
Chapter-11

SUMMARY AND CONCLUSION

11.1 PROJECT DESCRIPTION

11.1.1 PURPOSE OF THE REPORT

Makum and Dilli-Jeypore are the two major coalfields in Assam. The coal deposits occur in difficult terrain generally forest clad and in high rainfall areas. The quantity of reserve in Makum coalfield is 260.69 million tonnes (as on 1.1.2000, as per G.S.I). Though the reserves of Makum coalfield are small, yet the coal deposits are important by virtue of their location away from major coal deposits and quality. The coal is characterised by low ash percentage, high contents of volatile matter, sulphur, maceral, and show caking propensity. The coal can be blended to manufacture metallurgical coke.

Earlier, in 1986, CMPDI prepared a Feasibility Report for Lekhapani OCP to extract coal in the Tipong west underground block over developed workings. Mineable reserves of 2.67 Mt. had been identified at an average stripping ratio of 5.33 cum/t. This FR was based on a geological appraisal of quarriable potentiality of 60' seam in Lekhapani (Tipong west) area in Makum Coalfield, Assam, of March' 1984. The GR was based on data from only one borehole and other information was also very scanty. The mining never started in this block.

Later, CMPDI prepared a Geological Report on Lekhapani block, a new block in a virgin area west of Tipong west, in November 2000. The opencast mining is being proposed in the new block and the Feasibility Report for Lekhapani OCP is based on this new geological report (June 2007).

Lekhapani OC mine would be producing coal at the rate of 0.25 Mt per annum for another 26 years. The Lekhapani block (covering an area of 1.00 km²) is in the south central part of Makum coalfield (210 km²).

11.1.2 IDENTIFICATION OF PROJECT & PROJECT PROPONENT

Coal mining activities of North Eastern Coalfields, Coal India Limited are at present confined to Makum coalfields in Tinsukia District of Assam. Mining of Coal in the Makum Coal fields was started by the Assam Railways & Trading Company. The A.R & T. Co. was incorporated on 30/7/1881 and first colliery started was Ledo Colliery, in 1882. The Coal Mines were Nationalized w.e.f. 1/5/1973 under coal Mines(Nationalisation) Act.1973 and the coal Mines in Makum coalfields went under Coal Mines Authority Ltd. Coal India Ltd. was formed in November'1975 and since then the coal mines in the Makum coalfields are being managed by Coal India Ltd.

The Makum coalfield in the Tinsukia district of Assam state is the most important coalfield in the northeastern region of India. The coal deposits occur in difficult terrain generally forest clad and in high rainfall areas. The quantity of reserve in Makum coalfield is 304.87 million tonnes (as on 1.1.2006, as per G.S.I). Though the reserves of Makum coalfield are small, yet the coal deposits are important by virtue of their location away from major coal deposits and its quality. High vitrinite, low ash, strongly caking alongwith high volatile matter and high sulphur characterize the Makum coal. NEC operates 3 underground mines namely, Bargoloi, Tipong and Jeypore and 2 opencast projects namely, Tikak and Tirap.

NEC is administratively directly under Coal India Ltd. It is headed by Chief General Manager.

Mailing Address

Chief General Manager
North Eastern Eastern Coalfields Ltd.
PO-Margherita. Dist. Tinsukia.
Assam
PIN- 786181
Telephone- 03751-220329,220339

11.1.3 LOCATION, NATURE AND SIZE OF THE PROJECT

The proposed Lekhapani OCP is located in the south central part of Makum coalfield, Dist : Tinsukia, Assam and is under N.E.C., Coal India Ltd.

Geographical Location

- **Latitude** 27°16'4" to 27°17'6" N
- **Longitude** 95°48'11"to 95°49'32" E
- **Survey of India Topo sheet number** 83M/15
- **Elevation above Mean Sea Level** 280m -520 m
- **Total mining lease area (in ha.)** 235.00 ha

11.1.4 DESCRIPTION OF IMPORTANCE TO THE COUNTRY AND REGION

North Eastern Coalfields Limited is facing increasing demand of coal. The coals are relatively of better quality, being characterised by low ash (2.8-9.0%), high moisture (2.1–3.9%) and high sulphur content (1.5-3.5%). Overall grade of product Coal comes to 'A'. Caorific value (Kcal/kg)- >7000(approx.)

