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Approved on 17.12.2014

# REVISED PROJECT REPORT

# FOR

# RAJNAGAR OC EXPN. PROJECT (1.70 MTY)

## (HASDEO AREA)

OF

SOUTH EASTERN COALFIELDS LIMITED

(A Mini Ratna Company)

**FEBRUARY 2009**

**UPDATED AUGUST 2014**


**REGIONAL INSTITUTE-V**

CENTRAL MINE PLANNING & DESIGN INSTITUTE LIMITED

A Mini Ratna & an ISO 9001 Company

(A Subsidiary of Coal India Limited)

SECL Complex, Seepat Road,

Bilaspur (C.G.) 495006


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GENERAL MANAGER

एस.ई.सी.एल.,हसदेव क्षेत्र

SECL,Hasdeo Area

APPROVED ON
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# REVISED PROJECT REPORT

FOR

# RAJNAGAR OC EXPN. PROJECT (1.70 Mty)

(HASDEO AREA)

## SOUTH EASTERN COALFIELDS LIMITED

(A MINI RATNA COMPANY)

FEBRUARY 2009
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# REVISED PROJECT REPORT FOR RAJNAGAR OCP (1.70 MTY)

## PRE-PLANNING INTERACTIVE PROCESSING

| Sl.No. | Particulars | Date of Record Notes / Minutes of the meeting |
|---|---|---|
| 1. | Draft Project Report prepared and circulated on | 19th February,2009 |
| 2. | Record Note of discussions during the presentation of draft RPR for Rajnagar Expn. OC held on 25.3.09 in the Board Room of CMPDIL(Hq) Ranchi | 25th March, 2009 |
| 3. | Minutes of Planning Committee Meeting held on 1st April 2009 in the Board Room of CMD, SECL to discuss the draft RPR of Rajnagar OC(1.70Mty). | 1st April, 2009 |
| 4 | Final Project Report Submission. | 25 June 2009 |
| 8. | Final Project Report Updated and re-submitted. | 12 January 2010 |
| 9. | Final Project Report Updated and re-submitted. | 29 May 2010 |
| 10 | Minutes of 55th TSC Meeting held on 23rd June 2014 in the Conference Room of DT(P&P), SECL to discuss the RPR of Rajnagar OC(1.70Mty). | 23rd June 2014 |
| 10 | Final Project Report Updated and re-submitted based on TSC observation. | August 2014 |

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# REVISED PROJECT REPORT FOR RAJNAGAR OPENCAST PROJECT (1.70MTY)

## SUMMARISED DATA

| Sl. No. | Particulars | Unit | Value |
|---|---|---|---|
| A. | **GENERAL** | | |
| 1 | Name of Project | | RPR FOR RAJNAGAR OPENCAST |
| 2 | Name of Area / Company | | Hasdeo Area |
| 3 | Nearest Railway Station from project | Name<br>km | Manendragarh<br>8 |
| 4 | Nearest National / State Highway / Approach road | Name<br>km | Kotma-Manendragarh (NH-78) Passing through the proposed area |
| | | | |
| B. | **GEOLOGICAL** | | |
| 1 | Name of geological blocks considered | Name | Rajnagar, Dola, North Jhagrakhand block |
| 2 | Area of the geological blocks(part area) | sq. km | 4.80 |
| 3 | Borehole Density within blocks | BHs / sq.km | 21.87 |
| | | | |
| 4 | Description of all coal seams within block | | |

| *Stratigraphic Sequence* | *Thickness (m)* | | *No. of borehole intersections* | *Geological Reserves (Mt)* | *Remarks* |
|---|---|---|---|---|---|
| | *Min.* | *Max.* | | | |
| *Seam XIV* | 1.24 | 6.93 | 82 | 10.30 | Considered in RPR |
| *Parting* | 0.52 | 7.81 | | | |
| *Seam XIII* | 0.53 | 5.79 | 84 | 11.64 | Considered in RPR |
| *Parting with Seam XII* | 9.74 | 16.78 | | | |
| *Parting with Seam X* | 40.64 | 57.98 | | | |
| | | | | | |

| C. | **TECHNICAL** | | |
|---|---|---|---|
| 1 | Area of the proposed mine boundary | Ha | 479.76 |
| 2 | Borehole density within mine area | BHs/sq. km | 17.50 |

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| Sl. No. | Particulars | Unit | Value | |
|---|---|---|---|---|
| 3 | Mine parameters (Quarry-wise) | | QUARRY-1 | QUARRY-2 |
| | Extent along strike (min. – max.) | m | 840-1330 | 460-1020 |
| | Extent along dip (min.-max.) | m | 2730 | 2490 |
| 4 | Description of coal seams proposed to be worked along with the parting details | | | |

| *Name of seam* | ***Thickness range considered (m)*** | ***Av. Thickness / Parting Thickness (m)*** | ***Av. Grade (UHV/ GCV)*** | ***Av. gradient (in degrees)*** | ***Depth range (m)*** | ***Balance Mineable Reserves (Mt)*** | ***Balance Volume of OB (Mcum)*** |
|---|---|---|---|---|---|---|---|
| *Top OB* | 11.24 | 80 | | | | | 133.63 |
| *Seam XIV* | 1.24 | 6.93 | | $2\text{-}3^0$ | 10-98 | 7.84 | |
| *Parting* | 0.52 | 7.81 | | | | | 8.27 |
| *Seam XIII* | 0.53 | 5.79 | | $2\text{-}3^0$ | 10-104 | 8.84 | |
| *Total Coal/ OB* | | | | | | 16.68 | 141.90 |

| | | | |
|---|---|---|---|
| 5 | Av. Stripping Ratio | $m^3/t$ | 8.51 |
| 6 | Method of Mining | | Shovel – Dumper |
| | | | |
| 7 | Target Output | | |
| | Nominal production capacity (at 100%) | Mt | 1.70 |
| | Peak production capacity (at 135%) | Mt | 2.30 |
| | Production capacity (at 85%) | Mt | 1.45 |
| 8 | Year of achieving Target Production (from zero date) | | 2nd |
| 9 | Year of start of Internal Dumping | | 1st |
| 10 | Production Phasing ( from zero date upto target year) | Mt | |

| ***Year / Coal Seam*** | ***Year 1*** | ***Year 2*** | ***Year 3*** | ***Year 4 onwards*** | |
|---|---|---|---|---|---|
| ***Coal*** | 1.50 | 1.70 | 1.70 | 1.70 | |



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| | | | | | | |
|---|---|---|---|---|---|---|
| | ***OB*** | 15.00 | 18.00 | 18.00 | 18.00 | |
| 11 | Total Mine Life (at Nom. production capacity)<br>Pre-construction period<br>Construction period<br>Production build-up period<br>Production period<br>Tapering / mine closure period | | | Years<br><br>Years<br>Years<br>Years<br>Years | 12<br><br>Existing mine<br>Existing mine<br>2<br>9<br>1 | |
| 12 | Major HEMM Deployed for Coal<br>Shovel<br>Dumper<br>Drill<br>Dozer | | | Nos. & Capacity | Outsourced<br>-<br>-<br>- | |
| 13 | Major HEMM Deployed for OB<br>Dragline<br>Shovel<br>Dumper<br>Drill<br>Dozer | | | Nos. & Capacity | Outsourced<br>-<br>-<br>-<br>- | |
| 14 | Total Manpower | | | Nos | 335 | |
| 15 | Overall Output per manshift (OMS) | | | Tonnes | 15.72 | |
| 16 | Seam-wise weighted average grade of coal | | | | G-7 with GCV 5212 Kcal/Kg | |
| 17 | Presence of Major Surface Constraints (nallas, road, power line, etc.) | | | (type) | Road & Power lines of 11 kV | |
| 18 | Coal Transport within the mine (In-pit belt conveying system or by Truck) | | | | By Truck | |
| 19 | Surface Coal Transport to Siding/Despatch Point and Mode of Despatch | | | | By truck / through CHP | |
| 20 | Any Railway Siding and distance | | | | Rajnagar Siding, 3 - 4 km | |
| 21 | Name of any Specific Customer/Industry | | | | Basket linkage Thermal power & cement plant | |
| | | | | | | |
| **D.** | **ENVIRONMENTAL & OTHERS** | | | | | |
| 1 | Civil Construction<br>Residential houses Reqd | | | Nos. | 335 | |
| 2 | Water Demand<br>Colony | | | MLD | 0.511<br>0.408 | |

