Ref: - WJA/MND/ENV/2019/ 1154 (C)

Date: - 26/11/2019
27

To,
The Director,
Ministry of Environment & Forest and Climate Change
Regional Office (ECZ), Bungalow No. A-2,
Shyamali Colony, Ranchi – 834002

Sub: - Submission of six monthly reports on implementation of Environment measures for the period From **April '19 to Sept '19** in respect **Cluster-XIII** group of mines of BCCL.

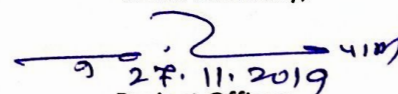Ref: EC Order No – J- **11015/11/2010-IA.II (M)** Dated: - **06.06.2013**

Dear Sir,

Please find enclosed herewith the six monthly reports on implementation of Environment protection measures for the period from **April '19 to Sept '19** in respect of **Cluster XIII** group of mines of BCCL. We hope you wil find in order.

Thanking you,

Encl: - As Above

Yours faithfully,

27. 11. 2019
Project Officer
Mahuda Group of mines

C C to:-

1. The Director, 1A Monitoring Cell, Paryavaran Bhawan, CGO Complex, New Delhi – 110003.
2. The Member Secretary , Jharkhand State Pollution Control Board, TA- Division Building , Dhurwa – Ranchi – 834004
3. Dy. GM (Env.) , BCCL, Koyla Bhawan Dhanbad
4. GM,W.J.Area
5. Nodal Officer (Env.) , WJ Area

"Copy for uploading on "parivesh portal" and send by e-mail"

ENVIRONMENTAL CLEARANCE COMPLIANCE OF CLUSTER-XIII (GRANTED VIDE LETTER NO.J-11015/11/2010-IA.II (M) DATED 06.06.2013

(APRIL'19 – SEPTEMBER'19)

Sl. No.	A. Specific Conditions by MOEF:	Compliance
i.	**No mining shall be undertaken in/under the forestland until prior forestry clearance has been obtained under the provisions of FC Act 1980.**	Stage-I forest clearance of 6.41 ha of forest land of proposed Murulidih O/C mine has been issued by MOEF vide letter no.5-JHC188/2010-BHU dated 05.03.13. All the conditions of the above letters are compiled including the total online payment of Rs 8155592.17/- was done to MoEF through RTGS/NEFT. Awaited for Stage-II forest clearance for the same.
ii	**The EC is granted to Murulidih 20/21 Pits U/G of 0.18 MTPA and a peak production of 2.34 MTPA in an ML area of 571. 32 ha.**	Coal production from cluster XIII group of mines is **Nil.** Production from Murulidih 20/21 Pits U/G is **suspended from December 2015.**
iii.	**The maximum production in the cluster shall not exceed beyond that for which environmental clearance has been granted for the cluster XIII as per given below:**	. Being Complied. (Presently there is not any producing mine under cluster XIII) **Annexure I**
iv.	**The measure identified in the environmental plan for cluster – XIII group of mine and the condition given in this environmental clearance letter shall be dovetailed to the implementation of Jharia Action Plan.**	Being Complied.
v.	**As there is no fire in cluster XIII but the measure should be adopted proponent to control spread of neighboring fire to this cluster XIII. The proponent shall prepare time series maps of Jharia Coal field through NRSA to monitor & prevent fire problems in this Jharia Coalfield by Isothermal mapping / imaging and monitoring temperatures of the coal seam (whether they are closed spontaneous ignition temperatures) and based on which, areas with potential fire problems shall be identified. Measures to prevent ingress of air (ventilation) in such areas, to prevent restart fresh/spread fire in other areas including in mines of cluster – XIV shall be undertaken.**	It has been complied. NRSC was engaged for preparation of time series maps to monitor and prevent fire problems of Jharia Coalfield by Isothermal mapping/imaging and monitoring temperature of the coal seams and NRSC has submitted their final report in January 2018 in which the area of fire has been reduced 9.00 KM^2 to 3.28 KM^2. NRSC report is enclosed as Annexure II.
Vi.	**Underground mining should be taken up after completion of reclamation of O/C mine area after two years.**	Agreed. Presently there is no running O/C mine in cluster XIII.

vii.	No mining shall be undertaken where underground fires continue. Measure shall be taken to prevent/check such fire including in old OB dump.	Complied.
Viii	There shall be no external OB dumps. OB from one patch OCP mine shall be backfilled. 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.	Being complied.
ix.	A detailed calendar plan of production with plan for OB dumping and back filling (for open cast mines) and reclamation and final mine closure plan for each mine of cluster XIII shall be drawn up & implemented.	Being implemented. Mine closure plan is approved. There is no producing mine in cluster XIII.
x.	The void in 5 ha. Area shall be converted in to a water reservoir of maximum depth of 15-20 mtr in post mining stage and shall be gently sloped and upper benches of the reservoir shall be stabilized with plantation and periphery of the reservoir fenced . The abandoned pits and voids should be backfilled with OB & biologically reclaimed with plantation and or may used for pisciculture.	Will be Complied.
xi.	Mining shall be carried out as per statutette 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 60m width shall be maintained along the nalas/water bodies. The small water bodies in OC shall be protected to the extend feasible and the embankment proposed along water body shall be strengthened with stone pitching.	Complied and will be complied as per statute.
xii.	Active OB dumps near water body and rivers should be rehandled for back filling abandoned mine voids. However, those which have been biologically reclaimed need not be disturbed.	There is no opencast project running in cluster XIII at present.

xiii.	**Thick green belt shall be developed along undisturbed areas, mine boundary and in mine reclamation. During post mining stage, a total of 91.75 ha would be reclaimed and afforested by planting native species in consultation with local DFO/Agriculture deptt. /Institutions with the relevant discipline. The density of the trees should be around 2500 plants per ha.**	It is being complied. Four Eco-restoration Sites of total area 8.4 Ha. (Site-A= 4.2 Ha. Site-B =1.5 Ha, Site-C =1.8 Ha and Site-D= 0.9 Ha) reclaimed area are developed and maintained at Murulidih (about 2500 plants per ha).
Ha	**The roads should be provided with avenue plantation on both sides as trees act as sink of carbon and other pollutant.**	Agreed. Being complied.
xv.	**Specific mitigative measures identified for the Jharia Coalfields in the Environmental Action Plan prepared for Dhanbad as a critically polluted are and relevant for Cluster XIII shall be implemented.**	Being Implemented.
xvi.	**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 vary 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 for the entire Jharia Coalfields. 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 the air pollution, based on which appropriate mitigative measures could be taken.**	Location of monitoring stations was already finalized with the consultation of Jharkhand State Pollution Control Board. Source Apportionment Study: - Work Order had already been issued to NEERI Nagpur on 12.05.2018. And work has been started in September 2018. Field data collection for Summer season has been done, winter data collection is in process. **The progress report sent by NEERI is attached.**
xvii.	**No ground water shall be used for mining activities. Additional water required, if any, shall be met from mine water or by recycling/ reused of the water from the existing activities and from rain water harvesting measures. The project authority shall meet water requirement of nearby village (s) in case the village wells go dry to dewatering of mine.**	Agreed. Being implemented.
xviii.	**Regular monitoring of groundwater level and quality of the study area shall be carried out by establishing a network of existing wells and**	It is being complied. Tender has been cancelled thrice. The estimate is being revised in association with CMPDI for re-tendering.

	construction of new piezometers. The monitoring for quantity shall be dome 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.	
xix.	Mine discharge water shall be treated to meet standards prescribed standards before discharge into natural water courses/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.	Agreed. Being implemented. CMPDIL, Dhanbad is monitoring the same. **Annexure- III**
xx.	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.	There is no effluent discharge into natural water course. However there is arrangement for treatment of effluent discharge to prescribed standards. There is neither Open Cast mine running nor CHP nor such workshop from where effluent discharge is found.
xxi.	Regular monitoring of subsidence movement on the surface over and around the working area and impact natural drainage pattern, water bodies, vegetation, structure, roads and surroundings shall be continued till movement ceases completely. In case observation of any high rate of subsidence movement, appropriate effective corrective measure shall be taken to avoid loss of life and material. Cracks shall be effectively plugged with ballast and clayey soil /suitable material.	Being implemented. Subsidence study is being conducted by ISM Dhanbad before the start of panel. Extraction done in Non-Effective Width Method so that there is no subsidence on the surface.
xxii.	Sufficient coal pillars shall be left un extracted around the air shaft (within subsidence influence area) to protect from any damage from subsidence, if any.	Complied.
xxiii.	High root density tree species shall be selected and planted over areas likely to be affected by subsidence.	Plantation in BCCL is being done on 3-tier basis, in which both, Monocotyledonae (Monocots) such as grasses, bamboo etc and Dicotyledonae (Dicots) such as sheesham, mango etc are being planted for developing an extensive root system. The Monocots having fibrous root system helps in developing the root density at the topsoil level while, Dicots having the tap root system have a distributed root density in

		topsoil, subsoil and regolith layer of soil. These two root system together forms the high root density system.
Xxiv.	**Depression due to subsidence resulting in water accumulating within low lying areas shall be filled up or drained out by cutting drains.**	Complied.
Xxv.	**Solid barriers shall be left below the roads falling within the blocks to avoid any damage to the road.**	Already complied as per statute.
xxvi.	**No depillaring operation shall be carried out below the township/colony.**	Complied. Depillaring operation are being carried out after getting written permission from DGMS which is statutory binding.
xxvii.	**The transportation plan for conveyor – cum – rail for cluster XIII 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 XIV should be dovetailed with Jharia Action Plan. The road transportation of coal during phase I should be by mechanically covered trucks.**	Will be Complied. Presently there is no producing mine under cluster-XIII.
xxviii.	**A study should be initiated to analyze extent of reduction in pollution load every year by reducing road transport.**	Pollution load study report for has been submitted by CMPDI. Presently there is no producing mine under cluster-XIII.
.xxix.	**R & R of 2187 nos. of PAF's involved. They should be rehabilitated at cost of Rs. 11199.89 lakhs as per the approved Jharia Action Plan.**	PAF's /PAP's involved is being rehabilitated as per cost specified as per Jharia Action Plan.

Xxx.	**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 for and submitted to Ministry.**	Being Complied. Will be submitted.
.Xxxi.	**A detailed CSR action plan shall be prepared for cluster XIII group of mines. Specific activities shall be identified for CSR of Rs. 20.25 / annum @of Rs.5/ton of coal production as**	

	recurring expenditure. The area within the cluster XIII ML that would be existing 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 . Third party evaluation shall be got carried out regularly for the proper implementation of activities under taken in the project area under CSR. Issue raised in the public hearing should 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 the 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.	Agreed. Being implemented.
xxxii.	For monitoring land use pattern and for post mining land use, a time series of land use maps, based on satellite imagery (on a scale of 1: 5000) of the core zone and buffer zone, from the start of the project until end of mine life shall be prepared once in 3 years (for any one particular season which is consistent in the time series), and the report submitted to MoEF and its Regional office at Bhubaneswar.	Time series map of vegetation cover in the Jharia Coal field has been carried out through CMPDI in the year 2014 and 2017 **(which is enclosed as Annexure- IV)=**
xxxiii.	A Final Mine Closure Plan along with details of Corpus Fund shall be submitted to the Ministry of Environment & Forests five year before mine closure for approval. Habitat 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 within the lease for reintroduction in the mine during mine reclamation and at the post mining stage for habitat restoration.	Agreed .Eco-restoration sites (4 no. of total area 8.4 ha) using native species are maintained. Mine closer plan is approved for Murulidih 20/21 Pits Colliery.
xxxiv.	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 Company for implementing environment policy and socio – economic issues and the capacity building required in this regard.	A full-fledged Environment Department, headed by a HOD (Environment) along with a suitable qualified multidisciplinary team of executives which includes Environment, Mining & Excavation, has been established in Headquarters. They are also trained in ecological restoration, sustainable development, rainwater Harvesting methods etc. At the project level, one Executive in each area has also been nominated as

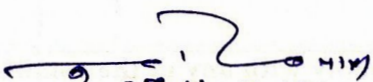|		Project Nodal Officer (Environment) and is also entrusted with the responsibility of compliance and observance of the environmental Acts/ Laws including environment protection measures .The activities are monitored on regular basis at Area and at Headquarters levels. GM (Environment) at head quarter 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.
xxxv.	**Implementation of final mine closure plan for cluster XIII, subject to obtaining prior approval of the DGMS in regard to Mines Safety issues.**	Will be implemented.
Xxxvi.	**Corporate Environment Responsibility:**	Annexure- V
a)	**The Company shall have a well laid down Environment Policy approved by the Board of Directors.**	Agreed.
b)	**The Environment Policy shall prescribe for standard operating process/procedures to bring into focus any infringements/deviation/violation of the environmental or forest norms/conditions.**	Already complied.
c)	**The hierarchical system or Administrative Order of the company to deal with environmental issues and for ensuring compliance with the environmental clearance conditions shall be furnished.**	Already complied.
d)	**To have proper checks and balances, the company shall have a well laid down system of Reporting of non-compliances/violations of environmental norms to the Board of Directors of the company and/or shareholders or stakeholders at large.**	Being followed.
Sl. No	**B. General Conditions Conditions by MOEF:**	**Compliance**
i.	**No change in mining technology and scope of working shall be made without prior approval of the Ministry of Environment and Forests.**	Being complied.
ii.	**No change in the calendar plan of production for quantum of mineral coal shall be made.**	Being Followed.

iii.	Four ambient air quality monitoring stations shall be established in the core zone as well as in the buffer zone for PM10, PM 2.5, SO 2 and NOx 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 locations of monitoring stations in the Jharia Coalfields has finalized in consultation with the Jharkhand State Pollution Control Board. The work of monitoring of ambient environment is being done through Central Mine Planning and Design Institute (CMPDI) having laboratory recognized under the EP Rules. Records for the same are maintained. Annexure - III
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.		Being complied. Monitoring done by CMPDIL. Enclosed as Annexure- III
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.
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.		The work of monitoring of ambient environment done through Central Mine Planning and Design Institute RI-II (CMPDI), Dhanbad which is having laboratory recognized under the EP Rules. There is no effluent discharge from workshop no coal production from any mines of Cluster-XIII. However, there is arrangement for treatment of effluent discharge to prescribed standards. There is neither Open Cast mine running nor CHP nor such workshop from where effluent discharge is found. Very small quantity of burnt oil is generated which is used to lubricate the machines.
vii.	Vehicular emissions shall be kept under control and regularly monitored. Vehicles used for transporting the mineral shall be covered with tarpaulins and optimally loaded.		Already Complied.
viii.	Monitoring of environmental quality parameters shall be carried out through establishment of adequate number and type of pollution monitoring and analysis equipment in consultation with the State Pollution Control Board and data got analyzed through a laboratory recognized under EPA Rules,		It is being complied. Monitoring is done by CMPDIL.

		Monitoring of environmental quality parameters shall be carried out through establishment of adequate number and type of pollution monitoring and analysis equipment in consultation with the State Pollution Control Board and data got analyzed through a laboratory recognized under EPA Rules, 1986.	
ix.		**Personnel working in dusty areas shall wear protective respiratory devices and they shall also be provided with adequate training and information on safety and health aspects.**	Being Complied. Vocational training Centers under Separate Human Resource Development Deptt. is Conducting regular training programme on these issues.
x.		**Occupational health surveillance program me of the workers shall be undertaken periodically to observe any contractions due to exposure to dust and to take corrective measures, if needed and records maintained thereof. The quality of environment due to outsourcing and the health and safety issues of the outsourced manpower should be addressed by the company while outsourcing.**	Initial Medical Examination (IME) and Periodical Medical Examination (PME) of all the personnel are carried out as per the Statutes and Director General of Mines Safety (DGMS) `s guideline.
xi.		**A separate environmental management cell with suitable qualified personnel shall be set up under the control of a Senior Executive, who will report directly to the Head of the company.**	A full-fledged Environment Department, headed by a HOD (Environment) along with a suitable qualified multidisciplinary team of executives which includes Environment, Mining, Excavation, have been established in Headquarters. They are also trained in ecological restoration, sustainable development, rainwater Harvesting methods etc. At the project level, one Executive in each area has also been nominated as Project Nodal Officer (Environment) and is also entrusted with the responsibility of compliance and observance of the environmental Acts/ Laws including environment protection measures .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 initiated to comply the same. Agreed to report the same.

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.
xiv.	**A copy of the environmental clearance letter shall be marked to concern Panchayat/Zila Parishad, Municipal Corporation or Urban local body and local NGO, if any, from whom any suggestion/representation has been received while processing the proposal. A copy of the clearance letter shall also be displayed on company's website.**	Complied.
xv.	**A copy of the environmental clearance letter shall be shall also be displayed on the website of the concerned State Pollution Control Board. The EC letter shall also be displayed at the Regional Office, District Industry Sector and Collector's Office/Tehsildar's Office for 30 days.**	Complied.
xvi.	**The clearance letter shall be uploaded on the company's website. The compliance status of the stipulated environmental clearance conditions shall also be uploaded by the project authorities on their website and updated at least once every six months so as to bring the same in public domain. The monitoring data of environmental quality parameter (air, water, noise and soil) and critical pollutant such as PM10, PM2.5, SO 2 and NOx (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.**	Complied.

xvii.	**The project proponent shall submit six monthly compliance reports on status of compliance of the stipulated environmental clearance conditions (both in hard copy and in e-mail) to the respective Regional Office of the Ministry, respective Zonal Office s of CPCB and the SPCB.**	Being complied.
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.**	Agreed. Being and shall be complied.
xix.	**The Environmental statement for each financial year ending 31 March in For –V is mandated to be submitted by the project proponent for the concerned State Pollution Control Board as prescribed Under the Environment (Protection) Rules, 1986, as amended subsequently, shall also be uploaded on the company's website along with the status of compliance of EC conditions and shall be sent to the respective Regional Offices of the MoEF by E-mail.**	Being complied. Agreed.
7	**The Ministry or any other competent authority may stipulate any further condition(s) for environmental protection.**	Agreed
8	**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.**	Agreed

9	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.	Agreed
10	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.	Agreed

Project officer,
Lohapatti colliery / 20/21 pits Murulidih colliery
Project Officer
LOHAPATI COLLIERY

ANNEXURE- I

A. Production from April'19 to September'19of Cluster XIII mines

	Total Month	Apr'19	May'19	June'19	July'19	Aug'19	Sept'19	(Million ton)
Cluster XIII	**Murulidih 20/21 pits**	0	0	0	0	0	0	0
	Bhurungiya Colliery							
	Muchraidih Colliery							
	Hantoodih Colliery			Nil				Nil
	Padugora Colliery							
	Murulidih Colliery							
	Bhatdeeh Colliery							
	Total (in Million ton)							0
	Remarks:- Murulidih 20/21 pits colliery temporarily closed for production from							

Dec'2015

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

Contents

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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.
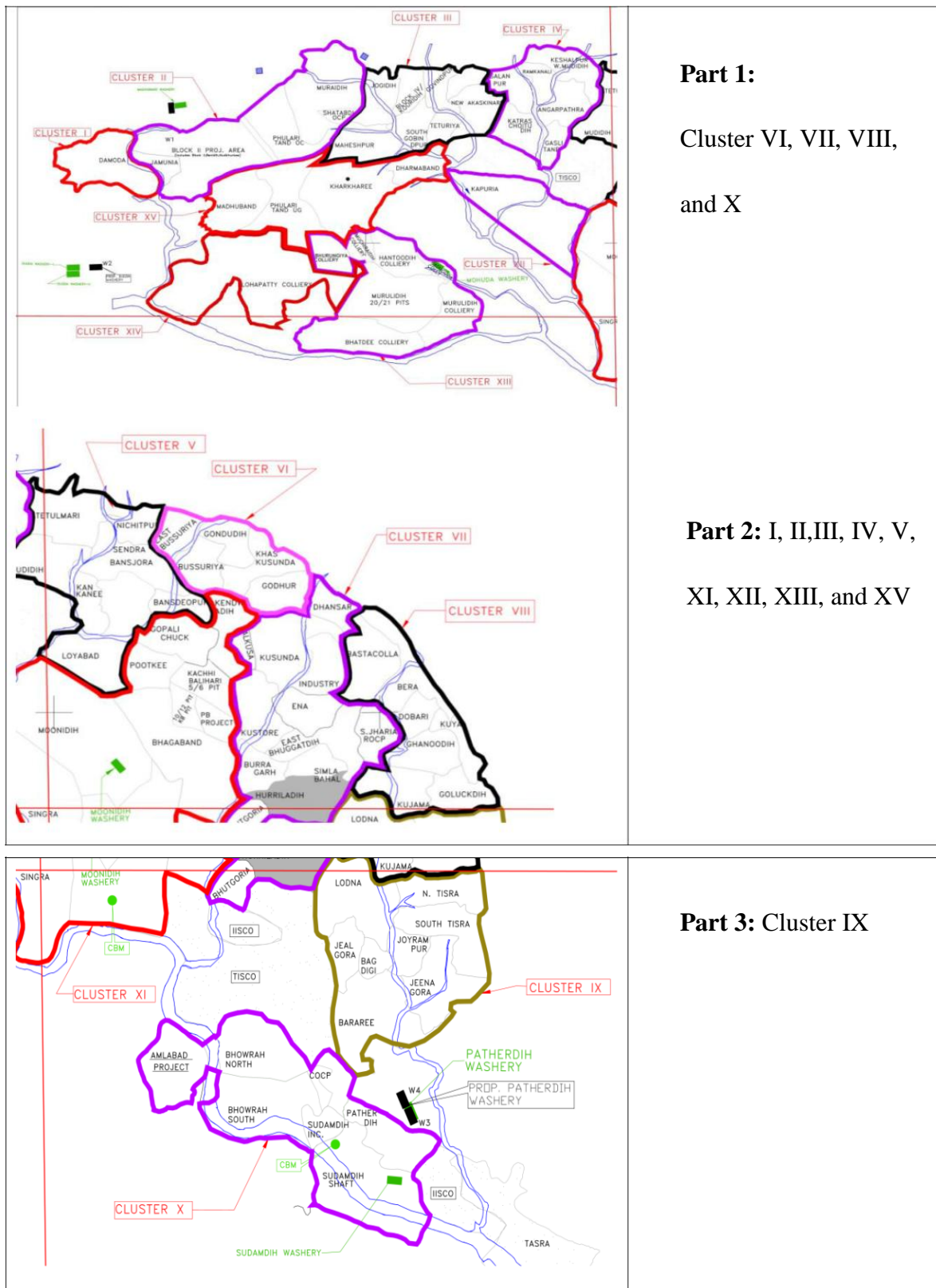
Part 1:

Cluster VI, VII, VIII,

and X

Part 2: I, II,III, IV, V,

XI, XII, XIII, and XV

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.
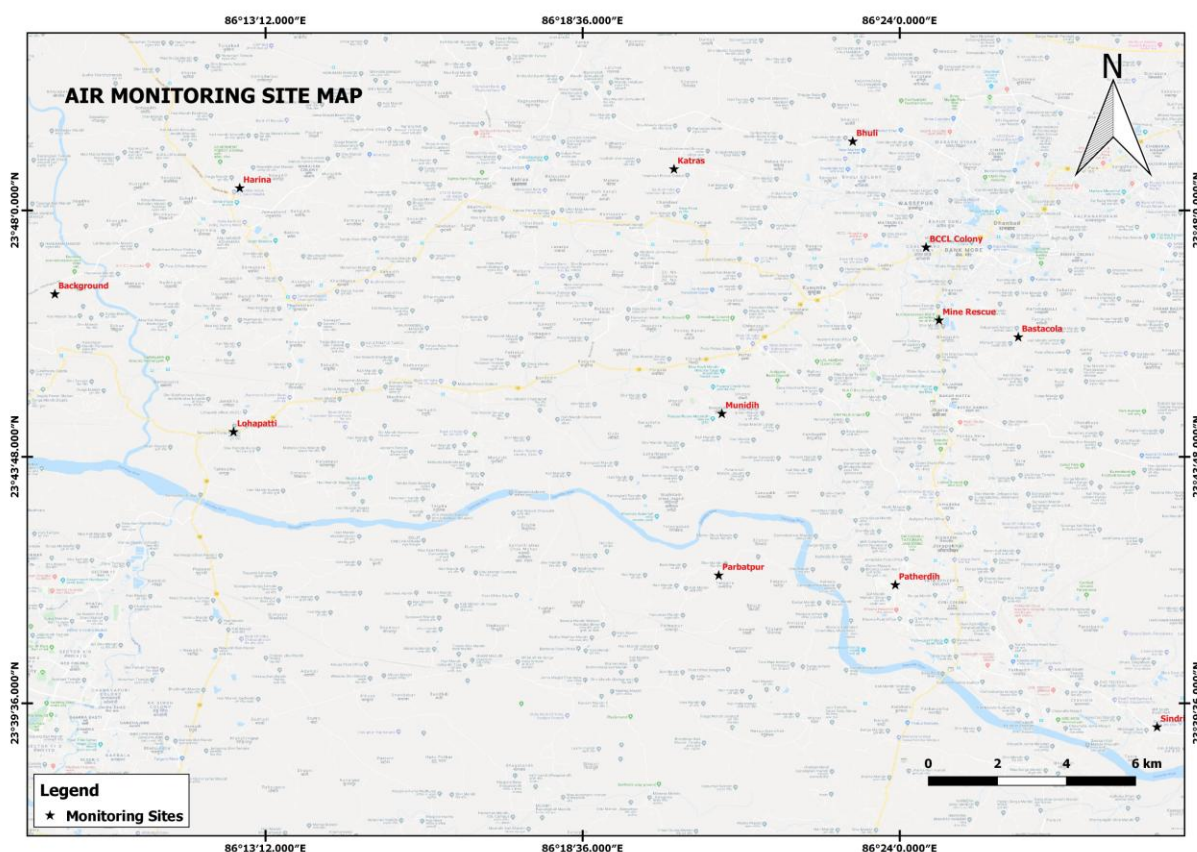
Figure2.1 Identified air monitoring station in Jharia Coalfield

