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FUEL RESEARCH INSTITUTE OF SOUTH AFRICA

Technical Memorandum No. 3 of 1958  
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PROPOSED PROGRAMME OF WORK FOR THE COAL  
PREPARATION PILOT PLANT, FEBRUARY - JULY 1958

BY

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THE POSITION AT PRESENT

On completion of the plant, all units were tested from a mechanical point of view and all apparent defects were made good. The plant was then painted and was not operated again until after the official opening.

After the opening, two problems required to be investigated urgently, viz:

- (a) Washing of nut coal at about 1.35 S.G. in the Barvoys and Drewboy for Rand Carbide
- (b) Washing of duff coal in the cyclone for Iscor.

At this stage, the Pilot Plant staff had absolutely no operating experience of the equipment and processes required for these investigations. As a first step, therefore, it was necessary to concentrate on operating the necessary units under the conditions required for the tests mentioned under (a) and (b) above. It soon became apparent that there were certain minor errors in the flow sheet etc. These were corrected and the tests for Rand Carbide and Iscor were ultimately carried out more or less successfully. By this time, the mechanical operation of the three dense medium separators presented no further problem, but it was clear that much had yet to be learned about the processes themselves.

Some time was then spent in becoming familiar with the operation of the Baum Jig. Minor alterations and additions were also found necessary and the stage has now been reached where it is possible to obtain a reasonably satisfactory separation in the Baum Jig when operated with automatic control. Once again there is still much to be learned about the influence of the various operating variables.

Some preliminary tests were conducted in the froth flotation equipment, but it was decided to postpone more intensive work until a continuous supply of slurry became available during subsequent tests on the Baum Jig and other units.

Generally speaking, it is considered that with the exception of froth flotation, the Institute is now in a position to make almost any separation in the plant likely to be required by the coal industry, but a certain amount of "playing around" will probably be necessary in order to arrive at the optimum operating conditions for each individual test.

It is most desirable to initiate as soon as possible, a programme of work aimed at making a systematic study of the influence of the various operating variables for each process. The data thus obtained will be invaluable as regards:

- (a) Investigating specific problems in the Pilot Plant on behalf of the coal industry and other interested parties, as they arise, with the minimum delay and expenditure.
- (b) Indicating further avenues of research in the Pilot Plant
- (c) Giving advice to collieries on the operation and choice of plant.

THE PROPOSED PROGRAMME OF WORK FOR THE PERIOD FEBRUARY -  
JULY, 1958

It is considered that the initial programme should aim at obtaining, in the shortest possible time, a general idea of the influence of the principal operating variables for each individual process. The results obtained would indicate the avenues requiring detailed study and would form a basis for the next programme.

With this in mind, the following minimum programme has been drawn up for the more important items of equipment:

Barvoys Washer

1. Determination of the critical stability index without coal.
2. Determination of the performance on - 3" +  $\frac{1}{4}$ " coal at designed load using shale medium at separating specific gravities 1.40, 1.45, 1.50, 1.55 and possibly 1.60 (5 performance tests)
3. Determination of the performance on - 3" +  $\frac{1}{4}$ " coal at designed load using magnetite medium at separating specific gravities 1.50, 1.55 and 1.60 (3 performance tests).
4. Determination of the influence of viscosity on the separating efficiency when treating - 3" +  $\frac{1}{4}$ " coal. Some data in this connection will be derived from (2) and (3) but in addition it is desirable to conduct tests in which a fixed separating specific gravity is maintained and the viscosity is varied (say 2 further performance tests).



5. Determination of the influence of load on the performance when treating - 3" +  $\frac{1}{4}$ " coal. A constant separating specific gravity will be maintained and the load will be varied (one test under load and two tests overload - i.e. 3 performance tests)

During all the above tests, the Barvoys Washer will be operated as a three product separator.

The programme for the Barvoys Washer entails detailed analysis of samples for some 13 performance tests on - 3" +  $\frac{1}{4}$ " coal.

#### Drewboy

1. Determination of the critical stability under various conditions of medium flow rate and distribution.
2. Determination of the performance when treating - 3" +  $\frac{1}{4}$ " coal at designed load with magnetite medium at separating specific gravities 1.40, 1.45, 1.50, 1.55 and 1.60 (5 performance tests)
3. As in (2) but using shale medium (5 performance tests).
4. Determination of the influence of viscosity on the separating efficiency when treating - 3" +  $\frac{1}{4}$ " coal, i.e. separation at a fixed specific gravity with the viscosity of the suspension as the variable (say 2 performance tests).
5. Determination of the influence of load on the separating efficiency when treating - 3" +  $\frac{1}{4}$ " coal i.e. separation at a fixed specific gravity with load as the variable (say 3 performance tests).

