EXECUTIVE SUMMARY

1.1 BACKGROUND OF THE PROJECT REPORT

A Project Report for Chhal OCP in Chhal Geological Block was prepared in March 2003, and was approved in May 2003 for a targeted capacity of 1.00 Mty at a capital expenditure of Rs.19.99 crores.

The proposed Chhal Opencast falls under the adminstrative control of Raigarh Area of SECL. The Project Report is based on the "Geological Report on Chhal Block" prepared by CMPDI in March 1991. Eight coal seams, namely, VI, V (T), V (B), Local, IV, III, II, II(A) and I occur within the block. Of these, olders seams I, II and IIA are generally thin and impersistant. In Dharam and Chhal Underground Mines, Seam III is being exploited.

The presence of major faults have divided the area into sub-blocks. Coal seams, namely, V(T), V(B), VI and III in the incrop and adjoining area were planned to be exploited by opencast mining method by dividing the property into four quarries along major faults and incrops. Out of four quarries, Quarry-1 & 2 are operative and operations in Quarry-3 & 4 could not be started.

Quarry No.3 could not been mined as below this area, Chhal Underground Mine was under operation. Quarry No.4 (part of incrop region of geological sector I- area containing boreholes 96, 40, 38, 94 and 36 of CMMRC series) is left out due to far off distance from Quarry 1 &2.

During the discussion of Planning Committee Meeting, it was decided that as no firm linkage is available for the coal from this project, a Project Report of annual production capacity (1.00 Mty) may be prepared. In future if demand arises and firm linkage is established, annual production capacity may be revised , considering remaining promising areas.

With an increased demand projected on SECL in XIth plan, Chhal OCP was proposed to expand from 1.0 Mty to 3.0 Mty.

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Accordingly, an expansion PR of Chhal OCP (1.0 – 3.0 Mty) was prepared and approved in September 2007 within the sanctioned mine boundary with an initial capital requirement of Rs. 50.38 crores. This report was completed March 2010 at a completion cost of Rs. 46.95 crores.

Liberalisation of power sector has resulted in a sharp increase in demand for power grade coal. Expansion of Chhal Opencast is, again therefore, proposed with a view to fulfill the growth in demand. In this context, this project named Chhal OC (Seam-III) Project (6.0 Mty) has been conceived.

1.1.1 SALIENT FEATURES OF LAST APPROVED REPORT(3.0 Mty)

Date of sanction	:	26.09.2007
Mineable reserves	:	19.00 Mt as on 1.4.2007
Total OBR	:	56.27 Mcum
Stripping Ratio	:	2.96 cum/t
Targeted production	:	3 Mty
Life of the projects	:	8 years
Seams to be worked	:	Seam-VI, Seam-V(Top) & V(Bot)
Average grade of coal	:	"E"
Maximum depth	:	140 m
Capital outlay	:	Rs.50.38 crores
Manpower	:	150
OMS	:	75.76 t

1.2 HISTORY OF THE BLOCK

The first prospecting by drilling in this area was carried out by GSI. Based on the data of regional exploration, total reserve potential of Mand Raigarh Coalfield is 5057 Mt as per the estimates pepared by the GSI in June 1989. Entire reserves have been assessed in indicated and inferred categories. These reserves have been assessed for Chhal, Dharamjaygarh - Khargaon, Kurumkela, Chintapani and Garepalma Sectors.

Detailed exploration in Chhal area were started in November 1987 by CMPDI.

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The exploration was mainly confined upto the eastern bank of Mand river in the west, a major east-west running fault in the north and upto the limits of incrop of Seam III in the south and east.

The investigations were concluded in June 1990. A total of 106 boreholes involving a total meterage of 14308.20 were drilled by CMPDI. 7 Nos. of boreholes drilled by GSI involving meterage of 2942.80 were also considered. The borehole density within the block came 14.79 boreholes / sq.km. The borehole density within the quarriable area came to 13.14 boreholes / sq.km. It was considered sufficient for planning an opencast mine. Electrical Resistivity Survey and Geophysical logging were also carried out in the area to supplement the geological information. Physico-mechanical properties of borehole No. CMMRC-99 (one borehole) has been carried out to know the nature of superincumbent strata and the floor.

As in the northwestern part sufficient number of boreholes were not lowered up to seam III, therefore, for proving the potentiality of the seam, 12 boreholes were taken up in the area in period April 2010 to August 2010. The exploration was confined up to the eastern bank of Mand River in the west.

1.2.2 HISTORY OF MINING

The proposed area under consideration falls in Mand - Raigarh Coalfield of Raigarh district (Chhattisgarh). Mining activities in the area started long back in 1940 but remained confined to very small manual quarrying. The coalfield is almost virgin barring two small opencast mines i.e. Domnara in the south-west and Barod in the north-east. Domnara opencast mine was closed due to lack of demand of grade 'G' coal produced by this mine. Baroud opencast mine is running.

1.3 OTHER RELEVANT PROJECT SPECIFIC INFORMATION

In the geological Chhal Block, two underground mines, namely, Dharam Incline (0.135 Mty) and Chhal Underground (0.135 Mty) were planned for exploitation of Seam III (Middle Section) . They are completed projects. Out of these two under ground mines, Chhal Underground has been closed & Dharam Incline is on the verge of closure. In the adjoining Domnara Block, a scheme of Mand Incline (0.135 Mty) was planned, approved and implemented. But due to adverse geo-mining condition, the scheme was closed.

1.4 JUSTIFICATION OF PREPARATION OF PR

i) Thermal Power Station is likely to be installed by Chhattisgarh Electricity Board in this area. To meet the demand of power grade coal, it is essential to open new projects.

ii) Quarriable reserves are available in Chhal Block for opening the opencast mine upto seam-III.

iii) Chhal block is located by the side of Kharsia-Dharamjaygarh State Highway and coal from this project can be despatched to the Robertson Railway Siding or to any other consumer even by road till rail dispatch is established.

1.5 SALIENT FEATURES OF PRESENT PR (6.0 MTY)

Two variants have been worked out in this project report. Variant-I will be worked by departmental equipment for both coal and OB. OB will be extracted by the combination of 20 & 10 cum Elect. Hyd. Shovels with 190T & 100T RD. For extraction of coal, surface Miner with a combination of 6 cum FEL & 35T RD coal body dumper / truck will be used in virgin areas whereas combination of 5 cum Hyd. Backhoe & 35T RD coal body dumper / truck will be deployed for extracting seam standing on pillars.

Variant-II will be operated contractually for both extraction of coal and removal of OB.

Sometimes with favorable geological conditions and improved productivity of the HEMM with better mining conditions project may produce upto 1.25 times

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of the planned capacity. So, EMP may be prepared for higher capacity and accordingly approval from the Competent Authority is to be sought.

The flexibility in the implementation stage may be exercised within the approved cost estimates to respond to improvements in technology and equipment which would result in improved profitability and productivity measures. Following points may be considered under the flexibility: -

a) Re-alignment of project boundaries for better working layout / dump etc.

b) Change in the specification of HEMM to higher capacity at the time of procurement of new equipment or replacement of the equipment.

c) To procure state-of-the-art safety equipment, whenever they are introduced, even if the same is not provided in approved Project Report.

d) Relocation of site for infrastructure facilities depending upon techno-economic reasons and availability of land / forest area etc.

e) Hiring of equipment for loading, transportation etc., at a competitive price, so as to cater to the needs of increased demand of coal and subsequent removal of higher OB and for augmentation of coal production.

f) For upgradation of new technology in mining method for improving performance and reduction in manpower, at a subsequent date before and after project completion.

As per the guidelines, a Project is economically viable when it achieves more than 12% IRR at 85% level of Production. Though Option-I gives a negative IRR at 85% level of production, Option-II yields 14.42% at the same level of production.

NPV at 100% and 85% level of production is estimated as Rs. -1942.40, Rs. -2163.20 & Rs. 198.48, 41.18 crores for Option-I & II respectively. The overall grade of coal is "F", which is easily marketable. As Option-II is having an IRR of 14.42% at 85% level of production, the same may be recommended for implementation .

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1.6 DIFFICULTIES AND CONSTRAINTS IN MINING WITH ASSOCIATED RISK

The quarriable property involves following main constraints e.g. –

I) VILLAGE

Seven villages consisting of 450 project affected families and around 675 land oustees are involved. These villages are to be shifted and properly rehabilitated. SECL should take appropriate action for early rehabilitation.

II) DISTANCE FROM RAILWAY SIDING

There is no suitable railway siding located nearby for the despatch of coal from the mine. The nearest railway siding, Robertson Siding, is located at a distance of about 18 km, for onward despatch of coal to customers. Till railway siding is constructed near the mines (New rail corridor) the coal will be despatched to Robertson Siding.

III) FOREST LAND

Out of the total quarriable area 875.50Ha, around 185.16 Ha falls within forest cover which is to be acquired before mining operation.

IV) STATE HIGHWAY

Dharamjaigarh-Kharsia state high way (State Highway no-22) lies on the eastern side of the quarry needs to be diverted .

V) REHANDLING

The total quantity of OB to be rehandled during the operations of the mine including external and internal is around 40 Mcum.

VI) SCIENTIFIC STUDY OF SLOPE STABILITY

As the maximum depth of the proposed quarry is going to be more than 300m and the fault planes are intersecting with the river course, it is envisaged to undertake regular hydro-geological test to estimate make of water. Adequate precautions should be taken while working near fault planes intersecting Mand river.

Study of strata control / slope stability of benches and assessment of the impact of the fault planes intersecting with the river course on opencast mining has to be carried out and accordingly safe width of the barrier against the river shall be ascertained. Financial provisions for the same have been made accordingly.