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

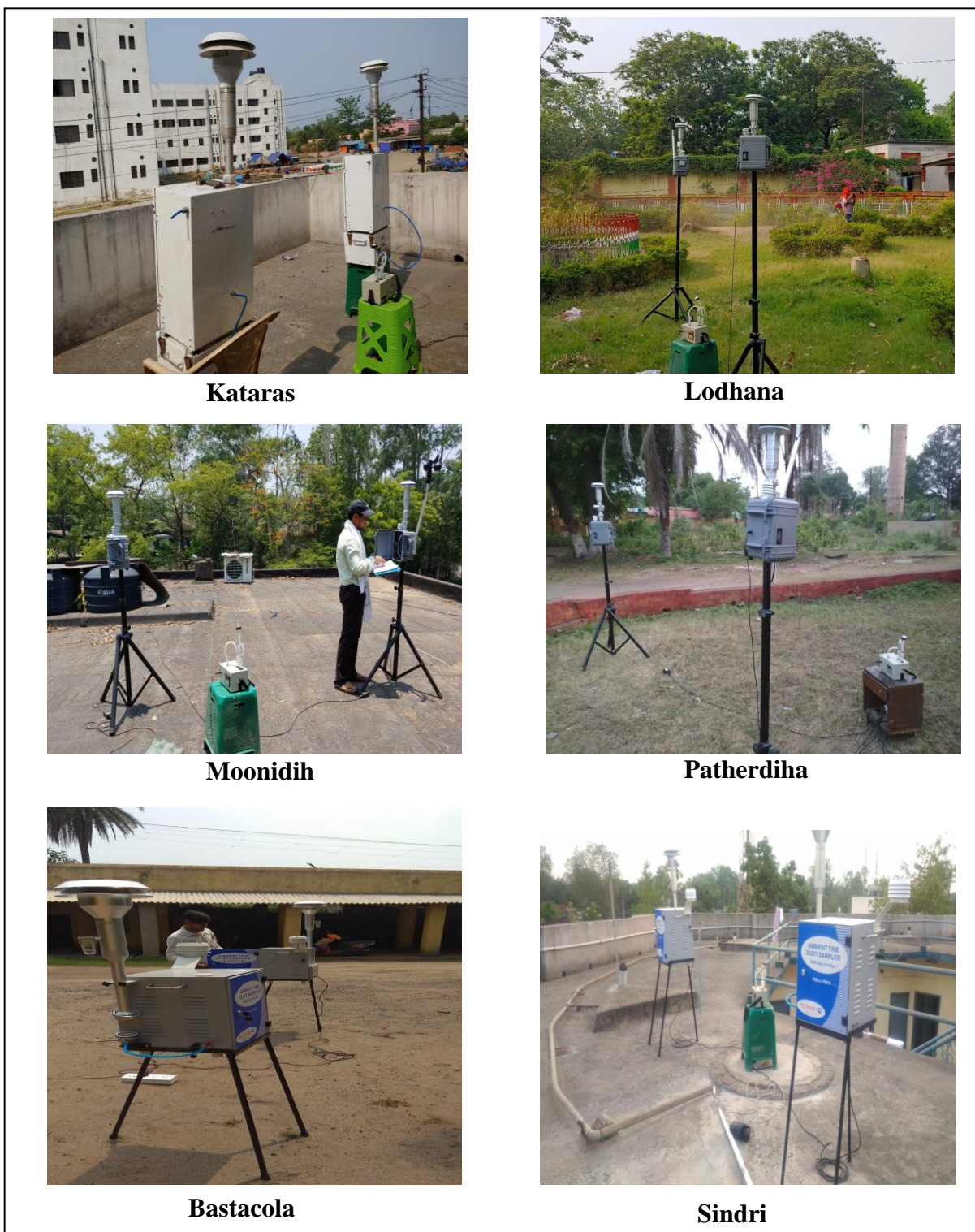**Patherdiha**

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   : Gravimetrically with GFA/EPM 2000 filter
(RSPM)   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

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

(FOR THE MONTH APRIL, 2019)

E. C. no. J-11015/11/2010-IA.II (M) dated 06.06.2013.

CMPDI

ISO 9001 Company
Regional Institute-II
Dhanbad, Jharkhand

AMBIENT AIR QUALITY DATA
Cluster –XIII,Bharat Coking Coal limited   Month: APRIL ,2019   Year   : 2019-20.

Station Name: A19 – Murlidih 20/21		Zone: Core		Category: Industrial[1]	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	11.04.19	92	53	14	32
2	23.04.19	96	54	13	31
	NAAQ Standards	100	60	80	80
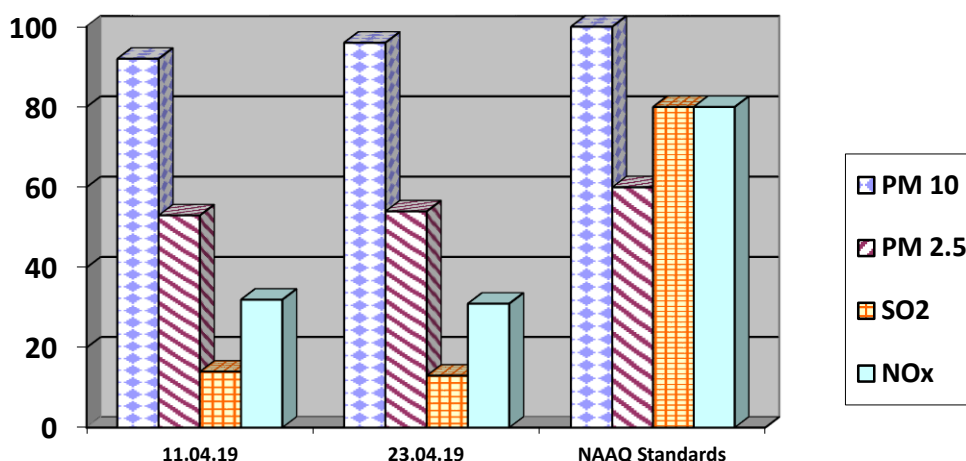
Station Name: A20, Lohapatti		Zone: Buffer		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_X
1	08.04.19	95	51	12	30
2	24.04.19	97	54	11	27
	NAAQ Standard	100	60	80	80
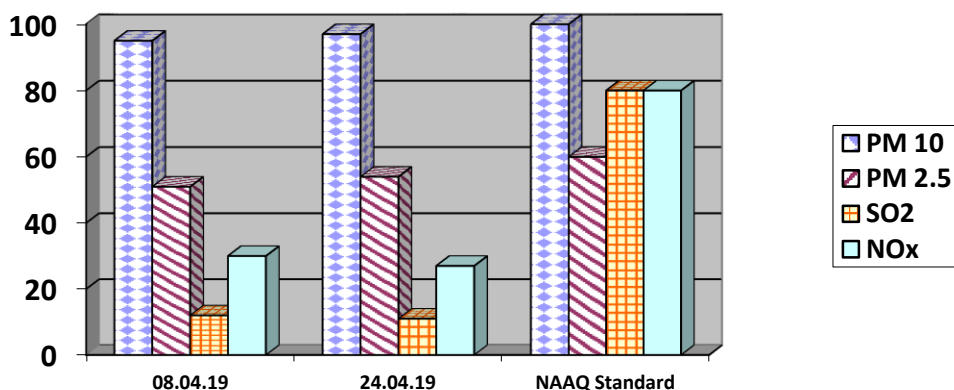
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[1] **AUTHORISED FOR RELEASE BY HOD (ENV), CMPDI, RL-2, DHANBAD,**   21/6/19   **DATED 22.06.19**

JOB NO. 200316028   Cluster – XIII   BCCL Environmental Monitoring Report

Station Name: A21 Kharkharee		Zone: Buffer		Category: Industrial[2]	
SI. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	04.04.19	113	64	13	32
2	25.04.19	97	56	12	33
	NAAQ Standards	100	60	80	80
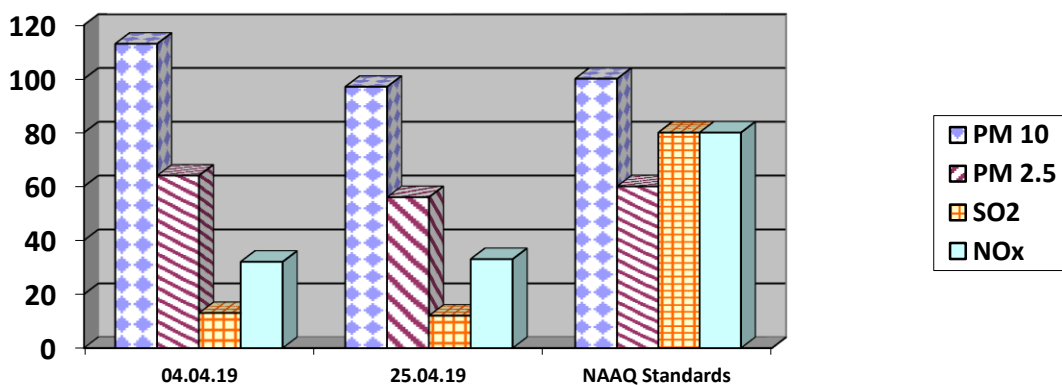
Station Name: A31 Dumarda		Zone: Buffer		Category: Residential	
SI. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	11.04.19	96	53	<10	30
2	23.04.19	94	51	<10	27
	NAAQ Standards	100	60	80	80

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

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[2] **AUTHORISED FOR RELEASE BY HOD (ENV), CMPDI, RL-2, DHANBAD,** 21/05/19 **DATED 22.06.19**

WATER QUALITY MONITORING

3.1   Location of sampling sites
(Refer **Plate No. – II**)

i)   **Mine Discharge of Murlidih 20/21 (MW13)**

A sampling point is fixed to assess the effluent quality of Mine discharge. This location is selected to monitor effluent discharge in to Jamunia.

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 -XIII**		Month: **APRIL, 2019**	Name of the Station: **Mine Discharge of Murlidih 20/21[3]**	
SI. No.	**Parameters**	**MW13** First Fortnight	**MW13** Second Fortnight	**As per MOEF General Standards for schedule VI**
		11.04.19	24.04.19	
1	Total Suspended Solids	36	28	*100 (Max)*
2	pH	7.97	8.04	*5.5 - 9.0*
3	Oil & Grease	<2.0	<2.0	*10 (Max)*
4	COD	32	36	*250 (Max)*

All values are expressed in mg/lit unless specified.

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[3] **AUTHORISED FOR RELEASE BY HOD (ENV), CMPDI, RL-2, DHANBAD,**   21/6/19   **DATED 22.06.19**

NOISE LEVEL QUALITY MONITORING

4.1 Location of sampling sites

  i)   **Murlidih (N19)**
  ii) **Lohapatti (N20)**
  iii) **Kharkharee CISF Office (N21)**
  iv) **Dumarda (N31)**

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 MoEFCC. 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 -XIII**			Month: **APRIL , 2019**[4]		
Sl. No.	**Station Name/Code**	**Category of area**	**Date**	**Noise level dB(A)LEQ**	***Permissible Limit of Noise level in dB(A)***
1	Murlidih 20/21 (N 19)	Industrial area	11.04.19	50.8	75
2	Murlidih 20/21	Industrial area	23.04.19	56.4	75
3	Lohapatti (N20)	Industrial area	08.04.19	61.2	75
4	Lohapatti	Industrial area	24.04.19	61.6	75
5	Kharkharee (N21)	Industrial area	04.04.19	51.9	75
6	Kharkharee	Industrial area	25.04.19	53.9	75
7	Dumarda (N31)	Residential area	11.04.19	49.3	55
8	Dumarda	Residential area	23.04.19	45.2	55

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,

[4] **AUTHORISED FOR RELEASE BY HOD (ENV), CMPDI, RL-2, DHANBAD,**   **DATED 22.06.19**

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

(FOR THE MONTH MAY, 2019)

## E. C. no. J-11015/11/2010-IA.II (M) dated 06.06.2013.

CMPDI

ISO 9001 Company
Regional Institute-II
Dhanbad, Jharkhand

AMBIENT AIR QUALITY DATA
Cluster –XIII,Bharat Coking Coal limited Month: **MAY ,2019** Year : **2019-20.**

Station Name: A19 – Murlidih 20/21		Zone: Core		Category: Industrial[1]	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	06.05.19	95	51	11.07	32.46
2	29.05.19	89	48	18.73	35.43
	NAAQ Standards	100	60	80	80
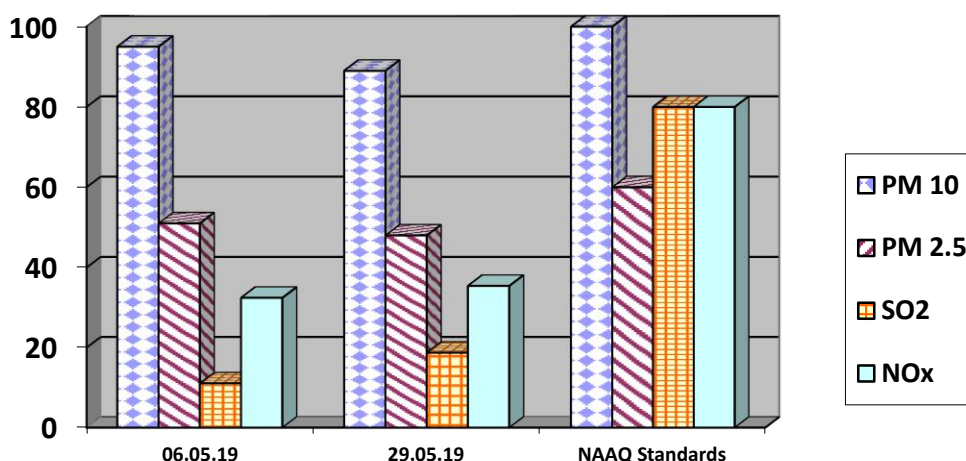
Station Name: A20, Lohapatti		Zone: Buffer		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_X
1	07.05.19	93	53	8.66	27.16
2	22.05.19	91	52	6.81	26.51
	NAAQ Standard	100	60	80	80
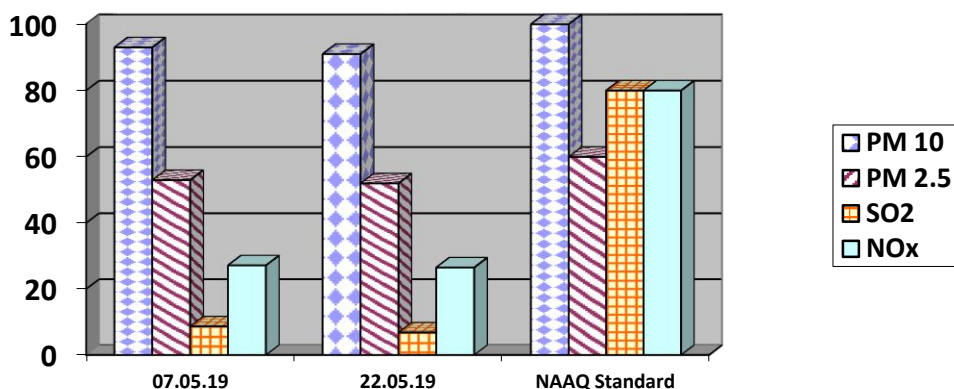
[1] **AUTHORISED FOR RELEASE BY HOD (ENV), CMPDI, RL-2, DHANBAD,** 21/0/19 **DATED 29.07.19**

JOB NO. 200316028   Cluster – XIII   BCCL Environmental Monitoring Report

Station Name: A21 Kharkharee		Zone: Buffer		Category: Industrial[2]	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	09.05.19	124	72	11.16	32.80
2	23.05.19	118	64	7.49	30.30
	NAAQ Standards	100	60	80	80
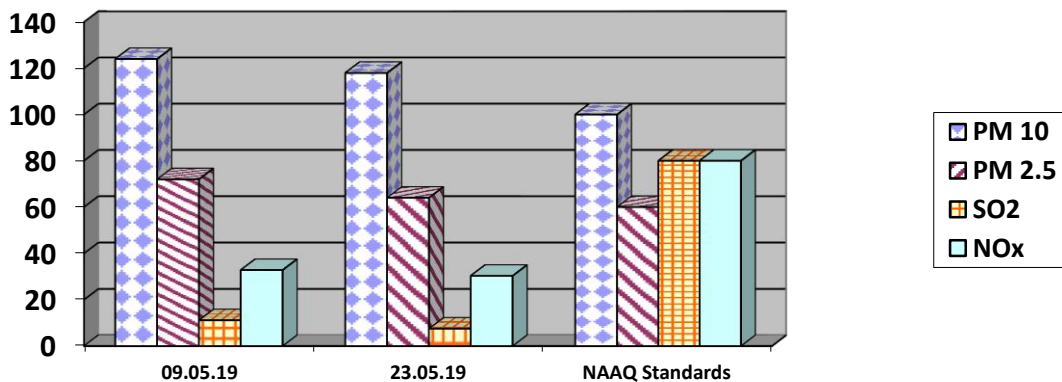
Station Name: A31 Dumarda		Zone: Buffer		Category: Residential	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	06.05.19	94	53	9.91	21.97
2	29.05.19	92	51	7.09	23.78
	NAAQ Standards	100	60	80	80

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

WATER QUALITY MONITORING

3.1   Location of sampling sites
(Refer **Plate No. – II**)
i)   Mine Discharge of Murlidih 20/21 (MW13)
A sampling point is fixed to assess the effluent quality of Mine discharge. This location is selected to monitor effluent discharge in to Jamunia.

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 -XIII**		Month: **MAY, 2019**	Name of the Station: **Mine Discharge of Murlidih 20/21[3]**	
Sl. No.	**Parameters**	**MW13** First Fortnight	**MW13** Second Fortnight	**As per MOEF General Standards for schedule VI**
		06.05.19	30.05.19	
1	Total Suspended Solids	26	28	*100 (Max)*
2	pH	8.03	8.11	*5.5 - 9.0*
3	Oil & Grease	<2.0	<2.0	*10 (Max)*
4	COD	28	36	*250 (Max)*

All values are expressed in mg/lit unless specified.

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[3] **AUTHORISED FOR RELEASE BY HOD (ENV), CMPDI, RL-2, DHANBAD,**   21/05/19   **DATED 29.07.19**

NOISE LEVEL QUALITY MONITORING

4.1 Location of sampling sites

    i)   **Murlidih (N19)**
    ii)   **Lohapatti (N20)**
    iii) **Kharkharee CISF Office (N21)**
    iv) **Dumarda (N31)**

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 MoEFCC. 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 -XIII**			Month: **MAY , 2019**[4]		
Sl. No.	**Station Name/Code**	**Category of area**	**Date**	**Noise level dB(A)LEQ**	***Permissible Limit of Noise level in dB(A)***
1	Murlidih 20/21 (N 19)	Industrial area	06.05.19	54.3	*75*
2	Murlidih 20/21	Industrial area	29.05.19	54.9	*75*
3	Lohapatti (N20)	Industrial area	07.05.19	59.2	*75*
4	Lohapatti	Industrial area	22.05.19	63.4	*75*
5	Kharkharee (N21)	Industrial area	09.05.19	54.8	*75*
6	Kharkharee	Industrial area	23.05.19	55.1	*75*
7	Dumarda (N31)	Residential area	06.05.19	50.8	*55*
8	Dumarda	Residential area	29.05.19	46.9	*55*

*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,

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[4] **AUTHORISED FOR RELEASE BY HOD (ENV), CMPDI, RL-2, DHANBAD,**　　21/5/9　　**DATED 29.07.19**

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

(FOR THE MONTH JUNE, 2019)

E. C. no. J-11015/11/2010-IA.II (M) dated 06.06.2013.

CMPDI
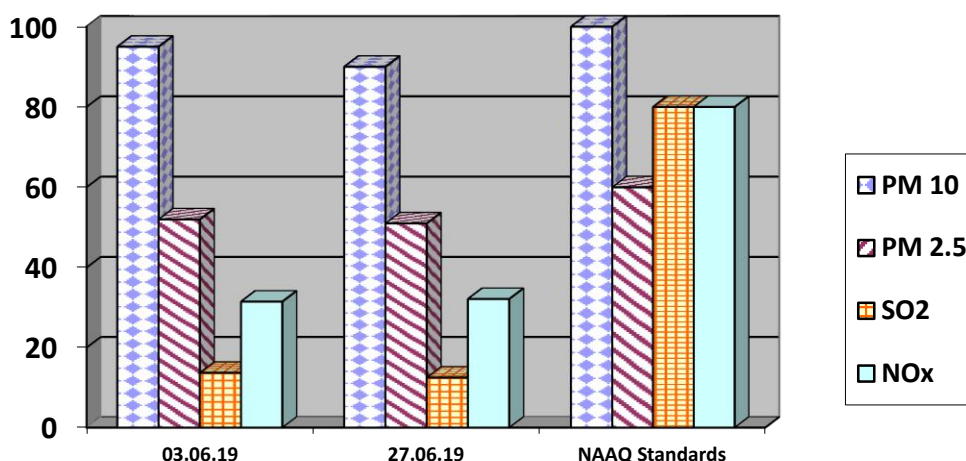
ISO 9001 Company
Regional Institute-II
Dhanbad, Jharkhand

AMBIENT AIR QUALITY DATA
Cluster –XIII,Bharat Coking Coal limited   Month: **JUNE ,2019**   Year   : **2019-20.**

Station Name: A19 – Murlidih 20/21		Zone: Core		Category: Industrial[1]	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	03.06.19	95	52	13.71	31.51
2	27.06.19	90	51	12.50	32.16
	NAAQ Standards	100	60	80	80

Station Name: A20, Lohapatti		Zone: Buffer		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_X
1	07.06.19	88	49	13.47	23.29
2	19.06.19	91	50	13.96	28.41
	NAAQ Standard	100	60	80	80
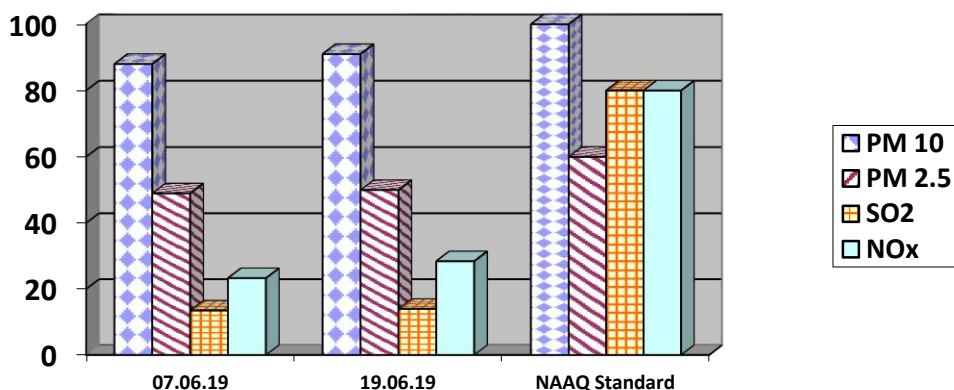
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[1] **AUTHORISED FOR RELEASE BY HOD (ENV), CMPDI, RL-2, DHANBAD,**   ~~21/5/9~~   **DATED 20.08.19**

JOB NO. 200316028   Cluster – XIII   BCCL Environmental Monitoring Report

Station Name: A21 Kharkharee		Zone: Buffer		Category: Industrial[2]	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	12.06.19	112	62	13.80	27.80
2	20.06.19	95	56	15.37	30.39
	NAAQ Standards	100	60	80	80
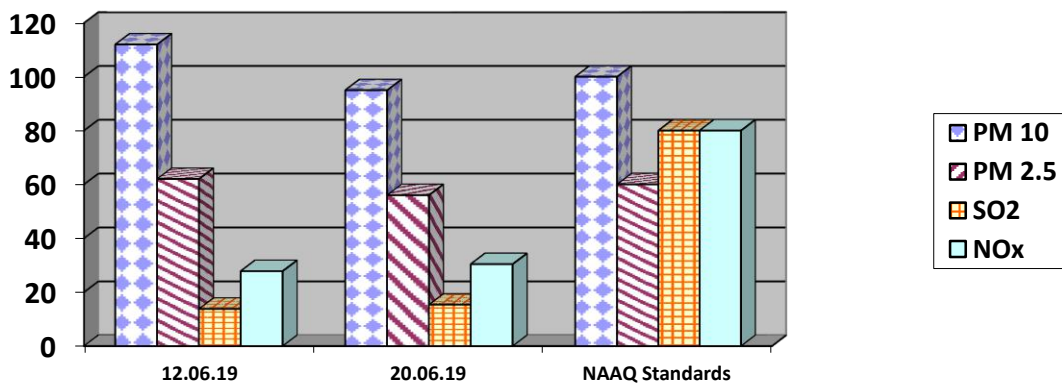
Station Name: A31 Dumarda		Zone: Buffer		Category: Residential	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	03.06.19	94	51	11.42	32.35
2	27.06.19	92	48	9.94	27.65
	NAAQ Standards	100	60	80	80

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

WATER QUALITY MONITORING

3.1   Location of sampling sites

(Refer **Plate No. – II**)

i)   **Mine Discharge of Murlidih 20/21 (MW13)**

A sampling point is fixed to assess the effluent quality of Mine discharge. This location is selected to monitor effluent discharge in to Jamunia.

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 -XIII**		Month: **JUNE, 2019**	Name of the Station: **Mine Discharge of Murlidih 20/21[3]**	
Sl. No.	**Parameters**	**MW13** First Fortnight	**MW13** Second Fortnight	**As per MOEF General Standards for schedule VI**
		04.06.2019	27.06.2019	
1	Total Suspended Solids	43	24	*100 (Max)*
2	pH	8.03	7.98	*5.5 - 9.0*
3	Oil & Grease	<2.0	<2.0	*10 (Max)*
4	COD	36	44	*250 (Max)*

All values are expressed in mg/lit unless specified.

