

# भारत कोकिंग कोल लिमिटेड

एक मिनी रत्न कम्पनी

(महारत्न कम्पनी कोल इंडिया का एक उपकम)

पंजीकृत कार्यालय : कोयला भवन, कोयला नगर,  
धनबाद-826005

सीआइएन : U10101JH1972GOI000918

परियोजना पदाधिकारी का कार्यालय  
महुदा ग्रुप

पोस्ट / थाना: महुदा, जिला: धनबाद (झारखण्ड)-828305

फोन नं.0326 2273483; फेक्स: 0326 2273445, ई-मेल: gmwj bccl@coalindia.in



# Bharat Coking Coal Limited

A Mini Ratna Company

(A Subsidiary of Coal India Limited: A Maharatna Company)

Regd. Off. : Koyla Bhawan, Koyla Nagar

Dhanbad - 826005

CIN : U10101JH1972GOI000918

**OFFICE OF THE PROJECT OFFICER  
MAHUDA GROUP**

PO & PS: Mahuda, DISTT: Dhanbad (Jharkhand)-828305

PHONE NO: 0326 2273483, FAX NO: 0326 2273445, e-mail : gmwj.bccl.coalindia.in

"For uploading online on "parivesh portal" of MoEF&CC and sending by e-mail"

Ref:- BCCL/WJA/ENV/2025/ 360 (C)

Date:- 22/05/2025

To,

The Regional Director,

Ministry of Environment & Forest and Climate Change

Regional Office (ECZ), Bunglow No. A-2,

Shyamali Colony, Ranchi – 834002.

**Sub:** - Submission of six-monthly reports on compliance of Environment Clearance for the period from **October'2024 to March'2025** with respect to **Cluster-XIV**, Lohapatti mines of M/s Bharat Coking Coal Limited.

**Ref:** EC Order No. – J-11015/10/2010-IA.II (M), Dated: - 06.06.2013.

Respected Sir,

Please find enclosed herewith the six-monthly reports on compliance of Environment Clearances for the period from **October'2024 to March'2025** in respect of **Cluster XIV**, Lohapatti Mines of M/s Bharat Coking Coal Limited. We hope you will find in order.

Thanking you,

Encl: - As Above

Yours faithfully,

Project officer  
Mahuda Group of Mine  
Lohapatti Mine  
(Cluster-XIV, BCCL)

**ENVIRONMENTAL CLEARANCE COMPLIANCE OF CLUSTER-  
XIV (GRANTED VIDE LETTER NO. J-11015/10/2010-IA. II  
(M) DATED 06.06.2013**

(October'24 to March'25)

<b>Sl. No.</b>	<b>A. Specific Conditions by MOEF:</b>	<b>Compliance</b>
i.	<b>No mining shall be undertaken in/under the forestland until prior forestry clearance has been obtained under the provisions of FC Act 1980.</b>	Being Complied.  Coal production from Cluster XIV group of mines is <b>Nil</b> .  Production from Lohapatti mine is <b>suspended from 1<sup>st</sup> April 2018</b> .
ii.	<b>The maximum production in the cluster shall not exceed beyond that for which environmental clearance has been granted for the cluster XIV.</b>	It is being complied.  Presently there is no producing mine under cluster XIV.  Annexure - I
iii.	<b>The measure identified in the environmental plan for cluster–XIV group of mine and the condition given in this environmental clearance letter shall be dovetailed to the implementation of Jharia Action Plan.</b>	Implementation of Jharia Action Plan is under process.
Iv.	<b>As there is no fire in cluster XIV but the measure should be adopted proponent to control spread of neighboring fire to this cluster XIV. The proponent shall prepare time series maps of Jharia Coal field through NRSA to monitor &amp; 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.</b>	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 temperatures of the coal seams and NRSC has submitted their final report in August 2021.  NRSC report is enclosed as Annexure II.
V.	<b>Underground mining should be taken up after completion of reclamation of O/C mine area after two years.</b>	Agreed.  <b>Lohapatti O/C project yet not started.</b>

vi.	<b>No mining shall be undertaken where underground fires continue. Measure shall be taken to prevent/check such fire including in old OB dump.</b>	At present there is no fire.
vii.	<b>A part of Cluster XIV is under River Damodar. It was clarified that although the mine is underground, there is no coal underneath River Damodar, which would be mined. The Committee desired that the data of bore wells near River Damodar require to be monitored for permeability and seepage of water of River Damodar.</b>	Complied. There is no coal mining underneath of River Damodar.
viii.	<b>The rejects of washeries in Cluster –XIV should be send to FBC based plant.</b>	There is no washery in cluster XIV, so rejects of washery in cluster XIV cannot be sent to FBC used plant.
ix	<b>There shall be no external OB dumps.OB produce from the whole cluster will be 7.29 Mm<sup>3</sup>. 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.</b>	Will be complied. There is no operating opencast mine in this cluster XIV at present.
x.	<b>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 XIV shall be drawn up &amp; implemented.</b>	Being implemented. Mine closure plan of Lohapatti mine is approved.
xi.	<b>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 &amp; biologically reclaimed with plantation and or may use for pisciculture.</b>	Will be Complied. As there is no opencast mine in this cluster at present.
xii.	<b>Mining shall be carried out as per statuette from the streams/nalas flowing within the lease and maintaining a safe distance from the Nalas flowing along the lease boundary. A safety barrier of a minimum 60m width shall be maintained along the nalas/water bodies. The small water bodies in OC shall be protected to</b>	Being Complied. There is no operating opencast mine in this cluster at present.

	<b>the extent feasible and the embankment proposed along water body shall be strengthened with stone pitching.</b>	
xiii.	<b>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.</b>	No active OB dumps in this Cluster at present.
xiv.	<b>Thick green belt shall be developed along undisturbed areas, mine boundary and in mine reclamation. During post mining stage, a total of 47.63 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.</b>	Agreed. Sufficient plantation in required area is done and is also being done. There is no reclaimed land under the leasehold area of cluster XIV and so thick green belt is already developed in adjoining area of cluster XIII (Ecological restoration of 8.4 ha area are maintained for the purpose in reclaimed land by planting native species – FRI, Dehradun is doing monitoring of 4.2 ha eco-restoration site). A Plantation site of 0.7 acre is being developed at Lohapatti in session of 2020-21 and continued to successive year. Plantation at 3.0 Ha. Land is being done and maintained through forest department.
xv.	<b>The roads should be provided with avenue plantation on both sides as trees act as sink of carbon and other pollutant.</b>	Agreed. Being complied.
xvi.	<b>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- XIV shall be implemented.</b>	Implemented. Environmental action plan is maintained for the purpose.
xvii.	<b>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, flyash 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.</b>	Location of monitoring stations was already finalized with the consultation of Jharkhand State Pollution Control Board.  Source Apportionment Study: -  Report of Source Apportionment Study has been submitted. <b>Progress report sent by NEERI is attached as Annexure-III.</b>

xviii.	<b>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.</b>	Already being done water supplied to Kandra and Bhurungia village and all other adjoining villages. There are 8 no. of ponds maintained for the purpose within leasehold area of Cluster XIV.
xix.	<b>Regular monitoring of groundwater level and quality of the study area shall be carried out by establishing a network of existing wells and construction of new peizometers. The monitoring for quantity shall be done four times a year in pre-monsoon (May), monsoon (August), post-monsoon (November) and winter (January) seasons and for quality including Arsenic and Fluoride during the month of May. Data thus collected shall be submitted to the Ministry of Environment &amp; 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.</b>	It is being complied. CMPDI RI-II has prepared a report for Location and design of Piezometers. Two number of Piezometer has been installed and ground water monitoring is being done regularly.
xx.	<b>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.</b>	Being complied. Monitoring work being done by CMPDI. Records maintained for the purpose.  Report enclosed as Annexure- IV.
xxi.	<b>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.</b>	There is no production at the present so no effulent is being discharged.
xxii.	<b>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</b>	At present there is no active depillaring operation in the underground workings of ClusterXIV. There is no chance of active subsidence at present. However subsidence monitoring is being done.

	<b>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.</b>	
xxiii.	<b>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.</b>	Already complied as per DGMS provisions.
xxiv.	<b>High root density tree species shall be selected and planted over areas likely to be affected by subsidence.</b>	Plantation in required area is done and is also being done.
Xxv.	<b>Depression due to subsidence resulting in water accumulating within low lying areas shall be filled up or drained out by cutting drains.</b>	At present there is no active depillaring operation in the underground workings of Cluster XIV. There is no chance of active subsidence at present. However subsidence monitoring is being done.
Xxvi.	<b>Solid barriers shall be left below the roads falling within the blocks to avoid any damage to the road.</b>	Already complied as per DGMS's statutory provisions.
xxvii.	<b>No depillaring operation shall be carried out below the township/colony.</b>	At present there is no active depillaring operation in the underground workings of Cluster XIV.
xxviii.	<b>The transportation plan for conveyor – cum – rail for cluster XIV 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.</b>	Presently no Coal Transportation from cluster- XIV mines as there is NIL Production.

xxix.	<b>A study should be initiated to analyze extent of reduction in pollution load every year by reducing road transport.</b>	Production from Lohapatti mine is suspended from <b>1<sup>st</sup> April 2018</b> . Therefore there is no transportation of coal from Lohapatti mine.
xxx.	<b>R &amp; R of 713 nos. of PAF's involved. They should be rehabilitated at cost of Rs. 5035.38 lacs as per the approved Jharia Action Plan.</b>	PAF's involved is being rehabilitated as per cost specified as per Jharia Action Plan.
Xxxi.	<b>Details of transportation, CSR, R&amp;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.</b>	Being Complied.
Xxxii.	<b>A detailed CSR action plan shall be prepared for cluster XIV 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 XIV 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.</b>	Agreed. Being complied

xxxiii.	<b>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.</b>	Time series map of vegetation cover in the Jharia Coal field has been carried out through CMPDI.
xxxiv.	<b>A Final Mine Closure Plan along with details of Corpus Fund shall be submitted to the Ministry of Environment &amp; 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.</b>	Mine closure plan has already been approved.
xxxv.	<b>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.</b>	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.

xxxvi.	<b>Implementation of final mine closure plan for cluster XIV, subject to obtaining prior approval of the DGMS in regard to mines safety issues.</b>	Mine closure plan has been approved. Will be implemented.
xxxvii.	<b>Corporate Environment Responsibility:</b>	Annexure- IV
a)	<b>The Company shall have a well laid down Environment Policy approved by the Board of Directors.</b>	Agreed
b)	<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.</b>	Complied
c)	<b>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.</b>	Complied
d)	<b>To have proper checks and balances, the company shall have a well laid down system of reporting of non-compliances/violations of environmental norms to the Board of Directors of the company and/or shareholders or stakeholders at large.</b>	Complied
<b>Sl. No.</b>	<b>B. General Conditions Conditions by MOEF:</b>	<b>Compliance</b>
i.	<b>No change in mining technology and scope of working shall be made without prior approval of the Ministry of</b>	Being Complied

	<b>Environment and Forests.</b>	
ii.	<b>No change in the calendar plan of production for quantum of mineral coal shall be made.</b>	Being Complied
iii.	<b>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<sub>2</sub> and NO<sub>x</sub> 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.</b>	The locations of monitoring stations in the Jharia Coalfields has been finalized in consultation with the Jharkhand State Pollution Control Board. The work of monitoring of ambient environment is being done through CMPDIL which is having laboratory under EP rule.  Records for the same are maintained.  Annexure - V
iv.	<b>Data on ambient air quality (PM10, PM 2.5, SO<sub>2</sub> and NO<sub>x</sub>) 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.</b>	Being complied. Monitoring for the same is done by CMPDIL.
v.	<b>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.</b>	Being complied  No operating mine at present in Cluster XIV.
vi.	<b>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 31<sup>st</sup> December 1993 or as amended from time to time before discharge. Oil and grease trap shall be installed before discharge of workshop effluents.</b>	The work of monitoring of ambient environment done through CMPDIL which is having laboratory under EP rule. 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.	<b>Vehicular emissions shall be kept under control and regularly monitored. Vehicles used for transporting the mineral shall be covered with tarpaulins and optimally loaded.</b>	Already Complied.
viii.	<b>Monitoring of environmental quality parameters shall be carried out through establishment of adequate number and type of pollution monitoring and analysis equipment in consultation with the State Pollution Control Board and data got analysed through a laboratory recognised under EPA Rules, 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.</b>	It is complied. Monitoring for the same is being done by CMPDI which is having laboratory under EP rule.  Annexure -VI
ix.	<b>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.</b>	Being Complied. Vocational training Centers under separate Human Resource Development Deptt. is conducting regular training programme on these issues.
x.	<b>Occupational health surveillance programme of the workers shall be undertaken periodically to observe any contractions due to exposure to dust and to take corrective measures, if needed and records maintained thereof. The quality of environment due to outsourcing and the health and safety issues of the outsourced manpower should be addressed by the company while outsourcing.</b>	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.	<b>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.</b>	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 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.	<b>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.</b>	It is being initiated to comply the same. Agreed to report the same.

xiii.	<b>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 &amp; Forests at <a href="http://envfor.nic.in">www.envfor.nic.in</a> <a href="http://envfor.nic.in">http://envfor.nic.in</a>.</b>	It has been complied.
xiv.	<b>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.</b>	Complied.
xv.	<b>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.</b>	Complied.

xvi.	<b>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 sectorial parameters shall also be displayed at the entrance of the project premises and mine office and in corporate office and on company's website.</b>	Complied.
xvii.	<b>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.</b>	Being complied.
xviii.	<b>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.</b>	Agreed .It is being and shall be complied.
xix	<b>The Environmental statement for each financial year ending 31<sup>st</sup> March – Form – V is mandated to be submitted by the Project proponent for the concerned State Pollution Control Board as prescribed under the Environmental (Protection) Rules, 1986 as amended subsequently, shall also be uploaded on the company's website along with the status of compliances of EC conditions and shall be sent to the respective Regional Officers of the MOEF by e-mail.</b>	Already complied
8	<b>The Ministry or any other competent authority may stipulate any further condition for environmental protection.</b>	Agreed
9	<b>Failure to comply with any of the conditions mentioned above may result in withdrawal of this clearance and attract the provisions of the Environment</b>	Agreed

(Protection) Act, 1986.

10


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

11

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

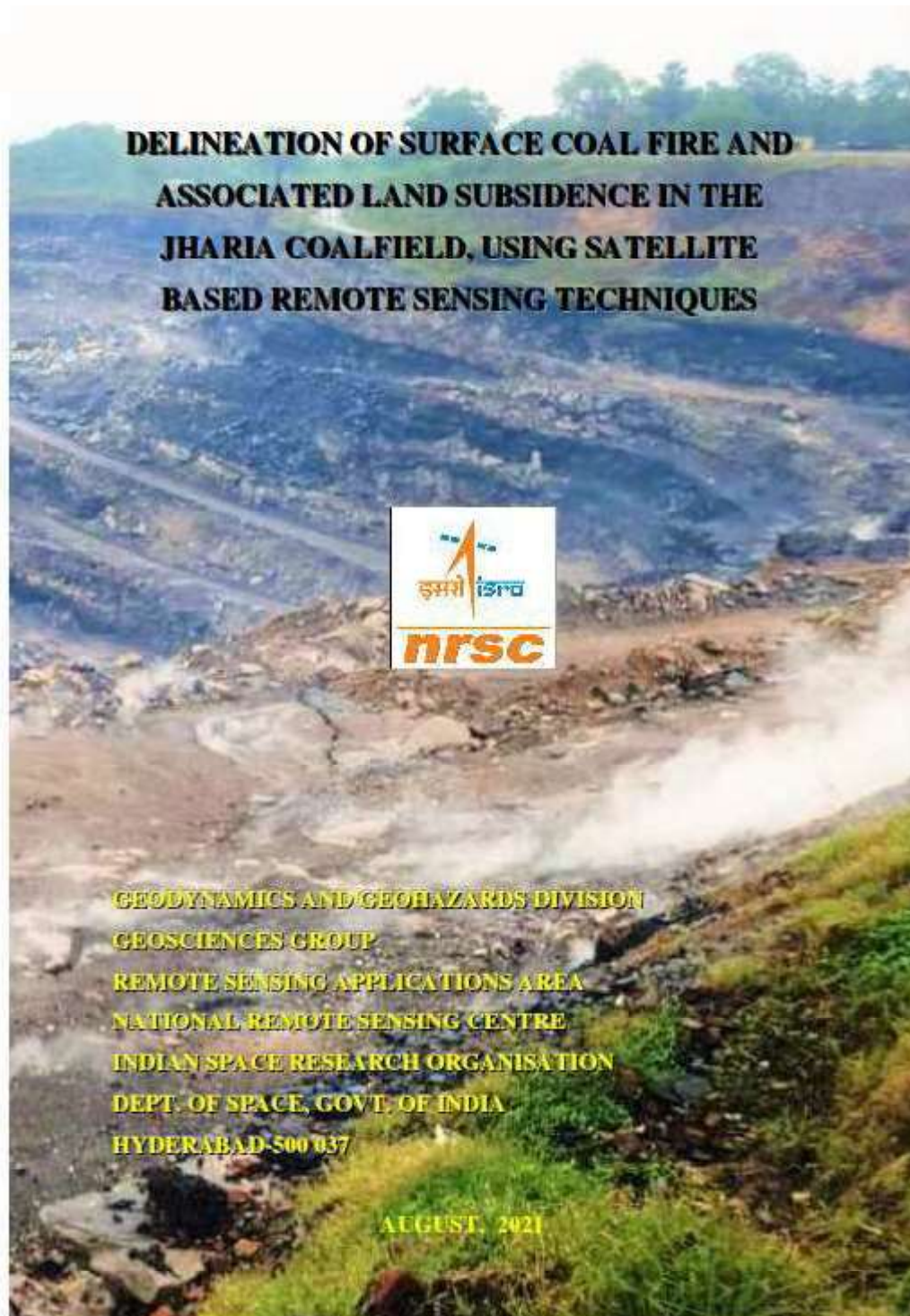
  
Project officer  
Lohapatti colliery  
(Cluster-XIV, BCCL)  
Project Officer  
LOHAPATI COLLIERY  
W.J. Area

**ANNEXURE- I**

**A. Production from October'24 to March'25 of Cluster XIV mines**

Total Month		Oct'24	Nov'24	Dec'24	Jan'25	Feb'25	March'25	Production (tonne)
Cluster XIV	Lohapatti UG Mine	0	0	0	0	0	0	0
	Lohapatti OC Mine	Nil						Nil
	Total (in tonne)							0
	Production from Lohapatti mine is suspended from April'2018.							

As per specific condition no xiii. The proponent shall prepare time -series maps of the Jharia Coalfields through NRSA to monitor and prevent fire problems in the Jharia Coalfields by Isothermal mapping /imaging and monitoring temperatures of the coal seams.



**DELINEATION OF SURFACE COAL FIRE AND  
ASSOCIATED LAND SUBSIDENCE IN THE  
JHARIA COALFIELD, USING SATELLITE  
BASED REMOTE SENSING TECHNIQUES**

**Report for**

**BHARAT COKING COAL LIMITED (BCCL)**

**(A SUBSIDIARY OF COAL INDIA LTD.)**

**ENVIRONMENT DEPARTMENT, KOYLA BHAWAN  
KOYLA NAGAR, DHANBAD – 826 005, JHARKHAND**

**GEODYNAMICS AND GEOHAZARDS DIVISION**

**GEOSCIENCES GROUP**

**REMOTE SENSING APPLICATIONS AREA**

**NATIONAL REMOTE SENSING CENTRE**

**INDIAN SPACE RESEARCH ORGANISATION**

**DEPT. OF SPACE, GOVT. OF INDIA**

**HYDERABAD-500 037**

**AUGUST, 2021**



**REPORT / DOCUMENT CONTROL SHEET**

1	<b>Security Classification</b>	<b>Restricted</b>			
2	<b>Distribution</b>	ISRO and BCCL			
3	<b>Report / Document version</b>	<b>(a) Issue no.</b> 01	<b>(b) Revision &amp; Date</b>	31.08.2021	
4	<b>Report / Document Type</b>	Project report			
5	<b>Document Control Number</b>	NRSC-RSA-GSG-GGD-Oct2021-TR-0001912-V1.0			
6	<b>Title</b>	<b>DELINEATION OF SURFACE COAL FIRE AND ASSOCIATED LAND SUBSIDENCE IN THE JHARIA COALFIELD, USING SATELLITE BASED REMOTE SENSING TECHNIQUES</b>			
7	<b>Particulars of collation</b>	<b>Pages</b> 33	<b>Figures</b> 20	<b>Tables</b> 4	<b>References</b> 14
8	<b>Author(s)</b>	Shri Priyom Roy, S/E 'SE' and Dr. Tapas Ranjan Martha S/E 'SG'			
9	<b>Affiliation of authors</b>	Geosciences Group, RSA-A, NRSC/ISRO			
10	<b>Scrutiny mechanism</b>	<b>Compiled by</b>  P. Roy	<b>Reviewed by</b>  Group Director, Geosciences Group	<b>Approved / Controlled by</b>  DD (RSAA)	
11	<b>Originating unit</b>	NRSC			
12	<b>Sponsor(s)/ Name and Address</b>	BHARAT COKING COAL LIMITED (BCCL)			
13	<b>Date of Initiation</b>	01.10.2020			
14	<b>Date of Publication</b>	31.08.2021			
15	<b>Abstract (with Keywords):</b>	<p>Coal fire is a serious problem in Jharia coal field, where high grade coals are gradually burnt due to these fires. The combined effect of surface and sub-surface fires and mining related subsidence has affected 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 data 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, 2021 have been used. The band 10 (10.60-11.19 <math>\mu\text{m}</math>) of Landsat-8 data are used to derive the relative radiant temperature. Further ALOS-PALSAR 2, L band microwave data have been used to delineate zone of probable land subsidence (using differential interferometry) due to mining. The study reflects that, compared to 2017, the eastern flanks (Lodna and Tisra etc) show a significant reduction in total fire area. The western flank (Block II and Shatabdi) and the northern flank (Katras and Gaslitand) show isolated fire pockets in active mines as well as in OB dumps. The current total fire area mapped is 1.8 sq.km. Apart from this, one distinctive area of land subsidence has been identified using interferometric method. These are primarily caused by older or active underground mining in the Moonidih Project. The coal mine fire and subsidence areas are further verified on the ground. The final coal mine fire and subsidence maps of Jharia coal field are prepared by using remote sensing data analysis with field validation.</p>			

***PROJECT TEAM***

1. **Dr. K VINOD KUMAR**, Group Director, Geosciences Group  
Project formulation and co-ordination
2. **Dr. Tapas R. Martha**, Head, Geodynamics and Geohazards Division  
Review and report preparation
3. **Shri Priyom Roy**, Scientist 'SE'  
Image processing, interpretation, field survey, maps and report preparation

**CONTENTS**

ACKNOWLEDGEMENTS	i
EXECUTIVE SUMMARY	ii
LIST OF FIGURES AND TABLES	iii
CHAPTER – I INTRODUCTION	1
1.1 BACKGROUND	2
1.2 OBJECTIVES	2
1.3 STUDY AREA	3
CHAPTER – II GENERAL DESCRIPTION OF THE STUDY AREA	4
2.1 LOCATION AND ACCESSIBILITY	4
2.2 PHYSIOGRAPHY, DRAINAGE AND CLIMATE	4
2.3 GENERAL GEOLOGY	4
CHAPTER – III DATA REQUIREMENTS	7
3.1 REMOTE SENSING DATA	7
3.2 ANCILLARY DATA	7
CHAPTER – IV REMOTE SENSING DATA ANALYSIS	8
4.1 METHODOLOGY	8
4.1.1 PROCESSING OF LANDSAT 8 DATA	8
4.1.2 THRESHOLDING OF RADIANT TEMPERATURE IMAGE	9
4.2 METHODOLOGY FOR SUBSIDENCE DETECTION	12
4.2.1 PROCESSING OF ALOS-PALSAR-2 DATA	12
CHAPTER – V FIELDWORK	17
CHAPTER – VI DISCUSSIONS AND CONCLUSIONS	20
7.1 DISCUSSION	20
7.2 CONCLUSIONS	22
CHAPTER – VIII LIMITATIONS	23
REFERENCES	25
Annexure – I	27
Annexure - II	29
Annexure - III	33

## **ACKNOWLEDGEMENTS**

The project team is grateful to Dr. Raj Kumar (Director, NRSC) and Shri Shantanu Chaudhury (Ex Director, NRSC) for their support at various stages during execution of this project. We are extremely grateful to Dr. V.V. Rao (Deputy Director, RSAA) and Dr. P.V.N. Rao (Ex Deputy Director, RSAA) NRSC for their overall guidance and encouragement. We thank Shri C. Goswami (Director, Technical Operations) BCCL, for this project initiative and for providing Geosciences group, NRSC, the opportunity to carry out the task. We also thank Shri Dipankar Maity, Deputy Manager (Survey) and Shri Mithilesh Kumar, Chief Manager (Mining) for their support and fruitful discussion during the fieldwork. The support of all the BCCL officials in various collieries visited during the course of the ground truth verification is duly acknowledged.

## EXECUTIVE SUMMARY

Coal fire is a serious problem in Jharia coal field, where high grade coals are gradually burnt due to these fires. The combined effect of surface and sub-surface fires and mining related subsidence has affected 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 has been addressed. Thermal band data 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, 2021 have been used. The band 10 (10.60-11.19  $\mu\text{m}$ ) of Landsat-8 data are used to derive the relative radiant temperature. Further ALOS-PALSAR 2, L band microwave data have been used to delineate zone of probable land subsidence (using differential interferometry) due to mining. The study reflects that, compared to 2017, the eastern flanks (Lodna and Tisra etc) show a significant reduction in total fire area. The western flank (Block II and Shatabdi) and the northern flank (Katras and Gaslitand) show isolated fire pockets in active mines as well as in OB dumps. The current total fire area mapped is 1.8 sq.km. Apart from this, one distinctive area of land subsidence has been identified using interferometric method. These are primarily caused by older or active underground mining in the Moonidih Project. The coal mine fire and subsidence areas are further verified on the ground. The final coal mine fire and subsidence maps of Jharia coal field are prepared by using remote sensing data analysis with field validation.

## ***LIST OF FIGURES AND TABLES***

- Figure 1 : Study area map of Jharia Coalfield, Jharkhand
- Figure 2 : Geological map of Jharia coal field, Dhanbad, Jharkhand (published by CMPDIL)
- Figure 3 : False colour composite image of Jharia Coalfield (VNIR 3N,2,1) , with subset blocks (in red) 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 36.5 °C
- Figure 5 : Coal mine fire map (May, 2020) of Jharia coal field, Dhanbad. The fire areas shown in this map have been verified in the field as per field points in figure 12.
- Figure 6 : DInSAR acquisition scheme
- Figure 7 : Work flow diagram for generating land subsidence map using DInSAR technique
- Figure 8 : ALOS-PALSAR - 2 Master-Slave pairs for short and long temporal base line processing
- Figure 9 : Fringe patterns generated from short baseline processing (e.g. Master: Oct, 19, Slave: Feb, 20).
- Figure 10 : Figure 10. Fringe patterns generated from long baseline processing (e.g. Master: Sept, 17, Slave: Feb, 2020).
- Figure 11 : Subsidence map of Jharia coal field, Dhanbad
- Figure 12. : Field data points for coal fire and subsidence verification

### **Field Photographs**

- Figure 13 : Active fires in Keshalpur-West Mudidih. (Points 1, 2, 3 & 4 in figure 12)
- Figure 14 : Active fires in Sendra-Bansjora Mines (Points 5, 6, 7 & 9 in figure 12)
- Figure 15 : OB dump fires in Sendra Bansjora (Points 10 in figure 12)
- Figure 16 : Active fires in Godhar-Kusunda Mines (Points 20 to 24 in figure 12)

- Figure 17 : Fire in R-OCP. (Point 28 in figure 12)  
Figure 18 : Active fires in N-S Tisra mines (Points 31-33 in figure 12).  
Figure 19 : Subsidence area in Bagdigi Mines  
Figure 20 : Subsidence (sag ponds) around Moonidih mine area

### **List of Tables**

- Table 1 : Generalised stratigraphy of JCF  
Table 2 : List of satellite data used in the present study  
Table 3 : Summary of field observations (refer figure 12)  
Annexure I : Colliery wise break-up of change in fire area from 2017 to 2020  
Annexure III : Coordinates of Fire locations.

## ***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<sup>0</sup> to 120<sup>0</sup>C, a steady reaction starts, which produces carbon dioxide. Temperature keeps on increasing once CO<sub>2</sub> started to form and at 2300°C, the exothermic reaction becomes rapid. It is known that high grade coals (high carbon content) are more fire prone, though the reason behind this is not well understood. Another important parameter, which controls fire, is the size of the particles. Larger the effective area of coal (fire particles), more rapidly the reaction proceeds. Cracks, fissures play a role like positive catalysts to coal oxidation by slowly supplying oxygen / air through their conduits.

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

## 1.1 Background

Remote sensing technique in thermal band offers a cost-effective and time-saving technology for mapping various geoenvironmental / hazardous features such as coal fires, forest fires, oil well fires, volcanic eruptions etc. NRSC has carried out coal fire mapping projects in the past; conducting an airborne campaign in 1989 and using Landsat-5 TM data in 1995 (Bhattacharya *et. al.*, 1995), over Jharia coalfield, Jharkhand and using Landsat-5 TM data for 2001 over Raniganj coalfield, West Bengal. Further, projects were executed in 2006 and 2012 in which coal fires of the JCF were mapped using Landsat-7 ETM+ and ASTER data, respectively. Additionally, a R&D study was taken up in 2013 to delineate subsidence areas using differential interferometric (DInSAR) technique. An operational fire and subsidence mapping activity was taken up in 2017. In view of the past experiences, based on the letter (Ref. no. MP/19/270) from General manager (JMP), BCCL addressed to Director, NRSC on 24-10-2019, 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 7<sup>th</sup> August, 2020.

## 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 2020 time period.
- II. To compare the change in the coal fire distribution in the Jharia coalfield between the period of 2017 and 2020.
- 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 approximately within latitudes 23° 42' N and 23° 50' N and longitudes 86° 09' E and 86° 30' E.

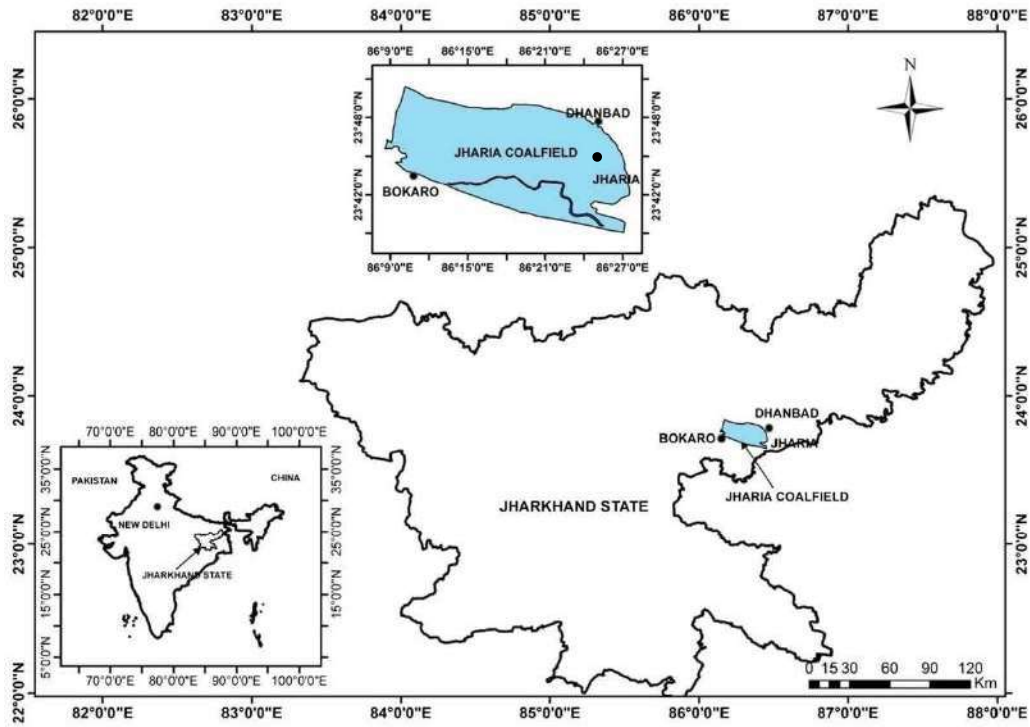


Figure 1: Study area map of Jharia Coalfield, Jharkhand

## ***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  $\sim 10^{\circ}$  C in the month of December – January and maximum temperature is  $\sim 50^{\circ}$  C in the month of May – June.

#### **2.3 General Geology**

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

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

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

Table 1: Generalised stratigraphy of JCF.

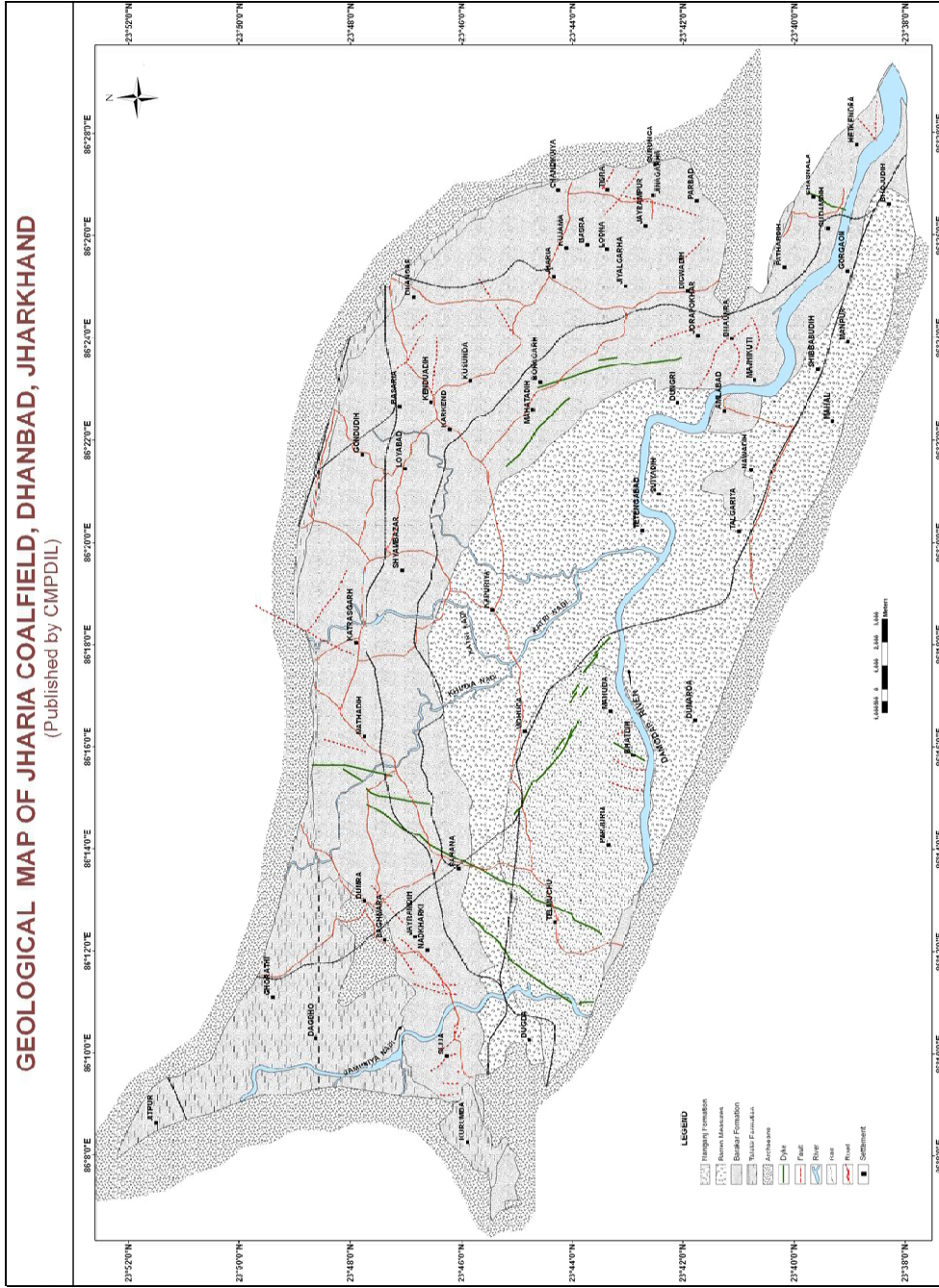


Figure 2 : Geological map of Jharia coal field, Dhanbad, Jharkhand (published by CMPDIL)

**CHAPTER III****DATA REQUIREMENTS****3.1 Remote Sensing Data**

Coal fire map was created from LANDSAT 8 TIRS data of 22 May 2020. Further, the coal fire map of 2017 prepared by NRSC (NRSC, 2017) from LANDSAT 8 data (of 14 May 2017), was used as a reference to identify the changes that has occurred in the extent and disposition of the fires from 2017 to 2020.

For the land subsidence study, L-band microwave data from ALOS-PALSAR satellite (JAXA) were used. Five scenes of "Fine Beam mode" SLC data were taken from PALSAR-2 archives over a period from September, 2017 to February, 2020. 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.

Satellite	Sensor	Resolution	Time	Date	Data source
LANDSAT-8	TIRS	100m resampled to 30m	Daytime	22 May 2020	USGS, USA
ALOS	PALSAR-2 (Fine Beam mode)	10 m	NA	30 September 2017	JAXA, Japan
				3 March 2018	
				19 January 2019	
				02 March, 2019	
				29 February. 2020	

**3.2 Ancillary data**

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

**CHAPTER IV****REMOTE SENSING DATA ANALYSIS****4.1 Methodology****4.1.1 Processing of Landsat 8 Data**

With the launch of the LANDSAT-8 mission in February, 2013; thermal space borne data are 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 (Gangopadhyay et al. 2012). In present study, band 10 of TIRS sensor (acquired on 22 May, 2020) has been used coal fire mapping. 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.

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

Where:

$L_{\lambda}$  = Spectral radiance (Watts/ (m<sup>2</sup> \* 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 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 literature (Gupta, 2003).

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

$T_R$  = Radiant (brightness) temperature,

$K_1$  = Calibration constant (1260.56 K),

$K_2$  = Calibration constant (666.09 watts/ (m<sup>2</sup> \*srad\* $\mu$ m)),

$L_\lambda$  = 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. 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 36.5°C (Figure 4). Based on this cut-offs, regional coal fire map was prepared (Figure 5).

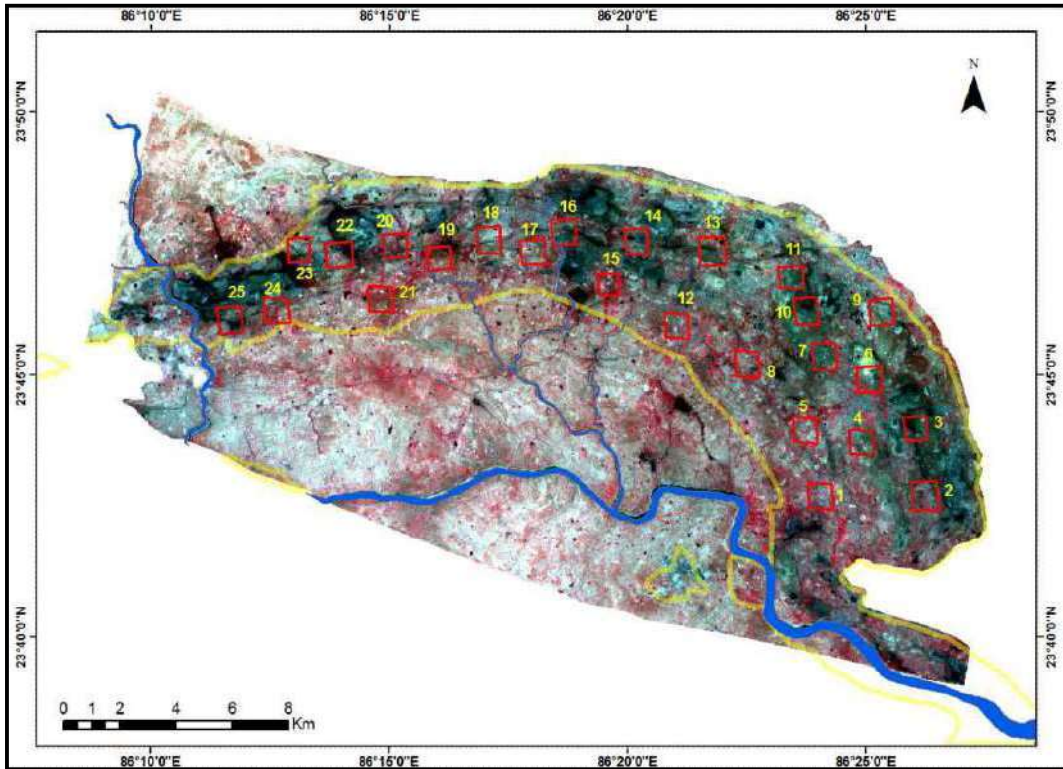


Figure 3. False colour composite image of Jharia Coalfield, with subset blocks (in red boxes) to obtain temperature values (from radiant temperature image) within the Barakar formation across the Jharia coalfield.

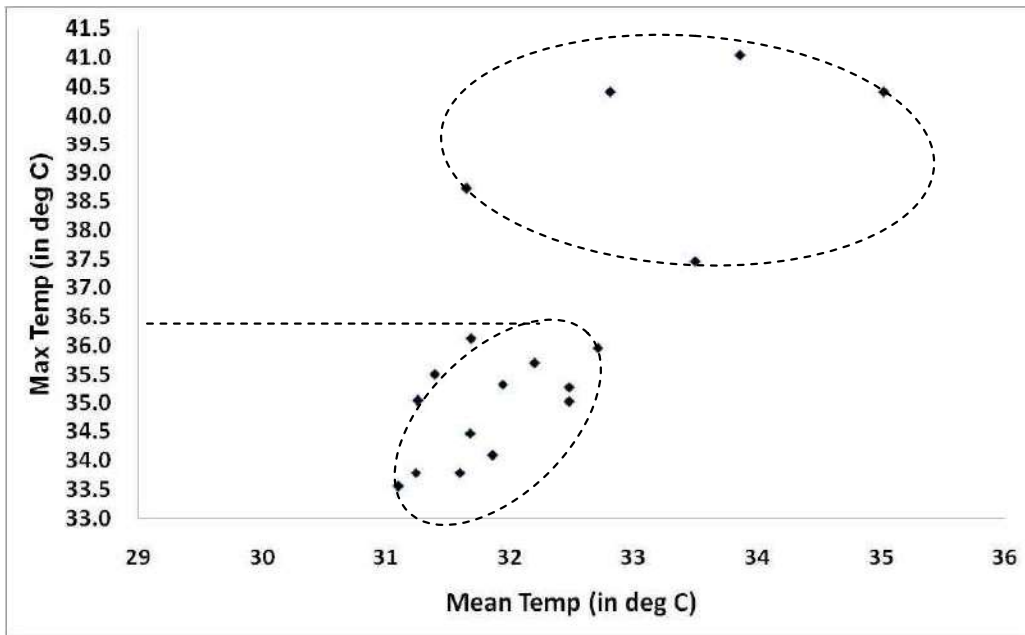


Figure 4. Maximum temperature plotted against mean temperature for various locations; cluster separation observed around 36.5 °C (marked with arrow)

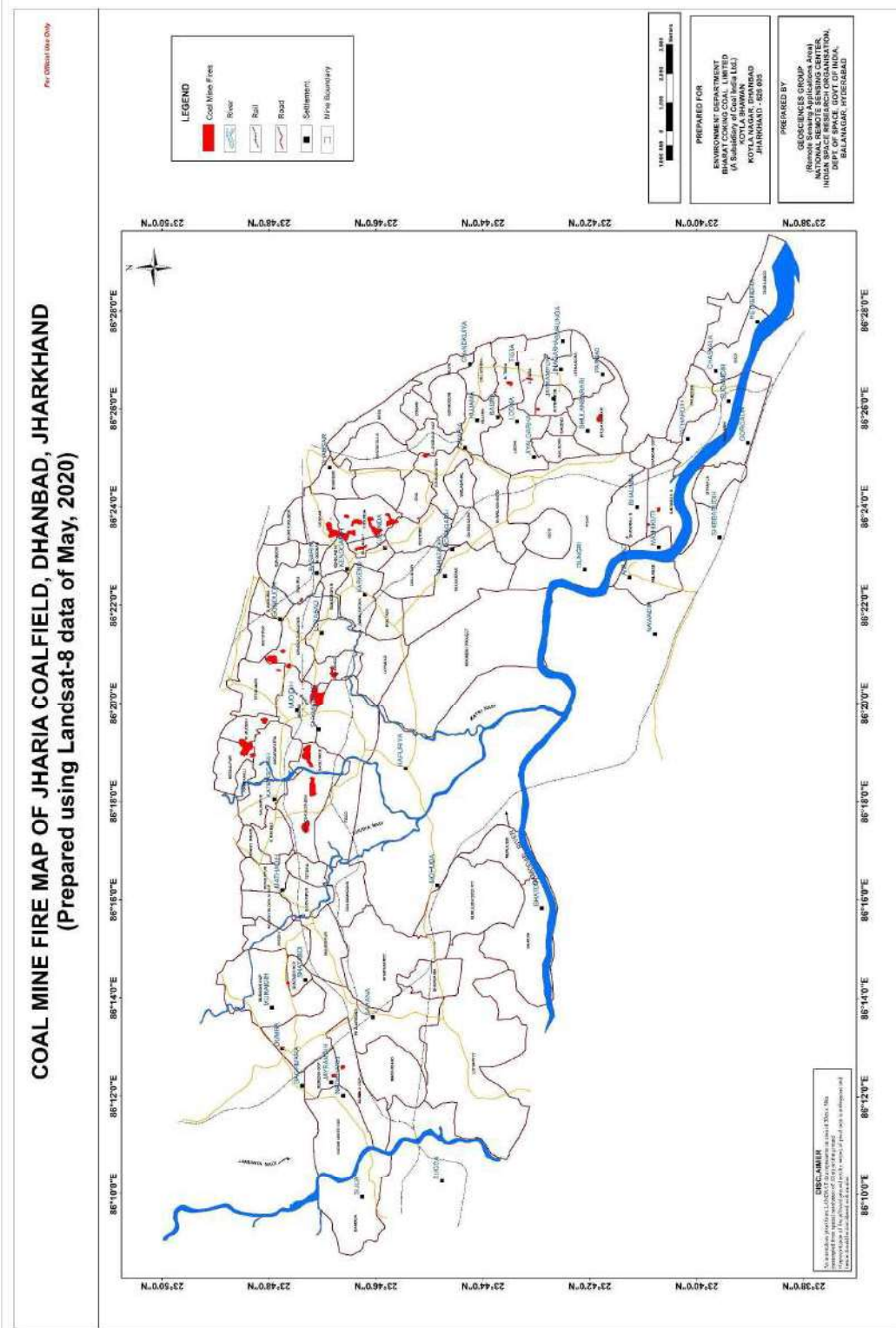


Figure 5: Coal mine fire map (May, 2020) of Jharia coal field, Dhanbad. The fire areas shown in this map have been verified in the field as per field points in figure 12.

## 4.2 Methodology For Subsidence Detection

### 4.2.1 Processing of ALOS-PALSAR 2 Data

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

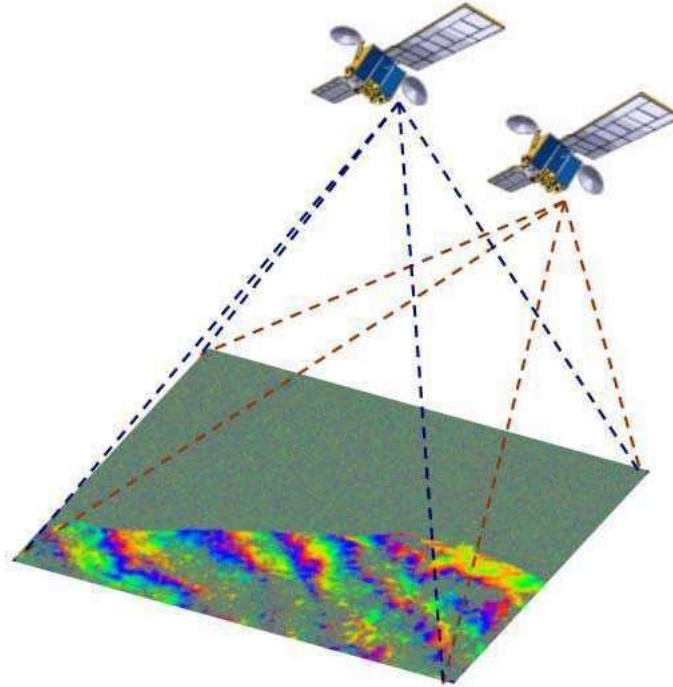


Figure 6. DInSAR acquisition scheme.

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

$$\Delta\Phi_{Int} = \Phi_{Topo} + \Phi_{Mov} + \Phi_{Atm} + \Phi_{Noise} \quad (3)$$

where,  $\Phi_{Topo}$  denotes the topographic component,  $\Phi_{Mov}$  denotes the terrain deformation/ displacement component,  $\Phi_{Atm}$  is the noise component and  $\Phi_{Noise}$  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 an external Digital Elevation Model (DEM) and the orbital ephemeris from the SAR acquisitions, considering no height errors on the DEM.

$$\Delta\Phi_{dif} = \Phi_{ErrorTopo} + \Phi_{Mov} + \Phi_{Atm} + \Phi_{Noise} \quad (4)$$

Since the coal mine area is very dynamic in terms of its surficial 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 (Carnec et al., 1996; Bürgmann et al., 2000).

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

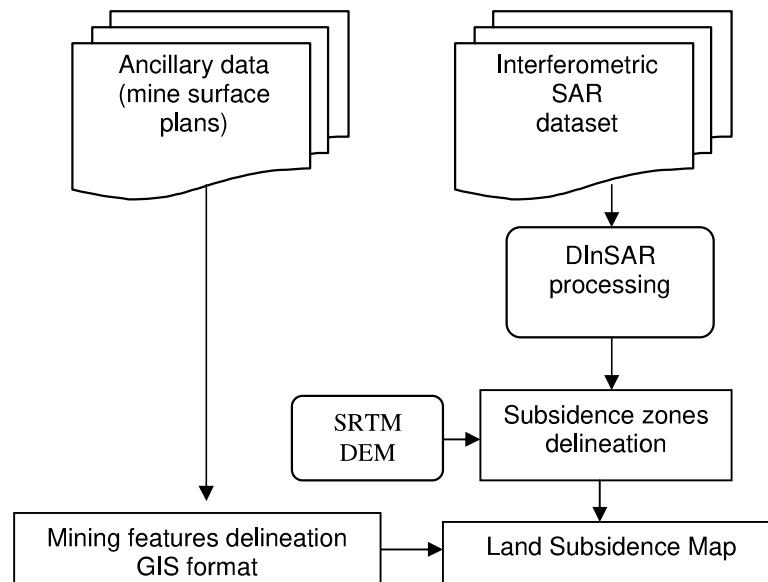


Figure 7. Work flow diagram for generating land subsidence map using DInSAR technique.

In the present study, 5 sets of ALOS-PALSAR L-band microwave data (as mentioned in table 1) were procured. The datasets were paired into master-slave pairs as per short and long temporal baselines. The short temporal base lines include master slave pairs of time difference of six months to one year, whereas long temporal baselines include data pairs of time difference of ~ one year.

This has been illustrated in figure 8.

		SLAVE IMAGE				
		30 September 2017	03 March 2018	19 January 2019	02 March 2019	29 February 2020
MASTER IMAGE	30 September 2017					
	03 March 2018					
	19 January 2019					
	02 March 2019					
	29 February 2020					
		Short Temporal Baseline Pair (less than 1 year)				
		Long Temporal Baseline Pair (~ 1 year)				

Figure 8. ALOS-PALSAR - 2 Master-Slave pairs for short and long temporal baseline 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).

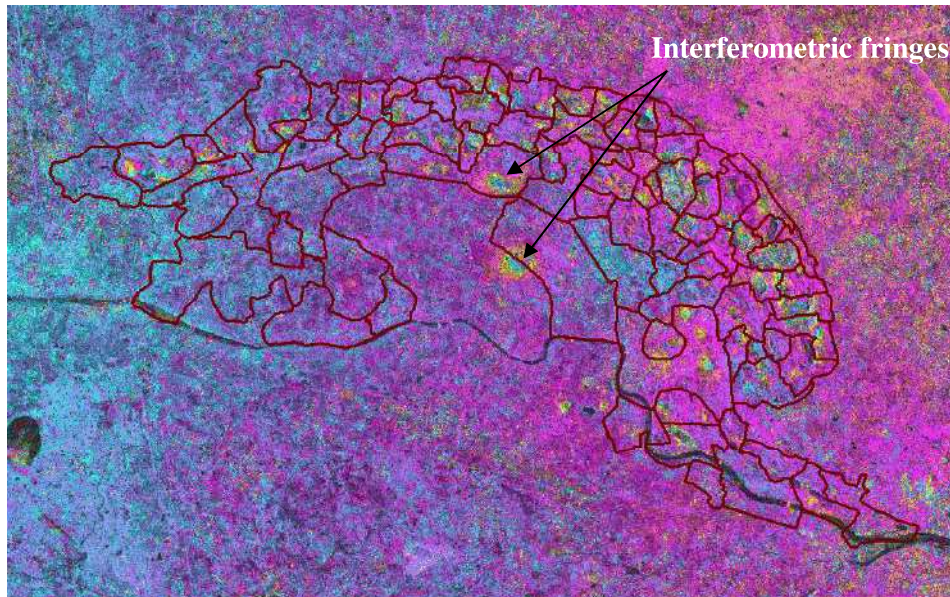


Figure 9. Fringe patterns generated from short baseline processing (e.g. Master: Oct, 19, Slave: Feb, 20).

On the other hand, master-slave pairs of long temporal baseline (approximately one year 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 (figure10)

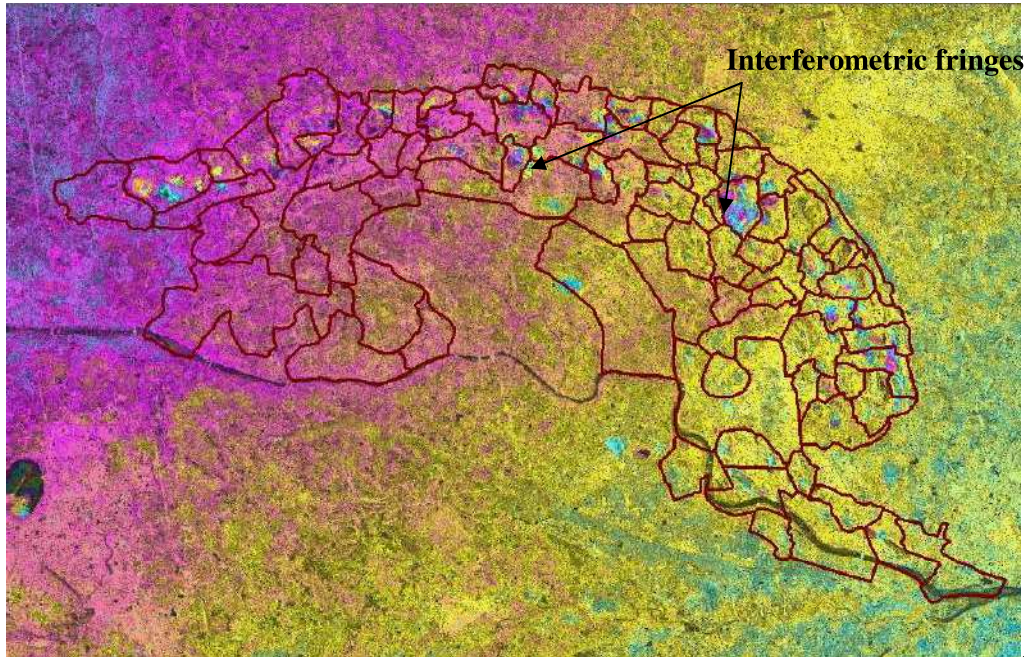


Figure 10. Fringe patterns generated from long baseline processing (e.g. Master: Sept, 17, Slave: Feb, 2020).