1.7 PROJECT OBJECTIVES AND TARGET BENEFICIARIES

The object of the project is to bridge the demand supply gap of coal. The overall demand from SECL is 269.07 Mt in 2012-13 and supply is 117.00 Mt. The deficit is 152.07 Mt. Enhanced production from this project will cater to the needs of the upcoming power plants.

2.0 MARKETABILITY

Liberalisation of power sector by Government of India has generated wide spread interests for private and public sector investments in power generation. As such, there is an appreciable increase in the number of upcoming new thermal power projects in both private and public sectors. This has resulted in a sharp increase in demand for power grade coal. Preparation of Chhal Opencast (Seam-III) Project is, therefore, proposed with a view to fulfil the above indicated growth in demand.

The on-going Chhal Opencast was sanctioned for a targeted coal production of 3.0 Mty. Presently, Chhal Opencast is producing coal approx. 3.5 Mty which is on verge of exhaustion of reserves. The Chhal OC (Seam-III) Project has been planned to a targeted capacity of 6.0 Mty. The additional production has been linked to various Thermal Power Stations. As such, there will be no problem to market the coal from this project.

3.0 PROJECT SITE INFORMATION

3.1 LOCATION

The project is located south of village Chhal at an approximate distance of 2.5 km on Kharsia - Dharamjaygarh State Highway and 16 km from Kharsia town. The block is bounded by latitude $22^0$4'40" and $22^0$6'27" and longitudes $83^0$6'10" and $83^0$9'10" and is included in the Survey of India Topo Sheet No. 64 N/4.It is situated in the Raigarh district of Chattisgarh

3.2 CLIMATE

The area is characterised by tropical climate with well defined summer from April to June, rainy season from July to September and winter from November to February. May is the hottest month when the temperature rises to a maximum of 48^0C. December being the coldest month, the temperature falls to a minimum of 7^0C.

The average annual rainfall is about 1500 mm. The wind direction is generally westerly to north westerly. Relative humidity during monsoon ranges from 75% to 80% and in summer from 18% to 60%.

3.3 PHYSIOGRAPHY

The Chhal Block is largely characterised by a plain country. The altitude varies between 231 m in the west to 267 m above MSL in the north eastern part of the block. The elevation of the ground varies between 255 m to 267 m along a linear patch running NE-SW in the central part of the property. The ground has a general slope towards NE, SE & SW. Most of the area is covered by soil and cultivate land. The southerly flowing Mand river and westerly flowing Kurket river with their tributaries form the main drainage of the Chhal Block. A small earthen dam has been constructed for the purpose of irrigation near village Khedapali in the eastern part of the block.

4.0 GEOLOGY

The block measures 8. 33 sq.km. The block is bounded in the

North	: Fault F1-F1 and mining lease boundary of Chhal U/G.
South	: Mand river and floor incrop of Seam III
East	: Floor incrop of Seam III
West	: Mand river

4.2 STRATIGRAPHIC SUCCESSION

The thick pile of sediments classified earlier by GSI as Talchir, Karharbari, Barakar and Kamthi formations have now been revised by them on the basis of further drilling & Geological mapping. The generalized sequence of strata as established by GSI (1989) is as under:

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Generalized stratigrpahic sequence in Mand-Raigarh Coalfield

Age	Formation	Thickness (m)	Lithology
Recent to sub-recent			Sandy soil & laterite
Lower to Middle Triassic	Kamthi	Up to 250	Coarse to pebbly sandstone and red clay
^^^^^^^^^^^^^^^^^^^^Unconformity^^^^^^^^^^^^^^^^^^^^			
Upper Permian	Raniganj	150-200	Fine to coarse grained sandstone, siltstone, grey shale, carbonaceous shale & thin coal seams.
Middle Permian	Barren Measures	250-300	Grey black to black shale, fine to medium grained sandstone and their alternations.
Lower Permian	Barakar	950+	Coarse, pebbly to conglomeratic sandstone, grey shale & coal seams.
Basal Permian (Permocarboniferous?)	Talchir	162+	Green, khaki green to yellow colour splintery shale.
----------Faulted contact----------			
Pre-cambrian	Chhattisgarh		Quartzite, sandstone, phyllite
^^^^^^^^^^^^^^^^^^^^Unconformity^^^^^^^^^^^^^^^^^^^^			
	Archaeans		Granites & pegmatite

The stratigraphic sequence of Formations as established on the basis of sub-surface data in Chhal block is given below:

Stratigraphic succession of Chhal Block.

Age	Formation	Lithology
Recent/Sub-recent		Alluvium, soil & sandy soil (Up to +10m).
Lower Permian	Lower Barakar (+600M)	Fine grained micaceous sandstone frequently associated with grey shale, Medium to coarse grained sandstone, coarse grained to gritty sandstone shale, carbonaceous shale along with coal seams.
Permo-Carboniferous	Talchirs (+95m)	Very fine to fine grained greyish white to white sandstone with greyish black shale. The litho units show greenish tinge.

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4.3 SEQUENCE OF COAL SEAMS

The sequence of coal seams and partings in the block is summarized as follows:-

Sequence and brief description of Coal Seams in the block

Seam	Surface Cover (m) (Min-Max)	FRL (Min-Max)	Thickness Range (m)	Grade Range (Dominant Grade)	Borehole Intersection (As per GR)	Borehole Density/ sq. Km.	Geological Reserves (Mt) [As per GR]
Seam-VI	9.00-86.40	154.50-233.48	6.10-11.49	G-D (F)	11	18.6	6.444
Parting			23.91-42.85				
Seam-VT1	10.64-117.62	129.49-233.85	0.20-1.20	G-D (F)	15	10.6	1.113
Parting			2.65-4.02				
Seam-VT	14.61-122.18	122.69-227.25	1.63-4.50	F-D (E)	17	11.3	6.086
Parting			2.99-16.94				
Seam-VM	8.20-128.10	115.52-238.70	0.70-7.02	UG-C (G)	17	9.4	5.860
Parting			1.00-4.90				
Seam-VB	3.02-134.20	105.37-245.85	6.75-15.39	G-E (F)	21	11.1	22.952
Seam-VMB	11.35-92.92	127.57-224.57	15.25-16.27	G-F (G)	3		
Parting	(Bet.VB&VB4)		0.92-3.05				
Seam-VB4	6.30-144.30	102.87-242.04	0.17-2.61	UG-D(F)	25	11.1	1.548
Parting			1.66-9.12				
Seam-VB3	7.24-151.45	96.42-232.64	0.05-3.05	UG-E(F)	18	10.6	1.539
Parting			1.00-2.85				
Seam-VB2	3.30-153.70	92.62-229.31	0.51-4.05	G-E (F)	21	11.6	4.125
Seam-VB32	9.35-95.95	151.92-233.54	3.90 -4.75	G-C (F)	8	11.6	3.238
Parting	(Bet.VB2&VB1)		1.56 – 6.77				
Seam-VB1	8.00-160.76	86.47-230.65	0.16-3.20	UG - C (F)	30	11.4	4.527
Parting			66.10-81.10				
Seam-IVT	8.55-156.17	88.05-231.93	0.20-2.45	UG-D(F)	11	9.4	1.518
Parting			1.10-3.51				
Seam-IVB	10.15-159.87	83.68-228.99	0.50-3.23	G-E (G)	11	9.4	2.091
Seam-IV	4.90-221.83	11.18-236.36	1.18-5.95	UG-D(G)	39	9.4	17.564
Parting	(Bet. IVB & L)		21.05 – 29.97				
Seam-L	21.75-255.50	(-)24.44-236.79	1.07-5.60	UG-B (G)	58	9.3	7.218
Parting			34.51-52.93				
Seam-III	7.70-314.03	(-)89.09-236.52	7.20-12.40	G-D (E)	82	10.0	111.434
Parting			54.15-77.53				
Seam-IIA	34.00-338.00	(-)91.36-210.09	0.07-2.15	F-A (C)	61	7.3	8.965
Parting			15.45-25.50				
Seam-II	62.55-362.40	(-)126.34-185.65	0.10-2.70	G-A (D)	33	4.1	11.760
Parting			21.52-29.05				
Seam-I	85.45-390.90	(-)155.89-163.19	0.10-1.95	E-B (C)	15	1.8	6.833

