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MINING PLAN AND MINE CLOSURE PLAN FOR BHUBANESWARI OCP 30 MTY

Modified Mining Plan seeking approval under Rule 22E of MCR, 1960

Coal Block Name: (1) Bhubaneswari Integrated Coal Block
Area in hectare (ha):

Block Area	:	1455.000 ha
Lease Area	:	658.724* ha
Project Area	:	808.294 ha

TALCHER COALFIELD, BHUBANESWARI AREA,
Talcher tehsil, Dist. Angul, State: Odisha

Applicant: GENERAL MANAGER, BHUBANESWARI AREA
MAHANADI COALFIELDS LIMITED
ANGUL, ODISHA
Email – gm-bhubaneswari.mcl@coalindia.in

Targeted Capacity:

(a) Rated capacity: 30.00 Million Tonne per year (Mty)

Name of the Accredited Mining Plan Preparing Agency (MPPA)
preparing the mining plan with details:



APRIL, 2022

CENTRAL MINE PLANNING & DESIGN INSTITUTE LIMITED
(A Subsidiary of Coal India Ltd.)
REGIONAL INSTITUTE-VII

Plot No. E-4; At: Samantapuri, P.O. – RRL; Bhubaneswar – 751013.

**MINING PLAN AND MINE CLOSURE PLAN FOR
BHUBANESWARI OCP (30 MTY) (REVISION-2)**

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CHECKLIST

Details		(✓/×)
	Expert Review Report	×
Chapter-1	Project Information	✓
Chapter-2	Exploration, Geology, Seam Sequence, Coal Quality and Reserve	✓
Chapter-3	Mining	✓
Chapter-4	Safety Management	✓
Chapter-5	Infrastructure Facilities Proposed and Their Location	✓
Chapter-6	Land Requirement	✓
Chapter-7	Environment Management	✓
Chapter-8	Progressive and Final Mine Closure Plan	✓
Annexure	Copy of Allotment Order / Vesting Order	×
Annexure	Certificate of Qualified Person/Accredited Mining Plan Preparing Agency, whether project area is confined within the vested / allotted block boundary	NA
Annexure	Certificate by Mines & Geology Department of State Government- (a) Intent of the State Government for grant of lease beyond the vested geological boundary (b) Non-existence of coal in the area beyond vested /allotted geological block boundary to rule out the issue of encroachment and use of coal bearing area beyond the vested geological boundary	NA
Annexure-I	Approval of the Company Board	× After Final MP
Annexure-II	Sanction Order for approval of Project Report for Bhubaneswari OCP (20 Mty) by MCL	✓
Annexure-III	Approval of Mining Plan for Bhubaneswari OCP Normative Capacity 20 Mty [Normative Capacity 25 Mty] MCL dated July,2013 by MoC	✓
Annexure-IV	Bhubaneswari Opencast Expansion from 25 MTPA to 28 MTPA in existing ML area of 638.341ha of M/s Mahanadi Coalfields Limited, Environmental clearance – regarding	✓
Annexure -V	Certificate of Accreditation	✓
Annexure -VI	Mining Plan showing EC boundary	✓

Annexure -VII	Consent letter from SPCB, Odisha vide letter No.2631, dtd.24.02.2014 (Office Memorandum) for enhancement of production from 20.0 Mty to 25.0 Mty.	✓
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Annexure -IX	Bhubaneswari OCP Coal Mine (10.0 Mty) of M/s Mahanadi Coalfields Ltd. Located at Village(s), Nakulbaspur, Ambamunda, Balugaon-Khamar, Kandhal, Anadipur, Hensamul/Jilinda, Naraharipur, Longijoda, Madanmohanpur, Alhadnagar (Uninhabited), Bira-Ramchandrapur and Khandulbahal, Tehsil, Talcher, Dist. Angul of Orissa – environmental clearance – reg.	✓
Annexure -X	Expansion [under 7(ii) of EIA Notification 2006] of Bhubaneswari Opencast project from 20 MTPA to 25 MTPA in ML AREA 638.341 ha (658.724 ha – 20.383 ha = 638.341 ha); Latitude 20°57'59" to 20°58'43" & Longitude 85°09'10" to 85°11'37") of M/s Mahanadi Coalfields Ltd. Village: Hensmul, Dist.: Angul, Orissa – Environmental Clearance – reg.	✓
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Annexure -XIII	Work Order for preparation MP & MCP in respect of Bhubaneswari OCP	✓
Plate GEN-I	Location Plan	✓
Plate	Plan certified by Qualified Person/Accredited Mining Plan Preparing Agency, if project area is confined within the vested / allotted block boundary	NA
Plate	Plan certified by Qualified Person/Accredited Mining Plan Preparing Agency with plan showing cardinal coordinates duly certified by Mines & Geology Department of State Government	X Certificate may be necessary from ORSAC

Plate GEN-VI	KML Boundary of proposed Mining Lease superimposed on dated satellite image, duly certified by accredited agency	✓
Plate GEN-IV	Cadastral Plan showing approved block boundary vis-à-vis proposed Mining Lease and mine boundary, showing land use and infrastructure	✓
Plate G-2	Geological Plan showing all drilled boreholes and boreholes to be drilled with allotted block boundary and required mining lease	✓
Plate G-III	Representative Graphic Litholog	✓
Plate GEN-V	Surface Plan showing drainage system, contours (at minimum 3 m intervals), location of bore holes	✓
Plate GEN-V	Conceptual Plan showing infrastructure facilities including colony, boundary of mining area, mine entries, roads and road diversion alignments etc.	✓
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Plate MIN-I	Final Stage Quarry Plan showing haul road alignment	✓
Plate MIN-II	Existing Mine Working Plan	✓
Plate MIN-III	Plan showing Mine Stage during 1 st Year (Yr-1)	✓
Plate MIN-IV	Plan showing Mine Stage during 3 rd Year (Yr-3)	✓
Plate MIN-V	Final Stage Dump Plan	✓
Plate MIN-VI	Final Mine Closure Plan (Reclamation Plan)	✓

LIST OF ABBREVIATIONS

A%	-	Ash percentage
CESCO	-	Central Electric Supply Company
cum	-	cubic meter
CMPDI	-	Central Mine Planning & Design Institute Limited
CMP	-	Comprehensive Master Plan
CPP	-	Captive Power Plant
CV	-	Calorific Value
dmmf	-	dry mineral matter free
E&M	-	Electrical & Mechanical
GCV	-	Gross Calorific Value
GR	-	Geological Report
Ha/HA	-	Hectares
HEMM	-	Heavy Earth Moving Machinery
HFL	-	High Flood Level
IDCO	-	Odisha Industrial Infrastructure Development Corporation
M%	-	Moisture percentage
m	-	Meter
Mcum	-	Million cubic meter
MECL	-	Mineral Exploration Corporation Limited
Max	-	Maximum
Min	-	Minimum
Mld	-	Million liter per day
MoC	-	Ministry of Coal
MoEF	-	Ministry of Environment & Forest

Mt	-	Million metric tonne
Mty, MTY	-	Million metric tonne per year
MVA	-	Mega Volt Ampere
MW	-	Megawatt
MCL	-	Mahanadi Coalfields Limited
OC	-	Open Cast
OMC	-	Odisha Mining Corporation
P&M	-	Plant & Machinery
PR	-	Project Report
RF	-	Reduction Factor
RH	-	Relative Humidity
UTES	-	A Government of India Public limited Consulting Company
ROM	-	Run off Mines
SH	-	State Highway
t	-	Metric tonne
tph	-	tonne per hour
T	-	US TON
TAMDA	-	Talcher Angul Meramandali Development Authority
TCF	-	Talcher Coal Field
Yr	-	Year
UG	-	Under Ground
UHV	-	Useful Heat Value
V.M.%	-	Volatile Matter percentage
OB	-	Overburden
MP & MCP	-	Mining Plan and Mine Closure Plan

TEXT

Chapter - 1

PROJECT INFORMATION

	Parameters	Details
1.1	INTRODUCTION	
1.1.1	Name of Coal/Lignite Block	1. Integrated Bhubaneswari, Arkhapal-A and Sakhigopal-A block 2. Parts of Ananta Extension, Subhadra East and Lingaraj Blocks
1.1.2	Name of the Coalfield/ Lignite Field	Talcher coalfield
1.1.3	Base data of Mining Plan/ Mine Closure Plan	Cost base of mine closure : March 2022
1.1.4	Linked End Use Plant	This mine has been planned to meet the demand of the present and future thermal power stations (basket linkage).
1.1.5	Distance of End use Plant from the pit head of the projection in “km”	NA
1.1.6	Mode of Coal Transport	1) Within the Mine: Truck transportation from mine face to pit top. 2) Surface Coal Transport: By belt conveyor from pit top to loading point & loading onto railway wagons through rapid loading system for major part of production.
1.2	LOCATION, TOPOGRAPHY AND & COMMUNICATION	
1.2.1	Location of coal deposit (District and State)	Location: Eastern part of Talcher coalfield, Dist. Angul, State: Odisha
1.2.2	Communication: PWD roads, railway lines, Air	<ul style="list-style-type: none"> ▪ NH 23 lies to the east of Project area. The project area is connected by an all-weather road to Talcher town which is about 9km away. NH no.23, passes near Talcher town and connects with NH 42, the distance being about 13 km. ▪ The nearest railhead is Talcher on Bhubaneswar-Talcher-Sambalpur line of East Coast railway and is located at a distance of 6km. ▪ The nearest port at Bay of Bengal - Distance of Paradeep and Dhamra ports of Odisha are about 200 km and 160 km respectively from Talcher. ▪ The nearest airport from the block- Bhubaneswar. The area is connected by all-weather metaled road to Bhubaneswar

		which is at a distance of about 170 km.																																																																
1.2.3	Availability of power supply, water, etc.	Power from existing 132/33 kV substation at Nandira.																																																																
1.2.4	Prominent physiographic features, drainage pattern, natural water courses, rainfall data	<ul style="list-style-type: none">Block (majorly) predominantly soil covered and gently undulating with paddy fields.Block is undulating and is used for agricultural purpose and some patches of barren lands.Altitude of the block: 92 m to 137 m above MSL.Bangaru Jhor - one seasonal nallah (partly forms northern boundary).The main drainage of is controlled by southerly flowing Brahmani river on the eastern side.Climate of the area is Tropical.The maximum rainfall recorded in the area is 15.4 cm in 24 hours on 09.09.1977.																																																																
1.2.5	Land use and ownership/ occupancy & involvement of forest land	<table><tr><th colspan="2">Items</th><th colspan="3">MP&MCP of Bhubaneswari (28 Mty),Revision-1</th><th colspan="3">Proposed MP&MCP of Bhubaneswari (30 Mty), Rev-2</th></tr><tr><th>Sl.</th><th>Particulars (ML-mining lease)</th><th colspan="3">Total Area in ha</th><th colspan="3">Total Area in ha</th></tr><tr><th></th><th></th><th>Forest</th><th>Non-forest</th><th>Total</th><th>Forest</th><th>Non-forest</th><th>Total</th></tr><tr><td>1.</td><td>Quarry Excavation area</td><td>105.808</td><td>477.944</td><td>583.752</td><td>126.191*</td><td>488.531**</td><td>614.722</td></tr><tr><td>2.</td><td>Safety zone</td><td></td><td>5.747</td><td>5.747</td><td></td><td>6.163**</td><td>6.163</td></tr><tr><td>3.</td><td>Infrastructure (CHP, Washery, Silo point, project office, laying of railway lines for dispatch point) and Future working expansion Area**</td><td>6.713</td><td>29.609</td><td>36.322</td><td>6.713</td><td>18.606</td><td>25.319</td></tr><tr><td>4.</td><td>Embankment</td><td>NIL</td><td>12.52</td><td>12.52</td><td>NIL</td><td>12.52</td><td>12.52</td></tr><tr><td>A.</td><td>Total ML area</td><td>112.521</td><td>525.820</td><td>638.341</td><td>132.904</td><td>525.820</td><td>658.724</td></tr></table> <p>Note: *20.383 Ha of Forest land is taken under Quarry Excavation area.</p> <p>**The area under Future Expansion area is annexed under the proposed quarry excavation area and safety zone.</p> <ul style="list-style-type: none">Additional 11.003 ha of future expansion area showed in Revision-1 goes to the Quarry area (10.587 ha) and partly to the safety zone of (0.416 ha), making it to a total of 11.003 ha. This was the non-forest area adjacent to the forest area of 20.383 ha blocked because of non-clearance of this forest area.Additionally 149.57 Ha of non-forest land may be required for residential colony, Rehabilitation & resettlement.	Items		MP&MCP of Bhubaneswari (28 Mty),Revision-1			Proposed MP&MCP of Bhubaneswari (30 Mty), Rev-2			Sl.	Particulars (ML-mining lease)	Total Area in ha			Total Area in ha					Forest	Non-forest	Total	Forest	Non-forest	Total	1.	Quarry Excavation area	105.808	477.944	583.752	126.191*	488.531**	614.722	2.	Safety zone		5.747	5.747		6.163**	6.163	3.	Infrastructure (CHP, Washery, Silo point, project office, laying of railway lines for dispatch point) and Future working expansion Area**	6.713	29.609	36.322	6.713	18.606	25.319	4.	Embankment	NIL	12.52	12.52	NIL	12.52	12.52	A.	Total ML area	112.521	525.820	638.341	132.904	525.820	658.724
Items		MP&MCP of Bhubaneswari (28 Mty),Revision-1			Proposed MP&MCP of Bhubaneswari (30 Mty), Rev-2																																																													
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A.	Total ML area	112.521	525.820	638.341	132.904	525.820	658.724																																																											
1.2.6	Important surface features within the project area and	Nil, Bangaru jhor passing towards north of block, suitable embankment will be constructed.																																																																

	major diversion or shifting involved	
1.3 DETAILS OF THE ALLOTMENT AGREEMENT		
1.3.1	Name of the Alottee	MAHANADI COALFIELDS LIMITED (MCL)
1.3.2	Status of the Applicant Company	Central Public Sector Undertaking (A Subsidiary of Coal India Ltd.) A Govt. of India Undertaking Registered Under Companies Act, 1956
1.3.3	Details of allotment/ vesting order	NA
1.3.4	Name and address of the applicant	Mahanadi Coalfields Limited Jagruti vihar, Burla Dist: Sambalpur (Odisha) – 768020
1.3.5	Relationship between the applicant and allottee company	MCL is a subsidiary of Coal India Ltd. which is a Govt. of India Undertaking.
1.3.6	Name of the previous allottee of the Block	NA
1.3.7	Starting date of the mine as per CMDPA	NA
1.3.8	Rated capacity as per CMDPA	28.0 Mty (approved); 30.0 Mty (proposed)
1.3.9	Production schedule as per opening permission (meeting provisions of CMDPA if any)	
1.3.10	End Use of Coal/Lignite as per allotment order if any	▪ To satisfy needs of different present and future customers of MCL
1.4 DETAILS OF THE PREVIOUS APPROVAL OF MINING PLAN		
1.4.1	Date of Approval	1) MP&MCP for Bhubaneswari OCP (28 Mty), Rev-1 was approved by the Board of Directors of MCL on 20.01.2022. 2) MP&MCP for Bhubaneswari OCP (28 Mty) was approved by MoC, Govt. of India on 20.11.2017. 3) Add. to MP&MCP for Bhubaneswari OCP (25 Mty, Peak capacity) was approved by MoC, Govt. of India on 03.02.2014. 4) MP for Bhubaneswari OCP (20 Mty) was approved by MoC, Govt. of India on 16.07.2013.
1.4.2	Conditions, if any	
1.4.3	Scheduled year of start of production	Already a running mine.
1.4.4	Proposed year of achieving the	Year-1

	targeted production									
1.4.5	Date of actual commencement of mining operations, if operations already started	2006-2007								
1.4.6	Likely date of mining operations, if operations not yet started & reasons for non-commencement of operations	NA								
1.4.7	Planned production and actual levels achieved in last 3 years (Coal in Mte, OB in MM ³ , SR in M ³ /te)	Calendar Year	Planned				Actual			
			Coal “Mt”			OB “Mm ³ ”	Coal “Mt”			OB “Mm ³ ”
		UG	OC	Total	UG		OC	Total		
		2018-19		28.0	28.0	20.5		28.0	28.0	14.09
		2019-20		28.0	28.0	20.5		28.0	28.0	15.07
2020-21		28.0	28.0	20.5		28.0	28.0	18.21		
1.4.8	Statutory obligations vis-à-vis compliance status in a tabular form									
1.4.9	Reasons for difference between the planned and actual production levels	NA								
1.5 PARAMETERS OF APPROVED MINING PLAN VIS-À-VIS PROPOSED MINING PLAN										
		Approved Mining Plan				Proposed Mining Plan				
1.5.1	Block Area in “Ha”	1455				1455				
1.5.2	Block Area Projected “Ha”	638.341				658.724				
1.5.3	Lease area “Ha”	638.341				658.724				
1.5.4	Project Area “Ha”	787.911				808.294				
1.5.5	Life of the Project “Yrs”	5 (balance life as on 01.04.2021)				5 (balance life as on 01.04.2022)				
1.5.6	Minimum and Maximum Depth of working “m”	Minimum - 97.99 m Maximum – 217.5 m				Minimum - 97.99 m Maximum – 217.5 m				
1.5.7	Net Geological Area “Ha”	583.752				614.722				
1.5.8	Production Target “MTPA”	28.0				30.0				
1.5.9	Seams Available “As per GR”	13 seams/22 section				13 seams/22 section				
1.5.10	Seams not considered for Mining with Reasons	Reserves have been estimated for all thirteen coal seams/splits.				Reserves have been estimated for all thirteen coal seams/ sections.				

1.5.11	Gross Geological Reserve (within pit) "Mt"	420.77	465.73
1.5.12	Net Geological Reserve (within pit) "Mt"	378.69	419.15
1.5.13	Mineable Reserve "Mt"	365.98	396.52
1.5.14	Extractable Reserves "Mt"	365.98	396.52
1.5.15	% of Extraction/recovery	86.98	85.14
1.5.16	Reserve Depleted (till the base date) Reserves "Mt"	244.06 (as on 01.04.2021)	272.06 (as on 01.04.2022*)
1.5.17	Balance Extractable reserve "Mt"	121.92 (as on 01.04.2021)	124.46 (as on 01.04.2022*)
1.5.18	Average Grade	mostly G11 to G13	mostly G11 to G13
1.5.19	OB in MM ³	Insitu OB: 115.12 OB with rehandle: 170.11	Insitu OB: 131.43 OB with rehandle: 186.42
1.5.20	SR MM ³ /te	0.94 (insitu) 1.40 (working) (as on 01.04.2021)	1.06 (insitu) 1.50 (working) (as on 01.04.2022)
1.5.21	Mining Technology	Shovel-Dumper and Surface miner-front end loader-dumper	Shovel-Dumper and Surface miner-front end loader-dumper
1.5.22	Coal Beneficiation envisaged	Beneficiation not envisaged	Beneficiation not envisaged
1.5.23	Handling of Rejects	NA	NA
1.5.24			
1.	Excavation Area	583.752	614.722
2.	Top Soil Dump	-	-
3.	External Dump	-	-
4.	Safety Zone	5.747	6.163
5.	Embankment	12.52	12.520
6.	Infrastructure area	36.322	25.319
7.	Green Belt		
8.	Garland drain		
9.	Undisturbed Area (Blasting danger zone & other future Expn area)	-	-
10.	Total Lease area	638.341	658.724

11.	Residential colony, R&R, other area for road diversion and railway siding (may vary in actual)	149.57	149.57**
	Total Project area	787.911	808.294
1.5.25	Reasons for revision	<ul style="list-style-type: none">• Change in quarry excavation area and project area• Change in mineable reserve, life and stripping ratio• Change in production – rate, built up and schedule	
<i>Note: * Production of Coal & OB value has been assessed considering the coal target as communicated by MCL.</i> <i>** This may actually vary as per the requirement of the company, i.e. MCL.</i>			

Chapter – 2

EXPLORATION, GEOLOGY, SEAM SEQUENCE, COAL QUALITY AND RESERVE

	Particulars	Details															
2.1	DETAILS OF THE BLOCK																
2.1.1	Particulars of adjacent blocks: North, South, East, West	North: North of Arkhapal-Srirampur Block and Arkhapal-A Block in rest of the area.	South: Lingaraj Block and part of Ananta Extn. Block.	East: Sakhigopal-A coal block Fault F11-F11 with straightening in the north and south.	West: Ananta Exp OCP & Subhadra east coal block.												
2.1.2	Location of the Block District/State	Angul district, Odisha															
2.1.3	Area of the Block “Ha”	577 Ha (Bhubaneswari coal block) 1455 Ha (combined Bhubaneswari, Sakhigopal-A, Arkhapal-A coal blocks)															
2.1.4	Area of the geological block projectised “in Ha” (Area of the geological block considered for liquidation of coal reserve)	658.724 Ha (6.58 sq.km)															
2.1.5	Balance area yet to be projectised “Ha”	796.276															
2.1.6	Likely Reserve in the area yet to be projectised “Mte”	around 1437.25															
2.1.7	Co-ordinates of the Block Boundary	<table><tr><th colspan="3">Co-ordinates of the Block Boundary</th></tr><tr><td>ID</td><td>Latitude</td><td>Longitude</td></tr><tr><td>1</td><td>20°57’5 9” N</td><td>85°09’10” E</td></tr><tr><td>2</td><td>20°58’43” N</td><td>85°11’37” E</td></tr></table>				Co-ordinates of the Block Boundary			ID	Latitude	Longitude	1	20°57’5 9” N	85°09’10” E	2	20°58’43” N	85°11’37” E
Co-ordinates of the Block Boundary																	
ID	Latitude	Longitude															
1	20°57’5 9” N	85°09’10” E															
2	20°58’43” N	85°11’37” E															
2.1.8	The project area, lease area and geological block area in “Ha” shall also be envisaged.	Geological block area: 1455 Ha (<i>Figure 2.1</i>) Lease area: 658.724* Ha Project area : around 808.294* Ha (includes *20.383 Ha of non-diverted forest area under process of diversion)															
2.1.9	KML file of the proposed lease and geological block	Included in plates															

2.1.10	Whether the proposed project area is confined within the allotted block boundary, if not, the reason for deviation from allotted block boundary, may be given	Mine excavation area falls within allotted block.
2.1.11	If the project area extends outside the allotted block boundary, confirmation about non-occurrence of coal/lignite in the area under reference needs to be furnished	NA
2.1.12	Type of the project (Operating/under implementation) and year of starting	Opencast Coal mining under operation and started in 2006-07.

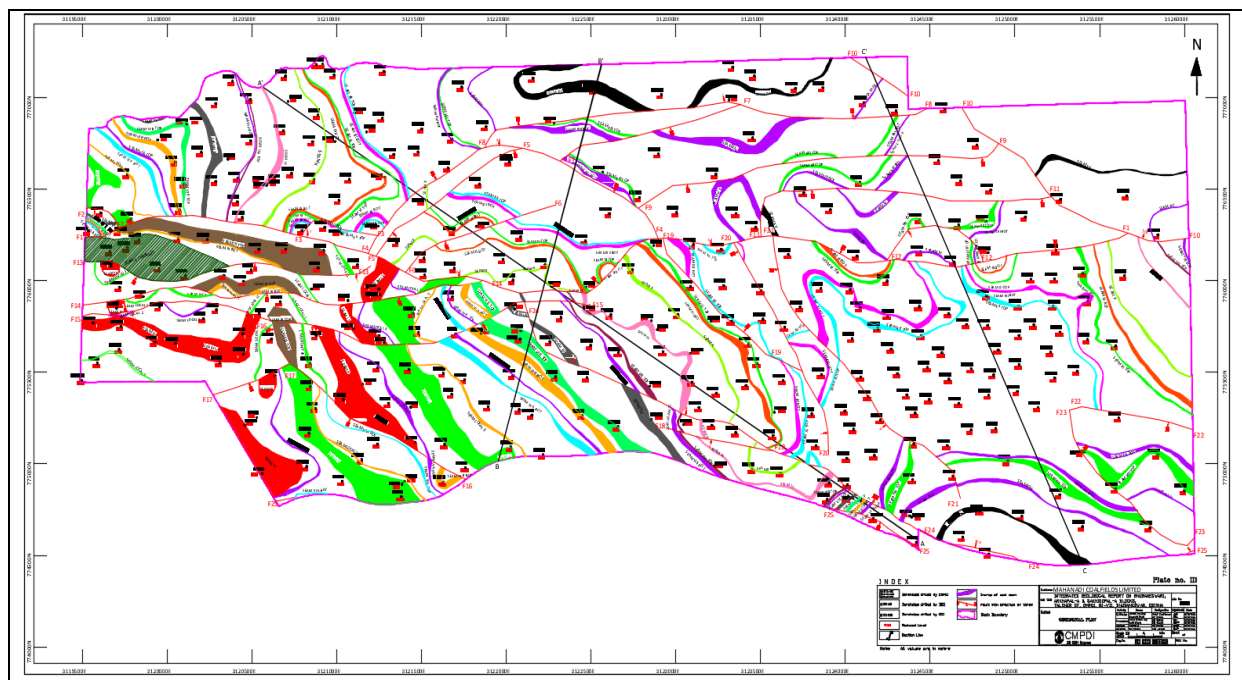


Figure 2.1 : Plan showing the Geological Block boundary

2.2 EXPLORATION, GEOLOGY AND ASSESSMENT OF RESERVE

This integrated block is located in the eastern part of the Talcher coalfield in Odisha state. It spans over an area of 14.55 sq. km between Latitude 20°57'47.779" & 20°59'19.442" North and Longitude 85°08'48.990" & 85°12'36.312" East. The block is covered under Survey

of India Toposheet No.F45T1 on R.F. 1:50000 and special toposheets nos. D1, D2, E1 & E2 on R.F. 1:10000 and falls within Angul district.

The GR of Integrated Bhubaneswari, Arkhapal-A and Sakhigopal-A block was submitted in December 2016.

The limits of integrated block in terms of cardinal points is given below:

Boundary	Limit	Cardinal Points
East	Part of Western boundary of Sakhigopal-B and Northern Extension Block	NE 3126002.47717, 776984.89901
West	Eastern boundary of Subhadra East	SW 3119486.67591 775446.49114
North	Southern boundary of North of Arkhapal-Srirampur block	NW 3119539.58119 776829.76106
South	Northern boundary of Lingaraj Block and part of northern boundary of Ananta Extension (Ext) Block	SE 3126061.13781 774509.52601

The total quantum of exploratory drilling for coal carried out in the integrated block is provided in the following table in Table 2.1.

Table 2.1

Agency wise boreholes drilled within the block boundary of Integrated GR

Agency	Series of Borehole	No. of boreholes	Year of drilling	Total Meterage	Remarks
CMPDI	CMTL	199	MARCH, 1984 TO MAY, 2011	37046.70	LITHOLOGICAL DATA OF BH NO. CMTL-124, 178, 429, 433, 434, 435, 438 NOT AVAILABLE
	CMTS	67		17876.60	
	CTAR	34		7252.7	
	CMTD	01		482.25	
MECL	METAX	01		206.00	
DGO	DGB	21		4892.15	
GSI	TCS	01		464.70	
		324		68221.10	

2.2.1 REGIONAL GEOLOGICAL SET UP OF THE AREA, LOCAL GEOLOGY, STRUCTURE, STRATIGRAPHIC SEQUENCE, CHARACTERISTICS OF THE LITHO-LOGICAL UNITS (COAL SEAMS/PARTINGS/OVERBURDEN)

Barakar and Karharbari are the two coal bearing formations in the block with Barakar being the store house of majority of coal seams (II to XV).

The sedimentary strata of this block are recent sediments, Barakar, Karharbari and Talchir Formations lying over Pre-Cambrian metamorphic basements. The geological succession of the block is tabulated below:

Table-2.2

Geological succession, Integrated Arkhupal-A, Bhubaneswari and Sakhigopal- Block, Talcher coalfield

Group	Age	Formation	Depth of Occurrence (m)		Lithology
			Min	Max	
	Recent	Recent deposits	0.00	15.25 (CMTL-188)	Soil, Sub-soil etc.
GONDWANA SUPER GROUP	Lower Permian	Barakar Formation	26.40 (CMTL-430)	393.25 (CMTD-029)	Medium to coarse grained greyish feldspathic sandstone, grey to dark grey shale and coal seams XV to IIB in descending order with oligomictic conglomerate (around 40m) at bottom.
	Lower Permian	Karharbari Formation	62.09 (CMTL-111)	163.15 (TCS - 002)	Pale brownish yellow colored massive medium to coarse grained sandstone, containing clasts of Talchir shale and coal seams I (in 5 to 6 splits)
	Upper Carboniferous to Lower Permian	Talchir Formation	Not encountered in BH.	-	Diamictite, sandstone, needle shale, turbidite, rhythmites and varves with khaki green tint.
Unconformity					
	Archaean to Lower Proterozoic	Pre-Cambrian Metamorphics	Not encountered in borehole		Granites, gneisses and associated supracrustals.

2.2.2 LOCAL GEOLOGY, STRUCTURE, STRATIGRAPHIC SEQUENCE, CHARACTERISTICS OF THE LITHO-LOGICAL UNITS (COAL SEAMS/ PARTINGS/ OVERBURDEN)

GEOLOGICAL STRUCTURE

Mostly soil, alluvium or weathered mantle cover the area in succession. As such, the geological features of the block are interpreted mainly on sub-surface data. The sub-surface borehole data as well as floor contour and cross-sections across the block reveal that the block is traversed by 25 faults, trending both east-west and northwest-southeast. Some east-west trending faults dip northerly and some southerly.

The northwest-southeast trending faults also dip both ways. There is one major east-west trending fault F_1 - F_1 which almost cuts across the block in the central portion, which is dipping towards north and has a varying throw of around 150 m to 10 m. There is also another major fault F_{24} - F_{24} in the southeastern boundary of the block, whose throw varies from 180 metre to almost nil within a short distance. This fault is continuing from adjacent Lingaraj block where its throw is around 250 metres. All other faults are minor having an average throw of around 20 to 30 metres throw. Most of the faults are truncated by other faults while some faults die out. The central and western part of the block is traversed by more number of faults and so the structure in this portion is complicated. Truncation of faults against other faults and block boundary forms the basis of sector formation for reserve estimation in the block. The data of the adjacent block has been fully utilized for ensuring the continuity of the seams, nomenclature, structural continuity, thickness and parting between the seams.

The block is traversed by 25 faults viz. F_1 - F_1 to F_{25} - F_{25} . While 7 no. of faults throw northerly with slight variations, rest 18 of the faults throw southerly with minor variations. Except faults F_1 - F_1 , F_{10} - F_{10} & F_{24} - F_{24} , rest of the faults have low to medium magnitude of throw.

The faults extending from adjacent blocks have been tallied with the structural interpretation within the block. Since 25 faults have been deciphered, the nomenclatures of the faults have been given afresh following certain pattern.

STRIKE AND DIP

The structure of the block is complicated as the entire block is traversed by 25 nos. of faults. The E-W trending F1-F1 fault which passes through the entire length divides the block into two sectors i.e. north of F1-F1 and south F1-F1. The Strike of the formation vary considerably as we move from west to east. The strike is NW to SE in the west whereas when we move towards east, the strike gradually swings to NE to SW i.e. on the southern side of F1-F1. There is also striking change in the dip of formation on the both sides of F1-F1 in the eastern part of the block. Towards north of F1-F1, the formation dips towards north whereas in the south, it dips towards south. In the central and eastern portion i.e. on the northern side of faults F1-F1, the strike becomes almost E-W. The gradient of the seams generally varies from 1 in 8 to 1 in 30 with local variations

SEQUENCE OF COAL SEAMS AND ITS DESCRIPTION

In Integrated block, the Karharbari Formation contains seam I and Barakar Formations contain seam XV to II Bottom. Altogether, 31 nos. of seams / sections are reported in Barakar Formation. Among these, seam II TOP, II COMB, V, III COMB, IV and IV+LOC 1 are the most potential coal horizons in this block.

This integrated block is covered by soil of thickness varying generally from 0.6 metres to 8.6 metres. It consists of sandy soil, clay and lateritic soil.

The general thickness of weathered mantle ranges from around 3.3 metres to 13.6 metres and consists of laterite, sandstone, sandy shale, intercalation of shale and sandstone, carbonaceous shale etc.

SEAM XV

Seam XV is the youngest coal seam in the block. Full seam intersection of seam XV has been encountered in 7 boreholes. The maximum thickness of the seam XV is 6.36 metres and its maximum depth of occurrence is 32.45 metres. The seam is interbanded in nature. Determined Proximate analysis data is not available for any of the boreholes drilled in

this block. But the Moisture, Ash & GCV values have been calculated on the basis of approximate M100 values taken from adjacent block. The proximate analysis on 60% RH and 40°C of seam XV on I₁₀₀ sample shows moisture%, and ash% varying from 6.1 to 6.5 & 44.9 to 47.7 respectively. The GCV varies from 3179 kcal/kg to 3384 kcal/kg. The grade varies from G13 to G14 and the general grade of the seam is G14. This is the topmost seam in the block with a total of 2.773 MT of net proved resource (0.15% of total net proved resource). Resources are maximum in the GCV band of G-14.

SEAM XIII TOP

Full seam intersection of seam XIII TOP has been occurred in 39 boreholes. The maximum thickness of the seam XIII TOP is 7.14 metres and its maximum depth of occurrence is 69.04 metres. The seam is less interbanded and contains mostly less than 1 metre in-seam dirt bands. The proximate analysis on 60% RH and 40°C of seam XIII on I₁₀₀ sample shows moisture%, ash% and volatile matter% as 4.3% to 9.5%, 20.2% to 57.6% and 30.1% to 30.1%. The GCV varies from 2984 kcal/kg to 5272 kcal/kg. The grade varies from G7 to G17. A total of 5.985 MT of net proved resource has been estimated for seam XIII TOP in this block. This is about 0.32% of total estimated net proved resource of the entire block. Out of this, 2.322 MT fall in the category of G-15 band and 2.302 MT in G-14 category.