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

**LAND SUBSIDENCE MAP OF THE JHARIA COALFIELD, DHANBAD, JHARKHAND**  
 (Prepared using Palsar-2 data)

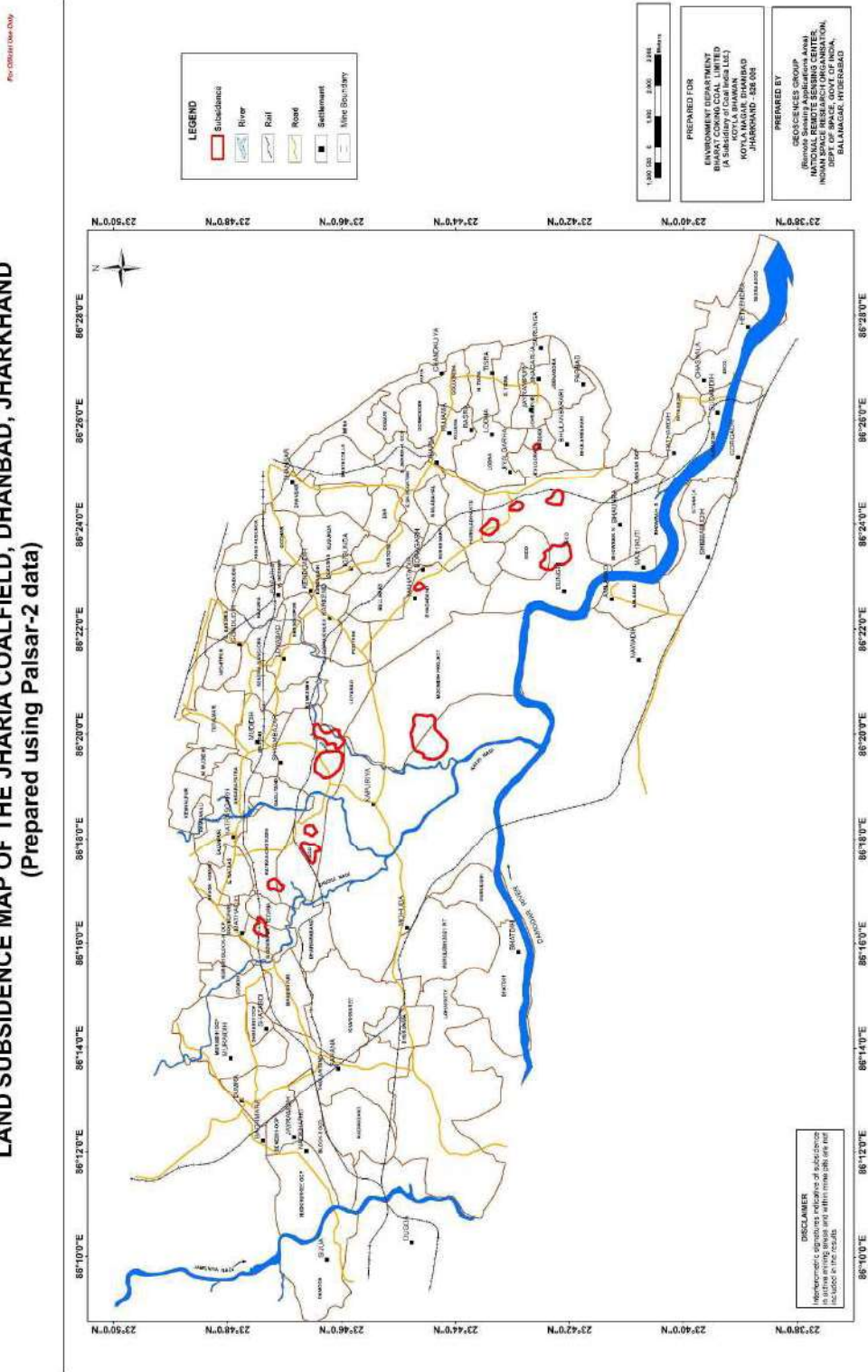


Figure 11: Subsidence map (2017-2020) of the Jharia coal field, Dhanbad.

## 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 during 2<sup>nd</sup> to 8<sup>th</sup> August, 2021. Both the coal fire and the subsidence locations were further independently verified by NRSC during the fieldwork. A total of 39 coal fire points and 13 land subsidence locations were identified from the satellite data analysis (figure 12). All 39 points were confirmed to be fire bearing as per the present status of fire in Jharia coalfield. The field observations of coal fire at each location are provided in table 3.

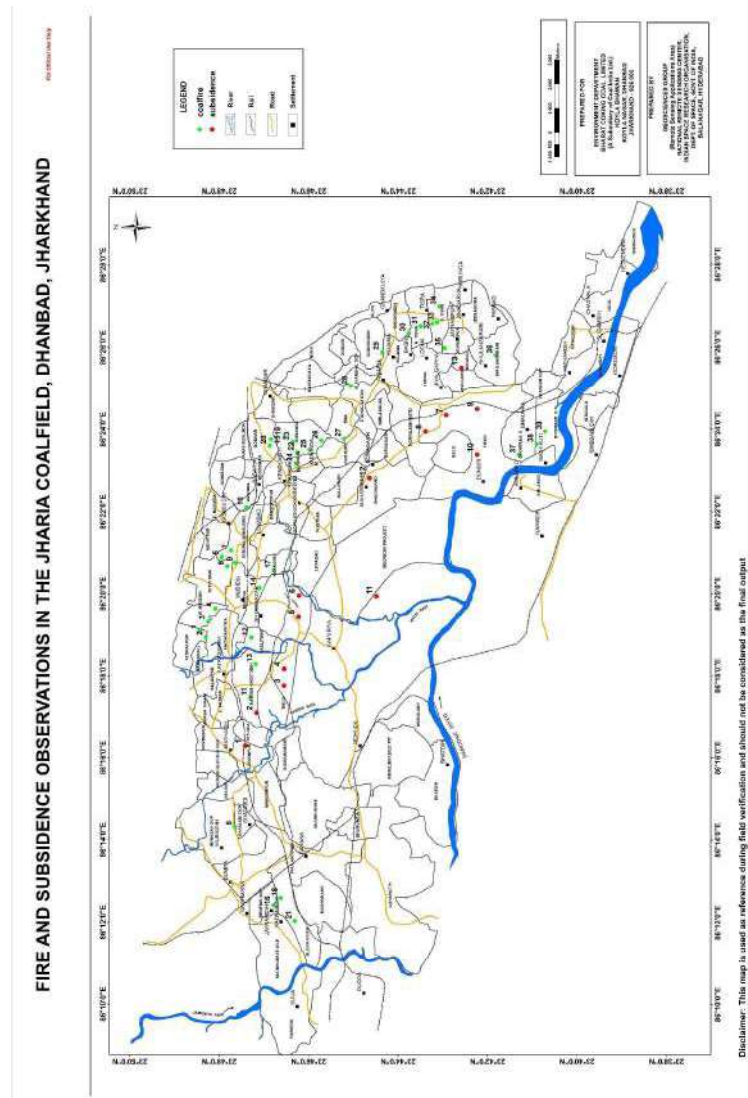


Figure 12. Field data points for coal fire and subsidence verification

Table 3: Summary of field observations (refer figure 12)

Field observation Point	Mine	Status of Fire (comments)*
1	Keshalpur	Active mine fire
2	Keshalpur	Active mine fire
3	W. Mudidih	Active mine fire
4	W. Mudidih	Active mine fire
5	Sendra Bansjora	Active mine fire
6	Tetulmari	Active mine fire
7	Sendra Bansjora	Active mine fire
8	Shatabdhi	Old Fire patch (minor fires)
9	Sendra Bansjora	Active mine fire
10	Sendra Bansjora	OB dump fire
11	Katras-Chotudih	Active mine fire (Confirmed by BCCL)
12	Gaslitand	Active mine fire
13	Katras-Chotudih	Active mine fire (Confirmed by BCCL)
14	Mudidih	Active mine fire
15	Godhar	Active mine fire
16	Benedih OCP	Active mine fire
17	Kankanee	Active mine fire
18	Block II OCP	Active mine fire
19	Kusunda	Active mine fire
20	Godhar	Active mine fire (High Risk)
21	Block II OCP	Active mine fire
22	Kusunda	Active mine fire
23	Kusunda	Active mine fire
24	Alkusha	Active mine fire
25	Kusunda	Active mine fire
26	Kusunda	Active mine fire
27	Ena	OB dump fire (small pockets of active mine fire)
28	R -OCP	Active mine fire
29	Goonhodih	Abandoned mine Fire(Fire cutting planned)
30	NT-ST	OB dump fire (small pockets)
31	NT-ST	Active mine fire (Ongoing mitigation measures)
32	NT-ST	Active mine fire (Ongoing mitigation measures)
33	NT-ST	Active mine fire (Ongoing mitigation measures)
34	NT-ST	Active mine fire (Ongoing mitigation measures)
35	Jayrampur	Abandoned mine Fire
36	Bhulanbarari	OB dump fire
37	Bhaura	OB dump fire (small pockets of active mine fire)
38	Bhaura	OB dump fire (small pockets of active mine fire)
39	Bhaura	OB dump fire (small pockets of active mine fire)

\* Fire Temperature reading from hand held IR thermometer were seen to be inconsistent due to rains and wet ground condition and hence are not reported.

*Subsidence location observations:*

1. Subsidence locations as identified by the data are 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 13 identified subsidence locations from the microwave data, 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 sagged ground are observed in the area.
3. Three other minor subsidence areas are identified within the South Govindpur, Bhagaband and Bagdigi mines, where old underground workings are present. However, there was no clear evidence of subsidence from the field based observations.
4. The 9 other locations where subsidence is seen from microwave data, falls within the mining lease of TISCO and IISCO, hence are not under the purview of BCCL mining authorities.

## 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 2020. Landsat-8 data of 22 May, 2020 was used to prepare the coal mine fire map (Figure 5) for the year 2020. 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 2020 when compared to map of 2017 (NRSC, 2017) 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 2020 (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 Tisra (North and South) and Bhaura, Bhulanbarari and R-OCP are affected by multiple small fire pockets. In Bhaura, the fire is seen mostly in OB dumps with minor presence of active mine fires. Similarly in Bhulanbarari, fire is seen in the OB dump only. The North and South Tisra mines have visible presence of fire, mostly manifested by high temperature fume cracks. Active fires are also seen in the R-OCP. Further, towards the north east, in Ena, Alkusha and Kusunda active fires are more prevalent and the area is extensively affected. The highest radiant temperatures (in order of  $\sim 50^{\circ}\text{C}$ ) 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 the related to the mining areas of Katras, Gaslitand, Mudidih and Sendra Bansjora. 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. An older fire patch is also seen in the Shatabdi mine.

Comparison of the 2020 coal fire map with that of 2017 (NRSC, 2017) 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 2017, the 2020 map shows that the significant decrease of fires in the eastern flank, namely Bhaura, Tisra (North and Soth), Lodna and R-OCP etc. Similar decrease is also observed in Bastacolla and Bhulanbarari.
- ii. The areal extent of major fire zone around Kusunda and Ena also appears to have decreased with change in the spatial location of the anomalies. This is probably due to the mitigation and active fire 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.
- iv. The spatial disposition of fire areas around Katras, Keshalpur, Gaslitand and Mudidih show minor increase. The fire pockets observed in 2017, have given away to a few fire zones of moderate disposition.

In summary, there is a change in the areal disposition of the fires from 2017 to 2020. Satellite and field observations both suggest that there has been an overall decrease in the extent of fire in the JCF. A quantitative comparison of the 2017 and 2020 data was carried out. As compared 2017, when the total fire affected extent of the JCF was about 3.28 km<sup>2</sup>; in 2020 total fire affected extent is about 1.89 km<sup>2</sup> (including TISCO mines). Within the mining lease of BCCL (excluding TISCO) in comparison 2017, when the total fire affected extent of the JCF was about 3.27 km<sup>2</sup>; in 2020 total fire affected extent is about 1.86 km<sup>2</sup>. The colliery wise break-up of change in fire area from 2017 to 2020 is given in Annexure-I. Herein, it should be noted that the minimum mapable unit from satellite image is 30m by 30m or 0.0009 km<sup>2</sup>.

### **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 2017 to 2020 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 of 4 subsidence areas, within the BCCL mine boundary. 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 three areas are south of South Govindpur, Bagdigi and Bhagaband mines, however, the field evidences of the same are not conclusive. No quantitative estimates of the subsidence have 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 2020 and in comparison with the previous study done in 2017, there has been a change in areal extent and disposition of the fire affected areas. On the other hand, persistent subsidence is seen in the Moonidih area due to underground mining activities.
2. Compared to 2012, the eastern flanks (Lodna, Tisra, Bhulanbarai areas) show considerable decrease in fire disposition and the western flank (Shatabdi and Block II area) show diminished fire presence.
3. The fires are continuation of existing fire affected areas as seen in the 2017 study.
4. The mines in Kusunda remain to be the worst affected with maximum presence of active fires.
5. There is a decrease in areal extent of the fire from 2017 to 2020. As compared 2017, when the total fire affected extent of the JCF was about 3.28 km<sup>2</sup>; in 2020 total fire affected extent is about 1.89 km<sup>2</sup> (including TISCO mines). Within the mining lease of BCCL (excluding TISCO) in comparison 2017, when the total fire affected extent of the JCF was about 3.27 km<sup>2</sup>; in 2020 total fire affected extent is about 1.86 km<sup>2</sup>.

*Note: The minimum mapable unit from satellite image is 30m by 30m or 0.0009 km<sup>2</sup>. Estimations of fire extent (in terms of sq.km.) both in 2017 and in the present 2020 study are pixel based. They may differ from 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.*

## ***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 in 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 4.1.2, 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 are 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.

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) Considering the precision of DInSAR data for different wavelengths, topographic and atmospheric errors, slow subsidence rates may not be detected. Further, the displacement measured is along the line of sight of the sensor and not vertical displacement.

8) Temporal decorrelation and noise due to adverse land use and land cover may affect DInSAR based detection and monitoring of land subsidence. Changes vegetation pattern over time can cause significant decorrelation between the master and slave image, thus producing a very low coherent output. Under such conditions, subsidence information may not be retrieved

9) 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 coalfield, 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, pp 3193-3220.
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*
12. Coal mine fire delineation and surface features mapping using satellite data in Jharia coal field, Dhanbad, Jharkhand. Geosciences Group. *Official report, NRSC, 2017*.

13. Carnec C, Massonnet D, King C (1996) Two examples of the use of SAR interferometry on displacement fields of small spatial extent. *Geophysical Research Letters* 23:3579–3582, 10.1029/96gl03042.
14. Bürgmann R, Rosen PA, & Fielding EJ (2000). Synthetic aperture radar interferometry to measure Earth's surface topography and its deformation. *Annual review of earth and planetary sciences*, 28(1), 169-209

## Annexure –I

## Colliery wise break-up of change in fire area from 2017 to 2020

COLLIERY AREA NAME	FIRE AREA 2017 (SQ. KM.)	FIRE AREA 2020 (SQ. KM.)	AREA CHANGE (SQ. KM.)	Increase/Decrease
BENEDIH OCP	0.045	0.020	-0.026	DECREASE
BLOCK-II OCP	0.135	0.034	-0.101	DECREASE
MURAI DIH OCP	0.002	0.006	0.004	INCREASE
SHATABDI OCP	0.036	0.005	-0.031	DECREASE
PHULARITAND	0.021	0.000	-0.021	DECREASE
KATRAS-CHOITUDI H	0.137	0.214	0.077	INCREASE
KESHALPUR	0.001	0.134	0.132	INCREASE
BASURIA	0.000	0.012	0.012	INCREASE
TETULMARI	0.022	0.011	-0.011	DECREASE
GODHAR	0.000	0.132	0.132	INCREASE
INDUSTRY	0.051	0.000	-0.051	DECREASE
KUSUNDA	0.740	0.399	-0.340	DECREASE
SENDRA-BANSJORA	0.027	0.110	0.083	INCREASE
BASTACOLLA	0.081	0.000	-0.081	DECREASE
GOLUCKDIH	0.112	0.000	-0.112	DECREASE
KUJAMA	0.240	0.000	-0.240	DECREASE
S. JHARIA-R. OCP	0.112	0.010	-0.102	DECREASE
GONHOODI H	0.032	0.001	-0.031	DECREASE
ENA	0.043	0.004	-0.040	DECREASE
N. TISRA	0.180	0.031	-0.149	DECREASE
LODNA	0.353	0.000	-0.353	DECREASE
S. TISRA	0.102	0.021	-0.081	DECREASE
BARAREE	0.107	0.040	-0.068	DECREASE
KENDUADI H	0.000	0.001	0.001	INCREASE
GASLITAND	0.122	0.156	0.034	INCREASE
KANKANEE	0.052	0.057	0.004	INCREASE
MUDIDI H	0.110	0.220	0.110	INCREASE
LOYABAD	0.006	0.000	0.079	DECREASE
E.BHUGGATDI H	0.021	0.020	-0.001	DECREASE
ALKUSHA	0.029	0.046	0.016	INCREASE
KUSTORE	0.046	0.014	-0.032	DECREASE
ANGARAPATRA	0.015	0.036	0.021	INCREASE
BHOWRAH. N	0.098	0.006	-0.092	DECREASE
BAGDIGI	0.021	0.000	-0.021	DECREASE
JEALGORA	0.007	0.000	-0.007	DECREASE
JEENAGORA	0.047	0.000	-0.047	DECREASE
JOYRAMPUR	0.104	0.011	-0.093	DECREASE

<b>TOTAL AREA</b>	<b>3.3</b>	<b>1.8</b>	<b>1.5</b>	<b>DECREASE</b>
<b>Note:</b>				
1) <b>The minimum mapable unit from satellite image is 30m by 30m or 0.0009 km<sup>2</sup></b>				
2) <b>"INCREASE" implies, increase in fire area OR emergence of fire areas not identified in 2017 study</b>				
3) <b>"DECREASE" implies, decrease in fire area OR fire areas in 2017 not identified in present study</b> <i>(either absent or below sensor resolution)</i>				
4) <b>Values marked in "blue" are collieries where fire has been reported in 2017 study but presently shows no such signatures.</b>				

*Annexure –II*



Figure 13: Active fires in Keshalpur-West Mudidih. (Points 1, 2, 3 & 4 in figure 12)



Figure 14: Active fires in Sendra-Bansjora Mines (Points 5, 6, 7 & 9 in figure 12)



Figure 15: OB dump fires in Sendra Bansjora (Points 10 in figure 12)



Figure 16: Active fires in Godhar-Kusunda Mines (Points 20 to 24 in figure 12)



Figure 17: Fire in R-OCP. (Point 28 in figure 12)



Figure 18: Active fires in N-S Tisra mines (Points 31-33 in figure 12).



Figure 19: Subsidence area in Bagdigi Mines



Figure 20: Subsidence (sag ponds) around Moonidih mine area

*Annexure –III*

Coordinates of Fire locations.

<b>Mine</b>	<b>UTM_X</b>	<b>UTM_Y</b>	<b>Longitude</b>	<b>Latitude</b>
Keshalpur	430560.28	2633068.44	86.3183	23.8074
Keshalpur	430287.86	2632817.14	86.3156	23.8051
W. Mudidih	430935.00	2632710.00	86.3220	23.8042
W. Mudidih	431468.57	2632417.14	86.3273	23.8015
Kendra Bansjora	433626.56	2632140.94	86.3484	23.7991
Tetulmari	433245.00	2631915.00	86.3447	23.7971
Kendra Bansjora	433899.00	2631765.00	86.3511	23.7958
Shatabdhi	422415.00	2631645.00	86.2384	23.7942
Kendra Bansjora	433383.75	2631563.75	86.3461	23.7939
Kendra Bansjora	435666.92	2631113.08	86.3685	23.7899
Katras-Chotudih	427797.06	2630997.35	86.2913	23.7886
Gaslitand	430270.06	2630936.18	86.3156	23.7881
Katras-Chotudih	429170.29	2630763.09	86.3048	23.7865
Mudidih	432313.36	2630596.98	86.3356	23.7851
Godhar	438450.00	2630085.00	86.3959	23.7808
Benedih OCP	419198.18	2630070.00	86.2069	23.7798
Kankanee	433072.50	2629995.00	86.3431	23.7797
Block II OCP	419491.36	2629772.73	86.2098	23.7771
Kusunda	438532.86	2629547.14	86.3967	23.7759
Godhar	438187.50	2630145.00	86.3933	23.7813
Block II OCP	418545.00	2629200.00	86.2006	23.7719
Kusunda	437910.00	2629005.00	86.3906	23.7710
Kusunda	438335.37	2629195.97	86.3948	23.7727
Alkusha	437452.80	2629068.00	86.3861	23.7715
Kusunda	438007.50	2628495.00	86.3916	23.7664
Kusunda	438392.33	2628011.36	86.3954	23.7620
Ena	438465.00	2627070.00	86.3962	23.7535
R -OCP	440644.55	2626785.45	86.4176	23.7510
Goonhodih	442050.00	2625480.00	86.4314	23.7393
NT-ST	442815.00	2624385.00	86.4389	23.7294
NT-ST	443100.00	2623890.00	86.4418	23.7250
NT-ST	443205.00	2623410.00	86.4428	23.7206
NT-ST	443253.33	2623211.67	86.4433	23.7189
NT-ST	443910.00	2623110.00	86.4497	23.7180
Jayrampur	442200.00	2622915.00	86.4330	23.7161
Bhulanbarari	441898.64	2620804.77	86.4301	23.6971
Bhaura	437768.57	2619865.71	86.3896	23.6884
Bhaura	438202.50	2619131.25	86.3939	23.6818
Bhaura	438720.00	2618775.00	86.3990	23.6786

# “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



April 2022

**Principal Investigator**

Dr. Rajesh Biniwale  
Senior Principal Scientist  
CSIR-National Environmental  
Engineering Research Institute  
Nagpur-440020, Maharashtra  
rb\_biniwale@neeri.res.in

**Scientific Team**

Dr. Yogesh Pakade  
Er. S.A. Praveen  
Dr. Rakesh Kadaverugu  
Dr. Anirban Middey  
Dr. A. D. Bhanarkar

**Project Team**

Mr. Pankaj Kaware  
Mr. Ariz Ahmed  
Ms. Anshu Pandey  
Ms. Samiksha Ashtikar  
Ms. Shruti Pande  
Ms. Punam Bagde  
Ms. Pratiksha Thombre  
Mr. Mohit Mahurkar  
Mr. Rahul Pawar  
Ms. Smita Aditya  
Mr. Ankush Rai  
Mr. Vijay Selvaraj

## Contents

List of Tables .....	6
Chapter 1 Introduction .....	7
1.1. Climate .....	8
1.2. Land use & Land cover .....	8
1.3. Population .....	9
1.4. Purpose of Study .....	9
1.5. Approach of study .....	11
Chapter 2 Emission Inventory .....	12
2.1. Inventory of Point Sources .....	12
2.2. Inventory of Area Sources.....	12
2.3. Inventory of Line Sources .....	12
2.4. Methodology .....	14
2.5. Results .....	15
2.5.1. Industrial Emission .....	15
2.5.2. Area/Distributed source .....	16
➤ Emission load from mining activities.....	17
➤ Cooking operations in non-slum household.....	17
➤ Cooking operations in slum households.....	18
➤ Emissions from crematorium .....	18
➤ Emissions from bakeries .....	18
➤ Emissions from hotels and restaurants .....	18
➤ Emission from open eat-outs.....	19
2.5.3. Grid wise emission inventory .....	19
Chapter 3 Air Quality Monitoring and Receptor modelling.....	22
3.1. Sampling Method and Schedule.....	24
3.2. Chemical Analysis .....	26
3.2.1. Gravimetric analysis .....	26
3.2.2. Elemental analysis .....	26
3.2.3. Analysis of SO <sub>2</sub> and NO <sub>2</sub> .....	26
3.2.4. Ion analysis .....	27
3.2.5. Polycyclic Aromatic Hydrocarbons (PAH) analysis .....	27
3.2.6. EC & OC analysis.....	27
3.3. Results .....	28
3.3.1. Mass concentration of PM <sub>10</sub> and PM <sub>2.5</sub> .....	28
3.3.2. Elemental concentration of PM <sub>10</sub> and PM <sub>2.5</sub> in summer.....	30
3.3.3. Elemental Concentration of PM <sub>10</sub> and PM <sub>2.5</sub> in Winter.....	31

3.3.4. SO <sub>2</sub> and NO <sub>2</sub> concentration in ambient air in the Summer season.....	33
3.3.5. SO <sub>2</sub> and NO <sub>2</sub> concentration in ambient air in Winter season.....	33
3.3.6. Carbonaceous Aerosol/EC & OC in Summer .....	34
3.3.7. Carbonaceous Aerosol/EC & OC in winter.....	34
3.3.8. Ionic composition of PM <sub>10</sub> and PM <sub>2.5</sub> in Summer season .....	36
3.3.9. Ionic composition of PM <sub>10</sub> and PM <sub>2.5</sub> in Winter season.....	36
Chapter 4 Receptor modelling .....	40
4.1. Source Apportionment .....	40
4.1.1. Chemical Mass Balance (CMB).....	40
4.1.2. Source profiling .....	42
4.1.3. Ambient profiling .....	42
4.2. Results of the Chemical Mass Balance .....	43
4.2.1. Domestic combustion .....	43
4.2.2. Industrial Emission.....	44
4.2.3. Coal Mining.....	44
4.2.4. Transportation.....	44
4.2.5. Secondary Inorganic Aerosol .....	44
4.2.6. Agriculture.....	45
4.2.7. Open burning .....	45
4.2.8. Road Resuspension dust .....	45
4.2.9. Other emission Contribution .....	45
Chapter 5 Dispersion Modelling.....	52
5.1. Wind data analysis .....	52
5.2. Dispersion of Particulate matter.....	54
Chapter 6 Recommendation.....	59
6.1. Mine industries.....	59
6.2. Area Sources .....	59
6.3. Line Source .....	60
6.4. Others .....	61

## List of Figures

Figure 1.1: Geographical location of Jharia Coalfield in India	7
Figure 1.2: Land Use land cover map of Jharia coal field area	8
Figure 1.3: Air quality Monitoring & emission source apportionment studies	11
Figure 2.1 Percentage of different types of vehicle surveyed on the road network during the field survey	14
Figure 2.2 PM <sub>10</sub> emission load for different categories of vehicle	15
Figure 2.3 Grid-wise emission inventory of PM <sub>10</sub> in tons/year over the study area	20
Figure 2.4 Grid-wise emission inventory of PM <sub>2.5</sub> in tons/year over the study area	20
Figure 2.5 (a) and (b) represents emission load from various sectors over JCF region for PM <sub>10</sub> and PM <sub>2.5</sub> respectively	21
Figure 3.1: Air monitoring sites under 30 km buffer area	23
Figure 3.2: Average concentration of PM <sub>10</sub> and PM <sub>2.5</sub> in JCF region in summer compared to NAAQS (2009)	29
Figure 3.3: Average concentration of PM <sub>10</sub> and PM <sub>2.5</sub> in JCF region during Winter compared to NAAQS (2009)	30
Figure 3.4: Metal concentration of PM <sub>10</sub> in the summer season	31
Figure 3.5: Metal concentration of PM <sub>2.5</sub> in the summer season	31
Figure 3.6: Metal concentration of PM <sub>10</sub> in winter season	32
Figure 3.7: Metal concentration of PM 2.5 in winter season	32
Figure 3.8: NO <sub>2</sub> and SO <sub>2</sub> Concentration of all monitoring sites in summer season	33
Figure 3.9: NO <sub>2</sub> and SO <sub>2</sub> Concentration of all monitoring sites in Winter season	34
Figure 3.10: EC & OC concentration in PM <sub>10</sub> and PM <sub>2.5</sub> in Summer season	35
Figure 3.11: EC & OC concentration in PM <sub>10</sub> and PM <sub>2.5</sub> in Winter Season	36
Figure 3.12: Anion and Cation concentration in PM <sub>10</sub> in summer	37
Figure 3.13: Anion and Cation concentration in PM <sub>2.5</sub> in summer	38
Figure 3.14: Anion and Cation concentration in PM <sub>10</sub> in winter	38
Figure 3.15: Anion and Cation concentration in PM <sub>2.5</sub> in winter	39
Figure 4.1: General methodology followed in the source apportionment studies	43
Figure 4.2: Source contribution at receptor locations of PM <sub>10</sub> and PM <sub>2.5</sub> in summer	47
Figure 4.3: Source contribution at receptor locations of PM <sub>10</sub> and PM <sub>2.5</sub> in winter	47
Figure 5.1: Methodology followed in the study.	52
Figure 5.2: Windrose of the study area during March-June, 2019 (wind direction blowing towards the center)	53
Figure 5.3: Windrose of the study area during November-December 2019 (wind direction blowing towards the centre)	54
Figure 5.4: AERMOD grid covering the Jharia Coal Fields (JCF). The line, area, and point sources covered in the study are indicated in red color. The UTM coordinates of the left bottom point are x=406111 and y=2603492, and the coordinates of the right top point are x=456248 and y=2653417.	56
Figure 5.5: Windrose diagram for the summer (left) and winter seasons (right) at Jharia Coal Fields during the sampling period. Wind direction is flowing towards the centre.	56
Figure 5.6: 24-hour average maximum ground level concentration of PM contours in the study area simulated during the study periods in summer (left) and winter (right) seasons (a) PM <sub>10</sub> (µg/m <sup>3</sup> ) and (b) PM <sub>2.5</sub> (µg/m <sup>3</sup> )	57

## List of Tables

Table 1.1: LULC classification of Dhanbad study area	9
Table 1.2: Population in the study area as per 2011 census	9
Table 2.1: Daily average vehicle activity on different road network considered during the field survey	13
Table 2.2: Utilization Factors for different types of vehicle	14
Table 2.3: Emission estimate for road transport	14
Table 2.4: Emission rate for the paved and unpaved road	15
Table 2.5: Emission factor for coal mining activities	16
Table 2.6: Emission load from Industrial sector in Dhanbad	16
Table 2.7: Emission load from coal mine activities in Jharia coalfield region	17
Table 2.8: Emissions from the use of LPG in non-slum households in Dhanbad	18
Table 2.9: Emission from coal as fuel	18
Table 2.10: Emission from Crematoria using Wood as fuel	18
Table 2.11: Emission from Bakeries using Coal as fuel	18
Table 2.12: Emission from Hotel & Restaurants using Coal	19
Table 2.13: Emission from Hotel & Restaurants using LPG	19
Table 2.14: Emission loads from open eat-outs	19
Table 3.3.1: The details of mine cluster in Jharia Coalfield	22
Table 3.3.2: Frequency of Air pollutants sampling in Jharia Coalfields	24
Table 3.3.3: Ambient Air Quality Sampling/Analysis Methodology for Target Pollutants	24
Table 3.3.4: National Ambient Air Quality Standards (2009)	25
Table 3.3.5 Standards for Coal Mines (Stipulated by Ministry of Environment and Forests (MoEF), Vide Notification No. GSR 742(E), Dt: 25.09.2000)	26
Table 4.1: Summary of relevant air quality studies from major Indian cities.	48
Table 5.1 Performance Stimulation Metric	58

## Chapter 1 Introduction

Jharia Coalfield (JCF) is one of the oldest coalfields of India and has been subjected to coal exploitation for more than 100 years. JCF is one of the significant coal-producing areas in the country and occupies an important place in India's industrial and energy scenario by virtue of prime coking coal and is an essential source of coal. Jharia coalfield is crucial and a large coalfield situated in Dhanbad and Bokaro district, Jharkhand. Geographically the JCF is bounded by latitude  $23^{\circ}38' N$  to  $23^{\circ}49' N$  and longitude  $86^{\circ}09'E$  to  $86^{\circ}30'E$  and encompassing a total area of about 450sq km (Figure 1.1). Jharia is the largest coal producer in India and has an estimated reserved of 19.4 billion tonnes of coking coal. The coalfield contributes to the local economy and directly or indirectly employs the local population.

Bharat Coking Coal Limited, a subsidiary of Coal India Limited, has been operating the majority of the coal mines in the Jharia coalfield regions since its inception in 1972. Jharia, one of the eight blocks in Dhanbad and the main source of metallurgical coal in India can be termed as the country powerhouse since its mines are the only source for the best quality coking coal required by the steel industries and others in the country.

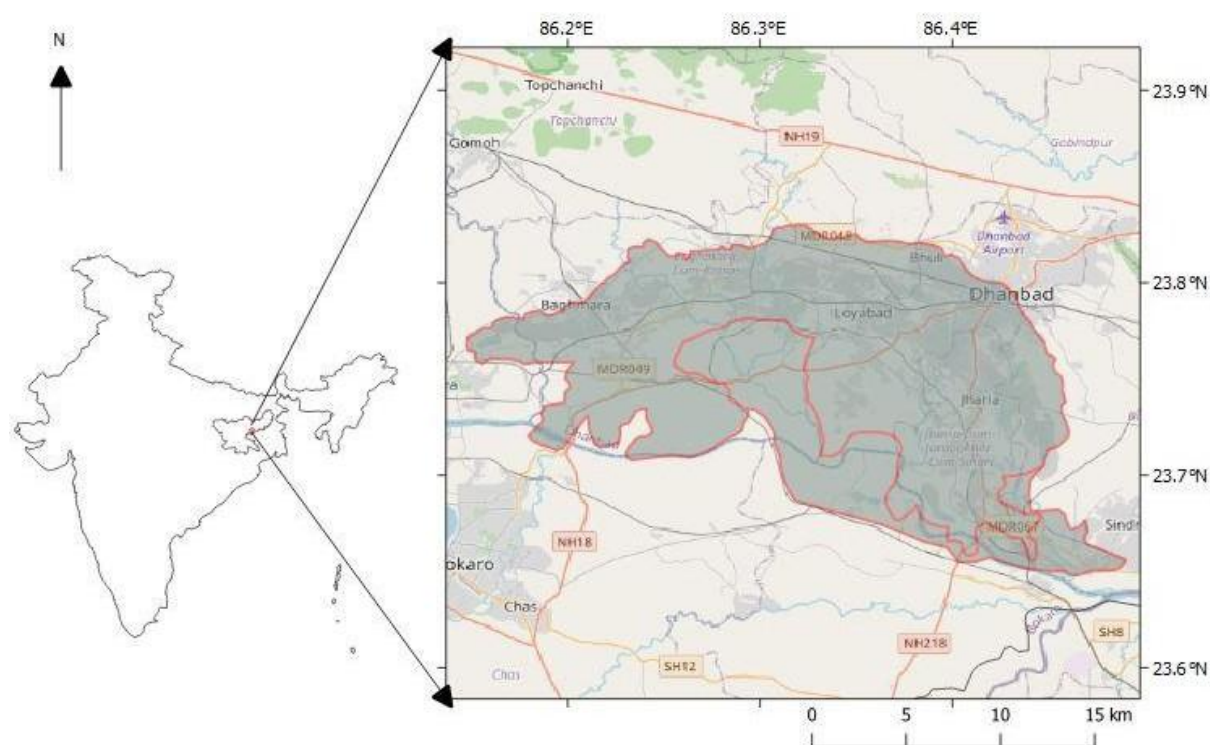


Figure 1.1: Geographical location of Jharia Coalfield in India

### 1.1. Climate

Dhanbad lies 236 m above the mean sea level and experiences the tropical climate. When compared with the winter, the summers have much more rainfall. The Köppen-Geiger climate classification is Aw (Tropical wet-dry climate) and experiences an average temperature of 25.9 °C and 1203 mm of precipitation falls annually. The driest month is December. There is 3 mm of precipitation in December. In July, the precipitation reaches its peak, with an average of 321 mm. With an average of 32.5 °C, May is the warmest month. At 18.4 °C on average, January is the coldest month of the year. The windrose for the March-June months is presented in Figure 1.2.

### 1.2. Land use & Land cover

In the present investigation, the Jharia coalfield area (2827.43 sq km) has been undertaken to study the Land use land cover (LULC), For this study, Sentinel-2A satellite image is used in the month of 17 February 2019 having a minimum cloud. These images were downloaded from the United States Geological Survey (USGS) Earth Explorer. Each Sentinel 2A satellite imagery band was geo-referenced to the WGS\_84 datum and Universal Transverse Mercator Zone 45 North coordinate system. The Sentinel 2A satellite image stacking of the band-2, band-3, band-4 and band-8 of 10 m resolution was performed on the ArcGIS 10.5 software for studying the LULC of the Jharia coalfield.

For LULC classification, supervised classification was carried out in the study area. Thus allocations of each classified area in sq. km and its percentages are tabulated in Table 1.1. The percentage of areas as classified as; agriculture (74.5%), barren land (7.45%) built-up areas (5.14%), mining (2.64%), vegetation (9.40%) and water body (0.86%) (Figure 1.2).

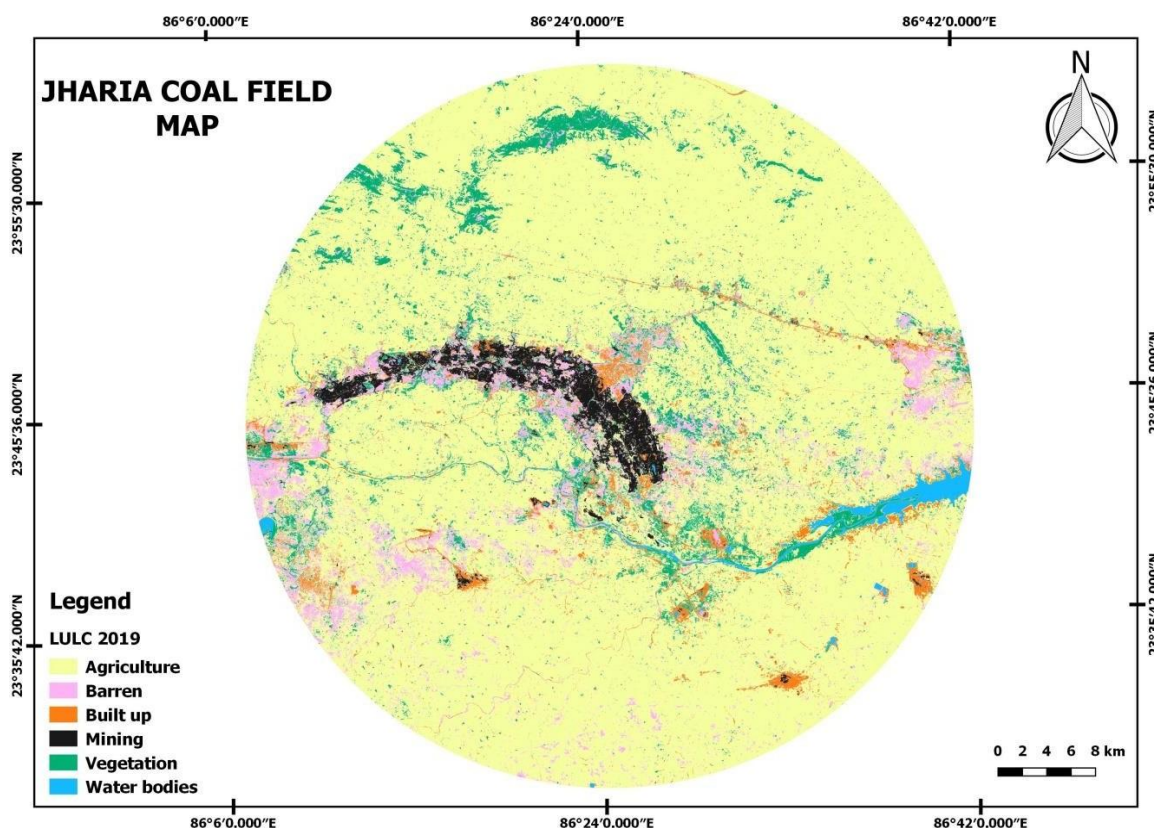


Figure 1.2: Land Use land cover map of Jharia coal field area

Table 1.1: LULC classification of Dhanbad study area

Sr. No	Name	Area in sq. km	Area in %
1.	Agriculture	2106.7	74.51
2.	Barren	210.64	7.45
3.	Built up	145.31	5.14
4.	Mining	74.67	2.64
5.	Vegetation	265.74	9.40
6.	Water bodies	24.37	0.86
<b>Total</b>		<b>2827.43</b>	<b>100</b>

### 1.3. Population

The study area covers four district boundaries; namely Dhanbad (1710.2sq km), Bokaro (620.43sq km), Giridih (29.8sq km) in Jharkhand and Puruliya (465.85sq km) district in West Bengal state. The Dhanbad district covers the maximum study area and the population is around 23, 94,434 in the year 2001 and is around 26,84,487 in 2011. The Bokaro district total population is in 2001 is 17, 75,961 and in 2011 it is 20, 62,330. The Giridih district total population is 19, 01,564 in 2001 and is 24,45,474 in 2011. The Puruliya district in West Bengal state total population is in 2001 is 25, 35,233 and in 2011 are 29, 30,115.

Based on the covered study area the total population in the study area is tabulated in Table 1.2. The total population in the study area based on Census book 2001 is 25,32,195 and 2011 is 28,62,600.

Table 1.2: Population in the study area as per 2011 census

District Name	District Area Covered by Study Area	% of Area Covered of District by Study Area	Population of 2001	Population 2001 in Study Area	Population of 2011	Population 2011 in Study Area
Bokaro	620.43	21.50	17,75,961	3,81,791	2,062,330	4,43,353
Dhanbad	1710.2	81.51	23,94,434	19,51,645	2,684,487	21,88,060
Giridih	29.8	0.59	19,01,564	11,275	2,445,474	14,500
Puruliya	465.85	7.40	25,35,233	1,87,484	2,930,115	2,16,686
Total	2826.28		Total Population 2001	25,32,195	Total Population 2011	28,62,600

### 1.4. Purpose of Study

Urban air pollution is a notable concern across the world. Inferring to the rapid rates of industrialization and urbanization in Indian cities, polluted air quality is considered a key factor in crumbling the quality of life with an adverse effect on the human being. Hence air quality gained a significant role in recent decades since it is worsened by emission from major pollutants including particulate matter (PM<sub>10</sub> and PM<sub>2.5</sub>), NO<sub>2</sub>, SO<sub>2</sub> and O<sub>3</sub> were found to exceed the national ambient air quality standard (NAAQS) limits.

Particulate pollution is a major concern in the field of air pollution. The particulate matter in the air result from dispersion of dust from industrial (mining and non-mining) and allied activities, transportation, local vehicular movement and domestic fuel (Coal, wood-burning etc.) burning. Assessment of the air quality can provide useful insight for the development of the air quality management plan. The database developed on air quality also helps the regulatory agency identify the locations where natural resources and human health could be at risk.

Jharia coal mines having low ash content and high calorific value coals are subjected to intensive mining activities because of the easy availability of coal at shallow depths in thick seams. 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 cause a lot of fugitive gaseous and PM emissions. Hence, the Jharia region has been under scrutiny by various public authorities and the 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 dust, fugitive emissions, fuel oils, household LPG. The percentage contribution of these factors in the ambient depends exclusively on a particular region's economic activities. To improve the existing ambient air quality, the major sources of PM emissions first need to be identified.

Hence, the environmental clearance committee of MoEFCC 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 the Jharia coalfields region to quantify the various sources of PM emissions and suggest an effective environmental management plan.

The study's major objective 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 includes the entire Jharia Coalfield and an area up to 10 Km from the periphery/boundary of BCCL mines.

The detailed objectives are as follows:

i. Ambient Air Monitoring

- Monitoring of ambient air quality at selected receptor locations for pollutants including PM<sub>10</sub>, PM<sub>2.5</sub>(limited), SO<sub>x</sub>, NO<sub>x</sub>, PAHs to establish the status of the air quality in Jharia Coalfields and an 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 validate dispersion modelling predictions using measured air quality parameters
- To draw supportive data through the 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 micrometeorological conditions of the Jharia Coalfields

- Emission Inventory related to Jharia Coalfields along with area up to 10 Km from the periphery/boundary of BCCL mines
- ii. 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
  - Source apportionment
  - To identify and apportion the pollution load at receptor level to various sources in the Jharia Coalfields along with an 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 periods of the day and day-of-the-week.
  - Any other item in consensus between both BCCL/CIL & NEERI evolved during the study.

### 1.5. Approach of study

The study approach has many components, each one of them having its importance and interdependence as shown in Figure 1.3. The ultimate objective is source apportionment of ambient air of JCF that primarily requires knowledge of ambient air quality status, sources and emission load. These three objectives were achieved by monitoring air pollutants at 13 locations in Jharia Coalfield using various instruments and multiple analyses. These locations were selected based on land use and activity profile. All monitoring was carried out using varied instruments and all attributes were analysed using standards methodologies. The study's methodology of the study was divided into three parts namely ambient air quality monitoring, sources emission inventory and source apportionment analysis.

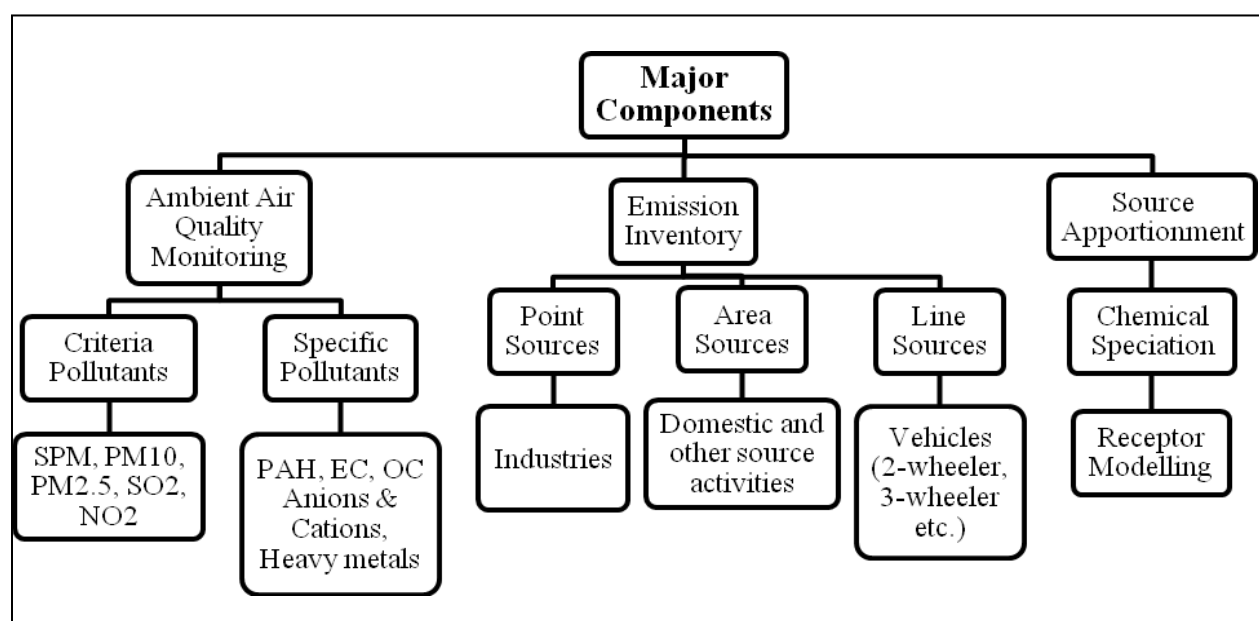


Figure 1.3: Air quality Monitoring & emission source apportionment studies

## Chapter 2 Emission Inventory

This section consists of all methodologies that have been applied for the emission inventory and dispersion modelling in the Jharia Coalfield. The emission inventory is the process to identify the possible source and its contribution. Emission inventory and dispersion modelling are based on the primary data collection to calculate emission load from a particular source. It provides fundamental information for air quality modelling and air pollution control strategy development. In the coal mining area, mining, non-mining, industrial, vehicular and other sources are contributing. Air quality monitoring includes the suitable location selected based on the metrological conditions, chemical characterization for identification of the source, CMB model to estimate the source apportionment to  $PM_{2.5}$ .

Air pollutant emission inventory is a process to identify the possible sources and their contribution. It provides fundamental information for air quality modelling and air pollution control strategy development. Mining, non-mining, industrial, vehicular and other sources are contributing to critical coal mining zone like JCF, India. According to possible emission sources, sources are divided into three categories like point sources, area sources and line sources. The inventory of these sources is important to make a proper source profile.

### 2.1. Inventory of Point Sources

A point source of pollution is a single identifiable source that is responsible for significant pollution load in the study area, like thermal power stations. A comprehensive list of different point-like industries in the study area was obtained from the regional office of the Jharkhand State Pollution Control Board (JSPCB), at Dhanbad. The industries specific information of includes production capacities, raw material used, manufacturing process, fuel consumption, etc. also collected from the regional office by the CSIR-NEERI team.

### 2.2. Inventory of Area Sources

Area sources are sources of pollution that emit a substance or radiation from a specified area. Mining activities, domestic/hotel fuel (coal) burning, garbage burning, etc. are the major contributor to area sources. In order to assess the fuel consumption in the study area, the necessary information was collected through surveys at petrol pumps, hotels and restaurants, bakeries, open eat out and crematoria. Also, surveys collected data on the seasonal implication of fuel used particularly wood and coal. The data on trash burning and solid waste generated in the study were collected from Municipal Corporation Dhanbad.

### 2.3. Inventory of Line Sources

Vehicles contribute a whole range of HCs besides contributing  $SO_x$ ,  $NO_x$  (as  $NO_2$ ), HC and lead. Diesel vehicles are the primary source of smoke and  $NO_x$  in addition to CO and HCs. However, CO and HCs per litre of fuel consumed by diesel vehicles is relatively low compared to gasoline-powered vehicles. In gasoline-powered vehicles, the exhaust is the major source of pollution that contributes 100 % CO and  $NO_x$  and 80% of HCs emitted to the atmosphere. The remaining 20% of HCs are emitted from crankcase blow-by and evaporative emissions. In the

two-stroke engine, the crankcase blow-by is absent. The exhaust emissions are the principal sources of pollutants emitting about 40% of fuel supplied without burning due to short circulating, contributing high concentration of HCs. In diesel vehicles, practically all pollutants are emitted through exhaust gases and the contribution to crankcase blow-by and evaporative fuel emission are negligible.

Though the quantity of pollutants emitted by the vehicles is directly proportional to the number of vehicles playing on the road, the intensity of pollution potential depends on several contributory factors such as a geographical location, unplanned development of central business areas, inadequate and ill-maintained road as well as the type of vehicle, unplanned traffic management, meteorological conditions, and non-availability of adequate emission control technology.

Vehicle activity data were collected during the field campaign at 12 road networks in the study area, and the daily average vehicular activity is presented in Table 2.1.

Table 2.1a: Daily average vehicle activity on different road network considered during the fieldsurvey

Label	Road Network	HDV	LMV	3W	2W	Total
L1	Jharia to Lodna -5 km	1254	1385	3640	9560	15839
L2	Pathardih to Sindri -7 km	1539	5356	4362	15633	26890
L3	Bastacola to Pathardih -13km	2153	8325	3678	10233	24389
L4	Bhuli to Bankmore - 6km	1475	13832	12965	18241	46513
L5	Katras to Harina–12.5 km	1802	7290	3156	15329	27577
L6	Bankmore to Kusunda -5 km	658	2685	1896	10235	15474
L7	Kusunda to Katras - 10 km	1306	4521	5327	15689	26843
L8	Monidih to Kusunda -7 Km	1208	7659	3985	14698	27550
L9	Lohpiti to Mahuda Area Colony - 8 km	1535	4523	2235	6356	14649
L10	Mahuda to Parasia Chowk -7 km	1223	4023	1759	5623	12628
L11	Parasia Chowk To Moonidih - 3 km	269	2159	236	2347	5011
L12	Bhowra to Parbatpur - 13 Km	2135	7856	4258	14578	28827

Table 2.1b: Average vehicle speed of different categories of vecle in the road network

Label	Road Network	Average vehicle speed*			
		HDV	LMV	3W	2W
L1	Jharia to Lodna -5 km	20	35	30	40
L2	Pathardih to Sindri -7 km	20	40	35	40
L3	Bastacola to Pathardih -13km	20	40	35	40
L4	Bhuli to Bankmore - 6km	15	30	30	30
L5	Katras to Harina–12.5 km	20	35	30	40
L6	Bankmore to Kusunda -5 km	15	30	20	30
L7	Kusunda to Katras - 10 km	20	40	30	40
L8	Monidih to Kusunda -7 Km	20	35	30	40
L9	Lohpiti to Mahuda Area Colony - 8 km	20	40	30	40
L10	Mahuda to Parasia Chowk -7 km	15	30	20	30

<b>L11</b>	Parasia Chowk To Moonidih - 3 km	20	35	35	40
<b>L12</b>	Bhowra to Parbatpur - 13 Km	20	40	30	40

\* Average travel speed on the road network is considered during traffic surveys and input form Traffic police and vehicle drivers

The vehicle utilization factors (km travelled per day per vehicle type) were adapted from the Auto Fuel Policy Report (Table 2.2). Two-to-four-wheelers Emission factors were taken from various project reports conducted by CPCB and Indian Clean Air Programmed (ICAP) (CPCB 2010; ARAI 2007). The percentage distribution of various types of vehicles moving on the road network considered during the field survey is presented in Fig 2.1. It shows that major numbers of vehicles moving in the considered Road network are two-wheelers (51%), followed by light motor vehicles (26%), three-wheeler (17%) and heavy-duty diesel vehicles (6%).

