BHARAT COKING COAL LIMITED
(A SUBSIDIARY OF COAL INDIA LIMITED)
OFFICE OF THE GENERAL MANAGER
LODNA AREA

Ref. No: - BCCL/LA/GM/19/1280

Dated:- 30/11/19

To,
The Director,
Ministry of Environment, Forest & Climate Change, Govt. Of India.
Regional Office (ECZ), Bunglow No. A-2,
Shyamli Colony,
Ranchi-834002

Sub:- Six monthly compliance report on implementation of Environmental Measures for the period from 1st April 2019 to 30th Sept. 2019 in respect of Cluster – IX Group of Mines, Lodna Area of BCCL.

Ref. No. 1: EC Order No.-J-11015/307/2010-IA.II (M), dated – 21st May, 2013.
Ref. No. 2: EC Order No. - J-11015/307/2010-IA.II (M), dated – 1st March, 2018.

Dear Sir,

Please find enclosed herewith the Six Monthly Compliance report on implementation of Environmental Measures for the period from 1st April 2019 to 30th Sept. 2019 in respect of Cluster – IX Group of Mines, Lodna Area of BCCL.

Hope you will find the same in order.

Enclosure: as above.

Yours faithfully,

30/11/19

General Manager
Lodna Area

Cc to (Through Email):-

1. Director 1A monitoring cell, Paryavaran Bhawan CGO Complex, New Delhi-110003.
2. General Manager (Env.) BCCL, Koyla Bhawan, Dhanbad.
3. File

(1/17)

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LODNA AREA

Ref. No: - BCCL/LA/GM/19/ 1280 Dated:- 30/11/19

ENVIRONMENTAL CLEARANCE COMPLIANCE OF CLUSTER – IX.
(GRANTED VIDE – J-11015/307/2010-IA.II (M), dated – 21st May, 2013 and amendment on dated- 1st March 2018)

Sl. No.	A.) Specific conditions by MOEF	Compliance
i	The Maximum production shall not exceed beyond that for which environmental clearance has been granted.	The production from the cluster is within the limit for which environment clearance has been granted. Details are attached as Annexure I
ii	Action should be taken to segregate and isolate the fire areas eg. Trench cutting for isolation of fire. Area-wise Action Taken report for extinguishing the fire should be provided.	It is being complied. Thereafter the coal is excavated and fire is doused by water. The doused coal is then loaded into trucks for transportation.
iii	"Mission Mode Programme' for extinguishing fire is required wherein scientists and other experts be involved. Any international agency may also be contacted for their expertise in extinguishing the fire in such big area.	Global Expression of Interest had been opened for the international experts/firms/consultants/agencies to deal with coal mine fire in Jharia Coalfield with vision of reclamation, further minimization of spread of fire & subsidence control for which no bidder has qualified to take up the work. Enclosed as Annexure II.
iv	The recommendations of Indira Gandhi Centre of Atomic Research, Kalpakam should followed dealing with fire in coal mine in Jharia coalfield.	A mail has been sent and requested for providing recommendation in this regard. Copy is attached as Annexure III.
v	Transportation Plan should be submitted to the MOEF.	Submitted with six monthly compliance report. At present, Phase -1 is under implementation and after completion of Pre-implementation (1st & 2nd Yr.) and Phase 1 (3rd to 7th year) and Phase 2 (8th to 12th year). The plan shall be prepared after the completion of the above said phases to have conveyor-cum-rail transportation as informed by CMPDIL to whom the said work of preparation of Rail-cum-conveyor plan has been awarded. During Phase- 1 & 2, covering of trucks by tarpaulin covers is being ensured. Transportation plan is enclosed as **annexure-IV.**

vi	The finalized Mine Closure Plan of Cluster – IX should be submitted to MOEF. The void should be in 30 ha. Area with 30 mt. depth.	Mine closure plan as per the guideline of Ministry of coal and on the basis of cluster concept has been prepared and submitted by CMPDIL and progressive mine closure plan is being followed. Progressive Mine Closure plan has been attached as Annexure V. As on date no such voids are available.
vii	The road transportation of coal during phase – I should be by mechanically covered trucks. The road used for coal transportation should be developed with avenue plantation on both sides.	Transportation of coal is being done by tarpaulin covered trucks at present as mechanically covered truck OEM not available in market. Avenue plantation is being done along the transportation route. 300 nos. of plants have been planted from South Tisra W/S to Thakur More (Jharia –Baliapur road), 400 nos. of plants from Indira Chowk to Patherdih, 25 nos. of plants in bararee More, 25 nos. of plants in chatkari jore, 25 nos. of plants in Magazine etc. Photographs are attached.
viii	The company must give priority to capacity building both within the company and to the local youth, who are motivated to carry out the work in future.	It is being done. Training and skill development programs are being conducted by VTCs and HRD of BCCL on regular basis. There are 02 Handloom Training Centres in Lodna area at Alakdiha and Mukunda, Dhanbad. Presently, 40 numbers of women are engaged with these training centres belonging to nearby villages like Alakdiha, Mukunda, Surunga and Rakshakali Dham, belonging to underprivileged class of the society. Another scheme known as BCCL ke Lal-Ladli has been launched. A centre at New MT Hostel, Denobili More, Jharia, Dhanbad in Lodna Area has been established under BCCL scheme for engineering aspirant under CSR initiative of BCCL. The target of this scheme is to provide free quality education support to meritorious students of PAPs (Project affected Persons) and students residing in the command area of BCCL.

		The centre of Lodna Area has started from 15th September, 2017 where presently 11 students (02 girls and 09 boys) are studying at the centre who have been selected through scrutiny test. The coaching classes is being provided by the faculties of Ranchi Centre (IIT'ans and NIT'ans) and class timings is from 4.00 PM to 7.30 PM from Monday to Friday. The doubt clearing classes/sessions is being conducted on every Saturday and Sunday from 3 PM onwards by Sri Manish Kumar Meena, Asst Manager (Excv), B Tech from IIT(ISM), Dhanbad at the centre. The coaching centre is fully air conditioned and enabled with digital equipments. Facilities like snacks, tea and drinking water to students and faculty is being provided by the Lodna Area Management. A separate toilet facility for boys and girls is available at the Centre.
ix	Details of transportation, CSR, R&R and implementation of environmental action plan for each of the 17 clusters should be brought out in a booklet form.	It is being complied. Details are attached as **Annexure VI.**
x	A study should be initiated to analyze extent of reduction in pollution load every year by reducing road transport.	It is being complied. More than 90% of coal is transported through railway which is environmentally better option than the road transportation. The study has been completed by the CMPDIL to analyse the extent of reduction in pollution load every year by reducing road transport. **Enclosed as Annexure VII.**
xi	The expertise available internationally should be utilized for control of fire in Jharia coalfields and for their reclamation and to further minimize time for fire and subsidence control.	**It is under process.** Global Expression of Interest had been opened for the international experts/firms/consultants/agencies to deal with coal Mine fire in Jharia Coalfield with vision of reclamation, further minimization of spread of fire & subsidence control for which no bidder has qualified to take up the work. The proven technology of Fiery coal excavation is practiced for liquidation of fire. Presently Master Plan Approved by Govt. of India is under implementation for this purpose. Enclosed as **Annexure II.**
xii	The abandoned pits and voids should be backfilled with OB and reclaimed with plantation and or may be used for pisciculture.	At present no abandoned pit is present. Reclamation of old dump has been taken up. About 33,600 Nos. of plants have been planted at Gokul Park in NT-ST till Sept, 2019. Details are attached as Annexure I.

xiii	BCCL may consider setting up a separate management structure for implementing environment policy and socio-economic issues and the capacity building required in this regard.	Environmental Engineer provided at mine and Area level. A full-fledged Environment Department, headed by a HOD (Environment) along with a suitable, qualified multidisciplinary team of executives has been established. The activities are monitored on regular basis at Area and at Headquarters levels. GM (Environment) at Head quarter level, Co-ordinates with all the Areas and reports to the Director (Technical) and in turn he reports to the CMD of the company. The team is multidisciplinary and very much motivated under the guidance of company's Director (Technical) and CMD. Further capacity building at both corporate and operating level is being done.
xiv	The locations of monitoring stations in the Jharia Coalfields should be finalized in consultation with the Jharkhand State Pollution Control Board.	Complied. The location of monitoring stations in Jharia Coal Field has been identified with the consultant advisory of CMPDIL and also finalized with the permission of Jharkhand State Pollution Control Board. The location of monitoring stations are: (i) Jeenagora (A13) (ii) Kusmatand Village (A12) (iii) Bhowrah North (A14) (iv) Hurriladih UGP (A28) **Enclosed as Annexure VIII.**
xv	The smoke / dust emission vary from source to source (fuel wood, coal, fly ash from TPPs, silica from natural dust, etc.) and a source Apportionment study should get carried out for the entire Jharia Coalfields.	Work order had already been issued to NEERI Nagpur on 12.05.2018 and Field data collection of first phase hes been done in summer of 2019, report will be submitted after winter data collection. Progressive report has been **enclosed as Annexure IX.**
xvi	Mineralogical composition study should be undertaken on the composition of the suspended particulate matter (PM10 and PM2.5) in Jharia Coalfields and also quantified. These studies would help ascertain source and extent of air pollution, based on which appropriate mitigative measures could be taken.	Work order had already been issued to NEERI Nagpur on 12.05.2018 and Field data collection of first phase hes been done in summer of 2019, report will be submitted after winter data collection. Progressive report has been **enclosed as Annexure IX.**
xvii	The proponent shall prepare time-series maps of the Jharia Coalfields through NRSA to monitor and prevent fire problems in the Jharia Coalfields by isothermal mapping / imaging and monitoring temperatures of the coal seams (whether they are close to spontaneous ignition temperatures) and based on which, areas with potential fire problems shall be identified.	NRSA is periodically conducting work of "Delineation of Surface Coal Fire and associated land Subsidence in Jharia Coal field, Jharkhand using satellite based remote –sensing techniques", latest report is received in 2018. As per report observed in 2017 the fire area in north tisra was 0.1802 Sq. km., in south tisra 0.1015 Sq. km. & in Jeenagora 0.0470 sq. km. **Enclosed as annexure-X.**

xviii	Measures to prevent ingress of air (Ventilation) in such areas, to prevent restart fresh / spread fires in other areas including in mines of cluster IX shall be undertaken.	Action is being taken as per Jharia Master Plan Approved by GOI and State Govt. of Jharkhand. Excavation/ Open Cast mining is being done in the Fire/subsidence affected mines to dig out combustible materials to save the coal from burning and to prevent further spread of the fire. Once the fiery coal is dugout/ excavated there will be no chance of further restarting/ spreading of fresh fire into other areas.
xix	Underground mining should be taken up after completion of reclamation of Opencast mine area after 15 Years.	**It shall be complied.** Underground Mining will be done after extraction of upper seams and beneath Backfilled and reclaimed area.
xx	No mining shall be undertaken where underground fires continue. Measure shall be taken to prevent / check such fire including in old OB dump areas where the fire could start due to presence of coal / shale with sufficient carbon content.	Action is being taken to control mine fires including old OB dump & areas as specified in Jharia Master Plan and the open cast mining is being done in fire affected areas.
xxi	The rejects of washeries in Cluster – IX should be sent to FBC based plant.	Coal washery does not exist in this cluster at present.
xxii	There shall be no external OB dumps. At the end of the mining there shall be no void and the entire mined out area shall be re-vegetated. Areas where opencast mining was carried out and completed shall be reclaimed immediately thereafter.	Action is being taken as specified in EMP. Backfilling of OB is going on with mining. Gokul park has been developed after backfilling of OB. At the end of Mining there shall be no void and area will be re-vegetated and reclaimed.
xxiii	A detailed calendar plan of production with plan for OB dumping and backfilling (for OC Mines) and reclamation and final mine closure plan for each mine of cluster – IX shall be drawn up and implemented.	Calendar Plan has been prepared. Details are attached as Annexure I. Mine closure plan as per the guidelines of Ministry of Coal has been prepared by Central Mine Planning and Design Institute (CMPDI). Progressive mine closure plan is being implemented. Activities under mine closure plan are: (i) Subsidence Management (ii) Reclamation of abandoned Quarry (iii) OB dump Reclamation (iv) Plantation (v) Entrepreneurship Development (vi) Miscellaneous activities
xxiv	The void shall be converted into a water reservoir of a maximum depth of 15-20 m and shall be gently sloped and the upper benches of the reservoir shall be stabilized with plantation and the periphery of the reservoir fenced. The abandoned pits and voids should be backfilled with OB and biologically reclaimed with plantation and or may be used for pisciculture.	It shall be complied. A part of the void will be converted into the water body as specified in EMP.

<table>
<tr><td>xxv</td><td>Mining shall be carried out as per statuette from the streams / Nalas flowing within the lease and maintaining a safe distance from the Nalas flowing along the lease boundary. A safety barrier of a minimum 60 m width shall be maintained along Nalas / water bodies. The small water bodies in OC shall be protected to the extent feasible and the embankment proposed along water body shall be strengthened with stone pitching.</td><td>Mining is being carried out as per Statute from the streams/Nalas flowing within the lease and maintaining a safe distance (>60 m) from the nalas flowing along the lease boundary.</td></tr>
<tr><td>xxvi</td><td>Active OB dumps near water bodies and rivers should be rehandled for backfilling abandoned mines voids. However, those which have been biologically reclaimed need not be disturbed.</td><td>No active dumps near water bodies exist. The OB dumps created earlier are stabilized and converted into Eco-restoration park.</td></tr>
<tr><td>xxvii</td><td>Thick green belt shall be developed along undisturbed areas, mine boundary and in mine reclamation. During post mining stage, a total of 937.84 ha. Area would be reclaimed. The total additional area under plantation would be 367.95 ha. (189.95) ha.abandoned quarry area, 178 ha. active quarry area, 104.34 OB dump outside quarry area, 36.49 ha.service building / Mine infrastructure area / coal dump etc., 165.88 ha. Green belt around OCP, 263.22 ha. barren area), by panting 2344700 plants at a total cost Rs. 10830.45 lakhs.</td><td>Year wise plantation is being done as per following details:
<table>
<tr><th>Year</th><th>Cluster/Mine/Area</th><th>Area of greenbelt (Ha.)</th></tr>
<tr><td>2014-15</td><td>Lodna</td><td>05</td></tr>
<tr><td>2015-16</td><td>Lodna</td><td>07</td></tr>
<tr><td>2016-17</td><td>Lodna</td><td>07</td></tr>
<tr><td>2017-18</td><td>Lodna</td><td>07</td></tr>
<tr><td>2018-19</td><td>Lodna</td><td>3.8</td></tr>
<tr><td>2019-20</td><td>Lodna</td><td>0.3</td></tr>
</table></td></tr>
<tr><td>xxviii</td><td>The road should be provided with avenue plantation on both side as trees act as sink of carbon and other pollutant.</td><td>Avenue plantation is being developed in phased manner.

300 nos. of plants have been planted from South Tisra W/S to Thakur More (Jharia –Baliapur road), 400 nos. of plants from Indira Chowk to Patherdih, 25 nos. of plants in bararee More, 25 nos. of plants in chatkari jore, 25 nos. of plants in Magazine etc. Photographs are attached.</td></tr>
<tr><td>xxix</td><td>Specific mitigative measures identified for the Jharia Coalfields in the Environmental Action plan prepared for Dhanbad as a critically polluted area and relevant for Cluster IX shall be implemented.</td><td>It shall be compiled. Dhanbad Action Plan is being implemented. The salient actions of this cluster.

1. Covered transportation of coal.
2. Water sprinkling: 1no. Of mobile tankers of capacity 28KL AND 6 nos. of mobile tankers of capacity 18KL. 4-5 trips/day covering 8-9 km of distance.
3. Plantation.</td></tr>
</table>

xxx	The locations of monitoring stations in the Jharia Coalfields should be finalized in consultation with the Jharkhand State Pollution Control Board. The committee stated that smoke / dust emission very from source to source (fuel wood, coal, fly ash from TPPs silica from natural dust, etc) and a source Apportionment Study should be got carried out the entire Jharia Coalfields. Mineralogical composition study should be undertaken on the composition for suspended particulate matter (PM 10 and PM 2.5) in Jharia coalfields and also qualified. These studies would help ascertain source and extent of the air pollution, based on which appropriate mitigative measures could be taken.	The locations of monitoring stations have been finalized with the Jharkhand State Pollution Control Board. The location of monitoring stations are: (i) Jeenagora (A13) (ii) Kusmatand Village (A12) (iii) Bhowrah North (A14) (iv) Hurriladih UGP (A28) Work order had already been issued to NEERI Nagpur on 12.05.2018 and Field data collection of first phase hes been done in summer of 2019, report will be submitted after winter data collection. Progressive report has been **enclosed as Annexure IX.** CMPDIL is now on work since 2015.
xxxi	No ground water shall be used for the mining activities. Additional water required, if any, shall be met from mine water or by recycling / reuse of the water from the existing activities and from rainwater harvesting measures.	No ground water is being used for mining activities. Mine water is being used for the industrial purpose. Pressure filters are installed for converting the mine water to portable water. Few lagoons are developed as ground water recharge structure. Further Mine Water is also utilized for the community and irrigation purpose. 1. Pressure filters have been installed at South Tisra workshop (10K gallon capacity), MOCP (10K gallon capacity) and Joyrampur colliery (15K gallon capacity) for utilization of Mine Water. 2. Rain water Harvesting.
xxxii	Regular monitoring of groundwater level and quality of the study area shall be carried out by establishing a network of existing wells and construction of new peizometers. The monitoring for quantity shall be done four times a year in pre-monsoon (May), monsoon (August), post-monsoon (November) and winter (January) seasons and for quality including Arsenic and Fluoride during the month of May. Data thus collected shall be submitted to the Ministry of Environment & Forest and to the Central Pollution Control Board / SPCB quarterly within one month of monitoring. Rainwater harvesting measures shall be undertaken in case monitoring of water table indicates a declining trend.	It is being complied. CMPDI RI-II is regularly Conducting study of groundwater level and quality of areas within Cluster IX. As per report ground water has not been declined. Groundwater monitoring data has been enclosed as **Annexure XI.** The drilling of Piezometric well tender is not successful thrice and being revised in association with CMPDI for retendering. Piezometric well: Tender Floating March 2020. Work execution June 2020.
xxxiii	Mine discharge water shall be treated to meet standards prescribed standards before discharge into natural water coursed / agriculture. The quality of the water discharged shall be monitored at the outlet points and proper records maintained thereof and uploaded regularly on the company website.	The report of mine water discharge is uploaded on BCCL official website which is also given in the six monthly EC compliance report. The monitoring of water quality parameters is being done through CMPDIL. Mine water quality data has been enclosed as **Annexure XII.**

xxxiv	ETP shall also be provided for workshop, and CHP, if any. Effluents shall be treated to confirm to prescribe standards in case discharge into the natural water course.	01 no of ETP/Oil grease Trap is in operation.
xxxv	Regular monitoring of subsidence movement on the surface over and around the working area and impact on natural drainage pattern, water bodies, vegetation, structure, roads, and surroundings shall be continued till movement ceases completely. In case of observation of any high rate of subsidence movement, appropriate effective corrective measures shall be taken to avoid loss of life and material. Cracks shall be effectively plugged with ballast and clayey soil / suitable material.	No UG working, only OC operation in the mine.
xxxvi	Sufficient coal pillars shall be left un-extracted around the air shaft (within the subsidence influence area) to protect from any damage from subsidence, if any.	No UG working, only OC operation in the mine.
xxxvii	High root density tree species shall be selected and planted over areas likely to be affected by subsidence.	No UG working, only OC operation in the mine. No such subsidence has been recorded in the area. However Planation is regularly done in Leasehold area of Cluster IX.
xxxviii	Depression due to subsidence resulting in water accumulating within the low lying areas shall be filled up or drained out by cutting drains.	It shall be complied. However No such subsidence has been recorded in the area.
xxxix	Solid barriers shall be left below the roads falling within the blocks to avoid any damage to the roads.	No UG working, only OC operation in the mine.
xL	No depillaring operation shall be carried out below the township / colony.	At present no depillaring operation is going on.
xLi	The transportation plan for conveyor-cum-rail for Cluster-IX should be dovetailed with Jharia Action plan. Road transportation of coal during Phase – I should be by mechanically covered trucks, which should be introduced at the earliest. The plan for conveyor-cum-rail for Cluster – IX should be dovetailed with Jharia Action Pan. The road transportation of coal during Phase – I should be done by mechanically covered trucks.	Action has been taken for formulating adequate transportation plan for conveyor-cum-rail system of dispatch. CMPDIL has been requested to prepare the plan. Till that time transportation is being done by covering vehicle with tarpaulin cover.

xLii	A study should be initiated to analyze extent of reduction in pollution load every year by reducing road transport.	It is being complied. More than 90% of coal is transported through railway which is environmentally better option than the road transportation. The study has been completed by the CMPDIL to analyse the extent of reduction in pollution load every year by reducing road transport. **Enclosed as Annexure VII.**
xLiii	R&R of 12246 Nos. of PAF's involved. They should be rehabilitated at cost of Rs. 126092.027 Lakhs as per the approved Jharia Action Plan.	Implementation is being done as per the Master Plan. As per the approved Master Plan prepared for dealing with fire subsidence and rehabilitation in the leasehold of BCCL for Jharia Coal Field, the master plan has identified 595 unstable sites in the entire Jharia Coal Field. Out of these, 98 sites covering an area of 224.56 Ha consisting of 12246 no. of houses/families fall in Cluster-IX mines. The cost for rehabilitation for the families is estimated to be Rs. 126092.03 lakhs. In the NT-ST-Jeenagora mining block, 1716 houses have to be rehabilitated. The cost for rehabilitation is estimated to be Rs. 6989.88 lakhs with an affected area of 22.74 ha. 771 Nos. of Quarters have been allotted for shifting of PAFs by JRDA at Belgaria Township, out of which 417 have shifted to this site. The shifted PAFs belongs to the fire affected areas of DB road and Bengal Jharia section of NT-ST OCP.

xLiv	A detailed CSR Action plan shall be prepared for Cluster IX group of mines. Specific activities shall be identified for CSR the budget of RS. 142.55 Lakhs per year @ Rs. 5/T of coal as recurring expenditure. The 391.28 ha. of area within Cluster IX Ml existing as waste land and not being acquired shall be put to productive use under CSR and developed with fruit bearing and other useful species for the local communities. In addition to afforesting 1942.12 ha. of area at the post-mining stage, the waste land / barren land within Cluster IX ML. shall be rehabilitated / reclaimed as forest / agricultural land under CSR Plan in consultation with local communities. Third party evaluation shall be got carried out regularly for the proper implementation of activities undertaken in the project area under CSR. Issue raised in the public Hearing shall also be integrated with activities being taken up under CSR. The details of CSR undertaken along with budgetary provisions for the village-wise various activities and expenditure thereon shall be uploaded on the company website every year. The company must give priority to capacity building both within the company and to the company and to the local youth, who are motivated to carry out the work in future.	It shall be complied. BCCL is implementing CSR activities. A separate CSR committee has been formed for this purpose. TISS has conducted the survey for effective and need based CSR activities implementation. Recommendations of TISS shall be followed. A handloom weaving project (JHARCRAFT) has been started in the area which provides employment to local womenfolk. Under the CSR activities in the purview of NTST-Jeenagora OC, the handloom making projects (Jharkraft) at Mukunda at an expenditure of about Rs.10.38 lakhs during the year 2015-17 and at Alakdiha at an expenditure of about Rs.10.72 lakhs during the year 2016-18 have been established. At these centres, local women are getting training for making of clothes through the handloom.
xLv	For monitoring land use pattern and for post mining land use, a time series of land use maps, based on satellite imagery (on a scale of 1:5000) of the core zone and buffer zone, from the start of the project until end of mine life shall be prepared once in 3years (for any one particular season which is consistent in the time series), and the report submitted to MOEF and its Regional office at Bhubaneswar.	It is being complied. Land Use Map of Cluster IX has been prepared by CMPDIL using remote sensing data for monitoring of land use pattern and for post mining land use. **Enclosed as Annexure XIII.**
xLvi	A final Mines Closure Plan along with details of Corpus Fund shall be submitted to the Ministry of Environment & Forest Restoration Plan of the mine area shall be carried out using a mix of native species found in the original ecosystem, which were conserved in-situ and ex-situ in an identified area during mine reclamation and at the post mining stage for habitat restoration.	Progressive Mine closure plan as per approved MCP is under implementation. Final closure plan will be submitted at appropriate time. Ecological Restoration a mix of native species are being used in mine reclamation. Approval of Mine Closure Plan is attached as **Annexure XIV.**

xLvii	A separate environmental management cell with suitable qualified personnel shall be set up under the control of a Senior Executive, who will report directly to the Head of the company for implementing environment policy and socio-economic issues and the capacity building required in this regard.	Separate multidisciplinary environmental management cell at Area Level has already been established. Office Order of the same has been enclosed as **Annexure XV**. Environmental Engineer provided at Mine and Area level. A full-fledged Environment Department, headed by a HOD (Environment) along with a suitable qualified multidisciplinary team of Executives has been established. Rainwater harvesting methods etc. Capacity building at both corporate and operating level is being done.
xLviii	Implementation of final mine closure plan for Cluster IX, subject to obtaining prior approval of the DGMS in regard to mine safety issues.	Final Mine Closure Plan, will be prepared at appropriate time. Mine closure plan as per the guidelines of Ministry of Coal has been prepared by Central Mine Planning and Design Institute (CMPDIL) and progressive mine closure plan is being implemented.
xLix	**Corporate Environment Responsibility** :- The company shall have a well laid down Environment Policy approved by the Board of Directors. The environment Policy shall prescribe for standard operating process / procedures to bring into focus any infringements / deviation / violation of the environmental or forest norms / conditions. The hierarchical system or Administrative Order of the company to deal with environmental issues and for ensuring compliance with the environmental clearance conditions shall be furnished. To have proper checks and balances, the company shall have a well laid down system of reporting of non-compliances / violations of environmental norms to the Board of Directors of the company and / or shareholders or stakeholders at large.	A well-defined Corporate Environment Policy has already been laid down and approved by the Board of Directors. This is also posted on BCCL website. http://www.bcclweb.in/environment/CEP_04.11.2019.pdf Complied. A hierarchical system of the company to deal with environmental issue from corporate level to mine level already exists. Flow chart is attached as **Annexure XVI.** Being complied.
Sl. No.	**B.) General Conditions**	**Compliance**
i	No change in mining technology and scope of working shall be made without prior approval of the Ministry of Environment and Forests.	No change in mining technology and scope of working has been undertaken.

ii	No change in the calendar plan of production for quantum of mineral coal shall be made.	The approved peak production of coal for Cluster IX is 8.512 MTPA. The production of coal for the cluster is well within the limit. Calendar plan has been enclosed as **Annexure I**.
iii	Four ambient air quality monitoring stations shall be established in the core zone as well as in the buffer zone for PM 10, PM 2.5, SO_2 and ND_X monitoring. Location of the stations shall be decided based on the meteorological data, topographical features and environmentally and ecologically sensitive targets in consultation with the state Pollution Control Board. Monitoring of heavy metals such as Hg, As, Ni, Cd, Cr, etc carried out at least once in six months.	The optimum location of monitoring stations in Jharia Coal Field has been identified with the consultant advisory of CMPDIL and finalized with the approval of Jharkhand State Pollution Control Board. The location of monitoring stations are: (i) Jeenagora (A13) (ii) Kusmatand Village (A12) (iii) Bhowrah North (A14) (iv) Hurriladih UGP (A28) **Enclosed as Annexure VIII.** The work of monitoring of ambient environment had been started by Central Institute of Mining & Fuel Research (CIMFR), Dhanbad which is having CSIR Laboratory recognized under the EP Rules. Currently CMPDIL is carrying out the work of monitoring. To maintain the air quality as per applicable standard following precaution measures is being taken:- 1. Sprinkling on Transportation road. 2. Covered truck transportation 3. Plantation 4. Dust controlled blasting and drilling. 5. Regular maintenance of machineries involved in mining. Air quality Monitoring report has been enclosed as **Annexure XVII.**
iv	Data on ambient air quality (PM 10, PM 2.5, SO_2 and NO_X) and heavy metals such as HG, As, Ni, Cd, Cr and other monitoring data shall be regularly submitted to the Ministry including its Regional Office at Bhubaneswar and to the State Pollution Control Board and the Central Pollution Control Board once in six months. Random verification of samples through analysis from independent laboratories recognized under the EPA rules, 1986 shall be furnished as part of compliance report.	It is being complied. Data is regularly submitted to ministry along with compliance report. IIT(ISM), CIMFR &PDIL Sindri has been contacted to conduct **random verification of samples.**
v	Adequate measures shall be taken for control of noise levels below 85 dBA in the work environment. Workers engaged in blasting and drilling operations, operation of HEMM, etc shall be provided with ear plugs / muffs.	Being complied. Personnel operating HEMMs, drilling machine and other machines comply with safety regulation and are equipped with Personal Protective Equipment. The noise and vibration during blasting operations are controlled by using Electronic Detonators. 75 nos. of ear plug have been provided to the workers engaged in blasting and drilling operations. Noise monitoring data has been enclosed as **Annexure XVIII.**

vi	Industrial wastewater (workshop and wastewater from the Mine) shall be properly collected, treated so as to conform to the standards prescribed under GSR 422 (E) dated 19th May, 1993 and 31st December 1993 or as amended from time to time before discharge. Oil and grease trap shall be installed before discharge of workshop effluents.	Industrial wastewater (workshop and wastewater from the Mine) is not discharged to any water body. Effluents discharge standards are regularly monitored by CMPDIL for cluster IX group of mines. Mine water is being treated using filter plants (Pressure, Sand filters etc.) for its further use in industrial purpose and supply to the community. Mine water monitoring report has been enclosed as **Annexure XII.** 01 no. of Oil & grease trap is in operation.
vii	Vehicular emission shall be kept under control and regularly monitored. Vehicles used for transporting the mineral shall be covered with tarpaulins and optimally loaded.	It is being complied. Vehicle no. & PUC Certificate no. are as follows: **Vehicle no.** — **PUC Certificate** JH10AG5638 — 25969 JH10AG5640 — 25970 JH10AG5637 — 25967 JH10AG5639 — 25968 JH10AG1636 — 25972 JH10AG1637 — 25971 PUC Certificate is enclosed as **Annexure XIX.**
viii	Monitoring of environment quality parameters shall be carried out through establishment of adequate number and type of pollution monitoring and analysis equipment in consultation with the State Pollution Control Board and data got analyzed through a laboratory recognized under EPA Rules, 1986.	It is complied. Ambient environmental monitoring is being done by CMPDIL. Monitoring data have been enclosed as Annexures XVII.

<table>
<tr>
<td>ix</td>
<td>Personnel working in dusty areas shall wear protective respiratory devices and they shall also be provided with adequate training and information on safety and health aspects.</td>
<td>Dust are suppressed at source by water sprinkling. Dust masks are provided to persons working in dusty areas. The details are given as follows:
<table>
<tr><th>FY</th><th>Dust Mask</th></tr>
<tr><td>2015-16</td><td>1000</td></tr>
<tr><td>2016-17</td><td>940</td></tr>
<tr><td>2017-18</td><td>1000</td></tr>
<tr><td>2018-19</td><td>1000</td></tr>
<tr><td>2019-20 (Till Sept. 2019)</td><td>-</td></tr>
</table>
Vocational training Centers under separate Human Resource Development Dept. is conducting regular training programme on these issues. Details of training programme are as:
<table>
<tr><th>Year</th><th>Total</th></tr>
<tr><td>2013-14</td><td>1348</td></tr>
<tr><td>2014-15</td><td>1353</td></tr>
<tr><td>2015-16</td><td>2715</td></tr>
<tr><td>2016-17</td><td>1004</td></tr>
<tr><td>2017-18</td><td>2145</td></tr>
<tr><td>2018-19</td><td>1013</td></tr>
<tr><td>2019-20</td><td>517 (Upto Oct'19)</td></tr>
</table>
</td>
</tr>
<tr>
<td>x</td>
<td>Occupational health surveillance programme of the workers shall be undertaken periodically to observe any contractions due to exposure to dust and to take corrective measure, if needed and records maintained thereof. The quality of environment due to outsourcing and the health and safety issues of the outsourced manpower should be addressed by the company while outsourcing.</td>
<td>Initial Medical Examination (IME) of contracted personnel and periodical Medical Examination (PME) of all the personnel are carried out as per the Statutes and Director General of Mines Safety (DGMS) guidelines.
Details of PME/IME:
<table>
<tr><th>Year</th><th>IME</th><th>PME</th></tr>
<tr><td>2014</td><td>09</td><td>1710</td></tr>
<tr><td>2015</td><td>333</td><td>1564</td></tr>
<tr><td>2016</td><td>257</td><td>1335</td></tr>
<tr><td>2017</td><td>245</td><td>1134</td></tr>
<tr><td>2018</td><td>Nil</td><td>1400</td></tr>
<tr><td>2019</td><td>380</td><td>1058</td></tr>
</table>
</td>
</tr>
</table>

xi	A separate environment management cell with suitable qualified personnel shall be set up under the control of a Senior Executive, who will report directly to the Head of the Company.	Separate multidisciplinary environmental management cell at Area Level has already been established. Office Order of the same has been enclosed as **Annexure XV.** Environmental Engineer provided at mine and Area level. The activities are monitored on regular basis at Area and at Head Quarters levels. GM (Environment) at Head Quarter level Co-ordinates with all the Areas and reports to the Director (Technical) and in turn he reports to the CMD of the company. The team is multidisciplinary and very much motivated under the guidance of company's Director (Technical) and CMD. Further capacity building at both corporate and operating level is being done.
xii	The funds earmarked for environmental protection measures shall be kept in separate account and shall not be diverted for other purpose. Year-wise expenditure shall be reported to this Ministry and its Regional Office at Bhubaneswar.	It is being complied. The funds are available at Area and HQ level for implementation of activities in the capital & revenue budget. The booking is being done as per operations by concerned department. Enclosed as **Annexure XX.**
xiii	The project authorities shall advertise at least in two local newspapers widely circulated around the project, one of which shall be in the vernacular language of the locality concerned within seven days of the clearance letter informing that the project has been accorded environmental clearance and a copy of the clearance letter is available with the State Pollution Control Board and may also be seen at the website of the ministry of Environment & Forests at http://envfor.nic.in.	It has been complied published timely. **Enclosed as Annexure XXI.**
xiv	A copy of the environmental clearance letter shall be marked to concern Panchayat/ZilaParished, Municipal Corporation or Urban local body and local NGO, if any, from whom any suggestion / representation has been received while processing the proposal. A copy of the clearance letter shall also be displayed on company's website.	It has been Complied. **Enclosed as Annexure XXII.** http://www.bcclweb.in/Environment%20Clearance/cluster%20IX_Modified.pdf
xv	A copy of the environmental clearance letter shall be displayed on the website of the concerned State Pollution Control Board. The EC letter shall also be displayed at the Regional Office District Industry Sector and Collector's Office/Tehsildar's Office for 30 days.	It has been complied.

16/17

xvi	The clearance letter shall be uploaded on the company's Website. The compliance status of the stipulated environmental clearance conditions shall also be uploaded by the project authorities on their website and updated at least once every six months so as to bring the same in public domain. The monitoring data environmental quality parameter (air, water, noise and soil) and critical pollutant such as PM_{10}, $PM_{2.5}$, SO_2 and NO_x (ambient) and critical sectoral parameters shall also be displayed at the entrance of the project premises and mine office and in corporate office and on company's website.	The EC, its compliance along with monitoring data is being uploaded regularly on BCCL official website. The photo of the display of critical sectoral parameters at the entrance of mine office is attached as **Annexure XXIII.** http://www.bcclweb.in/?page_id=20425
xvii	The project proponent shall submit six monthly compliance reports on status of compliance of the stipulated environmental clearance conditions (both in hard copy and in e-mail) to the respective Regional Office of the Ministry, respective Zonal Offices of CPCB and the SPCB.	Six monthly reports of cluster –IX is regularly submitted to (twice in a year) the Regional Office of MoEFCC, Ranchi along with required data and information both in hard copy soft copy.
xviii	The Regional Office of this Ministry located at Bhubaneswar shall monitor compliance of the stipulated conditions. The Project authorities shall extend full cooperation to the Office(s) of the Regional Office by furnishing the requisite data / information / monitoring reports.	Project will extend its all possible support and cooperation to the Regional Office in any kind of monitoring/visit/data collection etc.
xix	The Environment Statement for each financial year ending 31 March in for-V is mandated to be submitted by the project proponent for the concerned State Pollution Control Board as prescribed under the Environment (protection) Rules, 1996, as amended subsequently, shall also be uploaded on the company's website along with the status of compliance of EC conditions and shall be sent to the respective Regional Offices of the MOEF by E-mail.	Complied regularly on time. Attached as annexure XXIV.
Sl. No.	**C.) Other Conditions by MOEF :**	**Compliance**
i	The Ministry or any other Competent Authority may stipulate any further condition(s) for environmental protection.	Complied. Following additional measure as informed by MoEF and JSPCB from time to time
ii	Failure to comply with any of the conditions mentioned above may result in withdrawal of this clearance and attract the provisions of the Environment (Protection) Act, 1986.	Agree.

iii	The above conditions will be enforced inter-alia, under the provisions of the Water (Prevention & Control of Pollution) Act, 1974, the Air (prevention & Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986 and the Public Liability Insurance Act 1991 along with their amendments and Rules. the proponent shall ensure to undertake and provide for the costs incurred for taking up remedial measures in case of soil contamination, contamination of groundwater and surface water, and occupational and other diseases due to the mining operations.	The storage of materials does not attract PLA, 1991.
iv.	The Environmental clearance is subject to the outcome of the Writ Petition filed by M/s Bharat Coking Coal Limited (BCCL) in response to the closure orders issued by the Jharkhand State Pollution Control Board which is pending in the Jharkhand High Court.	Agree.

29/11/19

Addl. General Manager
Lodna Area
BCCL Dhanbad

Annexure I

Calendar Plan

PRODUCTION PROGRAM FOR 2020 - 21, LODNA AREA, BCCL

PRODUCTION TARGET

UNIT	PATCH	TYPE OF MINE	GRADE	COAL (MT)	OB (Mcum)	TPD	HELP REQUIRED
Amal. NT ST JG Colliery	PATCH-B	HOC	W-IV, G-IX,	1.60	7.78	4384	1.Proposal for construction of cement concrete road from 25 no. coal dump to Patherdih coal washery to be finalised. 2. Proposal for construction of cement concrete road from South Tisra Work shop to Jairampur More to be finalised.
	PATCH-F	HOC	W-III (STEAM), W-IV, G-IX,	2.40	6.65	6575	
	NTST DEP.	DOC	W-III (STEAM), W-V(P)(ROM)	1.00	3.50	2740	1.Shifting of encroachers to be expedited by JRDA. 2. Shifting of Goluckdih Sub Station by Bastacolla Area to be expedited for Departmental Patch
	TOTAL			5.00	17.93	13699	

LODNA AREA

PRODUCTION PROGRAMME (2019-20)

COAL PRODUCTION TARGET (2019-20) MONTH WISE (Fig. in 000)

UNIT	PATCH	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	March	TOTAL
AMAL. NT ST JG COLLIERY	PATCH-B	115	115	115	101	101	101	115	115	130	144	144	145	**1441**
	PATCH-F	133	133	133	112	112	112	133	133	152	173	170	173	**1669**
	SUB. TOTAL	248	248	248	213	213	213	248	248	282	317	314	318	**3110**
	DEP.	78	78	78	67	67	67	78	78	89	100	100	120	**1000**
	TOTAL	**326**	**326**	**326**	**280**	**280**	**280**	**326**	**326**	**371**	**417**	**414**	**438**	**4110**

O B R TARGET (2019-20) MONTH WISE (Fig. in 000)

UNIT	PATCH	April	May	June	July	August	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	March	TOTAL
AMAL. NT ST JG COLLIERY	PATCH-B	559	559	559	490	490	490	560	560	630	701	700	702	**7000**
	PATCH-F	366	366	366	299	299	299	366	366	428	495	485	495	**4630**
	SUB. TOTAL	**925**	**925**	**925**	**789**	**789**	**789**	**926**	**926**	**1058**	**1196**	**1185**	**1197**	**11630**
	DEP.	273	273	273	234	234	234	273	274	312	350	350	420	**3500**
	TOTAL	**1198**	**1198**	**1198**	**1023**	**1023**	**1023**	**1199**	**1200**	**1370**	**1546**	**1535**	**1617**	**15130**

COAL DESPATCH TARGET (2019-20) MONTH WISE (Fig. in 000)

UNIT	PATCH	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	TOTAL
AMAL. NT ST JG COLLIERY	RAIL	207.00	205.00	207.00	182.00	182.00	175.00	223.00	215.00	223.00	277.00	257.00	277.00	**2630.00**
	ROAD	113.00	117.00	117.00	103.00	103.00	100.00	122.00	126.00	126.00	155.00	143.00	155.00	**1480.00**
	TOTAL	**320.00**	**322.00**	**324.00**	**285.00**	**285.00**	**275.00**	**345.00**	**341.00**	**349.00**	**432.00**	**400.00**	**432.00**	**4110.00**

Year	Quantity of coal produced (LMT)	OB excavated (LCM)	Top soil generated (LCM)	Backfilling area (Ha.)	Reclaimed Area (Ha.)
2013-14	**3359851**	**12595276**	414332	3.60	Nil
2014-15	**3530017**	**16334190**	420456	4.38	5
2015-16	**3826689**	**18987993**	479584	5.00	7
2016-17	**3839054**	**23204981**	66049	1.60	7
2017-18	**3192316**	**17999510**	492342	4.75	7
2018-19	**2484642**	**10362176**	187598	-	3.8
2019-20	**660554**	**4598895**	137966	-	0.3

Global Expression of Interest (EoI)

For

Dealing with coal mine fires in lease hold of BCCL in Jharia Coalfield, Dhanbad, Jharkhand, India. Detailed scope of work as given in the document.

LAST DATE OF SUBMISSION : 28.04.2014

1. BHARAT COKING COAL LIMITED: A PROFILE

Bharat Coking Coal Limited incorporated in January, 1972 as a fully owned subsidiary of Coal India Limited a 'Maharatna' Public Sector Undertaking under the Ministry of Coal, Government of India. Being the sole repository of prime coking coal in the country, BCCL, at present operates 66 coal mines spread over in Jharia Coalfield and part of Raniganj Coalfield apart from 6 coking coal washeries & 2 non-coking coal washeries. The mines are grouped under 12 areas for administrative convenience. BCCL has some unique inherent and perennial characteristics which are adversely affect the normal operation of the Company. Difficult geo-mining conditions involving large number of overlying coal seams, preponderance of old workings, high degree of gassiness, coal fires affecting working seams, water logged upper seams above current places of working, etc., restricts coal production and productivity. Besides, high density of population in the coal bearing areas limits the equipment size of opencast operations apart from being an impediment to acquisition of land for uninterrupted operations. In the year 2012-13, the company achieved a coal production of 31.21 million tons and offtake of 32.99 million tons thereby registering the highest ever the Turnover and Profitability (PAT) of Rs 9176.62 Cr. and Rs 1709.06 respectively. A brief description of the organizational structure and the detailed activities of Bharat Coking Coal Limited can be viewed in the website http://www.bccl.gov.in.

The mission is to produce planned quantity of coal efficiently and economically in an Eco-friendly manner with due regard to Safety, Conservation & Quality. The company strives to meet the growing demand of thermal as well as metallurgical coal in the country in a environmentally and socially sustainable manner.

2.2. Bidder's Credential Requirement:

i) The bidder(s) must have successfully dealt with mine fire in at least two coal mines, one open cast and one underground mine. The annual capacity of opencast and underground mines should be at least 2 Mt and 0.5 Mt respectively during last seven years of last financial year. The documentary proof of successful dealing with fire should be submitted along with the bid.

ii) The bidders in their name must have achieved a minimum average annual financial turnover of INR One Hundred Million or equivalent USD during last 3 years ending 31st March of previous financial year. The documentary evidence to this effect would be copies of audited Balance Sheet and Profit & Loss A/c duly countersigned by the authorized representative of bidding company and a declaration to the above effect duly signed by the authorized representative of bidding company & countersigned by a Chartered Accountant or equivalent.

iii) The bidder must provide "key personnel" (minimum number) of the following categories with requisite qualification and experience :-

Sl. No	Skill of key personnel	Requisite Quantification	Minimum Experience	Minimum Nos. for eligibility
1.	Technical Expert (Mining/ Fire dealing/ Mine Rescue)	B.E./B.Tech (Mining) or equivalent	10 years	10
2.	Technical Expert (Geology/Remote Sensing)	M.Sc (Geology) or equivalent	10 years	2
3.	Technical expert (Environment)	B. Tech/BE/M.Sc (Envr) or equivalent	10 years	1
4.	Technical Expert (Infrastructure)	B.E./B.Tech (Mechanical / Electrical / Civil) or equivalent	10 years	3
5.	IT Expert	B.E./B.Tech/ M.Sc (Computer) or equivalent	10 years	1
6.	Financial Expert	MBA(Finance)/Chartered Accountant/ICWA or equivalent	10 years	1

Note :- The bidder shall designate one of the team members as the team leader.

The documentary evidence to the effect would be self-attested CVs including necessary competency certificate for work. In Indian mines duly countersigned by the authorized representative of bidding company.

iv) Copy of PAN (Permanent Account Number) with Income Tax Authority in India for bidder(s) from India.

v) Copy of PAN Based Service Tax Registration Number in India for bidder (s) from India.

3.0 Availability of details for EOI :

Details for EOI including Terms and Conditions of EOI can be collected from the following place during the period as stated below:

Date: From 27.01.2014 to 26.02.2014.

Time: **10.00 AM to 1.00 PM** (on all working days)

Office of the GM (CMC)
Contract Management Cell, BCCL
Level-V, Koyla Bhawan,
Dhanbad - 826005

Details for EOI including Terms and Conditions of EOI can also be downloaded directly from the BCCL web-site http://www.bccl.gov.in and NIC Portal, website http://www.tenders.gov.in during the period as mentioned above.

4.0 Pre - EOI submission meeting :

Pre - EOI submission meeting will be held on **14.02.2014 at 11:00AM** in the office of GM (CMC), BCCL, Level-V, Koyla Bhawan, Dhanbad for clarifications and discussion.

5.0 GENERAL INSTRUCTIONS FOR SUBMISSION OF EOI :

Expression of Interest (EOI) shall be submitted by the Consultants / agencies / firms / organizations in a sealed envelope superscribed with **"EOI for Dealing with coal mine fires in lease hold of BCCL in Jharia Coalfield, Dhanbad, Jharkhand, India. Detailed scope of work as given in the document."** giving EOI reference no. with date and full postal address & telephone nos. on the envelope.

6.0 RECEIPT OF EOI

EOI will be received in sealed envelopes up to **28.04.2014** at the following address only:

Office of the GM (CMC)
Contract Management Cell, BCCL
Level-V, Koyla Bhawan,
Dhanbad - 826005

The offers may be submitted through post also. BCCL takes no responsibility for delay, loss or non receipt of the offers sent by post. Fax offers or offers sent through e-mail shall not be accepted.

SCRIB

7.0 OPENING OF THE EOI :

EOI shall be opened on **29.04.2014 at 04.00 PM** in the office of the GM (CMC), BCCL, Level-V, Koyla Bhawan, Dhanbad-826005.

8.0 Bidders are requested to go through the details of EOI document & enclose all the required documents along with the proposal. Each page of the proposal shall be signed with seal.

9.0 Prospective parties may note that mere submission of EOI and / or submission of additional information do not automatically entitle them to claim for pre-qualification. BCCL reserves the right to seek for any other information during the process of evaluation, if required.

10.0 BCCL reserves the right to reject any / all the applications to EOI without assigning any reason(s) whatsoever thereof.

Sd/-
General Manager
(Contract Management Cell)

Distribution :

1. PRO – With a request to publish the abridged EOI as enclosed in local as well as National dailies as per norms of the Company and also arrange to send the paper cutting of publication to the Contract Management Cell.
2. D(T)CP / D(T)P&P / D(F) / D(P) / CVO.
3. GM(Co-ordn) / GM(S&M) / GM(F)/C / GM(M&M) / GM(C&M) / GM(Estv) / GM(P&P) / GM(IE) / GM(System) / Dy. GM (Estt.), BCCL.
4. Sr.ES to CMD – for kind information of CMD.
5. HOD (Admn) with a request to display this EOI in Koyla Bhawan Notice Boards.
6. All CGMs/GMs of the Areas including Washery Zones for wide circulation through display in the Notice Boards.
7. Inspector, CISF- with a request to deploy security personnel at the office of GM (CMC), Level-V, Koyla Bhawan on 28.04.2014 from 9:30A.M to 4:00P.M and on 29.04.2014 from 3:30 PM till completion of the meeting.
8. Asstt. In-Charge, BCCL, M.M Division, 4th floor, 6, Lyons Range, Kolkata.
9. CGM / GM (Contract Management Cell), WCL/SECL/NCL/MCL/ECL/CCL & CIL.
10. Sri R.K. Choubey, Sr.DEO / Sri P.N Banerjee, DEO, CMC Deptt. - to upload this EOI in BCCL Website and forward soft copy of NIC format to GM (System) for uploading the same at NIC portal website (soft copy of the same is enclosed for needful).

Sd/-
General Manager
(Contract Management Cell)

Annexure III

Gmail

Environment Lodna Area <envlodna@gmail.com>

Recommendation of Indira Gandhi Centre of atomic Research, Kalpakkam for dealing the fire in coal mine in Jharia coalfield.

Environment Lodna Area <envlodna@gmail.com> 20 November 2019 at 16:53
To: diradmn@igcar.gov.in

Sir,

As per **EC no: J-11015/307/2010-IA-II (M) dated: 21st May 2013**, **Specific condition no. iv** (copy attached) of Cluster IX, it is mentioned that the recommendation of Indira Gandhi Centre for Atomic Research, Kalpakkam should be followed. Cluster IX of mines situated in Lodna Area of Jharial Coal field is highly affected by fire.

We request you provide us the recommendation made by your institution for dealing the fire in the following address.

warm regards
General Manager
Lodna Area, Dhanbad

EC 2013_cluster-IX.pdf
157K

Annexure IV


KUMARDHUBI COLLIERY
KUNJAMA COLLIERY
LODNA COLLIERY
PATCH-B
O.B.DUMP
COAL DUMP NO.26
JEALGORA COLLIERY
BASSEIA COLLIERY
JOYRAMPUR COLLIERY
PATCH-D
XIV SM
DIENGDIH COLLIERY
BARAREE COLLIERY
C.F.R.I.
DENGDIH SCHOOL
BATHROOM WASHERY

CHAPTER – I
INTRODUCTION

1.0 Introduction

NT-ST-Jeenagora group of mines consist of three existing mines of Lodna Area of BCCL, namely, NTST OCP (256.15 Ha), Jeenagora OC (276.05 Ha) and North Tisra UG (246.24 Ha). These mines came into operation before nationalisation. In addition, the group also includes a very small part of Joyrampur UG. At present these mines are operating in NTST-Jeenagora Group of Mines.