SEAM XIII BOT

Full seam intersection of seam XIII BOT has been occurred in 44 boreholes. The maximum thickness of the seam XIII BOT is 5.94 metres and its maximum depth of occurrence is 72.70 metres. The seam is less interbanded and contains mostly less than 1 metre in-seam dirt bands except few boreholes which contain more than 1 m dirt bands. The proximate analysis on 60% RH and 40°C of seam XIII BOT on I₁₀₀ sample shows moisture%, ash% and volatile matter% as 4.9% to 6.5%, 42.6% to 54.2% and 24.3% to 24.3%. The GCV varies from 2742 kcal/kg to 3600 kcal/kg. The grade varies from G13 to G16 and the general grade of the seam is G13 to G15. Total estimated net proved resource comes to 4.551 MT for XIII BOT in this block. This is about 0.25% of total net proved resource of the block. Out of this 4.551 MT, 1.661 MT falls in G14 category, 1.436 in G13 Category and 1.354 in G15 category.

SEAM XII TOP

Full seam intersection of seam XII TOP has been occurred in 44 boreholes. The maximum thickness of the seam XII TOP is 2.41 metres and its maximum depth of occurrence is 125.72 metres. The seam is less interbanded and contains only less than 1 metre inseam dirt bands. The proximate analysis on 60% RH and 40°C of seam XII TOP on I100 sample shows moisture% and ash% as 4.8% to 5.4% and 50.6 to 55.2. The GCV varies from 2662 kcal/kg to 3008 kcal/kg. The grade varies from G15 TO G16 and the general grade of the seam is G15 to G16. A total of 1.027MT of net proved resource has been estimated for this seam in this block, which is about 0.06% of total estimated resource of the block. Out of this, 0.504 MT falls in the G16 band.

SEAM XII BOT

Full thickness of seam XII BOT has been encountered in 119 boreholes. The maximum thickness of the seam XII BOT is 3.12 metres and its maximum depth of occurrence is 126.27 metres. The seam is less interbanded and contains mostly less than 1 metre inseam dirt bands. The proximate analysis on 60% RH and 40°C of seam XII BOT on I100 sample shows moisture%, ash% and volatile matter% as 4.6% to 9.5%, 15.5% to 51.4% and 23.7% to 34.4%. The GCV varies from 3005 kcal/kg to 5714 kcal/kg. The grade varies from G15 to G6 and the general grade of the seam is G7 to G13. A total of 6.871 MT of net proved resource has been estimated for this seam in this block, which is about 0.37% of total estimated resource of the block. Out of this, 1.082 MT falls in the G12 band & 1.041 MT falls in G8 band.

SEAM XI TOP

Full seam intersection of seam XI TOP has been occurred in 144 boreholes. The maximum thickness of the seam XI TOP is 3.01 metres and its maximum depth of occurrence is 141.86 metres. The seam is less interbanded and devoid of more than 1 metre thick inseam dirt bands. The proximate analysis on 60% RH and 40°C of seam XI TOP on I100 sample shows moisture%, ash% and volatile matter% as 4.3% to 7.0%, 31.2% to 55.3% and 21.0% to 29.0%. The GCV varies from 2711 kcal/kg to 4600 kcal/kg. The grade varies from G9 to G16 and the general grade of the seam is G10 to G14. A total of 3.68 MT of net

proved resource has been estimated for this seam in this block, which is about 0.20 % of total estimated resource of the block. Out of this, 0.767 MT falls in the G13 band.

SEAM XI BOT

Full seam intersection of seam XI BOT has been occurred in 151 boreholes. The maximum thickness of the seam XI BOT is 3.76 metres and its maximum depth of occurrence is 145.89 metres. The seam is devoid of more than 1 metre in-seam dirt bands. The proximate analysis on 60% RH and 40°C of seam XI BOT on I100 sample shows moisture%, ash% and volatile matter% as 4.6% to 9.9%, 17.1% to 56.4% and 26.9% to 28.8%. The GCV varies from 2578 kcal/kg to 5505 kcal/kg. The grade varies from G6 to G16 and the general grade of the seam is G10 to G14. A total of 15.691 MT of net proved resource has been estimated for this seam in this block, which is about 0.85 % of total estimated resource of the block. Out of this, 4.05 MT falls in the G12 band, 3.5 MT in G13 band, 2.94 MT in G14 band & 2.226 MT in G11 band.

SEAM X

Full seam intersection of seam X has been occurred in 169 boreholes. The maximum thickness of the seam X is 3.75 metres and its maximum depth of occurrence is 152.70 metres. The seam is less interbanded and devoid of more than 1 metre thick in-seam dirt bands. The proximate analysis on 60% RH and 40°C of seam X on I100 sample shows moisture%, ash% and volatile matter% as 5.4% to 9.8%, 17.7% to 50.5% and 26.3% to 32.8%. The GCV varies from 3017 kcal/kg to 5704 kcal/kg. The grade varies from G6 to G15 and the general grade of the seam is G8 to G12. A total of 12.428 MT of net proved resource has been estimated for this seam in this block, which is about 0.67 % of total estimated resource of the block. Out of this, 3.681 MT falls in the G10 band, 2.42 MT in G9 band, 1.95 in G11 band and 1.671 in G8 band.

SEAM IX

Full seam intersection of seam IX has been occurred in 187 boreholes. The maximum thickness of the seam IX is 4.24 metres and its maximum depth of occurrence is 172.02 metres. Some boreholes of seam IX has more than 1 metre in-seam dirt bands. The

proximate analysis on 60% RH and 40°C of seam IX on I100 sample shows moisture%, ash% and volatile matter% as 4.2% to 9.2%, 22.3% to 58.1% and 21.7% to 29.5%. The GCV varies from 2447 kcal/kg to 5118 kcal/kg. The grade varies from G8 to G17 and the general grade of the seam is G10 to G14. A total of 10.264 MT of net proved resource has been estimated for this seam in this block, which is about 0.56 % of total estimated resource of the block. Out of this, 2.473 MT falls in the G13 band, 2.193 in G12 band and 2.051 in G11 band.

SEAM VIII TOP

Full seam intersection of seam VIII TOP has been occurred in 167 boreholes. The maximum thickness of the seam VIII TOP is 4.01 metres and its maximum depth of occurrence is 177.07 metres. The seam is less interbanded and contains mostly less than 1 metre in-seam dirt bands. The proximate analysis on 60% RH and 40°C of seam VIII TOP on I100 sample shows moisture%, ash% and volatile matter% as 4.2% to 8.5%, 18.7% to 54.9% and 26.9% to 29.2%. The GCV varies from 2594 kcal/kg to 5439 kcal/kg. The grade varies from G7 to G16 and the general grade of the seam is G10 to G14. A total of 10.286 MT of net proved resource has been estimated for this seam in this block, which is about 0.56 % of total estimated resource of the block. Out of this, 2.796 MT falls in the G12 band, 2.304 in G13 band, 2.162 in G14 band and 1.57 in G11 band.

SEAM VIII BOT

Full seam intersection of seam VIII BOT has been occurred in 177 boreholes. The maximum thickness of the seam VIII BOT is 3.44 metres and its maximum depth of occurrence is 179.63 metres. The seam is interbanded and contains more than 1 metre in-seam dirt bands in some boreholes. The proximate analysis on 60% RH and 40°C of seam VIII BOT on I₁₀₀ sample shows moisture%, ash% and volatile matter% as 4.2% to 8.5%, 18.7% to 54.9% and 26.9% to 29.2%. The GCV varies from 2778 kcal/kg to 5558 kcal/kg. The grade varies from G6 to G16 and the general grade of the seam is G9 to G13. A total of 5.204 MT of net proved resource has been estimated for this seam in this block, which is about 0.28 % of total estimated resource of the block. Out of this, 1.013 MT falls in the G10 band, 0.959 in G9 band and 0.896 in G13 band.

SEAM VII

Full seam intersection of seam VII has been occurred in 201 boreholes. The maximum thickness of the seam VII is 10.09 metres and its maximum depth of occurrence is 187.69 metres. The seam is interbanded and contains more than 1 metre in-seam dirt bands in some boreholes. The proximate analysis on 60% RH and 40°C of seam VII on I₁₀₀ sample shows moisture%, ash% and volatile matter% as 5.4% to 10.3%, 11.8% to 42.9% and 24.5% to 35.3%. The GCV varies from 3295 kcal/kg to 6339 kcal/kg. The grade varies from G4 to G14 and the general grade of the seam is G8 to G12. A total of 72.959 MT of net proved resource has been estimated for this seam in this block, which is about 3.96 % of total estimated resource of the block. Out of this, 17.578 MT falls in the G10 band, 16.259 MT in G9 band, 13.82 in G8 band, 13.13 in G11 band & 5.398 in G 7 band.

SEAM VI B TOP

Full seam intersection of seam VI B TOP has been occurred in 202 boreholes. The maximum thickness of the seam VI B TOP is 9.70 metres and its maximum depth of occurrence is 206.79 metres. The seam is interbanded and contains more than 1 metre in-seam dirt bands in some boreholes. The proximate analysis on 60% RH and 40°C of seam VI B TOP on I100 sample shows moisture%, ash% and volatile matter% as 3.6% to 9.1%, 23.2% to 63.5% and 20.4% to 26.6%. The GCV varies from 2056 kcal/kg to 5048 kcal/kg. The grade varies from Ungraded to G8 and the general grade of the seam is G12 to G16. A total of 40.883 MT of net proved resource has been estimated for this seam in this block, which is about 2.22 % of total estimated resource of the block. Out of this, 10.829 MT falls in the G14 band, 10.026 MT in G15 band, 9.107 in G13 band and 7.053 in G16 band.

SEAM VI B BOT

Full seam intersection of seam VI B BOT has been occurred in 210 boreholes. The maximum thickness of the seam VI B BOT is 9.95 metres and its maximum depth of occurrence is 212.63 metres. The seam is less interbanded and contains mostly less than 1 metre in-seam dirt bands but in some boreholes the in-seam band more than 1 m thickness occurs. The proximate analysis on 60% RH and 40°C of seam VI B BOT on I100 sample shows moisture%, ash% and volatile matter% as 3.1% to 8.9%, 24.7% to 67.5% and 20.8% to 28.8%. The GCV varies from 1752 kcal/kg to 5091 kcal/kg. The grade varies from

Ungraded to G8 and the general grade of the seam is G11 to G15. A total of 63.604 MT of net proved resource has been estimated for this seam in this block, which is about 3.45 % of total estimated resource of the block. Out of this, 18.443 MT falls in the G13 band, 16.764 in G12 band, 13.64 in G14 band and 7.185 in G11 band.

SEAM VI A TOP

Full seam intersection of seam VI A TOP has been occurred in 72 boreholes. The maximum thickness of the seam VI A TOP is 5.71 metres and its maximum depth of occurrence is 207.41 metres. The seam is less interbanded and contains mostly less than 1 metre in-seam dirt bands. The proximate analysis on 60% RH and 40°C of seam VI A TOP on I100 sample shows moisture%, ash% and volatile matter% as 5.1% to 10.7%, 11.5% to 52.6% and 25.3% to 30.2%. The GCV varies from 2578 kcal/kg to 5916 kcal/kg. The grade varies from G16 to G5 and the general grade of the seam is G10 to G14. A total of 8.615 MT of net proved resource has been estimated for this seam in this block, which is about 0.47 % of total estimated resource of the block. Out of this, 2.659 MT falls in the G12 band, 1.833 MT in G11 band, 1.743 in G13 band and 1.308 in G10 band.

SEAM VI A

Full seam intersection of seam VI A has been occurred in 24 boreholes. The maximum thickness of the seam VI A is 10.26 metres and its maximum depth of occurrence is 156.31 metres. The seam is less interbanded and contains mostly less than 1 metre in-seam dirt bands except three boreholes. The proximate analysis on 60% RH and 40°C of seam VI A on I₁₀₀ sample shows moisture% and ash% as 5.2% to 7.7% and 33.5% to 52.2. The GCV varies from 2886 kcal/kg to 4282 kcal/kg. The grade varies from G15 to G11 and the general grade of the seam is G14 to G11. A total of 11.523 MT of net proved resource has been estimated for this seam in this block, which is about 0.62 % of total estimated resource of the block. Out of this, 4.766 MT falls in the G12 band, 4.032 MT in G13 band and 1.535 in G11 band.

SEAM VI A BOT

Full seam intersection of seam VI A BOT has been occurred in 72 boreholes. The maximum thickness of the seam VI A BOT is 6.75 metres and its maximum depth of occurrence is 214.12 metres. The seam is less interbanded and contains mostly less than 1 metre inseam dirt bands except few boreholes. The proximate analysis on 60% RH and 40°C of seam VI A BOT on I100 sample shows moisture%, ash% and volatile matter% as 4.6% to 10.7%, 11.5% to 56.4% and 23.3% to 30.2% respectively. The GCV varies from 2578 kcal/kg to 5916 kcal/kg. The grade varies from G5 to G16 and the general grade of the seam is G14. A total of 63.604 MT of net proved resource has been estimated for this seam in this block, which is about 3.45 % of total estimated resource of the block. Out of this, 18.443 MT falls in the G13 band, 16.764 MT in G13 band, 13.64 in G14 band and 7.185 in G11 band.

SEAM LOC 3

Full seam intersection of seam LOC 3 has been occurred in 176 boreholes. The maximum thickness of the seam LOC 3 is 3.78 metres and its maximum depth of occurrence is 230.00 metres. The seam is less interbanded and contains mostly less than 1 metre inseam dirt bands. The proximate analysis on 60% RH and 40°C of seam LOC 3 on I100 sample shows moisture% and ash% as 3.8% to 8.6% and 26.5% to 62.0% respectively. The GCV varies from 2168 kcal/kg to 4810 kcal/kg. The grade varies from Ungraded to G9 and the general grade of the seam is G16 to G12. A total of 6.208 MT of net proved resource has been estimated for this seam in this block, which is about 0.34 % of total estimated resource of the block. Out of this, 1.601 MT falls in the G15 band and 1.147 MT in G14 band.

SEAM V

Full seam intersection of seam V has been occurred in 214 boreholes. The maximum thickness of the seam V is 19.50 metres and its maximum depth of occurrence is 231.78 metres. The seam is interbanded and some boreholes contain more than 1 metre inseam dirt bands. The proximate analysis on 60% RH and 40°C of seam V on I100 sample shows moisture%, ash% and volatile matter% as 4.3% to 8.1%, 26.4% to 56.4% and 23.8% to 28.1%. The GCV varies from 2622 kcal/kg to 4892 kcal/kg. The grade varies from G16 to

G9. The general grade is G11 to G14. A total of 222.028 MT of net proved resource has been estimated for this seam in this block, which is about 12.04 % of total estimated resource of the block. Out of this, 65.167 MT falls in the G12 band, 55.741 MT in G13 band, 42.09 in G11 band and 30.273 in G14 band.

SEAM LOC 2

Full seam intersection of seam LOC 2 has been occurred in 209 boreholes. The maximum thickness of the seam LOC 2 is 5.04 metres and its maximum depth of occurrence is 246.05 metres. The seam is less interbanded and contains mostly less than 1 metre in-seam dirt bands except few boreholes. The proximate analysis on 60% RH and 40°C of seam LOC 2 on I100 sample shows moisture%, ash% and volatile matter% as 3.9% to 8.6%, 24.3% to 57.1% and 20.6% to 35.3%. The GCV varies from 2614 kcal/kg to 5133 kcal/kg. The grade varies from G16 to G8. The general grade is G14 to G10. A total of 25.988 MT of net proved resource has been estimated for this seam in this block, which is about 1.41 % of total estimated resource of the block. Out of this, 6.334 MT falls in the G15 band, 5.695 MT in G13 band, 5.28 in G12 band, 3.947 in G14 band and 2.752 in G11 band.

SEAM IV

Full seam intersection of seam IV has been occurred in 139 boreholes. The maximum thickness of the seam IV is 19.62 metres and its maximum depth of occurrence is 253.39 metres. The seam is less interbanded and contains mostly less than 1 metre in-seam dirt bands except few boreholes. The proximate analysis on 60% RH and 40°C of seam IV on I100 sample shows moisture%, ash% and volatile matter% as 4.5% to 7.2%, 24.5% to 49.1% and 22.5% to 32.3%. The GCV varies from 3280 kcal/kg to 5202 kcal/kg. The grade varies from G14 to G7 and the general grade of the seam is G10 to G13. A total of 153.299 MT of net proved resource has been estimated for this seam in this block, which is about 8.31 % of total estimated resource of the block. Out of this, 50.774 MT falls in the G10 band, 41.181 MT in G11 band, 39.515 in G12 band and 11.937 in G9 band.

SEAM LOCAL 1

Full seam intersection of seam LOCAL 1 has been occurred in 149 boreholes. The maximum thickness of the seam LOCAL 1 is 5.32 metres and its maximum depth of occurrence is 267.40 metres. The seam is less interbanded and contains mostly less than 1 metre in-seam dirt bands. The proximate analysis on 60% RH and 40°C of seam LOCAL 1 on I100 sample shows moisture%, ash% and volatile matter% as 3.8% to 8.1%, 16.1% to 55.4% and 21.8% to 34.6%. The GCV varies from 2789 kcal/kg to 5861 kcal/kg. The grade varies from G16 to G5 and the general grade of the seam is G8 to G13. A total of 16.985 MT of net proved resource has been estimated for this seam in this block, which is about 0.92 % of total estimated resource of the block. Out of this, 4.435 MT fall in G11 band, 3.387 MT in the G9 band, 2.903 MT in G10 band, and 1.672 in G12 band.

SEAM IV+LOC 1

Full seam intersection of seam IV+LOC 1 has been occurred in 90 boreholes. The maximum thickness of the seam IV+LOC 1 is 24.66 metres and its maximum depth of occurrence is 245.80 metres. The seam is less interbanded and contains mostly less than 1 metre in-seam dirt bands except few boreholes. The proximate analysis on 60% RH and 40°C of seam IV+LOC 1 on I100 sample shows moisture%, ash% and volatile matter% as 5.0% to 7.5%, 26.9% to 47.7% and 24.7% to 29.1% respectively. The grade varies from G14 to G8. The general grade is G12 to G9. A total of 92.484 MT of net proved resource has been estimated for this seam in this block, which is about 5.02 % of total estimated resource of the block. Out of this, 32.045 MT falls in the G10 band, 25.738 MT in G11 band, 16.198 in G9 band and 15.302 in G12 band.

SEAM III TOP

Full seam intersection of seam III TOP has been occurred in 58 boreholes. The maximum thickness of the seam III TOP is 13.73 metres and its maximum depth of occurrence is 278.95 metres. The seam is less interbanded and contains mostly less than 1 metre in-seam dirt bands, except in few boreholes where it contains in-seam dirt band of more than 1 metre thickness. The proximate analysis on 60% RH and 40°C of seam III TOP on I₁₀₀ sample shows moisture%, ash% and volatile matter% as 4.8% to 7.6%, 21.1% to 44.5% and

25.2 to 28.1 respectively. The GCV varies from 3640 kcal/kg to 5464 kcal/kg. The grade varies from G7 to G13. The general grade is G9 to G12. A total of 61.76 MT of net proved resource has been estimated for this seam in this block, which is about 3.35 % of total estimated resource of the block. Out of this, 23.159 MT falls in the G10 band, 16.481 MT in G11 band and 14.346 in G9 band.

SEAM III BOTTOM

Full seam intersection of seam III BOTTOM has been occurred in 58 boreholes. The maximum thickness of the seam III BOTTOM is 5.75 metres and its maximum depth of occurrence is 291.61 metres. The seam is less interbanded and practically devoid of more than 1 metre dirt band except few boreholes where the in-seam dirt band thickness exceeds 1 m. The proximate analysis on 60% RH and 40°C of seam III BOTTOM on I100 sample shows moisture%, ash% and volatile matter% as 4.0% to 7.5%, 21.0% to 53.0% and 20.9% to 31.4% respectively. The GCV varies from 2972 kcal/kg to 5575 kcal/kg. The grade varies from G6 to G15. The general grade is G8 to G11. A total of 16.853 MT of net proved resource has been estimated for this seam in this block, which is about 0.91 % of total estimated resource of the block. Out of this, 5.645 MT falls in the G10 band, 5.271 MT in G10 band and 3.113 in G11 band.

SEAM III COMBINED

Full seam intersection of seam III BOTTOM has been occurred in 192 boreholes. The maximum thickness of the seam III COMB 16.84 metres and its maximum depth of occurrence is 272.42 metres. The seam is less interbanded and practically devoid of more than 1 metre dirt band except few boreholes where the in-seam dirt band thickness exceeds 1 m. The proximate analysis on 60% RH and 40°C of seam III BOTTOM on I100 sample shows moisture%, ash% and volatile matter% as 3.8% to 6.9%, 22.9% to 47.8% and 24.6% to 29.9% respectively. The GCV varies from 3431 kcal/kg to 5425 kcal/kg. The grade varies from G7 to G13. The general grade is G8 to G11. A total of 174.704 MT of net proved resource has been estimated for this seam in this block, which is about 9.47 % of total estimated resource of the block. Out of this, 60.947 MT falls in the G10 band, 50.048 MT in G8 band, 35.869 in G11 band and 19.947 in G18 band.

SEAM II TOP

Full seam intersection of seam II TOP has been occurred in 161 boreholes. The maximum thickness of the seam II TOP is 44.99 metres and its maximum depth of occurrence is 304.08 metres. The seam is highly interbanded and contains non combustible dirt bands upto 14% of its thickness. The proximate analysis on 60% RH and 40°C of seam II TOP on I100 sample shows moisture, ash and volatile matter as 4.4% to 6.3%, 26.9% to 43.9% and 23.9% to 27.4% respectively. The GCV varies from 3745 kcal/kg to 5107 kcal/kg. The grade varies from G8 to G12. The general grade is G9 to G11. A total of 512.243 MT of net proved resource has been estimated for this seam in this block, which is about 27.78 % of total estimated resource of the block. Out of this, 232.601 MT falls in the G10 band, 148.352 MT in G11 band, 108.687 in G9 band and 22.603 in G12 band.

SEAM II BOTTOM

Full seam intersection of seam II BOTTOM has been occurred in 136 boreholes. The maximum thickness of the seam II BOTTOM is 5.86 metres and its maximum depth of occurrence is 335.75 metres. The seam has upto 5 numbers of in-seam dirt bands which constitutes about 39% of its thickness. The proximate analysis on 60% RH and 40°C of seam II BOTTOM on I100 sample shows moisture%, ash% and volatile matter% as 2.8% to 6.0% and 28.8% to 54.2% respectively. The GCV varies from 2238 kcal/kg to 5645 kcal/kg. The grade varies from G6 to G17 to E. The general grade is G9 to G13. A total of 27.172 MT of net proved resource has been estimated for this seam in this block, which is about 1.47 % of total estimated resource of the block. Out of this, 8.991 MT falls in the G10 band, 5.076 MT in G12 band and 3.281 in G9 band.

SEAM II COMB

Full seam intersection of seam II COMB has been occurred in 81 boreholes. The maximum thickness of the seam II COMB is 49.61 metres and its maximum depth of occurrence is 288.35 metres. The seam has upto 22 numbers of in-seam dirt bands which constitutes about 16% of its thickness. The proximate analysis on 60% RH and 40°C of seam II COMB on I100 sample shows moisture%, ash% and volatile matter% as 4.2% to 6.0%, 24.1% to 43.6% and 23.6% to 26.1% respectively. The GCV varies from 3750 kcal/kg

to 5414 kcal/kg. The grade varies from G7 to G112 to E. The general grade is G9 to G12. A total of 231.358 MT of net proved resource has been estimated for this seam in this block, which is about 12.55 % of total estimated resource of the block. Out of this, 117.971 MT falls in the G11 band, 38.01 MT in G10 band, 36.722 in G9 band and 24.708 in G12 band.

COAL RESOURCE ESTIMATION - COAL BEARING AREA OF THE BLOCK

The integrated block covers an area of 14.55 sq. kms. The correlation of coal seams in this integrated block has been established in accordance with that established in the earlier prepared GRs on Bhubaneswari, Arkhapal-A and Sakhigopal-A Blocks with minor modifications. The minor modification is due to recent change in the norms of inclusion of Low Carbonaceous Shale having ash plus moisture percentage of 65 within the seam. Seam II BOT to XV occurring in Barakar Formation are considered potential for quarriable prospect and the exploration was carried out for proving reserve upto seam II BOT. However, information on Seam-I is limited in this integrated block as only 26 boreholes have been drilled in Karharbari formation. The study on Seam-I needs further detailed exploration. In this block altogether 31 distinct splits/combination of Barakar Formation, including 4 local seams in ascending order viz, Seam-II BOT, II COMB, II TOP, L0, III BOT, III COMB, III TOP, Loc 1, IV+Loc 1, IV, Loc 2, V, Loc 3, VI A TOP, VI A, VI A BOT, VI B TOP, VI B BOT, VII, VIII TOP, VIII BOT, IX, X, XI TOP, XI BOT, XII TOP, XII BOT, XIII TOP, XIII BOT, XIV, and XV. Out of these, 1 local coal seam L0 has been identified as either not so potential or having localized development and hence, is not dealt in detail. The remaining 30 coal seams of Barakar Formation from seams II BOT to XV including three locals Loc 1, Loc 2, Loc 3 are studied and assessed in detail in the present report.

Seam folio plans showing block boundary, seam incrops, effective thickness, in-seam dirt band if any, iso-chors and iso-grads (GCV band based) on I100 samples were generated and plotted through MINEX 6.4.2 software and have been used as base for estimation of coal resources and also the volume of coal having less than 1 metre thickness, ungraded coal as well as in-seam dirt bands. For different Grade bands of coal, different input of prescribed specific gravity were taken in database. The intersections of all the grids such as effective thickness, GCV and in-seam dirt band with limit of seam thickness of 1m and above, seam incrop, fault and block boundary were taken as input data and put in database of MINEX through Seam Model /Detailed Resources Reporting operations menu of MINEX

6.4.2 software. From the above operation, seam-wise, grade-band wise total area of each seam, total coal volume, Gross coal resource and total volume of waste were calculated and output obtained on CSV format. The CSV data were further brought to EXCEL format and different tables were prepared as per requirement. A 10 % deduction has been made to account for unforeseen geological disturbances from Gross Proved Resource to obtain Net Proved Resources of the seams. Net Proved Geological Resources is shown in Figure 2.2.

QUALITY OF COAL SEAMS

The coal seams occurring in this integrated block are interbanded in nature. The coal is generally having high moisture, high ash and high volatile matter contents and belongs to sub-bituminous rank under non-coking coal category. Moisture %, Ash% and VM% on 60% RH & 40°C generally vary between 2.8–10.7 %, 11-65 % and 18-35 % respectively on I100 samples. Generally the grade of the coal seams varies from G9 - G12.

COAL RESERVES

Altogether 30 no. of coal seams of Barakar Formation, in descending order. The Barakar seams viz., II BOT to XV have been considered for OC potentiality. The major contribution of reserves comes from the seams viz., II TOP, II COMB, V, III COMB, IV, IV+LOC 1 & VII. For the Karharbari seams the reserves has not been estimated due to the scanty of data. A total of 1843.989 MT of Net Proved resource have been estimated for entire block. Out of this, some of the coal resources have already been mined out through Bhubaneswari OCP. The Barakar seams viz., II BOT to XV have been considered for OC potentiality. The major contribution of reserves comes from the seams viz., II TOP, II COMB, V, III COMB, IV, IV+LOC 1 & VII. For the Karharbari seams the reserves has not been estimated due to the scanty of data.

The resources are estimated for the entire block and placed under Proved category, and net Proved resource after making 10 % deduction from the gross Resource. Seam wise, GCV grade/band-wise and depth wise coal Resources are calculated.

STRIPPING RATIO

As such, volumes of total waste of 1713.8976 million cubic metres are worked out against total net proved coal resources of 1843.989 million tonnes with resultant Stripping Ratio around 0.9 cubic meters of waste per tonne of coal upto seam II BOT/II COMB for integrated block

SEAM	Grade-wise Net Proved Resources in million tonnes														Net Proved Resources (MT)	Seam-wise (%)
	G-4	G-5	G-6	G-7	G-8	G-9	G-10	G-11	G-12	G-13	G-14	G-15	G-16	G-17		
XV	0	0	0	0	0	0	0.215	0.308	0.192	0.323	1.735	0	0	0	2.773	0.15%
XIV	0	0	0	0	0	0.025	0.244	0.375	1.014	0.534	0.725	0.223	0.102	0.007	3.249	0.18%
XIII TOP	0	0	0	0.005	0.033	0.039	0.029	0.096	0.17	0.576	2.302	2.322	0.413	0	5.985	0.32%
XIII BOT	0	0	0	0	0	0	0	0	0.078	1.436	1.661	1.354	0.022	0	4.551	0.25%
XII TOP	0	0	0	0	0	0	0	0	0.006	0.014	0.026	0.271	0.504	0.206	1.027	0.06%
XII BOT	0	0	0.232	0.702	1.041	0.993	0.824	0.835	1.082	0.831	0.268	0.06	0.003	0	6.871	0.37%
XI TOP	0	0	0	0	0	0.028	0.547	0.524	0.487	0.767	0.38	0.683	0.264	0	3.68	0.20%
XI BOT	0	0	0	0.023	0.276	0.399	1.382	2.226	4.05	3.5	2.94	0.872	0.023	0	15.691	0.85%
X	0	0	0.051	0.509	1.671	2.42	3.681	1.95	1.411	0.614	0.107	0.014	0	0	12.428	0.67%
IX	0	0	0	0	0.15	0.594	1.069	2.051	2.193	2.473	1.022	0.308	0.248	0.156	10.264	0.56%
VIII TOP	0	0	0	0.021	0.043	0.17	0.631	1.57	2.796	2.304	2.162	0.516	0.073	0	10.286	0.56%
VIII BOT	0	0	0.005	0.041	0.308	0.959	1.013	0.84	0.803	0.896	0.249	0.078	0.012	0	5.204	0.28%
VII	0.082	0.219	0.733	5.398	13.82	16.26	17.578	13.13	4.461	1.022	0.233	0.024	0	0	72.959	3.96%
VIB TOP	0	0	0	0	0.013	0.076	0.167	0.752	2.801	9.107	10.829	10.026	7.053	0.059	40.883	2.22%
VI B BOT	0	0	0	0	0.065	0.476	1.794	7.185	16.764	18.443	13.64	4.218	0.926	0.093	63.604	3.45%
VI A TOP	0	0	0.006	0.058	0.194	0.367	1.308	1.833	2.659	1.743	0.447	0	0	0	8.615	0.47%
VI A BOT	0	0.008	0.022	0.032	0.619	0.485	1.438	3.663	4.299	3.438	3.693	3.982	1.635	0	23.314	1.26%
VI A	0	0	0	0	0	0	0	1.535	4.766	4.032	1.023	0.167	0	0	11.523	0.62%
LOCAL 3	0	0	0	0	0	0.059	0.1	0.257	0.652	0.981	1.147	1.601	0.756	0.655	6.208	0.34%
V	0	0	0	0	0	0.608	15.62	42.09	65.167	55.741	30.273	9.778	2.751	0	222.03	12.04%
LOCAL 2	0	0	0	0	0.059	0.512	1.132	2.752	5.28	5.695	3.947	6.334	0.277	0	25.988	1.41%
IV	0	0	0	0.012	1.944	11.94	50.774	41.181	39.515	7.456	0.48	0	0	0	153.3	8.31%
LOCAL 1	0	0.005	0.057	1.162	2.219	3.387	2.903	4.435	1.672	0.664	0.333	0.141	0.007	0	16.985	0.92%
IV + LOCAL 1	0	0	0	0	0.149	16.2	32.045	25.738	15.302	2.795	0.257	0	0	0	92.484	5.02%
III TOP	0	0	0	1.947	3.528	14.35	23.159	16.481	2.292	0.007	0	0	0	0	61.76	3.35%
III BOT	0	0	0.152	0.48	1.67	5.271	5.645	3.113	0.356	0.166	0	0	0	0	16.853	0.91%
III COMB	0	0	0	1.439	19.947	50.05	60.947	35.869	4.478	1.976	0	0	0	0	174.7	9.47%
II TOP	0	0	0	0	0	108.7	232.6	148.35	22.603	0	0	0	0	0	512.24	27.78%
II BOT	0	0	0	0	0	3.281	8.991	7	5.076	2.824	0	0	0	0	27.172	1.47%
II COMB	0	0	0	0.205	13.742	36.72	38.01	117.97	24.708	0	0	0	0	0	231.36	12.55%
ALL SEAMS	0.082	0.232	1.258	12.03	61.491	274.3	503.85	484.11	237.13	130.36	79.879	42.972	15.07	1.176	1843.989	100%
GRADE-WISE PERCENTAGE	0.00%	0.01%	0.07%	0.65%	3.33%	14.88%	27.32%	26.25%	12.86%	7.07%	4.33%	2.33%	0.82%	0.06%	100%	

Figure 2: Seam-wise, Grade-wise Net Proved Geological Resources of Bhubaneswari, Arkhapal A & Sakhigopal A blocks, Talcher Coalfield

OVERBURDEN

The overburden consists of soil, weathered mantle and argillaceous as well as arenaceous rocks. The parting between two seams consists of argillaceous and arenaceous rocks with thin coal /carbonaceous bands. Broadly, the overburden and parting above seam II BOT has been divided into 5 categories as follows:

- i) Soil, weathered mantle and overburden above all the seams which incrop within the block.
- ii) Parting between respective seam and next lower seam from XV to II BOT/II COMB in descending order.
- iii) Volume of dirt bands of above 1 meter thickness occurring within coal seams has been added to the overburden /parting lying above.
- iv) Volume of unworkable coal seams having thickness less than 1 meter.
- v) Volume of ungraded coal ($GCV \leq 2200$ K.cal /kg).

Overburden/waste for integrated block have been estimated to assess the stripping ratio and to take as an input for project planning. Following methodology has been adopted for estimation of overburden above all the seams and parting for respective coal seams upto seam II BOT/II COMB in descending order (Figure 3).