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| | | | |
|---|---|---|---|
| | Industrial | MLD | 0.103 |
| 3 | Total Land to be acquired | Ha | 310.24 |
| | Government land | Ha | 18.57 |
| | Tenancy land | Ha | 122.36 |
| | Forest land (type of forest) | Ha | 169.31 |
| 4 | Land to be acquired within minetake area (excavation area) | Ha | 241.37 |
| | Government land | Ha | 18.45 |
| | Tenancy land | Ha | 53.61 |
| | Forest land (type of forest) | Ha | 169.31 |
| 5 | Land to be acquired outside minetake area (Beyond Excavation Area, such as, Approach Road, Infrastructure, Colony, etc.) | Ha | 68.87 |
| 6 | Land to be acquired for external dumping | Ha | Nil |
| 7 | Net Present Value of Forest Land | Rs.Lakhs/Ha | 10.00 |
| | Total Area | Ha | 169.31 |
| | Total Value | Rs.Lakhs | 1693.10 |
| 8 | Habitation & Rehabilitation<br>No. of villages within m ine boundary<br>No. of PAFs to be rehabilitated | Nos. | 3 (Dola, Naktitola and Khongapani)<br>1446 |
| 9 | Cost of Rehabilitation<br>R&R Cost | Rs. crores | 88.84 |
| 10 | Total EMP Capital | Rs. crores | 106.34 |
| 11 | Average annual rainfall | mm | 1150 |
| 12 | Make of Water | Cu.m/day | 588013 |
| 13 | Total installed pumping capacity | lps | 150 x 10 = 1500 |
| 14 | Drainage of the Area | | Towards SW |
| 15 | Any proposed diversion of road or power line | | Diversion of road & power line proposed. |
| | | | |
| E. | **FINANCIAL** | | |
| 1 | Total Capital Investment<br>Existing<br>Additional<br>Total | Rs. crores | <br>105.45<br>252.34<br>357.80 |
| 2 | Specific Investment | Rs. / tonne | 2104.69 |
| 3 | Total Capital Investment on P&M | Rs. crores | 107.90 |



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| | | | |
|---|---|---|---|
| | Existing<br>Additional | | 67.99<br>39.91 |
| 4 | Specific Investment on P&M<br>Total | Rs. / tonne | 634.69 |
| 5 | Capital requirement upto target year | Rs. crores | 126.66 |
| 6 | Earnings per manshift (EMS) | Rs. | 2968.69 |
| 7 | Estimated Cost of Production<br>At 100% production level<br>At 85% production level | Rs. / tonne | 1245.97<br>1352.35 |
| 8 | Estimated average selling price (at 95% sales realization) | Rs. / tonne | 1466.00 |
| 9 | Estimated Profit<br>At 100% production level<br>At 85% production level | Rs. / tonne | 220.03<br>113.65 |
| 10 | Financial Internal rate of return (FIRR)<br>At 100% production level<br>At 85% production level | % | 46.33<br>18.29 |
| 11 | Break-even point<br>Production<br>Production level | Mty<br>% | 1.25<br>73.26 |
| 12 | Cost of Outsourcing (average)<br>OB Transportation Rate(Lead 2.0km)<br>Coal Transportation face to siding (Lead face to pit top 2 to 3Km +pit top to siding 4Km) | $Rs/m^3$<br>Rs/tonne | Rs.47.36<br>Rs.91.54 |
| 13 | Mine Closure Cost | Rs/Te | Rs.74.84 |
| 14 | Expected Completion Capital | Rs. crores | 298.85 |

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# EXECUTIVE SUMMARY

# EXECUTIVE SUMMARY

## 1.1 INTRODUCTION

## 1.1 BACKGROUND OF THE PROJECT REPORT

The existing Rajnagar opencast project(1.0 Mty) was prepared and approved in the year 1979 with 10/70 Dragline with a capital of 13.09 Crores. Subsequently, RCE for Rajnagar opencast project(1.0 Mty) was prepared and approved in the year 1984 with a capital of investment of 25.539 crores. The Chronology of approved PR and RCE are as follows.

**Chronology of Previous Approved Reports**

| Name of PR | Year of Preparation | Year of Approval | Technology adopted | Production Capacity (Mty) | Approved Capital (₹.Crores) |
|---|---|---|---|---|---|
| Rajnagar OC | 1979 | 1979 | Dragline 10/70 | 1.00 | 13.09 |
| RCE for Rajnagar OC | 1984 | 1984 | Dragline 10/70 | 1.00 | 25.539 |

## 1.2 EXPLORATION STATUS

Detailed exploration data generated by DGM (MP), CMPDI. In the proposed area major geological disturbances like faults and other discontinuities has been encountered. Accordingly, the exploration was designed to delineate the lay and disposition of the coal seams and to generate reliable data pertaining to the coal quality in the proposed area.

In the proposed mine area, geological structure has been compiled from the data of 105 boreholes taken from the following Geological Reports.

### 1.2.1 History of the Block

The existing Rajnagar opencast project(1.0 Mty) was prepared and approved in the year 1979 with 10/70 Dragline with a capital of 13.09 Crores. RCE for Rajnagar opencast project(1.0 Mty) was prepared and approved in the year 1984

The mine is heading towards its closure as envisaged in the Project Report. The additional property has been identified in sector E and sector-A extn. which were not covered in the previously approved Project Report. Thus, preparation of RPR for Rajnagar Opencast will enhance coal production from the mine and



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life of the project will also be extended. The seam XII has not been proposed in the PR due to uneconomical high stripping ratio, patchy deposit and low & inconsistent thickness.

### 1.2.2 PAST PERFORMANCE OF THE EXISTING MINES

Past performance of the mine showing yearwise coal, OB removal, cost of production and profitability of mine for last few years are as given in the table.

| YEAR | COAL | OB | YEARWISE SR | COST OF PROD | PROFIT/LOSS |
|---|---|---|---|---|---|
| | | | | (Rs/Per Te) | (Rs/Per Te) |
| 2009-10 | 0.79 | 4.08 | 5.15 | 1423.09 | (-)121.96 |
| 2010-11 | 1.06 | 2.94 | 2.78 | 1099.56 | 246.61 |
| 2011-12 | 1.24 | 2.91 | 2.34 | 1195.80 | 804.63 |
| 2012-13 | 1.26 | 2.94 | 2.34 | 1373.02 | 1060.13 |
| 2013-14 | 1.15 | 3.11 | 2.70 | 1288.90 | 1242.60 |

## 1.3 JUSTIFICATION OF PREPARATION OF RPR

Rajnagar OC is an existing mine & Grade of coal is grade G-7 with GCV 5212 Kcal/Kg. The mine is heading towards its closure as envisaged in the Project Report. The additional property has been identified in sector-E and sector–A, extension which were not covered in the previously approved Project Report. Thus, preparation of RPR for Rajnagar Opencast will enhance coal production from the mine and life of the project will also be extended. Therefore to bridge the gap in demand, preparations of RPR for Rajnagar Opencast with enhance coal production and extended life is proposed with a view to fulfill the growth in demand.

## 1.4 SALIENT FEATURES OF PRESENT RPR (AS ON AUGUST 2014)

| Sl. No. | Particulars | Unit | Value |
|---|---|---|---|
| 1 | Thickness of Coal Seam<br>a) XIII<br>b) XIV | <br>m<br>m | <br>0.53-5.79<br>1.24-6.93 |
| 2 | Parting<br>a) XIII-XIV | <br>m | <br>0.52-7.81 |
| 3 | Average Grade | | G-7 with GCV 5212 |



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| Sl. No. | Particulars | Unit | Value |
|---|---|---|---|
| 4 | Balance Mineable Reserves<br>b) XIII<br>c) XIV | Mt<br>Mt<br>Mt | **16.68**<br>8.84<br>7.84 |
| 5 | Volume of OB | M.Cum | 141.90 |
| 6 | Stripping Ratio (Av.) | Cum/t | 8.51 |
| 7 | Target Output | Mt/Yr. | 1.70 |
| 8 | Peak OBR | Mcum/yr. | 18.00 |
| 9 | Project life | Year | 12 |
| 10 | a) Total additional capital investment<br>b) Additional Capital outlay per te of annual output | ₹. in crores<br>₹./t | 252.34<br>1484.37 |
| 11 | Addl. Capital requirement of P&M | ₹. crores | 39.91 |
| 12 | Selling price (95% of notified selling price in power) of processed ROM Coal. | ₹./ t | 1466.00 |
| 13 | Estimated cost of production<br>a) at 100% level of production<br>b) at 85% level of production | <br>₹./t<br>₹./t | <br>1245.97<br>1352.35 |
| 14 | Profit per tonne<br>a) at 100% level<br>b) at 85% level | <br>₹./t<br>₹./t | <br>220.03<br>113.65 |
| 15 | Break-even-point Mty<br>(%) | | 1.25<br>73.26 |
| 16 | No. of personnel | | 335 |
| 17 | OMS | t | 15.72 |
| 18 | EMS | ₹. | 2968.69 |
| 19 | Anticipated year of achieving target | Year | 2nd |
| 20 | IRR at 100% level of production | % | 46.33 |
| 21 | IRR at 85% level of production | % | 18.29 |
| 22 | Completion capital of the project | ₹. crores | 298.85 |
| 23 | NPV @ 12% at 100% level of production | ₹ crores | 124.63 |
| 24 | NPV @ 12% at 85% level of production | ₹ crores | 26.39 |

The RPR has been formulated by total outsourcing option and finally mine will be worked by total outsourcing. Accordingly existing manpower will also be phased down. In the outsourcing option both OB and coal will be worked outsourced HEMM.