The above Group of Mines are covered in Cluster IX for EMP. As per the approved Terms of Reference (TOR) in the proposed scenario (from April 2012 tentatively) for preparation of the Environment Management Plan of Cluster IX of BCCL, NT/ST (Exp) OCP is proposed to be worked by carving 755.15 Ha of land from the property of above four existing mines and additional 675.98 Ha land from outside coal bearing area for OB dumping and infrastructure. Hence the area of proposed NTST Expansion OCP is 1431.00 Ha which comprises 755.15 Ha land for mining and 675.85 Ha land from non-coal bearing area for OB dumping.

Within the proposed quarry area, there are three sanctioned opencast Mines viz. North Tisra OCP, South Tisra OCP and Sulunga- Jeenagora OCP (within Jeena Gora Colliery Boundary). All these projects are operating mines and are in the category of "Completed Projects of BCCL". In addition to these OCP's , there is one Underground production units in North Tisra Colliery boundary, namely 6 Incline .The underground production units along the three above mentioned opencast mine will be closed before merging into the proposed opencast project.

The present production from the different operational units is given in Table 1.1.

Table 1.1 Present Production Units – NT-ST-Jeenagora Group of mines

Sl. No.	Working Unit	Method of work with seam	Production ('12-'13) (MTY)	Remarks
1	NT/ST OCP	OCP (IV to I seam)	0.872	Shovel Dumper Combination by Deep Hole Blasting Method
2	Jeenagora OCP	OCP (IV Top to III seam)	1.057	Shovel Dumper Combination by Deep Hole Blasting Method
3	North Tisra UG	UG (IV BOTTOM)	0.095*	Bord & Pillar method with SDLs.

***** Likely to be closed soon due to OCP operation

This mine closure plan has been prepared on the basis of Project Report on NTST Expansion OCP & approved TOR/Form–I(Proposed Scenario) and data furnished by the officials of Lodna Area/ BCCL.

1.1 Name of mine owner / company

Project: North Tisra/ South Tisra (Expn.) OCP
Area: Lodna Area
Company: BCCL
Mine Owner: Director (Technical) (Operation), BCCL (Nominated)

1.2 Address for Communication with PIN and Phone nos.

PO : Khas Jeenagora
District : Dhanbad
State : Jharkhand
PIN : 828 115
Mob(Agent) : +91-9470596903

1.3 Location of mine:

Latitude :	$23^0$41'50'' to $23^0$43'48'' North
Longitude :	$86^0$26'14'' to $86^0$27'33'' East
Area :	Lodna Area
Coalfield :	Jharia Coalfield

1.4 Capacity of the mine

Mine started:	Proposed
Date of start of production:	Proposed
The capacity of the mines	6.0 MTY (PEAK – 7.8MTY)

1.5 Method of Mining including equipments deployment of in the area

There are three active units working in the lease hold area of NT/ST (Expn.) OCP as depicted in the Table 1.1. The NT/ST OCP is being worked in IVT, IVB, III, IIT, II B & I by opencast method using shovel & dumper combination, departmentally. Total O.B. of the running quarry is being dumped in decoaled area of the existing quarry on the floor of I seam. Deep hole blasting is being adopted for the quarrying. Blasted coal and overburden is further loaded by shovels on to the dumpers deployed for it. In Jeengora OCP, mechanised open cast mine is being worked in geologically IV Top, IV Bottom, & III seams. On an average IV Top seam & IV Bottom seams are 4.8m & 6.1m thick respectively while III seam is about 12m thick. IV Bottom has been developed in one section and SOP.

At North Tisra UG IV Bottom seam is being worked which has been extensively developed on B&P method of mining through 6 incline. The gradient of seams is suitable for the deployment of SDLs, wherever thickness permits. The average gradient of seam is around 1 in 5. It is, therefore will follow the B&P method of mining with SDL loading onto tubs. Apart from these three units, there is some part of Joyrampur UG mine considered in the proposed NTST Expansion OCP where VIII and IV Top seams are being worked at present. The seam IV (T) is being developed by Bord & Pillar with

SDL while the VIII seam is being depillared with stowing which will be replaced by V/VI Seam.

Seam IX/X, VIIIA, VIII, V/VI/VII, VII, V/VI, IVT, IVB, III, IIT, IIB & I have been considered for exploitation within the leasehold of the proposed NT/ST (Exp) OCP. The base of the quarry will be floor of I seam.

1.6 Coal Processing/ Beneficiation Operation

At present coal production from North Tisra UG is mostly linked by rail to steel sector and power plant through JGB No. 9 siding which is 2-3 km from the mine. Coal from pit head stock to siding is transported by road contractually. A part of its production is linked to various private cokeries through road. Coal from NT/ST OC is being dispatched through JGB No. 9 and 6 sidings for different thermal power stations. Road linkage for public sale is being carried through E-Auction. The production from Jeenagora OC is being sent to power house by rail. Some coal is being transported through road sale.

In proposed NT/ST (Expn.) OCP, the non-coking coal from the project will be linked to thermal power station. NLW coal will also be linked to TPS till it is unacceptable to SAIL/Washery. Coking coal (S-II to W-IV) will be linked to SAIL/Washeries. Jhama will be linked to cement companies, refractories etc.
No beneficiation is envisaged for the current output of the group of mines.

1.7 Total Lease/Project Area involved:-

Existing	:	755.15Ha
Proposed	:	1431.00Ha(including existing)
Total	**:**	**1431.00Ha**

1.8 Type of Lease /Project Area (Ha):-

Table 1.2 Type of Lease Area

Sl. No.	Particulars	Mining Area(Ha)	Outside mining area (Ha)	Total * (Ha)
1	BCCL land	568	65	633
2	Forest land	Nil	17	17
3	Govt. land	22	65	87
4	Tenancy land	60	616	676
5	Others (Rly. Land)	18.0	Nil	18.0
	Total	668.0	763.0	1431.0

*Includes 675.98 Ha of land outside of Cluster IX, proposed to be used for external dumping.

1.9 Communication and Physiography

The proposed NT/ST (Exp) OCP is well connected by rail and road. It is about 15Km south of Dhanbad town. The Jharia – Baliapur District Board road passes parallel to northern boundary and Patherdih-Pradhankhanta Rly. Line passes adjacent to southern boundary of the project.

The area has an undulating topography with a gentle slope towards west. The mining activity which is going on in the area since long time has severely obliterated the general topography. The maximum ground elevation of 202m has been observed in the north-eastern part while the minimum elevation is 163m in south-western part at BH No. ST-2. The drainage of the area is controlled by southerly flowing Tisra jore on the west side of the property.

1.10 Type of Present and Proposed Land Use of mining area (Ha)

Table 1.3 Land Use of Mining Area(Based on Mine data)

Sl. No.	TYPE OF LAND USE		Present mining land use (in Ha)	Post mining land use (in Ha)
1	Running quarry	Backfilled	47.11	0.00
		Not back filled	63.77	0.00
2	Abandoned quarry	Back filled	115.40	0.00
		Not back filled	35.85	0.00
3	External OB dump		45.93	0.00
4	Service Building/ Mine Infrastructure		36.61	25.00
5	Coal dump		5.42	5.00
6	Road & Rail		27.04	18.00
7	CHP/Siding			45.00
8	Homestead land		680.21	0.00
9	Agriculture land		6.00	0.00
10	Forest land		17.00	17.00
11	Plantation		20.80	886.93
12	Water body		9.62	164.46
13	Barren Land		320.24	269.61
	TOTAL		**1431.00**	**1431.00**

1.11 Statutory Approvals

Table 1.4 Statutory Approval Status

Sl. No	Particulars	Status
A	Mine plan / F.R / P.R	Formulated
B	Forestry clearance	Under process
C	Env clearance	Under process
D	Consent to operate	Existing Mines
E	Any other approval from Central / State regulatory authorities for operating mine with special reference to mine closure.	Mine closure plan to be approved by BCCL Board of Directors.

1.12 Reasons for Closure

The proposed NTST Expansion OCP has been planned after merging the properties of existing NTST –Jeenagora group of mines for a nominal capacity of 6.0MTY having an extractable reserves of 145.08MT. With this rate of production, the life of the project will be 30 years. This includes 2 years of pre-construction period, 2 years of construction periods and 26 years of production periods. There may be a scope of expansion of the mine further dip-side after reaching the proposed boundary as per the PR. In such situation, it is proposed that a new Mine Closure Plan should be prepared in the changed scenario.

A Report titled "***Draft scheme for dealing with fire by excavation method below Dhanbad-Patherdih Railway Line at Lodna Area (XI/XII Seam Base)***" was prepared and the Report is likely to be implemented in future to deal with the seams on fire. If the proposal is implemented, it is proposed that a Revised Mine Closure Plan should be prepared, taking into account the new emerging scenario.

Any mines in this group may be closed in future on account of exhaustion of economically recoverable coal reserves in the lease hold area before the start of the expansion project. It may also be closed on account of other unforeseen reasons i.e. Force Majeure or directives from statutory organizations or court etc. for which information and notices shall be served to concerned Government authorities and departments. Under such conditions, a revised Mine Closure Plan should be prepared. As per guidelines of Ministry of Coal, Govt. of India, mine closure plan has to be submitted along with the mine plan for getting competent approval within one or two years of date of approval of mine plan.

1.12.1 Need of Mine Closure Planning

Mining is a hazardous operation as it offsets the equilibrium of natural depositional environment viz. it alters or tries to alter the in-situ field stress, ground water, surface drainage system as well as the socio-economic

condition. Although mining activities are usually short term phenomena, they are liable to leave long lasting impacts on landscape, ecology and on the mind set of local inhabitants. Thus, it is imperative that any mining venture should have adequate closure plan addressing issues like reclamation, environmental protection and rehabilitation of disturbed area which should be acceptable to local community as well as the regulatory authority. Community acceptable implementation of mine closure plan bound to incur some extra cost. Neglecting this aspect will lead to future problems of attending compensation or may creep up expensive socio-economic problems.

Mine closure encompasses the restoration process designed to restore physical, chemical and biological quality disturbed by the mining activities. Mine closure is not just something that happens at the end of a mine's life, rather mine closure is an ongoing series of decisions and activities beginning in the pre-mining stage of mine and ending with a creation of self sustainable site that can be returned to the community.

Thus, a mine closure plan needs to define the liabilities, responsibilities and authorities of the different agencies like the mine management, other regulatory bodies, Central and State Governments after mine closure.

Various objectives of the advance mine closure planning are as given below.

a. To allow productive and sustainable after-use of the site, which is acceptable to the mine owner and the regulatory authority
b. To protect public health and safety
c. To eliminate environmental damage and thereby encourage environmental sustainability
d. To minimize adverse socio-economic impacts of mining activities
e. To protect the flora and fauna of the area affected by the mining
f. Effective use of the assets created during the course of mining

Primarily, the mine closure activities are planned in two stages. The initial plan identifies the activities required to be executed in line with the mining activities in progress, after the inception of the project, i.e., progressive mine closure activities. These activities may undergo subtle changes depending upon the actual site condition during implementation. Finally, a detailed closure plan is to be prepared 4-5 years before the actual closure time of the mine depending upon the existing parameters at that point of time, i.e., final mine closure activities.

1.12.2 Mine closure planning strategy in respect of NT-ST-Jeenagora Group of mines based on existing set of parameters

As the balance life of the mine is 30 years from now for the seams proposed to be worked , following activities are envisaged towards mine closure programme in respect of NT-ST-Jeenagora Group of mines.

a. Progressive mine closure activities will continue as envisaged in the project report and as enumerated in the various approvals, permits, consents etc. The progressive Closure activities are funded by levying a charge of ₹ 5.50/Te of coal for opencast mines.

   The recent guidelines issued in this regard by MoC, GoI will also be followed.

b. Although, it is very difficult to foresee the likely impacts due to closure of the mining activities in the leasehold area of the project, but in the present report, the same has been estimated and some mitigating measures have been suggested accordingly. These suggested measures along with certain other measures, as deemed fit, at the time of closure of mining activity in the seams being worked at present shall be taken up.

c. The final closure plan carrying the finer details would be prepared at the time of preparing the mine plan for last mineable patch of coal seam in the leasehold area of the group.

1.13 Approval of Company Board of Directors or any other competent authority

The closure plan will be placed to Board of Directors of BCCL for approval.

CHAPTER – II

MINE DESCRIPTION

2.1 Geology of the group

Geology of the block has been established by surface and sub surface data. The leasehold area of the NT-ST-Jeenagora Group of mines is entirely covered by Barakar formation. The coal bearing rocks of Barakar formation of Permian age occur in the NT-ST-Jeenagora Group of mines is located on the eastern edge of Jharia Coalfield, where rocks of Talchir, Barakar & Barren Measures are exposed in patches. However NT-ST-Jeenagora Group of mines is generally covered by soil which is underlain by the coal bearing rocks of the Barakar Measures.

A total of 44 boreholes have been drilled in time phases in the entire project. In addition, data of adjoining 10 boreholes have also been considered for the evaluation of geological features. The borehole density in the area is approximate 8/Sq. Km.

2.1.1 Geological Structure of the area

Dip & Strike

The general strike of the formation is North-South. In the small strip, strike of the formation swings to NNE-SSW, in the southern/south-western corner of the assessment area. The amount of dip varies from 8^0 to 11^0 westerly. The dip is however, steep towards southern part, adjacent to Fault F6-F6, because of the proximity of the area to the major fault.

Faults

A total of 7 faults having throw ranging from 2m to 20m have been deciphered in the area.

Pyrolitisation

The area is free from pyrolitisation, however seam II (Bottom) and I seam have been affected due to pyrolitisation in small part of the area, and the seam is partially/fully burnt in small part of the area.

2.1.2 General Description of coal seams

In NT-ST-Jeenagora Group of Mines, detailed drilling has proved existence of number of workable coal seams of over 0.50m thickness from XI/X to I seam.

2.1.3 Seam sequence

The generalised sequence of coal seams and the intervening partings in proposed NT/ST (Exp) OCP are given in Table 2.1.

Table 2.1 Generalised Seam Sequence and Parting

Seam/Parting	Thickness (m)	
	Minimum	Maximum
IX/X	8.17	12.06
P	14	38
VIIIA	1.00	5.47
P	4	30
VIII	1.45	3.93
P	2	3
V/VI/VII	15.10	17.74
P (VIII to VII)	3	22
VII	5.02	9.57
P	2	20
V/VI	4.32	8.44
P	20	33
IV TOP	1.52	6.95
P	13	19
L-5	0.76	2.60
P (L-5 to IVB)	2	6
P(IVT-IVB)	12	29
IVB	1.98	7.02
P	18	33
III	8.60	19.81
P	1	16
II TOP	0.90	5.75
P	1	13
II BOT	1.22	7.46
P (III to II Comb)	3	6
II (Comb)	5.80	7.6
P (IIB to I)	2	18
P (II Comb to I)	4	13
I	1.82	8.28

2.1.4 Reserves, Types and Quality

Balance mineable reserves have been given in the Table 2.2.

Table-2.2 Seam wise Grade & Reserve(as per PR)

Seam	Grade	Bal. Min. Res. (MT)
IX/X	W-IV	1.08
VIIIA	W-IV	2.27
VIII	W-III	2.69
V/VI/VII	W-IV	3.16
VII	W-IV	4.99
V/VI	W-IV	9.19
IVT	F	9.42
L-5	D	1.21
IVB	F	11.52
III	E	52.42
II Comb	E	5.32
IIT	D	7.42
IIB	E	12.37
I/I & IIB	W-IV	22.02
		145.08

Note: The reserve data estimated is based on the actual situation prevailing in the area. This reserve includes jhama also.

2.2 Mining Details

2.2.1 Boundary Details of NT-ST-Jeenagora Group of mines

North: - Colliery boundary between N. Tisra & Goluckdih/Kujama Collieries.

South:- Incrop of I seam in Bhulan Bararee thrust zone

East:- Intcrop of I seam and Metamorphics.

West:- 200m margin from incrop of XI/XII seam

2.2.2 Present Working Seams

North Tisra/South Tisra Opencast Mine: This opencast mine is operating within the sanctioned area and exploiting IV to I seams. Present production level is 0.872MTY.

Jeenagora Opencast (Patch): Production from III, IVB & IVT seams are being done in the name of Jeenagora (Patch) OC. OB Dumping in being done internally over the coal bearing area. Present production level is 1.057MTY.

Thus, total production from l these two opencast mines is 1.929MTY.

North Tisra UG: Total production from the underground unit from within the proposed quarry area is 0.095MTY. The winning of coal is being carried out from IVB seam.

2.3 Mining Methods

The proposed NTST Expansion OCP opencast is an expansion of the existing opencast mines. In the existing opencast mines, though infrastructure has been created but they are suitable for small level of production. The proposed opencast is a large mine with higher level of mechanisation. Therefore, all necessary infrastrcture need to be created for the larger project.

In the first two years of implementation of the proposed project (1st & 2nd) land will be acquired and shifting / rehabilitation of houses will be done to make the site available for working. During 3rd & 4th year of the project necessary infrastructure will be created like Workshop / Store, Power Supply arrangement, Feeder Breaker, Railway Siding etc. During these four years of construction (1st to 4th) of the expansion project, existing opencast mines will continue to produce coal & excavate OB. In fact the operation of the existing mines will be tailored to prepare the mine for larger level of mechanisation for the proposed 6.0 mty Opencast.

OB excavation and coal production from the proposed opencast will start by 5th year of operation and target will be achieved by 6th year. By this year all major construction activities will be completed for sustaining the production level for the entire project life.

2.3.1 The status of working and fire in different seams:

The status of exploitation of various coal seams and the area under fire considered in this report is based on the mine working plan supplied by the colliery authorities. The status of working and the fire limit of different seams are given below:

IX/X Seam: This seam has been extensively worked by UG method. The seam has been goaved in major part of the area and is under fire. This seam has also been quarried out in outcrop region.

VIIIA Seam: This seam has been quarried out in patches along the incrop region and extensively worked by underground method in major part of the area. The seam has been goaved also in major part, particularly in northern side of the area. The seam is under fire in northern part.

VIII Seam: The seam has been extensively worked by UG method. It has been quarried out along the incrop region. The seam has been goaved also in major part. The seam is under fire in northern half of the area.

V/VI/VII Seam: This combined seam is restricted to northern part of the area. The seam have been developed in two sections and quarried also towards incrop side. The seam is goaved at places. Seam is on fire in the northern part of the area.

VII Seam: This seam is quarried out in major part of incrop region. The seam has been worked through inclines in major part. It is developed in one section in major part and two sections working in small area in Jeenagora colliery only. The seam has been goaved also in patches. The part area of the seam is on fire also.

V/VI Seam: This seam is also extensively developed in the entire area and quarried out in incrop region. The seam has been goaved also in central part of the area. The seam has been developed in one section by underground method. The seam is under fire also in part area.

IV Top Seam: The seam is quarried in incrop region only and the seam is virgin in major part of the area. It has developed also through underground working in Jeenagora Colliery only.

IV Bot. Seam: The seam has been worked by underground method and it is quarried also. In small part, the seam is goaved and depillared.

III Seam: The seam has been quarried out in incrop region and it is extensively developed also. Two section of workings have been done in major part of the area.

II Top Seam: This seam has been mainly worked by opencast method. Underground development is restricted to South Tisra colliery only.

II Bot Seam: This seam is developed by UG method in major part of the area and quarried also in incrop region. The seam is virgin in dip side.

I Seam: This seam is developed only by underground method. In the northern side, the seam is goaved in incrop side. The seam is quarried also in small part.

2.3.1 OB dumps and their status

Table 2.3 OB Dump Status

	External OB Dump	Internal OB Dump
Nos.	Nil	4 (D1, D2, D3,D4)
Area (Ha)	Nil	(D1=31.9, D2=65.4, D3=7.15,D4=11) Total=115.45
Volume (capacity)	Nil	35 million Cum
Height (m)	----	D1=50, D2=70, D3=40,D4=50
Status	----	Active- D1, D2, D4 Dormant-D3

2.3.2 Depth of Workings & Mine Entries

At present all working seams occur at depth of 102 m in the quarry. All the underground mine entries except for the Incline of NT UG in the leasehold area are sealed or dozed off.

The details of existing outlets of North Tisra UG are as follows :

Name of the Outlet	Sunk in	X-sec. (mXm)	Purpose	winder/ Fan
1/6 Incline	IV Bot.	3.5X2	Intake, production	Haulage – 115 KW
3/6 Incline	IV Bot.	3.0X2	Intake, travelling	
Fan drift Adjacent to 3/6 Inc.	IV Bot.	4.25X2	Return	Fan- PV-160

2.3.3 Major Equipments

Table 2.4A List of major opencast equipment at NT ST OC

SL. No.	Existing Equipment	Annual Productivity/ Eqpt (MM^3)	No. Of Equip ment	Total annual Capacity (MM^3)
A	EXCAVATION CAPACITY			
1	5.0 m^3 Elect Rope Shovel with RD – 35 T	0.86	07	6.02
2	2.7 m^3 Elect. Hyd Shovel with RD – 35 T	0.65	02	1.3
3	1.3 m^3 Diesel Backhoe with RD – 35 T	0.40	01	0.40
4	1.2 m^3 Diesel Backhoe with RD – 35 T	0.30	01	0.30
5	Dragline 6/45	1.00		1.00
B	TRANSPORTATION CAPACITY (Avg. Lead - 1.00KM)			
1	Rear Dumper 35 Te with 5 m^3 Electric Rope Shovel		28	
2	Rear Dumper 35 Te with 2.7 m^3 Electric Hyd Shovel		06	
3	Rear Dumper 35 Te with 1.3 m^3 Diesel Backhoe		03	
4	Rear Dumper 35 Te with 1.2 m^3 Diesel Backhoe		03	
C	MINE CAPACITY (MM^3/Year)			

Table 2.4B List of major opencast equipment at Jeenagora OC

Sl No	Existing equipment	Bucket capacity (m^3)	No of equipment	Annual capacity Mm^3.
1	EKG - 399	5	1	0.86
2	EKG - 266	4.6	1	0.79
3	EKG - 519	5	1	0.86
4	H-55 (HYD)	3.3	1	0.68
5	TATA Hitachi (HYD)	2.8	1	0.54
	TOTAL	**--**	**5**	**3.73**
DUMPER				
1	35 Te Rear Dumper	--	21	(0.18 x 21)= 3.78
2	Water tanker	--	1	--
	TOTAL		**22**	**3.78**
DRILL				
1	IDM – 30 (160 mm)	--	1	N/A
2	IDM – 70 (250 mm)	--	1	N/A
3	R (Colla) (150 mm)	--	1	N/A
4	ICM – 260 (100 mm)	--	1	N/A
	TOTAL	--	4	N/A
DOZER				
1	155 D	320 HP	3	--
Crain	9 (T)	--	1	--
Motor Grader	Middle Blade	135 HP	1	--

Table 2.4C List of major UG equipment at North Tisra UG

Sl No	Existing equipment	No of equipment
I	**SURFACE**	
1	Haulage 150 HP	1No
2	Ventilation Fan PV -160	1No
II	UNDERGROUND	
1	SDL	3 nos.
2	Endless Haulage 50 H P	1 no.
3	Direct Haulage 75 H P	2 nos.
4	Main Pump 150 H P	2 nos.
5	Pump 70 H P	2 nos.
6	Air Compressor 60 H P	3 nos.
7	T S U (315 KVA)	4 nos.
8	Main Pump 1000 GPM	1 no.

Table 2.4D List of major opencast equipment proposed at NT-ST-Jeenagora Group of Mines(NTST EXPN. OCP)

Sl.No.	Particulars	Peak Population
A.	**HEMM for OB**	
1	10 m^3 Electric Rope Shovel	8
2	5 m^3 Electric Rope Shovel	2
3	250 mm (Elec.) Drill	8
4	160 mm (Elec.) Drill	2
5	410 HP Dozer	8
6	320 HP Dozer	2
7	85 t RD	96
8	35 t RD	26
B	**HEMM for Coal**	
1	3.8-4.2 m^3 Elec. Hyd. Shovel	4
2	2.8 m^3 Elec. Hyd. Backhoe	1
3	160 mm (Elec.) Drill	5
4	320 HP Dozer	6
5	35 t RD	47
C	**Common for HEMM**	
1	280 HP Motor Grader	2
2	50 t Rough Terrain Crane	1
3	10 t Vibratory Roller for Haul Road	2
4	Jack Hammer Drill	10
5	3.96 m^3 / min Compressor	4
D	**HEMM for Misc. Activities &for Ecology & Environment**	
1	1.5 m^3 Diesel Hyd. Backhoe	2
2	8.5 m^3 / 10 t Tipper	8
3	28 KL Water Sprinkler	3
4	Mobile Env. Lab. Van	1
5	410 HP Dozer (for Reclamation)*	4

Infrastructure Facilities:

Existing

A) Magazine – Location, capacity and Licence no.

NT-ST OC has surrendered its license. At present required explosive is procured from the Magazine located in the leasehold area of the Barari Colliery. The specification of the Magazine is given below:

Location – west side of 6 Pit.

Capacity:

E- 25 (6) 962/ BI-1143	E-25 (6) 964/ BI-1145
Explosive class – 3. 1950 Kg.	Explosive Class – 3. 1950 Kg.
Class 6, Div- 1, 10,000 mts.	Class-6, Div I , 5000 mtrs.
Class 6, Div 3 5000 Nos.	Class 6, Div 2 5000 mtrs.
Class 6, Div 44000 Nos.	Class 6 Div 3 44, 000 Nos.
As any one time shall not exceed	At any one time shall not be exceed.
Not more than 10 times shall be in a month.	Not more than 5 times shall be in a month
Area - 6300 m^2	

B) Workshop

Existing:

NT-ST OC

Two workshops (one for NT OCP and other for STOCP) with independent store have been functioning with all required facilities including required manpowers.

Jeenagora OC

The repair and maintenance of excavation equipment are being done at the Jeenagora OCP Excavation Workshop. This workshop has the following facilities:

1. Washing of dumpers.
2. Welding.
3. Charging of batteries.
4. Auto repair shed.

5. Dumper shed.
6. Diesel fuelling shed.

North Tisra UG

There is a Pit Head Workshop. Help is taken for major works from Area Central Workshop. The colliery store is available. We are collecting materials from Lodna Regional Store and preserving the materials at Collieary Store from where the Mine is served.

Proposed:

A workshop has been proposed to render services to routine maintenance, minor as well as capital repair of the equipment envisaged for N.Tisra / S.Tisra (Expansion) OCP. Both Excavation Workshop and E & M Workshop will be for maintenance of departmental equipment. Storage facilities will be provided for storing spares and consumables required for the Project. Mobile crane and fork lift truck have been provided for material handling and transportation

C) Fuelling station:

Existing:

There is a Diesel fuelling shed is available at Jeenagora OC.

Proposed

For fuelling the vehicles, fuelling stations fully equipped with required facilities has been provided. Racking System for stores has been provided for proper placement of consumables.

D) Pumping and Drainage

Existing: The seams encountered in this project are IX/X, VIIIA, VIII, VII, V/VI/VII, V/VI, IV T, IV B, III, II T, II B & I. Most of the seams are developed to varying extent. Presently the quarry operates up to II seam for which 3 nos. of submersible pumps are deployed for dewatering the needs of the quarry. Boreholes for these pumps extend up to 112 M depth in I seam. These three boreholes are located on the dip most side of the present quarry boundary.

North Tisra UG

Underground water from faces and developed area is collected in underground main sump. Coal particles and other solid tiny particles are settled in the main Sump. The fresh water is discharged by main pumps to surface in tank through boreholes.

Details of the pumps are given as follows:

Seam	Pump No.	Details of Pumps			Location Dip/ Level	Delivery through pit/inc./ BH	Discharge at settling tank/Nala/ River
		GPM	Head	KW			
IV Bot.	1	1000	200 m	110	-2 Dip, 35L	BH	Tank
	2	600	150 m	110	M/D, 36L	BH	Tank
	3	600	150 m	110	1Dip, 36L	BH	Tank

- Pumping Hours/day : 16 hrs
- Make of Water in Monsoon : 2000 GPM
- Make of Water in Lean Period : 1400 GPM
- Installed Capacity of main Pumps : 2200 GPM
- Quantity of Water Discharged on Surface :

Jeenagora OC

Present pumping arrangement

Presently 3 Bore holes submersible pumps are in operation with capacity of 500 GPM.

Total 500 x 3 = 1500 GPM.

Period	Installed capacity in GPM	Total Discharge (KLD)	Quantity wise use (KLD)				
			Domestic	Industrial	Other	Sulungajore	Total
Lean	500	1600	70	200	15	1315	1600
Monsoon	1500	4800	70	100	15	4615	4800

NTST OC

- Installed capacity of main pumps discharging water to surface – 1600 GPM.
- Quantity of water being discharged to surface – 1000 GPM.
- Point of discharged of water – Surface
- Use of discharged water.

  Industrial use – 252 KLD.
  Domestic – 200 KLD.

Proposed: Considering the project area, ultimate depth and life of the mine, the pumping capacity has been proposed to cover the entire mining activities under single stage of pumping operation. With the basic considerations as above, make of water has been estimated as 446512 Cum. (98.26 million gallon.) and the pumping requirement for the mine works out as to 21.55 Cum (It includes 30% reserve pumping capacity) up to the end of the project.

Water settling tank / pond (cemented floor) of 0.6 million gallon capacity has been envisaged for this project. This tank will be suitably located between the outside edge of quarry and Tisra river. The pumped out quarry water will be discharged into the proposed settling tank. Dust / contamination will be settled in the pond. Overflow water will be discharged into theTisra Jore.

In a separate fire dealing report titled “Scheme for Dealing with Fire at Lodna Area below DP Rly. Line (XI/XII Seam Base)” a surface water reservoir will be provided near Bararee Colliery site. This water reservoir will act as a reservoir for this project too.

The proposed reservoir receives water from pumping discharge of various collieries of Lodna Area (viz. Joyrampur, Bararee, Bagdigi, Lodna & Jealgora). The water from respective collieries will be guided into the reservoir from where water will be pumped to fire dealing site / faces of the proposed opencast.

E) Proposed Surface Coal Handling

Feeder Breaker

Six (6) nos. of feeder breakers having each of 300 to 350 tph capacity have been proposed for sizing of ROM coal down to (-) 100 mm to handle proposed production. The proposed feeder breaker will be installed near the Railway siding which will be located at SW corner of the proposed opencast mine.

Belt Conveyor

The crushed coal will be carried out by an elevating belt conveyor for a distance of about 100 m.

Loading & Transport arrangements

Loading of coal at surface stock yard into tippers as well as at Railway siding into wagon will also be arranged by BCCL with leased out equipment. This is as per present practices prevailing in BCCL mines. The tippers for transportation of coal from surface coal dump to the site of feeder breaker and to transport sized coal from hopper of the feeder breaker to spread all along the length of the proposed Railway siding will be arranged and organised by BCCL management with leased out equipment.

Railway Siding

There will be two nos. of conventional Railway siding of full length for accommodating two nos. of full rake capacity (each of 58 box wagons) proposed for this OCP. The loop take up arrangement for this siding will be such that there will be single entry at one end and single exist point at other end drawn from Patherdih Rakhitpur main line.

F) Power Supply Arrangement

Existing:

At present North Tisra , South Tisra and Jeenagora colliery receive power at 11 kV from Goluckdih 33 kV sub-station of BCCL. For power supply to these three collieries , three Nos. of 11 kV feeders viz. North Tisra , South Tisra and Jeenagora feeders emanate from one 7.5 MVA 33 / 11 kV transformer installed at Goluckdih sub-station .

The existing electrical load on these three feeders is as follows

a) North Tisra Feeder

Feeding Sub-stn.	Installed Transformers	Power consumers
Chhat Talab	2500 kVA 11/3.3 kV	North Tisra u/g (6 Incl.)
No.6 sub-stn.	2 MVA 11/3.3 kV 500 kVA 11/.55 kV 500 kVA 11/.44 kV	North Tisra OCP
Borehole sub-stn.	500 kVA 11/.55 kV	Submersible pumps
LUJ sub-stn.	500 kVA 11/.55 kV	LUJ pit colliery
No.6 Feeder Breaker	2 x 500 kVA 11/.55 kV	No.6 Feeder Breakers

b) South Tisra Feeder

Feeding Sub-stn.	Installed Transformers	Power consumers
G.J sub-stn.	3150 kVA 11/6.6 kV 630 kVA 6.6/.44 kV	South Tisra OCP - Dragline - Drill
South Tisra sub-stn.	2 MVA 11/3.3 kV 500 kVA 11/.55 kV 250 kVA .55/.44 kV	South Tisra OCP

c) Jeenagora Feeder

Feeding Sub-stn.	Installed Transformers	Power consumers
B.J. sub-stn.	250 kVA 11/.44 kV 300 kVA 11/.55 kV	Light Submersible pump
No.9 Feeder Breaker	1000 kVA 11/.55 kV	No.9 Feeder Breakers
K.T. sub-stn.	1000 kVA 11/3.3 kV 500 kVA 11/.55 kV 250 kVA 11/.44 kV	Jeenagora OCP Submersible pumps Light
E.B. sub-stn.	1000 kVA 11/.55 kV 300 kVA .55/.44 kV	Submersible pumps Light

Existing NTST OCP receives power at 3.3 kV by two Nos. of overhead lines which run along the periphery of the quarry to feed quarry bed power consuming units. From the Golden Jeenagora sub-station two Nos. of 6.6 kV overhead lines run to the quarry bed to feed power to one Dragline and one Drill at 6.6 kV.

Jeenagora OCP receives power at 3.3 kV by two Nos. of overhead lines coming from K.T. sub-station and running along the periphery of the quarry.

No. 6 Incline and LUJ pit colliery receive power at 11 kV from North Tisra Feede

In the proposed scheme Existing North Tisra, South Tisra and Jeenagora Opencast mines will continue to work for about four years. Thereafter, they will be merged and expanded to one single project viz. North Tisra / South Tisra (Expansion) OCP. Existing underground mines viz. N.Tisra 6 Incline will also be closed in due course. LUJ Pit of N.Tisra is already closed. Till then the existing power supply system of these mines will continue.

The following existing substations being used for No.6 Incline , LUJ pit colliery, and North Tisra , South Tisra and Jeenagora Opencast mines are proposed to continue till the new expanded Opencast project comes :

Sub-station	Being used for
No.6 sub-station	North Tisra OCP & No.6 Incline
LUJ pit sub-station	LUJ pit underground colliery
South Tisra sub-station	South Tisra OCP
Golden Jeenagora sub-station	South Tisra OCP
K.T. sub-station	Jeenagora OCP

After merger of the two OCPs, these sub-stations will be removed along with their overhead line feeders.

At present one No. 7.5 MVA 33 / 11 kV transformer installed at Goluckdih 33 kV sub-station feeds power to different collieries of North Tisra , South Tisra and Jeenagora area . In the proposed scheme , to meet the increased power demand of the Noirth Tisra / South Tisra (Expansion) OCP (Approximately 3 MVA over existing load) , the installed transformer capacity of Goluckdih 33 kV sub-station is required to be strengthened. One more 7.5MVA 33 / 11 kV transformer is proposed to be installed at Goluckdih 33 kV sub-station for this purpose . Thus , two Nos. of 7.5 MVA 33 / 11 kV transformers installed at Goluckdih 33 / 11 kV sub-station shall be used to meet the power demand of the new North Tisra / South Tisra (Expansion) OCP. From each of these two transformers three Nos. of 11 kV feeders will emerge for North Tisra / South Tisra (Expansion) OCP. Other existing power consuming units connected to the existing 7.5 MVA transformer shall continue to receive power from this transformer in addition.

Proposed:

Following sub-stations are proposed to be installed for North Tisra / South Tisra (Expansion) OCP for its various power consuming units :

Quarry sub-station – I : For HEMMs and pumps in the quarry
Quarry sub-station – II : For HEMMs and pumps in the quarry
Feeder Breaker sub-station – I : For 3 Nos. of Feeder Breakers
Feeder Breaker sub-station – II : For 3 Nos. of Feeder Breakers
Workshop sub-station : For HEMM and E&M workshop
Office building sub-station : For office building and other infrastructures

Two Nos. of 11 kV sub-stations viz. Quarry Sub-station-I and Quarry Sub-station-II will be installed near two nos. of entries of the quarry. These two sub-stations shall receive power at 11 kV by two nos. of separate Overhead Line feeders from Goluckdih sub-station. All the quarry power consuming units shall be fed power from these two substations.

Two more 11 kV Feeders will emanate from Goluckdih sub-station and shall run along the quarry periphery to the proposed location of Feeder breakers and workshop. They will feed power to the Feeder Breaker Sub-station-I, Feeder Breaker Sub-station-II and Workshop at 11 kV.

ii) Quarry Power Supply :

Installed transformer capacity of Quarry Sub-station-I and Quarry Sub-station-II will be as follows :

2 MVA 11 / 6.6 kV Transformer - 2 Nos.
2 MVA 11 / 3.3 kV Transformer - 1 No.
250 kVA 11 / 0.415 kV Transformer - 1 No.

a) Power Supply to HEMMs :

From the proposed Quarry sub-station I and II, 6.6 kV and 3.3 kV overhead lines will run along the periphery of the quarry for power supply to HEMMs and other quarry power consuming units in the quarry bed.

G) Telecommunication

EPABX system with 200 lines is proposed to be installed for the project with telephone sets in the office building, other infrastructural building and at all other strategic points. RAX sets of BCCL network shall also be provided at all strategic points.

H) Existing Infrastructural facilities available (Road, water supply etc.) :

NT-ST OC

Non metal Road is available from the mine area to nearest DB Road (Lodna and Jharia) leading to Dhanbad - Sindri. The water supply to residential areas is only through borehole pumps. Mine water is used for industrial purposes like sprinkling in the road as well as for washing of HEMM.

Jeenagora OC

Pucca Road has been provided from mine area to the nearest Bhaga – Jeenagora D.B. Road, which connects office & work shop to area office and dispensary.

North Tisra UG

D.B.Road - Jharia-Lodna DB road passes through the middle of the property**.**

Company's Road. – Network of kuchcha/pucca colliery roads exist in the leasehold of the Mine.

Water supply – Drinking water is supplied from MADA (200 KLD) through pipe network. For other miscellaneous domestic work mine water is supplied (350 KLD).

I) Existing effluent treatment plant & sewage treatment plant (Mine & Colony) with quantity per month:

There is no such plant available in the Mine. However, domestic effluent is disposed off in soak pit and solid waste is dumped off in abandoned quarry.

J) Location of Hospital, School, habitation and their distance from the mine:

NT-ST OC

Location	Distance from OCP
Hospital Near Colliery OCP workshop	1.0 KM
School Near project office	1.0 KM
Habitation within lease hold area	1.2 to 3.0KM

Jeenagora OC

1. One Dispensary with duly qualified Doctor, Paramedical staff and other staff has been functioning inside the mine for the treatment of employees.
2. Well equipped Regional Hospital is available for the whole Lodna Area.
3. Primary Schools situated within half kilometres and High School with in 5 KM. Sulunga Basti is situated within 1 KM.

North Tisra UG

Sl. No.	Name of Feature	Location	Distance (Km.)
1.	Middle School	Madhuban, Lodna Section	2
2.	Colliery Hospital	MOCP Colony	1
3.	Regional Hospital,	Lodna	7
4.	Central Hospital	Dhanbad	16
5	Residential Buildings along DB Road, Tilabani Basti, Madhuban Lodna Area, Depo Dhowra.	Within leasehold area of the Mine.	

2.5. Details of coal beneficiation plant and its use after closure of mine

There are no coal beneficiation arrangements in the leasehold area.

CHAPTER – III

CLOSURE PLAN AND RELATED ACTIVITIES

3.1 Closure Planning details of mine

The progressive mine closure activities will continue as envisaged in the project report and as enumerated in the various approvals, permits, consents etc. It is very difficult to predict the various parameters which would be prevalent at the time of final mine closure and also to foresee the likely impacts due to closure of the mining activities (when the entire reserve in the block would get exhausted). However, broad mine closure activities need to be identified under the various heads.

The mines falling in the NTST-Jeenagora Group are covered in Cluster IX for the purpose of EMP.

3.1.1 Mined out land & proposed final land use

After completion of mining activities, the quarried area shall be reclaimed by developing ponds, water bodies and plantation, which will not only improve the aesthetic value of the area but also be used for some productive purpose like pisciculture and water supply to the local communities. Formation of water bodies which develops aquatic life and with the plantation around it will lead to restoration of ecology of the area.

At present opencast mine is being worked in IVT, IVB, III, IIT, IIB and I seams, which along with other seams(upto X Seam) have balance extractable reserve of about 145.08 MT.

The proposed conceptual post-mining land use plan vis-à-vis present land use is provided in Para 1.10.

a. Total Mined out area (Ha) – Present + Proposed----568.38 Ha
b. Backfilled area (Ha)---------- 403.93 Ha.

c. Balance left mined out area (Ha) which will not be backfilled--164.59 Ha.
d. The balanced left mined out area will be developed into ponds which will be used for Pisciculture & water supply to the local villagers.

As regards, the underground void, if any, which will remain at the time of closure of the mine, the same will get gradually filled with water. The necessary precautions for the safety of the neighboring mine would be taken care of before deciding the voids to get water filled. Further, the water filled in UG voids will help in maintaining the water level in the nearby area. The Pit/Shaft will be covered with RCC structure with suitable opening for future inspection by competent person.

3.2 Water quality management

3.2.1 Drainage pattern of the area (pre and post closure)

3.2.1.1 Existing drainage pattern

The area has an undulating topography with a gentle slope towards west. The maximum elevation of 202m has been observed in the North-eastern part while the minimum elevation is 163m in the south-western part. The drainage of the area is control by the southerly flowing Tisra Jore on the west.

3.2.1.2 Post closure drainage pattern

Major area of the mine will be quarried out. Kuccha garland drain will be made around the periphery of the quarry. This garland drain will be connected to Tisra Jore which is not likely to be disturbed by mining operation. Thus, this garland drain will drain off the rain water away from the mine. Various measures to prevent water pollution will be taken.

3.2.2 Water Quality Status of Surface and Ground Water

3.2.2.1 Present Practice

The samples were analyzed for relevant physical, chemical and bacteriological parameters for drawing up the base line data.

All the basic precautions and care were taken during the sampling to avoid contamination. Analysis of the samples was carried out as per established standard method and a procedure prescribed by the relevant IS codes and standard methods (AAPHA).

Standards followed

Standard for mine water - GSR-742(E):2000
Standard for surface water - IS 2296:1982
Standard for drinking water - IS 10500:1991

3.2.2.2 Present status of water quality

The monitoring of water quality under Baseline Environment Data Generation for Cluster IX has been conducted by CIMFR, Dhanbad by collecting water samples from ground water, surface water and mine water discharge / workshop discharge (if any) for the proposed project. The various purposes of the water environment monitoring are as follows:

- To assess the water quality characteristics for critical parameters;
- To evaluate the impacts on agricultural productivity, habitat conditions, creational resources and aesthetics in the vicinity ; and
- To facilitate predication of impact on water quality by project activities

The results as per CIMFR, Dhanbad Report are given subsequently.

To assess the quality of lotic system (surface water), water samples were collected from the following locations (Refer to CIMFR, Dhanbad Report):

Table 3.1: Sampling Locations for Water Quality Monitoring in Cluster –-IX

S.N.	Sample	Sample Code	Description	Sampling Site	Remark
1.	Surface Water	SW-1	Kashi Jore	Bararee	Core Zone
2.		SW-2	Kari Jore	Burragarh	Buffer Zone
3.		SW-3	Pond water	Hurriladih	Buffer Zone
4.	Drinking Water	GW-1	Groundwater	Lodna	Core Zone
5.		GW-2	Groundwater	Joyrampur	Core Zone
6.		GW-3	Groundwater	Sudamdih	Buffer Zone
7.	Effluent water	EW-1	Mine water	Jeenagora	Core Zone
8.		EW-2	Mine water	Hurriladih	Buffer Zone

The physico-chemical characteristics of surface water samples collected from three different locations in Cluster IX have been presented in Table 3.2.

Table 3.2: Physico-chemical characteristics of surface water in Cluster-IX Mining Area

S.N.	Parameter and Unit	SW-1	SW-2	SW-3	IS:2296
1.	Odour	Unobjectionable	Unobjectionable	Unobjectionable	--
2.	Colour (True) (Hazen unit)	5.43	4.13	7.43	300
3.	pH (max) (min : 6.5)	7.9	7.5	7.4	8.5
4.	Conductivity (25^{o}C) µS/cm	1275	1262	623	--
5.	DO (mg/L) (minimum)	4.7	5.2	6.3	4
6.	BOD (3d, 27oC) (mg/L)	8.65	9.69	8.45	3
7.	Total Coliforms (MPN/100 mL)	312	232	423	5000
8.	Total Dissolved Solids (mg/L)	992	926	446	1500
9.	Oil and Grease (mg/L)	0.064	0.050	0.032	0.1
10.	Mineral oil (mg/L)	-	-	-	--
11.	Total Hardness (mg/L as $CaCO_3$)	562	368	156	--
12.	Chlorides (mg/L as Cl)	58.7	113.8	47.7	600
13.	Sulfates (mg/L as SO_4)	304.5	152.1	55.6	400

S.N.	Parameter and Unit	SW-1	SW-2	SW-3	IS:2296
14.	Nitrates (mg/L as NO_3)	29.3	19.2	2.52	50
15.	Free CO_2 (mg/L)	1.23	1.18	1.34	--
16.	Free NH_3 (mg/L as N)	0.14	0.45	1.12	--
17.	Fluorides (mg/L as F)	1.05	1.14	1.32	1.5
18.	Calcium (mg/L)	87.8	68.54	23.05	--
19.	Magnesium (mg/L)	83.3	47.85	23.82	--
20.	Copper (mg/L)	0.040	0.035	0.022	1.5
21.	Iron (mg/L)	0.167	0.134	0.054	50
22.	Manganese (mg/L)	0.045	0.054	0.026	--
23.	Zinc (mg/L)	0.076	0.078	0.067	15
24.	Boron (mg/L as B)	0.098	0.115	0.075	--
25.	Barium (mg/L)	0.086	0.096	0.074	--
26.	Silver (mg/L)	BDL	BDL	BDL	--
27.	Arsenic Total (mg/L)	0.016	0.012	BDL	0.2
28.	Mercury (mg/L)	BDL	BDL	BDL	--
29.	Lead (mg/L)	0.017	0.021	0.023	0.1
30.	Cadmium (mg/L)	BDL	BDL	0.006	0.01
31.	Chromium (VI) (mg/L)	0.036	0.043	0.033	0.05
32.	Selenium (mg/L)	BDL	BDL	BDL	0.05
33.	Cyanide (mg/L)	0.020	0.015	0.012	0.05
34.	Phenols (mg/L)	BDL	BDL	BDL	0.005
35.	Anionic detergents (mg/L as MBAS)	ND	ND	ND	1
36.	PAH (mg/L)	ND	ND	ND	--
37.	Pesticides (ug/L)	Absent	Absent	Absent	--
38.	Percent Sodium (%)	22.4%	43.7%	51.2%	--
39.	Sodium Absorption Ratio (SAR)	1.08	2.34	2.25	--

ND=Not Detected, BDL: Below detection limit

The analytical results of physico-chemical analysis of surface water samples collected from Kashi and Kari jores (stream) near Bararee and Burragar and ponds water near Hurriladih has been given in **Table 3.2**. To assess the quality of the surface water resource the results has been compared with the prescribed surface water standards IS-2296 for Class 'C' water (tolerance limit for stream water used drinking water sources with conventional treatment followed by disinfection). It can be seen that pH of the water is slightly alkaline in nature and found well within the prescribed limit of 8.5. In general the total dissolved solids and other analysed

parameters are found well within the threshold values. Concentration of sulphate varies between 55.6 and 304.5 mg L^{-1} and is below the prescribed value of 400 mg L^{-1} (IS-2296). The concentrations of the analysed heavy metals in the surface water resource are also found within the prescribed limits. It shows that the surface water of the area is fit for its designated use as a drinking water source with conventional treatment followed by disinfection.

The physico-chemical characteristics of ground water samples collected from three different locations in Cluster IX have been presented in Table 3.3.

Table 3.3: Physico-chemical characteristics of groundwater in Cluster-IX Mining Area

S.N.	*Parameters*	Station Code			IS: 10500
		W-1 (Lodna)	W-2 (JoyRampur)	W-3 (Sudamdih)	
1.	Colour, Hazen units	Colorless	Colorless	Colorless	Un-objectionable
2.	Odour	Un-objectionable	Un-objectionable	Un-objectionable	Un-objectionable
3.	Taste	Agreeable	Agreeable	Agreeable	Agreeable
4.	Turbidity NTU Max	0.76	1.23	2.13	10
5.	Dissolved Solids mg/l, Max	1186	828	399	500
6.	pH Value	7.6	8.1	7.48	6. 5 to 8. 5
7.	Total hardness (as $CaCO_3$) mg/l, Max	749	553	213	300
8.	Calcium (as Ca) mg/l, Max	112.9	95.5	66.2	75
9.	Magnesium (as Mg) mg/l, Max	113.6	76.4	11.5	75
10.	Copper (as Cu) mg/l, Max	0.030	0.031	0.015	0.05
11.	Iron (as Fe) mg/l, Max	0.112	0.106	0.065	0.3
12.	Manganese (as Mn) mg/l, Max	0.054	0.038	0.164	0.1
13.	Chlorides (as Cl) mg/l, Max	63.1	17.7	84.5	250
14.	Sulphate (as SO_4) mg/l, Max	414	365	16.2	150
15.	Nitrate (as NO_3)	16.7	5.3	23.61	45
16.	Fluoride (as F) mg/l)	1.32	0.96	0.30	0.6 to 1. 2
17.	Phenolic Compounds (as C_6H_5OH) mg/l, Max	BDL	BDL	BDL	0.001
18.	Mercury (as Hg) mg/l, Max	BDL	BDL	BDL	0.001
19.	Cadmium (as Cd) mg/l, Max	0.010	0.013	0.009	0.01
20.	Selenium(as Se mg/l, Max	BDL	BDL	BDL	0.01
21.	Arsenic (as As) mg/l, Max	0.012	0.019	0.008	0.05

S.N.	*Parameters*	Station Code			IS: 10500
		W-1 (Lodna)	W-2 (JoyRampur)	W-3 (Sudamdih)	
22.	Cyanide (as Cn) mg/l, Max	BDL	BDL	BDL	0.05
23.	Lead (As Pb) mg/l, Max	0.039	0.028	0.015	0.1
24.	Zinc (as Zn) mg/l, Max	0.065	0.059	0.063	5
25.	Arionic detergents (as MBAS), mg/l, Max	0.064	0.055	0.037	0.2
26.	Chromium (as Cr^{6++}) mg/l, Max	0.040	0.038	0.044	0.05
27.	Polynuclear aromatic hydrocarbon (PAH) mg/l, Max	ND	ND	ND	
28.	Mineral Oil mg/l, Max	BDL	BDL	BDL	0.01
29.	Residual, free chlorine, mg/l, Min	0.14	0.12	0.016	0.2
30.	Pesticides	Absent	Absent	Absent	Absent
31.	Radioactive materials a) Alpha emitters uc/ml, Max b) Beta emitters uc/ml, Max	ND	ND	ND	10^{-8} 10^{-7}

ND=Not Detected, BDL: Below detection limit

To assess the status of drinking water quality of IX area, three ground water samples were collected from hand pump at Lodna, Joyrampur and Sudamdih in May 2011 and analysed for parameters as per the drinking water standards (BSI 1993). The hydro-chemical parameters of the groundwater of the study area were compared with the prescribed limit of Indian Standard for drinking water (BIS 1991) to asses the suitability for drinking and public health purposes (**Table 3.3**). The analytical results show that most of the analysed parameters are well within desirable limits and water is potable for drinking uses. pH of the analysed groundwater are found well within the safe limit of 6.5 - 8.5, prescribed for drinking water by BIS (1991). The turbidity is one of the important physical parameters for water quality defining the presence of suspended solids in water which causes the muddy or turbid appearance of water body. The consumption of high turbid water may cause a health risk as excessive turbidity can protect pathogenic microorganisms from effects of disinfectants and also stimulate the growth of bacteria during storage. In the study area the turbidity in the groundwater are found below the recommended value of 5 NTU. The total dissolved solid (TDS) and Total Hardness (TH) exceed the desirable limit of 500 mg L^{-1} and 300 mg L^{-1} in the groundwater samples of Lodna and Joyrampur but below the desirable limit in the groundwater samples of Sudamdih. However, TDS is well within

the maximum permissible limit of 1000 mg L^{-1} in Joyrampur groundwater. Concentration of Ca, Mg, SO_4 and F are also slightly exceeding the desirable limit in the groundwater of Lodna area though it is below the maximum permissible limit of IS-10500. The other analysed parameters like Cl, NO_3, Na etc. were found below the desirable level.