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[3] **AUTHORISED FOR RELEASE BY HOD (ENV), CMPDI, RL-2, DHANBAD,**   21/5/19   **DATED 20.08.19**

NOISE LEVEL QUALITY MONITORING

4.1 Location of sampling sites

i)   **Murlidih (N19)**
ii)   **Lohapatti (N20)**
iii)   **Kharkharee CISF Office (N21)**
iv)   **Dumarda (N31)**

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 MoEFCC. 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 -XIII**			Month: **JUNE , 2019**[4]		
Sl. No.	**Station Name/Code**	**Category of area**	**Date**	**Noise level dB(A)LEQ**	***Permissible Limit of Noise level in dB(A)***
1	Murlidih 20/21 (N 19)	Industrial area	03.06.19	56.2	*75*
2	Murlidih 20/21	Industrial area	27.06.19	55.1	*75*
3	Lohapatti (N20)	Industrial area	07.06.19	59.5	*75*
4	Lohapatti	Industrial area	19.06.19	65.2	*75*
5	Kharkharee (N21)	Industrial area	12.06.19	50.9	*75*
6	Kharkharee	Industrial area	20.06.19	53.9	*75*
7	Dumarda (N31)	Residential area	03.06.19	49.4	*55*
8	Dumarda	Residential area	27.06.19	48.3	*55*

*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,

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[4] **AUTHORISED FOR RELEASE BY HOD (ENV), CMPDI, RL-2, DHANBAD,**   **DATED 20.08.19**

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

(FOR THE MONTH JULY, 2019)

## E. C. no. J-11015/11/2010-IA.II (M) dated 06.06.2013.

CMPDI

ISO 9001 Company
Regional Institute-II
Dhanbad, Jharkhand

AMBIENT AIR QUALITY DATA
Cluster –XIII,Bharat Coking Coal limited   Month: **JULY ,2019**   Year   : **2019-20.**

Station Name: A19 – Murlidih 20/21		Zone: Core		Category: Industrial[1]	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	10.07.19	85	51	11.38	18.65
2	22.07.19	82	49	11.46	16.71
	NAAQ Standards	100	60	80	80
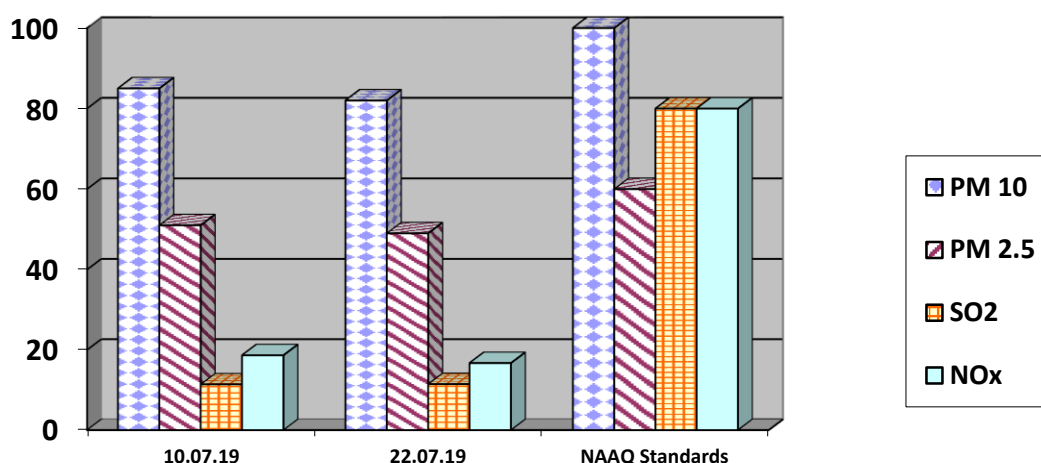
Station Name: A20, Lohapatti		Zone: Buffer		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_X
1	11.07.19	87	52	10.31	20.77
2	23.07.19	81	48	10.93	21.25
	NAAQ Standard	100	60	80	80
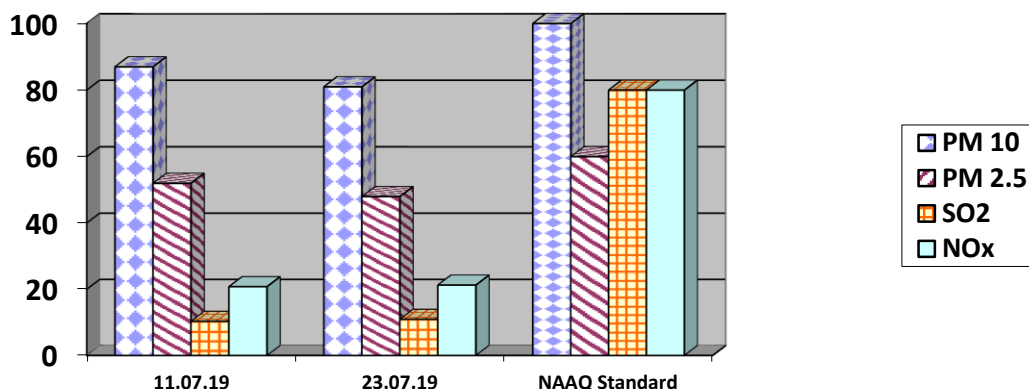
Station Name: A21 Kharkharee		Zone: Buffer		Category: Industrial[2]	
SI. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	01.07.19	93	54	14.03	22.83
2	18.07.19	96	57	13.08	26.34
	NAAQ Standards	100	60	80	80
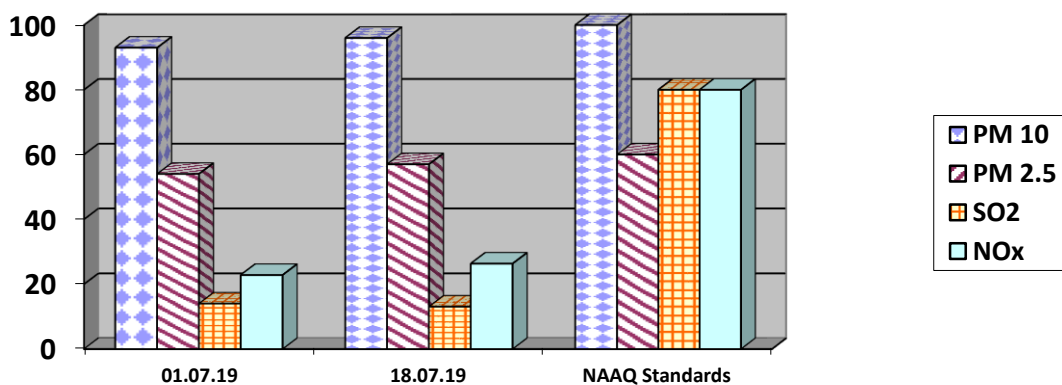
Station Name: A31 Dumarda		Zone: Buffer		Category: Residential	
SI. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	10.07.19	91	49	8.40	16.39
2	22.07.19	85	51	9.42	14.23
	NAAQ Standards	100	60	80	80

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

WATER QUALITY MONITORING

3.1 Location of sampling sites
(Refer **Plate No. – II**)

i) **Mine Discharge of Murlidih 20/21 (MW13)**

A sampling point is fixed to assess the effluent quality of Mine discharge. This location is selected to monitor effluent discharge in to Jamunia.

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 -XIII**		Month: **JULY, 2019**	Name of the Station: **Mine Discharge of Murlidih 20/21**[3]	
Sl. No.	**Parameters**	**MW13** First Fortnight	**MW13** Second Fortnight	**As per MOEF General Standards for schedule VI**
		15.07.2019	22.07.2019	
1	Total Suspended Solids	23	36	*100 (Max)*
2	pH	8.13	8.2	*5.5 - 9.0*
3	Oil & Grease	<2.0	<2.0	*10 (Max)*
4	COD	40	52	*250 (Max)*

All values are expressed in mg/lit unless specified.

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[3] **AUTHORISED FOR RELEASE BY HOD (ENV), CMPDI, RI-2, DHANBAD,** 21/5/19 **DATED 28.09.19**

NOISE LEVEL QUALITY MONITORING

4.1 Location of sampling sites

 i)   **Murlidih (N19)**
 ii)   **Lohapatti (N20)**
 iii) **Kharkharee CISF Office (N21)**
 iv)   **Dumarda (N31)**

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 MoEFCC. 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 -XIII**			Month: **JULY , 2019**[4]		
Sl. No.	**Station Name/Code**	**Category of area**	**Date**	**Noise level dB(A)LEQ**	***Permissible Limit of Noise level in dB(A)***
1	Murlidih 20/21 (N 19)	Industrial area	10.07.19	56.3	*75*
2	Murlidih 20/21	Industrial area	22.07.19	57.1	*75*
3	Lohapatti (N20)	Industrial area	11.07.19	58.3	*75*
4	Lohapatti	Industrial area	23.07.19	66.3	*75*
5	Kharkharee (N21)	Industrial area	01.07.19	52.7	*75*
6	Kharkharee	Industrial area	18.07.19	54.5	*75*
7	Dumarda (N31)	Residential area	10.07.19	48.3	*55*
8	Dumarda	Residential area	22.07.19	47.8	*55*

*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,

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[4] **AUTHORISED FOR RELEASE BY HOD (ENV), CMPDI, RI-2, DHANBAD,**   ~~21/9~~   **DATED 28.09.19**

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

(FOR THE MONTH AUGUST, 2019)

## E. C. no. J-11015/11/2010-IA.II (M) dated 06.06.2013.

CMPDI

ISO 9001 Company
Regional Institute-II
Dhanbad, Jharkhand
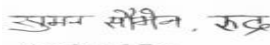
AMBIENT AIR QUALITY DATA
Cluster –XIII,Bharat Coking Coal limited   Month:**AUGUST ,2019**   Year   :   **2019-20.**

Station Name: A19 – Murlidih 20/21		Zone: Core		Category: Industrial[1]	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	12.08.19	86	53	11.13	24.23
2	23.08.19	91	54	12.13	23.39
	NAAQ Standards	100	60	80	80
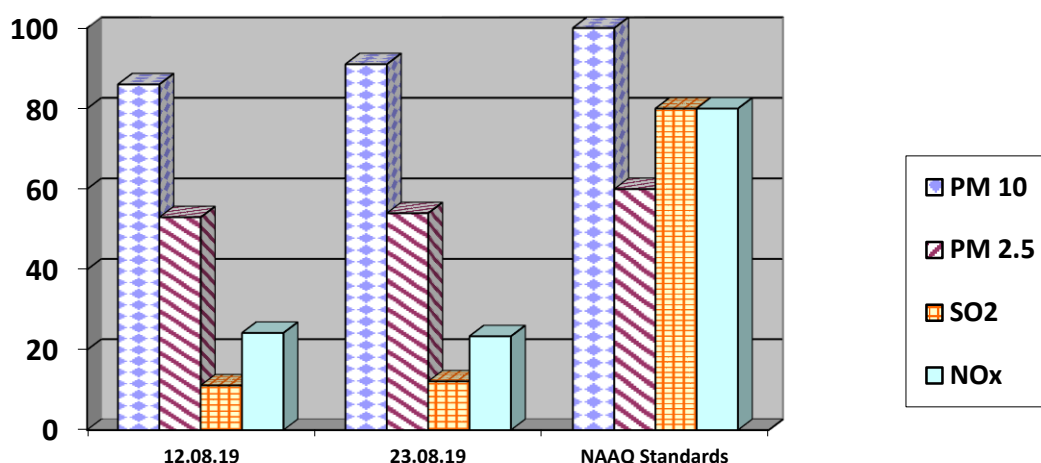
Station Name: A20, Lohapatti		Zone: Buffer		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_X
1	13.08.19	85	45	11.21	23.42
2	21.08.19	92	48	11.61	25.15
	NAAQ Standard	100	60	80	80
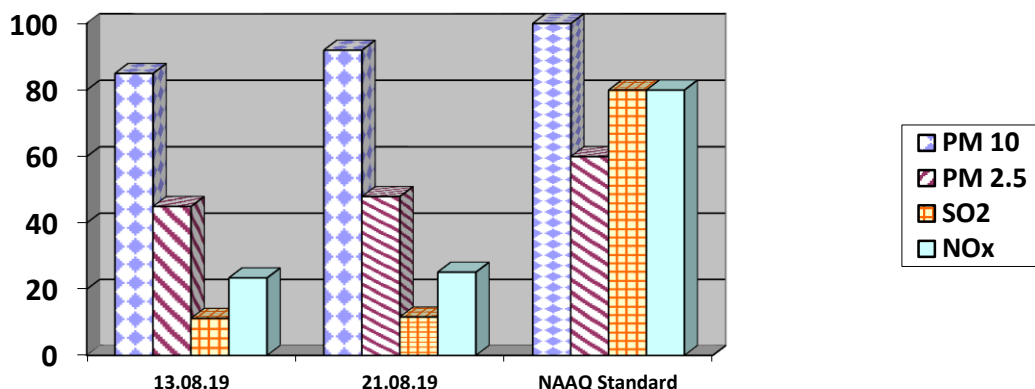
Analysed By
JSA/SA/SSA

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

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

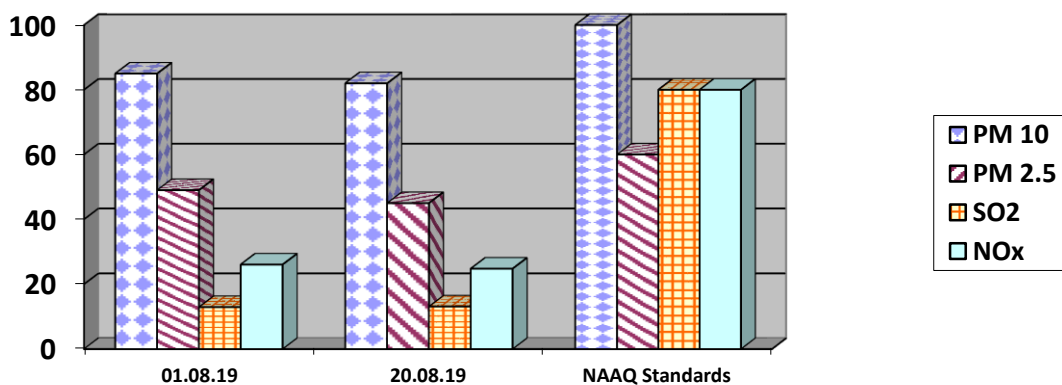| Station Name: A21 Kharkharee		Zone: Buffer		Category: Industrial[2]	
SI. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	01.08.19	85	49	12.94	26.06
2	20.08.19	82	45	13.11	24.78
	NAAQ Standards	100	60	80	80

Station Name: A31 Dumarda		Zone: Buffer		Category: Residential	
SI. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	12.08.19	86	53	8.27	19.5
2	29.08.19	84	55	7.48	17.45
	NAAQ Standards	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
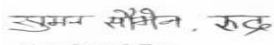
3.1   Location of sampling sites
(Refer **Plate No. – II**)
i)   **Mine Discharge of Murlidih 20/21 (MW13)**

A sampling point is fixed to assess the effluent quality of Mine discharge. This location is selected to monitor effluent discharge in to Jamunia.

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 -XIII**		Month: **AUGUST, 2019**	Name of the Station: **Mine Discharge of Murlidih 20/21[3]**	
Sl. No.	**Parameters**	**MW13** First Fortnight	**MW13** Second Fortnight	**As per MOEF General Standards for schedule VI**
		16.08.2019	24.08.2019	
1	Total Suspended Solids	27	40	*100 (Max)*
2	pH	8.01	8.19	*5.5 - 9.0*
3	Oil & Grease	<2.0	<2.0	*10 (Max)*
4	COD	16	20	*250 (Max)*

All values are expressed in mg/lit unless specified.

उत्तम सेंगित, ठठ्
Analysed By
JSA/SA/SSA

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

2/6/9
Approved By
HOD(Mining/Environment)
RI-2, CMPDI, Dhanbad

JOB NO. 200316028   Cluster – XIII   BCCL Environmental Monitoring Report

NOISE LEVEL QUALITY MONITORING

4.1 Location of sampling sites

   i) **Murlidih (N19)**
   ii) **Lohapatti (N20)**
   iii) **Kharkharee CISF Office (N21)**
   iv) **Dumarda (N31)**

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).
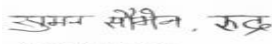
4.3 Results & Interpretations

Ambient noise levels were recorded during day time and the observed values were compared with standards prescribed by MoEFCC. 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 -XIII**			Month: **AUGUST , 2019**[4]		
Sl. No.	**Station Name/Code**	**Category of area**	**Date**	**Noise level dB(A)LEQ**	***Permissible Limit of Noise level in dB(A)***
1	Murlidih 20/21 (N 19)	Industrial area	12.08.19	55.4	*75*
2	Murlidih 20/21	Industrial area	23.08.19	55.5	*75*
3	Lohapatti (N20)	Industrial area	13.08.19	59.2	*75*
4	Lohapatti	Industrial area	21.08.19	64.7	*75*
5	Kharkharee (N21)	Industrial area	01.08.19	54.6	*75*
6	Kharkharee	Industrial area	20.08.19	53.8	*75*
7	Dumarda (N31)	Residential area	12.08.19	50.2	*55*
8	Dumarda	Residential area	29.08.19	45.9	*55*

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

WATER QUALITY REPORT
OF
BHARAT COKING COAL LIMITED, CLUSTER – XIII

(FOR THE Q.E.MARCH 2019)

E. C. no. J-11015/11/2010-IA.II (M) dated 06.06.2013.

CMPDI

ISO 9001 Company
Regional Institute-II
Dhanbad, Jharkhand

CLUSTER - XIII

(FOR THE Q.E. MARCH 2019)

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WATER QUALITY REPORT
OF
BHARAT COKING COAL LIMITED
CLUSTER – XIII

(FOR THE Q.E. MARCH 2019)

E. C. no. J-11015/11/2010-IA.II (M) dated 06.06.2013.

CMPDI

ISO 9001 Company
Regional Institute-II
Dhanbad, Jharkhand

EXECUTIVE SUMMARY

1.0 Introduction

The purpose of environmental monitoring is to assess the quality of various attributes that affects the environment around us. In accordance with the quality of these attributes appropriate strategy is to be developed to control the pollution level within the permissible limits. One of these major attributes is water.

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 $23^037'$ N to $23^052'$ N latitudes and $86^009'$ E to $86^030'$ 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 Water sampling stations

The Water sampling stations were selected for mine sump water, drinking water supply, well/ Hand pump water & also surface water samples.

3.0 Methodology of sampling and analysis

3.1 Water quality

Water samples were collected as per standard practice. Effluent samples were analyzed for 25 parameters on quarterly basis & for 27 parameters on half yearly basis. The drinking and Surface water samples were collected and analyzed for 25 and 17 parameters respectively, on quarterly basis. Thereafter the samples were preserved and analyzed at the Environmental Laboratory at CMPDI (HQ), Ranchi.

4.0 Results and interpretations

4.1 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, IS.10500/2012 (Drinking water) and IS: 2296 (Surface water), are with in permissible limits.

CHAPTER - I
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, Forests and Climate Change (MoEF&CC), Govt. of India.

Bharat Coking Coal Limited (BCCL), a subsidiary company of Coal India Limited (CIL) is operating UG Mines and Opencast Mines in Jharia Coalfield (JCF). The Jharia Coalfield (JCF) having an area of 450 Sq.KM.

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-XIII is in the Northern part of the Jharia coalfield. It includes a group of 7 Mines (viz. Murlidih, Bhurungiya, Mucharadih, Hantoodih, Padugora, Murlidih 20/21 Pits & Bhatdee. The Cluster – XIII is situated about 25 - 30 kms from Dhanbad Railway Station. The mines of this Cluster – XIII are operating since pre nationalization period (prior to 1972-73). It is connected by both Railway and Road. The drainage of the area is governed by Katri River & Damodar River.

1.2 The Cluster-XIII is designed to produce 0.18 MTPA (normative) and 2.34 MTPA (peak) capacity of coal.

The Project has Environmental Clearance from Ministry of Environment, Forests and Climate Change (MoEF&CC) for a rated capacity 0.18 MTPA (normative) and 2.34 MTPA (peak) capacity of coal production vide letter no. J-11015/11/2010-IA.II (M) dated 06th June, 2013.

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

•••

CHAPTER – II

WATER QUALITY MONITORING

3.1   Location of sampling sites
(Refer **Plate No. - I**)

i)   Drinking water quality at **Mine Discharge of MURLIDIH 20/21**

3.2   Methodology of sampling and analysis

Water samples were collected as per standard practice. Effluent samples were analyzed for 25 parameters on quarterly basis & for 27 parameters on half yearly basis. The drinking and Surface water samples were collected and analyzed for 25 and 17 parameters respectively, on quarterly basis. Thereafter the samples were preserved and analyzed at the Environmental Laboratory at CMPDI (HQ), Ranchi.

3.3   Results & Interpretations

The results are given in tabular form along with the applicable standards. Results show that most of the parmeters are within the permissible limits.

WATER QUALITY
(EFFFLUENT WATER- 25 PARAMETERS)

Name of the Company: **Bharat Coking Coal Limited**   Year : **2018-19.**

Name of the Cluster : **Cluster -XIII**   PERIOD: **Q. E. MARCH- 2019.**

Type of Sample:	Mine Discharge Water Sample	Name of Mine MURLIDIH 20/21
Testing Protocol:	As per DW Standards (IS- 10500)	Date of Sampling: **11.03.19**

Sl. No	Parameter	Test Result	Detection Limit	Permissible Limit	Method of Testing
1	Boron (as B), mg/l, Max	<0.02	0.02	0.5	APHA, 22nd Edition ,Carmine
2	Colour,in Hazen Units	2	1	5	APHA, 22nd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	34	1.60	75	IS-3025/40:1991, EDTA
4	Chloride (as Cl), mg/l, Max	54	2.00	250	IS-3025/32:1988, R-2007, Argentometric
5	Copper (as Cu), mg/l, Max	<0.03	0.03	0.05	IS 3025/42 : 1992 R : 2009, AAS-Flame
6	Fluoride (as F) mg/l, Max	0.59	0.02	1.0	APHA, 22nd Edition , SPADNS
7	Free Residual Chlorine, mg/l, Min	<0.02	0.02	0.2	APHA, 22nd Edition, DPD
8	Iron (as Fe), mg/l, Max	<0.06	0.06	0.3	IS 3025 /53 : 2003, R : 2009 , AAS-Flame
9	Lead (as Pb), mg/l, Max	<0.005	0.005	0.01	APHA, 22nd Edition, AAS-GTA
10	Manganese (as Mn), mg/l, Max	<0.02	0.02	0.1	IS-3025/59:2006, AAS-Flame
11	Nitrate (as NO_3), mg/l, Max	13.36	0.5	45	APHA, 22nd Edition, UV-Spectrphotometric
12	Odour	Agreeable	Qualitative	Agreeable	IS 3025 /05:1983, R-2012, Qualitative
13	pH value	7.88	2.5	6.5 to 8.5	IS-3025/11:1983, R-1996, Electrometric
14	Phenolic compounds (as C_6H_5OH), mg/l, Max	<0.001	0.001	0.001	APHA, 22nd Edition,4-Amino Autipyrine
15	Selenium (as Se), mg/l, Max	<0.002	0.002	0.01	IS 3025:56:2003, AAS-VGA
16	Sulphate (as SO_4) mg/l, Max	102	2.00	200	APHA, 22nd Edition. Turbidity
17	Taste	Acceptable	Qualitative	Acceptable	APHA, 22nd Edition. Taste
18	Total Alkalinity (c_aco_3),, mg/l, Max	108	4.00	200	IS-3025/23:1986, Titration
19	Total Arsenic (as As), mg/l, Max	<0.002	0.002	0.01	IS 3025/ 37:1988 R : 2003, AAS-VGA
20	Total Chromium (as Cr), mg/l, Max	<0.04	0.04	0.05	IS-3025/52:2003, AAS-Flame
21	Total Dissolved Solids, mg/l, Max	816	25.00	500	IS 3025 /16:1984 R : 2006, Gravimetric
22	Total Hardness (c_aco_3), mg/l, Max	518	4.00	200	IS-3025/21:1983, R-2002, EDTA
23	Turbidity, NTU, Max	1	1.0	1	IS-3025/10:1984 R-1996, Nephelometric
24	Zinc (as Zn), mg/l, Max	<0.01	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame
25	Nickel as Ni, mg/l Max	<0.005	0.005	0.02	IS 3025/ 49 : 1994, R : 2009, AAS-Flame

All values are expressed in mg/lit unless specified.

रुमन सौमेन, रुद्र		२१०७।१९
Analysed By JSA/SA/SSA	**Checked By** Lab In Charge RI-2, CMPDI, Dhanbad	**Approved By** HOD(Mining/Environment) RI-2, CMPDI, Dhanbad

Water Sampling Locations in BCCL

Map showing water sampling locations in Jharia Coalfield, BCCL, with clusters I–XVII marked.