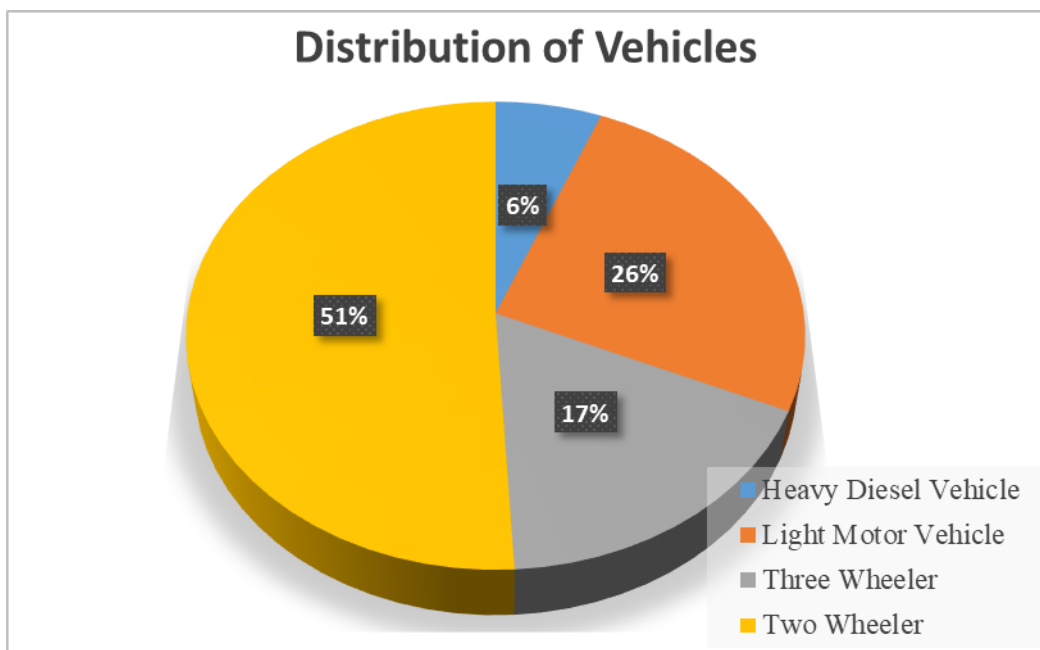


Figure 2.1 Percentage of different types of vehicle surveyed on the road network during the field survey

Table 2.2: Utilization Factors for different types of vehicle

Vehicle Type	km per day
LMV (Car Jeep)	52.6
LMV (Taxi)	77.89
2 Wheeler	25.1
3 Wheeler (Auto)	97.72
HDV	45.5

## 2.4. Methodology

The following method is adopted to estimate the emission load due to vehicles

$$E_i = N_v \times VKT \times E_f \quad (2.1)$$

Where,  $E_i$  is the emission from a particular type of vehicle

$N_v$  is the number of vehicles of a particular type

VKT is the vehicle km travelled

$E_i$ , km is the emission factor for a specific vehicle

Table 2.3a: Emission estimate for road transport

Label	Road Network	Emission (kg/day)	
		PM <sub>10</sub>	PM <sub>2.5</sub>
L1	Jharia to Lodna -5 km	230.12	113.08
L2	Pathardih to Sindri -7 km	379.07	180.37
L3	Bastacola to Pathardih -13km	632.21	451.98
L4	Bhuli to Bankmore - 6km	331.41	187.69
L5	Katras to Harina–12.5 km	719.42	415.63
L6	Bankmore to Kusunda -5 km	308.69	194.34
L7	Kusunda to Katras - 10 km	576.31	277.95
L8	Monidih to Kusunda -7 Km	317.83	114.25
L9	Lohpiti to Mahuda Area Colony - 8 km	360.24	151.99
L10	Mahuda to Parasia Chowk -7 km	241.56	148.24
L11	Parasia Chowk To Moonidih - 3 km	94.26	57.23
L12	Bhowra to Parbatpur - 13 Km	592.82	379.80

Re-suspension of the unpaved and paved roads depends on the „silt loading“ factor and „vehicles weight“ roaming on the road (Table 2.4). The silt loading ( $S_L$ ) is the mass of the silt-sized material per unit area of the road surface. The amount of dust produces by vehicles movement on paved (eq. 2.2a) and unpaved (eq. 2.2b) roads can be appraised by the following equations (adapted from US-EPA, AP-42):

$$E = k. (SL/2)^{0.65} . (W/3)^{1.5} \quad (2.2a)$$

$$E = [k. (SL/12).(S/30)^{0.5} (W/3)^{1.5}]/(M/0.5)^{0.2} \quad (2.2b)$$

Where, „E“ = emission rate of PMs (Table 2.3);

SL is silt load (g/m<sup>2</sup>);

W is the average weight of the vehicle (Tons);

M is the surface moisture content (%)

k is constant (the function of particle size) in g VKT<sup>-1</sup> (Vehicle Kilometer Travel)

Table 2.3b: Surface silt load in paved and unpaved road

Label	Road Network (Paved: 97.4%; Unpaved: 2.6%)	Surface Silt load (g/m <sup>2</sup> )	
		unpaved	paved
L1	Jharia to Lodna -5 km	102.3	18.2
L2	Pathardih to Sindri -7 km	--	16.8
L3	Bastacola to Pathardih -13km	63.2	12.1
L4	Bhuli to Bankmore - 6km	--	17.5
L5	Katras to Harina–12.5 km	92.8	12.6
L6	Bankmore to Kusunda -5 km	--	18
L7	Kusunda to Katras - 10 km	--	17.3
L8	Monidih to Kusunda -7 Km	56.5	12.8
L9	Lohpiti to Mahuda Area Colony - 8 km	--	15.5
L10	Mahuda to Parasia Chowk -7 km	--	19

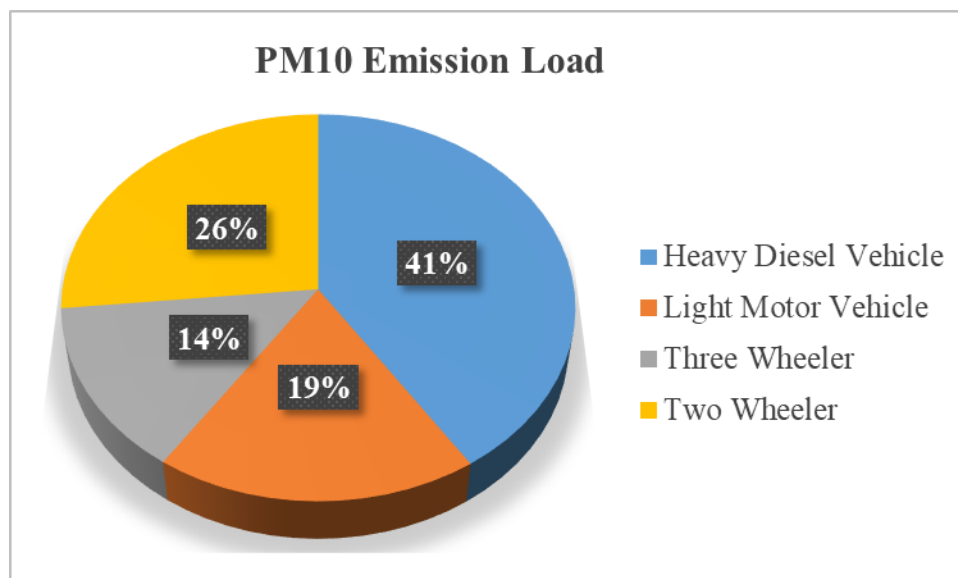


Figure 2.2 PM<sub>10</sub> emission load for different categories of vehicle

It is observed that 41% of PM<sub>10</sub> emission is contributed by the Heavy-duty diesel vehicles followed by two-wheelers (26%), Light motor vehicles (19%) and three-wheelers (14%) in the considered road network during the study period. The particle size multiplier (k) in the equations 2.2a and 2.2b varies with aerodynamic size range as shown in EPA technical document ([13.2.1\\_paved\\_roads.pdf \(epa.gov\)](#)).

Table 2.4: Emission rate for the paved and unpaved road

Emission Sector	Emission Rate	
	PM <sub>10</sub> (kg/day)	PM <sub>2.5</sub> (kg/day)
Re-suspension dust from Paved & Unpaved Road	1756	843

## 2.5. Results

### 2.5.1. Industrial Emission

Emission inventory estimates are determined based on considering available industrial activity information, emission factors (Table 2.5) and observations. For the current study, industrial and mining information was collected for emission inventory development. Emission inventory information for industries was collected from the regional office of JSPCB. In Dhanbad, the major industries are the power plant and the coking industry. Other

than those are coal mines, thus coal as a fuel is majorly used in industries and households. Emission loads by point source are depicted in Table 2.6 as per emission inventory.

Table 2.5: Emission factor for coal mining activities

EF	TSP	PM <sub>10</sub>	PM <sub>2.5</sub>	SO <sub>2</sub>	NO <sub>2</sub>
<b>g/Mg Coal</b>	1914	1864	1176	420	820

Table 2.6: Emission load from Industrial sector in JCF

Sr. No	Name of Industry	Type of Fuel	Fuel consumption	Unit	TSP (Ton/yr)	PM <sub>10</sub> (Ton/yr)	PM <sub>2.5</sub> (Ton/yr)	SO <sub>2</sub> (Ton/yr)	NO <sub>2</sub> (Ton/yr)
1	M/s Mahalaxmi Industries	Coal	4	MT/Oven/cycle (24hrs)	2.79	2.72	1.72	0.61	1.20
2	GEETEE Hard Coke Traders	Coal	100	TPD	69.86	68.04	42.92	15.33	29.93
3	M/s Shree Gopal Coke Industries	Coal	77.4	TPD	54.07	52.66	33.22	11.87	23.17
4	M/s Laxmi Hard coke Manufacturing Company	Coal	102	TPD	71.26	69.40	43.78	15.64	30.53
5	M/s - Sanjay Hard Coke Industries	Coal	70	TPD	48.90	47.63	30.05	10.73	20.95
6	M/s Inder Hard Coke Industries	Coal	36	TPD	25.15	24.49	15.45	5.52	10.77
7	M/s Shiv Shakti Coke Industries	Coal	80	TPD	55.89	54.43	34.34	12.26	23.94
8	Khetawat Coke Manufacturing Company	Coal	4.5	MT/Oven/ Batch (24hrs)	3.14	3.06	1.93	0.69	1.35
9	M/s Pawan Hard Coke Industries	Coal	100	TPD	69.86	68.04	42.92	15.33	29.93
10	M/s Ganapati Udyog	Coal	135	TPD	94.31	91.85	57.95	20.70	40.41
11	M/s Aman Soft Coke Industries	Coal	29.76	TPD	20.79	20.25	12.77	4.56	8.91

### 2.5.2. Area/Distributed source

An area source emission inventory estimates the pollutant loads emanating from several small but numerous individual sources in a specific geographic area and which cannot be included underline no point sources.

Area sources considered for emission inventory for JCF region are:

- Cooking operations in households: Slum and non-slum
- Cooking operations in hotels, restaurants, open eat-outs and bakeries
- Crematoria

The following sections will detail the methodology adopted for estimating emissions from each of the above-mentioned sources and the results thus obtained.

➤ **Emission load from mining activities**

The emission loads from coal mine activities are depicted in Table 2.7. The emission load is calculated based on the secondary data collected from the BCCL mines covered in the study. The data includes coal and overburden quantity handled per day during loading and unloading, transfer from pit to stockyard through haul road and conveyor, vehicular movement frequency and diesel consumption for HEMM and DG sets. Emission factors from EEA air pollutant emission inventory guidebook 2019 were considered for the estimations of TSP and PM load.

Table 2.7: Emission load from coal mine activities in Jharia coalfield region

Mine	Area (m <sup>2</sup> )	PM <sub>10</sub> (Tone/y)	PM <sub>2.5</sub> (Tone/y)
ABOCP	2355283	156.1	78.0
ADI Colliery	1444818	47.9	23.9
ASP Colliery	19540	27.7	13.8
Bhowra south	78079	26.9	13.4
Block IV Govindpur	432827	22.5	11.2
DBOCP	605747	64.7	32.4
East Bassuriya Colliery	576494	24.3	12.2
Gopalichuck Colliery	37573	3.7	1.9
Jeenagora OCP	2079123	208.0	104.0
Kuya OCP	1134723	90.1	45.1
NAKC	245205	78.3	39.1
NGK	261847	126.0	63.0
Nichitpur colliery	791140	61.4	30.7
Phularitand colliery	335887	84.1	42.1
Rajapur OCP	1170784	90.4	45.2
Sendra Bansjora	472760	63.0	31.5
Shatabdi colliery (Muraidhih)	34270	77.0	38.5
Tetulmari	876320	23.3	11.7
<b>Total</b>		<b>1275.4</b>	<b>637.7</b>

➤ **Cooking operations in non-slum household**

A survey of 20 non-slum household areas was conducted in randomly selected areas of Dhanbad to understand which fuels are being used in these households and their quantities. The survey results indicated that Liquefied Petroleum Gas (LPG) was the fuel of choice in all the households and that each household used about 1 cylinder per month on average. It was assumed that LPG use remains the same for all 365 days of the year. The results obtained are presented in Table 2.8.

Table 2.8: Emissions from the use of LPG in non-slum households in Dhanbad

<b>LPG Pollutant</b>	<b>PM<sub>10</sub></b>	<b>SO<sub>2</sub></b>	<b>NO<sub>2</sub></b>	<b>CO</b>	<b>HC</b>
<b>Emission Factor (g/kg)</b>	2.1	0.4	1.8	0.25	0.07
<b>Emission (T/Year)</b>	0.00575	0.0011	0.0049	0.0007	0.0002

#### ➤ **Cooking operations in slum households**

A survey of 15 areas having slum households was conducted, spread in Jharia Coalfield which was known to have significant slum populations, to understand which fuels are being used in these households and their quantities. It was seen that a majority of the slum households use coal as a cooking fuel (Table 2.9).

Table 2.9: Emission from coal as fuel

<b>Pollutant</b>	<b>SPM</b>	<b>SO<sub>2</sub></b>	<b>NO<sub>2</sub></b>	<b>CO</b>	<b>HC</b>
<b>Emission Factor (g/kg)</b>	20	13.3	3.99	24.92	0.5
<b>Emission (T/Year)</b>	28.354	18.856	5.657	35.330	0.709

#### ➤ **Emissions from crematorium**

In order to calculate emission from crematoria data were obtained from crematoriums in Dhanbad. Emission from the burning of bodies using woods mainly produces PM<sub>10</sub>, CO and HC majorly as depicted in Table 2.10.

Table 2.10: Emission from Crematoria using Wood as fuel

<b>Pollutant</b>	<b>PM<sub>10</sub></b>	<b>SO<sub>2</sub></b>	<b>NO<sub>2</sub></b>	<b>CO</b>	<b>HC</b>
<b>Emission Factor (g/kg)</b>	17.3	0.2	1.3	126.3	114.5
<b>Emission (T/Year)</b>	28.88	0.033	0.216	20.99	19.03

#### ➤ **Emissions from bakeries**

Data were collected from 34 bakeries operating in Dhanbad in which 12 bakeries were using electrical ovens. The emissions from such bakeries were not considered. All the other bakeries were using coal as fuel. Emissions from such bakeries are given in Table 2.11.

Table 2.11: Emission from Bakeries using Coal as fuel

<b>Pollutant</b>	<b>SPM</b>	<b>SO<sub>2</sub></b>	<b>NO<sub>2</sub></b>	<b>CO</b>	<b>HC</b>
<b>Emission Factor (g/kg)</b>	20	13.3	3.99	24.92	0.5
<b>Emission (T/Year)</b>	6.26	4.16	1.25	7.80	0.16

#### ➤ **Emissions from hotels and restaurants**

Data were collected from 35 hotels in Dhanbad city. It has been found that most hotels/restaurants were using a combination of coal and LPG as cooking fuel. Emission

from coal and LPG were calculated and depicted in Table 2.12 and 2.13.

Table 2.12: Emission from Hotel & Restaurants using Coal

Pollutant	SPM	SO <sub>2</sub>	NO <sub>2</sub>	CO	HC
Emission Factor (g/kg)	20	13.3	3.99	24.92	0.5
Emission (T/Year)	81.10	5.393	1.618	10.105	0.203

Table 2.13: Emission from Hotel & Restaurants using LPG

Pollutant	PM <sub>10</sub>	SO <sub>2</sub>	NO <sub>2</sub>	CO	HC
Emission Factor (g/kg)	2.1	0.4	0.8	0.25	0.07
Emission (T/Year)	0.136	0.026	0.117	0.016	0.005

#### ➤ Emission from open eat-outs

From the survey it has been observed that most of the open eat-outs were using coal as cooking fuel, only a few were using LPG (Table 2.14).

Table 2.14: Emission loads from open eat-outs

Pollutant	SPM	SO <sub>2</sub>	NO <sub>2</sub>	CO	HC
Emission Factor (g/kg)	20	13.3	3.99	24.92	0.5
Emission (T/Year)	140.7	9.36	2.81	17.54	0.35

### 2.5.3. Grid wise emission inventory

The grid-wise particulate emission inventory maps were prepared from the primary and secondary data collected during the field surveys and the information received from the open cast mines, respectively. The PM emissions from restaurants, eat-outs, domestic chullahs, vehicles, crematoria, etc. were estimated based on the primary data obtained from the filed campaigns, whereas, the emissions from the mine operations were estimated based on the data received from the mines and the emission factors reported in the literature. Once the emissions rates were estimated, the cumulative emissions (including all types of sources like line, point, and area) were calculated falling under the grid defined (shown in Figure 2.3 and Figure 2.4). From the figures, it can be interpreted that the PM emissions are high on the northeast side of the study area. Whereas, the actual transport and dispersion of these emissions can be interpreted through the dispersion modelling carried out using the AERMOD model.

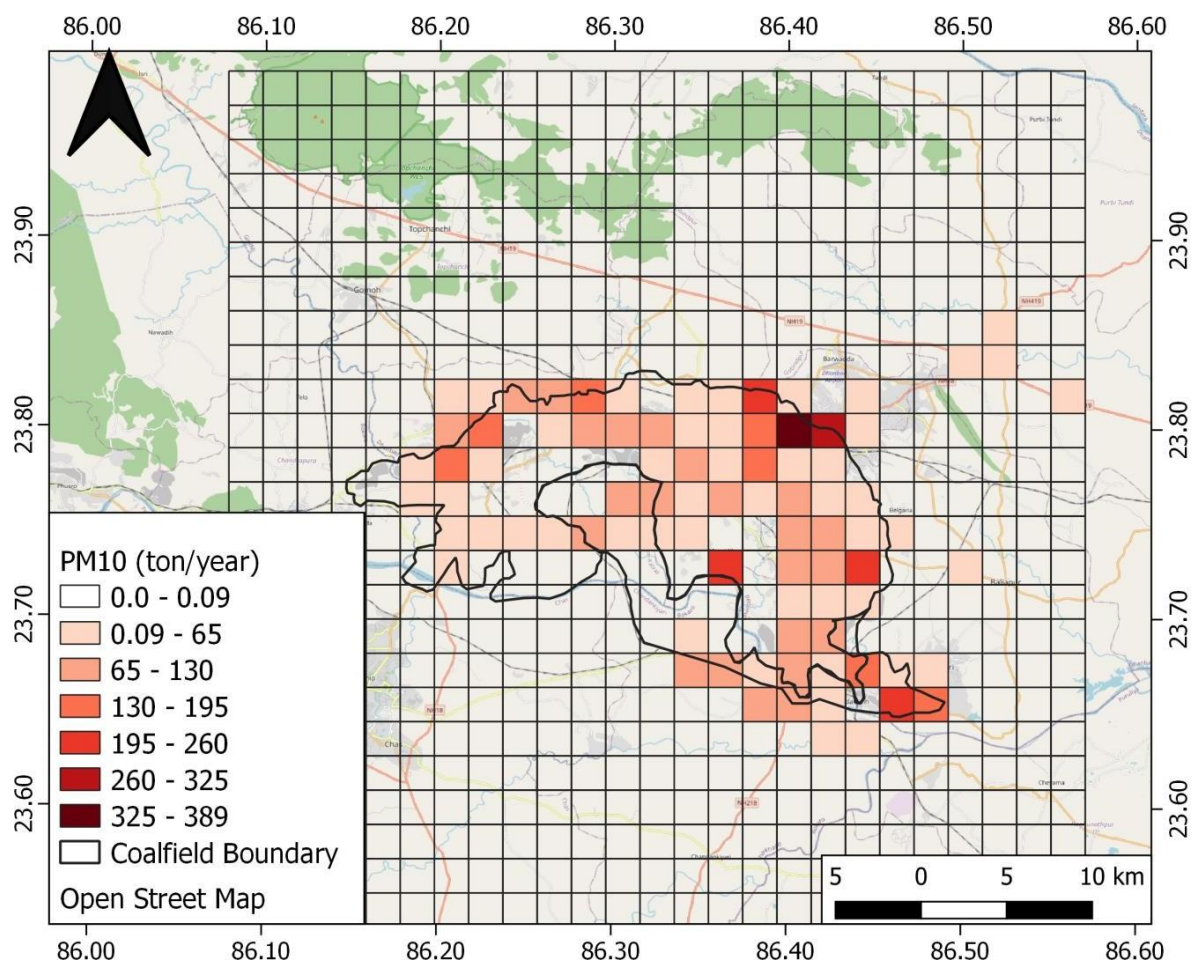


Figure 2.3 Grid-wise emission inventory of PM<sub>10</sub> in tons/year over the study area

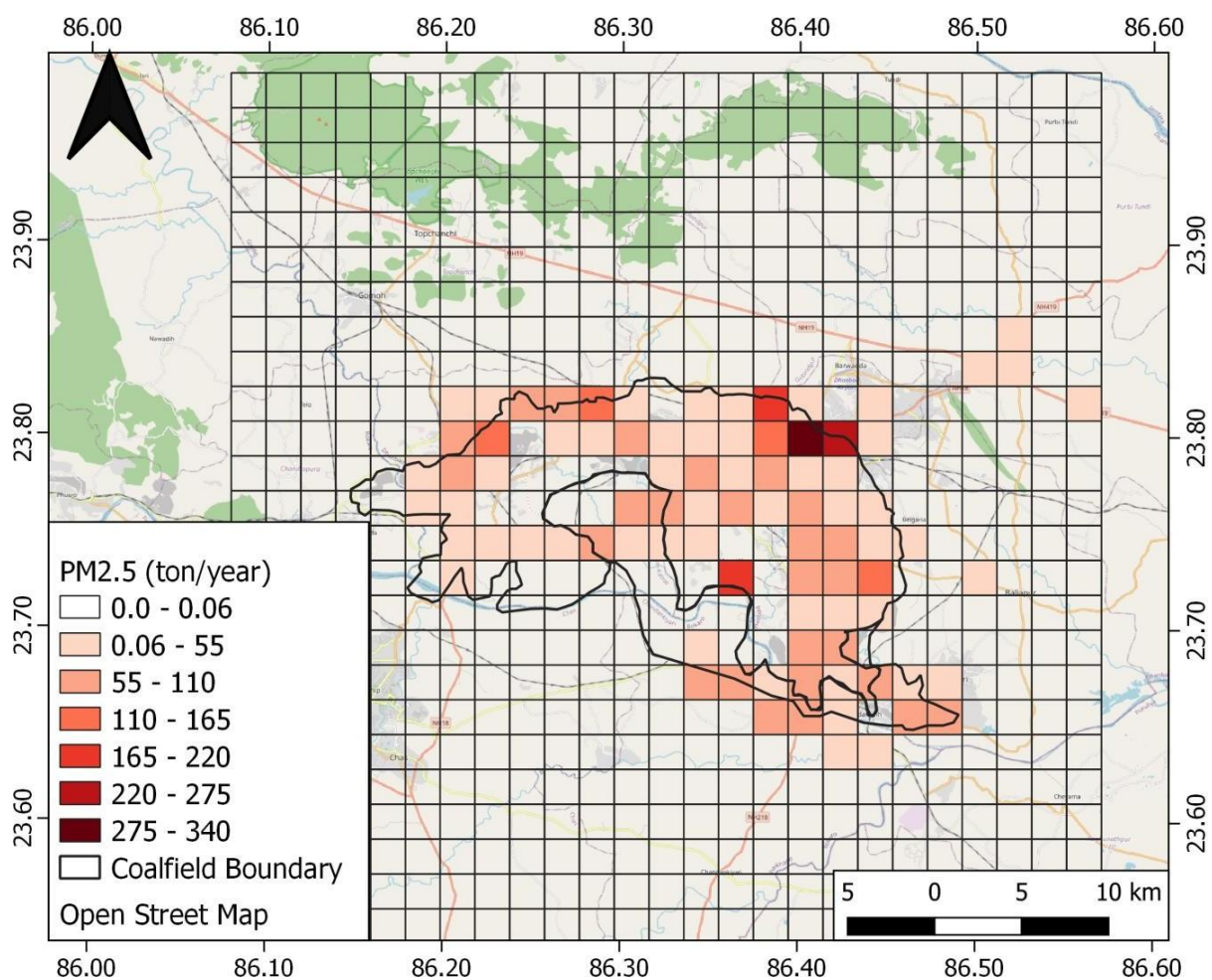
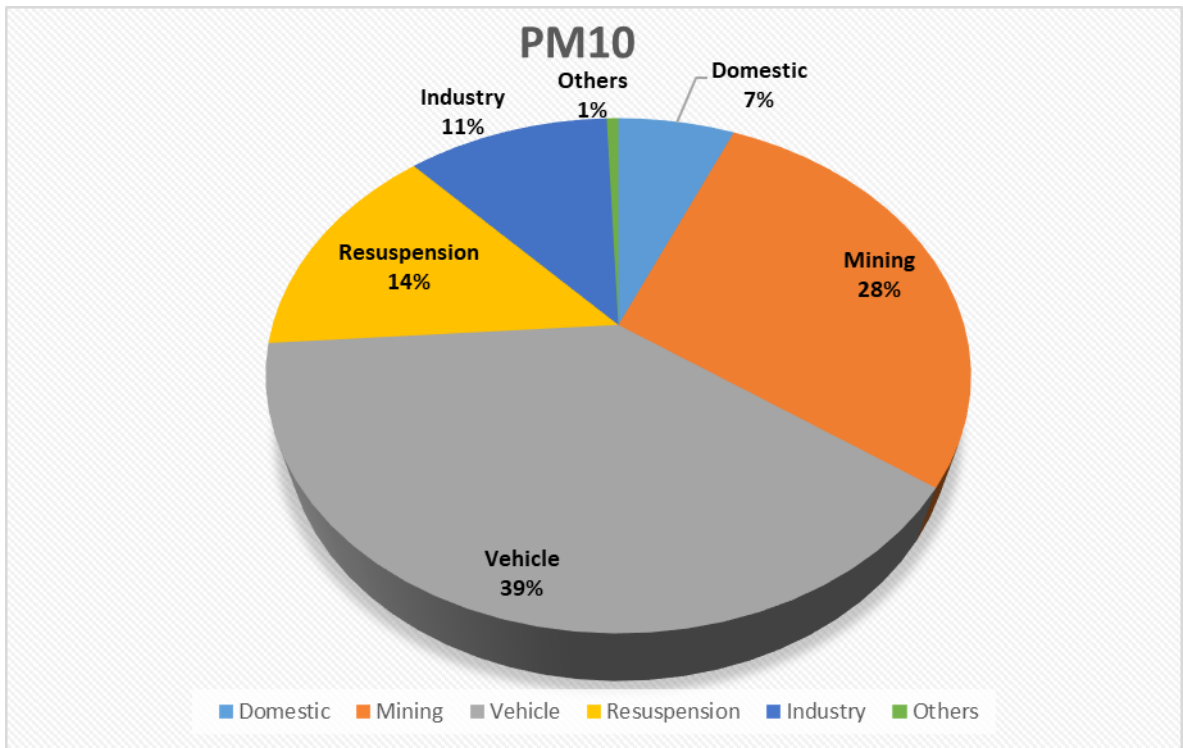


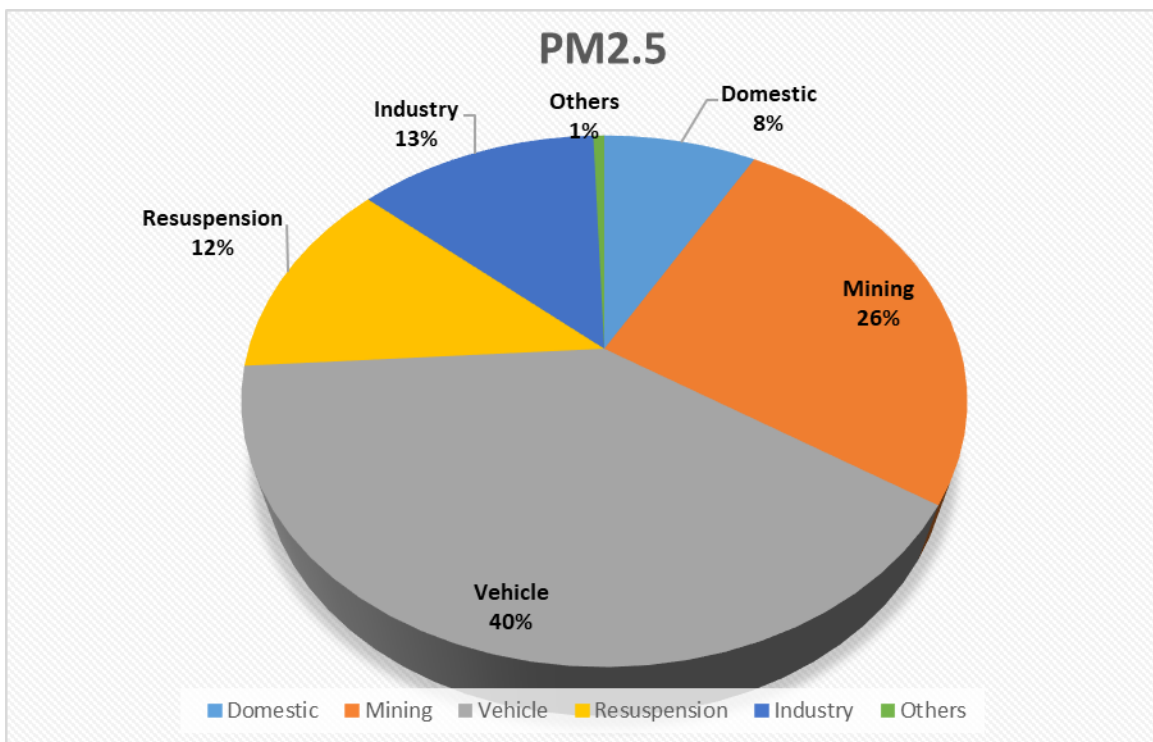
Figure 2.4 Grid-wise emission inventory of PM<sub>2.5</sub> in tons/year over the study area

The respective share of various emission sources is represented through pie diagrams shown in Figure 2.5. Data shows that PM<sub>10</sub> emissions are contributed mostly from vehicular emissions

followed by emissions from the mines whereas, PM<sub>2.5</sub> emissions are contributed mostly from vehicular emissions, domestic burning and mine activities. The grid-wise emission inventory maps and the information on the pollution sources provide the basis for the policymakers to target the hotspots of pollution generation in order to take effective mitigation actions.



(a)



(b)

Figure 2.5 (a) and (b) represents emission load from various sectors over JCF region for PM<sub>10</sub> and PM<sub>2.5</sub> respectively

**References**

- Automotive Research Association of India (ARAI), CPCB/MoEF. (2007). EF development for Indian vehicles, as a part of ambient air quality monitoring and emission source apportionment studies. AFL/2006-07/IOCL/Emission Factor Project/Final Rep. [https://www.cpcb.nic.in/DRAFT REPORT-on-efdiv .pdf](https://www.cpcb.nic.in/DRAFT%20REPORT-on-efdiv.pdf)
- Central Pollution Control Board, Delhi, India. (2008–2010). Air quality monitoring, emission inventory and source apportionment studies for Indian cities. <https://cpcb.nic.in>.
- Apoorva Pandey, Chandra Venkataraman, Estimating emissions from the Indian transport sector with on-road fleet composition and traffic volume, *Atmospheric Environment*, Volume 98, 2014, Pages 123-133, ISSN 1352-2310, <https://doi.org/10.1016/j.atmosenv.2014.08.039>.
- Roy, D., Singh, G., Sinha, S., Park, J., & Seo, Y. C. (2021). Emission inventory of PM10 in Dhanbad/Jharia coalfield (JCF), India: an intricate coal mining sector. *Environment, Development and Sustainability*, 23(3), 3048-3061. <https://doi.org/10.1007/s10668-020-00702-4>.

### Chapter 3 Air Quality Monitoring and Receptor modelling

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. The details of the visit and mine cluster names are given in Table 3.3.1. The Entire Jharia Coal Field (JCF) is divided into 16 clusters. Both open cast 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 with their 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.

Table 3.3.1: The details of mine cluster in Jharia Coalfield

	<p>Day 1: Cluster I, II, III, IV, XII, XIII, XV and XIV</p>
	<p>Day 2: Cluster V, VI, VII, and VIII</p>
	<p>Day 3: Cluster IX, X and XI</p>

Based on preliminary field visit by NEERI Scientists along with BCCL staffs, the following locations (Figure 3.1) were 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 V- Katras
4. Cluster IX Lodhna
5. Cluster XI Moonidih nearby sources: Coal Mine
6. Cluster X Patherdih: nearby sources: Coal Mine, Steel Industry
7. Cluster VIII Bastacola nearby sources: Coal Mine

- **Buffer Zone**

8. Bank More
9. Harina
10. Bhuli
11. Sindri
12. Parbatpur Electro steel/ Bhaga
13. Background

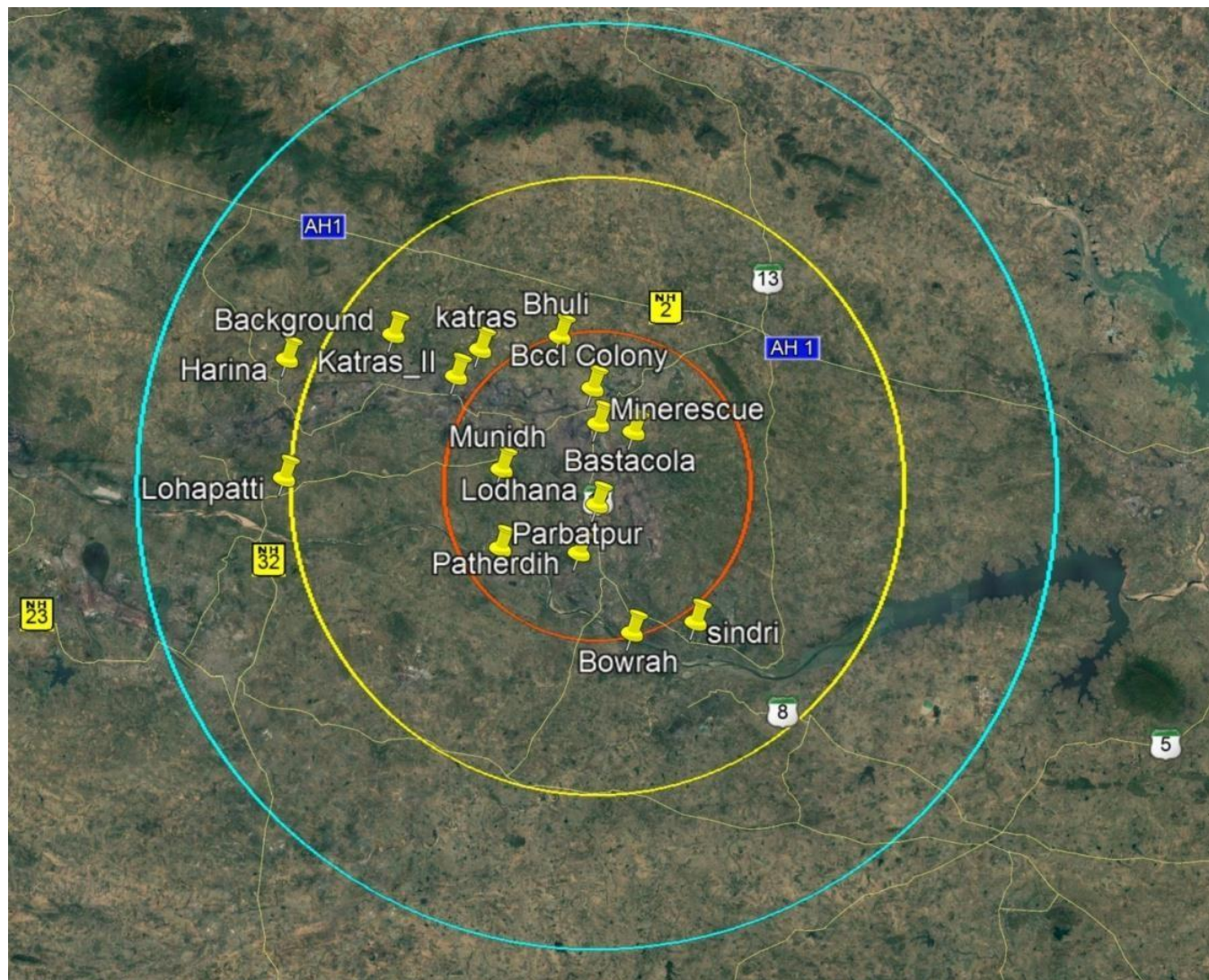


Figure 3.1: Air monitoring sites under 30 km buffer area

### 3.1. Sampling Method and Schedule

The PM<sub>10</sub> and PM<sub>2.5</sub> sampling for Jharia Coalfields was done at all the 13 sampling sites for the period of 24 h using low volume respirable suspended particulate matter samplers (Instrumax, ARA and Envirotech) on Quartz and polytetrafluoroethylene (PTFE) filter paper of 47 mm diameter. Samplers at a flow rate of 16.67 LPM were used. The filter papers were desiccated before and after sampling for 24h at a temperature of  $27 \pm 3^\circ\text{C}$  and at a relative humidity (RH) of  $55 \pm 2\%$  to remove the moisture present in them. The PM<sub>10</sub> and PM<sub>2.5</sub> field samples were collected periodically throughout the sampling period. The sampling frequency and types of equipment used for monitoring are described in Table 3.3.2 and 3.3.3. The national Ambient quality and Standards for Coal Mines (Stipulated by Ministry of Environment and Forests are depicted in Table 3.3.4. and Table 3.3.5.

Table 3.3.2: Frequency of Air pollutants sampling in Jharia Coalfields

Parameter	Number of Days	Change of Filter/ absorbing media	Reporting
PM <sub>10</sub>	10	24 hourly, Teflon: 5 Days Quartz: 5 Days	24 hourly
PM <sub>2.5</sub>	10	24 hourly Teflon: 5 Days Quartz: 5 Days	24 hourly
NO <sub>2</sub>	10	8 hourly	8 hourly
SO <sub>2</sub>	10	8 hourly	8 hourly

Table 3.3.3: Ambient Air Quality Sampling/Analysis Methodology for Target Pollutants

Particulars	Parameters			
	PM <sub>10</sub>	PM <sub>2.5</sub>	NO <sub>2</sub>	SO <sub>2</sub>
Sampling Instrument	INSTUMEX and ARA-N-FRM Sampler	INSTUMEX and ARA-N-FRM Sampler	APM sampler	APM sampler
Sampling Principle	Cyclonic Flow Technique	Cyclonic Flow Technique	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	7 days continuous, Teflon and quartz on alternate days	7 days continuous, Teflon and quartz on alternate days	7 days continuous	7 days continuous
Analytical Instrument	Electronic Micro Balance	Electronic Micro Balance	Spectrophotometer	Spectrophotometer
Analytical Method	Gravimetric	Gravimetric	Modified Jacob and Hochheiser method	Colorimetric Improved West & Gaeke Method
Minimum reportable value	5 $\mu\text{g}/\text{m}^3$	5 $\mu\text{g}/\text{m}^3$	9 $\mu\text{g}/\text{m}^3$	4 $\mu\text{g}/\text{m}^3$

Table 3.3.4: National Ambient Air Quality Standards (2009)

Sr. No.	Pollutant	Time Weighted Average	Concentration in ambient Air (in $\mu\text{g}/\text{m}^3$ ) Industrial, Residential Rural & Other Areas	Concentration in ambient Air (in $\mu\text{g}/\text{m}^3$ ) Ecologically Sensitive Area	Concentration In ambient Air (in $\mu\text{g}/\text{m}^3$ ) Methods of Measurement
1	Sulphur Dioxide ( $\text{SO}_2$ )	Annual*	50	20	Improved West & Geake, Ultraviolet fluorescence
		24Hours**	80	80	
2	Nitrogen Dioxide ( $\text{NO}_2$ )	Annual*	40	30	Modified Jacob & Hochheiser (Na-Arsenite) Chemiluminescence
		24Hours**	80	80	
3	Particulate matter (Size less than $10\mu\text{m}$ ) or $\text{PM}_{10}$	Annual*	60	60	Gravimetric, TOEM, Beta attenuation
		24Hours**	100	100	
4	Particulate matter (Size less than $2.5\mu\text{m}$ ) or $\text{PM}_{2.5}$	Annual*	40	40	Gravimetric, TOEM, Beta attenuation
		24Hours**	60	60	
5	Ozone ( $\text{O}_3$ )	8 Hours*	100	100	UV photometric, Chemiluminescence chemical method
		1 Hour	180	180	
6	Lead (Pb)	Annual*	0.5	0.5	ASS / ISP method after sampling on EPM 2000 or equivalent filter paper ED-XRF using Teflon filter
		24Hours**	1	1	
7	Carbon Monoxide ( $\text{CO}$ )	Annual*	0.2	0.2	Non-dispersive Infra-Red (NDIR) Spectroscopy
		24Hours**	0.4	0.4	
8	Ammonia ( $\text{NH}_3$ )	Annual*	100	100	Chemiluminescence, Indo-phenol's blue method
		24Hours**	400	400	
9	Benzene ( $\text{C}_6\text{H}_6$ )	Annual*	0.5	0.5	Gas Chromatography based continuous analyzer. Adsorption and desorption followed by GC analysis
10	Benzo (a) Pyrene (BaP)- particulate phase only	Annual*	0.1	0.1	Solvent extraction followed by HPLC / GC analysis
11	Arsenic (As)	Annual*	0.6	0.6	AAS/ ICP method after sampling on EPM 2000 or equivalent filter paper
12	Nickel (Ni)	Annual*	20	20	

Table 3.3.5 Standards for Coal Mines (Stipulated by Ministry of Environment and Forests (MoEF), Vide Notification No. GSR 742(E), Dt: 25.09.2000)

Pollutant	Time weighted Average	Concentration in Ambient Air	
		New Coal Mines (commenced after 25.09.2000)	Existing Coal Mines (commenced prior to 25.09.2000)
Suspended Particulates Matter (SPM)	Annual Average	360µg/m <sup>3</sup>	430µg/m <sup>3</sup>
	24 hours	500µg/m <sup>3</sup>	600µg/m <sup>3</sup>
Respirable Particulate Matter (size less than 10 µm) (RPM)	Annual Average	180µg/m <sup>3</sup>	215µg/m <sup>3</sup>
	24 hours	250µg/m <sup>3</sup>	300µg/m <sup>3</sup>
Sulphur Dioxide (SO <sub>2</sub> )	Annual Average	80µg/m <sup>3</sup>	80µg/m <sup>3</sup>
	24 hours	120µg/m <sup>3</sup>	120µg/m <sup>3</sup>
Oxides of Nitrogen as NO <sub>2</sub>	Annual Average	80µg/m <sup>3</sup>	80µg/m <sup>3</sup>
	24 hours	120µg/m <sup>3</sup>	120µg/m <sup>3</sup>

### 3.2. Chemical Analysis

#### 3.2.1. Gravimetric analysis

The exposed filters were analysed by gravimetric technique using a weighing balance for PM<sub>10</sub> particles and using a microbalance for PM<sub>2.5</sub> particles with a precision of 5µg with automatic (internal) calibration.

#### 3.2.2. Elemental analysis

PM<sub>10</sub> samples collected on glass fibre filters were digested in a microwave digester. The samples were made up to 50ml using deionized distilled water. Similarly, the exposed filters containing PM<sub>2.5</sub> particles were cut equally into 2 halves. A part of the exposed filter was used for ions analysis. Whereas, the other half was cut into tiny fragments and digested and made up to 15mL using distilled deionized water. The obtained samples (both PM<sub>10</sub> and PM<sub>2.5</sub>) after digestion were stored in vials and refrigerated at 4°C until further analysis. These samples were later subjected to estimate the elemental composition using ICP-OES (Thermo Scientific, USA).

#### 3.2.3. Analysis of SO<sub>2</sub> and NO<sub>2</sub>

SO<sub>2</sub> analysis: Modified West and Gaeke method was followed for sampling and analysis of Sulfur dioxide in ambient air. SO<sub>2</sub> from the air is absorbed in a solution of potassium tetracholo-mercute (TCM). A dichlorosulphitomercurate complex, which resists oxidation by the oxygen in the air was formed. Once formed, that complex was stable to strong oxidants such as ozone and oxides of nitrogen and therefore, the absorber solution may be stored for some time prior to analysis. The complex was made to react with pararosaniline and formaldehyde to form the intensely colored pararosaniline methylsulphonic acid. The absorbance of the solution was measured by means of a suitable spectrophotometer.

NO<sub>2</sub> analysis: Modified Jacobs and Hochheiser method was followed for sampling and analysis of NO<sub>2</sub> in ambient air. Ambient NO<sub>2</sub> was collected by bubbling air through a solution of sodium hydroxide and sodium arsenite. The concentration of nitrite ion produced during sampling was determined calorimetrically by the nitrite ion reaction with phosphoric acid, sulphanilamide, and N-(1-naphthyl)-ethylenediamine di-hydrochloride (NEDA) and the absorbance of the highly colored azo dye was measured at 540nm.

#### **3.2.4. Ion analysis**

The filter papers containing both PM<sub>10</sub> and PM<sub>2.5</sub> samples were extracted and subjected to ion analysis as per standards. The filter papers were divided into tiny fragments and moistened with isopropanol slightly before extraction since the filters are hydrophobic. Further 25 mL of deionized distilled water was added and sonicated using an ultrasonic bath for 60 min at 60°C. The samples were then kept overnight after sonication. Furthermore, the samples were then filtered using nylon filter discs (25mm, 0.45mm) and were refrigerated at 4°C until further analysis. The extracted samples were subjected to IC to analyse the ions (anions and cations) present in them.

#### **3.2.5. Polycyclic Aromatic Hydrocarbons (PAH) analysis**

Filter papers were cut into pieces using scissors and transferred to a 100 ml beaker and 50 ml of Dichloromethane (DCM) (GC/HPLC grade) was added. The samples were extracted with DCM using an ultrasonic bath for about 30 minutes. The extracted samples were filtered with Whatman filter paper containing 2gm Anhydrous Sodium Sulphate. After filtration, the filtrate is concentrated using a rotary vacuum evaporator to 2ml final volume. Solid-phase extraction may be used to clean up the impurities of the sample and re-concentrated in a rotary evaporator. The samples were analyzed through GC with conditions as injector 300°C and FID temperature 320°C.

#### **3.2.6. EC & OC analysis**

This is a thermal/optical-transmittance (TOT) method that speciates carbon in particulate matter collected on a quartz-fiber filter into OC, EC, and CC. In the first (or non-oxidizing) heating stage, organic and carbonate carbon is thermally desorbed from the filter under a flow of helium with controlled temperature ramps. The oven is then partially cooled, and the original flow of helium is switched to an oxidizing carrier gas (He/O<sub>2</sub>). In the second (or oxidizing) heating stage, the original elemental carbon component plus pyrolyzed organic carbon formed during the first heating stage are oxidized/desorbed from the filter with another series of controlled temperature ramps. All carbon evolved from the sample is converted to CO<sub>2</sub> in an oxidizing oven immediately downstream from the desorption oven, and the CO<sub>2</sub> is converted to methane (CH<sub>4</sub>) by a methanator oven before being measured with a flame ionization detector (FID). (<https://www3.epa.gov/ttnamti1/files/ambient/pm25/spec/RTIOCECSOP.pdf>)

### 3.3. Results

#### 3.3.1. Mass concentration of PM<sub>10</sub> and PM<sub>2.5</sub>

In summer monitoring, the mean mass concentrations of PM<sub>10</sub> particles in all 13 sampling sites were found to be in the range of 74-184 $\mu\text{g}/\text{m}^3$  with the highest concentration of 184 $\mu\text{g}/\text{m}^3$  at mine rescue site and lowest concentration of 74 $\mu\text{g}/\text{m}^3$  at Bastacola site. Also, the mean mass concentration of PM<sub>2.5</sub> particles was found in the range of 49-117 $\mu\text{g}/\text{m}^3$  with the highest concentration of 117 $\mu\text{g}/\text{m}^3$  and the lowest concentration of 49 $\mu\text{g}/\text{m}^3$  recorded at Harina and Lohapatti site respectively.

The average concentrations of PM<sub>10</sub> and PM<sub>2.5</sub> in two seasons are described in Table 3.6 and 3.7. Results revealed that the average concentrations of PM<sub>10</sub> are within the prescribed limits of MoEF notification guidelines for coal mine areas. In the case of PM<sub>2.5</sub>, there is no Govt. notified standard for mining areas but in the case of buffer zones, National Ambient Air Quality Standard, NAAQS, 2009 may be applicable. The highest PM<sub>10</sub> and PM<sub>2.5</sub> concentrations were found in Mine rescue and Harina (Figure 3.2 and 3.3).

Table 3.6: Average concentration of PM<sub>10</sub> and PM<sub>2.5</sub> in Summer of Jharia Coalfield

Monitoring Sites	Site Description	Average Concentration ( $\mu\text{g}/\text{m}^3$ )-Summer	
		PM <sub>10</sub> ( $\mu\text{g}/\text{m}^3$ )	PM <sub>2.5</sub> ( $\mu\text{g}/\text{m}^3$ )
Lohapatti	Core Zone	133.7	49.42
		(83-203)	(44-83)
Mines Rescue	Core Zone	184.8	83.43
		(124-255)	(55-205)
Katras	Core Zone	141.4	80.01
		(100-216)	(42-150)
Lodhna	Core Zone	156.8	63.98
		(100-303)	(32-99)
Moonidih	Core Zone	118.4	62.84
		(80-153)	(34-94)
Patherdih	Core Zone	94.7	67.22
		(50-119)	(37-91)
Bastacola	Core Zone	104.32	93.27
		(154 -316)	(64-158)
BCCL colony	Buffer Zone	157.35	74.37
		(113-222)	(47-103)
Harina	Buffer Zone	177.7	117.3
		(73-265)	(42-175)
Bhuli	Buffer Zone	141.7	105.89
		(85-243)	(44-161)
Sindri	Buffer Zone	122.2	76.05
		(82-139)	(18-127)
Parabatpur	Buffer Zone	122.4	110.98
		(86-171)	(70-150)
Background	Buffer Zone	144.4	57.13
		(24-255)	(23-97)

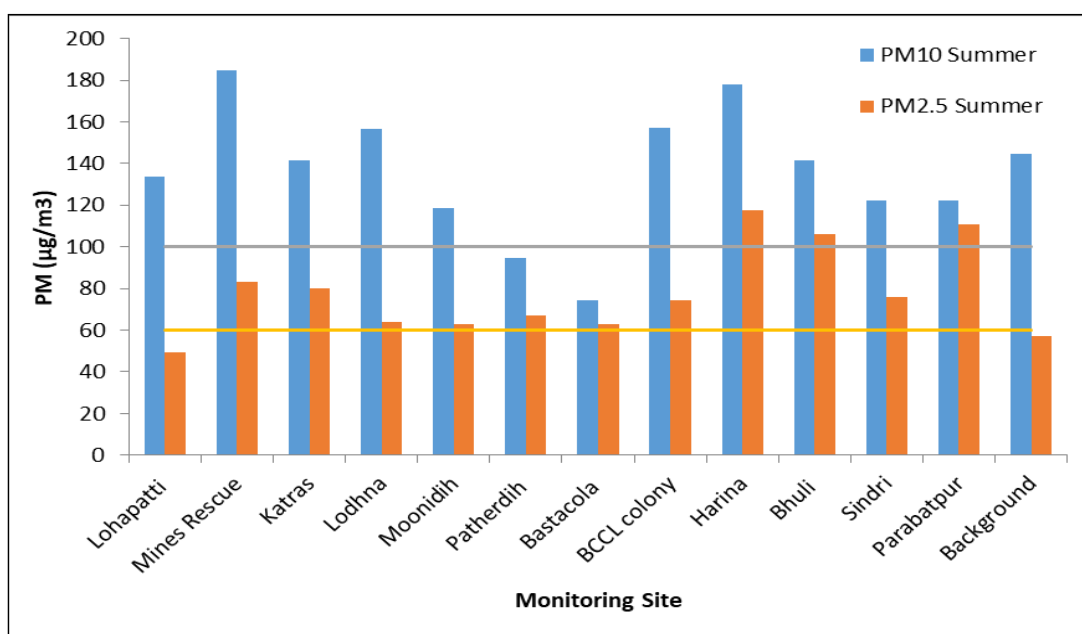


Figure 3.2: Average concentration of PM<sub>10</sub> and PM<sub>2.5</sub> in JCF region in summer compared to NAAQS (2009)

Table 3.7: Average concentration of PM<sub>10</sub> and PM<sub>2.5</sub> in winter of Jharia Coalfield.

Monitoring Sites	Site Description	Average Concentration (µg/m <sup>3</sup> )-Winter	
		PM <sub>10</sub> (µg/m <sup>3</sup> )	PM <sub>2.5</sub> (µg/m <sup>3</sup> )
Lohapatti	Core Zone	174.28	139.59
		(122-241)	(114-236)
Mines Rescue	Core Zone	303.49	176.97
		(175-350)	(114-233)
Katras	Core Zone	230.06	50.87
		(134-332)	(24-78)
Lodhna	Core Zone	322.8	112.17
		(243-412)	(98-209)
Moonidih	Core Zone	300.16	188.27
		(128-728)	(64-600)
Patherdih	Core Zone	222.71	113.23
		(182-246)	(111-167)
Bastacola	Core Zone	332.05	176.48
		(251-663)	(54-425)
BCCL colony	Buffer Zone	219.98	128.79
		(155-300)	(94-175)
Harina	Buffer Zone	130.73	42.93
		(65-215)	(44-98)
Bhuli	Buffer Zone	174.75	151.66
		(150-200)	(89-180)
Sindri	Buffer Zone	171.82	167.07
		(81-210)	(142-184)
Parabatpur	Buffer Zone	228.76	148.16
		(75-660)	(101-192)
Background	Buffer Zone	233	121.18
		(195-254)	(63-170)
Katras II	Core Zone	107.13	98.42
		(128-181)	(94-104)

Whereas in winter monitoring, the highest PM<sub>10</sub> mass concentration was found to be 332 µg/m<sup>3</sup> at Bastacola site (exceeding the prescribed limit of **GSR 742(E)**) along with other core mining zones like Mines Rescue, Moonidih. The lowest average concentration of PM<sub>10</sub> was found in Katras II (Table 3.7).