Heavy metal analysis in the groundwater samples indicated that all the analyzed heavy metals like As, Cd, Cr, Pb, Zn, Mn and Fe are found either below the detection limit or less than the desirable limit for drinking water.

The physico-chemical characteristics of effluent water samples collected from three different locations in Cluster IX have been presented in Table 3.4.

Table 3.4: Physico-chemical characteristics of effluent (mine water) in Cluster-IX Mining Area

S.N.	Parameter	EW-1 (Jeenagora)	EW-2 (Hurriladih)	Inland Surface water IS:2490
1.	Colour and odour	Colorless	Colorless	Of Annexure-1
2.	Suspended solids mg/l, max.	39.8	54.8	100
3.	pH value	7.7	8.3	5.5 to 9.0
4.	Temperature (^{0}C)	26.4	25.8	Shall not exceed 5ºC above the receiving water temperature
5.	Total Dissolved Solids mg/l	502	711	2100
6.	Oil and grease, mg/l max.	2.87	2.65	10
7.	Total residual chlorine, mg/l max.	0.28	0.19	1.0
8.	Ammonical nitrogen (as N), mg/l max.	6.76	5.87	50
9.	Total nitrogen (as N), mg/l max.	8.56	9.24	100
10.	Free ammonia (as NH_3), mg/l max.	4.23	5.34	5.0
11.	Biochemical oxygen demand, BOD (3 days at 27ºC), mg/l max.	5.67	5.54	30
12.	Chemical oxygen demand, mg/l max.	67.8	75.3	250
13.	Arsenic (as As), mg/l max.	0.012	0.027	0.2
14.	Mercury (as Hg), mg/l max.	0.008	0.012	0.01
15.	Lead (as Pb), mg/l max.	0.034	0.043	0.1
16.	Cadmium (as Cd), mg/l max.	0.012	0.015	2.0
17.	Hexavalent chromium (as Cr^{+6}), mg/l max.	0.037	0.030	0.1
18.	Total Chromium (as Cr), mg/l max.	0.065	0.068	2.0
19.	Copper (as Cu), mg/l max.	0.032	0.029	3.0
20.	Zinc (as Zn), mg/l max.	0.098	0.088	5.0
21.	Selenium (as Se), mg/l max.	0.009	0.012	0.05

S.N.	Parameter	EW-1 (Jeenagora)	EW-2 (Hurriladih)	Inland Surface water IS:2490
22.	Nickel (as Ni), mg/l max.	0.025	0.031	3.0
23.	Cyanide (as CN), mg/l max.	0.009	0.012	0.2
24.	Fluoride (as F), mg/l max.	1.67	0.97	2.0
25.	Dissolved phosphates (as P), mg/l max.	0.67	0.54	5.0
26.	Sulphide (as S), mg/l max.	0.95	0.76	2.0
27.	Phenolic compounds (as C_6H_5OH), mg/l max.	0.072	0.054	1.0
28.	Radioactive materials a. α emitters micro cure, mg/l max. b. β emitters micro cure, mg/l max.	ND	ND	 10^{-7} 10^{-6}
29.	Manganese (as Mn)	0.097	0.070	2 mg/l
30.	Iron (as Fe)	0.314	0.348	3 mg/l
31.	Vanadium (as V)	0.116	0.122	0.2 mg/l
32.	Nitrate Nitrogen	93.05	39.78	10 mg/l

ND=Not Detected, BDL: Below detection limit

Mine water samples discharged from Jeenagora and Hurladih underground mine were collected to assess the effluent water quality. The analytical results were compared with the inland surface water quality standard as per the IS-2490 and presented in **Table 3.4**. The mine water of the area is found to be alkaline in nature and measured pH was well within the prescribed limit of 5.5 to 9.0 as per IS:2490. Total Dissolved Solid Concentration in the discharged mine water were also found much below the recommended limit of 2100 mg L^{-1} for inland surface water as per IS:2490. The suspended sediment are found 39.8 and 54.8 mg L^{-1} respectively in the mine water of Jeenagora and Hurriladih which is less than the permissible limit of 100 mg L^{-1}. Concentration of heavy metals in the mine water of the area are also to be found within the permissible limit as per IS:2490.

3.2.2.3 Practice after the closure

The above practice of monitoring of quality of water would be continued for a period of 3 years after cessation of mining activities in the area. If required, corrective action/steps would be taken to mitigate any adverse effect on local water regime. The responsibility of maintaining the quality of drinking water will be entrusted on the State Authorities after 3 years of mine closure.

3.2.3 Measures for Control of Pollution (Details for Pollution Control Arrangement)

3.2.3.1 Impact due to Water Pollution and its Management

The mine discharge water may contain high-suspended solids and other pollutants. The treatment scheme thus needs to focus on the removal of suspended solids from the water. Mine water must be treated to meet the prescribed standards before being discharged into water bodies. When the water is used for agricultural or domestic work, it shall undergo further treatment, as established by Scientific Studies conducted in this regard. The important factors to be considered in selecting the appropriate method for treatment are as follows:

(a) Settling tank will be provided to collect the mine discharged water for settling the suspended solids.

(b) The flow and the quality of mine water vary seasonally. Therefore settling tank should be so constructed that it will be able to absorb these fluctuations.

(c) The mine water must be neutral in nature before discharge and therefore necessary neutraliser may be provided to maintain the pH of the settling pond water.

(d) In order to reduce the dependence on fresh water sources for meeting the demands of water in the mining related operations, the entire mining water will be utilised. The effluent free mine water will be utilised in water spraying for dust suppression, hydraulic stowing, equipment washing and other industrial requirements.

(e) Mine water discharge and drainage in the core zone has been planned to be regulated in a manner so that impact on surface and other water bodies of the area is not affected. No major diversion of surface drainage channel is required. Expected increase of solids particles due to surface handling of coal shall be controlled by:

i. Construction of garland drains around the OB dump & coal stock area

ii. Construction of settling tanks of adequate size for removal of particulate matters

iii. De-silting of settling ponds and drains at regular intervals

iv. Effluents from washing areas, garage and workshop will be collected in garlands and routed through a settling ponds and oil and grease trap. The solid wastes generated shall be treated as per the provisions of Hazardous Waste Management Act. The water shall be recirculated for washing.

3.2.4 Water Balance of the area

Hydrogeology and Aquifer characteristics of the area

Groundwater occurrence and storage in study area are mainly controlled by the geological setup of the area. The ability of geological formation to store and transmit water is dependent on its formation parameters, such as porosity and hydraulic conductivity. Based on these two parameters, the rock formation of the area may be classified as hard and soft rocks. Hard rocks (mainly crystalline and consolidated sedimentary rocks) are characterized by very little porosity. Ground water in such rocks circulated to a limited extent through the secondary openings represented by joints, cracks, fissures and such other planes of discontinuity. Soft rocks represented by sandstone, pebbles and loose sand, posses higher degree of primary porosity and as such characterized by higher water storage capacity. As greater part of the study area is underlain by Precambrian crystalline rocks, the weathered residual of the hard rocks as well as the fractures, joints, fissures, faults and other zones of discontinuity are the principle repositories of ground water in the area. The weathered zone is usually of limited thickness, fractures and joints generally close up with depth. The thickness of weathered mantle in the hard rock zone of area is about 10-20 meter in the topographic lows. Ground water in the weathered and fracture zones of hard rocks occur under unconfined condition. Ground water circulating through fracture zone is sometimes held under pressure. Depth of the water table in the hard rock of the area generally ranges from 3.0m to 15.0m below ground level.

The Gondwana sediments form the semi-consolidated formations and are better water potential zone. The splintery shales of Talchir and basal pebbles bed, the variegated Barren Measure shales and the sandstones are the major litho units of the Gondwana Formations. Gondwana sandstones in general, are known to constitute good aquifers at many places. Ground water occurs under unconfined condition in the weathered mantles varying depths from 4.23 – 12.34m as observed in the dugwells and semi-confined condition in the deeper aquifers. Depth of water level for pre-monsoon period varies from 5–12m below ground level and it stretches to a deeper depth of 7-12m in some places. The pre-monsoon water level rises due to recharge and becomes 2 - 8 m below ground level around the area during post-monsoon period.

Rainfall is the principal recharge source to groundwater. The area experiences an average annual rainfall of about 1200-1400 mm. Besides rainfall, the mine water discharge from the local mining areas and existing water bodies including water logged in abundant mine quarries are also contributed to the ground water recharge as return flow. In the study area, ground water is withdrawn usually by means of open dug wells and small diameter hand operated tube wells for domestic and irrigation purposes. The tube wells are most often deeper (25m – 58m) than the dug wells and tap the aquifer below the weathered mantle. As the area is being located in the hot-tropical belt, the temperature regime is very high; the daily maximum reaches to over 45^0C in summer. Due to excessive heat, the loss of moisture through evaporation is considerably high (60-65%). During the wet monsoon seasons, the net evaporation is less than the precipitation, resulting in surplus water which loss through either surface runoff or being part of the subsurface storage. The surface run-off and sub-surface storage of water depends upon various factors including the amount of rainfall, topography of the area, land use pattern, soil type, slope, physiographic, drainage pattern and hydro-geomorphology of the catchment/ sub-catchment. The study area is having gentle slope towards south and south east. Water received on the slopes, gets collected in low-lying area and is thus ultimately absorbed in the top soil cover and become part of the ground water flow according to the slope to form seasonal streams/nallas.

In the mining area, the water levels are bound to be affected and disturbed. The mining area of JCF area is highly disturbed and the permeability of individual geological units is spatially variable and depends on lithology, fracturing and attenuation with depth. The porous and more open-jointed sandstone members tend to form aquifers, the shaly members are aquitards, which may be leaky but are poorly permeable & form poor permeable barriers to the vertical groundwater movement.

Water quality monitoring will be done for three years after closure. The sampling stations shall be one number mine water with quarterly frequency and two numbers ground water samples in core and buffer zone with quarterly frequency.

3.2.5 Acid Mine Drainage Source

Not Applicable

3.2.6 Water Management

3.2.6.1 Existing mine water discharge details

a. Mine water is pumped out in a settling tank. Clean water coming out from the settling tank is used for dust suppression, stowing and other Industrial uses.
b. Excess pumped out mine water is allowed to flow into the surface water bodies.
c. Drains are provided around the coal stock to collect run-off for diverting into settling pond before discharge into the natural water courses.

Present pumping arrangement in opencast mine:

- Make of water:
  Monsoon: 8M Gallons/day
  Lean period: 1 M Gallons/ day.
- Installed capacity of main pumps discharging water to surface.: 1600 GPM
- Pumping hours/day : 18 hrs.

Pumps Installed for Dewatering and Domestic supply:

Type of Pumps	Total Nos.	Capacity (GPM)
Submersible Pump	1	1000
Pontoon Pump	2	300

3.2.7. Post closure Mine water discharge

Once the reserve is exhausted, the entries into the mine would be securely sealed for safety purposes. However, if for the safety of the future mine or any neighboring mine, pumping is required from the worked seams, then the arrangements for pumping will be kept intact and the water shall be discharged into the surface water bodies after passing the same through settling tank on the surface. The accumulated water in underground workings may be utilized to meet water shortage in nearby areas.

3.3 Air quality management

3.3.1 Present practice

a. At present air borne dust is suppressed by:

- Sprinkling water on the various roads of the mine where the vehicles ply.
- Water sprinkling at the various points where coal is handled.
- Proper loading of trucks to avoid any spillage of coal.
- Proper maintenance of I.C. engines.

The monitoring of air quality under Baseline Environment Data Generation for Cluster IX has been conducted CIMFR, Dhanbad and test results of air samples are furnished in Table 3.6A and 3.6B.

Table 3.5: Details of Sampling Locations

Stn. Code	Location	Source of Air Pollution
CORE ZONE		
CA_1	North Tisra	Mining and transportation of coal, domestic works and poor condition of road, heavy vehicular movement.
CA_2	Jeenagora	Domestic, background pollutants due to agricultural, domestic works and mining and transportation activities in buffer zone.
CA_3	Barari	Mining and transportation of coal, domestic works and poor condition of road, vehicular movement
CA_4	Lodna	Household Coal burning and poor condition of road and heavy vehicular movement, etc.

Stn. Code	Location	Source of Air Pollution
BUFFER ZONE		
BA_1	Golakdih	Mining and transportation of coal, coal burning and poor condition of road, heavy vehicular movement.
BA_2	Simlabahal	Mining and transportation of coal, domestic works and poor condition of road, heavy vehicular movement
BA_3	Patherdih	Mining and transportation of coal, domestic works and poor condition of road.
BA_4	Bhaga Mining Institute	Mining and transportation of coal, domestic works and poor condition of road, vehicular movement.

Table 3.6A: Ambient Air Quality in Cluster-IX Mine Area

Core Zone – North Tisra (CA_1)

(Pre-monsoon Season: April 2011 to June 2011)

Period			Parameters (µg/m^3)			
Month	**Weeks**	**Date**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**NO_x**
2011-April	*1st Week*	6/4/2011	57.9	111.4	30.3	55.7
		8/4/2011	58.4	106.2	31.9	55.4
	2nd Week	11/4/2011	51.8	89.3	30.9	52.9
		13/04/2011	61.2	111.3	23.9	50.6
	3rd Week	21/04/2011	47.2	81.4	33.8	47.9
		23/04/2011	52.4	90.3	29.8	58.7
	4th Week	28/04/2011	49.2	84.9	31.4	49
		30/04/2011	53.0	91.4	25.2	44.8
2011-May	*1st Week*	4/5/2011	61.7	110.2	32.3	49.7
		6/5/2011	57.0	103.7	27	50.7
	2nd Week	12/5/2011	61.3	105.7	31.9	56.7
		14/05/2011	61.4	113.7	23.9	58.3
	3rd Week	18/05/2011	58.6	104.7	29.2	57.1
		20/05/2011	56.4	100.7	21	47.2
	4th Week	25/05/2011	56.5	97.4	27.1	50.2
		27/05/2011	60.8	112.6	26.6	54.4
2011-June	*1st Week*	5/06/2011	61.4	105.8	28.8	53.6
		7/06/2011	60.9	110.8	28.1	55.3
	2nd Week	11/06/2011	65.8	117.5	30.6	57.2
		13/06/2011	56.6	97.5	26.1	54.4
	3rd Week	19/06/2011	48.5	83.7	21.5	43.1
		22/06/2011	49.7	85.7	21.7	38.4
	4th Week	27/06/2011	50.2	86.5	27.4	38.8
		29/06/2011	52.0	89.6	19.3	42.6

Minimum	**47.2**	**81.4**	**19.3**	**38.4**
Maximum	**65.8**	**117.5**	**33.8**	**58.7**
Average	**56.3**	**99.7**	**27.4**	**50.8**
Std. Deviation	**5.5**	**11.7**	**4.3**	**6.3**
98th Percentile	**63.9**	**115.8**	**33.1**	**58.5**

Table 3.6B: Ambient Air Quality in Cluster-IX Mine Area

Core Zone – Jeenagora (CA_2)

(Pre-monsoon Season: April 2011 to June 2011)

Period			Parameters (µg/m^3)			
Month	**Weeks**	**Date**	**$PM_{2.5}$**	**PM_{10}**	**SO_2**	**NO_x**
2011-April	*1st Week*	6/4/2011	60.8	110.6	28.2	52.1
		8/4/2011	60.6	104.4	27.6	56.3
	2nd Week	11/4/2011	50.8	92.4	26.2	49.2
		13/04/2011	51.5	92	23.6	48.5
	3rd Week	21/04/2011	57.1	98.4	25.9	48.1
		23/04/2011	49.5	85.4	32.4	50.5
	4th Week	28/04/2011	51.3	88.4	36.3	45.3
		30/04/2011	48.9	84.3	28.9	48.3
2011-May	*1st Week*	4/5/2011	53.7	92.5	28.2	47.2
		6/5/2011	55.3	95.4	28.4	47
	2nd Week	11/5/2011	54.5	93.9	29.2	47.5
		13/05/2011	53.9	93	26.3	46.3
	3rd Week	18/05/2011	61.0	105.1	29.1	52.2
		20/05/2011	52.1	89.9	27.2	47.5
	4th Week	25/05/2011	57.6	99.3	32.4	45.3
		27/05/2011	69.1	130.3	35	50.4
2011-June	*1st Week*	6/6/2011	60.8	104.9	36.1	49.6
		8/06/2011	59.5	114.5	35.9	53.1
	2nd Week	11/6/2011	39.7	68.4	27.6	41.7
		13/06/2011	48.3	83.3	30.2	51.5
	3rd Week	20/06/2011	40.8	70.4	22.3	40.1
		22/06/2011	43.3	74.7	25.3	38.2
	4th Week	27/06/2011	50.1	86.3	24.2	32.9
		29/06/2011	48.3	83.3	25.7	37.7
Minimum			**39.7**	**68.4**	**22.3**	**32.9**
Maximum			**69.1**	**130.3**	**36.3**	**56.3**
Average			**53.4**	**93.8**	**28.9**	**46.8**
Std. Deviation			**7.7**	**15.8**	**4.2**	**6.1**
98th Percentile			**65.3**	**123.0**	**36.2**	**54.8**

Table 3.7: National Ambient Air Quality Standards
(As per MoEF Notification on* 16th November, 2009*)

Sl. No.	Pollutant	Time weighted average	Concentration in Ambient Air		
			Industrial, Residential, rural and Other Area	Ecologically Sensitive Area (notified by Central Government)	Methods of Measurement
(1)	(2)	(3)	(4)	(5)	(6)
1	Sulpher Dioxide (SO_2), $\mu g/m^3$	Annual* 24 hours**	50 80	20 80	- Improved West and Gaeke - Ultraviolet fluorescence
2	Nitrogen Dioxide (NO_2), $\mu g/m^3$	Annual* 24 hours**	40 80	30 80	-Modified Jacob & Hochheiser (Na-Arsenite) - Chemiluminescence
3	Particulate Matter (Size less than 10 µm) or PM_{10} $\mu g/m^3$	Annual* 24 hours**	60 100	60 100	-Gravimetric -TOEM - Beta attenuation
4	Particulate Matter (Size less than 2.5 µm) or PM_2 $\mu g/m^3$	Annual* 24 hours**	40 60	40 60	-Gravimetric -TOEM - Beta attenuation
5	Ozone (O_3) $\mu g/m^3$	8 hours* 1 hour**	100 180	100 180	-UV photometric - Chemiluminescence -Chemical Method
6	Lead (Pb) $\mu g/m^3$	Annual* 24 hours**	0.50 1.0	0.50 1.0	-AAS/ICP method after sampling on EPM 2000 or equivalent filter paper - ED-XRF using Teflon filter
7	Carbon Monoxide(CO) mg/m^3	8 hours* 1 hour**	02 04	02 04	-Non Dispersive Infra Red (NDIR)Spectroscopy)
8	Ammonia(NH_3) $\mu g/m^3$	Annual*	100	100	- Chemiluminescence

Sl. No.	Pollutant	Time weighted average	Concentration in Ambient Air		
			Industrial, Residential, rural and Other Area	Ecologically Sensitive Area (notified by Central Government)	Methods of Measurement
		24 hours**	400	400	- Indophenol blue method
9	Benzene(C_6H_6) µg/m^3	Annual*	05	05	- Gas chromatography based continuous analyzer - Adsorption and Desorption followed by GC analysis
10	Benzo(o) Pyrine (BaP)-Particulate phase only, ng/m^3	Annual*	01	01	-Solvent extraction followed by HPLC/GC analysis
11	Arsenic(As), ng/m^3	Annual*	06	06	- AAS/ICP method after sampling on EPM 2000 or equivalent filter paper
12	Nickel(Ni), ng/m^3	Annual*	20	20	- AAS/ICP method after sampling on EPM 2000 or equivalent filter paper

* Annual arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals.

** 24 hourly or 08 hourly or 01 hourly monitored values, as applicable, shall be compiled with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

Note – Whenever and wherever monitoring results on two consecutive days of monitoring exceed the limit specified above for the respective category, it shall be considered adequate reason to institute regular or continuous monitoring and further investigation

3.3.2 Practice after the closure of the mine

a. As the sources of dust and fume generation would no longer be present, the present practice of arresting the air pollution, as enumerated above may be discontinued. However, water sprinkling would be done on the roads, which remain in use after the mine closure.

b. Quality of air would be monitored for a period of 3 years after cessation of mining activity. 3 samples at fortnight frequency for 3 years, one sample in core zone and one sample each in upwind and downwind direction will be collected and analyzed.

3.4 Dump Reclamation

External dump

The external OB dumps shall be formed in suitable lifts of appropriate height keeping an overall slope not exceeding 36^0 from the horizontal. In course of mining and after the completion of the final lift, the external OB dump shall be biologically reclaimed. The dumps shall be afforested by selecting proper plant species in consultation with State Forest Department.

As per new Guidelines for Preparation of Mine Closure Plan GOI (Ministry for Coal) Dated 7th January, 2013 all efforts should be made and reflected (in the Project Report/Mining Plan) to keep land requirement bare minimum for external OB dumping to minimise land degradation. This may necessitate increase of dump height to the maximum extent keeping in view the safety requirement with special emphasis on stability analysis. After back filling of quarry voids, the left out void may be allowed to be filled with water. This will help to recharge and stabilize the water table in the neighbourhood and the local populace will benefit from it.

Internal Dumps

The residual voids, if any, will serve as a lagoon and may be utilised as water reservoir for the locality. The entire area shall be suitably fenced. Most of the back filled area shall be afforested by selecting proper plant species in consultation with State Forest Department. A part of the back filled area would also be developed for agricultural purpose with the help of the concerned State Authority.

The underground unit is not likely to generate any solid waste during the mining operation.

3.5 Details of Surface Structures proposed for dismantling

3.5.1 Infrastructure details

As far as possible, industrial structures will be utilized by the adjacent mines. However, if these structures are not found fit at the end of mine life, the same will be dismantled and salvaged. The equipments will be removed and used somewhere else. Every effort will be made to restore the area to economic utilization value in line with mine closure plan.

A. SERVICE BUILDINGS: The service buildings/ structures, viz. workshop, stores, office building, cap-lamp room, Pit top office, winding rooms, etc. are to be demolished after collecting all re-useable items, or be used for some other projects and the land covered by them restored for productive use. However, it has to be ensured that as and when a service building is vacated/ abandoned, the same should be demolished to prevent any unauthorized occupation.

B.OTHER INFRASTRUCTURES: All other infrastructures like sub-stations, transformers, community services, pump-houses, water-treatment/ filtration plants, waterlines, power lines, roads etc. will be utilized for the neighbouring projects.

However, possibility shall be explored for handing over the buildings and other infrastructures including the reclaimed land to the State Government for the benefit of local villagers and strengthening the area infrastructures.

The end use of these facilities shall be decided by the State Government with the help of District Authorities and Village Panchayat. The peripheral village community facilities developed by the Mine Authorities will be left to the Local Body/ State Government for their management and public use.

Prior to surface demolition/ restoration, a surface audit will be undertaken on all surface structures, spoil heaps etc. to assess whether there is any hazardous material that could cause problem, i.e. explosive, asbestos, chemical, oil, etc.

A list of surface and UG assets (Plant & Machinery) will be prepared and made available to potential purchasers or transferred to other new/ working mines of the company. This will ensure that the assets perform during their economic life.

3.5.2 Post closure disposal/Re-use of the Buildings, Plants & Machineries

a. Disposal or reuse of existing HEMM, CHP, workshop and railway siding for OC

   Since the opencast is proposed to be operated through outsourced HEMM, disposal will not be required.

b. Disposal or reuse of haulage, ventilation, workshop and railway siding for UG.

   At the time of closure of the mine, it is expected that most of the equipments would complete its rated life and would be surveyed off as per the Company's guidelines. The surveyed off equipments would be auctioned as per prevalent norms.

   However, if some of the equipments would not have covered their rated life, they would be diverted to the neighbouring projects for gainful utilisation.

   There is no railway siding in the leasehold.

c. Disposal or reuse of transmission lines and sub-station

As per the electricity demand of the existing neighbouring projects, an analysis would be made as to whether the existing sub-station and transmission lines could be gainfully used or not. If the scope of gainful utilization is not found, they will be dismantled and the usable items/spares/conductors etc. would be dispatched to needy Areas/Projects.

d. Disposal or reuse of residential and non-residential buildings

At the time of final closure, a list of surface buildings would be prepared in detail. Thereafter following steps would be taken in chorological order in respect of the available buildings:

- An assessment would be made to find that whether the available buildings can be used by the existing neighboring projects or any new project that might have come up in the vicinity.
- In case, the listed assets cannot be utilized by the nearby project, efforts would be made to sale these assets after making the list available to potential purchasers and asking the interested purchasers to submit sealed bids.
- Thereafter, the state agencies/local agencies may be asked to take possession of the buildings, if they required few of them.
- When there would be no takers, the buildings would be demolished and usable items would be recovered for future use.

Table 3.8 Proposals for Infrastructure Facilities

Sl. No.	Particulars	Action Suggested
A	CHP	This will be dismantled and land will be covered with plantation
B	Workshop	-Do-
C	Railway Sidings	There is a proposal of Rly. Siding in the project.
D	Colony	These will be handed over to the State Government if fit for use or will be dismantled.
E	Details of non-residential buildings	-Do-

F	Other facilities (ETP /STP)	-Do-

3.6 Safety and Security Arrangement

3.6.1 Mine entry

After closure of the mining activities, all the entries to the mine will be effectively sealed off to avoid any accident and to prevent access to any unauthorized person. The area that is not reclaimed shall be properly fenced/ sealed to prevent any unauthorized entry into the area. Flags/Boards with warning signals shall be posted at vulnerable places to avoid chances of accidents. However, the guidelines / instructions from DGMS, if any, will be followed.

Sealing details and dimensions shall also be prepared for the purpose. The minimum thickness of mine sealing will be 100cm RCC (M20) with nominal reinforcement. For incline entry, the mine entry path of 5 m will be filled with debris and clay before sealing the mine.

Details of fencing around abandoned quarry, indicating the length of the fencing

As explained earlier the proposed OCP patches will not be backfilled and the void will act as water reservoir. It is proposed to develop a water lagoon in the area. The water lagoon may be handed over to State Authorities for conversion into a picnic spot.

The void of the quarry would be properly fenced to avoid any inadvertent entry of animals or human beings. Sufficient Boards and danger signs shall be placed all around.

Later on, the responsibility of keeping the fencing secured would be entrusted on the State Authorities.

The entry into the mine is the haul road. This haul road will remain for entry into the picnic spot. Both side of this haul road will be afforested.

3.6.2 Slope stability arrangement for high wall and back filled dumps

During operation of the mine, overall slope will be maintained at an angle not exceeding 22^0- 28^0. Vegetation cover will also be provided along the slopes to arrest any failure.

As regards stability of back-filled dumps, the final level of reclaimed backfill will be matched with the levels of surrounding areas leaving a final residual void which will serve as a lagoon which may be utilised as water reservoir for the locality.

During operation, the external and internal OB dump will be developed with 40 m berm width and maximum height of 60m in case of external OB dump and the overall dump slope shall not exceed **22^0- 28^0**. The waste dumps will be provided with toe wall and garland drains. The dump will be technically reclaimed and vegetation will be grown after spreading the top soil. The above measures will prevent slope failure and improve the aesthetic value.

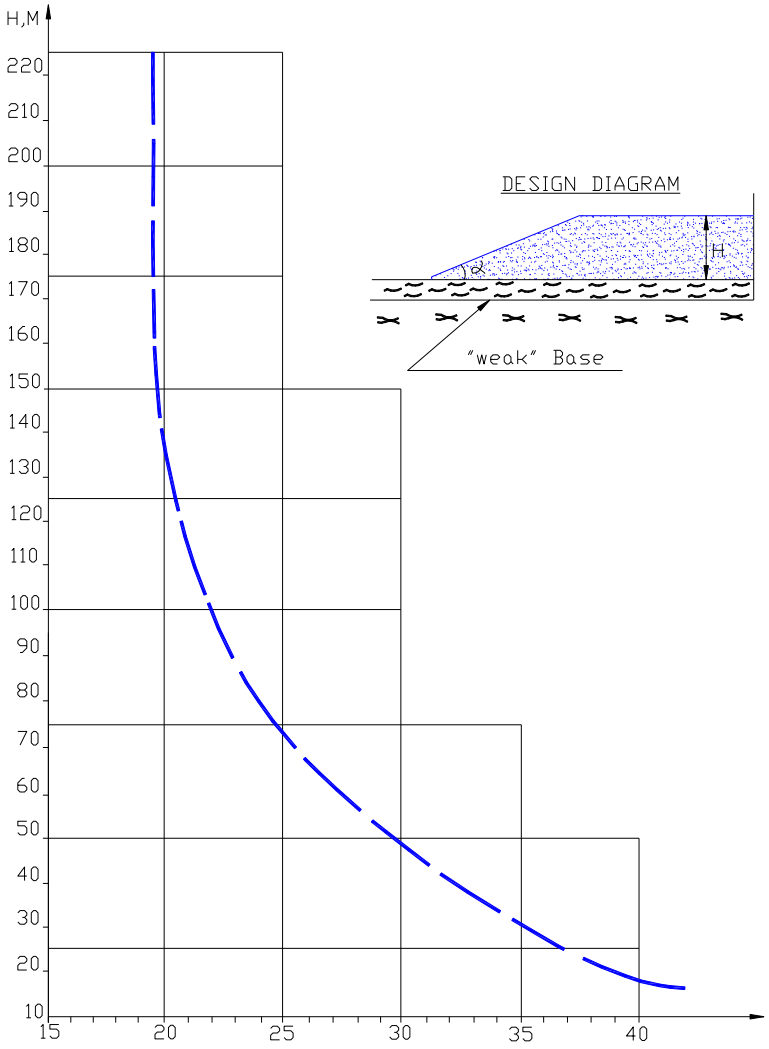


Fig. 5.5.4. Graph illustrating dependence of stable slope angle (α) on height (H) of ex-site dumps formed on "weak" Base

3.6.3 Providing one time lighting arrangement

Sufficient lighting as per standard is provided at all the required places, i.e., pit office, haulage room, fan house, cap lamp room, mine entry, workshop, sub-station haul road in quarry etc.

After closure of the mine, the lighting arrangements will be kept maintained at all locations which are not required to be demolished or dismantled like sub-stations, transformers, community services, pump-houses, water-

treatment/ filtration plants, waterlines, power lines, roads etc. to be utilised for the neighbouring projects and local communities.

3.6.4 Survey records of workings

All the mine workings including subsidence areas, roads, ponds, tanks etc. shall be resurveyed and records shall be updated. Copy of such records shall also be submitted to the appropriate competent authorities, such as DGMS and State Authorities.

Maintenance of records pertaining to Progressive Mine Closure

The Mine management shall maintain following Progressive mine closure plans for every 5 year period:

A Progressive mine closure plan for surface activities

This plan shall be maintained at a scale of 1: 4000 showing the entire progressive mine closure activities (surface) carried out on yearly basis. The plan shall be updated on annual basis and shall be signed by appropriate authorities from the Project and the Area. After every annual renewal, the plan shall be placed before HOD (Env.) of the Company for scrutiny and approval.

The UG unit is likely to be closed soon and entire Group is considered as an OC Unit for the purpose of Closure. However, if , for any reasons , whatsoever, UG Operation is continued, a progressive mine closure plan showing the UG activities shall be maintained. This plan shall also be updated on annual basis and signed by all the above mentioned officials.

Besides the above plan, a progressive mine closure register shall also be maintained by the mine management. This register shall carry details of the progressive mine closure activities carried out on yearly basis. The details to be maintained in the said register shall cover inter alia the name of activity, place, period of execution, executing agency, expenditure incurred, proof of expenditure incurred, final status of the area where activity was executed, plan on which such activity has been shown etc.

The entries into the said register shall be signed by the appropriate authorities from the Project and the Area. At the end of the year the said register (along with two plans) shall be placed before HOD (Env.) of the Company for scrutiny and approval.

3.6.5 Disposal management of hazardous material

At the time of closure, assessment would be made as to find whether there is any hazardous material that could cause problem. Such hazardous material e.g. explosives, chemicals, oil etc. shall be appropriately disposed off.

3.7 Entrepreneurship development Program

As the mine progresses, more and more local people gets indirectly dependent on the mine for their sustainable income. After closure of mine there would be no source of income for these people. In order to ensure that these people do not suffer in the post closure period, the Project authorities in consultation with BCCL (HQ) shall make efforts to develop entrepreneurial skills in the local people by imparting skill development/vocational training programs. It is expected that after developing adequate entrepreneurial skills, the local people would be able to run their own business in the post closure period and maintain a sustainable income for their livelihood.

3.8 Miscellaneous activities

In future, the prevalent geo-mining/environmental conditions in and around the project area may require execution of some other progressive mine closure activities not covered in the preceding paragraphs. Such activities may be carried out by the mine after observing the needful formalities and obtaining approval of HOD (Env.) of the Company.

3.9 Execution of progressive mine closure activities and 5 yearly monitoring

After observing the necessary administrative/financial formalities, the mine authorities shall execute the identified progressive mine closure activities,

whenever and wherever required. The executed activities shall be shown on the above said plans and recorded in the said registers.

The executed progressive mine closure activities shall be monitored on 5-yearly basis by 3rd party (ISM, CMPDI, NEERI etc.).

The 5 yearly return from escrow fund would be equal to expenditure incurred on progressive mine closure activities during last 5 years or 80 % of total deposited amount in the escrow account (including interest) whichever is less. The said return would be subject to above said monitoring of progressive MCP by a third party (ISM/CMPDI/NEERI etc.).

As the 5 yearly return from escrow fund is linked with the expenditure incurred on progressive mine closure activities during last 5 years, it is very important that progressive mine closure records, plans, expenditure details along with proof are properly maintained.

At this juncture it is important to note that some of the progressive mine closure activities, enumerated in the preceding paragraphs, are legal obligations specified in Project reports, EMP, permissions obtained from statutory bodies such as CPCB, SPCB, DGMS etc. The Project authorities are bound to comply with these obligations.

3.10 Re-deployment of work force

The current manpower of the project is 1752. And at present, it is very difficult to assess the manpower of the project, which will remain at the time of closure of mining activities in the presently worked seams. As some of the seams of the block is still virgin and is most likely to be mined in future, the remaining manpower will be gainfully utilized in continuing mining activity.

3.11 Emancipation from the community facilities and the facilities to the PAPs

3.11.1 The Project affected Persons (PAPs) and also the local communities are being provided many civic facilities, such as educational facilities, health

facilities, and drinking water. As some of the seams of the block are still virgin and are most likely to be mined in future, these facilities, in all probability, will be kept maintained.

3.11.2 However, at the time of final closure after exhaustion of entire mineable reserve these facilities will be entrusted upon the local bodies/Trust of PAPs/State bodies after consultation with local people and state authorities so that same could continue even after the mine closure. If needed, a lump sum reasonable amount would also be paid to the local bodies/Trust of PAPs/State bodies after proper approval for proper upkeep and maintenance of various community facilities.

3.11.3 To ensure that no financial loss due to the closure of mining activity in the presently worked seam occur to the local community engaged indirectly to the existing mine, following steps would be taken:

- It has been seen in past that in the event of closure of a mine, the local people indirectly dependent on the mine switch over their economic/professional activities in the existing/new or expansion mines located in the nearby area. Local management, if needed, extends some basic helps to them in such type of switching over. Hence, it is expected that in this project also the transition of the local people from one area to the other area for their sustenance would not be any problem.

- It is proposed that reclaimed and afforested land will be handed over to State Forest Dept. for the benefit of local ecosystem. The forest wealth can also be utilised by local people or tribal in the form of fruits and fodders.

- The proposed picnic spot would be handed over to a society of local people for commercial use of the picnic spot by them.

CHAPTER – IV

ECONOMIC REPURCUSSION

4.0 Economic Repercussions of closure of mine

4.1 Manpower of the project

The total proposed manpower strength of NT-ST-Jeenagora Group of Mines is 1752 (as per UCE of Proposed NTST Expansion OCP, October, 2011).

Table 4.1Present Manpower

Manpower	Strength (Nos.)
EXECUTIVE	87
NON EXECUTIVE	1665
TOTAL	1752

Post Closure Manpower

It has been proposed to monitor and implement the post-closure activities departmentally. Departmental manpower will be needed after closure of the mine for monitoring and implementation of the post closure activities. Manpower required for the same is given in Table- 4.2.

Table 4.2: Manpower required for monitoring and implementation of Mine Closure Activities

Sl. No.	Category of Manpower	Requisite heads
1	Officer-in-charge/ Manager (Mining)	2
2	Overman-in-charge	3
3	Foreman/Overseer-in-charge	3
TOTAL		**8**

4.2 Assessment of income scenario of local people

As NT-ST-Jeenagora Group of Mines is basically an opencast mining project in the long run, a lot of surface excavation will be undertaken. Moreover, the basic mining infrastructures have been made on the company acquired land. So there will be displacement of some local people from this project. Sufficient fund has been provided in the Jharia Action Plan to rehabilitate and resettlement of the project affected people of this project.

After the closure of the mine, the manpower deployed in the mine will be further redeployed in other mines of BCCL to make no loss of sustenance income of the eligible employee.

4.2.1 At present, it is very difficult to assess the manpower of the project, which will remain at the time of closure of mining activities in the existing project.

4.2.2 The local communities are being provided many civic facilities, such as educational facilities, health facilities, and drinking water. At the time of final closure after exhaustion of entire mineable reserve these facilities will be entrusted upon the local bodies/Trust of PAPs/State bodies after consultation with local people and state authorities so that same could continue even after the mine closure. If needed, a lump sum reasonable amount would also be paid to the local bodies/Trust of PAPs/State bodies after proper approval for proper upkeep and maintenance of various community facilities.

4.2.3 To ensure that no financial loss due to the closure of mining activity in the presently worked seam occur to the local community engaged indirectly to the existing mine, following steps would be taken:

- It has been seen in past that in the event of closure of a mine, the local people indirectly dependent on the mine switch over their economic/professional activities in the existing/new or expansion mines located in the nearby area. Local management, if needed, extends some basic helps to them in such type of switching over. Hence, it is

expected that in this project also the transition of the local people from one area to the other area for their sustenance would not be any problem.

- It is proposed that reclaimed and afforested land, if any, will be handed over to State Forest Dept for the benefit of local ecosystem. The forest wealth can also be utilised by local people in the form of fruits and fodders.

CHAPTER – V

TIME SCHEDULE FOR POST-CLOSURE ACTIVITIES

5.1 It is very difficult to predict the various parameters which would be prevalent at the time of final mine closure (when the entire block reserve would get exhausted) and therefore a mine closure activity schedule cannot be rigidly prepared at this point of time.

5.2 The closure of mine involving technical aspects, environmental aspects, socio-political aspects and financial assurances as implementing post-closure activities will run for three years. The time schedule envisaged for completion of all closure activities is presented in the following table in the form of bar chart.

Table 5.1 Implementation Schedule for post-closure activities for NT-ST-Jeenagora Group of mines.

Sl. No.	Major Activities	Time Period	Year-wise Phasing			
			Y1	Y2	Y3	Y4
1	Technical aspects	2 years				
2	Environmental aspects	2 years				
3	Post closure environment monitoring	3 years				
4	Socio-political aspects	3 years				

5.2.1 Technical Aspects:

i) **Safety & security**: In the mine closure plan, action will be taken to cover all the safety aspects including management of fire & subsidence and mine inundation.

i) **Management of pit slopes and waste dump**:

The same has been addressed in detail in the Para No. 3.4 and in Para. 3.6.2.

ii) **Management of hydrology and hydro-geology**: After closure of mining activities, the workings will be waterlogged which will help in maintaining the water table in the surrounding areas and may become a source of water supply to the neighbouring areas.

iii) **Closure of Mine Entries**: After closure of the mining activities, all the entries to the mine will be effectively sealed off to avoid any accident and to prevent access to any unauthorized person. The area that is not reclaimed shall be properly fenced/ sealed to prevent any unauthorized entry into the area. However, the guidelines / instructions from DGMS, if any, will be followed.

iv) **Disposal of mining machinery**: All the opencast machineries, which will have residual life, will be shifted to the other collieries of the area/company. The salvaging and shifting operation of mining machinery and other equipment will be done considering the ground realities during the period 1 (one) year advance of final mine closure.

v) **Details of surface structure proposed to be dismantled**:

As far as possible, industrial structures will be utilised by the adjacent mine. However, if these structures are not found fit at the end of mine life, the same will be dismantled and salvaged. The equipments will be removed and used somewhere else. Every effort will be made to restore the area to economic utilization value in line with mine closure plan.

A. **Service Buildings**: The service buildings/ structures, viz. workshop, stores, office building, Site office, rooms, etc. are to be demolished after collecting all re-useable items, or be used for some other projects and the land covered by them restored for productive use. However, it has to be ensured that as and when a service building is vacated/ abandoned, the same should be demolished to prevent any unauthorized occupation.

B. **Other Infrastructures**: All other infrastructures like sub-stations, transformers, community services, pump-houses, water-treatment/ filtration plants, waterlines, power lines, roads etc. will be utilized for the neighbouring projects.

However, possibility shall be explored for handing over the buildings and other infrastructures including the reclaimed land to the State Government for the benefit of local villagers and strengthening the area infrastructures. The end use of these facilities shall be decided by the State Government with the help of District Authorities and Village Panchayat. The peripheral village community facilities developed by the Mine Authorities will be left to the Local Body/ State Government for their management and public use.

Prior to surface demolition/ restoration, a surface audit will be undertaken on all surface structures, spoil heaps etc. to assess whether there is any hazardous material that could cause problem, i.e. explosive, asbestos, chemical, oil, etc.

A list of surface and OCP assets (Plant & Machinery) will be prepared and made available to potential purchasers or transferred to other new/ working mines of the company. This will ensure that the assets perform during their economic life.

5.2.2 Environment Aspects

i) **Mined-out land and proposed final land use:** At NT-ST-Jeenagora Group of mines it is proposed to extract coal by opencast method. The existing infrastructures, if not usable, will be dismantled and the land will be graded & will be handed over to the local authorities for community use.

ii) **Air & Water quality management:** Appropriate air and water pollution control measures will be taken to contain the air and water pollution for maintaining the ambient air and water quality within the stipulated standards besides making the mining operation eco-friendly in the project. These measures (both preventive and suppressive) are enumerated in Para 3.2.3 of the present report.

iii) **Management of waste:** The solid wastes generated by the mine during the coal production are non-hazardous and non-toxic in nature. The above solid wastes will be disposed off by backfilling the mined out area and then re-vegetating without causing any siltation problem on surface water bodies.

However, scientific studies shall be undertaken regarding applicability of solid wastes for various uses. Toxic solid wastes like used oil, used batteries, oily sludge, besides filters and filter materials containing oil during maintenance of vehicles, will be generated by the mining project. Used oil will be stored in drums safely for disposal through auction to the authorized re-processors. Similarly, used batteries will be stored safely for auction to the authorized re-processors. The oily sludge, besides filter and filter materials, will be disposed off in impervious layer lined pits without causing environmental hazards.

iv) **Management of final voids**: It will be dealt as per the directive provided in the EMP.

v) **Land reclamation and rehabilitation:** If any cracks or void is created due to mining activities, it will be restored to original profile by filling up cracks/ voids. It is proposed that the site restoration should be kept progressive so that the restoration is more or less similar to the rate of mining.

vi) **Reclamation of forest/ vegetation and plantation:** 17 Ha of forest land is required for the project. Moreover, regular plantation will be taken up during the life of the mine to create green barrier. The plant species will be selected in consultation with the state forest department.

The objective of restoration of post mining area will be determined through consultation with local community and the Government authority, so that the potential/ required end use of the mined out land is determined in advance. Such usage may be agriculture, forestry, amenity development or nature reserve.

5.2.3 Post Closure Environment Monitoring

After cessation of mining and its related activities, there will be no effect on ambient air and water quality due to this mine as proper mitigation measures for air and water pollution control are to be taken by the authorities of the mine. However, the air and water quality parameters in the mined out area will be monitored by some external agency for next three years after closure of the mine.

Air and water samples will be taken from the specified sampling stations at regular frequency for 3 consecutive years after the closure of the mining project. 1 sample of mine water will be collected and analyzed with fortnightly frequency and 2 samples of ground water from core & buffer zones with monthly frequency. Similarly, 1 air sample will be taken at core zone, and 1 air sample each in upwind and downwind directions of the project at fortnightly frequency.

5.2.4 Socio-Political Aspects

i) **Re-deployment of work force**: Due to closure of mining operations, the persons directly employed in the mine will be surplus. Suitable manpower re-deployment plan may be formulated by the mining company sufficiently before closure of mine for re-deployment of the work force in other units of the company. Alternatively, they would be given option of voluntary retirement.

ii) **Civic facilities**: It is proposed that the civic facilities developed during the mining phase will be transferred to the local government/ municipality so that the region transforms smoothly into post mining phase. A one-time payment should be made by the mine for obtaining its release from providing these facilities, which will there from be taken care of by the local and state bodies.

iii) **Channelisation of available water**: If the mine has sufficient water, this can be used for domestic and agriculture purpose by the local community. The water from this area shall be discharged after treatment for domestic and agricultural usages.

iv) **Emancipation for project affected population**: The village/ basti which are to be rehabilitated at North Tisra, Jeenagora OCP and South Tisra as per Master Plan of JCF (March'08) are given in Table No. 5.2A, 5.2B and 5.2C:

Table 5.2A Phasewise Rehabilitation as per Master Plan of JCF (March'08)

PHASE-I					
Village/Site	**BCCL**	**Pvt.**	**Enchr**	**Oth**	**Total**
BCCL Colony No. 1/O1	142	47	47	5	241
SG Section Basti /O3	41	0	0	0	41
Tilaboni Basti/O2	15	122	122	6	265
Tilaboni Basti/O2	0	153	0	0	153
Total(Phase-I)	**198**	**322**	**169**	**11**	**700**
PHASE-II(Block-II))					
Total(Phase-II)	**0**	**0**	**0**	**0**	**0**
Total(Phase I+II)	**198**	**322**	**169**	**11**	**700**

Table 5.2B Phasewise Rehabilitation as per Master Plan of JCF (March'08)

PHASE-I					
Village/Site	**BCCL**	**Pvt.**	**Enchr**	**Oth**	**Total**
Central Sulunga Colony No.1/ O9	90	1	5	1	97
E.B. Section colony no. 1/O1	19	9	0	0	28
E.B. Section colony no. 1/O1	0	0	10	0	10
EB Sec. Colony No. 2/O2	58	0	0	1	59
Khas Jeenagora Colony No.1/O3	88	0	0	0	88
Khas Jeenagora & Kalisthan /O5	40	0	0	1	41
Khas Jeenagora Colony No. 2/ O4	107	0	0	5	112
Khas Jeenagora Colony no. 3/ O6	64	43	10	1	118
Khas Jeenagora Colony no. 4/O7	13	0	0	1	14
Total(Phase-I)	**479**	**53**	**25**	**10**	**567**
PHASE-II(Block-II))					
Total(Phase-II)	**0**	**0**	**0**	**0**	**0**
Total(Phase I+II)	**479**	**53**	**25**	**10**	**567**

Table 5.2C Phasewise Rehabilitation as per Master Plan of JCF (March'08)

PHASE-I					
Village/Site	**BCCL**	**Pvt.**	**Enchr**	**Oth**	**Total**
B.J. & S.T. Section/ O3	110	85	42	3	240
Huchuktand Basti/O1	29	95	24	2	150
No.1 Pit S.T. Section /O2	38	21	0	0	59
Total(Phase-I)	**177**	**201**	**66**	**5**	**449**
PHASE-II(Block-II))					
Total(Phase-II)	**0**	**0**	**0**	**0**	**0**
Total(Phase I+II)	**177**	**201**	**66**	**5**	**449**

5.3 Although, it is very difficult to conclusively predict the likely impacts due to closure of the mining activities in the in the leasehold area of the Instant Project and the likely activities that would be taken up at that point of time, but a broad mine closure activity schedule may be prepared as per guidelines of Ministry of Coal. The post closure implementing activities will run for three years. The activities given overleaf as per the given bar chart are most likely to be implemented.

