COAL PRODUCT UPGRADE USING NEW SCREENING TECHNOLOGY

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OPTIMUM COLLIERY

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Introduction

Developments in spiral concentration technology and testwork carried out by Multotec have indicated that an export grade material (11,5 % ash at 58 % yield) can be produced by a two stage spiral circuit, with discrete size fractions being treated in separate secondary circuits.

The old smaller diameter primary spirals were decommissioned during 1996 and were retrofitted with large diameter spirals. As part of this project, a secondary test circuit was installed to confirm the results under actual plant conditions.

The testwork that was carried out using the secondary spiral test circuit proved to be successful and the installation of a full secondary spiral circuit was undertaken.

However, during the design phase of this project, Multotec introduced their latest invention, the new MX7 spirals. Considering the significant financial advantages that could be realised by utilising the compound MX7 spiral design, further testwork was conducted. The investigation revealed that if the –106um material could be efficiently removed from the secondary spiral stream, then an export grade product with an acceptable ash content of < 12% can be produced with a slight improvement in yield when compared to the previous testwork.

Project Scope and Brief Coal Flow Description

The scope of work included the following main activities: -

(a) Spirals Feed Circuit

A fines route splitter box can be automatically set to allow the –0.5+0.1mm coal fraction to either gravitate to the feed tank or fully bypass the spiral plant onto dewatering screens. The fine coal is pumped to a headbox before feeding the MX7 spirals.

(b) Clean Coal System

The product from the MX7 Spirals is gravity fed to a single $12m^2$ Delkor FAST screen. The oversize from this fine coal screen is then pumped to classifying cyclones before entering the screenbowl centrifuges.

(c) Middlings Dewatering System

The middlings from the spirals together with the undersize material from the fine coal screen is pumped to a cluster of classifying cyclones. The product from these cyclones is then dewatered on two dewatering screens before gravitating to two Wemco H900 centrifuges. If need be, provision is made to bypass these centrifuges.

(d) Discard Recovery And Dewatering System

The discard from the MX7 spirals gravitates to a splitterbox from where feeds onto two fordertechnic screens. The dewatered material is eventually discarded via the main plant discard conveyor.

Technical Description of Delkor FAST Screen

The screen comprises of an endless trackmatic belt that travels over support rollers and is driven by a head pulley coupled to a variable speed drive unit. The belt is guided by the machined grooves in the head and tail pulley. Tensioning is achieved by adjusting the tail pulleys. A series of spray pipes are located between the feed box and head pulley. The undersize material drains through the cloth by gravity while the oversize material is discharged at the drive pulley end. The angle of the spray is also important and is set at right angles to the cloth. Attached and supported by the trackmatic belt is an endless fine cloth with an aperture of 200x200um.

Problems experienced during commissioning

Insufficient Clarified Water

A mistake that we made was to take the spray water for the FAST screen from the same clarified water ring main used to make up level in the MX7 spiral feed tanks as well as in the clean coal tanks.

Blockage of Sprays

There was a problem of continuous blocking up of wash spray nozzles due to the presence of fine particles in the clarified water circuit.

Trackmatic Belt running off

When the FAST screen was started up for the first time, we experienced problems with the trackmatic belt running off.

Uneven feed distribution on FAST Screen

Another problem encountered with the FAST screen was that the area under the feed distribution box was not being effectively utilised because of the uneven distribution of feed on the perforated plates.

Tears at cloth eyelets

The double cloth configuration of two cloths fastened together using split rings and pig tail hooks required ongoing monitoring as tears on the cloth eyelets appeared soon after commissioning, although they seem to quickly stabilise.

Testwork

Extensive detailed testwork has been conducted to optimise the metallurgical performance of the spirals plant. The aim of this testwork was to ensure that a clean coal export product with an ash content of less than 12.0% could be consistently produced. A critical aspect that was considered to achieve the testwork objective was to determine the physical separation efficiency of the FAST screen.

The following is a summary of the test conditions:

	Total Pulp m3/hr	Solids t/hr	Solids %
Feed	**153.7**	**33.0**	**20.1**
Oversize	**56.4**	**17.8**	**28.6**
Undersize	**193.7**	**15.2**	**7.7**
Spray Water	**96.4**	**0.0**	**0.0**

The average size distribution data obtained for the different products is shown in the following tables:

Average Set of Testwork Results
Delkor FAST screen

Feed				
Size (um)	**Frac. Mass %**	**Cum Mass %**	**Frac. Ash %**	**Cum Ash %**
+500	16.9	16.9	9.5	9.5
-500+250	28.5	45.4	9.7	9.6
-250+150	10.8	56.2	11.5	10.0
-150+106	7.5	63.7	13.4	10.4
-106+75	6.9	70.6	17.4	11.1
-75+45	7.8	78.4	30.4	13.0
-45	21.6	100.0	36.9	18.2
Total	**100.0**			

Oversize				
Size (um)	Frac. Mass %	Cum Mass %	Frac. Ash %	Cum Ash %
+500	23.9	23.9	8.9	8.9
-500+250	55.4	79.3	10.0	9.7
-250+150	11.1	90.4	12.0	10.0
-150+106	2.8	93.2	18.1	10.2
-106+75	2.4	95.6	25.3	10.6
-75+45	1.2	96.8	37.2	10.9
-45	3.2	100.0	38.1	11.8
Total	100.0			

Undersize				
Size (um)	Frac. Mass %	Cum Mass %	Frac. Ash %	Cum Ash %
+500	0.0	0.0	0.0	0.0
-500+250	0.0	0.0	0.0	0.0
-250+150	7.1	7.1	10.9	10.9
-150+106	10.2	17.3	14.5	13.0
-106+75	15.3	32.6	18.5	15.6
-75+45	20.4	53.0	32.5	22.1
-45	47.0	100.0	36.4	28.8
Total	100.0			

This data from the size analysis of the feed, oversize and undersize products, together with the proportion of material reporting to the undersize and oversize, was used to plot partition curves based on the distribution by mass of products and reconstituted feed. The results of this analysis are as follows

% Yield (to 'o/size')	**54.1**
S50 (um)	**169**
% U/size in 'o/size'	**6.3**
% O/size in 'u/size'	**2.6**
Epm	**0.67**

The results show that a sharp and accurate separation was obtained by the FAST screen as was also evident from the relatively small amounts of misplaced material.