Note: Reserves of VMB merges with VB

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2 COAL SEAMS & QUALITY

Table: Seam wise coal quality, Chhal block, Mand-Raigarh C.F

Coal Seam/ Parting	Thickness range (m)/ Parting range	Dominant thickness (m)	Depth of occurrence (roof) (m)	Nature of sample	Range of Proximate Analysis at 60% RH & 40° C			Range		Grade (Dominant grade)
					M%	A%	VM%	Gross CV Kcal/kg	UHV Kcal/ kg	
VI	6.10-11.49	6.5-8.2	Incrop-86.4	I_{30}	6.8-10.3	30.0-38.9	25.9 - 27.8	3835-4690	2525-3821	F-E (F)
				I_{100}	6.1-9.0	33.7-40.8	21.7-27.2	3739-4450	2289-3421	G-E (F)
Parting	23.91-42.85									
VT1	0.20-1.20	0.6-1.0	Incrop-117.62	I_{30}	8.3-12.0	17.6-40.6	23.9	3531-5143	2156-4804	G-D (F)
				I_{100}	8.3-12.0	17.6-40.5	23.9	3531-5143	2156-4804	G-D (F)
Parting	2.65-4.02									
VT	1.63-4.50	3.0-3.8	Incrop-122.18	I_{30}	6.0-9.1	21.1-39.2	26.5-28.4	3864-5415	2538-4939	F-D (E)
				I_{100}	6.0-9.1	21.1-39.2	26.5-28.4	3864-5415	2538-4939	F-D (E)
Parting	2.99-16.94									
VM	0.70-7.02	4.3-4.5	Incrop-128.10	I_{30}	5.9-9.9	18.1-47.9	-	3197-5413	1484-5039	G-C (F)
				I_{100}	4.9-9.9	18.1-55.2	-	2655-5413	615-5039	UG-C (G)
Parting										
VMB	15.25-16.17	15.0-16.0	Incrop-92.92	I_{30}	7.2-7.4	31.7-33.0	-	4402-4502	3351-3511	F-E (E)
				I_{100}	5.8-6.5	38.3-45.6	-	3537-4003	1793-2717	G-F (G)
Parting										
VB	6.75-15.39	8.0-11.0	Incrop-134.20	I_{30}	5.7-8.6	21.8-39.0	23.3-23.8	3975-5252	2673-4702	F-D (E)
				I_{100}	5.5-7.4	30.9-45.9	20.9-23.5	3400-4562	1806-3606	G-D (F)
Parting										
VB4	0.17-2.61	0.5-1.0	Incrop-144.30	I_{30}	7.0-11.6	17.7-46.8	-	3127-5192	1469-4846	G-D (F)
				I_{100}	5.5-11.6	17.7-56.4	-	2446-5192	316-4846	UG-D (F)
Parting	1.66-9.12									
VB3	0.05-3.45	0.6-1.2	Incrop-151.45	I_{30}	5.6-10.2	28.8-50.2	23.1-27.0	3016-4334	1198-3518	UG-E (F)
				I_{100}	5.6-10.2	28.8-50.2	23.1-27.0	3016-4334	1198-3518	UG-E (F)
Parting										
VB32	4.05-4.75	4.0-4.5	Incrop-95.95	I_{30}	5.3-9.1	18.2-49.1	-	3175-5512	1460-5126	G-C (F)

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Coal Seam/ Parting	Thickness range (m)/ Parting range	Dominant thickness (m)	Depth of occurrence (roof) (m)	Nature of sample	Range of Proximate Analysis at 60% RH & 40° C			Range		Grade (Dominant grade)
					M%	A%	VM%	Gross CV Kcal/kg	UHV Kcal/ kg	
				I_{100}	5.3-9.1	18.2-49.1	-	3175-5512	1460-5126	G-C (F)
Parting										
VB2	0.51-4.05	1.5-2.0	Incrop-153.70	I_{30}	6.1-8.3	29.0-45.1	24.7	3414-4616	1824-3749	G-E (F)
				I_{100}	6.1-8.3	29.0-45.1	24.7	3414-4616	1824-3749	G-E (F)
Parting	1.56-6.77									
VB1	0.16-3.20	1.5-2.0	Incrop-160.76	I_{30}	5.2-9.4	18.2-50.4	-	3051-5477	1224-5095	UG-C (F)
				I_{100}	4.8-9.4	18.2-54.0	-	2779-5477	790-5095	UG-C (F)
Parting	66.10-81.10									
IVT	0.20-2.45	0.6-1.5	Incrop-156.17	I_{30}	6.7-9.6	22.3-42.9	-	3541-5059	2053-4497	G-D (F)
				I_{100}	5.5-9.6	22.3-81.7	26.2	2892-5059	1009-4497	UG-D (F)
Parting										
IVB	0.50-3.23	0.8-1.8	Incrop-159.87	I_{30}	5.6-8.2	28.9-48.7	-	3161-4639	1411-3776	G-E (F)
				I_{100}	5.6-8.2	28.9-48.7	-	3161-4639	1411-3776	G-E (G)
IV	1.18-5.95	3.0-4.5	Incrop-221.83	I_{30}	5.1-8.5	22.0-49.5	20.5-21.2	3157-5250	1369-4694	G-D (G)
				I_{100}	4.7-8.5	22.0-53.1	20.5-21.2	2879-5250	927-4694	UG-D (G)
Parting	18.45-39.08									
L	1.07-5.60	3.0-3.5	Incrop-255.50	I_{30}	4.8-9.4	13.4-51.7	19.4-20.6	2994-5918	1105-5745	UG-B (G)
				I_{100}	4.6-9.4	13.4-53.5	19.4-20.6	2859-5918	892-5745	UG-B (G)
Parting	34.51-52.93									
III	7.20-12.40	9.5-10.5	Incrop-314.03	I_{30}	6.7-8.3	22.0-35.4	23.2-27.3	5251-5320	3094-4760	F-D (F)
				I_{100}	5.6-8.3	22.0-44.5	20.3-24.5	3548-5278	1931-4722	G-D (E)
Parting	54.15-77.53									
IIA	0.07-2.15	0.6-1.2	34.0-338.0	Bcs	6.1-8.3	10.8-35.7	22.4-30.5	4366-6335	3145-6270	F-A (C)
				I_{30}	6.1-8.3	10.8-35.7	22.4-30.5	4366-6335	3145-6270	F-A (C)
Parting	15.45-25.50									
II	0.10-2.70	0.6-1.5	362.55-362.40	Bcs	5.0-8.8	10.6-45.5	21.7-28.1	3549-6279	1932-6285	G-A (D)
				I_{30}	5.0-8.8	10.6-45.5	1.7-28.1	3549-6279	1932-6224	G-A (D)

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Coal Seam/ Parting	Thickness range (m)/ Parting range	Dominant thickness (m)	Depth of occurrence (roof) (m)	Nature of sample	Range of Proximate Analysis at 60% RH & 40° C			Range		Grade (Dominant grade)
					M%	A%	VM%	Gross CV Kcal/kg	UHV Kcal/ kg	
Parting	21.52-29.05									
I	0.10-1.95	0.4-1.2	88.70-390.90	Bcs	6.2-8.5	11.4-30.7	25.5-27.6	4758-6112	3801-6385	E-A (C)
				I_{30}	6.2-8.5	11.4-30.7	25.5-27.6	4758-6112	3801-6385	E-A (C)

5.1 MINE BOUNDARIES

The quarry boundary for the complete mine in the Chhal block have been fixed in the following manner:-

North : Fault line – F1 – F1 having throw >400m.

South : Floor incrop of seam III

East : Floor incrop of seam III

West : 60m barrier from Eastern bank of Mand River.

5.2 MINEABLE RESERVES

The mineable reserves have been estimated by Gemcom Minex Software. The estimation of reserves is based on a minimum mineable seam thickness of 0.5 m. A geological loss of 10% and a mining loss of 10% have been considered in the estimation of mineable reserves.The volume of OBR has been estimated by Gemcom Minex Software.

The mining loss of 10% deducted from the mineable reserves has been added to the total volume of OBR. The total volume of Excavation including Coal & OBR has been calculated from Gemcom Minex Software. The quarry cross-sections have been given vide Plate No.XXXI. The mineable reserves & volume of OBR have been given in the following table:-

S.N.	Mineable Reserves	Unit	Total	Vol. of OB/Parting	Unit	Total	In-seam band	Unit	Total	Rehandling, Mcum	TOTAL OB	SR
1	III Seam	Mt	82.06	Top O.B.R.	Mcum	267.61	III Seam	Mcum	1.03			
2	L seam	Mt	6.89	Part_ III AND L	Mcum	189.24	L seam	Mcum	4.61			
3	IVB seam	Mt	7.48	Part_ L AND IVB	Mcum	124.18	IVB seam	Mcum	2.5			
4	IVT seam	Mt	5.73	Part. IVB and IVT	Mcum	6.94	IVT seam	Mcum	2.03			

5	VB1 seam	Mt	4.18	Part. IVTand VB1	Mcum	151.05	VB1 seam	Mcum	0.04				
6	VB2 seam	Mt	4.99	Part. VB1and VB2	Mcum	6.58	VB2 seam	Mcum	0.51				
7	VB3 seam	Mt	2.32	Part. VB2 and VB3	Mcum	3.65	VB3 seam	Mcum	0.12				
8	VB4 seam	Mt	1.7	Part. VB3 and VB4	Mcum	10.13	VB4 seam	Mcum	0				
9	VB seam	Mt	19.95	Part. VB4and VB	Mcum	3.42	VB seam	Mcum	0.21				
10	VM seam	Mt	5.06	Part. VBand VM	Mcum	4.02	VM seam	Mcum	1.57				
11	VT seam	Mt	5.09	Part. VM and VT	Mcum	7.69	VT seam	Mcum	0.35				
12	VT1seam	Mt	0.9	Part. VT and VT1	Mcum	3.59	VT1seam	Mcum	0.06				
13	VI seam	Mt	5.01	Part. VT1and V1	Mcum	19.6	VI seam	Mcum	1.08				
	Total	**Mt**	**151.36**			**797.96**			**14.11**	**40**	**852.07**	**5.63**	

5.3 TARGET OUTPUT & MINE LIFE

The mine is proposed for peak coal production of 6 0Mty and peak OB removal is of 37.00 Mcum .

Mine Life

The mine life for nominal production is 30 years. The break-up is as under:

- Construction period - 1 Years
- Production build-up period - 3 years
- Production period - 21 years
- Tapering period - 5 years
- Total period - 30 years

6.1 METHOD OF MINING

The selection of mining method for Chhal Opencast (Seam-III) Project (6.0Mty) has been based on the following factors:-

(i) Existing Chhal Opencast Project is being worked by opencast method deploying Surface Miner & dumper combination.

(ii) The coal deposit mainly constitutes of thick and thin coal seams occurring at favourable stripping ratio.

Based on the above factors, shovel dumper combination for OB removal and Surface Miner, FEL & dumper combination for coal extraction are proposed.