IMPLEMENTATION SCHEDULE FOR MINE CLOSURE IN NT- ST JEENAGORA GROUP OF MINES(OC)

(LIFE OF THE MINE: 30 YEARS)

S.N	Activity	Time Frame	Year								
			1st Phase	2nd Phase	3rd Phase	4th Phase	5th Phase	Final Phase	Post Closure Phase		
			1st - 5th	6th - 10th	11th -15th	16th-20th	21st - 25th	26th - 30th	PC1	PC2	PC3
A	**Dismantling of Structures**										
	Service Buildings	2 years									
	Residential Buildings	2 & ½ years									
	Industrial structures like CHP, Workshop, field sub-station, etc.	2 & ½ years									
B	**Permanent Fencing of mine void and other dangerous area**										
	Random rubble masonry of height 1.2 metre including leveling up in cement concrete 1:6:12 in mud mortar	2 years									
C	**Grading of highwall slopes**										
	Levelling and grading of highwall slopes	2 years									
D	**OB Dump Reclamation**										
	*Handling/Dozing of OB Dump and backfilling	Throughout the life of the mine including 3 years after cessation of mining operation									

S.N	Activity	Time Frame	Year								
			1st Phase	2nd Phase	3rd Phase	4th Phase	5th Phase	Final Phase	Post Closure Phase		
			1st - 5th	6th - 10th	11th -15th	16th-20th	21st - 25th	26th - 30th	PC1	PC2	PC3
	*Technical and Bio-reclamation including plantation and post care	Throughout the life of the mine including 3 years after cessation of mining operation									
E	**Landscaping**										
	Landscaping of the open space in the leasehold area for improving its esthetics and eco value	Throughout the life of the mine including 3 years after cessation of mining operation									
F	**Plantation**										
	Plantation over cleared area obtained after dismantling	2 years									
	*Plantation around the quarry area and in safety zone	Throughout the life of the mine including 3 years after cessation of mining operation									
	*Plantation over the external OB Dump	Throughout the life of the mine									
G	**Post Closure Env Monitoring / testing of parameters for three years**										
	Air Quality	3 years									
	Water Quality	3 years									

S.N	Activity	Time Frame	Year								
			1st Phase	2nd Phase	3rd Phase	4th Phase	5th Phase	Final Phase	Post Closure Phase		
			1st - 5th	6th - 10th	11th -15th	16th-20th	21st - 25th	26th - 30th	PC1	PC2	PC3
H	***Entrepreneurship Development (Vocational/skill development training for sustainable income of affected people**	Throughout the life of the mine									
I	***Miscellaneous and other mitigative measures**	Throughout the life of the mine including 3 years after cessation of mining operation									
J	**Post Closure Manpower cost for supervision**	3 years									

NOTE: *: To be covered under Progressive Mine Closure activities also**.**

NOTE: The progressive mine closure will be done as per the provisions made out in the Project report and as per the situation/requirement that may arise in course of execution of the Project Report.

CHAPTER – VI

MINE CLOSURE COST

6.0 Mine Closure activities would be a constant exercise for the mine which would begin with the commencement of mining operations and continue till post closure. The mine closure activities would naturally entail certain expenditures, which will have to be borne by the mine operator. There would be two types of expenditures on account of mine closure activities in respect of NT-ST-Jeenagora Group of mines:

6.1 Revenue expenditures

This would cover the activities which are being executed along with normal mining operation and would continue to be executed in course of execution of the project. The cost of progressive mine closure activities is already part of the project cost.

6.2.1 Expenditures to be incurred just prior to actual mine closure and in the post closure period

6.2.2 As per MOC guidelines, a corpus escrow account @ ₹ 1.0 lakhs (August, 2009 Price Level) per Ha (for UG) and @ ₹ 6.0 lakhs (for OC) of the project area shall be opened with the coal controller organization to meet the expenses of final mine closure. The current Guidelines read as:

"It has been estimated that typically closure cost for an opencast mine will come around Rs. 6.00 lakh per Hectare of the project area and it would be Rs. 1.00 lakh per Hectare for underground mine project area at current price levels (August, 2009) and these rates will stand modified based on Wholesale Price Index as notified by Government of India from time to time".

In NT-ST-Jeenagora Group of Mines, the proposed project area is about 1431.0Ha. Therefore, the entire 1431.0Ha of project area (existing and

proposed) has been considered for the calculation of closure cost of the area based on OC norms.

The money deposited in the Escrow Account has to deal with the following:

- Cost of closure activities.
- Cost towards organization for executing the closure activities.
- Cost of the post project monitoring.
- Creation of a corpus fund for the final mine closure

6.2.2 As per the above guidelines these rates will stand modified based on Whole Price Index as notified by Government of India from time to time. Thus the total expenditure on this front may be calculated in following manner:

- The total amount for mine closure activity in respect of the proposed NT-ST-Jeenagora Group of Mines = 1431.0 Ha X ₹6.00 lakhs X 1.35416 =₹11626.875 lakhs

*** The amount has been escalated based on WPI of July, 2013(175.5) vis-à-vis WPI of August '09(129.6).**

6.2.3 It is difficult to conclusively predict the mining parameters on a long term basis owing to rapidly changing mining technology, developments in the field of clean coal technologies and R&D activities in development of alternative energy sources.

As per the latest Guidelines issued by the MoC, GoI(dt. 07.01.2013) the *"annual closure cost is to be computed considering the total project area at the above mentioned rates and dividing the same by the entire life of the mine in years for new projects and balance life of mine in years for operating/existing mines."*

Jharia Coalfield is characterized by occurrence of a number of working coal horizons, giving a leverage of extended working life of the mines. Some more seams can come in the lap of workable horizons due to improvement in mining

technology in times to come. The underground mines in leasehold of JCF are generally small capacity mines, giving a false impression of very long lives due to small level of current production level. There may be a strategy in future to amalgamate the mines for higher production level to attain the economics of scale. The existing OC Mines working at shallow depth may be worked at a greater depth, In such a situation, the life of the mine arrived at with current level of production for the balance reserve may not be workable in the long run.

In view of the above, for the purpose of mine closure cost calculations, the life of the mine has been taken from formulated project report of NT-ST-Jeenagora Group of Mines as mentioned in the approved TOR/Form-I. Since the proposed life of the NT-ST-Jeenagora Group of Mines was calculated as 30 years, the life of NT-ST-Jeenagora group will be also 30 years.

To arrive, at the annual cost, to be deposited in each year in an escrow account, the mine closure cost has been divided by 30, as shown below:

- Amount to deposited in 1st year will be--------₹ 387.563 lakhs
- Amount to be deposited in 2nd year will be—₹ 387.563 (1 + 5%)^1 lakhs
- Amount to be deposited in 3rd year will be—₹ 387.563 (1 + 5%)^2 lakhs

6.2.4 In the above fashion, an amount will be deposited every year up to the last year of mine life by applying the following formula:

- Amount to be deposited in Nth year will be --- ₹ 387.563 (1 + 5%) ^(n-1) lakhs

6.2.5 The amount calculated by the above formula shall be deposited every year by BCCL in the Escrow Account opened with the Coal Controller organisation in a scheduled Bank. An agreement, outlining detailed terms and conditions of operating the said Escrow Account shall be executed amongst BCCL, the Coal Controller and the commercial Bank.

6.2.6 Thus, total amount that shall be deposited for final mine closure activities **NT-ST-Jeenagora Group of Mines** during the considered period of 30 years stands out to be ₹ 25749.206 lakhs as per the present status of the mine. The Break-Up cost of Mine Closure of NT-ST-Jeenagora Group of Mines Yearwise is given in Table No. 6.1.

Table No. 6.1 Yearwise Break-Up Mine Closure Cost

Year	Amount to be deposited per year ₹ in Lakhs
1	387.563
2	406.941
3	427.288
4	448.652
5	471.085
6	494.639
7	519.371
8	545.339
9	572.606
10	601.237
11	631.298
12	662.863
13	696.007
14	730.807
15	767.347
16	805.715
17	846.000
18	888.300
19	932.715
20	979.351
21	1028.319
22	1079.735
23	1133.721
24	1190.407
25	1249.928
26	1312.424
27	1378.045

Year	Amount to be deposited per year ₹ in Lakhs
28	1446.948
29	1519.295
30	1595.260
Total	25749.206

6.2.7 Based on the existing mine closure planning norms, the above calculated cost at WPI of July 2013 on mine closure may be tentatively grouped under different heads as given in Table No. 6.2 as per the guidelines of CMPDI(HQ).

Table 6.2 Break up Costs of Mine Closure Activities

Sl. No.	Activity	Mine Closure Cost (₹ in Lakhs)
A	**Dismantling of Structures**	
	Service Buildings	51.498
	Residential Buildings	687.504
	Industrial Structures like CHP, Workshop, field sub-station, etc.	77.248
B	**Permanent Fencing of Mine Void and other dangerous area**	
	Random Ruble masonry of height 1.2 metre including levelling up in cement concrete 1:6:12 in mud mortar	386.238
C	**Grading of Highwall slopes**	
	Levelling and grading of highwall slopes	455.761
D	**OB Dump Reclamation**	
	Handling/Dozing of external OB Dump into mine void	22829.246
	Bio-Reclamation including soil spreading, plantation and maintenance	102.997
E	**LANDSCAPING**	
	Landscaping of the cleared land for improving its aesthetics	77.248
F	**Plantation**	
	Plantation over area obtained after dismantling	128.746
	Plantation around fencing	51.498
	Plantation over the cleared external OB Dump	5.150

Sl. No.	Activity	Mine Closure Cost (₹ in Lakhs)
G	**Monitoring/Testing of parameters for three years**	
	Air Quality	56.648
	Water Quality	51.498
H	**Entrepreneurship Development(Vocational/skill development training for sustainable income of affected people**	66.948
I	**Miscellaneous and other mitigative measures**	514.984
J	**Manpower Cost for Supervision**	205.994
	TOTAL	**25749.206**

6.2.8 Thus, total amount that shall be deposited for final mine closure activities of **NT-ST-Jeenagora Group of Mines** mine during the period of 30 years has been estimated as **₹ 25749.206 lakhs** based on UG norms at WPI of July 2013.

6.2.9 *Mining is to be carried out in a phased manner initiating afforestation/reclamation work in the mined out area of the first phase while commencing the mining in the second phase i.e. continuation of mining activities from one phase to other indicating the sequence of operations depending on the geo-mining conditions of the mine. Up to 80% of the total deposited amount including interest accrued in the ESCROW account may be released after every five years in line with the periodic examination of the Closure Plan as per Clause 3.1 of the Annexure of the Guidelines. The amount released should be equal to expenditure incurred on the Progressive mine closure in past five years or 80% whichever is less. The balance amount shall be released to mine owner/leaseholder at the end of the final Mine Closure on compliance of all provisions of Closure Plan. This compliance report should be duly signed by the lessee and certify that said closure of mine complied all statutory rules, regulations, orders made by the Central or State Government, statutory organisations, court etc. and certified by the Coal Controller.*

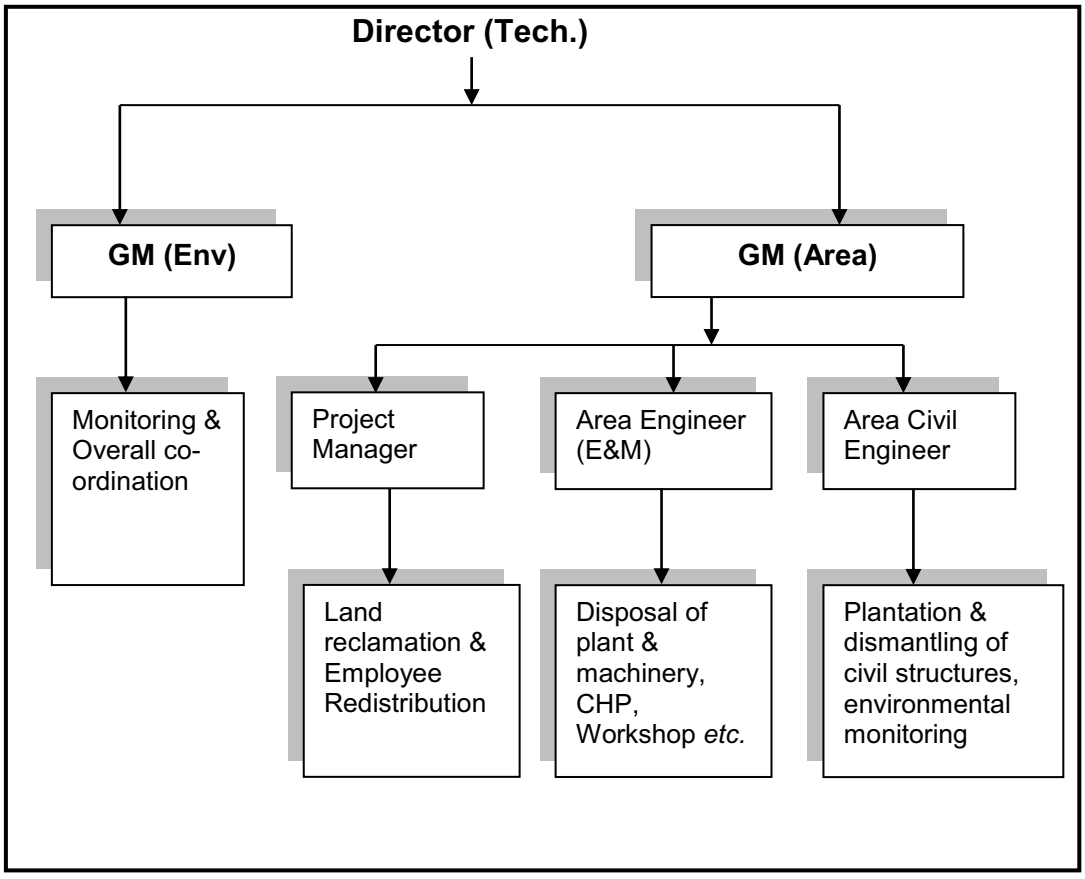
6.2.10 However, the additional amount beyond the escrow account, if any estimated later on, will be provided by the mine operator after estimating the final mine closure cost five years prior to mine closure (as per the mine closure guideline)**.**

CHAPTER-VII

IMPLEMENTATION PROTOCOL

7.1 As the mine closure activities would continue even after cessation of mining activities, an organization consisting of different discipline would be formed to undertake the implementation of mine closure activities as well as monitoring of the same**.** Such activity shall continue for a period of three years after the closure of mining activity in the mine. Once the closed mine becomes stabilized in respect of safety, environmental and social aspects, the monitoring team would be withdrawn.

7.2 For implementing the mine closure activities and monitoring thereof, the following organisational structure at Corporate level has been proposed:



7.3 Environmental monitoring for three years after closure of mine will be carried out to evaluate the environmental quality of the area. If need be, proper mitigation measures will be taken up after evaluating the environmental quality. Before closure of the mine, Area GM will prepare survey and disposal report and the same will be submitted to DGMS for acceptance.

7.4 When the mine closure activities would take final shape and the entire are under influence is brought to an acceptable shape, BCCL would obtain a mine closure certificate from Coal Controller to the effect that the protective, reclamation and rehabilitation works in accordance with the approved mine closure plan/final mine closure plan have been carried out for surrendering the reclaimed land to the State Government concerned.

CHAPTER – VIII

PLANS ENCLOSED

The following underground and surface plans have been enclosed along with this mine closure report plan:

a. Location Plan of Cluster IX
b. Surface cum Topographical plan of Cluster IX showing surface features, contours, roads, depot/siding, OB dumps, quarries (working/old/discontinued), subsidence, plantations, habitations, vacant land, surface water bodies, natural drainage and mine discharge water channels
c. Geological Plan of Cluster IX
d. Working plan of IV B Seam- North Tisra UG
e. Surface Plan of existing NTST OC.
f. Final Stage Dump Plan of NTST Expansion OCP

Annexure VI

CSR, R&R and Transportation Plan

LODNA AREA

CLUSTER IX

BHARAT COKING COAL LIMITED (BCCL)

Bharat Coking Coal Limited (BCCL) is a Public Sector Undertaking engaged in mining of coal and allied activities. It occupies an important place in as much as it produces bulk of the coking coal mined in the country. BCCL meets almost 50% of the total prime coking coal requirement of the integrated steel sector. BCCL was incorporated in January, 1972 to operate coking coal mines (214 Nos operating in the Jharia & Raniganj Coalfields, taken over by the Govt. of India on 16th Oct, 1971 to ensure planned development of the scarce coking coal resources in the country.

MAJOR CSR ACTIVITIES OF BCCL

Bharat Coking Coal Limited (BCCL) is committed to good corporate citizenship and makes constant efforts to build and nurture long lasting relationships with members of the society in general and its peripheral communities in particular.

The following activities have been carried out under the Corporation's CSR Programme.

Drinking Water Facilities: Provided deep bore wells, tube wells, pumps/motors, open wells, in the peripheral villages of BCCL. Water supply through pipeline, through water tanker is also provided to the villages.

Education: BCCL adopts a multi-pronged approach to promote quality education in backward areas. The measures taken by BCCL comprise Construction, Extension, and Renovation of school buildings etc are done to promote quality education in the nearby villages. BCCL is Extending financial aid for educational facilities to Private Committee Managed schools. Measures are taken to promote women literacy and career development.

Health Care: BCCL Conducts medical/health camps for dwellers of peripheral villages for rendering free medical consultancy. CSR Clinics, wellness clinics, artificial limbs centres are organised for the benefit of the needy section of the society. Mobile medical vans are deployed as special arrangement for medical service

AIDS awareness camps are organized as special drive to develop awareness and to render free consultancy.

"Ek Jagaran Jeevan Shaili"- A Life style Management Programme is being organised for de-addiction from ill habits of life style such as consuming tobacco, alcohol etc.

Occupational health awareness programmes are organised.

Other Welfare Activities: This includes Construction / renovation of Community Halls, construction / repair of roads, construction of Health-sub centres, construction of drain, construction of Chhat Ghat in the ponds, Construction of Boundary wall, providing Choupal for community gatherings, Installation of road side Water Kiosks during summer etc.

During winter, Blankets are distributed among poor section of the society.

Sports & Cultural: Various activities are organised to propagate sports and cultures. Sports/games items and instruments are also provided. To promote sports, children parks have been constructed.

Village adoption: Lahbera, a SC/ST village in Dhanbad has been adopted for its all-round development and a number of development activities have been carried out.

SCOPE

As per **Schedule VII of New Companies Act 2013** the following should be the Scope of Activities under Corporate Social Activities:

i) Eradicating hunger, poverty and malnutrition, promoting healthcare including preventive health care and sanitation and making available safe drinking water.
ii) Promoting education, including special education and employment enhancing vocation skills especially among children, women, elderly, and differently abled and livelihood enhancement projects;
iii) Promoting gender equality, empowering women, setting up homes and hostels for women and orphans, setting up old age homes, day care

centers and such other facilities for senior citizens and measures for reducing inequalities faced by socially and economically backward groups;

iv) Ensuring environmental sustainability, ecological balance, protection of Flora and Fauna, animal welfare, agro-forestry, conservation of natural resources and maintaining quality of soil, air and water;
v) Protection of national heritage, art and culture including restoration of buildings and sites of historical importance and works of art; setting up public libraries, promotion and development of traditional arts and handicrafts;
vi) Measures for the benefit of armed forces veterans, war widows and their dependents
vii) Training to promote rural sports, nationally recognized sports, Paralympics sports and Olympic sports;
viii) Contribution to the Prime Minister's National Relief Fund or any other fund set up by the Central Government for socio-economic development and relief and welfare of the Scheduled Castes, the Scheduled Tribes, other backward classes, minorities and women;
ix) Contributions or funds provided to technology incubators located within academic institutions which are approved by the Central Government;
x) Rural development projects

SOURCE OF FUND

The fund for the CSR should be allocated based on 2% of the average net profit of the Company for the three immediate preceding financial years or Rs. 2.00 per tonne of Coal Production of previous year whichever is higher.

ACTION PLAN FOR CORPORATE SOCIAL RESPONSIBILITY

As per the EC Granted to Cluster IX:
Normative Capacity of the Cluster IX is 3.048 MT. 5% of the retained earnings of the previous year subject to minimum of Rs. 5 per tonne of coal production of the previous year will be provided for Corporate Social Responsibility (CSR). An amount to the tune of Rs. 9.0 lakhs will be used for the CSR works per year for Cluster IX.

"In addition to afforesting 1026.66 ha of area at the post-mining stage, the waste land /barren land within Cluster V ML shall be rehabilitated/reclaimed as forest/agricultural land under CSR Plan in consultation with local

communities. Third party evaluation shall be got carried out regularly for the proper implementation of activities undertaken in the project area under CSR. Issue raised in the Public Hearing shall also be integrated with activities being taken up under CSR. The details of CSR undertaken along with budgetary provisions for the village-wise various activities and expenditure thereon shall be uploaded on the company website every year. The company must give priority to capacity building both within the company and to the local youth, who are motivated to carry out the work in future.

Upkeep and Maintenance of Assets

Responsibility of the concerned State Govt and the local representative of the Society. Before any capital investment is made, an undertaking would be taken from the representatives of the local community that they would be responsible for the maintenance of the assets.

Action Plan for CSR for the Cluster IX has been proposed which has been given in the table – as below:

S.N	HEAD OF WORKS	CSR expenditure to be done per year in Rs. lakhs				
		2011-12	2012-13	2013-14	2014-15	2015-16
1	Education facilities including grant of schools, providing education kits, running of schools etc.	40.00	45.00	35.00	40.00	40.00
2	Water Supply and rain water harvesting works, wells, ponds, hand pumps and tube wells	30.00	35.00	45.00	30.00	30.00
3	Health Care and vaccination, awareness camp, mobile medical camp, Immunisation, medicine etc.	20.00	20.00	10.00	20.00	20.00
4	Environnent Protection i.e plantation etc.	8.25	8.25	18.25	8.25	8.25
5	Social Empowerment like Community center, Literacy drive, shopping complex.	10.00	10.00	10.00	10.00	10.00
6	Infrastructure Development like road, bridge, repairing of school, drains, electric line etc.	20.00	10.00	10.00	20.00	20.00
7	Sports Culture like village stadium village stadium, grant to village sports body, organizing sports meet	3.00	3.00	3.00	3.00	3.00
8	Grant to NGO for community development	5.00	6.30	6.30	5.00	5.00
9	Miscellaneous welfare for adopted villages	6.30	5.00	5.00	6.30	6.30
	TOTAL	**142.55**	**142.55**	**142.55**	**142.55**	**142.55**

CSR Activities at Lodna Area for the FY 2014-15
Rs. In Lakh

Sl.No.	Activities	FY 2014-15	
		Budget Allocation	Utilisation
1.	One day Sustainable Development Awareness Programme on 02.08.2014 at North Tisra Work Shop for Peripheral Villages (Carried over of 2013-14).	2.36	2.36
2.	Construction of Community Centre at Amtal Village, Dhanbad (Carried over of 2013-14)	-	10.84
3.	Sanction against 300 brick gabions at Belgoria mouza/basti (Carried over of 2013-14)	1.17	1.17
4.	Maintenance of 300 brick gabions at Belgoria mouza/basti.	14.39	0.68

REHABILITATION AND RESETTLEMENT PLAN

The cluster of mines will be dovetailed with the approved Jharia A**ction Plan for** dealing with fire, subsidence and rehabilitation of people. **Master Plan** for dealing with fire, subsidence and rehabilitation within the leasehold area of BCCL has already been approved by Government of Jharkhand & Government of India.

As per EC granted to Cluster IX, R&R of 12246 nos. of PAFs are involved. They should be rehabilitated to safe areas at the cost of Rs 126092.027 Lakhs as per the approved Jharia Action Plan.

Following will be the R&R package that will be given to affected families as per approved Master Plan

A very attractive R&R package, for the affected people who are to be shifted from endangered areas, has been proposed in the Master plan and has been approved both by Govt. of Jharkhand and Govt. of India. **But no employment will be offered for any rehabilitation under this Master Plan.**

It may be noted that this R&R package is offered for safety of the people living in endangered areas and not for project implementation and mining of coal and thereby gaining any type of profit.

R&R package for non-BCCL authorized families:

a) Land Compensation:

Head of every displaced house shall be given compensation for his land at the market rate.

b) House Compensation:

Every head of displaced house will get replacement value for his house and other structures over the homestead land, the value of which shall be estimated on the basis of PWD civil rates. (Pucca house: Rs. 4.8 lakhs/unit and for Kutcha house: Rs. 1.37 lakhs/unit).

c) Other Benefits:

Head of each house will be provided a plot of 100 sq.m land at the proposed township. In case his requirement of land is more than 100 sq.m, additional land may be provided, on payment basis as per market rate if land is available. If this offer is not acceptable, head of each house shall be provided a constructed flat of around 40 m2 as super built up area in a triple storied building. A house owner not opting for a plot will be offered equivalent cash compensation in lieu of free plot.

d) Basic amenities:

Each township will be provided with all basic amenities and infrastructural facilities like Primary school, High school, Bank, Post office, Community centre, Shopping centre, Hospital, Play ground, Children Park, Water supply, Sewage disposal & sanitation, Road, Culverts & Drains, and Power Supply etc.

e) Income generation benefit:

Head of each house shall be paid 250 days/year wage as per State Govt.'s minimum wage rate for a period of 2 years.

f) Shifting Allowance:

The head of every house is proposed to be paid 0.10 lakhs as shifting allowance from their present living places to the resettlement sites.

R&R package for non-BCCL unauthorized families (encroachers):

a) No compensation will be paid to the house owner having no home stead land (Unauthorized). Instead the following benefits will be provided to them.

b) Head of each house will be provided a constructed house on 27 sq.m land as super built up area in triple storey building in resettlement site with all basic amenities like Primary school, High school, Bank , Post office, Community centre, Shopping centre, Hospital, Play ground & children park, Water Supply, Sewage disposal & sanitation, Road, Culverts & Drains, Power Supply etc.

c) **Income generation benefit**: Head of each house shall be paid 250 days/year wage as per State Govt.'s minimum wage rate for a period of 2 years.

d) **Shifting Allowance:** The head of every house is proposed to be paid 0.10 lakhs as shifting allowance from their present living places to the resettlement sites.

R&R package for BCCL families:

a) BCCL families from the endangered areas to be rehabilitated in satellite townships in non-coal bearing areas outside JCF with all basic infrastructural facilities.

b) For each BCCL house 160 sq.m (including for all amenities) resettlement land has been proposed.

KUJAMA COLLIERY
PATCH-B
JEALGORA COLLIERY

Annexure VII

STRICTLY RESTRICTED
FOR COMPANY USE ONLY
RESTRICTED
The information given in this report is not to be communicated either directly or indirectly to the press or to any person not holding an official position in the CIL/Government.

Study to Analyze the Extent of Reduction of Pollution Load Every Year by reducing Coal Transportation by Road

CLUSTER IX GROUP OF MINES

(NT/ST Expan. OCP, Amalgamated Joyrampur OC)

Peak Production : 8.512 MTPA
Lease Hold Area : 1942.12 Ha

Bharat Coking Coal Limited

(March, 2019)

Prepared by

Environment Division

Central Mine Planning & Design Institute Limited

CMPDI (HQ)

Gondwana Place

Kanke Road, Ranchi-834008

CONTENTS

Chapter – I

Introduction

1.1 Genesis:

MOEF provided Environmental Clearance to the various mines of the Cluster EC granted vide.J-11015/307 / 2010 -IA.II(M) ; dated 21st May 2013, Amended vide J-11015/307 / 2010 -IA.II(M) dated 01.03.2018 .

As per the Environmental Clearance Conditions given by the Ministry of Environment & Forest "A study should be initiated to analyse extent of reduction in pollution load every year by reducing road transport of coal". Therefore the present study has been carried out to quantify the pollution load due to coal transportation.

1.2 Methodology:

In order to find out the pollution load due to coal transportation a Questionnaire was developed by the Environment Division of CMPDI Headquarter and Regional Institute –II, Dhanbad. The Questionnaire was circulated to the various mines of BCCL for collection of the requisite inputs for this study. The quantification of pollution load for PM-10 has been carried out on the basis of the field visit, data provided by BCCL officials and interaction with them.

1.3 General Information about the Cluster:

1.3.1 Brief Description:

Cluster-IX group of mines of BCCL is a group of nine mines consisting of opencast and underground mines. BCCL is the proponent of the cluster and it is under the administrative control of Coal India Limited. Coal India Limited is a Public Sector Undertaking of Government of India and functioning under the Ministry of Coal, Govt. of India.

The history of coal mining in Jharia Coalfield was started since eighteenth century. The only energy source during those years, the mining was carried out through manual and semi-manual methods resulting into large scale degradation of land, forests and environment. The unscientific mining resulted into large scale mine fires, subsidence and land degradation. The mines of Jharia Coalfield were taken

over mines by BCCL from the erstwhile private mine owners. Most of the mines had their history from pre-nationalization period.

During the takeover of the mines in 1972 in BCCL from private mine owners, the data like leasehold area, underground mine planning, production capacity were unknown. However, most of the mines were further reorganized.

BCCL is the proponent of the cluster and it is under the administrative control of Coal India Limited.

1.3.2 Nature and Size of the Cluster:

The details of the mines showing normative/ peak productions, lease hold areas and life are given in Table no. 1.1.

Table 1.1: Details of the Mines of Cluster – IX

Sl No	Name of Mine	Production Capacity (MTY)		Lease Hold Area (Ha)
		Normative	Peak	
1	Amalgamated Joyrampur Colliery (OC)	2.512	3.25	1186.97
2	NT-ST Expansion OCP	6.0	7.8	755.15
	Total		8.512*	1942.12

*Peak of the cluster will remain same, as peak of individual will be achieved in different year.

1.3.3 Impact of Fire Control on Ambient Air Quality:

Due to unscientific mining prior to nationalization there are unstable sites identified in the BCCL. Out of 595 unstable sites identified in the Master Plan, 98 sites affected area of 2.246 Km2 consisting of 12246 no. of houses/families are affected. The affected families will be rehabilited in adjacent non coal bearing area at a cost of Rs. 126092.027 lakhs.

1.3.4 Impact of Resettlement on Ambient Air Quality:

As per Jharia Action Plan (JAP) household will be shifted for implementation of master plan. The reduction in number of households within the leasehold area of Cluster will lead to reduction in generation of air pollutants due to reduction in movement of man & materials apart from decrease in consumption of coal as a domestic fuel. As per Jharia Action Plan (JAP) household will be shifted as per for implementation.

1.4 Meteorological Data

A meteorological data generated during 1st January 16 to 31st March 2016 has been presented in this report .The micro meteorological set up was established at the roof of BCCL Dugda Guest house and parameters like temperature, relative humidity, wind speed and directions, cloud cover and rainfall were recorded. The data were collected on hourly basis during the entire study period.

Generally, moderate winds prevailed throughout the study period. The wind velocity ranged between ≤ 0.5 m/s to 13.2 m/s. The seasonal average wind speed was observed to be 0.69 m/s. Wind-roses were made by using latest WRPLOT View of Lakes Environmental Software.

The analysis of wind pattern during the season showed that the predominant wind directions were from North-West & West followed by North-East having frequencies 15.71%, 11.45% & 4.67% respectively. The receptors located in the Downwind directions i.e. SE and East from the dust generating sources are likely to be affected. The dispersion of air borne dust during calm period (45% of time) will be very poor and buildup of pollutant concentration during this period will occur.

The maximum temperature recorded was 39.3^{0}C and the minimum was 6.2^{0}C. The daily average relative humidity values were in the range of 32.2 to 65.0%. The sky was mostly clear during the study period. The average atmospheric pressure value has been found to be around 732.3 mm Hg. Total 94.5mm rainfall was recorded

during the study period. The average rainfall during the season was found to be 1.04 mm.

Table 1.2: SEASONAL WIND DISTRIBUTION

Period: 01st JAN.'2016 – 31stMAR.'2016

Wind Direction	Wind Velocity (m/s) & Duration (%)				
	< 0.5	0.6 -1.5	1.6 -3.5	>3.5	Total
N		1.61	0.78	0.00	2.38
NNE		0.83	0.37	0.00	1.19
NE		3.17	1.47	0.05	4.67
ENE		0.41	0.14	0.00	0.55
E		1.10	0.69	0.00	1.79
ESE		0.50	0.37	0.00	0.87
SE		1.28	0.41	0.05	1.74
SSE		0.64	0.18	0.00	0.82
S		0.41	0.09	0.00	0.50
SSW		0.28	0.05	0.00	0.32
SW		2.29	0.60	0.00	2.88
WSW		1.06	0.41	0.00	1.47
W		8.99	2.48	0.00	11.45
WNW		1.24	1.01	0.00	2.24
NW		11.47	4.22	0.05	15.71
NNW		2.11	3.59	0.00	5.7
CALM	44.97	-	-	-	44.97
Total	44.97	37.32	17.56	0.15	100

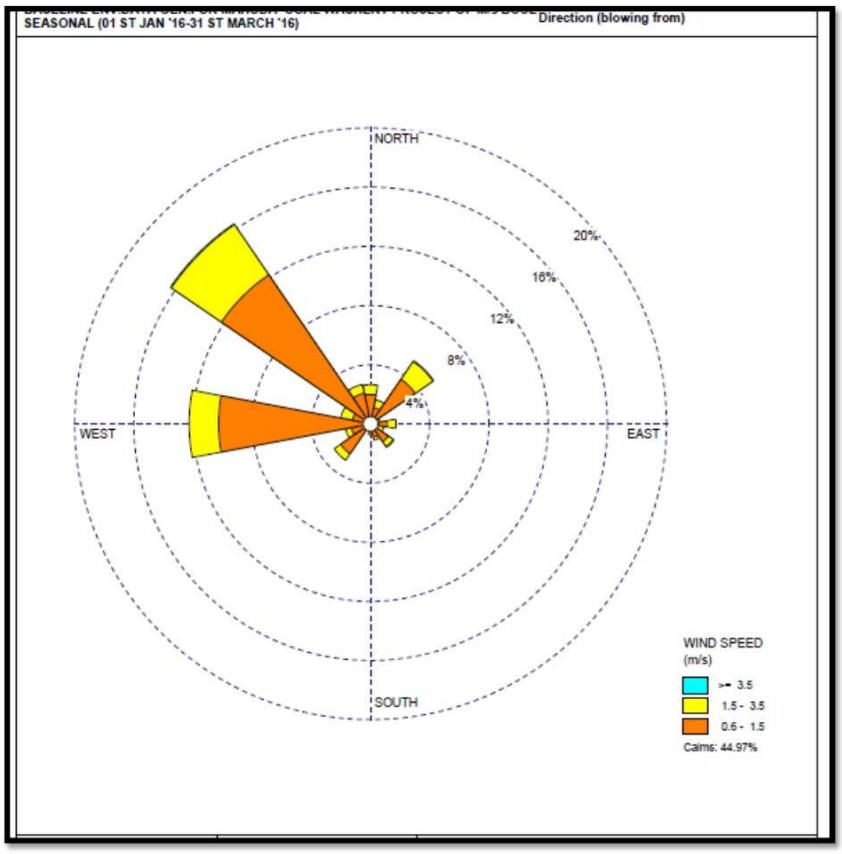


Figure No.-1.1 Wind Rose diagram for the period 1St Jan to 31St March 2016

Chapter – II

Fugitive Dust Generation Due To Movement of Coal

2.1 Introduction

The coal produced moves to the consumers via Road & Rail. Coal from the mine face is brought to the surface dumps and bulk of it goes to the nearby railway sidingsfor further movement to the consumer- end through rail. The journey from the mine face to the railway siding is covered by road. A portion of the coal produced by the mine directly goes to the consumers via road. Transportation of coal by rail is an environmentally better option than the road transportation. Road Transportation results in generation of fugitive dust from road surface apart from other pollutants released due to consumption of Diesel.

The fugitive dust generated due to coal transportation through road depend upon the following factors:

1. Speed and Weight of the moving vehicles.
2. Silt Content of the Road Dust (Particles less than 200 mesh size is considered as silt)
3. Silt loading of the road dust (Kg/m^2).
4. Moisture Content of the dust lying on the road surface.
5. Ambient Temperature, Humidity & wind velocity.

The dust generation will be lower if the quantity of dust (silt loading) lying on the road surface is minimum and the moisture content of the loose material lying on the road surface is high.

2.2 Movement of Coal

Distance travelled by coal and subsequent release of fugitive dust during its journey towards the consumer end has been described and dust load has been worked out.

2.2.1 Dust Generation :

Table: 2.1 Dust Generation (Kg/day)

Sl No.	Name of the Mine	Year	Location	Distance from Face to Siding (Km)	Coal Transferred (Te)	Daily Coal Production (Te/Day)	Capacity of the Dumper	Vehicle Kilometer Travelled	Emission Rate for PM 10 (kg/VKT)	Pollution Load * Dust Generated Per Day (Kg/day)	Dust generated Kg/per tonne
					Dust generated per day (Kg/Day)						
1	Amal. Joyrampur Colliery	16-17	9 no. siding	4.5	56363.00	185.41	10.00	166.87	0.53	88.441	
			Total for 16-17			**185.41**				**88.441**	0.48
2	Amal. NT-ST-JG Colliery	16-17	6/9 no. siding	3.47	3074877.00	9315.87	10.00	6465.21	0.53	3426.563	
			Total for 16-17			**9315.87**				**3426.563**	0.37
		17-18	6/9 no. siding	3.47	3324372.00	8300.45	10.00	5760.51	0.53	3053.072	
			Total for 17-18			**8300.45**				**3053.072**	0.37

* In terms of PM 10 expressed as kg/day, ** Average distance has been considered, *** Capacities of Dumpers used in transportation of coal from face to siding taken as 30Te, to Washery 20Te, and Outside Transport 15 Te. ..## Emission rate for PM_{10} has been taken from the S&T work (funded by MoC) carried out by CMPDI during 2002-2007.

2.3 Optimum Coal Transportation scheme in the Present Scenario:

Phase – I (for 10 + 05 Years)

As suggested by the Environmental Appraisal Committee, it is proposed to continue the existing Road–Rail transport network system in view of the implementation of the Jharia Action Plan (JAP) for 10 years and another 05 years gestation period after the completion of the JAP for consolidation of the backfilled dug out fire areas and unstable areas is required. Thus the period of 15 years, make the Phase – I. All mitigation measures like covered trucks, green belting on either side of the road, enhanced water sprinkling, proper maintenance of roads, removal of spilled materials etc shall be adopted for 15 years with the existing road – rails transport system.

2.4 Conceptual Plan of Proposed Integrated Coal Transportation Network for the Cluster:

Phase – II (after 15 Years):

As suggested by the EAC Members, BCCL shall implement conveyor –cum-rail transport to avoid movement of trucks within the cluster for coal transportation in Phase –II. Loading of coal by pay–loaders shall be discontinued.

During 2016-17, the combined daily coal production of the Cluster was 9501 tones resulting in 3535 kg of daily fugitive dust generation. The dust (PM-10) generation rate at present is 0.37 kg/te.

As a result of replacement of existing road transportation of coal by Conveyor to railway siding will result in reduction of fugitive dust generation to the extent of 9544 kg/day for daily coal production of 25797 tonnes (0.234 MTY) during Phase –II.

Table 2.2: Proposed Infrastructure for Coal Transportation (phase – II)

Cluster	Mines in Operation in Phase - II	Production Capacity (MTY)	Proposed Transport Infrastructure in Phase – II
IX	Amalgamated Joyrampur Colliery (OC)	3.25	**Coal transport by Conveyor to Railway Siding**
	NT-ST Expansion OCP	7.8	
		8.512*	

*Peak of the cluster will remain same, as peak of individual will be achieved in different year.

2.5 Conclusion:

On the basis of the study undertaken to assess the impact of coal transportation on pollution load, the followings may be concluded:

Phase – I :(2016-17 to 2028 -29):

1. During Phase – I, business as usual (BAU) scenario will prevail and the existing road cum rail transport network system will be used for coal dispatch to the consumers. During 2016-17, the combined daily coal production of the Cluster was 9501 tones resulting in 3515 kg of daily fugitive dust generation. The dust (PM-10) generation rate at present is 0.37 kg/te.
2. The generation of fugitive dust due to transportation of coal by road can be further reduced by enforcing covering of loaded trucks, periodical removal of loose materials lying on the road surface and black topping of coal transportation roads.
3. Avenue plantation, effective wetting of the road surface and proper maintenance of roads will further result in mitigation of the impact of road generated dust on ambient air quality.
4. Better road condition, by the use of Mechanical Sweeper or vacuum cleaner dust generation may be minimized.

Phase – II :(From 2029-30 Onwards):

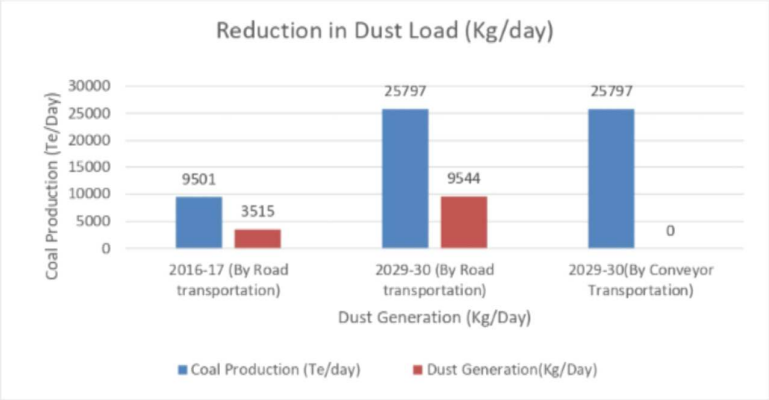
1. As a result of replacement of existing road transportation of coal by Conveyor to railway siding will result in reduction of fugitive dust generation to the extent of 9544 kg/day for daily coal production of 25797 tonnes (0.234 MTY) during Phase –II.
2. During Phase –II, dust load will further reduce due to quenching of mine fire and domestic coal consumption after resettlement of general population dwelling within the command area of cluster, as a result of implementation of Jharia Action Plan. It will result in significant improvement in ambient air quality.

3. **Coal Production Vs. Dust Generation due to Road Transportation is presented below:**

Table2.3: Coal Production Vs. Dust Generation due to Road Transportation

Year	Coal Production (Te/day)	Dust Generation(Kg/Day)
2016-17 (By Road transportation)	9501	3515
2029-30 (By Road transportation)	25797	9544
2029-30(By Conveyor Transportation)	25797	0

Figure 2.1: Presentation of reduction in dust generation due to replacement of Road transportation by Conveyor system.


Reduction in Dust Load (Kg/day)
Coal Production (Te/Day)
30000
25000
20000
15000
10000
5000
0
9501
3515
25797
9544
25797
0
2016-17 (By Road transportation)
2029-30 (By Road transportation)
2029-30(By Conveyor Transportation)
Dust Generation (Kg/Day)
Coal Production (Te/day)
Dust Generation(Kg/Day)

Annexure VIII

(7)

Ph: 0326-2204933

झारखण्ड राज्य प्रदूषण नियंत्रण पर्षद्

Jharkhand State Pollution Control Board

HIG-1, Housing Colony, Dhanbad-826001

Letter No....2650 Dated ....6/7/13....

From,

Regional Officer,
Dhanbad

To,

HOD (Envt.),
M/s. B.C.C.L.,
Koyla Bhawan, Koyla Nagar,
Dhanbad.

Sub: **Fixing up monitoring station/Sampling location of Air, Water & Noise.**

Sir,

With reference to you letter no. GM(Env.)/F-JSPCB/2013/783, dt. 06.07.2013 We have approved Air, Water & Noise monitoring Station/Sampling location after verification and return a copy of the map.

Encl-A/a.

Your's faithfully,

6/7/13

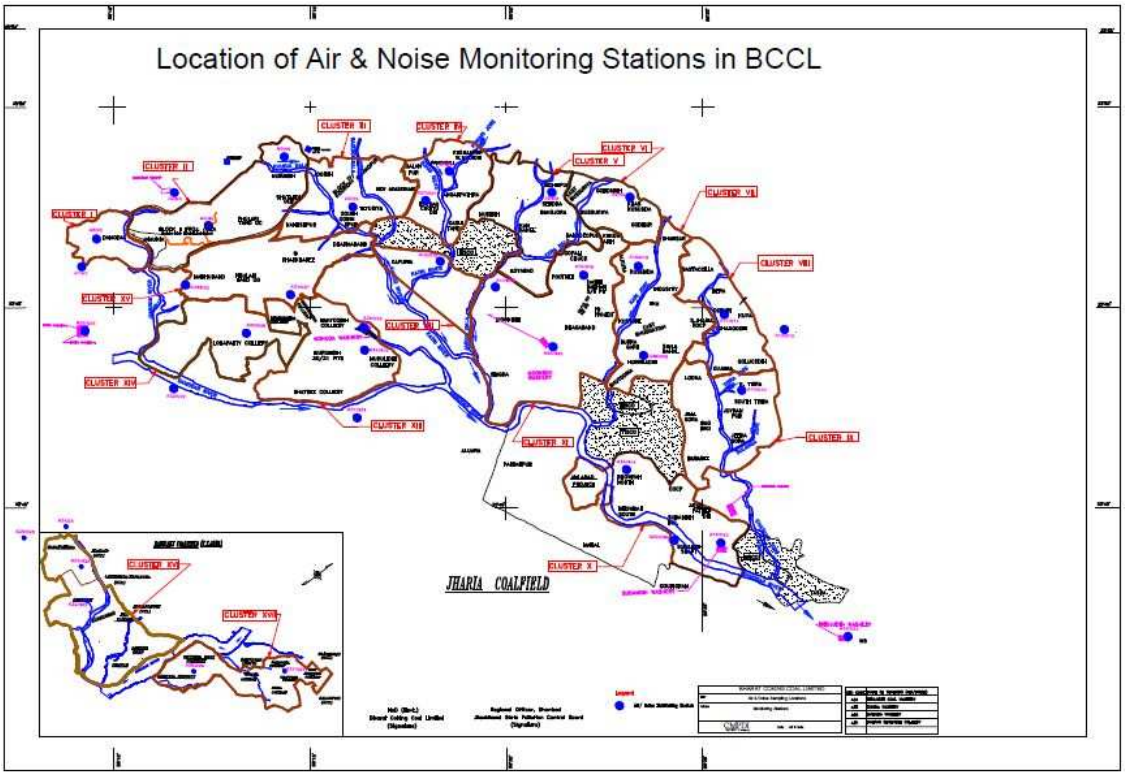
(Dinesh Prasad Singh)
Regional Officer.

Memo..... Dhanbad, dated.....

Copy to: The Member Secretary, Jharkhand State Pollution Control Board for information & enclose a copy of the map for necessary action.

Encl-A/a.

(Dinesh Pd. Singh)
Regional Officer.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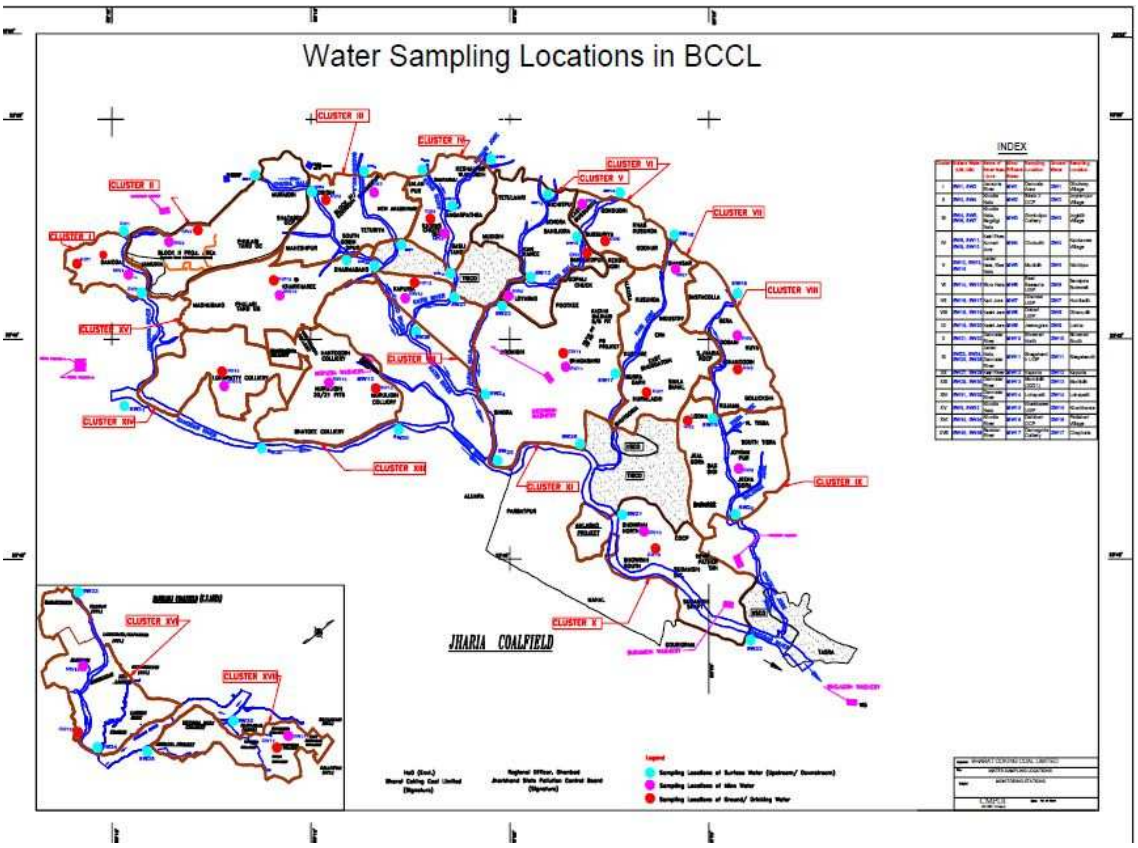
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Progress Report

1st Phase Air Monitoring report for

"Source apportionment of ambient air particulate matter in Jharia coalfields region, Jharkhand"

Sponsor

Bharat Coking Coal Limited (BCCL)

CSIR-National Environmental Engineering Research Institute, Nagpur

2019

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1. Introduction

1.1 Project Background

Bharat Coking Coal Limited, a subsidiary of Coal India Limited, has been operating the majority of the coal mines in the Jharia coal field regions since its inception in 1972. Jharia coal mines are special for its low ash content and high calorific value coals. Therefore, they are often used directly in iron and steel plants for metal oxide reduction after washing. Although these coal mines are highly priced for their high quality coal, they are notorious for their mine fires, which causes lot of fugitive gaseous and PM emissions. Hence, Jharia region has been under scrutiny by various public authorities and common public with a vision to improve the ambient air quality.

Various sources contribute to high particular matter concentration in the Jharia region: vehicles, mining activities, re-suspended dusts, fugitive emissions, fuel oils, household LPGs, etc. The percentage contribution of these factors in the ambient depends exclusively on the economic activities of that particular region. In order to improve the existing ambient air quality, the major sources of PM emissions first need to be identified. Hence, the environmental clearance committee of MoEF has directed BCCL to conduct a source apportionment study for particulate matter. In this context, BCCL has approached CSIR-NEERI to conduct a source apportionment study of ambient air particulate matter in Jharia coalfields region in order to quantify the various sources PM emissions and suggest an effective environmental management plan.

1.2 Project objectives

The major objective of the study is to assess the current ambient air quality, sources of air pollution and propose the priorities for the actions for improvement of air quality. The study to include the entire Jharia Coalfield along with area up to 10 Km from the periphery / boundary of BCCL mines.

The detailed objectives are as following:

i. Ambient Air Monitoring

- ✓ Monitoring of ambient air quality at selected receptor locations for pollutants including PM10, PM 2.5(limited), SO2, NOx, PAHs to establish the status of the air quality in Jharia Coalfields along with area up to 10 K.M from the periphery/boundary of BCCL mines. Also, review of the available air quality monitoring data from Central Pollution Control Board (CPCB) /Jharkhand State Pollution Control Board (JSPCB).

