

PRE-FEASIBILITY REPORT
FOR
SETTING UP OF KUSMUNDA WASHERY
(25.0 MTY) IN KUSMUNDA AREA
(SOUTH EASTERN COALFIELDS LIMITED)



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EXECUTIVE SUMMARY

- 1.0 The Pre-Feasibility Report for Kusmunda Washery which is an Integral part of Kusmunda Mine, has been prepared for submission of Form-I and subsequent issuance of ToR by MoEF. Thereafter, preparation of EIA/EMP will be taken up.
- 2.0 The linked seams of Kusmunda OCP, which will supply coal to the proposed Kusmunda Washery, are E & F Seam, Upper Kusmunda, Lower Kusmunda (Top), Lower Kusmunda (Bottom) and Lower Kusmunda (Combined). The RoM coal samples were collected in April 2015 and washability test has been carried out at CMPDI Laboratory on these samples.
- 3.0 A process flowsheet for achieving washed coal at 33.5% has been finalised based on the washability test results.
- 4.0 The salient features of process flow for achieving the targeted ash of $33.5\pm 0.5\%$ for thermal power station is briefly mentioned hereafter.
 - ❖ Receiving raw coal of (-) 100 mm from **12,000 t** raw coal bunker of mine CHP through belt conveyors and conveying the same to screen-cum-crusher house.
 - ❖ Screening at 50 mm to obtain two size fractions i.e. 100-50mm & (-) 50 mm.
 - ❖ Crushing of 100-50 mm coal down to 50 mm and mixing it with natural -50 mm coal.
 - ❖ Conveying of entire -50 mm fraction to washery building.
 - ❖ Screening of (-) 50 mm coal at 13 mm on vibrating screens to produce two size fractions i.e. 50-13 mm & -13 mm.
 - ❖ Storage of 50-13 mm fraction in surge hoppers for feeding to Coarse Coal Jigs.
 - ❖ Beneficiation of 50-13 mm fraction in two product electronically controlled improved type Coarse Coal Jigs to produce beneficiated coal (float) and rejects (sinks).

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- ❖ Dewatering of beneficiated coal obtained from jigs in Double Deck Dewatering Screens followed by dewatering of 25-13 mm fraction in Basket Centrifuge.
 - ❖ Mixing of untreated -13 mm raw coal either with beneficiated 50-13 mm coal obtained from jigs depending on its quality or if the quality is inferior
 - ❖ Wet screening of -13 mm fraction at 3 mm through screens to produce two size fractions viz. 13-3 mm and -3 mm.
 - ❖ Storage of 13-3 mm fraction in surge hoppers for feeding to Small Coal Jigs.
 - ❖ Beneficiation of 13-3 mm fraction in two product electronically controlled improved type Small Coal Jigs to produce beneficiated coal (float) and rejects (sinks).
 - ❖ Dewatering of beneficiated coal obtained from Small Coal Jigs in Basket type Centrifuge.
 - ❖ Conveying underflow of Screens (i.e. -3 mm) in Slurry Tank & that of Dewatering Screens, effluent of Centrifuges etc. in Raw Coal Thickener for thickening.
 - ❖ Classification of u/f of Slurry Tank in Classifying Cyclone at 0.1 mm to produce two size fractions viz. 3-0.1 mm and -0.1 mm.
 - ❖ Beneficiation u/f of Classifying Cyclone i.e. 3-0.1 mm from in Spiral Concentrator to produce cleans and tailings.
 - ❖ Dewatering of 3-0.1 mm cleans from Spiral Concentrator in Belt Filter Press and mixing with the dewatered floats (beneficiated coal) of Jigs.
 - ❖ Dewatering of 3-0.1 mm tailings from Spiral Concentrator in Pressure Filter and mixing with the dewatered sinks (rejects) of Jigs.
 - ❖ Conveying o/f of Classifying Cyclone i.e. -0.1 mm fraction from in Raw Coal Thickener for thickening.
 - ❖ Dewatering u/f of Raw Coal Thickener in Pressure Filter
 - ❖ Mixing dewatered product of Pressure Filter either with rejects of Jigs or dewatered beneficiated coal of jigs depending on its quality.
 - ❖ Conveying of washed coal (i.e. beneficiated 50-13 mm coal obtained from coarse coal jigs, untreated -13 mm raw coal fraction/ beneficiated 13-3 mm coal obtained from small coal jigs, dewatered cleans from Spiral Concentrator, dewatered -0.1

mm fraction of Raw Coal Thickener depending on its quality) by covered belt conveyor from washery building to covered washed coal bunkers of **2 X 30,000 t** capacity and conveying the same to silo(s) for onward dispatch through Railway.

- ❖ Dewatering of rejects produced from jigs in bucket elevators.
- ❖ Conveying of rejects (i.e. rejects obtained from Coarse & Small Coal Jigs, dewatered tailings of Spiral Concentrator & dewatered -0.1 mm fraction of Raw Coal Thickener depending on its quality) by covered belt conveyor to storage bunker of **1 X 20,000 t** capacity and conveying the same for onward dispatch through Railway.
- ❖ Reclamation of washed coal from storage bunker and conveying to Railway Siding for onward dispatch to consumers.
- ❖ Reclamation of rejects from the storage bunker and disposal of the same in an environment friendly manner.
- ❖ Provisioning of slurry pond(s) for emergency bleeding of thickener.
- ❖ Provision of dust suppression system at dust generating points by proper water spraying arrangement.
- ❖ Provision of rain water harvesting of roof top water.
- ❖ Provision of green belt of at least 10m width around the washery site.

5.0 Infrastructure facilities:

- a) Washery site An area of land around 22 Ha has been allocated for setting up of the washery including green belt of 10 m width around the washery site.
- b) Water The quantity of water required during construction as well as operation & maintenance of the proposed washery is about 1.7 MGD. This total water shall be supplied from Right Bank Canal of Hasdeo Barrage about 1 km away from the proposed washery.

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- c) Power The tentative requirement of power is about 25 MVA for operation & maintenance of the proposed washery. It is envisaged that the power at 132kV will be met from Power Transmission Line of CSPTCL which passes at a distance of 6/ 15 km from the proposed washery.
- d) Despatch of washed coal Washed coal produced from the washery shall be conveyed by covered belt conveyor to 2 x 30,000 T covered washed coal bunker from where SECL shall transport the same to the silo for onward dispatch to consumer(s) through Railway.
- e) Reject disposal/ utilization Based on the technology selected, the likely quantity of rejects to be produced from the washery has been estimated at about 7.5 Mty. Reject produced from the washery will be conveyed by covered belt conveyor to 20,000 T bunker. The rejects shall be sold through e-auction or MoU route.