Quality Implications

Adding the spirals concentrate product with an ash content of 12 % to the present combined drum & cyclone LAC, has the following quality implications:

- total product ash will increase by 0,1
- total product moisture will increase by 0,3
- the size distribution of the final export product will be finer as is indicated in the following table :

Size (mm)	Without Secondary Spirals	With Secondary Spirals
+50	0.5	0.5
-50+25	15.4	14.7
-25+12.5	26.3	25.1
-12.5+6.3	22.6	21.6
-6.3+3.0	13.2	12.7
-3.0+0.81	16.5	17.7
-0.81	5.5	7.7
Total	**100.0**	**100.0**

Financial Evaluation of Project

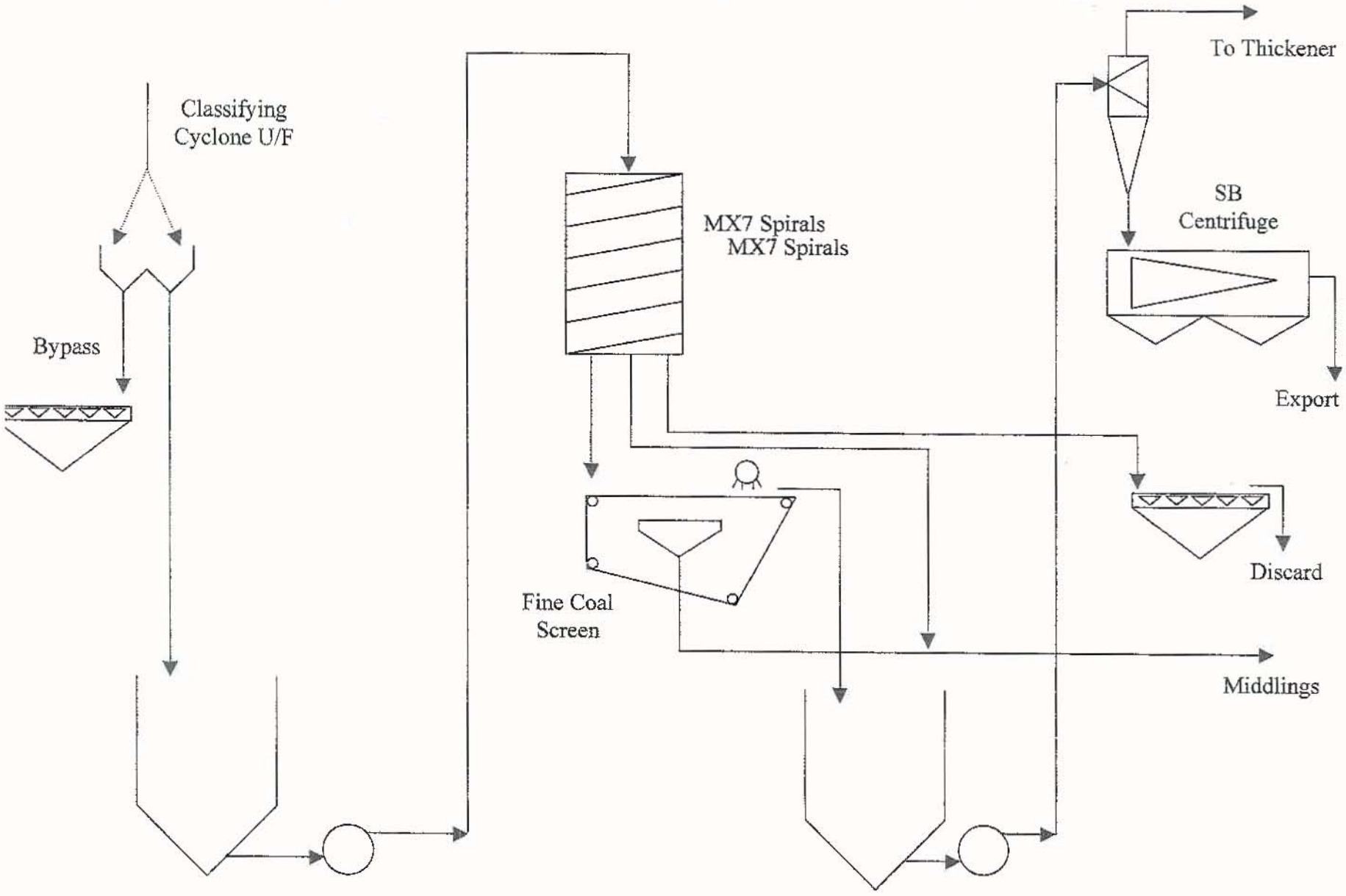
The total capital motivated for the project was R9.5 million, excluding the 4% Billiton fee. Assuming a project life of 5 years and taking into account that the spirals project has the potential to increase the overall export yield by approximately 2%, implies that:

IRR	-	137 %
Payback period	-	9 months

Conclusion

Finally, it can be concluded that by utilising the MX7 spirals together with the Delkor FAST screen as part of the Spirals Optimisation Project, Optimum Colliery has been able to produce a fine coal export product with an ash content of <12%.

The New Spirals Plant at Optimum Colliery



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