash %	Sw. No.	% Float Yield	Yield on Raw Coal
1¼ x ⅜ ex +1¼	16.5	1.65	15.1	5-5½	53.0	8.8
1¼ x ⅜ Natural	28.4	1.65	13.9	6½	71.8	20.4
-⅜ Natural	41.1	1.70 Guess	10.6	> 8	92	37.8
-⅜ ex +1¼	14	1.70 "	12	6(?)	75	10.5
Product (approx.)		Avg.	12.1	> 6(?)		77.5
					Discard	22.5

Loss of vend 6.2% on Raw Feed
on 50,000 t.p.m. ca. 38,700 t.p.m. of coking coal.

OR:

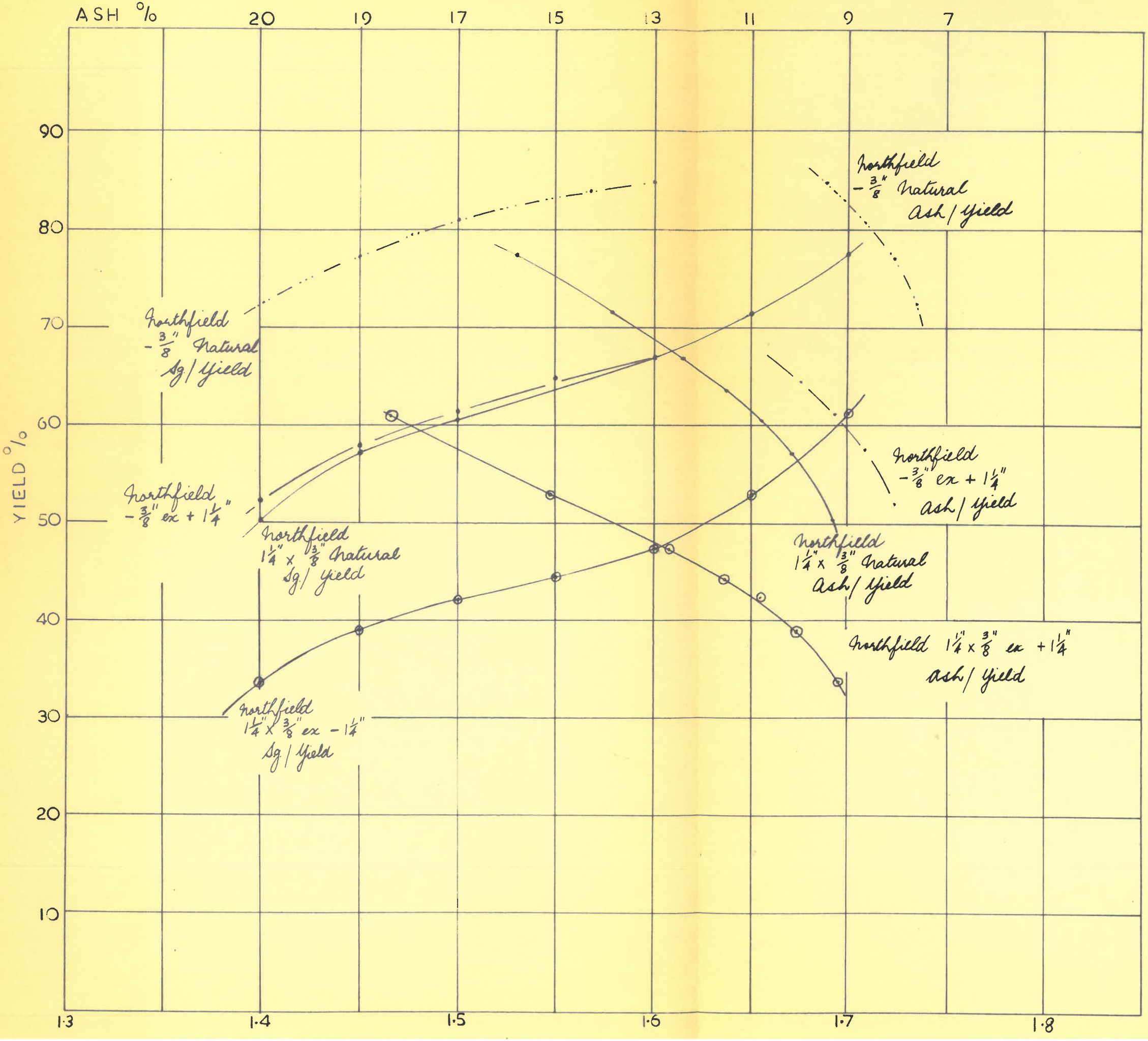
TABLE 3.

PRODUCTION OF COKING COAL BY WASHING ALL SIZES AT 1.70

1¼ x ⅜ ex 1¼	16.5	1.70	18.4	2½	61.1	10.1
1¼ x ⅜ Natural	28.4	1.70	15.8	6	77.6	22.0
-⅜" Natural	41.1	1.70 Guess	10.6	> 8	92	37.8
-⅜" ex +1¼	14	1.70 "	12	6 ?	75	10.5
Product (approx.)		Avg.	13.1	> 6 ?		80.4
					Discard	19.6

Loss of vend 3.3% on Raw Feed
on 50,000 t.p.m. ca. 40,000 t.p.m. of coking coal

FIGURE 1


ASH %
20
19
17
15
13
11
9
7
YIELD %
90
80
70
60
50
40
30
20
10
1·3
1·4
1·5
1·6
1·7
1·8
Northfield -3/8" Natural Sg/Yield
Northfield -3/8" Natural Ash/Yield
Northfield -3/8" ex +1¼" Sg/Yield
Northfield -3/8" ex +1¼" ash/Yield
Northfield 1¼" x 3/8" Natural Sg/Yield
Northfield 1¼" x 3/8" Natural Ash/Yield
Northfield 1¼" x 3/8" ex -1¼" Sg/Yield
Northfield 1¼" x 3/8" ex +1¼" ash/Yield