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6.2 GEOLOGICAL AND MINING CHARACTERISTICS OF THE QUARRY

The geological and mining characteristics of the quarry have been summarised in the following table: -

Geological and Mining Characteristics

Geological and Mining Characteristics (Within quarry area only)

Sl.No.	Particulars	Unit	Value	
I:	**COAL SEAMS**			
1.	Thickness : (In-bands) :			
	III	Metre	9.50-10.50	
	L	Metre	3.0-3.50	
	IVT&IV	Metre	0.60-1.50& 3.0-3.5	
	IV &IVB	Metre	3.0-3.5& 0.8-1.80	
	VB1	Metre	1.0-1.20	
	VB2 &VB32	Metre	1.50-2.0 & 4.2-4.5	
	VB32&VB3	Metre	4.2-4.5 & 0.6-1.20	
	VB4	Metre	0.50-1.0	
	VB	Metre	8.0-11.0	
	VM	Metre	4.3-4.5	
	VT	Metre	3.0-3.8	
	VT1	Metre	0.60-1.0	
	VI	Metre	6.5-8.25	
2.	Dip	Degree	4^0 - 11^0	
3.	Specific Gravity		1.67	
4.	Excavation category of coal	Assumed	III	
II:	**OVERBURDEN / PARTINGS**			
1.	Thickness :			
	Top O.B.	Metre	10-160	
	Parting between III AND L	Metre	34.51-52.93	
	Parting between L AND IVB	Metre	18.45-39.08	
	Part. between IVB and IVT	Metre	1.10-3.51	
	Part. between. IVT and VB1	Metre	66.10-81.10	
	Part. between. VB1and VB2	Metre	1.56-6.77	
	Part. between. VB2 and VB3	Metre	1.00-2.85	
	Part. between. VB3 and VB4	Metre	1.66-9.12	
	Part. between. VB4and VB	Metre	0.92-3.05	
	Part. between. VBand VM	Metre	1.00-4.90	
	Part. between. VM and VT	Metre	2.99-16.94	
	Part. between. VT and VT1	Metre	2.65-4.02	
	Part. between. VT1and VI	Metre	23.91-42.85	
2.	Specific Gravity	Assumed	2.40	
3.	Excavation Category	Assumed	50% III + 50% IV	
III:	**QUARRY PARAMETERS**		WEST	EAST
1	Maximum width along Strike :			
	^ At Surface	Metre	2500	2150
	^ At Floor	Metre	2200	2050
2	Minimum width along Strike:			
	^ At Surface	Metre	1650	1050
	^ At Floor	Metre	1100	1000

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Geological and Mining Characteristics (Within quarry area only)

Sl.No.	Particulars	Unit	Value	
3	Maximum length along Dip :			
	ˆ At Surface	Metre	3000	2850
	ˆ At Floor	Metre	2600	2450
4	Maximum Depth	Metre	300	280
	Minimum Depth	Metre	10	15
6	Maximum Lift	Metre	310	320
7	Area of Excavation :			
	ˆ At Surface	Sq km	5.20	3.55
	ˆ At Floor	Sq km	4.20	2.84

6.3 EQUIPMENT SELECTION

In variant 1 Excavation and dumping of OB will be under taken departmentally by deploying 20/10 cum capacity Electric Hyd. shovels and 190/100T Rear Dumpers.

HEMM have been provided as per the work load of coal and OBR in different horizons indicated in calendar programme of excavation.

Overburden will need to be prepared for excavation by carrying out drilling and blasting operations. For OB preparation, 250 mm RBH drills are proposed.

Dozing arrangements in the OB & coal benches and dump yards will be met by deploying 410 / 850HP dozers.

OB will be placed largely in the internal dumps. Progressive back-filling of worked out areas would be done by deposition of overburden in horizontal layers.

Coal will be won by Surface Miner. No drilling & blasting will be required for preparation of coal. Places worked out by u/g method and near the fault planes, will necessitate the use of backhoe in combination with semi-mobile crushers and trucks

Variant II is total contractual option.

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7.1 CONSTRAINTS ON MINE DEVELOPMENT

1) The mine will start from the incrop of Seam III.

2) Working at the initial stages will be carried out over the already developed pillars by underground workings, hence due precautions will have to be taken as discussed in chapter later on.

3) The mine will encounter 17 nos. of faults. Proper planning ,deployment of machineries and sequencing of operations will be required to counter the faults and accommodate maximum internal dump.

4) Internal haul roads for coal and OB Should be minutely planned to maximize productivity due to high throw faults.

5) At the latter stages of the mine, rehandling of internal & external dump of present workings will have to be done. The total rehandling quantity will be around 40 Million Cu.M.

7.2 MINING STRATEGY / MINING SEQUENCE

Chhal OC (Seam-III) Project is conceived enveloping the whole Chhal Geological Block which is interwoven by 17 nos. of faults having throw ranging from 5m to 400m. The distribution of faults is such that floor of the bottom most seams does not allow conventional development of quarry operation.

For proper working of mine the whole property has been divided into two sections (North-East and South-West). Each section is further subdivided into 10 sectors. Sequence of mining should be made according to the sectors marked in the Final Stage Quarry Plan.

In the beginning, quarry will be opened from the incrop of Seam III with two independent ramps 'X and Y'. As the quarry advances, another haul road 'Z' will be developed in the middle of the property at a gradient of 1 in 16 and on south-western side of the haul road inpit belt conveyor will be installed for transportation of coal. Gradually, ramp 'Y' will be discontinued and the area will be started for using internal dump.

Belt conveyor will be installed on the down thrown side as much close as possible of the fault F4F4. Coal from the south-western section, which is on the upthrown side of fault F4F4, will be brought down through a level road along fault F4F4 till it reaches the floor on down-thrown side. This will evacuate coal at a point inbye to the unloading of coal from north-eastern section. Thus loading of coal to belt conveyor from both sections will staggered.

Efforts must be made to advance north-eastern section faster so that the section is completed earlier and can be utilized for OB dumping of south-western section. Moreover south-western section should also progress as mentioned in the calendar programme to create extra internal dumping space.

As the property is divided into three parts by dip-rise faults, coal of upper seams of down thrown side will be juxtaposed with quarry floor on the up thrown side which will facilitate coal transport through belt conveyor. For other coal seams which can not be brought down to belt conveyor will be transported through south western flank batters via trucks to hoppers provided at surface CHP.

The belt conveyors and the haul roads will be extended gradually as the working progresses. Semi mobile crushers will be installed and planned so that shifting is minimum to improve productivity.

7.3 DUMPING STRATEGY

The proposed sequence of mining is ideally suited for achieving the objective of placing maximum possible waste in the internal dumps. External dumps will be created mainly during the initial years of mine expansion. The proposed reconstruction of the mine gives best possible back-filling opportunity. Thus, external dump quantities will be minimised.

By adopting the proposed sequence of mining, as the quarry advances, the amount of external dump will decrease and that of internal dump will increase as more space for the economic dumping is created. From the sixth year onwards majority dump will be accommodated internally.

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The total volume of overburden has been estimated as 852.07 Mcum, including 40 Mcum rehandling. . 71.52 Mcum will be placed in the external dumps located on the present site of external dumping. The balance 780.55 Mcum will be accommodated in the internal dump.

The land for external dump site will have to be acquired. Internal dump, due to the position of haul road, has been divided into two parts i.e. north-eastern dump and south-western dump. A plan showing location and capacity of dumps has been given vide drawing No. XXXIII.

The spoil dump in the internally backfilled OB will be in the form of benches. With the sufficient advance of coal production bench, the non-active backfilled OB will be levelled with dozer. Dumper/Tipper will transport soil/alluvium OB from the top OB bench and will dump the soil directly on the leveled backfilled OB.

Otherwise; top soil will be removed and stored separately. This soil will be directly spread over the levelled graded backfilled spoil for reclamation of the quarried out land. OB dumps will be properly benched and the maximum height of the bench will be kept not more than 30m. Dump benches will have a mild gradient of 0.6% to facilitate the drainage. Wherever possible, simultaneous land reclamation will be done along with the OB dumping.

8.1 DESIGN CRITERIA

The mine has been planned for 330 days of working. Three shift working will be practiced.

Duration of shift hours will be eight. Excavation category assumed

i) Coal	-	III
ii) Alluvial OB	-	Cat.I/II : Assumed
iii) Hard OB	-	50% cat.III + 50% cat.IV

Insitu volume weight t/cum

i) Coal	-	1.67 t/cum
ii) Overburden	-	2.40 t / cum

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8.2 ANNUAL PRODUCTIVITY OF HEMM PROPOSED IN TABULAR FORM AND WITH DIFFERENT LEAD DISTANCE FOR DUMPERS

The lead for OB & Coal has been calculated as 2.5 Km & 2.5 km respectively on weighted averages, which have been used for calculating the number of dumpers.

The annual productivity of shovels and dumpers combination as per the prevalent norms is given in the following Tables. The productivity has been calculated as per the design criteria mentioned.

Annual Productivity of shovels considering 330 working days

S.N.	Particulars of HEMM	Unit	Productivity per cum
I	**For OBR**		
1	20 m^3 Elect. hydraulic Shovel + 190 T Rear Dumper (EWD)	Mcum	5.35
2	10 m^3 Elect. hydraulic Shovel + 100 T Rear Dumper (EWD)	Mcum.	2.73
	For Coal		
1	Surface Miner	MT	2.0
2	Hydraulic backhoe, 3.8Cu.m	MT	1.81
3	6 cum FEL + 35 T Rear Dumper	MT	2.34

Productivity of dumper (Mcum/Mt) for different leads considering 330 working days

Lead in Km		Annual working days	1.5	2.0	2.5	3.0	3.5
1	190T Rear Dumpers + 20cum Hydraulic Shovels (Mcum)	330	0.7669	0.6978	0.6180	0.5590	0.5139
2	100 T Rear Dumpers + 10 cum hydraulic Shovels (Mcum)	330	0.4513	0.4000	0.3655	0.3313	0.3051
1	35T Rear Dumpers+ 3.8m3 hydraulic backhoe (MT)	330	0.2570	0.2282	0.2089	0.1892	0.1741
2	35 T Rear Dumpers + 6.0cum FEL(MT)	330	0.2888	0.2550	0.2327	0.2100	0.1929

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	For Coal		
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8.3 CALENDAR PROGRAMME OF EXCAVATION

The summarised calendar programme of excavation for both the variants is given in following tables. The mine will be advanced in both the section towards dip direction exposing the floor of III Seam along the sectors shown in the final stage quarry plan. The targeted level of the production will be achieved in the 5th year. First year will be construction period. From second to fifth year there will be production build up to achieve targeted level of production of 6.0 Mty. The peak natural volume of OB at targeted level of production has been estimated as 43.74 Mcum/year. It will be brought down to 37.00 Mcum/year in Variant-I by advance stripping of Top OB for smooth production of 6.0 Mty of coal/year.