5.0 Balance of products, operating conditions, capital cost, economics etc. are given hereafter in Summarized Data.

SUMMARISED DATA

1. Capacity & Operating conditions
 - a) Annual Capacity (Mty) : 25.0
 - b) Daily Capacity (tonne) : 76,000
 - c) Effective working hours per year : 6000
 - d) Hourly Capacity (tonne) : 4200

2. Raw coal linkage : E & F Seam, Upper Kusmunda, Lower Kusmunda (Top), Lower Kusmunda (Bottom) and Lower Kusmunda (Combined) seam of Kusmunda OCP of Kusmunda area.

3. Development period in years : 3
(Including construction period of 1.5 years)

4. Life of the washery after commissioning
 - a) Considering raw coal availability : 18 yrs.
 - b) For computation of economics : 18 yrs.

5. Balance of Products

Product	Size (mm)	Wt%	Ash%	Qty. (Mty)
Deshaled coal	50-13	49.3	33.5	12.3
	13-3	12.6	33.5	3.1
	3-0.1	7.1	34.0	1.8
Washed coal	50-0.1	69.0	33.6	17.2
Rejects	50-13	23.0	66.1	5.7
	13-3	3.3	71.7	0.8
	-3	4.8	50.1	1.2
Total Rejects	-50	31.0	64.2	7.8
Total		100.0	43.1	25.0

6. Broad initial capital investment : Rs. 941.17 Crores

7. Estimated operating cost/ te of raw coal input : Rs. 100.00

8. Construction period including trial run, PGT & commissioning : 18 Months

CHAPTER – 1

INTRODUCTION

Chapter – 1

INTRODUCTION

1.1 BACKGROUND

The Pre-Feasibility Report for Kusmunda Washery which is an Integral part of Kusmunda Mine, has been prepared for submission of Form-I and subsequent issuance of ToR by MoEF. Thereafter, EIA & EMP preparation will be taken up.

Based on the mine PR of Kusmunda OCP and various data supplied, this Pre-Feasibility Report has been prepared considering the following:

- i) Raw coal to the proposed washery will be made available at the rate of 25.0 Mty from Kusmunda OCP during initial 17 years of operation. Thereafter, since production from the mines will taper down, balance quantity of raw coal with similar characteristics will be made available from neighboring mines to meet the capacity of washery.
- ii) Kusmunda OCP which will supply coal to the proposed Kusmunda Washery envisages seam-wise production of coal from seams viz. E & F Seam, Upper Kusmunda, Lower Kusmunda (Top), Lower Kusmunda (Bottom) and Lower Kusmunda (Combined). The RoM coal samples were collected from Lower Kusmunda (Top) & Lower Kusmunda (Bottom) in April 2015 and washability tests has been carried out at CMPDI Laboratory on these samples for preparation of this pre-feasibility report.
- iii) Top size of feed to washery is -100 mm and the same will be received by conveyor to the washery.
- iv) SECL has identified an area of about 22 Ha for the proposed washery on the western side of upcoming 20,000 te overhead bunker proposed to be dedicated to nearby CSEB Power Plants.
- v) The quantity of water required during construction as well as operation & maintenance of the proposed washery is about 1.7 MGD. This total water

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- shall be supplied from Right Bank Canal of Hasdeo Barrage about 1 km away from the proposed washery, by providing 300mm dia CI pipeline to the length of about 1 km.
- vi) The tentative requirement of power is about 25 MVA for operation & maintenance of the proposed washery.
- vii) It is envisaged that the power at 132kV will be met from Power Transmission Line of CSPTCL which passes at a distance of 6/ 15 km from the proposed washery.
- viii) Washed coal produced from the washery shall be conveyed by covered belt conveyor to 2 x 30,000 T covered washed coal bunker from where SECL shall transport the same to the Silo for onward dispatch to consumer(s).
- ix) Reject produced from the washery (about 7.5 Mty) will be conveyed by covered belt conveyor to 20,000 T bunker. The rejects shall be sold through e-auction till the arrangement for supplying rejects to FBC based Power Plant is made. The rejects may also be sent to wharf-wall siding by covered belt conveyor for the purpose of selling to consumers. Later on, the rejects shall be sent to FBC based power plants by covered belt conveyor/ road.

1.2 OBJECTIVE

The preliminarily objective of this Pre-Feasibility Report is to assess the feasibility for setting up of washery of 25.0 Mty capacity for supply of washed coal with $33.5 \pm 0.5\%$ ash to thermal power stations as well as for submission of Form-I and subsequent issuance of ToR by MoEF.

1.3 RAW COAL LINKAGE TO THE PROPOSED WASHERY

The linked seams of Kusmunda OCP, which will supply coal to the proposed Kusmunda Washery, are E & F Seam, Upper Kusmunda, Lower Kusmunda (Top), Lower Kusmunda (Bottom) and Lower Kusmunda (Combined). The seamwise reserves and yearwise production from the linked seams of Kusmunda OCP are given hereafter

Job No. _____

in Table- 1.1. From this table we can illustrate that the raw coal can be supplied to the proposed washery to the tune of 25.0 Mty for 17 years. For rest of the washery life, raw coal of similar characteristics shall be supplied from neighbouring mines of Kusmunda area.