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RPR for Rajnagar OC Expn is giving IRR 18.29% at 85% level of production. The overall grade of coal is "grade G-7" with GCV 5212 Kcal/Kg, which is easily marketable. As per the guidelines, a Project is economically viable when it achieves more than 12% IRR at 85% level of Production. Since, this Project is having Internal Rate of Return more than 12% at 85% level of target production i.e. 18.29% and hence contractual option of this Project is economically viable Project.

## 1.5 PEAK CAPACITY

Sometimes with favorable geo-mining conditions and improved productivity of the HEMM, the project may produce coal upto 1.35 times of the planned capacity. So, EMP should be prepared for 2.295 Mty, accordingly approval from the Competent Authority is to be sought.

## 1.6 FLEXIBILITY IN IMPLEMENTATION

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

a) Re-alignment of project working layout for better working layout / dump etc.
b) Change in the specification of HEMM, for techno-economic consideration, to higher capacity at the time of procurement of new equipment or replacement of the equipment.
c) To procure state-of-the-art safety equipment, whenever they are introduced, even if the same is not provided in approved Project Report.
d) Relocation of site for infrastructure facilities depending upon techno-economic reasons and availability of land / forest area etc.
e) Hiring of equipment for loading, transportation etc., at a competitive price, so as to cater to the needs of increased demand of coal and subsequent removal of higher OB and for augmentation of coal production.
f) For upgradation of new technology in mining method for improving performance and reduction in manpower, at a subsequent date after project completion.



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## 1.7 CRITICAL ACTIVITIES PRIOR TO ENVIRONMENT CLEARENCE

Critical activities, which could be taken up prior to environmental, forestry and other statutory clearances to expedite project implementation are as given below.

(i) Rehabilitation & resettlement of three villages are involved in the Project. Three villages, namely, Dola, Naktitola and Khongapani are located within the proposed quarry area. It is proposed to rehabilitate all the families of all the three villages at suitable site, to be decided by area authority in consultation with district authorities. The process of acquisition of R&R site may be undertaken to take possession of the R&R site to rehabilitate the project affected family at the earliest.

(ii) There is a road (NH 78) within the proposed expansion boundary and it is passing through the central part of Quarry-1, so diversion of road will be necessary for working of this mine. Necessary action for diversion of road may be started.

(iii) Preliminary study for acquisition forest land is to be done. Study of shifting the infrastructures that lies within quarry area is to be conducted for to shift these infrastructures to the suitable site.

(iv) Geological data for the seam considered for opencast mine are inadequate particularly in the eastern part of the minetake area. The incrop zone anywhere is not proved. The clay zone, marked on the basis of data available is tentative. For this purpose, a total about 30 number of boreholes are proposed to be drilled before starting of the project. The total meterage involved is about 1000 Mt. So, it is required that boreholes should be drilled to confirm the thickness, development and quality of 13 & 14. Initial study to drill these boreholes may be started to drill these borehole at the earliest.

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## 2.1 UTILITY OR MARKET FOR THE COAL FROM MINE / PROJECT

Liberalisation of power sector by Government of India has generated wide spread interests for private and public sector investments in power generation. As such, there is an appreciable increase in the number of upcoming new thermal power projects in both private and public sectors. Rajnagar OC is an existing project & Grade of coal is grade 'G-7' with GCV 5212 Kcal/Kg . Preparation of RPR for Rajnagar Opencast with enhance coal production is, therefore, proposed with a view to fulfill the above indicated growth in demand.

## 2.2 AVAILABLE LINKAGE OR FIRM FUEL SUPPLY AGREEMENT (FSA)

Rajnagar OC is an existing project and firm linkage or FSA has already finalized.

## 3.1 LOCATION

Rajnagar Opencast Block is situated on North of Rajnagar UG Colliery. The block spreads over the leasehold of three collieries i.e. Rajnagar, West Jhagrakhand and Ramnagar Block-I, but major portion falls within leasehold of Rajnagar Colliery.

The nearest town Manendragarh, is connected to Rajnagar by 8 km metalled road. Manendragarh is also a railway station situated on Anuppur-Chirimiri Branch Line of SEC Railway. An all weather metal road linking Manendragarh with Anuppur passes 1.8 km north of Rajnagar through Bijuri.

## 4.1 SEQUENCE OF COAL SEAM & PARTING

The exploration in Rajnagar Area established eight correlatable horizons. The sequence in ascending order is being 4, 5, 7, 8, 10, 12, 13 & 14. In the present report only two seams-13 & 14 are considered for the preparation of this report. The sequence, thickness range, parting etc. are given in the following table: -

Sequence and brief description of coal seams in the block of PR. The details are given below: -

| Seam | Area of dev. | Thickness range (m) | Grade | BH inter-section | Density | Geological Reserves | Remarks |
|---|---|---|---|---|---|---|---|



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| | (sq km) | | | | | (Mt) | |
|---|---|---|---|---|---|---|---|
| 14 | 4.8 | 1.24-6.93 (P-18) (CMBJ-218) | C-E | 82 | 18 | 10.3013 | |
| Parting | | 0.52-7.81 (CMBJ-218) (WJ-1) | | | | | |
| 13 | | 0.53-5.79 (NJK-19) (MPRJ-146) | C-E | 84 | 19 | 11.6408 | |
| Parting | | 9.74-16.78 (CMBJ-219) (DL-15) | | | | | |
| 12 | | 0.05-1.70 (CMBJ-197) (WJ-10) | A-D | 53 | 12 | 4.8497 | |
| Parting with Seam 10 | | 40.64-57.98 (CMBJ-223) (CMBJ-137) | | | | | |

### 4.1.1 STRUCTURAL SETTING

The project area is bound on north and south by faults, on east by incrop of seams and on west the working Rajnagar OC. The minetake area shows a basin structure.

### 4.1.2 STRIKE

The strike of the coal seams is generally E-W, NE-SW and N-S.

**4.1.3 DIP :** The beds are dipping towards the centre forming a basinal structure. The gradient varies from $2^0$ to $10^0$.

### 4.2 RESERVES

A total of 26.79 Mt of geological reserves have been calculated within the minetake area. Seam wise, thickness wise and grade wise reserves are given in the chapter 4.

Geological data for the seam considered for opencast mine are inadequate particularly in the eastern part of the minetake area. The incrop zone anywhere is not proved. The clay zone, marked on the basis of data available is tentative.

For this purpose, a total about 30 number of boreholes are proposed to be drilled before starting of the project. The total meterage involved is about 1000 Mt. So, it is required that boreholes should be drilled to confirm the thickness, development and quality of Seam-13 and 14.

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## 5.1 PIT FORMULATION STRATEGY

The quarry has been formed as such the total proposed expansion area has been considered for exploitation. The quarry has been formed such as to start mining from bottom most seam considered for mining i.e. Seam – XIII. The proposed expansion area will worked out with two quarries, namely Quarry-1 & Quarry-2.

## 5.2 MINE BOUNDARIES

Reasons for selecting/omitting seams/sections.

The seam XII has not been proposed in the PR due to uneconomical high stripping ratio, patchy deposit and low & inconsistent thickness.

North : Fault F1F1, Dola OC boundary, Haldibari UG mine boundary has been considered as north side mine boundary as north side of Fault F1F1 already extracted by Dola OC. Over Haldibari UG mine area seam XIII to XIV washed out due to Fault F1F1.

South : Fault F2F2, Sector A and Sector B quarry boundary has been considered as south side mine boundary as south side of Fault F2F2 already extracted by Sector A and Sector B Quarry.

East : Beyond Incrop of Seam XIII there are no quarriable potential coal seams.

West : Beyond Incrop of Seam XIII there are no quarriable potential coal seams.

**Mine Boundary**

The proposed expansion area will worked out with two quarries, namely, Quarry-1 & Quarry-2. The proposed boundaries are as follows (Plate II).

**Quarry-1**

North : Fault F1F1, Haldibari UG mine boundary.

South : Fault F2F2, Sector B quarry boundary.



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East : Incrop of Seam XIII.

West : The Railway line to Rajnagar Railway siding. \

**Quarry-2**

North : Fault F1F1, Dola OC boundary.

South : Fault F2F2, Sector A quarry boundary.