But in Variant-II, no advance OB stripping will be done and natural OB will be excavated to achieve a production level of 6.0 Mty. Natural OB will vary from year to year. It has been smoothened for two to three years.

Considering the average width of quarry and annual advance of quarry floor, the calendar programme has been prepared and given in the following table: -

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Calender Programme for TOTAL QUARRY, VARIANT-I																
	NORTH-EAST SECTION						SOUTH-WEST SECTION						TOTAL		REHANDLING	TOTAL OB WITH REHANDLING
YEAR	TOTAL COAL	TOP OB NATURAL	TOP OB PLANNED	TOTAL PARTING	TOTAL BAND	TOTAL OB	TOTAL COAL	TOP OB NATURAL	TOP OB PLANNED	TOTAL PARTING	TOTAL BAND	TOTAL OB	TOTAL COAL	TOTAL OB		
1	CONSTRUCTION PERIOD															
2	0.50	1.28	3.41	0.00	0.09	3.50	1.00	2.71	3.92	0.08	0.00	4.00	1.50	7.50		7.50
3	1.00	2.63	4.83	0.00	0.17	5.00	2.00	5.64	8.35	0.15	0.00	8.50	3.00	13.50		13.50
4	2.00	6.47	12.00	0.00	0.00	12.00	3.00	8.94	11.77	0.22	0.00	11.99	5.00	23.99		23.99
5	3.00	12.89	14.08	0.79	0.13	15.00	3.00	10.75	13.44	1.47	0.09	15.00	6.00	30.00		30.00
6	3.00	14.66	15.71	3.09	0.20	19.00	3.00	12.74	15.01	2.82	0.17	18.00	6.00	37.00		37.00
7	3.00	16.23	11.09	7.63	0.28	19.00	3.00	12.70	12.34	5.33	0.33	18.00	6.00	37.00		37.00
8	3.00	10.33	5.91	12.63	0.46	19.00	3.00	12.67	10.35	7.21	0.44	18.00	6.00	37.00		37.00
9	3.00	8.24	5.71	12.83	0.46	19.00	3.00	12.14	9.45	8.06	0.49	18.00	6.00	37.00		37.00
10	3.00	4.88	5.34	13.16	0.50	19.00	3.00	11.42	8.20	9.24	0.56	18.00	6.00	37.00		37.00
11	3.00	4.88	5.34	13.16	0.50	19.00	3.00	9.47	7.44	10.08	0.48	18.00	6.00	37.00		37.00
12	3.00	4.80	5.39	13.13	0.48	19.00	3.00	6.05	6.06	11.58	0.36	18.00	6.00	37.00	1.50	38.50
13	3.00	3.37	5.67	12.89	0.44	19.00	3.00	6.05	6.06	11.58	0.36	18.00	6.00	37.00	1.50	38.50
14	3.00	3.37	5.67	12.89	0.44	19.00	3.00	5.32	6.25	11.50	0.25	18.00	6.00	37.00	3.00	40.00
15	3.00	3.37	5.67	12.89	0.44	19.00	3.00	5.19	6.30	11.48	0.22	18.00	6.00	37.00	3.00	40.00
16	3.00	2.80	2.59	12.97	0.39	15.95	3.00	4.21	1.70	11.08	0.19	12.97	6.00	28.92	3.00	31.92
17	3.00	2.63	2.58	12.99	0.38	15.95	3.00	2.27	2.54	10.28	0.15	12.97	6.00	28.92	4.00	32.92
18	3.00	2.63	2.58	12.99	0.38	15.95	3.00	2.27	2.54	10.28	0.15	12.97	6.00	28.92	4.00	32.92
19	3.00	2.72	2.47	13.12	0.36	15.95	3.00	2.27	2.54	10.28	0.15	12.97	6.00	28.92	4.00	32.92
20	3.00	3.13	1.88	13.73	0.34	15.95	3.00	1.91	2.17	10.67	0.13	12.97	6.00	28.92	4.00	32.92
21	3.00	3.13	1.88	13.73	0.34	15.95	3.00	1.70	1.93	10.93	0.11	12.97	6.00	28.92	4.00	32.92
22	3.00	2.72	1.53	14.12	0.30	15.95	3.00	1.70	1.93	10.93	0.11	12.97	6.00	28.92	4.00	32.92
23	3.00	1.98	0.95	14.81	0.19	15.95	3.00	1.70	1.93	10.93	0.11	12.97	6.00	28.92	4.00	32.92
24	3.00	1.98	0.95	14.81	0.19	15.95	3.00	1.36	1.04	11.74	0.15	12.93	6.00	28.88		28.88
25	3.00	1.98	0.00	14.81	0.19	15.00	3.00	0.37	0.00	14.11	0.25	14.36	6.00	29.36		29.36
26	1.94	1.28	1.17	9.57	0.11	10.85	3.00	0.37	0.00	14.11	0.25	14.36	4.94	25.21		25.21
27							3.00	0.37	0.00	14.11	0.25	14.36	3.00	14.36		14.36
28							3.00	0.37	0.00	14.11	0.25	14.36	3.00	14.36		14.36
29							3.00	0.37	0.00	14.11	0.25	14.36	3.00	14.36		14.36
30							1.92	0.23	0.00	9.04	0.15	9.19	1.92	9.19		9.19
TOTAL	68.44	124.38	124.40	262.74	7.76	394.90	82.92	143.26	143.26	267.51	6.40	417.17	151.36	812.07	40.00	852.07

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Calender Programme for TOTAL QUARRY, VARIANT-I																TOTAL OB WITH REHANDLING
	NORTH-EAST SECTION						SOUTH-WEST SECTION						TOTAL		REHANDLING	
YEAR	TOTAL COAL	TOP OB NATURAL	TOP OB PLANNED	TOTAL PARTING	TOTAL BAND	TOTAL OB	TOTAL COAL	TOP OB NATURAL	TOP OB PLANNED	TOTAL PARTING	TOTAL BAND	TOTAL OB	TOTAL COAL	TOTAL OB		
1	CONSTRUCTION PERIOD															
2	0.50	1.28	3.41	0.00	0.09	3.50	1.00	2.71	3.92	0.08	0.00	4.00	1.50	7.50		7.50
3	1.00	2.63	4.83	0.00	0.17	5.00	2.00	5.64	8.35	0.15	0.00	8.50	3.00	13.50		13.50
4	2.00	6.47	12.00	0.00	0.00	12.00	3.00	8.94	11.77	0.22	0.00	11.99	5.00	23.99		23.99
5	3.00	12.89	14.08	0.79	0.13	15.00	3.00	10.75	13.44	1.47	0.09	15.00	6.00	30.00		30.00
6	3.00	14.66	15.71	3.09	0.20	19.00	3.00	12.74	15.01	2.82	0.17	18.00	6.00	37.00		37.00
7	3.00	16.23	11.09	7.63	0.28	19.00	3.00	12.70	12.34	5.33	0.33	18.00	6.00	37.00		37.00
8	3.00	10.33	5.91	12.63	0.46	19.00	3.00	12.67	10.35	7.21	0.44	18.00	6.00	37.00		37.00
9	3.00	8.24	5.71	12.83	0.46	19.00	3.00	12.14	9.45	8.06	0.49	18.00	6.00	37.00		37.00
10	3.00	4.88	5.34	13.16	0.50	19.00	3.00	11.42	8.20	9.24	0.56	18.00	6.00	37.00		37.00
11	3.00	4.88	5.34	13.16	0.50	19.00	3.00	9.47	7.44	10.08	0.48	18.00	6.00	37.00		37.00
12	3.00	4.80	5.39	13.13	0.48	19.00	3.00	6.05	6.06	11.58	0.36	18.00	6.00	37.00	1.50	38.50
13	3.00	3.37	5.67	12.89	0.44	19.00	3.00	6.05	6.06	11.58	0.36	18.00	6.00	37.00	1.50	38.50
14	3.00	3.37	5.67	12.89	0.44	19.00	3.00	5.32	6.25	11.50	0.25	18.00	6.00	37.00	3.00	40.00
15	3.00	3.37	5.67	12.89	0.44	19.00	3.00	5.19	6.30	11.48	0.22	18.00	6.00	37.00	3.00	40.00
16	3.00	2.80	2.59	12.97	0.39	15.95	3.00	4.21	1.70	11.08	0.19	12.97	6.00	28.92	3.00	31.92
17	3.00	2.63	2.58	12.99	0.38	15.95	3.00	2.27	2.54	10.28	0.15	12.97	6.00	28.92	4.00	32.92
18	3.00	2.63	2.58	12.99	0.38	15.95	3.00	2.27	2.54	10.28	0.15	12.97	6.00	28.92	4.00	32.92
19	3.00	2.72	2.47	13.12	0.36	15.95	3.00	2.27	2.54	10.28	0.15	12.97	6.00	28.92	4.00	32.92
20	3.00	3.13	1.88	13.73	0.34	15.95	3.00	1.91	2.17	10.67	0.13	12.97	6.00	28.92	4.00	32.92
21	3.00	3.13	1.88	13.73	0.34	15.95	3.00	1.70	1.93	10.93	0.11	12.97	6.00	28.92	4.00	32.92
22	3.00	2.72	1.53	14.12	0.30	15.95	3.00	1.70	1.93	10.93	0.11	12.97	6.00	28.92	4.00	32.92
23	3.00	1.98	0.95	14.81	0.19	15.95	3.00	1.70	1.93	10.93	0.11	12.97	6.00	28.92	4.00	32.92
24	3.00	1.98	0.95	14.81	0.19	15.95	3.00	1.36	1.04	11.74	0.15	12.93	6.00	28.88		28.88
25	3.00	1.98	0.00	14.81	0.19	15.00	3.00	0.37	0.00	14.11	0.25	14.36	6.00	29.36		29.36
26	1.94	1.28	1.17	9.57	0.11	10.85	3.00	0.37	0.00	14.11	0.25	14.36	4.94	25.21		25.21
27							3.00	0.37	0.00	14.11	0.25	14.36	3.00	14.36		14.36
28							3.00	0.37	0.00	14.11	0.25	14.36	3.00	14.36		14.36
29							3.00	0.37	0.00	14.11	0.25	14.36	3.00	14.36		14.36
30							1.92	0.23	0.00	9.04	0.15	9.19	1.92	9.19		9.19
TOTAL	68.44	124.38	124.40	262.74	7.76	394.90	82.92	143.26	143.26	267.51	6.40	417.17	151.36	812.07	40.00	852.07