Table- 1.1: Raw Coal Linkage to Kusmunda Washery

YEAR ↓	Seam E&F	Seam UK	Seam LKT	Seam LKB/C	Total
	Production (Mty) →				
1 (2011-12)	-	0.26	11.42	3.32	15.00
2 (2012-13)	-	0.26	11.42	3.32	15.00
3 (2013-14)	-	0.26	11.42	3.32	15.00
4 (2014-15)	-	0.80	11.98	9.22	22.00
5 (2015-16)	-	1.17	15.44	13.39	30.00
6 (2016-17)	-	1.50	18.25	17.25	37.00
7 (2017-18)	-	1.84	20.93	21.23	44.00
8 (2018-19)	-	4.50	14.49	31.01	50.00
9 (2019-20)	-	<u>8.50</u>	<u>10.04</u>	<u>31.46</u>	<u>50.00</u>
10 (2020-21)	-	10.41	8.63	30.97	50.01
11 (2021-22)	0.02	11.52	8.56	29.91	50.01
12 (2022-23)	0.08	14.82	8.34	26.76	50.00
13 (2023-24)	0.08	14.82	8.34	26.76	50.00
14 (2024-25)	0.57	15.26	8.19	25.99	50.01
15 (2025-26)	1.40	16.00	7.93	24.68	50.01
16 (2026-27)	1.40	16.00	7.93	24.68	50.01
17 (2027-28)	2.32	15.66	8.26	23.77	50.01
18 (2028-29)	4.00	15.03	8.88	22.09	50.00
19 (2029-30)	4.00	15.03	8.88	22.09	50.00
20 (2030-31)	4.15	15.37	6.63	23.86	50.01
21 (2031-32)	4.18	15.44	6.09	24.28	49.99
22 (2032-33)	4.05	15.65	3.53	26.77	50.00
23 (2033-34)	3.88	15.91	0.16	30.05	50.00
24 (2034-35)	2.13	8.72	0.09	16.47	27.41
Total	32.26	234.73	225.83	512.65	1005.40

1.4 LOCATION & OTHER DETAILS OF LAND AT KUSMUNDA OCP

1.4.1 Location of Proposed Site

The proposed site of the washery is situated on the eastern side of the proposed CHP of Kusmunda OCP. This site has been earmarked on the Surface Plan (refer Plan. No. SECL/ KSM/ SUR/ 740 dtd 06.06.15). An area of about 22.0 Ha has been identified for setting up of the washery.

1.4.2 Communication

The site is well connected to Korba town by all-weather metalled Gevra road which is about 2-3 Km away. The distance of site from Bilaspur by road is about 90 Km.

Nearest Railway station is Korba Railway station on Champa-Gevra road branch line of South-Eastern Railway and is at a distance of 5-7 Km by road. Coal India Ltd. (HQ), Kolkata is about 700 kms away from the proposed site.

1.4.3 Topography & Drainage

The general topography is flat terrain with minor undulation. The general elevations of Hasdeo River & Canal above Mean Sea Level is shown in Surface plan (refer Plan. No. SECL/ KSM/ SUR/ 740 dtd 06.06.15). The general elevations ranges from 280 m to 300 m above Mean Sea Level. The highest recorded flood level to the area is 276m at the Railway Bridge. The general slope is towards east.

The main drainage of Kusmunda OCP is controlled by the perennial Hasdeo River flowing from North to South on eastern part of the site.

1.4.4 Climate & Rainfall

The climate of the area is dry to moist tropical with well-defined summer from April to June, rainy season from July to September and winter from November to February. The temperature rises to a maximum of about of 48⁰ C in May and drops to a minimum of about 6⁰ C in January.

The average annual rainfall is 1265 mm. The highest recorded rainfall within a period of 24 hours over the last 35 years is 252.22mm in September, 1973.

The wind direction is generally westerly to south westerly with wind velocity varying from 0.57 to 13.38 Kmph. The relative humidity ranges from 70% to 94% during monsoon and from 17% to 78% during summer.

1.4.5 Mineable Reserves and Life of Mine

Mineable reserves of Kusmunda OCP is 1005.40 Mt as per the mine PR, September '11. Raw coal to the proposed washery will be made available at the rate of 25.0 Mty from this OCP during initial 16 years of operation. Thereafter, since production from the mines will exhaust, the required quantity of raw coal with similar characteristics will be made available by SECL from neighboring mines to meet the capacity of washery.

1.5 LIFE OF THE PROPOSED WASHERY & CONSTRUCTION SCHEDULE

Life of the proposed washery has been considered as 18 years considering raw coal supply from the linked mines i.e. Kusmunda OCP and other neighbouring mines of Kusmunda Area.

It has been envisaged that the time required for testing of Raw coal from Kusmunda OCP, preparation of Feasibility Report & Bid Process Management including Environment clearance shall be about 30 months and a period of further 18 months has been considered for construction and commissioning of the washery, trial operation and Performance Guarantee Tests (PGT). Thus, total period of 4 years (i.e. Year-1 (2015-16), Year-2, Year-3 and Year-4) has been considered for development of washery. Thus, it has been envisaged that the washery will come in commercial operation from 2019-20 onwards.

CHAPTER – 2

RAW COAL CHARACTERISTICS

Chapter - 2

RAW COAL CHARACTERISTICS

2.1 RAW COAL LINKAGE TO KUSMUNDA WASHERY

The Raw coal supply to the proposed Kusmunda washery of 25.0 Mty capacity has been linked with Seams E & F, Upper Kusmunda, Lower Kusmunda (Top), Lower Kusmunda (Bottom) and Lower Kusmunda (Combined) of Kusmunda OCP. and are given hereafter:

2.2 SAMPLE COLLECTION

The RoM coal samples as well as coal samples from Surface Miner of Lower Kusmunda (Top) & Lower Kusmunda (Bottom) were collected in April 2015 and washability tests has been carried out at CMPDI Laboratory for these samples.

The coal sample was prepared by proper mixing and 3 parts were prepared by coning a quartering the whole coal. The sample preparation for various tests was carried out as per IS: 436; part-I. The testing of samples were carried out as per relevant IS codes 1350, part – I & II 6345 & 13810. The particulars of the samples collected are given hereafter in Table-2.1.

**Table-2.1: Sample Particulars of Lower Kusmunda (Top)
& Lower Kusmunda (Bottom)**

Sl. No.	Particulars	
1	Company	SECL
2	Area	Kusmunda
3	Name of colliery	Kusmunda Project
4	Sample No.	CMPDI/CMP/CMP Lab/561/15-16
5	Name of seam	LK (Top) and LK (Bottom)
6	Nearest Boreholes	CMKK-157
7	No. of bands	4
8	Wt of gross samples (approx)	20 tonne
9	Weight of coal sample approx	4 tonne
10	Nature of sample	Run of Mine (RoM) coal
11	Date of collection	15.04.2015-16.04.2015
12	Purpose of investigation	To generate data for washability study

2.3 TEST PROCEDURE

The coal sample collected was analyzed at the CMP Laboratory, CMPDI, Ranchi as per test procedure given hereafter.