East : The Railway line to Rajnagar Railway siding.

West : Incrop of Seam XIII.

**Vertical Mine Boundary : Reasons for selection of seam as base of quarry**

Seam – XIII will be the bottom most seam to be exploited. Below seam XIII, there are seam XII and it has not been proposed in the PR due to uneconomical high stripping ratio, patchy deposit and low & inconsistent thickness.

Below seam XII, there are seam X having average thickness of 1.5m at a parting thickness of 40.64m to 57.98m. Thus seam has been left out as the Stripping Ratio will increase sharply it will make the mine economically unviable.

## 5.3 MINEABLE RESERVES

10% geological and 5% mining losses are considered for reserves estimation.

**Sector & mineable reserves**

The calendar programme has been drawn by dividing the whole mine into five sectors (refer Plate III). The sectorwise and seamwise mineable coal reserves of both the Quarry are as follows.

Seamwise –Sectorwise details of Balance Mineable reserves (Mt) (as on 01.04.2014)

| **QUARRY 1** | | | | | | |
|---|---|---|---|---|---|---|
| SECTOR | SEC1 | SEC2 | SEC3 | SEC4 | SEC5 | **TOTAL** |
| SEAM 13 | 1.70 | 0.77 | 0.59 | 1.89 | 0.75 | **5.70** |
| SEAM 14 | 0.12 | 1.29 | 1.17 | 2.56 | 0.46 | **5.60** |
| **TOTAL** | **1.82** | **2.06** | **1.76** | **4.45** | **1.21** | **11.30** |
| QUARRY 2 | | | | | | |
| SECTOR | SEC1 | SEC2 | | | | **TOTAL** |



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| | | | | | | |
|---|---|---|---|---|---|---|
| SEAM 13 | 1.76 | 1.38 | | | | **2.95** |
| SEAM 14 | 1.38 | 1.05 | | | | **2.43** |
| **TOTAL** | **2.95** | **2.43** | | | | **5.38** |
| | | | | | | |
| **GRAND TOTAL** | **4.77** | **4.49** | **1.76** | **4.45** | **1.21** | **16.68** |

Seamwise –Sectorwise details of OB removal (Mm3) (as on 01.04.2014)

| **QUARRY 1** | | | | | | |
|---|---|---|---|---|---|---|
| SECTOR | SEC1 | SEC2 | SEC3 | SEC4 | SEC5 | **TOTAL** |
| Top OB | 13.49 | 26.95 | 22.07 | 31.02 | 2.48 | **96.01** |
| Parting between XIII & XIV | 0.26 | 1.17 | 1.65 | 2.32 | 0.58 | **5.98** |
| **TOTAL** | **13.75** | **28.12** | **23.72** | **33.34** | **3.06** | **101.99** |
| QUARRY 2 | | | | | | |
| SECTOR | SEC1 | SEC2 | | | | **TOTAL** |
| Top OB | 24.47 | 13.15 | | | | **37.62** |
| Parting between XIII & XIV | 0.89 | 1.40 | | | | **2.29** |
| **TOTAL** | **25.36** | **14.55** | | | | **39.91** |
| **GRAND TOTAL** | | | | | | **141.90** |
| **STRIPPING RATIO** | | | | | | **8.51** |

Below barrier between Quarry 1 & Quarry 2 additional coal reserve is 1.34Mt with additional OB is 7.89Mm3. This coal may extracted by shifting of railway line.

## 5.4 FUTURE EXPANSION POTENTIAL

It is expansion PR of Rajnagar OC Project. Both east and west side is proposed to be extracted upto the incrop of seam XIII. North side has already been extracted and exhausted by Dola OC. South side also has been extracted and exhausted by Rajnagar OC sector A & B Quarry. Thus, mine does not have the scope to expand further.

## 6.1 MINE PARAMETERS

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

Table : Geological and Mining Characteristics

| **Sl. No.** | **Particulars** | **Unit** | |
|---|---|---|---|
| **I.** | **Coal Seams thickness** | | |
| | Seam XIV | m | 1.24 to 6.93 |



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| Sl. No. | Particulars | Unit | | |
|---|---|---|---|---|
| | Seam XIII | m | 0.53 to 5.79 | |
| 2 | Average Dip | | 1 in 30 | |
| 3 | Specific gravity of coal in seams | t/m3 | 1.52 | |
| 4 | Excavation category of coal | | ←----------Cat.III----------→ | |
| **II.** | **Overburden / partings thickness** | | | |
| | Top OB | m | 11.24 – 80 | |
| | Between Seam XIV & XIII | m | 0.52 to 7.81 | |
| 2 | Specific Gravity | t/cum | 2.40 | |
| 3 | Excavation Category | | 50% Cat.III & 50% Cat.IV | |
| **III.** | **Quarry Parameters** | | **Quarry-1** | **Quarry-2** |
| 1 | Maximum width along strike | | | |
| | - at surface | m | 1330 | 1020 |
| | - at floor | m | 1214 | 883 |
| 2 | Minimum width along strike | | | |
| | - at surface | m | 840 | 460 |
| | - at floor | m | 640 | 290 |
| 3 | Maximum length along dip | | | |
| | - at surface | m | 2800 | 2580 |
| | - at floor | m | 2730 | 2490 |
| 4 | Maximum depth | m | 105 | 87 |
| 5 | Minimum depth | m | 10 | 10 |
| 6 | Maximum lift | m | 115 | 97 |
| 7 | Area of excavation | | | |
| | - at surface | Ha | 314.36 | 165.40 |
| | - at floor | Ha | 277.68 | 117.50 |
| 8 | Balance Coal (as on 1.4.2014) | Mt | 11.30 | 5.38 |
| 9 | Balance OB (as on 1.4.2014) | Mcum | 101.99 | 39.91 |
| 10 | Stripping Ratio | M3/t | 9.03 | 7.42 |

## 6.2 EQUIPMENT SELECTION

The RPR has been formulated by total outsourcing option and finally mine will be worked by total outsourcing. Accordingly existing manpower will also be phased down. As depth of OB increases the annual OB removal will also increased. To handle the larger OB quantity with optimum no of equipment with optimum capacity is proposed be used. Due to flexibility of operation, Shovel-Dumper combination will be suitable for working multiple seams and partings. The HEMM to be deployed for OB Removal by outsourcing agency should preferably be 5 cum shovels with 60 T Rear Dumpers. For thin parting, smaller backhoes may be deployed. Transport of coal from face to railway siding will be done either by ESM or by civilian contractor with higher capacity trucks



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IRR of departmental option was negative, so it has been decided in the planning committee meeting that the mine will be operated by total outsourcing of HEMM. Hence it has been projected that present departmental HEMM would not be replaced after completion of it's life. However, for essential HEMM for reclamation and common services would be kept in the project for operational convenience.

The proposed expansion area is highly disturbed with no of faults. The faults are criss-cross in nature. Thus sufficient face length will not be available for optimum efficiency of surface miner. Further the proposed area is divided into two quarries. Thus movement of surface miner from one quarry to another quarry is also a difficult tasks and it will reduce the productivity of surface miner. So, surface miner has not been proposed for this quarry. Existing Dragline at Rajnagar OC will be gainfully used at another suitable project.

## 6.6 MINING SYSTEM & SYSTEM PARAMETERS

In the outsourcing option blasting will be done departmentally and both OB and coal will be worked by outsourcing.

The salient features of mining system are as follows:-

i) Height of bench in OB will depend on the size of equipment.
Coal bench height will depend on the thickness of the coal seams.
The provision of coal mine regulations and related circulars shall be strictly followed for designing bench parameters in coal and OB.

ii) Average Seam gradient – 1 in 30.

iii) Total dump height – 140 m (4 benches of 30 m & one bench 20m)

iv) Bench slope –

Coal/OB - 70 degree

Spoil - 37 degree

It is proposed that mine will be operated for 330 days in a year. In a day, there will be 3 shifts and each shift is of 8 hours.

Keeping the geo-mining characteristics of the deposit in view optimum no. of equipment with optimum capacity is proposed be used. Considering, the general



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mine floor gradient of 1 in 30, the coal and OB benches are proposed parallel to the seam.

### CONSTRAINTS ON MINE DEVELOPMENT

1) Three villages, namely, Dola, Naktitola and Khongapani are located within the proposed quarry area. It is proposed to rehabilitate all the families of all the three villages at suitable site, to be decided by area authority in consultation with district authorities.
2) There is a road (NH 78) within the proposed expansion boundary and it is passing through the central part of Quarry-1, so diversion of road will be necessary for working of this mine.
3) There is a railway line within the proposed expansion boundary and it is passing between the Quarry-1 and Quarry 2. Proper precaution shall be taken for the Railway line.
4) Quarry-I falls in protected forest land area. It is to be acquired to extract coal from Quarry-I.
5) Some surface infrastructures are existing within quarry area. These surface infrastructures are to be shifted to the suitable site.