SEAM	TOTAL RESERVES (MT)	Volume of OB, PARTING & In seam band $\geq 1m$ (MCUM)	Volume of SEAM < 1M (MCUM)	Volume of Ungraded Coal (MCUM)	Total volume of Waste (MCUM)	Seam- wise stripping Ratio (CUM/T)	Successive Cumulative Reserves (MT)	Volume Of Successive Cumulative Waste (MCUM)	Successive cumulative Stripping Ratio (CUM/T)
XV	2.773	17.082042	0	0	17.082042	6.2	2.773	17.082042	6.2
XIV	3.249	41.142152	0	0	41.142152	12.7	6.022	58.224194	9.7
XIII TOP	5.985	47.8272	0	0	47.8272	8	12.007	106.051394	8.8
XIII BOT	4.561	9.361127	0	0	9.361127	2.1	16.558	115.412521	7
XII TOP	1.027	234.3307	0	0	234.330704	228.2	17.585	349.743225	19.9
XII BOT	6.871	19.671392	0	0	19.671392	2.9	24.456	369.414617	15.1
XI TOP	3.68	63.343228	0	0	63.343228	17.2	28.136	432.757845	15.4
XI BOT	15.691	18.766082	0	0	18.766082	1.2	43.827	451.523927	10.3
X	12.428	67.2616	0	0	67.2616	5.4	56.255	518.785527	9.2
IX	10.264	181.4411	0	0	181.441104	17.7	66.519	700.226631	10.5
VIII TOP	10.286	72.004048	0	0	72.004048	7	76.805	772.230679	10.1
VIII BOT	5.204	17.679914	0	0	17.679914	3.4	82.009	789.910593	9.6
VII	72.959	123.28881	0	0	123.288808	1.7	154.968	913.199401	5.9
VIB TOP	40.883	149.43976	0	0	149.43976	3.7	195.851	1062.63916	5.4
VI B BOT	63.604	37.213196	0	0.055061	37.268257	0.6	259.455	1099.90742	4.2
VI A TOP	8.615	79.985848	3.511502	0	83.49735	9.7	268.07	1183.40477	4.4
VI A BOT	23.314	17.44256	0.036256	0	17.478816	0.7	291.384	1200.88358	4.1
VI A	11.523	4.145023	0.000781	0	4.145804	0.4	302.907	1205.02939	4
LOCAL 3	6.208	66.382636	0	0.057973	66.440609	10.7	309.115	1271.47	4.1
V	222.028	29.985902	0	0	29.985902	0.1	531.143	1301.4559	2.5
LOCAL 2	25.988	61.281148	0	0	61.281148	2.4	557.131	1362.73705	2.4
IV	153.299	56.449536	0.010627	0	56.460163	0.4	710.43	1419.19721	2
LOCAL1	16.985	60.158152	3.103683	0	63.261835	3.7	727.415	1482.45905	2
IV + LOCAL 1	92.484	24.169012	0	0	24.169012	0.3	819.899	1506.62806	1.8
III TOP	61.76	24.471712	0	0	24.471712	0.4	881.659	1531.09977	1.7
III BOT	16.853	14.705768	0.139592	0	14.84536	0.9	898.512	1545.94513	1.7
III COMB	174.704	60.160212	0	0	60.160212	0.3	1073.216	1606.10534	1.5
II TOP	512.243	44.838892	0	0	44.838892	0.1	1585.459	1650.94423	1
II BOT	27.172	35.439572	0.619805	0	36.059377	1.3	1612.631	1687.00361	1
II COMB	231.358	26.894032	0	0	26.894032	0.1	1843.989	1713.89764	0.9
TOTAL	1843.989	1706.3624	7.422246	0.113034	1713.8976				

Figure 3: Detail of Total Waste Upto Seam II COMB, for Bhubaneswari, Arkhapal A & Sakhigopal A blocks, Talcher Coalfield

	Particulars	Details
2.2.3	Geological Block Area “Ha”	1674.71 Ha (Integrated block)
2.2.4	Status of Exploration of the block	GR of Integrated Bhubaneswari, Arkhapal-A and Sakhigopal-A block was submitted in December 2016.
2.2.5	Area covered by ‘detailed’ exploration within the block (sq.km)	Approx. Area = 17 sq.km.
2.2.6	Whether entire lease area has been covered by ‘detailed’ exploration	Yes
2.2.7	No. of boreholes drilled within the block	Total boreholes drilled: 324 nos. Drill Meterage: 68224.10 m
2.2.8	Whether any further exploration/study is required or suggested and time frame in which it is to be completed	No
2.2.9	Year wise future programme of exploration	NA
2.2.10	Overall borehole density within the block (no./sq.km)	Integrated block – 22 (approx.)
2.2.11	No of seams available as per GR (Geological Report)	31
2.2.12	Seams not considered for Mining with Reasons	Reserves have been estimated for all twenty-nine coal seams/splits.
2.2.13	Dip of the seam	<ul style="list-style-type: none"> • The strata dips southerly at 2°– 7° Gradient: (1 in 8 to 1 in 30) • North of F1-F1, it dips towards north, and • In the south, it dips towards south.

2.2.15	Methodology of reserves estimation (also mention if any software package has been used).	<p>Basic Assumptions & Norms Followed :</p> <ol style="list-style-type: none"> 1) In seam dirt bands of 1m and above thickness have been excluded from the thickness of the coal seams and considered as Intra-seam burden for which separate Iso-dirt bands have been drawn in respective seam Folio plans for estimating volume of in seam overburden. 2) Coal seam having minimum 1m thickness & consistent development has been considered for reserves estimation. 3) Seams/sections having less than (<) 1m thickness have been accounted for OB above the corresponding seam. 4) Normally, two coal seams or splits are considered separate if the intervening parting is 1m and more. However, depending upon regional continuity of the intervening parting the splits having even < 1m. Parting (at places) has also been considered as separate seams. 5) Reserves have been estimated on I100 basis for full thickness as well as for incrop zones separately. 6) All the reserves of coal seams from II BOT to seam XV (in ascending order) have been placed under 'proved category'. 7) Specific gravity for each grade has been calculated by using the following formula. $\text{Sp. Gr.} = 1.29 + 0.01 \times \text{Ash}$ 8) Useful heat value (UHV) has been calculated by the following formulae. $\text{UHV} = 8900 - 138 (\text{Ash} + \text{Moisture})$ 9) Coal seam with UHV 1300 K.cal./Kg or less has been placed under upgraded category.
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2.2.16	Average GCV of the total block	F (in UHV) – contributes 46% of total coal grade (Tentative weighted average GCV: G11)	
2.2.17	Gross Geological Reserve of the block “Mte”	Total Block	2048.87
		Projectised Area	465.73
2.2.18	Net Geological Reserve of the block “Mte”	Total Block	1843.98
		Projectised Area	419.15
2.2.20	Mineable Reserve of the block “Mte” (Projectised Area)		396.52
2.2.21	Corresponding extractable reserve of the block “Mte” (Projectised Area)		396.52
2.2.22	Percentage of Extraction(Projectised Area)		85.14
2.2.23	Reserve already depleted (Base date of Mining Plan) (Projectised Area)		272.06
2.2.24	Balance Reserve (as on Base Date) (Projectised Area)		124.46

Chapter – 3

MINING

	<i>Particulars</i>	<i>Details</i>
3.1	MINING METHOD	
3.1.1	Existing method of mining if the mine is under operation	Opencast (OC) mining (shovel-dumper mining for overburden (OB)/parting, surface miner, FEL and truck/ dumper for coal extraction), all the mining operations are being done through outsourcing.
3.1.2	Proposed method of mining with justification on suitability of method of mining	<p>The same method will be continued.</p> <p>The proposed mining block represents the presence of moderately flat multiple coal seams with intermediate varying parting. Thick seams occur at shallow depth in more expansive areas having power-grade coal reserves. So this will make the project most viable by adopting the opencast mining method.</p> <p>OB REMOVAL: The shovel-dumper mining method is adopted for overburden removal. This is very flexible and offers convenient mining operations to deal with sudden occurrences of unworkable or poor quality patches and changes of floor position due to repeated faulting and varying seam gradient and thickness. It also offers flexibility for an easy transition to any other technology or equipment configuration.</p> <p>COAL EXTRACTION: Coal seams are mostly thick with varying intermediate bands. Surface miners and front-end loader and dumper will be mostly used to extract coal from major seams. Surface miners will work in the windrowing method as per current practice.</p> <p>Thin horizons of both coal and partings are proposed to be ripped, dozed, and loaded by Front-End-Loaders onto trucks/dumpers.</p>

3.1.3	Coal production capacity proposed "Mtpa"	30						
3.1.4	Justification for optimization Coal production capacity	Considering available strike length, the thickness of seams and dumping requirement capacity of 30 Mty is justified.						
3.1.5	Calendar year from which the production will start	Running Mine						
3.1.6	Year of Achieving rated production	Year-1 (Working mine)						
3.1.7	Coal production plan "MT"	OC (opencast mining) - Proposed ; UG (Underground mining) – Not proposed.						
	Year		Coal Production Schedule			OB "Mcum"	RH "Mcum"	SR "cum/t"
	<i>Year of Operation</i>	<i>Calendar Year</i>	<i>UG</i>	<i>OC</i>	<i>Total</i>			
	Yr-1	2022-23	-	30.00	30.00	32.00	23.00	1.83
	Yr-2	2023-24	-	30.00	60.00	32.00	24.00	1.87
	Yr-3	2024-25	-	30.00	90.00	32.00	7.99	1.33
	Yr-4	2025-26	-	28.00	118.00	30.00	0.00	1.07
	Yr-5	2026-27	-	6.46	124.46	5.43	0.00	0.84
	TOTAL			124.46		131.43	54.99	1.50
3.1.8	Peak/Rated Capacity	30						
	- By OC	30						
	- By UG	NA						
	- Overall	30						
3.1.9	Life of the mine:	5 (as of 01.04.2022*)						
	- By OC	5						
	- By UG	NA						
	- Overall	5						
3.1.10	Whether the proposed external OB dumpsite is coal/lignite bearing: If so, whether coal/lignite below the waste disposal area is extractable	100% Internal dumping only. No External dumping is proposed.						
3.1.11	Whether negative proving for coal/lignite in the proposed site for OB dump/ infrastructure has been done	NA No External dumping.						

3.1.12	Results of any investigation carried out for scientific mining, conservation of minerals and protection of environment; future proposals	No
3.1.13	Type of Equipment/ HEMM proposed	Mining is continuing with total Outsourcing variant, the variant approved for the PR.

3.2 CHOICE OF TECHNOLOGY

The proposed mining block represents the presence of multiple coal seams with intermediate varying partings. Seams occur in wide areas having power-grade coal reserves. So this will make the project most viable by adopting the opencast mining method.

The geological exploration has established 13 coal seams of Barakar formation for opencast quarrying, including 3 local seams, occurring as 22 distinct splits, viz. Seam II Bot, II Top, II Comb, III Bot, III Top, III Comb, L1, IV, IVL1, L2, V, L3, VIAB, VIAT, VIBB, VIBT, VII, VIII Top, VIII Bot, IX, X, XI Bot and XI Top occurring in ascending order. The block is traversed by altogether 25 faults. Fault F1-F1 traverses midway through the block dividing the block into two sectors, with throw varying from 8-120m.

3.3 MINE BOUNDARIES

The total area of this integrated coal block of Bhubaneswari, Sakhigopal-A & Arkhapal-A is 14.55 sq. km. As per the earlier approved mining plan, mine excavation was limited to the Bhubaneswari coal block & some part of the Subhadra east coal block. Now MCL has advised viding e-office note E543918 to expand the mine boundary further north in Arkhapal-A coal block in the area where external dumping has been done. As per the earlier approved mining plan, this proposed expansion area was marked for external dumping, and the same was done in the initial days of operation. This northern area is a downthrown area where coal is marginally deep-seated due to the occurrence of a fault. MCL has advised extending the mine excavation boundary towards the north and extracting coal below this external dump after rehandling the same. This external dump is within the mine lease area. Mine Lease Area has been taken from the “EC Plan of Bhubaneswari OCP” supplied by the concerned Project office on 01.11.2021.

Revised mine excavation boundaries have been fixed as described below:

Based on the criteria explained above, mine boundaries adopted are summarised below (ref. plate MIN-I).

- North* : Fault F1 – F1 and over the part where Arkhapal-A block is being taken, the surface boundary is fixed after leaving a surface barrier of 60 m against Bangaru jhor and leaving a safety zone of 7.5m against North of Arkhapal-Srirampur, a non-CIL block.
- East* : The boundary is aligned from the borehole no. CTAR-177 and CMTL-042.
- South* : The floor boundary is the Northern boundary of Lingaraj block and part of the northern boundary of Ananta Extn. Block. The surface boundary is projected correspondingly.
- West* : About 300m west of geological block boundary, near borehole METAX-43 (same as in approved PR, 20 Mty).

3.4 RESERVES AND STRIPPING RATIO

It is estimated that **124.46** Mt of mineable coal would be available for extraction as on 01.04.2022.

Correspondingly, the overburden to be removed is estimated as 131.43 Mcum. Additionally, a total volume of 36.99 Mcum of overburden lying as an External dump over Arkhapal-A Block and 18.00 Mcum of backfill dump is to be rehandled for the quarry extension back to the proposed internal dump of the Extension quarry. Thus the total overburden to be removed and rehandled amounts to 186.42 Mcum. The overall stripping ratio works out to 1.50 cum/t.

Also, 109.55 Mcum of internal dump (as on 01.04.2022) is lying on the worked-out portion of Bhubaneswari expansion quarry.

The total mineable coal within the mine boundaries explained in section 3.4 is estimated as 124.46 Mt with corresponding total overburden of 186.42 Mcum. The stripping ratio of the proposed mine will be 1.50 cum/t as on 01.04.2022.

It may be mentioned here that mineable reserve is arrived at after a 10% deduction from the Gross Geological reserves (to arrive at the Net Geological reserve) and after considering suitable deduction for mining losses. So, actual reserve realization during mining may vary compared to the estimated mineable reserves due to geological uncertainty and mining methods. Losses due to mining and geological uncertainty may be reviewed during actual mining operations if the mine is operated through outsourcing means.

Table - 3.1
The break-up of total Overburden handling

Sl.	Overburden (OB) Details	Measured vol. (Mcum)
1.	Insitu-OB for the proposed mine life	131.43
2.	Rehandling of External OB (existing at the northern patch of Arkhapal-A Block)* <i>*Quantity of overburden dump as measured by Project Authority</i>	36.99
3.	Rehandling of Internal backfilled OB (Northern Quarry part adjacent to the existing external dump for quarry expansion)	18.00
Total overburden volume to be handled (<i>Million cubic metres-Mcum</i>)		186.42

3.4.1 SPECIFIC GRAVITY

As already mentioned, grade-wise specific gravities are adopted to calculate coal quantity and are detailed in table 3.2.

Table - 3.2
Grade wise specific gravity of coal

<i>Grade of coal</i>	<i>Specific Gravity</i>
G1	1.33
G2	1.41
G3	1.43
G4	1.47
G5	1.50
G6	1.53
G7	1.57
G8	1.60
G9	1.62
G10	1.66
G11	1.70
G12	1.72
G13	1.75
G14	1.78
G15	1.82
G16	1.86
G17	1.88

- i) Net Geological Reserve as given in Chapter-2 has been arrived after providing 10 % loss on Gross Reserve to account for geological uncertainties.
- ii) Due to multiple seams of different thicknesses and in-seam bands of more than 1 m thickness, **Mining Loss** has been estimated for each seam separately to arrive at **Mineable Coal Reserve**.

3.4.2 MINING LOSSES

Seam-wise mining losses are calculated based on the average thickness of the coal seam and presence of thick bands (>1m). A deduction has been made from net geological coal to calculate mineable coal based on these assessed losses. Details of seam-wise mining losses adopted are given in table 3.3.

Table - 3.3
Seam-wise mining losses

Seam	Mining Loss (%)
Seam IIBOT	14
Seam IITOP	2
Seam II Comb	2
Seam IIIBOT	3
Seam IIITOP	3
Seam III Comb	3
Seam L 1	29
Seam IV	4.5
Seam IVL1	4.5
Seam L 2	29
Seam V	4
Seam L 3	29
Seam VIABOT	6.5
Seam VIATOP	6.5
Seam VIBBOT	6.5
Seam VIBTOP	6.5
Seam VII	6.5
Seam VIIIBOT	15
Seam VIIITOP	15
Seam IX	10
Seam X	16
Seam XIBOT	12
Seam XITOP	12
Seam XIIBOT	12
Seam XIITOP	12

3.5 ANNUAL TARGET AND LIFE

An annual target of 30 Mt is proposed. At the targeted capacity, the balance mine life would be 5 years for the revised excavation area.

3.6 GEO-MINING CHARACTERISTICS

The block is about 6.3 km along strike (East-West) and 2.4 km along with the dip (South-North). The remaining two blocks, Ananta Extn. Block and Subhadra East block already form a part of approved Bhubaneswari OC Project, 20 Mty. Further, on the eastern part, the southern batter of the quarry falls in Lingaraj block. Geo-mining characteristics of the proposed quarry are given in table 3.4.

Table - 3.4
Geo-mining Characteristics (Including mined out area)

Sl.	Particulars	Unit	As per Expn. Project (30 Mty)
1.	Area		
i)	Along floor (Total)	ha	425.925
ii)	Along surface(Total)	ha	614.722
2.	Mineable Reserve*	Mt	124.46
3.	Overburden*	Mcum	186.42
4.	Stripping ratio*	m ³ /t	1.50
5.	Annual production	Mt	30
6.	Life of quarry*	year	5
7(a)	Strike length along floor		
i)	Minimum	m	189.86
ii)	Maximum	m	2100
7(b)	Strike length along surface		
i)	Minimum		550.54
ii)	Maximum		2400
8.	Depth of quarry		
i)	Minimum	m	97.99
ii)	Maximum	m	217.50
9.	Avg. seam thickness	m	95.30
10.	Gradient	-	2° - 7°
11.	Quarry perimeter Total	m	11858.70

*balance life as on 01.04.2022

GEOLOGICAL DISTURBANCES

The block is traversed by altogether 25 faults, viz. F1-F1 to F25-F25, of which seven nos. throw northerly, and the rest throw southerly. They are trending east-west and northwest-southeast. One major east-west trending fault, F1-F1, almost cuts across the block in the central section, dipping towards the north and has a varying throw of around 150 m to 10 m. This fault divides the block into two sectors, i.e., north of F1-F1 and south of F1-F1. One other major fault, F24-F24 is on the southern boundary with throw varying from 180m to almost nil within a short distance. While seven nos. of faults throw northerly with slight variations, rest 18 throw southerly with minor variations. Except faults F1-F1, F10-F10 & F24-F24, rest of the faults have low to the medium magnitude of throw.

3.7 OPENING OF DEPOSIT AND SEQUENCE OF WORKING

The top-soil is proposed to be removed and stacked either in temporary storage areas or directly transported to a backfilled area and leveled for reclamation. Coal is proposed to be excavated by deploying a surface miner and a combination of Front End Loader (FEL) and rear dumpers.

In the original approved PR, an access trench for the main quarry had been proposed from the southwestern end of the quarry. The main haul road is proposed to be advanced straight along the (approx.) dip direction of the quarry, generally parallel to the southern floor boundary of the final quarry.

In the previous MP&MCP of Bhubaneswari OCP, Revision-1, the quarry extension is proposed over the northern patch in the Arkhapal-A block. A new access trench was proposed in the south of CMTL-168 from the surface RL of 87.0 m through the western and northern batter touching the floor at – 60 mRL. For Revision-2, the working quarry has to be extended over the eastern part to take the forest area and the left-out area due to forest, the new extension area is aligned by the borehole no. CTAR-177 and CMTL-042.

For coal deposits in the block under consideration, surface miner-pay loader-dump truck mining is being proposed. In the earlier approved report, a shovel dumper mining system was proposed to remove OB above the seams. The same is to continue.

Operation of the surface miner is found to be successful and environment friendly as it does not require drilling, blasting, and crushing of coal. It is proposed that surface miners will do the total coal production of 30 Mty. The total extraction of coal will be done through an outsourcing agency as per existing practice.

Top overburden above various seams will be continued to be removed by shovel dumper method through existing outsourcing agency.

3.8 MINING SYSTEM

Benchs will be aligned along the general strike. The bench floor should follow its own seam floor/roof or that of an adjacent seam. Main bench parameters for the above-mentioned types of equipment are:

Working Coal bench width will be kept at a minimum width of 50 m for surface miner operations.

Working angle : 70° with horizontal for individual working bench.

Again, bench dimensions may vary with different equipment deployed.

3.9 HEMM CONFIGURATION

The approved variants for working the proposed mine is,

- ***Coal production and overburden removal by outsourcing means, by the approved variant.***

3.10 DUMPING AND EMBANKMENT

The initial overburden has been dumped externally during earlier mining operations as per the approved Project report towards the north of the mine boundary. This external dump area is the coal-bearing area of Arkhapal-A block, where the coal is deep-seated due to a downthrown fault, and the remaining overburden has been dumped internally. At present, the working mine has many patches of the void that are being filled up by overburden removed from existing benches.

Keeping in view the Bangaru Jhor Nala flowing eastwardly adjacent to Arkhapal-A block on its north, provision of an embankment to protect the mine from water ingress has been made. The embankment has been made 3 meters above the Highest Flood Level (HFL) of the adjacent water body, i.e., the Nala. The HFL, as indicated in the Working Plan of the quarry dated 01.10.2021, is 84.65 MRL (Base year given – August 1974). The embankment has been proposed with slopes of 1:3 on the Nala side and 1:2 on the quarry side. The top of the embankment is proposed to have 5-meter wide road. This embankment is proposed with the overburden removed from the quarry, consuming a total volume of 0.36 Million cubic meters (Mcum). The construction of embankment must be completed by year-1. It is also recommended that regular monitoring of the embankment should be carried out. While preparing the embankment, due safety statutory compliances shall be adhered to.

In the present working quarry, the overburden removed from the first year will be dumped internally over the existing quarry and void created by the mine advancement. The total volume of in-situ overburden removed corresponding to the total production of 124.46 Mt is 131.43 Mcum. Again the External and Internal Dumps lying over the quarry area is 36.99 Mcum (to be rehandled back to the proposed internal dump of the Expansion quarry) and 109.55 Mcum respectively. In addition to the external dump rehandling, a measured volume of 18.00 Mcum of the northern backfilled part adjacent to the external dump is to be rehandled for the quarry extension over the northern patch of the Arkhapal-A block.

The calendar program of dumping/backfilling is given in Table-3.5. The table shows the break-up of the in situ volume of overburden (131.43 Mcum) along with the rehandled volume of External dump (36.99 Mcum) and the internal backfilled portion (18.00 Mcum). In the initial years of working, around 33.0 Mcum of overburden will have to be accommodated within the existing void of quarry or Ananta Expn OCP. This dumping may be accommodated inside the internal dump of existing quarry, depending upon the evacuation of Hensmul Village and Sahara sahi basti. This amount may vary as per actual void availability in Bhubaneswari OCP. It is assessed that the total accommodation capacity of the final stage is 265.97 Mcum, including 109.55 Mcum of the existing backfill. Accordingly, the calendar program of dumping proposes the distribution of overburden removed to over Bhubaneswari OCP (Internal Dump 1) and Bhubaneswari OCP*/Ananta Expn. OCP (Internal Dump 2).

Therefore, strategically the extra load of External OB Dump of 36.99 Mcum over Arkhapal-A block is to be shared by the backfilling space of Ananta Expansion OCP or inside

the Bhubaneswari OCP Expn quarry (depending upon the void availability), over which 33.00 Mcum will have to be moved in the initial years to avoid the shortage of internal dumping space area mostly during year 1 and year 2. The Remainder rehandled volume of 3.99 Mcum of External dump and 18.00 Mcum of Internal dump is to be fully accommodated in Bhubaneswari OCP's void itself.

Mine stage, including dumps during Year 1, Year 3, and Final stage dump plan of operation are shown in **Plate Nos. MIN-III, MIN-IV, and MIN-V** respectively. Final stage excavation Plan is shown in **Plate No. MIN-I**.

Table-3.5
Calendar Programme of Backfilling

<i>Year of Operation</i>	<i>Programmed total coal (Yearly)</i>	<i>Programmed total OB (Yearly)</i>	<i>OB to Internal Dump 1 (Yearly)</i>	<i>OB to Internal Dump 2 (Yearly)</i>
Year 1	30.00	55.00	37.00	18.00
Year 2	30.00	56.00	41.00	15.00
Year 3	30.00	39.99	39.99	0.00
Year 4	28.00	30.00	30.00	0.00
Year 5	6.46	5.43	5.43	0.00
Total :	124.46	186.42	153.42	33.00

3.11 DRILLING AND BLASTING

Overburden and parting are to be drilled and blasted before excavation. Coal is to be mined using blast free method. Drilling and blasting parameters are to be arrived after conducting a series of trial blasts. However, the following blasting pattern is tentatively suggested based on the assumed powder factors of 0.35 kg/cum for OB and is given in Table-3.6.

Table – 3.6
Blasting pattern

Description	Bench height	Blasting pattern
Overburden	10-15m	9m x 7.5m

3.12 CALENDAR PROGRAMME OF EXCAVATION

It is already a working mine, and the proposed quarry extension is over the eastern side of the Bhubaneswari Block. To continue with the production of 30 Mty, the evacuation of villages and the forest clearance of 20.383 Ha are to be done at the earliest possible.

The yearly schedule of overburden removal and coal extraction is based on sector-wise quantities of coal and overburden. Year-wise schedules of coal production and overburden removal and stripping ratio are given in Table nos. 3.7 and 3.8. Mine capacity is 30.0 Mty. It is envisaged that the production of 30 Mty can be achieved under present geo-mining conditions.

Table – 3.7
Production Programme

YEAR	Coal(Mt)	OB (Mcum)	SR(cum/t)
Year 1 (2022-23)	30.00	55.00	1.83
Year 2 (2023-24)	30.00	56.00	1.87
Year 3 (2024-25)	30.00	39.99	1.33
Year 4 (2025-26)	28.00	30.00	1.07
Year 5 (2026-27)	6.46	5.43	0.84
TOTAL	124.46	186.42	1.50

Table – 3.8
Production Program

Year	Coal(Mt)	Insitu OB (Mcum)	Rehandling (Mcum)	TOTAL OB (Mcum)	SR (cum/t)
Year 1 (2022-23)	30.00	32.00	23.00	55.00	1.83
Year 2 (2023-24)	30.00	32.00	24.00	56.00	1.87
Year 3 (2024-25)	30.00	32.00	7.99	39.99	1.33
Year 4 (2025-26)	28.00	30.00	0.00	30.00	1.07
Year 5 (2026-27)	6.46	5.43	0.00	5.43	0.84
TOTAL :	124.46	131.43	54.99	186.42	1.50

The above calendar programme is subject to timely possession of land, forestry clearance/ EMP clearance/ R & R etc.

Chapter - 4

SAFETY MANAGEMENT

4.1 SAFETY MANAGEMENT

The opencast mining operation, in general, is associated with several hazards/risks. Some of the various anticipated sources of danger are enumerated as under:

- Slope failure.
- Dangers due to handling and use of explosives and accidents due to fly-rocks and air-blasts following a faulty heavy blast.
- Hazards associated with use of electricity.
- Accidents due to unruly operation of HEMM.
- Dust hazards.
- Fire hazards due to spontaneous heating of coal in stockpiles and exposed benches.
- Fire hazards in stores & workshops where inflammable & highly inflammable materials are stored or used.
- Danger of inundation from surface and groundwater.

Adequate provisions have been made for safe working of the mine in form of design of operational systems, provision of safety measures for safe use of explosives, electricity and HEMM etc. Sufficient financial provisions have been made under different heads for the procurement of necessary safety equipment.

Adequate skilled and trained manpower has also been provided for compliance with safety provisions. Regular training/refresher courses, "on job" training shall be conducted & mock rehearsals shall be made to make the workforce conversant with various rules, regulations, methods of prevention & combat with hazards.

4.1.1 INUNDATION

Major threat of Inundation is from Bangaru jhor, which flows along the northern boundary of the block. Due care should be taken during mining to prevent water ingress operations from the higher ground local rivers/reservoir. Embankment with a height of three meter above the HFL has been proposed against Bangaru jhor. Provisions of coal Mine Regulations shall be followed. There are three sources of water in the mine:

i) **Surface run-off from the surrounding area and nallah flowing over the property:**

Seasonal nallah flowing through the mine should be observed property, as also their catchment area. Due to mining operations, the existing drainage pattern will be disrupted. Hence, it is suggested in the PR for re-coursing of surface run-off from the catchment area of the nallah through suitable watercourse directed towards the Bangaru nallah flowing ultimately to Brahmhane river.

ii) **Direct Precipitation
Rain Water**

- a) Garland drains along the periphery of the excavated area of the mine shall be provided to stop rainwater from the surface entering into the mine. Garland drains shall be kept clean without any obstruction and shall be inspected regularly during the monsoon.
- b) All rainwater in the catchment area of the opencast mine shall be channelized to gravitate into the main sump constructed in the dip most of the mine. An adequate pumping arrangement shall be kept to pump out water from the sump to the surface.

iii) **Seepage from Strata:** There is no danger of inundation due to the make of water in the mine while mining coal. The water will gravitate into the sump and will be pumped out.

4.1.2 DUST SUPPRESSION

Inventory of Dust Generation Sources

The likely dust generation sources due to various mining operations in the project are envisaged as under:

- Drilling, blasting, excavation, and transportation of overburden material ;
- Drilling, blasting, excavation, crushing, and transportation of run-of-mine (ROM) coal;
- Construction and demolition activities like land clearing, material/debris storage and handling, etc.;
- Loading of coal at stockpile, reclaiming from pile and movement of vehicle and loading equipment;
- Wind erosion;
- Movement of vehicles on haul roads (black topped and non-black topped) for transportation of coal and overburden.

Dust Pollution Control Measures

Systematic and regular air quality monitoring is necessary to examine the status of compliance with the statutory standards and make an accurate assessment of ambient air quality.

The following measures are suggested in the PR to contain the pollution arising out of dust emission within limits:

- All the drills are provided with well-designed dust extraction/suppression system;
- Blasting operations are designed in such a way so that these produce minimum dust;

- Effective use of sprinklers and dust suppression units during loading, transportation, and handling of ROM/processed coal and overburden;
- Dust extraction/suppression system is proposed in coal handling plant;
- Provision of greenbelt around quarry, industrial and residential areas, and avenue plantation along the haul roads on the surface;
- Black-topping of permanent service roads besides proper maintenance, wetting the surface by deploying water tankers/sprinklers to reduce dust generation from haul roads.

4.1.3 FIRE AND SPONTANEOUS HEATING

Fire Due to Spontaneous Heating in Coal Benches & Ground Stocks

The following measures will be taken to avoid spontaneous heating:

- a) Coal bench slopes and seam outcrops will be overlain with an impervious layer of soil/clay.
- b) Treatment of exposed coal seams & outdoor coal stocks with anti-pyrogenic substances.
- c) Exposure of coal benches for long time shall be avoided.

Fire in Project Stores and Workshops

Sufficient provision has been made to prevent fire control in the project store, both E&M/HEMM workshops, and sub-stations by installing fire extinguishers of the right type & size. Timely inspection and refilling of fire extinguishers will be done.

The systematic layout of both stores & workshops has been made so that inflammable and highly inflammable materials do not come in contact with any spark or flame. An adequate number of cautions in the form of hoardings will be displayed near such places.

4.1.4 SLOPE STABILITY

The exposed ends of the coal seams and OB shall be left with a safe slope to avoid slope failure and collapse of benches. Similarly, at the end of the mining operation, a safe terminal pit slope is provided to prevent pit failure. At the design stage, a safe angle of not steeper than 40 degrees has been proposed as a quarry slope. Detailed site-specific tests for slope stability shall be carried out and site-specific parameters determined. Present provision is a broad guideline. **Continuous monitoring of working mine slope & dump slope should be done with the latest technique & instrument available. All the necessary prevalent guidelines of slope monitoring and precautions by a statutory agency should be followed.**

Considering the gradient of coal seam (2° - 7°) with local variations in this project area, it is proposed to excavate top OB by level slicing. Higher capacity shovels are proposed to be deployed for both top overburden and thicker parting removal. Thinner partings are proposed to be removed by smaller capacity shovels. Benches will be aligned along general strike. Bench floor should follow own seam floor/roof or that of adjacent seam. Main bench parameters are given below.

FOR COAL SEAMS

Coal bench width will be kept at a minimum width of 50m for surface miner operations. Bench height and angle should as per guidelines from statutory authority & will vary with equipment size.

OB DUMP

In the quarry, the overburden removed completely from the first year is to be dumped over the existing quarry void created by the mine advancement. The total volume of insitu overburden removed corresponding to the total production of 124.46 Mt is 131.43 Mcum. The external dump lying over the northern part of the quarry excavation area is of 36.99 Mm³ and the internal dump is of 18.00 Mcum. So, the overburden of 54.99 Mm³ is to be rehandled back into the proposed internal dump of the extended quarry. The internal Dump of 109.55 Mm³ is already lying on the existing void of the quarry as on 01.04.2022. The total volume of OB programmed for the proposed excavation area is of 186.42 Mm³.

Overall slope of internal dump is 26° , individual dump tiers will be constructed at a maximum height of 30 m at an angle of 37° and a leveled berm of width 30 m is kept between individual tiers. The height of each dump may even be kept at a lesser height where the dump is near any road or locality. Berm between each dump tier should be properly graded, and drains should be provided at toe with proper gradient. Fencing may be done near the bottom-most tier to stop unauthorized entry near the dump, adequate safety distance on the surface from dump toe should be maintained to avoid any accident due to slope failure.

For better stability of internal dumps, it is suggested to rip the mine floor in strips before backfilling. It is suggested to level the dumps and grade them outward properly to obviate water accumulation and will be followed by garland drains all along the periphery of the dump.

B) HAZARD AND RISK ASSESSMENT OF OB DUMPS

The hazard of OB dump failure is mainly governed by the following factors:

1. Height of benches.
2. Slope of benches.
3. Nature of material.
4. Slope of foundation rock.
5. Nature of foundation rock.
6. Drainage of foundation.
7. Depth of groundwater table.

The following precautions will be taken to reduce the risk of dump failure:

1. OB benches will be made of <30 m height in each tier.
2. The dumped material shall be allowed to settle at the natural angle of repose of the material as prescribed in Reg. 108(2) of CMR, 2017. The spoil bank face shall not be retained by artificial means at an angle in excess of its natural angle of repose. The angle of repose of individual OB benches will be around 37° .
3. The topsoil should not be mixed with Overburden (OB) and dumped at the bottom or middle of the dump. It should be stacked separately and spread at the top of the dump for plantation as prescribed in Reg.108 (1) of CMR, 2017.