- i) Screening of representative coal sample (as received in laboratory) at 200 mm, 150mm, 100 mm, 50 mm, 25mm, 10mm, 6 mm, 3mm & 0.5mm screen apertures and determination of weight%, ash% & moisture% of each screened fraction.
- ii) Proximate analysis of as-received coal sample under equilibrated condition i.e. 60% RH & 400 C including GCV & HGI.
- iii) Crushing of as received coal sample down to 50mm size and screening at 25mm, 10mm, 6mm, 3mm & 0.5mm screen apertures and determination of weight%, ash% & moisture of each screened fraction.
- iv) Float & Sink test of 50-25 mm, 25-10mm, 10-6 mm, 6-3 mm & 3-0.5 mm size fractions of crushed coal and determination of wt% & ash% at each specific gravity (from 1.4 to 1.9 at an interval of 0.1).
- v) Wet sieving of - 0.5 mm size fraction at 72# (mesh), 100 # (mesh), 200 # (mesh) & 300 # (mesh) obtained at Sl. No. (iii) and determination of wt% and ash% of each size fraction.
- vi) Generation of washed coal (50-0.5mm) at targeted ash% of 34 from crushed coal samples (based on data at Sl. No. (iv).
- vii) Proximate analysis of washed coal & rejects under equilibrated condition i.e. 60% RH & 40^o C including GCV & HGI. Determination of moisture % of washed coal & rejects on as generated basis.
- viii) Separate Screening of coal sample collected from Surface miner at 100mm, 50mm, 25mm, 10mm, 6mm, 3mm & 0.5 mm screen apertures and determination of weight%, ash% & moisture% of each size fraction.

2.4 TEST RESULTS

The washability tests were carried out in CMP Laboratory, CMPDI as per the test procedure after combining the samples of the seams and results are given hereafter:

2.4.1 Screen-cum-Ash & Moisture Analysis of RoM Coal sample (as received) from LK (T) & LK (B)

Representative raw coal sample was drawn after coning & quartering and was subjected to screen analysis at various aperture screens. Weight%, ash% and moisture% were determined for respective size fractions. The test results of the composite samples of seams from LK (T) & LK (B) are given hereafter in Table-2.2.

Table-2.2: Screen-cum-ash & Moisture Analysis (as received Coal)

Colliery : Kusmunda OCP
 Seam : LK (T) & LK (B) (Composite)
 Nature of sample : Run of Mine (RoM) Coal

Size Fraction (mm)	Lower Kusmunda Composite		
	Wt%	Ash%	M%
+ 200	4.5	56.8	3.0
200 - 150	3.9	50.8	3.2
150 - 100	7.6	44.3	3.4
100 - 50	22.8	43.5	3.7
50 - 25	28.2	42.6	3.9
25 - 13	12.4	41.5	3.9
13 - 6	6.1	40.3	3.8
6 - 3	4.3	38.4	3.9
3 - 0.5	5.7	36.9	4.0
- 0.5	4.5	41.3	4.0
Total	100.0	43.1	3.8

2.4.2 Screen-cum-ash & moisture analysis of raw coal sample (as received) of surface miner FROM LK (T) & LK (B)

Representative raw coal sample was drawn after coning & quartering and was subjected to screen analysis at various aperture screens. Weight%, ash% and moisture% were determined for respective size fractions. The test results of the

composite samples from LK (T) & LK (B) seams of Surface Miner are given hereafter in Table-2.3.

Table-2.3: Screen-cum-ash & Moisture Analysis (as received Coal)

Colliery : Kusmunda OCP
 Seam : LK (T) & LK (B) (Composite)
 Nature of sample : Raw coal sample from Surface Miner

Size Fraction (mm)	Lower Kusmunda Composite		
	Wt%	Ash%	M%
+ 100	2.1	39.5	3.6
100 - 50	24.7	39.4	3.9
50 - 25	43.8	40.1	4.0
25 - 13	14.7	39.0	4.0
13 - 6	6.7	38.5	3.9
6 - 3	3.4	33.4	4.0
3 - 0.5	2.7	28.1	4.1
- 0.5	1.9	30.5	4.2
Total	100.0	38.9	4.0

2.4.3 Screen-cum-ash & Moisture Analysis of RoM coal crushed down to 50 mm

Representative RoM coal sample was crushed down to 50 mm and subjected to screening at 25, 13, 6, 3 & 0.5 mm aperture screens. Weight%, ash% and moisture% of each screened fraction were determined and the results so obtained are given in Table - 2.4.

Table-2.4: Screen-cum-ash & Moisture Analysis of RoM Coal Crushed to -50 mm

Colliery : Kusmunda OCP
 Seam : LK (T) & LK (B) (Composite)
 Sample to be tested: RoM coal crushed down to 50 mm

Size (mm)	Wt %	Ash %	Moist %
50-25	53.1	44.2	3.7
25-13	16.9	43.1	3.8
13-6	9.5	42.0	3.8
6-3	5.7	40.7	3.9
3-0.5	7.6	38.6	4.0
-0.5	7.2	42.3	4.2
Total	100.0	43.0	3.8

2.4.4 Float & Sink Test of 50-0.5 mm Coal

The float & sink test of different size fractions upto 0.5 mm coal for LK (composite) seam was done at CMP Laboratory and the results obtained are given hereafter in Table -2.5. The results are also shown as washability curves given in Plate No. 1.

Table-2.5: Float & Sink Test Results

Colliery : Kusmunda OCP
 Seam : LK (T) & LK (B) (Composite)
 Sample tested : RoM coal crushed down to 50 mm
 Size of Coal (in mm) : 50-25, 25-13, 3-6, 6-3, 3-0.5 mm
 % of coal tested on raw coal basis: 92.8