### DUMPING STRATEGY

1. Internal dumping will start at 2nd year in Quarry 1. In Quarry 2 internal dumping has already started.
2. For initial dumping no additional land is required. This dumping will be done over the exhausted quarry area of sector A & B (Plate-IX).
3. Top soil will be separately dumped in external dump

Proper precautions / observations should be taken to avoid sliding of internal and external OB bench.

## 7.1 SEQUENCE OF DUMPING OPERATIONS & STAGE-WISE DETAILS

| Sl.No. | Particulars of working | Total |
|---|---|---|
| **B** | **Final year stage** | |
| 1. | Coal mined (Mt) | 16.68 |
| 2. | OBR (Mcum) | 141.90 |
| 3. | Stripping ratio (Mcum/t) | 8.51 |
| 4. | Excavated quarry area (Ha) | 479.76 |



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| Sl.No. | Particulars of working | Total |
|---|---|---|
| 5. | Internal dump (Mcum) | 121.20 |
| 6. | External dump (Mcum) | 20.70 |

## 8.1 DESIGN CRITERIA

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

Excavation category assumed

i) Coal - III ii) Alluvial OB - Cat.I/II: Assumed

iii) Hard OB - 50% cat.III + 50% cat.IV

Insitu volume weight t/m3

i) Coal-1.42 to 1.52 t/cum ii) Overburden-2.40 t / cum

## 8.2 HEMM PRESENT FLEET

Presently OB removal and drilling & dozing in coal is being done by departmental HEMM. Coal loading and transport is being done by outsourced HEMM. It is being proposed that in future no replacement of HEMM for coal and OB related departmental HEMM would be considered and this would be done by hiring of HEMM. Departmental capacity of HEMM for OB removal is enclosed as Annexure IV. Details of existing HEMM as on 01.04.2014 are as follows.

| Sl. No. | Particulars | Unit | Size/ Capacity | Existing No |
|---|---|---|---|---|
| A. | **OVERBURDEN** | | | |
| 1 | Drag Line 10-70 | Cum | 10 | 1 |
| 2 | Hydraulic Shovel | Cum | 4 | 5 |
| 3 | Rear Dumpers* | T | 35 | 20 |
| 4 | RBH Drills | mm | 250 | 2 |
| 5 | RBH Drills | mm | 160 | 2 |
| 6 | Dozers | HP | 320/410 | 2 |
| B. | **COAL** | | | |
| 7 | RBH Drills | mm | 160 | 2 |
| 8 | Dozers | HP | 320 | 2 |
| C. | **RECLAMATION** | | | |
| 9 | Dozers | HP | 320 | 1 |
| 10 | Water Sprinkler | KL | 28 | 3 |
| D. | **COMMON** | | | |
| 11 | Dozers | HP | 320 | 2 |
| 12 | Motor Grader | HP | 280 | 1 |



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| | | | | |
|---|---|---|---|---|
| 13 | Loader | Cum | 1.5/2.0 | 2 |
| 14 | Crane | T | 70/8 | 3 |
| | **Total (A+B+C+D)** | | | **48** |

Average lead for OB removal is 2.0Km. Capacity of existing HEMM after completion of their life will be replaced by outsourcing gradually and finally mine will be worked by total outsourcing. In the outsourcing option blasting will be done departmentally and both OB and coal will be worked contractually. The Annual productivity of HEMM will depends on the size of deployed HEMM.

## 8.3 CALENDAR PROGRAMME OF EXCAVATION

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

**CALENDER PROGRAMME FOR QUARRY NO – 1 & 2**

| | QUARRY 1 | | QUARRY 2 | | TOTAL | | | | |
|---|---|---|---|---|---|---|---|---|---|
| YEAR | COAL | OB PLANNED | COAL | OB PLANNED | TOTAL COAL | TOTAL OB | DEPT OB | OUT SOURCED OB | STRIPPING RATIO |
| 1 | 1.00 | 9.50 | 0.50 | 5.50 | 1.50 | 15.00 | 1.04 | 13.96 | 10.00 |
| 2 | 1.00 | 12.00 | 0.70 | 6.00 | 1.70 | 18.00 | 0.23 | 17.77 | 10.59 |
| 3 | 1.00 | 12.00 | 0.70 | 6.00 | 1.70 | 18.00 | | 18.00 | 10.59 |
| 4 | 1.00 | 12.00 | 0.70 | 6.00 | 1.70 | 18.00 | | 18.00 | 10.59 |
| 5 | 1.00 | 12.00 | 0.70 | 6.00 | 1.70 | 18.00 | | 18.00 | 10.59 |
| 6 | 1.00 | 12.00 | 0.70 | 5.00 | 1.70 | 17.00 | | 17.00 | 10.00 |
| 7 | 1.00 | 8.00 | 0.70 | 3.50 | 1.70 | 11.50 | | 11.50 | 6.76 |
| 8 | 1.00 | 8.00 | 0.68 | 1.91 | 1.68 | 9.91 | | 9.91 | 5.90 |
| 9 | 1.00 | 8.00 | | | 1.00 | 8.00 | | 8.00 | 8.00 |
| 10 | 1.00 | 5.50 | | | 1.00 | 5.50 | | 5.50 | 5.50 |
| 11 | 1.00 | 2.22 | | | 1.00 | 2.22 | | 2.22 | 2.22 |
| 12 | 0.30 | 0.77 | | | 0.30 | 0.77 | | 0.77 | 2.57 |
| **TOTAL** | **11.30** | **101.99** | **5.38** | **39.91** | **16.68** | **141.90** | **1.27** | **140.63** | **8.51** |

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Below barrier between Quarry 1 & Quarry 2 additional coal reserve is 1.34Mt with additional OB is 7.89Mm3. This coal may extracted by shifting of railway line.

## 9.1 PROJECTED COAL QUALITY

The seamwise tentative GCV and average GCV of mine area of Rajnagar OC are as given below.

| SL NO | SEAM NAME | GCV (Kcal/kg) |
|---|---|---|
| 1 | Seam 13 | 5528 |
| 2 | Seam 14 | 4865 |
| | Average | 5212 |

The average GCV of mine area of Rajnagar OC is 5212 Kcal/Kg has been considered for project costing.

## 10.0 WATER MANAGEMENT

The yearly rainfall is approximately 1150mm. The maximum rainfall in a day is estimated as 193 mm from probability curve and total water collected in a day is estimated as 588013 cum. (max.) in 10th yr. in quarry 1 & 2. The number of pumps is estimated on the basis of total water collected in a day which will be dewatered in 100 hours. In this report, maximum 8 nos. of main pumps each of 150 lps and 120 m head have been proposed, considering existing 2 nos. main pumps, to dewater the accumulated water from sumps of both quarries. Intermediate pumps and diesel pumps already exist for operation in initial period and then will be used as standby. Diesel engine operated face pumps also exist for keeping the working places dry. Separate sumps and pumping stations have been proposed for each quarry. The layout of quarry provides suitable gradient along the floor of the benches to facilitate self-drainage of water into the sump

## 11.0 COAL HANDLING PLANT AND DESPATCH ARRANGEMENT



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11.1 EXISTING CHP (Fig. 11.1):- R.O.M. coal from the coal faces is being transported up to receiving hoppers of two numbers of feeder breakers by means of contractual trucks. Feeder breakers are used to crush the coal to (-) 200 mm size coal. The crushed coal is then passed through fixed grizzly or vibratory screen for segregating coal into steam and slack steam coal fractions. Steam and slack coal fractions are collected on conveyor C8 and C2 respectively and stored in ground bunker of 7000 t capacity (with I5 numbers of pockets) with separate compartments to store steam and slack coal fractions. Coal fractions are stored in the bunker with the help of conveyor C4 and 8 nos. manually operated ploughs provided on conveyor C4. Steam/slack fractions of coal are reclaimed with the help of reciprocating feeders and carried to conventional loading point with the help of conveyors C5 and C6 in series A wagon hauler is used for wagon movement while loading and 100 t rail weigh bridge is used for wagon weighment. All the conveyors are of 1000 mm wide except loading conveyors i.e. C5 and C6 which are of 1200 mm wide coal is dispatched to various power houses and miscellaneous customers by rail.