JHARIA COALFIELD

Legend

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

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

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

	BHARAT COKING COAL LIMITED
Title	WATER SAMPLING LOCATIONS
Subject	MONITORING STATIONS
CMPDI	Scale: Not to Scale

Land Restoration / Reclamation Monitoring of Clusters of (Opencast + Underground) Coal Mines of Bharat Coking Coal Limited based on Satellite Data for the Year 2018

Kusunda Colliery

Cluster VII
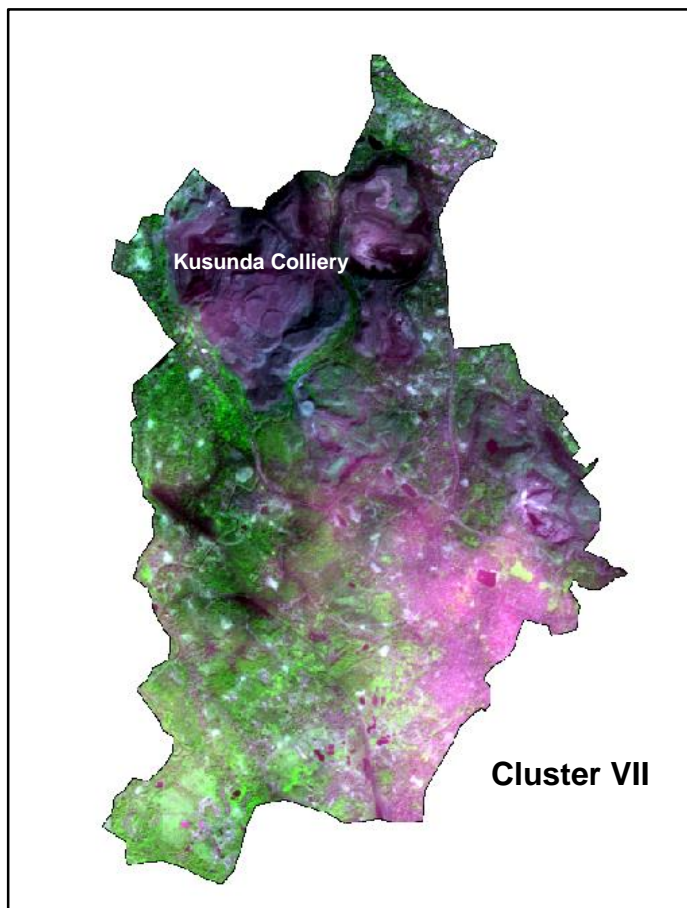
Submitted to

Bharat Coking Coal Limited

cmpdi

A Mini-Ratna Company

Land Restoration / Reclamation Monitoring of Clusters of (Opencast + Underground) Coal Mines of Bharat Coking Coal Limited based on Satellite Data for the Year 2018

March-2019

Remote Sensing Cell
Geomatics Division
CMPDI, Ranchi

CONTENTS

Executive Summary

1.	Project	Land restoration / reclamation monitoring of clusters of (Opencast + Underground) coal mines of Bharat Coking Coal Ltd. (BCCL), based on satellite data, on every three year basis.
2.	Objective	Objective of the land restoration / reclamation monitoring is to assess the area of backfilled, plantation, social forestry, active mining area, water bodies, and distribution of wasteland, agricultural land and forest in the leasehold area of the project. This will help in assessing the progressive status of mined land reclamation and to take up remedial measures, if any, required for environmental protection.

3. Salient Findings

- Four Clusters viz. I, IV, VII, X were selected in 2018-19 for land reclamation/restoration monitoring. These clusters consist of mainly opencast mines.

- Out of the total leasehold area of 5883.96 Ha., total mined out area is only 1075.76 Ha., belonging to the OC mines.

- It is evident from the analysis that 58.11% of excavated area is under technical reclamation and 35.02% of the excavated area is under active mining. Cluster wise details are given in Table-1 & Fig-1.

- 13.61% of total leasehold area has come under plantation (% green cover)

- Study reveals that out of total mine leasehold area of 5883.96 Ha. of the above mentioned 04 nos. clusters of BCCL taken up for the land reclamation monitoring during the year 2018-19; total excavated area is 1075.76 Ha. (18.28%) out of which 73.92 Ha. (6.87%) has been planted *(Biologically Reclaimed)*, 625.15 Ha. (58.11%) is under backfilling *(Technical Reclamation)* and

balance 376.69 Ha. (35.02%) is under active mining

- This report and the findings will act as the basis for further monitoring and reclamation related activities.

- Out of the four clusters of BCCL, maximum land reclamation has been done in Cluster VII (76.09%) followed by Cluster X (71.00%).

Table 1

Land Reclamation Status in Clusters of (Underground + Opencast) Projects of BCCL based on Satellite Data of the Year 2018

(Area in Hectare)

Sl. No.	Cluster No.	Total Leasehold Area	Technical Reclamation — Area under Backfilling	Biological Reclamation — Plantation on Excavated / Backfilled Area	Plantation — Other Plantations — Plantation on External Over Burden Dumps	Other Plantations — Social Forestry, Avanue Plantation Etc.	Area under Active Mining	Total Excavated Area	Total Area under Plantation (% Green Cover)	Total Area under Reclamation
1	2	3	4	5	6	7	8	9 (=4+5+8)	10 (=5+6+7)	11(=4+5)
1	Cluster I	575.00	10.11	7.29	47.99	25.53	28.39	45.78	80.80	17.40
			22.08%	15.91%			62.00%		14.05%	38.00%
2	Cluster IV	1123.79	147.22	0.00	27.11	165.09	166.67	313.88	192.20	147.22
			46.90%	0.00%			53.10%		17.10%	46.90%
3	Cluster VII	2127.70	351.54	37.47	15.52	238.67	122.23	511.24	291.67	389.01
			68.76%	7.33%			23.91%		13.71%	76.09%
4	Cluster X	2057.47	116.28	29.16	66.09	140.75	59.41	204.86	236.00	145.44
			56.76%	14.23%			29.00%		11.47%	71.00%
	TOTAL	**5883.96**	**625.15**	**73.92**	**156.71**	**570.04**	**376.69**	**1075.76**	**800.66**	**699.07**
			58.11%	6.87%			35.02%	18.28%	13.61%	64.98%

(% is calculated with respect to Excavated Area as applicable)

Note: In reference of the above Table, different parameters are classified as follows:

1. Area under Biological Reclamation includes Areas under Plantation done on Backfilled Area Only.
2. Area under Technical Reclamation includes Area under Barren Backfilling only
3. Area under Active Mining Includes Coal Quarry, Advance Quarry Site and Quarry filled with water etc., if any.
4. Social Forestry and Plantation on External OB Dumps are not included in Biological Reclamation and are put under separate categories as shown in the above Table.
5. (%) calculated in the above Table is in respect to Total Excavated Area except for ""Total Area under Plantation"" where % is in terms of "Leasehold Area"'.
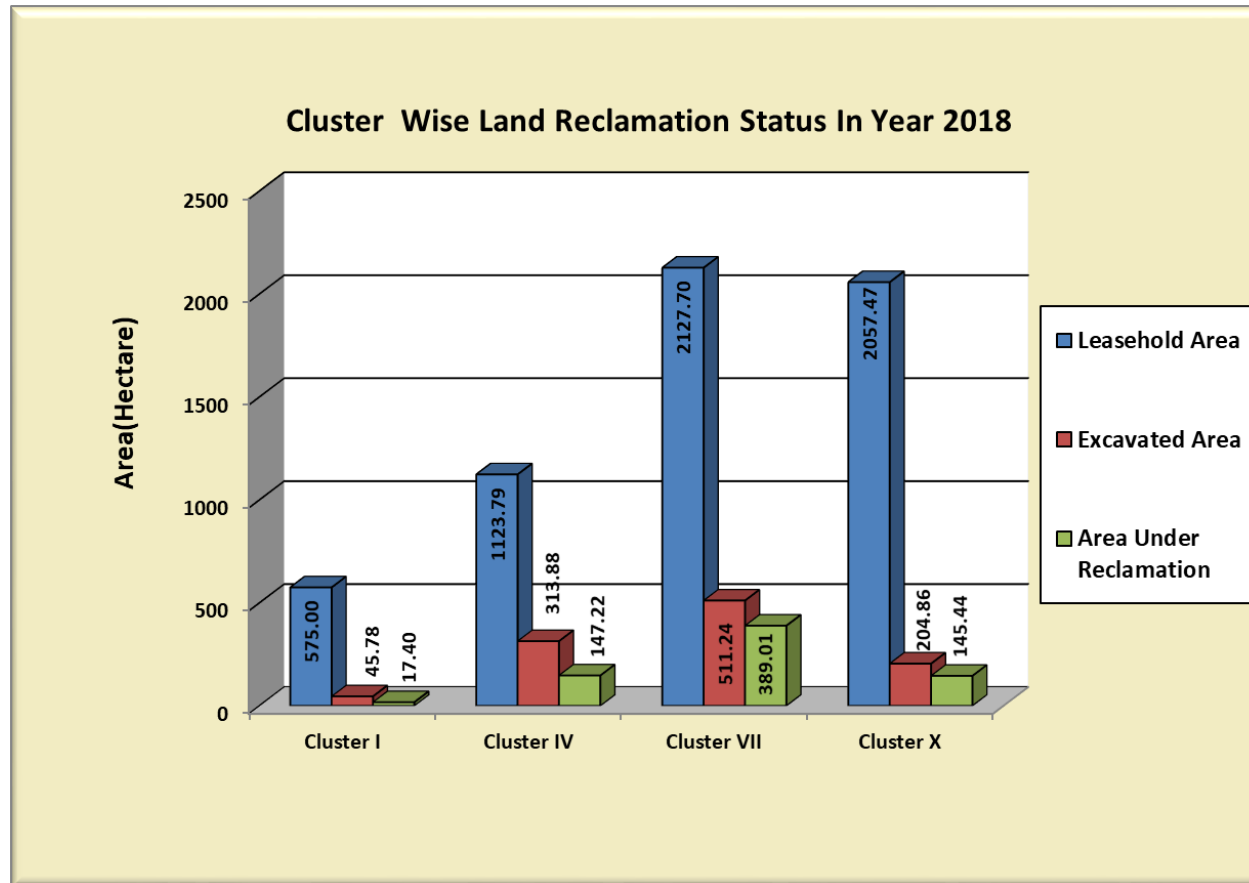
Fig. 1: Cluster wise Land Reclamation Status-2018 (BCCL)

1. Background

1.1 Land is the most important natural resource which embodies soil, water, flora, fauna and total ecosystem. All human activities are based on the land which is the scarcest natural resource in our country. Mining is a site specific industry and it could not be shifted anywhere else from the location where mineral occurs. It is a fact that surface mining activities do affect the land environment due to ground breaking. Therefore, there is an urgent need to reclaim and restore the mined out land for its productive use for sustainable development of mining. This will not only mitigate environmental degradation, but would also help in creating a more congenial environment for land acquisition by coal companies in future.

1.2 Keeping above in view, Coal India Ltd. (CIL) issued a work order vide letter no. CIL/WBP/ENV/2017/DP/8391 dated 22.06.2017 to Central Mine Planning & Design Institute (CMPDI), Ranchi, for monitoring of clusters with coal mines (both underground and open cast projects) having less than 5 million m^3 per annum capacity (Coal +OB) at an interval of three years based on remote sensing satellite data for sustainable development of mining. Earlier, CMPDI used to carry out land reclamation monitoring for individual projects of less than 5 million capacity, but from 2018 the same will be carried out cluster wise for mines of ECL & BCCL. For operational reasons and convenience, underground and opencast mines (often with multiple overlapping seams), have now been clustered together. The result of land reclamation status of all such mines are hosted on the website of CIL, (www.coalindia.in), CMPDI (www.cmpdi.co.in) and the concerned coal companies in public domain. Detailed report is submitted to Coal India and respective subsidiaries.

1.3 Land reclamation monitoring of all cluster coal mining projects would also comply the statutory requirements of Ministry of Environment & Forest (MoEF). Such monitoring would not only facilitate in taking timely mitigation measures against environmental degradation, but would also enable coal companies to utilize the reclaimed land for larger socio-economic benefits in a planned way.

1.4 Present report is embodying the finding of the study based on satellite data of the year 2018 carried out for four clusters of mines comprising both underground and OC projects for Bharat Coking Coal Ltd.

2. Objective

Objective of the land reclamation/restoration monitoring is to assess the area of backfilled, plantation, OB dumps, social forestry, active mining area, settlements and water bodies, distribution of wasteland, agricultural land and forest land in the leasehold area of the project. This is an important step taken up for assessing the progressive status of mined land reclamation and for taking up remedial measures, if any, required for environmental protection.

3. Methodology

There are number of steps involved between raw satellite data procurement and preparation of final map. National Remote Sensing Centre (NRSC) Hyderabad, being the nodal agency for satellite data supply in India, provides only raw digital satellite data, which needs further digital image processing for extracting the information and map preparation before uploading the same in the website. Methodology for land reclamation monitoring is given in fig 2. Following steps are involved in land reclamation /restoration monitoring:
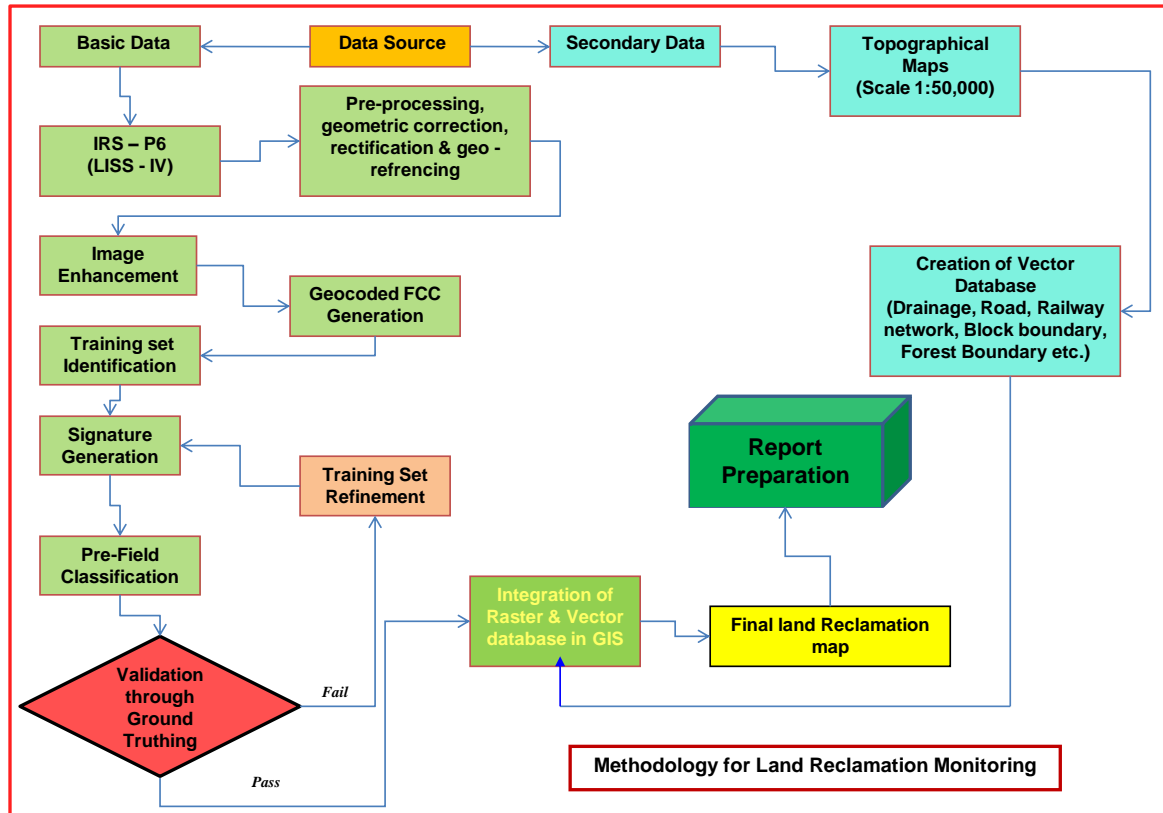
Fig. 2: Methodology of Land Reclamation Monitoring

3.1   Data Procurement: After browsing the data quality and date of pass on internet, supply order for data is placed to NRSC. Secondary data like leasehold boundary, toposheet are procured for creation of vector database.

3.2   Satellite Data Processing: Satellite data are processed using ERDAS IMAGINE digital image processing s/w. Methodology involves the following major steps:

- **Rectification & Geo-referencing:** Inaccuracies in digital imagery may occur due to 'systematic errors' attributed to earth curvature and rotation as well as 'non-systematic errors' attributed to satellite receiving station itself. Raw digital images contain geometric distortions, which make them

unusable as maps. Therefore, geo-referencing is required for correction of image data using ground control points (GCP) to make it compatible to SoI toposheet.

- **Image enhancement:**

  To improve the interpretability of the raw data, image enhancement is necessary. Local operations modify the value of each pixel based on brightness value of neighbouring pixels using ERDAS IMAGINE 14.0 s/w. and enhance the image quality for interpretation.

- **Training set selection**

  Training set requires to be selected, so that software can classify the image data accurately. The image data are analysed based on the interpretation keys. These keys are evolved from certain fundamental image-elements such as tone/colour, size, shape, texture, pattern, location, association and shadow. Based on the image-elements and other geo-technical elements like land form, drainage pattern and physiography; training sets were selected/identified for each land use/cover class. Field survey was carried out by taking selective traverses in order to collect the ground information (or reference data) so that training sets are selected accurately in the image. This was intended to serve as an aid for classification.

- **Classification and Accuracy assessment**

  Image classification is carried out using the maximum likelihood algorithm. The classification proceeds through the following steps: (a) calculation of statistics [i.e. signature generation] for the identified training areas, and (b) the decision boundary of maximum probability based on the mean vector, variance, covariance and correlation matrix of the pixels. After evaluating the statistical parameters of the training sets, reliability test of training sets is conducted by measuring the statistical separation between

the classes that resulted from computing divergence matrix. The overall accuracy of the classification was finally assessed with reference to ground truth data.

- **Area calculation**

  The area of each land use class in the leasehold is determined using ERDAS IMAGINE v. 14.0 s/w.

- **Overlay of Vector data base**

  Vector data base is created based on secondary data. Vector layer like drainage, railway line, leasehold boundary, forest boundary etc. are superimposed on the image as vector layer in the Arc GIS database.

- **Pre-field map preparation**

  Pre-field map is prepared for validation of the classification result

3.3 Ground Truthing:

Selective ground verification of the land use classes   are carried out in the field and necessary corrections if required, are incorporated before map finalization.

3.4 Land reclamation database on GIS:

Land reclamation database is created on GIS platform to identify the temporal changes identified from satellite data of different cut - of dates.

4. Land Reclamation Status in Bharat Coking Coal Ltd.

4.1 In BCCL, a total of twelve clusters of mines are selected for land reclamation monitoring. Following four clusters of mines comprising both underground and OC projects of Bharat Coking Coal Ltd. have been taken up for land reclamation monitoring in 2018.

- Cluster I (Damoda OCP)
- Cluster IV (Salanpur Colliery, Katras Choitudih Colliery, Gaslitand Colliery, Amalgamated Keshalpur West Mudidih Colliery, Angarpathra Colliery & Ramkanali Colliery)
- Cluster VII (Amalgamated East Bhuggatdih Simlabahal Colliery, Ena OC, Vishwakarma OCP, Kustore OCP)
- Cluster X (Bhowrah North, Bhowrah South, Patherdih)

4.2 All the four above clusters, have been mapped during the year 2018 for assessing the progress of land reclamation.

4.3 Area statistics of different land use classes present in OC projects till the year 2018 is given in Table 2. Land use maps derived from the satellite data are given in Plate nos.1, 2, 3 & 4. The land use status are shown in Fig. 3, 4, 5 & 6.
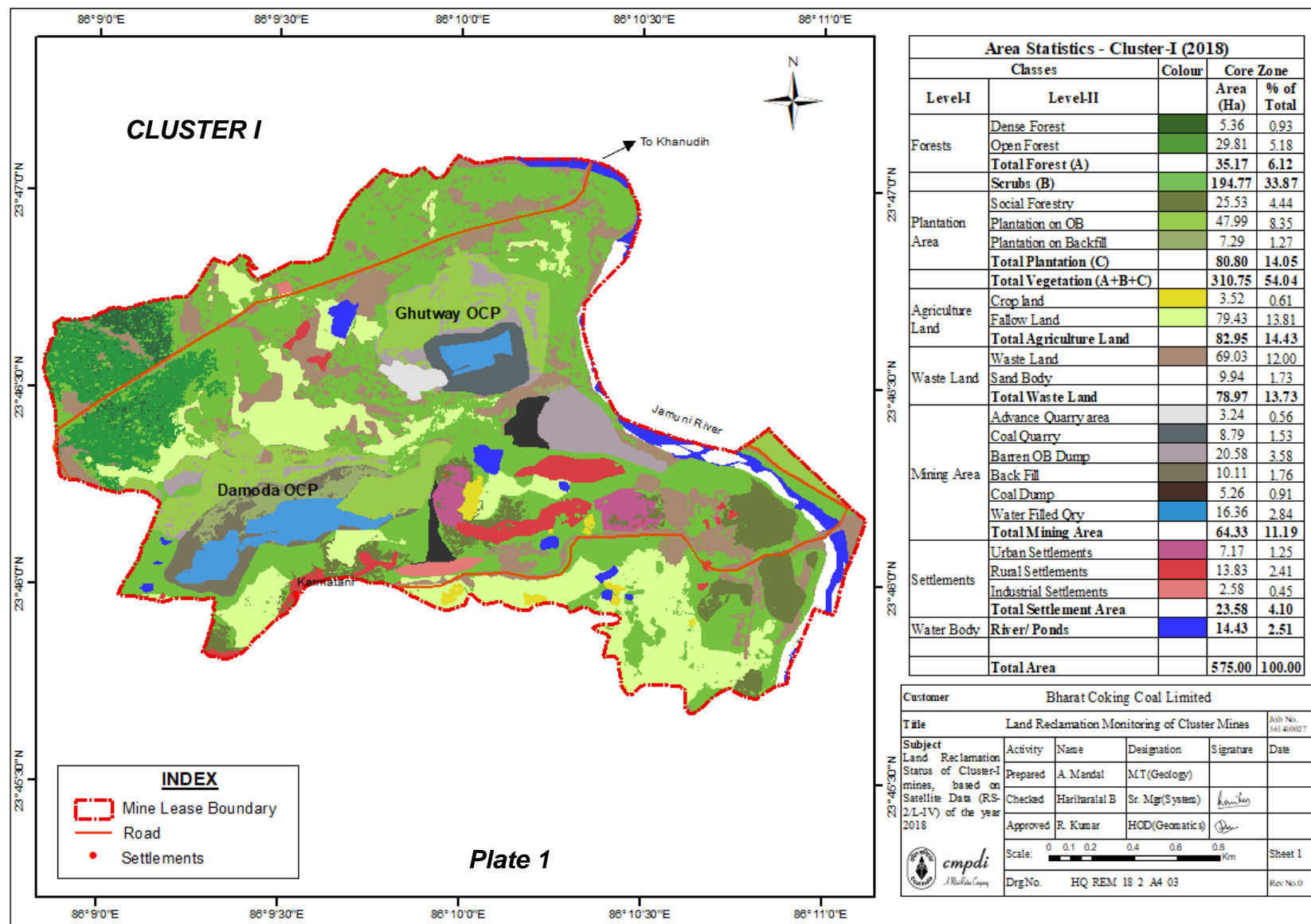
4.4 Study reveals that majority of the mines under the clusters considered for monitoring are of opencast type. 35.02% of excavated area is under active mining in the opencast mines. 58.11% of the excavated area have come under technical reclamation till 2018
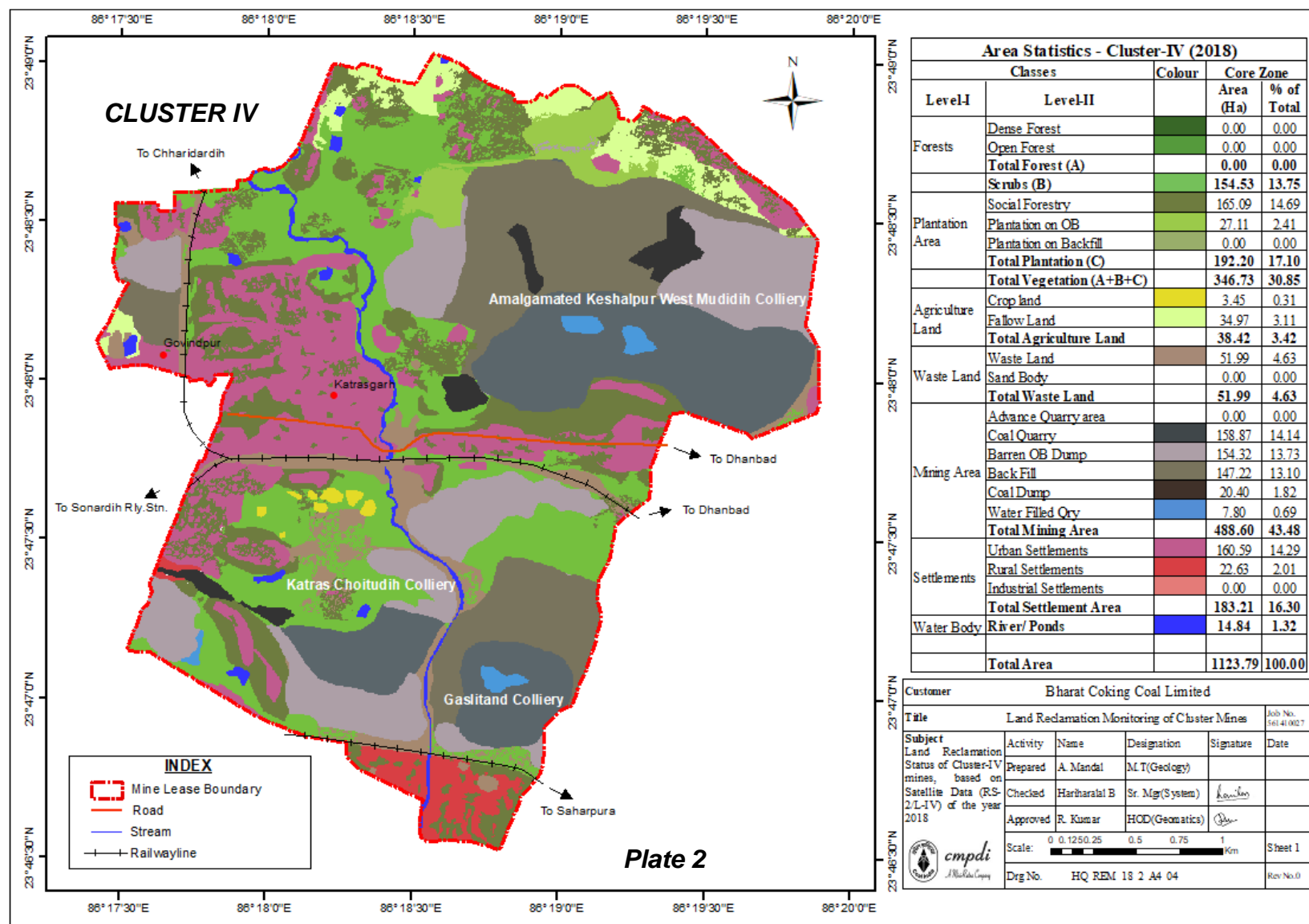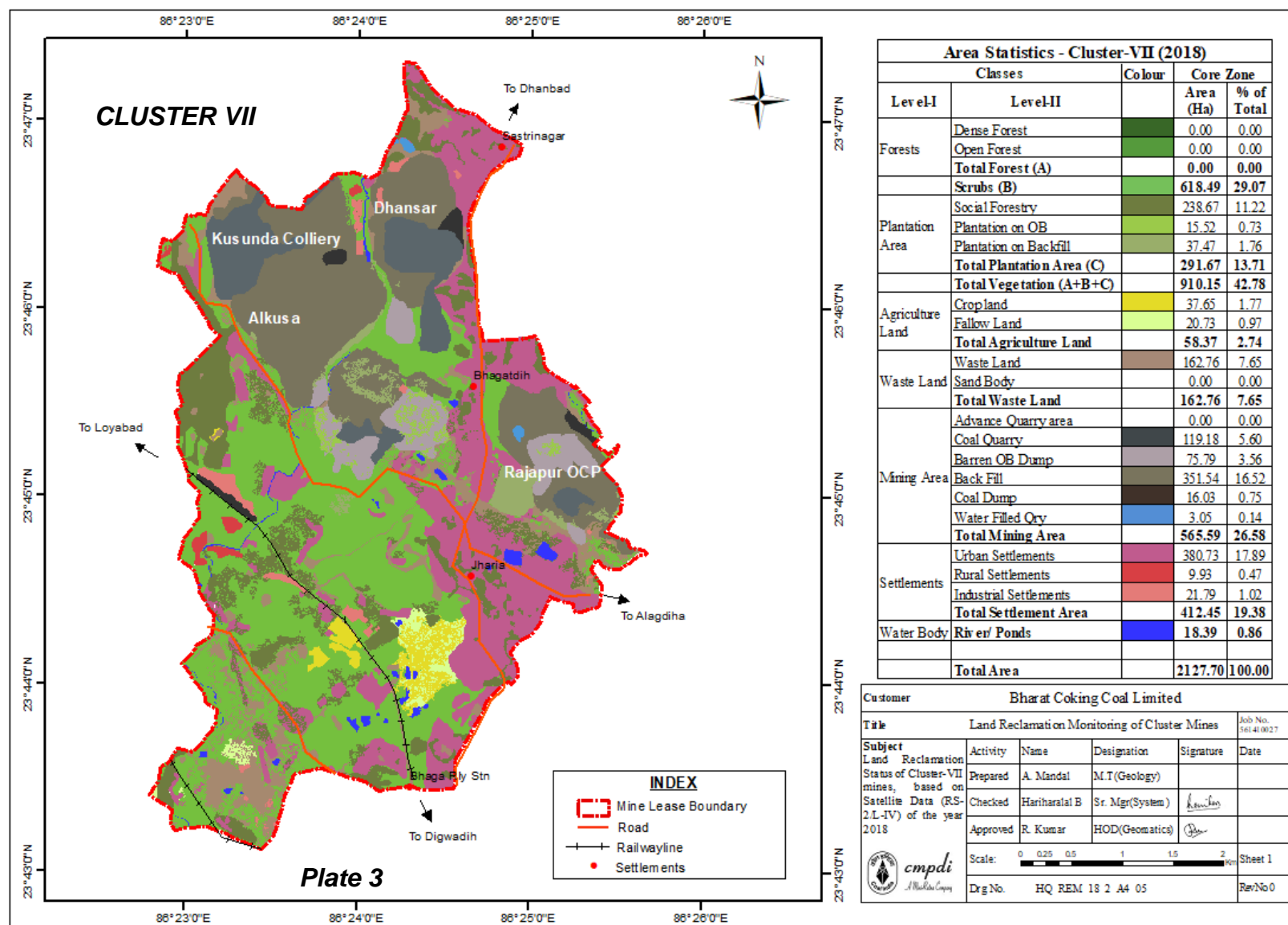
Table 2