Size (mm)	50 - 25		25 - 13		13 - 6		6 - 3		3 - 0.5		50 -0.5				
Wt% raw	53.1		16.9		9.5		5.7		7.6		92.8				
Wt% 100	57.2		18.2		10.2		6.2		8.2		100				
Sp.gr.	W%	A%	W%	A%	W%	A%	W%	A%	W%	A%	W%	A%	Cu W%	Cu A%	Cu W% raw
<1.40	19.8	16.5	21.8	16.6	25.8	13.6	28.4	13.1	36.2	11.6	22.7	15.3	22.7	15.3	19.8
1.40 -1.50	8.1	25.3	19.9	31.1	15.5	26.9	13.1	22.3	12.4	22.1	11.7	26.8	34.3	19.2	8.1
1.50 -1.60	17.7	32.8	15.9	39.9	16.9	37.6	9.6	33.0	8.5	33.6	16.0	34.6	50.4	24.1	17.7
1.60 -1.70	10.7	44.7	6.1	43.4	4.8	43.2	6.9	38.3	5.0	38.2	8.6	43.8	58.9	27.0	10.7
1.70 -1.80	5.9	52.5	7.7	50.3	6.7	49.5	6.6	44.9	4.7	44.1	6.3	50.7	65.2	29.3	5.9
1.80 -1.90	6.4	57.2	4.0	56.9	3.7	54.9	4.6	50.2	3.9	51.2	5.4	56.3	70.6	31.3	6.4
> 1.90	31.4	68.5	24.6	74.8	26.6	78.1	30.8	75.6	29.3	78.4	29.5	71.6	100.0	43.2	31.4
Total	100.0	44.2	100.0	43.3	100.0	42.2	100.0	41.0	100.0	38.7	100.0	43.2	-	-	100.0

2.4.5 Wet Sieve Analysis of Coal Fines

Wet sieve analysis of coal fines (-0.5mm) generated from raw coal crushed down to 50 mm was done for LK (Composite) seam at CMP lab and the results obtained are given in Table-2.6.

Table-2.6: Wet sieve analysis of (-) 0.5 mm coal

Colliery : Kusmunda OCP
Seam : LK (T) & LK (B) (Composite)
Size of coal tested : - 0.5 mm

Size (mesh)	Wt%	Ash%
+72	52.2	40.2
72-100	8.0	40.9
100-200	11.9	42.4
200-300	6.0	41.1
-300	21.9	52.1
Total	100.0	43.2

2.4.6 Generation of Washed Coal

Based on the float & sink data, the washed coal was generated at 1.90 sp. gravity of cut for size fraction 50-0.5 mm for coal samples of LK (Composite). The washed coal generated of +0.5 mm size fraction of coal samples of LK (Composite) has been presented in Table-2.7.

Table – 2.7: Generation of washed coal 1.90 Sp. Gravity of cut for +0.5 mm Size Fraction – LK (Composite) seam

Sp. Gr.	Wt%	Ash%
< 1.90	70.8	31.5
> 1.90	29.2	71.8
Total	100.0	43.3

2.4.7 Proximate Analysis

2.4.7.1 Proximate Analysis of RoM coal sample, generated washed coal and rejects

Proximate analysis on air dried basis and equilibrated basis (i.e. at 60% RH & 40°C) was carried out for RoM coal (as received), generated washed coal and rejects. The results of proximate analysis thus obtained are given hereafter in Table-2.8.

Table-2.8: Proximate Analysis of RoM Coal, Generated Washed Coal and Rejects

	Particulars	RoM coal (as received)		Generated Washed coal		Rejects	
		Air dried basis	At 60%RH & 40°C	Air dried basis	At 60%RH & 40°C	Air dried basis	At 60%RH & 40°C
	RoM Coal	Size: 50-0 mm		Size: 50-0.5 mm		Size: 50-0.5 mm	
i)	Moisture%	3.7	4.9	5.1	6.2	1.5	2.1
ii)	Ash%	43.2	42.7	31.5	31.1	71.8	71.4
iii)	VM%	23.9	23.6	24.8	24.5	11.7	11.6
iv)	FC%	29.2	28.8	38.6	38.2	15.0	15.0
v)	GCV (kcal/kg)	3940	-	4730	-	1420	-
vi)	HGI	65	-	69	-	78	-

2.4.7.2 GCV and HGI of RoM coal sample, generated washed coal and rejects

Tests for determination of GCV and HGI was carried out for RoM coal (as received), generated washed coal and rejects. The results thus obtained are given in Table-2.9.

Table-2.9: GCV and HGI of RoM Coal, Generated Washed Coal and Rejects

Particulars	RoM coal (as received)	Generated Washed coal	Rejects
GCV (kcal/kg)	3940	4730	1420
HGI	65	69	78

2.4.8 Moisture% of Washed Coal & Rejects (as generated basis)

The total moisture (air dried + surface moisture) percent on as generated basis was determined for generated washed coal and rejects. The results are given in Table-2.10.

Table-2.10: Moisture% on as Generated Basis for Generated Washed Coal & Rejects

Particulars	Moisture% on as generated basis
Washed coal	7.2
Rejects	2.4

2.5 STUDY OF WASHABILITY TEST RESULTS & SELECTION OF PROCESS

The main washing process for the washery has been selected on the basis of qualitative requirement of washed coal of $33.5 \pm 0.5\%$ ash of the thermal power stations and in line with the MoEFCC guidelines.

Selection of process is based on the test results of coal samples. The results of screen analysis of coal sample crushed down to 50mm (refer Table- 2.3) reveals that the ash percentage of different size fractions is varying from 42.3% to 44.2% and the average ash of -50mm fraction coal is 43.0%. The screen-cum-ash analysis of raw coal crushed down to 50mm and screened at 13mm has been computed from Table-2.3 and given hereafter in Table-2.11.

Table-2.11: Screen-cum-Ash Analysis

Size (mm)	Wt %	Ash %
50 - 13	70.0	43.9
13-0.5	22.8	40.5
-0.5	7.2	42.3
Total	100.0	43.0

The screen-cum-ash analysis of raw coal crushed down to 50mm and screened at 13mm has been further computed from Table-2.11 above and given hereafter in Table-2.12.

Table-2.12: Screen-cum-Ash Analysis

Size (mm)	Wt %	Ash %
50 - 13	70.0	43.9
13-3	15.2	41.5
3 - 0.1	12.3	39.3
-0.1	2.5	46.1
Total	100.0	43.0

It can be seen from Table-2.12 that the ash% of 50-13mm, 13-3mm, 3-0.1 and - 0.5 mm fractions are 43.9, 41.5, 39.3 and 46.1 respectively. Hence, full scale beneficiation of the total coal i.e. all the fractions has been envisaged to get the desired

washed coal ash of $33.5 \pm 0.5\%$. The proposed Kusmunda washery has been planned to produce two products i.e. washed coal and rejects.