## 11.2 PROPOSED EXPANSION OF CHP (Fig. 11.1)

One crushing station with one number of feeder breaker and one double roll crusher of 400 tph capacity has been proposed to reduce r.o.m. coal of 1200 mm size to (-) 100 mm size. Crushed coal will be collected on conveyor PC1 and elevated for loading in wagons at the proposed new loading point with conventional wagon loading arrangement. The existing electronic in motion weigh bridge, 100 t capacity for weighment of wagons will be shifted to a new proposed loading point and a new wagon hauler for hauling a rake of 58 'N' Box wagons while being loaded will be provided. After commissioning of the proposed CHP, the loading conveyor C5 (existing) will be extended by 20 m so that it can discharge on the proposed conveyor PC1. By this existing loading point, conveyor C6, existing wagon loading house, existing wagon hauler etc will be dismantled. Two new crushing stations consisting of feeder breakers and double roll crushers will be established in the existing CHP after shifting the existing feeder breakers to the new location for crushing coal to (-) 100 mm size.

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## 12.0 UNIT WORKSHOP AND STORES

Unit excavation and E&M workshop are existing in the mine which are meeting the daily requirements, scheduled maintenance needs of equipment operating at the mine. The capital overhauling of assemblies and sub assemblies of HEMM are being carried out central workshop Korba and Central workshop Gevra. In the revised project report it is being proposed not to replace the existing HEMM after they are surveyed off and out source for the equivalent work load .Due to the above reasons it is felt that the facilities available at the existing unit workshop are not sufficient so in this revised project report necessary additional facilities have been proposed in the workshop to meet the maintenance requirements of the HEMM operating in the project.

The medium repair, minor repairs, scheduled maintenance of HEMM, daily maintenance of HEMM, washing of the equipment will be carried out in unit excavation workshop. Capital and major overhaules of the HEMM will be carried out in the Central workshop at Gevra and Korba.

The minor repairs, schedule maintenance of E&M plant and machinery will be carried out in E&M workshop major overhaules of the equipment will be carried in area/Regional workshop. The maintenance of HEMM will be out sourced.

The existing stores needs some additional storage facilities to store the additional spares etc.

## 13.0 POWER SUPPLY, ILLUMINATION AND COMMUNICATION

Presently, power supply to being made available from Rajnagar O/C project substation with installed capacity of 2 x 3 MVA, 33/6.3kV and partly from Dola substation having installed capacity of 1 x 2 MVA, 33/3.4kV. In the proposed system one additional transformer of 2 MVA, 33/3.4kV is to be installed at Dola substation. This substation will feed power to Drills and quarry pumps whereas the other loads like CHP, workshop and colony etc.



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will be continued to be fed from Rajnagar O/C substation. The maximum demand at Dola substation will be 1890kVA with a corrective power factor of 0.98 (lag). Total 5 nos. 3.3kV quarry feeders will be drawn to feed Drills and pumps. The specific energy consumption will be around 6.42 kwh/te. Provision for telephone communication and data communication alongwith LAN and Internet has been envisaged.

## 14.0 CIVIL CONSTRUCTION (ALONGWITH COST INDEX)

The planned balance life of the proposed block with total outsourcing option is 12 years. All civil structures should preferably be constructed over non-coal bearing area. Proposed service infrastructures should preferably be located near the working area as per service requirement.

The preparation of cost estimates for civil infrastructure is based on prevailing cost index of the area in June 2014. The cost index value has been calculated from the market rate of the area. Considering the prevailing rates of materials and labour in Hasdeo Area, the cost index works out to 2591 w.r.t. 100 base in Delhi as on 1.10.1976.

Service road of length of 5.7 km within the quarry and 7.0 km for interconnection between existing and proposed operational area as well as serving the purpose of coal and OB transportation from the quarries have been envisaged. The detail cost estimates alongwith tentative specifications have been elaborated in the Appendix-A.8.2.2 and A.8.2.3.

Major road leading to Manendragarh will be affected due to extension of present mining boundary. So, provision has been made for the diversion of the road which will be affected.

## 15.1 SAFETY MEASURES AGAINST INUNDATION OF RAIN WATER

The topography of the quarriable and adjoining area shows that rain water from the northern side area of the quarry will flow down in the quarry. And this water will hamper the production target. And so, on the northern side of the quarry, embankment and drainage nala is to be constructed.

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## 15.2 DUST SUPPRESSION

Major source of dust in opencast mine operation have been identified to be from haul roads, due to spillage from dumpers and abrasion by their wheels. Provision of adequate nos. of water sprinklers have been made for spraying of water on haul roads to prevent emission of dust. All along life, haul roads and other heavy duty roads likely to be negotiated by heavy vehicles and equipment have been proposed to be metalled and coated to facilitate control of emission of dust.

The drills to be engaged is to be equipped with dust arrester so that dust emission is minimum. As the blasting is not continuous one and while blasting, persons will be removed to the safe zone, chances of exposure to dust due to blasting are less. At CHP, sufficient arrangements have been provided to suppress coal dust at vulnerable points.

## 15.3 SLOPE STABILITY

### SPOIL DUMP

The spoil will be stacked in the external and internal dump space at the natural angle of repose to avoid the sliding of OB bench. The OB dump will be terraced at the height of 30m. The barrier distance between internal dump and coal production bench will be 100 m to have smooth functioning of machineries. The surface of OB dump will be leveled and graded.Plantation will be made on the slope of OB heap to avoid the sliding of spoil. Clay in OB if found, should be covered by other OB and pressed to avoid sliding of OB dump otherwise it should be separately stacked.

To monitor the dump slope stability slope stability radder has been provided.

## 15.4 HAUL ROAD MAINTENANCE

Haul road for dumper / tipper has been designed double lane with shoulders on both side for movement of dumper and ancillary equipment. Sharp turnings have been avoided to reduce the chance of any unhappenings. The access trench is graded to 6% slope. The ramp from one bench to another bench is graded at 1 in 10 slopes.



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## 15.5 BLASTING

For blasting crews, the blasting shelter has been provided. To reduce the chance of fly rock and misfire, the perfect blasting pattern is to be developed by trial. In view of the safety of the villages / public / mine infrastructure against blasting hazards like fly rocks, ground vibrations etc. proper safe distance has been kept from the mine working. However, when the mine working reaches near to the village boundaries/mine infrastructure, controlled blasting will be adopted alongwith other necessary precautions laid down by the DGMS. Misfire if any, should be handled cautiously.

## 16.1 ENVIRONMENTAL MANAGEMENT

Three additional villages, namely, Dola, Naktitola and Khongapani will fall within the core zone involving a total of 310.24 Ha of additional land & 1446 nos. of homestead. The existing project involved additional 310.24 Ha of land in which additional agriculture land was 122.36Ha.

The Socio economic profile within 10-km. radius of the existing project with Land use pattern, economic profile and civic amenities details are based on available census data.

Out of a total population of 137478 persons, 53.02% are male and 46.98% are female. The Scheduled castes account for 11.53 % of total population and the scheduled tribes for 24.22 %. About 41.00 % population is literate.

The data in respect of economic profile reveals that 28.57% of the population is main workers and 1.92% is marginal workers, the rest 69.51% are a non-worker. Main workers and Non-workers ratio is 1:2.43.

The workforce pattern in the study area reveals that 17.40% of main workers are cultivators supported by 6.36% agricultural labourers, 76.24% workers are engaged in household industries and other allied activities like live stock, forestry, transportation & storage, communication, trade and commerce, manufacturing processing services and repairs etc.



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It has been found that there is a good network of infrastructural facilities of civic amenities within 10-km. radius of Rajnagar OC Project. The present level of availability of the civic amenities may be attributed to the existence of several coal-mining projects in the neighbourhood.

## 17.0 LAND REQUIREMENT

The land already acquired is 803.04 Ha and remaining 310.24 ha land is additional land for the expansion project. Break-up of land use and R&R details has been estimated based on landuse plan supplied by area authority. The break-up of land are as follows:-

( AREA IN Ha)

| SL. No | Particulars | | Additional LAND (1.70 Mty) to be acquired | | | | | | TOTAL LAND |
|---|---|---|---|---|---|---|---|---|---|
| | | TOTAL EXISTING | TENANCY LAND | FOREST LAND | GOVT. LAND | WASTE LAND | WATER BODY | TOTAL | |
| | | | | | | | | | |
| 1. | QUARRY AREA | 574.34 | 53.61 | 169.31 | 18.45 | | | 241.37 | 815.71 |
| 2. | SAFETY ZONE | | 16.10 | | 0.12 | | | 16.22 | 16.22 |
| 3. | REHABILITATION | 2.02 | 52.65 | | | | | 52.65 | 54.67 |
| 4 | COLONY | 11.41 | | | | | | 0.00 | 11.41 |
| 5 | EXTERNAL DUMP | 78.40 | | | | | | 0.00 | 78.40 |
| 6 | INFRASTRUCTURE | 9.46 | | | | | | 0.00 | 9.46 |
| 8 | OTHERS | 127.41 | | | | | | 0.00 | 127.41 |
| | | | | | | | | | |
| | GRAND TOTAL | 803.04 | 122.36 | 169.31 | 18.57 | 0.00 | 0.00 | 310.24 | 1113.28 |

Note : Break-up of land use and R&R details has been estimated based on landuse plan supplied by area authority.

