FUEL RESEARCH INSTITUTE OF SOUTH AFRICA

TECHNICAL MEMORANDUM NO. 13 OF 1965

EXPORT GRADING CONTROL

by

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The intention to specify at least two grades of anthracite will probably result in more samples being received which are outside the specification of the grade applying to the coal. There are likely to be fairly frequent occasions when a decision must be taken to alter the grade of a coal. It will be very useful if certain conditions can be established which will lead to the automatic replacement of a grading certificate, whether such replacement means up-grading or down-grading.

In the past, if a sample was undergrade, three check samples would be taken at weekly intervals, if obtainable, unless the first or second check sample was within the grade, when check sampling would stop. Only if four consecutive samples were undergrade would the certificate be withdrawn. This method could lead to a repetitive sequence of, say, one sample complying and two samples not complying with the specification, the net result being that the grading status was maintained although the average analysis of the coal for the year was undergrade. This has happened in the past, and recently the Board decided that if the average analysis of samples taken over a period was undergrade, the certificate could be replaced. There were no conditions laid down, and the decision as to if and when action should be taken was thus a subjective decision.

A study of several series of consecutive analyses of export samples (based on ash content of anthracites) has been made, and the desirability of a set of conditions for automatic replacement of a certificate became apparent.

There/...

There are two factors which should control the grade of a coal, namely the relative frequency of samples within and outside the grade, and the average value of a consecutive series of samples. At its simplest, control could be based on a single sample, but this is unreasonable. It is felt that four consecutive samples (as at present) outside the grade should be sufficient to cause automatic change of grade, and that other series containing samples within the grade could be added.

It is proposed that the following four cases be used as the basis for automatic change of grade:

Case 1: Four consecutive samples are outside the specification of the current grade. (For a grade with upper and lower limits, obviously the same limit must be exceeded. This applies also to the following cases.)

Case 2: One internal sample in a series of five samples shall be within the grade, and the running cumulative average ash content* shall always be outside the grade.

Case 3: Two internal samples in a series of six samples shall be within the grade, and the running cumulative average ash content shall always be outside the grade.

Case 4: Three internal samples in a series of seven samples shall be within the grade, and the running cumulative average ash content shall always be outside the grade.

If none of the above cases apply, a subjective decision must be made. It is proposed that at least seven consecutive samples be used as the basis of a subjective decision.

Where samples tend to fluctuate about the limiting ash content of a grade, it is possible to get rapid automatic changes in

grade/...

* The same principle for automatic change of grade should be adopted for bituminous coal. In this case calorific value would be the criterion.

grade, as an intermediate sample in a series causing change of grade may qualify as the start of another series causing reversion to the original grade. The possibility of rapid reversion is particularly great with Case 4 above, but it is felt that Case 4 would in any case be sufficient grounds for taking a subjective decision to change the grade of the coal.

Various examples, taken from actual serial ash contents obtained from grading samples, are used to illustrate the application of the above proposals. In some of the examples an ash limit of 8.5% has been used for demonstration purposes, although the limit proposed for premium grade anthracite in Technical Memorandum No. 6 of 1965 was 9.0%.

EXAMPLE 1

ALPHA ANTHRACITE PEAS

Assuming a Limit of 8.5% Ash for Premium Grade

Sample No.	Ash Content %	Running Cumulative Average Ash Contents %	
1	8.8*	8.8	
2	8.2	8.5	
3	8.8*	8.6	8.8
4	7.9	8.4	8.35
5	8.9*	8.5	8.5
6	10.1*	8.8	8.9
7	8.8*	8.8	
8	8.6*	8.8	
9	8.4	8.7	
10	8.1	8.7	
11	8.2	8.6	
12	7.7	8.5	
13	7.6	8.5	
14	8.6*	8.5	
15	8.2	8.5	
16	8.9*	8.5	
17	9.0*	8.5	
18	8.0	8.5	

* Samples with ash contents above 8.5%

Samples/...