The Float & Sink analysis of 50 -13 mm and 13 – 3 mm has been computed from Table-2.5 and given hereafter in Table-2.13 and 2.14 respectively.

Table-2.13: Float & Sink Analysis for 50-13 mm fraction

Seam	Lower Kusmunda Composite								
Size (mm)	50-25		25 - 13				Cumulative		
Contribution	53.1		16.9		70.0				
Sp. Gr.	75.9		24.1		100.0				
	W%	A%	W%	A%	W%	A%	W%	A%	
<1.40	19.8	16.5	21.8	16.6	20.3	16.5	20.3	16.5	
1.40-1.50	8.1	25.3	19.9	31.1	10.9	27.8	31.2	20.5	
1.50-1.60	17.7	32.8	15.9	39.9	17.3	34.4	48.5	25.4	
1.60-1.70	10.7	44.7	6.1	43.4	9.6	44.5	58.1	28.6	
1.70-1.80	5.9	52.5	7.7	50.3	6.3	51.9	64.4	30.9	
1.80-1.90	6.4	57.2	4.0	56.9	5.8	57.2	70.2	33.0	
>1.90	31.4	68.5	24.6	74.8	29.8	69.8	100.0	44.0	
Total	100.0	44.2	100.0	43.3	100.0	44.0			

Table-2.14: Float & Sink Analysis for 13-3 mm fraction

Seam	Lower Kusmunda Composite								
Size (mm)	13 -6		6 - 3		13 - 3		Cumulative		
Contribution	9.5		5.7		15.2				
Sp. Gr.	62.5		37.5		100				
	W%	A%	W%	A%	W%	A%	W%	A%	
<1.40	25.8	13.6	28.4	13.1	26.8	13.4	26.8	13.4	
1.40-1.50	15.5	26.9	13.1	22.3	14.6	25.4	41.4	17.6	
1.50-1.60	16.9	37.6	9.6	33.0	14.2	36.4	55.5	22.4	
1.60-1.70	4.8	43.2	6.9	38.3	5.6	40.9	61.1	24.1	
1.70-1.80	6.7	49.5	6.6	44.9	6.7	47.8	67.8	26.4	
1.80-1.90	3.7	54.9	4.6	50.2	4.0	52.9	71.8	27.9	
>1.90	26.6	78.1	30.8	75.6	28.2	77.1	100.0	41.8	
Total	100.0	42.2	100.0	41.0	100.0	41.8			

The washing equipment available for treatment of 50-13 mm and 13-3mm size coal are jigs & heavy media cyclones. It can be inferred from Table-2.13 & 2.14 that the

specific gravity of cut for both the size fractions is higher & maintaining the same is difficult by heavy media process due to high viscous media. Hence, beneficiation by jig (improved type), has been considered for both the size fractions, as the separation at high specific gravity of cut is feasible in jig. Beneficiation of 3-0.1 mm fraction by Spiral Concentrator has been considered.

2.6 PROJECTED SCREEN-CUM-ASH ANALYSIS

Based on the study of test results and considering likely degradation of RoM coal prior to feeding to washery, the expected screen-cum-ash analysis of feed considered is given in Table-2.15.

Table-2.15: Projected Screen-cum-Ash Analysis

Size (mm)	Wt %	Ash %
50 - 13	72.3	43.9
13-3	12.9	41.5
3 - 0.1	12.3	39.3
-0.1	2.5	46.1
Total	100.0	43.1

CHAPTER – 3

CAPACITY AND OPERATING CONDITIONS OF THE WASHERY

Chapter – 3**CAPACITY AND OPERATING CONDITIONS OF THE WASHERY****3.1 CAPACITY**

SECL has decided to set up Kusmunda washery of 25.0 Mty throughput capacity in Kusmunda Area with linkage of coal from Kusmunda OCP. The washery has been envisaged to produce two products viz. washed coal of $33.5 \pm 0.5\%$ ash & rejects. It has been envisaged to deshale 50-13 mm & 13-3 mm coal in improved type jigs and beneficiation of 3-0.1 mm coal in Spiral Concentrator to obtain washed coal of desired quality.

The raw coal throughput capacity of the proposed washery is mentioned below:

- a) Annual : 25.0 Mt
- b) Daily : 76,000 tonnes
- c) Hourly : 4,200 tonnes

3.2 OPERATING CONDITIONS OF DIFFERENT SECTIONS

It has been envisaged that -100mm size raw coal from Kusmunda OCP will be transported by belt conveyors. The proposed washery has been designed to have raw coal receiving section, washing section (i.e. from raw coal storage to beneficiation) and delivery section (conveying of washed coal and rejects to storage bunkers). The operating conditions of different sections are given hereafter.

3.2.1 Raw Coal Receiving Section

The operating conditions of the raw coal receiving section are given hereafter:

- a) No. of working days per annum : 330
- b) No. of working shifts per day : 3 (8 hours each)
- c) Hourly throughput capacity (tonnes) : 5,000

3.2.2 Washing Section

The operating conditions of the washing section are given below:

- a) No. of working days per annum : 330
- b) No. of working shifts per day : 3 (8 hours each)
- c) No. of effective working hours per year : 6000
- d) Hourly throughput capacity (tonnes) : 4,200

3.2.3 Delivery Section

Washed coal from the washery building will be conveyed through set of belt conveyors to washed coal storage bunker of capacity 2 x 30,000 T capacity and conveying the same to silo(s) for onward dispatch through Railway.

The operating conditions of loading & dispatch section are given below:

- a) No. of working days per annum : 365
- b) No. of working shifts per day : 3 (8 hours each)
- c) No. of loading hours per year : round the clock

3.2.4 Reject Storage

Rejects shall be transported by belt conveyor to reject storage bunker having capacity of 20,000 T capacity and conveying the same for onward dispatch through Railway.

CHAPTER - 4

PROCESS FLOWSHEET & BALANCE OF PRODUCTS

Chapter - 4

PROCESS FLOWSHEET & BALANCE OF PRODUCTS

4.1 SELECTION OF PROCESS

The selection of process has been deliberated in detail at Para 2.5 to get the washed coal of desired quality i.e. $33.5 \pm 0.5\%$ for supply to power plant(s).