Status of Land Use/Reclamation Status in Clusters of (OC + Underground) mines of Bharat Coking Coal Limited based on Satellite Data of the year 2018
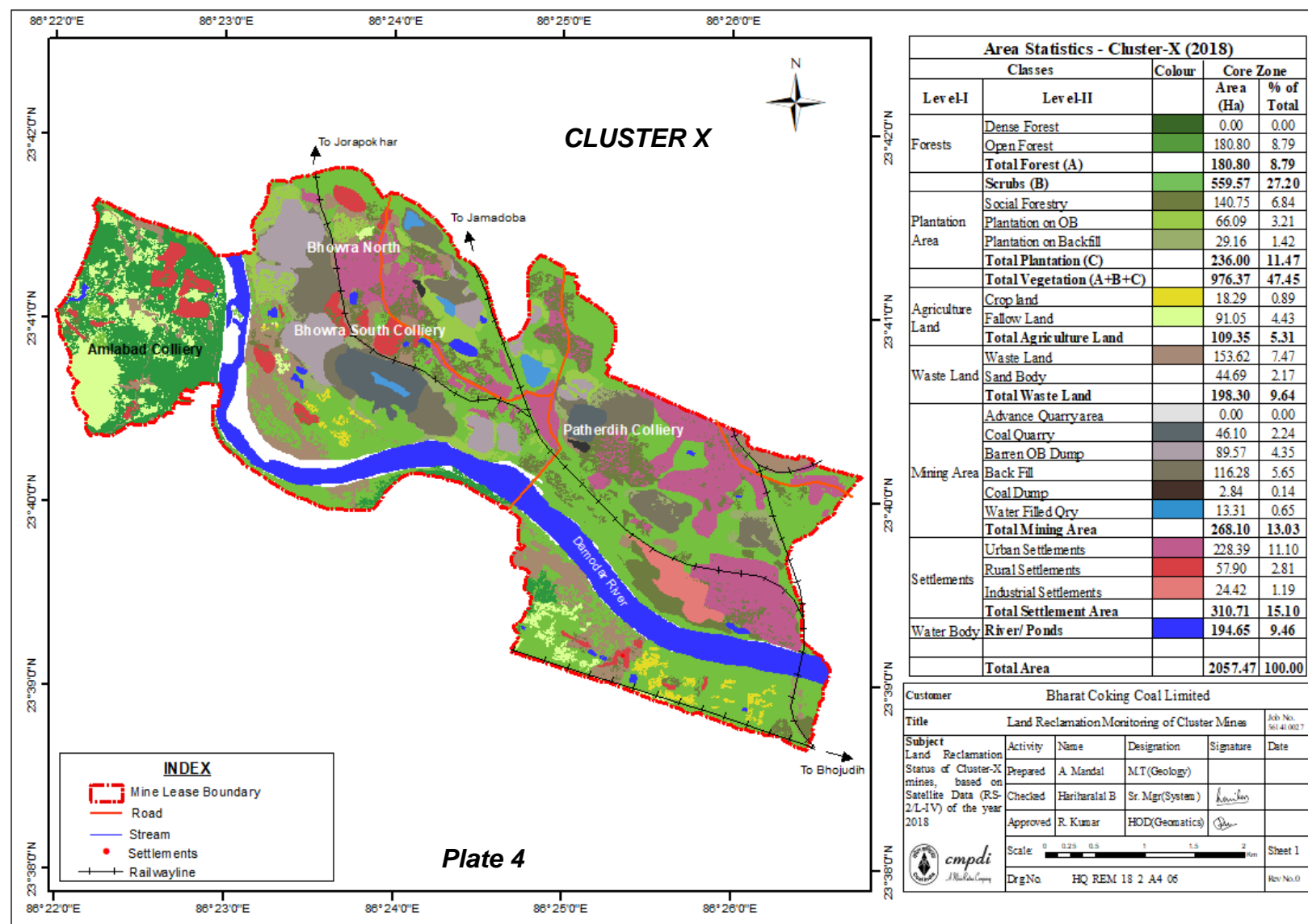
(Area in Hectare)

		CLUSTER I Area	CLUSTER I %	CLUSTER IV Area	CLUSTER IV %	CLUSTER VII Area	CLUSTER VII %	CLUSTER X Area	CLUSTER X %	TOTAL Area	TOTAL %
FORESTS	Dense Forest	5.36	0.93	0.00	0.00	0.00	0.00	0.00	0.00	5.36	0.09
FORESTS	Open Forest	29.81	5.18	0.00	0.00	0.00	0.00	180.80	8.79	210.61	3.58
FORESTS	**Total Forest**	**35.17**	**6.12**	**0.00**	**0.00**	**0.00**	**0.00**	**180.80**	**8.79**	**215.97**	**3.67**
SCRUBS	Scrubs	194.77	33.87	154.53	13.75	618.49	29.07	559.57	27.20	1527.35	25.96
PLANTATION	Social Forestry/Avenue Plantation	25.53	4.44	165.09	14.69	238.67	11.22	140.75	6.84	570.04	9.69
PLANTATION	Plantation on OB Dump	47.99	8.35	27.11	2.41	15.52	0.73	66.09	3.21	156.71	2.66
PLANTATION	Plantation on Backfill (Biological Reclamation)	7.29	1.27	0.00	0.00	37.47	1.76	29.16	1.42	73.92	1.26
PLANTATION	*Total Plantation*	80.80	14.05	192.20	17.10	291.67	13.71	236.00	11.47	800.66	13.61
	Total Vegetation	**310.75**	**54.04**	**346.73**	**30.85**	**910.15**	**42.78**	**976.37**	**47.45**	**2543.99**	**43.24**
ACTIVE MINING	Coal Dump	5.26	0.91	20.40	1.82	16.03	0.75	2.84	0.14	44.53	0.76
ACTIVE MINING	Coal Quarry	8.79	1.53	158.87	14.14	119.18	5.60	46.10	2.24	332.94	5.66
ACTIVE MINING	Advance Quarry Site	3.24	0.56	0.00	0.00	0.00	0.00	0.00	0.00	3.24	0.06
ACTIVE MINING	Quarry Filled With Water	16.36	2.84	7.80	0.69	3.05	0.14	13.31	0.65	40.52	0.69
ACTIVE MINING	**Total Area under *Active Mining***	**28.39**	**4.93**	**166.67**	**14.83**	**122.23**	**5.74**	**59.41**	**2.89**	**376.69**	**6.40**
RECLAIMED	Barren OB Dump	20.58	3.58	154.32	13.73	75.79	3.56	89.57	4.35	340.25	5.78
RECLAIMED	Area Under Backfilling (Technical Reclamation)	10.11	1.76	147.22	13.10	351.54	16.52	116.28	5.65	625.15	10.62
RECLAIMED	**Total Area under *Technical Reclamation***	**10.11**	**1.76**	**147.22**	**13.10**	**351.54**	**16.52**	**116.28**	**5.65**	**625.15**	**10.62**
	Total Area under Mine Operation	**64.33**	**11.19**	**488.60**	**43.48**	**565.59**	**26.58**	**268.10**	**13.03**	**1386.62**	**23.57**
WASTELAND	Waste Lands	69.03	12.00	51.99	4.63	162.76	7.65	153.62	7.47	437.40	7.43
WASTELAND	Fly Ash Pond / Sand Body	9.94	1.73	0.00	0.00	0.00	0.00	44.69	2.17	54.63	0.93
WASTELAND	**Total Wasteland**	**78.97**	**13.73**	**51.99**	**4.63**	**162.76**	**7.65**	**198.30**	**9.64**	**492.02**	**8.36**
WATERBODIES	Reservoir, nallah, ponds	14.43	2.51	14.84	1.32	18.39	0.86	194.65	9.46	242.30	4.12
WATERBODIES	**Total Waterbodies**	**14.43**	**2.51**	**14.84**	**1.32**	**18.39**	**0.86**	**194.65**	**9.46**	**242.30**	**4.12**
AGRICULTURE	Crop Lands	3.52	0.61	3.45	0.31	37.65	1.77	18.29	0.89	62.91	1.07
AGRICULTURE	Fallow Lands	79.43	13.81	34.97	3.11	20.73	0.97	91.05	4.43	226.18	3.84
AGRICULTURE	**Total Agriculture**	**82.95**	**14.43**	**38.42**	**3.42**	**58.37**	**2.74**	**109.35**	**5.31**	**289.09**	**4.91**
SETTLEMENTS	Urban Settlement	7.17	1.25	160.59	14.29	380.73	17.89	228.39	11.10	776.88	13.20
SETTLEMENTS	Rural Settlement	13.83	2.41	22.63	2.01	9.93	0.47	57.90	2.81	104.29	1.77
SETTLEMENTS	Industrial Settlement	2.58	0.45	0.00	0.00	21.79	1.02	24.42	1.19	48.80	0.83
SETTLEMENTS	**Total Settlement**	**23.58**	**4.10**	**183.21**	**16.30**	**412.45**	**19.38**	**310.71**	**15.10**	**929.96**	**15.80**
	Grand Total	**575.00**	**100.00**	**1123.79**	**100.00**	**2127.70**	**100.00**	**2057.47**	**100.00**	**5883.96**	**100.00**

CLUSTER I

To Khanudih

Ghutway OCP

Jamuni River

Damoda OCP

Karmatanh

INDEX

- Mine Lease Boundary
- Road
- Settlements

Plate 1

Area Statistics - Cluster-I (2018)

Classes		Colour	Core Zone	
Level-I	Level-II		Area (Ha)	% of Total
Forests	Dense Forest		5.36	0.93
	Open Forest		29.81	5.18
	Total Forest (A)		**35.17**	**6.12**
	Scrubs (B)		**194.77**	**33.87**
Plantation Area	Social Forestry		25.53	4.44
	Plantation on OB		47.99	8.35
	Plantation on Backfill		7.29	1.27
	Total Plantation (C)		**80.80**	**14.05**
	Total Vegetation (A+B+C)		**310.75**	**54.04**
Agriculture Land	Crop land		3.52	0.61
	Fallow Land		79.43	13.81
	Total Agriculture Land		**82.95**	**14.43**
Waste Land	Waste Land		69.03	12.00
	Sand Body		9.94	1.73
	Total Waste Land		**78.97**	**13.73**
Mining Area	Advance Quarry area		3.24	0.56
	Coal Quarry		8.79	1.53
	Barren OB Dump		20.58	3.58
	Back Fill		10.11	1.76
	Coal Dump		5.26	0.91
	Water Filled Qry		16.36	2.84
	Total Mining Area		**64.33**	**11.19**
Settlements	Urban Settlements		7.17	1.25
	Rural Settlements		13.83	2.41
	Industrial Settlements		2.58	0.45
	Total Settlement Area		**23.58**	**4.10**
Water Body	River/ Ponds		14.43	2.51
	Total Area		**575.00**	**100.00**

Customer	Bharat Coking Coal Limited				
Title	Land Reclamation Monitoring of Cluster Mines				Job No. 561410027
Subject Land Reclamation Status of Cluster-I mines, based on Satellite Data (RS-2/L-IV) of the year 2018	Activity	Name	Designation	Signature	Date
	Prepared	A. Mandal	M.T (Geology)		
	Checked	Hariharalal B	Sr. Mgr (System)		
	Approved	R. Kumar	HOD (Geomatics)		
cmpdi A Miniratna Company	Scale: 0 0.1 0.2 0.4 0.6 0.8 Km				Sheet 1
	DrgNo. HQ REM 18 2 A4 03				Rev No.0

CLUSTER IV

Plate 2

Area Statistics - Cluster-IV (2018)

Level-I	Level-II	Colour	Core Zone Area (Ha)	% of Total
Forests	Dense Forest		0.00	0.00
	Open Forest		0.00	0.00
	Total Forest (A)		0.00	0.00
	Scrubs (B)		154.53	13.75
Plantation Area	Social Forestry		165.09	14.69
	Plantation on OB		27.11	2.41
	Plantation on Backfill		0.00	0.00
	Total Plantation (C)		192.20	17.10
	Total Vegetation (A+B+C)		346.73	30.85
Agriculture Land	Crop land		3.45	0.31
	Fallow Land		34.97	3.11
	Total Agriculture Land		38.42	3.42
Waste Land	Waste Land		51.99	4.63
	Sand Body		0.00	0.00
	Total Waste Land		51.99	4.63
Mining Area	Advance Quarry area		0.00	0.00
	Coal Quarry		158.87	14.14
	Barren OB Dump		154.32	13.73
	Back Fill		147.22	13.10
	Coal Dump		20.40	1.82
	Water Filled Qry		7.80	0.69
	Total Mining Area		488.60	43.48
Settlements	Urban Settlements		160.59	14.29
	Rural Settlements		22.63	2.01
	Industrial Settlements		0.00	0.00
	Total Settlement Area		183.21	16.30
Water Body	River/ Ponds		14.84	1.32
	Total Area		1123.79	100.00

Customer	Bharat Coking Coal Limited				
Title	Land Reclamation Monitoring of Cluster Mines				Job No. 561410027
Subject Land Reclamation Status of Cluster-IV mines, based on Satellite Data (RS-2/L-IV) of the year 2018	Activity	Name	Designation	Signature	Date
	Prepared	A. Mandal	M T(Geology)		
	Checked	Hariharalal B	Sr. Mgr(System)		
	Approved	R. Kumar	HOD(Geomatics)		
	Scale: 0 0.125 0.25 0.5 0.75 1 Km				Sheet 1
	Drg No. HQ REM 18 2 A4 04				Rev No.0

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- Road
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- Railwayline

To Chharidardih
To Sonardih Rly. Stn.
To Dhanbad
To Dhanbad
To Saharpura

Govindpur
Katrasgarh
Amalgamated Keshalpur West Mudidih Colliery
Katras Choitudih Colliery
Gaslitand Colliery

cmpdi
A Miniratna Company

CLUSTER VII

To Dhanbad

Sastrinagar

Dhansar

Kusunda Colliery

Alkusa

To Loyabad

Bhagatdih

Rajapur OCP

Jharia

To Alagdiha

Bhaga Rly Stn

To Digwadih

Plate 3

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Mine Lease Boundary
Road
Railwayline
Settlements

Area Statistics - Cluster-VII (2018)				
Classes		Colour	Core Zone	
Level-I	Level-II		Area (Ha)	% of Total
Forests	Dense Forest		0.00	0.00
	Open Forest		0.00	0.00
	Total Forest (A)		**0.00**	**0.00**
	Scrubs (B)		**618.49**	**29.07**
Plantation Area	Social Forestry		238.67	11.22
	Plantation on OB		15.52	0.73
	Plantation on Backfill		37.47	1.76
	Total Plantation Area (C)		**291.67**	**13.71**
	Total Vegetation (A+B+C)		**910.15**	**42.78**
Agriculture Land	Cropland		37.65	1.77
	Fallow Land		20.73	0.97
	Total Agriculture Land		**58.37**	**2.74**
Waste Land	Waste Land		162.76	7.65
	Sand Body		0.00	0.00
	Total Waste Land		**162.76**	**7.65**
Mining Area	Advance Quarry area		0.00	0.00
	Coal Quarry		119.18	5.60
	Barren OB Dump		75.79	3.56
	Back Fill		351.54	16.52
	Coal Dump		16.03	0.75
	Water Filled Qry		3.05	0.14
	Total Mining Area		**565.59**	**26.58**
Settlements	Urban Settlements		380.73	17.89
	Rural Settlements		9.93	0.47
	Industrial Settlements		21.79	1.02
	Total Settlement Area		**412.45**	**19.38**
Water Body	River/ Ponds		18.39	0.86
	Total Area		**2127.70**	**100.00**

Customer	Bharat Coking Coal Limited				
Title	Land Reclamation Monitoring of Cluster Mines				Job No. 561410027
Subject Land Reclamation Status of Cluster-VII mines, based on Satellite Data (RS-2/L-IV) of the year 2018	Activity	Name	Designation	Signature	Date
	Prepared	A. Mandal	M.T(Geology)		
	Checked	Hariharalal B	Sr. Mgr(System)		
	Approved	R. Kumar	HOD(Geomatics)		
	Scale: 0 0.25 0.5 1 1.5 2 km				Sheet 1
cmpdi A Miniratna Company	Drg No. HQ REM 18 2 A4 05				RevNo 0

CLUSTER X

| Area Statistics - Cluster-X (2018) |
| Classes | | Colour | Core Zone | |
Level-I	Level-II		Area (Ha)	% of Total
Forests	Dense Forest		0.00	0.00
	Open Forest		180.80	8.79
	Total Forest (A)		180.80	8.79
	Scrubs (B)		559.57	27.20
Plantation Area	Social Forestry		140.75	6.84
	Plantation on OB		66.09	3.21
	Plantation on Backfill		29.16	1.42
	Total Plantation (C)		236.00	11.47
	Total Vegetation (A+B+C)		976.37	47.45
Agriculture Land	Crop land		18.29	0.89
	Fallow Land		91.05	4.43
	Total Agriculture Land		109.35	5.31
Waste Land	Waste Land		153.62	7.47
	Sand Body		44.69	2.17
	Total Waste Land		198.30	9.64
Mining Area	Advance Quarry area		0.00	0.00
	Coal Quarry		46.10	2.24
	Barren OB Dump		89.57	4.35
	Back Fill		116.28	5.65
	Coal Dump		2.84	0.14
	Water Filled Qry		13.31	0.65
	Total Mining Area		268.10	13.03
Settlements	Urban Settlements		228.39	11.10
	Rural Settlements		57.90	2.81
	Industrial Settlements		24.42	1.19
	Total Settlement Area		310.71	15.10
Water Body	River/ Ponds		194.65	9.46
	Total Area		2057.47	100.00

Customer: Bharat Coking Coal Limited
Title: Land Reclamation Monitoring of Cluster Mines
Job No. 561410027

Subject: Land Reclamation Status of Cluster-X mines, based on Satellite Data (RS-2/L-IV) of the year 2018

Activity	Name	Designation	Signature	Date
Prepared	A. Mandal	M.T (Geology)		
Checked	Hariharalal B	Sr. Mgr(System)		
Approved	R. Kumar	HOD(Geomatics)		

cmpdi A MiniRatna Company

Scale: 0 0.25 0.5 1 1.5 2 Km Sheet 1
Drg No. HQ REM 18 2 A4 06 Rev No.0

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- Road
- Stream
- Settlements
- Railwayline

Plate 4

Fig. 3: Land Reclamation status of Cluster I

Fig. 4: Land Reclamation status of Cluster IV

Fig. 5: Land Reclamation status of Cluster VII

Fig. 6: Land Reclamation status of Cluster X

23°46'50", 86°9'59", 139.0m, 230°
13/12/2018 10:30:51 AM

Photo 1: Ecological Restoration Site, Damoda Colliery, Cluster I

23°48'43", 86°18'34", 145.2m, 295°

Photo 2: Ecological Restoration Site in Cluster IV

Photo 3: Ecological Restoration Site in Cluster VII

Photo 4: Plantation on OB in Cluster X

BHARAT COKING COAL LIMITED
(A Subsidiary of Coal India Limited – A Maharatna Company)

CORPORATE ENVIRONMENTAL POLICY

Bharat Coking Coal Limited (BCCL), a subsidiary of Coal India Limited, is a Public Sector Undertaking engaged in mining of coal and allied activities. It is the only producer of Prime Coking Coal in India. BCCL was incorporated in 1972 to operate coking coal mines operating in the Jharia and Raniganj Coalfields. Currently, the Company operates 66 coal mines and 8 Coal Washeries.

Our mission is to produce the planned quantity of coal efficiently and economically with due regard to safety, conservation and quality. BCCL affirms its commitment for environment friendly mining with right mitigation of pollution, reclamation of the degraded land, preservation of biodiversity and proper disposal of waste following the best environmental practices including judicious use of the non-renewable energy on the path of continual improvement. Towards this commitment, BCCL shall endeavor to:

❖ Conduct mining and associated operations in an environmentally responsible manner to comply with applicable laws and other requirements related to environmental aspects.

❖ Design projects with due consideration of Sustainable Development by integrating sound environmental management practices in all our activities.

❖ Prevent pollution of surrounding habitation by continuous monitoring and adopting suitable measures for environment protection.

❖ Ensure compliance of all applicable Environmental and Forest Clearance conditions and other statutory conditions issued by regulatory agencies.

❖ Implement the Environmental Management Plans in all our mines effectively to mitigate pollutions on air, water and noise; proper disposal of wastes and reclamation and ecological restoration of degraded land; and by also dovetailing the Jharia action/ Master Plan for dealing with Fires, Subsidence and Rehabilitation of affected people with the Environmental Management Plans under the Cluster Concept.

❖ Strive to conserve Bio-Diversity through Ecological restoration methods.

❖ Conserve natural resources through recycling of wastes on the principle of Reduce, Recycle and Reuse. Put special thrusts on efficient energy utilization as a measure to reduce carbon foot-print.

❖ Strive for continual improvement in our environmental performances by setting targets, measuring progress and taking corrective action.

❖ Create environmental awareness among the employees and the local communities through pro-active communication and training and encourage our business associates to adopt similar approach for environmental protection.

Place: Dhanbad
Date: 25.5.12

Chairman-cum-Managing Director

Chairman-cum-Mg. Director
BHARAT COKING COAL LIMITED
Koyla Bhawan, Dhanbad-826 005

A. Training from April '19 to Sept'19

No of employees (Departmental & Contractual) received training in cluster XIII (April' 19 to Sept'19)	
Type of Training	Number
Refresher Training	18

A. PME from April '19 to Sept'19

No of employees PME in cluster XIII (April' 19 to Sept'19)	
PME	Number
Lohapatti colliery	38

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

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

PROJECT TEAM

1. **Dr. K VINOD KUMAR**, Group Head, Geosciences Group

   Project formulation and coordination

2. **Dr. Tapas R. Martha**, Scientist 'SF'

   Field survey and report preparation

3. **Shri Priyom Roy,** Scientist 'SD'

   Image processing, interpretation, field survey, maps and report preparation

CONTENTS

ACKNOWLEDGEMENTS

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.

LIST OF FIGURES AND TABLES

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List of Tables

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.