Samples 1 to 6 would make Case 3, but the average after the first two samples (and again after four and five samples) is within the limit, so no loss of certificate is involved. Again, samples 3 to 7 would make Case 2, except that the average falls within the limit after samples 4 and 5. However, samples 1 to 7 make a series of seven samples for a subjective decision, with five of the samples above 8.5% ash and an average after six and seven samples of 8.8%. This would appear to be reasonable grounds for loss of certificate. If a wait-and-see policy were adopted, the certificate would in any case be lost at sample 8, samples 5 to 8 forming Case 1. Immediately thereafter follow four samples (9 to 12) with less than 8.6% ash, so Case 1 is again applied for reversion to premium grade. Only three further samples are above 8.5% in ash content (the series actually extends considerably beyond sample 18, but ash contents varied between 7.4% and 8.3%), so there is no further change in grade.

For interest's sake, the continuing average ash content has been given, starting from sample 1. It is interesting to note that - purely by chance - the cumulative average ash content falls to 8.5% after sample 12, when the premium grade is restored automatically.

EXAMPLE 2/...

EXAMPLE 2

NATAL AMMONIUM GRAINS

Assuming a Limit of 8.5% Ash for Premium Grade

Sample No.	Ash Content %	Cumulative Average Ash Contents %		
1	9.6*	9.6		
2	8.5	9.05		8.5
3	8.8*	9.0		8.65
4	8.3	8.8		8.5
5	9.1*	8.9		8.7
6	8.9*	8.9		8.7
7	8.3	8.8	8.3	8.65
8	7.6	8.6	7.95	8.5
9	8.4	8.6	8.1	8.5
10	8.4	8.6	8.2	
11	8.4	8.6	8.2	
12	8.5	8.6	8.3	
13	8.8*	8.6	8.3	
14	8.4	8.6	8.35	
15	7.9	8.5	8.3	
16	8.3	8.5	8.3	
17	8.5	8.5	8.3	
18	8.3	8.5	8.3	
19	8.6*	8.5	8.3	

* Samples with ash contents above 8.5%.

Case 3 applies to samples 1 to 6, so the premium grade is withdrawn. Samples 7 to 10 make Case 1 for reversion of grade, and premium grade is maintained to the end of the series. Samples 2 to 8 and 2 to 9 form series for a possible subjective decision to restore the grade. If such a decision were taken, samples 2 to 6 would be concerned in both changes of grade.

In this example, although the premium grade is restored after sample 10, the cumulative average from sample 1 only falls to 8.5% after 15 samples. However, the cumulative average from sample 7 is always less than 8.4%.

EXAMPLE 3/...

EXAMPLE 3

NATAL AMMONIUM PEAS

Assuming a Limit of 8.5% Ash for Premium Grade

Sample No.	Ash Content %	Cumulative Average Ash Contents %	
1	9.2*	9.2	
2	8.7*	8.95	
3	8.4	8.8	
4	8.9*	8.8	
5	8.3	8.7	
6	8.9*	8.7	
7	8.3	8.7	
8	9.1*	8.7	
9	8.8*	8.7	
10	8.1	8.7	8.1
11	8.5	8.7	8.3
12	8.0	8.6	8.2
13	8.6*	8.6	8.3
14	8.1	8.6	8.3
15	8.9*	8.6	8.4
16	8.2	8.6	8.3
17	8.0	8.5	8.3

* Samples with ash contents above 8.5%

Case 3 applies to samples 1 to 6, and the premium grade is lost. Samples 10 to 14 form Case 2 for restoration of premium grade, and this is maintained to the end. Starting from any of samples 2 to 8, the cumulative average ash content falls to 8.5% at sample 12, so a subjective decision to reinstate the grade could be taken at this point. If such a decision were not taken, it could only be taken at sample 14 (sample 13 has more than 8.5% ash), when in any case the grade is reinstated as Case 2.

Here again premium grade is restored before the cumulative average ash content from sample 1 falls to 8.5%.

EXAMPLE 4/...

EXAMPLE 4

NATAL ANTHRACITE PEAS

Assuming a Limit of 8.5% Ash for Premium Grade

Sample No.	Ash Content %	Cumulative Average Ash Contents %	
1	8.6*	8.6	
2	9.1*	8.85	
3	8.2	8.6	8.2
4	8.3	8.55	8.25
5	8.7*	8.6	8.4
6	8.1	8.5	8.3
7	9.0*	8.6	8.5
8	8.9*	8.6	8.5
9	7.3	8.5	8.4
10	8.3	8.45	
11	8.1	8.4	
12	8.9*	8.5	

* Samples with ash contents above 8.5%

In this series Case 4 nearly applies to samples 1 to 7, but the average ash falls to 8.55% (this, being an exact figure, may be taken as 8.5 or 8.6) after four samples and to 8.5% after six samples. As none of Cases 1 to 4 applies otherwise, one would have to make a subjective decision. The grade could only be lost at samples 7 or 8, as thereafter the cumulative average value is 8.5% or less.