4. The slope of the ground is kept mild so that it will not have any adverse effect.
5. The soil from the foundation ground should be scrapped before starting of OB dumping.
6. Garland drain to be made around OB dump area to avoid water flow during monsoon below the OB dump.
7. Ground water table is generally 3-5 m below ground level hence may have no adverse impact.
8. Leveling, grading and drainage arrangement for top of OB dumps will be done.
9. Technical & Biological reclamation will be done.
10. The remnant or insitu coal rib (barrier) shall not be left unextracted within opencast workings. The presence of the rib on the dip-side of the dump acts as a barrier. It checks the flow of the collected water near the dump toe and the natural flow of dumped material, thereby exerting pressure on the rib, ultimately leading to the failure of the rib. The presence of coal pillars in the workings may lead to spontaneous heating of the coal and thereby fire in the coal pillar.
11. The OB shall not be dumped in the sump. In unavoidable circumstances, the water and slush in the sump shall be cleared up to the hard floor of the pit. The hard floor of the pit shall be broken to improve the frictional resistance at the base of the dump before starting the dumping. It should be filled with the OB consisting of coarse-grained sandstone. It will facilitate the passage of water through the dump floor, thus preventing water accumulation at the base of the dump.
12. The water shall not be allowed to accumulate over the dumps. Proper levelling of the dumped material should be done.
13. The backfilled area shall be kept benched, and the distance of any active mine workings (faces) from the toe of the bottom-most backfilled face (bench) shall not be less than 100 m or height of the OB dump whichever is higher without prior permission from this directorate based on scientific study. Blasting shall not be carried out within 300 m of the OB dump without prior consent from this directorate.
14. The discontinuous dumping shall be avoided to check water accumulation between heaps as far as practicable. The open cracks developed in the partially developed ump shall be filled and consolidated with the proper

levelling of the benches with the help of a dozer. It will help to reduce the dumped material and will minimize the infiltration of water inside the dumps. The proper gradient along the benches, top and floor of the dump shall be ensured. It will facilitate an effective seepage/flow of water retained in dumps and run-off rainwater to the drains to take the same away from the dump. The drains should be effectively maintained to divert the drained water away from the dump.

4.1.5 HAUL ROAD MAINTENANCE

For proper haul road maintenance, the following aspects have to be considered and implemented:

- i) Proper design and maintenance of the haul roads
 - a) The height of the benches in overburden, coal, or other rock formation shall not be more than the digging height of the machine deployed thereat for digging, excavation, or removal.
 - b) The width of any bench shall not be less than (i) the width of the broadest machine plying on the bench plus two meters, or (ii) three times the width of the largest dumper/truck/tipper if dumpers/trucks/tippers ply on the bench, or (ii) the height of the bench, whichever is more.
 - c) Height and width of surface miner benches :
- ii) The final sides of surface miner faces shall be kept sloped and benched, and the height of each such bench shall not exceed 10m at any place, and the width thereof shall not be less than the height.
- iii) The length and width of the operation of surface miners, loading machines, and transport vehicles shall be decided depending upon the numbers of loading machines, tippers, and other types of machinery deployed to provide sufficient space and avoid crowding of operations.
- iv) Formulation, approval, and enforcement of traffic rules regarding:
 - a) Speed limit
 - b) Parking and standing
 - c) Overtaking

- v) One-way traffic; otherwise, the width should not be less than 3 times the width of the largest vehicle.
- vi) The gradient should not be greater than 1 in 16.
- vii) Berm should not less than 1 m in width.
- viii) Separate machines and personnel for maintenance of haul road

During the rainy season, soil erosion will occur, and it will deteriorate the haul road corridor.

- i) Proper drainage arrangement shall be made along the haul road.
- ii) Cross slopes (1 in 50 to 1 in 25) shall be provided on the haul road so that water flows into the drain.
- iii) Water barriers, cross drains, relief drains etc., should be constructed and maintained properly.
- iv) Culverts shall be designed, installed, and maintained to withstand the vertical soil pressure, the weight of the vehicles plying over the road etc.

4.1.6 **BLASTING**

SAFE USE OF EXPLOSIVES

Site Mixed Slurry (SMS) has been proposed for good fragmentation and obviate storage of bulk quantum of explosives. However, for storage of explosives meant for priming, detonating fuse, and detonators, two explosive magazines have been provided in this report.

For transportation of explosives, the explosive van of approved type is also envisaged.

For proper blasting and minimizing the adverse side effects due to blasting viz. noise, ground vibration, back-breaks, air blast and fly rocks etc., the optimal blast design parameters will be suggested during the mine operation after conducting a study for determining the blasting parameters.

Provision has been made in the PR for qualified blasting-in-charge with a requisite number of assistants. Adherence to relevant statutory safety provisions as stipulated by DGMS, Chief Controller of Explosives and others shall be made.

Blasting danger zone of 300m for blasting has been taken in a non-forest area. In the forest area, this demarcation will be done on the ground as only 7.5m has been considered a safety zone for permissive possession in the forest area. Accordingly, the land beyond the quarry limit is envisaged to be acquired for the project from safety considerations. It is suggested to resort to controlled blasting near built-up areas and surface features, if any, within the safety zone.

4.1.7 SAFETY MANAGEMENT

Special precautions should be taken while deploying workers in the mine. Before employing any labour in the mine, proper vocational training should be imparted, and recommendations of the latest Safety Conference should be strictly followed. Management for the deployment of labours by an outside agency shall fix terms and conditions. Some of the major aspects are as follows:

A) FOR PERSONS

- i) No persons shall be deployed unless he is trained at VTC
- ii) Records in Form-B, Form-D shall be maintained.
- iii) Records of Vocational training Certificate and drivers' driving license shall be kept by HEMM outsourcing agency and shall be made readily available for inspection by management.
- iv) No person shall be employed unless the person holds a VTC certificate and Management is informed. A record of it shall be maintained.
- v) Qualified competent persons shall maintain adequate supervision.
- vi) Outside agency shall follow safety guidelines and safety instruction from Project Authorities.

B) FOR MACHINERIES AS RECOMMENDED BY DGMS CIR. (TECH.) 1 OF 1999.

- i) All the machinery to be deployed in mines should be checked before deployment by the competent authority.
- ii) Regular checking of m/c deployed by an outside agency shall be done. No unfit machine shall be deployed before the defect is rectified.
- iii) A proper record of repair and maintenance and inspection done by the management and defect pointed out shall be maintained and signed by an authorized person.
- iv) The trucks deployed outside the agency shall be provided with Audio-visual alarms, proper light for use at night and a period when natural light is not sufficient. Also, audio-visual alarms for reversing on trucks shall be provided.

4.1.7.1 OTHER PRECAUTIONS FOR MACHINE

Based on the excavation requirement of the mine and the envisaged calendar programme, an adequate number of HEMM has been envisaged in the PR.

A well-equipped workshop is suggested in the PR to cater to the maintenance needs of HEMM and other equipment besides the provision of a necessary maintenance crew. A project store is provided to store slow and fast-moving spares and other critical spares of vital importance.

An adequate number of trained/skilled operators and maintenance crew are provided in the PR with due consideration of leave/sick provisions.

Properly designed haul roads are envisaged in the PR, away from the general and traffic congestion. The traffic rules as enforced by the DGMS shall be strictly followed by the operators of mobile equipment like rear dumpers, water sprinklers, tippers, and other light motor vehicles. All mobile equipment shall be provided with audio-visual alarms.

Following norms regarding machinery and its safety should be ensured:

RTO certificate photocopies of all vehicles shall be submitted to management

- i) Daily welding, monitoring, inspection shall be done by the agency's mechanic as directed by management.
- ii) Machine manufacturers should be asked to give risk analysis details in respect to machines deployed by outside agencies.
- iii) Suitable types of the fire extinguishers shall be provided in every machine.
- iv) No person/vehicle shall be deployed at any place other than authorised place.
- v) All worker should obey lawful instruction of mine management.
- vi) Risk management Plan shall be made and implemented.
- vii) All driver shall obey systematic traffics rules prepared by management
- viii) Before deploying workers, they must be trained and briefed about safety aspects in opencast mine. However, during the course of execution of the work, if any accident occurs, whether major or minor, the matter shall have to be immediately informed to mine management i.e., Colliery Manager/Agent/GM of the area so that Notices of accidents in accordance of (Reg.9 of CMR 1957) and Section 23 of Mines Act 1952 may be given and other necessary steps may be taken in accordance with the Mines Act 1952.
- ix) The outside agency shall operate the transport system in such a way so as to minimize pollution in the mine.
- x) Safety devices like fire alarm and control, operated by sensors, should be inbuilt in the equipment/HEMM. Flashers should be fitted in relevant HEMM. The haul roads should be sufficiently wide to prevent accidents.
- xi) Inter-locking of starting with normal positioning of the dumper body should be provided, so that dumper cannot be started when the body is lifted beyond a specific limit.

4.1.7.2 PRECAUTIONS AGAINST DANGER OF INUNDATION FROM SURFACE WATER

- 1) A careful assessment is to be made against the danger from surface water before the onset of rainy seasons. The necessary precautions should be laid down and implemented. A garland drain needs to be provided to drain away from the surface rainwater from coming into the mine.

- 2) Inspections for any accumulation of rainwater, obstruction in normal drainage and weakening in embankment.
- 3) Standing order; for withdrawal of working persons in case of apprehended danger.
- 4) During heavy rain inspection of vulnerable points is essential. In case of any danger persons are to be withdrawn to safer places.
- 5) Nallah or water inlets may be diverted or isolated by embankments/if so required.

4.1.7.3 PREVENTIONS OF FLOODING OF EQUIPMENT DEPLOYED AT BOTTOM HORIZONS

During the heavy monsoon period, the mining operation in the lower-most bench may have to be stopped. Therefore, it is proposed to draw the lowest bench, which would work as a sump. The water will be pumped out and discharged into the drain through the settling tank. For ensuring the safety of the equipment while working out horizons with no access to surface profile, the following measures should be taken:

- 1) Drivage of initial trenches and coal cutting benches should be done during the dry period of the year.
- 2) Ramps should be made for quick shifting of equipment from bottom horizons, liable to be flooded during the monsoon period and top horizons.

4.1.7.4 PREVENTION OF ELECTRIC SHOCKS

During mining operations, all the statutory provisions of the Indian Electricity Rules 1956 and the Indian Standards for installation and maintenance of electrical equipment etc. should be observed.

- 1) For protection from electric shocks to persons, Earth Leakage Relay should be provided, which will automatically disconnect electrical circuits from electrical equipment with high voltage.

- 2) Closed mobile substations and switchgear should be mechanically interlocked, excluding the possibility of opening the door when oil switch and air circuit breaks are in operation.
- 3) All metal parts of electrical equipment should be adequately earthed to avoid failure of insulation.
- 4) All H.T. lines and cables located within the blasting zones should be disconnected during blasting operations.

4.1.7.5 MEASURES TO BE TAKEN FOR FIRE FIGHTING AND FIRE PREVENTION

In addition to statutory provisions, the measures for firefighting and prevention of fires are as follows:

- 1) Organization of particular cell for systematic observations to examine and prevent fire.
- 2) Removal of spillage of coal on benches and cleaning of coal horizons to prevent cases of coal heating.
- 3) Storage of lubricants and cotton waste in enclosed fireproof containers in working places.
- 4) Provisions of fire extinguishers.

4.1.7.6 MEASURES TO BE TAKEN WHILE DRILLING BLASTING

Following measures should be taken while drilling and blasting operations in the quarry:

- 1) Drilling and Blasting in quarry should be done in accordance with the provisions of the Mines Safety Act, rules, and regulations.
- 2) Adequate safety measures have to be taken during blasting operations in the quarry so that men/machines are not affected.

4.1.8 SCIENTIFIC STUDIES

It is proposed that scientific studies respect the effects of vibration and flying fragments on surface buildings/ structures due to blasting. Studies regarding slope stability should also be carried out

4.1.9 ADDITIONAL PERMISSION/RELAXATIONS REQUIRED FROM DGMS

For usage of bulk explosive, following permission from the competent authority will be required:

- i) Approval will be needed under CMR 161 clause (1) and CMR 168(5) for the usage of explosives other than cartridge form and different types of explosives.
- ii) Permission for sleeping holes shall be obtained.

4.2.2	A commitment from the Company Board that entire mining operation will be carried out as per the Statutory provision given under Mines Act 1952, Coal mine Regulation 2017 and wherever specific permission will be required the company will approach the concerned authorities.	Will be provided by MCL
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Chapter – 5

INFRASTRUCTURE FACILITIES

	<i>Particulars</i>	<i>Details</i>
CHAPTER 5: INFRASTRUCTURE FACILITIES		
5.1.1	Mine infrastructure required e.g. Equipment maintenance planning, Office buildings, Workshop, Power supply arrangement, Water supply etc.	<p>In the total outsourcing variant the OB and coal both will be extracted contractually. Hence, there is no need of HEMM workshop. Only E&M workshop and store will be in the scope of MCL. Minor repair and maintenance of the HEMM provided in this variant shall be done in the E&M workshop</p> <ul style="list-style-type: none"> • E&M WORKSHOP • STORES • COLONY • PROJECT SUBSTATION • CHP SUBSTATION • PROJECT & SITE OFFICE • WATER SUPPLY ARRANGEMENT • ETP & STP PLANT <p>Equipment maintenance planning</p> <p>a) Stores Provision for a closed shed is made for the project stores. Separate provision for a store yard of adequate area is also made for loading/unloading, truck movement etc. Store racking system, weigh scale, fork lift truck have also been provided in the stores which shall be located adjacent to the workshop complex for quick issuing of materials to the workshops.</p> <p>OFFICE BUILDINGS Workshop</p> <p>a.) HEMM Workshop Outsourcing mode.</p> <p>b.) E&M Workshop E&M workshop, is envisaged for LMV and E&M equipment (components of CHP equipment and Electricals etc.) repair, lubrication, inspection and</p>

		<p>minor repairs, incidental minor repair/replacement limited to sub-assemblies. The scope also includes repair of small electric motors, switch gears and instruments including rewinding jobs.</p> <p>Inspection and scheduling will be carried out for jobs which requires major repairs and overhauling from outside agencies/Central Workshop IB Valley. A separate area is envisaged for dumper parking.</p> <ul style="list-style-type: none"> • Water Supply Arrangement • ETP & STP Plant
5.1.2	Power supply and illumination	<ul style="list-style-type: none"> • Presently existing project substation at Bhubaneswari opencast project is receiving power at 33 kV, through one number of single circuit 33 kV overhead line, drawn from 132/33 kV Nandira substation of MCL. The existing Bhubaneswari OCP project substation is having total three number of transformers (3x10 MVA, 33/6.6 kV transformer. This existing 3x10 MVA, 33/6.6 kV project substation-I has been envisaged for providing power supply to all proposed additional CHP loads. Power shall be distributed at 6.6 kV for HT loads, at 415 Volts for LT loads and at 230 (L-L) Volts for lighting loads of entire proposed and under- construction CHP from this existing 33/6.6 kV CHP main substation through 6.6 kV substations & MCC's located at suitable locations depending on the load center. • The Connected load and Maximum demand have been mentioned in Chapter-13 of this PR. The 6.6 kV Capacitor Banks have been proposed to be installed in 6.6 kV substations to improve the P.F to 0.98 for loads fed from the 6.6 kV substations. • The surface conveyors along with RLS of proposed 30 MTY CHP will receive power from existing 33/6.6 kV project substation-I through 6.6 kV overhead lines. The existing 33/6.6 kV project substation-I has sufficient number of 6.6 kV VCB feeders for supplying power to 6.6/0.415 kV substations. • The control scheme of the CHP and rapid loading system along with sequencing shall be done through dual redundant hot standby microprocessor based programmable logic controller (PLC) suitable for industrial control system.

5.1.2.1 DETAILS OF POWER SUPPLY SYSTEM

Presently existing project substation at Bhubaneswari opencast project is receiving power at 33 kV, through one number of single circuit 33 kV overhead line, drawn from 132/33kV Nandira substation of MCL. The existing Bhubaneswari OCP project substation is having total three number of transformers (3X 10 MVA, 33/6.6 kV transformer. This existing 3x10 MVA, 33/6.6 kV project substation-I has been envisaged for providing power supply to all proposed additional CHP loads. Power shall be distributed at 6.6 kV for HT loads, at 415 Volts for LT loads and at 230 (L-L) Volts for lighting loads of entire proposed and under-construction CHP from this existing 33/6.6 kV CHP main substation through 6.6 kV substations & MCC's located at suitable locations depending on the load center. The Connected load and Maximum demand have been mentioned in Chapter-13 of this PR. The 6.6 kV Capacitor Banks have been proposed to be installed in 6.6 kV substations to improve the P.F to 0.98 for loads fed from the 6.6 kV substations.

POWER DISTRIBUTION ARRANGEMENT

The CHP and 6.6 kV substations shall have separate power (HT & LT) cables, control cables, plant illumination system, plant earthing system, plant lightning protection system, pressurization and air conditioning system, instrumentation and telecommunication arrangement. For supplying power to different equipment at CHP as well as RLS, 6.6/0.415 kV substations have been proposed.

6.6 kV SUB-STATIONS

Seven numbers of 6.6 kV substations have been proposed for supplying power to 6.6 kV conveyors and LT loads. Two numbers of 6.6 kV have been proposed for feeding section and five number of 6.6 kV substations have been provided for evacuation section. Each 6.6 kV substation will receive power through two numbers of 6.6 kV over headlines originating from 6.6 kV switch board installed at 33/6.6 kV project substation-I. The 6.6 kV substations will be consists of 6.6kV VCB/VCP switch board panels, 415V motor control centers, 6.6/415V distribution power transformers, 6.6/.0230V (L-L) lighting transformers and main lighting distribution boards etc.

UTILIZATION VOLTAGE

All motors above 110 kW shall get power at 6.6 kV. All motors of 110 kW & below shall get power at 415 V.

CONTROL POWER SUPPLY

In the motor control centers, the control power supply to auxiliary circuit and contactor coils shall be supplied from a Control Transformer.

PROTECTION AT 6.6 kV

All the incoming 6.6 kV panels will be provided with over load, short circuit, earth fault and earth leakage protection.

All the outgoing panels supplying power to HT motors will be provided with motor protection relay (MPR) and all the panels supplying power to transformer or to any substation or capacitor bank will be provided with over load and short circuit protection.

PROTECTION AT 415V SIDE

- (i) All the 415V incoming panels will be provided with over load, short circuit and earth leakage protection.
- (ii) All the 415 V outgoing panels supplying power to motors will have over load protection along with single phasing protection and short circuit protection.
- (iii) All the 415 V outgoing panels supplying power to motors above 45 KW in sequence control will be provided with motor protection relay.

POWER FACTOR

The power factor of the plant has to be improved to a level above 0.98 lagging at the 6600 volts switch board of 6.6/0.415 kV substations. For this purpose required capacitor bank with automatic power factor correction relay have been provided in all seven numbers of 6.6 kV substations.

PLANT ILLUMINATION SYSTEM

The areas covered under this package will be illuminated by light fittings, which will get power from the secondary of lighting transformers located at different locations. Required number of 6.6/0.230 (L-L) kV lighting transformers have been provided at different substations for illumination of the CHP.

PLANT EARTHING SYSTEM

Proper earthing arrangement for the plant has to be provided as per I.E Rules. As per amended CMR, restricted earthed neutral system has been envisaged for the said installations. An earthing grid shall have to be developed around the periphery of main substations as well along the conveyors. In addition all the motors will be earthed through the armoring of the connecting cable.

PLANT LIGHTNING PROTECTION SYSTEM

In order to protect the CHP from direct lightning strokes, a proper lightning protection system as per relevant Indian standards shall be provided. For this purpose required numbers of spikes/interceptors of at least 2m height will be provided on the roof tops of the CHP. The spikes/interceptors provided on each building and will be interconnected by means of suitable size G.I. flats supported on saddles to form a grid.

Separate earth pits independent of the earth pits provided for equipment earthing will be provided around CHP and interconnected by means of minimum 25x6 sq.mm Galvanized steel flats. The earth pits will be constructed as per Indian Standards.

SYSTEM VOLTAGE

The supply voltage and operating voltage used in the project are as follows:

Sl. No.	Equipment	Voltage
1.	Incoming supply voltage	33.0 kV
2.	Surface conveyors	6.6 kV
3.	Coal Handling Plant	6.6 kV
4.	Supply voltage to Main Pumps	6.6 kV
5.	Supply voltage to workshop	6.6 kV

Sl. No.	Equipment	Voltage
6.	Supply Voltage to Colony & Water Supply	415 V
6.	SILO loading arrangement	415 V
8.	Quarry lighting	230 V (L-L)

TELECOMMUNICATION

Telecommunication system consisting of EPBAX based system and loud hailing communication system required for facilitating efficient functioning of production and administration units of the project has been proposed.

5.1.3	Drainage & Pumping: Assessment of volume of water for pumping, pumping capacity and pump selection	The principal drainage in the block is controlled by Bangaru jhor in the northern side of the block. The pumping and drainage system will be assessed by the outsourced agency.															
5.1.4	Coal Handling Arrangement: Brief detail of the CHP/ Mode of Dispatch, Coal quality and Coal staking and handling arrangement	<p>The proposed CHP of Bhubaneswari Extn. OCP (30 Mty) is planned to have a capacity to handle the production of 25 Mty by CHP under construction. Remainder 5 Mty will be dispatched through Rail by nearby wharf wall siding.</p> <p>The basic parameters considered for the planning of the coal handling plant will be as under:</p> <table> <tr> <td>Maximum Capacity (Mty)</td><td>:</td><td>25</td></tr> <tr> <td>No. of working days</td><td>:</td><td>330</td></tr> <tr> <td>No. of shifts/day</td><td>:</td><td>3</td></tr> <tr> <td>No. of hours/shift</td><td>:</td><td>8</td></tr> <tr> <td>No. of effective hours of work of CHP/shift</td><td>:</td><td>5</td></tr> </table> <ul style="list-style-type: none"> Coal from the quarry handled by private mine operators will be received at Truck Receiving Hopper complexes. From TRH's coal will transported through conveyors to 02 nos. of over ground bunker of capacity 15000Te each. The coal from the Over Ground Bunker (GB-1) will be carried with the help of conveyors C2 and C2A to TH-5. 	Maximum Capacity (Mty)	:	25	No. of working days	:	330	No. of shifts/day	:	3	No. of hours/shift	:	8	No. of effective hours of work of CHP/shift	:	5
Maximum Capacity (Mty)	:	25															
No. of working days	:	330															
No. of shifts/day	:	3															
No. of hours/shift	:	8															
No. of effective hours of work of CHP/shift	:	5															

		<ul style="list-style-type: none"> At TH-5, coal transportation will take place by the conveyors C5 and C5A up to TH-6. From TH-6, coal will be carried through the Pipe conveyor to be delivered to Silo, located near Spur Siding-III. The Silo will have a capacity of 4000Te and shall consist of Rapid loading system along with 02 nos. of pre-weigh hopper and telescopic chute which will load the wagons. From Over Ground Bunker (GB-2) will be transported through conveyors C3 and C4 to TH-7 and TH-8 respectively. From the Transfer houses TH-7 & TH-8 the Coal will be taken by the Conventional conveyors and a Pipe conveyors to a Silo (4000 Te) located near spur siding V to dispatch a coal of around 12 Mty. The Silo will have a capacity of 4000Te and shall consist of Rapid loading system along with 02 nos. of pre-weigh hopper and telescopic chute over two separate rail lines which will load the wagons. The coal of around 5.0 Mty will be tapped from the conveyor circuit from GB-2 for mechanized truck loading system. Other facilities like Dust control (Plain water (PWDS) and Dry fog (DFDS) types), Industrial and drinking water supply, Firefighting and Plant cleaning, Belt weigher, Electrical and Mechanical hoists, Tramp iron magnet (ILMS) and Metal detector, Automatic mechanical sampling system, In motion rail weigh bridges etc. will be also envisaged.
5.1.5	Coal washing and the proposed handling/ disposal of rejects	Washing not proposed in present proposal

Chapter – 6 LAND REQUIREMENT

	Particulars	Details							
CHAPTER 6 : LAND REQUIREMENT									
6.1.1	Total Land requirement for the mine in “Ha”	Break up of pre-mining land type (indicative)(as received from project authority as calculated from land use /revenue plan)							
		Particulars				Area (Ha)			
		Agricultural				445.030			
		Forest				132.904			
		Waste land							
		Surface water bodies							
		Others (specify) settlement				80.790			
		Total				658.724			
		Items		MP&MCP of Bhubaneswari (28 Mty), Revision-1			Proposed MP&MCP of Bhubaneswari (30 Mty), Rev-2		
		Sl.	Particulars (ML-mining lease)	Forest	Non-forest	Total	Forest	Non-forest	Total
		1.	Quarry Excavation area	105.808	477.944	583.752	126.191*	488.531**	614.722
		2.	Safety zone		5.747	5.747		6.163**	6.163
		3.	Infrastructure (CHP, Washery, Silo point, project office, laying of railway lines for dispatch point) and Future working expansion Area**	6.713	29.609	36.322	6.713	18.606	25.319
		4.	Embankment	NIL	12.52	12.52	NIL	12.52	12.52
		A.	Total ML area	112.521	525.820	638.341	132.904	525.820	658.724
Note: *20.383 Ha of Forest land is taken under Quarry Excavation area.									
**The area under Future Expansion area is annexed under the proposed quarry excavation area and safety zone.									
• Additional 11.003 ha of future expansion area showed in Revision-1 goes to the Quarry area (10.587 ha) and partly to the safety zone of (0.416 ha), making it to a total of 11.003 ha. This was the non-forest area adjacent to the forest area of 20.383 ha blocked because of non-clearance of this forest area.									
• Additionally 149.57 Ha of non-forest land may be required for residential colony, Rehabilitation & resettlement.									

6.1.2 During mining Land use details:									
Type	Land use (Pro posed)	Land use (End of Life)	Land Use (Post Closure)						
			Agricultural land	Plantation/ grass carpeting	Unfilled void	Pubic/ Company use	Forest land (Returned)	Undist-urbed	Total
Excavation Area	614.722								614.722
Backfilled Area		339.488		339.488					339.488
Excavated Void		275.234			266.628	8.606			275.234
Without plantation									
Temp Top soil dump									
External dump									
Safety zone	6.163	6.163		4.093	2.07				6.163
Haul road between quarries									
Road diversion									
Diversion/ below river/ nala/ canal									
Settling pond									
Road & infrastructure area	25.319	15.319		6.713		8.606			15.319
Rationalisation area									
Garland drains**	2.07	2.07			2.07				2.07
Embankment	12.52	12.52		12.52					12.52
Green Belt		10.00		10.00					10.00
Water Reservoir near pit									
UG entry									
Undisturbed/ Mining right for UG									
Resettlement									
Pit head power plant									
Water harvesting									
Agricultural land									
Total Lease area	658.724	658.724		372.814	268.698	17.212			658.724
colony	32.00	32.00		6.400		25.600			32.00
Resettlement	117.57	117.57		23.520		94.050			117.57
outside infrastructure									
Total outside area	149.57	149.57		29.920		119.650			149.57
Total Project area	808.294	808.294		402.734	268.698	136.862			808.294
*undisturbed area is for further future expansion & same may be partially planted or grass carpeted.									
Area outside lease area is indicative & may vary as per actual implementation of the project.									
** Garland-drain is included in the safety zone area.									

6.1.3	Surface features over the block area	This is a working mine. The block has mostly agricultural land interspersed by forest plots, grazing land and habitations, scattered all over. The area is represented by a plain country with very gentle undulations at places. The southerly flowing Brahmani River on the eastern extremity of the Talcher coalfield mainly controls drainage in the area. There is one seasonal nallah, Bangaru jhor that flows in the northern and north western boundary of the block and drains into the Brahmani River. The coal evacuation arrangement is being made on the southern side of the quarry.
6.1.4	No. of villages/ Houses to be shifted	<p>Within the existing project, nine villages are being affected (Jilinda, Hensmul (Sharasahi), Hensmul (Talasahi), Naraharipur, Khandualbhal, Kandhal, Madanmohanpur, Langijoda and Anadipur).</p> <p>Total no PAF affected as per approved Mining Plan: 1142. Most of villagers shifted except Hensmul (Talasahi) and Hensmul (Sahasahi). Around 126 PAF of Hensmul village is yet to be shifted.</p>
6.1.5	Population to be affected by the project	Estimated Around 4504
6.1.6	Proposed rehabilitation programme	Land has been provided for R & R benefits including well developed rehab site and other cash compensation will be given to PAF as per R & R policy of MCL & norms of state Govt. of Odisha
6.2	DETAILS OF LEASE	
6.2.1	Status of Lease	658.724 Ha* (*includes 20.383 ha of non-diverted forest area under process of diversion)
6.2.2	Existing Lease Area "Ha"	638.341
6.2.3	Period for which Mining Lease has been granted/ is to be renewed/ is to be applied for	NA
6.2.4	Date of expiry of earlier Mining Lease, if any	NA
6.2.5	Whether the lease boundary/ required boundary is same as mentioned in the allotment order	Mine excavation area along with other infrastructure are located within geological block.

6.2.6	Lease Area (applied/ required) as per the Mining Plan under consideration (Ha)	658.724 Ha* (*includes 20.383 ha of non-diverted forest area under process of diversion)
6.2.7	Whether the applied lease area falls within the allotted block	Total lease area falls within geological block, Mine excavation area, also (infrastructure/office fall within allotted block. Despatch arrangement, lies outside the block.
6.2.8	Area (Ha) of lease which falls outside the delineated block/sub-block	NIL. (Excl. land for colony, R&R)
6.2.9	Details of outside area:	
	<input type="checkbox"/> Whether forms part of any other coal block <input type="checkbox"/> Whether it contains any coal/lignite reserves <input type="checkbox"/> Purpose for which it is required, e.g. roads/ OB dumps/ service buildings/ colony/safety zone/ others (specify)	<ul style="list-style-type: none"> Other infrastructure are located in coal bearing area which does not belong to the same coal block. For safety zone, project office, workshops, sub-station, etc.
6.2.10	- Whether some part(s) of the allotted block has not been applied for mining lease	Eastern part of this block has been left out for future expansion.

6.3 PROPOSED SURFACE REORGANISATION

- Infrastructural facilities have been located, as far as possible, to avoid forest land. Land use Plan and Surface & Conceptual Layout Plan is shown in **Plate No. GEN-IV and GEN-V** respectively.
- A proper resettlement and rehabilitation (R&R) plan is to be drawn up in consultation with the state govt. and project affected persons (PAPs) taking into consideration the existing norms of Government of Odisha.
- Suitable provision for compensatory afforestation, arboriculture and technical, and biological reclamation have been made per the latest EAC guidelines. Govt. land shall be chosen for compensatory afforestation and resettlement of PAPs. These shall be finalized during implementation.
- In the rainy season, mining operation may disrupt the existing drainage system. Garland drains around the periphery have therefore, been provided.

Chapter – 7

ENVIRONMENTAL MANAGEMENT

	<i>Particulars</i>	<i>Details</i>
CHAPTER 7: ENVIRONMENTAL MANAGEMENT		
7.1	Commitment from the project proponent that the company will comply Environment and Forest Condition stipulated in the respective clearances	Will be provided by MCL

Chapter – 8

PROGRESSIVE AND FINAL MINE CLOSURE PLAN

8.1	LAND DEGRADATION AND RESTORATION SCHEDULE																																																																							
8.1.1	Tentative Land Degradation and Technical Reclamation (Commutative Area “Ha”)																																																																							
	<table><tr><th rowspan="2"></th><th colspan="4">Land Degraded</th><th colspan="4">Technically Reclaimed Area</th></tr><tr><th>Excavn. area</th><th>Dump (Extn + Top soil)</th><th>Infra/ others</th><th>Total</th><th>Backfill</th><th>Dump (Extn + Top soil)</th><th>Others</th><th>Total</th></tr><tr><td>As on 01.04.22</td><td>428.625</td><td>83.97</td><td>36.202</td><td>548.797</td><td>148.500</td><td>-</td><td></td><td>148.50</td></tr><tr><td>YR-1</td><td>494.726</td><td>53.30</td><td>37.762</td><td>585.789</td><td>172.350</td><td>-</td><td>37.762</td><td>210.112</td></tr><tr><td>YR-3</td><td>590.222</td><td>5.233</td><td>38.769</td><td>634.224</td><td>319.524</td><td></td><td>38.769</td><td>358.293</td></tr><tr><td>YR-5</td><td>614.722</td><td></td><td>44.002</td><td>658.724</td><td>339.488</td><td></td><td>44.002</td><td>383.490</td></tr><tr><td colspan="3">Post-closure* (Conceptual)</td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>YR-8</td><td colspan="8">The mine to be continued further.</td></tr></table> <p><i>*mine will be continued for further expansion towards dipside</i></p>		Land Degraded				Technically Reclaimed Area				Excavn. area	Dump (Extn + Top soil)	Infra/ others	Total	Backfill	Dump (Extn + Top soil)	Others	Total	As on 01.04.22	428.625	83.97	36.202	548.797	148.500	-		148.50	YR-1	494.726	53.30	37.762	585.789	172.350	-	37.762	210.112	YR-3	590.222	5.233	38.769	634.224	319.524		38.769	358.293	YR-5	614.722		44.002	658.724	339.488		44.002	383.490	Post-closure* (Conceptual)									YR-8	The mine to be continued further.							
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8.2	<p><u>Post-closure water quality management:</u></p> <p>Maximum effort will be made to recycle or reuse the treated effluents totally to the extent possible by keeping the make of water in different sumps or low-lying areas of the mine. The final voids of the quarries will be left as a water reservoir for water harvesting and also recharging the aquifer in the surrounding area, which will serve the following purposes:</p> <ul style="list-style-type: none">Source of supply of water for industrial and fire-fighting purposes of nearby mines.Source of supply of potable water after necessary treatment.A place of bathing and washing for the local population.Pisciculture.For recharging the aquifer in the area.																																																																							

	<p>In the post-mining period, the drainage pattern of the reclaimed area will be such that the run-off will be diverted to the final void of the quarry, which will be developed as a water reservoir for water harvesting and recharging aquifer in the surrounding area.</p> <p>During the operation of the mine, water samples covering surface water, groundwater, and effluent are being analysed in the core and buffer zones of the project. Out of the above, three sample points will be utilized for Water quality monitoring for three years after the closure of the mine. One number of sampling stations shall be for mine water with fortnightly frequency and two numbers of sampling stations will be for groundwater samples in the core and buffer zone with monthly frequency.</p>																																																																												
8.3	<p><u>Post-Closure Air Quality management</u></p> <p>Air quality monitoring will be continued after three years after the stoppage of mining operations. This includes the identification of major dust and gaseous sources and estimation of their levels of emission. The monitoring network will be consisting of the monitoring stations in consultation with SPCB considering various environmental impacts of air pollution. In the core zone, frequency of monitoring is fortnightly as per GSR 742 (E) Coal Mines Standard 2000 for six parameters, namely SPM, RPM, PM_{2.5}, SO_x, NO_x, and CO. Five heavy metal parameters As, Ni, Pb, Hg, Cd, and Cr are being monitored once in six months at all core zone locations.</p> <p>However, for buffer zone stations, the frequency of monitoring is weekly twice as per National Ambient Air Quality Standard (NAAQS) 2009, and 12 parameters <i>PM</i>₁₀, <i>PM</i>_{2.5}, <i>SO</i>_x, <i>NO</i>_x, <i>CO</i>, Ozone, Ammonia, BaP, Benzene, As, Ni, and Pb are being monitored.</p>																																																																												
8.4	<p><i>Waste Management (Figures in MM³)</i></p>																																																																												
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	<p>8.4.1 SOLID WASTE GENERATION DURING PROGRESSIVE CLOSURE:</p> <ul style="list-style-type: none"> ➤ All overburden from the mine will be brought to quarry's earlier generated as well as the created void forming its Internal dump, accommodating 100% of the overburden removed. ➤ Internal dumping can be started from Yr 1, and simultaneous backfilling will be continued up to the end of quarry life. Around 36.99 Mcum of overburden dumped externally over Arkhapal-A will be rehandled back to the internal dump during year one to year 3 while operating this quarry. ➤ The backfilling will be carried out in a phased manner. Once the backfilling has reached a certain predetermined reduced level, the plots will be levelled, graded and cleared of large stone pieces lying on the surface. The slope of the ground will be made very gentle as far as possible (preferably less than 2%). The graded and leveled area will be divided into small sectors and small check bunds will be constructed to retain moisture and humus in the soil. The outer slope of each bench will be kept at the natural angle of repose of the spoil material and at an overall slope angle of 26° considering all benches. ➤ Considering the proximity of the mine infrastructure, it is suggested to excavate topsoil and sub-soil up to 1m depth before commencing external dump to increase the dump stability. Further, it is recommended that a vibratory compactor may compact overburdened spoil after necessary leveling for early compaction and improved stability. ➤ Surface shall be maintained less than 2%, i.e., very gently sloping to prevent standage of water. Drainage arrangement will be provided for smooth disposal of stormwater to avoid gully formation. Garland drains shall be provided around the external dump to collect run-off sedimentation ponds one to be provided in order to avoid silt.
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8.4.2 **MANAGEMENT OF WASTES**

NON-TOXIC SOLID WASTE

The solid wastes (overburden) generated from the mine during coal production are non-hazardous and non-toxic in nature. The above solid wastes are disposed of to backfill the mined-out area and then revegetate without causing any siltation problem on surface water bodies.