11.1.5 SCOPE OF THE STUDY

Details of regulatory scoping carried out and communicated vide letter no. J-11015/24/2008-IA.11(M) dated 25.08.08 by MoEF. (As per Terms of Reference discussed on 28th- 30th July 2008 at MoEF, New Delhi)

11.1.6 TECHNOLOGY AND PROCESS DESCRIPTION

The conventional shovel-dumper system of mining is proposed to be followed for O.B removal and coal extraction by drilling and blasting. Blasting will be restricted to hard OB benches only.

11.2 DESCRIPTION OF THE ENVIRONMENT

The terrain is gently undulating topography with a few remnants of old terraces and elevation ranging between 280-520 m above mean sea level. The Lekhapani river in the north and the Tipong river in south control the drainage of the block. The water flowing from northerly slopes feeds the Lekhapani river. The Lekhapani river flows from SW to NE and joins the Tirap river, which flows from east to west. The water flowing from southerly slopes feed the Tipong river flowing from south to north.

11.2.1 AMBIENT AIR QUALITY STUDY

The Ambient Air Quality and noise level study was carried out during January to March 2009

LOCATION OF AIR SAMPLING STATIONS

To assess the ambient air quality, sampling stations were fixed on the basis of meteorological parameters like predominant wind direction and wind speeds besides physiography of the area. The locations of air sampling stations and details are given below

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Description of the air sampling stations-

Sl. No.	Location Code	Location Type	Direction w.r.t. centre of core zone	Aerial Distance from Project boundary	Location Highlight
01	A ₁	Core Zone	---	---	Proposed mine area
02	A ₂	Core Zone	---	---	Proposed mine area, near Bhangapool
03	A ₃	Buffer Zone	SW	1.8 km	Dense Forest
04	A ₄	Buffer Zone	NW	0.75 km	Adjacent to Lama Basti, near Burma Camp
05	A ₅	Buffer Zone	SW	0.70 km	Village Lalpahar, near Tipong Colliery
06	A ₆	Buffer Zone	NW	1.5 km	Residential area at Sindhi Gaon

Summary of Ambient Air Quality Data for One Season

(January '2009 to March '2009)

AAQ Station	Concentration ($\mu\text{g}/\text{m}^3$)			
	SPM	RPM	SO ₂	NO _x
A₁ Core Zone				
Maximum	55	28	BDL	07
Minimum	37	12	BDL	04
95 Percentile	55	25	---	---
Mean	45	19	---	---
Permissible Limit (NAAQS)	500	200	120	120
A₂ Core Zone				
Maximum	58	29	BDL	08
Minimum	34	12	BDL	06
95 Percentile	55	27	---	---
Mean	45	20	---	---
Permissible Limit (NAAQS)	500	200	120	120

A₃ Buffer Zone				
Maximum	89	39	11	18
Minimum	40	17	09	12
95 Percentile	81	37	---	---
Mean	57	25	---	---
Permissible Limit (NAAQS)	200	100	80	80
A₄ Buffer Zone				
Maximum	77	41	09	20
Minimum	36	10	06	14
95 Percentile	68	32	---	---
Mean	51	20	---	---
Permissible Limit (NAAQS)	200	100	80	80
A₅ Buffer Zone				
Maximum	81	39	13	25
Minimum	33	24	09	18
95 Percentile	68	40	---	24
Mean	53	27	---	20
Permissible Limit (NAAQS)	200	100	80	80
A₆ Buffer Zone				
Maximum	89	44	10	21
Minimum	42	19	09	06
95 Percentile	89	44	---	21
Mean	59	25	---	17
Permissible Limit (NAAQS)	200	100	80	80

CONCLUSIONS

The following conclusions can be drawn from the study of results of ambient air quality monitoring:

The concentration level for SPM, RPM, SO₂ and NO_x recorded at stations representing industrial and residential areas are within the prescribed limits as per GSR 742 (E) Dated 25.09.2000 of MOEF and NAAQS respectively.