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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.
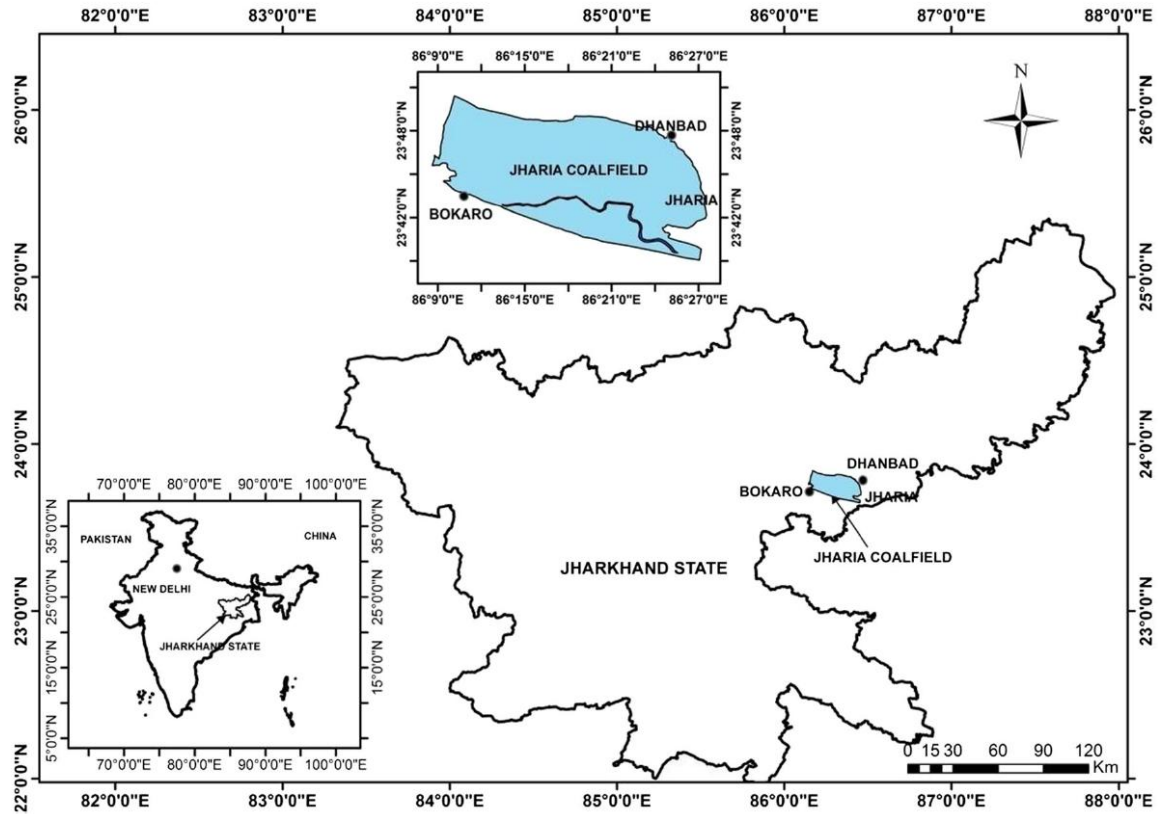

Figure 1: Study area map of Jharia Coalfied, Jharkhand

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

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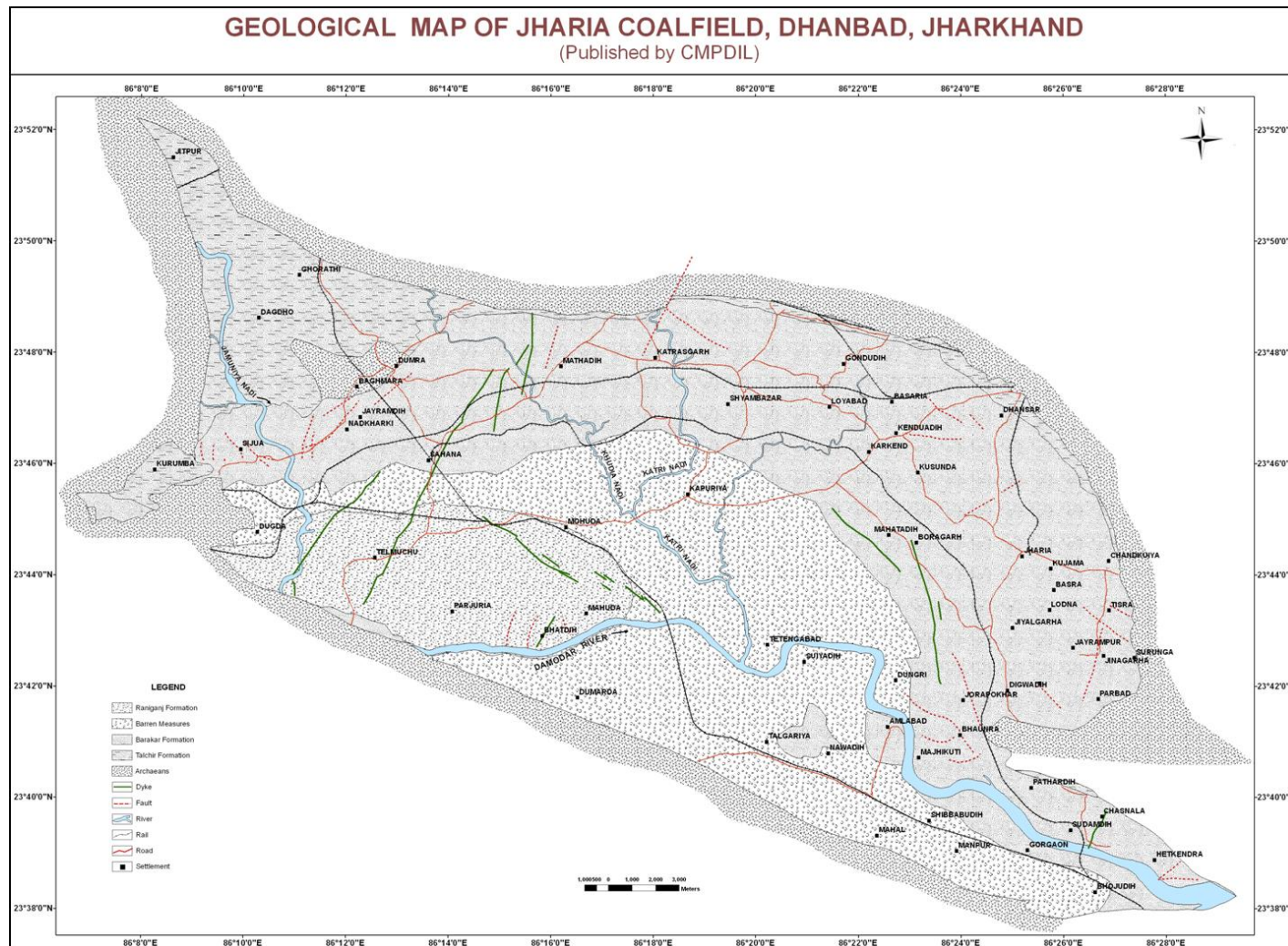
Figure 2 : Geological map of Jharia coal field, Dhanbad, Jharkhand (published by CMPIDL)

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.

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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.

$$L_\lambda = M_L Q_{cal} + A_L \dots\dots (1)$$

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 ($L\lambda$) 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).

$$T_R = K_2 / \ln((K_1 / L_\lambda) + 1) \dots\dots (2)$$

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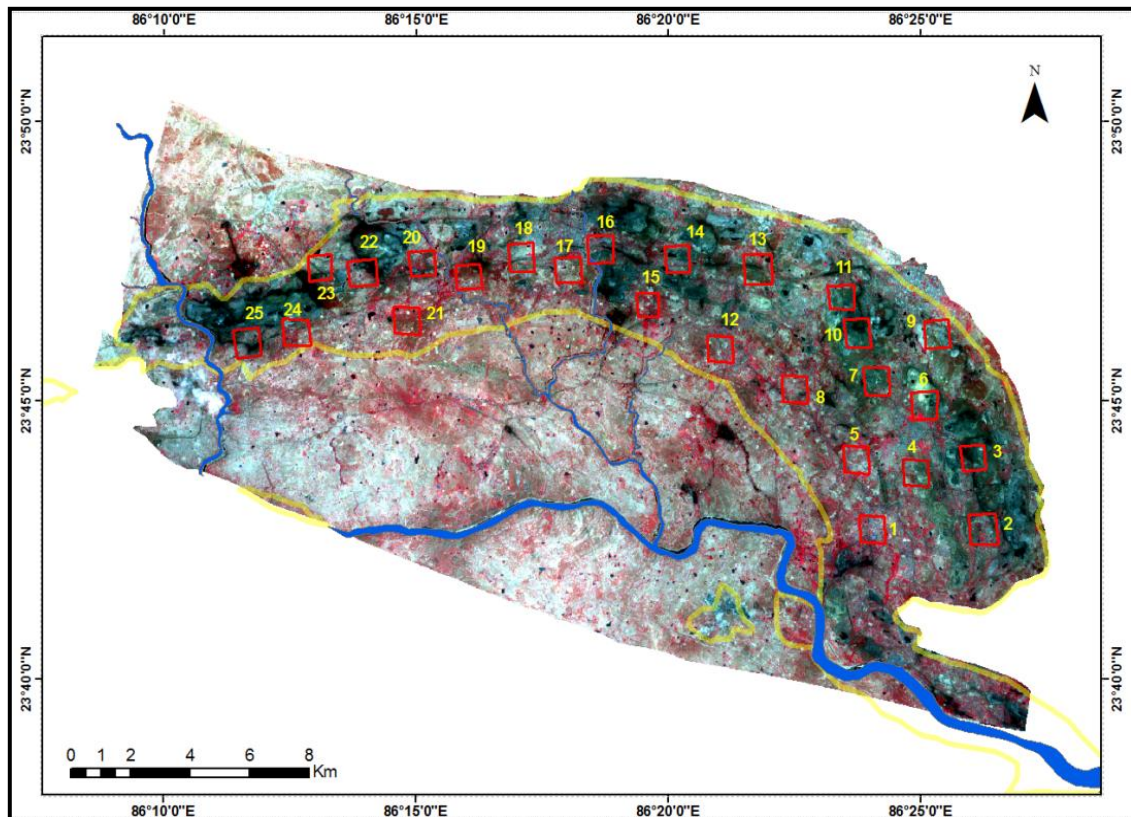
Figure 3. False colour composite image of Jharia Coalfield, with subset blocks (in red boxes) to obtain temperature values (from radiant temperature image) within the Barakar formation across the Jharia coalfield.
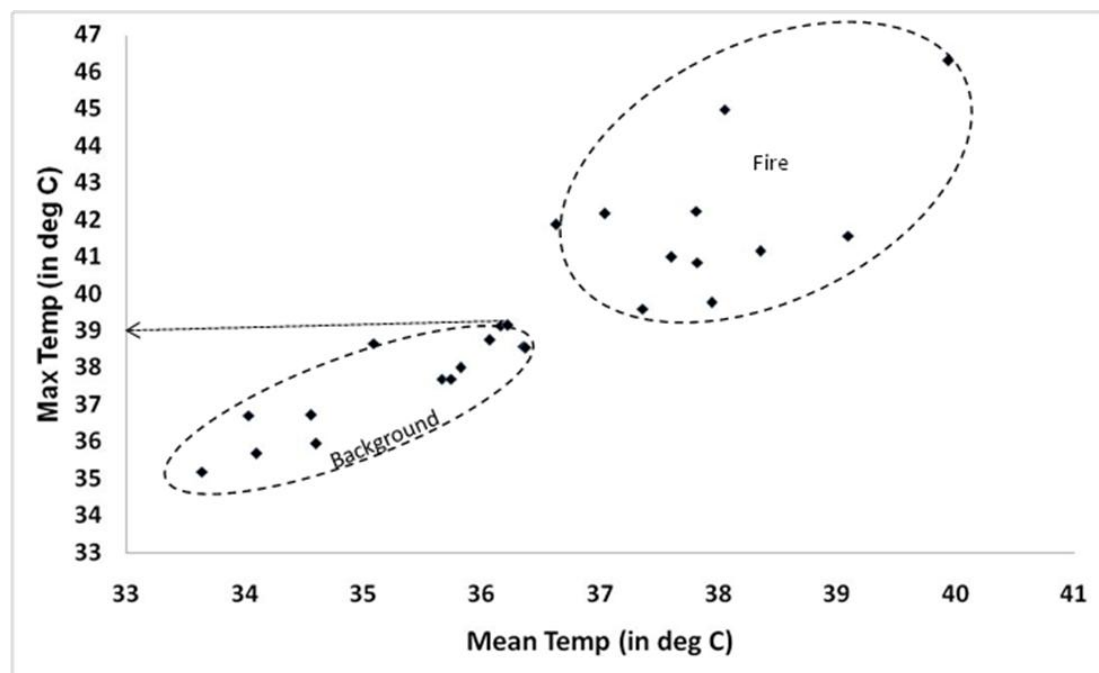

Figure 4. Maximum temperature plotted against mean temperature for various locations; cluster separation observed around 39 °C (marked with arrow)
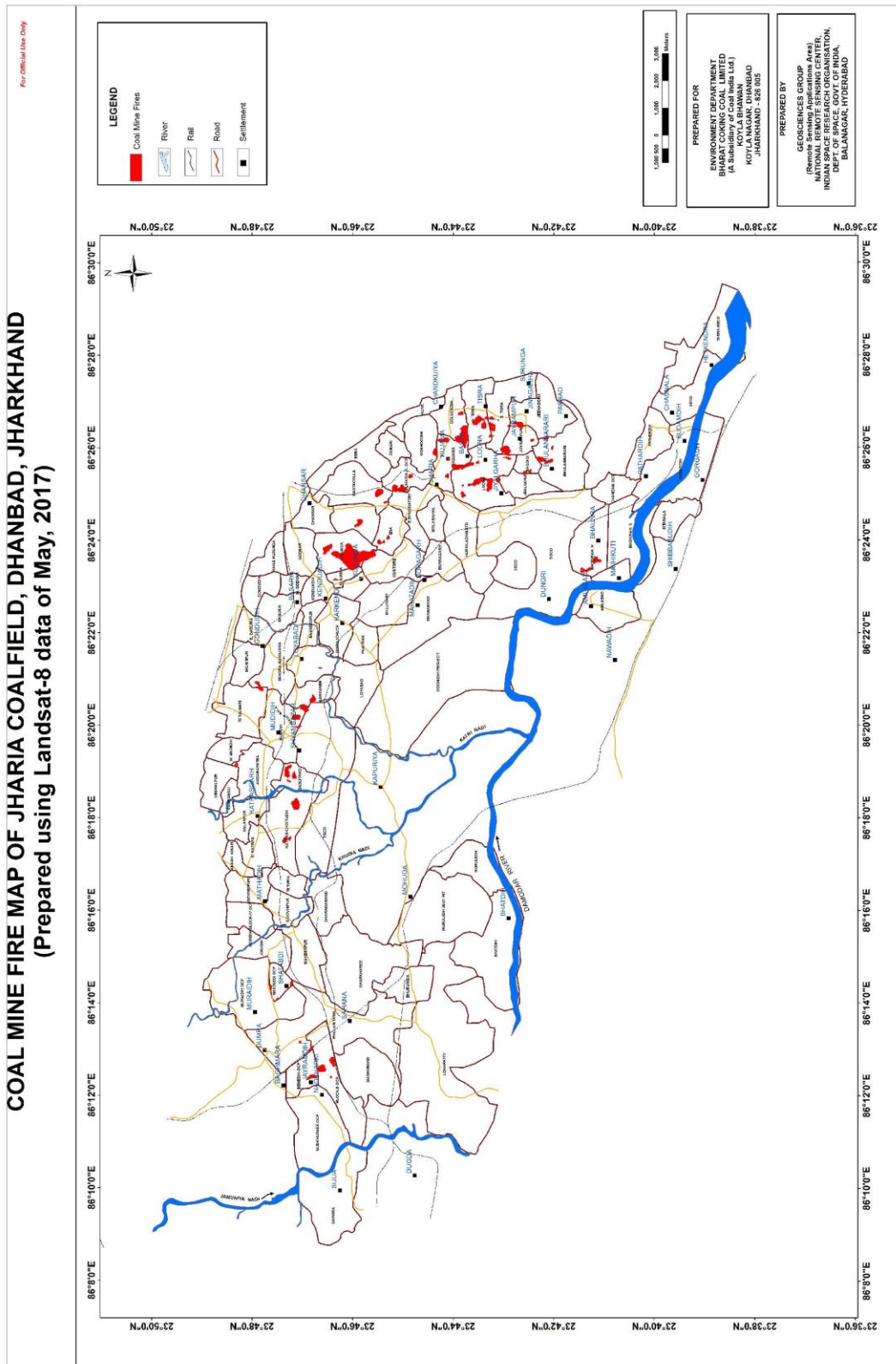
Figure 5: Coal mine fire map (May, 2017) of Jharia coal field, Dhanbad. The fire areas shown in this map have been verified in the field as per field points in figure 13.

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).
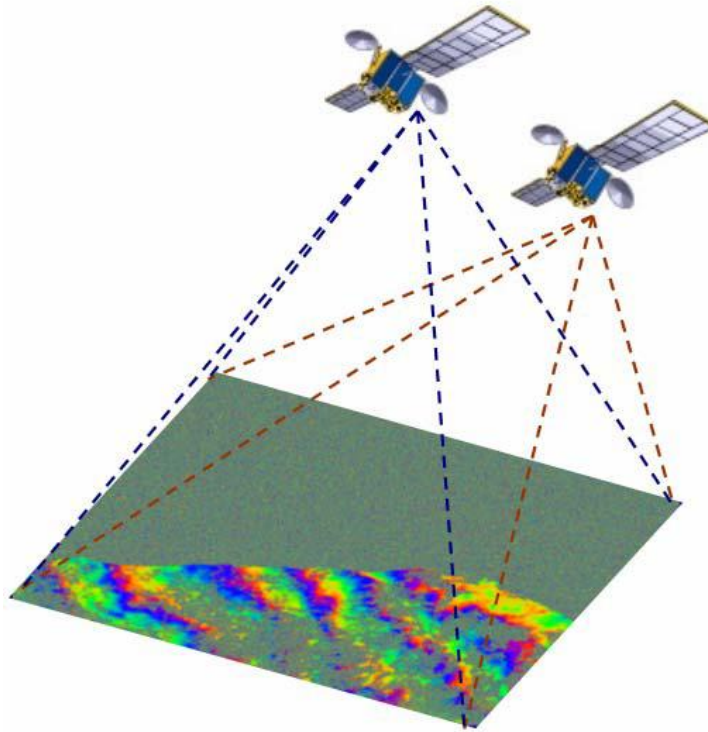

Figure 6. DInSAR acquisition scheme.

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

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

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.
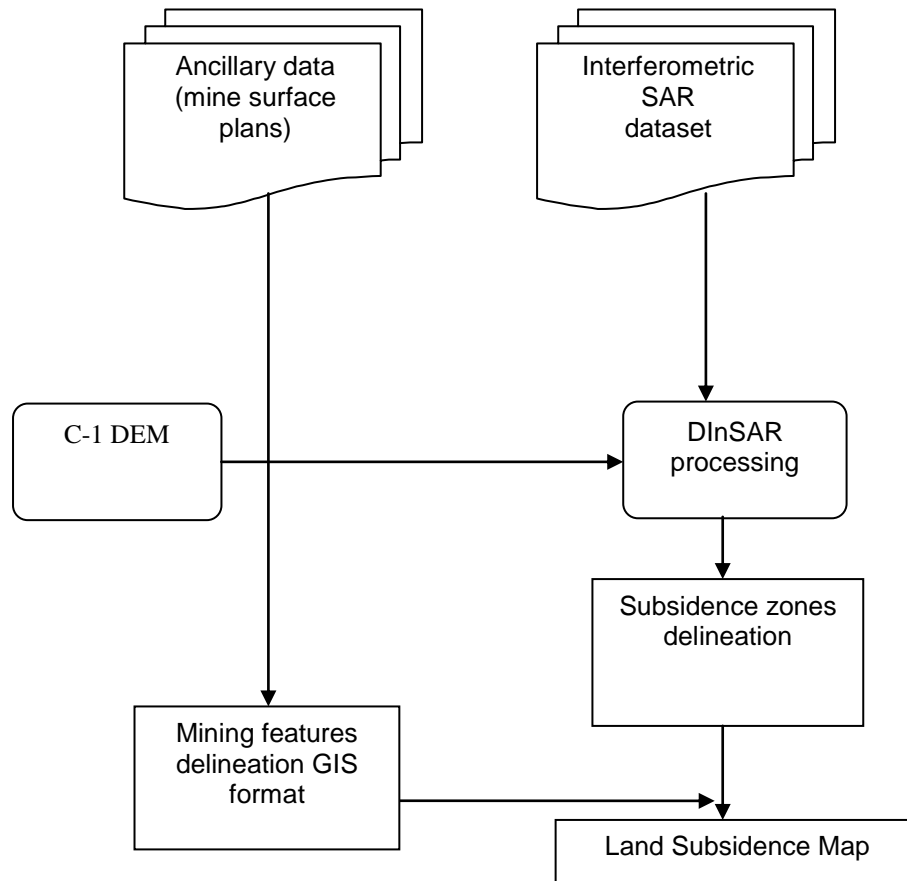

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Figure 7. Work flow diagram for generating land subsidence map using DInSAR technique.

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 baselines 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.

		SLAVE IMAGE				
		October, 2014	October, 2015	February, 2016	October, 2016	February, 2017
MASTER IMAGE	October, 2014	■	green	green	green	green
	October, 2015		■	red	green	green
	February, 2016			■	red	green
	October, 2016				■	red
	February, 2017					■
	red	Short Temporal Baseline Pair (less than 1 year)				
	green	Long Temporal Baseline Pair (more than 1 year)				

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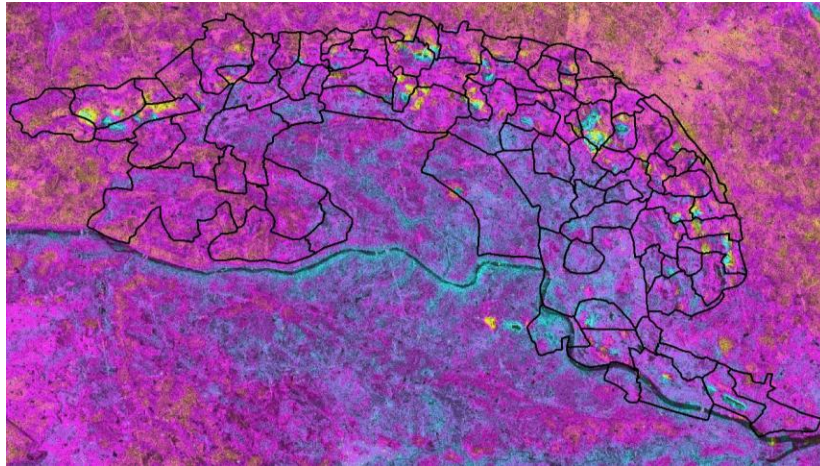
Figure 9. Fringe patterns generated from short baseline processing (e.g. Master: Oct, 16, Slave: Feb, 17).

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).
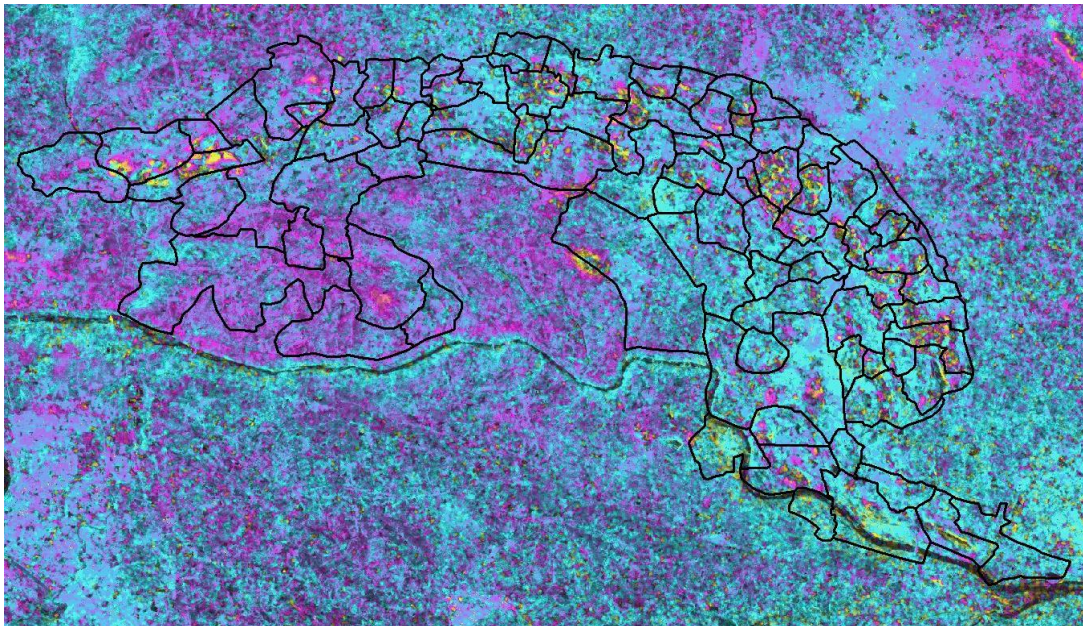

Figure 10. Fringe patterns generated from long baseline processing (e.g. Master: Oct, 15, Slave: Feb, 17).

