OPERATING COSTS

a	Fuel:	Unit price (c/l)	50	
		Consumption (l/hr)	10	5,00
b	Lubes, Oils, Fillers, Grease (10% of a)			0,50
c	Tyre replacement:	Tyre cost (R)	4200	
		Life in hours	4000	1,05
d	Undercarriage cost:	Impact	N/A	
		Abrasiveness	N/A	
		Z factor	N/A	
		TOTAL	N/A	
		Basic factor	N/A	N/A
e	Repair reserve:	Extended use mult.		
		Basic repair factor		3,75
f	Special wear items:	Item cost	]	
		Life in hours	]	1,80
g	TOTAL OPERATING COST			12,10

*Operating cost excludes operator wage.

APPENDIX 3.2 (b)

HOURLY OWNING AND OPERATING COST ESTIMATE — DATE: 31/01/84

A	Machine designation	Leyland 3,5m^3 tip truck
B	Estimated ownership period (years)	5
C	Estimated usage (hours / year) (6 x 260)	1560,00
D	Ownership usage (total hours)	7800,00

OWNING COSTS

E	Delivered price	30000,00
F	Less tyre replacement cost	3000,00
G	Delivered price less tyres	27000,00
H	Less residual value at replacement (45%)	6750,00
I	Value to be recovered through work	20250,00
J	Ownership cost per hour	2,60
K	Interest costs: $\frac{\frac{B+1}{2B} \times G \times \text{Interest Rate (16\%)}}{C}$	1,66
L	Insurance: $\frac{\frac{B+1}{2B} \times G \times \text{Insurance Rate (1\%)}}{C}$	0,10
M	Property tax $\frac{\frac{B+1}{2B} \times G \times \text{Tax Rate (1\%)}}{C}$	0,10
N	TOTAL HOURLY OWNING COST	4,64

OPERATING COSTS

a	Fuel:	Unit price (c/l)	50	
		Consumption (l/hr)	8	4,00
b	Lubes, Oils, Fillers, Grease (10% of a)			0,40
c	Tyre replacement:	Tyre cost (R)	3000	
		Life in hours	3500	0,86
d	Undercarriage cost:	Impact	N/A	
		Abrasiveness	N/A	
		Z factor	N/A	
		TOTAL	N/A	
		Basic factor	N/A	N/A
e	Repair reserve:	Extended use mult.		
		Basic repair factor		2,00
f	Special wear items:	Item cost		
		Life in hours		0,50
g	TOTAL OPERATING COST			7,76

NB R to $ factor of 1.10 used in e.

*Operating cost excludes operator wage.

APPENDIX 4.1 (a)

HOURLY OWNING AND OPERATING COST ESTIMATE — DATE: 31/01/84

A	Machine designation	CAT 140G
B	Estimated ownership period (years)	5
C	Estimated usage (hours / year) (6 x 260)	1040,00
D	Ownership usage (total hours)	5200,00

OWNING COSTS

E	Delivered price	153000,00
F	Less tyre replacement cost	12000,00
G	Delivered price less tyres	131000,00
H	Less residual value at replacement (30%)	39300,00
I	Value to be recoved through work	91700,00
J	Ownership cost per hour	17,63
K	Interest costs: $\frac{\frac{B+1}{2B} \times G \times \text{Interest Rate (16\%)}}{C}$	12,09
L	Insurance: $\frac{\frac{B+1}{2B} \times G \times \text{Insurance Rate (1\%)}}{C}$	0,76
M	Property tax $\frac{\frac{B+1}{2B} \times G \times \text{Tax Rate \% (1\%)}}{C}$	0,76
N	TOTAL HOURLY OWNING COST	31,24

OPERATING COSTS

a	Fuel:	Unit price (c/l)	50	
		Consumption (l/hr)	21	10,50
b	Lubes, Oils, Fillers, Grease (10% of a)			1,05
c	Tyre replacement:	Tyre cost (R)	12000	
		Life in hours	6000	2,00
d	Undercarriage cost:	Impact	N/A	
		Abrasiveness	N/A	
		Z factor	N/A	
		TOTAL	N/A	
		Basic factor	N/A	N/A
e	Repair reserve:	Extended use mult.	1,0	
		Basic repair factor	5,00	5,50
f	Special wear items:	Item cost	]	
		Life in hours	]	0,75
g	TOTAL OPERATING COST			19,80

NB Rand to $ factor of1.10 used in e.

*Operating cost excludes operator wage.