As far as possible, the same coal should be used for tests on the Barvoys and Drewboy Washers in order that the performance of the two units may be compared. The Programme for the Drewboy Washer entails detailed analysis of samples for some 15 performance tests.

Cyclone Washer

1. Study of the influence of the following factors on the overflow and underflow specific gravities when using magnetite.
  - (a) Addition of clay
  - (b) Fineness of medium
  - (c) Feed pressure
  - (d) Nozzle diameter
2. As in (1) when using shale medium
3. Using selected operating conditions obtained from (1) and (2), performance tests should be carried out on -  $\frac{1}{4}$ " +  $\frac{1}{2}$  mm. coal at 1.35, 1.45 and 1.55 specific gravities (say 10 performance tests in all).

Baum Jig

1. Determination of the influence of load on the separating performance when treating - 3" + 0 coal (say 3 performance tests).
2. Determination of the influence of the separating specific gravities on the performance when treating - 3" + 0 coal (say 3 performance tests).
3. Determination of the influence of the amount of top water on the performance when treating - 3" + 0 coal (say 2 performance tests).

4. Determination of the influence of the air cycle on the performance when treating - 3" + 0 coal. The conventional British cycle will be used for (1), (2) and (3) and say 2 of these tests should be repeated using the Bird cycle. (2 performance tests).

The programme for the jig entails the detailed analysis of samples for some 10 performance tests.

#### Froth Flotation Cells

When slurry becomes available during the tests on the cyclone and Baum Jig, the froth flotation cells will be run primarily with a view to gaining operating experience.

#### Ancillary Equipment

In addition to the programme outlined for the main separating units, it will be desirable to obtain some idea of the characteristics of the following ancillary equipment.

- (a) Magnetic recovery equipment
- (b) Primary crusher
- (c) Recirculation crusher.

The tests under (b) will be carried out when the raw coal is crushed for the main programme while the remainder can be fitted in wherever possible.

#### Staff Requirements

The operating staff at the Pilot Plant consists of:

- 1 Senior Fitter Operator
- 2 Fitter Operators (1 vacancy at present)

1 Operator  
10 Permanent Natives.

This staff is adequate for handling coal, for running the plant and for maintenance. In fact the plant could virtually be run continuously and, in theory, the programme outlined above could probably be completed in about 2 months, if no unforeseen difficulties are experienced. The analysis of the samples, however, represents the bottle neck.

In order to make the fullest possible use of the existing analytical facilities, it is considered that the following minimum team will be required for the Pilot Plant programme outlined above.

- 1 Senior Technical Officer for planning and report writing
- 1 Technical Officer to arrange and supervise the actual tests on the plant and to supervise the analytical work.
- 1 Assistant Technical Officer to sample and generally assist during the plant tests and to evaluate results.
- 1 Assistant Technical Officer to screen samples, prepare samples, carry out ash and moisture determinations.
- 1 Assistant Technical Officer to carry out float and sink analysis
- 1 Assistant Technical Officer for sampling during tests, milling of medium and plant control tests.



- 1 Technical Officer for determining the viscosity and stability of heavy medium suspensions and for analysing slurries
- 10 Natives for float and sink analysis screening, sampling etc.
- 1 Assistant Technical Officer in addition to the above would be highly desirable to act as a relief when another officer is absent, but he should primarily be available for training.

With this team it is considered that it should be possible to carry out on the average, 2 performance tests per week on - 3" coal and to carry out all the necessary analyses. In the case of -  $\frac{1}{4}$ " coal, about 4 tests per week should be possible.

The programme as outlined entails the following performance tests:

		Estimated weeks required
		-----
- 3" + $\frac{1}{4}$ " coal	28	14
- 3" + 0 "	10	5
- $\frac{1}{4}$ " "	10	<u>2<math>\frac{1}{2}</math></u>
		21 $\frac{1}{2}$
Crushing tests etc.		<u>2<math>\frac{1}{2}</math></u>
		24
		===

In other words, provided there are no unforeseen delays, it should be possible to complete the programme in roughly 6 months.