It is estimated that total 1113.28 Ha land will be involved for Rajnagar Expansion Opencast Project including land for quarry, dumps, road diversion, and safety zone.

The estimated capital requirement for land acquisition of the quarry has been given in Appendix-A.1.

## 18.0 MINE CLOSURE

The mine closure cost will cover the following activities for which a corpus escrow account @ Rs. 6.0 lakhs per Ha. for OCP & @ Rs. 1.0 lakh per Ha for UG mine of the property leasehold shall be opened with the coal controller organization. In case of mines having acid mine drainage, post closure acid mine drainage management cost shall also be included in the total closure cost.



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### 18.1 Mine Closure Cost for OC mine

As per the guidelines of the MoC, the cost of the mine closure is to be computed based on the basis of involved project area. In Rajnagar OCP, the total project area is **1113.28 Ha**. So, the closure cost is to be computed considering a project area of 1113.28 Ha. Considering the wholesale price index as 181.70 (provisional value), as on May 2014, the updated cost of the mine closure is estimated to be Rs. 8.412 lakhs per hectare considering the admissible escalation over Rs. 6.00 lakh per Ha as on August 2009 when wholesale price index was 129.60.

Total Final mine closure cost (@ Rs.8.412/Ha.)**: Rs. 9364.911 Lakhs**

The current value of corpus is **Rs. 9364.911 Lakhs** (as on May 2014). This corpus is to be divided by estimated life of mine. Since, the balance life of the mine is estimated as **12 years,** the annual corpus comes to **Rs. 780.410 Lakhs** by dividing 12 years. This amount is to be deposited in escrow account every year.

**Fund to be deposited in escrow account:** Year wise amount to be deposited has been given below in table 18.13.

**Table – 18.13**

| Year | Fund Deposited in Escrow Fund | Fund to be Reimbursed (Maximum) | |
|---|---|---|---|
| 1 | 780.410 | Nil | (+) accrued interest as applicable |
| 2 | 819.431 | Nil | |
| 3 | 860.402 | Nil | |
| 4 | 903.422 | Nil | |
| 5 | 948.593 | Nil | |
| **Phase 1** | **4312.258** | **3449.806** | |
| 6 | 996.023 | Nil | |
| 7 | 1045.824 | Nil | |
| 8 | 1098.115 | Nil | |
| 9 | 1153.021 | Nil | |
| 10 | 1210.672 | Nil | |
| **Phase 2** | **5503.655** | **4402.924** | |
| 11 | 1271.206 | Nil | |
| 12 | 1334.766 | Nil | |
| **Final stage** | **2605.972** | **4569.155** | |

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| Year | Fund Deposited in Escrow Fund | Fund to be Reimbursed (Maximum) |
|---|---|---|
| Total | 12421.885 | 12421.885 |

**The total escalation from the base year Aug'2009 is given in the table 18.17 (b) below:**

**Table – 18.14**

| Year | Escrow Fund as on Aug 2009 | Total escalation | Fund Deposited in Escrow Fund |
|---|---|---|---|
| 1 | 556.640 | 223.770 | 780.410 |
| 2 | 556.640 | 262.791 | 819.431 |
| 3 | 556.640 | 303.762 | 860.402 |
| 4 | 556.640 | 346.782 | 903.422 |
| 5 | 556.640 | 391.953 | 948.593 |
| **Phase 1** | **2783.200** | **1529.058** | **4312.258** |
| 6 | 556.640 | 439.383 | 996.023 |
| 7 | 556.640 | 489.184 | 1045.824 |
| 8 | 556.640 | 541.475 | 1098.115 |
| 9 | 556.640 | 596.381 | 1153.021 |
| 10 | 556.640 | 654.032 | 1210.672 |
| **Phase 2** | **2783.200** | **2720.455** | **5503.655** |
| 11 | 556.640 | 714.566 | 1271.206 |
| 12 | 556.640 | 778.126 | 1334.766 |
| **Final Stage** | **1113.280** | **1492.692** | **2605.972** |
| **Grand total** | **6679.680** | **5742.205** | **12421.885** |

**Note:** 1.An agreement, outlining detailed terms and conditions of operating the Escrow Account, shall be executed amongst the mining company, the coal controller, and the concerned bank in order to give effect to this. The agreement shall be executed before the grant of permission by the coal controller to open the mine.

2. Up to 80% of the total deposited amount including interest accrued (as applicable), in the Escrow account may be recovered after every five years in line with the periodic examination of closure plan. The recoverable amount should be equal to expenditure incurred on the progressive mine closure plan in the past five years or 80% whichever is less. The balance amount at the end of final mine closure shall be recovered by the mine owner/lease holder on compliance of all provisions of closure plan duly signed by lessee to the effect that said closure of



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mine complied all statutory rules, regulations, orders made by the Central or State Government, statutory organisations court etc. and duly certified by the coal controller.

### 18.2 Mine Closure Activities & Tentative Cost Break-up:

The break-up of some major mine closure activities along with their tentative estimation of cost in terms of percentages of mine closure cost (stage wise) has been indicated in Table-18.19 below. The detailed activity schedule for the 'Final Mine Closure Plan' would be prepared five years before the intended final closure of the mine along with the detailed mine closure cost break-up.

**Table : TENTATIVE MINE CLOSURE ACTIVITIES & COST BREAK-UP**

**Type of mine:** Open cast **Production Capacity:** 1.70 MTY

**Mining Project Area:** 1113.28 Ha **Depth of the mine:** 105m & 87m

| Sl. No. | Activity | Mine Closure Cost (Percentage Weightage) | Remarks |
|---|---|---|---|
| A | **Dismantling of Structures** | | To be included in final mine closure plan |
| | - Service Buildings | 0.20 | |
| | - Residential Buildings, | 2.67 | |
| | Industrial Structures like CHP, workshop, Field Sub -Station etc. | 0.30 | |
| B | **Permanent Fencing of mine void and other dangerous area** | | To be included in final mine closure plan |
| | - Random rubble masonry of height 1.2 metre including levelling up in cement concrete 1:6:12 in mud mortar. | 1.50 | |
| C | **Grading of highwall Slopes** | | To be included in final mine closure plan. |
| | - Levelling & Grading of highwall slopes. | 1.77 | |
| D | **OB Dump Reclamation** | | |
| | - Handling/Dozing of external OB dump into mine void. | 88.66 | 71% for progressive & 17.66% for Final mine closure. |
| | - Bio-reclamation including soil spreading, plantation & maintenance. | 0.40 | Equal Weightage throughout the life of the mine |
| E | **Landscaping** | | |
| | - Landscaping of the cleared land for improving its esthetic. | 0.30 | To be included in final mine |



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| | | | |
|---|---|---|---|
| | | | closure plan. |
| F | **Plantation** | | |
| | - Plantation over area obtained after dismantling. | 0.50 | To be included in final mine closure plan. |
| | - Plantation around fencing. | 0.20 | To be included in progressive mine closure plan. |
| | - Plantation over the cleared off external OB dump | 0.00 | To be included in progressive mine closure plan. |
| G | **Monitoring / testing of environmental parameters for three years.** | | For three years after mine closure. |
| | - Air quality | 0.22 | |
| | - Water quality. | 0.20 | |
| H | **Entrepreneurship development (vocational and skill development training for sustainable income of affected people).** | 0.26 | Equal Weightage throughout the life of the mine |
| I | **Miscellaneous & other mitigative measures.** | 2.02 | Equal Weightage throughout the life of the mine |
| J | **Manpower cost for Supervision** | 0.80 | To be included in final mine closure plan. |
| | **Total** | **100** | |

**NOTE:** (i) In case of mines having acid mine drainage, post closure acid mine drainage management cost shall also be included in the total closure cost.

(ii) Additional amount beyond the escrow account will be provided by the mine operator after estimating the final mine closure cost five years prior to mine closure (as per the mine closure guideline).

Environmental monitoring for three years after closure of mine will be carried out to evaluate the environmental quality of the area. If needed, proper mitigation measures will be taken up after evaluating the environmental quality. The funds for this have been provided in the cost estimate. Before closure of the mine, Area GM will make arrangement to prepare survey and disposal report and the same will be submitted to DGMS for acceptance.



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## 19.1 MANPOWER ASSESSMENT

The requirement of manpower at the rated capacity of 1.70 Mt of coal and 18.00 Mcum of OB removal per year has been estimated as 335 numbers. While estimating the total manpower an additional provision of 15.5% has been made for leave and sick. From 1st years onwards the mine will run on total outsourcing and manpower will be 335.