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CALENDER PROGRAMME FOR TOTAL QUARRY, VARIANT-II															
	NORTH-EAST SECTION					SOUTH-WEST SECTION					TOTAL			REHANDLING	TOTAL OB WITH REHANDLING
YEAR	TOTAL COAL	TOP OB NATURAL	TOTAL PARTING	TOTAL BAND	TOTAL OB	TOTAL COAL	TOP OB NATURAL	TOTAL PARTING	TOTAL BAND	TOTAL OB	TOTAL COAL	TOTAL OB NATURAL	TOTAL OB NATURAL SMOOTHENED		
1	CONSTRUCTION PERIOD														
2	0.5	1.28	0	0.09	1.37	1	2.71	0.08	0	2.79	1.5	4.16	4.50		4.50
3	1	2.63	0	0.17	2.80	2	5.64	0.15	0	5.79	3	8.59	8.50		8.50
4	2	6.47	0	0	6.47	3	8.94	0.22	0	9.16	5	15.63	16.00		16.00
5	3	12.89	0.79	0.13	13.81	3	10.75	1.47	0.09	12.31	6	26.12	26.00		26.00
6	3	14.66	3.09	0.2	17.95	3	12.74	2.82	0.17	15.73	6	33.68	34.00		34.00
7	3	16.23	7.63	0.28	24.14	3	12.7	5.33	0.33	18.36	6	42.50	43.00		43.00
8	3	10.33	12.63	0.46	23.42	3	12.67	7.21	0.44	20.32	6	43.74	43.00		43.00
9	3	8.24	12.83	0.46	21.53	3	12.14	8.06	0.49	20.69	6	42.22	43.00		43.00
10	3	4.88	13.16	0.5	18.54	3	11.42	9.24	0.56	21.22	6	39.76	40.00		40.00
11	3	4.88	13.16	0.5	18.54	3	9.47	10.08	0.48	20.03	6	38.57	40.00		40.00
12	3	4.8	13.13	0.48	18.41	3	6.05	11.58	0.36	17.99	6	36.40	35.00	1.50	36.50
13	3	3.37	12.89	0.44	16.70	3	6.05	11.58	0.36	17.99	6	34.69	35.00	1.50	36.50
14	3	3.37	12.89	0.44	16.70	3	5.32	11.5	0.25	17.07	6	33.77	33.00	3.00	36.00
15	3	3.37	12.89	0.44	16.70	3	5.19	11.48	0.22	16.89	6	33.59	33.00	3.00	36.00
16	3	2.8	12.97	0.39	16.16	3	4.21	11.08	0.19	15.48	6	31.64	33.00	3.00	36.00
17	3	2.63	12.99	0.38	16.00	3	2.27	10.28	0.15	12.70	6	28.70	29.00	4.00	33.00
18	3	2.63	12.99	0.38	16.00	3	2.27	10.28	0.15	12.70	6	28.70	29.00	4.00	33.00
19	3	2.72	13.12	0.36	16.20	3	2.27	10.28	0.15	12.70	6	28.90	29.00	4.00	33.00
20	3	3.13	13.73	0.34	17.20	3	1.91	10.67	0.13	12.71	6	29.91	29.00	4.00	33.00
21	3	3.13	13.73	0.34	17.20	3	1.7	10.93	0.11	12.74	6	29.94	30.00	4.00	34.00
22	3	2.72	14.12	0.3	17.14	3	1.7	10.93	0.11	12.74	6	29.88	30.00	4.00	34.00
23	3	1.98	14.81	0.19	16.98	3	1.7	10.93	0.11	12.74	6	29.72	30.00	4.00	34.00
24	3	1.98	14.81	0.19	16.98	3	1.36	11.74	0.15	13.25	6	30.23	30.00		30.00
25	3	1.98	14.81	0.19	16.98	3	0.37	14.11	0.25	14.73	6	31.71	30.00		30.00
26	1.94	1.28	9.57	0.11	10.96	3	0.37	14.11	0.25	14.73	4.94	25.69	27.00		27.00
27					0.00	3	0.37	14.11	0.25	14.73	3	14.73	15.00		15.00
28					0.00	3	0.37	14.11	0.25	14.73	3	14.73	15.00		15.00
29					0.00	3	0.37	14.11	0.25	14.73	3	14.73	13.00		13.00
30					0.00	1.92	0.23	9.04	0.15	9.42	1.92	9.42	9.07		9.07
TOTAL	68.44	124.38	262.74	7.76	394.88	82.92	143.26	267.51	6.4	417.2	151.36	812.07	812.07	40.00	852.07

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8.4 EQUIPMENT SCHEDULE

HEMM have been provided as per the work load of coal and OBR in different horizons indicated in calendar programme of excavation.

As the quantum of annual OB removal is very high, it is proposed to maximize the use of higher size equipment i.e. combination of 20 cum capacity electric hydraulic shovels & 190T Rear Dumpers. It is also intended to have few sets of lower size equipment i.e. combination of 10 cum capacity Rope shovels & 100T Rear Dumpers to deal with frequent fleeting.

For OB removal, 4 set of combination of 20 cum capacity electric hydraulic shovels with 33 nos.190T Rear Dumpers have been provided. In addition to that 6 nos. of 10 cum electric hydraulic shovels with 45 nos Rear Dumpers have been provided for smooth running of of the Project.

Coal will be extracted with the help of surface miner. For this 3 set of surface miner, 3 set of FEL with 35T have been provided. For In-seam band and coal production above developed gallery workings, 2 nos. of 3.8 cum Backhoe with 35T dumper are provided. The combined total number of 35T required for coal, band will be 35. Other existing auxiliary equipments will be utilised as and when required.

The drilling activities for OB will be under taken by 10nos. 250mm Blast Hole Drills. 4nos. 160 mm drills will be used for dirt bands, near the fault planes and over the areas where developed galleries are worked.

Similarly, on benches 410 Hp dozers will take care of dozing requirements necessitated for the face. For dumps, 850 Hp dozers will be deployed for levelling and reclamation operations.

One 28 KL water sprinklers will be used at the coal face and 6 nos. of 60KL water sprinklers will be used for overburden benches and reclamation purpose.

On common category, grader of 280 HP and some frequently required equipments are provided for smooth operation of the mine.

The average lead for OB transport to the dump site has been calculated as 2.5 Km and that for coal transport from the face to inpit belt is also 2.5 km.

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Internal dump (about 40 Mcum) of existing Chhal OC (3.0 Mty) which is operating on the upper seams in dip most side property of proposed Chhal OC (Seam-III) Project(6.0 Mty) is to be rehandled through outsourcing means.

It can be seen from the calendar programme that from 15th year onwards planned OB removal will come down to 28.92 Mcum/year. Therefore, two shovel units one each of 20 cum & 10 cum will be withdrawn from 15th year from the total fleet of HEMM. Year wise deployment of various equipments is shown in the following table.

The estimated capital expenditure on major HEMM is given in Appendix-A.3.