TOXIC WASTES

Toxic solid wastes like used oil, used batteries, oily sludge, besides filter and filter materials containing oil during maintenance of vehicles are generated from this project.

Used oil is stored in drums safely in store either for disposal through auction to authorized recyclers. Used batteries are stored safely for auction to authorized recyclers. As regards oily sludge besides filter and filter materials, the same is disposed of off in impervious layer-lined pits without causing environmental hazards.

8.4.3 **ALTERNATIVE USE OF LAND**

There are several options available for the land use pattern of the reclaimed land. The following factors have been considered for the selection of appropriate land-use patterns:

- Pre-mining land use pattern
- Topsoil/sub-soil quality
- Socio-economic parameters of the area
- Availability of technology for land reclamation
- Climatic conditions of the area
- Local flora.

The alternatives available for utilising the reclaimed land are :

- ❖ Agricultural use
- ❖ Afforestation

The option for using the reclaimed backfilled area for the agricultural purpose

immediately is ruled out due to the following reasons :

- The reclaimed land is very different from its pre-mining conditions. It cannot sustain crops as the soil has poor fertility status. So the agriculture may prove an uneconomic venture compared to afforestation.
- The development of a soil regime for agriculture will take considerable time.
- Reclamation is proposed to be done progressively and concurrently with the mining operation. Carrying out agriculture within mining activity areas by releasing reclaimed areas in a phase-wise manner may not be advisable from the safety point of view.

Given the above, it is suggested to utilise the reclaimed land for afforestation purposes which will help improve the soil status, i.e., texture and nutrient levels, etc.

“Though the Bhubaneswari OCP continues for further expansion. However, in a general scenario, the mine will be closed after exhaustion of the coal reserve in the mining block. All the dumping and final quarry slopes will be grass-carpeted or covered with plantation. The final mine void in the quarry will be around 215 m, which will be kept as a water body.”

8.5

Topsoil Management – (Including Action Plan for Top Soil Management)

(All Figures are Cumulative and in mm³)

		Top Soil Removal Plan (in Mcum)	Top Soil Used (in Mcum)			
			Spreading Over Embankment	Spreading over Backfill area	Spreading over External OB Dump area	Total Utilized
Yr 1	2022-23				-	
Yr 3	2024-25	0.26	0.13	0.13	-	0.26
Yr 5	2026-27	0.34	0.13	0.21		0.34
Post closure						
Yr 8	2029-30			0.34	-	0.34

Topsoil shall be progressively and concurrently utilized during physical/ technical reclamation of ext. OB dumps and backfilled area, thus preventing the necessity of the storage of topsoil separately. However, topsoil will be stored temporarily during the initial years with proper preservation measures for utilization during technical reclamation of external OB dump areas and backfilled areas.

Depth of topsoil depends on the following:

- i) Physiography.
- ii) Climatic conditions like temperature, rainfall etc.
- iii) The uses to which the land has been put before.

In a mining block, it is necessary to have a close soil survey to determine its depth.

8.5.1 STORAGE AND PRESERVATION OF TOPSOIL

(A) Topsoil undergo many changes during preservation. These are changes in topsoil due to storage.

- i) Stockpiling has profound effects on physicochemical and biological properties.
- ii) Biological activity deteriorates after 3 to 6 months of storage.
- iii) Stockpiling reduces organic content and affects the organic compound concerned in soil aggravation.
- iv) Aggregate stability is reduced to some extent due to storage.
- v) Following three zones are developed in the topsoil mound during storage:

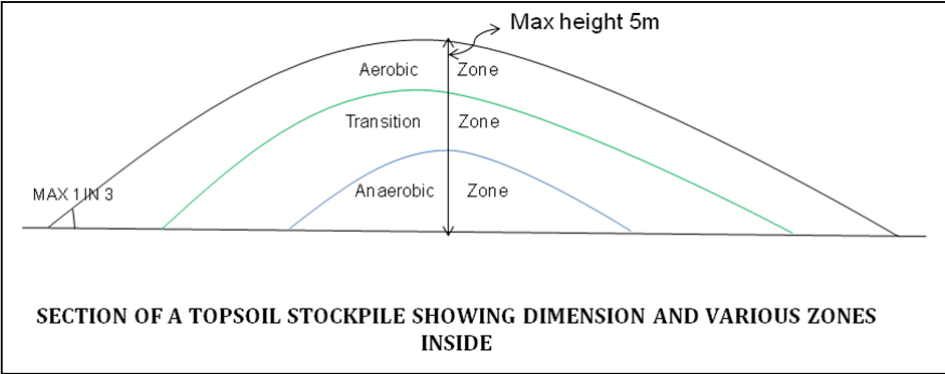
- Aerobic zones: Soil is active in this zone
- Transition zone: Fluctuates between predominantly aerobic and anaerobic status.
- This zone is inactive and low in biological activity as well as organic content.

(B) Methodology of Stripping: The stripping method should generally be by the scrappers/ small excavators only. The routing of scrappers/excavators during this operation must be planned to minimise the travel of machines to avoid compaction and damage to soil structure. Further careful control of the operation is necessary to ensure planned stripping depths of the topsoil and subsoil. These soils should be stripped and stored separately. The intermingling of these soils during stripping is not a good practice.

(C) It is essential that topsoil stripping should be carried out when it is dry as far as possible to reduce the risk of compaction and damage to the soil structure by smearing and remolding. Prolonged rainfall is unsuitable. The best part of the year is when evapo-transportation exceeds precipitation, i.e., during March-September.

	<p>(D) Geometry of Topsoil Heap: The heap should be constructed to facilitate the following:</p> <ul style="list-style-type: none"> • To provide the maximum surface area for maintaining a greater level of Biological activity. • To have slopes capable of sustaining vegetation to avoid erosion and gully formation. <p>Space constraints imposed by the site factors and soil texture would generally dictate the overall size and shape of the heap.</p> <p>As a rule of thumb, the following stack geometry may be maintained as far as possible to preserve the topsoil and increase the shelf life.</p> <p>a) Height:</p> <ol style="list-style-type: none"> i) 4.0m (Max) for sand soil ii) 2.0 to 3.0 for loamy soil iii) 1.0 for heavy clayey soil iv) 0.5 to 1.0 for intermediate soil texture. <p>b) Slope:</p> <p>The wide slope of 1 in 3 (i.e., 18.50 to the horizontal)</p> <p>If there is a constraint in the availability of area, one or both of the following strategies can be adopted:</p> <p>ALT-I</p> <p>An acoustic barrier of topsoil may be constructed in the safety zone near the working face. When the working face advances, the embankment away from it may be reclaimed and respread over the subsoil of the technically reclaimed area. This would lessen the noise pollution besides preservation of topsoil and reduction of the demand on the land requirement.</p> <p>ALT-II</p> <p>Initial topsoil may be spread over the area to be mined. When the scope for progressive reclamation is available, the respread topsoil and the insitu one may be stripped carefully and utilised. This method would also preserve the topsoil and reduce the demand for land intake.</p> <p>a) It is advisable to avoid topsoil storage, specifically the long-term one. However, if storage is unavoidable upon completion of the surface of the heap, the following steps are to be followed to keep the soil in good health and to increase its shelf life :</p> <p>b) Surface ripping with the suitable sub-soiling machine for aeration and</p>
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	<p>relieving surface compaction.</p> <p>c) Immediate cultivation of suitable low maintenance species like dwarf grasses to prevent erosion and gully formation.</p> <p><i>Maintenance of surface vegetation actively by seeding, mowing, and weed control operation.</i></p> <p>8.5.2 TOPSOIL CARPETING</p> <p>The following golden rules need to be observed:</p> <ul style="list-style-type: none"> i) Overburden, sub-soil, and topsoil should be respread to correct sequence putting the topsoil on the top of the backfilled area. ii) Topsoil should be respread over the restoration area at an even depth so as to achieve the final level and suitable configuration for drainage. iii) As far as possible progressive topsoil reclamation technique should be practiced. The topsoil from the area lying just ahead of the advancing opencast mine edge should be scrapped off by scrapper and immediately placed over the technically reclaimed area. iv) Compaction of topsoil after respreading over the reclaimed area should be avoided by properly planning the movement of Earth Moving Machinery and carrying out the operation in dry period only. v) Suppose topsoil is to be reclaimed from the heap for spread in the backfilled area and OB dump area. In that case, the reclamation should be planned in such a way that materials from aerobic, transition, and anaerobic zones are taken simultaneously. The above zones should not be taken out separately. It is essential to use the active surface layer as 'inoculum' during soil respreading to recover the inactive portion of the mound as quickly as possible. vi) Revegetated topsoil dumps with legumes (<i>Stylosanthus</i>) and grasses protect the stockpiles from wind and water erosion, maintain active soil microbes population and help to restore the nutrient cycling. vii) Mulching: If possible, after topsoil application, a layer of mulch (2-3" or 5-8 cm thick) may apply to cover topsoil and provide organic matter initially. The mulch layer will prevent soil from drying out and crusted, reduce evaporation, ameliorate extreme temperature, prevent erosion, and create a congenial microhabitat for the soil biological community.
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	<div data-bbox="453 353 1402 725" data-label="Figure">  <p>SECTION OF A TOPSOIL STOCKPILE SHOWING DIMENSION AND VARIOUS ZONES INSIDE</p> </div>	
8.6	Management of Coal Rejects	NA
8.7	Restoration of Land used for Infrastructure	This mine is to further run for the whole Integrated geological block. Land use to be restored after completion of the whole mining operation.
8.8	Disposal of Mining Machinery	This mine is to further run for the whole Integrated geological block. Land use to be restored after completion of the whole mining operation
8.9	Safety & Security	<p>a) DETAILS OF FENCING AROUND ABANDONED QUARRY INDICATING THE LENGTH OF THE FENCING</p> <p>Fencing around the abandoned quarry will be done as per details given in D.G.M.S Circulars.</p> <p>b) MINE ENTRY SEALING ARRANGEMENTS AND SUBSIDENCE MANAGEMENT FOR UG MINES</p> <p>Not Applicable.</p> <p>c) PROVIDING ONE TIME LIGHTING ARRANGEMENT</p> <p>Sufficient lighting as per standard will be provided at all the required places, i.e.</p>

		<p>working faces, OB dump area, haul road, coal transfer points, loading points, CHP, workshop, etc., to avoid accidents and to create efficient working conditions.</p> <p>After the closure of the mine, the lighting arrangements will be kept maintained at all locations which are not required to be demolished or dismantled like sub-stations, transformers, community services, pump-houses, water-treatment/ filtration plants, water lines, power lines, roads, etc. to be utilized for the neighboring projects and at critical places for safety point of view.</p> <p>The guidelines/instructions from DGMS will be followed in case of discontinuance of mine operation if any.</p> <p>d) SLOPE STABILITY ARRANGEMENT FOR HIGH WALL AND BACKFILLED DUMPS</p> <p>During the process, the geometrical shape of the dumps is altered to make them amenable to effective biological reclamation and provide safety. Stability and high wall will be maintained and stabilized as per norms.</p> <p>The details of the final Mine Closure plan along with the details of the updated cost estimates for various mine closure activities and the Escrow account already set up shall be submitted to the Ministry of Coal for final approval at least five years before the intended final closure of the mine.</p>
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8.10	Abandonment Cost and Financial Assurance		
8.10.1	Abandonment Cost: Cost of Activities to be taken up for the closure of the mine		
	The item-wise cost of progressive and final closure will be assessed during and before starting the mining operations and while preparing the final mine closure plan. However, a broad guideline has been detailed below:		
	Sl. No.	ACTIVITY	Weighted % of Mine Closure Cost Progressive (%)
A		Dismantling of Structures	0
		Service Buildings	
		Residential Buildings	
		Industrial structures	
B		Safety & Security	6.5
		Random rubble masonry/concrete wall	
		Toe wall around dump/Gabion wall	
		Barbed wire fencing	
		Fencing/boundary wall, fencing around water body	
		Garland drains	
C		OB Dump Reclamation	60.5
CA		Technical Reclamation	
		Re-handling of OB	
		Levelling by Dozer	
		Grading	
		Levelling & grading of highwall slopes & OB dump	
CB		Biological Reclamation & Plantation	15
		Top soil Management	
		Grassing of OB dump	
		Plantation around virgin Area, safety zone, green belt, over external dump and internal reclaimed area	
		Plantation post care (including manpower)	
		Plantation over cleared area obtained after dismantling	
D		Landscaping: Landscaping of the open space in leasehold area for improving its aesthetics, drain, pipelines, peripheral road, gates view point, cemented steps on bank etc	4
		Development of Agriculture land	
E		Environment mitigation & management	12
		Air Quality (Water tanker, sprinkler & other control measures)	
		Water Quality (ETP & STP etc. operating cost)	
		Manpower cost and supervision	
F		Post Closure Env. Monitoring	0
		Air Quality	
		Water Quality	
		Power cost	
		Manpower cost & supervision	
G		Entrepreneurship Development (Vocational/skill development training for sustainable income of affected people	1
I		Miscellaneous and other mitigative measures like golden handshake, one-time financial grant, alternative jobs other service etc.	1
		TOTAL	100

8.10.2

Financial Assurance: Amount to be deposited in Escrow account as a security against the mine activities to be carried out for the closure of the mine.

WPI as on	March 2022* (Prov.)	148.8
WPI as on base data	01-04-2019*	121.1
Escalation rate of closure cost		1.229

Particulars	UG	OC
Base Rate of Closure Cost “Rs. (₹) Lakh/Ha”	1	9
Closure cost “₹ Lakh./Ha”	na	11.059
Project Area “Ha”	na	808.294
Amount to be deposited into Escrow Account “₹ in Lakh.	na	8938.624
Amount already deposited into Escrow Account upto 31.03.2022* ₹ in Lakh.	na	5211.32
Net Amount to be deposited into Escrow Account * ₹ in Lakh.	na	3727.304
Rate of compounding of Annual Closure Cost	na	5%
Balance life of the project “in yrs”	na	5
Annual Closure Cost (Base Year-1) (₹ in Lakh)	na	745.461
Amount to be deposited into Escrow Account after compounding at the rate of 5% (₹. In Lakh)		4119.142

**Base date considered is 01.04.2022 and life of the mine considered is 5 years.*

Year	Mine closure cost (₹ in Lakhs)
Year-1	745.461
Year-2	782.734
Year-3	821.871
Year-4	862.964
Year-5	906.112
Total	4119.142

8.11	<p>FINANCIAL ASSURANCE</p> <ol style="list-style-type: none"> 1. MCL has already opened an Escrow Account in bank with the Coal Controller Organization (on behalf of the Central Government) as exclusive beneficiary & deposited the annual amount as per the earlier approved mine closure plan for last four years. 2. MCL shall cause payments to be deposited in the Escrow Account per year as per the table given above. The amount being deposited will be reviewed with such periodicity as deemed fit by the Coal Controller. 3. Final Mine Closure: The details of the Mining Plan (covering Final Mine Closure Plan envisaging the details of the updated cost estimates for various mine closure activities and the Escrow Account already set up, shall be submitted to the approving authority for approval at least five years before the intended final closure of the mine. 4. Final Mine Closure would be considered to be completed only after acceptance of the third party audit report by the Coal Controller on the compliance of all provisions of a Mine Closure Plan. Any Institute/ Organization/ Agency as may be notified by the government for this purpose may be engaged for Third-Party audit to create a self-sustained ecosystem. Failure of restoration within the specified period may result in forfeiture of Escrow Account created as above. The details of the Final Mine Closure Plan, along with the details of the updated cost estimate for various mine closure activities and escrow account already set up, shall be submitted at the time of approval of the final mine closure plan. 5. Mining is to be carried out in a phased manner, i.e., a continuation of mining activities from one phase to another, indicating the sequence of operations depending on the geo-mining conditions of the mine. Up to 50% of the total deposited amount, including interest accrued in the ESCROW account, may be released after every five years in line with the periodic examination of the Closure Plan as per the latest guidelines of the Ministry of Coal for preparation of Mining plan for the coal & lignite blocks vide F.No.34011/28/2019-CPAM dated 16.12.2019. The amount release should be equal to expenditure incurred on the progressive mine closure in the past five years or 50% whichever is less. The balance amount shall be released to the mine owner/leaseholder at the end of
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	<p>the final Mine Closure in compliance with all closure plan provisions. This compliance report should be duly signed by the lessee and certify that said closure of mine complied with all statutory rules, regulations, orders made by the Central or State Government, statutory organisations, court, etc., and certified by the Coal controller.</p> <p>6. An Agreement outlining detailed terms and conditions of operating the Escrow Account shall be executed amongst MCL, Coal Controller, and the concerned bank to give effect to this.</p>
8.12	<p>RESPONSIBILITIES OF THE MINE OWNERS</p> <ol style="list-style-type: none"> 1. It is the responsibility of MCL to ensure that the protective measures contained in the mine closure plan, including reclamation and rehabilitation works, have been carried out in accordance with the approved mine closure plan and final mine closure plan. 2. MCL shall submit to the Coal Controller a yearly report before 1st July of every year setting forth the extent of protective and rehabilitative works carried out as envisaged in the mine closure plans. 3. The details of the final Mine Closure plan along with the details of the updated cost estimates for various mine closure activities and the Escrow account already set up shall be submitted to the Ministry of Coal for final approval at least five years before the intended final closure of the mine.
8.13	<p>PROVISIONS OF MINE CLOSURE</p> <ol style="list-style-type: none"> 1. MCL shall be required to obtain a mine closure certificate from Coal Controller to the effect that the protective, reclamation, and rehabilitation works in accordance with the approved mine closure plan/final mine closure plan have been carried out by the mine owner for surrendering the reclaimed land to the State Government concerned. 2. The balance amount at the end of the final Mine Closure may be released to MCL in compliance of all provisions of the Closure Plan duly signed by MCL to the effect that said the closure of mine complied with all statutory rules, regulations, orders made by the Central or State Government, statutory organizations, court, etc. and duly certified by the

	<p>Coal Controller. This will also indicate the estimated extractable coal reserves and actual coal mined out.</p> <p>3. If the Coal Controller has reasonable grounds for believing that the protective, reclamation and rehabilitation measures as envisaged in the approved mine closure plan regarding which financial assurance was given has not been or will not be carried out under the mine closure plan, either fully or partially. The Coal Controller shall give MCL a written notice of his intention to issue the orders for forfeiting the sum assured at least thirty days before the date of the order to be issued after allowing being heard.</p>
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ANNEXURES

ANNEXURE-I

APPROVAL OF COMPANY BOARD IN FOLLOWING POINTS:

Mandatory Document Board approval must specify:

- Approvals of Mining Plan from the Board of the company giving undertaking for correctness of data used in preparation of Mining Plan;
- Details of the **Qualified Person (QP)/Accredited Mining Plan Preparing Agency (MPPA)** with certification that the eligibility of Qualified person/Accredited Mining Plan preparing agency has been verified.
- Acceptance of the Mining Plan by the company board with recommendation for approval;
- Undertaking that the mine will be developed as per the approval of the Mining Plan from Ministry of Coal and all other approvals, as required will be obtained from relevant authorities.
- Commitment that entire mining operation will be carried out as per the Statutory provision given under Mines Act 1952, Coal Mine Regulation 2017, EP Act 1986 and FC Act 1980 and wherever specific permission will be required the company will approach the concerned authorities.
- Financial Assurance for implementation.
- Undertaking that the reclamation & rehabilitation work shall be carried out in accordance with the approved Mine Closure Plan and any modification/amendments which may be made in the Mine Closure Plan by Ministry of Coal, from time to time.
- Undertaking that the protective measures contained in the mine closure plan including reclamation and rehabilitation works will be carried out in accordance with the approved mine closure plan and final mine closure plan and undertake to submit a yearly report before 1st July of every year to the Coal Controller setting forth the extent of protective and rehabilitative works carried out as envisaged in the approved mine closure plans (Progressive and Final Closure);
- Undertaking that they will obtain a mine closure certificate from Coal Controller to the effect that the protective, reclamation and rehabilitation works carried out in accordance with the approved mine closure plan/final mine closure plan and will surrender the reclaimed land to the State Government concerned.

ANNEXURE-II



Mahanadi Coalfields Limited

(A Subsidiary of Coal India Limited)
OFFICE OF THE CHIEF GENERAL MANAGER (CP&P)
AT/P.O. JAGRITI VIHAR, BURLA
Dist - SAMBALPUR - 768 020 (ORISSA)
Phone - (0663) 2542808 (O) / Fax - 2542767

Ref. No: MCL/HQ/CP&P/08/ 3118

Dated : 11.01.08

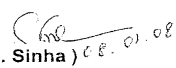
SANCTION ORDER

Sub : Approval of Project Report of Bhubaneswari OC (20.0 Mty) at total capital investment of Rs.490.10 crore including Rs.336.68 crores approved by Govt. of India for Bhubaneswari OC (10.0 Mty) to be implemented in both coal & OB outsourced variant.

The Project Report of Bhubaneswari OC for an annual coal production of 20.0 Mty with a total capital investment of Rs.490.10 crores including Rs.336.68 crores approved by Govt. of India for Bhubaneswari OC (10.0 Mty) to be implemented in both coal & OB outsourced variant has been approved by MCL Board in its 92nd meeting held on 22.12.2007 at Bhubaneswar.

However, the above approval is subject to amendment of Articles of Association (AoA) and enhancement of Delegation of Powers of Board to approve PRs up to Rs.500.00 crores or equal to Net worth of the Company whichever is lower as required, on attaining Miniratna status by MCL.

The zero date of monitoring of the project will be from the date of issue of the letter. The monthly monitoring report should be sent to this office by 10th of every month for onward submission to CIL & Ministry. This is for kind information & necessary action.


(S. Sinha) C.E. 01.08
Chief General Manager (CP&P)

Distribution :

1. CMD, MCL
2. D(T)/ D(F)/ D(P), MCL
3. CVO, MCL
4. Advisor (Projects), Gol, MOC, New Delhi – With a copy of MCL Board Resolution
5. CGM (PMD), CIL, Kolkata
6. Company Secretary, MCL
7. CGMs/GMs – Excavation/Finance/E&M/Civil/Environment/L&R/Production/S&R/TC
8. CGM, Jagannath Area – With a copy of MCL Board Resolution & PR
9. RD, CMPDIL, RI-VII, Bhubaneswar
10. Sri P.N. Sahu, SOM, CP&P Deptt., MCL Hqrs.
11. Sri G.K. Mishra, Supdt. Geologist, MCL Hqrs.
12. Bhubaneswari OCP file / Project Sanction file

SANCTION ORDER

ANNEXURE-III

No. 34012/(4)/2011-CPAM
Government of India
Ministry of Coal
(CPAM Section)

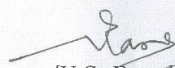
New Delhi, the 16th July, 2013

To
Shri B.N. Shukla,
General Manager (CP&P),
Mahanadi Coalfields Limited,
P.O. Jagriti Vihar, Burla,
Distt.Sambalpur - 768020 (ODISHA).

Subject	Approval of Mining Plan for Bhubaneswari Open Cast Project [Normative Capacity 20 MTY [Peak capacity 25 MTY] MCL dated July, 2013.
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Sir,

I am directed to refer to MCL's letter No. MCL/HQRS/GM[CP&P]/13/377 dated 12.07.2013 on the subject mentioned above and to forward herewith **4** copies of Mining Plans for Bhubaneswari Open Cast Project [Normative Capacity 20 MTY [Peak capacity 25 MTY] of MCL dated July, 2013 duly approved and signed by Adviser [Projects], Ministry of Coal.


[V.S. Rana]

Under Secretary to the Govt. of India.

Encl: As above.

ANNEXURE-III (Cont...)

No.34012/4/2011-CPAM
Government of India
Ministry of Coal
(CPAM Section)

New Delhi, the 3rd February, 2014.

To

Shri B N Shukla,
General Manager (CP&P)
Mahanadi Coalfields Limited (MCL)
P.O. Jagriti Vihar, Burla,
Distt. Sambalpur – 768020 (Odisha)

Subject :	Approval of Addendum to Mining Plan of Bhubaneswari Open Cast Project (25 Mty Peak Capacity) of Mahanadi Coalfields Limited.
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Sir,

I am directed to refer to MCL's letter No.MCL/HQRS/GM(CP&P)/14/1190 dated 01-02-2014 on the subject Mentioned above and to forward herewith 4 copies of Addendum to Mining Plan (Revised Production Schedule - One Page) of Bhubaneswari Open Cast Project (25 Mty Peak Capacity) of Mahanadi Coalfields Limited duly approved and signed by Adviser (Projects), Ministry of Coal.

Encls : as above.


(Sanjib Bhattacharya)
Under Secretary (CPAM)
Tele: 011 2307 3934
Fax: 011 2338 7738

ANNEXURE-III (Cont..)

File No.CPAM-34011/36/2017-CPAM

**No.34011/36/2017-CPAM
Government of India
Ministry of Coal**

**Shastri Bhawan, New Delhi
Dated: 20th November, 2017**

To,

**Chairman-Cum-Managing Director
Mahanadi Coalfields Limited,
AT/P.O Jagruti Vihar,
Burla Distt. Sambalpur
Odisha
E-mail: cmd.mcl.cil@coalindia.in**

**Subject: Approval of Mine Plans and Mine Closure Plans for the following projects of MCL
namely: Basundhara West, Samleswari OCP Expansion, Bhubaneswari OCP, Lakhanpur
OC Expansion -reg.**

Sir,

I am directed to refer to your letter no. MCL/HQ/GM(P&P)17/972 Dated 12.11.2017 regarding above mentioned subject for approval of the following projects of MCL:

1. Basundhara (West) Expansion OCP (7.00 Mty)(Revision-1), duly approved by MCL Board in its 194th meeting held on 08.09.2017
2. Samleswari OCP Expansion (Phase-IV)(Revision-1) (15.00 Mty), duly approved by MCL Board in its 194th meeting held on 08.09.2017
3. Bhubaneswari OCP (28.00 Mty), duly approved by MCL Board in its 196th meeting held on 07.11.2017
4. Lakhanpur OC Expansion, Ph-II (21.00 Mty), duly approved by MCL Board in its 196th meeting held on 07.11.2017.

The above mentioned projects duly signed and stamped by the competent authority are hereby approved.

Four copies of approved plans of each project are returned herewith this letter.

Enclosures: As above.

Yours Faithfully

Signature valid

Digitally signed by ANANDA
KUMAR MANDAL
Date: 2017.11.20 19:27:59 +05'30'
Reason: Approved

A.K. Mandal
Under Secretary to the Govt. of India
CPAM Section

Copy to: CCO, Kolkata, West Bengal

"PR Approval File"

ANNEXURE-IV

No.J-11015/280/2013-IA-II(M)pt.
Government of India
Ministry of Environment, Forest and Climate Change
IA-II (Coal Mining) Division

Indira Paryavaran Bhawan,
Jorbagh Road, N Delhi-3
Dated: 16th February, 2018

To,

The Chief General Manager (CP&P)
M/s Mahanadi Coalfields Limited
PO - Jagruti Vihar, Burla,
Sambalpur - 768 020 (Odisha)

E-mail: cgmenvt2014@gmail.com; cgmenvt_mcl@yahoo.co.in

Sub: Bhubaneswari Opencast Expansion from 25 MTPA to 28 MTPA in existing ML area of 638.341 ha of M/s Mahanadi Coalfields Ltd. Tehsil Talcher, District Angul (Odisha) - Environmental Clearance - reg.

Sir,

This refers to your letter No.MCL/HQ/Environment/Bhubaneswari OCP Expn. Project/17-18/2755 dated 17.11.2017 along with online proposal No. IA/OR/CMIN/71006/2017, dated 23.11.2017 and subsequent letters/email dated 24.11.2017, 27.11.2017, 18.01.2018 and 19.01.2018 on the above-mentioned subject.

2. The proposal is for grant of environmental clearance to the Bhubaneswari Opencast expansion Project from 25 MTPA to 28 MTPA in Mining lease area of 638.341 ha of M/s Mahanadi Coalfield Limited at district Angul (Odisha).

3. The proposal was considered by the Expert Appraisal Committee (EAC) in the Ministry for Thermal & Coal Mining sector in its 22nd meeting held on 27th November, 2017. The details of the project, as per the documents submitted by the project proponent, and also as informed during the meeting, are reported to be as under:-

(i) Earlier, the Environmental Clearance of Bhubaneswari Opencast was accorded by the Ministry vide letter dated 30th November, 2012 for production capacity of 20 MTPA in an area of 808.294 ha. Public Hearing for same was held on 10th February, 2009.

(ii) Further, the project was accorded EC from 20 MTPA to 25 MTPA on 19th February, 2014 under clause 7(ii) of EIA Notification, 2006 in accordance with OM J-11015/30/2004.IA.II(M) dated 19th December, 2012 exempting from fresh public hearing.

(iii) Meanwhile, OM No.J-11015/224/2015-IA.II, dated 15/09/2017, was issued for production capacity expansion up to 40% of PH capacity without Public Hearing with certain conditions. On the basis of the above said OM this proposal has been submitted for grant of EC for expansion of Bhubaneswari opencast coal mine from 25 MTPA to 28 MTPA without public hearing in the existing mine lease area of 638.341 ha.

(iv) To verify the status of compliance of EC conditions for Bhubaneswari opencast expansion project 25 MTPA, the Regional Office of MoEF&CC, Bhubaneswar has carried out Bhubaneswari OCP 25-28 MTPA of MCL280_2013_EC

Page 1 of 8

ANNEXURE-IV (Cont..)

the site inspection on 31.10.2017. The monitoring report has been forwarded to this Ministry vide their letter No. 101-980/EPE dated 24.11.2017, which was deliberated in the EAC meeting. The project proponent presented the action taken on each of the observations made by Regional Office during the site visit.

(v) The latitude and longitude of the project are 22° 19' 00" to 22° 19' 30" North and 82° 42' 30" to 82° 44' 30" East respectively.

(vi) Joint Venture: No

(vii) Coal Linkage : Thermal Power Plant & Basket Linkage

(viii) Employment generated / to be generated: Direct employment already provided to 1002 persons further 51 employment are in process.

(ix) Benefits of the project: (a) Improvement in Physical Infrastructure (b) Improvement in Social Infrastructure (c) Increase in employment potential (d) Contribution to the Exchequer (both State and Central Govt.) (v) Post mining enhancement of Green Cover (e) Improvement of Electrical Power Generation and availability of electricity for 24x7 in rural areas (f) Overall economic growth of the country.

(x) The land usage of the project will be as follows:

Pre-Mining:

	Type of Land	Area (Ha)
a.	Agriculture	445.030
b.	Forest	112.521
c.	Waste land	---
d.	Grazing	---
e.	Surface water bodies	---
f.	Others (specify)	80.790
	Total	638.341

Post- Mining:

Sl. No.	Category	Land use (In Ha)					
		Plant-ation	Water body	Dip side slope and haul road	Undisturbed	Built-up area	Total
1	Excavation (backfill)	355.517	31.000	55.741	--	--	442.258
2	Danger zone for blasting	83.150	--	--	--	--	83.150
3	External OB dumps	94.000	--	--	--	--	94.000
4	Railway siding	1.600	--	--	--	6.400	8.000
5	Infrastructure	0.850	--	--	--	10.083	10.933
6	Residential colony	6.400	--	--	--	25.600	32.000
7	Rehabilitation site	23.520	0.00	0.00	0.00	94.050	117.570
	Total	565.037	31.000	55.741	0.000	136.133	787.911

ANNEXURE-IV (Cont..)