The existing manpower as on 01.04.2014 is 801. The RPR has been formulated by total outsourcing option and finally mine will be worked by total outsourcing. It is proposed in the RPR that requirement of manpower will be 335. Accordingly existing manpower will be phased down. It is suggested that remaining surplus manpower would be gainfully deployed in other mines of SECL.

## 19.2 Manpower phasing as per Project Implementation Schedule and building up of production capacity

| Year | Coal/OB | | Manpower(cumulative) | | | |
|---|---|---|---|---|---|---|
| | Coal | OB | Coal | OB | Common | Total |
| 1 | 1.50 | 15.00 | 125 | 44 | 166 | 335 |
| 2 | 1.70 | 18.00 | 125 | 44 | 166 | 335 |
| 3 | 1.70 | 18.00 | 125 | 44 | 166 | 335 |

## 20.1 PROJECT IMPLEMENTATION SCHEDULE

Rajnagar OC is an existing mine. It is well known fact that for timely implementation of this revised project, it is essential that all the activities related with project construction are properly planned, closely monitored and effectively supervised.

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All implementing departments have their own implementation manuals which are followed for monitoring and construction of the project, so that, man, materials and money are made available to the project in time as spelt in the project report, with a view to prevent cost and time over-run. Responsibility, power for each executive has also been included in the implementation manual to prevent overlapping of operational areas. Sufficient administrative and financial power has been defined for key executive to take timely and effective decisions for the implementation of the project.

Time estimates are broad and indicative only, necessary modifications to suit local site conditions are to be incorporated subsequently.

## 21.1 CAPITAL INVESTMENT

21.1.1 Existing capital and additional capital with phasing

| Existing Capital | Phasing of addl. capital (₹. In lakhs) | | | | | | Total addl. Capital | Total capital |
|---|---|---|---|---|---|---|---|---|
| | 1st | 2nd | 3rd | 4th | 5th | 6th | | |
| 10545.42 | 5806.30 | 6860.07 | 6968.64 | 5097.42 | 327.33 | 174.49 | 25234.25 | 35779.67 |

## 21.2 METHOD OF ESTIMATION OF CAPITAL COST:

**a) Land**

Rate of revenue, forest and tenancy land are provided by SECL.

**b) Civil Construction (alongwith Cost Index)**

The preparation of cost estimates for civil infrastructure is based on prevailing cost index of the area in August 2014. The cost index value has been calculated from the market rate of the area. Considering the prevailing rates of materials and labour in Hasdeo Area, the cost index works out to 2591 w.r.t. 100 base in Delhi as on 1.10.1976.

**c) P&M**

Price of P&M has been taken from the standard price list published by CMPDI, HQ on May 2013. Prices have been updated upto August 2014 as per escalation rate given in the price list.



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## 21.3 COST OF PRODUCTION AT DIFFERENT LEVEL OF PRODUCTION

### a) Salaries & Wages Cost

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

Estimated salaries & wages cost is worked out as ₹.188.89/Te.

### b) Stores Cost

Stores Cost has been estimated taking into account provision for Repair & Maintenance, POL, Explosive and miscellaneous stores cost. The estimated Stores Cost has been worked out to ₹.111.94/Te.

### c) Power Cost

Estimated Energy Consumption is given in the relevant chapter for Power Supply. The power cost has been taken as ₹.6.0/unit. The average power cost per tonne of coal production works out to ₹.43.52 at 100% level of operation.

### d) Misc. Expenditure & Community Development

This cost has been estimated to cover expenditure on Printing & Stationary, Postage, Telephone, Repair & Maintenance of assets other than P&M, Workshop Workshop Debit, and Insurance & Taxes for vehicles and other repairs and a further provision has been made for deterioration of coal stock. Miscellaneous expenditure per tonne works out to ₹.52.79. The 1.5 % of sale value of coal which was previously considered in the cost of production towards loss of coal in stock due to fire, grade deterioration etc has been deleted as decided in TSC meeting.

Provision has been kept for community development at the rate of Re.2/tonne and it is also included in the miscellaneous head.

### e) Administrative Charges

A provision has been made in total revenue cost estimate for Administrative charges based on the Admn. Cost per tonne of coal production as was appearing in the last Annual Report of Coal India Ltd. Total Admn. Cost has been calculated at 100% level and treated as fixed



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cost. As such for all other estimated level of operation the absolute Admn. Cost has been taken as it worked out for 100% level of operation. The Admn. Cost comes to ₹.64.00 /Te.

**f) Interest on Working Capital**

Interest on Working Capital has been calculated on the basis of 4 months operating expenditure. Rate of interest is taken as 14.50%. The working capital comes to ₹. 26.00 /Te.

**g) Depreciation**

Straight line method of depreciation has been provided to arrive at Depreciation cost per tonne of coal production. The depreciation Cost comes to ₹.167.46 /Te.

**h) Interest on Loan Capital**

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

**i) Environment related Cost**

₹.184.32/Te of coal has been provided to absorb Environmental related Cost in the project.

**j) Mine Closure Cost**

The average mine closure cost per tonne of coal production works out to ₹.74.84 at 100% level of operation.

k) Cost of production per tonne at 100%, 85% and 80% level of production works out to ₹.1245.97, ₹. 1352.35 & ₹. 1396.68.

**l) CSR cost** as per latest CIL's CSR Policy communicated vide CGM (Welfare), CIL, letter No.CIL/C-5C/231(CSR)/269 dated 3.12.2009, source of fund under this head will be 5% of the retained earning of the previous year subject to minimum Rs.5/- per tonne of coal production of previous year. However, this fund is not a part of project costing and the same will be spent by company as per CSR activities.



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## 21.4 SELLING PRICE

The weighted average grade of coal is ' G-7' grade with GCV 5212 Kcal/Kg.

Project Costing with selling price of coal with(1) non power sector price (2) power sector price has been assessed.

CALCULATION OF SELLING PRICE

| Particulars | Power Sector | Non Power Sector |
|---|---|---|
| Base price* | 1400.00 | 1890.00 |
| 5 % grade slippage | 1330.00 | 1795.50 |
| Crushing Charges for -100 mm | 79.00 | 79.00 |
| TPT REIM (3 to 4 km) | 57.00 | 57.00 |
| **Total** | **1466.00** | **1931.50** |

*As per price notification No. CIL:S&M:GM(F):Pricing:235 dated 27.05.2013.
**95% of the grade based on borehole data as per norms.

The weighted average GCV of coal is 5212 KCal/Kg. However, the weighted average selling price of coal for economic evaluation of this project has been taken as Rs.1466.00 /t for Power sector price, Rs.1931.50 /t for Non Power sector price. The selling price of coal for economic evaluation has been done considering price of coal based on GCV norms mentioned in CIL website.

Project Costing with selling price of coal with power sector price has been given in appendices. Project Costing with selling price of coal with Non power sector price has been given in the annexures.

## 21.5 OUTSOURCING RATES

Coal extraction and OB removal is proposed to be done by outsourcing. The rates have been considered based on the escalated rates table received from SECL.

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For OB removal yearwise lead has been estimated and based on that average lead for OB removal is estimated to 2.0 Km.The outsourcing rate of OB for average lead of 2.0Km based on the escalated rates table received from SECL is comes to Rs.47.36 per cum. The outsourcing cost of Coal loading and transport from face to pit top and pit top to siding are as follows:-

| **Coal** | Rs / Te |
|---|---|
| Transportation from Face to Pit top (2 to 3 Km) & from Pit top to siding (about 4Km) (Rs./t) | 67.19 |
| Drilling & Dozing rate | 10.00 |
| Loading Rate | 14.35 |
| | |
| **Total (Rs./t)** | **91.54** |

Service Tax has not been considered in costing of the project as CENVAT credit is available to the extent of Service Tax rate.

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

**21.6** Profitability (Profit/Loss) ₹./t at 100% = 220.03
85% = 113.65
80% = 69.32

**21.7** Manpower - 335

**21.8** OMS - 15.72

**21.9** EMS - 2968.69

**21.10** Financial IRR - at 100% level of production = 46.33%
at 85% level of production = 18.29%

**21.11 BREAK-EVEN PRODUCTION**

It is estimated that the project will achieve Break-even point at 1.25 te of production which is 73.26% of rated capacity.

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



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**21.13 Sensitivity Analysis** - given in the Appendix-C.4.

**21.14 CONCLUSION**

RPR for Rajnagar OC Expn. is yielding IRR of 18.29% at 85% level of production in outsourcing option for power sector consumer. The overall grade of coal is "G-7" with GCV 5212 Kcal/Kg, which is easily marketable. As per the guidelines, Project is economically viable when it achieves more than 12% IRR at 85% level of Production. Since, this Project is having Internal Rate of Return more than 12% at 85% level of target production i.e. 18.29% and hence outsourcing option of this Project is economically viable for power sector consumer.

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