11.2.2 NOISE LEVEL STUDY

LOCATION OF NOISE LEVEL MEASUREMENT STATIONS

Six stations were selected for measuring the noise levels. The locations of noise level measurement stations and details are given below.

Details of the noise level measurement stations

Sl.No.	Station Code	Location Type	Details of Location
1	NC ₁	Core Zone	Proposed Mine site
2	NC ₂	Core Zone	Proposed Mine site, near Bhangapool
3	NB ₁	Buffer Zone	Dense Forest
4	NB ₂	Buffer Zone	Lamabasti

5	NB ₃	Buffer Zone	Lalpahargaon
6	NB ₄	Buffer Zone	Sindhi Gaon

Results

The noise level measurements from above stations are given below :

Ambient Noise Monitoring Results (Core Zone)

Sl. No.	Date	Location	dB (A), Leq		Permissible Limits	
			Daytime	Night time	Daytime	Night time
01	02.02.2009	NC ₁	46	43	75	70
02	03.02.2009	NC ₂	44	41	75	70

Ambient Noise Monitoring Results (Buffer Zone)

Sl. No.	Date	Location	dB (A), Leq		Permissible Limits	
			Daytime	Night time	Daytime	Night time
01	04.02.2009	NB ₁	42	40	55	45
02	06.02.2009	NB ₂	51	41	55	45
03	07.02.2009	NB ₃	49	39	55	45
04	09.02.2009	NB ₄	53	38	55	45

Conclusion

From the Noise Monitoring result it can be seen that the Ambient Noise Levels at all the Core Zone & Buffer Zone monitoring locations are well within the permissible limits.

11.2.3 WATER QUALITY STUDY LOCATION OF SAMPLING STATIONS

Five sampling stations, one for industrial water, three for surface waters and one for drinking water were selected in the core and buffer zone of the project.

The locations of water sampling stations and details are given below.

Description of the water sampling stations

Sl. No.	Location Code	Location Type	Water Type	Details of Location
01	WE ₁	Buffer Zone	Mine Water	Existing Tirap OCP
02	WE ₂	Buffer Zone	Mine Water	Existing Tipong Underground Mine
02	WD ₁	Buffer Zone	Drinking Water	Dugwell water from Sindhi gaon
03	WS ₁	Buffer Zone	Surface Water	Stream water near Bhangapool
05	WS ₂	Buffer Zone	Surface Water	Downstream Lekhapani Nala
06	WS ₃	Buffer Zone	Surface Water	Upstream Lekhapani Nala

OBSERVATIONS

- **Drinking water**

Sample WD₁ was from ground water source (Dugwell). The analysis shows that various physical and chemical parameters are within the limits of Indian Drinking Standards (IS: 10500 – 1991).

- **Surface Water**

Samples WS₁, WS₂ & WS₃ were collected from natural streams. The analysis show that various parameters are within the limits as per IS:2296 – 1982 (Surface water, Class “C” : Tolerance limits for surface waters used as drinking water sources with conventional treatment followed by disinfection).

- **Effluents**

Samples WE₁ and WE₂ were collected from the mine discharge water of existing Tirap Opencast and Existing Tipong Underground Mine. The analysis result of WE₁ and WE₂ indicates that various parameters are within the limits of MoEF’s General Standards (Schedule-VI), Part-A: Effluent.

HYDROGEOLOGICAL STUDY

WATER LEVEL

Dug-well inventory and water level monitoring were carried out in 21 villages around the project during April, 2008. The water level ranges between 0.60 to 6.60 m below ground level. The groundwater level trend study did not indicate alarming negative trend. On the whole the water level in the area is shallow and recouped by copious rainfall. Long term trend analysis of Lekhapani Observation Well of CGWB indicates an annual rising trend of 0.026 m.

GROUNDWATER POTENTIAL

As per CGWB the ground water annual recharge for Tinsukia district where the project is located is 1107.3 M.cum and the annual groundwater draft is 149.8 M.cum and the resource availability is 940.7 M.cum. This region has a groundwater utilization of 14% and falls in category “SAFE”.