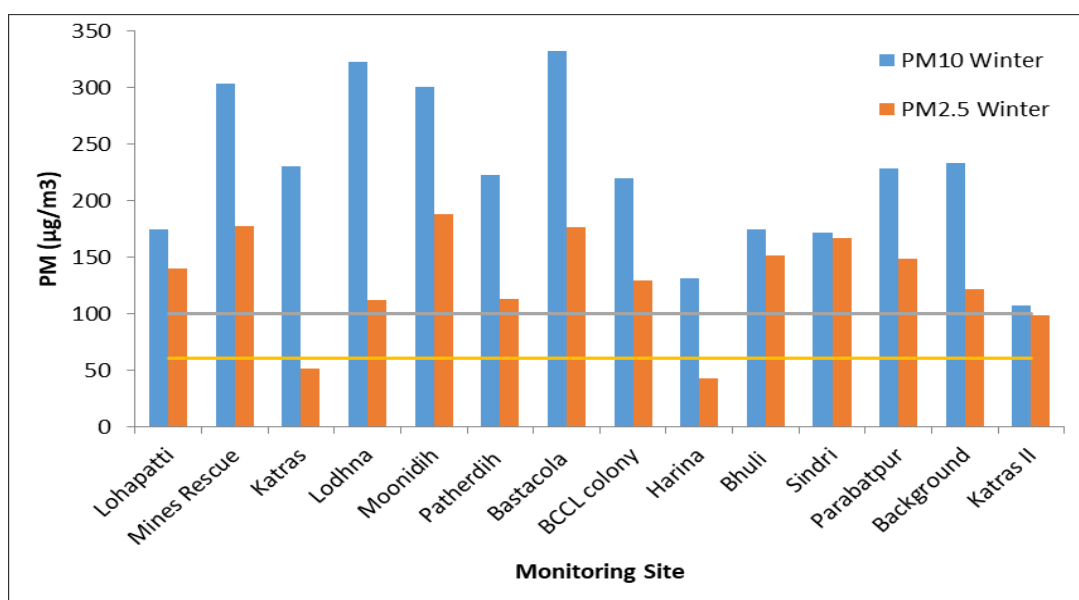
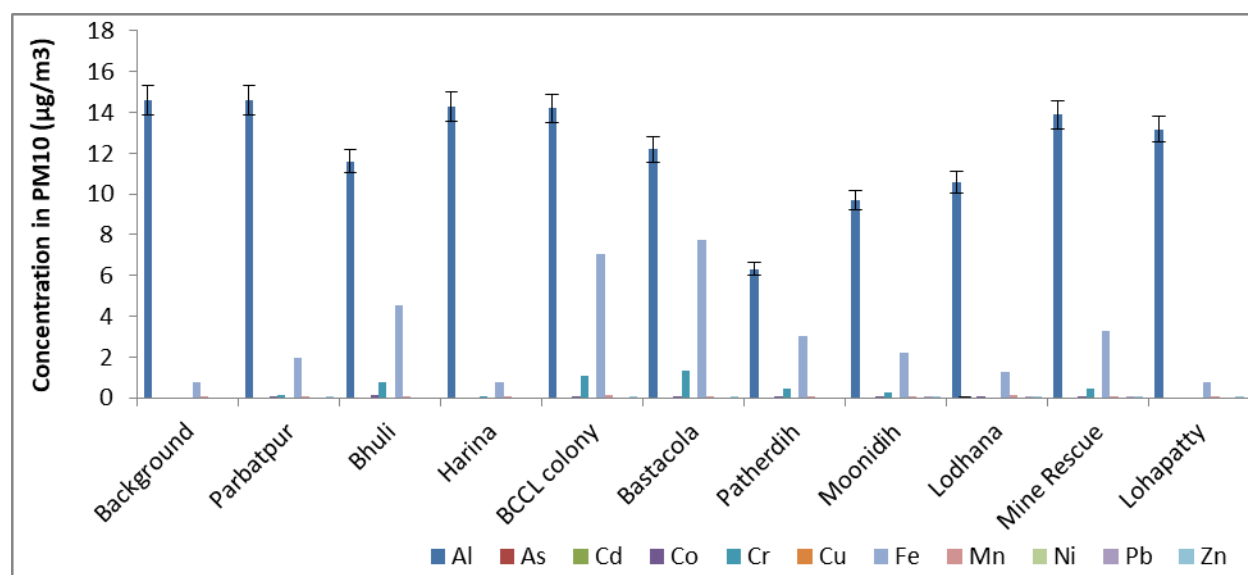
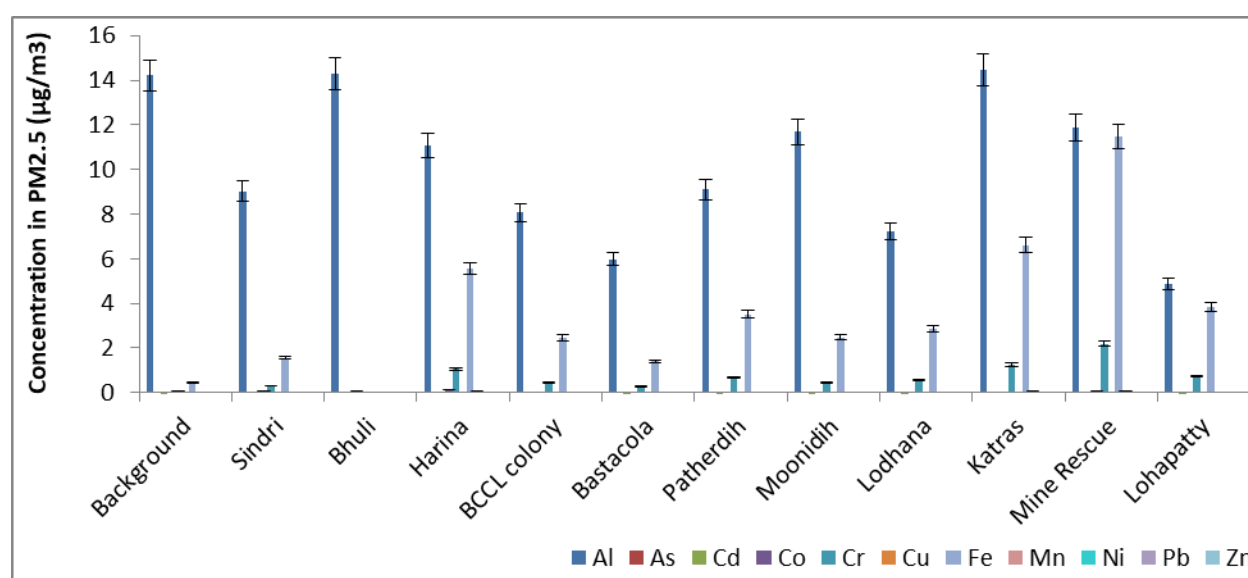


Figure 3.3: Average concentration of PM<sub>10</sub> and PM<sub>2.5</sub> in JCF region during Winter compared to NAAQS (2009)

### 3.3.2. Elemental concentration of PM<sub>10</sub> and PM<sub>2.5</sub> in summer

The digested samples of PM<sub>10</sub> and PM<sub>2.5</sub> particles from all the 13 sampling sites were subjected to estimate the elemental composition using ICP-OES. The analysis of PM<sub>10</sub> particles yields 11 different elements such as Al, As, Cd, Co, Cu, M, Ni, Pb, Zn, Fe and Cr. Similarly, the samples containing PM<sub>2.5</sub> particles revealed the same elements as PM<sub>10</sub>. It was observed that Al and Fe were found to be higher for both PM<sub>10</sub> and PM<sub>2.5</sub> particles. Al is the most abundant element. The concentration of Al was detected in the range of 6.32-14.62 µg/m<sup>3</sup>. Maximum Al concentrations were found at BCCL colony, Parbatpur, Harina and Background. The concentrations of Fe and Cr were estimated as 0.78-7.74 µg/m<sup>3</sup> and 0.075-1.32 µg/m<sup>3</sup> respectively. The highest concentrations of both Fe (7.74 µg/m<sup>3</sup>) & Cr (1.32 µg/m<sup>3</sup>) were found at the Bastacola site Figure 3.4. Similarly, in the case of PM<sub>2.5</sub> particles the concentrations of Al (4.87-14.47 µg/m<sup>3</sup>), Fe (0.44-11.77 µg/m<sup>3</sup>) and Cr (0.066-2.17 µg/m<sup>3</sup>) were found higher than other elements. For PM<sub>2.5</sub> particles, maximum concentrations of Fe (11.77 µg/m<sup>3</sup>) and Cr (2.17 µg/m<sup>3</sup>) were obtained at the Mine Rescue site and Al (14.47 µg/m<sup>3</sup>) at Katras. Since, the elements such as Al, Fe and Cr possess higher concentrations in the PM<sub>10</sub> elemental composition, Al would have been emitted from road dust, whereas Fe would have been emitted from the re-suspension of dust containing deposits from the emissions of vehicular and other anthropogenic activities Figure 3.5.

Figure 3.4: Metal concentration of PM<sub>10</sub> in the summer seasonFigure 3.5: Metal concentration of PM<sub>2.5</sub> in the summer season

### 3.3.3. Elemental Concentration of PM<sub>10</sub> and PM<sub>2.5</sub> in Winter

The elemental analysis was performed using inductively coupled plasma optical emission spectroscopy (ICP-OES). For the air quality assessment, the concentrations of 11 elements i.e. Al, As, Cd, Cr, Cu, Fe, K, Mn, Ni, Pb, and Zn in PM<sub>10</sub> and PM<sub>2.5</sub> samples, were measured. Among all the elements, Al, Fe, and K concentrations were found considerably higher for PM<sub>10</sub> samples in the winter season. Al was observed in the range of 2.02-10.77µg/m<sup>3</sup> followed by Fe (0.79-9.26µg/m<sup>3</sup>) and K (0.90-4.19µg/m<sup>3</sup>). Maximum Al concentration (10.77µg/m<sup>3</sup>) was observed at the BCCL colony, followed by Lodhna (10.29µg/m<sup>3</sup>). The Highest Fe concentration (9.26µg/m<sup>3</sup>) was observed at Bastacola while K (4.19µg/m<sup>3</sup>) at the Lodhna site. This may be due to vehicular emissions, paved roads, construction dust, coal combustion, soil dust, etc. The concentration of As, Ni, Pb was found within the limits of CPCB standards. The remaining elements i.e. Cd, Cr, Cu, Mn, and Zn were found very low (Figure 3.6).

Similarly, in the case of PM<sub>2.5</sub> samples concentrations of Al, Fe and K were detected higher than other elements. The concentration of Al, Fe, and K was obtained as 0.11-2.91µg/m<sup>3</sup>, 0.05-1.93µg/m<sup>3</sup> and 0.08-2.12µg/m<sup>3</sup>. For PM<sub>2.5</sub> particles, maximum Al and K were found at the Munidih site, which were 2.91µg/m<sup>3</sup> and 2.12µg/m<sup>3</sup> respectively. The highest concentration of

Fe i.e.  $1.93\mu\text{g}/\text{m}^3$  was detected at Lodhna site. The concentrations of all other analysed elements were low (Figure 3.7).

From the elemental analysis of the summer and winter seasons, it was observed that the average Al concentration obtained was more in the summer season than in the winter season. In contrast, the average concentration of Cr was more in the winter season.

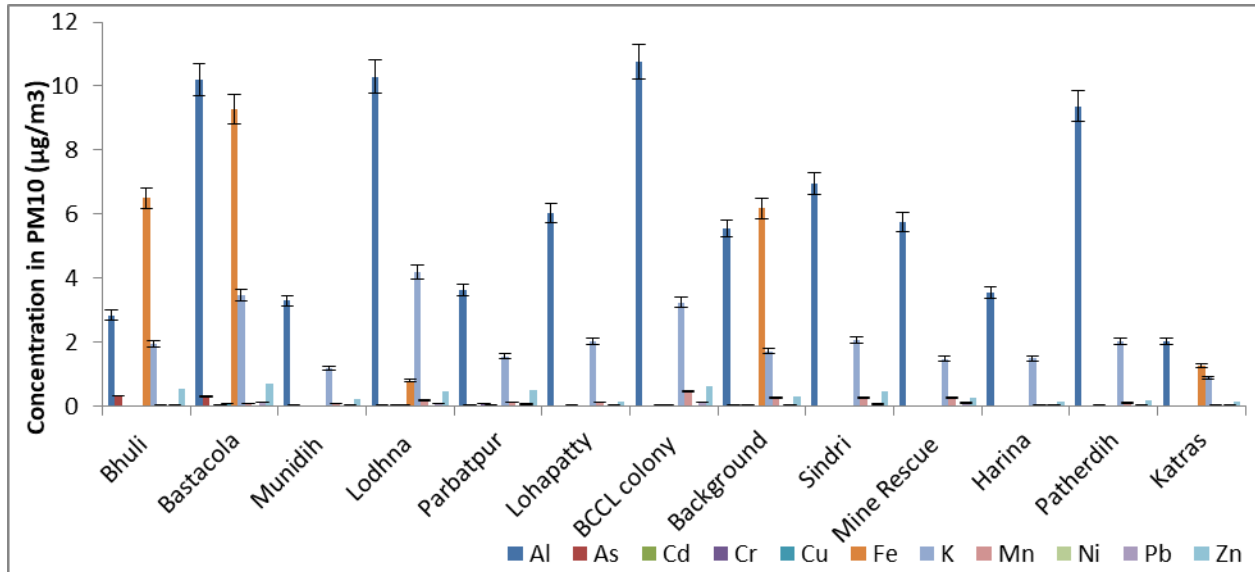


Figure 3.6: Metal concentration of PM<sub>10</sub> in winter season

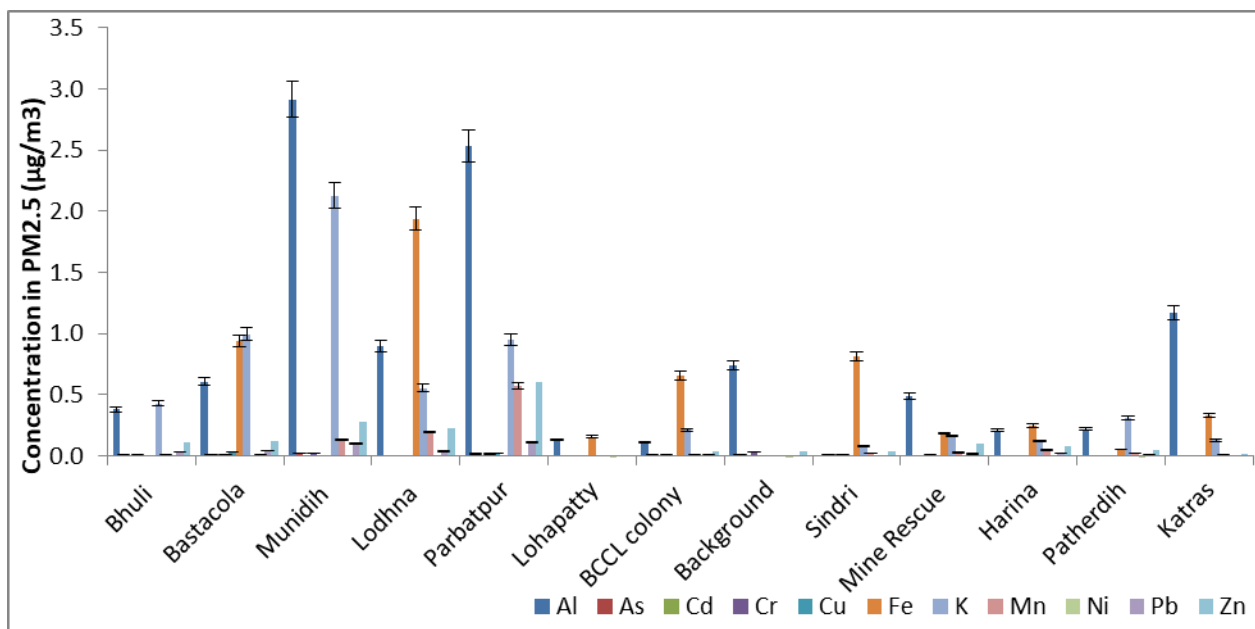


Figure 3.7: Metal concentration of PM 2.5 in winter season

### 3.3.4. SO<sub>2</sub> and NO<sub>2</sub> concentration in ambient air in the Summer season

The mean average SO<sub>2</sub> concentration in the summer season among all the monitoring stations ranged between 11µg/m<sup>3</sup> (Harina & Bastacola) and 24.5µg/m<sup>3</sup> (Moonidih), being well below the threshold limits of 80µg/m<sup>3</sup> (residential or industrial). The 8-hour average NO<sub>2</sub> concentrations were between 10.3µg/m<sup>3</sup> (Background) and 40.9µg/m<sup>3</sup> (Lodhana), well within the standard limits of 80µg/m<sup>3</sup> (residential or industrial) Figure 3.8. The SO<sub>2</sub> in the residential areas may be received from the open burning of raw coal and other domestic and commercial activities.

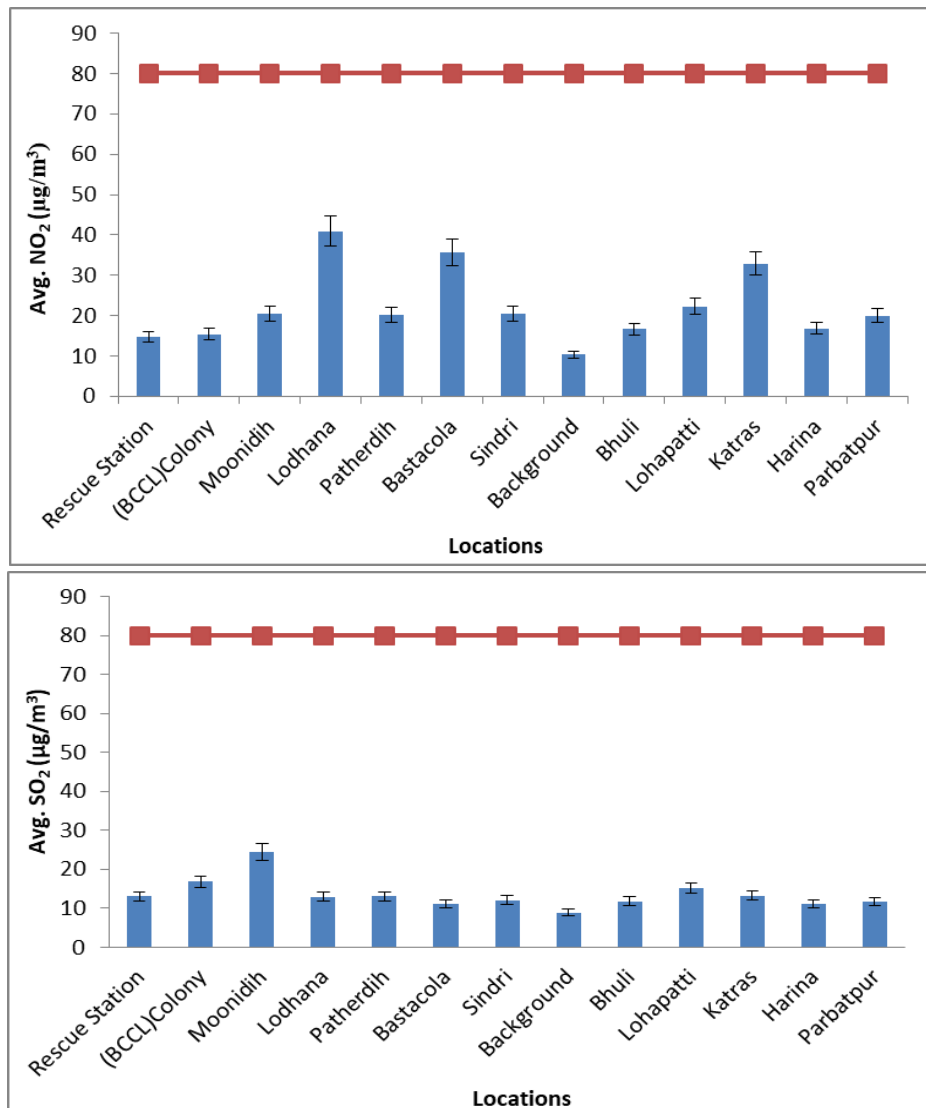


Figure 3.8: NO<sub>2</sub> and SO<sub>2</sub> Concentration of all monitoring sites in summer season

### 3.3.5. SO<sub>2</sub> and NO<sub>2</sub> concentration in ambient air in Winter season

The mean concentration of NO<sub>2</sub> and SO<sub>2</sub> in the winter season was found below the threshold limit i.e. 80µg/m<sup>3</sup>. The concentration of SO<sub>2</sub> was below 10µg/m<sup>3</sup> in Katra, BCCL colony, Mine Rescue, Bastacola, Lodhana and Munidih. Bastacola and Bhuli site has a NO<sub>2</sub> concentration above 10µg/m<sup>3</sup> (Figure 3.9). It has been observed that the concentration of NO<sub>2</sub> and SO<sub>2</sub> in the winter and summer seasons were below the standard limit. But the average concentration of NO<sub>2</sub> and SO<sub>2</sub> in the summer season was higher than in the winter season.

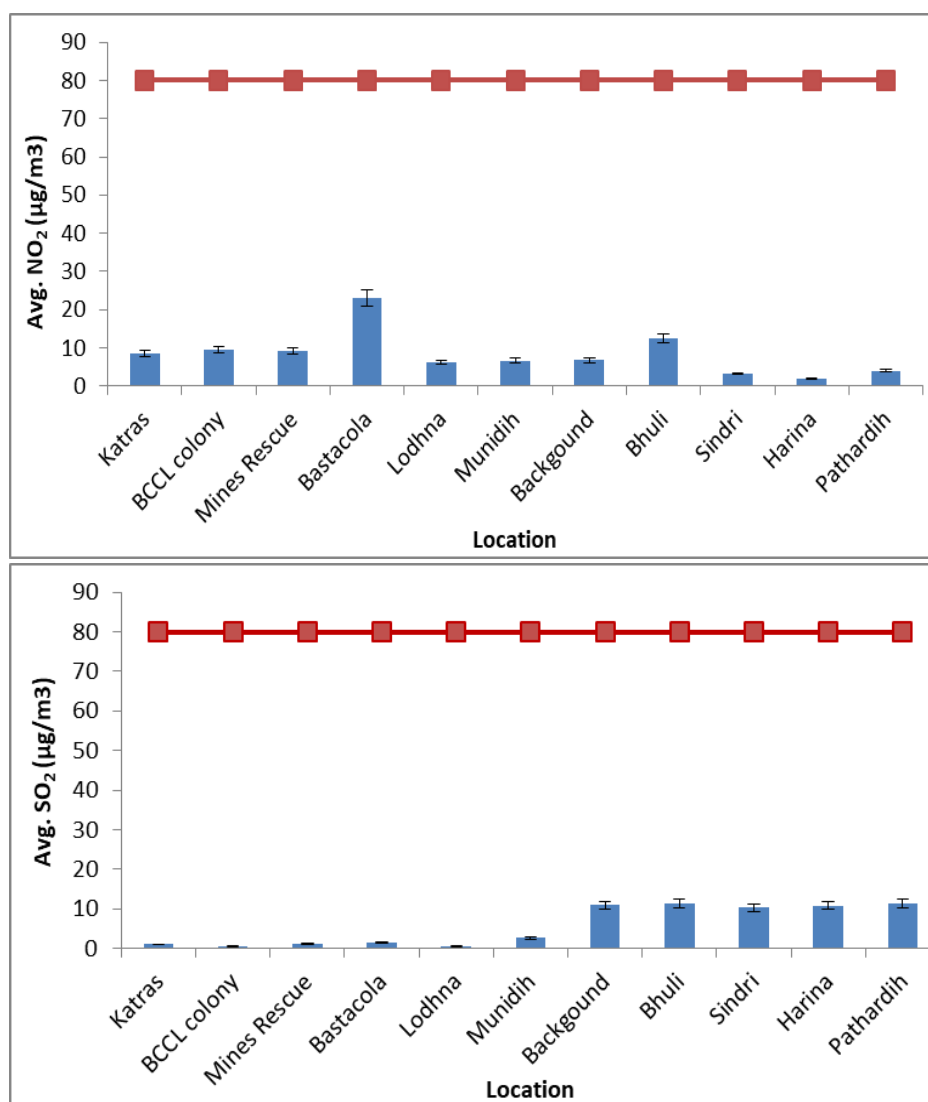


Figure 3.9: NO<sub>2</sub> and SO<sub>2</sub> Concentration of all monitoring sites in Winter season

### 3.3.6. Carbonaceous Aerosol/EC & OC in Summer

Data were obtained for four OC fractions (OC1, OC2, OC3 and OC4 in He atmosphere at 140, 280, 480 and 580°C, respectively) and three EC fractions (EC1, EC2, and EC3 in a 2% O<sub>2</sub>/98% He atmosphere at 580, 740 and 840°C, respectively). The IMPROV protocol defines OC as OC1 + OC2 + OC3 + OC4 and EC as EC1 + EC2 + EC3. The mass concentration of organic matter (OM) in the atmosphere was estimated by multiplying OC by 1.6 (conversion factor for urban aerosol). The total carbonaceous aerosol (TCA) was calculated as the sum of OM and EC. The highest concentration of OC and EC in PM<sub>2.5</sub> was found in the BCCL colony site i.e. 37.85 and 42.33µg/m<sup>3</sup>, respectively, and the lowest OC concentration was 15.36µg/m<sup>3</sup> and EC was 13.08µg/m<sup>3</sup> in Sindri site. In comparison, the concentration of OC (67.35µg/m<sup>3</sup>) and EC (81.67µg/m<sup>3</sup>) in PM<sub>10</sub> were higher in the BCCL colony among all the sites. The lowest OC concentration as 17.95µg/m<sup>3</sup> was in Bastacola and EC in Parbatpur i.e. 15.44µg/m<sup>3</sup> (Figure 3.10).

### 3.3.7. Carbonaceous Aerosol/EC & OC in winter

The mass concentration of EC and OC in PM<sub>10</sub> and PM<sub>2.5</sub> are more significant than 100µg/m<sup>3</sup> and 70µg/m<sup>3</sup>, respectively in Bastacola, Katras, Mine Rescue, Background, and Sindri. The highest concentration of EC in PM<sub>10</sub> and PM<sub>2.5</sub> was observed in the Sindri site, whereas OC was found higher in Sindri and Bastacola. OC contributing to PM<sub>10</sub> mass concentration was lowest in

Harina followed by Lohapatti and Patherdih. In the case of PM<sub>2.5</sub>, Parbatpur was found to have the lowest concentration among other sites.

The higher mean concentration of EC and OC in winter were likely related to the influence of emissions from residential heating (in addition to traffic source) and, on the other hand, to the unfavourable meteorological conditions leading to more excellent dispersion of pollutants in the atmosphere during this season. Elemental carbon is emitted directly into the atmosphere during incomplete combustion emissions, such as motor vehicle exhaust, fuel burning, and biomass burning (Figure 3.11).

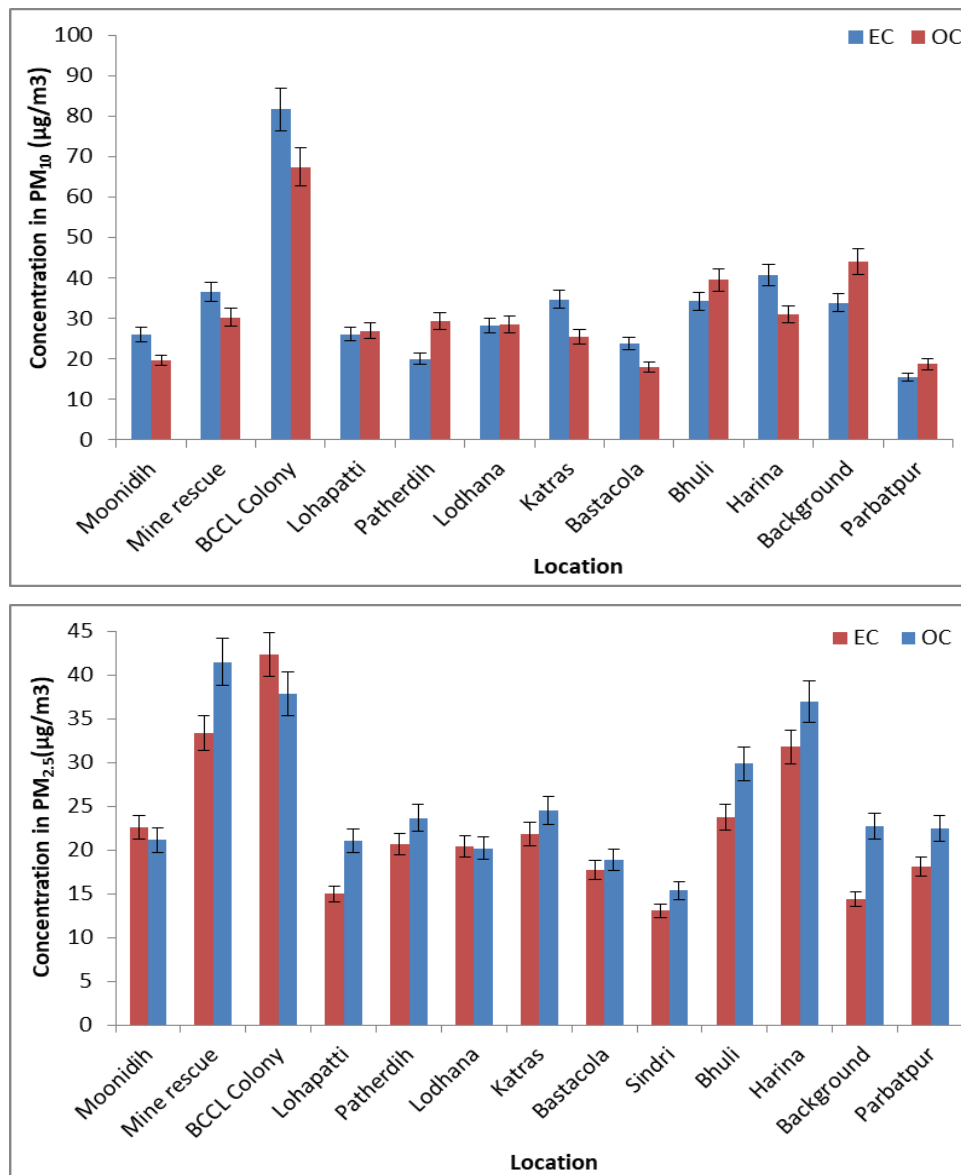


Figure 3.10: EC & OC concentration in PM<sub>10</sub> and PM<sub>2.5</sub> in Summer season

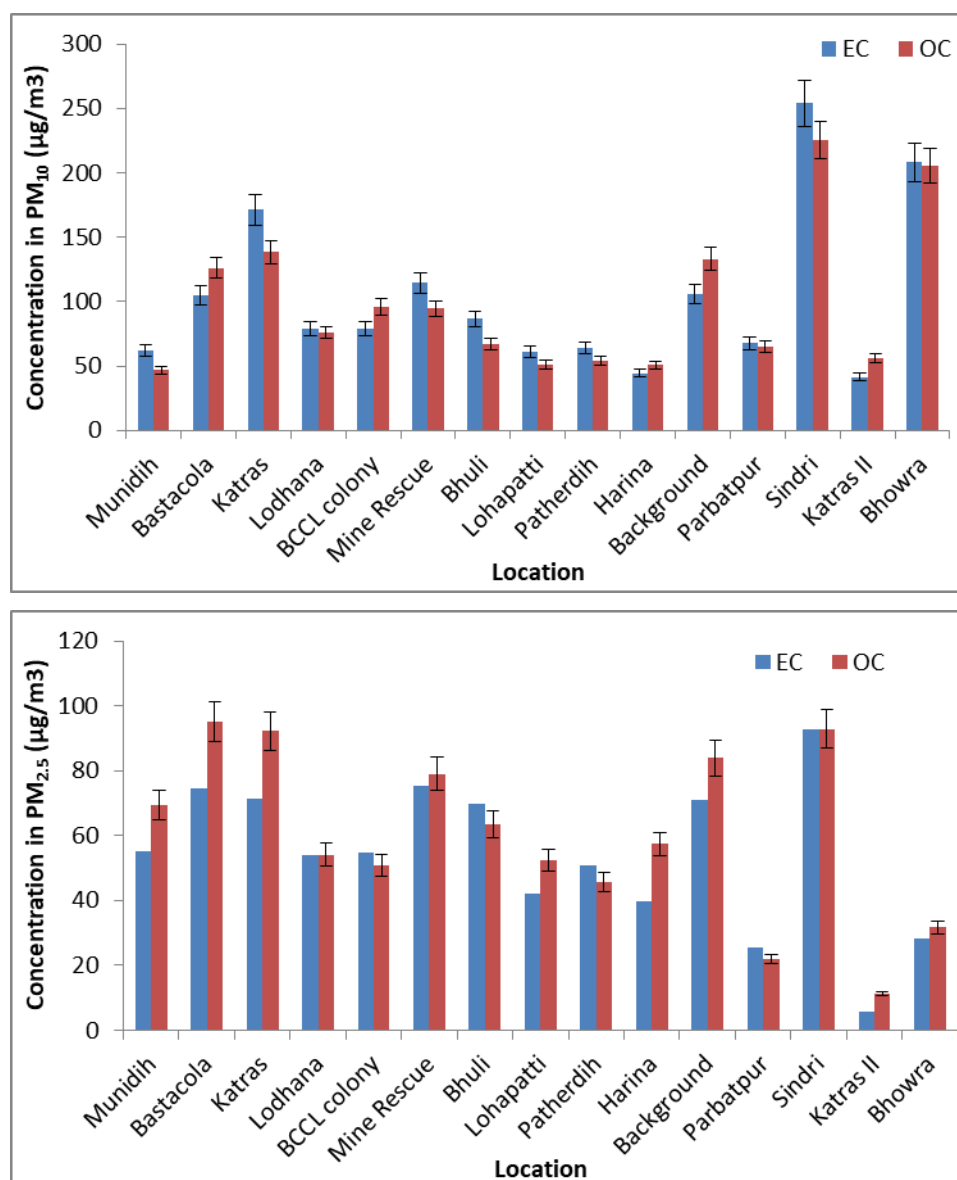


Figure 3.11: EC & OC concentration in PM<sub>10</sub> and PM<sub>2.5</sub> in Winter Season

### 3.3.8. Ionic composition of PM<sub>10</sub> and PM<sub>2.5</sub> in Summer season

The anions ( $\text{SO}_4^{2-}$ ,  $\text{NO}_3^-$  and  $\text{Cl}^-$ ) and cations ( $\text{NH}_4^+$ ,  $\text{Na}^+$ ,  $\text{Ca}^{2+}$ ,  $\text{K}^+$ ) are the water-soluble inorganic ions found in abundance. In summer, the mass concentration of  $\text{SO}_4^{2-}$  in PM<sub>10</sub> was in the range of 1.06-20.17 $\mu\text{g}/\text{m}^3$  where a higher concentration was observed in Harina, BCCL colony, and Lodhana sites. Likewise,  $\text{NO}_3^-$  was in the range of 0.32-19.2 $\mu\text{g}/\text{m}^3$  with the highest in the Harina site.  $\text{PO}_4^{3-}$  and  $\text{Cl}^-$  concentration was highest in Harina and  $< 2\mu\text{g}/\text{m}^3$  in other locations.  $\text{NH}_4^+$  was in the range of 0.75-16.24 $\mu\text{g}/\text{m}^3$ , Harina with the highest concentration, and Bastacola with the lowest concentration.  $\text{Na}^+$  concentration (0.18-8.6 $\mu\text{g}/\text{m}^3$ ) was highest in Harina followed by BCCL colony and less than 2 $\mu\text{g}/\text{m}^3$  in remaining sites.  $\text{Ca}^{2+}$  concentration (1.5-11.77 $\mu\text{g}/\text{m}^3$ ) was highest in Lohapatti and BCCL colony while lowest in Katras.  $\text{K}^+$  ion was also observed in the Harina site with a concentration of 5.85 $\mu\text{g}/\text{m}^3$  (Figure 3.12).

The mass concentration of  $\text{SO}_4^{2-}$  in PM<sub>2.5</sub> was highest in Patherdih with a concentration of 15.13 $\mu\text{g}/\text{m}^3$  and lowest in Bhuli. In Bastacola site, the concentration of  $\text{NO}_3^-$  (2.85 $\mu\text{g}/\text{m}^3$ ),  $\text{Cl}^-$  (2.04 $\mu\text{g}/\text{m}^3$ ),  $\text{K}^+$  (1.84 $\mu\text{g}/\text{m}^3$ ) were the highest among the other sites.  $\text{Ca}^{2+}$  (6.17 $\mu\text{g}/\text{m}^3$ ) and  $\text{Mg}^{2+}$  (0.57 $\mu\text{g}/\text{m}^3$ ) concentration was highest in Lohapatti site (Figure 3.13).

### 3.3.9. Ionic composition of PM<sub>10</sub> and PM<sub>2.5</sub> in Winter season

PM<sub>10</sub> ions concentration in Bastacola and Background were highest among all the monitoring

sites which followed the increasing order of  $\text{Na}^+ < \text{Mg}^{2+} < \text{F}^- < \text{K}^+ < \text{Ca}^{2+} < \text{Cl}^- < \text{NH}_4^+ < \text{SO}_4^{2-} < \text{NO}_3^-$ . It has been observed that  $\text{SO}_4^{2-}$ ,  $\text{NO}_3^-$  and  $\text{NH}_4^+$  ions were present in abundant in  $\text{PM}_{10}$  mass concentration, and concentration of  $\text{NO}_3^-$  in these sites contributes majorly to  $\text{PM}_{10}$ . Ions concentration in Katras, Lohapatti, and Bhuli sites were observed having lower ionic concentration Figure 3.14.

The ionic composition of  $\text{PM}_{2.5}$  comprises mainly of  $\text{SO}_4^{2-}$ ,  $\text{NO}_3^-$ ,  $\text{Cl}^-$ ,  $\text{NH}_4^+$ ,  $\text{Ca}^{2+}$  and  $\text{K}^+$  ions. Locations such as Bastacola and Parbatpur have higher concentration of ions compared to remaining sites in following order:  $\text{Mg}^{2+} < \text{Na}^+ < \text{Ca}^{2+} < \text{K}^+ < \text{Cl}^- < \text{NH}_4^+ < \text{SO}_4^{2-} < \text{NO}_3^-$ . The same trend has been observed i.e.  $\text{SO}_4^{2-}$ ,  $\text{NO}_3^-$  and  $\text{NH}_4^+$  ions contribute mainly in  $\text{PM}_{2.5}$  mass concentration. The average concentration of  $\text{SO}_4^{2-}$  and  $\text{NO}_3^-$  in winter was higher than in summer.

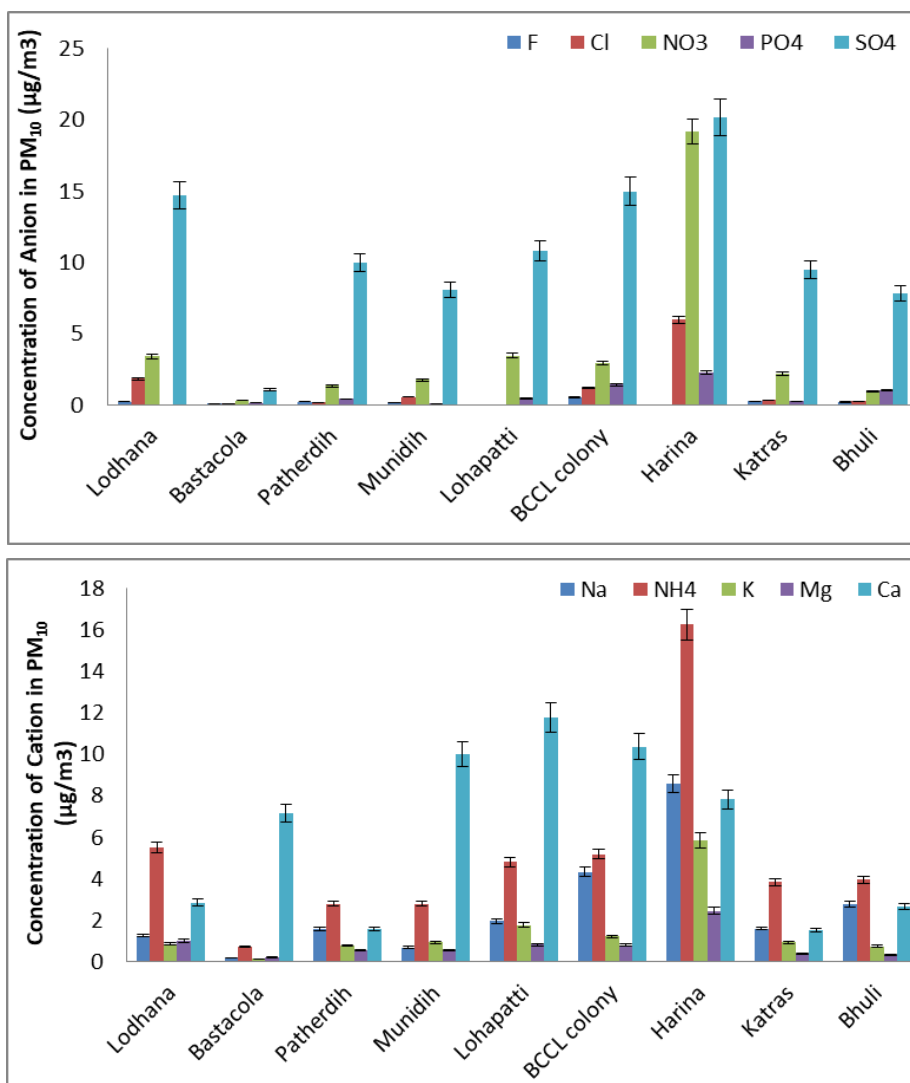


Figure 3.12: Anion and Cation concentration in  $\text{PM}_{10}$  in summer

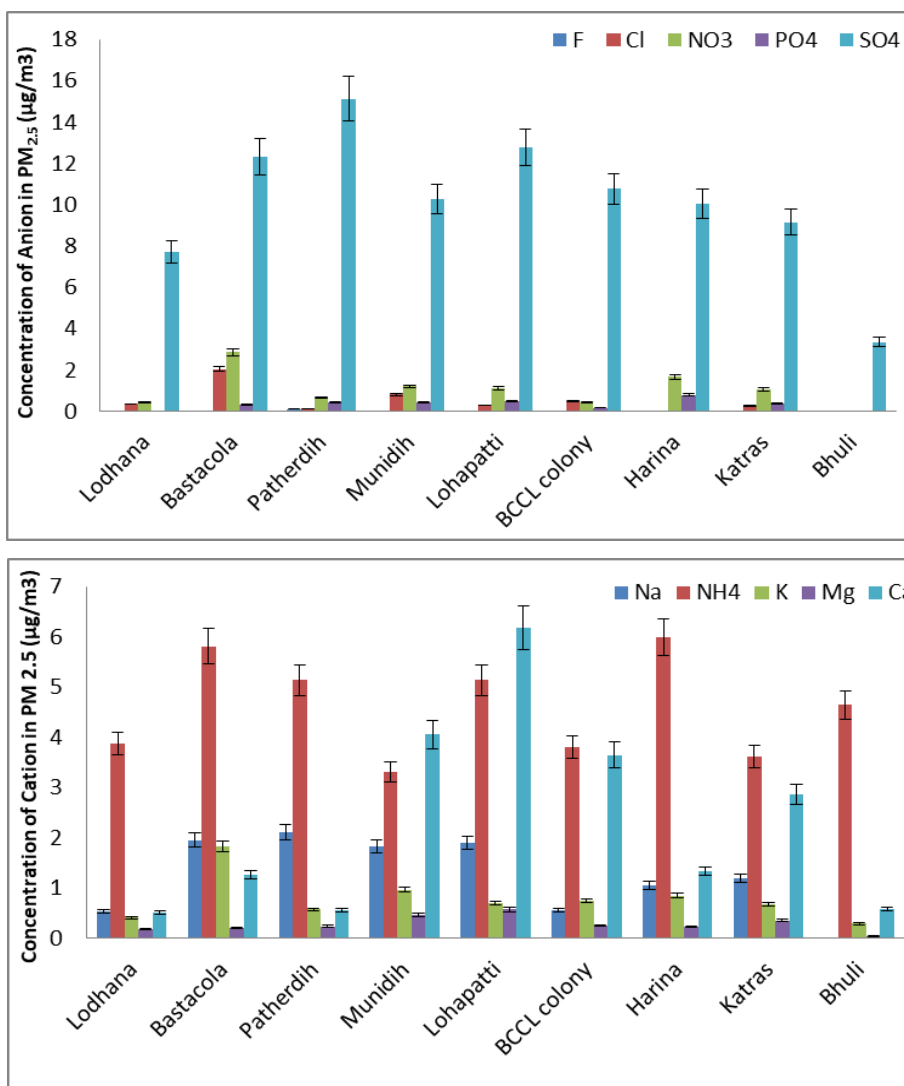


Figure 3.13: Anion and Cation concentration in PM<sub>2.5</sub> in summer

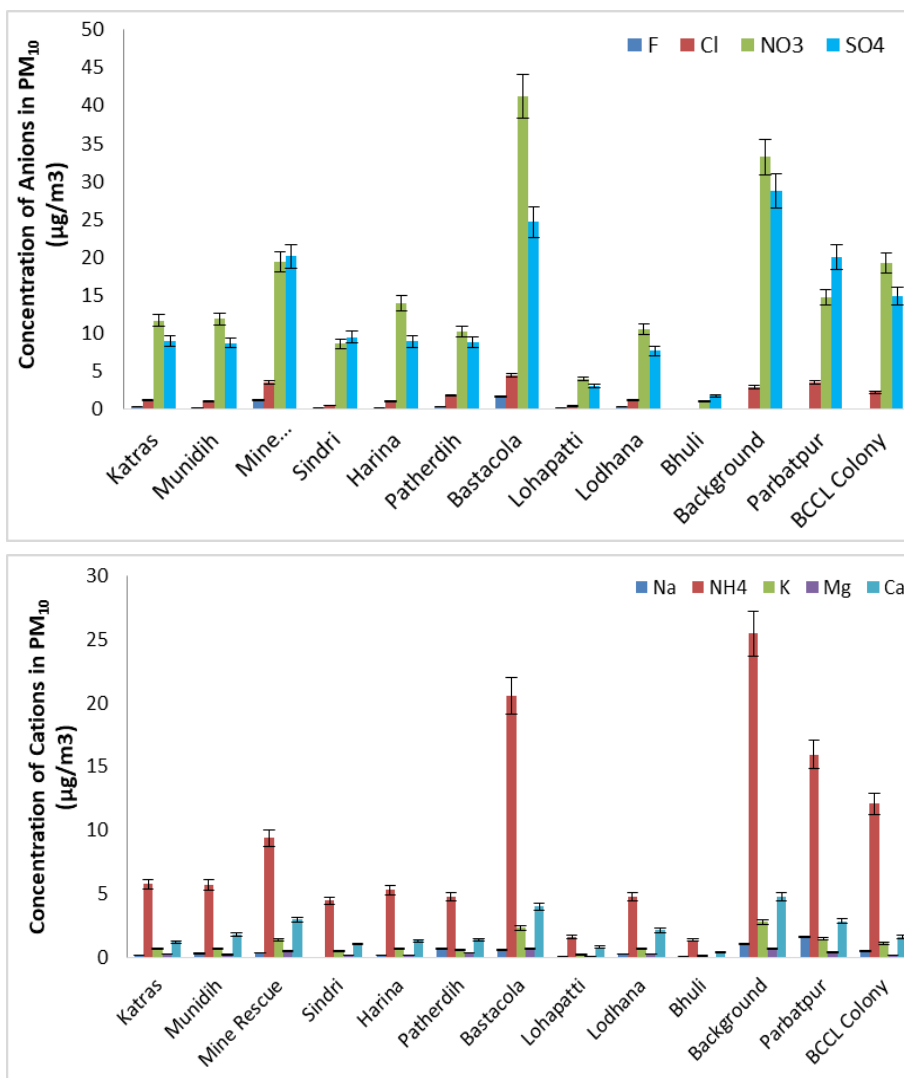


Figure 3.14: Anion and Cation concentration in PM<sub>10</sub> in winter

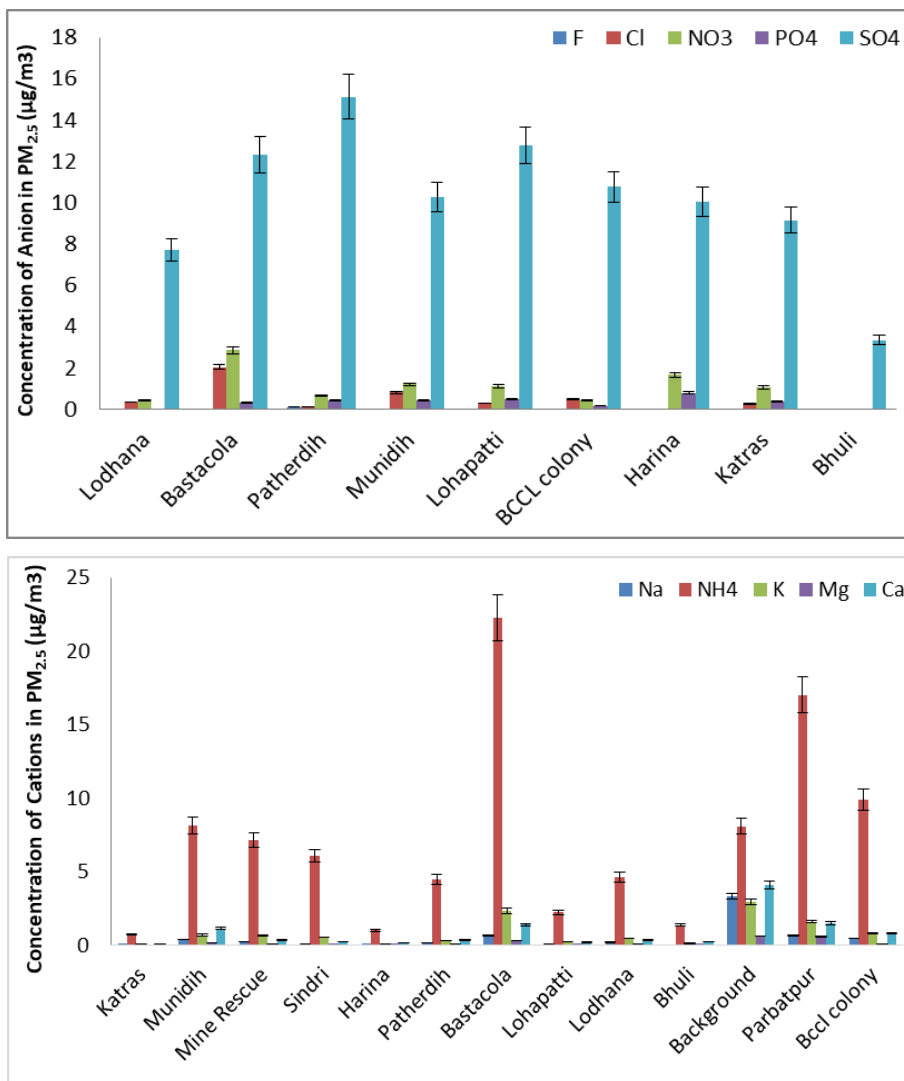


Figure 3.15: Anion and Cation concentration in  $\text{PM}_{2.5}$  in winter

## Chapter 4 Receptor modelling

### 4.1. Source Apportionment

The source apportionment study was carried out to identify the potential sources contributing to the particulate matter of aerodynamic size less than 10  $\mu\text{m}$  in the Jharia coalfield (JCF) using a receptor modelling approach. In receptor modelling, the particulate matter ( $\text{PM}_{10}$ ) characterization in terms of metal, ions, elementary and organic carbon profiles is statistically matched with that of various source profiles in the study area. For the source apportionment study of JCF, the area is divided into various zones (buffer, core and background zone). And the ambient  $\text{PM}_{10}$  characterization obtained from the multiple monitoring locations in the study area is conflated and compared with source profiles viz. industrial (mining and non-mining) and allied industrial activities, transportation, local vehicular movement and domestic fuel (coal wood burning, etc.). The chemical mass balance (CMB) model EPA-CMB v8.2 is one of the several receptor models and is most trusted for coarse and fine particulate matter source apportionment. The CMB model estimates source contributions by determining the best linear combination of emission source profiles and the chemical composition of ambient particulate, aerosol, and volatile organic compound samples. The study is studying the apportionment of particulate matter is considered owing to the nature of high particulate matter pollution in the study area. The source apportionment study is useful for devising an effective action plan for abatement of emission load in the region; thereby the region's overall air quality can be improved.

Jharia is one of the eight blocks in Dhanbad and is the main source of metallurgical coal in India, and is termed as the powerhouse of the country owing to its best quality coking coal, which is required by the steel and other industries in India. Dhanbad lies between 23°37'3" N and 24°4' N latitude and between 86°6'30" E and 86°50' E longitude with an average elevation of 222 m. Its geographical length, extending from North to South, is 43 miles and width 47 miles, stretching across East to West. It shares its boundaries with West-Bengal in the Eastern and Southern parts, Dumka and Giridih in the North, Bokaro in the west. It is the administrative headquarter of the district and Dhanbad Municipal Corporation (DMC).

The air quality status is determined by dividing the study area into background, core, and buffer zones. Thirteen sites were selected to represent various regions, including two references or background sites. The sampling locations are shown in Figure 3.1.

#### 4.1.1. Chemical Mass Balance (CMB)

A mass balance equation can be written to account for all the chemical species in the samples as contributions from independent sources:

$$C_i = \sum_j m_j X_{ij} a_{ij} \quad 4.1$$

$C_i$  is the concentration of species  $i$  measured at a receptor site (derived from the chemical analysis),  $X_{ij}$  is the  $i^{\text{th}}$  elemental concentration measured in the  $j^{\text{th}}$  sample, and  $m_j$  is the airborne mass concentration of material from the  $j^{\text{th}}$  source contributing to the  $j^{\text{th}}$  sample. The term  $a_{ij}$  is

included as an adjustment for any gain or loss of species  $i$  between the source and receptor. The term is assumed to be unity for most of the chemical species.

The CMB 8.2 software (USEPA 1997) is used in this study. It is windows-based software that requires input data on ambient (at receptor locations) and source profiles of PM characterization. The model runs multiple iterations to provide optimum goodness of fit among the sources and receptors and verifies the model with various checks viz. Chi-square statistic, t-tests, mass percentage, and correlation coefficient. The following assumptions should be understood before proceeding with the CMB analysis.

The CMB model assumptions are:

- The concentration of emissions sources is constant throughout ambient and source sampling;
- Chemical species do not react with each other (i.e., they add linearly);
- All sources with potential for contributing to the receptor have been identified and have had their emissions characterized;
- The number of sources or source categories is less than or equal to the number of species;
- The source profiles are linearly independent of each other; and
- Measurement uncertainties are random, uncorrelated, and normally distributed.

The following steps are followed for running the CMB model:

- Identification of the contributing emission source types based on primary survey and emission inventory data collected around the monitoring sites.
- The selection of chemical species to be included in the CMB modelling calculation is based on the Central pollution control board (CPCB) guidelines.
- The source profiles with the fraction of each chemical species and uncertainty are withdrawn from the SPECIATE 5.1 database. SPECIATE 5.1 is US-EPA's repository of organic gas and particulate matter (PM) speciation profile of air pollution sources.
- Estimate ambient concentration (ambient data) is based on chemical analysis of the PM samples collected at the respective site during monitoring. The uncertainty of the chemical species is mainly based on the instrument uncertainty.
- The CMB 8.2 model run provides the solution of the chemical mass balance equation.

For source apportionment of  $PM_{10}$ , CMB 8.2 software (USEPA 1997) provides many goodness's of fit tests to verify the accuracy of the model. The normal checks, as specified in the manual by USEPA (1997) to accept the model are; t-statistics i.e., source contribution divided by the error of source contribution should be greater than 2,  $\chi^2$  (chi-square) is the weighted sum of squares of the differences between calculated and measured fitting species concentrations divided by the effective variance and the degrees of freedom, it should be less than 4. The weighting is inversely proportional to the squares of the precision in the source profiles and ambient data for each species. Ideally,  $\chi^2$  would be zero, there would be no difference between calculated and measured species concentrations. The  $\chi^2$  less than one indicate a very good fit for the data. Values greater than 4 indicate that one or more of the fitting species concentrations are

not well-explained by the source contribution estimates (SCE). The source contribution estimate approximates the total mass concentration which is a convenient check on the %mass explained value. When the SCE is less than its standard error, the source contribution is undetectable. Two or three times the standard error may be taken as the upper limit of the SCE in this case. Assuming that the errors are normally distributed, there is about a 66% probability that the true source contribution is within one standard error and about a 95% probability that the true concentration is within two standard errors of the SCE.

$R^2$  is determined by the linear regression of the measured versus model-calculated values for the fitting species.  $R^2$  ranges from 0 to 1. The closer the value is to 1.0, the better the SCEs explain the measured concentrations. When  $R^2$  is less than 0.8, the SCEs does not explain the observations very well with the given source profiles. The percentage mass explained should be between 80% and 120%, the ratio of the computed and the measured concentration of each element (C/M ratio) should be close to 1 and R/U ratio, i.e., the ratio of residuals to uncertainty should be less than 2. As the model requires the source contribution estimates and receptor concentrations in ambient air, the significant sources in the area need to be identified first. The investigation of sources of  $PM_{10}$  to be accounted for in the CMB model is carried out using emission inventory studies.

#### **4.1.2. Source profiling**

The Chemical profile needs to be developed for the air-polluting source as input to the receptor-oriented source apportionment models like CMB8.2 (chemical mass balance). The U.S Environmental Protection Agency's (EPA) SPECIATE database and several studies carried out in other parts of the world provide an extensive collection of source profiles. The source profiles required in this study are extracted from SPECIATE5.1 the database.

The source of the particulate matter in JCF accompanies various coal handling activities such as opencast coal mining and its associated activities, thermal power stations, automobiles, generator sets fuel burning, construction activities, domestic coal, cooking gas burning, etc. and even the background contribution of natural dust (crustal origin) cannot be ruled out, particularly, in the zones having loose topsoil (Roy and Singh 2014). So, the sources profiles considered here are coal dust, coal combustion, road dust, heavy vehicle diesel, light vehicle gasoline, etc.

#### **4.1.3. Ambient profiling**

As discussed in Chapter 3, the samples collected from the sampling location undergo chemical characterization. The species obtained from the chemical analysis used in ambient profile structuring and the uncertainty is based on the instrument.