- ✓ To calibrate dispersion modelling predictions using measured air quality parameters.

- ✓ To draw supportive data through specific site related monitoring regarding impact causing sources such as kerbside monitoring.
- ✓ To establish the impact of meteorological conditions on a few select indicator pollutants in different micro meteorological conditions of the Jharia Coalfields.

ii. Emission Inventory related of Jharia Coalfields along with area up to 10 Km from the periphery / boundary of BCCL mines.

- ✓ To identify the pollution load grid wise for point, line and area source
- ✓ To establish possibilities of receptor level concentrations of air pollutants by matching dispersion modelling and air quality-monitoring data.

iii. Source apportionment related

- ✓ To identify and apportion the pollution load at receptor level to various sources in the Jharia Coalfields along with area up to 10 Km from the periphery / boundary of BCCL mines.
- ✓ To carry out the source apportionment using molecular markers for a limited number of samples through a time resolved sample collection at various period of the day and day-of-the-week.

iv. Any other item in consensus between both BCCL/CIL & NEERI evolved during the study.

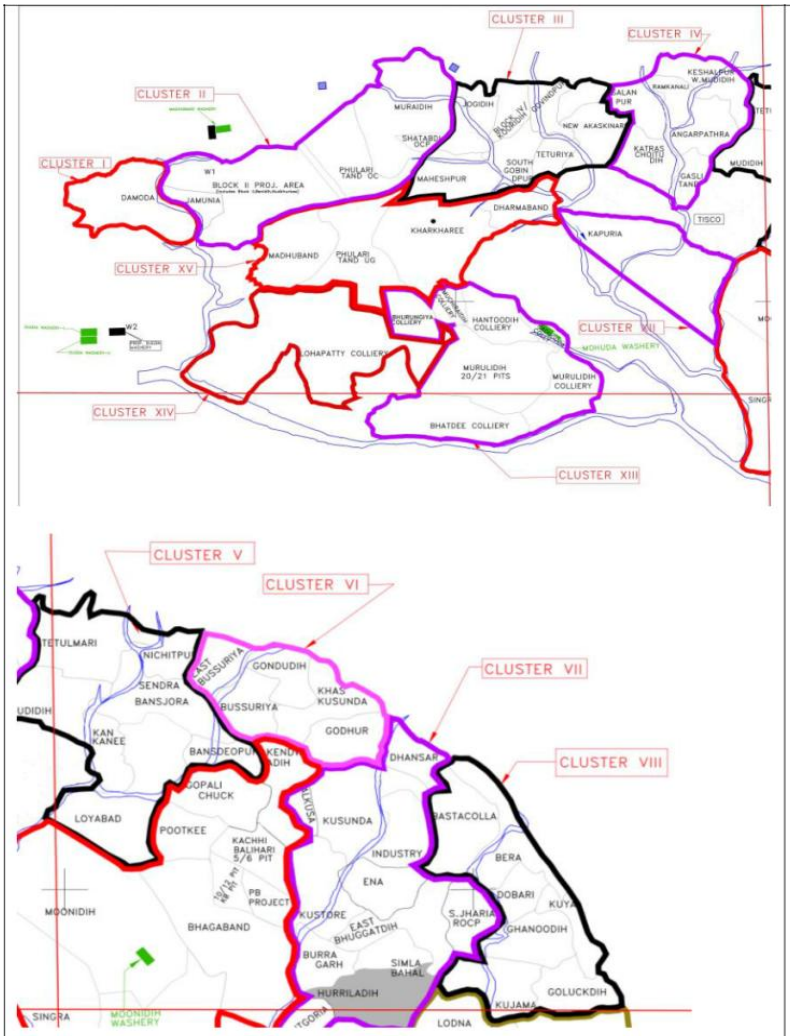
2. Field visit

In connection with the above objectives, the NEERI's team and BCCL's team visited BCCL's Jharia coal filed for 3 days from 23 September to 27 September 2018. The team covered the entire Jharia coalfield, which spans roughly 30km in length and 22 km wide in three days with the following purpose.

To identified the location for air monitoring station in entire Jharia Coal Field region.

2.1 Jharia coalfield maps:

BCCL environmental department provided the map of the Jharia region. The site visit was carried out with assistance from BCCL's team. The 15 Jharia mines coal fields were segregated into three parts and details of the visit along with mine cluster names are given in Table 2.1.

	**Part 1:** Cluster VI, VII, VIII, and X
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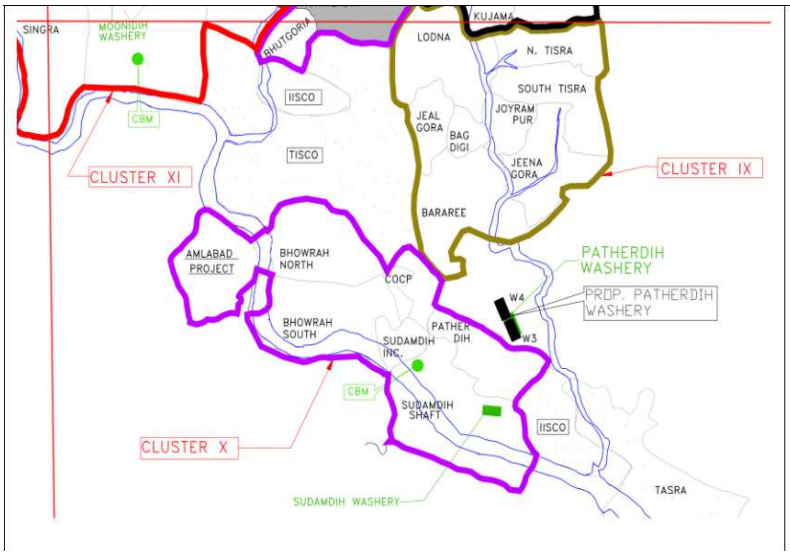
	**Part 3:** Cluster IX

Table 2.1 Jharia coalfields Site visit on cluster-base

Based on the objectives and outcomes envisaged, the various mine areas were visited to identify sources of emissions such dumpsite emissions, fugitive emissions, blasting emissions. Furthermore, the already existing PM monitoring sites of BCCL were also visited to explore of possibility of installing NEERI's PM monitoring stations.

2.2 Site Identification:

The Entire Jharia Coal Field (JCF) is divided into 16 clusters. Both opencast and underground mines are operational in JCF. Standard mining operations like drilling, blasting, hauling, accumulation, and transfer are the major sources of emissions and air pollution. Apart from that, a typical emission source, mine fire, is prevailing at JCF. Besides, JCF encompasses large non-mining regions, which have their own emission sources like vehicular emission in congested traffics, road dust, Power Plant emission, other industrial emissions (coke oven plants, brick kilns, stone crushers, etc.), crematoria, domestic burning, open burning etc.

Based on the preliminary field visit by CSIR-NEERI Scientists along with BCCL staffs, the following locations are selected for the establishment of Air Quality Monitoring Stations for source apportionment study;

Core Zone

1. Cluster XIV (Lohapatty) – nearby sources: Chandrapura Thermal Power Plant
2. Cluster VII (Mine rescue station)- nearby sources: Coal Mine, Industry
3. Cluster IV or Cluster V – Banssuriya or Katras
4. Cluster IX (Lodhna)
5. Cluster XI (Moonidih)
6. Cluster X (Patherdih): nearby sources: Coal Mine, Steel Industry
7. Cluster VIII (Bastacola)

Buffer Zone

8. Bank More
9. Harina
10. Bhuli
11. Sindri
12. Parbatpur Electrosteel/ Bhaga

13. Background site (Upwind & away from sources) and also secondary Data from DVC, CCL mines Sail Bokaro and Jharkhand pollution Control Board will be obtained.

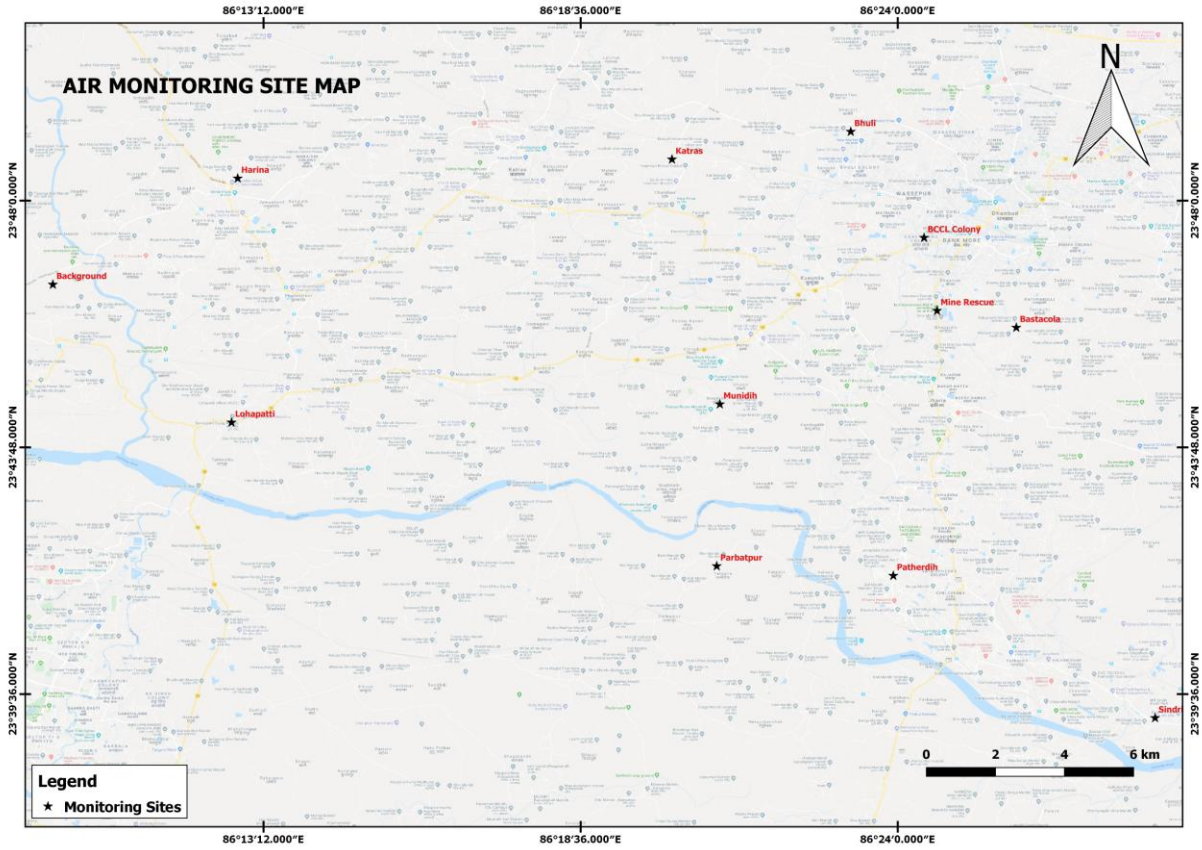


Figure2.1 Identified air monitoring station in Jharia Coalfield

3. Sampler Selection and Procurement

Standard equipment were catered for the parameter required towards ambient air particulate characterization and gaseous sampling in the initial phase of the project.

Table 3.1 Samplers Procured for Monitoring

Sampler	**Brief Description of operating conditions**
Fine Dust Sampler	Sampling Inlets- $PM_{2.5}$, PM_{10} and TSP Flow rate-16.7LPM
FRM Sampler	Versatile inlet configurations for $PM_{2.5}$, PM_{10}, or TSP sampling FRM quality 24-hour sampling at 16.7 LPM
Gaseous Sampler	Sampling Rate-0.5-1.0 LPM Operation time-8 hours

4. Monitoring parameters

Parameters of monitoring were decided based on the objectives of air pollution and source apportionment study. The source apportionment analysis required air monitoring for particulate matter ($PM_{2.5}$ and PM_{10}) and its chemical speciation to develop signature profiles of pollution sources that can be used in chemical mass balance models. The analysis data could also be used to interpret the overall loading of different chemicals contributed varied sources. Monitoring included air quality attributes such as Particulate matter, Sulphur Dioxide (SO_2) and Oxides of Nitrogen as NO_2, to understand not only the regulatory compliance but also their inter-correlations with other species such as Heavy metals, EC, OC etc. Since the objective of source apportionment study is to determine the contributions from various sources such as industries, vehicular and other area sources additional parameters were also monitored such as Polycyclic Aromatic Hydrocarbons (PAHs). List of all parameters, sampling flow rate and analytical methods are provided in Table 4.1

Table 4.1 Ambient Air Quality Sampling/Analysis Methodology for Target Pollutants

Particulars	Parameters			
	PM_{10}	$PM_{2.5}$	NO_2	SO_2
Sampling Instrument	Fine Dust Sampler & FRM Sampler	Fine Dust Sampler & FRM Sampler	APM sampler	APM sampler
Sampling Principle	Cyclonic Flow Technique	Cyclonic Flow Technique/ WINS Impactor	Chemical absorption in suitable media	Chemical absorption in suitable media
Flow rate	16.7 LPM	16.7 LPM	0.5 LPM	0.5 LPM
Sampling Period	24 hourly	24 hourly	8 hourly	8 hourly
Sampling Frequency	10 days continuous, Teflon and quartz on alternate days	10 days continuous, Teflon and quartz on alternate days	10 days continuous	10 days continuous

Analytical Instrument	Electronic Micro Balance	Electronic Micro Balance	Spectrophoto-meter	Spectrophoto-meter
Analytical Method	Gravimetric	Gravimetric	Colorimetric Improved West & Gaeke Method	Colorimetric Improved West & Gaeke Method
Minimum reportable value	5 $\mu g/m^3$	5 $\mu g/m^3$	9 $\mu g/m^3$	4 $\mu g/m^3$

4.1 Monitoring Frequency

All pollutants exhibit diurnal and seasonal variations, which have been taken into account while determining the frequency of the sampling. In order to assess the impact of the diurnal variations in source contributions for a given meteorology of the day, 24 hourly monitoring plan was envisaged (8 hourly sampling for gaseous pollutants and 24 hourly sampling for particulate matter). The field study was planned for a period of 10 days at each monitoring site for the season to represent variation in air quality. The sampling frequency details are presented in Table 4.1.

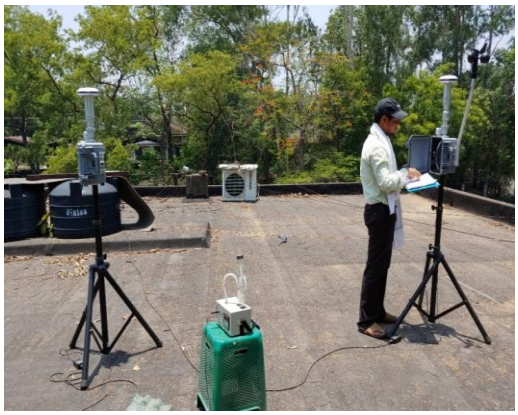
Table 4.1.1 Frequency of Air pollutants sampling in Jharia Coalfield

Parameter	Number of Days	Change of Filter/ absorbing media	Reporting
PM_{10}	10	24 hourly, Teflon: 05 days Quartz: 05 days	24 hourly
$PM_{2.5}$	10	24 hourly Teflon: 05 days Quartz: 05 days	24 hourly
NO_2	10	8 hourly	8 hourly
SO_2	10	8 hourly	8 hourly

The glimpses of air monitoring of some locations are shown in Figure 4.1.

Kataras

Lodhana



Moonidih

Patherdiha

Bastacola

Sindri

Figure 4.1 Glimpses of air monitoring of some locations

4.2 Filter handling and Weighing:

Teflon-membrane and quartz-fibre filter are most commonly used for chemical analysis. Each filter was individually examined prior to labelling for discoloration, pinholes, creases, separation of ring, chaff or flashing, loose material, or other defects.

Gravimetry measured the net mass on a filter by weighing the filter before and after sampling with balance in temperature and relative humidity controlled environment. To minimize particle volatilization and aerosol liquid water bias, $PM_{2.5}$ Filters were equilibrated for 24 hours at a constant (within ±5%) relative humidity between 30% and 40% at a constant (within ±2°C) temperature between 20°C and 23°C. PM_{10} filters were equilibrated at 20% to 45% relative humidity (±5%) and 15°C to 30°C temperature (±3°C).

Methods of Chemical characterization:

Sulphur dioxide (SO_2)	: Modified West and Gaeke method
Nitrogen dioxide (NO_2)	: Sodium Arsenite method
Suspended Particulate Matter (SPM)	: High Volume method (Gravimetric method)
Respirable suspended Particulate Matter (RSPM)	: Gravimetrically with GFA/EPM 2000 filter paper using respirable dust sampler (Cyclonic Flow Technique)

5. Ambient Air Quality Monitoring

Core Zone

Site 1: Cluster XIV (Lohapatty)

The samplers were installed on the roof of area office of Lohapatty (Latitude 23.737066 and Longitude 86.210894). It was located near residential colony. Coal mine was 1 km away from the sampling site. Coal has been transported through railway line which is 1.5 km away on a daily basis and also through trucks. NH-32 construction was going on 500 m away from the site. The major fuel used for cooking is coal in the study area.

Site 2: Cluster VII Mine rescue Station

Monitoring station was positioned in Mine rescue station, Dhansar on the roof of office building (Latitude 23.768746 and Longitude 86.411141). Mine rescue station is next to

the state highway 12 where continuous movement of heavy vehicles takes place. Mining activities were also observed nearby the location.

Site 3: Cluster V Katras

In Katras, samplers were installed at Expert hostel (Latitude 23.811692 and Longitude 86.335910). There was a settlement residential area nearby. Mining activities was in progress within 500m area. Railway track was nearly at 150m distance from the site. Coal was used for cooking. Many other activities were observed during sampling in the nearby area which may contribute. 'Mela' and continuous 'Hawan' were going on within 100m area. Also road construction was in progress near 7km.

Site 4: Cluster IX (Lodhana)

Samplers were installed at office in Lodhna (Latitude 23.721713 and Longitude 86.410260). Near Lodhna, colliery was 2 km away from the site. Nearest Railway track was 1.5 km away. Coal was mostly used for cooling.

Site 5: Cluster XI (Moonidih)

Moonidih mine is one of the underground mine of BCCL. Sampler was stationed in Area office of Moonidih mine (Latitude 23.742228 and Longitude 86.349494). Since monitoring location was 250-300m from the mine, movement of heavy vehicles was continuous. There is washery also at distance of 500m where trucks and conveyor were used for transportation of coal. So the mining activities nearby contributes to particulate matter emission.

Site 6: Cluster X (Patherdih)

Samplers were stationed in guest house of BCCL in Patherdih area (Latitude 23.693577 and Longitude 86.398728). It is situated beside highway where continuous movement of heavy vehicles observed. TATA steel coal mine is situated 1km away from the location where continuous mining activities takes place. Transportation of coal through railway wagons in same area also contributes to particulate matter emission.

Site 7: Cluster VIII (Bastacola)

The samplers were positioned in area office of Bastacola mine (Latitude 23.763966 and Longitude 86.433635). Here also, coal was used as a cooking media. Railway track was

at Jodaphata which was 3-4 km away from the site. Residential area was nearly 0.5-1km. Mine was situated 3km from the site but no Mining activity was observed during monitoring.

Buffer zone

Site 8: Bank More (BCCL Colony)

Sampling station was installed in BCCL colony, Jawahar Nagar on the roof of a resident (Latitude 23.789463 and Longitude 86.407448). No mining activities were observed but the colony was beside the NH 18 highway so it may contribute to particulate matter emission.

Site 9: Harina

At Harina, the site chosen for air sampling was BCCL colony (Latitude 23.806308 and Longitude 86.212641). Since it was BCCL residential area, fuel used for cooking purpose was LPG. Settlement residential area was observed nearby where coal was used as a media for cooking. Colliery and Railway track were 3km and 2 km away from the site respectively. Highway was 1km away from the site and Coal washery at distance of 4.5km.

Site 10: Bhuli

The samplers were installed on the roof of Saraswati Vidya Mandir, Bhuli (Latitude 23.819554 and Longitude 86.386647). The location was in residential area. Mining activity was going at a distance of 8-10km. A closed Brick factory was located in the nearby area. Fuel used for cooking was mostly coal. Railway track used for coal transportation was 4km from the site. Construction of highway was also going on within 1.5km area during the monitoring.

Site 11: Sindri

Air samplers were installed at BIT Sindri college campus (Latitude 23.653214 and Longitude 86.473022). Transportation of coal was done by railway wagons at distance of 2km from monitoring site. LPG was mostly used for cooking rather than coal. A construction activity was going on nearby. The site was near the highway at a distance of <100m.

Site 12: Parbatpur

The sampling station was installed on roof of a house (Latitude 23.696296 and Longitude 86.348609). Mining activity was no longer going nearby. Coal was primarily used for cooking.

Site 13: Background

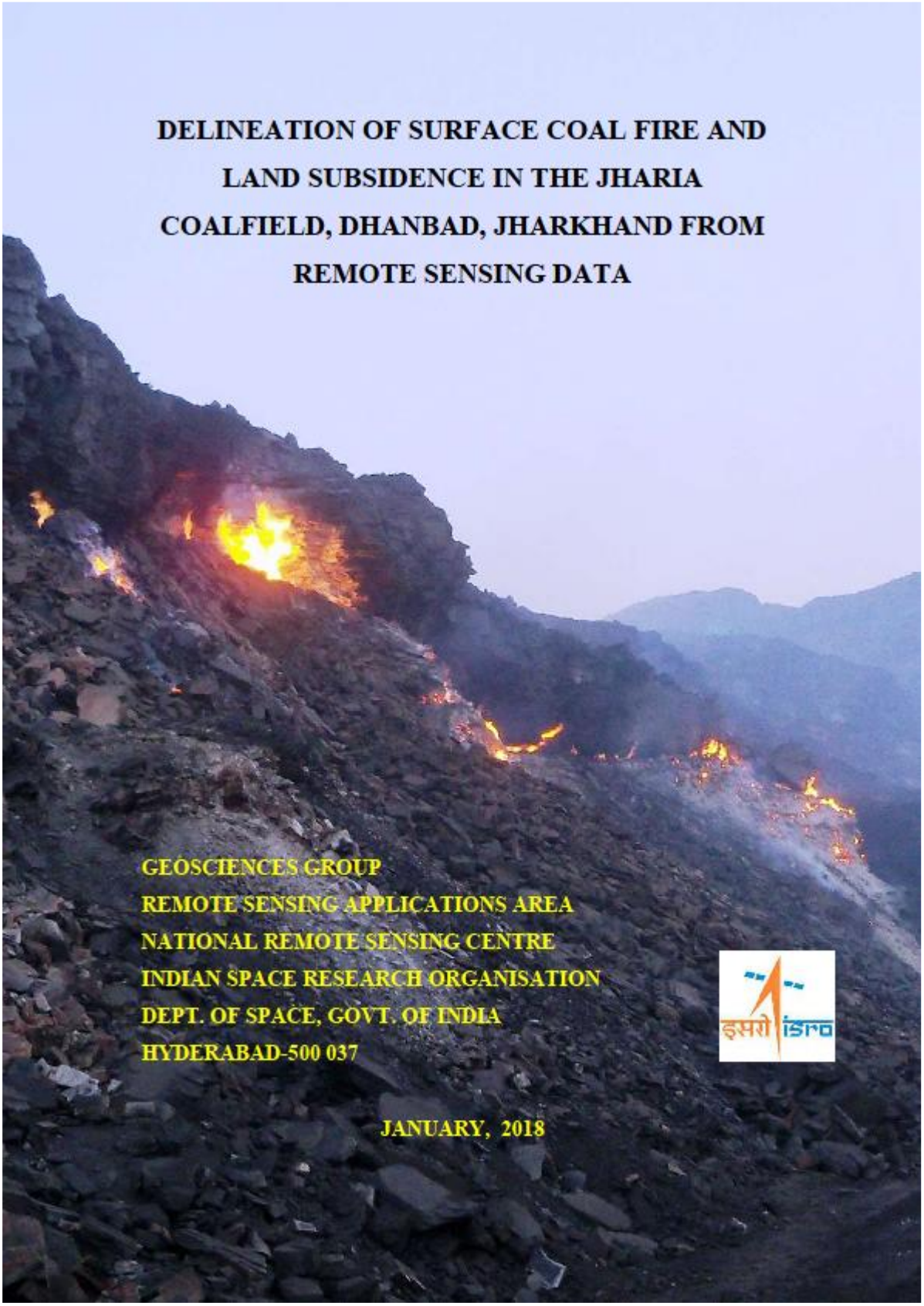
The air monitoring samplers were installed on roof of resident's house which was near to the highway at a distance of less than 1 km (Latitude 23.776180 Longitude 86.160177). Construction activities were going on nearby the location. Heavy rainfall also occurred during monitoring period. Mine activities were also observed in radius of 2-3km. Settlement resident's uses coal for cooking purposes.

Sample collection Transportation and Preservation

Ambient $PM_{2.5}$ and PM_{10} samples were collected using suitable sampler at a desired flow rate. Filters were wrapped carefully with aluminium foil and stored in re-sealable plastic bags. At sampling site, the filter that collected the particle sample on the previous day was taken out of the filter holder and immediately wrapped with aluminium foil and sealed. The sample filers were transported back to the laboratory in an isolated cooler container with ice and then frozen at -10°C until analysis.

Table 5. 1 Physical and Chemical components for characterization of Particulate matter

Components	**Filter Matrix**	**Analytical Methods**
PM10/ PM2.5	Teflon/Quartz filter paper	Gravimetric
Elements (Na, Mg, Al, Si, P, S, Cl, Ca, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Ga, As, Se, Br, Rb, Sr, Y, Zr, Mo, Pd, Ag, Cr, Cd, In, Sn, Sb, Ba, La, Hg, Ti, and Pb)	Teflon/Quartz filter paper	ICP-OES
Ions ($NO2^-$, $NO3^-$, SO_4^{-2}, K+, NH^{4+}, Na^+)	Teflon/Quartz filter paper	Ion chromatography with conductivity detector
Carbon Analysis (OC, EC)	Quartz filter paper	TOR/TOT method
PAHs	Teflon/Quartz filter paper	Extraction followed by GC-MS analysis with and without derivatization



DELINEATION OF SURFACE COAL FIRE AND LAND SUBSIDENCE IN THE JHARIA COALFIELD, DHANBAD, JHARKHAND FROM REMOTE SENSING DATA

GEOSCIENCES GROUP
REMOTE SENSING APPLICATIONS AREA
NATIONAL REMOTE SENSING CENTRE
INDIAN SPACE RESEARCH ORGANISATION
DEPT. OF SPACE, GOVT. OF INDIA
HYDERABAD-500 037

JANUARY, 2018

DELINEATION OF SURFACE COAL FIRE **AND** LAND SUBSIDENCE IN THE JHARIA COALFIELD, DHANBAD, JHARKHAND FROM REMOTE SENSING DATA

Report for

BHARAT COKING COAL LIMITED (BCCL)

(A SUBSIDIARY OF COAL INDIA LTD.)

ENVIRONMENT DEPARTMENT, KOYLA BHAWAN

KOYLA NAGAR, DHANBAD – 826 005, JHARKHAND

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HYDERABAD-500 037

JANUARY, 2018

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CONTENTS

ACKNOWLEDGEMENTS

The project team is grateful to Dr. Y.V.N. Krishnamurthy, Director, NRSC, for his support at various stages during execution of this project. We are extremely grateful to Dr. P.V.N. Rao, Deputy Director (RSAA), NRSC for his overall guidance and encouragement. We thank Shri D. Gangopadhyay (Director, P&P). BCCL, for this project initiative and for providing Geosciences group, NRSC, the opportunity to carry out the task. We are thankful to Shri A. K. Singh (GM, I/C), BCCL for taking keen interest in the project work and for the support during our fieldwork. We also thank Shri Dipankar Maity, Surveyor (Mining) and Shri Mithilesh Kumar, Sr. Manager (Mining) for their support and fruitful discussion during the fieldwork. The support of all the BCCL officials in the various collieries visited during the course of the ground truth verification is duly acknowledged.

EXECUTIVE SUMMARY

Coal fire is a serious problem in Jharia coal field, where high ranking coals are gradually burnt due to these fires. The combined effect of surface and sub-surface fires and mining related subsidence has endangered the environmental stability of Jharia coal field. Coupled with the ecological changes instigated by open cast mining, the landscape in and around Jharia have changed drastically over the years. In the present study, delineation of coal fire and mining related land subsidence have been addressed. Thermal band of Landsat-8 (100m resolution) have been used to demarcate the coal mine fire areas from non fire areas. For this study, Landsat-8 data of May, 2017 have been used. The band 10 (10.60-11.19 μm) of Landsat-8 data is used to derive the relative radiant temperature. Further ALOS-PALSAR 2, L band microwave data has been used to delineate zone of probable land subsidence (using differential interferometry) due to mining. The study reflects that, compared to 2012, the eastern flanks (Lodna and Tisra) show a larger fire area. The western flank (Nadkhurkee and Shatabdi) and the northern flank (Katras and Gaslitand) show isolated fire pockets in active mines as well as OB dumps. Among all the colliery areas, Kusunda and Lodna area is most affected by coal mine fire. The current fire area mapped is 3.28 sq.km. Apart from this, five distinctive areas of land subsidence have been identified using interferometric method. These are primarily caused by older or active underground mining. The Moonidih Project is most affected by subsidence. The coal mine fire and subsidence areas are further verified on the ground. The final coal mine fire and subsidence map of Jharia coal field is prepared by using remote sensing data analysis with field validation.

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CHAPTER I

INTRODUCTION

Coal fire is a perennial problem in Jharia coal field (JCF) covering 447 sq. km. area in the Dhanbad district of Jharkhand state. Subsurface and surface coal fires are a serious problem in many coal-producing countries. The severity and extent of mine fires in some of the Indian coalfields, particularly Jharia and Raniganj coalfields, are quite alarming. Combustion can occur either within coal or in coal dumps on the surface. Considerable economic loss and environmental problem arises due to the coal fire. Coal fire burns valuable coal and also creates difficulties in mining by increasing the cost of production or making existing operations difficult. Noxious gases like sulphur dioxide, nitrogen oxide, carbon monoxide, carbon dioxides, which are the result of coal burning processes, often affect the immediate surroundings of an active coal fire area (Gangopadhyay, 2003). These greenhouse gases not only affect local atmosphere but also play a crucial role in the damages, found associated with coal fire such as land surface subsidence and surface cracking. Coal fires are caused by oxidation of coal but the reaction involved in oxidation of coal is not understood till date. Broadly, the potential for spontaneous combustion lies in its ability to react with oxygen at ambient temperature. This occurs through the reaction of oxygen at the surface of the coal resulting in an exothermic reaction. As a consequence, the temperature of coal rises and if temperature reaches the threshold temperature, ranging between 80^0 to 120^0C, a steady reaction starts, which produces carbon dioxide. Temperature keeps on increasing once CO_2 started to form and at 2300°C, the exothermic reaction becomes rapid. It is known that high grade coals (high carbon content) are more fire prone, though the reason behind this is not well understood. Another important parameter, which controls fire, is the size of the particles. Larger the effective area of coal (fire particles), more rapidly the reaction proceeds. Cracks, fissures play a role like positive catalysts to coal oxidation by slowly supplying oxygen / air through their conduits.

Coal mining in Jharia Coal Field (JCF) started way back in 1895. History of fire in Jharia Coal Field date back to 1916 when the first incidence of fire was reported from XIV seam of Bhowrah colliery. JCF was nationalised in 1972 and over the decades, the fire has spread or been contained but never extinguished. The combination of underground fire and subsidence have affected vast areas of JCF.

1.1 Background

Remote sensing technique in thermal band offers a cost-effective and time-saving technology for mapping various geoenvironmental / hazardous features such as coal fires, forest fires, oil well fires, volcanic eruptions etc. NRSC has carried out coal fire mapping projects in the past; conducting an airborne campaign in 1989 and using Landsat-5 TM data in 1995 (Bhattacharya *et. al.,* 1995), over Jharia coalfield, Jharkhand and using Landsat-5 TM data for 2001 over Raniganj coalfield, West Bengal. Further, projects were executed in 2006 and 2012 in which coal fires of the JCF were mapped using Landsat-7 ETM+ and ASTER data, respectively. Additionally, a R&D study was taken up in 2013 to delineate subsidence areas using differential interferomteric (DInSAR) technique. In view of the past experiences, based on the letter (Ref. no. NRSC/16/76) from Director (Tech.), Operations, BCCL addressed to Director, NRSC on 01 February 2016. a project was formulated to take up Coal fire and Land Subsidence study of the Jharia Coal Field using space-borne remote sensing technique. The formal Memorandum of Understanding between BCCL and NRSC was signed on 23rd of Dec, 2016.

1.2 Objectives

The following objectives are formulated on the basis of the above mentioned background:

I. To map Coal fire in the study area based on pixel integrated relative radiant temperature derived from latest available Landsat-8 data of 2016-17 time period.

II. To compare the change in the coal fire distribution in the Jharia coalfield within the period of 2012 and 2016-17.

III. To delineate probable subsidence areas in the region using differential interferometry method.

1.3 Study Area

Jharia Coalfield is located in the Dhanbad district of Jharkhand state (Figure 1) and it is named after the main coal mining town of Jharia. It is situated in the Damodar River valley and is about 250 km NW of Kolkata. The coalfield is contained roughly within latitudes 23º 42' N and 23º 50'N and longitudes 86º 09'E and 86º 30'E.

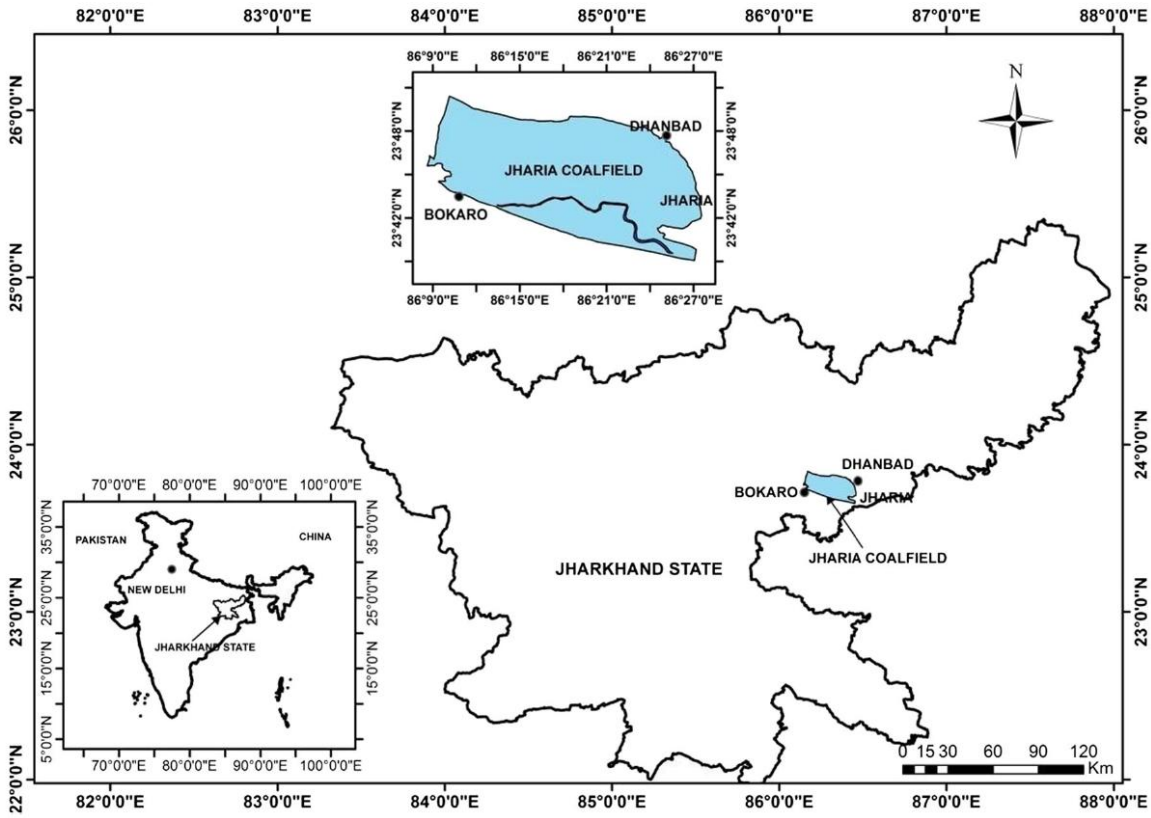

Figure 1: Study area map of Jharia Coalfied, Jharkhand

CHAPTER II

GENERAL DESCRIPTION OF THE STUDY AREA

2.1 Location and Accessibility

Jharia is an old mining town in the Dhanbad district of Jharkhand. This town is famous for its surrounding mines producing high grade coal and supplying mainly to the neighbouring industrial areas. Jharia is approximately 6 km in south western direction from Dhanbad town and connected by metal road. Dhanbad is well connected to Kolkata by road and rail.

2.2 Physiography, Drainage and Climate

Jharia coalfield is characterised by undulatory topography with very low rolling slope towards the eastern part of the area. The average height of the area is around 200 meters above the mean sea level. Damodar is the major river in the study area. The other tributaries to the Damodar River in this area are Jamuniya Nadi, Khudia Nadi, Khatri Nadi, Jarian Nala, Kari Jora and Domohani Nadi. Damodar River flows from west to east in this area. The minimum temperature is <10º C in the month of December – January and maximum temperature is >50º C in the month of May – June.

2.3 General Geology

Gondwana Super Groups of rocks of Up. Carboniferous to Lr. Cretaceous age (i.e. from 320 MY to 98 MY) are exposed here. Gondwana Super Group rocks unconformably overlie Archaean rocks. In Gondwana Rocks, Raniganj and Barakar Formations of Permian age have more potential as far as the coal production is concerned. Barakar Formation is exposed in north and north eastern part of the basin (Figure 2). Most of the coal mines are confined to the Barakar Formation in JCF. Barakars consists of coarse, medium grey and white sandstones, shales and coal seams. Raniganj consists of grey and greenish soft feldspathic sandstones, shales and coal seams. Faults are prevalent in this portion of basins (Figure 2). NW trending faults are conspicuous north to Jharia. Many lamprophyre and dolerite dykes are also exposed in this area in a criss-cross manner. The Raniganj Formation though coal bearing, has suffered much deformation due to faulting, thus causing difficulty for

mining in the area. The generalised stratigraphy of JCF is mentioned below (after Saraf, et al., 1995).

FORMATION	LITHOLOGY	MAXIMUM THICKNESS
Supra Panchet	Red and Grey sandstones and shales	300m
Panchet	Micaceous Yellow and Grey sandstones, Red and Greenish shales	600m
Raniganj	Grey and Greenish soft feldspathic sandstones, shales and coal seams	1050m
Ironstone Shales	Dark carbonaceous shales with ironstone bands	360m
Barakar	Coarse and medium Grey and white sandstones, shales and coal seams	630m
Talchir Boulder Bed	Coarse sandstones above and Greenish shales below	300m

Table 1: Generalised stratigraphy of JCF.

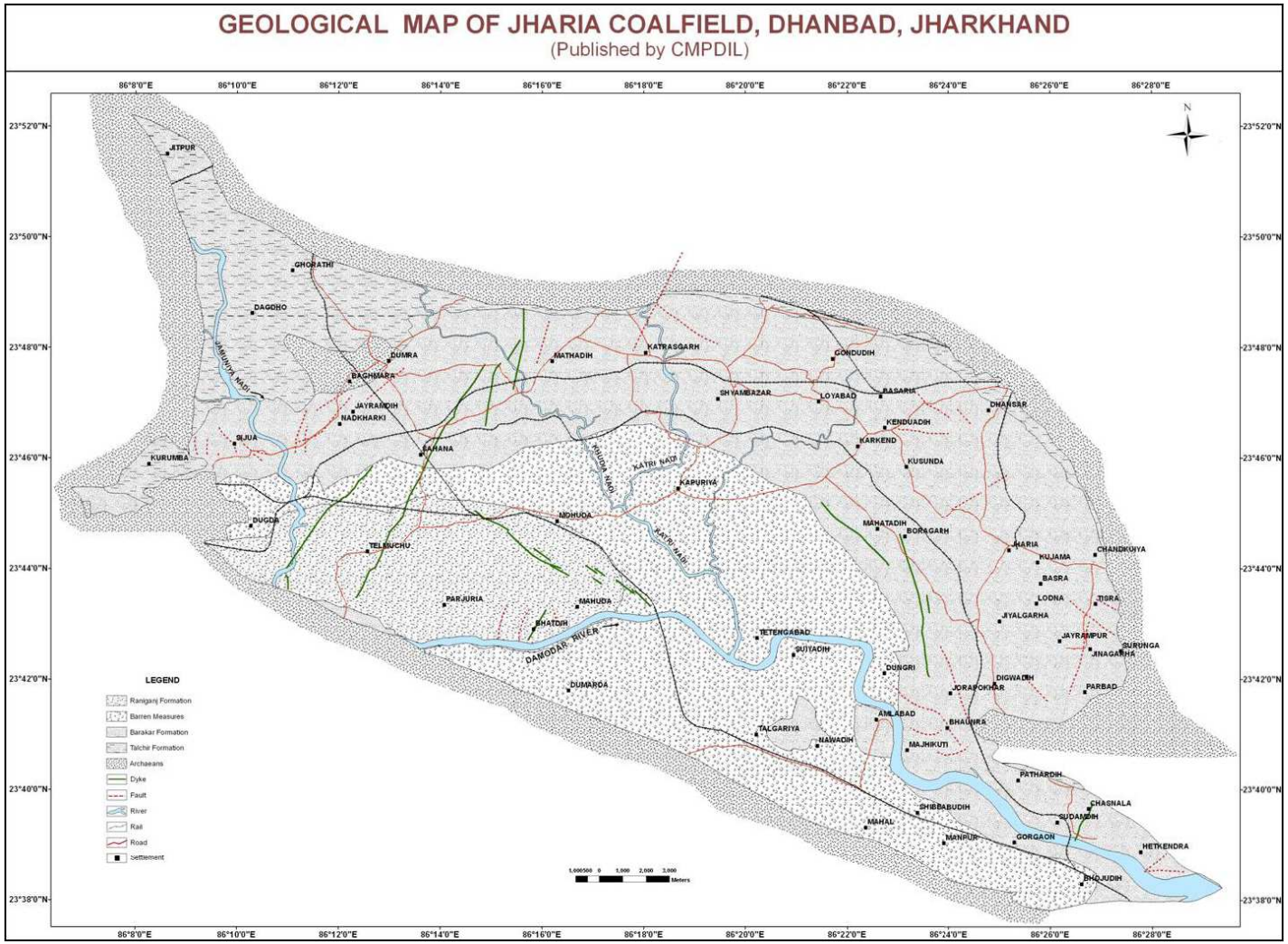

Figure 2 : Geological map of Jharia coal field, Dhanbad, Jharkhand (published by CMPIDL)

CHAPTER III

DATA REQUIREMENTS

3.1 Remote Sensing Data

The most recent available thermal satellite data was used in conjunction with the fieldwork for mapping coal fire in JCF. A coal fire map generated from the same, would serve as a reference for the fieldwork, as the observations can be verified in the field. For this purpose, a coal fire map was created from LANDSAT 8 TIRS data of 14-May 2017 .

Further, the coal fire map of 2012 prepared by NRSC (NRSC, 2012) from ASTER data was used as a reference to identify the changes that has occurred in the extent and disposition of the fires from 2012 to 2017.

For the land subsidence study, L-band microwave data from ALOS-PALSAR satellite (JAXA) were used. Five scenes of "Fine mode" SLC data were taken from PALSAR-2 archives over a period from October, 2014 to February, 2017. This was done to identify long term terrain changes and differentiate the same from short term changes due to mining excavations and overburden dumping.

Table 2: List of satellite data used in the present study.

Sl. No	Satellite	Sensor	Time	Date	Data source
1	LANDSAT-8	TIRS	Daytime	14 May 2017	USGS, USA
2	ALOS-PALSAR-2 (Fine mode)	PALSAR-2	-	4 October. 2014	JAXA, Japan
3				3 October, 2015	
4				20 February. 2016	
5				01 October, 2016	
6				18 February. 2017	

3.2 Ancillary data

1. Geological map of Jharia coal field.
2. Mine surface plans as provided by BCCL.

CHAPTER IV

REMOTE SENSING DATA ANALYSIS

4.1 Methodology

4.1.1 Processing of Landsat 8 Data

With the launch of the LANDSAT-8 mission in February, 2013; thermal space borne data is available from its thermal infrared sensor (TIRS). This has enabled monitoring of the earth with a spatial resolution of 100 m in the thermal domain with a repeat cycle of 16 days. The LANDSAT-8 has two channels (Band 10 and Band 11) in the thermal infrared region (Table 1) which ranges from 10.4 micrometer to 12.5 micrometer. In present study, band 10 of TIRS sensor (acquired on 14 May, 2017) has been used coal fire mapping (Gangopadhyay et al. 2012). The spectral domain of the band is known for its maximum transmittance (Chatterjee et al. 2007; Martha et al. 2010). The data are freely accessible through USGS portal (Landsat 8 download source: http://landsatlook.usgs.gov).

Landsat-8 data are available in GeoTiff format and the data are converted to top of the atmosphere spectral radiance using the radiance rescaling factors provided in the metadata file, using equation 1.

$$L_\lambda = M_L Q_{cal} + A_L \text{ …….. (1)}$$

Where:

L_λ = Spectral radiance (Watts/ (m2 * srad * μm)).

M_L = Band-specific multiplicative rescaling factor from the metadata.

A_L = Band-specific additive rescaling factor from the metadata.

Q_{cal} = Quantized and calibrated standard product pixel values (DN).

Once the spectral radiance (Lλ) for ASTER Band 13 and Landsat-8 band 10 data is generated, it is possible to calculate radiant (brightness) temperature directly using equation 2. Planck's radiation function (Planck, 1914) forms the basis of radiant temperature derivation from spectral radiances and the theory is discussed in detail in existing literatures (Gupta, 2003).

$$T_R = K_2 / \ln ((K_1 / L_\lambda) + 1) \text{…….. (2)}$$

T_R = Radiant (brightness) temperature,

K_1 = Calibration constant (1260.56 K),

K_2 = Calibration constant (666.09 watts/ (m2 *ster*μm)),

L_λ = Spectral radiance

4.1.2 Thresholding of radiant temperature image

Once the Landsat-8 data are converted to radiant temperature image, the next step was to segregate fire pixels from the background, which requires the estimation of the cut-off temperature (Roy et al. 2015). This has been attempted by the statistical analysis of sensor derived radiant temperature to delineate clusters (in the scatter-plot) indicative for fire and non-fire pixels. Mean and maximum radiant temperatures are derived from randomly sampled uniform sized pixel blocks distributed in entire spatial extent of Barakar formation (Figure 3) known for fire bearing coal seams. The pixel block sizes are chosen to adequately represent the overall areal extent of the coalfield and homogeneously encompass all the mining blocks (27x27 pixels for Landsat-8, Figure 3). The maximum temperature value recorded in each representative area, derived from each of the datasets, is plotted against the mean temperature. The maximum temperature represents that of fire (wherever present), whereas the mean temperature represents the average background temperature, for normalization. The fire and background populations show considerable variance, separating coal fire and background radiant temperatures. The cut-off temperature derived is the maximum temperature of the background cluster, above which all temperatures represent coal fires. In the case of the Landsat-8 data used in this study, the cut-off temperature was determined around 39°C (Figure 4). Based on this cut-offs, regional coal fire map was prepared (Figure 5).

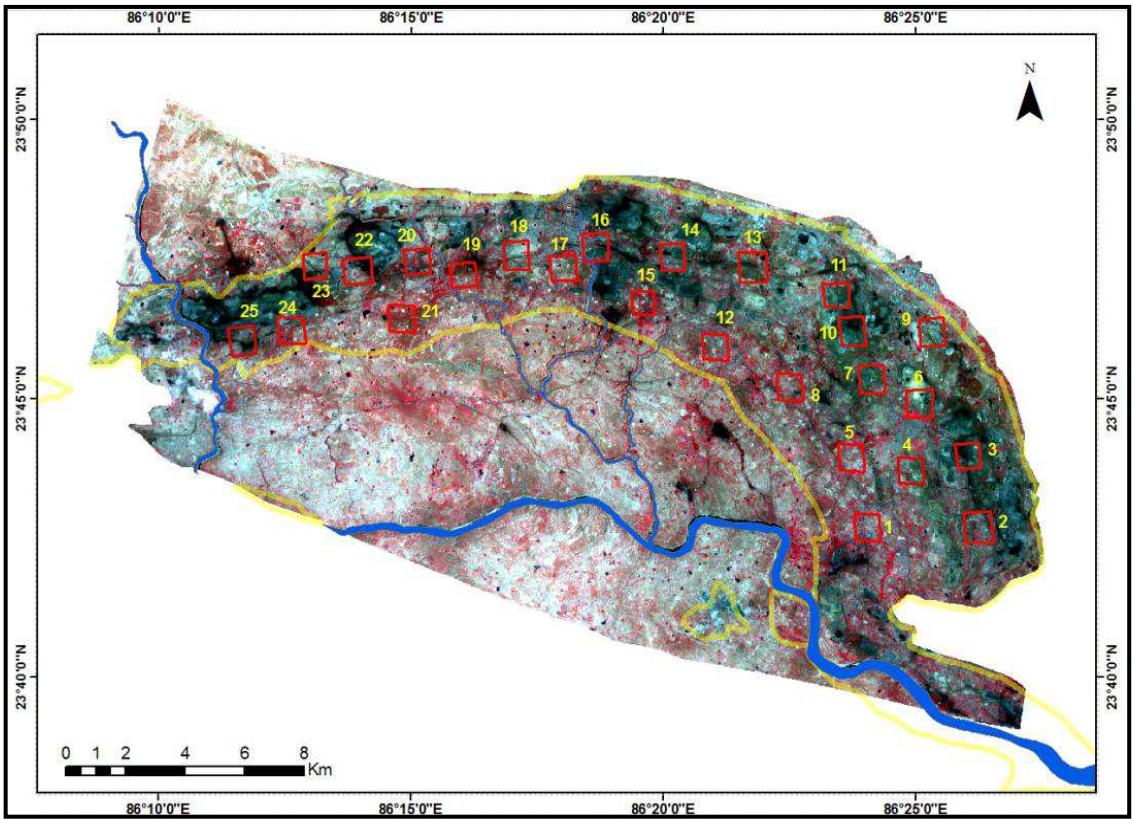

Figure 3. False colour composite image of Jharia Coalfield, with subset blocks (in red boxes) to obtain temperature values (from radiant temperature image) within the Barakar formation across the Jharia coalfield.