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).
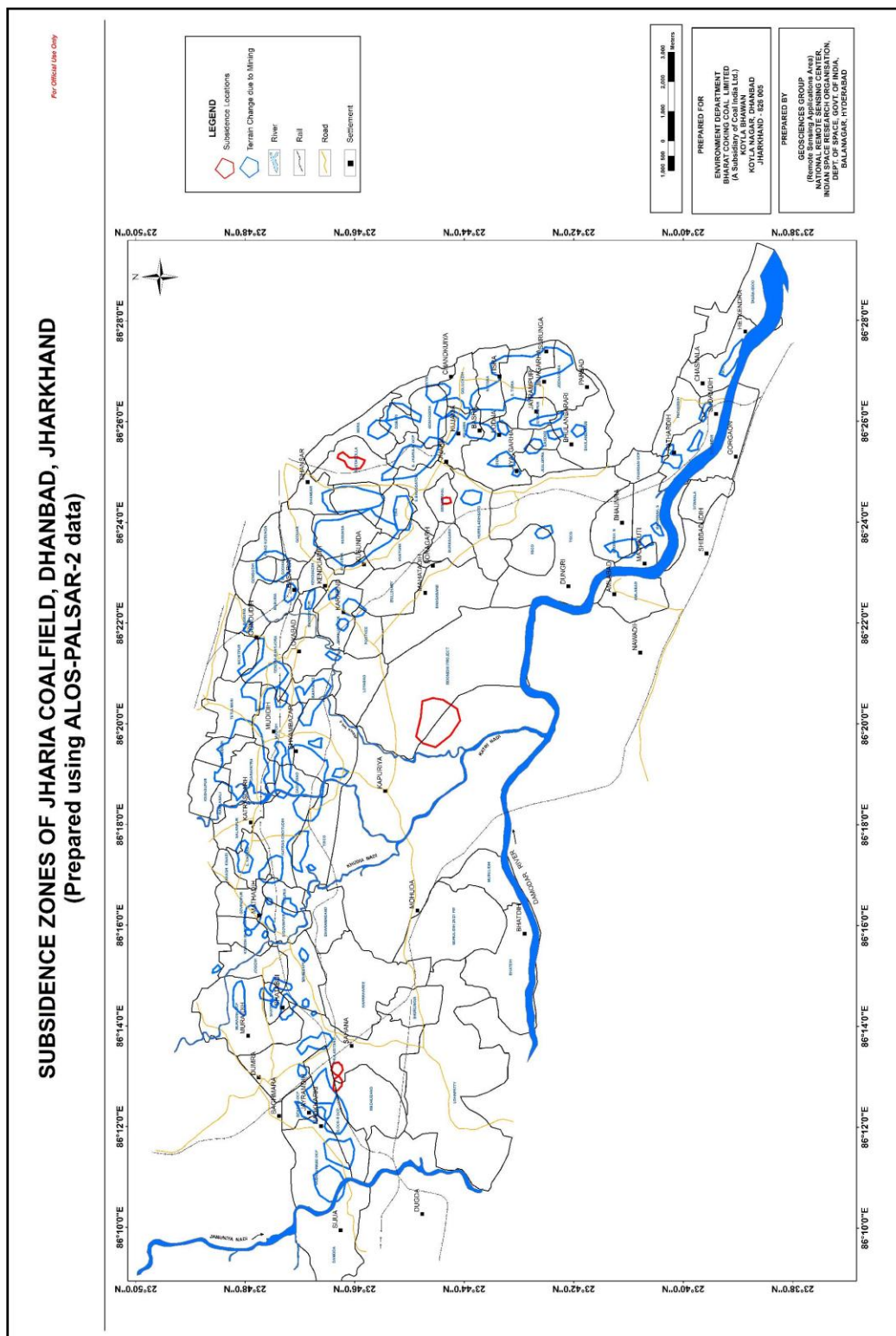

Figure 11: Subsidence map of Jharia coal field, Dhanbad.

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.

DISCUSSIONS AND CONCLUSIONS

CHAPTER VII

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.
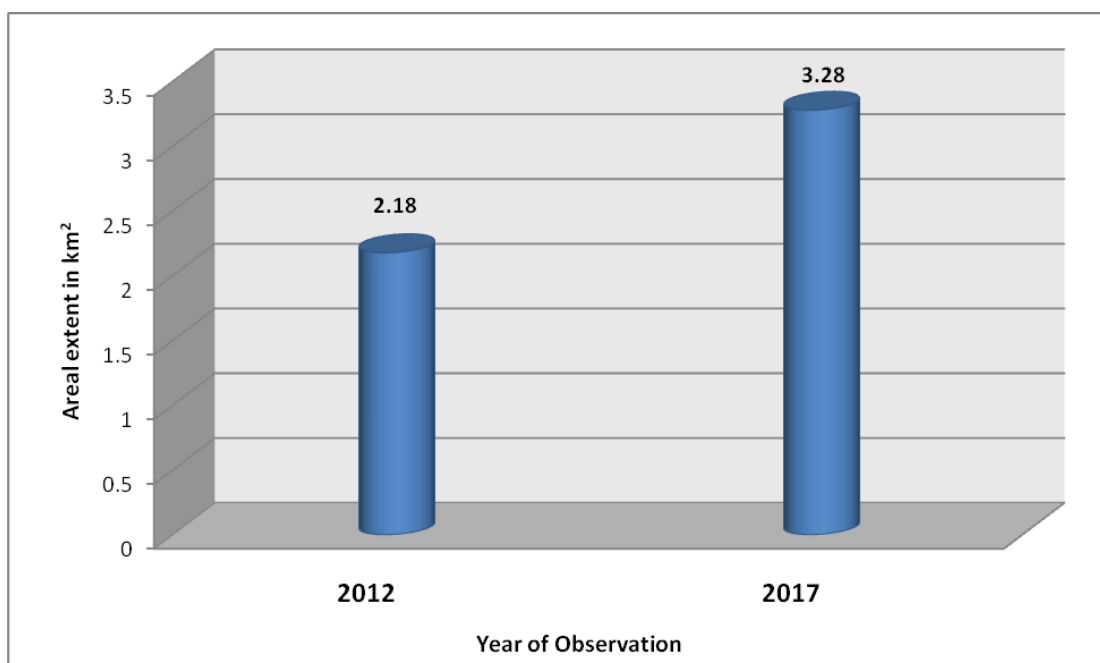

Figure 12: Total fire area statistics

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.

References

1. Gangopadhyay, P.K., Lahiri-dutt, K., Saha, K. (2005): "Application of remote Sensing to identify coal fires in the Raniganj coal belt, India." *Int. Jour of Applied Earth Observation and Geoinformation.*

2. Gangopadhyay, P.K., Malthuis.B, Van Dink (2005): "Aster Derived emissivity and coal-fire related surface temperature anomaly a case study in Wuda, North China," *Int. Jour. of Remote Sensing*, vol-26, No.-24, pp-5555-5571.

3. Schmugge, T., French, Ritchie, J.C., Rango, A., Pelgrum, H. (2002): "Temperature and emissivity separation from multispectral thermal infrared observation," *Remote Sensing of Environment*, 79, pp-189-198.

4. Saraf A.K., Prakash A., Sengupta, S., Gupta, R.P (1995): "Landsat-TM data for estimating ground temperature and depth of sub-surface coal fire in the Jharia coalfiled, India," *Int. Jour. Remote sensing vol-16, no-12*, 2111-2124.

5. Gangopadhyay P.K., (2003): "Coalfire detection and monitoring in Wuda, North China, A multispectral and multi-sensor approach:-Ph.D. Thesis, ITC Netherland.

6. Gupta, R.P. (2003): "Remote Sensing Geology", *Springer-Verlag.Third ed.*pp-183-216.

7. Kealey, P.S and Hook S.J(1993): "Separating temperature and emissivity in thermal infrared Multispectral Scanner Data: Implication for recovering land surface temperatures", *IEE Transaction on Geoscience and Remote Sensing,vol,31,no-6*,pp-1155-1164

8. Zhang, J., Wagner, W., Prakash, A., Mehl,H. and Voigt,S.(2004): "Detecting coal fires using remote sensing techniques,*" Int. Jour. Remote sensing, vol-25, no-6,* pp3193-3220.

9. Bhattacharya, A. and Reddy, C.S.S. (1995): Inventory and monitoring of underground and surface coal mine fire in Jharia coalfield, Bihar using thematic mapper thermal IR data: *Geosciences Group, Official report, NRSA.*

10. Coal mine fire delineation and surface features mapping using satellite data in Jharia coal field, Dhanbad, Jharkhand. Geology and Geophysics division. *Official report, NRSA, 2006*

11. Coal mine fire delineation and surface features mapping using satellite data in Jharia coal field, Dhanbad, Jharkhand. Geosciences Group. *Official report, NRSC, 2014*
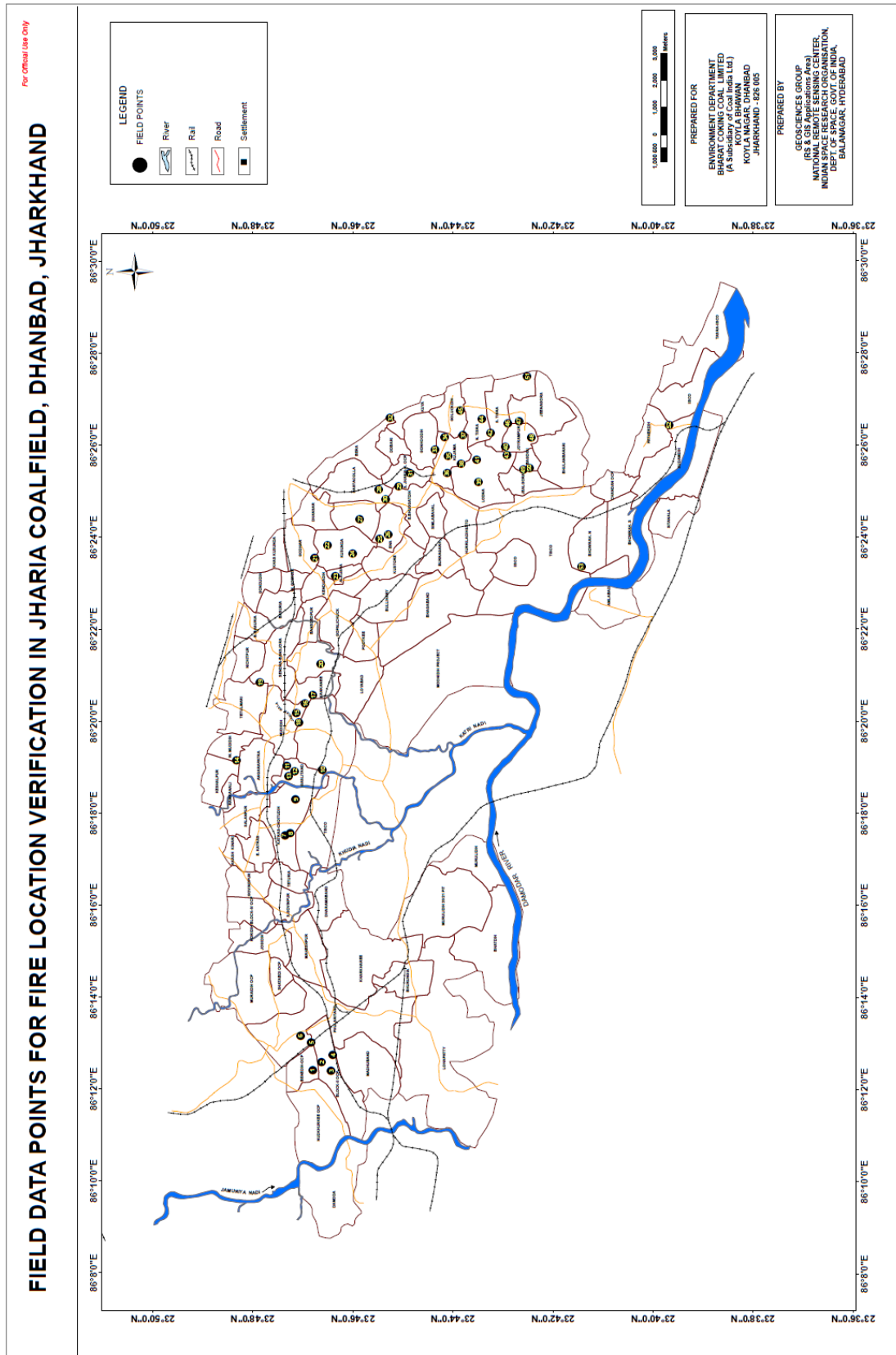
Annexure –I

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)

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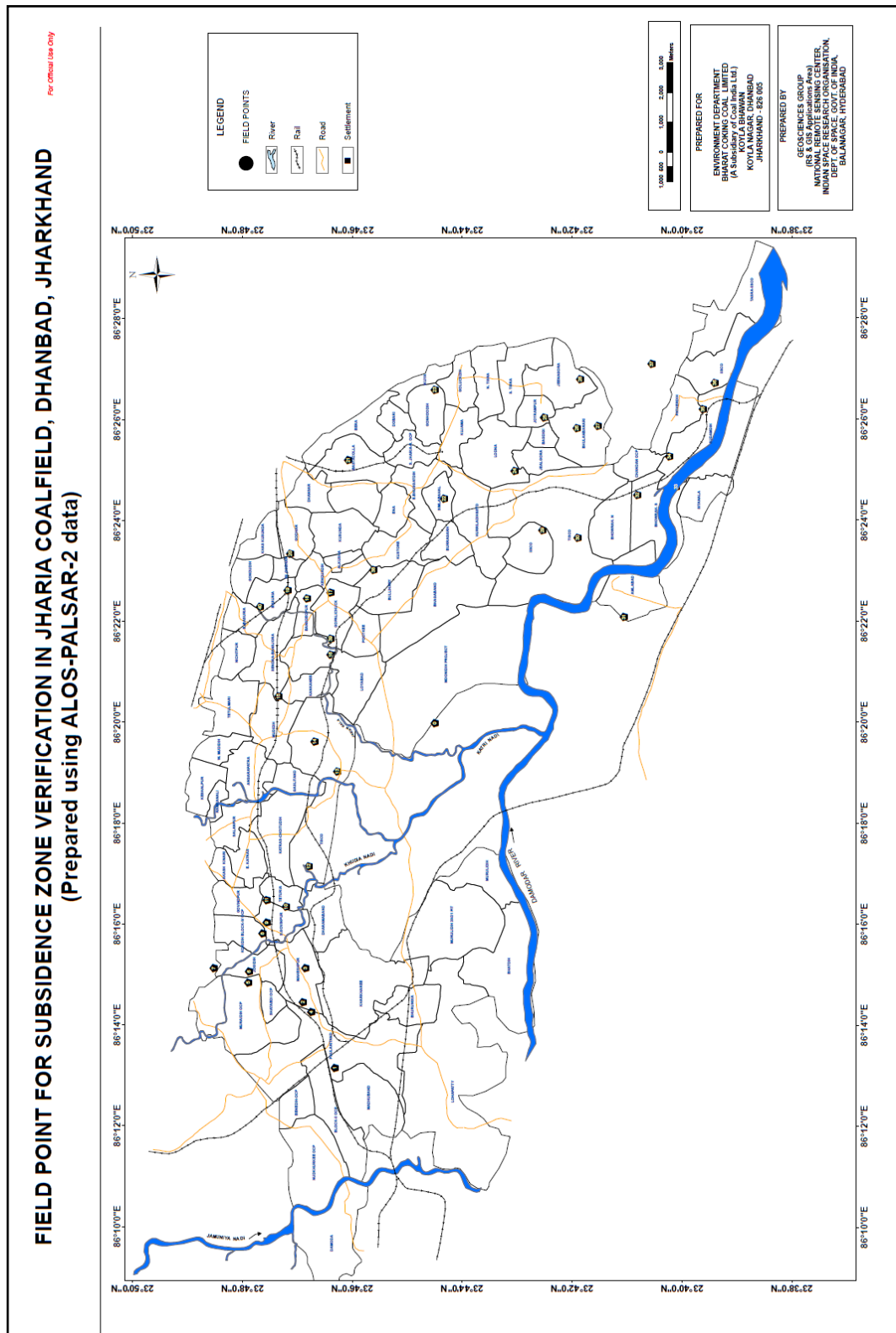*Annexure –II*

Figure 14. Field data points for subsidence verification

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

Sr. no.	Point of Observations		Comments	
	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.

Ref:- BCCL/WJA/MND/2019/ 1141 (C)   Date:- 29|08|2019

To,
The Member Secretary,
Jharkhand State Pollution Control Board
T.A. Division Building, HEC Dhurwa,
Ranchi – 834004
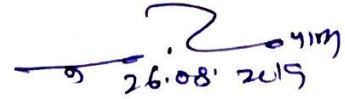
Sub : Environmental Statement for the year ending 31st March 2019 in respect of
Murulidih 20/21 Pits Colliery, W.J. Area, BCCL.

Dear Sir,

Please find enclosed herewith the Environmental Statement of Murulidih 20/21 Pits
Colliery, Western Jharia, BCCL (Dhanbad) for the year ending 31st March 2019.

Thanking You,

You're faithfully

26.08. 2019
Project Officer
Murulidih 20/21 Pits Colliery
Murlidih 20/21 PITS Colliery

Copy to:-

1. Regional Officer, JSPCB, HIG-1, Housing colony, Bartand Dhanbad, Pin- 826015(By Speed Post)
2. GM, W.J. Area, Moonidih
3. Dy GM (Env.), BCCL Koyla Bhawan, Dhanbad
4. AM (Env.), W.J. Area, Moonidih

FORM- V

ENVIRONMENTAL STATEMENT

For the Financial year ending

31st March 2019

MURULIDIH 20/21 PITS COLLIERY
WESTERN JHARIA AREA

BHARAT COKING COAL LIMITED

[FORM – V][1]

(See rule 14)

Environmental Statement for the financial year ending the 31st March 2019

PART – A

(i)	Name and address of the owner/occupier of the industry operation or process	NAME :- Shri Rakesh Kumar Designation:- Director (Tech) P&P, Bharat Coking Coal Limited Address:-KOYLA BHAWAN, P.O.-KOYLA NAGAR DISTT- DHANBAD (JHARKHAND) PIN:- 826005 Telephone:- 0326 2230163
(ii)	Industry category Primary ----(STC code) Secondary.-----(SIC Code)	Coal Mining Large Scale
(iii)	Production capacity.----Units----	Nil (Mine is close from Dec'2015) **(0.18MTY NORM 0.234 MTY PEAK AS PER EC)**
(iv)	Year of establishment	1964
(v)	Date of the last environmental statement submitted	19.09.2018

PART – B

Water and Raw Material Consumption:
- (i) Water consumption m³/d:
  - **a. Process:** Nil
  - **b. Cooling:** Nil
  - **c. Domestic:** 445 KL/Day

	Name of Products	Process water consumption per unit of product output.	
		During the previous financial Year	During current financial Year
1	Coal	Nil	Nil

---

[1] . Substituted by Rule 2 (b) of the Environment (Protection) Amendment Rules, 1993 notified vide G.S.R 3'6 (E) dated 22.04.1993.

ii) Raw Material Consumption - (NIL)

*Name of raw materials	Name of products	Consumption of raw material per Unit of output	
		During the previous financial year	During the current financial year
Nil	Coal	NIL	NIL

*Industry may use codes if disclosing details of raw material would violate contractual obligations, otherwise all industries have to name the raw materials used.

PART - C

Pollution discharged to environment/unit of output:
(Parameter as specified in the consent issued)

1) Pollutants	Quantity of pollutants discharged (mass/day)	Concentrations of pollutants in discharges (mass/volume)	Percentage of variation from prescribed standards with reasons
a) Water	NA	NA.	Within the prescribed limit
b) Air SPM SO₂ NOx	Within the prescribed limit.	The emissions are mainly from fugitive sources (non-point sources) which are difficult to be assessed.	Within the prescribed limit

Enclosed: - (i) Monitoring report done by CMPDI.

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)
a). From Process	(a) Burnt Oil- NIL (b)Jute cloth/Soft Cotton- NIL	(a) Burnt Oil- NIL (b)Jute cloth/Soft Cotton- NIL
	Note: - Murulidih 20/21 PITS Colliery is closed for production since **Dec' 2015.**	
b). From pollution control facilities	Nil	Nil

PART – E
Solid Wastes

Solid Wastes	Total Quantity (Kg.)	
	During the previous Financial year	During the current Financial Year
m) From Process	NIL (U/G Mine)	NIL (U/G Mine)
n) From pollution control facilities	NIL	NIL
o) (i) Quantity recycled or re-utilized within the unit	NIL	NIL
(ii) Soil	NIL	NIL
(iii) Disposed	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.

No such waste is generated in underground and on surface.

PART – G

Impact of the pollution abatement measures taken on conservation of natural resources and on the cost of production.
Various pollution abatement measures are practiced by which the impacts on the environment become positive. Due care is taken to conserve the natural resources and protect the environment and all its components.

Following pollution abatement measures are undertaken:-

1. **Water sprinkling:** Murulidih 20/21 Pits mine is close from Dec'2015. Therefore no coal production and transportation from Murulidih 20/21 pits mine.
2. **Road maintenance:** Maintenance of all roads within the unit leasehold area is being done to control dust. This also helps in reducing the vehicle exhaust.
3. **Tree plantation:** Tree plantation is done as a part of biological reclamation. Plantation helps in reducing noise, dust, as soil erosion control etc. There are four Eco-restoration sites of total 8.4 Ha. area are maintained at Murulidih.

4. **Noise abatement:** Noise abatement is done by proper maintenance of vehicles and other machines. Workers are provided with air muffs. Trees have been planted near the work place on surface that helps in dampening the extra noise.
5. **Machine maintenance:** Proper and timely maintenance of the machine/vehicles operating in the unit are done which help in reducing of vehicle exhausts and noise pollution.
6. **Ambient air, water & noise monitoring:** Monitoring of ambient air, water quality and noise levels are periodically done by CMPDIL. (Report enclosed)
7. **Community awareness:** Welfare offices are there in the unit to propagate awareness regarding environmental protection measures like tree plantation, soil erosion control, domestic exhaust control etc. among colony/village resident. Tree plantation, sapling distribution, Safety awareness and culture programs are organized on important occasions.

PART – H
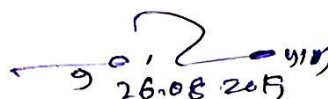
Additional measures/investment proposal for environmental protection including abatement of pollution, prevention of pollution.

❖ Biological reclamation are being done and maintained at Eco- Restoration Sites of Total 8.4 Ha of area at Murulidih.
❖ The discharge of water is passing through settling tanks and pressure filter.

PART – I

Any other particulars for improving the quality of the environment:

❖ Ambient air, water quality level are periodically assessed.
❖ Improved sanitation and drainage is being practiced in all houses of the colony.
❖ Employees are dissuaded from open burning of coal through reimbursement of their bills of cooking gas.
❖ EIA (Environmental impact Assessment) is being done at corporate level. This helps in identifying the environmental impact and thereby adopting necessary mitigation measures.

26.08.2015

Project Officer
Murulidih 20/21 PITS Colliery
Western Jharia Area
Bharat Coking Coal Limited

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

(FOR THE MONTH JANUARY, 2019)

E. C. no. J-11015/11/2010-IA.II (M) dated 06.06.2013.

CMPDI

ISO 9001 Company
Regional Institute-II
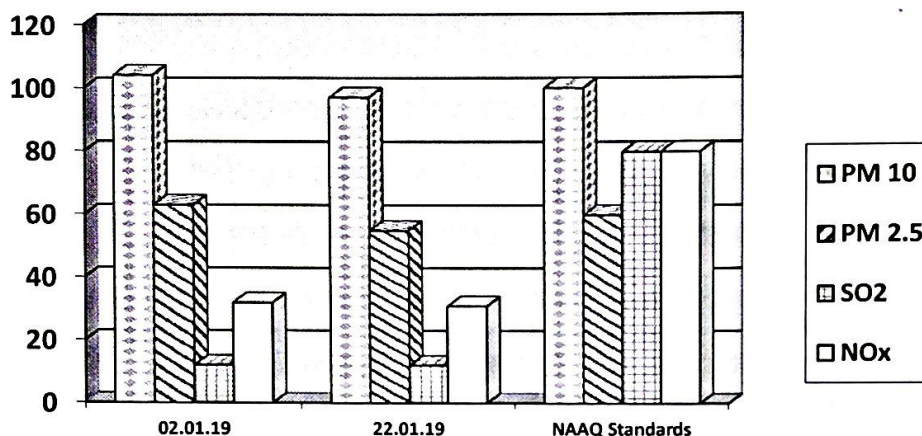**Dhanbad, Jharkhand**

AMBIENT AIR QUALITY DATA

Cluster –XIII,Bharat Coking Coal limited   Month: JAN,2019   Year   : 2018-19.

Station Name: A19 – Murlidih 20/21		Zone: Core		Category: Industrial	
SI. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	02.01.19	104	63	12	32
2	22.01.19	97	55	12	31
	NAAQ Standards	100	60	80	80

Station Name: A20, Lohapatti		Zone: Buffer		Category: Industrial	
SI. No.	Dates of sampling	PM 10	PM 2.5	SO$_2$	NO$_x$
1	03.01.19	98	57	13	33
2	21.01.19	95	53	12	33
	NAAQ Standard	100	60	80	80
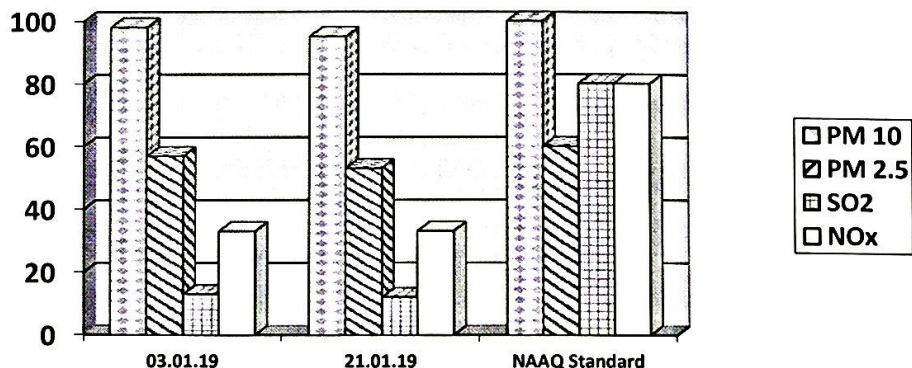
Analysed By
JSA/SA/SSA

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

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

JOB NO. 200316028   Cluster – XIII   BCCL Environmental Monitoring Report

Station Name: A21 Kharkharee		Zone: Buffer		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	09.01.19	94	57	13	32
2	24.01.19	92	54	12	33
	NAAQ Standards	100	60	80	80
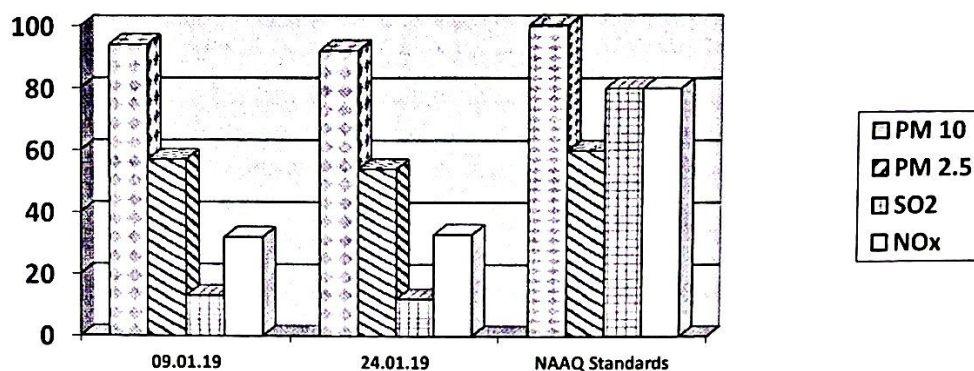
Station Name: A31 Dumarda		Zone: Buffer		Category: Residential	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	31.12.18	94	52	11	30
2	22.01.19	92	50	<10	29
	NAAQ Standards	100	60	80	80

➢ 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 Murlidih 20/21 (MW13)**
A sampling point is fixed to assess the effluent quality of Mine discharge. This location is selected to monitor effluent discharge in to Jamunia.