However, if a subjective decision to change the grade is taken at sample 7 or 8 (there is quite a good argument for this at sample 8 with five out of eight samples outside the limit, and the minimum cumulative average up to sample 8 only just within the grade), the certificate must be restored at sample 9, as samples 3 to 9 make Case 4.

EXAMPLE 5/...

EXAMPLE 5

ALPHA ANTHRACITE GRAINS

At an Ash Limit of 9.0% for Premium Grade

Sample No.	Ash Content %	Cumulative Average Ash Contents %	
1	9.3*	9.3	
2	8.7	9.0	
3	8.0	8.7	
4	9.5*	8.9	9.5
5	8.7	8.8	9.1
6	9.8*	9.0	9.3
7	9.4*	9.1	9.35
8	8.6	9.0	9.2
9	8.3	8.9	9.05
10	8.5	8.9	9.0
11	9.3*	8.9	9.0
12	8.6	8.9	9.0
13	8.1	8.8	8.9
14	8.4	8.8	8.9
15	8.5	8.8	8.8

* Samples with ash contents above 9.0%

This example was included, as it was felt that there might be difficulty in maintaining premium grade (see Technical Memorandum No. 6 of 1965).

Samples 1 to 7 have the right shape for Case 4, but five of the cumulative average ash contents do not exceed 9.0%. There is no starting point in the series for any of Cases 1 to 4. Thus a change could only be made on a subjective basis.

Considered subjectively, samples 1 to 7 form a series in which four samples are outside the premium grade limit, and the overall average ash content at 9.1% is also outside the limit. However, the figure of 9.1% is just outside the limit, and the five previous average values were within the limit; also, samples 4 to 7, with the addition of one further sample with more than 9.0% ash, would make Case 2 for automatic change of grade, so a wait-and-see

policy/...

policy may be adopted. If this were done, no change in grade would occur. The only other starting point for a subjective decision is sample 4, but by sample 10 the cumulative average ash content has fallen to 9.0%, and it never again rises above this value, so here too no change in grade would be made.

EXAMPLE 6

ALPHA ANTHRACITE DUFF (0-5 mm.)

At Ash Limits of 12.0% and 11.5% for First Grade

Sample No.	Ash Content %	Cumulative Average Ash %		Sample No.	Ash Content %	Cumulative Average Ash %		
1	10.5			21	10.2			
2	10.0			22	7.6			
3	12.1**			23	10.3			
4	10.5			24	9.8			
5	12.1**			25	9.0			
6	10.7			26	12.7**	12.7		
7	9.5			27	11.6*	12.15		
8	11.3			28	11.3	11.9		
9	9.3			29	11.5	11.8		
10	11.2			30	11.7*	11.8		
11	14.9**	14.9		31	13.0**	12.0	13.0	
12	11.6*	13.25		32	12.5**	12.0	12.75	
13	14.1**	13.5		33	12.0*	12.0	12.5	
14	9.5	12.5	9.5	34	11.7*	12.0	12.3	
15	12.8**	12.6	11.15	35	11.2	11.9	12.1	11.2
16	11.8*	12.45	11.4	36	9.0	11.7	11.6	10.1
17	11.7*	12.3	11.45	37	11.3	11.6	11.5	10.5
18	10.5	12.1	11.3	38	11.9*	11.6		10.85
19	9.1	11.8	10.9	39	8.4	11.4		10.4
20	11.1	11.7	10.9	40	11.0	11.4		10.5

* Ash content 11.6% to 12.0%
** Ash content over 12.0%

In the above example there is a very wide range of ash contents, namely from 7.6% to 14.9%. From sample 13 onwards there is a definite correlation between ash content and size grading. All later samples with less than 10% ash have from 32% to about 50% oversize at 5 mm.; sample 23 at 10.3% ash has over 40% oversize, but of the rest with 10% or more ash, only a few exceed 32% oversize, and the maximum oversize is always below 35%.

A./...