The overall methodology used in the source apportionment study is depicted by the flow diagram as follows:

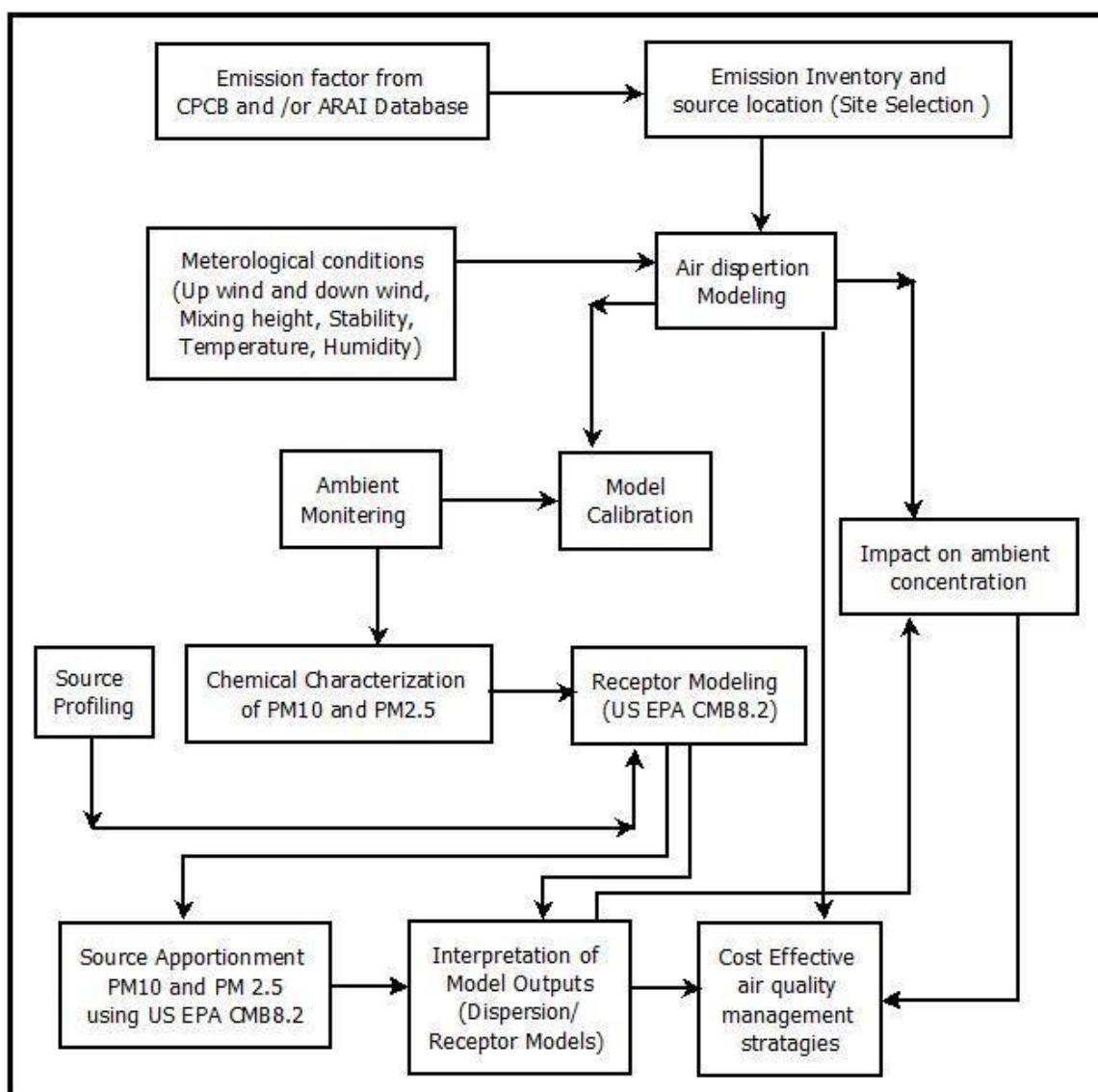


Figure 4.1: General methodology followed in the source apportionment studies

## 4.2. Results of the Chemical Mass Balance

CMB8.2 is performed for all the air quality monitoring locations. The significant sources in the area are identified first based on the field surveys. The general category of sources included in the model for all the sites are composites of all the vehicular sources, domestic combustion, road dust, agricultural waste burning, Industries, etc (Summary of relevant air quality studies from major Indian cities is given in Table 4.1). However, the choice of sources varies concerning the activities prevailing in the area and CMB model performance. A similar approach also applies to the selection of species. Efforts were made to include as many species in the model as possible. The choice was, however, restricted based on model performance. The source contributions are shown in the following Figures 4.3. The CMB model performance with respect to various sources is shown in Annexure 1.

### 4.2.1. Domestic combustion

In the summer season, the foremost emission source was domestic combustion for  $PM_{10}$  and  $PM_{2.5}$ . The domestic combustion percentage was observed at 22% and 25% for  $PM_{10}$  and  $PM_{2.5}$  in the summer season. In the winter season, domestic combustion contribution was the second most percentage contributor for  $PM_{10}$  and  $PM_{2.5}$ . The  $PM_{10}$  percentage was 23% while the  $PM_{2.5}$

percentage contribution was 28% in this season. The higher concentration of  $\text{Cl}^-$ ,  $\text{F}^-$ ,  $\text{Cr}$ , and  $\text{Br}$ .  $\text{Cl}^-$  and  $\text{F}^-$  are the markers of coal-burning and wood-burning (Jain et al., 2020). High  $\text{Br}$  along with  $\text{Cl}^-$  suggests the contributions from coal combustion.

#### 4.2.2. Industrial Emission

The industrial combustion percentage contribution observed 16% in  $\text{PM}_{10}$  and 13% in  $\text{PM}_{2.5}$  in the summer season. In the winter season, contribution to industries is determined to be 15% in  $\text{PM}_{10}$  and 24% in  $\text{PM}_{2.5}$ . The abundances of elements like  $\text{As}$ ,  $\text{Zn}$ ,  $\text{Fe}$ ,  $\text{Cu}$ ,  $\text{Cr}$ ,  $\text{Pb}$ , and  $\text{S}$  indicate the industrial source's emissions. Kumar et al. (2001) used  $\text{Cu}$ ,  $\text{Mn}$ , and  $\text{Ni}$  as tracers for industrial emissions in Mumbai; Sharma et al. (2014b) used  $\text{Cu}$ ,  $\text{Cr}$ ,  $\text{Mn}$ ,  $\text{Ni}$ ,  $\text{Co}$ , and  $\text{Zn}$  as industrial emission tracers for metal manufacturing plants in Delhi; Kulshrestha et al. (2009) used a combination of  $\text{Ni}$ ,  $\text{Cu}$ ,  $\text{Fe}$ , and  $\text{Cr}$  as a marker for construction activities in Agra; and Karet al. (2010) used  $\text{Zn}$ ,  $\text{Cu}$ , and  $\text{Ni}$  as tracers of galvanizing, metallurgy, and electroplating industries while  $\text{Cr}$  from tannery industry in Kolkata.

#### 4.2.3. Coal Mining

Opencast coal mining activity comprises heavy-duty diesel vehicle usage, blasting, Coal handling and overburden management. During the summer season, the coal mining activity in  $\text{PM}_{10}$  and  $\text{PM}_{2.5}$  is observed to be 8% and 7% respectively while in the winter season it contributes somewhat 6% and 5% in  $\text{PM}_{10}$  and  $\text{PM}_{2.5}$  respectively.

#### 4.2.4. Transportation

The overall transportation contribution is 25% for  $\text{PM}_{10}$  and 32% for  $\text{PM}_{2.5}$  in the summer season. In the winter season, the transportation emission contribution is examined at 16% for  $\text{PM}_{10}$  and 18% for  $\text{PM}_{2.5}$ . The OC/EC ratio is a convenient diagnostic tool for investigating the sampling site and its emission sources. In the present study, the OC/EC ratio shows significant seasonal variations for a coarser fraction of PM than for a finer fraction. It is well established that OC/EC ratio values between 1.4 and 4 indicate emissions from gasoline catalyst vehicles and 0.3 to 1 suggest diesel vehicle emissions (Amato et al., 2016; Cesari et al., 2018). Assessing the ratio of  $\text{nss-K}^+/\text{EC}$  is another diagnostic check for estimating the relative loading of vehicular emissions, where  $\text{nss-K}^+$  is a non-sea-salt water-soluble potassium ion (calculated as  $\text{K}^+ - 0.129\text{Na}^+$ ) (Andreae and Merlet, 2001).

#### 4.2.5. Secondary Inorganic Aerosol

During summer, the secondary inorganic aerosol contribution to  $\text{PM}_{10}$  and  $\text{PM}_{2.5}$  is about 8% and 16%, respectively. Secondary inorganic aerosols contribution found in winter is about 14% and 17%, respectively for  $\text{PM}_{10}$  and  $\text{PM}_{2.5}$ . The secondary inorganic aerosol source is a high concentration of nitrate ( $\text{NO}_3^-$ ), sulphate ( $\text{SO}_4^{2-}$ ), and ammonium ( $(\text{NH}_4^+)$ ). These secondary products are formed in the atmosphere, being emitted either by natural or anthropogenic sources. The oxidation of  $\text{NO}_x$  forms the secondary nitrate. It is favoured by low temperature (Li et al. 2004), while high temperature and strong solar radiations favour the formation of secondary sulfates through photochemical reactions (Seinfeld and Pandis, 2016). Secondary inorganic aerosol formation from precursors ( $\text{SO}_2$  and  $\text{NO}_2$ ) enhances the pollution burden over the

vicinity. Biomass burning, the presence of metal traces (Fe, Al, Mn, Zn, Cr etc.) from vehicular or industrial emission play a key role to neutralise the oxides of nitrogen and sulphur and thus raises the amount of secondary inorganic aerosols in the atmosphere.

#### **4.2.6. Agriculture**

The agriculture contribution observed that 5% for PM<sub>10</sub> and 2% for PM<sub>2.5</sub> in the study period during the summer season. In the winter season, the contribution is 3% and 2% for PM<sub>10</sub> and PM<sub>2.5</sub> respectively. Agricultural activities contribute ammonium to the atmosphere (Pant and Harrison, 2012; Jain et al., 2019). The OC and EC are also significant agricultural activity sources (Ram and Sarin 2011; Sharma et al.2016a).

#### **4.2.7. Open burning**

The contribution of open burning in the summer season is 5% for both PM<sub>10</sub> and PM<sub>2.5</sub>. In winter, the garbage burning contribution is 6% and 2% for PM<sub>10</sub> and PM<sub>2.5</sub> respectively during study time. The abundance of tracers like K<sup>+</sup>, Pb, Br and considerable Cl<sup>-</sup> marks this garbage/biomass burning source. K<sup>+</sup> and levoglucosan are globally employed as biomass burning markers. Biomass consists of residential and agricultural wastes, post-harvest residue, cow dung, dry leaves, fuelwood, and wildfires (Almeida et al., 2006; Khare and Baruah, 2010; Shridhar et al., 2010). The OC and EC are also traced insignificant amounts along with K<sup>+</sup>, indicating the biomass burning emanations (Cesari et al., 2018; Sharma et al., 2014; Jain et al., 2018).

#### **4.2.8. Road Resuspension dust**

The re-suspension dust is a significant contributor to PM<sub>10</sub>. The contribution of resuspension dust is during the summer season 12% while in the winter season the emission contribution is 10% for PM<sub>10</sub>. In the summer season, resuspension dust's contribution is higher because of the high wind velocity and dry condition. The lower percentage contribution of road dust to fine particulate matter is attributed to substantial road dust particulates in coarse mode, found in other studies (Gupta et al., 2007; Masri et al., 2015). Crustal elements are significant constituents of airborne soil and re-suspension road dust. Generally, they contribute to coarse aerosols, including Al, Si, Ca, Ti, Mg, Fe, and Na used as tracers for soil dust or crustal re-suspension (Lough et al.2005; Begum et al. 2011). The marker elements that have been used in India for the identification of soil dust include Al, Si, Ca, Ti, Fe, Pb, Cu, Cr, Ni, Co, and Mn (Sharma et al., 2017). Cu, Zn, and Ba are associated with road dust/re-suspension dust due to the release of these marker elements from cars and non-exhaust sources.

#### **4.2.9. Other emission Contribution**

Other area sources contributed in the summer season is 12% for PM<sub>10</sub> and 7% for PM<sub>2.5</sub> during the study period. In the winter season, emission contribution is 14% for PM<sub>10</sub> and 9% for PM<sub>2.5</sub>.

### 4.3 Inferences

The receptor modelling (CMB) results (Figure 4.3) revealed that the transport sector and domestic combustion are the predominant emission sources contributing to the receptor levels. During the summer season, the contribution of the transport sector was found maximum in both PM<sub>10</sub> (23%) and PM<sub>2.5</sub> (30%) followed by the contribution of domestic combustion (17% and 23% for PM<sub>10</sub> & PM<sub>2.5</sub> respectively). While in the winter season, the contribution of domestic combustion outruns the contribution of the transport sector. During the winter season, domestic combustion has contributed 22% (PM<sub>10</sub>) and 28% (PM<sub>2.5</sub>) whereas the transport sector has contributed 16% (PM<sub>10</sub>) and 21% (PM<sub>2.5</sub>) of the total emission.

After transport sector and domestic combustion, Industrial emission (12% of PM<sub>10</sub> emission) and Road Resuspension (12% of PM<sub>10</sub> emission) followed by Coal mining activity and secondary inorganic aerosol formation (both 8%) are contributing majorly to PM<sub>10</sub> emission at receptor during the summer season.

In PM<sub>2.5</sub> source contribution, secondary inorganic aerosol formation contributed majorly (16% & 15% in summer and winter seasons respectively) after domestic combustion and transport sector. Secondary inorganic aerosol formation from precursors (SO<sub>2</sub> and NO<sub>2</sub>) enhances the pollution burden over the vicinity. Biomass burning, the presence of metal traces (Fe, Al, Mn, Zn, Cr etc.) from vehicular or industrial emission play a key role to neutralise the oxides of nitrogen and sulphur and thus raises the amount of secondary inorganic aerosols in the atmosphere.

Industrial activity contributed 12% and 11% of total PM<sub>10</sub> load in summer and winter respectively but in the case of finer dust (PM<sub>2.5</sub>), it contributed 17% in the winter season at the receptor level. This may be due to the calm winter conditions that allow finer dust (PM<sub>2.5</sub>) to settle near to ground than that of summer conditions that allow more turbulence mixing in the atmosphere.

Road re-suspension of dust contributes significantly in PM<sub>10</sub> load at receptor both in summer (12%) and in winter (8%). As these are larger and heavier particles, they contribute to PM<sub>10</sub> fraction and are not found in PM<sub>2.5</sub> fraction at the receptor.

After the contribution of the industrial sector, coal-mining activity contributed around 8% and 6% of the total PM<sub>10</sub> receptor dust load during summer and winter respectively. In the case of PM<sub>2.5</sub> dust load at the receptor, coal-mining activity contributed 7% and 5% during summer and winter respectively.

From the results and analysis of receptor modelling, it can be summarised that mitigation and abatement of the emissions from domestic combustion and transport sector alone may reduce receptor dust load by 40% (approx.).

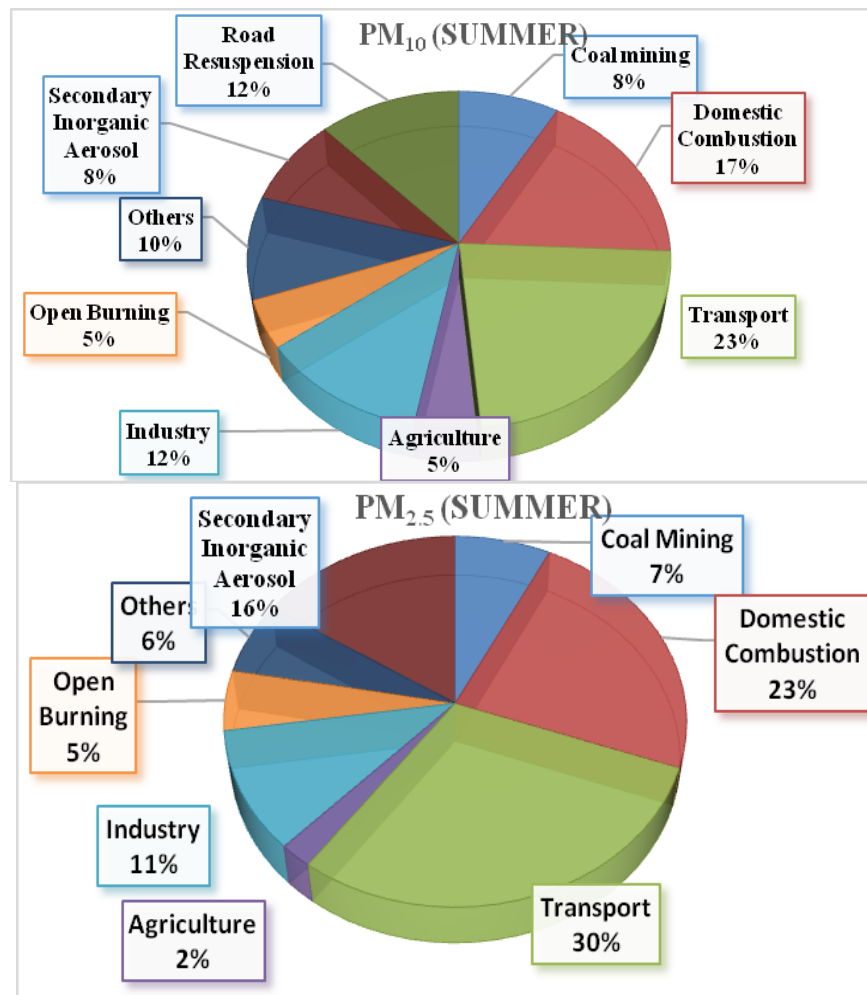


Figure 4.2: Source contribution at receptor locations of PM<sub>10</sub> and PM<sub>2.5</sub> in summer

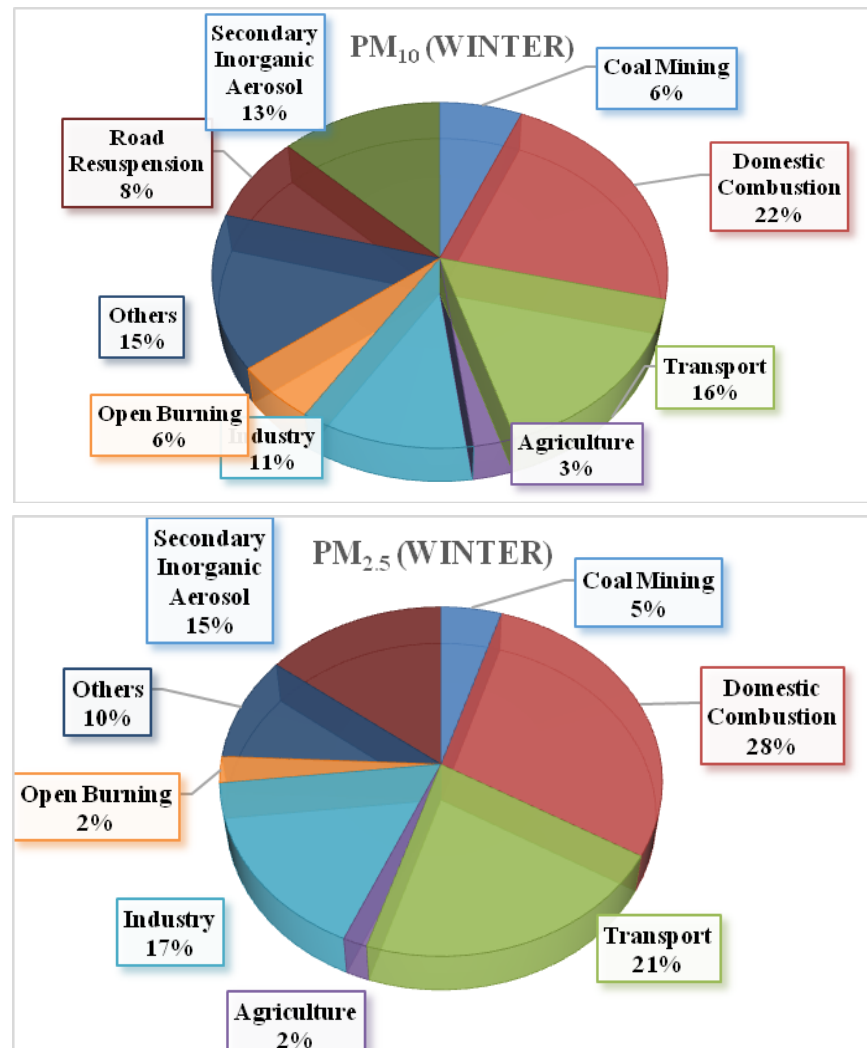


Figure 4.3: Source contribution at receptor locations of PM<sub>10</sub> and PM<sub>2.5</sub> in winter

Table 4.1: Summary of relevant air quality studies from major Indian cities.

Area/Location	Particle size	Sources	Elements and Ions	References
Delhi	PM <sub>10</sub> and PM <sub>2.5</sub>	Secondary Nitrate, Secondary Sulfate, Vehicular emission, Biomass burning, Soil dust, Fossil fuel combustion, Sodium and magnesium salt, Industrial emission	Al, Mg, Ca, Ti, Fe, Cr, Mn, Zn, As, Pb, Br, M, F <sup>-</sup> , Cl <sup>-</sup> , NO <sub>3</sub> <sup>-</sup> , SO <sub>4</sub> <sup>2-</sup> , K <sup>+</sup> , NH <sub>4</sub> <sup>+</sup> , and Na <sup>+</sup>	Jain et. Al., 2020
Mangalore	PM <sub>10</sub> and PM <sub>2.5</sub>	Construction dust, Diesel generator, Tyre wear emission, Brake lining emission, Sand dust emission, gasoline vehicle emission, Diesel vehicle emission, Unpaved and paved road emission, Biomass burning, LPG stove emission, Solid fuel emission, Ferrous and steel industries emission, Fabrication and welding emission, Kerosene stove emission	As, Ba, Cd, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sr, Zn, F <sup>-</sup> , Cl <sup>-</sup> , NO <sub>3</sub> <sup>-</sup> , PO <sub>4</sub> <sup>3-</sup> , SO <sub>4</sub> <sup>2-</sup> , Na <sup>+</sup> , K <sup>+</sup> , Mg <sup>2+</sup> and Ca <sup>2+</sup>	G. Kalaiarasan et al. 2018
Delhi NCR	PM <sub>10</sub> and PM <sub>2.5</sub>	Dust construction, Vehicle emission, Biomass Burning, Industrial emission, Secondary Pollutants, DG sets emission,	Al, Si, P, S, Cl, Br, V, Mn, Fe, Co, Ni, Cu, Zn, As, Ti, Ca, F <sup>-</sup> , Cl <sup>-</sup> , NO <sub>3</sub> <sup>-</sup> , Br <sup>-</sup> , NO <sub>2</sub> <sup>-</sup> , SO <sub>4</sub> <sup>2-</sup> , Na <sup>+</sup> , K <sup>+</sup> , Mg <sup>2+</sup> and Ca <sup>2+</sup>	Report No. ARAI/16- 17/DHI-SA- NCR/Final Report August 2018
Delhi	PM <sub>2.5</sub>	Secondary Aerosol, Vehicular emission, Biomass burning, Soil dust, Fossil fuel combustion, Sea salt, Industrial emission	Al, Mg, S, Si, Cl, K, Ca, Ti, Cu, Mn, Fe, Zn, Br, Cr, As, Pb, F <sup>-</sup> , Cl <sup>-</sup> , NO <sub>3</sub> <sup>-</sup> , SO <sub>4</sub> <sup>2-</sup> , K <sup>+</sup> , NH <sub>4</sub> <sup>+</sup> , and Na <sup>+</sup>	Jain et. Al., 2017
Nagpur	PM <sub>2.5</sub>	DG sets, biomass burning, resuspended dust, secondary aerosol and mobile sources.	Al, Ba, Cd, Cr, Cu, Fe, Mg, Mn, Ni, Pb, Si, Zn. F <sup>-</sup> , Cl <sup>-</sup> , NO <sub>3</sub> <sup>-</sup> , PO <sub>4</sub> <sup>3-</sup> , SO <sub>4</sub> <sup>2-</sup> , Na <sup>+</sup> , K <sup>+</sup> , Mg <sup>2+</sup> and Ca <sup>2+</sup>	Pipalatkhar et al., 2014
Raipur	PM <sub>2.5</sub>	Brick kiln process, steel re- rolling mills, steel processing  industries, biomass burning, metallurgical industrial emissions and coal burning	Al, As, Ca, Cd, Co, Cr, Cu, Fe, Hg, K, Mg, Mn, Mo, Na, Ni, Pb, S, Sb, Se, V, Zn, Na <sup>+</sup> , K <sup>+</sup> , Mg <sup>2+</sup> NH <sub>4</sub> <sup>+</sup> , F <sup>-</sup> , Cl <sup>-</sup> , NO <sub>3</sub> <sup>-</sup> , SO <sub>4</sub> <sup>2-</sup> , and Ca <sup>2+</sup>	Matawle et al., 2014
Hyderabad	PM <sub>10</sub> and PM <sub>2.5</sub>	Vehicles exhaust, resuspension of dust, secondary sulfates, secondary nitrates, biomass	Na, Mg, K, Al, Si, Ca, Fe, Cl, SO <sub>4</sub> <sup>2-</sup> , NO <sub>3</sub> , NH <sub>4</sub> <sup>+</sup>	Guttikunda et al., 2013

		burning, coal burning.		
Pune	PM <sub>10</sub> and PM <sub>2.5</sub>	Vehicles, DG sets, construction dust, solid fuels emissions, resuspended dust	Al, Pb, Cu, Zn, As, Se, Br, Ni, Fe, Mn, Mg, Cr, Ti, Ca, Cd, S, Si, Na, Ba, Sb, Cd, Sr, Cl <sup>-</sup> , NO <sub>3</sub> <sup>-</sup> , SO <sub>4</sub> <sup>2-</sup> , K <sup>+</sup> , NH <sub>4</sub> <sup>+</sup>	ARAI, 2010
Kanpur	PM <sub>10</sub> and PM <sub>2.5</sub>	Vehicles, open burn, road dust, domestic wood, coal and LPG, metal smelting, DG sets.	Cl <sup>-</sup> , NO <sub>3</sub> <sup>-</sup> , SO <sub>4</sub> <sup>2-</sup> , K <sup>+</sup> , NH <sub>4</sub> <sup>+</sup> , Na <sup>+</sup> , Ca <sup>2+</sup> , Mg <sup>2+</sup> , Si, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Se, Cd, Sn, Sb, Pb	CPCB, 2010b
Mumbai	PM <sub>10</sub> and PM <sub>2.5</sub>	Wood combustion, Fuel oil combustion, kerosene combustion, biomass burning, LPG, ammonium sulfate, ammonium nitrate, heavy duty diesel vehicles emissions, soil dust.	Na, Mg, Al, Si, P, S, Cl, Ca, Br, V, Mn, Fe, Co, Ni, Cu, Zn, As, Ti, Ga, Rb, Y, Zr, Pd, Ag, In, Sn, La, Se, Sr, Mo, Cr, Cd, Sb, Ba, Hg, and Pb. F <sup>-</sup> , Cl <sup>-</sup> , Br <sup>-</sup> , NO <sub>2</sub> <sup>-</sup> , NO <sub>3</sub> <sup>-</sup> , SO <sub>4</sub> <sup>2-</sup> , K <sup>+</sup> , NH <sub>4</sub> <sup>+</sup> , Na <sup>+</sup> , Ca <sup>2+</sup> , Mg <sup>2+</sup>	CPCB, 2010a
Chennai	PM <sub>10</sub> and PM <sub>2.5</sub>	Vehicles, DG sets, bakeries, soil dust, construction dust, paved road dust, kerosene and LPG emissions.	As, Ag, Ca, Na, Fe, Mg, Cu, Zn and other metals. Cl <sup>-</sup> , NO <sub>3</sub> <sup>-</sup> , SO <sub>4</sub> <sup>2-</sup> , K <sup>+</sup> , NH <sub>4</sub> <sup>+</sup> , Na <sup>+</sup> , Mg <sup>2+</sup>	IIT Madras, 2010
Bangalore	PM <sub>10</sub> and PM <sub>2.5</sub>	Petrol vehicles, diesel vehicles, secondary particulates, fuel oil burning, wood domestic wood burning, DG set, kerosene generator set, paved road dust re suspension, soil dust.	Na, Mg, Al, Si, P, S, Cl, Ca, Br, V, Mn, Fe, Co, Ni, Cu, Zn, As, Ti, Ga, Rb, Y, Zr, Pd, Ag, In, Sn, La, Se, Sr, Mo, Cr, Cd, Sb, Ba, Hg, and Pb. F <sup>-</sup> , Cl <sup>-</sup> , Br <sup>-</sup> , NO <sub>2</sub> <sup>-</sup> , NO <sub>3</sub> <sup>-</sup> , SO <sub>4</sub> <sup>2-</sup> , Na <sup>+</sup> , K <sup>+</sup> , Mg <sup>2+</sup> and Ca <sup>2+</sup>	TERI, 2010

DG - Diesel generators; LPG - Liquefied petroleum gas; OC - Organic carbon; EC - Elemental carbon.

**References:**

- Srishti Jaina, S. K. Sharma, N. Vijayan, T. K. Mandal, Seasonal characteristics of aerosols (PM<sub>2.5</sub> and PM<sub>10</sub>) and their source apportionment using PMF: A four-year study over Delhi, India. *Environmental Pollution* 262 (2020) 114337.
- G. Kalaiarasan, R. M. Balakrishnan, N. A. Sethunath, S. Manoharan. Source apportionment studies on particulate matter (PM<sub>10</sub> and PM<sub>2.5</sub>) in ambient air of urban Mangalore, India. *Journal of Environmental Management* 217 (2018) 815e824816.
- Source Apportionment of PM<sub>2.5</sub> & PM<sub>10</sub> of Delhi NCR for Identification of Major Sources. Report No. ARAI/16-17/DHI-SA-NCR/Final Report August 2018.
- Jain, Srishti; Sharma, Sudhir Kumar; Choudhary, Nikki; Masiwal, Renu; Saxena, Mohit; Sharma, Ashima; Mandal, Tuhin Kumar; Gupta, Anshu; Gupta, Naresh Chandra; Sharma, Chhemendra (2017). Chemical characteristics and source apportionment of PM<sub>2.5</sub> using PCA/APCS, UNMIX, and PMF at an urban site of Delhi, India. *Environmental Science and Pollution Research*, 24(17), 14637–14656. doi:10.1007/s11356-017-8925-5.
- Pipalatkhar, P., Khaparde, V.V., Gajghate, D.G., Bawase, M. a, 2014. Source apportionment of PM<sub>2.5</sub> using a CMB model for a centrally located Indian city. *Aerosol Air Qual. Res.* 14, 1089-1099.
- Matawle, J.L., Pervez, S., Dewangan, S., Tiwari, S., Bisht, D.S., Pervez, Y.F., 2014. PM<sub>2.5</sub> chemical source profiles of emissions resulting from industrial and domestic burning activities in India. *Aerosol Air Qual. Res.* 14, 2051-2066.
- Guttikunda, S.K., Kopakka, R.V., Dasari, P., Gertler, A.W., 2013. Receptor model-based source apportionment of particulate pollution in Hyderabad, India. *Environ. Monit. Assess.* 185, 5585-5593.
- Gummeneni, S., Yusup, Y. Bin, Chavali, M., Samadi, S.Z., 2011. Source apportionment of particulate matter in the ambient air of Hyderabad city, India. *Atmos. Res.* 101, 752-764.
- ARAI, 2010. In: C.P.C.B (Ed.), *Air Quality Monitoring and Emission Source Apportionment Study for Pune, India*. The Automotive Research Association of India, Pune, India.
- CPCB, 2010b. In: C.P.C.B (Ed.), *Air Quality Assessment, Emissions Inventory and Source Apportionment Studies for Kanpur City, India*. Indian Institute of Technology Kanpur, India.
- CPCB, 2010a. In: C.P.C.B (Ed.), *Air Quality Assessment, Emissions Inventory and Source Apportionment Studies Mumbai, India*. National Environmental Engineering Research Institute, India.
- IIT Madras, 2010. In: C.P.C.B (Ed.), *Air Quality Monitoring, Emission Inventory and Source Apportionment Study for Chennai, India*. Indian Institute of Technology Madras, India.
- TERI, 2010. In: C.P.C.B (Ed.), *Air Quality Assessment, Emission Inventory and Source Apportionment Study for Bangalore City, India*. The Energy and Resources Institute, India.
- D. Cesari, G.E. De Benedetto, P. Bonasoni, M. Busetto, A. Dinoi, E. Merico, D. Chirizzi, P. Cristofanelli, A. Donato, F.M. Grasso, A. Marinoni, Seasonal variability of PM<sub>2.5</sub> and PM<sub>10</sub> composition and sources in an urban background site in Southern Italy. *Sci. Total Environ.*, 612 (2018), pp. 202-213.
- F. Amato, A. Alastuey, A. Karanasiou, F. Lucarelli, S. Nava, G. Calzolari, M. Severi, S. Becagli, L.G. Vorne, C. Colombi, C. Alves, D. Custódio, T. Nunes, M. Cerqueira, C. Pio, K. Eleftheriadis, E. Diapouli, C. Reche, M.C. Minguillón, M.I. Manousakas, T. Maggos, S. Vratolis, R.M. Harrison, X. Querol, AIRUSE-LIFEC: a harmonized PM speciation and source apportionment in five southern European cities. *Atmos. Chem. Phys.*, 16 (2016), pp. 3289-3309.

- M.O. Andreae, P. Merlet, Emission of trace gases and aerosols from biomass burning. *Glob. Bio Geochem. Cycles*, 15 (2001), pp. 955-966.
- Li Z, Hopke PK, Husain L, Qureshi S, Dutkiewicz VA, Schwab JJ, Demerjian KL (2004) Sources of fine particle composition in New York city. *Atmos Environ* 38(38):6521–6529.
- Seinfeld J H, Pandis S N (2016) *Atmospheric chemistry and physics: from air pollution to climate change*. John Wiley & Sons.
- Kumar AV, Patil RS, Nambi KSV (2001) Source apportionment of suspended particulate matter at two traffic junctions in Mumbai, India. *Atmos Environ* 35(25):4245–4251.
- Sharma SK, Mandal TK, Saxena M, Sharma A, Datta A, Saud T (2014b) Variation of OC, EC, WSIC and trace metals of PM<sub>10</sub> in Delhi, India. *J Atmos Solar-Terres Phy* 113:10–22.
- Kulshrestha A, Satsangi PG, Masih J, Taneja A (2009) Metal concentration of PM<sub>2.5</sub> and PM<sub>10</sub> particles and seasonal variations in urban and rural environment of Agra, India. *Sci Total Environ* 407(24):6196–6204.
- Kar S, Maity JP, Samal AC, Santra SC (2010) Metallic components of traffic-induced urban aerosol, their spatial variation, and source apportionment. *Environ Monit Assess* 168(1–4):561–574.
- S.M. Almeida, C.A. Pio, M.C. Freitas, M.A. Reis and M.A. Trancoso. Source apportionment of atmospheric urban aerosol based on weekdays/weekend variability: evaluation of road re-suspended dust contribution. *Atmos. Environ.*, 40 (11) (2006), pp. 2058-2067.
- P. Khare and B.P. Baruah. Elemental characterization and source identification of PM<sub>2.5</sub> using multivariate analysis at the suburban site of north-east India. *Atmos. Res.*, 98 (1) (2010), pp. 148-162.
- V. Shridhar, P.S. Khillare, T. Agarwal and S. Ray. Metallic species in ambient particulate matter at rural and urban location of Delhi. *J. Hazard Mater.*, 175 (1) (2010), pp. 600-607.
- D. Cesari, G.E. De Benedetto, P. Bonasoni, M. Busetto, A. Dinoi, E. Merico, D. Chirizzi, P. Cristofanelli, A. Donato, F.M. Grasso and A. Marinoni. Seasonal variability of PM<sub>2.5</sub> and PM<sub>10</sub> composition and sources in an urban background site in Southern Italy. *Sci. Total Environ.*, 612 (2018), pp. 202-213.
- S. Jain, S.K. Sharma, T.K. Mandal and M. Saxena. Source apportionment of PM<sub>10</sub> in Delhi, India using PCA/APCS, UNMIX and PMF. *Particuology*, 37 (2018), pp. 107-118.
- Ram K, Sarin MM (2011) Day–night variability of EC, OC, WSOC and inorganic ions in urban environment of Indo-Gangetic Plain: implications to secondary aerosol formation. *Atmos Environ* 45(2):460–468.
- Sharma SK, Mandal TK, Srivastava MK, Chatterjee A, Jain S, Saxena M, Ghosh SK (2016a) Spatio-temporal variation in chemical characteristics of PM<sub>10</sub> over Indo-Gangetic Plain of India. *Environ Sci Poll Res* 23(18):18809–18822.

## Chapter 5 Dispersion Modelling

Air quality modeling includes four major processes (a) emission of pollutants, (b) transportation of the pollutants due to mean wind profile (c) chemical transformations and (d) deposition/removal. In the present study the particulate matter emissions, transportation and dispersion are carried out using the AERMOD model, which is developed by USEPA. AERMOD model estimates the spatial profile of pollutants based on the Gaussian plume equation, which is an analytical solution to the steady-state approximation of the advection-diffusion phenomenon. The boundary conditions about the atmospheric mixing height and other thermodynamic vertical profiles for the simulations are derived from the mesoscale model. The model relies on the atmospheric stability classes for deriving the dispersion coefficients across the multiple dimensions with respect to the distance away from the sources. In this study, only the ground level concentrations of the particulate matter are simulated during the study period. The study domain envelops the Jharia Coal Fields situated in the Jharkhand state of India. The methodology followed in the present study is shown in Figure 5.1. The southwest part of the Dhanbad City shares borders with the study area, but the majority of emission load used in the study is included from the JCF.

### 5.1. Wind data analysis

The nearest IMD (India Meteorological Department) observations are at Patna and Kolkata, which are approximate >150km from the study area. Hence, hourly meteorological observations required for the study for the AERMOD dispersion model were simulated through the Weather Research and Forecast, version-3.9 (WRF), which is a meteorological model that dynamically downscales the global NCAR/UCAR meteorological data to the regional level data ([www.mmm.ucar.edu](http://www.mmm.ucar.edu)). Nested domains of grid resolution 12km and 4km, respectively were laid over the study area for simulation of hourly meteorological variables using the WRF model (Figure 5.2). Hourly meteorological data, including both the surface variables and upper atmosphere variables, were simulated for the study period viz. 23 May to 12 June 2019 and 23 January to 12 February 2020, representing the summer and winter seasons, respectively.

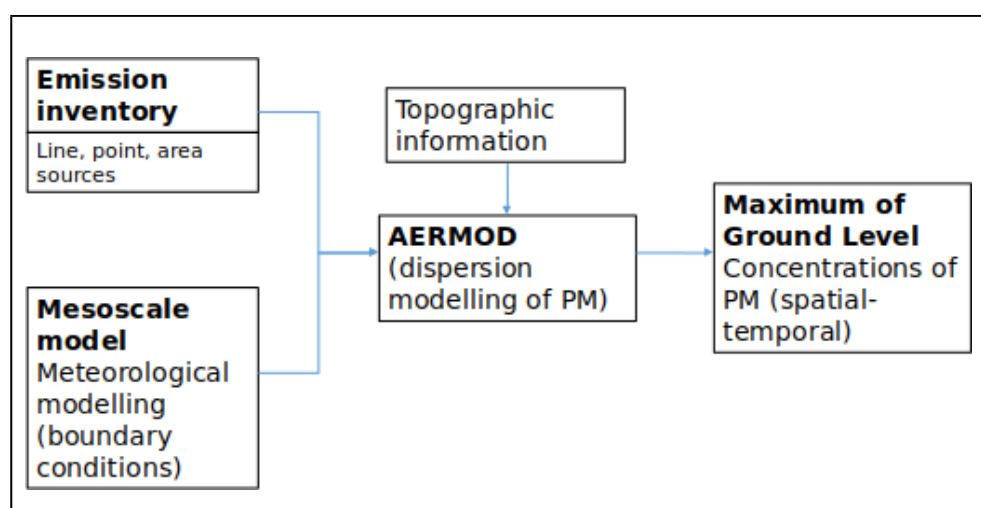


Figure 5.1: Methodology followed in the study.

The mesoscale model interface program MMIF (<https://www.epa.gov/>) converter tool was used

to convert the inner domain's gridded WRF model simulated meteorological data into a format suitable for the AERMOD model. The AERMOD receptor grid covering the study area is shown in Figure 5.3. A Cartesian receptor grid having 21 rows and 21 columns with a resolution of 2000 m was laid for the simulation of particulate matter dispersion /concentration at the receptor locations. Overall there are 20 grids in each direction covering an area of 40 km by 40 km enveloping the JCF.

The spatial pattern of the predominant wind profile over the study area is plotted using the windrose diagrams for the summer (March to May 2019) and winter season (November 2019 to February 2020), shown in Figures 5.2 and 5.3, respectively. Results show that the study area is experiencing the predominant wind (having high frequency) flow from east to west direction followed by north-west to south-east direction during summer, while in winter the predominant wind direction is from north to south. The wind speeds vary in the range of 0.5 to 11.1m/s during the summer predominantly in the range of 2.1 to 3.6m/s whereas wind speeds vary in the range of 0.5 to 8.8m/s during the winter, predominantly in the range of 2.1 to 3.6m/s.

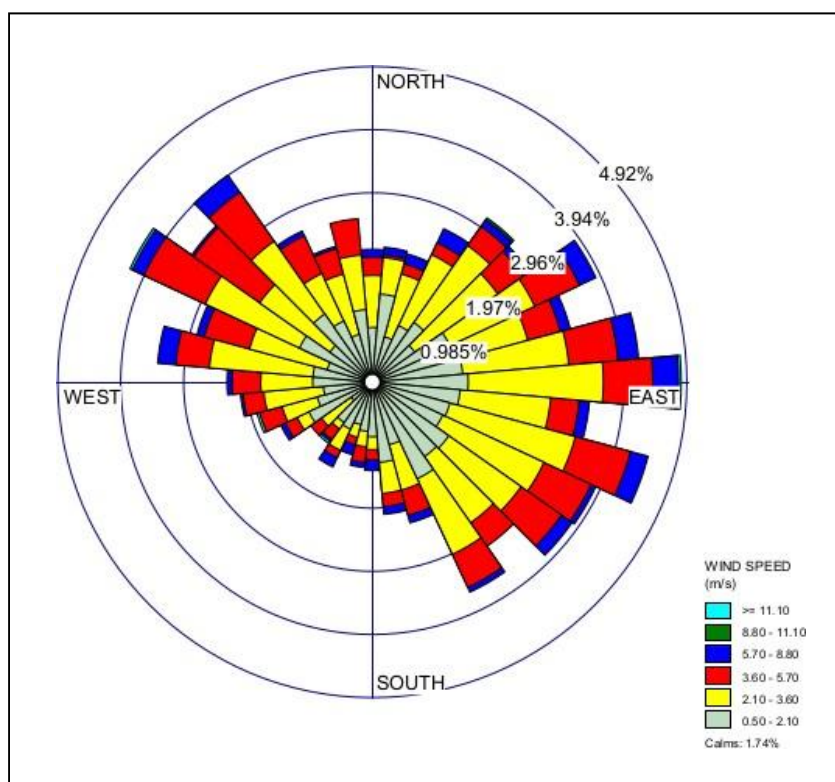


Figure 5.2: Windrose of the study area during March-June, 2019 (wind direction blowing towards the center)

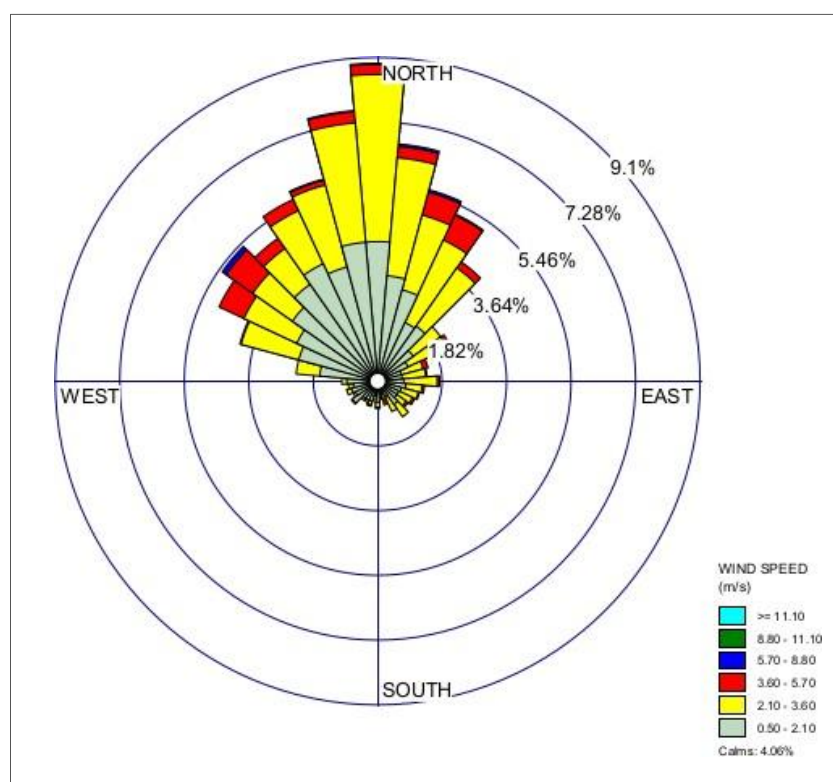


Figure 5.3: Windrose of the study area during November-December 2019 (wind direction blowing towards the centre)

## 5.2. Dispersion of Particulate matter

Spatial profiles of maximum ground-level concentrations of 24-hour average values of  $PM_{10}$  and  $PM_{2.5}$  were simulated using the AERMOD Gaussian plume model. The emission rates of particulate matter from multiple source types including the point, line, and area were derived from the field monitoring of the emission inventory. Point sources mainly include the emissions from the industries situated in the study area that mainly use coke/coal as the fuel. The line sources include the emissions from the vehicular exhaust. Emission inventory of traffic pollution was carried out in the study area by noting down the vehicular activity. The vehicular activity of different vehicular types such as trucks, light motor vehicles, three-wheeled vehicles, motorbikes, etc. was multiplied by the corresponding emission factors for the estimation of gaseous pollution. The summation of emissions from all vehicle types adds to the overall line sources contributing to the pollution load in the study area. The area sources include emissions from the open cast mining emissions (including all the activities in the mine premises) and domestic burning (including emissions from crematoria, bakeries, open eat-outs, restaurants, chulha burning from the slum, etc.).

The emissions in grams per second were calculated from the emission inventory survey, for the line and point sources. Whereas, the emission rates in  $g/s/m^2$  were calculated for the area sources including mining. These emission rates from each source type have been computed in the study area and fed into the AERMOD model domain for the simulation of spatial average concentrations of  $PM_{10}$  and  $PM_{2.5}$ . In the present study, the maximum GLC (ground level concentrations, in  $\mu g/m^3$ ) was simulated at several receptor grid locations in AERMOD domains. The AERMOD model was run during the sampling period in May 2019 and November 2019, representing the pre-monsoon and post-monsoon seasons, respectively.

Analysis of WRF model simulated wind speed and direction data shows that the wind is

predominantly flowing from south-east direction to north-west direction, followed by the reversal in the direction, during the monitoring in summer, representing pre-monsoon conditions (Figure 5.5). The wind speeds during the monitoring period in summer month varied between 0.5 and 8.8m/s. During the monitoring period in winter (post-monsoon), the wind predominantly flowed from the north-east to south-west direction having wind speeds in the range of 0.5 to 3.6m/s (Figure 5.5).

The wind blowing from different directions in the study area determines the direction of pollution dispersion. The Gaussian plume equation used in the AERMOD model estimates the diffusion and advection of the pollutants concerning the emission rates and meteorology (wind speed, direction and atmospheric stability categories). The model simulated maximum ground level concentration of the particulate matter (PM<sub>10</sub> and PM<sub>2.5</sub>) in the study area covering the JCF is shown through the isopleths. The isopleths (contours connecting the regions with the same ground level concentration in the context of the present study) of maximum GLC of PM<sub>10</sub> and PM<sub>2.5</sub> were observed to form a pattern according to the predominant wind directions flowing in different monitoring seasons. It is observed that the line sources in the study area have contributed the maximum to the surface GLC of PM<sub>10</sub>, following the open cast mines. The AERMOD model simulated the value of GLC of PM<sub>10</sub> due to line sources, open cast mines, and all sources are 927, 286, and 978 $\mu\text{g}/\text{m}^3$ , respectively, for the summer season. The PM<sub>2.5</sub> maximum GLC contributed by the line sources, open cast mines, and all sources included are 809, 143, and 835 $\mu\text{g}/\text{m}^3$ , respectively. It is evident from the result that the line sources are significantly contributing to the overall particulate pollution in the study area during summer. The analysis of the PM<sub>10</sub> and its maximum GLC simulated by the AERMOD model for the winter season also follows a similar pattern as of summer. The contribution of line sources, open cast mines, and all sources included are 1565, 597, and 1679 $\mu\text{g}/\text{m}^3$ , respectively. The PM<sub>2.5</sub> maximum GLCs during the winter are 1004, 299, 1167 $\mu\text{g}/\text{m}^3$  as contributed by line, open cast mines, and all sources including, respectively. Based on the emission inventory and the prevailing meteorological conditions during the winter season have in general contributed to the higher particulate matter than that of the summer season.

Pockets of maximum concentrations of PM<sub>10</sub> (200-1000  $\mu\text{g}/\text{m}^3$  and above) are observed in the vicinity to roads nearer to the open cast mines south of Dhanbad City during the winter (Figure 5.5). The localities of the high concentrations of PM<sub>10</sub> are Sabji Patti road and Sudamdih mine area, which is reflected in the figure. The area covering the Dhanbad city and the mines situated in the southwest have PM<sub>10</sub> concentrations in the range of 200-900 $\mu\text{g}/\text{m}^3$ . The fringes of the JCF have recorded the PM<sub>10</sub> concentrations in the range of 100-250 $\mu\text{g}/\text{m}^3$ . In contrast, the PM<sub>10</sub> concentrations for the summer season have significantly lower and the majority of the study area have PM<sub>10</sub> < 100 $\mu\text{g}/\text{m}^3$ , however, the area extending from south of Dhanbad City and Sudamdih mine have relatively high PM<sub>10</sub> concentration in the range of 100-500 $\mu\text{g}/\text{m}^3$ . Baghmara and Sonardih mine area in the west of Dhanbad City have also been observed to have high GLC of PM<sub>10</sub> in the range of 100-500 $\mu\text{g}/\text{m}^3$ .

A similar pattern of the spatial distribution of PM<sub>2.5</sub> is reflected as of PM<sub>10</sub>. As the underlying meteorological conditions are the same for both the PM<sub>10</sub> and PM<sub>2.5</sub> simulations the

spatial pattern is nearly similar. High concentrations of  $PM_{2.5}$  ( $100-500\mu g/m^3$ ) are observed in the southwest direction of Dhanbad City (Figure 5.6). The maximum GLC of  $PM_{10}$  is found to be higher than  $PM_{2.5}$  during both the monitoring seasons, and higher concentrations are observed during the winter season. The prevailing winter meteorology in the region has lower wind speeds and mixing heights, which poses an unfavorable situation for the dispersion of particulate matter, hence containing a high chance of accumulation of airborne pollutants. The significant contribution of particulate matter from the line sources is observed in the study area, followed by the area sources (from open cast mining, domestic burning, bakeries, open eat-outs, and restaurants). The locations of the highly polluted can be interpreted from the images shown in Figures 5.6 (a) and 5.6 (b) for devising realistic and grass-root level mitigation strategies.

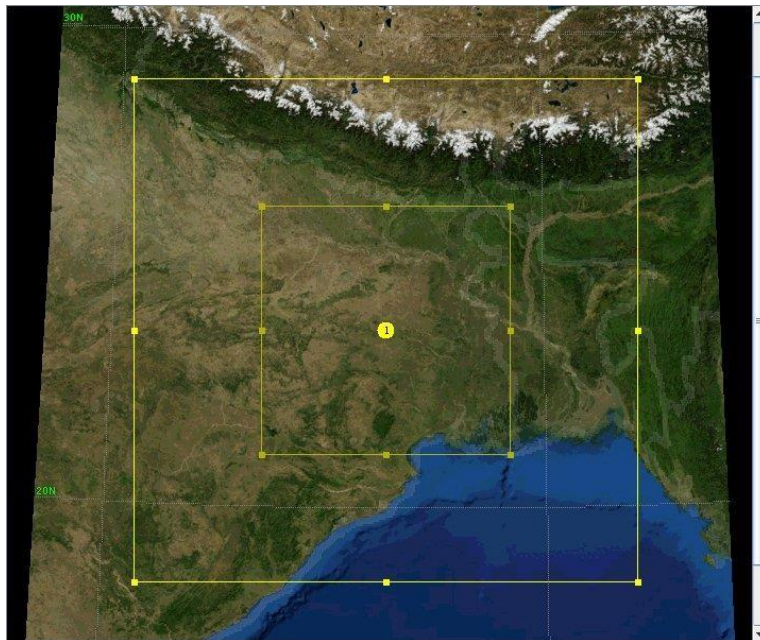


Figure 5.4: AERMOD grid covering the Jharia Coal Fields (JCF). The line, area, and point sources covered in the study are indicated in red color. The UTM coordinates of the left bottom point are  $x=406111$  and  $y=2603492$ , and the coordinates of the right top point are  $x=456248$  and  $y=2653417$ .

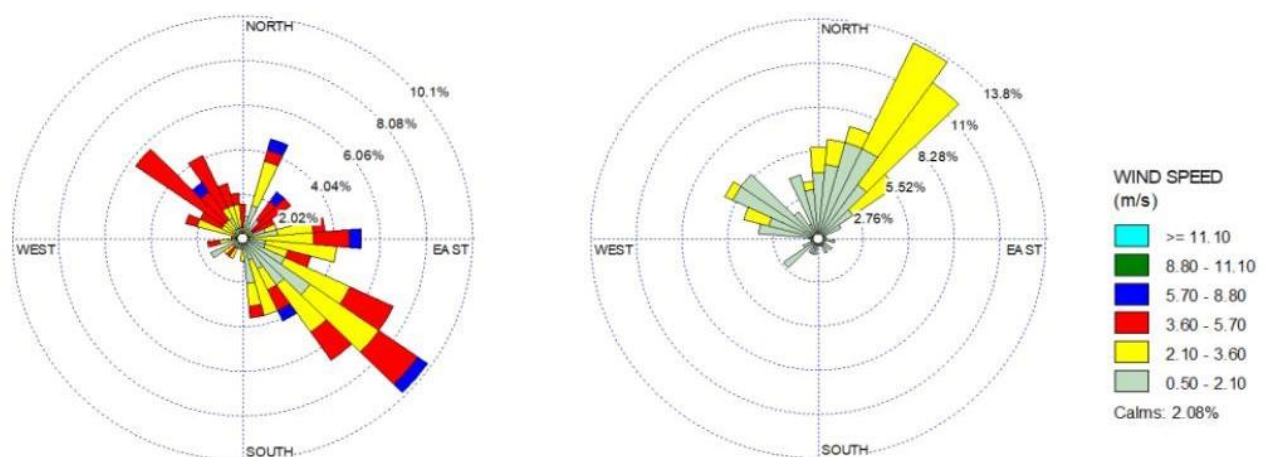


Figure 5.5: Windrose diagram for the summer (left) and winter seasons (right) at Jharia Coal Fields during the sampling period. Wind direction is flowing towards the centre.