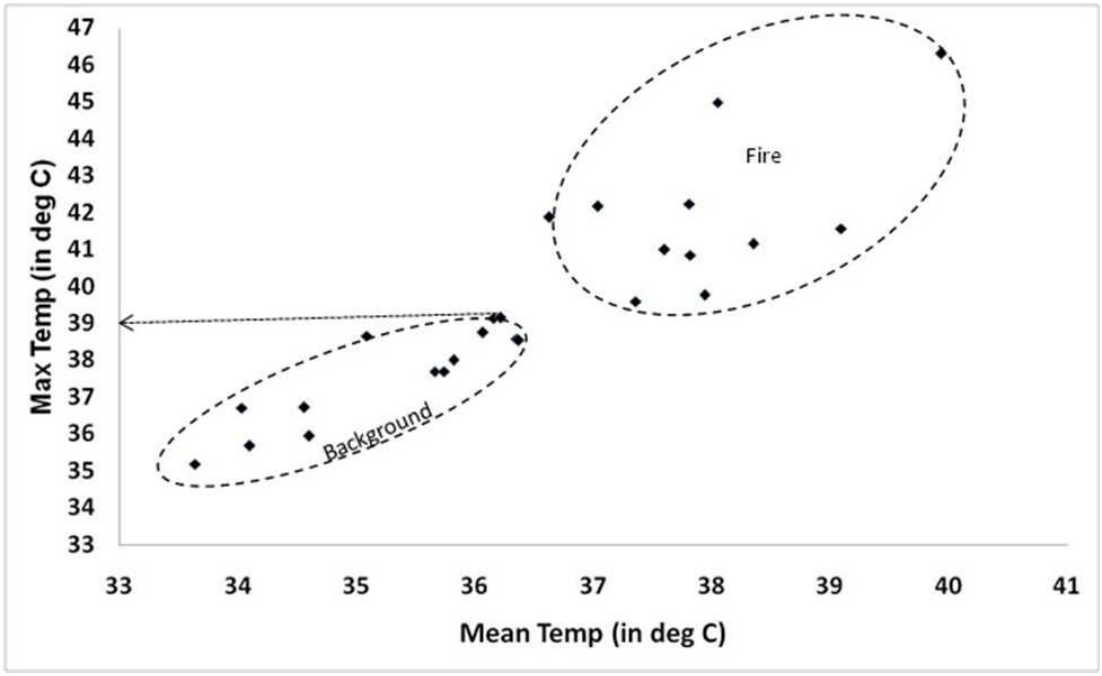

Figure 4. Maximum temperature plotted against mean temperature for various locations; cluster separation observed around 39 °C (marked with arrow)

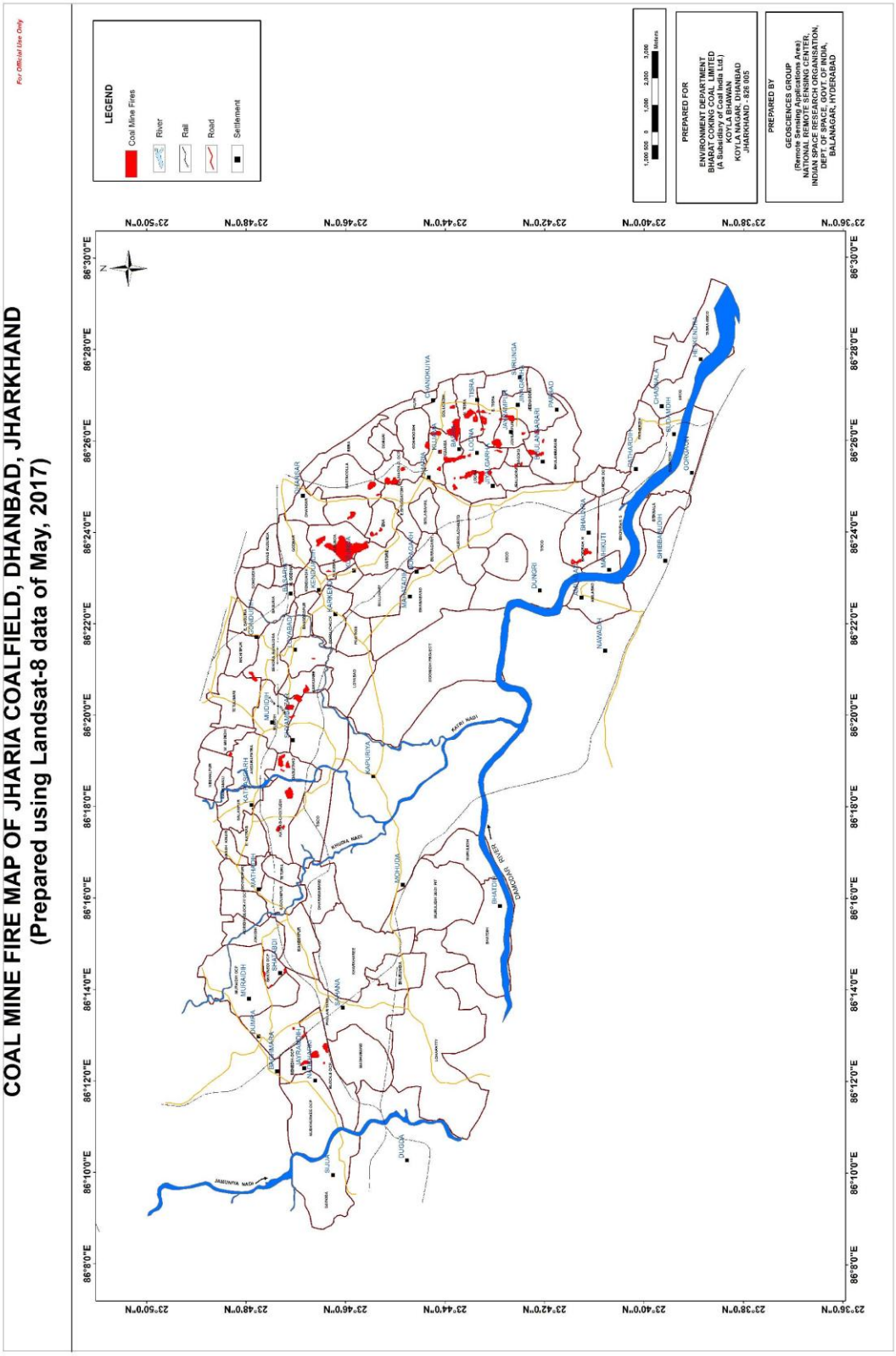

Figure 5: Coal mine fire map (May, 2017) of Jharia coal field, Dhanbad. The fire areas shown in this map have been verified in the field as per field points in figure 13.

4.2 Methodology For Subsidence Detection

4.2.1 Processing of ALOS-PALSAR 2 Data

Differential Interferometric SAR (DInSAR) techniques consist of combination of two SAR images of the same area acquired from slightly different positions (Figure 6).

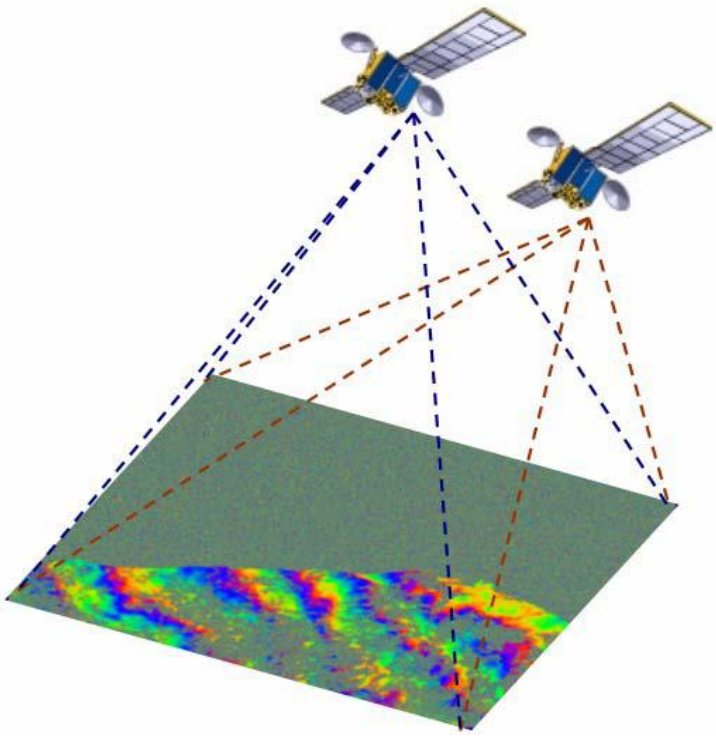

Figure 6. DInSAR acquisition scheme.

The result of this combination provides a new image, known as 'interferogram', whose phase component is formed by the following term:

$$\Delta\Phi Int = \Phi Topo + \Phi Mov + \Phi Atm + \Phi Noise \quad (3)$$

where, ΦTopo denotes the topographic component, ΦMov denotes the terrain deformation/ displacement component, ΦAtm is the noise component and ΦNoise is the thermal noise.

Topography, atmospheric effects and thermal noise needs to be removed or optimized to obtain precise measurements of terrain movement. When working with classical DInSAR interferograms (combination of two SAR images) the main problem is the presence of atmospheric artefacts, since there is no way to cancel them without a priori information. On the other hand, the term related with topography can be cancelled out using and external Digital Elevation Model (DEM) and the orbital ephemeris from the SAR acquisitions, considering no height errors on the DEM.

$$\Delta\Phi dif = \Phi ErrorTopo + \Phi Mov + \Phi Atm + \Phi Noise \qquad (ii)$$

Since the coal mine area is very dynamic in terms of its surfacial changes (open cast mine, abandoned mine, fire affected waste/reclaimed land, over burden dumps) over time, it is proposed to utilize an advanced DInSAR technique. It is a recent remarkable improvements in SAR differential interferometry that has led to an innovative approach based on the use of a large dataset of SAR images over the same area to overcome the intrinsic limitations of conventional DInSAR in terms of temporal and geometrical decorrelation as well as atmospheric disturbances (Ferretti et al 2001; Hooper et al 2004; Kampes, 2006; Lanari et al 2004; Mora et al 2003;Werner et al 2003).

Broad work flow diagram for generating land subsidence map using satellite based DInSAR technique is shown in Figure 7.

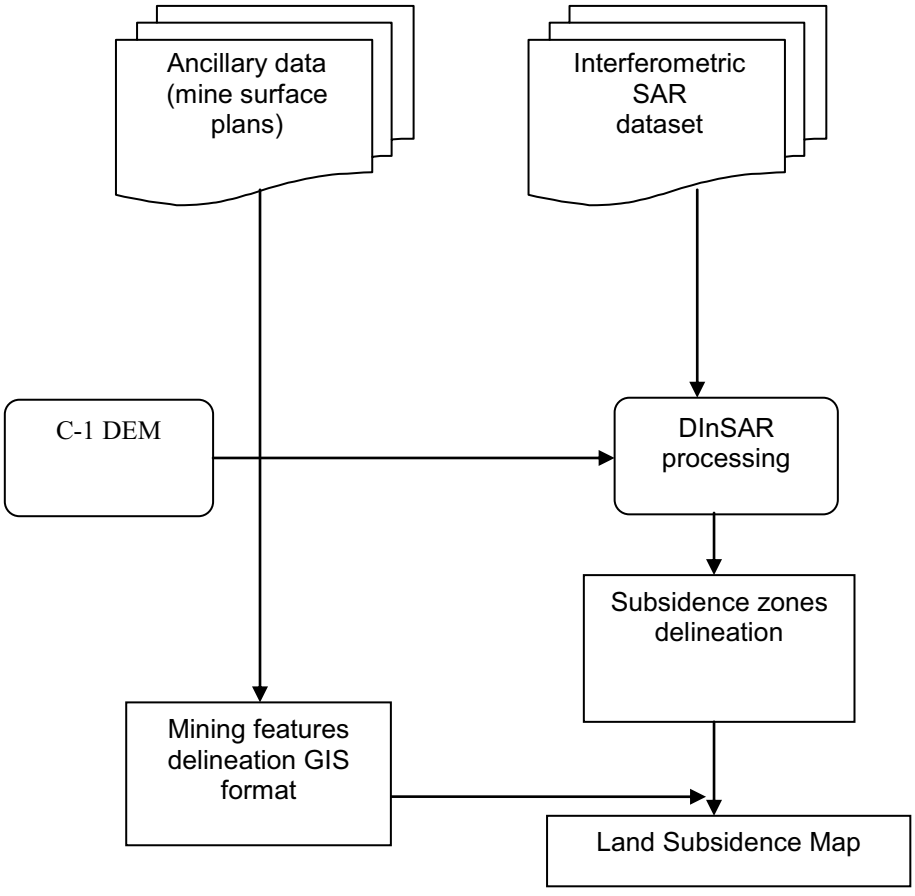

Figure 7. Work flow diagram for generating land subsidence map using DInSAR technique.

In the present study, 5 sets of ALOS-PALSAR L-band microwave data (as mentioned in table 1) were procured. The datasets were paired into master-slave pairs as per short and long temporal baselines. The short temporal baseslines include master slave pairs of time difference of six months or less, whereas long temporal baselines include data pairs of time difference of one year or more. This has been illustrated in figure 8.

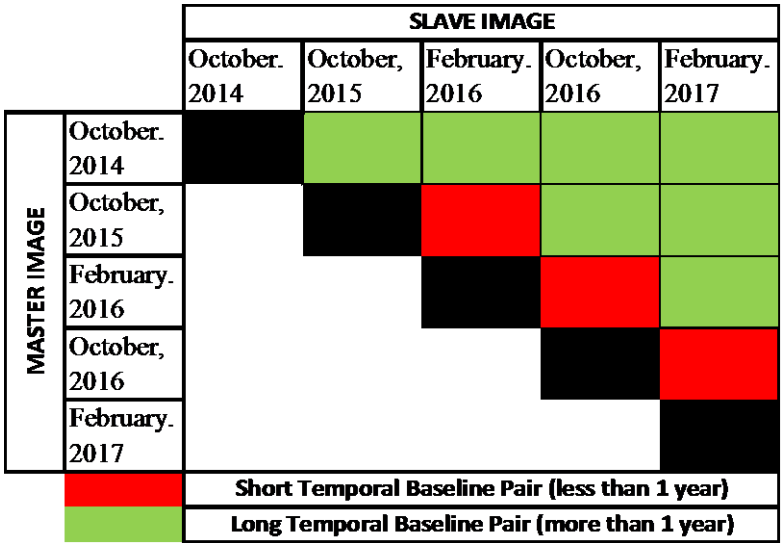

Figure 8. ALOS-PALSAR - 2 Master-Slave pairs for short and long temporal base line processing

The interferometric fringes generating from short baseline pairs will generally indicate terrain changes due to mining activity happening over a short period of time. This will include mining excavations and creation of new OB dumps adjacent to the mining area. Any incidences of slow land subsidence will not be demarcated in the results (figure 9).

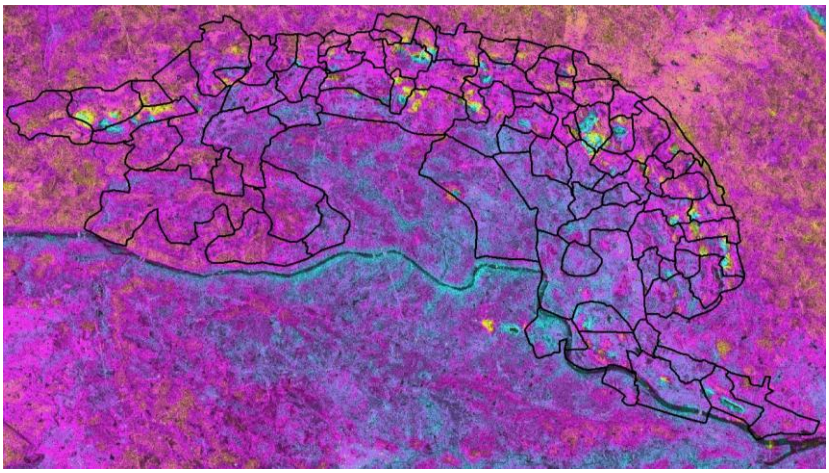

Figure 9. Fringe patterns generated from short baseline processing (e.g. Master: Oct, 16, Slave: Feb, 17).

On the other hand, master-slave pairs of long temporal baseline (one year or more, as shown in figure 8) will incorporate terrain changes due to mining activities as well, as long term ground subsidence from underground mining where ever present (figure 10).

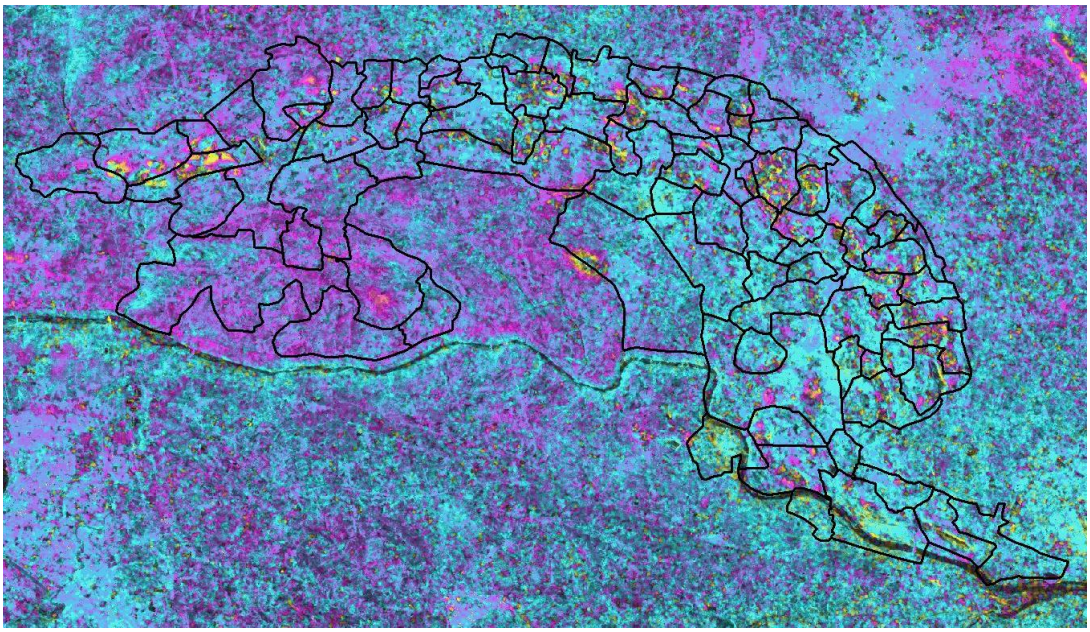

Figure 10. Fringe patterns generated from long baseline processing (e.g. Master: Oct, 15, Slave: Feb, 17).

The results from the long and short baseline processing can be compared and zone where fringes have been developed due to terrain changes due to mining excavation and dumping, can be systematically identified and demarcated. The remaining fringes from the long temporal baseline processing will then indicated towards zones where subsidence has taken place due to underground mining. Using this, a terrain change

map of the Jharia Coalfield was generated demarcating terrain changes due to mining activities and subsidence areas (Figure 11).

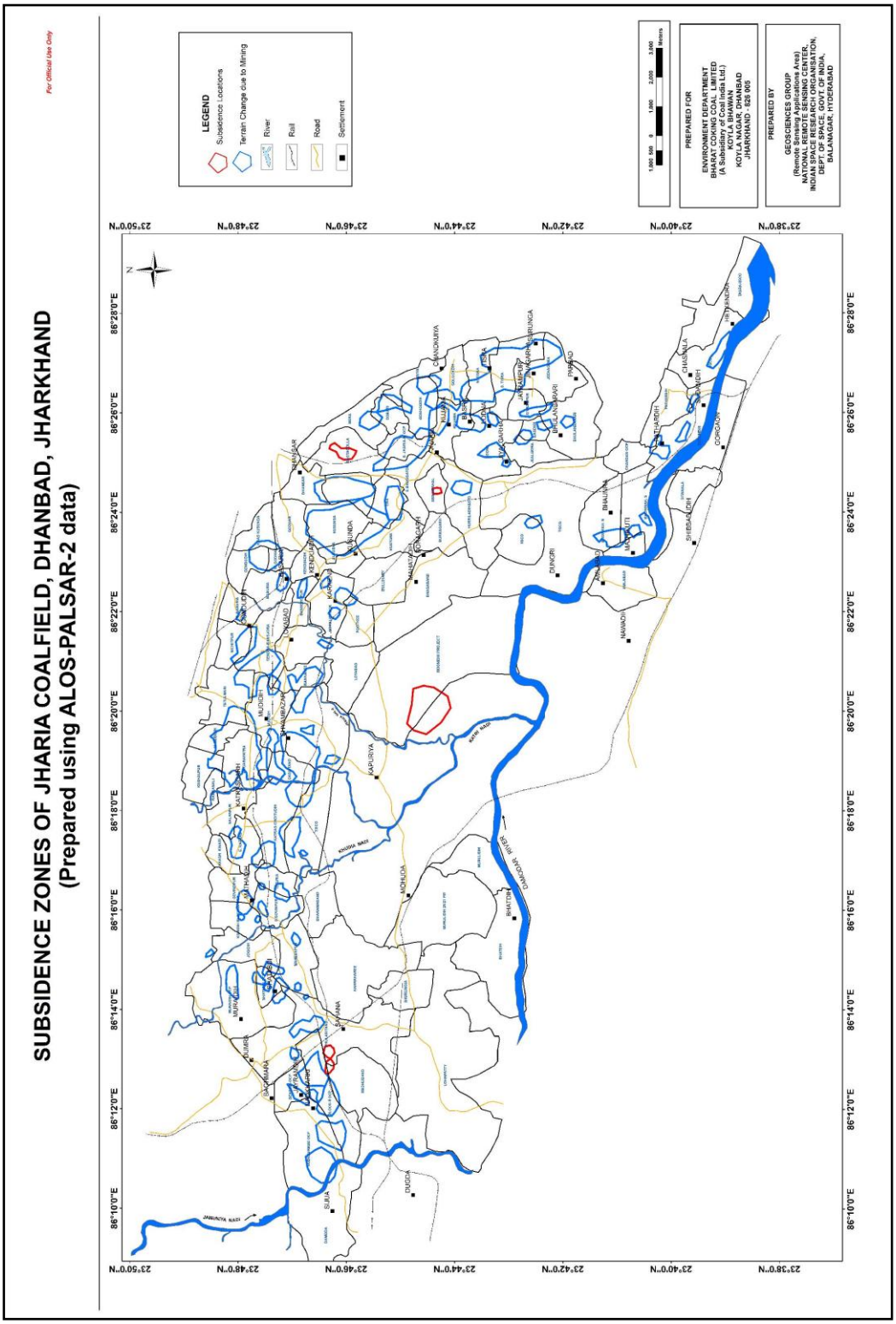

Figure 11: Subsidence map of Jharia coal field, Dhanbad.

CHAPTER V

FIELD WORK

A field work for verification of the coal fire locations and the subsidence zones as identified by the satellite data were taken up in December, 2017. A total of 53 coal fire points and 37 land subsidence locations were identified from the satellite data analysis. The locations of these points along with geographic coordinates were given to BCCL prior to the December, 2017 field work for their feedback on the status of these points. Out of the 53 coal fire locations identified, 52 points were confirmed to be fire bearing as per the present masterplan of the Jharia coalfield created by BCCL Both the coal fire and the subsidence locations were further independently verified by NRSC during the fieldwork in December, 2017. The locations and the observations are coal fire and subsidence are provided in annexure 1 and annexure 2 of this report respectively.

The salient overview of the field observations are as follows:

Coal-fire observations:

1. The coal fires as observed identified by the Landsat-8 data are mostly accurately delineated. Fires have been identified in the western, northern and eastern flank of the coalfield with considerable accuracy in the spatial locations.
2. In the eastern flank, the main fire affected mines are Kusunda, Lodna and Tisra. Active fires area present in the mines and fumes can be seen from the OB dumps. The Bhowra and Bhulanbarari mines also show presence of fire, however, the extent of the fire area appears to be underestimated in the data. Similarly, the extent of fires in Lodna and Tisra appears to have been overestimated in the data. The largest extent of fire in the single mine block is that in Kusunda.
3. In the northern flank, the main fire bearing mines are Katras, Gaslitand and Mudidih, However, it is seen that in these areas, the fires appears in pockets and are not pervasively present. The spatial extent of the fires on the ground and as estimated in the data can be correlated.

4. In the western flank, the Block II OCP is the primary fire affected region. However, it is seen that the Shatabdi OCP also bears fire pockets along semi-vertical mine walls, This is not identified in the data.

Subsidence location observations:

1. Subsidence locations as identified by the data area difficult to verify in the field, unless there are tell-tale signatures like large cracks or fissures on the ground or damage to anthropogenic constructions like vertical cracks on building cracks etc.
2. Out of the 37 identified subsidence locations from the microwave data, it is seen that 32 are due to terrain changes resulting from mining activities like ongoing excavations or formation of new mining dump. These decrease or increase in elevations has resulted in forming of interferometric fringes in the data thus creating false positives.
3. Five areas were firmly established as subsidence zones. Out of these, the main area where subsidence is occurring in a pervasive scale, is that in the Moonidih Underground Project. The Moonidih Project is an underground long wall mine where excavations are going on for over decades. This may have resulted in pervasive subsidence in the region. The signatures of subsidence such as ground cracks are observed in the area.
4. Two adjacent locations are observed south of the Block II OCP and in Phularitand mining block. This may be resulted due to older underground mining in the area. Signatures such as sagging of ground is seen.
5. Another minor subsidence region was identified around the Simlabahal underground mining project. This is again due to active underground mining in the area. A similar region was also observed in the northern part of the Bastacolla mines where active underground mining is ongoing.

In lieu of the observations in field on the fire and subsidence locations, few post field work correction in the coal fire and subsidence maps was necessitated and has been discussed in the next chapter.

CHAPTER VI

POST FIELDWORK ANALYSIS

As observed in the fieldwork, there were certain mine areas where the presence of fire was not detected by the satellite data. For example in Shatabdi and Bhulanbarari mine areas, the fire appears in small pockets on mine faces and was possibly not detected by the threshold temperature calculated for the entire mine area. On the other hand, in the Bhowra, Lodna and Tisra mine areas, the spatial extent of fire appears to have been overestimated by the regional threshold temperature use to separate the fire and the background areas.

Therefore, mine specific threshold temperature analysis was carried out for Shatabdi, Bhulanbarari, Bhowra, Lodna and Tisra mine areas to correctly depict the fire areas on the ground. The threshold temperature selected from each of these mine areas are given in Table 3.

Table 3: Threshold temperature for fire area estimation of individual mines.

Name of the Mine Block	Threshold Temperature (in °C)
Bhowra	38.5
Tisra (north and south)	North : 41; South : 40.5
Lodna	41
Bhulanbarari	38.5
Shatabdi	38

Using the threshold temperatures as mentioned in the table 3, the previously undetected fire areas in the Shatabdi and Bhulanbarari mines were detected. Further the spatial extent of the fire areas in Bhowra, Lodna and Tisra mines were changed to adequately represent the actual extent of the fire on the ground. These were incorporated in the coalfire map shown in figure 5.

CHAPTER VII

DISCUSSIONS AND CONCLUSIONS

7.1 Discussions

7.1.1 Coal fire analysis

The present study is aimed to provide the status of coal fire in the Jharia coal field for the period of 2017. Landsat-8 data of May, 2012 was used to prepare the coal mine fire map (Figure 5) for the year 2017. The data have 100 m spatial resolution in the thermal bands and is as on study date, the best thermal satellite data available. The Coal fire maps of 2017 when compared to map of 2012 (NRSC, 2014) depicts the dynamics of coal fire. Coal fire is difficult to mitigate because of its dynamic nature. But the understanding the trend in the shift of coal fire zones and over all distribution of coal fire will help in environmental and risk management related to coal mining activities.

The coal mine fire map for the year 2017 (Figure 5 illustrates the overall fire distribution in the area). The maps reveal that the coal fires are distributed across the Jharia coal field in pockets associated with major open cast mining activities. All most all the coal mine fires are restricted to the Barakar Formation where coal seams are exposed. In the eastern flank of the arcuate shaped mining extent, the collieries in Lodna and Tisra (North and South) is the highest fire affected mining blocks and Bhowra, Bhulanbarari, Kujama and Jharia are also affected by multiple smaller fire pockets. The fire in the areas is mostly manifested by high temperature fume cracks with occasional presence of active flames especially the the Lodna-Tisra area. Further, towards the north east, in Ena and Kusunda active fires are more prevalent and the area is extensively affected. The highest radiant temperatures (in order of ~50°C) are recorded by the satellite sensors in these areas. In the north, a large number of moderate to small fire pockets are seen in the areas around Shyambazar (Figure 5 & 6). These are related to the mining areas of Katras, Gaslitand, Mudidih and Kankanee. Mining activity, over the last few of years has exposed new, isolated and discontinuous fires in these regions.

In the western flank, three distinguishable fire affected zones are seen. Toward the western end of the mining area, the Benedih and Block II OCP are affected by smaller fires from isolated coal seams. These again are surfacialy manifested in the

form of fume cracks with smoke emanating from them. The Shatabdi OCP are also affected but fire is manifested in the along vertical mining wall sections.

Comparison of the 2017 coal fire map with that of 2012 (NRSC, 2014) indicated the dynamism in the spatial extent and distribution of the coal fires. The changes are highlighted as follows:

i. In reference to the map generated in 2012, the 2017 map shows that the emergence/re-emergence of fires in the eastern flank, namely Kujama, Tisra, Lodna and Jharia etc. The entire zone has been affected by multiple fire occurrences. The spatial disposition of fires in Bastacolla, Jharia and Bhulanbarari appear to have a minor increase.
ii. The areal extent of major fire zone around Kusunda/Kenduadih and Ena appears to remain the same, though here again the spatial location of the anomalies has changed. This is probably due to the mitigation and active mining in this region.
iii. The fire zones in Benedih/Block II OCP and Shatabdi OCP have also changed/diminished in areal extent with presence of isolated smaller anomalies. There has been a considerable reduction in fire areas in and around the Shatabdi OCP.
iv. The spatial disposition of fire areas around Katras, Gaslitand and Mudidih show minor change. In 2012, a number of small fire pockets were seen, however presently those fire pockets have given away to a few fire zones of moderate disposition.
v. It needs to be noted that the 2012 study was carried out using ASTER data whereas the present study is carried out using Landsat-8 data. Therefore, the difference of sensor sensitivities will have a influence on the way the fires are sensed on the ground. Difference of sensor sensitivities will influence the number of fires identified as well as the areal extent of the fires in the data.

In summary, there is a change in the areal disposition of the fires from 2012 to 2017. Observations suggest the emergence/re-emergence of new areas in the eastern flanks in areas around Lodna and Tisra. Concurrently, there is a decrease in extent of fire areas Shatabdi, Nadkhurkee area in the western flank from 2012 to 2017. A quantitative comparison of the 2012 and 2017 data was carried out. As compared

2012, when the total fire affected extent of about 2.18 km^2; in 2017 total fire affected extent is about 3.28 km^2. The colliery wise break-up of change in fire area from 2012 to 2017 is given in Annexure III.

7.1.2 Subsidence analysis

An attempt to identify subsidence zones in the Jharia Coalfield was also carried out using ALOS-PALSAR-2 L band microwave data using differential interferometric technique. 5 scenes of PALSAR-2 data spanning over a period of 2014 to 2017 were used to delineate the subsidence if any in the region and separately identify them from the terrain changes due to mining. Verification of the subsidence zones as seen from data is difficult as it requires visible signatures of subsidence in the form of cracks on the ground and damage to anthropogenic structures. In this study, data analysis and consequent field verification resulted in identification is 5 prominent subsidence areas. Of these, the major area where considerable ground subsidence is occurring is the Moonidih UG project. Long term underground mining has resulted in continuous subsidence in the area. Apart from this, the other four areas are south of Block II OCP, Simlabahal and Bastacolla. No quantitative estimates of the subsidence has been carried out in the study.

7.2 Conclusions

The following conclusions can be made:

1. As of the date of study in the year 2017 and in comparison with the previous study done in 2012, there has been a change in areal extent and disposition of the fire affected areas.
2. Compared to 2012, the eastern flanks (Lodna, Tisra areas) show considerable increase in fire disposition and the western flank (Shatabdi and Block II area) show diminished fire presence.
3. The major new fire areas are observed in the northern flank in the areas around Lodna and Tisra etc. These areas were not mapped as fire in the 2012 study.
4. The mines in Kenduadih and Lodna remain to be the worst affected with maximum presence of active fires.
5. There is a increase in areal extent of the fire (Figure 12) from 2012 to 2017.

Note: *Estimations of fire extent (in terms of sq.km.) both in 2012 and in the present 2017 study are pixel based. They do not represent the actual ground area under fire. These estimations are made for comparative purpose only, to indicate the increase or decrease of areal disposition of fire. Hence, they should not be quoted as fire area on the ground.*

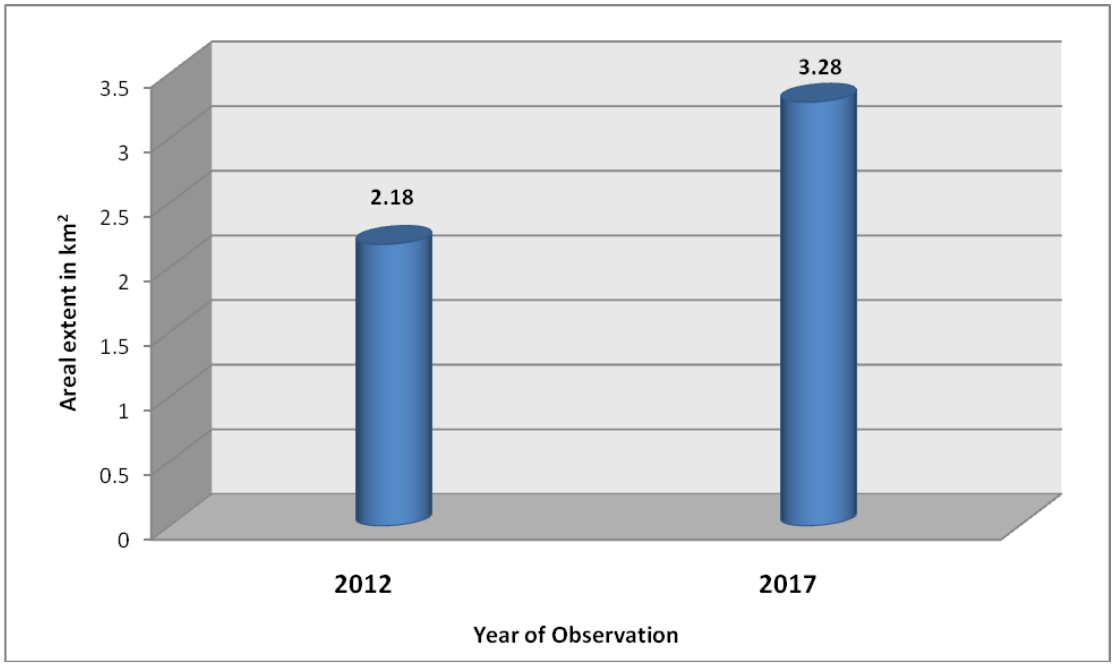

Figure 12: Total fire area statistics

CHAPTER VIII

LIMITATIONS

Delineation and mapping of coal fire from thermal data of remote sensing platforms carries with it some inherent limitations which needs to be understood in order to decipher the results obtained from it. This will assist is deducing the correct information and remove any ambiguity associated with the results. The key limitations of the data and the results obtained are as follows:

1) An anomalous pixel from LANDSAT data represents an area of 30m x 30m (resampled from spatial resolution of 100m) on the ground whose temperature is considerably higher than its surroundings. This can be attributed to two circumstances, namely the area has a very high intensity fire located within a smaller pocket or there are a number of low intensity fires spread across it. In both the mentioned cases the actual areal extent of the fire on the surface differs, but appears as a single anomalous pixel in the data. Hence, representation of fire affected ground area by means of pixel area is ambiguous and hence should be considered with caution.

2) There are locations as observed during the fieldwork, where coal seams are affected by active fires along vertical/semi-vertical sections of open cast mines (see cover page). In such cases, the actual areal expression of the fire affected area as seen by the sensor changes considerably and the representation from the same is not accurate.

3) As discussed in section 4.2.1, thresholding the data to separate the fires from the non fire areas, is a statistical technique. However, this method is dependent on how the temperature of non-fire background area is distinctive from the fire temperature.

4) The background temperatures vary with the time of the day when the data is collected, topography, and season of the year when the data is acquired. Night-time data has lower background temperature as compared to day-time. Similarly a data collected in October-November will have a considerably lower background temperature than that collected in May-June due to seasonal temperature variations. Hence, identification of the background temperature range becomes essential in

estimation of threshold temperature and the same varies depending upon the discussed controlling factors.

5) Generally, a constant threshold temperature is estimated over the entire study area, and the same is applied to delineate the fire areas from those of non-fire. However, it is seen that the application of such global thresholding may mask fires which are in turn seen in the field and that the threshold temperature value may vary locally. In the current scenario, it is seen that the fire locations as verified in the fieldwork at Bhulanbarari and Shatabdi were not identified in the data on application of a global threshold of 39°C. However, a subset of the data within the Bulanbarari area only, is analyzed with a lower threshold of 38.5°C, the fire pixels are manifested in the data. Hence, the appropriateness of a singular thresholding temperature value may need to be relooked upon. Future studies can be carried out using colliery wise statistical local thresholding to create a composite coal fire map.

6) Due to the mitigation measures taking place in various mines, it is seen that in a number of places the fire affected seam is excavated and dumped as overburden. However, these overburden dumps retains the excavated burning coals and thus are seen to have active fires occasionally. There lies a possibility that the same will be identified as anomalous pixels and hence, although the fire is not a part of any active coal seam, it will be included as a fire affected area in the final map.

7) Verification of the subsidence zones as detected from the interferometric technique is sometimes difficult due to lack in observable signatures of subsidence such as cracks on the ground and damage to anthropogenic structures.

Therefore, in quantitative estimation of fire affected areas and areas denoted as subsidence, the above mentioned limitations needs to be taken into account diligently, as it is inevitable that the area estimate will not define the actual fire/subsidence affected area on the ground. However, the areal extent estimated from the data can be "like to like" compared to earlier estimates of similar studies to understand the change and dynamism of the fire in terms of area affected and spatial disposition.

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Annexure –I

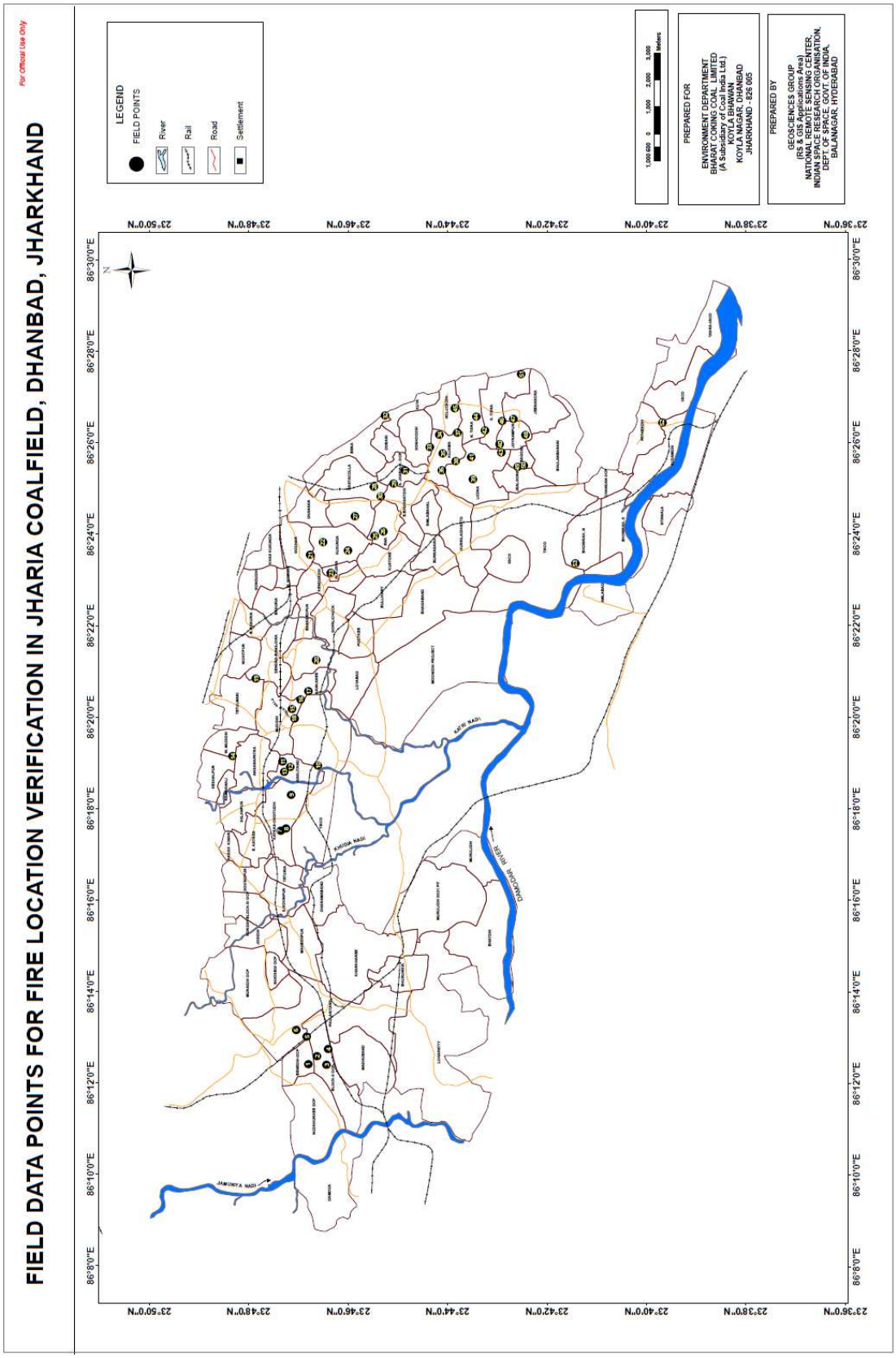

Figure 13. Field data points for coal fire verification

Table – 4: Coal Fire observations during fieldwork (see figure 13 for reference)

SL. No.	Point of Observations		Comments		
	Latitude	Longitude	Type of Mining Activity	Presence of Coal Fire	Mine name and Any other Comments
1	23.7801	86.2068	OB Dump	Fire	ABOCP
2	23.7771	86.2097	Active Mine	Fire	ABOCP
3	23.7739	86.2066	Active Mine	Fire	ABOCP
4	23.7733	86.2124	OB Dump	Fire	ABOCP
5	23.7806	86.2168	No Working	Fire	ABOCP
6	23.7841	86.2192	No Working	Fire	Phularitand
7	23.7893	86.2919	No Working	Fire	Katras Chatudih
8	23.7875	86.2926	No Working	Fire	Katras Chatudih
9	23.7857	86.3049	Working	Fire	Gaslitand
10	23.7768	86.3157	Outside Jharia Mines		Tata
11	23.7887	86.3170	OB Dump	Fire	Gaslitand
12	23.7862	86.3151	OB Dump	Fire	Gaslitand
13	23.7880	86.3133	OB Dump	Fire	Gaslitand
14	23.8054	86.3191	Working	Fire	AKWMC
15	23.7855	86.3363	OB Dump	Fire	Mudidh
16	23.7826	86.3397	Working	Fire	Kankanee
17	23.7800	86.3427	Working	Fire	Kankanee
18	23.7848	86.3327	OB Dump	Fire	Mudidih
19	23.7977	86.3473	OB Dump	Fire	Sendra Bansjora
20	23.7775	86.3540	OB Dump	Fire	Loyabad
21	23.7793	86.3924	No Working	No fire	Kusunda (Domestic coal burning)
22	23.7753	86.3970	Working	Fire	Kusunda
23	23.7724	86.3858	Working	Fire	Kusunda
24	23.7669	86.3940	OB Dump	Fire	Kusunda
25	23.7578	86.3993	OB Dump	Fire	Ena
26	23.7550	86.4009	OB Dump	Fire	Ena
27	23.7645	86.4065	Working	Fire	ADIC
28	23.7580	86.4172	Old Quarry	Fire	ROCP
29	23.7515	86.4184	OB Dump	Fire	ROCP
30	23.7559	86.4137	OB Dump	Fire	ROCP
31	23.7476	86.4232	Working	Fire	ROCP
32	23.7543	86.4431	Outside Jharia Mines		Unknown site (Out side of Kuya)
33	23.7394	86.4317	Active Mine	Fire	Ghanoodih
34	23.7360	86.4362	OB dump	Fire	Goluckdih
35	23.7349	86.4293	OB Dump	Fire	Kujama
36	23.7354	86.4232	No Working	Fire	Kujama
37	23.7301	86.4369	Working	Fire	NT-ST
38	23.7305	86.4265	OB dump	Fire	Kujama
39	23.7249	86.4200	No Working	Fire	Lodna
40	23.7159	86.4327	Working	Fire	Joyrampur
41	23.7254	86.4280	No Working	No fire	Lodna
42	23.7209	86.4376	Working	Fire	NT-ST
43	23.7154	86.4296	Working	Fire	Lodna
44	23.7238	86.4427	Working	Fire	NT-ST
45	23.7309	86.4457	OB dump	Fire	NT-ST
46	23.7151	86.4412	Active Mine	Yes	NT-ST
47	23.7114	86.4419	OB Dump	Fire	NT-ST
48	23.7073	86.4360	Active Mine	Fire	Joyrampur
49	23.7097	86.4243	Working	Fire	Bagdigi/Joyrampur
50	23.7079	86.4249	Active Mine	Fire	Bagdigi/Joyrampur
51	23.7086	86.4582	Outside Jharia Mines		Unknown site (Out side of NT-ST)
52	23.6614	86.4404	Outside Jharia Mines		Chasnala
53	23.6906	86.3892	OB dump	Fire	Bhowrah (North)

Annexure –II

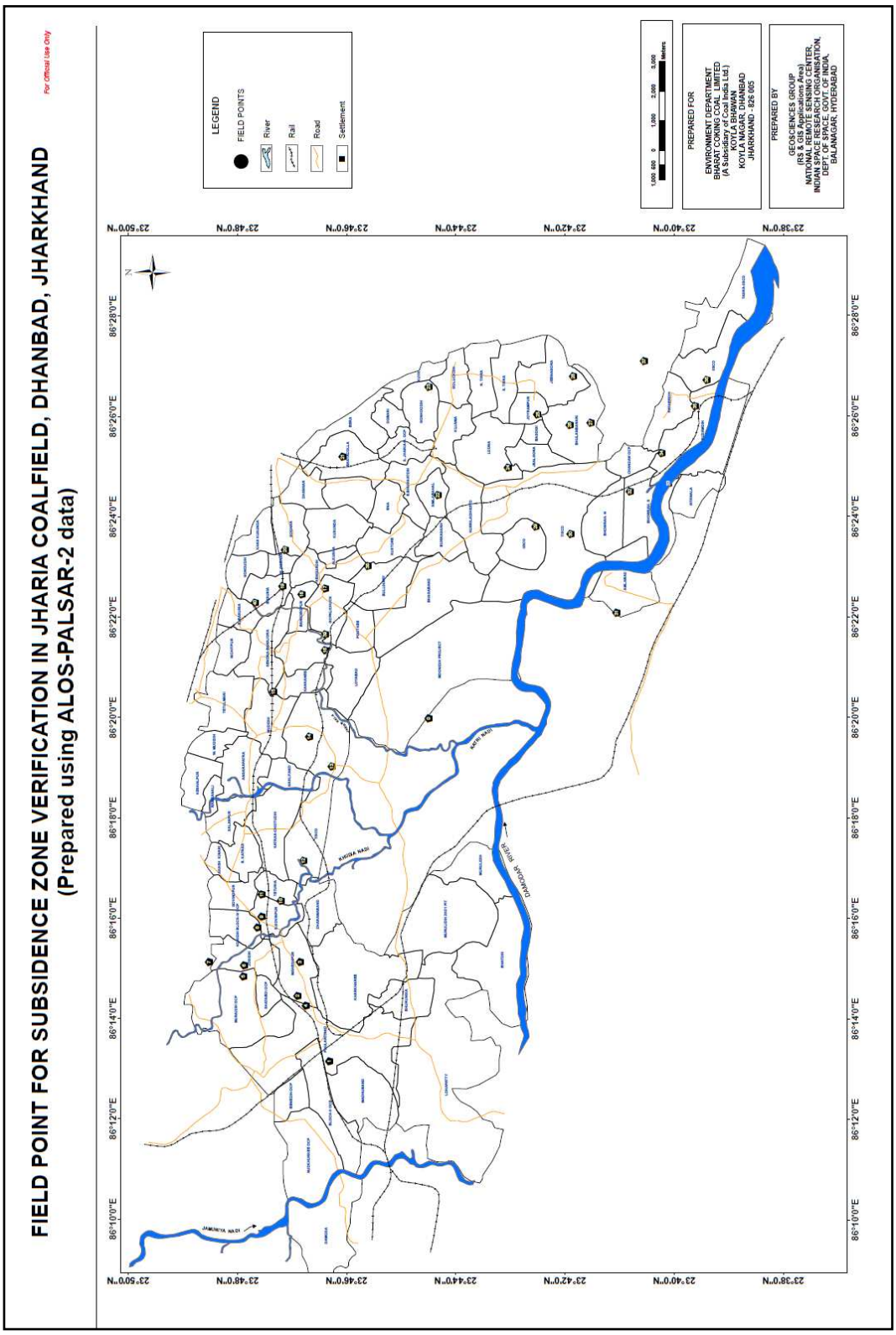

Figure 14. Field data points for subsidence verification

Table – 5: Coal Fire observations during fieldwork (see figure 14 for reference)