APPENDIX 4.1 (b)

HOURLY OWNING AND OPERATING COST ESTIMATE		DATE: 31/01/84
A	Machine designation	O + K RH 4
B	Estimated ownership period (years)	5
C	Estimated usage (hours / year) (4 x 260)	1040,00
D	Ownership usage (total hours)	5200,00
OWNING COSTS		
E	Delivered price	78000,00
F	Less tyre replacement cost	N/A
G	Delivered price less tyres	78000,00
H	Less residual value at replacement (45%)	23400,00
I	Value to be recovered through work	54600,00
J	Ownership cost per hour	10,50
K	Interest costs: $\frac{\frac{B+1}{2B} \times G \times \text{Interest Rate (16\%)}}{C}$	7,20
L	Insurance: $\frac{\frac{B+1}{2B} \times G \times \text{Insurance Rate (1\%)}}{C}$	0,45
M	Property tax $\frac{\frac{B+1}{2B} \times G \times \text{Tax Rate (1\%)}}{C}$	0,45
N	TOTAL HOURLY OWNING COST	18,60

APPENDIX 6.1

CORRESPONDENCE FROM CATERPILLAR

RE: MAINTENANCE OPTIONS

BARLOW'S TRACTOR DIVISION
Afdeling van/Division of Barlow Rand Ltd.
YOUR CATERPILLAR® DEALER

Handel Road/Handelweg, Ormonde Ext. 5/Uitb. 5, 2093
Telegrams and Cables/Telegramme en Kabels:
'Barwing' Johannesburg
International Dial Code/Internasionaleskakelkode: 27
Telephone/Telefoon (011)835-4151 □ Telex/8-9985/6 SA
P.O. Box/Posbus 4862, Johannesburg 2000

Date/Datum: 6 March 1984

Our Ref./Ons Verw: NDS/ln

Your Ref./U Verw:

Steffen Robertson & Kirsten Inc.
P O Box 8856
JOHANNESBURG
2000

Attention: Mr J Allen

Dear Sir

AFTER-SALES-SERVICE

In response to your telephonic enquiry regarding after-sales-service of earthmoving machinery, a few of the options available for the servicing of machines are as follows:

a) It is possible for a service agreement to be drawn up between ourselves and Escom for instance, where Barlows are responsible for repairing and maintaining the machines on site. With this type of agreement Escom will only be responsible for daily maintenance and a few minor repairs.

b) Another alternative is where Escom are responsible for all repairs and maintenance. However, Barlows will have parts and service representatives inspecting the machines and recommending repairs or replacements of parts. This is a free service with the number of visits dependant on the rate of usage of the machines concerned.

c) Another option is to have an analytical inspection at say every 1000 hours. This inspection will give a comprehensive report on the condition of the machine together with recommendation regarding repairs to be done.

2/...

OPERATING COSTS

a	Fuel:	Unit price (c/l)	50	
		Consumption (l/hr)	7	3,50
b	Lubes, Oils, Fillers, Grease (10% of a)			0,35
c	Tyre replacement:	Tyre cost (R)	N/A	
		Life in hours	N/A	N/A
d	Unercarriage cost:	Impact	0,1	
		Abrasiveness	0,2	
		Z factor	0,5	
		TOTAL	0,8	
		Basic factor	4,50	3,96
e	Repair reserve:	Extended use mutl.	N/A	
		Basic repair factor	3,0	3,30
f	Special wear items:	Item cost	]	
		Life in hours	]	1,40
g	TOTAL OPERATING COST			12,51

NB R to $ factor of 1.10 applied in d and e.

*Operator cost excludes operator wage.

ELECTRICITY SUPPLY COMMISSION

TUTUKA POWER STATION
ASH DISPOSAL
OPERATING MANUAL

REPORT MI.3155 NOVEMBER 1984

Steffen, Robertson and Kirsten (Mining) Inc
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20 Anderson Street
JOHANNESBURG
2000

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2000
TEL (011) 832-1201

CONTENTS

STEFFEN ROBERTSON AND KIRSTEN (MINING) INC
MINING AND TAILINGS AND WASTE DISPOSAL ENGINEERS • MYNBOU-INGENIEURS EN ERTSUITSKOT-EN AFVAL-BERGINGSINGENIEURS

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*(British)

MES/ee

REPORT MI.3155

November 1984

ELECTRICITY SUPPLY COMMISSION

TUTUKA POWER STATION

ASH DISPOSAL

OPERATING MANUAL

1 DESCRIPTION OF PRELIMINARY CIVIL WORKS

1.1 Introduction

Ash from the Tutuka Power Station will be transported in a 'semi-dry' state (20% to 30% moisture content) by means of a conveyor system from the station terrace to the ash disposal site. The ash disposal site which covers an area of approximately 2 500 Ha is located approximately 4 km east of the station terrace. The method of ash disposal on the dump site will be by means of a stacking system. The stacking system will consist of a stacker supplimented by a spreader to handle ash during stacker maintenance and down time periods. The general layout of the ash disposal site is shown on Dwg 3155/1.