The present coal preparation division staff consists of:

- 1 Senior Technical Officer
- 2 Technical Officers
- 5 Assistant Technical Officers (1 vacancy)
- 9 Natives.

Except for 1 native this complement represents the requirements for the pilot plant programme. In other words, it will not be possible to carry out any other work. Or alternatively, if other work has to be done, the pilot plant programme will be delayed accordingly. Because of the interruptions, the delay in the programme will probably be rather greater than the actual time involved in the additional work.

The Institute is frequently called upon to render service to the collieries and it is considered most desirable that such service should continue. By rendering this service, the Institute is kept in close touch with practical problems and developments. It is considered, therefore, that at least 1 assistant technical officer should be available full time for this field work. When not actually required in the field, this officer will be required to acquaint himself with developments at the pilot plant. In fact, this knowledge should form the basis of his service to the Industry. The field work naturally requires the supervision of a senior officer and this will have to be shared by myself and the senior technical officer of the coal preparation division.

One assistant technical officer has been engaged for some time on research relating to the accuracy of sampling, sample division and float and sink analysis. These are all problems which have an important bearing on the Pilot Plant

programme. The time required for float and sink analysis etc. is roughly proportional to the size of sample to be analysed. It is most desirable, therefore, that only the minimum size of samples should be taken consistent with the desired accuracy. In the absence of reliable data relating to the size of samples and the corresponding accuracy, there is a tendency to work with samples which are unnecessarily large. It is considered, therefore, that this work should continue probably for the next 6 - 12 months. This officer will require at least 1 native to assist him. An additional assistant technical officer and 1 native will, therefore, be required to complete the pilot plant team. The officer engaged on the sampling investigation will also be available to assist in any urgent analytical work to be done for collieries (e.g. washability characteristics of run of mine coal) and it will not then be necessary to interfere with the pilot plant programme. Float and sink apparatus which is suitable for this type of work and which would not be used for the pilot plant tests is available.

The technical officer who will be engaged on viscosity and stability tests for the pilot plant, should have some time available which should be devoted to a continuation of the research on the properties of suspensions which is in progress at present. A sound knowledge of the properties of suspensions is essential in dense medium washing. The indications at present are that the suspensions that may be encountered in South Africa have properties quite unlike those encountered overseas and it is most desirable that this work should be continued.

To summarise, in order to undertake the programme envisaged for the coal preparation division during the next

six months to a year in the best possible manner, it appears that the staff will have to be increased by 2 assistant technical officers and 2 natives.

#### TESTS FOR COLLIERIES AND ISCOR

All colliery companies and other interested parties were asked to indicate before the end of January, 1958, if there were any specific problems which they wished to have investigated in the Pilot Plant during 1958. The response was generally rather disappointing. Requests received for Pilot Plant investigations are summarised below:

##### Iscor

Thorough investigation of the washing and coking properties of Waterberg coal when the Pilot coke ovens have been erected. This investigation will probably not materialise, therefore, before the end of 1958 or early 1959.

##### Natal Navigation Collieries

May require a test on Kilbarchan coal early in 1958 but will inform the Institute later when a definite decision has been made.

##### Anglo Transvaal Consolidated Investment Co.

Wish to have tests conducted on coal from Albion Colliery about the middle of June, 1958.

In addition, one or two collieries have indicated verbally that they may wish to have tests conducted in the plant, but to date there is nothing definite.



It appears, therefore, that not more than 1 or 2 tests for collieries can be expected before July, 1958. Should these materialise, they will have to take priority over the research programme already outlined. There should be no difficulty in fitting in such tests when they are required. Each test will probably delay the research programme by about two weeks.

A few companies have indicated their interest in minor investigations which do not concern the Pilot Plant at present. These are:

- (a) Dry cleaning of anthracite for Alpha Anthracite Colliery.
- (b) Separation of coal and oil shale for S. A. Torbanite and Mining Company
- (c) Drying of small coal for Natal Cambrian Colliery.

Preliminary discussions have been arranged and should this work materialise, it will have to be undertaken mainly by the officer reserved for field services as and when he is available.

The following work is either in progress or will be undertaken in the near future.

- (1) Determination of the washability characteristics of Carnarvon and Impati Anthracite.
- (2) Adjustment of Baum Jig at Newcastle-Platberg Colliery.

P. J. van der WALT.

ASSISTANT DIRECTOR

PRETORIA

31st January, 1958