Core area:

Particulars	Existing		
	Forest	Non-Forest	Total
Quarry excavation	105.808	336.450	442.258
Blasting danger zone (excluding the part of OB dump)	--	83.150	83.150
OB dumps (external)	--	94.000	94.000
Railway siding	--	8.000	8.000
Infrastructure	6.713	4.220	10.933
Mine Lease Area	112.521	525.820	638.341*
Residential Colony	--	32.000	32.000
Rehabilitation site	--	117.570	117.570
Outside lease area	--	149.57	149.57
Total	112.521	675.39	787.911

*Out of the total Area of the project mining lease area of 658.724 ha, the project was granted EC for 638.341 Ha. Remainder forest land of 20.383 ha, falling in the excavation area, is non-diverted and the diversion proposal for the same is under progress. This Mining Plan is for the mining lease area of 638.341 Ha inclusive of the forest land 112.51 ha for which EC and FC is already granted. The total land area is 787.911 ha, initially.

(xi) The total geological reserve of the block is 741.09 MT. The minable reserve for the proposed project is 233.39 MT (in 638.314 Ha ML Area in Phase-I) & 259.45 MT(in 658.724 Ha ML Area in Phase- I+II) and extractable reserve is 233.39 MT (in 638.314 Ha ML Area in Phase-I) & 259.45 MT(in 658.724 Ha ML Area in Phase-I+II) (As on 01.04.2017). The percentage extraction would be 100 %.

(xii) The coal grade is G-12 TO G-16. The stripping ratio is 0.71 Cum/tonne. The average Gradient is 4.5°. There will be 15 seams with thickness ranging (0.2 m to 40.90 m).

(xiii) The total estimated water requirement is 2423 m³/day.

(xiv) The level of ground water ranges (0.80 m to 10.90 m bgl).

(xv) The Method of mining would be Open cast mining.

(xvi) There is three external OB dump with Quantity of 35.82 Mcum in an area of 94.00 ha with height of 52 meters above the surface level and one internal dump with Quantity of 212.87 Mcum in an area of 355.517 ha with height Up to ground level in major part, 10 m above ground level at some parts

(xvii) The final mine void would be in 31.00 Ha with depth 187.5 m and the total quarry area is 442.258. Backfilled quarry area of 355.517 Ha shall be reclaimed with plantation. A void of 31.00 ha with depth upto 187.5 m which is proposed to be converted into a water body.

(xviii) The life of mine is 9 Years as on 01.04.2017(Phase-I)

(xix) Transportation: Coal transportation from face to pit top: by trucks. surface to siding: by conveyor to silo; siding to consumer; rail.

(xx) There is R & R involved. There are 1111 PAFs.

(xxi) Total capital cost of the project is Rs. 490.10 Crores. CSR Cost According to New CSR policy, the fund for the CSR should be allocated based on 2% of the average net profit of the Company for the three immediate preceding financial years or Rs. 2.00 per tonne of coal production of previous year whichever is higher. R&R Cost Rs. 31.22 Crores. Environmental Management Cost Rs. 71.41 Cr.

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ANNEXURE-IV (Cont..)

- (xxii) Bangaru Jhor is flowing adjacent (North), Brahmani River is about 6.0 km (East); Nandira Jhor is located at 9.0 km (South), Singada Jhor is about 12.0 km (West).
- (xxiii) Ground water clearance : Not applicable.
- (xxiv) Mining plan for the 28 MTPA was approved by MCL Board on 07.11.2017 & by MoC Vide letter no. 34011/36/2017-CPAM dated 20-11-2017. Mine closure plan is an integral part of mining plan.
- (xxv) There are no national Parks, wildlife sanctuary, biosphere reserves found in the 10 km buffer zone.
- (xxvi) Total forest land 112.521 ha in ML area of 638.341 Ha, Status of Forest clearance: Stage-II available vide letter no.8-18/2002-FC dt: 06-12-2004.
- (xxvii) Total afforestation plan shall be implemented covering an area of 355.517 ha at the end of mining including green Belt over an area of 83.15 ha. Density of tree plantation 2500 trees/ha of plants.
- (xxviii) There are no court cases/violation pending with the project proponent.

4. The Expert Appraisal Committee in its 22nd meeting held on 27th November, 2017, has recommended the proposal for grant of Environmental Clearance. Based on recommendations of the EAC, the Ministry of Environment, Forest and Climate Change hereby accords environmental clearance to **Bhubaneswari Opencast Expansion from 25 MTPA to 28 MTPA in existing ML area of 638.341 ha of M/s Mahanadi Coalfields Ltd. Tehsil Talcher, District Angul (Odisha)**, under the provisions of the Environment Impact Assessment Notification, 2006, read with subsequent amendments/circulars thereto, and subject to compliance of the terms and conditions and environmental safeguards as below:

- (i) Adequate ambient air quality monitoring stations shall be established in consultation with the State Pollution Control Board, and regular monitoring shall be carried out for particulate emissions (both PM₁₀ & PM_{2.5}), SO₂ & NO_x. The monitoring results for the period during summer season (April - June, 2018) shall be submitted to the SPCB and the Regional Office of the Ministry.
- (ii) The EAC shall review the compliance of the action taken on the observations of the Regional Office, before December, 2018 and make its recommendations for continuance of the project thereafter. Also, based on the monitoring results, the Committee shall examine efficacy and adequacy of the proposed control measures and its impact on the ambient air quality.
- (iii) To control the dust generation at source, the crusher and in-pit belt conveyors shall be provided with mist type sprinklers.
- (iv) Mitigative measures shall be undertaken to control dust and other fugitive emissions all along the roads by providing sufficient numbers of water sprinklers. Adequate corrective measures shall be undertaken to control dust emissions as presented before the Committee, which would include mechanized sweeping, water sprinkling/mist spraying on haul roads and loading sites, long range misting/fogging arrangement, wind barrier wall and vertical greenery system, green belt, dust suppression arrangement at railway siding, etc.
- (v) Thick green belt of 50 m width at the final boundary in the down wind direction of the project site shall be developed to mitigate/check the dust pollution.
- (vi) Persons of nearby villages shall be given training for their livelihood and skill development.
- (vii) To ensure health and welfare of nearby villages, regular medical camps shall be organized at least once in six months.
- (viii) In view of the mining potential of the area and the prevailing environmental concerns, carrying capacity of the eco-system shall be studied through some expert agencies to assess

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ANNEXURE-IV (Cont..)

optimal mining operations in the area with minimal impact on the environmental components.

(ix) The mine is surrounded by large opencast mines operated by M/s MCL and shall have a cascading impact on air pollution. Therefore, a stage wise response plan vis-a-vis varying level of air pollution level be prepared and implemented in the mine during its operation.

(x) A mechanism of inter- project environmental audit shall be devised and implemented with reporting to this ministry along-with half yearly reports.

4.1 The grant of EC is further subject to compliance of the generic conditions as under:

(a) Mining

(i) No change in mining technology and scope of work shall be made without prior approval of the Ministry of Environment, Forest and Climate Change. No change in the calendar plan including excavation, quantum of coal and waste should be made.

(ii) Mining shall be carried out as per the approved mining plan, and also abiding by the relevant laws related to coal mining and the circulars issued by Directorate General Mines Safety (DGMS). An approved progressive Mine Closure Plan shall strictly be complied with and submitted.

(b) Land reclamation

(i) Digital processing of the entire lease area using remote sensing technique shall be carried out regularly once in three years for monitoring land use pattern and report submitted to Ministry of Environment, Forest and Climate Change its Regional Office.

(ii) Final mine void depth should not be more than 40 m. The void area should be converted into water body. The remaining area should be back filled up to the ground level and covered with thick top soil. The land after mining should be restored for agriculture or forestry purpose.

(iii) The top soil, if any, shall temporarily be stored at earmarked site(s) only and it should not be kept unutilized for long. The topsoil shall be used for land reclamation and plantation. The overburden dumps should be vegetated with suitable native species to prevent erosion and surface run off. The entire excavated area shall be backfilled and afforested in line with the approved Mine Closure Plan. Monitoring and management of rehabilitated areas should continue until the vegetation becomes self-sustaining. Compliance status shall be submitted to the Ministry of Environment, Forest and Climate Change and its Regional Office on six monthly basis.

(iv) Greenbelt shall be developed all along the mine lease area in a phased manner. The width of the green belt along forest area should not be less than 7.5 m, and the total area covered by 3 tier green belt shall not be less than 100 ha. A 3-tier green belt comprising of a mix of native species shall be developed all along the major approach roads.

(c) Emissions, Effluents, and Waste Disposal

(i) Transportation of coal by road should be carried out by covered trucks only. Effective measures such as regular water sprinkling shall be carried out in critical areas prone to air pollution and having high levels of PM₁₀ and PM_{2.5} such as haul road, loading and unloading point and transfer points. Fugitive dust emissions from all the sources shall be controlled regularly. It shall be ensured that the Ambient Air Quality parameters conform to the norms prescribed by the Central/State Pollution Control Board in this regard.

ANNEXURE-IV (Cont..)

(ii) Vehicular emissions shall be kept under control and regularly monitored. Project should obtain 'PUC' certificate for all the vehicles from authorized pollution testing centres.

(iii) Adequate ambient air quality monitoring stations shall be established in the core zone as well as in the buffer zone for monitoring of pollutants, namely PM₁₀, PM_{2.5}, SO₂ and NO_x. Location of the stations shall be decided based on the meteorological data, topographical features and environmentally and ecologically sensitive targets in consultation with the State Pollution Control Board. Monitoring of heavy metals such as Hg, As, Ni, Cd, Cr, etc carried out at least once in six months.

(iv) Crusher/feeder and breaker material transfer points should invariably be provided with dust suppression system. Belt-conveyors should be fully covered to avoid air borne dust. Drills shall be wet operated or fitted with dust extractors.

(v) The project proponent shall not alter the major channels around the site. Appropriate embankment should be provided along the side of the river/nallah flowing near or adjacent to the mine. The embankment constructed along the river/nallah boundary should be of suitable dimensions and critical patches should be strengthened by stone pitching on the river front side and stabilised with plantation so as to withstand the peak water flow and prevent mine inundation.

(vi) Rainwater harvesting shall be implemented for conservation and augmentation of ground water resources in the area in consultation with Central Ground Water Board.

(vii) Catch drains and siltation ponds of appropriate size shall be constructed around the mine working, coal heaps and OB dumps to prevent run off of water and flow of sediments directly into the river and other water bodies. The water so collected should be utilized for watering the mine area, roads, green belt development etc. The drains shall be regularly desilted particularly after monsoon and maintained properly. Sump capacity should provide adequate retention period to allow proper settling of silt material. Dimension of the retaining wall to be constructed at the toe of the dumps and OB benches within the mine to check run-off and siltation should be based on the rainfall data.

(viii) Industrial waste water (CHP, workshop and waste water from the mine) should be properly collected and treated so as to conform to the standards prescribed under the Environment (Protection) Act, 1986 and the Rules made there under, and as amended from time to time. Oil and grease trap should be installed before discharge of workshop effluents.

(d) Noise & Vibration Control

(i) Adequate measures shall be taken for control of noise levels below 85 dBA in the work environment. Workers engaged in blasting and drilling operations, operation of HEMM, etc shall be provided with ear plugs/muffs.

(ii) Controlled blasting techniques should be practiced with use of delay detonators to mitigate ground vibrations and fly rocks.

(e) Occupational Health & Safety

(i) Besides carrying out regular periodic health check-up of their workers, 20% of the workers identified from workforce engaged in active mining operations shall be subjected to health check-up for occupational diseases and hearing impairment, if any, through an specialised agency /institution within the District/State and the results reported to this Ministry and to DGMS.

ANNEXURE-IV (Cont..)

- (ii) Personnel working in dusty areas should wear protective respiratory devices and they should also be provided with adequate training and information on safety and health aspects. Supervisory staff shall be held responsible for ensuring compulsory wearing of dust mask.
- (iii) In case of outsourcing of work through MDO, the project proponent shall ensure the strict enforcement of the above conditions.

(f) Biodiversity

- (i) The project proponent shall take all precautionary measures during mining operation for conservation and protection of endangered fauna, if any, spotted in the study area. Action plan for conservation of flora and fauna shall be prepared and implemented in consultation with the State Forest and Wildlife Department. A copy of action plan shall be submitted to the Ministry of Environment, Forest and Climate Change and its Regional Office.

(g) Implementation of Action Plan as per Public Hearing and CSR Activities

- (i) Implementation of Action Plan on the issues raised during the Public Hearing shall be ensured. The Project Proponent shall complete all the tasks as per the Action Plan submitted with budgetary provisions during the Public Hearing. Land oustees should be compensated as per the norms laid out R&R Policy of the Company or the National R&R Policy or R&R Policy of the State Government, whichever is higher.
- (ii) The Board of every company, shall ensure that the company spends, in every financial year, at least two per cent. of the average net profits of the company made during the three immediately preceding financial years, in pursuance of its Corporate Social Responsibility Policy under Section 135 of the Companies Act, 2013, for the socio economic development of the neighbourhood.

(h) Corporate Environment Responsibility

- (i) The Company should have a well laid down Environment Policy approved by the Board of Directors.
- (ii) To have proper checks and balances, the Company should have a well laid down system of reporting of non-compliances/violations of environmental norms to the Board of Directors of the Company and/or shareholders or stakeholders at large.
- (iii) A separate environmental management cell with suitable qualified personnel should be set-up under the control of a Senior Executive, who will report directly to the Head of the Organization.
- (iv) The funds earmarked for environmental protection measures should not be diverted for other purpose. Year wise expenditure should be reported to the Ministry and its Regional Office.

(i) Statutory Obligations

- (i) Environmental clearance is granted subject to final outcome of Hon'ble Supreme Court of India, Hon'ble High Court, NGT and any other Court of Law, if any, as applicable to the project.
- (ii) This Environmental Clearance is subject to obtaining requisite NBWL Clearance from the Standing Committee of National Board for Wildlife, if any, as applicable to the project.
- (iii) The project proponent shall obtain Consent to Establish and Consent to Operate from the concerned State Pollution Control Board prior to increase in capacity of washery and effectively implement all the conditions stipulated therein.

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ANNEXURE-IV (Cont..)

(iv) Project Proponent shall obtain the necessary prior permission from the Central Ground Water Authority (CGWA) for drawl of water (surface and ground water).

(j) Monitoring of Project

(i) Regular monitoring of ground water level and quality shall be carried out in and around the mine lease by establishing a network of existing wells and constructing new piezometers during the mining operation. The monitoring shall be carried out four times in a year pre-monsoon (April-May), monsoon (August), post-monsoon (November) and winter (January) and the data thus collected may be sent regularly to Ministry of Environment, Forest and Climate Change and its Regional Office, Central Ground Water Authority and Regional Director, Central Ground Water Board.

(ii) The project proponent shall submit six monthly reports on the status of the implementation of the stipulated environmental safeguards to the Ministry of Environment, Forest and Climate Change, its Regional Office, Central Pollution Control Board and State Pollution Control Board.

(iii) The Regional Office of this Ministry shall monitor compliance of the stipulated conditions. The project authorities should extend full cooperation to the officer (s) of the Regional Office by furnishing the requisite data/information/monitoring reports.

(iv) The activities pertaining to development of green belt/horticulture shall be reported to concerned Regional Office of MoEF&CC on six monthly basis from the date of commencement of mining operations.

(v) For half yearly monitoring reports, the data should be monitored for the period of April to September and October to March of the financial years and submitted to the concerned authorities within 2 months of the completion of periodicity of monitoring.

(k) Miscellaneous

(i) A copy of clearance letter will be marked to concerned Panchayat/local NGO, if any, from whom suggestion / representation has been received while processing the proposal.

(ii) An electronic copy of the EC letter shall be marked to the concerned State Pollution Control Board, Regional Office, District Industry Sector and Collector's Office/Tehsildar Office for information in public domain within 30 days.

(iii) The EC letter shall be uploaded on the company's website. The compliance status of the stipulated EC conditions shall also be uploaded by the project authorities on their website and updated at least once every six months so as to bring the same in public domain. The monitoring data of environmental quality parameter (air, water, noise and soil) and critical pollutant such as PM₁₀, PM_{2.5}, SO₂ and NO_x (ambient) and critical sectoral parameters shall also be displayed at the entrance of the project premises and mine office and in corporate office and on company's website.

(iv) The project authorities should advertise at least in two local newspapers widely circulated, one of which shall be in the vernacular language of the locality concerned, within 7 days of the issue of the clearance letter informing that the project has been accorded environmental clearance and a copy of the clearance letter is available with the State Pollution Control Board and also at web site of the Ministry of Environment, Forest and Climate Change at www.environmentclearance.nic.in and a copy of the same should be forwarded to the Regional Office.

(v) The Environmental Statement for each financial year ending 31 March in Form-V is mandated to be submitted by the PP for the concerned State Pollution Control Board as

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ANNEXURE-IV (Cont..)

prescribed under the Environment (Protection) Rules, 1986, as amended subsequently, shall also be uploaded on the Company's website along with the status of compliance of EC conditions and shall be sent to the respective Regional Offices of the MoEF&CC by e-mail.

5. The proponent shall abide by all the commitments and recommendations made in the EIA/EMP report and also that during presentation to the EAC. All the commitments made on the issues raised during public hearing shall also be implemented in letter and spirit.

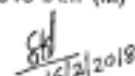
6. The proponent shall obtain all necessary clearances/approvals that may be required before the start of the project. The Ministry or any other competent authority may stipulate any further condition for environmental protection. The Ministry or any other competent authority may stipulate any further condition for environmental protection.

7. Concealing factual data or submission of false/fabricated data and failure to comply with any of the conditions mentioned above may result in withdrawal of this clearance and attract action under the provisions of Environment (Protection) Act, 1986.

8. The above conditions will be enforced inter-alia, under the provisions of the Water (Prevention & Control of Pollution) Act, 1974, the Air (Prevention & Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986 and the Public Liability Insurance Act, 1991 along with their amendments and Rules and any other orders passed by the Hon'ble Supreme Court of India/High Courts and any other Court of Law relating to the subject matter.

9. Any appeal against this environmental clearance shall lie with the National Green Tribunal, if preferred, within a period of 30 days as prescribed under Section 16 of the National Green Tribunal Act, 2010.

10. This EC supersedes the earlier EC granted vide letter No. J-11015/280/2013-IA.II (M) dated 19.02.2014 with a capacity 25 MTPA.


(S. K. Srivastava)
Scientist E

Copy to:

1. The Secretary, Ministry of Coal, Shastri Bhawan, New Delhi
2. The APPCF, Regional office (EZ), MoEF&CC, A-31, Chandrashekarpur, Bhubaneswar. 751023 (Odisha)
3. The Secretary, Department of Environment & Forest, Government of Odisha, Secretariat, Bhubaneswar (Odisha)
4. The Member Secretary, Central Ground Water Authority, Ministry of Water Resources, Curzon Road Barracks, A-2, W-3 Kasturba Gandhi Marg, New Delhi
5. The Member Secretary, CPCB, CBD-cum-Office Complex, East Arjun Nagar, Delhi - 32
6. The Member Secretary, Odisha SPCB, Neelakanth Nagar, Unit-VIII, Bhubaneswar
7. The District Collector, Angul, Government of Odisha
8. Monitoring File 9. Guard File 10. Record File 11. Notice Board

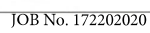

(S. K. Srivastava)
Scientist E

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ANNEXURE-V





ANNEXURE - VII



OFFICE OF THE
STATE POLLUTION CONTROL BOARD, ODISHA

Parivesh Bhawan, A/118, Nilakantha Nagar, Unit-VIII,
Bhubaneswar - 751 012

BY REGD POST

No. 2631 /

Ind-II-NOC-5837

Date 24.02.19

OFFICE MEMORANDUM

In consideration of the application for obtaining **Consent to Establish for Bhubaneswari OCP** of M/s. Mahanadi Coal Fields Ltd., the State Pollution Control Board has been pleased to convey its Consent to Establish under section 25 of Water (Prevention & Control of Pollution) Act, 1974 and section 21 of Air (Prevention & Control of Pollution) Act, 1981 for enhancement of production capacity of Coal from **20.0MTPA to 25.0MTPA**, over mine lease hold area of 638.341 ha. (658.724 ha. - 20.383 ha = 638.341 ha.), At-Jagannath Area, Talcher, P.O:- Dera Colliery of Angul District with the following conditions.

GENERAL CONDITIONS:

1. This Consent to establish is valid for the product, method of mining and capacity mentioned in the application form. This order is valid for five years, which means the proponent shall commence mining activities for the proposal within a period of five years from the date of issue of this consent to establish order. If the proponent fails to commence mining activities for the proposal within five years then a renewal of this consent to establish shall be sought by the proponent.
2. Adequate effluent treatment facilities are to be provided such that the quality of sewage and trade effluent satisfies the standards as prescribed under Environment Protection Rule, 1986 or as prescribed by the Central Pollution Control Board and/or State Pollution Control Board or otherwise stipulated in the special conditions.
3. All emission from the mining activities as well as the ambient air quality and noise shall conform to the standards as laid down under Environment (Protection) Act, 1986 or as prescribed by Central Pollution Control Board/State Pollution Control Board or otherwise stipulated in the special conditions.
4. Appropriate method of disposal of solid waste is to be adopted to avoid environmental pollution.
5. The mine shall comply to the provisions of Environment Protection Act, 1986 and the rules made there under with their amendments from time to time such as the Hazardous Waste (Management, Handling & Transboundary Movement) Rules 2008, Hazardous Chemical Rules /Manufacture, Storage and Import of Hazardous Chemical Rules, 1989 etc. and amendments there under. The mine shall also comply to the provisions of Public Liability Insurance Act, 1991, if applicable.

[1]

ANNEXURE – VII (Cont..)

6. The mine shall apply for grant of Consent to operate under section 25/26 of Water(Prevention & Control of Pollution)Act, 1974 & Air (Prevention & Control of Pollution)Act, 1981 at least 3 (three) months before the commencement of production and obtain Consent to Operate from this Board.
7. **This consent to establish is subject to statutory and other clearances from Govt. of Odisha and/or Govt. of India, as and when applicable.**

SPECIAL CONDITIONS :

1. **The proponent shall comply to the conditions imposed in environmental clearance issued by MoEF. Govt. of India vide letter No. J-11015/280/2013-IA.II (M), dtd. 19.02.2014.**
2. **The proponent shall carry out mining activity within the existing mining lease area of 638.341 ha. (i.e. total ML area 658.724ha - 20.383ha, for which the proponent has not obtained forest clearance) as per environmental clearance granted by the MoEF, Govt of India vide letter no. J-11015/280/2013-IA.II (M), dtd. 19.02.2014.**
3. The mine shall use surface miner instead of sovel dumper for mining activity.
4. Mining operations for the expansion project shall not involve drilling and blasting operations and surface miner shall be used for the mining operation.
5. The roads should be developed with a 3-tier avenue plantation preferably of 20-30m width using native species. The road transportation should be by mechanically covered trucks and not tarpaulin covered trucks, which should be introduced within 9-12 months from the date of issue of this order.
6. The mine shall explore the possibility for back filling of mine voids by fly ash generation from nearby thermal power plant.
7. No change in mining technology and scope of working shall be made without prior approval of the Board.
8. Top soil should be stacked separately with proper slope at earmarked site(s) with adequate measures and shall be used for reclamation and rehabilitation of mined out areas.
9. **Back filling of abandoned pit shall be carried out as per approved mining plan. Monitoring and management of rehabilitated areas should continue until the vegetation becomes self-sustaining. Compliance status in this regard shall be submitted to the Ministry of Environment & Forests with a copy to the Board on yearly basis.**
10. Garland drains (size, gradient and length) and sump capacity shall be designed keeping 50% safety margin over and above the peak sudden rain fall and maximum discharge in the area adjoining the mine site. Sump capacity should also provide adequate retention period to allow proper settling of silt material.
11. Dimension of the retaining wall at the toe of dumps and OB benches within the mine to check run-off and siltation shall be based on the rainfall data. The detail specification shall be worked out and submitted to the Board.
12. Catch drains of appropriate size should be constructed to divert the run off from the OB dump to the siltation pond of appropriate size to arrest silt and sediment flows from soil, OB and

ANNEXURE – VII (Cont..)

mineral dumps. Similar arrangement shall be done around the coal stack pile area. The drains should be regularly desilted and maintained properly. Surface run-off from OB dump area, coal pile area, top soil storage area shall be routed through adequate settling pond (designed maximum hourly rain fall basis) to meet prescribed standard of **SS-50 mg/l and Oil & Grease-10 mg/l** before discharge into natural stream/water courses during monsoon.

13. Regular monitoring of ground water level and quality should be carried out by establishing a network of existing wells. The monitoring should be done four times a year in pre-monsoon (April/May), monsoon (August), Post – monsoon (November) and winter (January) seasons. Data thus collected should be submitted to the Board quarterly.
14. Sewage Treatment Plant should be installed for the treatment of domestic effluent generated from the colony and mines so as to meet the prescribed standard such as **pH=5.5-9.0, SS=100mg/l, BOD=30mg/l & O&G=10mg/l** and shall be reused for green belt development
15. Wastewater (workshop) shall be properly collected, treated in ETP consists of primary settling tank, O&G trap, flash mixer with chemical dosing and secondary settling tank so as to conform the prescribed standard **pH = 5.5-9.0, SS = 100mg/l, O&G = 10mg/l** or as amended from time to time and reused for washing with make-up water.
16. Mine drainage water, shall be treated properly in adequate size of settling tanks with coagulation and chemical dosing facilities. The mine shall explore to reuse it for dust suppression, green belt and vehicle washing. Balance treated mine drainage water shall be discharged to sewer or land or stream then the effluent shall confirm to standard prescribed by the Board i.e. **pH =5.5 to 9.0, total SS = 100mg/l, O&G = 10mg/l**. and other parameters conforming to standards for discharge to inland surface water as prescribed under EP Act, 1986.
17. Rain water harvesting practice shall be followed by utilizing the rain water collected from the roof of the buildings for recharging of ground water within the premises and other large structures as per the concept and practices prescribed by CPCB, New Delhi and details of which is available in the web site.
18. The mine shall take adequate preventive measures for spontaneous fire in the coal seam as well as stock yard and an action plan regarding this shall be submitted at the time of consent to operate application.
19. **Crushers at the CHP** of adequate capacity for the expansion project shall be operated with high efficiency bag filters. Water sprinkling systems shall be provided to check fugitive emissions from crushing operations, conveyor system, haulage roads, transfer points etc.
20. **Provision of movable chutes shall be made during loading at CHP to avoid free fall of coal.**
21. Water sprinkling shall be carried out on unplanted surface of OB dump to control fugitive emission.
22. Drilling shall be avoided to the maximum possible extent. However, drill should be wet operated or with dust extractors and controlled blasting should be practiced.
23. The mine shall provide water or water mixed chemicals for dust suppression at all strategic points such as coal stack yards, loading and unloading points, all transfer points, conveyors etc. to suppress dust fine atomizer nozzles arrangement shall be provided on the coal heaps

ANNEXURE – VII (Cont..)

and on land around the crusher / pulverizes. As far as possible conveyors and transfer points etc. shall be provided with enclosures.

24. **Four ambient air quality monitoring stations** for 24 hours operation should be established in the core zone as well as in the buffer zone for PM₁₀, PM_{2.5}, SO₂, NO_x, and CO monitoring. Location of the stations should be decided based on the metrological data, topographical features and environmentally and ecologically sensitive targets in consultation with the State Pollution Control Board.
25. Data on ambient air quality (PM₁₀, PM_{2.5}, SO₂, NO_x and CO) shall be regularly submitted to the State Pollution Control Board once in six months.
26. The mine has to comply the following standard at the loading or unloading, haul road, coal transportation road, coal handling plant(CHP), overburden dumps or any other dust generating external sources as per the Rule2(1) of the Environmental Amendment Rules, 2000 notified vide notification G.S.R. 742(E), dated 25.09.2000.

Pollutant	Time weighted average	Concentration in Ambient Air	Method of Measurement
1	2	3	4
SPM	Annual Average*	360µg/m ³	High volume sampling (Average flow rate not less than 1.1m ³ /min)
	24 hours**	500µg/m ³	
RPM(size less than 10 µm)	Annual Average*	180µg/m ³	Respirable Particulate matter sampling and analysis
	24 hours**	250µg/m ³	
SO ₂	Annual Average*	80µg/m ³	Improved west and Gaeke method Ultraviolet fluorescence
	24 hours**	120µg/m ³	
NO ₂	Annual Average*	80µg/m ³	Jacob & Hochheiser Modified (Na-Arsenic) Method Gas phase Chemiluminescence
	24 hours**	120µg/m ³	

* Annual Arithmetic mean for the measurements taken in a year, following the guidelines for frequency of sampling laid down in clause2.

**24 hourly/ 8 hourly values shall be met 92% of the time in a year. However, 80% of the time may exceed but not on two consecutive days.

27. The haul roads and arterial roads shall be made black topped / concrete with avenue plantation.
28. A green belt of adequate width and density preferably with local species along the periphery of the mine, inactive dumps, backfilled area, vacant area, colony and any other vacant area shall be raised so as to provide protection against particulates and noise to ameliorate the environment. A detailed plantation programme in this regard shall be prepared and submitted at the time of making application for consent to operate for assessment.

ANNEXURE – VII (Cont..)

29. Adequate measures shall be taken for control of noise levels below 85 dB (A) in the work environment.
30. Environmental laboratory should be established with adequate number and type of pollution monitoring and analysis equipment in consultation with the State Pollution Control Board.
31. A separate environmental management cell with suitable qualified personnel should be set up under the control of a Senior Executive, who will report directly to the Head of the organization.
32. All efforts shall be taken to protect the existing water bodies in the surrounding. A definite plan in this regard shall be submitted to the Board within 06 months from the date of issue of this order.
33. The Board may impose further condition or modify the conditions stipulated in this order during installation, and / or at the time of obtaining consent to operate and may revoke this clearance in case the stipulated conditions are not implemented and / or any information suppressed in the application form.
34. The above conditions will be enforced, inter-alia, under the provisions of the Water (Prevention & Control of Pollution) Act, 1974 the Air (Prevention & Control of Pollution) Act, 1981 the Environment (Protection) Act, 1986 and the Public Liability Insurance Act, 1991 along with their amendments and rules.

To,

Mr. Sahab Singh, Project Officer,
Bhubaneswari OCP of M/s. Mahanadi Coal Fields Ltd.,
At/Po- Dera, Tahasil- Talcher,
Dist- Angul-759103,
Odisha.


MEMBER SECRETARY



Memo No. _____/Dt. _____/

Copy forwarded to:

1. The Secretary Steels & Mines, Govt. of Odisha, Bhubaneswar.
2. The District Magistrate & Collector, Angul.
3. The Director, Directorate of Mines, Govt. of Odisha, Bhubaneswar.
4. The Deputy Director of Mines, Talcher.
5. The Regional Officer, SPC Board, Angul.
6. The DFO, Angul.
7. Copy to HSM Cell, SPC Board, Bhubaneswar.
8. Consent to operate section, SPC Board, Bhubaneswar.
9. Copy to Guard file.


SR. ENV. ENGINEER (N)

ANNEXURE-VII (A)

FAX : 2562822/2560955
Tel : 2564033/2563924
EPABX : 2561909/2562847
E-mail: paribesh1@ospcbboard.org
Web site : www.ospcbboard.org

**OFFICE OF THE
STATE POLLUTION CONTROL BOARD, ODISHA**
Parivesh Bhawan, A/118, Nilakantha Nagar, Unit-VIII,
Bhubaneswar - 751 012

No. 2385 / IND-II-NOC - 6139 Date 06.03.2018 / BY REGD POST

OFFICE MEMORANDUM

In consideration of the online application no. 1894616 for obtaining Consent to Establish for **Bhubaneswari OCP of M/s Mahanadi Coalfields Ltd.**, the State Pollution Control Board is pleased to convey its Consent to Establish under section 25 of Water (Prevention & Control of Pollution) Act, 1974 and section 21 of Air (Prevention & Control of Pollution) Act, 1981 for **enhancement of production of coal from 25.00 MTPA to 28.00 MTPA over existing mining lease hold area of 638.341 ha. (as per land requirement breakup enclosed as Annexure- I), At-Jagannath Area, Talcher, P.O:- Dera Colliery in the district of Angul with the following conditions.**

GENERAL CONDITIONS:

1. This Consent to establish is valid for the product, method of mining and capacity mentioned in the application form. This order is valid for five years. The proponent shall commence mining activities for the proposal within a period of five years from the date of issue of this consent to establish order. If the proponent fails to commence mining activities for the proposal within five years then a renewal of this consent to establish shall be sought by the proponent.
2. The mine shall apply for grant of Consent to operate under section 25/26 of Water(Prevention & Control of Pollution) Act, 1974 & Air (Prevention & Control of Pollution) Act, 1981 at least 3 (three) months before the commencement of production and obtain Consent to Operate from this Board.
3. This consent to establish is subject to statutory and other clearances from Govt. of Odisha and/or Govt. of India, as and when applicable.

SPECIAL CONDITIONS:

A. GENERAL CONDITIONS:

1. The proponent shall comply to the conditions imposed in environmental clearance issued vide letter no. J-11015/280/2013-IA.II(M)pt, dated 16.02.2018.
4. The mine should not store for more than seven days of coal production to avoid coal fire in stock yard as well as coal seam. The mine shall take adequate preventive measures for spontaneous fire in the coal seam as well as stock yard and an action plan regarding this shall be submitted at the time of consent to operate application.
5. The method of mining shall be opencast mining by shovel-dumper in overburden and surface miner, loader and tipper in coal. No change in mining technology and scope of working shall be made without prior approval of the Board.

Page 1 of 6

ANNEXURE-VII (A) (Cont..)