1.2 Initial Earth Platform and Roadway Network

The starting point for ash despoition is defined by an initial Earth Platform as indicated in 'brown' on Dwg 3155/1. The platform which is a combination of cut and fill extends for a distance of 850 m in a north-south direction. The platform has a 0,125% gradient rising to the north with a cross fall of 3%.

The prime function of the platform is firstly to provide an assembly area for the stacker and then to create an initial working area for the stacker's future operation in a north-south direction advancing eastwards. The spreader will be constructed at the southern extremity of the platform with future deposition in an easterly direction.

A network of roadways adjacent to the clean and dirty water drainage system has been provided for easy access around the site. The extent of the roadway system is also shown in 'brown' on Dwg 3155/1.

1.3 Surface Runoff Water Systems

1.3.1 Introduction

With the exception of the initial earth platform and roadway network described previously all the structures constructed on the ash disposal site are associated with the control of surface runoff water. The surface runoff water can in turn be subdivided into two categories viz Clean and Dirty water.

- **Clean Water**

  Water which has not come in contact with the ash. This includes surface runoff from undisturbed areas, surface runoff from rehabilitated areas and clean water from the power station. This water will be suitable for irrigation purposes or re-use in the power station and can be allowed to spill into the natural water courses.

- **Dirty Water**

  Surface runoff from exposed ash surfaces, seepage from the ash dump and power station effluent. This water will be suitable only for dust suppression on exposed ash surfaces and should not be allowed to discharge into natural water courses.

1.3.2 The Clean Water System

The clean water system consists of a series of stormwater cut-off drains, diversion bunds, berm penstocks, culverts and clean water dams as indicated in 'light and dark blue' on Dwg 3155/1 attached. Stormwater cut-off drain west intercepts and drains the north western catchment area into the northern clean water dam. The northern clean water dam is located in the northern extremity of the site and dams the valley intercepting the northern catchment area. Spillage from the northern clean water dam is routed into the stormwater cut-off drain east which also intercepts runoff from the north eastern catchment area. This cut-off drain flows in an easterly direction and discharges into a natural drainage channel which drains the eastern catchment area. An existing farm dam is located in the northern part of this natural drainage channel.

The southern clean water dam wall is located across a narrow valley at the southern extremity of the site imediately downstream of the settling basin and dirty water dam.

All clean water is prevented from entering the settling basin and dirty water dam by a series of stormwater cut-off drains (ie south east drain and south west drain) which intercept and route flow either into (0 to 5 m^3/s max) and beyond the southern clean water dam. This is made possible by the use of the clean water turnout east (maximum inlet 5 m^3/sec) and spillway to the clean water dam. It should be noted that provision has been made to augment the level of the dirty water dam with stormwater should it be necessary. This will be achieved by the use of sluice gate controlled turnouts in the stormwater diversion canals adjacent to the dirty water dam.

In order to minimise the amount of dirty water at any point in time, a stormwater diversion arrangement has been provided in the immediate vicinity of the ash dump area. This system consists of a stormwater diversion bund located at the upstream or northern toe of the emergency spreader dump. The bund extends in a east-west direction. Water accumulating against this bund and flowing eastwards will be routed into a stormwater trench north, then through stormwater culverts under the spreader dump into the natural stormwater course.

Surface runoff from the rehabilitated ash dump surface will be controlled by a series of penstock pipes which will route flow through an energy dissipator into the clean water trenches. These penstock pipes and intakes can only be installed after the final side slopes of the dump are finalised. The penstock energy dissipator at the base of the dump together with a penstock extension pipe has, however, been installed during the initial construction phase.

Pumpstations and decant arrangements are provided at both clean water dams. These pumpstations will be used to reticulate water through pipe columns for rehabilitation irrigation purposes and for dust suppression in cases when a shortfall of dirty water occurs.

1.3.3 The Dirty Water System

The Dirty Water System consists of a series of dirty water cut-off drains, a dirty water pipeline, settling basin, and dirty water dam indicated in 'light and dark green' on Dwg 3155/1.