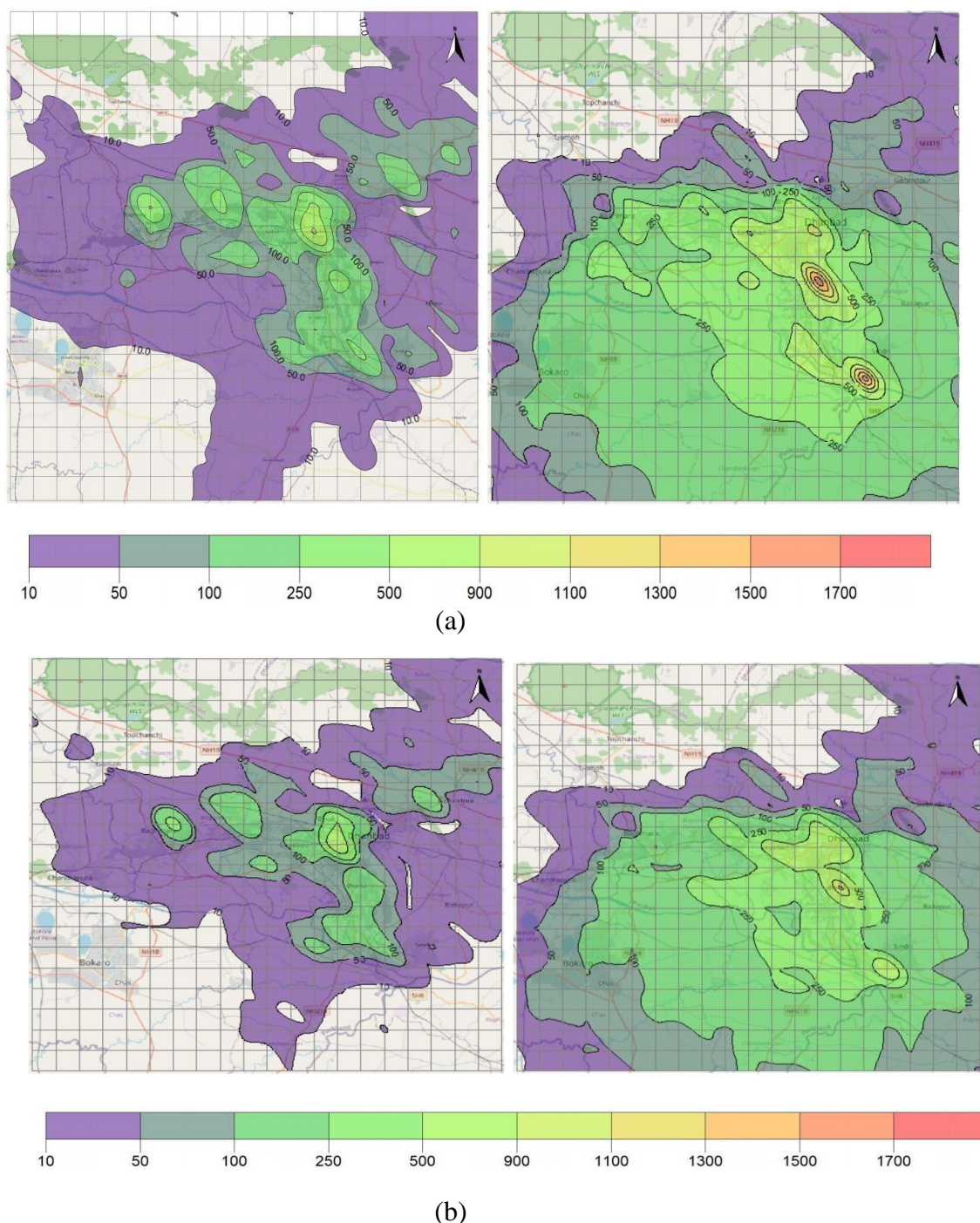


Figure 5.6: 24-hour average maximum ground level concentration of PM contours in the study area simulated during the study periods in summer (left) and winter (right) seasons (a) PM<sub>10</sub> ( $\mu\text{g}/\text{m}^3$ ) and (b) PM<sub>2.5</sub> ( $\mu\text{g}/\text{m}^3$ )

### 5.3 Validation of the model

Comparison between the model simulated period average PM and the measured PM concentrations was made to determine the overall efficiency of the dispersion model. In the present study, the model validation metrics viz. mean bias (MB), normalized mean bias (NMB), mean gross error (MGE), normalized mean gross error (NMGE), and Pearson's correlation ( $r$ ) were calculated for PM<sub>10</sub> and PM<sub>2.5</sub> separately including data of both seasons. At some of the monitoring locations like Mines Rescue, Katras, Patherdih, Harina, Lodhna, and Lohapatti the discrepancies between the modeled and observed data were found to be high, for both summer and winter seasons. At remaining locations for both seasons, the results indicate an acceptable/fair degree of model performance in simulating the particulate dispersion. Results show that the correlation coefficient between the measured and modeled PM<sub>10</sub> is 0.6, which is

fair enough in environmental open systems, similarly, for  $PM_{2.5}$  the correlation value is around 0.7 (Table 5.1).

Table 5.1 Performance Stimulation Metric

Model metric	$PM_{10}$	$PM_{2.5}$
MB	-19.46	20.67
NMB	-0.11	0.24
NMGE	0.32	0.37
Correlation Coefficient	0.6	0.7

The NMB values are observed to be lower for  $PM_{10}$  (-0.11) than  $PM_{2.5}$  (0.24), which indicates the slight negative bias in  $PM_{10}$  simulations (under-prediction of the concentrations) and positive bias in  $PM_{2.5}$  (over-prediction of the concentrations). Whereas, the NMGE for both  $PM_{10}$  and  $PM_{2.5}$  are 0.32 and 0.37, respectively, which indicates the variation in the model simulations deviate around 30% from the mean values on average (which is a result due to some extreme values in the simulations). However, this discrepancy could be minimized if long-term simulations are carried out, which is highly computationally intensive. Nevertheless, the model performance metrics in terms of correlation and normalized mean gross error infer that the model could capture the spatial profile of the particulate matter distribution to a good extent.

## Chapter 6 Recommendation

### 6.1. Mine industries

1. The project proponent might consider installing conveyor systems for transporting the coal from the coal handling plant to the railway siding or to the nearest thermal power plant (if feasible).
2. A sufficient number of plants should be planted around the mine pit to arrest the movement of particulate matter or dust into the surrounding areas.
3. Scientific studies might be necessary to design a green belt with an optimized dimension of plot size and direction as per the prevailing meteorology. Similar studies are required to design a wind barrier for optimized benefits.
4. Adequate dust control measures should be in place, like mechanized sweeping, water sprinkling or mist spraying systems on the haul roads and at loading sites. Long-range misting or fogging canons are also should be in place.
5. Dust suppression measures at all operations of mining should be ensured.
6. Ensuring the complete coverage of the trucks and railway wagons that carry coal with a tarpaulin sheet is necessary.
7. In the long-run mobilization of closed trucks to carry the coal is preferable.
8. The coal transport roads should not be left with open curb sides. End to end covering up of curb side is essential to avoid the re-suspension of coal due to the truck movement.

### 6.2. Area Sources

Area sources are mainly domestic sources of fuel (coal, wood, kerosene, LPG) burning, trash/MSW combustion, bakeries, hotels/restaurants etc. and re-suspension of dust. Based on the survey and assessment, the following recommendations emerge:

1. Construction and demolition of buildings in the urban area give high local dust contribution resulting health problems. These practices need to follow compliance guidelines to reduce emissions.
2. Road and pavement should be well constructed to suppress road dust. The standard specifications and code of practice for road construction should be followed and implemented as per the Indian Road Congress (IRC) guidelines or international standard guidelines.
3. Strategically placed green cover in urban and semi-urban areas can help to improve local air quality.
4. Manage agricultural residues, including strict enforcement of bans on open burning
5. Strictly enforce bans on the open burning of household waste.
6. Use clean fuels – electricity, natural gas, liquefied petroleum gas (LPG) in cities, and LPG and advanced biomass cooking and heating stoves in rural areas; substitution of coal by briquettes
7. Use incentives to improve the energy efficiency of household appliances, buildings, lighting, heating and cooling; encourage roof-top solar installations
8. Promote the use of electric vehicles

9. Encourage centralized waste collection with source separation and treatment, including gas utilization.
10. There is a substantial population that also uses available coal. These houses could be given a combination of improved chulla or free/subsidised power for cooking purposes.
11. Hotels and dhabas need to be educated and compulsorily asked to use LPG for its cooking purposes.
12. The trash and MSW burning is very common. Some of the places contain a mix of plastics and thermocol. The combustion of these materials is very harmful to human health.
13. Coal depot pollution is due to open storage and unregulated buying, selling and transportation. These coal depots are responsible for nearby air pollution peaks. However, the contribution of the same need to be assessed.

### 6.3. Line Source

The vehicular sector in cities has been seen to be a major source of gaseous and fine particulate matter. The action plan for this sector would need a combination of efforts:

1. Vehicle inspection and maintenance: Enforce mandatory checks and repairs for vehicles.
2. Improved public transport: Encourage a shift from private passenger vehicles to public transport.
3. Set up a mechanism of Inspection and Maintenance programme for all vehicles in the district through RTO with automated system assessment.
4. The Inspection & Maintenance (I & M) centre shall also test all vehicles for their inbuilt emission tests.
5. All commercial vehicles should be phased out after 8 years of age or subjected to two years extension after rigorous I&M tests
6. All private vehicles should be subjected to proper assessment and fitness tests through I&M centres.
7. All autos and buses shall also be subjected to I&M tests
8. Dhanbad city does not have a designated place for truck parking and maintenance related activities. A separate designated place should be allocated to prevent illegal parking and repair shops on the roads and kerbside.
9. Dhanbad city does not have a designated place for Auto-rikshaw. A separate designated place should provide to prevent traffic congestion and control vehicle emission.
10. Major haul trucks with heavy loads should not pass through the main city. The plan being made should be implemented in the next 1-1.5 years.
11. Overloading is a common phenomenon in the region resulting in poor road quality. This can be avoided through online checking when vehicles leave industries with a guarantee that the vehicle is not carrying more material than its designated loads.

#### 6.4. Others

- There is a need to explore various options for controlling air pollutants to tackle increased emissions in future.
- The local authority should stress sustainable and affordable public transport keeping clean air goals in mind.
- Frequent (time to time) arrangement of campaign/awareness programmes for lawmakers, stakeholders, health professionals, academicians to brainstorm about the future scenario and importance of clean air.
- Strategic installation of continuous air quality monitoring systems at various locations of urban, semi-urban and rural areas to check the existing air quality and information dissemination to the general public.

**Annexure -1**

[A] Cumulative receptor sample of PM<sub>10</sub> for source profiling with fitting parameters

Source contribution estimate	Source profiles	Std Error	R-square	Chi-square
82.7% mass	Unpaved road	0.056	0.96	2.41
	Coal combustion	0.643		
	Light Duty vehicle	1.60		
	Heavy Diesel vehicle	2.19		
	Residential combustion	5.59		
	Iron and steel industry	7.16		
	Agriculture soil dust	0.212		
	Solid waste	1.37		

[B] Cumulative receptor sample of PM<sub>2.5</sub> for source profiling with fitting parameters

Source contribution estimate	Source profiles	Std Error	R-square	Chi-square
88.1% mass	Residential combustion	3.34	0.98	2.44
	Coal combustion	0.094		
	Light Duty vehicle	0.30		
	Heavy Diesel vehicle	1.91		
	Agriculture soil dust	0.10		
	Flyash	0.51		

### Emission Inventory Data

Name of Mine:

S.no	Operation	Quantity Kg/day	Type of fuel & quantity (litre/day)	Moisture content %	Silt content %	Details
<b>Point source</b>						
1	Drilling					Hole dia ---mm & Frequency ---/day
2	Blasting					----/day
3.	Overburden loading					Drop height ----m; Frequency -----/day
4	Coal loading					Drop height ----m; Frequency -----/day
5	Overburden unloading					Drop height ----m; Frequency ----/day
6	Coal unloading					Drop height ----m; Frequency -----/day
7	Top soil removal					
8	Crushing					
9	DG sets					
<b>Line source</b>						
10	Transfer of coal through haul road					Average speed ----- km/hr & frequency -----/day Distance ---- km Width -----m
11	Transfer of OB through haul road					Average speed ----km/hr & frequency -----/day Distance ----km
12	Transport road					Average speed ----km/hr Distance ----- km
13	Haul Road length (km)					-----Km
<b>Area Source</b>						
14	Stockyard					Unloading freq. -----/day & Coal Loading -----T/day Area ----- m <sup>2</sup>
15	Workshop (m <sup>2</sup> )					Area
16	Exposed pit (km <sup>2</sup> )					
17	Colony					Fuel for cooking :-----

**STRICTLY RESTRICTED**  
**FOR COMPANY USE ONLY RESTRICTED**

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

**WATER QUALITY REPORT  
OF  
BHARAT COKING COAL LIMITED,  
CLUSTER – XIV**

**(FOR THE Q.E. DEC 2024)**

**E. C. no. J-11015/10/2010-IA.II (M) dated 06.06.2013-**



**CMPDI**

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

**CLUSTER - XIV**  
**(FOR THE Q.E. DEC 2024)**

**CONTENTS**

<b>SL. NO.</b>	<b>CHAPTER</b>	<b>PARTICULARS</b>
1.		EXECUTIVE SUMMARY
2.	CHAPTER - I	INTRODUCTION
3.	CHAPTER-II	WATER SAMPLING & ANALYSIS
	<b>PLATES:</b>	
4.	PLATE No. - I	SURFACE PLAN SHOWING WATER MONITORING LOCATIONS

# 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°37' N to 23°52' N latitudes and 86°09' E to 86°30' E longitude occupying an area of 450 Sq.km. BCCL has awarded Environmental monitoring work of Jharia Coalfield (JCF) to Central Mine Planning & Design Institute Limited (CMPDIL). The environmental monitoring has been carried out as per the conditions laid down by the MoEFCC 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 were collected.

## 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 RI-II, Dhanbad.

## 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, Forest 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-XIV is in the Western part of the Jharia coalfield and situated in the Western Jharia area of BCCL. It includes 1 Mine (viz. Lohapatti (UG & OC). The Cluster – XIV is situated about 25 - 30 kms from Dhanbad Railway Station. The mines of this Cluster – XIV 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 Damodar River.
- 1.2 The Cluster-XIV is designed to produce 0.405 MTPA (normative) and 0.526 MTPA (peak) capacity of coal.

The Project has Environmental Clearance from Ministry of Environment, Forest and Climate Change (MoEF&CC) for a rated capacity 0.405 MTPA (normative) and 0.526 MTPA (peak) capacity of coal production vide letter no. J-11015/10/2010-IA.II (M) dated 06<sup>th</sup> 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**

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

- i) Ground Water quality at **Lohapatti (GW14)**
- ii) Surface Water quality at **U/S of Damodar River (SW31)**
- iii) Surface Water quality at **D/S of Damodar River (SW29)**
- iv) Mine Water Quality at Lohapatti) **(MW14)**

#### **2.2 Methodology of sampling and analysis**

Water samples were collected as per standard practice. Effluent samples were analyzed for 25 parameters on quarterly 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 RI-II, Dhanbad.

#### **2.3 Results & Interpretations**

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



**cmpdi**  
A Mini Kailash Company

**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**GROUND WATER ANALYSIS TEST REPORT**

CMPDIL, RI-II  
KOYLA BHAWAN COMPLEX  
DHANBAD. -826005  
Phone:0326-223-850  
email: rdri2cmpdi@coalindia.in

Month & Year	QUARTER ENDING DEC 2024	Name of Cluster	CLUSTERXIV			ULR No.	TC1432125000001660P	
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bcl@coalindia.in)					Date of Issue	10.03.2025	
Project	Lohapatti		Sample Ref. No.	REM/BCCL/24-25/GW/	Sampling Method	CMPDI/RI-II/LPM 13,(IS 3025:Part -1)		
Sampling Stations	GW14		Date of Sampling	04.11.2024	Sample Collected in 5 Ltr Jerricane , Color as observed is transparent			
			Period of Analysis		04.11.2024	to	18.03.2025	
Sl. No.	Parameter	Method of Analysis	Observed Values			IS 10500: 2012		
			GW14 G0143	Range Of Testing	LDL	Acceptable Limit (Max)*	Permissible Limit in the Absence of Alternate Source (Max)	
1	Colour, Hazen unit	APHA, 24th edition ,2120-c-Spectrophotometric Single Wavelength Method ,2023	1	1-500.0	1	5	15	
2	Calcium, mg/l	IS 3025, (Part 40): 1991 R:2019,AAS-Flame Method & EDTA Method	104	2.0-800.0	2	75	200	
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 , Argentometric Method	50	2.0-1500.0	5	250	1000	
4	Fluoride, mg/l	APHA, 24th Edition, SPADNS Method	0.67	0.2-2.00	0.2	1	1.5	
5	Iron, mg/l	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame Method	<0.2	0.2-10	0.2	1	No relaxation	
6	Magnesium	APHA 24th edition, 3500-Mg B: Calculation Method	96	6.0-700	6	30	100	
7	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	4.5	0.5-45.0	0.5	45	No relaxation	
8	Odour	APHA, 24th Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Agreeable	Agreeable	
9	pH value	IS 3025, Part 11 : 1983 R 2023 Electrometric(pH Meter) Method	8.05	1-14	0.1	6.5-8.5	No relaxation	
10	Sulphate, mg/l	APHA -24th edition, 4500 S , Turbidity Method	88	10.0-400.0	10	200	400	
11	Taste	APHA,24th edition, 2160-C	Acceptable	Qualitative	Qualitative	Acceptable	Agreeable	
12	Total Alkalinity (CaCO <sub>3</sub> ), mg/l, Max	IS 3025, Part 23: 1986 R 2019 Titration Method	230	4.0-2000.0	4	200	600	
13	Total Dissolved Solids, mg/l	IS 3025, Part 16: 1984 R 2023 Gravimetric method	781	25.0-5000.0	25	500	2000	
14	Total Hardness, mg/l	IS 3025, (Part 21): 2019 EDTA Method	655	4.0-2000.0	4	200	600	
15	Turbidity, NTU	IS 3025, (Part 10):1984, R-2023 Nephelometric/Turbiditometric Method	3.1	1-800	0.1	1	5	
16	Zinc, mg/l	IS 3025(Part 49) : 1994,R:2019, AAS-Flame Method	<0.1	0.10 - 10.0	0.1	5	15	

\*\*\*All units in mg/L unless specified otherwise,

\*\*Grab sampling carried out for water samples. \*LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,

(Kumar Vaibhav)

(Amit Raj Mishra)

**ANALYSED BY**

**REVIEWED BY**

**Authorised Signatory**

**Note:** The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**GROUND WATER ANALYSIS TEST REPORT**

CMPDIL, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmpdi@coalindia.in

Month & Year	QUARTER ENDING DEC 2024	Name of Cluster	CLUSTER XIV			ULR No.	TC143212500001660P
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)					Date of Issue	10.03.2025
Project	Lohapatti	Sample Ref. No.	REM/BCCL/24-25/GW/	Sampling Method	CMPDI/RI-II/LPM 13,(IS 3025:Part -1)		
Sampling Stations	GW14	Date of Sampling	04.11.2024	Sample Collected in 5 Ltr Jerricane , Color as observed is transparent			
		Period of Analysis		04.11.2024	to	18.03.2025	
Sl. No.	Parameter	Method of Analysis	Observed Values			IS 10500: 2012	
			GW14	Range Of Testing	LDL	Acceptable Limit (Max)*	Permissible Limit in the Absence of Alternate Source (Max)
1	Boron (as B), mg/l, Max	APHA, 24th edition ,Carmine	<0.2	0.2-10	0.2	0.5	1
2	Copper (as Cu), mg/l, Max	IS 3025 Part 42 : 1992 R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.01-10.0	0.01	0.05	1.5
3	Free Residual Chlorine, mg/l, Min	APHA, 24th Edition, , 4500-Cl-B. (Iodometric Method-I)	<0.04	0.04-5	0.04	0.2	1
4	Lead (as Pb), mg/l, Max	IS:3025(Part 47):1994 (Reaffirmed 2019) APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.01	No relaxation
5	Phenolic compounds (as C6H5OH), mg/l, Max	APHA, 24 <sup>th</sup> Edition,4-Amino Autipyrine	<0.001	0.001-10	0.001	0.002	0.002
6	Selenium, mg/l, Max	APHA 24th edition IS-3025,part 56:2003, R-2019/, AAS-VGA	<0.007	0.007-10	0.007	0.01	No relaxation
7	Total Arsenic (as As), mg/l, Max	IS-3025,part 37:1988, R-2019/ APHA 24th edition AAS-VGA	<0.006	0.006-10	0.006	0.01	0.05
8	Total Chromium (as Cr), mg/l, Max	IS-3025 Part 52:2003, R:2019,AAS-Flame APHA, 24th edition, AAS-GTA	<0.01	0.01-10.0	0.01	0.05	No relaxation
9	Nickel as Ni, mg/l Max	IS 3025 Part 54 : 2003,R : 2019, AAS-Flame APHA, 24th edition, AAS-GTA	<0.005	0.005-10	0.005	0.02	No relaxation
10	Manganese as Mn, mg/l, Max	APHA, 24 <sup>th</sup> Edition:2023 AAS-GTA Method	<0.02	0.02-10.0	0.02	0.1	0.3

*\*\*\*All units in mg/L unless specified otherwise,*

*\*\*Grab sampling carried out for water samples. \*LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

 ANALYSED BY	 (Kumar Vaibhav) <b>REVIEWED BY</b>	 (Amit Raj Mishra) <b>Authorised Signatory</b>
-----------------	---	--

**Note:** The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.



**cmpdi**  
A Mini Ratna Company

**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**SURFACE WATER ANALYSIS TEST REPORT**

CMPDIL, RI-II  
KOYLA BHAWAN COMPLEX  
DHANBAD. -826005  
Phone: 0326-223-850  
email: rdri2.cmpdi@coalindia.in

<b>Month &amp; Year</b>	<b>QUARTE ENDI NG DEC 2024</b>		<b>Name of Cluster</b>	<b>XIV &amp;XV</b>		<b>ULR No.</b>	TC143212500001613P TC143212500001611P	
<b>Customer</b>	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)					<b>Date of Issue</b>	10.03.2025	
<b>Project</b>	<b>Sample Ref. No.</b>			REM/BCCL/24-25/SW /	<b>Sampling Method</b>	(IS 3025 , Part-1) CMPDI/RI-II/LPM 13		
<b>Sampling Stations</b>	(i)	Upstream in Damodar River(SW31)		<b>Date of Sampling</b>	30.12.2024	<b>Period of Analysis</b>		
	(ii)	Damodar River (upstream wrt clusterXIII, Downstream wrt clusterXIV) (SW29)		<b>Date of Sampling</b>	30.12.2024	30.12.2024 TO 13.03.2025		
<b>Sl. No.</b>	<b>Parameter</b>	<b>Method of Analysis</b>	<b>Observed Values</b>		<b>IS : 2296 INLAND SURFACE WATER [1982] Class °C</b>	<b>Range of Testing</b>	<b>LDL</b>	
			S0040	(ii)				
1	BOD (3 days 27°C), mg/l	IS 3025 ( Part 44 ) : 1993, R-2019 , 3 day incubation at 27°C	<2.0	<2.0	3	2.00-100.00	2	
2	Colour,Hazen Units	APHA 24th edition , 2120-B-:2023	2	1	10	1-500.0	1	
3	Chlorides, mg/l	IS-3025(Part 32):1988, R-2019 Argentometric Method	43	38	600	2.0-1500.0	5	
4	Copper, mg/l	IS 3025 (Part 42) : 1992 R : 2019, AAS-Flame Method	<0.2	<0.2	1.5	0.2-10.0	0.2	
5	Dissolved Oxygen, mg/L	IS 3025 (Part 38) : 1989, R:2003 Winkler Azide Method	4.4	4.2	4	1.0-10.0	0.1	
6	Fluoride, mg/l	APHA, 24th edition, SPADNS Method	0.60	0.77	1.5	0.2-2.00	0.2	
7	Hexavalent Chromium, mg/l	APHA 24th edition, 1,5-Diphenylcarbohydrazide Method IS 3025 (Part 52) : 2003,R-2019	<0.01	<0.01	0.05	0.01-1.4	0.01	
8	Iron, mg/l	IS 3025 (Part 53):2003,R:2019, AAS-Flame Method	0.2	<0.2	50	0.2-10	0.2	
9	Nitrate , mg/l	APHA, 24th edition, UV-Spectrophotometric Method	6.32	7.68	50	0.5-45.0	0.5	
10	pH value	IS 3025, (Part 11) : 1983 R-2023 Electrometric (Ph Meter) method	8.04	7.98	6.5-8.5	1.0-14.0	2	
11	Sulphate, mg/l	APHA -24th edition,4500- S, Turbidity Method	40	46	400	10.0-400.0	10	
12	Total Dissolved Solids, mg/l	IS 3025, (Part 16): 1984 R-2023 Gravimetric method	275	289	1500	25.0-10000.0	25	
13	Zinc, mg/l	IS 3025(Part 49) : 1994, R : 2019, AAS-Flame Method	<0.1	<0.1	15	0.10 - 10.0	0.1	

**\*\*Grab sampling carried out for water samples. \*LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit**

**\*\*\*All units in mg/L unless specified otherwise Sample Collected in 5 Ltr Jerricane , Color as observed is transparent**

(Kumar Vaibhav)		(Amit Raj Mishra)
<b>Analysed by</b>	<b>REVIEWED BY</b>	<b>Authorised Signatory</b>

**Note:** The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----

<b>Month &amp; Year</b>	<b>QUARTER ENDING</b> DEC 2024	<b>Name of Cluster</b>	<b>XIV &amp; XV</b>		<b>Report No.</b>	TC143212500001613P TC143212500001611P	
<b>Customer</b>	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)				<b>Date of Issue</b>	10.03.2025	
<b>Project</b>	<b>Sample Ref. No.</b>		REM/BCCL/24-25/SW /	<b>Sampling Method</b>	<b>(IS 3025 , Part-1) CMPDI/RI-II/LPM 13</b>		
<b>Sampling Stations</b>	(i)	Upstream in Damodar River(SW31)	<b>Date of Sampling</b>	30.12.2024	<b>Period of Analysis</b>		
	(ii)	Damodar River (upstream wrt clusterXIII, Downstream wrt clusterXIV) (SW29)	<b>Date of Sampling</b>	30.12.2024	30.12.2024 TO 13.03.2025		
Sl. No.	Parameter	Method of Analysis	Observed Values		IS : 2296 INLAND SURFACE WATER [1982] Class 'C	Range of Testing	LDL
			(i)	(ii)			
1	Arsenic (as As), mg/l, Max	IS-3025,Part 37:1988, R-2019/ APHA 24th edition AAS-VGA	<0.006	<0.006	0.2	0.006-10	0.006
2	Lead (as Pb), mg/l, Max	APHA, 24th edition, AAS-GTA	<0.005	<0.005	0.1	0.005-10	0.005
3	Phenolic compounds (as C6H5OH), mg/l, Max	APHA, 22nd Edition 4-Amino Antipyrine	<0.002	<0.002	0.005	0.002-10	0.002
4	Selenium, mg/l, Max	IS-3025 ,Part 56:2003, R-2019/ APHA 24th edition, AAS-VGA	<0.007	<0.007	0.05	0.007-10	0.007

*\*\*Grab sampling carried out for water samples. \*LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit*

*\*\*\*All units in mg/L unless specified otherwise **Sample Collected in 5 Ltr Jerricane, Color as observed is transparent***



(Kumar Vaibhav)



(Amit Raj Mishra)

**Analysed by**

**REVIEWED BY**

**Authorised Signatory**

**Note:** The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----

Page -2of 2



**cmpdi**  
A Miniratna Company

**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**MINE EFFLUENT ANALYSIS TEST REPORT**

**CMPDIL, RI-II**  
**KOYLA BHAWAN COMPLEX**  
**DHANBAD. -826005**  
**Phone:0326-223-850**  
**email: rdri2cmpdi@coalindia.in**

Month & Year	QUARTER ENDING DEC 2024	Name of Cluster	CLUSTER XIV			Report No.	TC1432125000001638P
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)					Date of Issue	10.03.2025
Project	Lohapatti	Sample Ref. No.	REM/BCCL/24-25/MW/	Sampling Method	CMPDI/RI-II/LPM 13,(IS 3025:Part -1)		
Sampling Stations	MW14	Date of Sampling	23.12.2024	Sample Collected in 5 Ltr Jerricane, Color as observed is transparent			

Sl. No.	Parameter	Method of Analysis	Period of Analysis			MOEF -SCH-VI STANDARDS Class 'A'
			MW14 M1283	Range Of Testing	LDL	
1	B.O.D (3 days 27°C), mg/l, Max	IS 3025 /44:1993,R:20033 day incubation at 27°C	<2.0	2-10000.0	2	30
2	Colour	APHA,24th edition ,2120-B:-2023	1	1.0-500.0	1	-
3	COD, mg/l, Max	APHA 24th edition 5220 C Titrimetric Method	32	4.0-800.0	4	250
4	Copper (as Cu), mg/l, Max	IS 3025(Part42): 1992 R : 2019, AAS-Flame	<0.2	0.2-10.0	0.2	3
5	Dissolved Phosphate (as P), mg/l, Max	IS 3025/ 31, 1988 R 2019	0.10	0.1-5.0	0.1	5
6	Fluoride (as F) mg/l, Max	APHA, 23RD Edition, Page 4-90 to , 4500 -F- D (SPADNS Method)	0.44	0.2-2.0	0.2	2
7	Hexavalent Chromium, mg/l, Max	IS 3025 (Part 52) : 2003,Reaffirmed 2019	<0.01	0.01-1.40	0.01	0.1
8	Iron (as Fe), mg/l, Max	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame	<0.2	0.2-10	0.2	3
9	Manganese(as Mn), mg/l, Max	APHA, 24th edition, AAS-Flame	<0.1	0.1-10	0.1	0.1
10	Nickel (as Ni), mg/l, Max	IS-3025(Part 54):2003, R:2019 AAS-Flame	<0.1	0.1-10.0	0.1	3
11	Nitrate Nitrogen, mg/l, Max	APHA, 23 rd Edition,UV-Spectrphotometric	3.26	0.5-45	0.5	10
12	Oil & Grease, mg/l, Max	IS 3025/39:1991, R : 2019, Partition Gravimetric	<4.0	2.0-1000	2	10
13	pH value	IS-3025/11:1983, R-2023, Electrometric	7.73	1 -14	0.1	5.5 to 9.0
14	Temperature (°C )	IS-3025/09:1984, Thermometric	25.8	1-100	.	Shall not exceed 5° C above the receiving temp.
15	Total Chromium (as Cr), mg/l, Max	IS-3025(Part 52):2003, R:2019 AAS-Flame	<0.1	0.1-10.0	0.1	2
16	Total Suspended Solids, mg/l, Max	IS 3025/17:1984, R :2023, Gravimetric	41	10-5000	10	100
17	Zinc (as Zn), mg/l, Max	IS 3025 /49 : 1994, R : 2019, AAS-Flame	<0.1	0.1-10.0	0.1	5
18	Odour	APHA, 23rd Edition, , 2150-C	Agreeable	Qualitative	Qualitative	Qualitative

\*\*\*All units in mg/L unless specified otherwise,

\*\*Grab sampling carried out for water samples. \*LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,



**ANALYSED BY**

  
(Kumar Vaibhav)  
**REVIEWED BY**

  
(Amit Raj Mishra)

**Authorised Signatory**

**Note:** The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----

Page -1 of 2

Month & Year	QUARTER ENDING DEC 2024	Name of Cluster	CLUSTER XiV		Report No.	TC143212500001638P
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)				Date of Issue	10.03.2025
Project	Lohapatti	Sample Ref. No.	REM/BCCL/24-25/MW/	Sampling Method	CMPDI/RI-II/LPM 13,(IS 3025:Part -1)	
Sampling Stations	MW14	Date of Sampling	23.12.2024	Sample Collected in 5 Ltr Jerricane , Color as observed is transparent		
		Period of Analysis		23.12.2024	TO	13.03.2025

Sl. No.	Parameter	Method of Analysis	MOEF -SCH-VI STANDARDS Class 'A'			
			MW14	Range Of Testing	LDL	
1	Ammonical Nitrogen, mg/l, Max	IS 3025/34:1988,R : 2009, Nessler's	<0.02	0.02-100	0.02	50
2	Arsenic (as As), mg/l, Max	IS-3025,part 37:1988, R-2019/ APHA 24th edition AAS-VGA	<0.006	0.006-5	0.006	0.2
3	Free Ammonia, mg/l, Max	IS:3025/34:1988, Nessler's	<0.01	0.01-10	0.01	5
4	Lead (as Pb), mg/l, Max	IS-3025(Part 59):2006, R 2023 AAS-GTA/APHA, 24 <sup>th</sup> Edition, 3111B, AAS-GTA	<0.005	0.005-10	0.005	2
5	Phenolic compounds	APHA, 24th edition 4-Amino Antipyrine	<0.002	0.002-5	0.002	1
6	Selenium, mg/l, Max	IS-3025,part 56:2003, R-2019/ APHA 24th edition, AAS-VGA	<0.007	0.007-5	0.007	0.05
7	Sulphide (as S <sup>2-</sup> ) mg/l Max.	APHA 24th edition Methylene Blue Method	<0.005	0.005-5	0.005	2
8	Total Kjeldahl Nitrogen, mg/l, Max	IS:3025/34:1988, Nessler's	<1	1-200	1	100
9	Total Residual Chlorine, mg/l, Max	APHA, 23rd Edition, , 4500-Cl B. (Iodometric Method-I)	<0.04	0.04-5.00	0.04	1

\*\*\*All units in mg/L unless specified otherwise,

\*\*Grab sampling carried out for water samples. \*LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,



**ANALYSED BY**

(Kumar Vaibhav)

**REVIEWED BY**



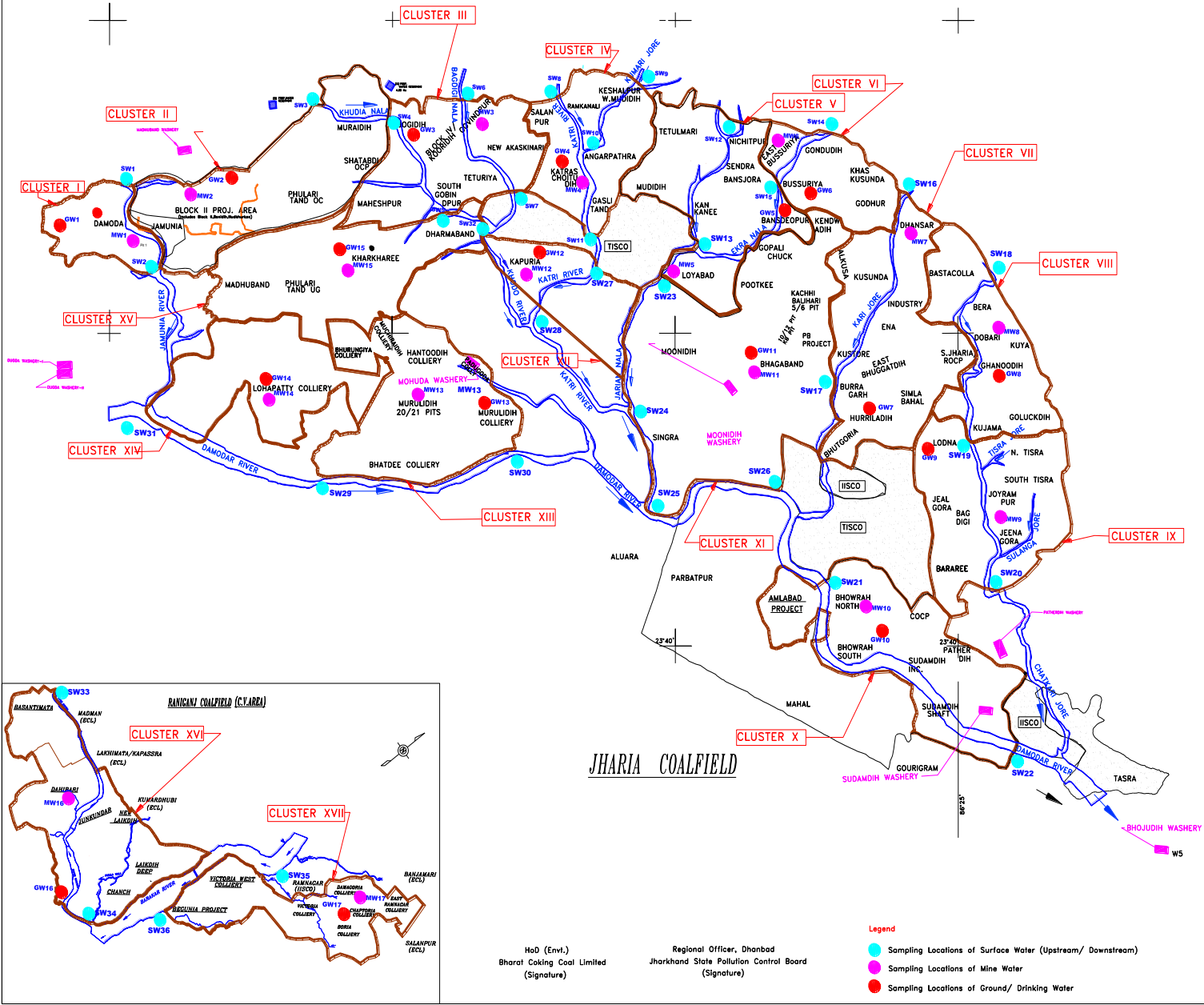
**Authorised Signatory**

**Note:** The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----

Page -2 of 2

# Water Sampling Locations in BCCL



## INDEX

Cluster	Surface Water (U/S, D/S)	Name of River/Nala / Jore	Miner Effluent Water	Sampling Location	Ground Water	Sampling Location
I	SW1, SW2	Jamunia River	MW1	Damoda Area	GW1	Chutway Village
II	SW3, SW4	Khudia Nala	MW2	Block II OCP	GW2	Joyrampur Village
III	SW4, SW5, SW6, SW7	Khudia Nala, Bagdigi Nala	MW3	Govindpur Colliery	GW3	Jogidh Village
IV	SW8, SW11, SW9, SW10	Kari Jore	MW4	Chotudih	GW4	Kankanee Village
V	SW12, SW13, SW15	Jarian Nala, Ekra Nala	MW5	Mudidih	GW5	Nichtpur
VI	SW14, SW15	Ekra Nala	MW6	East Bessuria UGP	GW6	Bansjora Borwell
VII	SW16, SW17	Kari Jore	MW7	Dhanbar JGP	GW7	Hurladih
VIII	SW18, SW19	Kashi Jore	MW8	Dobani UGP	GW8	Shanudih
IX	SW19, SW20	Kashi Jore	MW9	Jeenagora	GW9	Lodna
X	SW21, SW22	Bamodar River	MW10	Bhowrah North	GW10	Bhowrah South
XI	SW23, SW24, SW25, SW26	Nala, Bamodar River	MW11	Bhagaband h-UGP	GW11	Bhagabandh
XII	SW27, SW28	Kari River	MW12	Kapunia	GW12	Kapunia
XIII	SW29, SW30	Bamodar River	MW13	Munlidih (20/21)	GW13	Munlidih
XIV	SW31, SW32	Bamodar River	MW14	Lohapatti	GW14	Lohapatti
XV	SW5, SW32	Kharkharae Nala	MW15	Kharkharae JGP	GW15	Kharkharae
XVI	SW33, SW34	Khudia River	MW16	Darbani OCP	GW16	Pallaban Village
XVII	SW35, SW36	Barakar River	MW17	Damaogona Colliery	GW17	Chaptoria

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

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

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

Bharat Coking Coal Limited	
WATER SAMPLING LOCATIONS	
MONITORING STATIONS	
CMPDI	

**STRICTLY RESTRICTED**  
**FOR COMPANY USE ONLY RESTRICTED**

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

**TRACE METAL CONCENTRATION OF  
AMBIENT AIR QUALITY REPORT  
OF  
BHARAT COKING COAL LIMITED,  
(FOR THE HALF YEAR ENDING, DECEMBER, 2024)**



**CMPDI**

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

(FOR THE Q.E. DECEMBER, 2024)

## CONTENTS

SL. NO.	CHAPTER	PARTICULARS
1.	CHAPTER - I	EXECUTIVE SUMMARY INTRODUCTION
2.	CHAPTER-II	AIR SAMPLING & ANALYSIS
3.	<b>PLATES:</b> PLATE NO. - I	SURFACE PLAN SHOWING AIR & NOISE MONITORING LOCATIONS

# 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°37' N to 23°52' N latitudes and 86°09' E to 86°30' E longitude occupying an area of 450 Sq.km. BCCL has awarded Environmental monitoring work of Jharia Coalfield (JCF) to Central Mine Planning & Design Institute Limited (CMPDIL). The environmental monitoring has been carried out as per the conditions laid down by the MoEF&CC while granting environmental clearance of project, consent letter issued by the respective SPCB, and other statutory requirements.

## 2.0 Sampling location and rationale

### 2.1 Ambient air sampling locations

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

## 3.0 Methodology of sampling and analysis

### 3.1 Heavy Metal in Ambient Air

Parameters chosen for assessment of Heavy metal in Ambient Air Quality were Cadmium (Cd), Mercury (Hg), Arsenic (As), Chromium (Cr), Nickel (Ni), and Lead (Pb). Respirable Dust Samplers (RDS) were used for sampling these heavy metals on EPM filter paper. These heavy metals are analyzed regularly on half yearly basis. The samples were analyzed in Environment Laboratory of CMPDI, RI-II, Dhanbad.

## 4.0 Results and interpretations

### 4.1 Heavy Metal in Ambient Air

The results of Heavy metal in Ambient Air Quality are presented in tabular form for each monitoring station. The concentration of heavy metals in ambient air is well within the permissible limit.

# 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 guidelines stipulated by Ministry of Environment, Forest and Climate Change (MoEF&CC), Govt. of India.

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

Bharat Coking Coal 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.

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

## CHAPTER – II

### AMBIENT AIR QUALITY MONITORING

#### 2.1 Results and interpretations

The results of Heavy metal in Ambient Air Quality are presented in tabular form for each monitoring station. The concentration of heavy metals in ambient air is well within the permissible limit.

#### TRACE METAL CONCENTRATION IN AMBIENT AIR QUALITY

Name of the Company: **Bharat Coking Coal Limited**

Year : **2024-25.**

PERIOD: **HALF YEAR ENDING DEC. 24**

#### HEAVY METAL ANALYSIS REPORT OF AMBIENT AIR QUALITY

SAMPLE CODE	DATE	Station Name	Cd CONC. IN $\mu\text{g}/\text{m}^3$	Hg CONC. IN $\mu\text{g}/\text{m}^3$	As CONC. IN $\text{ng}/\text{m}^3$	Cr CONC. IN $\mu\text{g}/\text{m}^3$	Ni CONC. IN $\text{ng}/\text{m}^3$	Pb CONC. IN $\mu\text{g}/\text{m}^3$
A1	16.11.2024	Karmatand Village	<0.001	<0.001	<1.0	<0.01	3.06	0.007
A2	17.11.2024	Damoda	<0.001	<0.001	<1.0	<0.01	2.34	<0.005
A3	26.11.2024	Madhuband Washery	<0.001	0.001	<1.0	<0.01	<2.0	<0.005
A4	17.11.2024	Block-II	<0.001	<0.001	<1.0	<0.01	2.01	0.011
A5	30.11.2024	Muraidih	<0.001	<0.001	<1.0	<0.01	4.16	<0.005
A6	23.11.2024	Block-IV	<0.001	<0.001	<1.0	<0.01	<2.0	<0.005
A7	23.11.2024	Govindpur/Ramkanali	<0.001	<0.001	<1.0	<0.01	<2.0	0.035
A8	25.11.2024	Nichitpur	<0.001	<0.001	<1.0	<0.01	<2.0	<0.005
A9	25.11.2024	East Basseriya	<0.001	<0.001	<1.0	<0.01	<2.0	<0.005
A10	23.11.2024	Dhansar/Kusunda	<0.001	<0.001	<1.0	<0.01	<2.0	0.005
A11	23.11.2024	Dobari	<0.001	<0.001	<1.0	<0.01	<2.0	0.010
A12	29.11.2024	Kusmatand Village	<0.001	<0.001	<1.0	<0.01	<2.0	<0.005
A13	28.11.2024	Jeenagora	<0.001	<0.001	<1.0	<0.01	<2.0	<0.005
A14	16.11.2024	Bhowrah North	<0.001	<0.001	<1.0	<0.01	<2.0	<0.005
A15	16.11.2024	Sudamdih Washery	<0.001	0.002	<1.0	<0.01	<2.0	0.045
A16	16.11.2024	Pootki	<0.001	<0.001	<1.0	<0.01	<2.0	0.013
A17	29.11.2024	Moonidih UGP	<0.001	<0.001	<1.0	<0.01	<2.0	<0.005
A18	25.11.2024	Rudih Basti	<0.001	<0.001	<1.0	<0.01	<2.0	0.010
A19	26.11.2024	Murlidih 20/21	<0.001	<0.001	<1.0	<0.01	<2.0	<0.005
A20	22.11.2024	Lohapatti	<0.001	<0.001	<1.0	<0.01	<2.0	<0.005
A21	22.11.2024	Kharkharee	<0.001	<0.001	<1.0	<0.01	<2.0	<0.005

SAMPLE CODE	DATE	Station Name	Cd CONC. IN $\mu\text{g}/\text{m}^3$	Hg CONC. IN $\mu\text{g}/\text{m}^3$	As CONC. IN $\text{ng}/\text{m}^3$	Cr CONC. IN $\mu\text{g}/\text{m}^3$	Ni CONC. IN $\text{ng}/\text{m}^3$	Pb CONC. IN $\mu\text{g}/\text{m}^3$
A22	27.11.2024	Dahibari	<0.001	<0.001	<1.0	<0.01	<2.0	0.016
A23	27.11.2024	Basantimata	<0.001	<0.001	<1.0	<0.01	<2.0	<0.005
A24	28.11.2024	Gopinathpur	<0.001	<0.001	<1.0	<0.01	<2.0	<0.005
A25	28.11.2024	Guliardih	<0.001	<0.001	<1.0	<0.01	<2.0	0.009
A26	25.11.2024	Begunia	<0.001	<0.001	<1.0	<0.01	3.26	0.010
A27	25.11.2024	Damagoria	<0.001	<0.001	<1.0	<0.01	2.22	0.036
A28	16.11.2024	Hurriladih	<0.001	<0.001	<1.0	<0.01	<2.0	0.006
A29	30.11.2024	Moonidih Washery	<0.001	0.003	<1.0	<0.01	<2.0	<0.005
A30	17.11.2024	Sitanala	<0.001	<0.001	<1.0	<0.01	<2.0	0.048
A31	27.11.2024	Dumarda	<0.001	<0.001	<1.0	<0.01	<2.0	0.005
A32	29.11.2024	Telmacho Bridge	<0.001	<0.001	<1.0	<0.01	<2.0	<0.005
A33	30.11.2024	Madhuband UGP	<0.001	0.005	<1.0	<0.01	<2.0	<0.005
A34	30.11.2024	Bhojudih Washery	<0.001	0.02	<1.0	<0.01	<2.0	0.049
A35	16.11.2024	Dugda Washery	<0.001	0.003	<1.0	<0.01	<2.0	0.016
A36	30.11.2024	Mahuda	<0.001	0.001	<1.0	<0.01	<2.0	<0.005
A37	23.11.2024	Katras Choitudih	<0.001	<0.001	<1.0	<0.01	<2.0	<0.005
A38	23.11.2024	Sinidih Workshop	<0.001	<0.001	<1.0	<0.01	<2.0	0.009
A39	17.11.2024	Patherdih	<0.001	<0.001	<1.0	<0.01	<2.0	<0.005
A40	22.11.2024	Koyla Nagar	<0.001	<0.001	<1.0	<0.01	<2.0	<0.005
A41	17.11.2024	Sudamdih Shaft	<0.001	<0.001	<1.0	<0.01	<2.0	0.024
A42	29.11.2024	RHB	<0.001	<0.001	<1.0	<0.01	2.56	0.017
A43	16.11.2024	Pandwabhita	<0.001	<0.001	<1.0	<0.01	<2.0	<0.005
A44	17.11.2024	Sadariadih	<0.001	<0.001	<1.0	<0.01	<2.0	0.007
A45	30.11.2024	Bhojudih Buffer	<0.001	<0.001	<1.0	<0.01	2.15	<0.005
A46	16.11.2024	C.H.D	<0.001	<0.001	<1.0	<0.01	<2.0	<0.005

<i>Metal (Unit)</i>	<i>LDL</i>	<i>Standard as per NAAQS</i>
Hg ( $\mu\text{g}/\text{m}^3$ )	0.001	*Standard Not defined
Cr( $\mu\text{g}/\text{m}^3$ )	0.01	*Standard Not defined
As ( $\text{ng}/\text{m}^3$ )	1	6
Pb ( $\mu\text{g}/\text{m}^3$ )	0.005	0.5
Ni ( $\text{ng}/\text{m}^3$ )	2	20
Cd ( $\mu\text{g}/\text{m}^3$ )	0.001	*Standard Not defined

सुमान रंजु रामुल

Analysed By  
JSA/SA/SSA

U

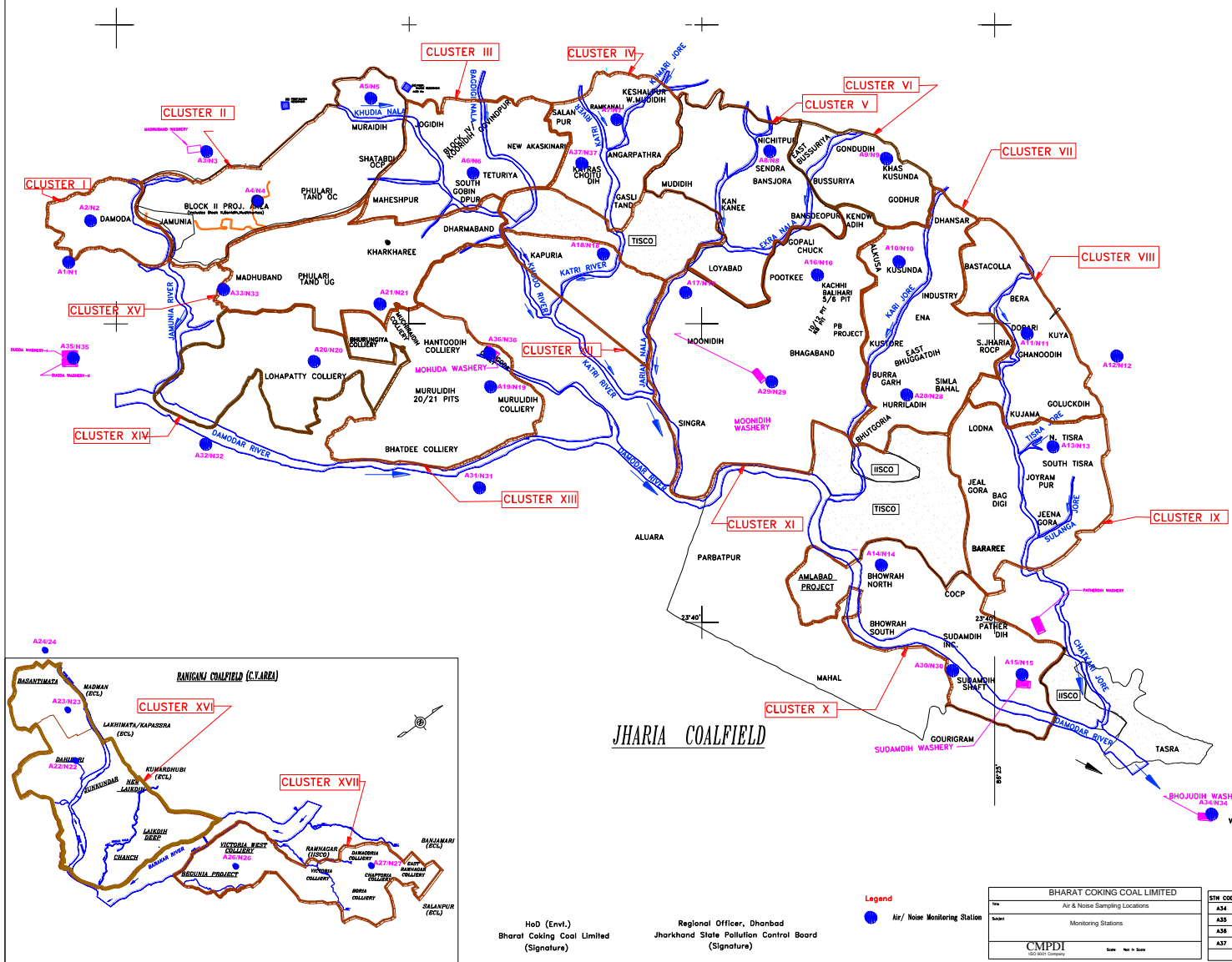
Checked By  
Lab In Charge  
RI-2, CMPDI, Dhanbad

अमित

Approved By  
HOD(In-charge) Environment  
RI-2, CMPDI, Dhanbad



# Location of Air & Noise Monitoring Stations in BCCL



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

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

**Legend**  
● Air / Noise Monitoring Station

BHARAT COKING COAL LIMITED	
Site	Air & Noise Sampling Locations
Scale	Monitoring Stations
CMPDI Coal Monitoring & Pollution Diagnostic Institute	
Date	Mo to Date

STM CODE	NAME OF STATIONS (AIR/NOISE)
A34	BHOJUDIH COAL WASHERY
A35	MADHUA WASHERY
A36	MAHURA WASHERY
A37	KATRAS CHOTUWHI COLLIERY

**STRICTLY RESTRICTED**

**FOR COMPANY USE ONLY RESTRICTED**

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

**ENVIRONMENTAL MONITORING REPORT  
OF  
BHARAT COKING COAL LIMITED,  
CLUSTER – XIV**

**(FOR THE MONTH OCTOBER , 2024)**

**E. C. no. J-11015/10/2010-IA.II (M) dated 06.06.2013.**



**CMPDI**

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

# CONTENTS

<b>SL. NO.</b>	<b>CHAPTER</b>	<b>PARTICULARS</b>	<b>PAGE NO.</b>
1.	CHAPTER - I	EXECUTIVE SUMMARY	3-5
2.	CHAPTER-II	INTRODUCTION	6
3.	CHAPTER-III	RESULTS	7-19
4.	CHAPTER-IV	STANDARDS AND PLANS	20-21

## **EXECUTIVE SUMMARY**

### **1.0 Introduction**

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

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

### **2.0 Sampling location and rationale**

#### **2.1 Ambient air sampling locations**

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

#### **2.2 Water sampling stations**

The Water sampling stations were selected for mine sump water.

#### **2.3 Noise level monitoring locations**

Noise levels vary depending on the various activities in mining areas. The monitoring of noise level in different locations will be helpful to take appropriate mitigating measures. The noise levels were recorded in mining areas, washeryareas and in residential areas.

### **3.0 Methodology of sampling and analysis**

#### **3.1 Ambient air quality**

Parameters chosen for assessment of ambient air quality were Particulate Matter (PM<sub>10</sub>), Fine Particulate Matter (PM<sub>2.5</sub>), Sulphur Di-oxide (SO<sub>2</sub>) and Nitrogen Oxides (NO<sub>x</sub>). Respirable Dust Samplers (RDS) and Fine Dust

Sampler (PM<sub>2.5</sub> sampler) were used for sampling of PM<sub>10</sub>, SO<sub>2</sub>, & NO<sub>x</sub> and Fine Dust Sampler (PM<sub>2.5</sub> sampler) were used for sampling of PM<sub>2.5</sub> at 24 hours interval once in a fortnight and the same for the gaseous pollutants. The samples were analyzed in Environmental Laboratory of CMPDI, RI-II, Dhanbad.

### **3.2 Water quality**

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

### **3.3 Noise level monitoring**

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

## **4.0 Results and interpretations**

### **4.1 Air quality**

It has been seen from the analysis results that the 24 hours average concentration parameters like PM<sub>10</sub>, PM<sub>2.5</sub>, SO<sub>2</sub> and NO<sub>x</sub> are mostly within the permissible limits in all sampling locations as per MoEF&CC Gazette Notification No. GSR 742(E) dt 25.09.2000 Standards for Coal Mines and National Ambient Air Quality Standard -2009. Sometimes the concentration of PM<sub>10</sub>& PM<sub>2.5</sub> exceeds the limits due to heavy public traffic, poor road condition, coke oven plants, burning of coal by surrounding habitants, brick making, municipal waste dumps and industries like Steel Plant, thermal Plants including their fly ash etc.

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

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

#### **4.2 Water quality**

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

#### **4.3 Noise Level**

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

## INTRODUCTION

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

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-XIV is in the Western part of the Jharia coalfield and situated in the Western Jharia area of BCCL. It includes 1 Mine (viz. Lohapatti (UG & OC). The Cluster – XIV is situated about 25 - 30 kms from Dhanbad Railway Station. The mines of this Cluster – XIV 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 Damodar River.
- 1.2 The Cluster-XIV is designed to produce 0.405 MTPA (normative) and 0.526 MTPA (peak) capacity of coal.

The Project has Environmental Clearance from Ministry of Environment, Forest and Climate Change (MoEF&CC) for a rated capacity 0.405 MTPA (normative) and 0.526 MTPA (peak) capacity of coal production vide letter no. J-11015/10/2010-IA.II (M) dated 06<sup>th</sup> June, 2013.

Ministry of Environment, Forest and Climate Change while granting environmental clearance has given one of the General conditions that “ Four ambient air quality monitoring stations should be established in the core zone as well as in the buffer zone for PM<sub>10</sub>, PM<sub>2.5</sub>, SO<sub>2</sub>, NO<sub>x</sub> monitoring. Location of the stations should be decided based on the meteorological data, topographical features and environmentally and ecologically sensitive targets in consultation with the State Pollution Control Board.” And other conditions regarding water / effluent and noise level monitoring.

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

## AMBIENT AIR QUALITY MONITORING

### 2.1 Location of sampling station and their rationale:

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

#### 2.1.1 Ambient Air Quality Sampling Locations

##### I. CORE ZONE Monitoring Location

###### i) Lohapatti (A20): Industrial Area

The location of the sampling station is 23° 44' 29.42" N & 86° 12' 49.96" E. The sampler was placed at a height of approx. 1.5m above ground level at Project Office.

##### II. BUFFER ZONE Monitoring Location

###### i) Kharkharee CISF Office (A21): Industrial Area

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 Safety Office.