11.2.4 SOIL QUALITY STUDY

SOIL QUALITY ANALYSIS

In order to assess the quality of soil of the Lekhapani OCP area, three sites were selected which would be representative of the entire area. The sites were named as S₁, S₂ and S₃.

A brief description of the sites are as follows

1. S₁ (Near Bhangapool)
2. S₂ (Near Sindhigoan)
3. S₃ (Near Lalpahargaon)

OBSERVATIONS

From the soil analysis results it can be seen that the soil quality of the study area is normal and satisfactory.

11.2.5 FLORA AND FAUNA STUDY

The flora and fauna of the Core and the Buffer Zone was surveyed by ENVIROCON, Digboi, Assam. The Survey Report shows that there are no rare and endangered flora and fauna species in the Core Zone.

11.2.6 SOCIO-ECONOMIC STUDY

Socio-economic study of the Core and the Buffer Zone was done by ENVIROCON, Digboi, Assam,

DEMOGRAPHIC AND SOCIO-ECONOMIC SCENARIO

CORE ZONE

The Core Zone of Lekhapani OCP does not have any human habitation. Hence Socio-economic survey of Lekhapani OCP Core Zone is not applicable.

BUFFER ZONE

Socio-economic survey of the study area was carried out in the Buffer Zone only. The villages covered in the study are as follows-

Sl. No.	Location Name	Approximate distance from project boundary	Households Sampled
01	Ledogaon	6 km	35
02	Lalpahargaon	2.5 km	80
03	Lekhapani Nepaligaon	3 km	65
04	Kambagaon	4.5 km	30
05	Udoypur	5.5 km	40

DEMOGRAPHIC PROFILE OF THE SAMPLED HOUSEHOLDS

The study area is covered under two gaon panchayats, namely Lekhapani Gaon Panchayat & Ledo Gaon Panchayat. The two gaonpanchayats have 10 wards each under their jurisdiction. Total no. of households under the Lekhapani gaonpanchayat are 3661 and that under Ledo gaonpanchayat are 2144. total population in this region was around 31,000 in the year 2001.

11.2.7 LAND USE STUDY:

Classification of land

The mining and dumping strategies have been formulated to keep the land requirement to the minimum to control land degradation in environmentally sensitive region. Head-wise requirement of land for Lekhapani OCP is presented in Table below. Total land falls in the reserved forest land category. The mining area including the area required for mine infrastructures are under the existing leasehold of NEC (Lekhapani-Tipongpani leasehold). NEC will be required to acquire the fresh leasehold for the area of external dump, approach road & mine infrastructure etc.

11.3 DETAIL OF ANTICIPATED ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

11.3.1 SOURCES OF AIR POLLUTION

The main sources of air pollution are identified as-

- 1) Mining activities inside the OCP viz. Drilling, Blasting, OB removal, transport and dumping, both externally and internally and finally extraction and loading of coal.
- 2) Transport of coal from mine to coal stock yard.
- 3) Coal handling activities at coal stock yard.
- 4) Coal transportation from coal stock yard to Railway Siding.
- 5) Storage and Wagon loading of coal at the Railway Siding.

AIR QUALITY MANAGEMENT

The drilling equipment will be equipped with dust arresting devices so that fugitive dust generation is minimal. Blasting will be done in controlled way to minimize the generation of fugitive dust. The blasting will be done once in a day to give sufficient time for settling of dust and for settling of the coarser particles. The haul road will be regularly sprayed with water sprinkler to prevent dust from getting air borne. The coal transportation to siding will be done through covered tipping trucks. All dust generating points will be equipped with nozzle sprinkler to minimise the fugitive dust emission. Green belt will be developed around mine infrastructure.

OBSERVATIONS

As per Air Quality prediction done by using ISCST3 model, the future values of SPM is likely to remain within the limits prescribed by MOEF. There is also increase in the levels of the SPM in the core & buffer zone (one location – down wind direction). The proposed mining activity is not likely to have any adverse effect on the existing environment in Core and Buffer Zone. Still all control measures suggested in this report will be strictly adhered to.