Sl. No.	Particulars	Unit	Size/ Capacity	Total Provision	6.0MTY					
					2nd	3rd	4th	5th	6th	15th
					1.50	3.00	5.00	6.00	6.00	6.00
					7.5	13.5	24.0	30.0	37.0	28.9
A.	**OVERBURDEN**									
1	Electric Hydraulic Shovel	Cum	20	4	1	1	3	3	4	3
2	Electric Hydraulic Shovel	Cum	10	6	1	3	4	6	6	5
3	Rear Dumpers	T	190	33	8	8	24	24	33	25
4	Rear Dumpers	T	100	45	7	23	26	41	45	37
5	Elect.RBH Drills	mm	250	10	2	4	7	9	10	8
6	Dozers	HP	850	4	1	1	3	3	4	3
7	Dozers	HP	410	6	1	3	4	6	6	5
8	Wheel Dozer	HP	410	2	1	2	2	2	2	2
B.	**COAL**									
1	Surface Miner	KW	700	3	1	2	2	3	3	3
2	Diesel RBH Drills	mm	160	4	1	2	3	4	4	4
3	FEL	Cum	6	3	1	2	2	3	3	3
4	Truck for Coal/Band	T	35	35	9	17	27	35	35	35
5	Backhoe	Cum	3.8	2	1	2	2	2	2	2
6	Water Tanker / Sprinkler	KL	28	1	1	1	1	1	1	1
7	Diesel Bouser	KL	22	1		1	1	1	1	1
8	Dozers	HP	410	4	1	2	3	4	4	4
C.	**RECLAMATION**									
1	Dozers	HP	400-410	2	1	1	2	2	2	2
2	Dozer	HP	850	2	1	1	2	2	2	2
3	Water Sprinkler	KL	60	6	2	3	4	6	6	6
D.	**COMMON**									
1	Grader	HP	280	5	1	2	3	5	5	5
2	Diesel Hydraulic Backhoe	Cum	2	2	1	1	2	2	2	2
3	Vibratory Compactor	T	25	2	1	1		2	2	2
4	Crane	T	100/75	1	1	1	1	1	1	1

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5	Crane	T	40-60	2		1	1	2	2	2
6	Crane	T	20	3	1	2	3	3	3	3
7	Crane	T	8-10	8	3	4	5	8	8	8
8	Diesel Bouser	Kl	22	3	1	2	2	3	3	3

9.1 COAL QUALITY

On the basis of moisture and ash percentage different litho units are defined as under: -

Coal	:	Ash + Moisture up to 40%.
Shaly Coal	:	Ash + Moisture from 40% to 55%.
Carbonaceous shale/ Combustible dirt band	:	Ash + Moisture from 55% to 75%.
Obvious dirt bands	:	Ash + Moisture more than 75%.

Initially, the band by band analysis of the coal cores were obtained and subsequently special tests and the proximate analysis at 60% RH and 40^0C were advised for Bcs, I_{30}, I_{10}, I_{100} and I_p basis which are defined as under: -

Bcs Sample : only coal and shaly coal.

I_{30} Sample : including combustible bands upto a thickness of 30cm. This type of analysis has been asked only for assessing under ground reserves. Dirt bands upto 5 cm irrespective of lithology have been included in the seam for quality assessment. Carbonaceous shale bands having thickness more than 30cm have been excluded from the seam thickness.

I_{10} Sample : including both combustible and non-combustible bands upto 0.10m thickness. This analysis has been carried out for the seams having quarriable potentiality.

I_{100} Sample : 'Bcs' sample + carbonaceous shale (ash + moisture upto 75%) bands upto 1m in thickness + grey shale (ash + moisture >75%) bands upto 1m in thickness and excluding all other obvious bands such as sandy shale, shaly sandstone, sandstone etc. irrespective of their thickness.

I_p Sample : I_{100} Sample + carbonaceous and grey shale bands irrespective of their thickness and excluding all other obvious bands as in I_{100} Sample.

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PROJECTED COAL QUALITY

Considering the average grade of all individual seams (Upto seam III), the weighted average grade on I_{100} basis (including bands of 100cm) is estimated as 'F'. By judiciously extracting of the seams, quality of the coal can be improved to some extent. Financial evaluation has been done with weighted average coal grade as 'F' which has a corresponding GCV of 4264.00 KCAL/KG. However, it is suggested that every effort should be done to segregate the incombustible material from the surface miner cut coal to upgrade the coal quality mined.

10.0 WATER MANAGEMENT (PUMPING AND DRAINAGE)

The maximum rainfall in a day is estimated as 172 mm from probability curve and total water collected in a day in final year is estimated as 1127636 cu m. The number of pumps is estimated on the basis of total water collected in a day which will be dewatered in 100 hours with 10% extra pumps.

In this report,16 nos. of 225 lps main pumps with 180m head, 5nos. of 80 lps pump with 100m head, have been provided. In addition to these pumps four numbers of diesel operated pump, four numbers of submersible slurry pumps, 7nos.of priming pumps and 7Nos. of face pumps have also been provided. Main Pumps will be installed on pontoon to work efficiently. Main pumps will discharge water to natural Nala.

14km long 355.6mm diameter main pipes have been provided for the main pumps, while 6km long 273mm diameter pipes and other pipes have been provided for slurry, intermediate, diesel pumps and other small pumps.

11.0 COAL HANDLING PLANT

The coal extracted by surface miners require no crushing arrangement & the same will be loaded to Reclaim feeders which will discharge coal to inpit belt conveyors. The coal extracted by shovel & dumper combination will be discharged to feeder breaker & further to secondary sizer for crushing to (-)100mm size & the output will discharge coal to inpit belt conveyors. It is

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proposed to dispatch (-) 100mm size coal to distant consumers by rail. To meet the above requirement a CHP with coal storage in 20000Te over ground bunker and rapid loading system with 4000Te Silo has been proposed for dispatch of coal to the distant consumers by rails. Road dispatch facility has also been provided to meet the requirements of local customers.

A railway line will be constructed up to Chhal open cast project from the Rabertsion nearby railway station which is about 18 km.. This will consist of permanent way, culverts, bridges, electrification, signaling, block stations etc. A railway siding consisting of one load standage line (suitable for 58 box-N-wagons), one empty standage line (suitable for 58 box-N-wagons), engine escape line, one loading station, crossovers, turnouts, electrification, signaling etc. will be constructed at a suitable location near the project for loading of coal through a Silo of 4000te capacity.

2Nos. of truck weigh bridges near pit top and 1No. of rail weigh bridges on railway siding have been provided for records and checking of pilferages.

11.0 POWER SUPPLY, ILLUMINATION AND COMMUNICATION

The project shall receive power at 33kV by strengthening two independent over head lines from Gharghora Sub Station of CSEB. The power will be received at Quarry Sub Station located near quarry. From this sub station power will be fed to quarry & other surface loads.

For outsourcing option the maximum Demand of Quarry Sub Station after correcting pf to 0.98 comes to 13089 kVA for which 2 nos. 12.5 MVA 33/6.6kV Transformers have been provided where as for departmental option the maximum Demand of Quarry Sub Station after correcting pf to 0.98 comes to 19964 kVA for which 2 nos 20MVA 33/6.6kV Transformers have been provided.

In order to maintain high system power factor of around 0.98 two sets of 4125 kVAr capacity have been envisaged in Quarry Sub Station for outsourcing

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option and two sets of 6300 kVAr capacity have been envisaged in Quarry Sub Station for departmental option.

Adequate provision has been kept in the project for Earthing, Lightning Protection, Illumination & for safety & fire fighting.

Adequate provision has been kept for tele-communication system for both voice & data communication.

Provision has been kept in the project for township electrification & for power supply to surface loads.

Specific Energy Consumption of the project comes to the tune of 7.65 kWH/Te for outsourcing & 13.07 kWH/Te for departmental option.

13.0 WORKSHOP

A Unit E&M workshop , Excavation workshop and store shed have been proposed to cater the maintenance of HEMM, pumps, coal handling plant, power supply arrangement etc. for different options as per requirement mine. The details of shops are given in Drg. No. 12.1,12.2 & 12.3.

14.0 CIVIL CONSTRUCTION

The preparation of cost estimates for civil infrastructure is based on prevailing cost index of the area in May 2013. The cost index value has been calculated from the market rate of the area. Considering the prevailing rates of materials and labour in Raigarh Area, the cost index works out to 2478 with reference to 100 base in Delhi as on 1.10.1976.

Additional service buildings envisaged is sub-station and repair shed for dumpers. In residential buildings, additional types of quarters are provided. The details of capital provision for service buildings, residential buildings, roads and culverts and water supply & sewerage have been given in Appendix-A.2.1, A.2.2, A.8.2 and A.8.3 respectively.

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15.0 MANPOWER & PRODUCTIVITY

The requirement of manpower at the rated capacity of 6.0 Mt of coal and 37.0 Mcum of OB removal per year has been estimated as 1915 for Option-I, 296 for Option-II.

The overall OMS will be 11.92 t, 77.08 t for Option-I, and Option- II.

16.0 LAND

The project envisages 1342.86 Ha of land for quarry, industrial and residential complex, safety zone and external dumps etc. This includes 516.59 Ha of land already acquired/under process and, 826.07Ha of land to be acquired.The break-up of the land is as follows:-

REQUIREMENT OF LAND IN Ha							
SL. NO.	PARTICULARS	LAND ALREADY ACQUIRED/UNDER PROCESS	LAND TO BE ACQUIRED				TOTAL LAND REQUIREMENT
			TENANCY / AGRICULTURE LAND	FOREST LAND	GOVT. LAND	TOTAL	
1	LAND FOR QUARRY	516.79	16.64	185.155	156.42	358.22	875.00
2	FOR EXTERNAL DUMP	-	110.73		20.00	130.73	130.73
3	SURFACE INDUSTRIAL DEVELOPMENT RLY. SIDING,COLONY,APPROACH ROAD, ETC.	-	50			50	50.00
4	LAND FOR HOMESTEAD/FAMILY	-	50			50	50
5	LAND FOR ENVIRONMENT AND SAFETY	-	92.65			92.65	92.65
6	SAFETY ZONE	-	144.47			144.47	144.47
	TOTAL LAND	516.79	464.49	185.16	176.42	826.07	1342.86

17.0 ENVIRONMENT MANAGEMENT

Seven villages consisting of 450 project affected families and around 675 land custees are involved. These villages are to be shifted and properly rehabilitated. SECL should take appropriate action for early rehabilitation.

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Estimated capital investment for the rehabilitation of affected families has been given in Appendix-A.8.1 and Appendix-A.1.