A. At an ash limit of 12% for first grade

None of Cases 1 to 4 apply to the results for loss of first grade status. Starting at sample 11, the cumulative average ash content remains above 12% up to sample 18. However, unless a subjective decision to alter the grade is taken at sample 15 when the series consists of only five samples, it does not appear reasonable to change the grade at sample 17 (7 samples in the series), as the last two samples in the series are within the specifications of the current grade. If a change of grade were made, it would have to be reversed at sample 18, as samples 14 to 18 form Case 2 for regaining first grade. The only other possible starting point for a subjective decision is sample 31, but here only the first two samples have more than 12% ash and after six samples the average falls below 12%.

B. At an ash limit of 11.5% for first grade

Although samples 3 and 5 have over 12% ash, no loss of grade would occur in the first ten samples.

Samples 11 to 15 make Case 2 for loss of certificate.

Samples 14 to 20 make Case 4 for regaining first grade.

Samples 26 to 31 make Case 3 for further loss of grade.

Samples 35 to 39 make Case 2 for regaining first grade.

By coincidence, the cumulative average ash content from sample 26 falls below 11.6% ash content at sample 39.

EXAMPLE 7/...

EXAMPLE 7

NATAL AMMONIUM DUFF (0-5 mm.)

At Ash Limits of 11.5% and 12.0% for First Grade

Sample No.	Ash Content %	Cumulative Ash Contents %			
1	10.6				
2	11.4				
3	10.3				
4	10.3				
5	12.9**	12.9			
6	11.7*	12.3			
7	12.3**	12.3			
8	10.8	11.9	10.8		
9	11.1	11.8	10.95		
10	11.0	11.6	11.0		
11	11.8*	11.7	11.2	11.8	
12	12.3**	11.7	11.4	12.05	
13	11.1	11.7	11.35	11.7	
14	11.6*	11.7		11.7	
15	10.0	11.5		11.4	
16	12.1**	11.6		11.5	12.1
17	13.5**	11.7		11.8	12.8
18	11.7*	11.7		11.8	12.4
19	11.5	11.7		11.7	12.2
20	11.6*	11.7		11.7	12.1
21	12.4**	11.7			12.1
22	12.6**	11.8			12.2
23	11.6*	11.8	11.6		
24	11.6*	11.8	11.6		
25	11.2	11.7	11.5	11.2	
26	12.3**	11.8	11.7	11.75	
27	10.6	11.7	11.5	11.4	10.6
28	11.2	11.7	11.4	11.3	10.9
29	11.7*	11.7	11.5	11.4	11.2
30	11.4	11.7	11.45	11.4	11.2
31	11.7*	11.7	11.5	11.4	11.3

* Ash Content 11.5% to 12.0%

** Ash Content over 12.0%.

A. At an ash limit of 11.5%

Samples 5 to 11 constitute Case 4 for loss of grade.

Samples 8 to 13 constitute Case 3 for recovery of grade.

Starting with sample 11, there are six samples with the shape

of/...

of Case 3, but the average is below 11.6% at samples 15 and 16; however, a subjective decision to change the grade may be made at samples 17 or 18. If such a decision is not taken, the grade will in any case be lost on samples 16 to 20 as Case 2.

Sample 25 is a possible starting point of a subjective series for recovery of grade; however, at sample 30 only six samples constitute the series, and sample 31 has more than 11.5% ash, so the decision could only be taken at the next sample if 11.5% or less in ash content. If this were so, samples 27 to 32 would in any case form Case 3 for automatic recovery of grade.

B. At an ash limit of 12.0%

Samples 16 to 22 form Case 4 for loss of grade.

Samples 23 to 27 form Case 2 for recovery of grade.

EXAMPLE 8

NATAL AMMONIUM DUFF

At Ash Limits of 12.0% and 11.5% for First Grade

Sample No.	Ash Content %	Cumulative Average Ash Content %			
1	12.8**	12.8			
2	11.4	12.1			11.4
3	13.1**	12.4			12.25
4	14.0**	12.8			12.8
5	12.5**	12.8			12.75
6	10.3		10.3		12.3
7	11.2		10.75		12.1
8	10.3		10.6		11.8
9	12.3**		11.0	12.3	
10	12.9**		11.4	12.6	
11	11.7*		11.45	12.3	11.7
12	11.9*		11.5	12.2	11.8
13	13.0**		11.7	12.4	12.2
14	12.3**		11.75	12.35	12.2
15	10.0				11.8
16	10.8				11.6
17	11.1				11.5
18	11.0				
19	11.8*	11.8			
20	12.3**	12.05			
21	11.1	11.7			
22	11.6*	11.7			
23	10.0	11.4			
24	12.8**	11.6			
25	12.8**	11.8			
26	12.1**	11.8			
27	13.5**	12.0			

* Ash Content 11.6% to 12.0%

** Ash Content more than 12.0%.

This/...