	Point of Observations		Comments	
Sr. no.	Latitude	Longitude	Mine name and Any other Comments	Signs of Subsidence (crack on building/ground crack etc.)
0	**23.7416**	**86.3338**	Moonidih UG Project	Sagged area, Building damage
1	**23.7722**	**86.2192**	South of Block II (2 areas)	Cracks on the ground
2	**23.7817**	**86.2409**	Terrain Change due to mining	
3	**23.7811**	**86.2521**	Terrain Change due to mining	
4	**23.7792**	**86.2376**	Terrain Change due to mining	
5	**23.7983**	**86.2473**	Terrain Change due to mining	
6	**23.7981**	**86.2510**	Terrain Change due to mining	
7	**23.8088**	**86.2521**	Terrain Change due to mining	
8	**23.7941**	**86.2636**	Terrain Change due to mining	
9	**23.7926**	**86.2671**	Terrain Change due to mining	
10	**23.7868**	**86.2724**	Terrain Change due to mining	
11	**23.7928**	**86.2746**	Terrain Change due to mining	
12	**23.7800**	**86.2857**	Terrain Change due to mining	
13	**23.7713**	**86.3171**	Terrain Change due to mining	
14	**23.7783**	**86.3270**	Terrain Change due to mining	
15	**23.7893**	**86.3419**	Terrain Change due to mining	
16	**23.7734**	**86.3556**	Terrain Change due to mining	
17	**23.7734**	**86.3762**	Terrain Change due to mining	
18	**23.7804**	**86.3742**	Terrain Change due to mining	
19	**23.7865**	**86.3769**	Terrain Change due to mining	
20	**23.7855**	**86.3890**	Terrain Change due to mining	
21	**23.7679**	**86.4199**	Bastacolla	Sagged areas
22	**23.7390**	**86.4071**	Simlabahal UG	Sagged areas
23	**23.7417**	**86.4431**	Terrain Change due to mining	
24	**23.7176**	**86.4163**	Terrain Change due to mining	
25	**23.7085**	**86.4339**	Terrain Change due to mining	
26	**23.6986**	**86.4304**	Terrain Change due to mining	
27	**23.6923**	**86.4312**	Terrain Change due to mining	
28	**23.6977**	**86.4466**	Terrain Change due to mining	
29	**23.7092**	**86.3967**	Terrain Change due to mining	
30	**23.6985**	**86.3942**	Terrain Change due to mining	
31	**23.6845**	**86.3681**	Terrain Change due to mining	
32	**23.6804**	**86.4083**	Terrain Change due to mining	
33	**23.6685**	**86.4110**	Terrain Change due to mining	
34	**23.6706**	**86.4211**	Terrain Change due to mining	
35	**23.6603**	**86.4366**	Terrain Change due to mining	
36	**23.6568**	**86.4454**	Terrain Change due to mining	
37	**23.6760**	**86.4516**	Terrain Change due to mining	
38	**23.7603**	**86.3836**	Terrain Change due to mining	
39	**23.7734**	**86.3609**	Terrain Change due to mining	
40	**23.7948**	**86.3715**	Terrain Change due to mining	

Annexure –III

SL. NO.	COLLIERY AREA NAME	FIRE AREA 2012 (SQ. KM.)	FIRE AREA 2017 (SQ. KM.)	AREA CHANGE (SQ. KM.)	Increase/Decrease
1	DAMODA	0.0000	0.0000	0.000	NO FIRE
2	TISCO (west)	0.0000	0.0000	0.000	NO FIRE
3	IISCO	0.0000	0.0000	0.000	NO FIRE
4	TISCO (north)	0.0885	0.0153	-0.073	DECREASE
5	NUDKHURKEE OCP	0.0000	0.0000	0.000	NO FIRE
6	BENEDIH OCP	0.0530	0.0453	-0.008	DECREASE
7	BLOCK-II OCP	0.0530	0.1353	0.082	INCREASE
8	MURAIDIH OCP	0.1478	0.0022	-0.146	DECREASE
9	SHATABDI OCP	0.0378	0.0361	-0.002	DECREASE
10	TETURIA	0.0000	0.0000	0.000	NO FIRE
11	S.GOVINDPUR	0.0000	0.0000	0.000	NO FIRE
12	KORIDIH BLOCK-IV OCP	0.0000	0.0000	0.000	NO FIRE
13	JOGIDIH	0.0000	0.0000	0.000	NO FIRE
14	DHARAMABAND	0.0000	0.0000	0.000	NO FIRE
15	MAHESHPUR	0.0000	0.0000	0.000	NO FIRE
16	PHULARITAND	0.0133	0.0205	0.007	INCREASE
17	MADHUBAND	0.0000	0.0000	0.000	NO FIRE
18	AKASH KINARI	0.0000	0.0000	0.000	NO FIRE
19	GOVINDPUR	0.0000	0.0000	0.000	NO FIRE
20	E. KATRAS	0.0133	0.0000	-0.013	DECREASE
21	KATRAS-CHOITUDIH	0.1021	0.1368	0.035	INCREASE
22	KESHALPUR	0.0000	0.0013	0.001	INCREASE
23	RAMKANALI	0.0000	0.0000	0.000	NO FIRE
24	NICHITPUR	0.0000	0.0000	0.000	NO FIRE
25	E. BASURIA	0.0000	0.0000	0.000	NO FIRE
26	KHAS KUSUNDA	0.0000	0.0000	0.000	NO FIRE
27	GONDUDIH	0.0000	0.0000	0.000	NO FIRE
28	W. GODHAR	0.0012	0.0000	-0.001	DECREASE
29	BASURIA	0.0000	0.0000	0.000	NO FIRE
30	TETULMARI	0.0223	0.0220	0.000	DECREASE
31	DHANSAR	0.0000	0.0000	0.000	NO FIRE
32	GODHAR	0.1073	0.0000	-0.107	DECREASE
33	INDUSTRY	0.0119	0.0513	0.039	INCREASE
34	KUSUNDA	0.4243	0.7398	0.315	INCREASE
35	SENDRA-BANSJORA	0.0796	0.0275	-0.052	DECREASE
36	BASTACOLLA	0.0663	0.0810	0.015	INCREASE
37	BERA	0.0000	0.0000	0.000	NO FIRE
38	KUYA	0.0000	0.0000	0.000	NO FIRE
39	GOLUCKDIH	0.0301	0.1122	0.082	INCREASE
40	KUJAMA	0.0398	0.2404	0.201	INCREASE

41	S. JHARIA-R. OCP	0.0244	0.1118	0.087	INCREASE
42	DOBARI	0.0000	0.0000	0.000	NO FIRE
43	GONHOODIH	0.0398	0.0322	-0.008	DECREASE
44	SIMLABAHAL	0.0000	0.0000	0.000	NO FIRE
45	HURRILADIH&STD	0.0000	0.0000	0.000	NO FIRE
46	ENA	0.0918	0.0432	-0.049	DECREASE
47	BURRAGARH	0.0000	0.0000	0.000	NO FIRE
48	N. TISRA	0.0098	0.1802	0.170	INCREASE
49	LODNA	0.0000	0.3527	0.353	INCREASE
50	S. TISRA	0.0000	0.1015	0.102	INCREASE
51	BARAREE	0.1037	0.1074	0.004	INCREASE
52	AMLABAD	0.0000	0.0000	0.000	NO FIRE
53	PATHERDIH	0.0000	0.0000	0.000	NO FIRE
54	SUDAMDIH	0.0000	0.0000	0.000	NO FIRE
55	SITANALA	0.0000	0.0000	0.000	NO FIRE
56	MURULIDIH 20/21 PIT	0.0000	0.0000	0.000	NO FIRE
57	MURULIDIH	0.0000	0.0000	0.000	NO FIRE
58	BHATDIH	0.0000	0.0000	0.000	NO FIRE
59	LOHAPATTY	0.0000	0.0000	0.000	NO FIRE
60	IISCO	0.0000	0.0000	0.000	NO FIRE
61	TASRA-IISCO	0.0000	0.0000	0.000	NO FIRE
62	KENDUADIH	0.0610	0.0000	-0.061	DECREASE
63	BULLIHARY	0.0000	0.0000	0.000	NO FIRE
64	GOPALICHUCK	0.0000	0.0000	0.000	NO FIRE
65	POOTKEE	0.0000	0.0000	0.000	NO FIRE
66	BHURUNGIA	0.0000	0.0000	0.000	NO FIRE
67	KHARKHAREE	0.0000	0.0000	0.000	NO FIRE
68	GASLITAND	0.1194	0.1215	0.002	INCREASE
69	KANKANEE	0.0530	0.0525	-0.001	DECREASE
70	MUDIDIH	0.1141	0.1104	-0.004	DECREASE
71	W. MUDIDIH	0.0171	0.0000	-0.017	DECREASE
72	LOYABAD	0.0133	0.0063	-0.007	DECREASE
73	BHAGABAND	0.0000	0.0000	0.000	NO FIRE
74	MOONIDIH PROJECT	0.0000	0.0000	0.000	NO FIRE
75	E.BHUGGATDIH	0.0022	0.0214	0.019	INCREASE
76	ALKUSHA	0.0326	0.0294	-0.003	DECREASE
77	KUSTORE	0.0524	0.0463	-0.006	DECREASE
78	ANGARAPATRA	0.1331	0.0149	-0.118	DECREASE
79	SALANPUR	0.0000	0.0000	0.000	NO FIRE
80	BHOWRAH. N	0.0133	0.0980	0.085	INCREASE
81	BHOWRAH. S	0.0000	0.0000	0.000	NO FIRE
82	BAGDIGI	0.0000	0.0209	0.021	INCREASE
83	JEALGORA	0.0000	0.0067	0.007	INCREASE
84	JEENAGORA	0.0000	0.0470	0.047	NO FIRE

85	JOYRAMPUR	0.0099	0.1042	0.094	**INCREASE**
86	CHANDAN OCP	0.0000	0.0000	0.000	**NO FIRE**
87	BANSDEOPUR	0.0000	0.0000	0.000	**NO FIRE**
	TOTAL AREA	**2.18**	**3.28**	**1.10**	**INCREASE**

Table 6: Colliery wise break-up of change in fire area from 2012 to 2017

Note:
1) "**NO FIRE**" implicates that the fire has not been identified satellite data *(either absent or below sensor resolution)*
2) "**INCREASE**" implies, increase in fire area OR emergence of fire areas not identified in 2012 study.
3) "**DECREASE**" implies, decrease in fire area OR fire areas of 2012, which are not identified in present study *(either absent or below sensor resolution)*.
4) Estimations of fire extent (in terms of sq.km.) both 2012 and in present 2017 study are pixel based. They do not represent the actual ground area under fire. These estimations are made for comparative purpose only, to indicate the increase or decrease of areal disposition of fire. Hence, they should not be quoted as fire area on the ground.

Annexure –IV

Figure 15: Fume cracks in Lodna-Tisra Area. (point 39 in figure 13 and table 4)

Figure 16: Burnt area near OB dump in Lodna area (point 41 in figure 13 and table 4)

Figure 17: Coalfries in active seams in Kusunda (point 23 in figure 13 and table 4)

Figure 18: Sagged area due to subsidence, south of Block II OCP. (point 1 in figure 14 and table 5)

Figure 19: Fire in OB dumps in Kusunda area. (point 24 in figure 13 and table 4)

Figure 20: Fume cracks in the Bhulanbarari area.

Annexure XI

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The information given in this report is not to be communicated either directly or indirectly to the press or to any person not holding an official position in the CIL/

GROUNDWATER LEVEL & QUALITY REPORT

FOR CLUSTER OF MINES, BCCL

(Assessment year – 2018-19)

[CLUSTER – I, II, III, IV, V, VI, VII, VIII, IX, X, XI, XIII, XIV, XV & XVI of Mines, BCCL]

JHARIA COALFIELD AND RANIGANJ COALFIELD (PART)

For

(BHARAT COKING COAL LIMITED)

(A Subsidiary of Coal India Limited)

KOYLA BHAWAN (DHANBAD)

Prepared by

Hydrogeology Department

Exploration Division

CMPDI (HQ), Ranchi

MARCH – 2019

Job no-514218177

3.3 I Monitoring of Ground Water Levels of Cluster-IX

Cluster-IX consists of eight mines namely; North Tisra/South Tisra Expansion OCP, Lodna UG, Bagdigi UG, Bararee UG and Joyrampur UG and Jealgora UG (closed) are under the administrative control of Lodna Area of BCCL. This Cluster of mines is located in eastern part of Jharia Coalfield in Dhanbad district of Jharkhand.

The present leasehold area of Cluster-IX is 1942.12 Ha. The topography of the area is undulating with gentle slope towards south. The RL varies from 221 m to 188.44 m AMSL. Chatkari Jore, Tisra Jore, Sulunga Jore and its tributaries controlling the drainage pattern of the area. The area comes under the watershed of Chatkari Jore.

6 hydrograph stations (**D-5, D-7, D-39, D-40A, D-41 and D-74**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has been done in the months of February, April, August & November'2018 and the Ground water level data is enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)			
			Feb'18	Apr'18	Aug'18	Nov'18
1	D-5	Jiyalgora	5.80	7.80	4.39	5.30
2	D-7	Golden Pahari	5.15	7.53	2.23	2.83
3	D-39	Tilaboni	3.18	4.95	2.50	4.35
4	D-40A	Khapa Dhawra	1.70	2.10	1.10	1.40
5	D-41	Joyrampur	1.30	1.59	1.08	1.32
6	D-74	Bhulan Bararee	5.80	8.60	3.40	4.80
Average WL (bgl)			3.82	5.43	2.45	3.33

Ground Water Level (in bgl) varies from 1.30 to 5.80 m during February, 1.59 to 8.60 m during April, 1.08 to 4.39 m during August and 1.32 to 5.30 m during November within the Core Zone of Cluster-IX area.

4.0 GROUNDWATER LEVEL SCENARIO

During the month of February'2018 the depth to water level (in bgl) within 15 nos Cluster of mines varies from 0.50 m to 11.68 m with an average varies from of 1.55 m to 5.39 m. During the month of April'2018 the depth to water level varies from 1.20 m to 14.58 m with an average varies from 3.12 m to 8.50 m. During the month of August'2018 the depth to water level varies from 0.80 m to 6.47 m with an average varies from 0.80 m to 3.73 m. During the month of November'2018 the depth to water level varies from 0.40 m to 7.17 m with an average varies from 1.75 m to 4.26 m. The summarized water level data of all clusters are given in **Table No – 4**.

Depth to water level (in bgl) values described that water level goes down to maximum 14.58 m during pre-monsoon'2018 and maximum upto 8.50 m during post-monsoon'2018. Un-confined aquifer is affected around 20 m to 30 m maximum close to active opencast mining areas, showing steep gradient towards mine void. Other than that, there is no mining effect in the water level within JCF area and RCF area (part). Historical water level data and hydrograph of permanent observation stations from CGWB shown in **Annexure–III**.

Monitoring groundwater (quantity & quality) to assess the present condition and resource has been done regularly in the coalfield areas. Well hydrographs (**Annexure–III and VI**) are prepared and studied to identify potentially adverse trends so that appropriate action can be taken to protect groundwater resource. According to the hydrograph trend analysis of CGWB monitoring wells and CMPDI observation wells, there are decline trends in both Pre and Post-monsoon GW level trends (max. upto 0.50 cm/year in Patherdih/D-35) but no significant decline trend (>1.0 m/year) of water level is noticed in any particular area for the last 10 years within the coalfield area. Regarding quality monitoring, the water sample location map (**Figure No–2**) with collection points details (dug wells) are given in **Annexure–IV** and Quality is given in **Annexure–V**.

Table No–4: Groundwater level data Cluster-wise

Sl. No.	Cluster of BCCL	No. of Monitoring Wells	Water level fluctuation Below ground level (Feb, Apr, Aug & Nov'18)	Formation
1	I	4 nos.	0.75 to 9.65 m	Barakar
2	II	5 nos.	0.90 to 13.68 m	Barakar
3	III	5 nos.	0.40 to 6.63 m	Barakar
4	IV	4 nos.	0.55 to 10.03 m	Barakar
5	V	4 nos.	0.37 to 4.40 m	Barakar
6	VI	2 nos.	0.50 to 4.58 m	Barakar
7	VII	7 nos.	0.45 to 9.35 m	Barakar
8	VIII	4 nos.	1.45 to 10.93 m	Barakar
9	IX	6 nos.	1.08 to 8.60 m	Barakar
10	X	4 nos.	0.45 to 8.40 m	Barakar
11	XI	5 nos.	1.0 to 3.65 m	Barakar & Barren Measure
12	XIII	6 nos.	1.10 to 11.15 m	Raniganj
13	XIV	3 nos.	1.74 to 9.55 m	Raniganj
14	XV	3 nos.	1.27 to 14.58 m	Barakar & Barren Measure
15	XVI	4 nos.	1.20 to 8.70 m	Barakar

Table No–6: Cluster-wise Groundwater development scenario

Cluster/ Area	Adminis-trative Blocks/Stage Of GW Develo-Pment (SOD)	Total Water demand (Lakh cum/year)				Avg. GW level (bgl in m) 2018		GW level declining trend 2005-2018		Quantity Recharge/ future use (Lakh Cum/ Year)
		Mine Discharge (GW + Rainwater)	Surface Water Source	Total Use (Domestic + Industrial)	Excess Or other use	Pre-monsoon	Post-monsoon	Pre-monsoon	Post-monsoon	
Cluster-I	Bermo (SOD: Over-exploited)	9.56	NIL	7.42	2.14	5.11	1.84	YES	YES	NIL
Cluster-II	Baghmara (SOD: Critical)	170.17	Jamunia river	22.55	23.83	6.57	2.84	YES	NO	123.75
Cluster-III		58.18	NIL	2.58	12.65	6.64	2.64	NO	YES	42.95
Cluster-IV		68.84	MADA (Damodar river)	18.47	12.31	5.64	2.66	NO	NO	38.06
Cluster-V		127.29	MADA	77.92	31.02	3.22	2.13	YES	YES	18.35
Cluster-VI	Dhanbad (SOD: Over-exploited)	3.86	MADA (Damodar river)	3.69	0.0	3.60	1.75	YES	YES	NIL (loss due to FF)
Cluster-VII		93.33	MADA	27.70	6.87	4.87	2.50	YES	NO	58.76
Cluster-VIII	Jharia (SOD: Over-exploited)	29.27	MADA	24.04	1.18	6.80	3.71	NO	NO	4.05
Cluster-IX		310.34	MADA	160.28	45.05	5.43	3.33	NO	NO	105.01
Cluster-X		59.38	Damodar river	11.47	0.0	5.36	3.18	YES	NO	47.91
Cluster-XI	Dhanbad (SOD: Over-exploited)	249.67	MADA & DVC	19.86	43.92	3.20	2.16	YES	YES	185.89
Cluster-XIII	Baghmara (SOD: Critical)	64.61	Damodar river	10.09	9.86	6.88	3.97	YES	YES	44.66
Cluster-XIV		NA	NA	NA	NA	8.49	3.49	NO	NO	NA
Cluster-XV		5.11	Jamunia river	0.0	5.11	7.97	4.27	NO	YES	0.0
Cluster-XVI	Nirsa (SOD:Safe)	29.78	DVC (Barakar river)	14.60	6.57	4.34	2.75	NO	NO	8.61

WATER QUALITY MONITORING

3.1 Location of sampling sites

(Refer **Plate No. – II**)

i) **Mine Discharge of Jeenagora (MW9)**

A sampling point is fixed to assess the effluent quality of Mine discharge.

3.2 Methodology of sampling and analysis

Water samples were collected as per standard practice. The effluent samples were collected and analyzed for four parameters on fortnightly basis at the Environmental Laboratory of CMPDI RI-II, Dhanbad.

3.3 Results & Interpretations

The results are given in tabular form along with the applicable standards. Results are compared with Schedule - VI, effluent prescribed by MoEF&CC. Results show that most of the parameters are within the permissible limits.

WATER QUALITY DATA

(EFFLUENT WATER- FOUR PARAMETERS)

Name of the Cluster: **Cluster -IX**		Month: **AUG,2019**	Name of the Station: **Mine Discharge of Jeenagora**	
Sl. No.	**Parameters**	**MW9** First Fortnight 12.08.2019	**MW9** Second Fortnight 17.08.2019	**As per MOEF General Standards for schedule VI**
1	Total Suspended Solids	60	74	*100 (Max)*
2	pH	8.05	8.13	*5.5 - 9.0*
3	Oil & Grease	<2.0	<2.0	*10 (Max)*
4	COD	24	44	*250 (Max)*

All values are expressed in mg/lit except pH.

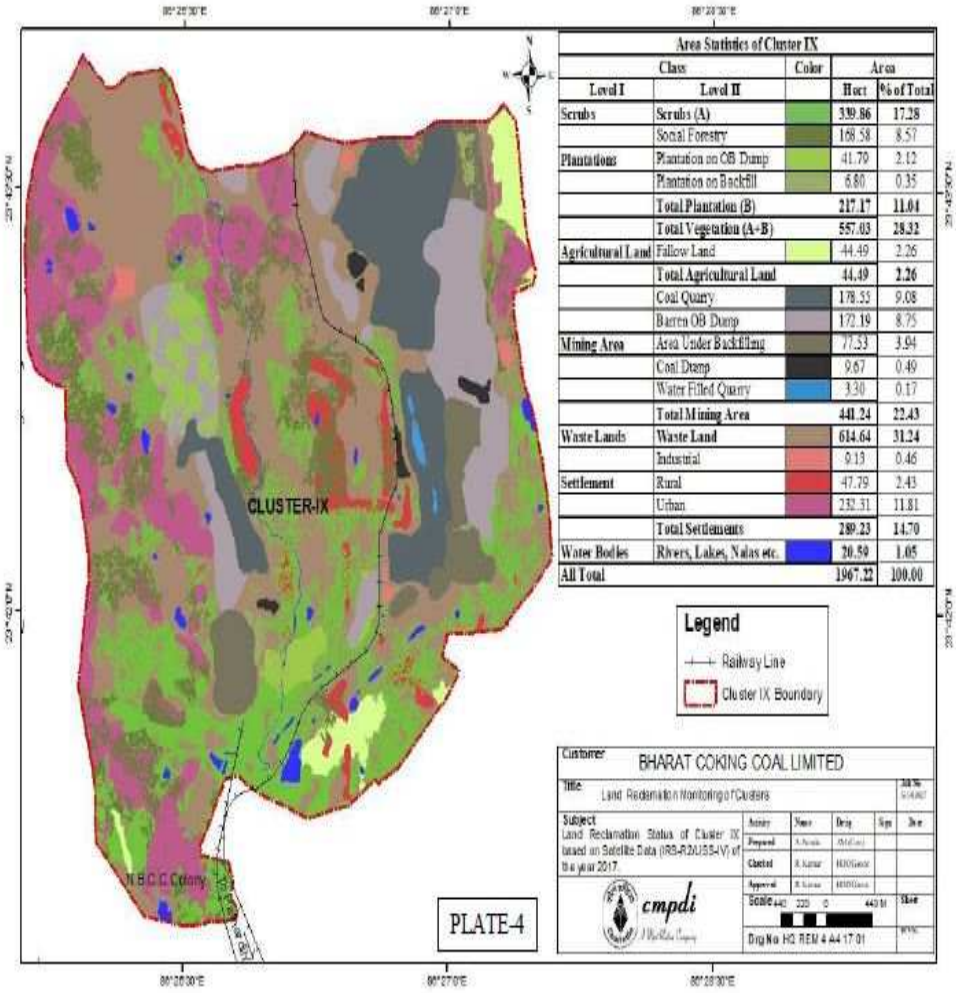
Analysed By
JSA/SA/SSA

Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(Mining/Environment)
RI-2, CMPDI, Dhanbad

Annexure XIII

Landuse Map generated from Remote Sensing Data



Area Statistics of Cluster IX

Class		Color	Area	
Level I	Level II		Hect	% of Total
Scrubs	Scrubs (A)		339.86	17.28
	Social Forestry		168.58	8.57
Plantations	Plantation on OB Dump		41.79	2.12
	Plantation on Backfill		6.80	0.35
	Total Plantation (B)		217.17	11.04
	Total Vegetation (A+B)		557.03	28.32
Agricultural Land	Fallow Land		44.49	2.26
	Total Agricultural Land		44.49	2.26
	Coal Quarry		178.55	9.08
	Barren OB Dump		172.19	8.75
Mining Area	Area Under Backfilling		77.53	3.94
	Coal Dump		9.67	0.49
	Water Filled Quarry		3.30	0.17
	Total Mining Area		441.24	22.43
Waste Lands	Waste Land		614.64	31.24
	Industrial		9.13	0.46
Settlement	Rural		47.79	2.43
	Urban		232.31	11.81
	Total Settlements		289.23	14.70
Water Bodies	Rivers, Lakes, Nalas etc.		20.50	1.05
All Total			1967.22	100.00

Annexure XIV

F-20A

त कोकिंग कोल लिमिटेड
(इंडिया लिमिटेड का एक अंग)
कोयला भवन/ कोयला नगर,
धनबाद -826005
:0326-2230190/ फैक्स-0326-2230050
ईमेल: cos@bccl.gov.in

Bharat Coking Coal Limited
(A Subsidiary of Coal India Limited)
Koyla Bhawan/ Koyla Nagar
Dhanbad-826005
Phone No. 0326-2230190/Fax-0326-2230050
email ID: cos@bccl.gov.in

बोर्ड सचिवालय /Board Secretariat

Extracts of Minutes of 300th Board Meeting held on 21.09.2013.

300.4N **Approval of Mine Closure Plan.**

Board after deliberation passed the following resolution:

Resolved that the proposal of Mine Closure Plan of the 20(Twenty) mines (as per the enclosed mine closure list vide enclosure 'A') including the total closure cost of ₹ 27980.77 Lakh (Rupees two hundred seventy nine crore eighty lakh and seventy seven thousand only) to be depositec in "Escrow Account" under Revenue head be and is hereby approved.

Further resolved that the said 'Escrow Account' will be opened in accordance with the guidelines issued by D(F),CIL vide letter No.168/96 dated 26.06.2013 and 168/98 dated 28.06.2013 (copy attached vide enclosure-'B') be and is hereby approved.

Certified to be True Copy

B. K. Prasad
Company Secretary
Bharat Coking Coal Limited
Koyla Bhawan
Dhanbad - 826005

Board file
16/10

Annexure XV

भारत कोकिंग कोल लिमिटेड
एक मिनिरत्न कम्पनी
(कोल इंडिया लिमिटेड का एक अंग)
महाप्रबंधक का कार्यालय, लोदना क्षेत्र
पो.ओ.- भागा, जिला - धनबाद (झारखण्ड)
पंजीकृत कार्यालय: कोयला भवन, कोयला नगर,
धनबाद- 825005, (झारखण्ड)
CIN:U10101JH1972GOI000818

Bharat Coking Coal Limited
A MINI RATNA Co.
(A Subsidiary of Coal India Ltd)
Office of the General Manager, Lodna Area
P.O. Bhaga, Dist: Dhanbad (Jharkhand)
Regd.Off: Koyla Bhawan, Koyla Nagar, Dhanbad-825005,
CIN:U10101JH1972GOI000818

Ref. No.: BCCL/LA/GM/2019/ 198 Date: 29/8/2019

OFFICE ORDER

An Environment Management Cell (EMC) of Lodna Area is hereby constituted with following members:

1. General Manager, Lodna Area – Chairman
2. Addl. General Manager, Lodna Area – Vice Chairman
3. Area Manager (Environment), Lodna Area – Member
4. Area Safety Officer, Lodna Area – Member
5. Area Manager (Planning), Lodna Area – Member
6. Area Finance Manager, Lodna Area – Member
7. Area Personnel Manager, Lodna Area – Member
8. Area Manager (Survey), Lodna Area – Member
9. Area Manager (E&M), Lodna Area – Member
10. Area Manager (Excavation), Lodna Area – Member
11. Area Manager (Estate), Lodna Area – Member
12. Project Officer – Amal NT-ST-JG/Amal Joyrampur/Kujama Colliery – Member
13. Assistance Manager (Environment), Lodna Area – Member

Environment Management Cell will monitor & co-ordinate with project officers to ensure the compliance of conditions imposed in Environment Clearance granted by Ministry of Environment, Forest & Climate Change.

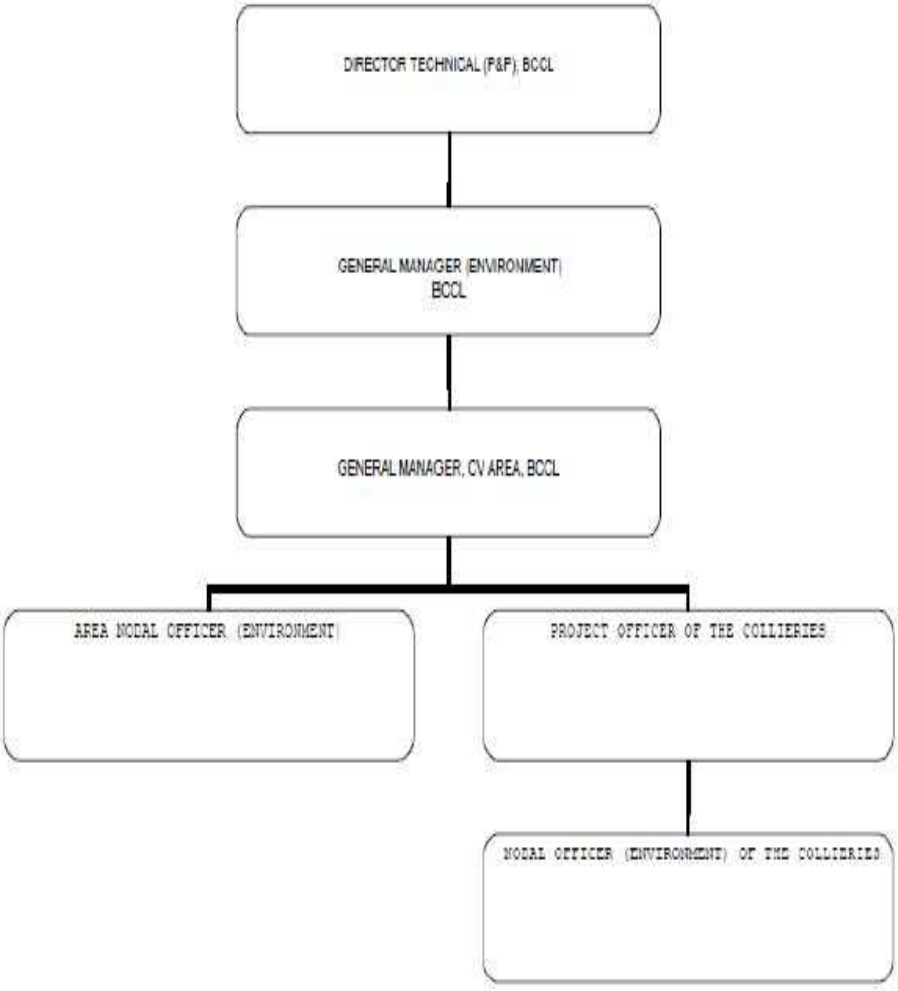
29/8/19
General Manger
Lodna Area

Copy to:

1. Dy.GM / HOD (Env.), KB, BCCL
2. All Project Officers, Lodna Area
3. Executive concerned
4. Office copy

Annexure XVI

Fig 17 ORGANIZATION CHART



ENVIRONMENTAL MONITORING REPORT OF BHARAT COKING COAL LIMITED, CLUSTER –IX

(FOR THE MONTH AUGUST 2019)

E. C. no. J-11015/307/2010-IA.II (M) dated 21.05.2013

CMPDI
ISO 9001 Company
Regional Institute-II
Dhanbad, Jharkhand

CONTENTS

EXECUTIVE SUMMARY

1.0 Introduction

The purpose of environmental monitoring is to assess the quality of various attributes that affects the fauna and flora. In accordance with the quality of these attributes appropriate strategy is to be developed to control the pollution level within the permissible limits. The three major attributes are air, water and noise level.

Bharat Coking Coal Limited (BCCL), a Subsidiary company of Coal India Limited is operating Underground and Opencast Mines in Jharia Coalfield (JCF) is a part of Gondwana Coalfields located in Dhanbad district of Jharkhand, the JCF is bounded by $23^0$37' N to $23^0$52' N latitudes and $86^0$09' E to $86^0$30' E longitude occupying an area of 450 Sq.km. BCCL has awarded Environmental monitoring work of Jharia Coalfield (JCF) to Central Mine Planning & Design Institute Limited (CMPDIL). The environmental monitoring has been carried out as per the conditions laid down by the MoEF&CC while granting environmental clearance of project, consent letter issued by the respective SPCB, and other statutory requirements.

2.0 Sampling location and rationale

2.1 Ambient air sampling locations

The ambient air quality monitoring stations were selected to represent core, buffer zone area. The rationale has been based on the guidelines stipulated by MoEF&CC, consent letter of SPCB, as well as other statutory requirements.

2.2 Water sampling stations

The Water sampling stations were selected for mine sump water.

2.3 Noise level monitoring locations

Noise levels vary depending on the various activities in mining areas. The monitoring of noise level in different locations will be helpful to take appropriate mitigating measures. The rationale has been based on the guidelines stipulated by MoEF&CC, consent letter of SPCB, as well as other statutory requirements

3.0 Methodology of sampling and analysis

3.1 Ambient air quality

Parameters chosen for assessment of ambient air quality were Particulate Matter (PM_{10}), Fine Particulate Matter ($PM_{2.5}$), Sulphur Di-oxide (SO_2) and Nitrogen Oxides (NO_x). Respirable Dust Samplers (RDS) and Fine Dust Sampler ($PM_{2.5}$

sampler) were used for sampling of $PM_{10,}$ SO_2, & NO_x and Fine Dust Sampler ($PM_{2.5}$ sampler) were used for sampling of $PM_{2.5}$ at 24 hours interval once in a fortnight and the same for the gaseous pollutants. The samples were analysed in Environmental Laboratory of CMPDI, RI-II, Dhanbad.

3.2 Water quality

Water samples were collected as per standard practice. The Mine effluent samples were collected and analyzed for four parameters on fortnightly basis. Thereafter the samples were preserved and analyzed at the Environmental Laboratory of CMPDI, RI- II, Dhanbad.

3.3 Noise level monitoring

Noise level measurements in form of 'L_{EQ}' were taken using Integrated Data Logging Sound Level Meter. Noise levels were measured in Decibels, 'A' weighted average, i.e. dB(A).

4.0 Results and interpretations

4.1 Air quality

It has been seen from the analysis results that the 24 hours average concentration parameters like $PM_{10,}$ $PM_{2.5}$, SO_2 and NO_x are mostly within the permissible limits in all sampling locations as per MoEF&CC Gazette Notification No. GSR 742(E) dt 25.09.2000 Standards for Coal Mines and National Ambient Air Quality Standard -2009. Sometimes the concentration of PM_{10}& $PM_{2.5}$ exceeds the limits due to heavy public traffic, poor road condition, coke oven plants, burning of coal by surrounding habitants, brick making, municipal waste dumps and industries like Steel Plant, thermal Plants including their fly ash etc.

The following preventive and suppressive mitigative measures can be undertaken to contain the pollution level within prescribed level:-

- Wet drilling and controlled blasting should be practice.
- Explosive used should be optimised to restrict the dust generation.
- Transportation roads should be permanently asphalted free of ruts, potholes etc.
- Water should be sprayed on coal transportation road, service road more frequently and at regular interval.
- Dust from roads should be removed physically or mechanically.
- Greenbelts around industrial sites, service building area besides Avenue plantation along roads should be created.
- Coal dust should be suppressed by using fixed sprinklers.
- Regular maintenance of plant and machinery should be undertaken.

4.2 Water quality

The test results indicate that the major parameters compared with MoEF&CC Gazette Notification No. GSR 742(E) dt.25.09.2000 Standards for Coal Mines were within permissible limits.

4.3 Noise Level

During the noise level survey it has been observed that the noise level in the sampling locations is within the permissible limits prescribed as per MoEF&CC Gazette Notification No. GSR 742(E) dt.25.09.2000 Standards for Coal Mines for Industrial Area and Noise pollution (Regulation and Control) Rules, 2000.

INTRODUCTION

1.0 Any industry and development activities including coal mining is bound to affect environmental attributes. There are positive as well as negative impacts of such operations. For controlling the adverse impacts a regular monitoring is essential. The environmental monitoring is being done as per the guide-lines stipulated by Ministry of Environment, Forest and Climate Change (MoEF&CC), Govt. of India.

The very purpose of environmental monitoring is to assess the quality of various attributes which affects the environment. As per quality of these attributes appropriate strategy is to be developed to control the pollution level within the permissible limits. The three major attributes are air, water and noise level.

Bharat Coking Coal has awarded Environmental Monitoring work of all Projects, Cluster wise, to Central Mine Planning & Design Institute Limited (CMPDIL). The environmental monitoring has been carried out as per conditions laid down by MoEF&CC while granting environmental clearance to different projects. CMPDI has trained manpower and well equipped laboratory to carry out monitoring, analysis and R&D work in the field of environment.

1.1 The Cluster-IX is in the Eastern part of the Jharia coalfield. It includes a group of 7 Mines (viz. Lodna, S. Tisra/NTST OC, Jealgora, Joyrampur, Jeenagora, Bararee, S.Tisra/NTST Expan. OC. The Cluster – IX is situated about 25 - 30 kms from Dhanbad Railway Station. The mines of this Cluster – IX are operating since pre nationalization period (prior to 1972-73). It is connected by both Railway and Road. The drainage pattern of the area is governed by Kashi Jore.

1.2 The Cluster-IX is designed to produce 6.548 MTPA (normative) and 8.512 MTPA (peak) capacity of coal.

The Project has Environmental Clearance from Ministry of Environment, Forest and Climate Change (MoEF&CC) for a rated capacity 6.548 MTPA (normative) and 8.512 MTPA (peak) capacity of coal production vide letter no. J-11015/307/2010-IA.II (M) dated 21st May, 2013.

Ministry of Environment, Forest and Climate Change while granting environmental clearance has given one of the General conditions that " Four ambient air quality monitoring stations should be established in the core zone as well as in the buffer zone for PM_{10}, $PM_{2.5}$, SO_2, NOx monitoring. Location of the stations should be decided based on the meteorological data, topographical features and environmentally and ecologically sensitive targets, other conditions regarding water / effluent and noise level monitoring in consultation with the State Pollution Control Board."

In compliance of these conditions the Environmental Monitoring has been carried out & report prepared for submission to MoEF&CC & JSPCB and other statutory authorities.

AMBIENT AIR QUALITY MONITORING

2.1 Location of sampling station and their rationale:

(As per G.S.R. 742 (E) dt. 25th December, 2000)

2.1.1 Ambient Air Quality Sampling Locations

I. CORE ZONE Monitoring Location

i) Jeenagora (A13) : Industrial Area

The location of the sampling station is 23^0 42' 31.00'' N & 86^0 25' 48.00'' E. The sampler was placed at a height of 1.5 m from the ground level at the Safety Office.

II. BUFFER ZONE Monitoring Location

i) Kusmatand Village (A12): Industrial Area

The location of the sampling station is $23^0$45' 4.65'' N & 86^0 26' 42.10'' E. The sampler was placed at a height of 1.5 m from the ground level of the village.

ii) Bhowrah North (A14) : Industrial Area

The location of the sampling station is 23^o41' 37.00'' N & 86^o23' 54.00''E. The sampler was placed at 1.5 m above the ground level of Project Office.

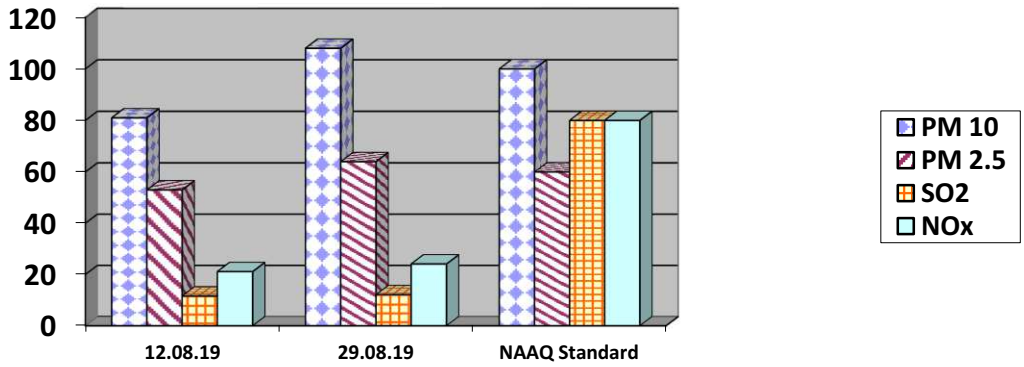
Iii) Hurriladih UGP (A28) : Industrial Area

The location of the sampling station is $23^0$44' 4.18'' N & 86^0 24' 6.21'' E. The sampler was placed at a height of 1.5 m from the ground level of the mine office.

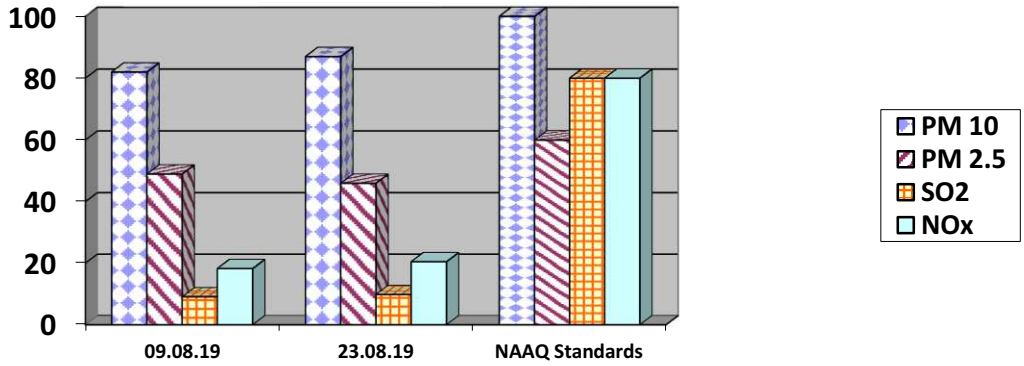
AMBIENT AIR QUALITY DATA

Cluster – IX, Bharat Coking Coal limited Month: **AUG,2019** Year: **2019-20.**

Station Name: A13 – Jeenagora		**Zone: Core**		**Category: Residential**	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO_2**	**NO_x**
1	12.08.19	81	53	11.61	21.11
2	29.08.19	108	64	12.10	24.09
	NAAQ Standard	100	60	80	80



StationName:A12 Kusmatand Village		**Zone: Buffer**		**Category: Industrial**	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO2**	**NOx**
1	09.08.19	82	49	9.07	18.26
2	23.08.19	87	46	9.82	20.48
	NAAQ Standards	100	60	80	80

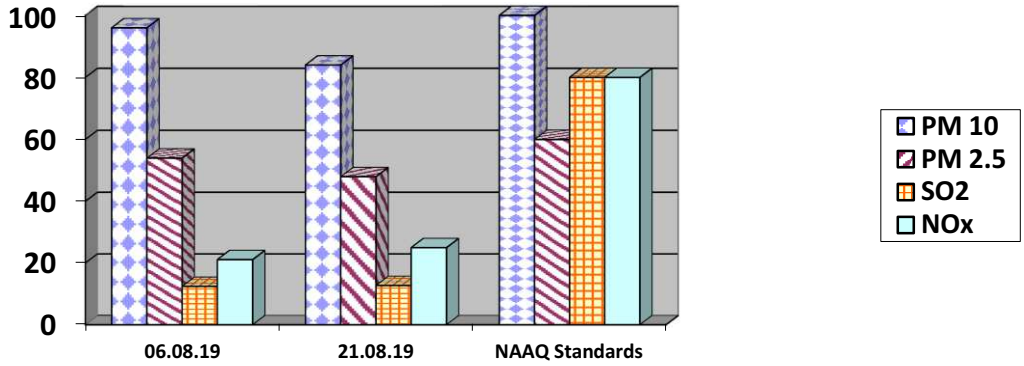


Analysed By
JSA/SA/SSA

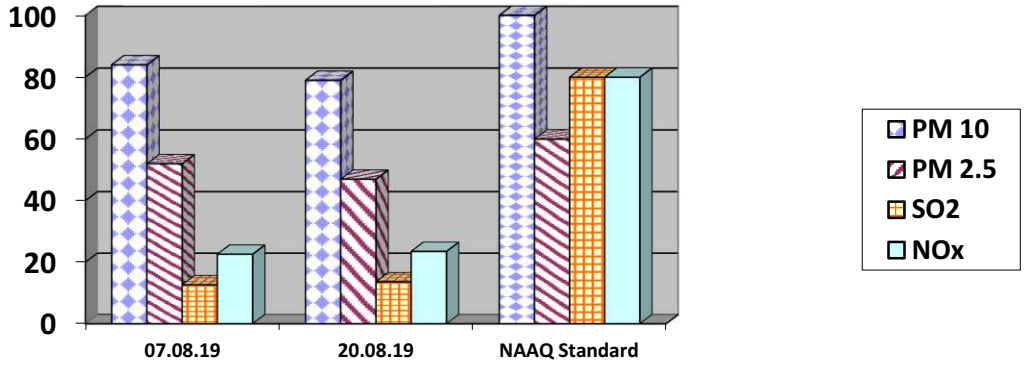
Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(Mining/Environment)
RI-2, CMPDI, Dhanbad

Station Name:A14- Bhowrah North		Zone: Buffer		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	06.08.19	96	54	12.43	21.1
2	21.08.19	84	48	12.71	24.98
	NAAQ Standards	100	60	80	80



Station Name: Hurriladih UGP (A28)		Zone: Buffer		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_x
1	07.08.19	84	52	12.67	22.6
2	20.08.19	79	47	13.62	23.51
	NAAQ Standard	100	60	80	80



- *All values are expressed in microgram per cubic meter.*
- *24 hours duration*

Analysed By
JSA/SA/SSA

Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(Mining/Environment)
RI-2, CMPDI, Dhanbad

WATER QUALITY MONITORING

3.1 Location of sampling sites

(Refer **Plate No. – II**)

i) **Mine Discharge of Jeenagora (MW9)**

A sampling point is fixed to assess the effluent quality of Mine discharge.

3.2 Methodology of sampling and analysis

Water samples were collected as per standard practice. The effluent samples were collected and analyzed for four parameters on fortnightly basis at the Environmental Laboratory of CMPDI RI-II, Dhanbad.

3.3 Results & Interpretations

The results are given in tabular form along with the applicable standards. Results are compared with Schedule - VI, effluent prescribed by MoEF&CC. Results show that most of the parameters are within the permissible limits.

WATER QUALITY DATA

(EFFLUENT WATER- FOUR PARAMETERS)

Name of the Cluster: **Cluster -IX**		Month: **AUG,2019**	Name of the Station: **Mine Discharge of Jeenagora**	
Sl. No.	**Parameters**	**MW9** First Fortnight	**MW9** Second Fortnight	**As per MOEF General Standards for schedule VI**
		12.08.2019	17.08.2019	
1	Total Suspended Solids	60	74	*100 (Max)*
2	pH	8.05	8.13	*5.5 - 9.0*
3	Oil & Grease	<2.0	<2.0	*10 (Max)*
4	COD	24	44	*250 (Max)*

All values are expressed in mg/lit except pH.

Analysed By
JSA/SA/SSA

Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(Mining/Environment)
RI-2, CMPDI, Dhanbad

NOISE LEVEL QUALITY MONITORING

4.1 Location of sampling sites

1. **Jeenagora (N13)**
2. **Kusmatand Village (N12)**
3. **Bhowrah North (N14)**
4. **Hurriladih UGP (N28)**

4.2 Methodology of sampling and analysis - Noise level measurements in form of 'L_{EQ}' were taken using Integrated Data Logging Sound Level Meter (NL-52 OF RION CO. Ltd. Make) during day time. Noise levels were measured for about one hour time in day time. Noise levels were measured in Decibels, 'A' weighted average, i.e. dB (A).

4.3 Results & Interpretations

Ambient noise levels were recorded during day time and the observed values were compared with standards prescribed by MoEF&CC. The results of Noise levels recorded during day time on fortnightly basis are presented in tabular form along with the applicable standard permissible limits. The observed values in terms of L_{EQ} are presented**.** The observed values at all the monitoring locations are found to be within permissible limits.

NOISE LEVEL DATA

Name of the Project : **Cluster -IX**			Month**: AUGUST, 2019**		
Sl. No.	**Station Name/Code**	**Category of area**	**Date**	**Noise level dB(A)LEQ**	***Permissible Limit of Noise level in dB(A)***
1	**Kusmatand Village (N12)**	**Residential area**	09.08.19	50.7	*55*
2	**Kusmatand Village (N12)**	**Residential area**	23.08.19	51.4	*55*
3	**Jeenagora (N13)**	**Industrial area**	12.08.19	58.3	*75*
4	**Jeenagora (N13)**	**Industrial area**	29.08.19	61.3	*75*
5	**Bhowrah North(N14)**	**Industrial area**	06.08.19	46.3	*75*
6	**Bhowrah North(N14)**	**Industrial area**	21.08.19	61.8	*75*
7	**Hurriladih UGP (N28)**	**Industrial area**	07.08.19	46.1	*75*
8	**Hurriladih UGP (N28)**	**Industrial area**	20.08.19	65.8	*75*

Permissible limits of Noise Level as per MOEF Gazette Notification No. GSR 742(E) dt. 25.09.2000 Standards for Coal Mines and Noise Pollution (Regulation and Control) Rules, 2000.
*** Day Time: 6.00 AM to 10.00 PM.**

Analysed By
JSA/SA/SSA

Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(Mining/Environment)
RI-2, CMPDI, Dhanbad

Ambient Air Quality Standards for Jharia Coal Field
As per the Environment (Protection) Amendment Rules, 2000 notified vide notification G.S.R. 742(E), dated 25.9.2000.

Category	Pollutant	Time weighted average	Concentration in Ambient Air	Method of Measurement
1	2	3	4	5
III Coal mines located in the coal fields of • Jharia • Raniganj • Bokaro	Suspended Particulate Matter (SPM)	Annual Average * 24 hours **	500 µg/m^3 700 µg/m^3	- High Volume Sampling (Average flow rate not less than 1.1
	Respirable Particulate Matter (size less than 10 µm) (RPM)	Annual Average * 24 hours **	250 µg/m^3 300 µg/m^3	Respirable Particulate Matter sampling and analysis
	Sulphur Dioxide (SO_2)	Annual Average * 24 hours **	80 µg/m^3 120 µg/m^3	1.Improvedwest and Gaeke method 2.Ultraviolet fluorescene
	Oxide of Nitrogen as NO_2	Annual Average * 24 hours **	80 µg/m^3 120 µg/m^3	1. Jacob & Hochheiser Modified (Na-Arsenic) Method 2. Gas phase Chemilumine-scence

Note:

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

** 24hourly/8hourlyvaluesshallbemet92%ofthetimeinayear.However,8% of the time it may exceed but not on two consecutivedays.

NATIONAL AMBIENT AIR QUALITY STANDARDS

New Delhi the 18th November 2009

In exercise of the powers conferred by Sub-section (2) (h) of section 16 of the Air (Prevention and Control of Pollution) Act, 1981 (Act No. 14 of 1981), and in supersession of the notification No(s).S.O.384(E), dated 11th April 1994 and S.O.935(E), dated 14th October 1998, the Central Pollution Control Board hereby notify the National Ambient Air Quality Standards with immediate effect.