4.2 PROCESS FLOWSHEET

It can be seen from Table-2.12 that the ash% of 50-13mm, 13-3mm, 3-0.1 and -0.5 mm fractions are 43.9, 41.5, 39.3 and 46.1 respectively. Hence, full scale beneficiation of the total coal i.e. all the fractions has been envisaged to get the desired washed coal ash of $33.5 \pm 0.5\%$. The proposed Kusmunda washery has been planned to produce two products i.e. washed coal and rejects. The salient features of process are shown in Drawing No. HQ/ CMP/ 000000/ 04/ 01 and briefly described below:

- ❖ Receiving raw coal of (-) 100 mm from **12,000 t** raw coal bunker of mine CHP through belt conveyors and conveying the same to screen-cum-crusher house.
- ❖ Screening at 50 mm to obtain two size fractions i.e. 100-50mm & (-) 50 mm.
- ❖ Crushing of 100-50 mm coal down to 50 mm and mixing it with natural -50 mm coal.
- ❖ Conveying of entire -50 mm fraction to washery building.
- ❖ Screening of (-) 50 mm coal at 13 mm on vibrating screens to produce two size fractions i.e. 50-13 mm & -13 mm.
- ❖ Storage of 50-13 mm fraction in surge hoppers for feeding to Coarse Coal Jigs.
- ❖ Beneficiation of 50-13 mm fraction in two product electronically controlled improved type Coarse Coal Jigs to produce beneficiated coal (float) and rejects (sinks).
- ❖ Dewatering of beneficiated coal obtained from jigs in Double Deck Dewatering Screens followed by dewatering of 25-13 mm fraction in Basket Centrifuge.
- ❖ Mixing of untreated -13 mm raw coal either with beneficiated 50-13 mm coal obtained from jigs depending on its quality

or if the quality is inferior

- ❖ Wet screening of -13 mm fraction at 3 mm through screens to produce two size fractions viz. 13-3 mm and -3 mm.
- ❖ Storage of 13-3 mm fraction in surge hoppers for feeding to Small Coal Jigs.
- ❖ Beneficiation of 13-3 mm fraction in two product electronically controlled improved type Small Coal Jigs to produce beneficiated coal (float) and rejects (sinks).
- ❖ Dewatering of beneficiated coal obtained from Small Coal Jigs in Basket type Centrifuge.
- ❖ Conveying underflow of Screens (i.e. -3 mm) in Slurry Tank & that of Dewatering Screens, effluent of Centrifuges etc. in Raw Coal Thickener for thickening.
- ❖ Classification of u/f of Slurry Tank in Classifying Cyclone at 0.1 mm to produce two size fractions viz. 3-0.1 mm and -0.1 mm.
- ❖ Beneficiation u/f of Classifying Cyclone i.e. 3-0.1 mm from in Spiral Concentrator to produce cleans and tailings.
- ❖ Dewatering of 3-0.1 mm cleans from Spiral Concentrator in Belt Filter Press and mixing with the dewatered floats (beneficiated coal) of Jigs.
- ❖ Dewatering of 3-0.1 mm tailings from Spiral Concentrator in Pressure Filter and mixing with the dewatered sinks (rejects) of Jigs.
- ❖ Conveying o/f of Classifying Cyclone i.e. -0.1 mm fraction from in Raw Coal Thickener for thickening.
- ❖ Dewatering u/f of Raw Coal Thickener in Pressure Filter
- ❖ Mixing dewatered product of Pressure Filter either with rejects of Jigs or dewatered beneficiated coal of jigs depending on its quality.
- ❖ Conveying of washed coal (i.e. beneficiated 50-13 mm coal obtained from coarse coal jigs, untreated -13 mm raw coal fraction/ beneficiated 13-3 mm coal obtained from small coal jigs, dewatered cleans from Spiral Concentrator, dewatered -0.1 mm fraction of Raw Coal Thickener depending on its quality) by covered belt conveyor from washery building to covered washed coal bunkers of **2 X 30,000 t** capacity and conveying the same to silo(s) for onward dispatch through Railway.
- ❖ Dewatering of rejects produced from jigs in bucket elevators.

-
- ❖ Conveying of rejects (i.e. rejects obtained from Coarse & Small Coal Jigs, dewatered tailings of Spiral Concentrator & dewatered -0.1 mm fraction of Raw Coal Thickener depending on its quality) by covered belt conveyor to storage bunker of **1 X 20,000 t** capacity and conveying the same for onward dispatch through Railway.
 - ❖ Reclamation of washed coal from storage bunker and conveying to Railway Siding for onward dispatch to consumers.
 - ❖ Reclamation of rejects from the storage bunker and disposal of the same in an environment friendly manner.
 - ❖ Provisioning of slurry pond(s) for emergency bleeding of thickener.
 - ❖ Provision of dust suppression system at dust generating points by proper water spraying arrangement.
 - ❖ Provision of rain water harvesting of roof top water.
 - ❖ Provision of green belt of at least 10m width around the washery site.

The process of the proposed washery is based on closed water circuit system. All the water fed into the system will be collected after use and re-circulated after treatment in various units and no effluent will be allowed to escape into the natural drainage system. Provision of rain water harvesting of roof top water has been envisaged by recharging the same to ground and/or by collecting the same into the constructed/developed water bodies for use in the washery.

4.3 PROJECTED BALANCE OF PRODUCTS

Considering the screen analysis of washery feed and the float & sink data of raw coal crushed down to 50 mm, the yield of washed coal at $33.5 \pm 0.5\%$ ash from the washery under actual plant conditions has been projected. The expected yield of washed coal & rejects on the proposed scheme under practical conditions as per raw coal ash based on washability test results has been estimated and given hereafter in Table-4.1.

Table- 4.1: Balance of Products

Product	Size (mm)	Wt%	Ash%	Qty. (Mty)
Deshaled coal	50-13	49.3	33.5	12.3
	13-3	12.6	33.5	3.1
	3-0.1	7.1	34.0	1.8
Washed coal	50-0.1	69.0	33.6	17.2
Rejects	50-13	23.0	66.1	5.7
	13-3	3.3	71.7	0.8
	-3	4.8	50.1	1.2
Total Rejects	-50	31.0	64.2	7.8
Total		100.0	43.1	25.0

CHAPTER – 5

INFRASTRUCTURE FACILITIES

Chapter - 5**INFRASTRUCTURE FACILITIES****5.1 WASHERY SITE**

An area of land around 22 Ha has been allocated for setting up of the washery including green belt of at least 10 m width around the washery site, which is not in the eco-sensitive zone. The land requirement has been estimated considering receipt of - 100mm raw coal from raw coal bunker of mine CHP of Kasmunda OCP through belt conveyors, screen-cum-crusher house, washery building, emergency slime pond, radial thickener etc., administrative buildings and other allied structures as per the technological requirement.