This series contains both 0-5 mm. and 0-12 mm. samples, the former being a portion of Example 7, sample No. 2 being the same in each case.

A. At an ash limit of 12.0%

Samples 1 to 5 constitute Case 2 for loss of certificate.

From sample 2 one gets a possible subjective series to sample 8 for regaining grade. If not changed at this point, samples 6 to 11 constitute Case 3 for regaining grade.

Samples 9 to 14 constitute Case 2 for a further loss of certificate.

Samples 11 to 17 form a subjective series for restoring the certificate. Thus sample 11 could be concerned in three series involving change of grade. If the grade is not restored at sample 17, samples 15 to 18 form Case 1 for restoration.

Samples 24 to 27 represent Case 1 for further loss of grade. (Subsequent samples are all 0-5 mm. and consist of sample 18 onwards of Example 7.)

B. At an ash limit of 11.5%

Samples 1 to 5 represent Case 2 for loss of grade.

From sample 6 to sample 12, a series of seven samples occurs with the average ash content never exceeding 11.5%, but the last four members of the series all have more than 11.5% ash.

Samples 15 to 18 represent Case 1 for recovery of grade.

Samples 19 to 24 have the shape of Case 3, but at sample 23 the cumulative average falls below 11.6%. At samples 25 and 26 subjective decisions can be taken for loss of grade. If such a decision is not taken, grade is lost anyway on samples 24 to 27 as Case 1.

The/...

The above examples can be summarised as follows:-

A. Excluding Any Subjective Changes in Grade

(1) No change in grade:

Examples 4, 5 and 6 (at 12% ash limit).

(2) Two changes in grade:

Example 1. Changes at samples 8 and 12. No overlap.

Example 2. Changes at samples 6 and 10. No overlap.

Example 3. Changes at samples 6 and 14. No overlap.

Example 7 (12% limit). Changes at samples 22 and 27. No overlap.

(3) Three changes in grade:

Example 8 (11.5% limit). Changes at samples 5, 18, 27. No overlap.

Example 7 (11.5% limit). Changes at samples 11, 13, 20. Samples 8 to 11 overlap.

(4) Four changes in grade:

Example 6 (11.5% limit). Changes at samples 15, 20, 31, 39. Samples 14 and 15 overlap.

(5) Five changes in grade:

Example 8 (12.0% limit). Changes at samples 5, 11, 14, 18, 27. Samples 9 to 11 overlap.

B. Including Subjective Changes in Grade That Are Reasonably Well-Grounded

(1) Example 1:

Samples 1 to 7 form a subjective series for loss of grade. As the grade would in any case be lost objectively at sample 8, the general picture is not changed.

(2) Example 4:

Samples 1 to 7 or 1 to 8 form subjective series for loss of grade. If the grade were changed it would have to be restored at sample 9, as samples 3 to 9 form Case 4 for

restoration/...

restoration of grade. Thus samples 3 to 7 or 3 to 8 would overlap.

(3) Example 7 (at 11.5% ash limit):
Samples 11 to 17 or 18 form a subjective series for loss of grade. If the certificate is lost here, there will be overlapping changes in grade of loss, recovery and further loss, with sample 11 concerned in three changes of grade (overlaps are samples 8 to 11 and 11 to 13).

(4) Example 8 (at 12% ash limit):
Samples 11 to 17 form a subjective series for recovery of grade. In this case three changes in grade would overlap, with sample 11 being concerned in each change. Overlapping samples are 9 to 11, and 11 to 14.

(5) Example 8 (at 11.5% ash limit):
Samples 19 to 26 form a subjective series for ~~recovery~~ loss of grade. As the grade would be ~~recovered~~ lost anyway on sample 27 (Case 1), the general picture is not changed.