6. A green belt of adequate width and density, preferably with local species along the periphery of the mine, inactive dumps, backfilled area, vacant area and any other vacant area shall be raised so as to provide protection against particulates and noise to ameliorate the environment. A detailed plantation programme in this regard shall be prepared and submitted at the time of making application for consent to operate for assessment.
7. Adequate measures shall be taken for control of noise levels below 85 dB (A) in the work environment.
8. Environmental laboratory should be established with adequate number and type of pollution monitoring and analysis equipment in consultation with the State Pollution Control Board.
9. A separate environmental management cell with suitable qualified personnel should be set up under the control of a Senior Executive, who will report directly to the Head of the organization.
10. The Board may impose further condition or modify the conditions stipulated in this order during installation, and / or at the time of obtaining consent to operate and may revoke this clearance in case the stipulated conditions are not implemented and / or any information suppressed in the application form.
11. The conditions as stipulated in this consent to establish order will be enforced, inter-alia, under the provisions of the Water (Prevention & Control of Pollution) Act, 1974 the Air (Prevention & Control of Pollution) Act, 1981 the Environment (Protection) Act, 1986 and the Public Liability Insurance Act, 1991 along with their amendments and rules.
12. The project shall use fly ash bricks and other building materials made out of fly ash for construction of township.
13. The proponent shall install solar powered lighting and heating system whenever possible in township.

B. WATER POLLUTION:

14. Garland drains (size, gradient and length) and sump capacity shall be designed keeping 50% safety margin over and above the hourly peak rain fall and maximum discharge in the area adjoining the mine site. Sump capacity should have adequate retention period to allow proper settling of silt material.
15. Dimension of the retaining wall at the toe of dumps and OB benches within the mine to check run-off and siltation shall be based on the rainfall data. The detail specification shall be worked out and submitted to the Board.
16. Catch drains of appropriate size should be constructed to divert the run off from the OB dump to the siltation pond of appropriate size to arrest silt and sediment flows from soil, OB and mineral dumps. Similar arrangement shall be done around the coal stack pile area. The drains should be regularly desilted and maintained properly. Surface run-off from OB dump area, coal pile area, top soil storage area shall be routed through adequate settling pond (designed maximum hourly rain fall basis) to meet prescribed standard of **SS-100 mg/l and Oil & Grease-10 mg/l** before discharge into natural stream/water courses during monsoon.

ANNEXURE-VII (A) (Cont..)

17. Regular monitoring of ground water quality should be carried out by establishing a network of existing wells. The monitoring should be done four times a year in pre-monsoon (April/May), monsoon (August), Post – monsoon (November) and winter (January) seasons. Data thus collected should be submitted to the Board quarterly.
18. The domestic wastewater generated from the township will be treated in sewage treatment plant. The treated water shall be reused for gardening and plantation and the surplus water if any shall be discharged to outside after meeting the following prescribed standards as notified by the MoEF&CC, Govt. of India vide G.S.R. 1265 (E), dated 13.10.2017.

Sl. No.	Parameters	Standards
1.	pH	6.5-9.0
2.	BOD(mg/l)	30
3.	TSS(mg/l)	<100
4.	Fecal Coliform (MPN/100ml)	< 1000

19. Oil and grease trap shall be installed before discharge of effluent from workshop. Wastewater from the mine pit, check dams or any other discharge leaving lease boundary of the mine should be properly collected, treated so as to conform the following standard i.e. pH = 5.5 – 9.0, SS = 100 mg/l, COD = 250 mg/l & Oil & Grease = 10 mg/l.
20. Rain water harvesting practice shall be followed by utilizing the rain water collected from the roof of the buildings for recharging of ground water within the premises and other large structures as per the concept and practices prescribed by CPCB, New Delhi and details of which is available in the web site.

C. AIR POLLUTION:

21. High efficiency bag filters shall be installed at crushers of the Coal Handling Plant. Water sprinkling systems shall be provided to check fugitive emissions from crushing operations, conveyor system, haulage roads, transfer points etc. **Provision of movable chutes shall be made during loading at CHP to avoid free fall of coal.**
22. Water sprinkling shall be carried out on unplanted surface of OB dump to control fugitive emission.
23. Drilling shall be avoided to the maximum possible extent. However, drill should be wet operated or with dust extractors and controlled blasting should be practiced.
24. The mine shall provide water or water mixed chemicals for dust suppression at all strategic points such as coal stack yards, loading and unloading points, all transfer points, conveyors etc. to suppress dust fine atomizer nozzles arrangement shall be provided on the coal heaps and on land around the crusher / pulverizers. As far as possible conveyors and transfer points etc. shall be provided with enclosures.
25. **Four (4) ambient air quality monitoring stations** for 24 hours operation should be established in the core zone as well as in the buffer zone for PM₁₀, PM_{2.5}, SO₂, NO_x, and CO monitoring. Location of the stations should be decided based on the metrological data, topographical features and environmentally and ecologically sensitive targets in consultation with the State Pollution Control Board.

ANNEXURE-VII (A) (Cont..)

26. Data on ambient air quality (PM₁₀, SO₂, NO_x and CO) shall be regularly submitted to the State Pollution Control Board once in six months.
27. The mine shall comply the following standard at the loading or unloading, haul road, coal transportation road, coal handling plant (CHP), railway siding, blasting, drilling, overburden dumps or any other dust generating external sources as per the Rule 2(1) of the Environmental Amendment Rules, 2000 notified vide notification G.S.R. 742 (E), dated 25.09.2000.

Pollutant	Time weighted average	Concentration in Ambient Air	Method of Measurement
1	2	3	4
SPM	Annual Average* 24 hours**	360µg/m ³ 500µg/m ³	High volume sampling (Average flow rate not less than 1.1m ³ /min)
RPM(size less than 10 µm)	Annual Average* 24 hours**	180µg/m ³ 250µg/m ³	Respirable Particulate matter sampling and analysis
SO ₂	Annual Average* 24 hours**	80µg/m ³ 120µg/m ³	Improved west and Gaeke method Ultraviolet fluorescence
NO ₂	Annual Average* 24 hours**	80µg/m ³ 120µg/m ³	Jacob & Hochheiser Modified (Na-Arsenic) Method Gas phase Chemiluminescence

(*Annual Arithmetic mean for the measurements taken in a year, following the guidelines for frequency of sampling laid down in clause-2.


**24 hourly/ 8 hourly values shall be met 92% of the time in a year. However, 80% of the time may exceed but not on two consecutive days.)

28. The haul roads and arterial roads shall be made black topped / concrete with avenue plantation.

D. SOLID WASTE:

29. Intermediate storage area for Municipal Solid Waste (MSW) shall be developed inside the premises of township before handing over the MSW to the concerned ULBs for final disposal.
30. The proponent shall segregate organic waste from the MSW of township and segregated organic waste shall be converted to manure through organic waste converter. The proponent shall store the organic waste in closed shed inside the township before use the same in organic waste converter.
31. All required sanitary and hygienic measures should be in place before starting construction activities of township and to be maintained throughout the construction phase.
32. All the top soil excavated during construction activities of township should be stored for use in horticulture / landscape development within the project site.
33. Disposal of muck during construction phase of township should not create any adverse effect on the neighbouring communities and be disposed taking the necessary precautions for general safety and health aspects of people, only in approved sites with the approval of competent authority.

ANNEXURE-VII (A) (Cont..)



34. The proponent shall comply the provisions of Construction & Demolition Waste Management Rules, 2016.

35. Construction spoils of township, including bituminous material and other hazardous materials, must not be allowed to contaminate watercourses and the dump sites for such material must be secured so that they should not leach into the ground water.


36. The Project proponent shall dispose off hazardous waste materials such as tarry products, lead containing products, paints & pigments residues, broken fluorescent and mercury lamps during construction and operational phase as per Hazardous and Other Wastes (Management and Trans boundary Movement) Rules, 2016 as amended from time to time

37. Municipal solid waste generated from the township shall be disposed off as per Solid Waste Management Rules, 2016.

38. Top soil of mining area shall be stacked separately with proper slope at earmarked site (s) with adequate measures and shall be used for reclamation and rehabilitation of mined out areas.

39. **Back filling of abandoned pit shall be carried out as per approved mining plan. Monitoring and management of rehabilitated areas should continue until the vegetation becomes self-sustaining. Compliance status in this regard shall be submitted to the Board on yearly basis. The mine shall explore the possibility for back filling of mine voids by fly ash generation from nearby thermal power plant.**

To,



MEMBER SECRETARY

Mr. P. B. Reddy, Project Officer,
Bhubaneswari OCP of M/s Mahanadi Coal Fields Ltd.,
Jagannath Area, Talcher, P.O- Dera Colliery,
Dist- Angul, Odisha.

Memo No. 2386 /Dt. 06.03.2018 /

Copy forwarded to:

1. The Secretary Steels & Mines, Govt. of Odisha, Bhubaneswar
2. The Collector & District Magistrate, Angul
3. The Director, Directorate of Mines, Govt. of Odisha, Bhubaneswar
4. The Regional Officer, SPC Board, Angul
5. The DFO, Angul
6. Copy to HSM Cell, SPC Board, Bhubaneswar
7. Consent to Operate Section, SPC Board, Bhubaneswar.
8. Copy to Guard file


SR. ENV. SCIENTIST, L-I (N)

ANNEXURE-VII (A) (Cont..)

Annexure-I

Land Requirement Break-up (In Ha.) for Bhubaneswari OCP of M/s Mahanadi Coalfields Ltd.

Particulars	Forest	Non- Forest	Total
Quarry excavation	105.808	336.450	442.258
Blasting danger zone (excluding the part of OB dump)	—	83.150	83.150
OB dumps (external)	----	94.000	94.000
Railway siding	----	8.000	8.000
Infrastructure	6.713	4.220	10.933
Mine Lease Area	112.521	525.820	638.341*
Residential Colony	----	32.000	32.000
Rehabilitation site	----	117.570	117.570
Outside lease area	----	149.57	149.57
Total	112.521	675.39	787.911

ANNEXURE-VIII

F.No.8-18/2002-FC
Government of India
Ministry of Environment & Forests
(FC Division)

Paryavaran Bhawan, CGO Complex,
Laxmi Road, New Delhi-110003
Dated the 16th October, 2002

To
The Secretary (Forests),
Government of Orissa,
Bhubaneswar.

Sub: Diversion of 132.994 ha. of forest land in Talcher Coalfields of Angul District in favour of Bhubaneswari OCP of Mahanadi Coalfields Ltd., Orissa.

Sir,

I am directed to refer your letter No.10F(Cons)-128/01/2347/F&E dated: 5-2-2002 on the above-mentioned subject seeking prior approval of the Central Government under Section-2 of the Forest (Conservation) Act, 1980.

After careful examination of the proposal of the State Government, the Central Government hereby agrees in-principle for diversion of 112.521 ha. of forest land in Talcher Coalfields of Angul District in favour of Bhubaneswari OCP of Mahanadi Coalfields Ltd., Orissa, subject to fulfillment of following conditions:

1. The User Agency shall transfer the cost of raising and maintaining the compensatory afforestation over degraded forest land area double in extent i.e.225.042 ha., to the State Forest Department.
2. The cost of biological reclamation and afforestation shall be deposited with the State Forest Department by the User Agency.
3. The User Agency shall prepare a plan for habitat improvement of the surrounding areas for next 5(five) years at the project cost in consultation with the State Forest Department.
4. The rehabilitation plan shall be immediately implemented under the supervision of the State Government and the Regional Office, Bhubaneswar.

After receipt of compliance report on the fulfillment of the conditions (1), (2) & (3) and progress report on condition (4) from the State Government, formal approval will be issued in this regard under Section 2 of the Forest (Conservation) Act, 1980.

Yours faithfully,

(Anurag Bajpai)

Asstt. Inspector General of Forests (FC)

Copy to:

1. The Principal Chief Conservator of Forests, Government of Orissa, Bhubaneswar.
2. The Nodal Officer, Forest Department, Government of Orissa, Bhubaneswar.
3. The Chief Conservator of Forests (Central), Regional Office, Bhubaneswar.
4. User Agency.
5. Guard File.

(Anurag Bajpai)

Asstt. Inspector General of Forests (FC)

ANNEXURE-VIII (Cont..)

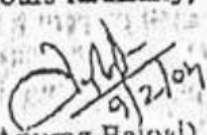
AM/PO, Jagriti Vihar, Sambalpur-768020, Orissa.

Conversion of 132.904 ha. of forest land in Talcher Coalfields of Angul District in Orissa of Bhubaneswar OCP of Mahanadi Coalfields Ltd., Orissa.

Kindly refer to your D.O. letter no. MCL/HQ/SBP/CF/04/03 dated 4th January 2014 on the above mentioned subject. In this regard, I am directed to inform you that request for modification of condition No.2 has been examined by the Central Committee and it does not stand merit for consideration.

It is, therefore, requested that the user agency may be asked to deposit the whole amount with the State Government at the earliest and the State Government will deposit the same with Compensatory Afforestation Management and Planning Agency (P.A).

Yours faithfully,


(Anurag Bajpai)
Asstt. Inspector General of Forests

10:

1. The Principal Secretary (Forests), Government of Orissa, Bhubaneswar.
2. The Principal Chief Conservator of Forests, Government of Orissa, Bhubaneswar.
3. The Nodal Officer, Forest Department, Government of Orissa, Bhubaneswar.
4. The Chief Conservator of Forests (Central), Regional Office, Bhubaneswar.
5. User Agency.
6. Guard File.

(Anurag Bajpai)
Asstt. Inspector General of Forests

10/11/2014

ANNEXURE-VIII (Cont..)

F.No.8-18/2002-FC

Government of India

Ministry of Environment & Forests
(FC Division)

Paryavaran Bhawan, CGO Complex,
Lodi Road, New Delhi-110003
Dated the 6th December 2004

To
The Secretary (Forests),
Government of Orissa,
Bhubaneswar.

Sub: Diversion of 132.904 ha. (approved area 112.521 ha). of forest land in Talcher Coalfields of Angul District in favour of Bhubaneswari OCP of Mahanadi Coalfields Ltd., Orissa.

Sir,
I am directed to refer to your letter No. 10F(Cons)-128/01/2347/F&E dated: 5-2-2002 on the above mentioned subject seeking prior approval of the Central Govt. under Section-2 of Forest (Conservation) Act, 1980 and to say that the proposal has been examined by the Advisory Committee constituted by the Central Government under Section 3 of the aforesaid Act.

After careful consideration of the proposal of the State Government and on the basis of the recommendation of the above mentioned Advisory Committee, the Central Government hereby, conveys its approval under Section-2 of Forest (Conservation) Act, 1980 for diversion of 112.521 ha. of forest land in Talcher Coalfields of Angul District in favour of Bhubaneswari OCP of Mahanadi Coalfields Ltd., Orissa, subject to the fulfilment of the following conditions:

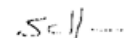
1. Legal status of forest land shall remain unchanged.
2. Compensatory afforestation shall be raised and maintained by the State Forest Department over degraded forest area double in extent, at the project cost.
3. Safety zone shall be regenerated and protected and plantations shall be raised and maintained over degraded forest lands elsewhere, over an area one and half times of the extent of the safety zone, by the State Forest Department, at the project cost.
4. Biological reclamation and afforestation shall be done by the State Forest Department at the project cost.
5. Habitat improvement plan for the surrounding areas shall be implemented by the State Forest Department at the project cost.
6. The State Government shall maintain the above-mentioned funds in the form of Fixed Deposits in the name of concerned DFO/ Nodal Officer of the State, in a nationalized bank, till such time the Compensatory Afforestation Fund

ANNEXURE-VIII (Cont..)

Management and Planning Authority (CAMPA) intimates the head of account for transfer/deposition of funds.

7. Demarcation of the area will be done on ground at project cost using four feet high RCC pillars. The pillars shall indicate serial numbers, forward and back bearings and distance between adjacent pillars.
8. The user agency shall protect the top soil at the project cost.
9. Concurrent Reclamation plan shall be executed by the user agency from the very first year and an annual report shall be sent to the Nodal Officer and the Regional CCF, Bhubaneswar. If it is found from the Annual report that the annual programme mentioned in Concurrent Reclamation Plan is not being adhered to by the user agency, the mining activities shall remain suspended till such time the annual programme is completed for that year.
10. Trees shall be felled only when it becomes necessary and under strict supervision of State Forest Department.
11. The user agency shall protect the top soil at the project cost.
12. No labour camps shall be established on the forest land.
13. Sufficient firewood shall be provided by the User Agency to the labourers at the project cost after purchase from the State Forest Department/Forest Development Corporation.
14. Mining shall be done as per the approved mining plan.
15. The User Agency shall ensure that there is no damage to the available wildlife.
16. The forest land shall not be used for any purpose other than that specified in the proposal.
17. The lease period shall be co-terminus with the current lease granted under MMRD Act, 1957.
18. Rehabilitation Plan shall be adhered to by the user agency/State Government.
19. Any other condition that the State Government as well as CCF (Central) Regional Office, Bhubaneswar, may impose from time to time for the protection and improvement of flora and fauna in the forest area.

Yours faithfully



(Anurag Bajpai)
Asstt. Inspector General of Forest

Copy to:

1. The Principal Chief Conservator of Forests, Government of Orissa, Bhubaneswar.
2. The Nodal Officer, Forest Department, Government of Orissa, Bhubaneswar.
3. The Chief Conservator of Forests (Central), Regional Office, Bhubaneswar.
4. User Agency.
5. Monitoring Cell of FC Division
6. Guard File.



(Anurag Bajpai)
Asstt. Inspector General of Forest

ANNEXURE-IX

No.J-11015/45/96-IA.II(M)
Government of India
Ministry of Environment & Forests

Paryavaran Bhawan,
C.G.O.Complex, Lodi Road,
New Delhi-110 003.

To
Director (Technical),
Mahanadi Coalfields Ltd.,
At/P.O.-Jagriti Vihar, Burla,
District Sambalpur,
ORISSA- 768 020.

1413
24/7/2003
Dated the 6th June 2003

Subject: Bhubaneswari opencast coal mine (10.0 MTY) of M/s Mahanadi Coalfields Ltd. located at Village(s) Nakulbaspur, Ambamunda, Balugaon-Khamar, Kandhal, Anadiour, Hensamul, Jilinda, Naraharipur, Longijoda, Madanmohanpur, Alhadnagar (Uninhabited), Bira Ramchandrapur, and Khandulbahal, Tehsil Talcher, District Angul of Orissa - environmental clearance - reg.

Sir,

This has reference to the Ministry of Coal's letters No. 43011/45/91-CPA dated 24.12.1993, 26.03.1996 and 17.11.1998 and MCL's letters dated 27.02.1996, 28.10.1998, 07.09.1999, 27.10.1999, 10.03.2000, 05.08.2000, 28.02.2001, 01.09.2001, 09.04.2002, 04.06.2002, 13.07.2002, 21.08.2002, 24.08.2002, 28.01.2003, 04.03.2003 and 25.04.2003 on the subject mentioned above. The Ministry of Environment & Forests has examined the application. It has been noted that the total land requirement for the project is 808.294 ha, out of which 675.990 ha is non-forestland and 132.904 ha is forestland. After deducting 32.0 ha area for residential colony and 117.57 ha residential site, the total lease area comes 658.724 ha of which 525.82 ha is non-forestland and 132.904 ha forestland. Out of the 132.904 ha forestland, stage-I forestry clearance had been accorded for 112.521 ha (up to 25th years of mine operation), therefore environmental clearance is restricted to 638.341 ha area only. Township is outside the mine lease area, about 5-km from the mine site comprising an area of 32 ha. Annual production capacity of the mine is 10.0 million tonnes. Working will be opencast by mechanised method using shovel dumper combination. The project involves displacement of 1012 families comprising population of 4657 people from three villages namely Hensamul, Jilinda. The R&R will be followed as per the norms of the State Government of Orissa and CIL. It has been mentioned that about 19045 m³ /day of OB will be generated. Backfilling of OB will start from the 5th year of the production and continue till the end of mine life. Total water requirement for the project envisaged is 2770 m³ /day out of which 970 m³ /day will be met from Bramhani River through Integrated Water Supply Scheme and the

Annexure-IX (Contd.)

- 2 -

remaining 1800 m³/day will be met from accumulated water in the huge mine voids from different underground mines of Talcher Coalfield. Consent to Establish from the Orissa State Pollution Control Board has been obtained on 22.04.2000. The Ministry of Coal has given its approval to the project report on 11.04.2002. Capital cost of the project is Rs. 762.81 crores.

2. The Ministry of Environment and Forests hereby accords environmental clearance to the above mentioned mechanised opencast coal mine of M/s Mahanadi Coalfields Limited for 10.0 million TPA production involving lease area of 638.341 ha only under the provisions of the Environment Impact Assessment Notification, 1994 as amended on 04.05 1997 and 10.04.1997 subject to the compliance of the terms and conditions mentioned below:

A. Specific conditions

- (i) Top soil should be stacked with proper slope at earmarked site(s) and adequate measures should be used for reclamation and rehabilitation of mined out area.
- (ii) OB dumps should be stacked at earmarked dump site(s) only and should not be kept active for long period. The total height of the dumps should not exceed 90m, each stage should preferably be of 15m but should not exceed 20m. Overall slope of the dump should not exceed 28°. Concurrent back-filling should be started from the fifth year of operation. Monitoring and management of rehabilitated areas should continue until the vegetation becomes self-sustaining. Compliance status should be submitted to the Ministry of Environment & Forests on yearly basis.
- (iii) Catch drains, and siltation ponds of appropriate size should be constructed to arrest silt and sediment flows from soil, OB and mineral dumps. The water so collected should be utilised for watering the mine area roads, green belt development etc. The drains should be regularly desilted and maintained properly.

Garland drains (size, gradient and length) and sump capacity should be designed keeping 50% safety margin over and above the peak sudden rainfall and maximum discharge in the area adjoining the mine site. Sump capacity should also provide adequate retention period to allow proper settling of silt material.
- (iv) Dimension of the retaining wall at the toe of dumps and OB benches within the mine to check run-off and siltation should be based on the rainfall data.

Annexure-IX (Contd.)

-3-

- (v) A detailed mine decommissioning plan should be submitted to the Ministry of Environment and forests 5 years in advance of closure for approval.
- (vi) A green belt of adequate width should be raised by planting the native species around the ML area, coal handling plant, roads, OB dump sites, etc., in consultation with the local DFO/Agriculture Department. The density of the tree should be around 2500 plants per ha.
- (vii) Regular monitoring of ground water level and quality should be carried out by establishing a network of existing wells and constructing new piezometers. The monitoring should be done four times a year in pre-monsoon (April/May), monsoon (August), post-monsoon (November) and winter (January) seasons. Data thus collected should be submitted to the Ministry of Environment & Forests and Central Ground water Board quarterly.
- (viii) Coal handling plant (CHP) should be provided with adequate number of high efficiency dust extraction system. Loading and unloading areas including all the transfer points should also have efficient dust control arrangements. These should be properly maintained and operated.
- (ix) Drill should be wet operated or with dust extractors and Controlled blasting should be practiced.
- (x) Project authority should undertake sample survey to generate data on pre-project community health status within a radius of 1 km from proposed mine.
- (xi) Coal Drills should be operated with dust extracted or should be wet operated.
- (xii) A comprehensive R&R plan should be submitted to the Ministry as per the final package finalized in consultation with the State Government for rehabilitation of project effected families within 3 months.
- (xiii) Digital processing of the entire lease area using remote sensing technique should be done regularly once in three years for monitoring land use pattern and report submitted to MOEF and its Regional Office.
- (xiv) Before commencing the work, the proponent should obtain the sanction of the power and water from the concerned authorities and submit the same to the Ministry.
- (xv) Sewage Treatment Plant should be installed for the colony. ETP should also be provided for workshop and CHP waste water.

Annexure-IX (Contd.)

B. General Conditions

- (i) No change in mining technology and scope of working should be made without prior approval of the Ministry of Environment and Forests.
- (ii) No change in the calendar plan including excavation, quantum of mineral coal and waste should be made.
- (iii) Five ambient air quality-monitoring stations should be established in the core zone as well as in the buffer zone for RPM, SPM, SO₂, NO_x and CO monitoring. Location of the stations should be decided based on the meteorological data, topographical features and environmentally and ecologically sensitive targets in consultation with the State Pollution Control Board.

Data on ambient air quality (RPM, SPM, SO₂, NO_x and CO) should be regularly submitted to the Ministry including its Regional Office at Bhubneshwar and to the State Pollution Control Board/Central Pollution Control Board once in six months.

- (iv) Fugitive dust emissions from all the sources should be controlled regularly monitored and data recorded properly. Water spraying arrangements on haul roads, wagon loading, dump trucks (loading & unloading) should be provided and properly maintained.
- (v) Adequate measures should be taken for control of noise levels below 85 dBA in the work environment. Workers engaged in blasting and drilling operations, operations of HEMM, etc., should be provided with ear plugs/muffs.
- (vi) Industrial waste water (workshop and waste water from the mine) should be properly collected, treated so as to conform to the standards prescribed under GSR 422(E) dated 19th May 1993 and 31st December 1993 or as amended from time to time. Oil and grease trap should be installed before discharge of effluents from workshop.
- (vii) Acid mine water, if any has to be treated and disposed of after conforming to the standard prescribed by the competent authority.
- (viii) Personnel working in dusty areas should wear protective respiratory devices and they should also be provided with adequate training and information on safety and health aspects.

Occupational health surveillance programme of the workers should be undertaken periodically to observe any contractions due to exposure to coal dust and take corrective measures, if needed.

Annexure-IX (Contd.)

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- (ix) Environmental laboratory should be established with adequate number and type of pollution monitoring and analysis equipment in consultation with the State Pollution Control Board.
 - (x) A separate environmental management cell with suitable qualified personnel should be set up under the control of a senior Executive, who will report directly to the Head of the organization.
 - (xi) The funds earmarked for environmental protection measures should be kept in separate account and should not be diverted for other purpose. Year-wise expenditure should be reported to the Ministry and its Regional Office located at Bhubneshwar.
 - (xii) The Regional Office of this Ministry located at Bhubneshwar shall monitor compliance of the stipulated conditions. The Project authorities should extend full cooperation to the officer(s) of the Regional Office by furnishing requisite data/information/monitoring reports.
 - (xiii) A copy of the clearance letter will be marked to the concerned Panchayat /local NGO, if any, from whom any suggestions/representation has been received while processing the proposal.
 - (xiv) The project authorities should inform to the Regional Office located at Bhubneshwar regarding date of financial closures and final approval of the project by the concerned authorities and the date of start of land development work.
 - (xv) State Pollution Control Board should display a copy of the clearance letter at the Regional Office, District Industry Centre and Collector's/Tehsildar's Office for 30 days.
 - (xvi) The project authorities should advertise at least in two local newspapers widely circulated, one of which shall be in the vernacular language of the locality concerned, within 7 days of the issue of the clearance letter informing that the project has been accorded environmental clearance and a copy of the clearance letter is available with the State Pollution Control Board and may also be seen at web site of the Ministry of Environment and Forests at <http://envfor.nic.in> and a copy of the same should be forwarded to the Regional Office of this Ministry located at Bhubneshwar.
3. The Ministry or any other competent authority may stipulate any further condition for environmental protection.
4. Failure to comply with any of the conditions mentioned above may result in withdrawal of this clearance.

Annexure-IX (Contd.)

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5. The above conditions will be enforced, *inter-alia*, under the provisions of the Water (Prevention & Control of Pollution) Act, 1974, the Air (Prevention & Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986 and the Public Liability Insurance Act, 1991 along with their amendments and rules.

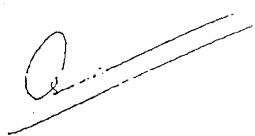
Yours faithfully,

8

(Dr.T.Chandini)
Additional Director

Copy to:

1. Secretary, Ministry of Coal & Mines, Department of Coal, Government of India, Shastri Bhawan, New Delhi.
2. Secretary, Department of Environment & Forests, Government of Orissa, Bhubaneswar.
3. Chief Conservator of Forests, Regional Office (EZ), Ministry of Environment and Forests, A-3 Chandrashekharpur, Bhubaneswar-751023
4. Chairman, Central Pollution Control Board, Parivesh Bhawan, CBD-cum-Office Complex, East Arjun Nagar, Delhi-110032.
5. Chairman, Orissa State Pollution Control Board, Parivesh Bhawan, A/118 Nilakantha Nagar, Unit-VIII, Bhubaneswar-751012.
6. Member Secretary, Central Ground Water Authority, Ministry of Water Resources, A-2, W-3, Curzon Road Barracks, New Delhi-110001.
7. District Collector, Angul District, Government of Orissa.
8. Shri M.K.Shukla, Chief Engineer(Env.Engineering), Coal India Limited, 407/3, Surya Kiran, 19 Kasturba Gandhi Marg, New Delhi-110 001
9. Advisor (EI), Ministry of Environment and Forests, New Delhi
10. Monitoring File.
11. Guard File.
12. Record File.
13. CCM, IBM, Nagpur



(Dr.T.Chandini)
Additional Director

ANNEXURE - X

No. J-11015/280/2013-IA.II (M)
Government of India
Ministry of Environment & Forests

Paryavaran Bhawan,
CGO Complex, Lodhi Road,
New Delhi-110003
Dated: 19th February, 2014

To,

Shri B.C. Tripathy,
General Manager (Env.)
M/s Mahanadi Coal Fields Ltd.,
Bhubaneswari OCP,
P.O. Jagriti Vihar, Burla,
Dist. Sambalpur-768020,
Orissa.

Sub. : Expansion [under 7(ii) of EIA Notification 2006] of Bhubaneswari Opencast project from 20 MTPA to 25 MTPA in ML area 638.341 ha (658.724 ha – 20.383 ha = 638.341 ha); Latitude 20° 57' 59" to 20° 58'43" & Longitude 85° 09' 10" to 85° 11'37") of M/s Mahanadi Coalfields Ltd. Village: Hensmul, Dist. Anugul, Orissa – Environment Clearance - reg.

Sir:

This is with reference to letter no. CIL/DIL/EMP/2013/29 dated 24.07.2013 with the application and subsequent letter no. dated 25.12.2013 for Environmental Clearance for Expansion under 7(ii) of EIA Notification 2006 for the above-mentioned project.

2. The Ministry of Environment & Forests has considered the application. It is noted that the proposal is for grant of Environmental Clearance for **expansion [under 7(ii) of EIA Notification 2006] of Bhubaneswari Opencast project from 20 MTPA to 25 MTPA in ML area 638.341 ha (658.724 ha – 20.383 ha = 638.341 ha); Latitude 20° 57' 59" to 20° 58'43" & Longitude 85° 09' 10" to 85° 11'37") of M/s Mahanadi Coalfields Ltd. Village: Hensmul, Dist. Anugul, Orissa.** The proposal was considered in the 2nd EAC held on 3-4th October, 2013 and reconsidered in the 9th EAC meeting held on 20th - 21st January, 2014. The proponent has informed that:

- i. It was noted that EC was granted for Bhubaneswari Opencast vide letter no. J-11015/45/96-IA.II (M) dated 06.06.2003 for 10 MTPA. The project was again granted EC vide letter no. J-11015/128/2007-IA.II (M) dated 30.11.2012 for an expansion in production from 10 MTPA to 20 MTPA in a Mining lease area of 808.294 ha.
- ii. M/s MCL is seeking expansion in production capacity from 20 MTPA to 25 MTPA in ML area 658.724 ha under 7(ii) of EIA Notification 2006 with 25 % expansion.
- iii. The land usage of the project will be as follows:



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ANNEXURE – X (Cont..)

Post Mining

Sl.	Item	Post Mining Land Use (in ha)					
		Plantation	Water body	Dip side slope and haul road	Undisturbed	Built-up area	Total
1	Quarry excavation	375.900	31.000	55.741	0.000	0.000	462.641
2	Blasting danger zone (excluding the part of OB dump)	83.150	0.000	0.000	0.000	0.000	83.150
3	OB Dumps (external)	94.000	0.000	0.000	0.000	0.000	94.000
4	Infrastructure including CHP, magazine, etc.	0.850	0.000	0.000	0.000	10.083	10.933
5	Railway siding	1.600	0.000	0.000	0.000	6.400	8.000
	Mining lease area (1 to 5)	555.500	31.000	55.741	0.000	16.483	658.724
6	Residential colony	6.400	0.000	0.000	0.000	25.600	32.000
7	Rehabilitation Site	23.520	0.000	0.000	0.000	94.050	117.570
	Outside Lease area (6 to 7)	29.920	0.000	0.000	0.000	119.650	149.570
	Total :	585.420	31.000	55.741	0.000	136.133	808.294

Pre-Mining

Sl.	Item	Pre-Mining Land Requirement (in ha)		
		Forest	Non-forest (Govt. & Tenancy)	Total
1	Quarry excavation	126.191	336.450	462.641
2	Blasting danger zone (excluding the part of OB dump)	--	83.150	83.150
3	OB Dumps (external)	--	94.000	94.000
4	Infrastructure including CHP, magazine, etc.	6.713	4.220	10.933
5	Railway siding	--	8.000	8.000
	Mining lease area (1 to 5)	132.904	525.82	658.724
6	Residential colony	--	32.000	32.000
7	Rehabilitation Site	--	117.570	117.570
	Outside Lease area (6 to 7)	0	149.570	149.570
	Total :	132.904	675.39	808.294

- iv. The total geological reserve is 741.09 MT. The mineable reserve is 374.12 MT, extractable reserve is 374.12 MT. The per cent of extraction would be 100 %.
- v. The coal grades are D to G having stripping ratio of 0.67 m³/t. The average Gradient is 4.5 degree. There will be total ten seams with thickness ranging from 0.42 to 44.99 m.
- vi. The total estimated water requirement is 4.36 MLD. The level of ground water ranges from 80 to 134 m.
- vii. The Method of mining would be opencast mining with shovel- dumper.
- viii. There are one external OB dump covering an area of 62.40 ha having a height upto 52 m

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ANNEXURE – X (Cont..)