The washed coal produced is proposed to be conveyed through set of covered belt conveyors to washed coal storage bunker of capacity 2 x 30,000 T.

Rejects produced from the washery shall be also be transported by covered belt conveyor to reject storage bunker having capacity of 20,000 T.

5.2 AVAILABILITY OF WATER

The quantity of water required during construction as well as operation & maintenance of the proposed washery is about 1.7 MGD. This total water shall be supplied from Right Bank Canal of Hasdeo Barrage about 1 km away from the proposed washery, by providing 300mm dia CI pipeline to the length of about 1 km.

5.3 AVAILABILITY OF POWER

The tentative requirement of power is about 25 MVA for operation & maintenance of the proposed washery. It is envisaged that the power at 132kV will be met from Power Transmission Line of CSPTCL which passes at a distance of 6/ 15 km from the proposed washery.

5.4 RAILWAY SIDING FOR LOADING & DISPATCH OF WASHED COAL

Washed coal produced from the washery shall be conveyed by covered belt conveyor to covered washed coal bunkers of **2 X 30,000 t** capacity and conveying the same to silo(s) for onward dispatch through Railway.

The construction of washed coal bunker & Silo and delivery of washed coal through Rapid Loading System is covered under the scope of proposed mine CHP. As such, cost towards these has not been considered while preparing this Pre-Feasibility Report. Construction/ strengthening of Railway siding, if any, is also under the scope of proposed mine CHP.

5.5 REJECT DISPOSAL/ UTILISATION

The washery has been designed for a throughput capacity of 25.0 Mty of raw coal per annum. The washery will produce two products viz. washed coal for thermal power stations and rejects.

The likely average quantity of rejects to be produced from the washery has been estimated as about 7.5 Mty. Reject produced from the washery shall be conveyed by covered belt conveyor to storage bunker of **1 X 20,000 t** capacity and conveying the same for onward dispatch through Railway. The rejects shall be sold through e-auction or MoU route.

5.6 EFFLUENT TREATMENT

Provision has been envisaged to collect the surface water and rain water of the washery complex in a sump and recirculate the same for plant use after treatment.

5.7 RESIDENTIAL AND WELFARE FACILITIES

While computing economics, Residential facilities has been envisaged for the personnel employed for operation and maintenance of the washery, whereas welfare facilities of the area will be utilized.

CHAPTER – 6

ECONOMICS

Chapter - 6

ECONOMICS

6.1 CAPITAL ESTIMATE

The tentative capital investment for setting up of Kusmunda Washery for civil engineering works, procurement of P&M, design, erection & commissioning and others has been estimated considering the tentative process flow sheet and infrastructure facilities as about Rs. 941.17 crore. The capital expenditure for land has not been included in these estimates as location of land is within the lease hold boundary of project. It has been considered that total capital will be as 100% equity capital.

The revenue expenditure to be capitalized has not been considered as the washery is an integral part of the OCP. The yearwise phasing of broad capital has been done keeping in view the production programme during initial years of the mine project and likely date of commissioning of the washery. The broad break-up alongwith yearwise phasing is given in Table-6.1. However, the estimates are tentative and subject to change depending upon technology and other facilities.

Table-6.1: Statement Showing Estimated Broad Capital Investment & its Year wise Phasing

Sl. No.	Description	Total Cost	(Rs. in Lakh)	
			2 nd Year	3 rd Year
1	Service & Residential buildings, structures & other civil works including water supply, roads & culverts and development works etc.	38563.325	23137.995	15425.33
2	Plant & Machinery alongwith two years critical spares etc.	55278.8	33167.28	22111.52
3	Others (e.g. testing of coal, furniture & fittings, R&D, FR preparation, Bid Process Management including EMP etc.)	275	105	170
Total		94117.125	56410.275	37706.85

6.2 OPERATING COST

The operating cost per tonne of raw coal input has been estimated considering the broad capital investment and the technology envisaged. However, based on the technology, the capital estimate as well as economics will vary accordingly. The operating cost of washery per tonne raw coal input has been computed based on the following:

- Power consumption for similar type of projects
- Salary, wages & benefits as per prevailing CIL pay structure
- Security services, canteen services, transportation services etc. will be outsourced
- Interest on working capital at 14.5%
- Projected yield of clean coal

The operating cost per tonne of raw coal input has been worked out to Rs. 100.00.

CHAPTER – 7

PROJECT CONSTRUCTION

MANAGEMENT

Chapter – 7

PROJECT CONSTRUCTION MANAGEMENT

7.1 GENERAL

Project construction management is a highly specialized job and it is a vital tool for successful completion of a project as per schedule. This is achieved by a well organized management system and proper planning which help in completion of project on schedule.

This report envisages 25 Mty washery from concept to commissioning which inter-alia includes planning, design & engineering, selection of necessary equipment & machinery (including two years critical spares), construction, successful commissioning, PGT (including procurement, delivery, fabrication & erection of P&M equipment & civil works and all associated works etc.) of washery from raw coal receiving arrangement at washery, washing of coal, delivery of washed coal & rejects to storage bunker for onward dispatch through Railway to the consumer(s).

7.2 CONSTRUCTION SCHEDULE

The 25 Mty washery is expected to be completed within 18 months period comprising various activities such as planning, design & engineering, selection of equipment/ machinery, procurement, erection of P&M and structurals associated with civil works, trial-run, performance guarantee tests including environmental clearances etc. The zero date for construction activities will be considered from the date of signing of Contract Agreement.

7.3 PROJECT MONITORING

Monitoring of progress by SECL for construction of the project is essential to adhere to the envisaged time schedule. The measurement of progress can be done either in part or as a whole. CPM/ PERT chart will be strictly followed for the purpose of

monitoring the progress of the project. This chart is to be updated on the basis of feed back information, received from time to time regarding progress of work. This will reveal the up-to-date status regarding progress and accordingly subsequent corrective measures can be adopted. However, the critical path should never be allowed to be disturbed, if the time schedule is to be maintained.
