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FUEL RESEARCH INSTITUTE

OF SOUTH AFRICA

TEGNIESE MEMORANDUM
TECHNICAL

NO. 30 OF 1974

COMPARISON OF SAMPLES TAKEN BY THE SUCTION DRILL SAMPLER AND BY SHOVEL FROM TRUCK TOPS

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INTRODUCTION

At various times complaints have been received from the Transvaal Coal Owners Association and collieries about low calorific values obtained by the Institute on samples taken for the S.A.R. locomotive contract. In order to check on the method of sampling, duplicate samples were taken, one by the drill sampler and the other by taking shovel samples from the truck tops, or sometimes from the belt.

PROCEDURE

This memorandum deals with recent results obtained by such duplicate sampling, where the bulk samples were all taken from the truck tops, and covers two periods. Firstly, in the period September to November, 1972, six comparative tests were done on Greenside coal. In the second period, April to June, 1974, coal from six collieries, including Greenside, was tested. The collieries were selected as being those whose calorific values showed the largest variation over a period.

RESULTS

The results obtained in these tests are given in Table 1 below, together with the differences in calorific value, positive differences being shown when the drill sample gave the higher values, and negative values when the truck top values were higher.

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TABLE 1

CALORIFIC VALUES OF DRILL AND TRUCK-TOP SAMPLES FROM THE SAME TRUCKS OF COAL

Colliery	Sample No.	Calorific Value MJ/kg		Difference D-S(MJ/kg)	
		Drill Sample	Shovel Sample	+	-
A 1972 Samples					
Greenside	W2405	27,84	27,53	0,31	
Greenside	W2411	27,61	27,35	0,26	
Greenside	W2432	28,92	28,90	0,02	
Greenside	W2451	28,57	28,23	0,34	
Greenside	W2508	28,29	28,49		0,20
Greenside	W2527	28,04	28,28		0,24
B 1974 Samples					
Greenside	W3647	27,94	27,70	0,24	
Greenside	W3676	28,45	27,91	0,54	
Greenside	W3707	28,26	28,06	0,20	
Greenside	W3734	28,34	28,22	0,12	
Bank	W3626	29,62	29,10	0,52	
Bank	W3662	29,36	29,25	0,11	
Bank	W3748	29,63	29,08	0,55	
Koornfontein	W3627	29,67	29,57	0,10	
Koornfontein	W3661	28,42	28,78		0,36
Koornfontein	W3688	29,85	29,45	0,40	
Koornfontein	W3723	29,91	29,70	0,21	
Springbok	W3630	29,84	29,24	0,60	
Springbok	W3689	29,24	29,59		0,35
Springbok	W3757	29,03	28,64	0,39	
Tweefontein	W3645	28,15	28,34		0,19
Tweefontein	W3674	28,03	27,84	0,19	
Tweefontein	W3703	27,77	27,69	0,08	
Tweefontein	W3733	28,20	28,05	0,15	
Landau	W3672	28,41	28,08	0,33	
Landau	W3702	28,55	28,19	0,36	
Landau	W3732	28,58	28,05	0,53	
Averages (A + B)		28,69	28,49	0,24	0,05

/DISCUSSION .....

DISCUSSION

The average values of the drill and shovel samples indicate that for the 27 samples the drill values averaged 0,20 MJ/kg higher (28,69 - 28,49), indicating a bias towards high values with the drill compared with the shovel method. Considering the average values for the differences in the last two columns, the bias works out at 0,24 minus 0,05 MJ/kg, namely 0,19 MJ/kg. In fact, if the calculations are based on four places of decimals, both methods work out at 0,193 MJ/kg, or two places 0,19 MJ/kg. This is roughly equivalent to a bias of 0,5% ash.

The average difference between duplicates is the sum of the average differences for the plus and minus averages, namely 0,29 MJ/kg. This is roughly equivalent to an average difference between duplicates of 0,75% ash.

Both methods of sampling must be considered as non-ideal, and thus possibly subject to bias.

The drill sampler drills through large lumps of coal directly in its path, and recovers most of the coal in its path, losing a little at initial penetration of a lump and more at final penetration. Where the drill encounters an angled edge, there is a tendency either for the course of the drill to be diverted or for the lump to be displaced. Where hard material (e.g. sandstone, pyrites) is encountered, again either the drill or the lump is likely to be diverted. Much of the chippings formed during the passage of the drill through the coal is lost to the sample, and if dry dust is present in the truck, it is inclined to be overrepresented in the sample. Larger samples are obtained when drilling larger lumps than when drilling cobbles. As all coals consist of a range of sizes, the sample will tend to be biassed towards the properties of the larger lumps. This has been demonstrated by drilling a mixture of large cobbles and small cobbles derived from two collieries with roughly 18% ash and 12% ash. Where the coarse component has the higher ash, the sample tends to have an ash content above

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the average of the consignment, and where the large coal has the lower ash content, lower ash contents than that of the consignment are obtained. Finally, when drilling cobbles, the drill penetrates the first 30 cm or more of the coal more or less in free fall, and only the lower part of the coal in the truck is sampled. That the drill sampler manages to get a sample with a reasonably small bias can be ascribed to the fairly homogeneous nature of South African coal, and to the fact that normally there is but little difference in quality between the various size grades of coal from a single colliery.

The samples taken by shovel from truck tops are liable to bias due to only the top layer of coal being sampled, which is not representative of the full depth of the truck. It is felt, however, that these samples are reasonably representative, and the average differences in calorific value are in line with results obtained in previous test work, where other more reliable methods of obtaining the bulk samples (e.g. sampling from a belt during loading, or during discharge) were used.

CONCLUSION

This series of tests has shown that there is a tendency for the drill sampler to give calorific values that are slightly high compared with other more reliable sampling methods. As this is the case, it is unlikely that samples taken with the drill sampler will, over a period, give average results lower than the true values.

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