In general terms all runoff from exposed ash surfaces is intercepted in a series of open trenches surrounding the ash dump. This water is in turn isolated from clean water runoff by transporting the water into the settling basin and dirty water dam area by means of a buried reinforced concrete pipe (diameter 750 mm) equipped with manholes for flushing and inspection purposes. It can be anticipated that the dirty water runoff will contain an amount of fine ash in suspension. The settling dam has therefore been provided to allow settlement of the suspended particles prior to being decanted into the dirty water dam. Periodic desludging of the settling dam will have to be undertaken preferably during the dry winter periods when minimum dirty water runoff can be expected.

It is important to note that as the ash dump surfaces are finalised, topsoiled and grassed then runoff from the rehabilitated areas will be reclassified from dirty to clean water. The design makes provision for the flow in these trenches to be routed from the dirty water into the clean water system as required. (Refer Section 4 of Manual).

The dirty water dam is equipped with a decant and pumpstation arrangement which will be coupled to a pipe reticulation system which will be used for dust suppression purposes.

1.3.4 Characteristics of Surface Runoff Water Systems

DAM	WALL CHARACTERISTICS							STORAGE CHARACTERISTICS				
	TYPE	MAX HEIGHT	CREST WIDTH	SIDE SLOPES U/S	SIDE SLOPES D/S	EROSION PROTECTION U/S	EROSION PROTECTION D/S	STORAGE VOLUME AND R.I	DESIGN FLOOD STORAGE VOLUME AND R.I.	FREEBOARD	SPILLWAY WIDTH & R.I	MAXIMUM SURFACE AREA
Settling Basin	Earth Embankment	3,0 m	3,0 m	1:3	1:3	Rip-rap	Rip-rap	30 000 m^3 R.I. N/A	100 000 m^3 1 in 10 yrs	Nil	900 Ø Penstock	80 000 m^2
Dirty Dam	Dolerite fill with clay core	4,0 m	5,0 m	1:3	1:3	Rip-rap	Rip-rap	200 000 m^3 1 in 100 yrs	200 000 m^3 P.M.F.	0,5 m	8,0 m	250 000 m^2
Clean Dam South	Dolerite fill with clay core	6,5 m	5,0 m	1:3	1:3	Rip-rap	Grassed	250 000 m^3 1 in 100 yrs	300 000 m^3 P.M.F	0,5 m	8,0 m	300 000 m^2
Clean Dam North	Dolerite fill with clay core	9,5 m	9,5 m	1:3	1:3	Rip-rap	Grassed	500 000 m^3 1 in 100 yrs	100 000 m^3 1 in 100 yrs	0,5 m	6,0 m	170 000 m^2

NOTE 1. For details refer Drawing 3155/26/28/31/33/53 - Drawing Appendix A

TRENCH/BUND OR PIPE	TRENCH, BUND OR PIPE CHARACTERISTICS						
	TYPE	AVE BASE WIDTH	AVERAGE DEPTH/HEIGHT	SIDE SLOPES	EROSION PROTECTION	CAPACITY R.I	REMARKS
Cut-off Drain West (Clean)	Trapezoidal Grass Lined	4 000	1 500	1:3	Grass/Reno Mattress	1:50 yrs	Reno mattresses have been installed along sections of canal where high velocities are likely to cause excessive erosion
Cut-off Drain West (Dirty)	Trapezoidal Earth	1 000	1 300	1:1,5	Nil	1:10 yrs	
Cut-off Drain East (Northern) (Clean)	Trapezoidal Grass Lined	6 000	1 500	1:3	Grass/Reno Mattress	1:50 yrs	
Cut-off Drain East (Northern) (Dirty)	Trapezoidal Earth	1 000	1 300	1:1,5	Nil	1:10 yrs	
Cut-off Drain SE & SW (Clean)	Trapezoidal Grass Lined	6 000	1 500	1:3	Grass/Reno Mattress	1:50 yrs	
Cut-off Drain around Spreader (Clean)	Trapezoidal Earth	3 000	1 200	1:1,5	Nil	1:10 yrs	
Diversion Bund around Spreader (Clean)	Earth	N/A	1 000	1:1,5	Nil	1:10 yrs	
Cut-off Drain around Spreader (Dirty)	Trapezoidal Earth	1 000	1 300	1:1,5	Nil	1:10 yrs	
Dirty Water Pipeline	Concrete	750 Ø	N/A	N/A	N/A	1:10 yrs	

NOTE 2. For details refer Drawing 3155/3/6/9/10/11/12/13/18 - Drawing Appendix B

NOTE 3. For details of clean and dirty water dam turnouts as well as details of penstock pipe drainage system to side slopes refer Drawing 3155/23/51/52 - Drawing Appendix C.