###### ii) Telmachho Bridge (A32): Industrial Area

The location of the sampling station is 23° 44' 14.90" N & 86° 12' 21.20" E. The location was selected for studying the impact of the mining activity on the Telmachho Bridge area as it lies in the buffer zone for the Cluster XIV.

###### iii) Madhuband UGP Office (A33): Industrial Area

The location of the sampling station is 23° 45'24.48" N & 86°11'59.44"E. The sampler was placed at a height of approx. 1.5m above ground level at Safety Office.

## AMBIENT AIR QUALITY DATA



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**Ambient Air Quality Test Report**


CMPDIL, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmpdi@coalindia.in

### Test Report for Ambient Air Samples

Month & Year		10/2024	Cluster		Cluster XIV			ULR No.	TC1012224000001270F
Customer		Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)					Date of Issue	31.12.2024	
Project		Lohapatti	Sample Ref. No.	REM/BCCL/2024/10	Sampling Method		CMPDI/RI-II/LPM 11, ( IS 5182)		
Date of Sampling		05.10.2024	19.10.2024	Period of Analysis	05.10.2024	28.11.2024	Zone of Station:	Buffer Zone	
Sl. No.	Parameter	Method Analysis	Observed Values ( in $\mu\text{g}/\text{m}^3$ )		Range Of Testing	LDL	MoEF Standards Notification dated 25th September,2000 (GSR 742 E )	NAAQS, 2009	
			1st FN A2775	2nd FN A2856					
1	PM <sub>10</sub>	IS -5182(Part 23):2006, R-2017	112	126	10 $\mu\text{g}/\text{m}^3$ - 1000 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	300	100	
2	PM <sub>2.5</sub>	IS -5182(Part 24):2019	62	65	10 $\mu\text{g}/\text{m}^3$ - 400 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	Not Specified	60	
3	SO <sub>2</sub>	IS-5182(Part-2): 2001, R-2017	<10	11	10 $\mu\text{g}/\text{m}^3$ - 1050 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	120	80	
4	NO <sub>2</sub>	IS-5182 (Part-6): 2006, R-2017	26	26	06 $\mu\text{g}/\text{m}^3$ - 420 $\mu\text{g}/\text{m}^3$	06 $\mu\text{g}/\text{m}^3$	120	80	

\* LDL indicates Lower Detection Limit,

\*\*All units are in  $\mu\text{g}/\text{m}^3$ , 24 hourly Average,

  
 ANALYSED BY

  
 (Gaurav Kant)  
 REVIEWED BY

  
 (Amit Raj Mishra)  
 Authorised Signatory

**Note:** The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----

Page -1 of 1



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**Ambient Air Quality Test Report**

CMPDI, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmpdi@coalindia.in

**Test Report for Ambient Air Samples**

Month & Year	10/2024	Cluster	Cluste XIV			ULR No.	TC1012224000001270F	
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)				Date of Issue	31.12.2024		
Project	Kharkharee	Sample Ref. No.	REM/BCCL/2024/10	Sampling Method		CMPDI/RI-II/LPM 11, ( IS 5182)		
Date of Sampling	04.10.2024	18.10.2024	Period of Analysis	04.10.2024	28.11.2024	Zone of Station:	Core Zone	
Sl. No.	Parameter	Method Analysis of	Observed Values ( in $\mu\text{g}/\text{m}^3$ )		Range Of Testing	LDL	MoEF Standards Notification dated 25th September,2000 (GSR 742 E )	NAAQS, 2009
			1st FN A2766	2nd FN A2849				
1	PM <sub>10</sub>	IS -5182(Part 23):2006, R-2017	94	98	10 $\mu\text{g}/\text{m}^3$ - 1000 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	300	100
2	PM <sub>2.5</sub>	IS -5182(Part 24):2019	51	53	10 $\mu\text{g}/\text{m}^3$ - 400 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	Not Specified	60
3	SO <sub>2</sub>	IS-5182(Part-2): 2001, R-2017	10	<10	10 $\mu\text{g}/\text{m}^3$ - 1050 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	120	80
4	NO <sub>2</sub>	IS-5182 (Part-6): 2006, R-2017	27	26	06 $\mu\text{g}/\text{m}^3$ - 420 $\mu\text{g}/\text{m}^3$	06 $\mu\text{g}/\text{m}^3$	120	80

\* LDL indicates Lower Detection Limit,

\*\*All units are in  $\mu\text{g}/\text{m}^3$ , 24 hourly Average,

*[Signature]*

**ANALYSED BY**

*[Signature]*

(Gaurav Kant)  
**REVIEWED BY**







*[Signature]*

(Amit Raj Mishra)  
**Authorised Signatory**

**Note:** The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env), CMPDI, RI-II.

---- End of Report ----

Page -1 of 1

CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED										
Environment Laboratory, Regional Institute-II										
Ambient Air Quality Test Report										
								CMPDIL, RI-II KOYLA BHAWAN COMPLEX DHANBAD. -826005 Phone:0326-223-850 email: rdri2cmpdi@coalindia.in		
Test Report for Ambient Air Samples										
Month & Year	10/2024	Cluster	CLUSTER XIV				ULR No.	TC1012224000001270F		
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)					Date of Issue	31.12.2024			
Project	Telmacho Bridge	Sample Ref. No.	REM/BCCL/2024/10		Sampling Method		CMPDI/RI-II/LPM 11, ( IS 5182)			
Date of Sampling	05.10.2024	19.10.2024	Period of Analysis	05.10.2024	28.11.2024	Zone of Station:	Buffer Zone			
Sl. No.	Parameter	Method Analysis	Observed Values (in $\mu\text{g}/\text{m}^3$ )		Range Of Testing	LDL	MoEF Standards Notification dated 25th September, 2000 (GSR 742 E)	NAAQS, 2009		
			1st FN A2776	2nd FN A2857						
1	PM <sub>10</sub>	IS -5182(Part 23):2006, R-2017	93	109	10 $\mu\text{g}/\text{m}^3$ - 1000 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	300	100		
2	PM <sub>2.5</sub>	IS -5182(Part 24):2019	48	61	10 $\mu\text{g}/\text{m}^3$ - 400 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	Not Specified	60		
3	SO <sub>2</sub>	IS-5182(Part-2): 2001, R-2017	<10	<10	10 $\mu\text{g}/\text{m}^3$ - 1050 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	120	80		
4	NO <sub>2</sub>	IS-5182 (Part-6): 2006, R-2017	31	28	06 $\mu\text{g}/\text{m}^3$ - 420 $\mu\text{g}/\text{m}^3$	06 $\mu\text{g}/\text{m}^3$	120	80		
**All units are in $\mu\text{g}/\text{m}^3$ , 24 hourly Average * LDL indicates Lower Detection Limit,										
										
ANALYSED BY		REVIEWED BY		Authorised Signatory						
<b>Note:</b> The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env), CMPDI, RI-II.										
---- End of Report ----										
Page -1 of 1										



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**Ambient Air Quality Test Report**

CMPDIL, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmpdi@coalindia.in

**Test Report for Ambient Air Samples**

<b>Month &amp; Year</b>	10/2024	<b>Cluster</b>	Cluster XIV			<b>ULR No.</b>	TC1012224000001270F	
<b>Customer</b>	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)					<b>Date of Issue</b>	31.12.2024	
<b>Project</b>	Madhuband UGP	<b>Sample Ref. No.</b>	REM/BCCL/2024/10	<b>Sampling Method</b>		CMPDI/RI-II/LPM 11, ( IS 5182)		
<b>Date of Sampling</b>	04.10.2024	18.10.2024	<b>Period of Analysis</b>	04.10.2024	28.11.2024	<b>Zone of Station:</b>	Core Zone	
<b>Sl. No.</b>	<b>Parameter</b>	<b>Method Analysis</b>	<b>Observed Values (in µg/m<sup>3</sup>)</b>		<b>Range Of Testing</b>	<b>LDL</b>	<b>MoEF Standards Notification dated 25th September,2000 (GSR 742 E)</b>	<b>NAAQS, 2009</b>
			<b>1st FN A2767</b>	<b>2nd FN A2850</b>				
1	PM <sub>10</sub>	IS -5182(Part 23):2006, R-2017	93	81	10 µg/m <sup>3</sup> - 1000 µg/m <sup>3</sup>	10 µg/m <sup>3</sup>	300	100
2	PM <sub>2.5</sub>	IS -5182(Part 24):2019	45	38	10 µg/m <sup>3</sup> - 400 µg/m <sup>3</sup>	10 µg/m <sup>3</sup>	Not Specified	60
3	SO <sub>2</sub>	IS-5182(Part-2): 2001, R-2017	10	<10	10 µg/m <sup>3</sup> - 1050 µg/m <sup>3</sup>	10 µg/m <sup>3</sup>	120	80
4	NO <sub>2</sub>	IS-5182 (Part-6): 2006, R-2017	30	23	06 µg/m <sup>3</sup> - 420 µg/m <sup>3</sup>	06 µg/m <sup>3</sup>	120	80

\* LDL indicates Lower Detection Limit,

\*\*All units are in µg/m<sup>3</sup>, 24 hourly Average,

**ANALYSED BY**

(Gaurav Kant)  
**REVIEWED BY**

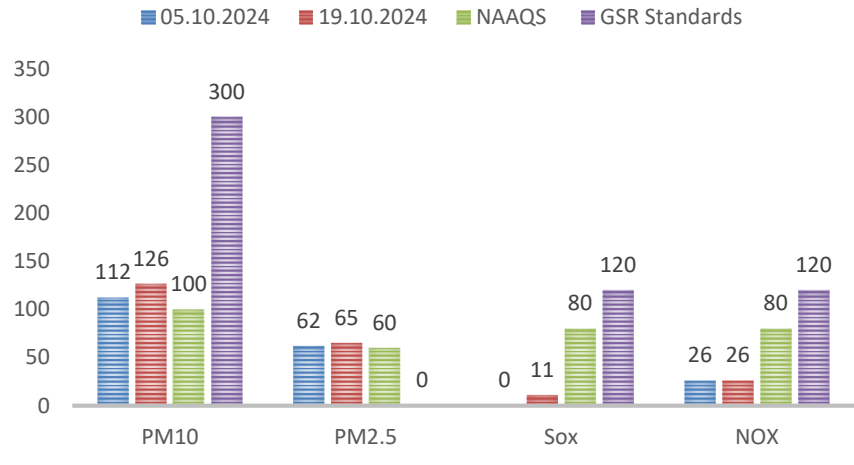
(Amit Raj Mishra)  
**Authorised Signatory**

**Note:** The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

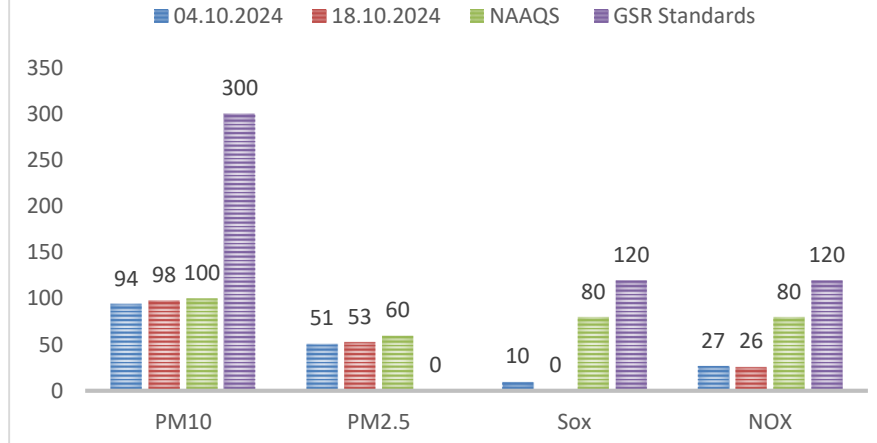
---- End of Report ----

Page -1 of 1

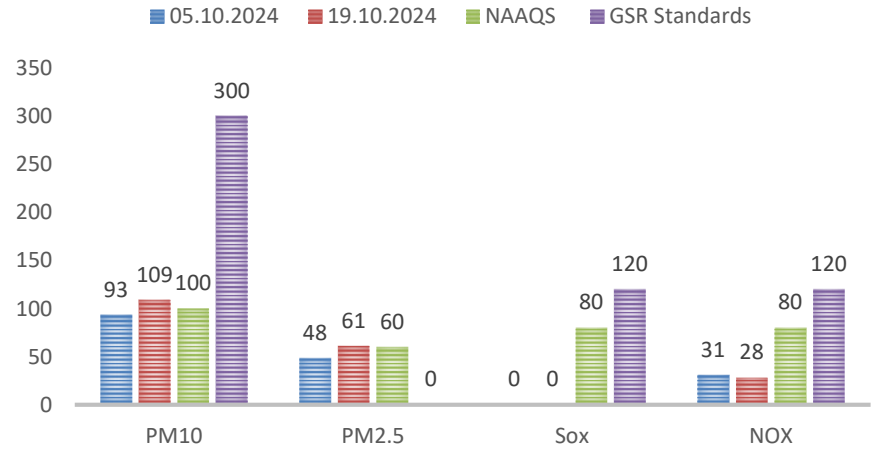
### AMBIENT AIR QUALITY AT LOHAPATTI



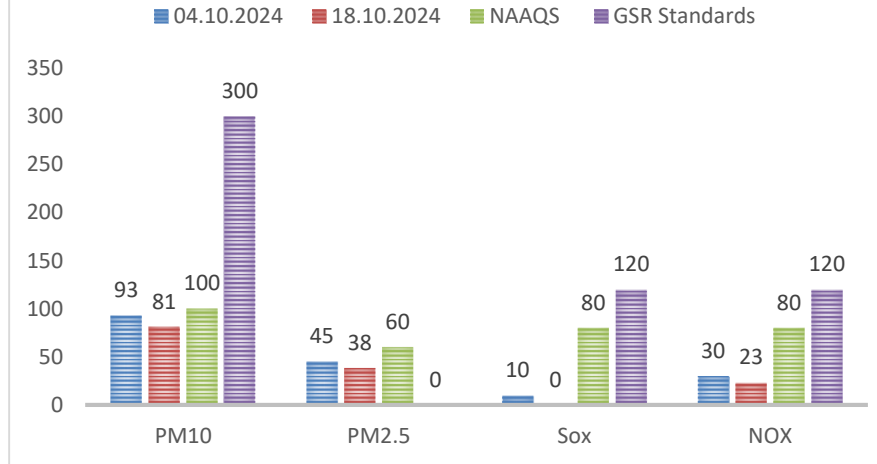
### AMBIENT AIR QUALITY AT KHARKHAREE CISF OFFICE



### AMBIENT AIR QUALITY AT TELMACHHO BRIDGE



### AMBIENT AIR QUALITY AT MADHUBAND UGP OFFICE



## **WATER QUALITY MONITORING**

### **3.1 Location of sampling sites**

(Refer **Plate No. – II**)

#### **i) Mine Discharge of Block II (MW14)**

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

### **3.2 Methodology of sampling and analysis**

Water samples were collected as per standard practice. The effluent samples were collected and analysed 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.



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**MINE EFFLUENT TEST REPORT**

CMPDIL, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmpdi@coalindia.in

**Test Report for Mine Effluent samples**

<b>Month &amp; Year</b>	10/2024	<b>Cluster</b>	Cluster XIV		<b>ULR No.</b>	TC1012224000001287F	
<b>Customer</b>	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)					<b>Date of Issue</b>	31.12.2024
<b>Project</b>		<b>Sampling Ref. No.</b>	REM/BCCL/2024/10		<b>Sampling Method</b>	IS 3025 (Part-1) CMPDI/RI-II/LPM 13	
<b>Sampling Stations</b>	(i)	<b>Block II</b>	Sample Collected in 2.5 Ltr Jerricane , Color as observed is transparent			<b>Period of Analysis</b>	01.10.2024 TO 31.10.2024
			<b>Date of Sampling</b>		01.10.24	21.10.24	
<b>Sl. No.</b>	<b>Parameter</b>	<b>Method of Analysis</b>	<b>Observed Values</b>		<b>STANDARDS FOR COAL MINES</b> (Stipulated by Ministry of Environment and Forests (MoEF), Vide Notification No. GSR 742(E), Dt: 25.09.2000)	<b>LDL</b>	
			<b>First Fortnight M1146</b>	<b>Second Fortnight M1158</b>			
1	Total Suspended Solids	IS 3025/17:1984, R :2017, Gravimetric	44	46	100 (Max)	10	
2	pH	IS-3025/11:1983, R-2017, Electrometric	7.69	7.71	5.5 - 9.0	0.2	
3	Oil & Grease	IS 3025/39:1991, R : 2019, Partition Gravimetric	<4.0	<4.0	34	33	
4	COD	APHA 23rd Edition 5220 C Titrimetric Method	44	40	7.69	7.81	

*\*\*All units in mg/L unless specified otherwise. \*LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,*

*\*\*Grab sampling carried out for water samples.*

**ANALYSED BY**

(Kumar Vaibhav)  
**REVIEWED BY**

(Amit Raj Mishra)  
**Authorised Signatory**

*Note: The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.*

---- End of Report ----

## **NOISE LEVEL QUALITY MONITORING**

### **4.1 Location of sampling sites**

- i) **Lohapatti (N20)**
- ii) **Kharkharee CISF Office (N21)**
- iii) **Telmacho Bridge (N32)**
- iv) **Madhuband UGP (N33)**

**4.2** Noise level measurements in form of 'L<sub>EQ</sub>' were taken using Integrated Data Logging Sound Level Meter during day time & night time. Noise levels were measured for the complete day & night time, the Intergration time taken was one hour or 3600 seconds. 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 & night time and the observed values were compared with standards prescribed by MoEF&CC. The results of Noise levels recorded during day & night time on fortnightly basis are presented in tabular form along with the applicable standard permissible limits. The observed values in terms of L<sub>EQ</sub> are presented. The observed values at all the monitoring locations are found to be within permissible limits.



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**Ambient Noise Level Test Report**

CMPDIL, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmpdi@coalindia.in

Month & Year	10/2024	Cluster	Cluster XIV				ULR No.	TC1012224000001304F	
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)						Date of Issue	31.12.2024	
Project		Sample Ref. No.	REM/BCCL/2024/10			Sampling Method	CMPDI/RI-II/LPM 22		
Sampling Stations	i	Lohapatti		Date of Sampling	05.10.2024	19.10.2024	Zone Category of Station:	CORE Zone	
Sl. No.	Parameter	Hour / Time of day	Observed Values ( in Leq dB(A) )		Method of Analysis	Range Of Testing	LDL	NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 Standards	
			First Fortnight	Second Fortnight				Zones	Limits in dB
1	Noise Level dB(A)Leq - Day	06:00 - 07:00	32.7	33.4	CPCB, Protocol for Ambient Level Noise Monitoring - 2015	35 dB-135 dB	35 Db (A)	Industrial Commercial Residential Silence	75 65 55 50
2		07:00 - 08:00	42.2	41.5					
3		08:00 - 09:00	37.5	42					
4		09:00 - 10:00	35.1	37.2					
5		10:00 - 11:00	37.5	38.8					
6		11:00 - 12:00	36.3	40.9					
7		12:00 - 13:00	37.2	39.6					
8		13:00 - 14:00	38.4	41.1					
9		14:00 - 15:00	37.8	39.1					
10		15:00 - 16:00	40.1	40.4					
11		16:00 - 17:00	40.2	40.3					
12		17:00 - 18:00	40	41.1					
13		18:00 - 19:00	40	40.9					
14		19:00 - 20:00	39.6	39.3					
15		20:00 - 21:00	39.5	39.4					
16		21:00 - 22:00	39.4	39.3					
		<b>Leq Day</b>	<b>38.9</b>	<b>40.0</b>					
1	Noise Level dB(A)Leq -Night	22:00-23:00	41	41	CPCB, Protocol for Ambient Level Noise Monitoring - 2015	35 dB-135 dB	35 dB (A)	Industrial Commercial Residential Silence	70 55 45 50
2		23:00- 00:00	40.9	40.4					
3		00:00- 01:00	40.6	40.5					
4		01:00-02:00	40.3	41.1					
5		02:00-03:00	40.2	40.4					
6		03:00-04:00	40.1	40.2					
7		04:00-05:00	39.7	40.3					
8		05:00-06:00	40.4	40.7					
		<b>Leq Day</b>	<b>40.4</b>	<b>40.6</b>					

\*\*All noise measurements are integrated for a 01 hour period, All units in dB(A) \*LDL indicates Lower Detection Limit

Sampling Assistants

*Gaurav Kant*  
 (Gaurav Kant)  
**REVIEWED BY**

*Amit Raj Mishra*  
 (Amit Raj Mishra)  
**Authorised Signatory**

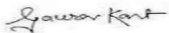

ANALYSED BY

Note: The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----

Month & Year		10/2024	Cluster		Cluster XIV	ULR No.		TC1012224000001304F							
Customer		Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)				Date of Issue		31.12.2024							
Project			Sample Ref. No.		REM/BCCL/2024/10	Sampling Method		CMPDI/RI-II/LPM 22							
Sampling Stations		i	Kharkharee UGP		Date of Sampling		04.10.2024	18.10.2024							
Sl. No.		Parameter		Hour / Time of day		Observed Values (in Leq dB(A))		Method of Analysis		Range Of Testing		Zone Category of Station:		Core Zone	
						First Fortnight		Second Fortnight				LDL		NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 Standards	
												Zones		Limits in dB	
1				06:00 - 07:00		39.3		39.9	CPCB, Protocol for Ambient Level Noise Monitoring -2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	75 65 55 50		
2				07:00 - 08:00		53.1		53							
3				08:00 - 09:00		63.1		63.2							
4				09:00 - 10:00		63		62.8							
5				10:00 - 11:00		59.7		58.7							
6				11:00 - 12:00		57.2		56.8							
7				12:00 - 13:00		55		55.9							
8				13:00 - 14:00		53.5		52.9							
9				14:00 - 15:00		51.5		50.9							
10				15:00 - 16:00		50.1		50.4							
11				16:00 - 17:00		50.4		51							
12				17:00 - 18:00		50.2		50.8							
13				18:00 - 19:00		47.9		47.9							
14				19:00 - 20:00		46.3		46.4							
15				20:00 - 21:00		44.5		44.7							
16				21:00 - 22:00		43.9		44.3							
				<b>Leq Day</b>		<b>56.3</b>		<b>56.2</b>							
1				22:00-23:00		43.6		41.6	CPCB, Protocol for Ambient Level Noise Monitoring -2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	70 55 45 50		
2				23:00-00:00		41		41.5							
3				00:00-01:00		41.1		41.5							
4				01:00-02:00		39.4		40.5							
5				02:00-03:00		39.1		36.1							
6				03:00-04:00		38.6		39.9							
7				04:00-05:00		38.4		37.4							
8				05:00-06:00		37.2		35.2							
				<b>Leq Day</b>		<b>40.2</b>		<b>39.8</b>							

\*\*All noise measurements are integrated for a 01 hour period, All units in dB(A) \*LDL indicates Lower Detection Limit

Sampling Assistants <b>ANALYSED BY</b>	 (Gaurav Kant) <b>REVIEWED BY</b>	 (Amit Raj Mishra) <b>Authorised Signatory</b>
---	---	---

Note: The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----

Page -1 of 1



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**Ambient Noise Level Test Report**

CMPDIL, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmndi@coalindia.in

Month & Year	10/2024	Cluster	Cluster XIV				ULR No.	TC1012224000001304F	
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)						Date of Issue	31.12.2024	
Project		Sample Ref. No.	REM/BCCL/2024/10			Sampling Method	CMPDI/RI-II/LPM 22		
Sampling Stations	i	Telmacho Bridge		Date of Sampling	05.10.2024	19.10.2024	Zone Category of Station:	Buffer Zone	
Sl. No.	Parameter	Hour / Time of day	Observed Values (in Leq dB(A))		Method of Analysis	Range Of Testing	LD L	NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 Standards	
			First Fortnight	Second Fortnight				Zones	Limits in dB
1	Noise Level dB(A)Leq - Day	06:00 - 07:00	37.1	39.7	CPCB, Protocol for Ambient Level Noise Monitoring -2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	75 65 55 50
2		07:00 - 08:00	47.2	47.7					
3		08:00 - 09:00	50.2	47.6					
4		09:00 - 10:00	54.7	55.3					
5		10:00 - 11:00	54	53					
6		11:00 - 12:00	54.9	54.3					
7		12:00 - 13:00	56.3	58.2					
8		13:00 - 14:00	54.7	59.5					
9		14:00 - 15:00	53.1	54.3					
10		15:00 - 16:00	52.3	53.5					
11		16:00 - 17:00	50.1	49					
12		17:00 - 18:00	46.4	46.8					
13		18:00 - 19:00	43.3	47.2					
14		19:00 - 20:00	42	41.1					
15		20:00 - 21:00	39.3	39.4					
16		21:00 - 22:00	38.6	38.3					
		<b>Leq Day</b>	<b>51.6</b>	<b>53.0</b>					
1	Noise Level dB(A)Leq -Night	22:00-23:00	39.2	38.8	CPCB, Protocol for Ambient Level Noise Monitoring -2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	70 55 45 50
2		23:00- 00:00	38.3	38.3					
3		00:00- 01:00	38.2	38.2					
4		01:00-02.00	38.2	39.1					
5		02.00-03.00	39	39.1					
6		03.00-04.00	39.2	39.2					
7		04.00-05.00	39.4	39.4					
8		05:00-06:00	39.5	39.6					
		<b>Leq Day</b>	<b>38.9</b>	<b>39.0</b>					

\*\*All noise measurements are integrated for a 01 hour period, All units in dB(A) \*LDL indicates Lower Detection Limit

Sampling Assistants  
ANALYSED BY

(Gaurav Kant)  
**REVIEWED BY**

(Amit Raj Mishra)  
**Authorised Signatory**

Note: The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----

Page -1 of 1



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**Ambient Noise Level Test Report**

CMPDIL, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmpdi@coalindia.in

Month & Year	10/2024	Cluster	Cluster XIV	ULR No.	TC101222400001304F				
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)				Date of Issue	31.12.2024			
Project		Sample Ref. No.	REM/BCCL/2024/10	Sampling Method	CMPDI/RI-II/LPM 22				
Sampling Stations	i	Madhuband UGP	Date of Sampling	04.10.2024	18.10.2024	Zone Category of Station:	Buffer Zone		
Sl. No.	Parameter	Hour / Time of day	Observed Values (in Leq dB(A))	Observed Values (in Leq dB(A))	Method of Analysis	Range Of Testing	LDL	NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 Standards	
			First Fortnight	Second Fortnight				Zones	Limits in dB
1	Noise Level dB(A)Leq - Day	06:00 - 07:00	36.8	37.3	CPCB, Protocol for Ambient Level Noise Monitoring - 2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	75 65 55 50
2		07:00 - 08:00	39.4	38.6					
3		08:00 - 09:00	42.3	42.7					
4		09:00 - 10:00	43.4	43.2					
5		10:00 - 11:00	43.2	43.3					
6		11:00 - 12:00	42.9	42.7					
7		12:00 - 13:00	43.8	43.5					
8		13:00 - 14:00	46.8	50					
9		14:00 - 15:00	47.9	47.9					
10		15:00 - 16:00	48.3	45.4					
11		16:00 - 17:00	42	42.1					
12		17:00 - 18:00	41	40.9					
13		18:00 - 19:00	40.4	40.3					
14		19:00 - 20:00	40.3	39.9					
15		20:00 - 21:00	40.1	39.6					
16		21:00 - 22:00	39.1	39.3					
		<b>Leq Day</b>	<b>43.6</b>	<b>43.7</b>					
1	Noise Level dB(A)Leq - Night	22:00-23:00	40.3	40.7	CPCB, Protocol for Ambient Level Noise Monitoring - 2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	70 55 45 50
2		23:00- 00:00	40.2	40.8					
3		00:00- 01:00	40.1	40.2					
4		01:00-02:00	39.4	39.8					
5		02:00-03:00	39.1	39.6					
6		03:00-04:00	40.4	40.7					
7		04:00-05:00	40.7	40.9					
8		05:00-06:00	41	40.8					
		<b>Leq Day</b>	<b>40.2</b>	<b>40.5</b>					

\*\*All noise measurements are integrated for a 01 hour period, All units in dB(A) \*LDL indicates Lower Detection Limit

Sampling Assistants  
 ANALYSED BY

*Gaurav Kant*  
 (Gaurav Kant)  
 REVIEWED BY

*Amit Raj Mishra*  
 (Amit Raj Mishra)  
 Authorised Signatory

Note: The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----

Page -1 of 1



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

Category	Pollutant	Time weighted average	Concentration in Ambient Air	Method of Measurement
1	2	3	4	5
<b>III</b> Coal mines located in the coal fields of <ul style="list-style-type: none"> <li>• Jharia</li> <li>• Raniganj</li> <li>• Bokaro</li> </ul>	Suspended Particulate Matter (SPM)	Annual Average * 24 hours **	500 $\mu\text{g}/\text{m}^3$  700 $\mu\text{g}/\text{m}^3$	- High Volume Sampling (Average flow rate not less than 1.1)
	Respirable Particulate Matter (size less than 10 $\mu\text{m}$ ) (RPM)	Annual Average * 24 hours **	250 $\mu\text{g}/\text{m}^3$  300 $\mu\text{g}/\text{m}^3$	Respirable Particulate Matter sampling and analysis
	Sulphur Dioxide ( $\text{SO}_2$ )	Annual Average * 24 hours **	80 $\mu\text{g}/\text{m}^3$  120 $\mu\text{g}/\text{m}^3$	1.Improvedwest and Gaeke method 2.Ultraviolet fluorescene
	Oxide of Nitrogen as $\text{NO}_2$	Annual Average * 24 hours **	80 $\mu\text{g}/\text{m}^3$  120 $\mu\text{g}/\text{m}^3$	1. Jacob & Hochheiser Modified (Na-Arsenic) Method 2. Gas phase Chemiluminescence

**Note:**

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

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

## NATIONAL AMBIENT AIR QUALITY STANDARDS

New Delhi the 18<sup>th</sup> November 2009

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

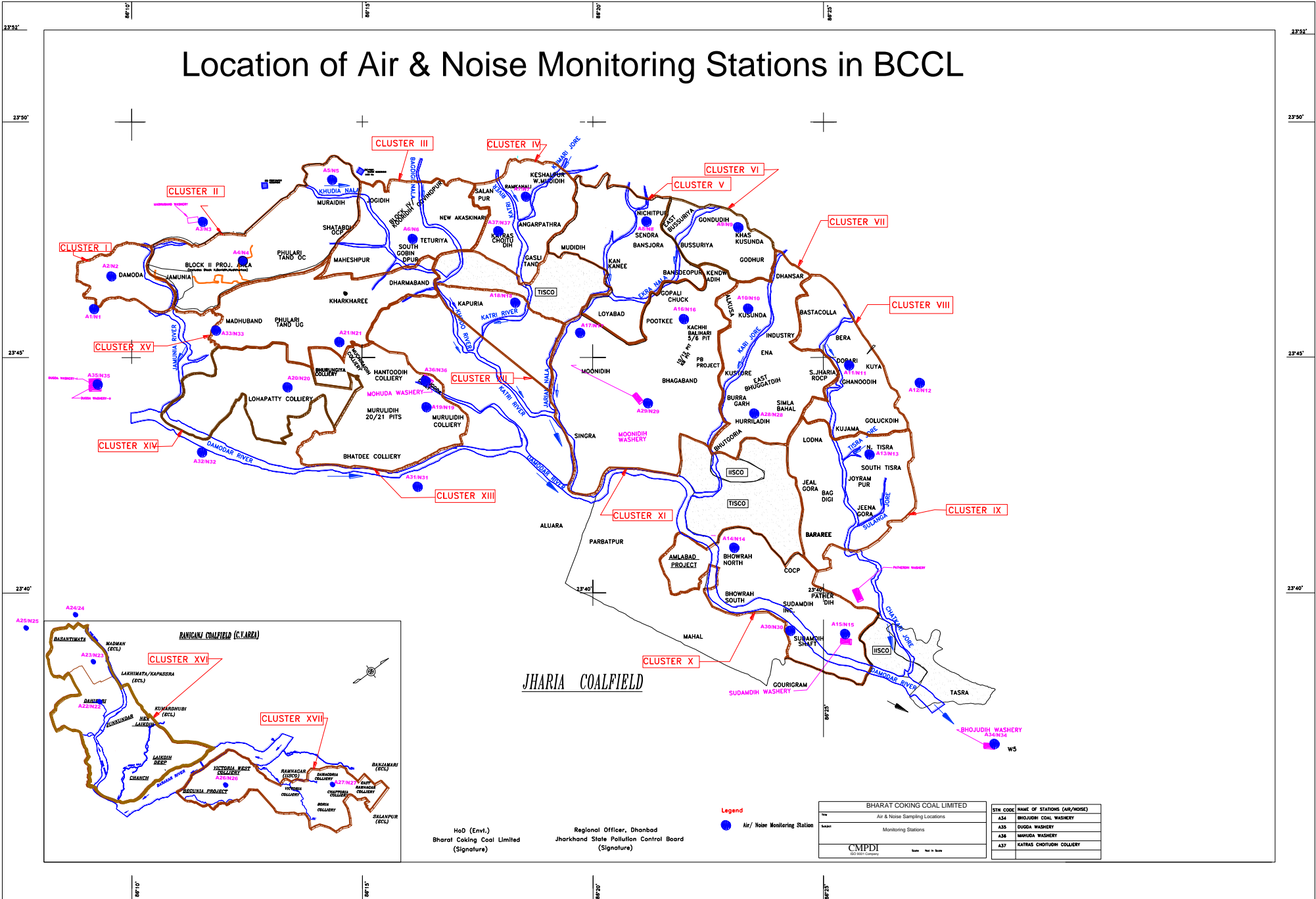
Pollutant	Time Weighted Average	Concentration in Ambient Air		Methods of Measurement
		Industrial, Residential, Rural and other Areas	Ecologically Sensitive Area (Notified by Central Government)	
<b>Sulphur Dioxide (SO<sub>2</sub>), µg/m<sup>3</sup></b>	Annual * 24 Hours **	50 80	20 80	-Improved West and Gaeke Method -Ultraviolet Fluorescence
<b>Nitrogen dioxide (NO<sub>2</sub>), µg/m<sup>3</sup></b>	Annual * 24 Hours **	40 80	30 80	-Jacob & Hochheiser modified (NaOH-NaAsO <sub>2</sub> ) Method -Gas Phase Chemiluminescence
<b>Particulate Matter (Size less than 10µm) or PM<sub>10</sub>, µg/m<sup>3</sup></b>	Annual * 24 Hours **	60 100	60 100	-Gravimetric -TEOM -Beta attenuation
<b>Particulate Matter (Size less than 2.5µm) or PM<sub>2.5</sub>, µg/m<sup>3</sup></b>	Annual * 24 Hours **	40 60	40 60	-Gravimetric -TEOM -Beta attenuation
<b>Ozone (O<sub>3</sub>), µg/m<sup>3</sup></b>	8 Hours * 1 Hour **	100 180	100 180	-UV Photometric -Chemiluminescence -Chemical Method
<b>Lead (Pb), µg/m<sup>3</sup></b>	Annual * 24 Hours **	0.50 1.0	0.50 1.0	-AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper -ED-XRF using Teflon filter
<b>Carbon Monoxide (CO), mg/m<sup>3</sup></b>	8 Hours ** 1 Hour **	02 04	02 04	-Non dispersive Infrared (NDIR) Spectroscopy
<b>Ammonia (NH<sub>3</sub>), µg/m<sup>3</sup></b>	Annual * 24 Hours **	100 400	100 400	-Chemiluminescence -Indophenol blue method
<b>Benzene (C<sub>6</sub>H<sub>6</sub>), µg/m<sup>3</sup></b>	Annual *	05	05	-Gas Chromatography (GC) based continuous analyzer -Adsorption and desorption followed by GC analysis
<b>Benzo(a)Pyrene (BaP) Particulate phase only, ng/m<sup>3</sup></b>	Annual *	01	01	-Solvent extraction followed by HPLC/GC analysis
<b>Arsenic (As), ng/m<sup>3</sup></b>	Annual *	06	06	-AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper
<b>Nickel (Ni), ng/m<sup>3</sup></b>	Annual *	20	20	-AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper

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

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

**NOTE:** Whenever and wherever monitoring results on two consecutive days of monitoring exceed the limits specified above for the respective category

# Location of Air & Noise Monitoring Stations in BCCL



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

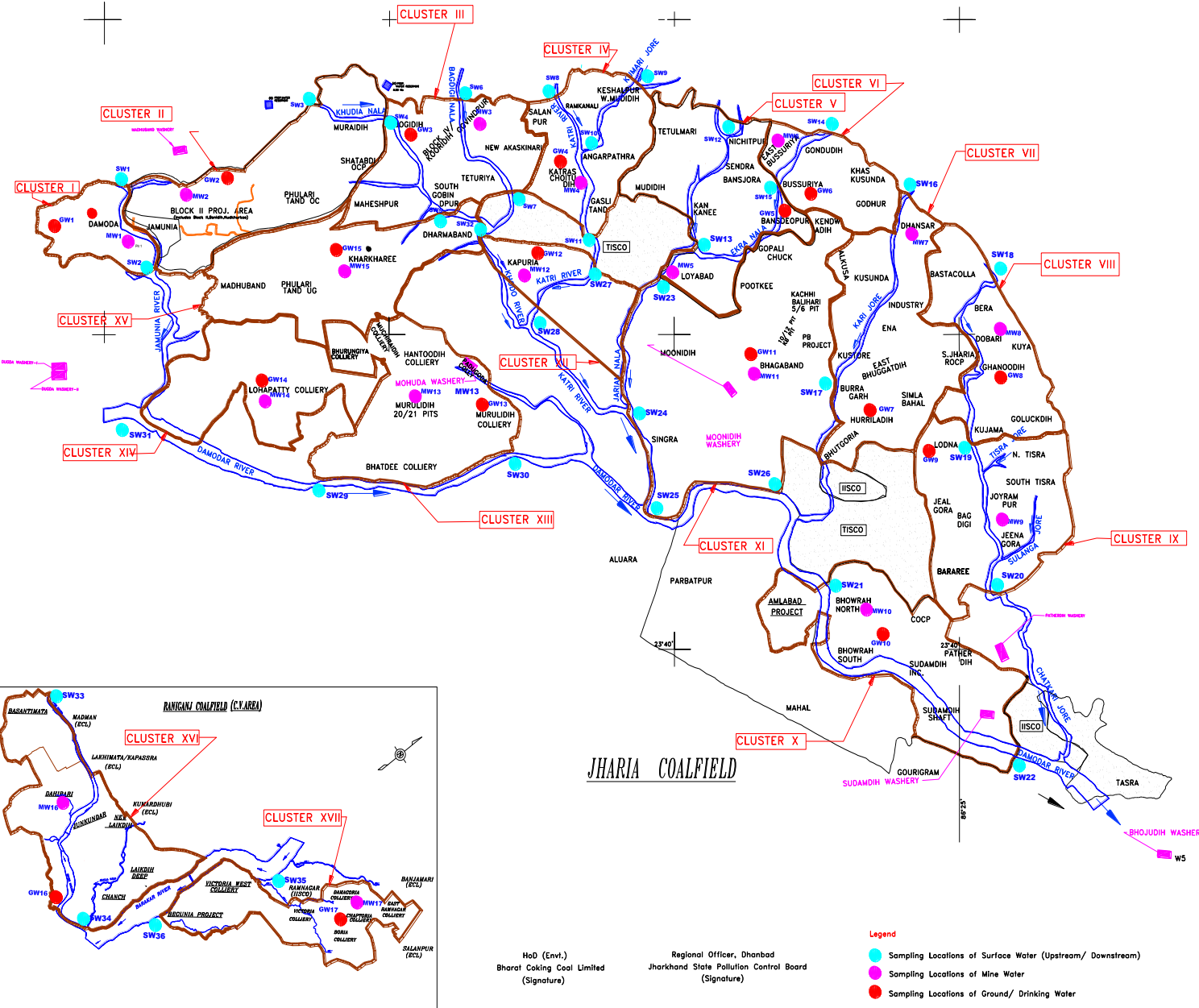
Regional Officer, Dhanbad  
Jharkhand State Pollution Control Board  
(Signature)

Legend  
● Air / Noise Monitoring Station

BHARAT COKING COAL LIMITED	
For	Air & Noise Sampling Locations
Scale	Monitoring Stations
CMPDI Coal Monitoring & Pollution Data Institute	
Date	Not to Scale

STN CODE	NAME OF STATIONS (AIR/NOISE)
A34	BHOJUDIH COAL WASHERY
A35	DUGGA WASHERY
A36	MARUDA WASHERY
A37	KATRAS CHOTUDIH COLLIERY

# Water Sampling Locations in BCCL



### INDEX

Cluster	Surface Water (US, DS)	Name of River/ Nala/ Effluent Water	Mineral Effluent Location	Sampling Location	Ground Water	Sampling Location
I	SW1, SW2	Jamunia River	MW1	Damoda Area	GW1	Chutway Village
II	SW3, SW4	Khudia Nala	MW2	Block II OCP	GW2	Joyrampur Village
III	SW4, SW5, SW6, SW7	Khudia Nala, Bagdigi Nala	MW3	Govindpur Colliery	GW3	Jogdih Village
IV	SW8, SW11, SW9, SW10	Katri River, Kuman Jore	MW4	Chotudih	GW4	Kankaneh Village
V	SW12, SW13, SW15	Jarian Nala, Ekra Nala	MW5	Mudidih	GW5	Nichitpur
VI	SW14, SW15	Ekra Nala	MW6	East Bassuria UGP	GW6	Bansara Borewell
VII	SW16, SW17	Kan Jore	MW7	Bansara UGP	GW7	Hurmidih
VIII	SW18, SW19	Kashi Jore	MW8	Doban UGP	GW8	Qharudih
IX	SW19, SW20	Kashi Jore	MW9	Jeenagora	GW9	Lodna
X	SW21, SW22	Damodar River	MW10	Bhowrah North	GW10	Bhowrah South
XI	SW23, SW24, SW25, SW26	Jarian Nala, Damodar River	MW11	Bhagband UGP	GW11	Bhagband
XII	SW27, SW28	Kan River	MW12	Kapura	GW12	Kapura
XIII	SW29, SW30	Damodar River	MW13	Muridih	GW13	Muridih
XIV	SW31, SW32	Damodar River	MW14	Lohapatti	GW14	Lohapatti
XV	SW5, SW32	Khudih Nala	MW15	Kharkhaneh UGP	GW15	Kharkhaneh
XVI	SW33, SW34	Khudia River	MW16	Bahaban OCP	GW16	Pallabani Village
XVII	SW35, SW36	Barakar River	MW17	Bamagoria Colliery	GW17	Chaptora

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

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

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

**STRICTLY RESTRICTED**  
**FOR COMPANY USE ONLY RESTRICTED**

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

**ENVIRONMENTAL MONITORING REPORT  
OF  
BHARAT COKING COAL LIMITED,  
CLUSTER – XIV**

**(FOR THE MONTH NOVEMBER, 2024)**

**E. C. no. J-11015/10/2010-IA.II (M) dated 06.06.2013.**



**CMPDI**

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

# CONTENTS

<b>SL. NO.</b>	<b>CHAPTER</b>	<b>PARTICULARS</b>	<b>PAGE NO.</b>
1.	CHAPTER - I	EXECUTIVE SUMMARY	3-5
2.	CHAPTER-II	INTRODUCTION	6
3.	CHAPTER-III	RESULTS	7-19
4.	CHAPTER-IV	STANDARDS AND PLANS	20-21

## **EXECUTIVE SUMMARY**

### **1.0 Introduction**

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

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

### **2.0 Sampling location and rationale**

#### **2.1 Ambient air sampling locations**

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

#### **2.2 Water sampling stations**

The Water sampling stations were selected for mine sump water.

#### **2.3 Noise level monitoring locations**

Noise levels vary depending on the various activities in mining areas. The monitoring of noise level in different locations will be helpful to take appropriate mitigating measures. The noise levels were recorded in mining areas, washeryareas and in residential areas.

### **3.0 Methodology of sampling and analysis**

#### **3.1 Ambient air quality**

Parameters chosen for assessment of ambient air quality were Particulate Matter (PM<sub>10</sub>), Fine Particulate Matter (PM<sub>2.5</sub>), Sulphur Di-oxide (SO<sub>2</sub>) and Nitrogen Oxides (NO<sub>x</sub>). Respirable Dust Samplers (RDS) and Fine Dust

Sampler (PM<sub>2.5</sub> sampler) were used for sampling of PM<sub>10</sub>, SO<sub>2</sub>, & NO<sub>x</sub> and Fine Dust Sampler (PM<sub>2.5</sub> sampler) were used for sampling of PM<sub>2.5</sub> at 24 hours interval once in a fortnight and the same for the gaseous pollutants. The samples were analyzed in Environmental Laboratory of CMPDI, RI-II, Dhanbad.

### **3.2 Water quality**

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

### **3.3 Noise level monitoring**

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

## **4.0 Results and interpretations**

### **4.1 Air quality**

It has been seen from the analysis results that the 24 hours average concentration parameters like PM<sub>10</sub>, PM<sub>2.5</sub>, SO<sub>2</sub> and NO<sub>x</sub> are mostly within the permissible limits in all sampling locations as per MoEF&CC Gazette Notification No. GSR 742(E) dt 25.09.2000 Standards for Coal Mines and National Ambient Air Quality Standard -2009. Sometimes the concentration of PM<sub>10</sub>& PM<sub>2.5</sub> exceeds the limits due to heavy public traffic, poor road condition, coke oven plants, burning of coal by surrounding habitants, brick making, municipal waste dumps and industries like Steel Plant, thermal Plants including their fly ash etc.

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

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

#### **4.2 Water quality**

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

#### **4.3 Noise Level**

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

## INTRODUCTION

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

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-XIV is in the Western part of the Jharia coalfield and situated in the Western Jharia area of BCCL. It includes 1 Mine (viz. Lohapatti (UG & OC). The Cluster – XIV is situated about 25 - 30 kms from Dhanbad Railway Station. The mines of this Cluster – XIV 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 Damodar River.
- 1.2 The Cluster-XIV is designed to produce 0.405 MTPA (normative) and 0.526 MTPA (peak) capacity of coal.

The Project has Environmental Clearance from Ministry of Environment, Forest and Climate Change (MoEF&CC) for a rated capacity 0.405 MTPA (normative) and 0.526 MTPA (peak) capacity of coal production vide letter no. J-11015/10/2010-IA.II (M) dated 06<sup>th</sup> June, 2013.

Ministry of Environment, Forest and Climate Change while granting environmental clearance has given one of the General conditions that “ Four ambient air quality monitoring stations should be established in the core zone as well as in the buffer zone for PM<sub>10</sub>, PM<sub>2.5</sub>, SO<sub>2</sub>, NO<sub>x</sub> monitoring. Location of the stations should be decided based on the meteorological data, topographical features and environmentally and ecologically sensitive targets in consultation with the State Pollution Control Board.” And other conditions regarding water / effluent and noise level monitoring.

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

## AMBIENT AIR QUALITY MONITORING

### 2.1 Location of sampling station and their rationale:

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

#### 2.1.1 Ambient Air Quality Sampling Locations

##### I. CORE ZONE Monitoring Location

###### i) Lohapatti (A20): Industrial Area

The location of the sampling station is 23° 44' 29.42" N & 86° 12' 49.96" E. The sampler was placed at a height of approx. 1.5m above ground level at Project Office.

##### II. BUFFER ZONE Monitoring Location

###### i) Kharkharee CISF Office (A21): Industrial Area

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 Safety Office.

###### ii) Telmachho Bridge (A32): Industrial Area

The location of the sampling station is 23° 44' 14.90" N & 86° 12' 21.20" E. The location was selected for studying the impact of the mining activity on the Telmachho Bridge area as it lies in the buffer zone for the Cluster XIV.

###### iii) Madhuband UGP Office (A33): Industrial Area

The location of the sampling station is 23° 45'24.48" N & 86°11'59.44"E. The sampler was placed at a height of approx. 1.5m above ground level at Safety Office.

## AMBIENT AIR QUALITY DATA

 TC-14321	 <i>cmpdi</i> A Mini Ratna Company	<b style="color: red;">CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED</b> <b style="color: green;">Environment Laboratory, Regional Institute-II</b> <b style="color: red;">Ambient Air Quality Test Report</b>	CMPDIL, RI-II KOYLA BHAWAN COMPLEX DHANBAD. -826005 Phone:0326-223-850 email: rdri2cmpdi@coalindia.in
---	---	---	---

### Test Report for Ambient Air Samples

Month & Year	11/2024	Cluster	Cluster XIV			ULR No.	TC1012224000001322F	
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)					Date of Issue	16.01.2025	
Project	Lohapatti	Sample Ref. No.	REM/BCCL/2024/11	Sampling Method		CMPDI/RI-II/LPM 11 , ( IS 5182)		
Date of Sampling	07.11.2024	22.11.2024	Period of Analysis	07.11.2024	26.12.2024	Zone of Station:	Buffer Zone	
Sl. No.	Parameter	Method Analysis of	Observed Values ( in $\mu\text{g}/\text{m}^3$ )		Range Of Testing	LDL	MoEF Standards Notification dated 25th September,2000 (GSR 742 E )	NAAQS, 2009
			1st FN A2942	2nd FN A3008				
1	PM <sub>10</sub>	IS -5182(Part 23):2006, R-2017	124	97	10 $\mu\text{g}/\text{m}^3$ - 1000 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	300	100
2	PM <sub>2.5</sub>	IS -5182(Part 24):2019	65	52	10 $\mu\text{g}/\text{m}^3$ - 400 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	Not Specified	60
3	SO <sub>2</sub>	IS-5182(Part-2): 2001 , R-2017	10	10	10 $\mu\text{g}/\text{m}^3$ - 1050 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	120	80
4	NO <sub>2</sub>	IS-5182 (Part-6): 2006 , R-2017	27	25	06 $\mu\text{g}/\text{m}^3$ - 420 $\mu\text{g}/\text{m}^3$	06 $\mu\text{g}/\text{m}^3$	120	80

\* LDL indicates Lower Detection Limit,

\*\*All units are in  $\mu\text{g}/\text{m}^3$ , 24 hourly Average,

 <b>ANALYSED BY</b>	 (Gaurav Kant) <b>REVIEWED BY</b>	 (Amit Raj Mishra) <b>Authorised Signatory</b>
---	--	---

**Note:** The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----

Page -1 of 1



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**Ambient Air Quality Test Report**

CMPDI, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD - 826005  
 Phone:0326-223-850  
 email: rdri2cmpdi@coalindia.in

**Test Report for Ambient Air Samples**

<b>Month &amp; Year</b>		11/2024	<b>Cluster</b>	Cluste XIV			<b>ULR No.</b>	TC1012224000001322F	
<b>Customer</b>		Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)					<b>Date of Issue</b>	16.01.2025	
<b>Project</b>		Kharkharee		<b>Sample Ref. No.</b>	REM/BCCL/2024/11	<b>Sampling Method</b>		CMPDI/RI-II/LPM 11, ( IS 5182)	
<b>Date of Sampling</b>		05.11.2024		22.11.2024	<b>Period of Analysis</b>	05.11.2024	26.12.2024	<b>Zone of Station:</b>	Core Zone
<b>Sl. No.</b>	<b>Parameter</b>	<b>Method Analysis</b>	<b>Observed Values (in µg/m<sup>3</sup>)</b>		<b>Range Of Testing</b>	<b>LDL</b>	<b>MoEF Standards Notification dated 25th September,2000 (GSR 742 E )</b>	<b>NAAQS, 2009</b>	
			<b>1st FN A2929</b>	<b>2nd FN A3006</b>					
1	PM <sub>10</sub>	IS -5182(Part 23):2006, R-2017	92	94	10 µg/m <sup>3</sup> - 1000 µg/m <sup>3</sup>	10 µg/m <sup>3</sup>	300	100	
2	PM <sub>2.5</sub>	IS -5182(Part 24):2019	51	52	10 µg/m <sup>3</sup> - 400 µg/m <sup>3</sup>	10 µg/m <sup>3</sup>	Not Specified	60	
3	SO <sub>2</sub>	IS-5182(Part-2): 2001, R-2017	10	<10	10 µg/m <sup>3</sup> - 1050 µg/m <sup>3</sup>	10 µg/m <sup>3</sup>	120	80	
4	NO <sub>2</sub>	IS-5182 (Part-6): 2006, R-2017	28	26	06 µg/m <sup>3</sup> - 420 µg/m <sup>3</sup>	06 µg/m <sup>3</sup>	120	80	

\* LDL indicates Lower Detection Limit,

\*\*All units are in µg/m<sup>3</sup>, 24 hourly Average,

*[Signature]*

**ANALYSED BY**

*[Signature]*

(Gaurav Kant)  
**REVIEWED BY**







*[Signature]*

(Amit Raj Mishra)  
**Authorised Signatory**

**Note:** The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env), CMPDI, RI-II.

---- End of Report ----

Page -1 of 1

CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED										
Environment Laboratory, Regional Institute-II										
Ambient Air Quality Test Report										
								CMPDIL, RI-II KOYLA BHAWAN COMPLEX DHANBAD. -826005 Phone:0326-223-850 email: rdri2cmpdi@coalindia.in		
<b>Test Report for Ambient Air Samples</b>										
Month & Year	11/2024	Cluster	CLUSTER XIV				ULR No.	TC1012224000001322F		
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)					Date of Issue	16.01.2025			
Project	Telmacho Bridge	Sample Ref. No.	REM/BCCL/2024/11		Sampling Method		CMPDI/RI-II/LPM 11, ( IS 5182)			
Date of Sampling	11.11.2024	29.11.2024	Period of Analysis	11.11.2024	26.12.2024	Zone of Station:	Buffer Zone			
Sl. No.	Parameter	Method Analysis	Observed Values (in $\mu\text{g}/\text{m}^3$ )		Range Of Testing	LDL	MoEF Standards Notification dated 25th September,2000 (GSR 742 E)	NAAQS, 2009		
			1st FN A2960	2nd FN A3056						
1	PM <sub>10</sub>	IS -5182(Part 23):2006, R-2017	97	118	10 $\mu\text{g}/\text{m}^3$ - 1000 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	300	100		
2	PM <sub>2.5</sub>	IS -5182(Part 24):2019	52	65	10 $\mu\text{g}/\text{m}^3$ - 400 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	Not Specified	60		
3	SO <sub>2</sub>	IS-5182(Part-2): 2001, R-2017	<10	<10	10 $\mu\text{g}/\text{m}^3$ - 1050 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	120	80		
4	NO <sub>2</sub>	IS-5182 (Part-6): 2006, R-2017	22	29	06 $\mu\text{g}/\text{m}^3$ - 420 $\mu\text{g}/\text{m}^3$	06 $\mu\text{g}/\text{m}^3$	120	80		
<b>**All units are in <math>\mu\text{g}/\text{m}^3</math>, 24 hourly Average * LDL indicates Lower Detection Limit,</b>										
 <b>ANALYSED BY</b>			 <b>REVIEWED BY</b>			 <b>Authorised Signatory</b>				
<b>Note:</b> The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env), CMPDI, RI-II.										
---- End of Report ----										
Page -1 of 1										



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**Ambient Air Quality Test Report**

CMPDIL, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmpdi@coalindia.in

**Test Report for Ambient Air Samples**

<b>Month &amp; Year</b>	11/2024	<b>Cluster</b>	Cluster XIV			<b>ULR No.</b>	TC1012224000001322F	
<b>Customer</b>	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)					<b>Date of Issue</b>	16.01.2025	
<b>Project</b>	Madhuband UGP	<b>Sample Ref. No.</b>	REM/BCCL/2024/11	<b>Sampling Method</b>		CMPDI/RI-II/LPM 11, ( IS 5182)		
<b>Date of Sampling</b>	08.11.2024		<b>Period of Analysis</b>	08.11.2024	26.12.2024	<b>Zone of Station:</b>	Core Zone	
<b>Sl. No.</b>	<b>Parameter</b>	<b>Method Analysis</b>	<b>Observed Values (in <math>\mu\text{g}/\text{m}^3</math>)</b>		<b>Range Of Testing</b>	<b>LDL</b>	<b>MoEF Standards Notification dated 25th September, 2000 (GSR 742 E)</b>	<b>NAAQS, 2009</b>
			<b>1st FN A2948</b>	<b>2nd FN A3062</b>				
1	PM <sub>10</sub>	IS -5182(Part 23):2006, R-2017	94	88	10 $\mu\text{g}/\text{m}^3$ - 1000 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	300	100
2	PM <sub>2.5</sub>	IS -5182(Part 24):2019	51	48	10 $\mu\text{g}/\text{m}^3$ - 400 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	Not Specified	60
3	SO <sub>2</sub>	IS-5182(Part-2): 2001, R-2017	<10	<10	10 $\mu\text{g}/\text{m}^3$ - 1050 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	120	80
4	NO <sub>2</sub>	IS-5182 (Part-6): 2006, R-2017	31	24	06 $\mu\text{g}/\text{m}^3$ - 420 $\mu\text{g}/\text{m}^3$	06 $\mu\text{g}/\text{m}^3$	120	80

\* LDL indicates Lower Detection Limit,

\*\*All units are in  $\mu\text{g}/\text{m}^3$ , 24 hourly Average,

*(Signature)*

**ANALYSED BY**

*(Signature)*

(Gaurav Kant)

**REVIEWED BY**

*(Signature)*

(Amit Raj Mishra)

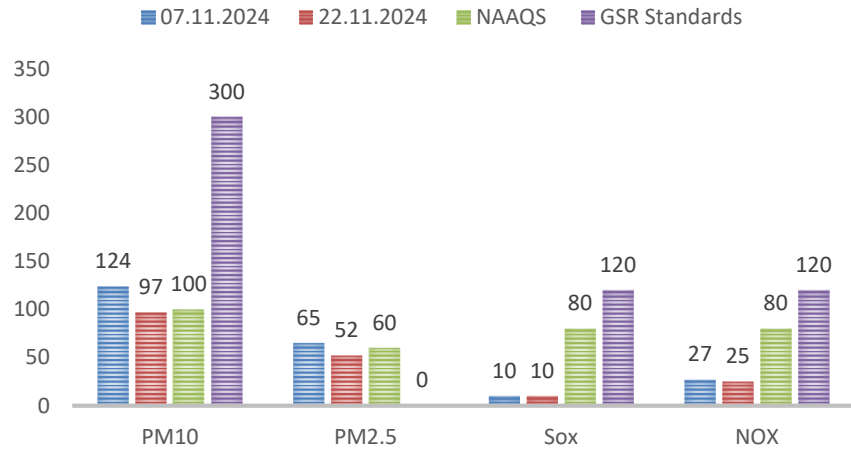
**Authorised Signatory**

**Note:** The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env), CMPDI, RI-II.

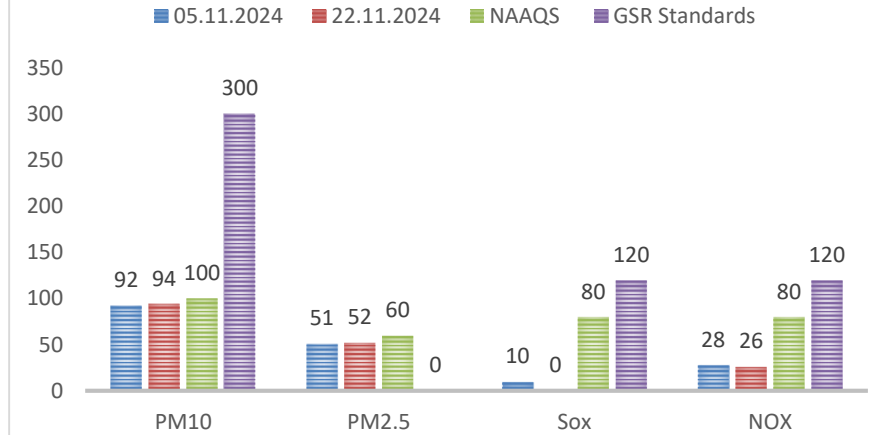
---- End of Report ----

Page -1 of 1

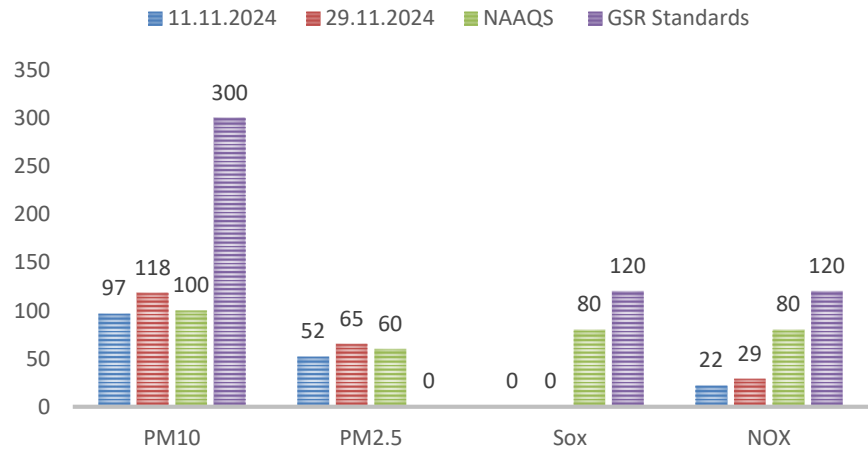
### AMBIENT AIR QUALITY AT LOHAPATTI



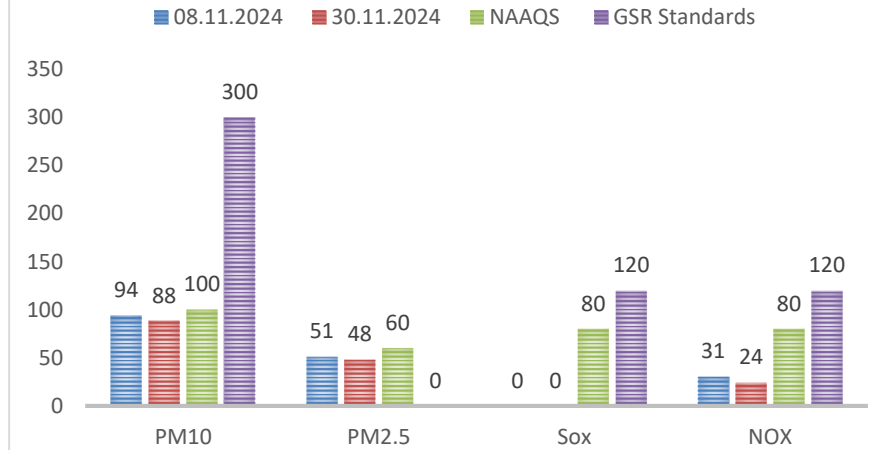
### AMBIENT AIR QUALITY AT KHARKHAREE CISF OFFICE



### AMBIENT AIR QUALITY AT TELMACHHO BRIDGE



### AMBIENT AIR QUALITY AT MADHUBAND UGP OFFICE



## **WATER QUALITY MONITORING**

### **3.1 Location of sampling sites**

(Refer **Plate No. – II**)

#### **i) Mine Discharge of Block II (MW14)**

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

### **3.2 Methodology of sampling and analysis**

Water samples were collected as per standard practice. The effluent samples were collected and analysed 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.