18.0 CAPITAL INVESTMENT

18.1.1 Additional capital with phasing

OPTION-I

Phasing of additional capital (Rs in lakhs)							Total additional capital
1st	2nd	3rd	4th	5th	6th	7th to 20nd	
2000	39797.03	26952.86	67556.85	41432.81	34079.51	940.09	212759.14

OPTION-II

Option	Phasing of addl. capital (Rs. In lakhs)						Total addl. Capital
	1st	2nd	3rd	4th	5th	6^{th} to 20^{th}	
Option II	2063.96	7030.67	13567.33	15293.66	18537.72	4569.99	61063.32

18.1.2 Basis of price of P&M, Civil works & hiring rate

Price of P&M has been taken from the standard price list published by CMPDI, HQ on July 2012 and Nov 2007. Prices have been updated upto May 2013 as per escalation rate given in the price list. But in case of surface miner tentative price has been considered for the purpose of economic evaluation.

The preparation of cost estimates for civil infrastructure is based on prevailing cost index of the area in May 2013 The cost index value has been calculated from the market rate of the area. Considering the prevailing rates of materials and labour in Raigarh Area, the cost index works out to 2478 with reference to100 base in Delhi as on 1.10.1976.

18.1.3 Foreign Capital

No Foreign capital investment has been envisaged.

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18.1.4 Capital Investment

Particulars	Option -I	Option -II
Capital upto target year (Rs. crores)	1777.39	564.93
Specific investment (Rs,/t)	3545.99	1017.72
Specific investment for P&M (Rs,/t)	2765.35	462.90

18.2 OPENING OF REVENUE ACCOUNT

In Option II, Revenue expenditure net of sales have been capitalized upto 1st year since revenue expenses are more than the corresponding revenue sales in this period and revenue account has been opened at the beginning of 2nd year where the revenue sales is 118.25 cr. against revenue expenses of 77.75 cr.

The capacity build-up for the Project would be as follows:-

YEAR	1	2	3	4	5	6	15-22
Total Coal,MT	-	1.5	3.0	5.0	6.0	6.0	6.0
Total OBR Planned,Mcum	-	7.5	13.5	23.99	30	37	28.92

18.3 REPLACEMENT CAPITAL

Year-wise phasing of replacement capital is given in Appendix-D.1 column No.3.

18.4 SOURCES OF FINANCE

The project will be financed completely by internal resources.

18.5 METHOD OF ESTIMATION OF CAPITAL COST

a) Land

Rate of forest & Govt. land is considered as Rs.10 lakhs per Ha and agriculture land is considered as Rs.25 lakhs per Ha.

b) Civil Construction (alongwith Cost Index)

The preparation of cost estimates for civil infrastructure is based on prevailing cost index of the area in May 2013. The cost index value has been calculated from the market rate of the area. Considering the prevailing rates of materials and labour in Raigarh Area, the cost index works out to 2478 with reference to 100 base in Delhi as on 1.10.1976.

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c) P&M

Price of P&M has been taken from the standard price list published by CMPDI, HQ on June 2012. Prices have been updated upto May 2013 as per escalation rate given in the price list.

18.6 COST OF PRODUCTION AT DIFFERENT LEVEL OF PRODUCTION

a) Salaries & Wages Cost

The detail of category-wise / scale-wise manpower requirement and year-wise estimated wages cost is given in Appendix-B.1.

Estimated salaries & wages cost is worked out as Rs.238.62 & Rs.41.66 for Option-I & II respectively.

b) Stores Cost

Stores Cost has been estimated taking into account provision for Repair & Maintenance, POL, Explosive and miscellaneous stores cost. The estimated Stores Cost has been worked out to Rs.478.74 & Rs.55.86 for Option-I & II respectively.

c) Power Cost

Estimated Energy Consumption is given in the relevant chapter for Power Supply. The power cost has been taken as Rs.6.0/unit. The average power cost per tonne of coal production works out to Rs.73.46 & Rs.44.99 for Option-I & II respectively at 100% level of operation.

d) Misc. Expenditure

This cost has been estimated to cover expenditure on Printing & Stationary, Postage, Telephone, repair & Maintenance of assets other than P&M, Workshop Debit, and Insurance & Taxes for vehicles and other repairs and a further provision has been made for deterioration of coal stock. Miscellaneous expenditure per tonne works out to Rs.35.10 & Rs.10.22 for Option-I & II respectively.

e) Administrative Charges

A provision has been made in total revenue cost estimate for Administrative charges based on the Admn. Cost per tonne of coal production as was appearing in the last Annual Report of Coal India Ltd. Total Admn. Cost has been calculated at 100% level and treated as fixed cost. As such for all other estimated level of operation the absolute Admn. cost has been taken as it worked out for 100% level of operation. The Admn. Cost comes to Rs.48.99/Te.

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f) Outsourcing cost - year wise with lead distance

The rates have been considered based on the prevailing rates at the mines plus escalation rates table received from SECL.

The outsourcing cost of OB for average lead of 2.5Km is considered as Rs.54.50 per cum. The outsourcing cost of Coal for average lead of 2.5km is follows:-

For Surface miner- Rs 48.00.

For Shovel dumper- Rs 34.50.

Outsourcing rates are inclusive of Service Tax of 12.36%.

The scope of work by outsourcing will include drilling, loading andtransportation, dozing and maintenance of haul roads

g) Interest on Working Capital

Interest on Working Capital has been calculated on the basis of 4 months operating expenditure. Rate of interest is taken as 14.50%.

h) Depreciation

Straight line method of depreciation has been provided to arrive at depreciation cost is Rs.234.68 & Rs.45.03 for Option-I & II respectively per tonne of coal production.

i) Interest on Loan Capital

Interest @11.5% on loan capital is to be considered for computation based on given Debt Equity Mix. However, loan capital in this project is NIL.

j) Environment related Cost

Rs.57.41/Te of coal and Rs47.50/te of coal has been provided to absorb Environmental related Cost in the project for option I and optionII respectively.

k) Mine Closure Cost

Rs.7.80/Te has been provided in the project against Mine Closure Cost.

l) Cost of production per tonne at 100%, 85% and 80% level of production has been given in Appendix-C-1.

18.7 SELLING PRICE

The weighted average GCV of coal is 4264.00KCal/Kg. However, the weighted average selling price of coal for economic evaluation of this project has been taken as Rs.785.78 per tonne for ROM processed coal (-) 100 mm based on GCV norms mentioned in CIL website.

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CALCULATION OF SELLING PRICE

(a) Price of 'F' grade coal per tonne as per GCV norms* -Rs.665.00

(b) Sizing charges (- 100 mm) per tonne -Rs. 61.00

(c) Sizing charges (conventional) per tonne - Rs 39.00

(c) Rapid Loading Charges - Rs. 20.00

(d) Transportation reimbursement for 18 Km Upto Robertson Siding for initial 5 years - Rs. 77.00

(e) Transportation reimbursement for 5 Km Upto Rail corridor from 6th year onwards - Rs. 44.00

(d) Weighted Average Selling price considered in PR per te-Rs.785.78

*95% of the grade based on borehole data as per norms.

18.8 RATE OF LEASING OF HEMM

The rates have been considered based on the prevailing rates at the mines plus escalation rates table received from SECL.

The outsourcing cost of OB for average lead of 2.5Km is considered as Rs.54.50 per cum. The outsourcing cost of Coal for average lead of 2.5km is follows:-

For Surface miner- Rs 48.00.

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Outsourcing rates are inclusive of Service Tax of 12.36%.

The scope of work by outsourcing will include drilling, loading and transportation, dozing and maintenance of haul roads. All statutory rules, regulations and applicable laws are to be followed.

18.9 Grade of Coal - F

(a) Price of 'F' grade coal per tonne as per GCV norms* -Rs.665.00

(b) Sizing charges (- 100 mm) per tonne -Rs. 61.00

(c) Sizing charges (conventional) per tonne - Rs 39.00

(c) Rapid Loading Charges - Rs. 20.00

(d) Transportation reimbursement for 18 Km Upto Robertson Siding for initial 5 years - Rs. 77.00

(e) Transportation reimbursement for 5 Km Upto Rail corridor from 6th year onwards - Rs. 44.00

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(f) Average Selling price considered in PR per te -Rs.785.78

*95% of the grade based on borehole data as per norms.

18.10 Profitability (Profit/Loss) Rs./t at 100%, 85% and 80% level of production has been given in Appendix-C-3.

18.11 Manpower - 1915 & 296 for Option-I & II respectively.

OMS - 11.92 & 77.08 for Option-I & II respectively.

18.12 EMS - Rs.2844.68 & Rs.3211.21 for Option-I & II respectively.

18.13 Financial IRR

- at 100% level of production – Negative & 25.72% for Option-I & II respectively.
- at 85% level of production – Negative & 14.42% for Option-I & II respectively.

NPV @12% at 100% and 85% level of production comes to Rs.-1942.40 crores & Rs.198.48 crores and Rs.-2163.20 crores & Rs41.18for Option-I & II respectively.

18.14 BREAK-EVEN PRODUCTION

It is estimated that the project will achieve Break-even point at 11.08 & 3.58 te of production which is 184.69% & 59.68% for Option-I & II respectively of rated capacity.

18.15 Desired Selling Price: At 85% level of production,desired selling price to get 12% IRR is estimated as Rs.1591.71 for Option I and Rs769.90 for Option II.

18.16 Completion IRR: Capital Expenditure has been estimated / increased for forward escalation on the Phasing of Initial Estimated Capital. The escalation rate is based on W.P.I. of preceding 12 months.

18.17 Sensitivity Analysis - given in Appendix-C.4.

18.18 CONCLUSION

The project has been planned with a high degree of mechanisation, in line with the present and forthcoming changes in neighbouring mines as well as in other parts of the country. The techno-economics have been worked out based on the prevalent norms of productivity, operating cost, spare consumption etc.

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(f) Average Selling price considered in PR per te -Rs.785.78

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As per the guidelines, a Project is economically viable when it achieves more than 12% IRR at 85% level of Production. As option I is having negative IRR at 85% level of target production, it is not thus economically viable .

Option II is having an IRR of 14.42% at 85% level of production, the same may be recommended for implementation .

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