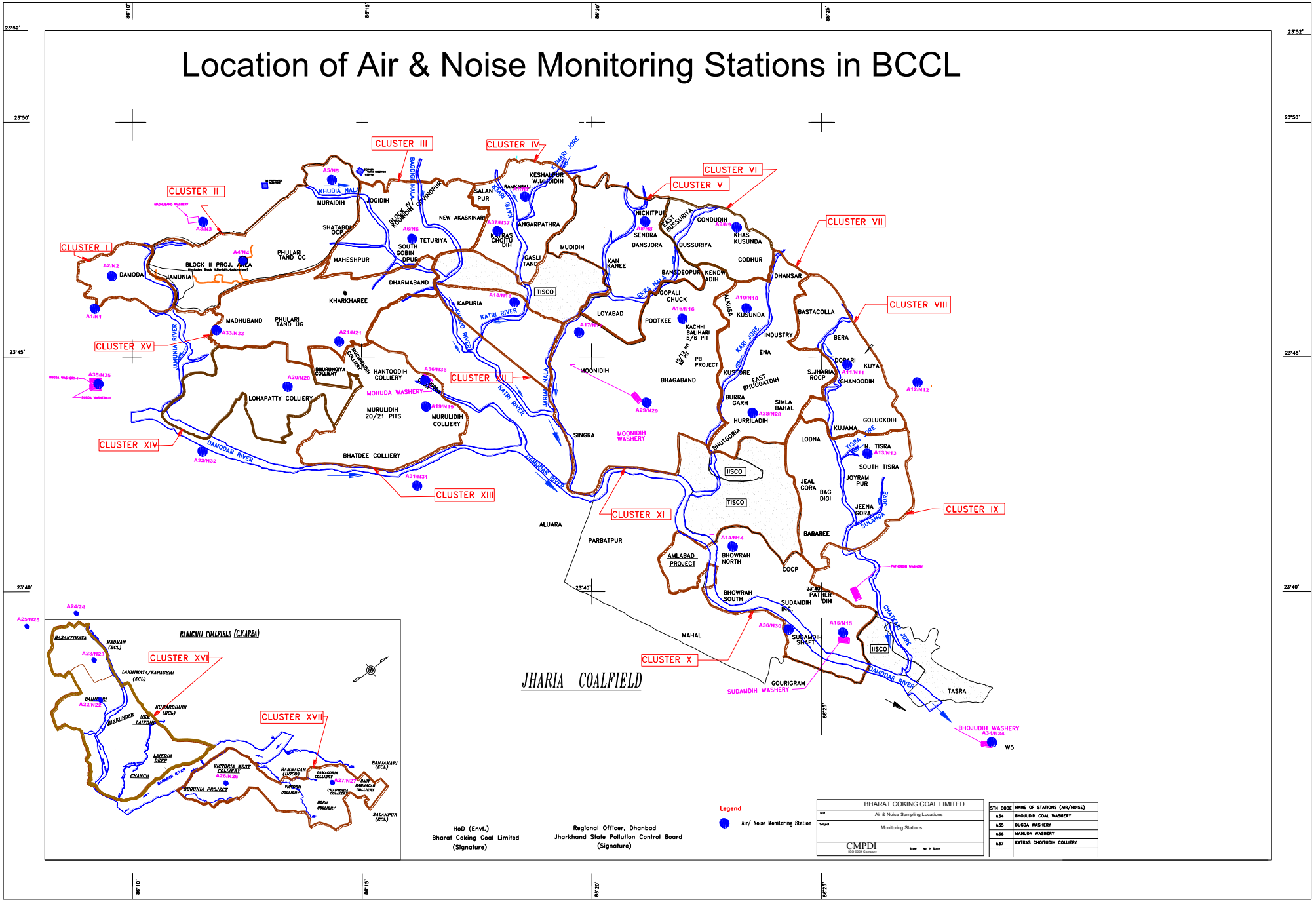
Pollutant	Time Weighted Average	Concentration in Ambient Air		Methods of Measurement
		Industrial, Residential, Rural and other Areas	Ecologically Sensitive Area (Notified by Central Government)	
Sulphur Dioxide (SO_2), µg/m³	Annual * 24 Hours **	50 80	20 80	-Improved West and Gaeke Method -Ultraviolet Fluorescence
Nitrogendioxide (NO_2), µg/m³	Annual * 24 Hours **	40 80	30 80	-Jacob &Hochheiser modified ($NaOH$-$NaAsO_2$) Method -Gas Phase Chemiluminescence
Particulate Matter (Size less than 10µm) or PM_{10}, µg/m³	Annual * 24 Hours **	60 100	60 100	-Gravimetric -TEOM -Beta attenuation
Particulate Matter (Size less than 2.5µm) or $PM_{2.5}$, µg/m³	Annual * 24 Hours **	40 60	40 60	-Gravimetric -TEOM -Beta attenuation
Ozone (O_3) , µg/m³	8 Hours * 1 Hour **	100 180	100 180	-UV Photometric -Chemiluminescence -Chemical Method
Lead (Pb) , µg/m³	Annual * 24 Hours **	0.50 1.0	0.50 1.0	-AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper -ED-XRF using Teflon filter
Carbon Monoxide (CO), mg/m³	8 Hours ** 1 Hour **	02 04	02 04	-Non dispersive Infrared (NDIR) Spectroscopy
Ammonia (NH_3), µg/m³	Annual * 24 Hours **	100 400	100 400	-Chemiluminescence -Indophenol blue method
Benzene (C_6H_6), µg/m³	Annual *	05	05	-Gas Chromatography (GC) based continuous analyzer -Adsorption and desorption followed by GC analysis
Benzo(a)Pyrene (BaP) Particulate phase only, ng/m³	Annual *	01	01	-Solvent extraction followed byHPLC/GC analysis
Arsenic (As), ng/m³	Annual *	06	06	-AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper
Nickel (Ni), ng/m³	Annual *	20	20	-AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper

* Annual Arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals.

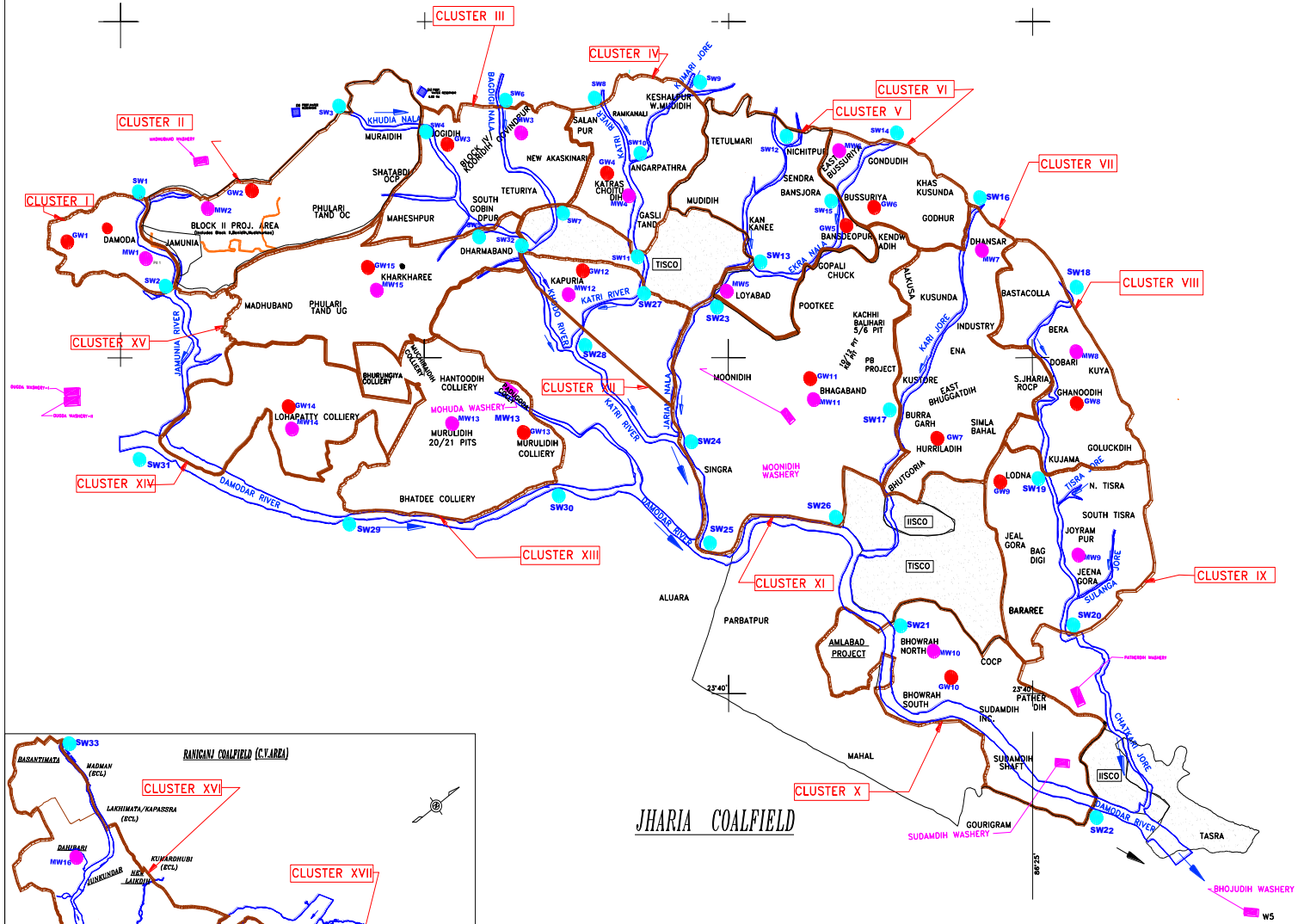
** 24 hourly or 8 hourly or 1 hourly monitored values, as applicable, shall be complied with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

NOTE: Whenever and wherever monitoring results on two consecutive days of monitoring exceed the limits specified above for the respective category, it shall be considered adequate reason to institute regular or continuous monitoring and further investigations.

Location of Air & Noise Monitoring Stations in BCCL



Water Sampling Locations in BCCL



INDEX

Cluster	Suface Water (U/S, D/S)	Name of River/ Nala / Jore	Mine/ Effluent Water	Sampling Location	Ground Water	Sampling Location
I	SW1, SW2	Jamunia River	MW1	Damoda Area	GW1	Ghutway Village
II	SW3, SW4	Khudia Nala	MW2	Block II OCP	GW2	Joyrampur Village
III	SW4, SW5, SW6, SW7	Khudia Nala, Bagdigi Nala	MW3	Govindpur Colliery	GW3	Jogidih Village
IV	SW8, SW11, SW9, SW10	Katri River, Kumari Jore	MW4	Chotudih	GW4	Kankanee Village
V	SW12, SW13, SW15	Jarian Nala, Ekra Nala	MW5	Mudidih	GW5	Nichitpur
VI	SW14, SW15	Ekra Nala	MW6	East Bassuria UGP	GW6	Bansjora Borewell
VII	SW16, SW17	Kari Jore	MW7	Dhansar UGP	GW7	Hurriladih
VIII	SW18, SW19	Kashi Jore	MW8	Dobari UGP	GW8	Ghanudih
IX	SW19, SW20	Kashi Jore	MW9	Jeenagora	GW9	Lodna
X	SW21, SW22	Damodar River	MW10	Bhowrah North	GW10	Bhowrah South
XI	SW23, SW24, SW25, SW26	Jarian Nala, Damodar River	MW11	Bhagaband h UGP	GW11	Bhagabandh
XII	SW27, SW28	Katri River	MW12	Kapuria	GW12	Kapuria
XIII	SW29, SW30	Damodar River	MW13	Murulidih (20/21)	GW13	Murulidih
XIV	SW31, SW29	Damodar River	MW14	Lohapatti	GW14	Lohapatti
XV	SW5, SW32	Khudia Nala	MW15	Kharkharee UGP	GW15	Kharkharee
XVI	SW33, SW34	Khudia River	MW16	Dahibari OCP	GW16	Patlabari Village
XVII	SW35, SW36	Barakar River	MW17	Damagoria Colliery	GW17	Chaptoria

HoD (Envt.)
Bharat Coking Coal Limited
(Signature)

Regional Officer, Dhanbad
Jharkhand State Pollution Control Board
(Signature)

Legend
- Sampling Locations of Surface Water (Upstream/ Downstream)
- Sampling Locations of Mine Water
- Sampling Locations of Ground/ Drinking Water

Customer: BHARAT COKING COAL LIMITED
Title: WATER SAMPLING LOCATIONS
Subject: MONITORING STATIONS
CMPDI (ISO 9001 Company)
Scale: Not To Scale

NOISE LEVEL QUALITY MONITORING

4.1 Location of sampling sites

1. **Jeenagora (N13)**
2. **Kusmatand Village (N12)**
3. **Bhowrah North (N14)**
4. **Hurriladih UGP (N28)**

4.2 Methodology of sampling and analysis - Noise level measurements in form of 'L_{EQ}' were taken using Integrated Data Logging Sound Level Meter (NL-52 OF RION CO. Ltd. Make) during day time. Noise levels were measured for about one hour time in day time. Noise levels were measured in Decibels, 'A' weighted average, i.e. dB (A).

4.3 Results & Interpretations

Ambient noise levels were recorded during day time and the observed values were compared with standards prescribed by MoEF&CC. The results of Noise levels recorded during day time on fortnightly basis are presented in tabular form along with the applicable standard permissible limits. The observed values in terms of L_{EQ} are presented. The observed values at all the monitoring locations are found to be within permissible limits.

NOISE LEVEL DATA

Name of the Project : **Cluster -IX**			Month: **AUGUST, 2019**		
Sl. No.	**Station Name/Code**	**Category of area**	**Date**	**Noise level dB(A)LEQ**	***Permissible Limit of Noise level in dB(A)***
1	**Kusmatand Village (N12)**	**Residential area**	09.08.19	50.7	*55*
2	**Kusmatand Village (N12)**	**Residential area**	23.08.19	51.4	*55*
3	**Jeenagora (N13)**	**Industrial area**	12.08.19	58.3	*75*
4	**Jeenagora (N13)**	**Industrial area**	29.08.19	61.3	*75*
5	**Bhowrah North(N14)**	**Industrial area**	06.08.19	46.3	*75*
6	**Bhowrah North(N14)**	**Industrial area**	21.08.19	61.8	*75*
7	**Hurriladih UGP (N28)**	**Industrial area**	07.08.19	46.1	*75*
8	**Hurriladih UGP (N28)**	**Industrial area**	20.08.19	65.8	*75*

Permissible limits of Noise Level as per MOEF Gazette Notification No. GSR 742(E) dt. 25.09.2000 Standards for Coal Mines and Noise Pollution (Regulation and Control) Rules, 2000.
*** Day Time: 6.00 AM to 10.00 PM.**

Analysed By
JSA/SA/SSA

Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(Mining/Environment)
RI-2, CMPDI, Dhanbad

Annexure XIX

POLLUTION UNDER CONTROL CERTIFICATE
TRANSPORT DEPARTMENT, GOVT. OF JHARKHAND,
प्रदूषण नियंत्रित प्रमाण पत्र
परिवहन विभाग, झारखण्ड सरकार
मेसर्स शुभम् इन्टरप्राइजेज, भागा (धनबाद)
आइडलिंग पर Co2 एवं HSU स्तर (% आयतन) (PPM)
Co2 एवं Hsu level at Idling (%Volume) (PPM)
आइडलिंग पर RMP /IDLING RPM

LICENCE NO:- 07/17(R)
All India Valid
25969
झारखण्ड सरकार
PUCC NO. 39276
प्रमाण पत्र संख्या
Vehicle Reg. No: JH10AG 5638
वाहन पंजी संख्या
Make:- TATA
मेक
Model:- TIPPER
मॉडल
Category:- 10W
वर्ग
Engine Stroke :-
इंजन स्टोक
Year of Mfg.-- 2012
निर्माण का वर्ष
Emission Norms :-
उत्सर्जन मानक
ईंधन
Fuel :- DIESEL
दिनांक
DATE:- 13/06/2019

Fuel	निर्धारित मानक Co Prescribed Standard CO_2	मापित मान Co Measured Level CO	निर्धारित मानक HSU Prescribed Standard	मापित मानक HSU Measured Level HSU
पेट्रोल Petrol	------	------	------	------
डिजल Diesel	------	------	65	36

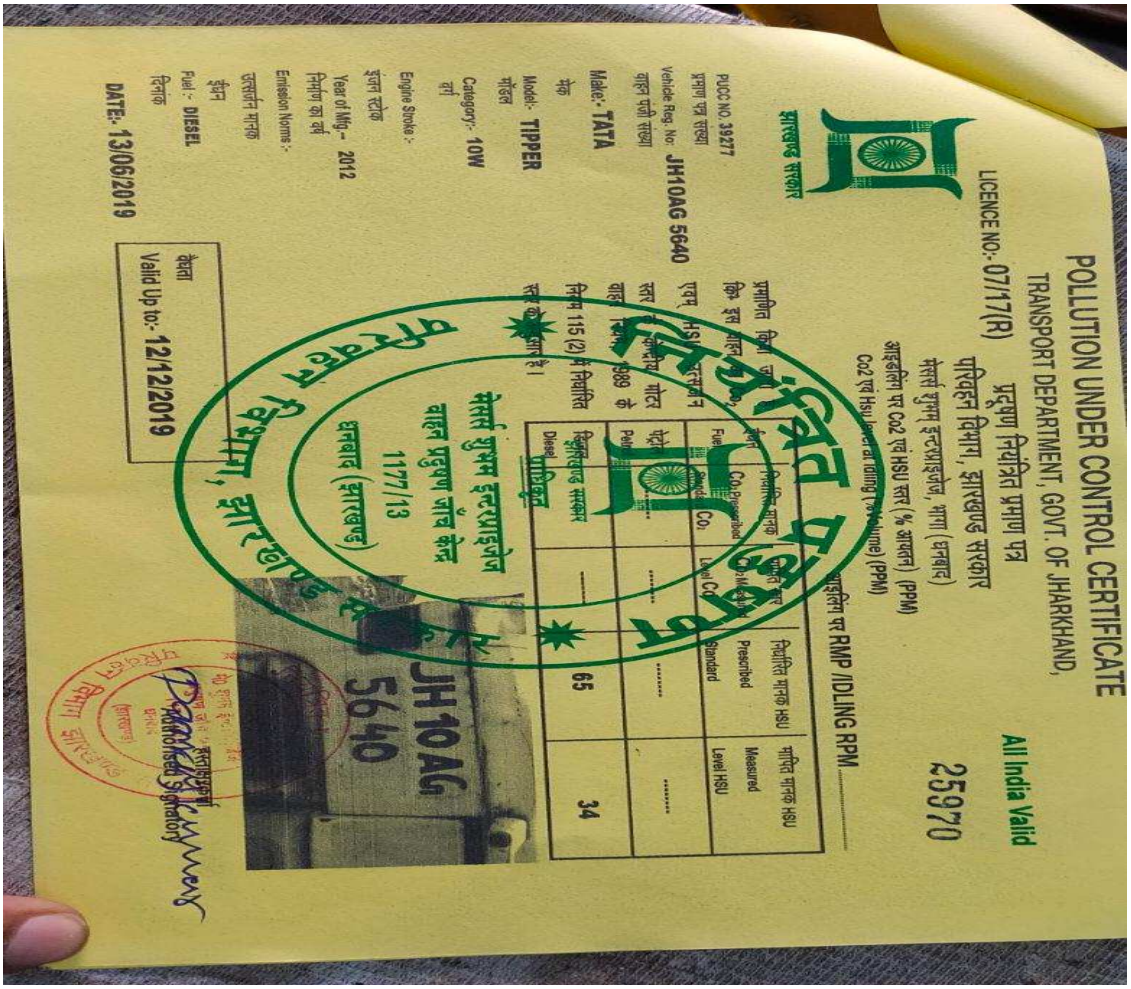
प्रमाणित किया जाता है कि इस वाहन का CO_2 एवम् HSU उत्सर्जन स्तर केन्द्रीय मोटर वाहन नियम, 1989 के नियम 115 (2) में निर्धारित स्तर के अनुसार है।

मेसर्स शुभम इन्टरप्राइजेज
वाहन प्रदुषण जाँच केन्द्र
1177/13
धनबाद (झारखण्ड)

परिवहन विभाग, झारखण्ड सरकार

वैधता
Valid Up to:- 12/12/2019

Authorised Signatory



POLLUTION UNDER CONTROL CERTIFICATE
TRANSPORT DEPARTMENT, GOVT. OF JHARKHAND,
प्रदूषण नियंत्रित प्रमाण पत्र
परिवहन विभाग, झारखण्ड सरकार
मेसर्स शुभम इन्टरप्राइजेज, भागा (धनबाद)
आइडलिंग पर Co2 एवं HSU स्तर (% आयतन) (PPM)
Co2 एवं Hsu level at Idling (%Volume) (PPM)
आइडलिंग पर RMP /IDLING RPM

LICENCE NO:- 07/17(R)
All India Valid
25970
झारखण्ड सरकार
PUCC NO. 39277
प्रमाण पत्र संख्या
Vehicle Reg. No: JH10AG 5640
वाहन पंजी संख्या
Make:- TATA
मेक
Model:- TIPPER
मॉडल
Category:- 10W
वर्ग
Engine Stroke :-
इंजन स्टोक
Year of Mfg.-- 2012
निर्माण का वर्ष
Emission Norms :-
उत्सर्जन मानक
ईंधन
Fuel :- DIESEL
दिनांक
DATE:- 13/06/2019

Fuel	निर्धारित मानक Co Prescribed Standard CO_2	मापित मान Co Measured Level CO	निर्धारित मानक HSU Prescribed Standard	मापित मानक HSU Measured Level HSU
पेट्रोल Petrol	------	------	------	------
डिजल Diesel	------	------	65	34

प्रमाणित किया जाता है कि इस वाहन का CO_2 एवम् HSU उत्सर्जन स्तर केन्द्रीय मोटर वाहन नियम, 1989 के नियम 115 (2) में निर्धारित स्तर के अनुसार है।

मेसर्स शुभम इन्टरप्राइजेज
वाहन प्रदुषण जाँच केन्द्र
1177/13
धनबाद (झारखण्ड)

परिवहन विभाग, झारखण्ड सरकार

वैधता
Valid Up to:- 12/12/2019

Authorised Signatory

POLLUTION UNDER CONTROL CERTIFICATE

TRANSPORT DEPARTMENT, GOVT. OF JHARKHAND,

झारखण्ड सरकार

LICENCE NO:- 07/17(R) प्रदूषण नियंत्रित प्रमाण पत्र

परिवहन विभाग, झारखण्ड सरकार

मेसर्स शुभम् इन्टरप्राइजेज, भागा (धनबाद)

आइडलिंग पर Co2 एवं HSU स्तर (% आयतन) (PPM)

Co2 एवं Hsu level at idling (%Volume) (PPM)

All India Valid

25967

आइडलिंग पर RMP /IDLING RPM

PUCC NO. 39274
प्रमाण पत्र संख्या

Vehicle Reg. No: JH10AG 5637
वाहन पंजी संख्या

Make:- TATA
मेक

Model:- TIPPER
मॉडल

Category:- 10W
वर्ग

Engine Stroke :-
इंजन स्टोक

Year of Mfg.- 2012
निर्माण का वर्ष

Emission Norms :-
उत्सर्जन मानक

ईंधन
Fuel :- DIESEL

दिनांक
DATE:- 13/06/2019

प्रमाणित किया जाता है कि इस वाहन का CO_2 एवम् HSU स्तर केन्द्रीय मोटर वाहन नियम, 1989 के नियम 115 (2) में निर्धारित स्तर के अनुसार है।

ईंधन Fuel	निर्धारित मानक CO_2 Prescribed Standard CO_2	मापित स्तर CO_2 Measured Level CO_2	निर्धारित मानक HSU Prescribed Standard	मापित मानक HSU Measured Level HSU
पेट्रोल Petrol	--------	--------	--------	--------
डिजल Diesel	-------	-------	65	38

प्रमाणित

झारखण्ड सरकार

मेसर्स शुभम इन्टरप्राइजेज
वाहन प्रदुषण जाँच केन्द्र
1177/13
धनबाद (झारखण्ड)

परिवहन विभाग, झारखण्ड

वैधता
Valid Up to:- 12/12/2019

हस्ताक्षरकर्ता
Authorised Signatory

परिवहन विभाग झारखण्ड

POLLUTION UNDER CONTROL CERTIFICATE

TRANSPORT DEPARTMENT, GOVT. OF JHARKHAND,

झारखण्ड सरकार

LICENCE NO:- 07/17(R) प्रदूषण नियंत्रित प्रमाण पत्र

परिवहन विभाग, झारखण्ड सरकार

मेसर्स शुभम् इन्टरप्राइजेज, भागा (धनबाद)

आइडलिंग पर Co2 एवं HSU स्तर (% आयतन) (PPM)

Co2 एवं Hsu level at idling (%Volume) (PPM)

All India Valid

25968

आइडलिंग पर RMP /IDLING RPM

PUCC NO. 39275
प्रमाण पत्र संख्या

Vehicle Reg. No: JH10AG 5639
वाहन पंजी संख्या

Make:- TATA
मेक

Model:- TIPPER
मॉडल

Category:- 10W
वर्ग

Engine Stroke :-
इंजन स्टोक

Year of Mfg.- 2012
निर्माण का वर्ष

Emission Norms :-
उत्सर्जन मानक

ईंधन
Fuel :- DIESEL

दिनांक
DATE:- 13/06/2019

प्रमाणित किया जाता है कि इस वाहन का CO_2 एवम् HSU स्तर केन्द्रीय मोटर वाहन नियम, 1989 के नियम 115 (2) में निर्धारित स्तर के अनुसार है।

ईंधन Fuel	निर्धारित मानक CO_2 Prescribed Standard CO_2	मापित स्तर CO_2 Measured Level CO_2	निर्धारित मानक HSU Prescribed Standard	मापित मानक HSU Measured Level HSU
पेट्रोल Petrol	--------	--------	--------	--------
डिजल Diesel	-------	-------	65	35

प्रमाणित

झारखण्ड सरकार

मेसर्स शुभम इन्टरप्राइजेज
वाहन प्रदुषण जाँच केन्द्र
1177/13
धनबाद (झारखण्ड)

परिवहन विभाग, झारखण्ड

वैधता
Valid Up to:- 12/12/2019

हस्ताक्षरकर्ता
Authorised Signatory

परिवहन विभाग झारखण्ड

Annexure XX

1.

Statement Showing Escrow Accounts details				
Name of Subsidiary	Sl.No	Name of Block/Mine	Escrow A/c No.	Total amount in Escrow fund till 31st March 2019 (in Rs. lakhs)
BCCL	1.	NT-ST-JG GROUP OF MINES	**00150100009046**	**3,117.762540**
	2.	JOYRAMPUR UG MINES	**00150100009049**	**53.243040**
	3.	BARAREE COLLIERY	**00150100008940**	**335.662330**
	4.	LODNA COLLIERY	**00150100008942**	**158.532260**
	5.	KUJAMA COLLIERY	**00150100008941**	**366.469240**
	6.	Amal. Joyrampur OC	**00150100011026**	**1,183.020640**

2. Environmental Monitoring- 25 Lakhs
3. Maintenance of Gokul park- 1.2 lakh/year
4. CTE of NT-ST-JG GROUP OF MINES- 833280.00
5. CTO of NT-ST-JG GROUP OF MINES- 1099882.00
6. CTE of Amal. Joyrampur OC- 75000.00
7. CTO of Amal. Joyrampur OC- 337500.00

Annexure XXI

तः सूत्रों का कहना है कि राज्य ...विलय की प्राक्रया पूरी की जाएगी। शिक्षक बीआरसी पहुंचे थे। पारा शिक्षकों का कहना था कि विद्यालय

रत कोकिंग कोल लिमिटेड
'एक मिनीरत्न कम्पनी'
(कोल इण्डिया लिमिटेड का एक अंग)
कोयला भवन, कोयला नगर, धनबाद
पर्यावरण विभाग

BHARAT COKING COAL LIMITED
(A Mini Ratna Company)
(A subsidiary of Coal India Limited)
Koyla Bhawan, Koyla Nagar, Dhanbad
Environment Department

s is to bring to notice of all concerned that the Environmental Clearance granted to Cluster-IX of Bharat king Coal Limited, located at Dhanbad District, Jharkhand vide letter-no.J- 11015/307/2010-IA.II(M), ted 21st May, 2013 has been amended as following by Ministry of Environmental, Forests and Climate ange Vide sanctioned Order No. J-11015/307/2010IA.II(M), dated 1st March, 2018.

Name of the Mine	Lease hold Area	Normative Capacity	Peak Capacity
Amalgamated Joyrampur Colliery (OC)	1186.97 ha	2.512 MTPA	3.25 MTPA
NT-ST Expansion OCP	755.15 ha	6.0 MTPA	7.8 MTPA
Cluster Total peak capacity of 8.512 MTPA on lease hold area of 1942.12 ha			

Environmental clearance and a copy of the clearance letter is available with the State Pollution Control Board and may be seen at the website of the Ministry of Environment & Forests at http://envfor.nic.in and also on Bharat Coking Coal Limited official Website http://www.bcclweb.in

सभी सम्बंधित व्यक्तियों को सूचित किया जाता है कि भारत कोकिंग कोल लिमिटेड के क्लस्टर-9 को पर्यावरण एवं वन मंत्रालय के द्वारा पर्यावरणीय स्वीकृति में बदलाव की गई है जिसकी स्वीकृति पत्र संख्या -11015/307/2010-IA.II (M) दिनांक 01 मार्च, 2018 है।

खान का नाम	खान पट्टा क्षेत्र	उत्पादन क्षमता सामान्य	अधिकतम क्षमता
अमलगमेटेड जयरामपुर कोलियरी (ओसीपी)	११८६.९७ हेक्टॅर	२.५१२ मिलियन टन प्रति वर्ष	३.२५ मिलियन टन प्रति वर्ष
एन टी-एस टी बिस्तार (ओसीपी)	७५५.१५ हेक्टॅर	६.0 मिलियन टन प्रति वर्ष	७.८ मिलियन टन प्रति वर्ष
कल्स्टर कुल अधिकतम क्षमता ८.५१२ मिलियन टन प्रति वर्ष एवं खान पट्टा क्षेत्र १९४२. १२ हेक्टेर			

पर्यावरणीय स्वीकृति की प्रतिलिपि झारखंड राज्य प्रदूषण नियंत्रण बोर्ड के पास उपलब्ध है तथा इसे पर्यावरण एवं वन मंत्रालय की आधिकारिक वेबसाईट http://envfor.nic.in और भारत कोकिंग कोल लिमिटेड के आधिकारिक वेबसाईट http://www.bccl.gov.in पर उपलब्ध है।

28.03.2018

Annexure XXII

No.J-11015/307/2010-IA-II (M)
Government of India
Ministry of Environment, Forest and Climate Change
IA-II (Coal Mining) Division

Indira Paryavaran Bhawan,
Jorbagh Road, N Delhi-3
Dated: 1st March, 2018

To,

The General Manager (E&F)
M/s Bharat Coking Coal Ltd,
Koyala Bhawan,
District Dhanbad (Jharkhand)
Email: envbccl@gmail.com

Sub: Cluster IX Coal Mining Project (Group of 6 Mixed Mines) of total capacity 8.512 MTPA (peak) of M/s Bharat Coking Coal Limited located in Jharia Coal field, District Dhanbad (Jharkhand) - Amendment in EC - reg.

Sir,

This has reference to your letter No. BCCL/GM (Lodhna Area) /F-EC/318 dated 14.11.2017 along with online proposal No.IA/JH/CMIN/8452/2010, and subsequent letters dated 19.12.2018, 22.12.2018, 06.01.2018, 07.01.2018 and 11.01.2018 on the above mentioned subject.

2. The Ministry of Environment, Forest and Climate Change has considered the proposal for amendment in environmental clearance granted vide letter No.J-11015/307/2010-IA.II (M) dated 21st May, 2013 in favour of M/s Bharat Coking Coal Limited for the Cluster IX Coal Mining project (Group of 6 Mixed Mines) of total capacity of 8.512 MTPA in a total ML area of 1942.12 ha of located in Jharia Coal field District Dhanbad (Jharkhand), due to restructuring of individual mines of the cluster.

3. The proposal was considered by the Expert Appraisal Committee (EAC) in the Ministry for Thermal & Coal Mining Sector in its 24th meeting held on 11th January, 2018. During the meeting the project proponent informed about the proposed amendment in the above said Environmental clearance due to restructuring of individual mines of the cluster, with the total production capacity of 8.512 MTPA and the total mining lease area remaining same, with the details as under:-

As per existing EC							Modification sought					
S. No.	Mine	Status	Normative Capacity (MTPA)	Peak Capacity (MTPA)	Lease Hold Area (Ha)	Life (years)	Sl No	Name of the Mine	Production Capacity (MTPA)		Lease Hold Area (Ha)	Life (Yr)
									normative	peak		
1	Lodna UG	In operation	0.115	0.150	391.64	30	1	Amalgamated Joyrampur Colliery(OC)	2.512	3.25	1186.97	25
2	Bagdigi UG	In operation	0.110	0.143	61.0	30						
3	Joyrampur UG	In operation	0.153	0.199	89.04	30						
4	Bararee UG	In operation	0.170	0.221	475.0	30						
5	JealgoraUG		Nil	nil	138.0(wil	-						

	(closed for operation, mine not closed)				l be closed after fire dealing)							
6	NT/ST Expan. OCP	Propose d	6.0	7.8	755.15	30	2	NT-ST expan sion OCP(i n operati on)	6.0	7.8	755. 15	26
	total		6.548	8.512	1942.12*					8.512 **	1942 .12	

*Inclusive of 14.24 ha of North Tisra UG & 18.05 ha of Jeenagora OCP.**Peak of Cluster will remain same, as peak of individual will be achieved in different years.

The EAC was also informed that the Mining Plan after the proposed restructuring of individual mines was duly revised and approved by the Board of M/s BCCL on 9th December, 2017.

4. The EAC has recommended the amendments in the environmental clearance dated 21st May, 2013 due to restructuring of individual mines within the cluster, as proposed by the project proponent, on the above lines.

5. Based on recommendations of the EAC, the Ministry of Environment, Forest and Climate Change hereby accords approval to the amendments in the environmental clearance dated 21st May, 2013 for **Cluster IX Coal Mining Project (Group of 6 Mixed Mines) of total capacity 8.512 MTPA** of M/s Bharat Coking Coal Limited in combined ML area of 1942.12 ha located in Jharia Coal field, District Dhanbad (Jharkhand), as proposed by the project proponent and mentioned in para 3 above, with the total production capacity of 8.512 MTPA and the total mine lease area of 1942.12 ha remaining the same.

6. All other terms and conditions stipulated in the said environmental clearance dated 21st May, 2013 shall remain unchanged.

1/3/2018

(S K Srivastava)
Scientist E

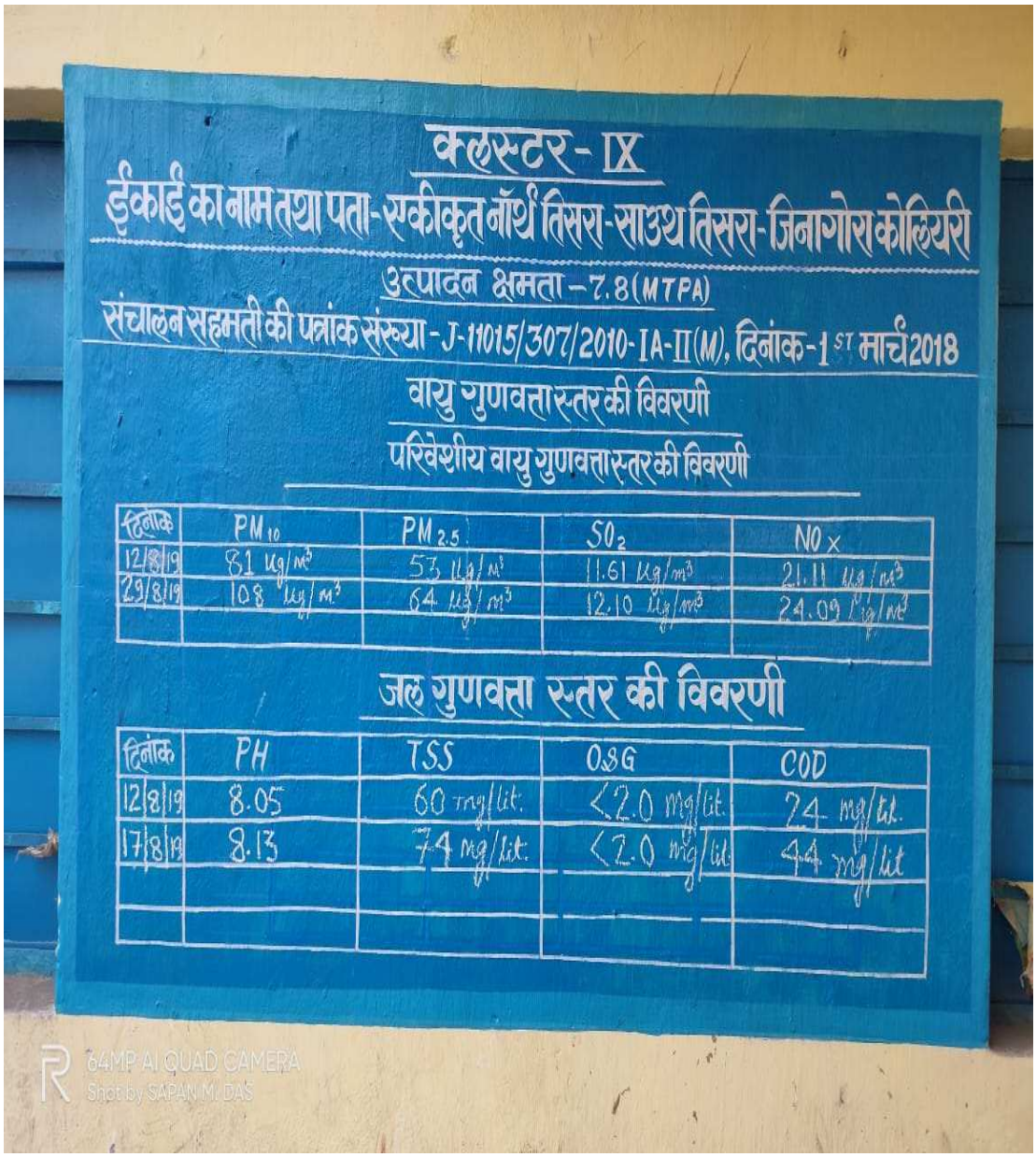
Copy to:

1. The Secretary, Ministry of Coal, Shastri Bhawan, New Delhi.
2. Secretary, Department of Environment & Forests, Govt. of Jharkhand, Secretariat, Ranchi
3. The APCCF, Ministry of Environment Forest and Climate Change, Regional Office (EZ), A-31, Chandrashekarpur, Bhubaneswar - 751023 (Odisha)
4. The Member Secretary, Jharkhand State Pollution Control Board, TA Building, HEC Complex, PO Dhurwa, Ranchi (Jharkhand)
5. The Member Secretary, CPCB, CBD-cum-Office Complex, East Arjun Nagar, Delhi - 2
6. The Member-Secretary, Central Ground Water Authority, Ministry of Water Resources, Curzon Road Barracks, A-2, W-3 Kasturba Gandhi Marg, N Delhi
7. The District Collector, Dhanbad , Government of Jharkhand
8. Monitoring File 9. Guard File 10. Record File. 11. Notice Board

1/3/2018

(S K Srivastava)
Scientist E

Annexure XXIII



"FORM V"

(See Rule 14)

Environmental statement for financial year ending the 31st March,2019

PART-A

(i) Name and address of the Mine
Name-NTST(Expansion)OCP
Address- Md. Hafizul Qurashi ,NT-ST(Expansion)OCP
Place- Tisra
Post-Pargha, PIN-828201
Dist-Dhanbad,Jharkhand

(ii) Industry category : Primary
(iii) Production capacity : 6MTPA(Normal) 7.8MTPA(Peak)
(iv) Year of establishment :Since Nationalisation 1972
(v) Date of last environmental Statement submitted :11.6.2018

PART-B

2. Water and Raw material consumption

Water Consumption	
1. Process	1000kl/d
2. Cooling	nil
3. Domestic	2000kl/d

Name of Products	Process water consumption per unit of product point	
	During the previous Financial year 2017-2018	During the current Financial year 2018-2019
1.Coal	0.12 Kl/Te	0.14 Kl/Te

3.Raw material consumption

	Name of products	Consumption of Raw materials per unit of product output	
		During the previous Financial year 2017-2018	During the current Financial year 2018-2019
1. Explosive		0.624Kg/Te	2.94Kg/Te
2. Diesel		0.30Lts/Te	1.43Lts/Te

industry may use codes if disclosing details of raw material would violate contractual obligation otherwise all industries have to name the materials used.

PART-C

Pollution discharged to Environment /Unit of output (Parameter as specified in the consent issued)

Pollution	Quantity of pollutants Discharged (Mass/day)	Concentrations of pollution in discharges (Mass/Volume)	Percentage of variation From prescribed Stack with reason
(c) Water:- Analysis report enclosed			
(d) Air:- Analysis report enclosed			

PART-D

Hazardous wastes	Total Quantity (in Kl)	
	During the previous Financial year 2017-2018	During the current Financial year 2018-2019
(C) From process	Burnt oil- 3.8kl	Burnt oil-2.4kl
D) From pollution control facilities	nil	nil

PART-E

Solid Wastes OB

Solid Wastes	Total Quantity (in kg.)	
	During the previous Financial year 2017-2018	During the current Financial year 2018-2019
(vi) From process	13882505 m3	10678570m3
(vii) From pollution facilities	nil	Utilized for backfilling/reclamation of the mined out area
3. Quantity recycled or Reutilized with the unit		
4. Solid	nil	nil
5. Disposal		nil

PART-F

Please specify the charactgerizations (in term of composite and quantum) of hazardous as well as solid wastes and indicate disposal practice adopted for both these categories of wastes.

PART-G

Impact of the pollution abatement measures taken on conservation of natural resources and on the cost of production.

PART-H

Additional measures/ envestment proposal for environment protection including abatement or pollution,Prevention of pollution.

PART-I

Any other particulars for improving the quality of the environment- Regular Monitoring of Environmental condition (Air & Water)

06/9/19

Project Officer
Amal.NTST-JG Colliery

Project Officer
Amlg. NTST-JG Colliery
Area-X

Environmental Statement [FORM – V]

(See rule 14)

Environmental Statement for the financial year ending with 31st March 2019.

PART – A

(i) Name and address of the owner/occupier of the industry operation or process:

Name: Shri Perwez Alam
Designation: Project Officer
Address: Amal. Joyrampur Colliery
M/s BCCL,
P.O. – Khas Jeenagora
Dist. - Dhanbad
State- Jharkhand
Pin – 828115

(ii) Industry category: Primary (RED Category)

(iii) Production capacity- 3.25 MTY (Peak Production Capacity) and 2.512 MTY (Normative Production Capacity) as per EC granted by MOEF vide EC No. J-11015/307/2010-IA.II (M) dated 21.05.2013 (amendment in EC on dated: 01st March 2018).

(iv) Year of establishment- Prior to Nationalization of Coal Mines.

(v) Date of the last environmental statement submitted -

PART – B

Water and Raw Material Consumption

I (A) Water consumption m3/d:

Name of products	Water consumption (m3/d) (2018-19)	
	Mining Operation	Domestic Supply
• Coal	2000	4000

I (B) Process water consumption per unit of product output:

Name of Products	During the previous financial Year (2017-18) (m3/Te)	During the Current financial Year (2018-19) (m3/Te)
Coal	1.47	Nil

II. Raw Material Consumption:

Name of raw materials	Name of products	Consumption of raw material per Unit of output	
		During the previous financial year (2017-18)	During the current financial year (2018-19)
Explosive	Coal	0.018 (kg/Te)	Nil
	OB	0.15 (kg/ m3)	Nil

PART - C

Pollution discharged to environment/unit of output
(Parameter as specified in the consent issued)

Pollutants	Quantity of pollutants discharged (mass/day)	Concentrations of pollutants in discharges (mass/volume)	Percentage of variation from prescribed standards with reasons
a) Water	N/A	-	-
b) Air	N/A	-	-

PART – D

Hazardous Wastes

As specified under Hazardous Waste Management and Handling Rules, 1989

Hazardous Wastes	Total Quantity (Kg.)	
	During the previous Financial Year (2017-18)	During the current Financial year (2018-19)
1. From Process: (a) Oil Soaked Cotton (b) Burnt Oil (Used/Spent Oil)	----Kg. NIL	----Kg NIL
2. From Pollution Control Facilities	NIL	NIL

PART – E
Solid Wastes

Solid Wastes	Total quantity(Kg)	
	During the previous Financial Year (2017-18)	During the current Financial year (2018-19)
a. From process	OB- 4248456 m3	N/A
b. Form pollution control facility	NIL	NIL
c. Quantity recycled or re-utilized within the unit	NIL	NIL

PART – F

Please specify the characterizations (in terms of composition of quantum) of hazardous as well as solid wastes and indicate disposal practice adopted for both these categories of wastes. : - NIL

PART – G

Impact of the pollution abatement measures taken on conservation of natural resources and on the cost of production.

In order to carry out mining operation in eco-friendly manner the following pollution control measures have been adopted:

A. **Air Pollution Control Measures**:
- Regular water spraying is done with the help of mobile tankers wherever there is possibility of dust generation throughout the mine.
- Quarterly monitoring of ambient air quality parameters is being done by CMPDIL.

B. **Water Pollution Control Measures:**
- Most of the parameters of mine water conform to General Standard of MOEF for Class- A effluent as mentioned earlier.
- CMPDI RI-II is regularly conducting study of groundwater level and quality of areas within Cluster IX.

C. **Noise Pollution Control Measures:**
- Noise levels are in prescribed limit.
- Quarterly monitoring of Noise level parameters is being done by CMPDIL.

PART – H

Additional measures/investment proposal for environmental protection including abatement of pollution, prevention of pollution.

- Ambient Environmental Monitoring will be continued as per the guidelines of MoEF and Jharkhand State Pollution Control.
- Application for consent for emission/continuation of emission under section 21 of the Air (prevention and control of pollution) Act, 1981 and Application for consent for discharge Continuation of discharge under section 25/26 of Water (Prevention and Control of Pollution) Act, 1974 will be regularly done and Conditions laid down in Consent to Operate granted by JSPCB will be strictly followed.

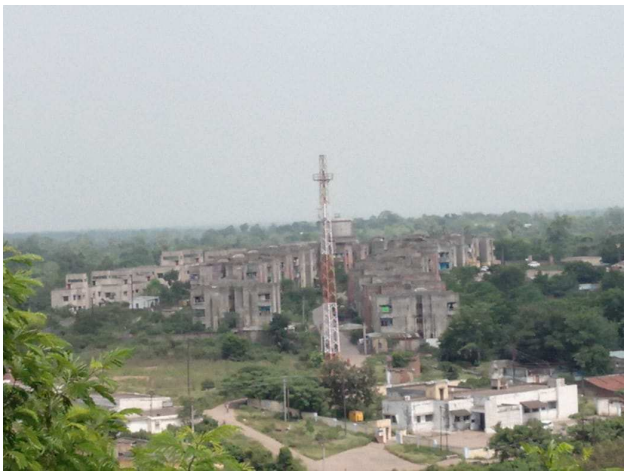
PART – I
MISCELLANEOUS

Any other particulars in respect of environmental protection and abatement of pollution

After complete extraction of coal from coal bearing area, the small area will be backfilled and re-vegetated using technical/biological reclamation techniques.

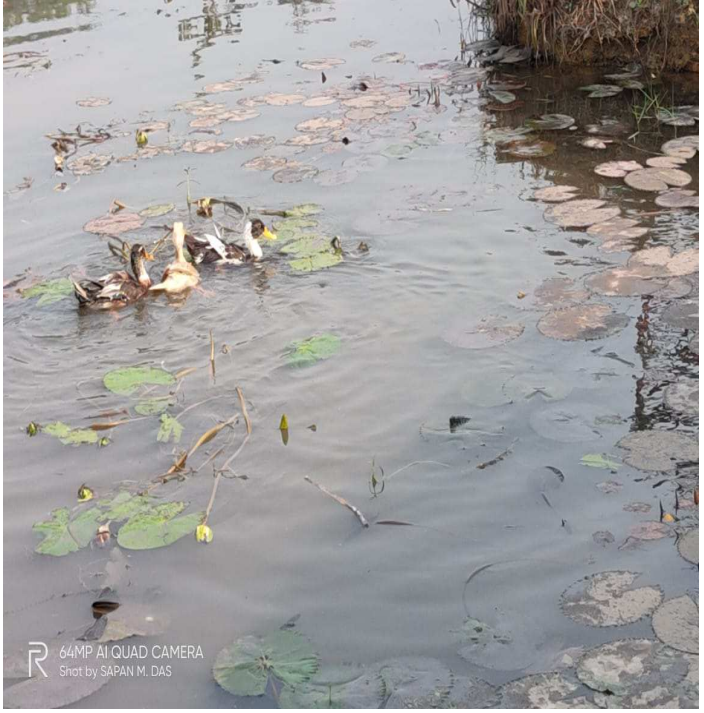
SOME PHOTOGRAPHS OF NTST PROJECTS, CLUSTER IX


Sintex
Sintex



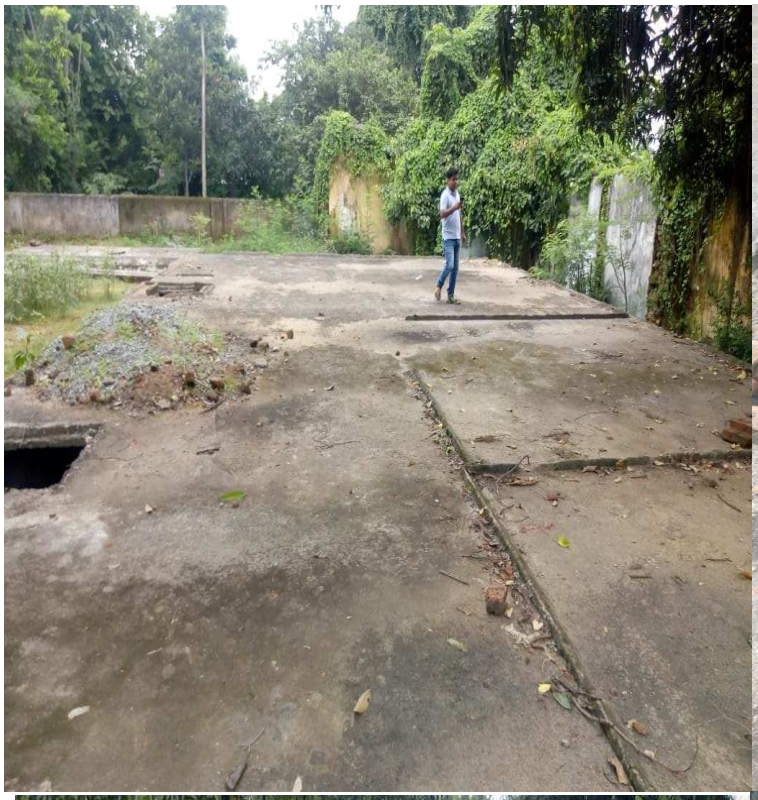

Sintex
Sintex

Avenue Plantation and lagoon:


64MP AI QUAD CAMERA
Shot by SAPAN M. DAS


64MP AI QUAD CAMERA
Shot by SAPAN M. DAS

Rain water Harvesting:




जल महल
SMP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