11.3.2 WATER QUALITY MANAGEMENT:

Water quality may be affected due to the following activities:

- * Mine water discharge into surface water source.
- * Workshop effluent discharge due to washing of dumper, dozer, grader and floor washing.

The mine water quality varies seasonally due to contamination during seepage in mine floor resulting in a higher value of total suspended solids (TSS) and acidic. The effluent from the mine may contain high TSS concentration and acidity. Similarly, the workshop effluent may contain high TSS and oil & grease due to washing of HEMMs and floor. The effluent from the mine and workshop will be treated in treatment plant consisting of oil & grease trap and acid neutralization with settling tank before being discharged into river.

IMPACT ON GROUNDWATER DUE TO MINING AND REMEDIAL MEASURE

Due to mine pumping the water levels upto a distance of 300 m from mine edge is likely to be affected. This impact is likely to be reduced by recharge from Lekhapani river running close to the project.

The coal has high percentage of sulphur, which may form acid mine drainage during/after mining due to oxidation. The mine water will be treated by lime enhancing the pH of the water to >6.0 before pumped into the nala. At the time of closure of the mine, it will be flooded with water to prevent further oxidation giving rise to acid mine drainage.

11.3.3 NOISE LEVEL MANAGEMENT:

Noise is considered as an occupational hazard. Blasting is an occasional and impulsive event, which needs to be carried out in an isolated manner. No workforce shall be allowed during blasting time so that the workers are not exposed to impulsive noise level. The noise generating points will be enclosed to minimize the propagation of high noise intensity. The workforce working at the coalface, where high noise level is expected, will be provided with protective device for occupational safety. Apart from above, the formation of internal spoil dump and green belt development will also muffle the noise to a great extent.

11.3.4 FLORA &-FAUNA CONSERVATION :

Plantation will be done as per the norms and guidelines of forest department. This will help in restoring the flora and fauna of project area.

11.3.5 SOCIO-ECONOMIC CONDITION:

The project is likely to give a boost to the economy of the area and providing secondary and tertiary employment to local people. The infra-structural facilities provided by the project will benefit local villagers also.

11.3.6 Land Resource Management

Pre-mining vs post-mining land use

Land Use During Mining		Post –mining Land Use (Conceptual)	
Particulars	Area (ha)	Particulars	Area (ha)
1. Area to be excavated	80.0	Reclaimed (Internal dump) and afforested area	34.0
		Water Body Void	8.0 38.0
2. Mine Pheriphery & safety zone	15.0	Green belt (already exists)	15.0
3. Approach road	10.0	Community use	10.0

4. Coal storage & handling/office/Workshop/Store /power supply arrangements/ETP (including haul/service roads)	10.0	Decommissioning and Afforestation	6.0
		Existing plantation	4.0
5.External dumps	120.0	Reclaimed and afforested area	120.0
TOTAL	235.0	TOTAL	235.0

The progressive mine closure activity is likely to significantly reduce the impact of mining activity on the land apart from increasing the green cover and surface water availability.

11.4 ENVIRONMENTAL MONITORING PROGRAM

For effective implementation, a time bound action plan for environmental management including all aspects shall be followed by the project.

Samples for study of air quality, water quality and noise level shall be collected and tested quarterly at strategic places representing all the categories of location. The Implementing Authority will be guided and advised by feed back data obtained from these tests.

PARAMETERS TO BE MONITORED :

AMBIENT AIR QUALITY, WATER QUALITY , GROUND WATER LEVEL & NOISE LEVEL

Ambient air quality, water quality (mine discharge and drinking water samples), ground water level and noise level will be monitored for standard parameters.

Plantation

Plant growth, its maintenance and survival rate will be monitored.

Land Reclamation and Plantation

Overburden to be excavated, backfilled and the plantation schedules etc. will be monitored in the light of EMP.

Health

Health of the employees will be examined for identifying occupational diseases etc. to initiate remedial measures in time. This is already being implemented by NEC in other running projects by way of Periodic Medical Examination as per DGMS guidelines.