Excluding the subjective changes, there are eleven examples (counting examples 6, 7 and 8 twice) involving 23 changes of grade. Of these changes, fifteen are second or subsequent changes. The distribution of the intervals (in number of samples) between changes is shown below:-

No. of samples between changes	Frequency
13, 11, 7, 6, 3, 2	1
9, 8, 5	2
4	3

Three overlaps of samples involved in successive changes occur, at intervals of 2, 3 and 5 (Example 6, 11.5% ash limit) samples apart, the number of overlapping samples being 4, 3, and 2 respectively.

Including the subjective changes, given under B. above, the number of changes increases by two (Example 4), the distribution

of/...

of intervals between changes of grade is changed (the pattern depending on when the subjective change is made in two cases), and three more overlaps occur, two overlaps each including one sample in two successive overlaps, so that in these two cases one sample is concerned in three consecutive changes in grade.

Although the number of changes in grade in the examples is large, and some of these changes follow in quick succession - sometimes with certain samples being involved in two or three successive changes in grade - most of the examples do not represent factual conditions. Only Examples 5, 6 and 7 represent real cases.

In Example 5 no change of grade occurs.

In Example 6 (12% ash limit) no change of grade occurs. At a limit of 11.5% ash, four changes of grade - with one overlap of two samples - occur.

In Example 7 (12% ash limit) two changes of grade occur. At a limit of 11.5% ash, three changes of grade occur; overlapping samples would be involved in two or three consecutive changes of grade, depending on whether a subjective change in grade was or was not made.

CHECK SAMPLING:

As already stated, check sampling is normally done at weekly intervals, provided that the coal is available for sampling. In the recent past, however, where samples (while not complying with the original stipulation that four consecutive samples be out of grade) fluctuated above and below the limits, fortnightly sampling was undertaken so as to get more information.

If Cases 1 to 4, and also subjective series, are used in determining the change of grade of a coal, extended check sampling may be necessary. Check sampling will in any case be stopped when four consecutive samples are in the same grade, and may be stopped when three consecutive samples are in the same grade,

depending/...

depending on the values obtained and those of the immediately preceding samples. Check sampling should never be stopped on less than three consecutive samples in the same grade.

Example 7, at an ash limit of 11.5%, may be used to illustrate how much check sampling can be necessary. Sample 5 is out of grade, so check sampling must start at sample 6 and must be continued at least to sample 18. Even here check sampling should be continued, as the cumulative average ash contents from sample 13 are 11.1, 11.35, 10.9, 11.2, 11.7 and 11.7, and the addition of one more sample (No. 19) at a value of 10.0% ash (which was the value obtained for sample 15) would give an average value of 11.4% and thus form a subjective series for possible reversion to first grade. At sample 22 (i.e. also after three values above 11.5%) check sampling could be stopped. Samples 23, 24 and 25 would be normal monthly samples, but as the latter was within first grade limits, check sampling would have to be reinstated at sample 26, and would continue to the end of the series at sample 31. Thus, from the first undergrade sample (No. 5) to the end of the series, 23 check samples and only three monthly samples would be taken, so that with weekly check sampling 26 samples would have been taken from one product from one colliery in the space of nine months or less.

Normally, calorific values and proximate analyses only are done on individual export samples, with ash fusion temperature and sulphur determinations on quarterly composite samples. During check sampling, with the possibility of frequent and even overlapping samples being concerned in changes of grade, it might be found preferable to do these latter determinations also on the individual check samples. There could thus be a very large amount of analytical work involved in controlling only one coal.

Some coals arrive at irregular intervals at the Bluff; for these coals, check sampling should be done at weekly intervals, if coal is available. For coals that arrive regularly, however, it is considered preferable to take check samples only in alternate weeks to reduce the amount of analytical work required.

SPORADIC/...

SPORADIC EXPORTS

Certain coals may only be exported at infrequent intervals. If such a coal should go undergrade, sufficient check samples may not be taken in the course of the year to justify changing the grade on the basis of Cases 1 to 4 or a subjective decision, although the average values for the year show the coal to be undergrade. Should the grade be changed on this average value, and if so, on what minimum number of samples should this decision be based? The total number of samples taken could well be four or less.

CHANGE OF GRADE

It is suggested that where there has been a change of grade of a coal during the year, both grades be mentioned in the Annual Report with an indication as to which is current at the end of the year. One reason for doing this is that if a coal's grade is changed during the year, the annual average values may not comply with the specifications of the grade current at the end of the year.

W.H.D. SAVAGE
Chief of Survey Division.

PRETORIA,
3rd May, 1965.

OvR.