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 -XIII**		Month: **JAN, 2019**	Name of the Station: **Mine Discharge of Murlidih 20/21**	
SI. No.	**Parameters**	MW13 First Fortnight	MW13 Second Fortnight	**As per MOEF General Standards for schedule VI**
		02.01.19	23.01.19	
1	Total Suspended Solids	26	20	*100 (Max)*
2	pH	7.94	7.99	*5.5 - 9.0*
3	Oil & Grease	<2.0	<2.0	*10 (Max)*
4	COD	40	36	*250 (Max)*

All values are expressed in mg/lit unless specified.

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

i) **Murlidih (N19)**
ii) **Lohapatti (N20)**
iii) **Kharkharee CISF Office (N21)**
iv) **Dumarda (N31)**

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 MoEFCC. 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 -XIII			Month: JAN, 2019		
SI. No.	Station Name/Code	Category of area	Date	Noise level dB(A)LEQ	*Permissible Limit of Noise level in dB(A)
1	Murlidih 20/21 (N 19)	Industrial area	02.01.19	54.9	75
2	Murlidih 20/21	Industrial area	22.01.19	58.2	75
3	Lohapatti (N20)	Industrial area	03.01.19	60.1	75
4	Lohapatti	Industrial area	21.01.19	62.3	75
5	Kharkharee (N21)	Industrial area	09.01.19	59.7	75
6	Kharkharee	Industrial area	24.01.19	51.8	75
7	Dumarda (N31)	Residential area	31.12.18	54.6	55
8	Dumarda	Residential area	22.01.19	50.7	55

*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

JOB NO. 200316028   Cluster – XIII   BCCL Environmental Monitoring Report

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

(FOR THE MONTH FEBRUARY, 2019)

E. C. no. J-11015/11/2010-IA.II (M) dated 06.06.2013.

CMPDI

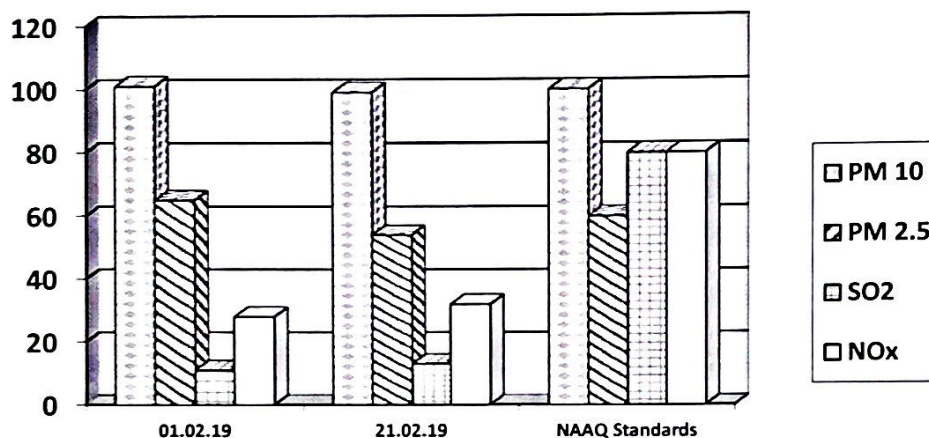ISO 9001 Company
Regional Institute-II
Dhanbad, Jharkhand

AMBIENT AIR QUALITY DATA
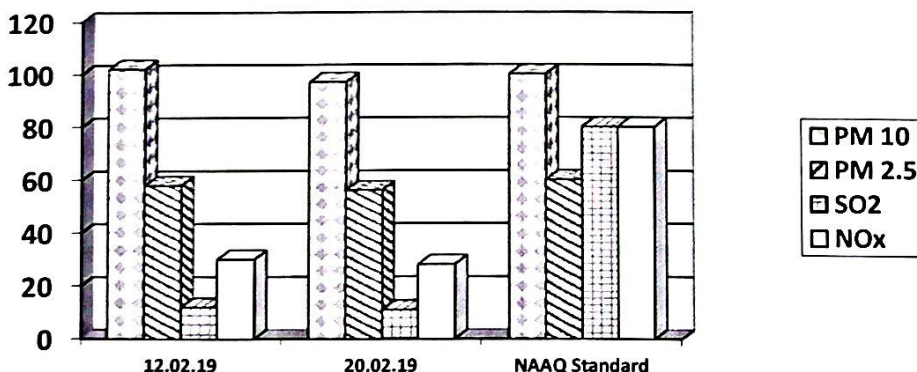
Cluster –XIII,Bharat Coking Coal limited   Month: FEB,2019   Year   : **2018-19.**

Station Name: A19 – Murlidih 20/21		Zone: Core		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	01.02.19	101	65	11	28
2	21.02.19	99	54	13	32
	NAAQ Standards	100	60	80	80

Station Name: A20, Lohapatti		Zone: Buffer		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_x
1	12.02.19	102	58	12	30
2	20.02.19	97	56	11	28
	NAAQ Standard	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

JOB NO. 200316028   Cluster – XIII   BCCL Environmental Monitoring Report

WATER QUALITY MONITORING

3.1 Location of sampling sites
(Refer **Plate No. – II**)
i) **Mine Discharge of Murlidih 20/21 (MW13)**

A sampling point is fixed to assess the effluent quality of Mine discharge. This location is selected to monitor effluent discharge in to Jamunia.

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 -XIII**		Month: **FEB, 2019**	Name of the Station: **Mine Discharge of Murlidih 20/21**	
Sl. No.	**Parameters**	MW13 First Fortnight	MW13 Second Fortnight	**As per MOEF General Standards for schedule VI**
		1ST	2ND	
1	Total Suspended Solids	02-02-2019	22-02-2019	*100 (Max)*
2	pH	34	28	*5.5 - 9.0*
3	Oil & Grease	7.84	8.03	*10 (Max)*
4	COD	<2.0	<2.0	*250 (Max)*

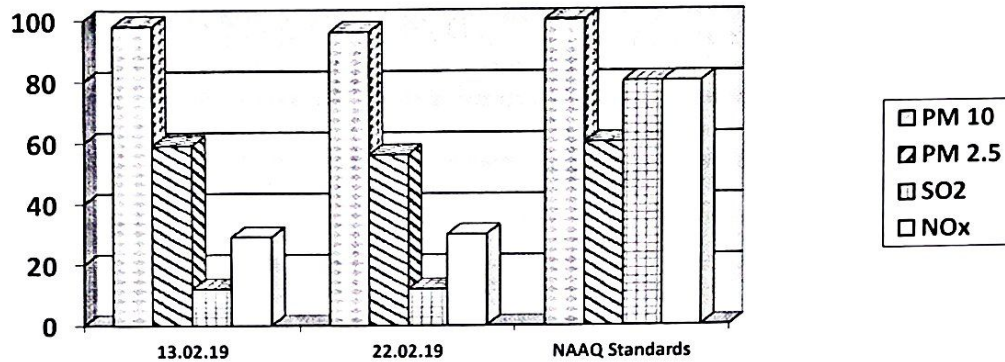All values are expressed in mg/lit unless specified.
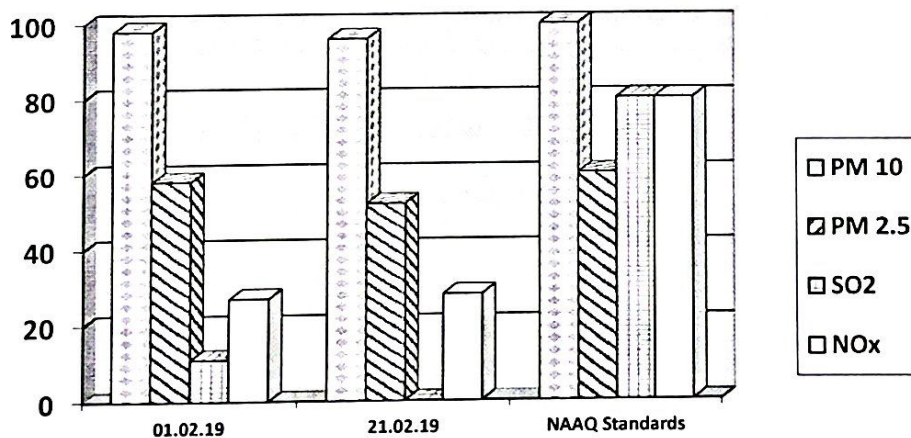
सुमन संगीन ठाकुर
Analysed By
JSA/SA/SSA

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

21/03/19
Approved By
HOD(Mining/Environment)
RI-2, CMPDI, Dhanbad

Station Name: A21 Kharkharee		Zone: Buffer		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	13.02.19	98	59	12	29
2	22.02.19	96	56	12	30
	NAAQ Standards	100	60	80	80

Station Name: A31 Dumarda		Zone: Buffer		Category: Residential	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	01.02.19	98	58	11	27
2	21.02.19	96	52	<10	28
	NAAQ Standards	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
R1-2, CMPDI, Dhanbad

Approved By
HOD(Mining/Environment)
R1-2, CMPDI, Dhanbad

NOISE LEVEL QUALITY MONITORING

4.1 Location of sampling sites

i) **Murlidih (N19)**
ii) **Lohapatti (N20)**
iii) **Kharkharee CISF Office (N21)**
iv) **Dumarda (N31)**

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 MoEFCC. 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 -XIII**				Month: **FEB, 2019**	
SI. No.	Station Name/Code	Category of area	Date	Noise level dB(A)LEQ	*Permissible Limit of Noise level in dB(A)
1	Murlidih 20/21 (N 19)	Industrial area	01.02.19	56.2	75
2	Murlidih 20/21	Industrial area	21.02.19	56.7	75
3	Lohapatti (N20)	Industrial area	12.02.19	63.2	75
4	Lohapatti	Industrial area	20.02.19	61.9	75
5	Kharkharee (N21)	Industrial area	13.02.19	50.2	75
6	Kharkharee	Industrial area	22.02.19	53.2	75
7	Dumarda (N31)	Residential area	01.02.19	49.2	55
8	Dumarda	Residential area	21.02.19	48.4	55

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

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

(FOR THE MONTH MARCH, 2019)

E. C. no. J-11015/11/2010-IA.II (M) dated 06.06.2013.

CMPDI
ISO 9001 Company
Regional Institute-II
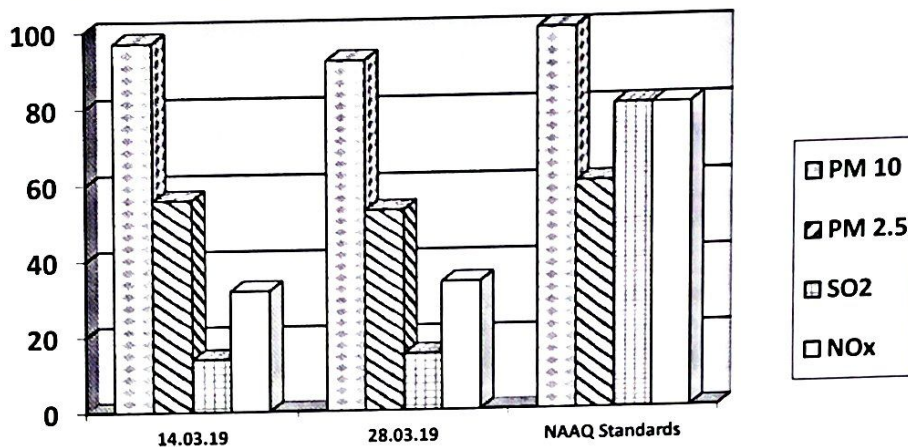**Dhanbad, Jharkhand**

# AMBIENT AIR QUALITY DATA
Cluster –XIII,Bharat Coking Coal limited   Month: MARCH ,2019   Year : 2018-19.

Station Name: A19 – Murlidih 20/21		Zone: Core		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	14.03.19	97	56	14	32
2	28.03.19	92	53	15	34
	NAAQ Standards	100	60	80	80

Station Name: A20, Lohapatti		Zone: Buffer		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_x
1	11.03.19	98	59	11	30
2	28.03.19	96	54	11	28
	NAAQ Standard	100	60	80	80
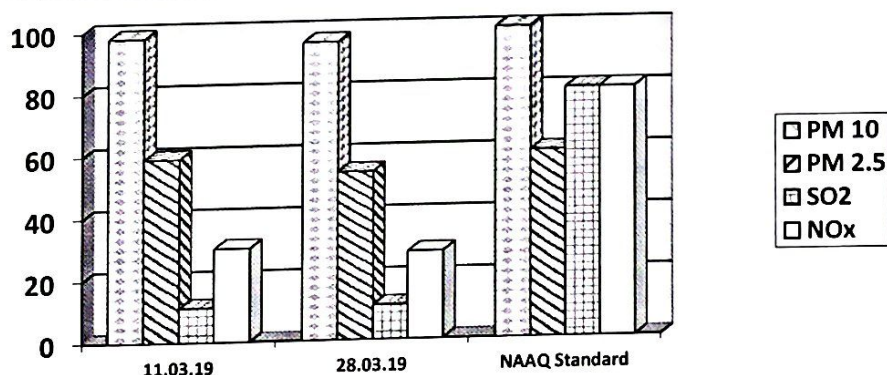
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RI-2, CMPDI, Dhanbad

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Station Name: A21 Kharkharee		Zone: Buffer		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	08.03.19	96	53	12	29
2	26.03.19	97	52	12	30
	NAAQ Standards	100	60	80	80
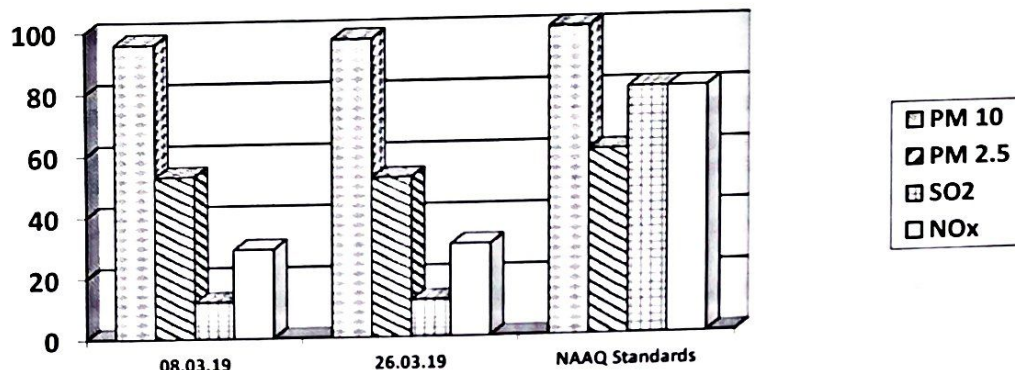
Station Name: A31 Dumarda		Zone: Buffer		Category: Residential	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	14.03.19	97	56	<10	27
2	28.03.19	93	52	10	27
	NAAQ Standards	100	60	80	80

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

Analysed By
JSA/SA/SSA

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Lab In Charge
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WATER QUALITY MONITORING

3.1   Location of sampling sites
(Refer **Plate No. – II**)

i)   **Mine Discharge of Murlidih 20/21 (MW13)**

A sampling point is fixed to assess the effluent quality of Mine discharge. This location is selected to monitor effluent discharge in to Jamunia.

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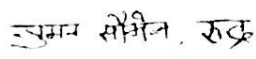
3.3   Results & Interpretations
The results are given in tabular form along with the applicable standards. Results are compared with Schedule - VI, effluent prescribed by MoEF&CC. Results show that most of the parameters are within the permissible limits.

WATER QUALITY DATA
(EFFLUENT WATER- FOUR PARAMETERS)

Name of the Cluster: **Cluster -XIII**		Month: **MARCH, 2019**	Name of the Station: **Mine Discharge of Murlidih 20/21**	
Sl. No.	Parameters	MW13 First Fortnight	MW13 Second Fortnight	As per MOEF General Standards for schedule VI
		13.03.19	27.03.19	
1	Total Suspended Solids	24	34	100 (Max)
2	pH	8.07	8.18	5.5 - 9.0
3	Oil & Grease	<2.0	<2.0	10 (Max)
4	COD	28	20	250 (Max)

All values are expressed in mg/lit unless specified.

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Analysed By
JSA/SA/SSA

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R1-2, CMPDI, Dhanbad

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HOD(Mining/Environment)
R1-2, CMPDI, Dhanbad

NOISE LEVEL QUALITY MONITORING

4.1 Location of sampling sites

i)   **Murlidih (N19)**
ii) **Lohapatti (N20)**
iii) **Kharkharee CISF Office (N21)**
iv) **Dumarda (N31)**

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 MoEFCC. 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 -XIII			Month: MARCH , 2019		
SI. No.	Station Name/Code	Category of area	Date	Noise level dB(A)LEQ	*Permissible Limit of Noise level in dB(A)
1	Murlidih 20/21 (N 19)	Industrial area	14.03.19	52.4	75
2	Murlidih 20/21	Industrial area	28.03.19	58.3	75
3	Lohapatti (N20)	Industrial area	11.03.19	60.1	75
4	Lohapatti	Industrial area	28.03.19	63.7	75
5	Kharkharee (N21)	Industrial area	08.03.19	53.4	75
6	Kharkharee	Industrial area	26.03.19	55.6	75
7	Dumarda (N31)	Residential area	14.03.19	50.5	55
8	Dumarda	Residential area	28.03.19	46.9	55

*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,

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RI-2, CMPDI, Dhanbad

JOB NO. 200316028   Cluster – XIII   BCCL Environmental Monitoring Report

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

(FOR THE MONTH SEPTEMBER, 2019)

E. C. no. J-11015/11/2010-IA.II (M) dated 06.06.2013.

CMPDI

ISO 9001 Company
Regional Institute-II
Dhanbad, Jharkhand

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) Murlidih 20/21 (A19): Industrial Area
The location of the sampling station is 23°43' 51.82" N & 86° 16' 21.17" E. The sampler was placed at a height of approx. 1.5m above ground level at Project Office.

II. BUFFER ZONE Monitoring Location

i)   Lohapatti (A20)
The location of the sampling station is 23°44'29.42" N & 86°16'49.96" E. The sampler was placed at a height of approx. 1.5m above ground level at Safety Office.

**ii)   Kharkharee CISF Office (A21)**
The location of the sampling station is 23°46' 29.00" N 86° 14' 37.08"E. The sampler was placed at a height of approx. 1.5m above ground level at Project Office.

ii)   Dumarda (A31)
  The location of the sampling station is 23° 42' 50.00" N 86° 15' 4.00"E.The location was selected for studying the impact of the mining activity on the Dumarda village   as   it   lies   in   the   buffer   zone   for   the   Cluster   XIII.

AMBIENT AIR QUALITY DATA

Cluster –XIII,Bharat Coking Coal limited   Month: **SEPT. ,2019**   Year   : **2019-20.**

Station Name: A19 – Murlidih 20/21		Zone: Core		Category: Industrial[1]	
SI. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	12.09.19	68	34	11.38	20.96
2	30.09.19	63	32	12.57	21.92
	NAAQ Standards	100	60	80	80
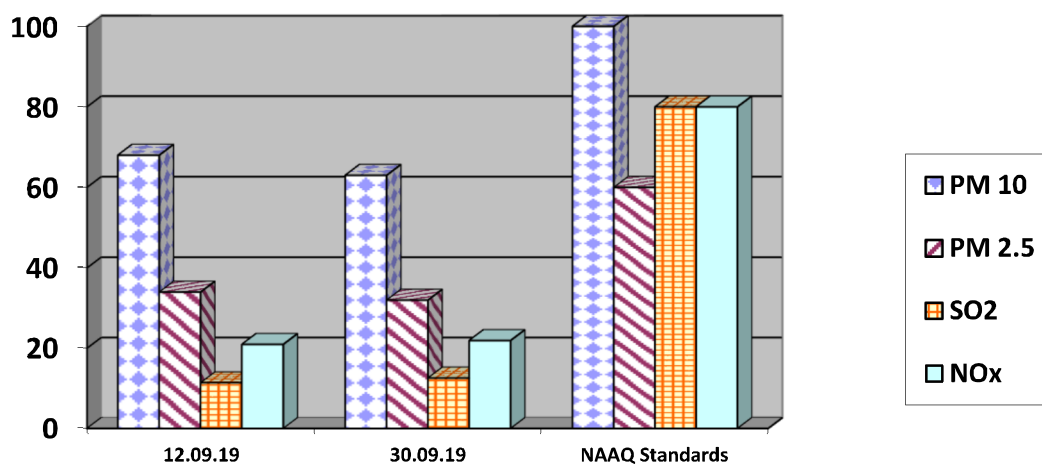
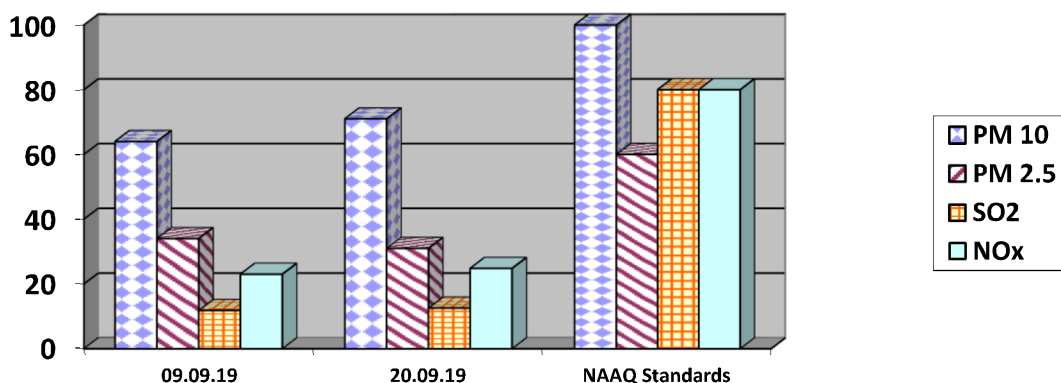| Station Name: A20, Lohapatti		Zone: Buffer		Category: Industrial	
SI. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_X
1	11.09.19	66	35	11.84	23.54
2	18.09.19	61	33	11.68	21.84
	NAAQ Standard	100	60	80	80
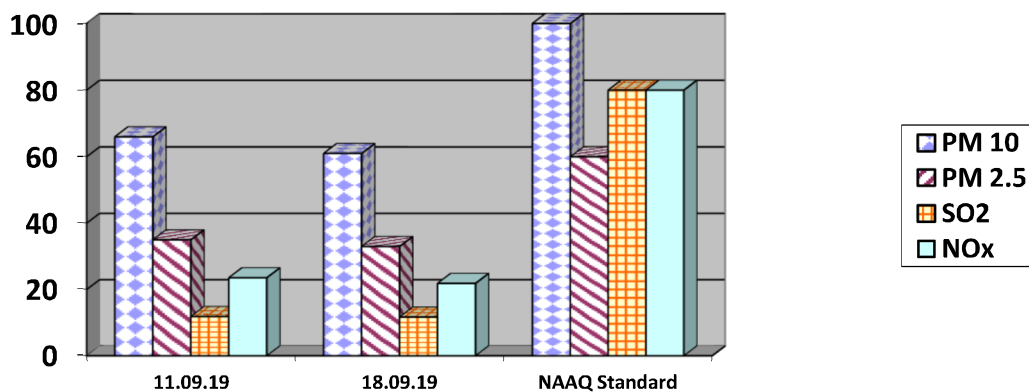
Analysed By
JSA/SA/SSA

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Lab In Charge
RI-2, CMPDI, Dhanbad

Approved By
HOD(Mining/Environment)
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JOB NO. 200316028   Cluster – XIII   BCCL Environmental Monitoring Report

Station Name: A21 Kharkharee		Zone: Buffer		Category: Industrial[2]	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	09.09.19	64	34	11.82	23.01
2	20.09.19	71	31	12.56	24.80
	NAAQ Standards	100	60	80	80

Station Name: A31 Dumarda		Zone: Buffer		Category: Residential	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	12.09.19	53	28	7.31	15.32
2	30.09.19	56	23	9.18	16.22
	NAAQ Standards	100	60	80	80

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

Analysed By
JSA/SA/SSA

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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 Murlidih 20/21 (MW13)**
A sampling point is fixed to assess the effluent quality of Mine discharge. This location is selected to monitor effluent discharge in to Jamunia.

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 -XIII**		Month: **SEPT, 2019**	Name of the Station: **Mine Discharge of Murlidih 20/21[3]**	
Sl. No.	**Parameters**	**MW13** First Fortnight	**MW13** Second Fortnight	**As per MOEF General Standards for schedule VI**
		12.09.2019	30.09.2019	
1	Total Suspended Solids	42	38	*100 (Max)*
2	pH	8.12	8.18	*5.5 - 9.0*
3	Oil & Grease	<2.0	<2.0	*10 (Max)*
4	COD	36	48	*250 (Max)*

All values are expressed in mg/lit unless specified.

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