11.5 ADDITIONAL STUDIES

11.5.1 PUBLIC CONSULTATION & PUBLIC HEARING

The following detail will be incorporated after public hearing:-

Date of Advertisement- -----

Newspapers in which the advertisement appeared - -----

Date of public hearing - -----

Public Hearing Panel chaired by & members present- -----

Nos. of people attended the public hearing meeting and number of people from the lease area- -----

SUMMARY/ DETAILS OF PUBLIC HEARING

11.5.2 RISK ASSESSMENT

A comprehensive blue print for risk assessment and management has been drawn for the project incorporating the following:

- Identification and assessment of risks.
- Recommendation of measures to prevent damage to life and property against such risks.

Special care will be taken for following aspects related to safe mining practices as stipulated by DGMS:-

Slope Failure in Mine Pit
Barbed Wire Fencing
Blasting
Explosive Handling
Safety Rules
Mine Inundation
Fire
Road Accidents
Illumination and Communication
Training
Medical Aid

11.5.3 CLOSURE ACTION PLAN

In case of Lekhapani OC, the mine is being planned up-to a certain depth for a specified life of the mine. If the decision for further extension of the mine is taken before closure of the proposed quarry, mine closure will be deferred as mining activities shall continue beyond present eastern limits.

In the event of no further extension beyond the proposed mine limits, mine closure plan becomes necessary and MOEF also desires the submission of such plan five years in advance of closure.

Closure planning is a life-of-mine exercise that begins with the commencement of mining operations and continues till post closure. The dynamic nature of closure planning requires regular and critical review to reflect changing circumstances as a result of any operational change, new regulation, new technology and remain flexible enough to cope with unexpected events.

Following steps have to be undertaken in relation to Mine Closure Planning:

- (a) Dense forest consists the leasehold area of the project, so the ecological aspects of mine closure should be duly taken care of. Study with regards to impact on Flora & Fauna due to mining activity shall be taken up.
- (b) In order to identify potential impact necessary hydrogeological studies into post-mining groundwater recharge has to be done. The void of the mine can be proposed as a water resource to be utilized for aquaculture.
- (c) As a detailed component of the Closure Plan, a Decommissioning Plan is to be developed towards the final stages preferably 5 years prior to tentative closure of mine. Once established, it may be updated annually.

11.6 PROJECT BENEFITS

The opening of the Lekhapani OCP will enhance the socio-economic activities in the adjoining areas. This will result in following benefits

- Improvements in Physical Infrastructure
- Improvements in Social Infrastructure
- Increase in Employment Potential
- Contribution to the Exchequer
- Prevention of Illegal Mining
- Post-mining Enhancement of Green Cover

11.7 ENVIRONMENTAL MANAGEMENT PLAN

The scope of environmental management includes plantation, surface drainage, industrial waste water treatment plant, air, water and noise pollution check etc. For the purpose of land reclamation and afforestation, the Project shall interact with different Government departments like SPCB, Forest Department etc. Guidelines and advice from Ministry of Environment and Forest will also result in systematic approach towards environmental management and control. The administrative setup for implementation of environmental control measures is given below:-

- Chief General Manager, NEC, Margarita
- Project Officer/Environmental Cell, Lekhapani OCP
- Environmental Cell, NEC

11.8 FUND PROVISION

The following budgetary provision has been made for environmental control measures.

• Capital	
• ETP	Rs. 20.00 Lakh
• Biological Reclamation	Rs. 50.00 Lakh
• Pollution Control Measures	<u>Rs 25.00 Lakh</u>
Sub-total	Rs. 95.00 Lakh
• Green Belt Development	Rs. 20.00 Lakh
• EMP preparation	Rs. 20.00 Lakh
• Revenue cost/year	Rs. 50.00 Lakh
• Mine closure Fund (proposed)	Rs. 2.50/tonne
• R & R	Rs. Nil
• Forest land Compensation	
• NPV of forest land	Rs 2350.00 Lakh
• Compensatory Affores.	Rs. 125.00 Lakh
• Enrichment of Safety zone	<u>Rs 62.50 Lakh</u>
Grand Total	Rs. 2697.50 Lakh