- with the quantity of 26658480 m³. The final mine voids will have an area of 31 Ha with 187.5 m depth. There is one internal dumps having an area of 23.25 ha and height 54 m . Out of total quarry area 462.641 Ha. backfilled quarry area will be 375.90 Ha which shall be reclaimed with plantation. A void of 31 ha with depth of about 180 m, which is proposed to be converted into water body.
- ix. The seasonal data for ambient air quality has been documented and all results at all stations are within prescribed limits.
 - x. **The life of mine** is 15 Years.
 - xi. **Transportation:** Transportation of coal in pit by dumper. Surface to siding by tipper/conveyor, and rakes loading by pay loaders. Provision was by belt to washery and from washery to siding by tube conveyor and rakes loading through silo but the same is delayed.
 - xii. There is R & R involved. There are 1012 PAFs.
 - xiii. **Cost:** Total capital cost of the project is Rs. 490 Crore. The cost of production would be Rs. 153 /tonnes. CSR Cost (Capital cost: Rs.296 lakhs / tonne of Coal production. R&R Cost Rs. 31.22 crore. Environmental Management Cost is Rs. 71.41 Crore.
 - xiv. **Approvals:** Ground water clearance obtained on 09.01.2000. The Mine Closure approval obtained on 28.09.2013. Date of approval of mine plan is 23.06.2011. Board's approval obtained on 22.12.2007.
 - xv. **Wildlife issues:** There are no national Parks, wildlife sanctuary, biosphere reserves found in the 10 km buffer zone.
 - xvi. **Forestry issues:** Total forest area involved for mining 132.904 ha. FC was granted vide letter no. 8-18/2002-FC dated 6.12.2004 for diversion of 112.521 ha of forest land.
 - xvii. Total **afforestation** plan shall be implemented covering an area of 585.42 ha at the end of mining where reclaimed external OB dump is 94 Ha and Internal OB Dump 375.90 ha. Green Belt over an area of 83.13 ha. Density of tree plantation 2500 trees/ ha of plants.
 - xviii. There are no court cases/violation pending with the project proponent.
 - xix. Earlier EC was obtained on 30.11.2012 for which the Public Hearing was held on 10.02.2009 at Jagannath Kala Kendra, Talchar, Angul district of Orissa.
 - xx. Certificate of compliance of earlier EC from MoEF, Regional office, Bhubaneswar has been issued vide their letter no. 106-102/EPE dtd. 16.09.2013.
3. The project proponent further informed on the Report of the RO, MOEF vis-a-vis the commitments made by the proponent which are as follows:
- i. The Source Apportionment Study for which the works order has been placed to ARAI, Pune. The Report will be submitted within 4 months i.e., 27/03/2014.
 - ii. Tender for construction of Washery-Conveyor-Silo is under process and award of work and completion of construction will take at least 3 years' time. Completion of the above work is not possible within 18 months. It is committed to implement the Action Plan by 01/01/2017. Land has been acquired and fencing is under construction, NIT ready and to be floated.
 - iii. Planning, Design & Engineering, erection/ installation along with all associated civil and structural works, testing, successful commissioning of coal washing plant including PGT with two years critical spares, operation and maintenance for supply of washed coal of requisite quality at the designated delivery places and disposal of washery rejects on BOM is ready. There will not be any tipper for feeding of coal to washery. Coal will come through belt conveyor from the receiving pit.
 - iv. EC has been granted for 20 MTPA in Nov.2012 and production achieved during 2013-13 was 17.93 MT. 20 MT will be achieved this year and since there is further scope for additional production from this mine and EC has been sought for 25 MTPA.

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ANNEXURE – X (Cont..)

- v. The additional 5 MTPA of coal production in Bhubaneswari OCP will be transported to the power plant consumers only through Rail Mode.
- vi. MCL will establish conveyor system from mine to siding, without considering the intermediate washery arrangement, within 24 months' time, and thus our earlier commitment in this regard stands revised.
- vii. MCL will ensure that only native species are planted by the Forest Department in the plantation programme of this project.

4. Reference is invited to the e-mail dated 07 February, 2014 stating that "Stage -I Forest Clearance for 112.521 ha was granted by MoEF vide letter dtd. 6th December, 2004, against total forest diversion proposal of 132.904 ha. Total Forest land involved for the entire life of the Project is 132.904 ha. Forest land involved for 25 years was assessed as per MOEF directive and it was 112.521 ha and this area was approved by MoEF and it was directed to approach MoEF after 25 years for balance 20.383 ha of forest land" and hence will not be diverted. In this regard, you are required to follow the guidelines issued by the FC Division of the Ministry of Environment & Forests vide no. 11-362/2012-FC dated 01-02-2013 "Guidelines for diversion of forest land for non-forest purposes under the Forest (Conservation) Act 1980. Submission of proposals to obtain forest land located within the mining lease and grant of environment clearance to mining projects" addressed to the Principal Secretary (Forests), Principal Secretary (Environment) of all the States/UT Govts. and copy to concerned Government Departments/Organisations which prescribes, inter-alia, the following:

" (iii) As regards Environment Clearance (EC) cases of existing mining operations, where approval under the FC Act for the full forest area in the mining lease area is not available, granting of EC may be considered and the following process will be adopted for processing such cases:

- a) Grant of EC may be considered only for the non-forest area plus the forest area within the mining lease for which FC is available. No mining activities will be allowed in forest area for which the FC is not available; and
- b) The project proponent will seek and obtain approval under the FC Act for diversion of the entire forest land located within the mining lease within a period of two years from the date of issue of these guidelines, failing which the mining lease area will be reduced to the non-forest area plus the forest area for which the project proponent has been able to obtain the FC at the end of this time period. In the case of reduction in mine lease area, the project proponent will need to get a revised mining plan approved from the competent authority for reduced area and enter into a new mining lease as per reduced lease area. The EC will be construed to be available for the mining lease area as per the revised mining lease deed."

5. The proposal was reconsidered in the Expert Appraisal Committee (EAC) (Thermal & Coal Mining) and recommended in its 5th meeting held on 26th - 25th November, 2013 for granting Environmental Clearance. The Ministry of Environment & Forests hereby accords environmental clearance for the above-mentioned **expansion [under 7(ii) of EIA Notification 2006] of Bhubaneswari Opencast project from 20 MTPA to 25 MTPA in ML area 638.341 ha (658.724 ha – 20.383 ha = 638.341 ha); Latitude 20° 57' 59" to 20° 58' 43" & Longitude 85° 09' 10" to 85° 11' 37") of M/s Mahanadi Coalfields Ltd. Village: Hensmul, Dist. Anugul, Orissa under the provisions of the Environment Impact Assessment Notification, 2006 and subsequent amendments thereto subject to the compliance of the terms and conditions mentioned below. You will need to seek and obtain approval under the FC Act for diversion of the entire**

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ANNEXURE – X (Cont..)

forest land located within the mining lease within a period of two years from the date of issue of these guidelines (i.e. 01 February, 2013), failing which the mining lease area will be reduced to the non-forest area plus the forest area for which you have been able to obtain the FC at the end of this time period. In the case of reduction in mine lease area, you will need to get a revised mining plan approved from the competent authority for reduced area and enter into a new mining lease as per reduced lease area. The EC will be construed to be available for the mining lease area as per the revised mining lease deed.

A. Specific Conditions:

- i. No mining operations shall be undertaken in the forestland until clearance has been obtained under the provisions of FC Act, 1980.
- ii. The maximum production from the mine at any given time shall not exceed the limit as prescribed in the EC.
- iii. The report of ARAI, Pune on Source Apportionment Study be submitted to the concerned State Pollution Control Board and the Regional office of the MoEF submitted within 4 months i.e., 27/03/2014.
- iv. There will not be any tippers for feeding of coal to washery. Coal will come through belt conveyor from the receiving pit
- v. The conveyor system from Mine to Siding, without considering the intermediate washery arrangement, shall be established within 24 months i.e. by January, 2016. This has already been highly delayed.
- vi. Only native species to be planted by the Forest Department in the plantation programme of this project.
- vii. Proponent should expeditiously take up the matter with the Coal India to create an Environment Cadre for future employment in Coal India and its subsidiaries.
- viii. MCL has committed to implement the Action Plan by 01/01/2017
- ix. The coal production in Bhubaneswari OCP will be transported to the power plant and other consumers only through Rail Mode.
- x. Transportation of coal in pit by dumper. Surface to siding by tipper/conveyor, and rakes loading by pay loaders. Provision wasby belt to washery and from washery to siding by tube conveyor and rakes loading through silo but the same is delayed. Roads shall be metal topped and mechanical sweepers shall be regularly deployed to clear the dust off the main approach and mineral transportation roads. Water sprinkling (fixed and mist type, mobile) shall be regularly done along the main haul roads.
- xi. Mining operations for the expansion project shall not involve drilling, blasting and rushing operations as a result of use of surface miner.
- xii. The production shall be within the same Mining Lease area.
- xiii. The OB shall be completely re-handled at the end of the mining.
- xiv. Final mine void depth will not be more than 40 m. The void area will be converted into waterbody. The rest of the area will be back filled upto the ground level and covered with about a meter thick top soil and put to use.
- xv. Garland drains be provided.
- xvi. Appropriate embankment shall be provided along the side of the river/nallah flowing near or adjacent to the mine.
- xvii. The land after mining shall be brought back for agriculture purpose.
- xviii. Mine water should be treated for discharge into the lagoon. The quality of lagoon water shall be regularly monitored and mitigation measures taken.

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ANNEXURE – X (Cont..)

- xix. The CSR cost should be Rs 5 per Tonnes of Coal produced which should be adjusted as per the annual inflation. Annual social audit should be got carried out and details furnished as part of compliance report and also uploaded on the company website.
- xx. Everybody in the core area should be provided with mask for protection against fugitive dust emissions.
- xxi. Dust mask to be provided to everyone working in the mining area. The supervisory staff should be held personally responsible for ensuring compulsory regarding wearing of dust mask in the core area.
- xxii. People working in the core area should be periodically tested for the lung diseases and the burden of cost on account of working in the coal mine area. The lung burden analysis report of workers working in coal mining area should be provided and uploaded on the company website.
- xxiii. R&R for the 1185 PAFs of Hensamul, Jilinda and Naraharipur which are yet to be resettled, shall be implemented within a specified time-frame. R&R norms shall be not less than of the National R&R Policy.
- xxiv. The topsoil, if any, should be stacked properly with proper slope at earmarked site(s) and should not be kept active and shall be used for reclamation and development of green belt. The time schedule for development of green cover should be provided.
- xxv. The OB shall be simultaneously backfilled in the decoaled area. No new OB dumps shall be created for the OB to be generated in the balance life of mine. sequential operation of mines should be done so that the voids of adjoining mines can be used for dumping OB
- xxvi. No external OB dump should be left at the Final Mine Closure stage and the mined out area and void should be backfilled up to ground level to the extent possible and the void if left, should be no more than 30-40m depth. Fly ash should not be dumped in mine void.
- xxvii. Water from River Brahmani should not be drawn for these purposes and an awareness campaign should be launched by MCL for proper use of water from various sources. The Committee desired that a trend analysis of the water quality (surface and ground water) including heavy metals, should be carried out and data uploaded on the company website. Mine water be used for irrigation of nearby agricultural land and also for green belt and other uses.
- xxviii. Long-term monitoring on the impacts of simultaneous operation of large opencast mines should be carried out on the confined and unconfined aquifers.
- xxix. The roads should be developed with a 3-tier avenue plantation preferably of 20-30m width using native species. The Committee also desired that road transportation should be by mechanically covered trucks and not tarpaulin covered trucks, which should be introduced within 9-12 months. An 'Action Plan' for the transportation of coal by road to major consumers (during the initial years) should be submitted to ministry for record and the FSA entered with the major linkages should stipulate a condition to the effect that only mechanically covered trucks are used for coal transportation.
- xxx. The mining area should be grounded by green belt having thick closed thick canopy of the tree cover.
- xxxi. The embankment constructed along the river boundary shall be of suitable dimensions and critical patches shall be strengthened by stone pitching on the river front side and stabilised with plantation so as to withstand the peak water flow and prevent mine inundation.
- xxxii. There shall be no overflow of OB into the river and into the agricultural fields and massive plantation of native species shall be taken up in the area between the river and the project.
- xxxiii. OB shall be stacked at two earmarked external OB dumpsite(s) only. The ultimate slope of the dump shall not exceed 28°. Monitoring and management of existing reclaimed dumpsites shall continue until the vegetation becomes self-sustaining. Compliance status shall be submitted to the Ministry of Environment & Forests and its concerned Regional office on yearly basis.

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ANNEXURE – X (Cont..)

- xxxiv. Catch drains and siltation ponds of appropriate size shall be constructed to arrest silt and sediment flows from soil, OB and mineral dumps. The water so collected shall be utilised for watering the mine area, roads, green belt development, etc. The drains shall be regularly desilted and maintained properly. Garland drains (size, gradient and length) and sump capacity shall be designed keeping 50% safety margin over and above the peak sudden rainfall and maximum discharge in the area adjoining the mine site. Sump capacity shall also provide adequate retention period to allow proper settling of silt material.
- xxxv. Dimension of the retaining wall at the toe of the dumps and OB benches within the mine to check run-off and siltation shall be based on the rainfall data.
- xxxvi. Crushers at the CHP of adequate capacity for the expansion project shall be operated with high efficiency bag filters, water sprinkling system shall be provided to check fugitive emissions from crushing operations, conveyor system, haulage roads, transfer points, etc.
- xxxvii. Drills shall be wet operated.
- xxxviii. The project authorities shall undertake regular repairing and tarring of roads used for mineral transportation. A 3-tier green belt comprising of a mix of native species shall be developed all along the major approach roads,
- xxxix. Controlled blasting shall be practiced with use of delay detonators and only during daytime. The mitigative measures for control of ground vibrations and to arrest the fly rocks and boulders shall be implemented.
- xl. A Progressive afforestation plan shall be implemented covering an area of 585.420 ha at the end of mining, which includes reclaimed External OB dump area (94 ha), Internal OB dump area (375.90 ha), along roads and infrastructure (32.37 ha), and Green belt (83.150 ha) and in township located outside the lease by planting native species in consultation with the local DFO/Agriculture Department. The density of the trees shall be around 2500 plants per ha. Massive plantation shall be carried out in open spaces in and around the mine and a 3-tier avenue plantation along the main approach roads to the mine.
- xli. An estimated total 251.39 Mm³ of OB will be generated during the entire life of the mine. Out of which 52.37 Mm³ of OB will be dumped in two external OB Dumps an earmarked area covering 94 ha of land. 199.02 Mm³ of will be one internal OB dump in covering an area of 279.65 ha. The maximum height of external OB dump for hard OB will not exceed 90 m and that for soft OB shall not exceed 60 m. The maximum slope of the dump shall not exceed 28 degrees. Monitoring and management of reclaimed dump sites shall continue till the vegetation becomes self- sustaining and compliance status shall be submitted to MOEF and its Regional Office on yearly basis.
- xl.ii. The proponent should prepare restoration and reclamation plan for the degraded area. The land be used in a productive and sustainable manner.
- xl.iii. Compensatory Ecological & Restoration of waste land, other degraded land and OB dumps in lieu of breaking open the land be carried out.
- xl.ii. The mining should be phased out in sustainable manner. No extra over burden dumps are permitted.
- xl.ii. No groundwater shall be used for mining operations.
- xl.ii. Of the total quarry area of 462.641 ha, the backfilled quarry area of 279.65 ha shall be reclaimed with plantation and a void of 182.991 ha at a depth of 30-40 m which is proposed to be converted into a water body shall be gently sloped and the upper benches shall be terraced and stabilised with plantation/afforestation by planting native plant species in consultation with the local DFO/Agriculture Department. The density of the trees shall be around 2500 plants per ha.
- xl.ii. Regular monitoring of groundwater level and quality shall be carried out by establishing a network of existing wells and construction of new peizometers. The monitoring for quantity shall be done four times a year in pre-monsoon (May), monsoon (August), post-monsoon (November) and winter (January) seasons and for quality in May. Data thus collected shall be

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ANNEXURE – X (Cont..)

- submitted to the Ministry of Environment & Forests and to the Central Pollution Control Board quarterly within one month of monitoring.
- xlvi. The Company shall put up artificial groundwater recharge measures for augmentation of groundwater resource in case monitoring indicates a decline in water table. The project authorities shall meet water requirement of nearby village(s) in case the village wells go dry due to dewatering of mine.
 - xlix. Sewage treatment plant shall be installed in the existing colony. ETP shall also be provided for workshop and CHP wastewater.
 - i. Besides carrying out regular periodic health check-up of their workers, 10% of the workers identified from workforce engaged in active mining operations shall be subjected to health check-up for occupational diseases and hearing impairment, if any, through an specialised agency /institution within the District/State and the results reported to this Ministry and to DGMS.
 - ii. Land oustees shall be compensated as per the norms laid out R&R Policy of CIL or the National R&R Policy or R&R Policy of the State Government whichever is higher.
 - iii. For monitoring land use pattern and for post mining land use, a time series of land use maps, based on satellite imagery (on a scale of 1: 5000) of the core zone and buffer zone, from the start of the project until end of mine life shall be prepared once in 3 years (for any one particular season which is consistent in the time series), and the report submitted to MOEF and its concerned Regional office
 - liii. A detailed Final Mine Closure Plan along with details of Corpus Fund shall be submitted to the Ministry of Environment & Forests within 6 months of grant of Environmental Clearance.
 - liv. The project authorities shall in consultation with the Panchayats of the local villages and administration identify socio-economic and welfare measures under CSR to be carried out over the balance life of the mine.
 - lv. The commitment made by the Proponent to the issue raised during Public Hearing shall be implemented by the Proponent.
 - lvi. Corporate Environment Responsibility:
 - a) The Company shall have a well laid down Environment Policy approved by the Board of Directors.
 - b) The Environment Policy shall prescribe for standard operating process/procedures to bring into focus any infringements/deviation/violation of the environmental or forest norms/conditions.
 - c) The hierarchical system or Administrative Order of the company to deal with environmental issues and for ensuring compliance with the environmental clearance conditions shall be furnished.
 - d) To have proper checks and balances, the company shall have a well laid down system of reporting of non-compliances/violations of environmental norms to the Board of Directors of the company and/or shareholders or stakeholders at large.

B. General Conditions

- i. No change in mining technology and scope of working shall be made without prior approval of the Ministry of Environment and Forests.
- ii. No change in the calendar plan of production for quantum of mineral coal shall be made.
- iii. Four ambient air quality monitoring stations shall be established in the core zone as well as in the buffer zone for PM₁₀, PM_{2.5}, SO₂ and NO_x monitoring. Location of the stations shall be decided based on the meteorological data, topographical features and environmentally and ecologically sensitive targets in consultation with the State Pollution Control Board.

Bhubaneswari_EC_Expansion 7(ii)

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ANNEXURE – X (Cont..)

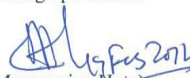
- Monitoring of heavy metals such as Hg, As, Ni, Cd, Cr, etc carried out at least once in six months.
- iv. Data on ambient air quality (PM₁₀, PM_{2.5}, SO₂ and NO_x) and heavy metals such as Hg, As, Ni, Cd, Cr and other monitoring data shall be regularly submitted to the Ministry including its concerned Regional Office and to the State Pollution Control Board and the Central Pollution Control Board once in six months. Random verification of samples through analysis from independent laboratories recognised under the EPA rules, 1986 shall be furnished as part of compliance report.
 - v. Adequate measures shall be taken for control of noise levels below 85 dBA in the work environment. Workers engaged in blasting and drilling operations, operation of HEMM, etc shall be provided with ear plugs/muffs.
 - vi. Industrial wastewater (workshop and wastewater from the mine) shall be properly collected, treated so as to conform to the standards prescribed under GSR 422 (E) dated 19th May 1993 and 31st December 1993 or as amended from time to time before discharge. Oil and grease trap shall be installed before discharge of workshop effluents.
 - vii. Vehicular emissions shall be kept under control and regularly monitored. Vehicles used for transporting the mineral shall be covered with tarpaulins and optimally loaded.
 - viii. Monitoring of environmental quality parameters shall be carried out through establishment of adequate number and type of pollution monitoring and analysis equipment in consultation with the State Pollution Control Board and data got analysed through a laboratory recognised under EPA Rules, 1986.
 - ix. Personnel working in dusty areas shall wear protective respiratory devices and they shall also be provided with adequate training and information on safety and health aspects.
 - x. Occupational health surveillance programme of the workers shall be undertaken periodically to observe any contractions due to exposure to dust and to take corrective measures, if needed and records maintained thereof. The quality of environment due to outsourcing and the health and safety issues of the outsourced manpower should be addressed by the company while outsourcing.
 - xi. A separate environmental management cell with suitable qualified personnel shall be set up under the control of a Senior Executive, who will report directly to the Head of the company.
 - xii. The funds earmarked for environmental protection measures shall be kept in separate account and shall not be diverted for other purpose. Year-wise expenditure shall be reported to this Ministry and its concerned Regional Office.
 - xiii. The Project authorities shall advertise at least in two local newspapers widely circulated around the project, one of which shall be in the vernacular language of the locality concerned within seven days of the clearance letter informing that the project has been accorded environmental clearance and a copy of the clearance letter is available with the State Pollution control Board and may also be seen at the website of the ministry of Environment & Forests at <http://envfor.nic.in>.
 - xiv. A copy of the environmental clearance letter shall be marked to concern Panchayat/Zila Parishad, Municipal Corporation or Urban local body and local NGO, if any, from whom any suggestion/representation has been received while processing the proposal. A copy of the clearance letter shall also be displayed on company's website.
 - xv. A copy of the environmental clearance letter shall be shall also be displayed on the website of the concerned State Pollution Control Board. The EC letter shall also be displayed at the Regional Office, District Industry Sector and Collector's Office/Tehsildar's Office for 30 days.
 - xvi. The clearance letter shall be uploaded on the company's website. The compliance status of the stipulated environmental clearance conditions shall also be uploaded by the project authorities on their website and updated at least once every six months so as to bring the same in public domain. The monitoring data of environmental quality parameter (air, water, noise and soil)

Bhubaneswari_EC_Expansion 7(ii)

Page 9 of 11

ANNEXURE – X (Cont..)

- and critical pollutant such as PM₁₀, PM_{2.5}, SO₂ and NO_x (ambient) and critical sectoral parameters shall also be displayed at the entrance of the project premises and mine office and in corporate office and on company's website.
- xvii. The project proponent shall submit six monthly compliance reports on status of compliance of the stipulated environmental clearance conditions (both in hard copy and in e-mail) to the respective Regional Office of the Ministry, respective Zonal Office s of CPCB and the SPCB.
- xviii. The Regional Office of this Ministry located in the Region shall monitor compliance of the stipulated conditions. The Project authorities shall extend full cooperation to the office(s) of the Regional Office by furnishing the requisite data/ information/monitoring reports.
- xix. The Environmental statement for each financial year ending 31 March in For –V is mandated to be submitted by the project proponent for the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently, shall also be uploaded on the company's website along with the status of compliance of EC conditions and shall be sent to the respective Regional Offices of the MoEF by e-mail.
6. This EC supersedes the earlier EC, vide letter no. J-11015/128/2007-IA.II (M) dated 30.11.2012, for an expansion in production from 10 MTPA to 20 MTPA in a Mining lease area of 808.294 ha
7. The proponent shall abide by all the commitments and recommendations made in the EIA/EMP report so also during their presentation to the EAC.
8. The proponent is required to obtain all necessary clearances/approvals that may be required before the start of the project. The Ministry or any other competent authority may stipulate any further condition for environmental protection.
9. The Ministry or any other competent authority may stipulate any further condition for environmental protection.
10. The Proponent shall setup an Environment Audit cell with responsibility and accountability to ensure implementation of all the EC Conditions.
11. Failure to comply with any of the conditions mentioned above may result in withdrawal of this clearance and attract the provisions of the Environment (Protection) Act, 1986.
12. The above conditions will be enforced *inter-alia*, under the provisions of the Water (Prevention & Control of Pollution) Act, 1974, the Air (Prevention & Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986 and the Public Liability Insurance Act, 1991 along with their amendments and Rules. The proponent shall ensure to undertake and provide for the costs incurred for taking up remedial measures in case of soil contamination, contamination of groundwater and surface water, and occupational and other diseases due to the mining operations.



(Dr. Manoranjan Hotar)
Director

Copy to:

1. Secretary, Ministry of Coal, New Delhi.
2. Secretary, Department of Environment & Forests, Government of Orissa, Secretariat, Bhubaneswar, Orissa.

ANNEXURE – X (Cont..)

3. Chief Conservator of Forests, Regional office (EZ), Ministry of Environment & Forests, A-31, Chandrashekarpur, Bhubaneswar – 751023, Orissa.
4. Member Secretary, Orissa State Pollution Control Board, Parivesh Bhawan, A/118, Nilkanthanagar, Unit VIII, Bhubaneswar – 751012, Orissa.
5. Member Secretary, Central Pollution Control Board, CBD-cum-Office Complex, East Arjun Nagar, New Delhi -110032.
6. Member-Secretary, Central Ground Water Authority, Ministry of Water Resources, Curzon Road Barracks, A-2, W-3 Kasturba Gandhi Marg, New Delhi.
7. Dr. R.K. Garg, Advisor, Coal India Limited, SCOPE Minar, Core-I, 4t Floor, Vikas Marg, Laxmi Nagar, New Delhi.
8. District Collector, Angul, Government of Odisha.
9. Monitoring File 10. Guard File 11. Record File. 12. Notice Board


(Dr. Manoranjan Hota)
Director

ANNEXURE-XI

F. No.J-11015/224/2015-IA.II
Government of India
Ministry of Environment, Forest and Climate Change
(IA-II Section)

Indira Paryavaran Bhawan,
Jorbagh Road, N Delhi - 3
Dated: 15th September, 2017

Office Memorandum

**Sub: Environmental Clearance for expansion of Coal Mining Projects -
Exemption from Public hearing - reg.**

In order to facilitate grant of Environmental Clearance (EC) to the expansion projects of coal mines, Office Memorandums have been issued by this Ministry from time to time providing exemption from public hearing.

2. Ministry of Coal in order to allow rapid expansion in coal production has made request for further dispensation in public hearing to expedite Environmental Clearances.

3. The request of Ministry of Coal was considered by the Expert Appraisal Committee (EAC) in the Ministry constituted for appraisal of projects relating to Thermal and Coal sectors. The Committee has recommended for exemption from public hearing while considering grant of environmental clearances to the expansion projects of coal mines, involving increase in production capacity up to 40% in 2-3 phases after the due diligence and subject to fulfilment of certain requirements as under:-

- (i) Predicted air quality parameters are within the prescribed norms.
- (ii) Coal transportation is through conveyor system up to the silo and then loading to railway wagons, involving no transportation through roads.
- (iii) Coal mining is done through deployment of surface miners, replacing three dust generating operations of the conventional mining system namely drilling, blasting and crushing in one go.
- (iv) Public hearing already conducted for the total mine lease area involved and no more area is required for the proposed expansion.
- (v) Compliance status of EC conditions monitored by the concerned Regional Office of this Ministry is found to be satisfactory.
- (vi) Other statutory requirements like Consent to Establish/Operate, Clearance from CGWA, approval of Mining Plan and the Mine Closure Plan, Mine Closure Status Report as applicable, Forest Clearance, etc are satisfactorily fulfilled.



ANNEXURE-XI (Cont..)


4. In view of the aforesaid recommendations by EAC, the Ministry has decided to consider the proposals for grant of EC to the expansion of coal mining projects providing exemption from public hearing, in the manner and/or subject to the conditions as under:-

- (a) The proposed expansion can go up to a maximum of 40% of capacity, wherein the last public hearing was conducted.
- (b) There is no increase in area for the proposed expansion vis-a-vis the area in EC, wherein last public hearing was conducted.
- (c) Coal transport is through conveyor system up to the silo and loading to railway wagons, and not by road.
- (d) The EAC shall carry out the due diligence on all the parameters mentioned in para 3 above, and make its recommendations accordingly.
- (e) EAC may consider the need for a third party study through an expert agency in a time bound manner, after grant of EC.

5. This OM shall be in supersession of the earlier OMs issued by the Ministry as under:

- (i) OM No. J-11015/30/2004-IA.II (M) dated 19th December, 2012
- (ii) OM No. J-11015/30/2004-IA.II (M) dated 7th January, 2014
- (iii) OM No. J-11015/30/2004-IA.II (M) dated 30th May, 2014
- (iv) OM No. J-11015/30/2004-IA.II (M) dated 28th July, 2014
- (v) OM No. J-11015/30/2004-IA.II (M) dated 2nd September, 2014

6. This issues with approval of the competent authority.


15/9/2017
(S.K. Srivastava)
Scientist E

ANNEXURE-XII

APPROVAL OF MP&MCP OF BHUBANESWARI OCP, REV-1

ମହାନଦୀ କୋଲ୍‌ଫିଲ୍ଡ୍‌ସ୍ ଲିମିଟେଡ୍
महानदी कोलफील्ड्स लिमिटेड
Mahanadi Coalfields Limited
(A subsidiary of Coal India Limited)

Office of the Company Secretary
At/Po. Jagruti Vihar, Burla, MCL
Dist. Sambalpur – 768020 (Odisha)
CIN: U10102OR1992GOI003038
TeleFax No. 06632542977
Email id: cosecymcl@gmail.com
Website: www.mahanadicoal.in



MCL

Ref. No. MCL/SBP/CS/BD-243/Exct/2022/ 12291

Date: 01.02.2022

गोपनीय/CONFIDENTIAL

सेवा में,
The GM(P&P)
एम सी एल मुख्यालय, सम्बलपुर ।

Sub: Extract from the minutes of the 243rd meeting of Board of Directors of MCL held at 11.00 AM on Thursday, the 20th January, 2022 at Registered Office of the Company, Jagruti Vihar, Burla, Sambalpur, Odisha-768020.

प्रिय महोदय,

आप के सूचनार्थ एवं उचित कार्यवाही हेतु एम.सी.एल. निदेशक मण्डल की 243 वी बैठक का उद्धृत दिया जा रहा है।

243.C/4 Approval of Mining Plan for Bhubaneswari OCP (28 MTY) Rev-1 with estimated mine closure cost of Rs.3853.253 Lakhs compounded @ 5% annually for 05 years.

4.1 The Board deliberated on the proposal in detail and based on the clarifications offered by GM(P&P) & RD CMPDIL, approved the Mining Plan and Mine Closure Plan Bhubaneswari OCP (28 MTY) Rev-1 with total mine closure cost of Rs.3744.28 lakhs compounded @5% annually for 05 years as per the details brought out in the agenda note.

भवदीय,

कंपनी सचिव

ANNEXURE – XIII

ମହାନଦୀ କୋଲ୍‌ଫିଲ୍ଡ୍‌ସ୍ ଲିମିଟେଡ୍
Mahanadi Coalfields Limited
(A subsidiary of Coal India Limited)



ମହାପ୍ରबंधक(परियोजना एवं योजना) कार्यालय
Office of the General Manager (P&P)
At/Po: Jagruti Vihar, Burla, Dist.: Sambalpur-768020 (Odisha)
Phone-(0663) 2950562,
E-mail: cgm-cnp.mcl@coalindia.in/ gmprojectsmcl@gmail.com
Web site: www.mahanadicoal.in
CIN No.: U10102OR1992GOI003038

संदर्भ संख्या: एमसीएल/मुख्यालय/महाप्रबंधक(परियोजना एवं योजना)/22/ 04-H दिनांक: 19/04/2022

REVISED WORK ORDER

In partial modification to the earlier Work Order issued vide no. 839-H dated 14.03.2022; the revised Work Order is as below.

सेवा मे,
क्षेत्रीय निदेशक,
क्षेत्रीय संस्थान- 7,
सेंट्रल माईन प्लानिंग एंड डिजाइन इंस्टिट्यूट लिमिटेड (सी.एम.पी.डी.आई.एल.),
सामंतपुरी (सांझी पार्क के नजदिक), आर. आर. एल,
भुवनेश्वर -751 013 (ओडिशा)

विषय: Work Order for "Preparation of Mining Plan & Mine Closure Plan for ML area of 658.724 Ha including Forest Area of 20.383 Ha in respect of Bhubaneswari OCP (30 MTY)" beyond approved Annual Work Programme 2021-22 for CMPDI.

संदर्भ : Computer No: 689754 File No: 192, dtd:21.02.2022

महोदय,

With reference to the above, this is to inform you that the Competent Authority of MCL has accorded the financial approval for the work "Preparation of Mining Plan & Mine Closure Plan for ML area of 658.724 Ha including Forest Area of 20.383 Ha in respect of Bhubaneswari OCP (30 MTY)" beyond approved Annual Work Programme 2021-22 for CMPDI for an amount of Rs. 41,08,170 /- (Rupees Forty-One Lakh Eight Thousand One Hundred Seventy only).

Details of value of job:

- Total EDs assigned for the job: 150
- Total amount for EDs – Rs. 34,81,500.00 (150ED, @23,210/-, ED rate of 2021-22)
- GST- Rs. 6,26,670.00 (@ 18% of Rs. 34,81,500.00)
- Grand Total: Rs. 41,08,170 /- (Rupees Forty-One Lakh Eight Thousand One Hundred Seventy only).

FC Details:

FC No:- FC/MCL/SBP/2021-22/CAP/C-982/TCR/OTHER MINING INFRASTRUCTURE(MINE DEVELOPMENT)/BHUBANESWARI OCP, BHUBANESWARI AREA/Rs.41,08,170/- Dt.14.03.2022.

Note: Work must be completed within this financial year and subsequently submitting the bills within current Financial Year i.e. 2021-22

Please acknowledge and arrange to complete the job at the earliest.

भवदीय

महाप्रबंधक (परियोजना एवं योजना) 22

सूचनार्थ:

- निदेशक (तकनीकी / संचालन)
- निदेशक (वित्त)
- निदेशक (तकनीकी / परियोजना एवं योजना)

प्रतिलिपि:

- GM(BD), CMPDI, Ranchi
- TS to CMD, MCL
- GM(Finance – Commercial Accounts) / HOD MCL HQ
- GM(Finance – Corporate Accounts) / HOD MCL HQ
- GM(Finance – C & B) / HOD MCL HQ

Corporate Office : Jagruti Vihar, Burla, Sambalpur, Odisha - 768 020, Phone: (PBX) +91 (663) 2542461-65, Website : www.mahanadicoal.in

Central Mine Planning and Design Institute Limited

(A Subsidiary of Coal India Limited)

Regional Institute – VII

**Plot No. E-4, Near Gandhi Park, Samantapuri, P.O.: RRL,
Bhubaneswar – 751013, Odisha, India**

Phone: 0674-2974271 (O), Fax: 0674-2301762 (O)

E-Mail: rdri7.cmpdi@coalindia.in