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**MINE EFFLUENT TEST REPORT**

CMPDIL, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmpdi@coalindia.in

**Test Report for Mine Effluent samples**

<b>Month &amp; Year</b>	11/2024	<b>Cluster</b>	Cluster XIV		<b>ULR No.</b>	TC1012224000001339F		
<b>Customer</b>	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)					<b>Date of Issue</b>	16.01.2025	
<b>Project</b>		<b>Sampling Ref. No.</b>	REM/BCCL/2024/11		<b>Sampling Method</b>	IS 3025 (Part-1) CMPDI/RI-II/LPM 13		
<b>Sampling Stations</b>	(i)	<b>Block II</b>	Sample Collected in 2.5 Ltr Jerricane , Color as observed is transparent			<b>Period of Analysis</b>	05.08.2024 to 31.08.2024	
			<b>Date of Sampling</b>		11.11.24	25.11.24		
<b>Sl. No.</b>	<b>Parameter</b>	<b>Method of Analysis</b>	<b>Observed Values</b>		<b>STANDARDS FOR COAL MINES</b> (Stipulated by Ministry of Environment and Forests (MoEF), Vide Notification No. GSR 742(E), Dt: 25.09.2000)	<b>LDL</b>		
			<b>First Fortnight</b>	<b>Second Fortnight</b>				
			M1203	M1229				
1	Total Suspended Solids	IS 3025/17:1984, R :2017, Gravimetric	46	47			100 (Max)	10
2	pH	IS-3025/11:1983, R-2017, Electrometric	8.01	8.04			5.5 - 9.0	0.2
3	Oil & Grease	IS 3025/39:1991, R : 2019, Partition Gravimetric	<2.0	<2.0	34	33		
4	COD	APHA 23rd Edition 5220 C Titrimetric Method	36	32	7.69	7.81		

\*\*All units in mg/L unless specified otherwise. \*LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,

\*\*Grab sampling carried out for water samples.

**ANALYSED BY**

(Kumar Vaibhav)  
**REVIEWED BY**

(Amit Raj Mishra)  
**Authorised Signatory**

Note: The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----

## **NOISE LEVEL QUALITY MONITORING**

### **4.1 Location of sampling sites**

- i) **Lohapatti (N20)**
- ii) **Kharkharee CISF Office (N21)**
- iii) **Telmacho Bridge (N32)**
- iv) **Madhuband UGP (N33)**

**4.2** Noise level measurements in form of 'L<sub>EQ</sub>' were taken using Integrated Data Logging Sound Level Meter during day time & night time. Noise levels were measured for the complete day & night time, the Intergration time taken was one hour or 3600 seconds. 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 & night time and the observed values were compared with standards prescribed by MoEF&CC. The results of Noise levels recorded during day & night time on fortnightly basis are presented in tabular form along with the applicable standard permissible limits. The observed values in terms of L<sub>EQ</sub> are presented. The observed values at all the monitoring locations are found to be within permissible limits.



TC-14321



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**Ambient Noise Level Test Report**

CMPDIL, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmpdi@coalindia.in

Month & Year	11/2024	Cluster	Cluster XIV				ULR No.	TC1012224000001356F	
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)					Date of Issue	16.01.2025		
Project		Sample Ref. No.	REM/BCCL/2024/11			Sampling Method	CMPDI/RI-II/LPM 22		
Sampling Stations	i	Lohapatti		Date of Sampling	07.11.2024	22.11.2024	Zone Category of Station:	CORE Zone	
Sl. No.	Parameter	Hour / Time of day	Observed Values (in Leq dB(A)) First Fortnight	Observed Values (in Leq dB(A)) Second Fortnight	Method of Analysis	Range Of Testing	LDL	NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 Standards Zones Limits in dB	
1	Noise Level dB(A)Leq - Day	06:00 - 07:00	44.9	44.5	CPCB, Protocol for Ambient Level Noise Monitoring - 2015	35 dB-135 dB	35 Db (A)	Industrial Commercial 1 Residential Silence	75 65 55 50
2		07:00 - 08:00	44.3	45					
3		08:00 - 09:00	47.2	48.5					
4		09:00 - 10:00	50.3	50					
5		10:00 - 11:00	51.7	50.7					
6		11:00 - 12:00	51.1	55.4					
7		12:00 - 13:00	60.9	59.7					
8		13:00 - 14:00	58.6	59.1					
9		14:00 - 15:00	61.1	62					
10		15:00 - 16:00	45.2	45.6					
11		16:00 - 17:00	69.5	69.6					
12		17:00 - 18:00	48.3	57.5					
13		18:00 - 19:00	45.6	46.3					
14		19:00 - 20:00	44.6	44.3					
15		20:00 - 21:00	44.9	43.9					
16		21:00 - 22:00	44.7	44.1					
		<b>Leq Day</b>	59.1	59.4					
1	Noise Level dB(A)Leq -Night	22:00-23:00	42.4	42.6	CPCB, Protocol for Ambient Level Noise Monitoring - 2015	35 dB-135 dB	35 dB (A)	Industrial Comm ercial Residenti al Silence	70 55 45 50
2		23:00-00:00	42.1	42.1					
3		00:00- 01:00	40.9	40.8					
4		01:00-02:00	40.6	41.4					
5		02:00-03:00	40.5	40.7					
6		03:00-04:00	40.4	40.5					
7		04:00-05:00	40	40.6					
8		05:00-06:00	40.7	41					
		<b>Leq Day</b>	41.0	41.3					

\*\*All noise measurements are integrated for a 01 hour period, All units in dB(A) \*LDL indicates Lower Detection Limit

Sampling Assistants

ANALYSED BY

(Gaurav Kant)

**REVIEWED BY**

(Amit Raj Mishra)

**Authorised Signatory**

Note: The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----

Page -1 of 1



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**Ambient Noise Level Test Report**

CMPDIL, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmpdi@coalindia.in

Month & Year	11/2024	Cluster	Cluster XIV			ULR No.	TC1012224000001356F		
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)					Date of Issue	16.01.2025		
Project		Sample Ref. No.	REM/BCCL/2024/11		Sampling Method	CMPDI/RI-II/LPM 22			
Sampling Stations	i	Kharkharee UGP		Date of Sampling	05.11.2024	22.11.2024	Zone Category of Station:	Core Zone	
Sl. No.	Parameter	Hour / Time of day	Observed Values (in Leq dB(A))		Method of Analysis	Range Of Testing	LDL	NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 Standards	
			First Fortnight	Second Fortnight				Zones	Limits in dB
1	Noise Level dB(A)Leq - Day	06:00 - 07:00	45	44.3	CPCB, Protocol for Ambient Level Noise Monitoring -2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	75 65 55 50
2		07:00 - 08:00	45.3	45.8					
3		08:00 - 09:00	47.3	46.1					
4		09:00 - 10:00	49.5	50.5					
5		10:00 - 11:00	52.2	52.7					
6		11:00 - 12:00	53.3	51.3					
7		12:00 - 13:00	60.1	59.8					
8		13:00 - 14:00	60.9	58.7					
9		14:00 - 15:00	61.3	61.2					
10		15:00 - 16:00	56.5	56.8					
11		16:00 - 17:00	69.5	60.1					
12		17:00 - 18:00	58	56.1					
13		18:00 - 19:00	45	45.6					
14		19:00 - 20:00	45.2	45					
15		20:00 - 21:00	44.7	45.3					
16		21:00 - 22:00	47.8	45.6					
		<b>Leq Day</b>	59.5	55.4					
1	Noise Level dB(A)Leq -Night	22:00-23:00	45	44.3	CPCB, Protocol for Ambient Level Noise Monitoring -2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	70 55 45 50
2		23:00- 00:00	43.6	43.1					
3		00:00-01:00	41.4	41.8					
4		01:00-02:00	39.7	40.8					
5		02:00-03:00	39.4	36.4					
6		03:00-04:00	38.9	40.2					
7		04:00-05:00	38.7	37.7					
8		05:00-06:00	37.5	35.5					
		<b>Leq Day</b>	41.3	40.9					

\*\*All noise measurements are integrated for a 01 hour period. All units in dB(A) \*LDL indicates Lower Detection Limit

Analysed By  
 Sampling Assistants

*Gaurav Kant*  
 (Gaurav Kant)  
 REVIEWED BY

*Amit Raj Mishra*  
 (Amit Raj Mishra)  
 Authorised Signatory

Note: The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----

Page -1 of 1



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**Ambient Noise Level Test Report**

CMPDIL, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmndi@coalindia.in

Month & Year	11/2024	Cluster	Cluster XIV				ULR No.	TC1012224000001356F	
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)						Date of Issue	16.01.2025	
Project		Sample Ref. No.	REM/BCCL/2024/11			Sampling Method	CMPDI/RI-II/LPM 22		
Sampling Stations	i	Telmacho Bridge		Date of Sampling	11.11.2024	29.11.2024	Zone Category of Station:	Buffer Zone	
Sl. No.	Parameter	Hour / Time of day	Observed Values (in Leq dB(A))	Observed Values (in Leq dB(A))	Method of Analysis	Range Of Testing	LD L	NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 Standards	
			First Fortnight	Second Fortnight				Zones	Limits in dB
1	Noise Level dB(A)Leq - Day	06:00 - 07:00	41.9	44.7	CPCB, Protocol for Ambient Level Noise Monitoring -2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	75 65 55 50
2		07:00 - 08:00	53.2	53.7					
3		08:00 - 09:00	56.6	53.6					
4		09:00 - 10:00	61.7	62.5					
5		10:00 - 11:00	60.8	59.8					
6		11:00 - 12:00	62	61.1					
7		12:00 - 13:00	63.5	65.6					
8		13:00 - 14:00	61.7	67.1					
9		14:00 - 15:00	59.9	61.2					
10		15:00 - 16:00	59	60.3					
11		16:00 - 17:00	56.5	55.4					
12		17:00 - 18:00	52.3	52.8					
13		18:00 - 19:00	48.8	53.2					
14		19:00 - 20:00	47.3	46.4					
15		20:00 - 21:00	44.3	44.3					
16		21:00 - 22:00	43.6	43.2					
		<b>Leq Day</b>	58.5	60.1					
1	Noise Level dB(A)Leq -Night	22:00-23:00	39.5	39.1	CPCB, Protocol for Ambient Level Noise Monitoring -2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	70 55 45 50
2		23:00- 00:00	38.6	38.6					
3		00:00- 01:00	38.5	38.5					
4		01:00-02:00	38.5	39.4					
5		02:00-03:00	39.3	39.4					
6		03:00-04:00	39.5	39.5					
7		04:00-05:00	39.7	39.7					
8		05:00-06:00	39.8	39.9					
		<b>Leq Day</b>	39.2	39.3					

\*\*All noise measurements are integrated for a 01 hour period, All units in dB(A) \*LDL indicates Lower Detection Limit

Sampling Assistants  
ANALYSED BY

*Gaurav Kant*  
(Gaurav Kant)  
**REVIEWED BY**

*Amit Raj Mishra*  
(Amit Raj Mishra)  
**Authorised Signatory**

Note: The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----

Page -1 of 1



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**Ambient Noise Level Test Report**

CMPDIL, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmpdi@coalindia.in

Month & Year	08/2024	Cluster	Cluster XIV				ULR No.	TC1012224000001356F	
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)						Date of Issue	16.01.2025	
Project		Sample Ref. No.	REM/BCCL/2024/11			Sampling Method	CMPDI/RI-II/LPM 22		
Sampling Stations	i	Madhuband UGP		Date of Sampling	08.11.2024	30.11.2024	Zone Category of Station:	Buffer Zone	
Sl. No.	Parameter	Hour / Time of day	Observed Values (in Leq dB(A))		Method of Analysis	Range Of Testing	LDL	NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 Standards	
			First Fortnight	Second Fortnight				Zones	Limits in dB
1	Noise Level dB(A)Leq - Day	06:00 - 07:00	41.5	42.1	CPCB, Protocol for Ambient Level Noise Monitoring - 2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	75 65 55 50
2		07:00 - 08:00	44.3	43.6					
3		08:00 - 09:00	47.7	48.1					
4		09:00 - 10:00	48.9	48.8					
5		10:00 - 11:00	48.8	48.8					
6		11:00 - 12:00	48.5	48.1					
7		12:00 - 13:00	49.3	49					
8		13:00 - 14:00	52.8	56.4					
9		14:00 - 15:00	54	54					
10		15:00 - 16:00	54.5	51.1					
11		16:00 - 17:00	47.3	47.4					
12		17:00 - 18:00	46.3	46.2					
13		18:00 - 19:00	45.6	45.5					
14		19:00 - 20:00	45.4	45					
15		20:00 - 21:00	45.2	44.6					
16		21:00 - 22:00	44.1	44.3					
		<b>Leq Day</b>	49.3	49.5					
1	Noise Level dB(A)Leq - Night	22:00-23:00	40.6	41	CPCB, Protocol for Ambient Level Noise Monitoring - 2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	70 55 45 50
2		23:00- 00:00	40.5	41.1					
3		00:00- 01:00	40.4	40.5					
4		01:00-02:00	39.7	40.1					
5		02:00-03:00	39.4	39.9					
6		03:00-04:00	40.7	41					
7		04:00-05:00	41	41.2					
8		05:00-06:00	41.3	41.1					
		<b>Leq Day</b>	40.5	40.8					

\*\*All noise measurements are integrated for a 01 hour period, All units in dB(A) \*LDL indicates Lower Detection Limit

Analysed by  
 Sampling Assistants

*Gaurav Kant*  
 (Gaurav Kant)  
**REVIEWED BY**

*Amit Raj Mishra*  
 (Amit Raj Mishra)  
**Authorised Signatory**

Note: The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

--- End of Report ---

Page -1 of 1



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

Category	Pollutant	Time weighted average	Concentration in Ambient Air	Method of Measurement
1	2	3	4	5
<b>III</b> Coal mines located in the coal fields of <ul style="list-style-type: none"> <li>• Jharia</li> <li>• Raniganj</li> <li>• Bokaro</li> </ul>	Suspended Particulate Matter (SPM)	Annual Average * 24 hours **	500 $\mu\text{g}/\text{m}^3$  700 $\mu\text{g}/\text{m}^3$	- High Volume Sampling (Average flow rate not less than 1.1)
	Respirable Particulate Matter (size less than 10 $\mu\text{m}$ ) (RPM)	Annual Average * 24 hours **	250 $\mu\text{g}/\text{m}^3$  300 $\mu\text{g}/\text{m}^3$	Respirable Particulate Matter sampling and analysis
	Sulphur Dioxide ( $\text{SO}_2$ )	Annual Average * 24 hours **	80 $\mu\text{g}/\text{m}^3$  120 $\mu\text{g}/\text{m}^3$	1.Improvedwest and Gaeke method 2.Ultraviolet fluorescene
	Oxide of Nitrogen as $\text{NO}_2$	Annual Average * 24 hours **	80 $\mu\text{g}/\text{m}^3$  120 $\mu\text{g}/\text{m}^3$	1. Jacob & Hochheiser Modified (Na-Arsenic) Method 2. Gas phase Chemilumine-scence

**Note:**

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

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

## NATIONAL AMBIENT AIR QUALITY STANDARDS

New Delhi the 18<sup>th</sup> November 2009

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

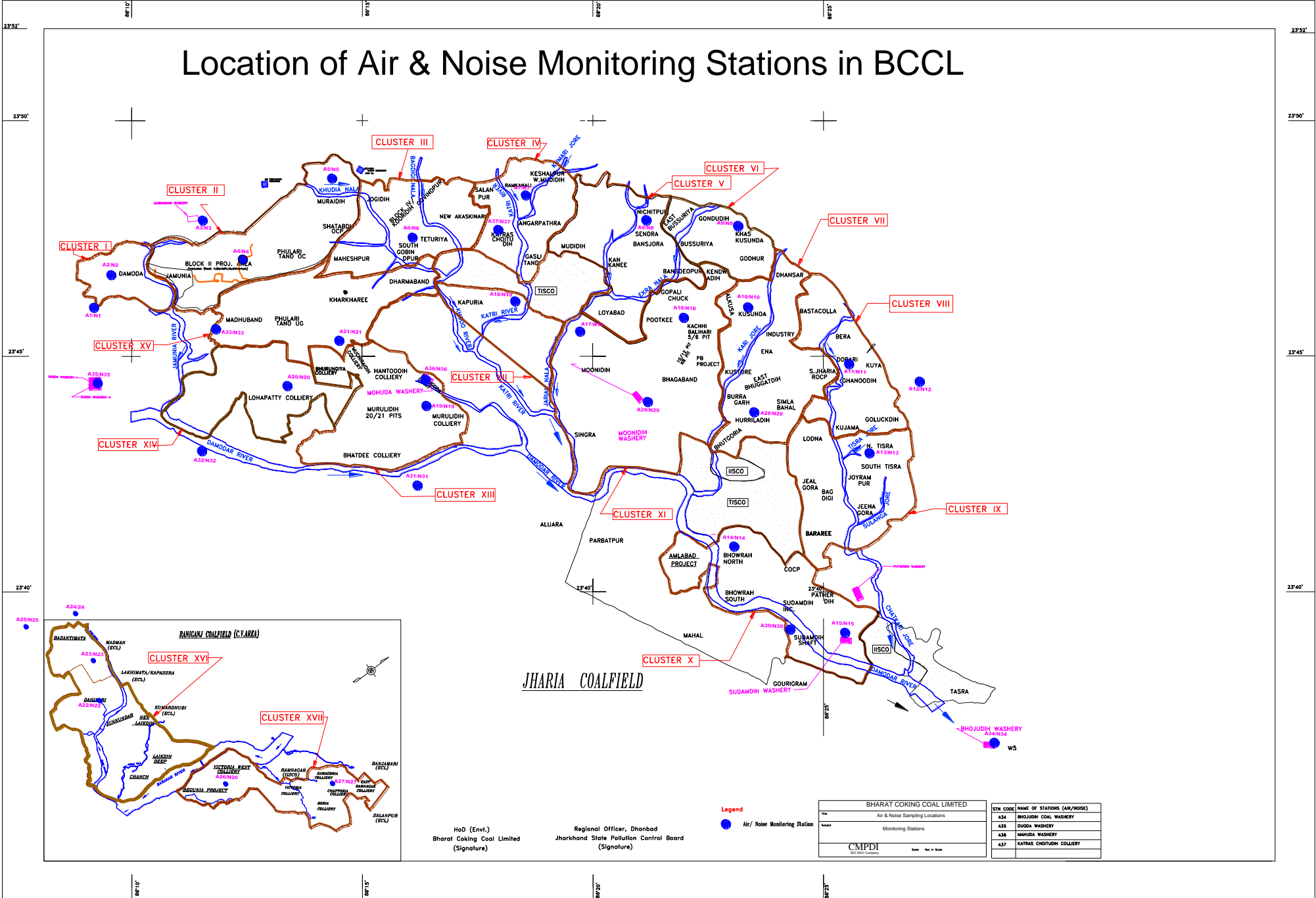
Pollutant	Time Weighted Average	Concentration in Ambient Air		Methods of Measurement
		Industrial, Residential, Rural and other Areas	Ecologically Sensitive Area (Notified by Central Government)	
<b>Sulphur Dioxide (SO<sub>2</sub>), µg/m<sup>3</sup></b>	Annual * 24 Hours **	50 80	20 80	-Improved West and Gaeke Method -Ultraviolet Fluorescence
<b>Nitrogen dioxide (NO<sub>2</sub>), µg/m<sup>3</sup></b>	Annual * 24 Hours **	40 80	30 80	-Jacob & Hochheiser modified (NaOH-NaAsO <sub>2</sub> ) Method -Gas Phase Chemiluminescence
<b>Particulate Matter (Size less than 10µm) or PM<sub>10</sub>, µg/m<sup>3</sup></b>	Annual * 24 Hours **	60 100	60 100	-Gravimetric -TEOM -Beta attenuation
<b>Particulate Matter (Size less than 2.5µm) or PM<sub>2.5</sub>, µg/m<sup>3</sup></b>	Annual * 24 Hours **	40 60	40 60	-Gravimetric -TEOM -Beta attenuation
<b>Ozone (O<sub>3</sub>), µg/m<sup>3</sup></b>	8 Hours * 1 Hour **	100 180	100 180	-UV Photometric -Chemiluminescence -Chemical Method
<b>Lead (Pb), µg/m<sup>3</sup></b>	Annual * 24 Hours **	0.50 1.0	0.50 1.0	-AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper -ED-XRF using Teflon filter
<b>Carbon Monoxide (CO), mg/m<sup>3</sup></b>	8 Hours ** 1 Hour **	02 04	02 04	-Non dispersive Infrared (NDIR) Spectroscopy
<b>Ammonia (NH<sub>3</sub>), µg/m<sup>3</sup></b>	Annual * 24 Hours **	100 400	100 400	-Chemiluminescence -Indophenol blue method
<b>Benzene (C<sub>6</sub>H<sub>6</sub>), µg/m<sup>3</sup></b>	Annual *	05	05	-Gas Chromatography (GC) based continuous analyzer -Adsorption and desorption followed by GC analysis
<b>Benzo(a)Pyrene (BaP) Particulate phase only, ng/m<sup>3</sup></b>	Annual *	01	01	-Solvent extraction followed by HPLC/GC analysis
<b>Arsenic (As), ng/m<sup>3</sup></b>	Annual *	06	06	-AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper
<b>Nickel (Ni), ng/m<sup>3</sup></b>	Annual *	20	20	-AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper

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

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

**NOTE:** Whenever and wherever monitoring results on two consecutive days of monitoring exceed the limits specified above for the respective category

# Location of Air & Noise Monitoring Stations in BCCL



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

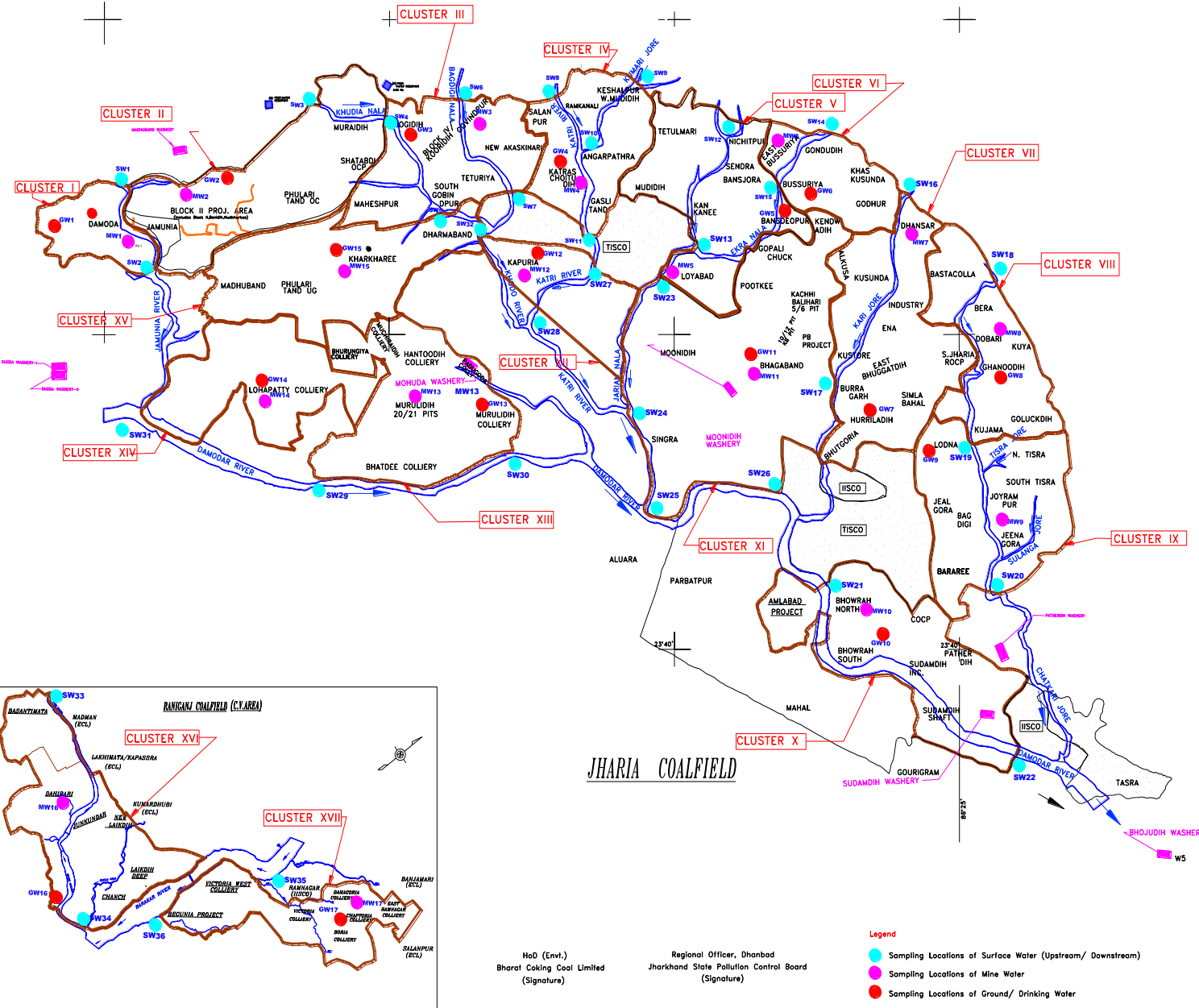
Regional Officer, Dhanbad  
Jharkhand State Pollution Control Board  
(Signature)

Legend  
● Air / Noise Monitoring Station

BHARAT COKING COAL LIMITED	
Area	Air & Noise Sampling Locations
Scale	Monitoring Stations
CMPDI Coal Monitoring & Pollution Data Institute	
Date	Not to Scale

STN CODE	NAME OF STATIONS (AIR/NOISE)
A34	BHOJUDIH COAL WASHERY
A35	DUGGA WASHERY
A36	MARUDA WASHERY
A37	KAYRAS CHOTUDIH COLLIERY

# Water Sampling Locations in BCCL



### INDEX

Cluster	Surface Water (US, DS)	Name of River/ Nala/ Effluent Water	Minel Effluent Location	Sampling Location	Ground Water	Sampling Location
I	SW1, SW2	Jamunia River	MW1	Damoda Area	GW1	Chutway Village
II	SW3, SW4	Khudia Nala	MW2	Block II OCP	GW2	Joyrampur Village
III	SW4, SW5, SW6, SW7	Khudia Nala, Bagdigi Nala	MW3	Govindpur Colliery	GW3	Jogdih Village
IV	SW8, SW11, SW9, SW10	Kasi River, Kuman Jore	MW4	Chotudih	GW4	Kankanee Village
V	SW12, SW13, SW15	Jarian Nala, Ekra Nala	MW5	Mudidih	GW5	Nichitpur
VI	SW14, SW15	Ekra Nala	MW6	East Bassuria UGP	GW6	Bansara Borewell
VII	SW16, SW17	Kari Jore	MW7	Bansara UGP	GW7	Hurmidih
VIII	SW18, SW19	Kashi Jore	MW8	Doban UGP	GW8	Qharudih
IX	SW19, SW20	Kashi Jore	MW9	Jeenagora	GW9	Lodna
X	SW21, SW22	Damodar River	MW10	Bhowrah North	GW10	Bhowrah South
XI	SW23, SW24, SW25, SW26	Jarian Nala, Damodar River	MW11	Bhagaband UGP	GW11	Bhagaband
XII	SW27, SW28	Kashi River	MW12	Kapuria	GW12	Kapuria
XIII	SW29, SW30	Damodar River	MW13	Muridih	GW13	Muridih
XIV	SW31, SW32	Damodar River	MW14	Lohapatti	GW14	Lohapatti
XV	SW5, SW32	Khudhane Nala	MW15	Kharkhane UGP	GW15	Kharkhane
XVI	SW33, SW34	Khudia River	MW16	Dahaban OCP	GW16	Pallabani Village
XVII	SW35, SW36	Barakar River	MW17	Damagoria Colliery	GW17	Chaptora

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

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

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

**STRICTLY RESTRICTED**  
**FOR COMPANY USE ONLY RESTRICTED**

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

**ENVIRONMENTAL MONITORING REPORT  
OF  
BHARAT COKING COAL LIMITED,  
CLUSTER – XIV**

**(FOR THE MONTH DECEMBER, 2024)**

**E. C. no. J-11015/10/2010-IA.II (M) dated 06.06.2013.**



**CMPDI**

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

# CONTENTS

<b>SL. NO.</b>	<b>CHAPTER</b>	<b>PARTICULARS</b>	<b>PAGE NO.</b>
1.	CHAPTER - I	EXECUTIVE SUMMARY	3-5
2.	CHAPTER-II	INTRODUCTION	6
3.	CHAPTER-III	RESULTS	7-19
4.	CHAPTER-IV	STANDARDS AND PLANS	20-21

## **EXECUTIVE SUMMARY**

### **1.0 Introduction**

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

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

### **2.0 Sampling location and rationale**

#### **2.1 Ambient air sampling locations**

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

#### **2.2 Water sampling stations**

The Water sampling stations were selected for mine sump water.

#### **2.3 Noise level monitoring locations**

Noise levels vary depending on the various activities in mining areas. The monitoring of noise level in different locations will be helpful to take appropriate mitigating measures. The noise levels were recorded in mining areas, washeryareas and in residential areas.

### **3.0 Methodology of sampling and analysis**

#### **3.1 Ambient air quality**

Parameters chosen for assessment of ambient air quality were Particulate Matter (PM<sub>10</sub>), Fine Particulate Matter (PM<sub>2.5</sub>), Sulphur Di-oxide (SO<sub>2</sub>) and Nitrogen Oxides (NO<sub>x</sub>). Respirable Dust Samplers (RDS) and Fine Dust

Sampler (PM<sub>2.5</sub> sampler) were used for sampling of PM<sub>10</sub>, SO<sub>2</sub>, & NO<sub>x</sub> and Fine Dust Sampler (PM<sub>2.5</sub> sampler) were used for sampling of PM<sub>2.5</sub> at 24 hours interval once in a fortnight and the same for the gaseous pollutants. The samples were analyzed in Environmental Laboratory of CMPDI, RI-II, Dhanbad.

### **3.2 Water quality**

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

### **3.3 Noise level monitoring**

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

## **4.0 Results and interpretations**

### **4.1 Air quality**

It has been seen from the analysis results that the 24 hours average concentration parameters like PM<sub>10</sub>, PM<sub>2.5</sub>, SO<sub>2</sub> and NO<sub>x</sub> are mostly within the permissible limits in all sampling locations as per MoEF&CC Gazette Notification No. GSR 742(E) dt 25.09.2000 Standards for Coal Mines and National Ambient Air Quality Standard -2009. Sometimes the concentration of PM<sub>10</sub>& PM<sub>2.5</sub> exceeds the limits due to heavy public traffic, poor road condition, coke oven plants, burning of coal by surrounding habitants, brick making, municipal waste dumps and industries like Steel Plant, thermal Plants including their fly ash etc.

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

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

#### **4.2 Water quality**

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

#### **4.3 Noise Level**

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

## INTRODUCTION

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

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-XIV is in the Western part of the Jharia coalfield and situated in the Western Jharia area of BCCL. It includes 1 Mine (viz. Lohapatti (UG & OC). The Cluster – XIV is situated about 25 - 30 kms from Dhanbad Railway Station. The mines of this Cluster – XIV 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 Damodar River.
- 1.2 The Cluster-XIV is designed to produce 0.405 MTPA (normative) and 0.526 MTPA (peak) capacity of coal.

The Project has Environmental Clearance from Ministry of Environment, Forest and Climate Change (MoEF&CC) for a rated capacity 0.405 MTPA (normative) and 0.526 MTPA (peak) capacity of coal production vide letter no. J-11015/10/2010-IA.II (M) dated 06<sup>th</sup> June, 2013.

Ministry of Environment, Forest and Climate Change while granting environmental clearance has given one of the General conditions that “ Four ambient air quality monitoring stations should be established in the core zone as well as in the buffer zone for PM<sub>10</sub>, PM<sub>2.5</sub>, SO<sub>2</sub>, NO<sub>x</sub> monitoring. Location of the stations should be decided based on the meteorological data, topographical features and environmentally and ecologically sensitive targets in consultation with the State Pollution Control Board.” And other conditions regarding water / effluent and noise level monitoring.

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

## AMBIENT AIR QUALITY MONITORING

### 2.1 Location of sampling station and their rationale:

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

#### 2.1.1 Ambient Air Quality Sampling Locations

##### I. CORE ZONE Monitoring Location

###### i) Lohapatti (A20): Industrial Area

The location of the sampling station is 23° 44' 29.42" N & 86° 12' 49.96" E. The sampler was placed at a height of approx. 1.5m above ground level at Project Office.

##### II. BUFFER ZONE Monitoring Location

###### i) Kharkharee CISF Office (A21): Industrial Area

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 Safety Office.

###### ii) Telmachho Bridge (A32): Industrial Area

The location of the sampling station is 23° 44' 14.90" N & 86° 12' 21.20" E. The location was selected for studying the impact of the mining activity on the Telmachho Bridge area as it lies in the buffer zone for the Cluster XIV.

###### iii) Madhuband UGP Office (A33): Industrial Area

The location of the sampling station is 23° 45'24.48" N & 86°11'59.44"E. The sampler was placed at a height of approx. 1.5m above ground level at Safety Office.

## AMBIENT AIR QUALITY DATA



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**Ambient Air Quality Test Report**

CMPDIL, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmpdi@coalindia.in

### Test Report for Ambient Air Samples

Month & Year	12/2024	Cluster	Cluster XIV			ULR No.	TC1012224000001374F	
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)					Date of Issue	27.01.2025	
Project	Lohapatti	Sample Ref. No.	REM/BCCL/2024/12	Sampling Method		CMPDI/RI-II/LPM 11, ( IS 5182)		
Date of Sampling	05.12.2024	19.12.2024	Period of Analysis	05.12.2024	25.01.2025	Zone of Station:	Buffer Zone	
Sl. No.	Parameter	Method Analysis	Observed Values ( in $\mu\text{g}/\text{m}^3$ )		Range Of Testing	LDL	MoEF Standards Notification dated 25th September,2000 (GSR 742 E)	NAAQS, 2009
			1st FN A3090	2nd FN A3171				
1	PM <sub>10</sub>	IS -5182(Part 23):2006, R-2017	128	94	10 $\mu\text{g}/\text{m}^3$ - 1000 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	300	100
2	PM <sub>2.5</sub>	IS -5182(Part 24):2019	62	55	10 $\mu\text{g}/\text{m}^3$ - 400 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	Not Specified	60
3	SO <sub>2</sub>	IS-5182(Part-2): 2001, R-2017	<10	<10	10 $\mu\text{g}/\text{m}^3$ - 1050 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	120	80
4	NO <sub>2</sub>	IS-5182 (Part-6): 2006, R-2017	28	26	06 $\mu\text{g}/\text{m}^3$ - 420 $\mu\text{g}/\text{m}^3$	06 $\mu\text{g}/\text{m}^3$	120	80

\* LDL indicates Lower Detection Limit,

\*\*All units are in  $\mu\text{g}/\text{m}^3$ , 24 hourly Average,

  
**ANALYSED BY**

  
 (Gaurav Kant)  
**REVIEWED BY**

  
 (Amit Raj Mishra)  
**Authorised Signatory**

**Note:** The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----

Page -1 of 1



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**Ambient Air Quality Test Report**

CMPDI, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmpdi@coalindia.in

**Test Report for Ambient Air Samples**

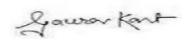
Month & Year	12/2024	Cluster	Cluste XIV			ULR No.	TC1012224000001374F	
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)				Date of Issue	27.01.2025		
Project	Kharkharee	Sample Ref. No.	REM/BCCL/2024/12	Sampling Method		CMPDI/RI-II/LPM 11, ( IS 5182)		
Date of Sampling	04.12.2024	18.12.2024	Period of Analysis	04.12.2024	25.01.2025	Zone of Station:	Core Zone	
Sl. No.	Parameter	Method Analysis of	Observed Values ( in $\mu\text{g}/\text{m}^3$ )		Range Of Testing	LDL	MoEF Standards Notification dated 25th September,2000 (GSR 742 E )	NAAQS, 2009
			1st FN A3085	2nd FN A3165				
1	PM <sub>10</sub>	IS -5182(Part 23):2006, R-2017	91	85	10 $\mu\text{g}/\text{m}^3$ - 1000 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	300	100
2	PM <sub>2.5</sub>	IS -5182(Part 24):2019	48	42	10 $\mu\text{g}/\text{m}^3$ - 400 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	Not Specified	60
3	SO <sub>2</sub>	IS-5182(Part-2): 2001, R-2017	10	<10	10 $\mu\text{g}/\text{m}^3$ - 1050 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	120	80
4	NO <sub>2</sub>	IS-5182 (Part-6): 2006, R-2017	26	29	06 $\mu\text{g}/\text{m}^3$ - 420 $\mu\text{g}/\text{m}^3$	06 $\mu\text{g}/\text{m}^3$	120	80

\* LDL indicates Lower Detection Limit,

\*\*All units are in  $\mu\text{g}/\text{m}^3$ , 24 hourly Average,



**ANALYSED BY**



(Gaurav Kant)  
**REVIEWED BY**



(Amit Raj Mishra)  
**Authorised Signatory**

**Note:** The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env), CMPDI, RI-II.

---- End of Report ----

Page -1 of 1

**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**Ambient Air Quality Test Report**



**cmpdi**  
A Mini Ratna Company

CMPDIL, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmpdi@coalindia.in

**Test Report for Ambient Air Samples**

<b>Month &amp; Year</b>	12/2024	<b>Cluster</b>	CLUSTER XIV			<b>ULR No.</b>	TC1012224000001374F	
<b>Customer</b>	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)				<b>Date of Issue</b>	27.01.2025		
<b>Project</b>	Telmacho Bridge	<b>Sample Ref. No.</b>	REM/BCCL/2024/12	<b>Sampling Method</b>		CMPDI/RI-II/LPM 11 , ( IS 5182)		
<b>Date of Sampling</b>	04.12.2024	18.12.2024	<b>Period of Analysis</b>	04.12.2024	25.01.2025	<b>Zone of Station:</b>	<b>Buffer Zone</b>	
<b>Sl. No.</b>	<b>Parameter</b>	<b>Method of Analysis</b>	<b>Observed Values (in <math>\mu\text{g}/\text{m}^3</math>)</b>		<b>Range Of Testing</b>	<b>LDL</b>	<b>MoEF Standards Notification dated 25th September,2000 (GSR 742 E)</b>	<b>NAAQS, 2009</b>
			<b>1st FN A3086</b>	<b>2nd FN A3166</b>				
1	PM <sub>10</sub>	IS -5182(Part 23):2006, R-2017	108	94	10 $\mu\text{g}/\text{m}^3$ - 1000 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	300	100
2	PM <sub>2.5</sub>	IS -5182(Part 24):2019	63	51	10 $\mu\text{g}/\text{m}^3$ - 400 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	Not Specified	60
3	SO <sub>2</sub>	IS-5182(Part-2): 2001 , R-2017	<10	11	10 $\mu\text{g}/\text{m}^3$ - 1050 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	120	80
4	NO <sub>2</sub>	IS-5182 (Part-6): 2006 , R-2017	30	28	06 $\mu\text{g}/\text{m}^3$ - 420 $\mu\text{g}/\text{m}^3$	06 $\mu\text{g}/\text{m}^3$	120	80

\*\*All units are in  $\mu\text{g}/\text{m}^3$ , 24 hourly Average \* LDL indicates Lower Detection Limit,

*[Signature]*

**ANALYSED BY**

*[Signature]*

**(Gaurav Kant)**  
**REVIEWED BY**

*[Signature]*

**(Amit Raj Mishra)**  
**Authorised Signatory**

**Note:** The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----

Page -1 of 1



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**Ambient Air Quality Test Report**

**CMPDIL, RI-II**  
**KOYLA BHAWAN COMPLEX**  
**DHANBAD. -826005**  
**Phone:0326-223-850**  
**email: rdri2cmpdi@coalindia.in**

**Test Report for Ambient Air Samples**

<b>Month &amp; Year</b>	12/2024	<b>Cluster</b>	Cluster XIV			<b>ULR No.</b>	TC1012224000001374F	
<b>Customer</b>	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)					<b>Date of Issue</b>	27.01.2025	
<b>Project</b>	Madhuband UGP	<b>Sample Ref. No.</b>	REM/BCCL/2024/12	<b>Sampling Method</b>		CMPDI/RI-II/LPM 11, ( IS 5182)		
<b>Date of Sampling</b>	05.12.2024	19.12.2024	<b>Period of Analysis</b>	05.12.2024	19.12.2024	<b>Zone of Station:</b>	Core Zone	
<b>Sl. No.</b>	<b>Parameter</b>	<b>Method of Analysis</b>	<b>Observed Values ( in <math>\mu\text{g}/\text{m}^3</math>)</b>		<b>Range Of Testing</b>	<b>LDL</b>	<b>MoEF Standards Notification dated 25th September,2000 (GSR 742 E )</b>	<b>NAAQS, 2009</b>
			<b>1st FN A3091</b>	<b>2nd FN A3172</b>				
1	PM <sub>10</sub>	IS -5182(Part 23):2006, R-2017	83	90	10 $\mu\text{g}/\text{m}^3$ - 1000 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	300	100
2	PM <sub>2.5</sub>	IS -5182(Part 24):2019	45	51	10 $\mu\text{g}/\text{m}^3$ - 400 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	Not Specified	60
3	SO <sub>2</sub>	IS-5182(Part-2): 2001 , R-2017	<10	<10	10 $\mu\text{g}/\text{m}^3$ - 1050 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	120	80
4	NO <sub>2</sub>	IS-5182 (Part-6): 2006 , R-2017	26	29	06 $\mu\text{g}/\text{m}^3$ - 420 $\mu\text{g}/\text{m}^3$	06 $\mu\text{g}/\text{m}^3$	120	80

\* LDL indicates Lower Detection Limit,

\*\*All units are in  $\mu\text{g}/\text{m}^3$ , 24 hourly Average,

*[Signature]*

**ANALYSED BY**

*[Signature]*

(Gaurav Kant)  
**REVIEWED BY**

*[Signature]*

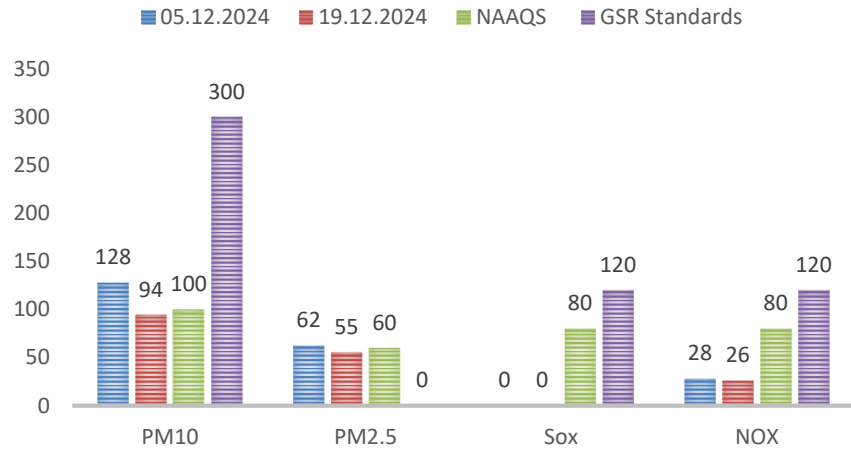
(Amit Raj Mishra)  
**Authorised Signatory**

**Note:** The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

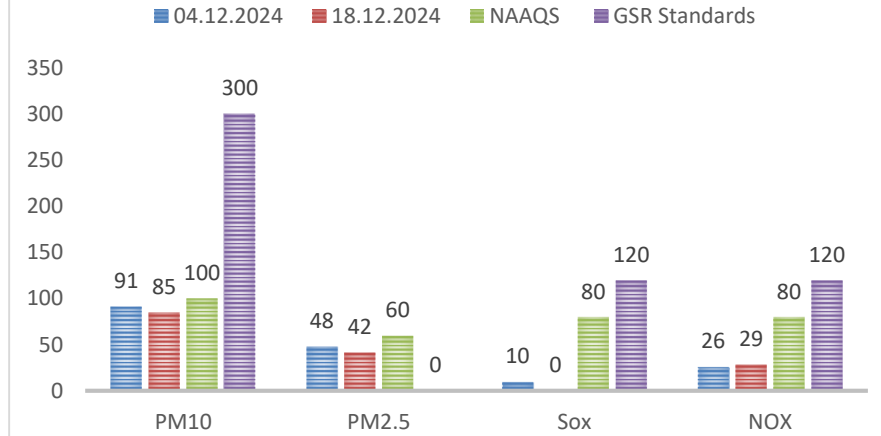
---- End of Report ----

Page -1 of 1

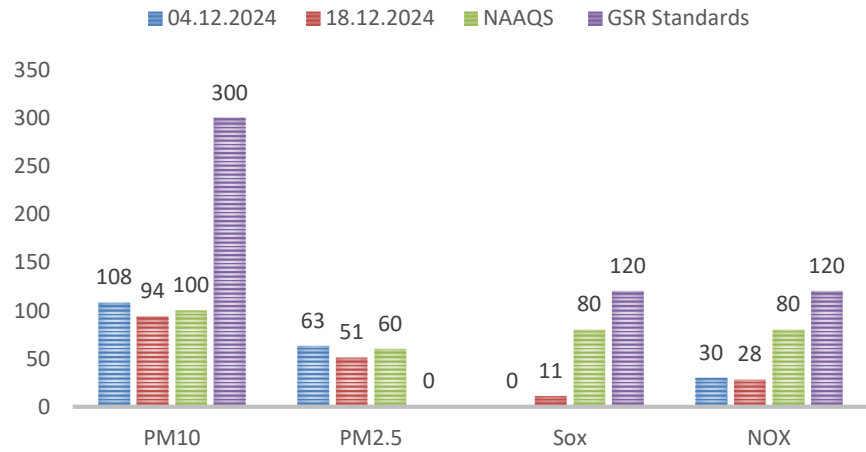
### AMBIENT AIR QUALITY AT LOHAPATTI



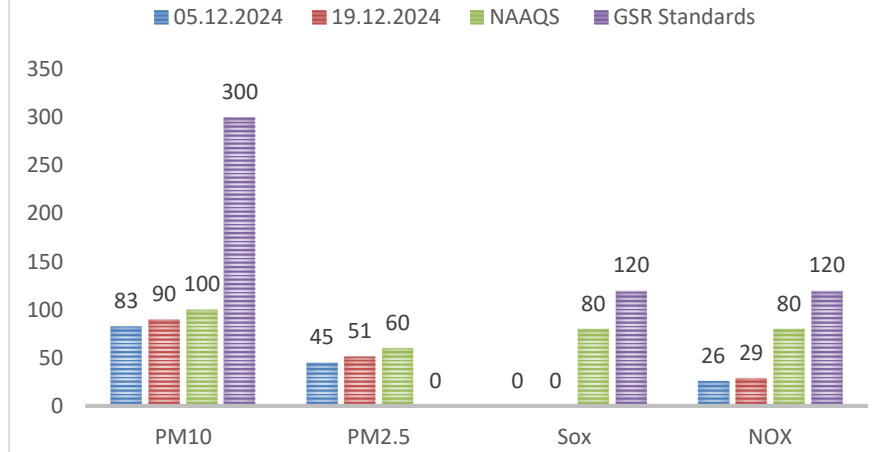
### AMBIENT AIR QUALITY AT KHARKHAREE CISF OFFICE



### AMBIENT AIR QUALITY AT TELMACHHO BRIDGE



### AMBIENT AIR QUALITY AT MADHUBAND UGP OFFICE



## **WATER QUALITY MONITORING**

### **3.1 Location of sampling sites**

(Refer **Plate No. – II**)

#### **i) Mine Discharge of Block II (MW14)**

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

### **3.2 Methodology of sampling and analysis**

Water samples were collected as per standard practice. The effluent samples were collected and analysed 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.



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**MINE EFFLUENT TEST REPORT**

CMPDI, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmpdi@coalindia.in

**Test Report for Mine Effluent samples**

<b>Month &amp; Year</b>	12/2024	<b>Cluster</b>	Cluster XIV		<b>ULR No.</b>	TC1012224000001391F		
<b>Customer</b>	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)					<b>Date of Issue</b>	27.01.2025	
<b>Project</b>		<b>Sampling Ref. No.</b>	REM/BCCL/2024/12		<b>Sampling Method</b>	IS 3025 (Part-1) CMPDI/RI-II/LPM 13		
<b>Sampling Stations</b>	(i)	Block II	Sample Collected in 2.5 Ltr Jerricane, Color as observed is transparent				Period of Analysis	
			<b>Date of Sampling</b>		09.12.24	23.12.24	09.12.24 to 31.12.2024	
<b>Sl. No.</b>	<b>Parameter</b>	<b>Method of Analysis</b>	<b>Observed Values</b>		<b>STANDARDS FOR COAL MINES</b> (Stipulated by Ministry of Environment and Forests (MoEF), Vide Notification No. GSR 742(E), Dt: 25.09.2000)	<b>LDL</b>		
			<b>First Fortnight M1250</b>	<b>Second Fortnight M1276</b>				
1	Total Suspended Solids	IS 3025/17:1984, R :2017, Gravimetric	39	37	100 (Max)	10		
2	pH	IS-3025/11:1983, R-2017, Electrometric	7.81	7.88	5.5 - 9.0	0.2		
3	Oil & Grease	IS 3025/39:1991, R : 2019, Partition Gravimetric	<2.0	<2.0	34	33		
4	COD	APHA 23rd Edition 5220 C Titrimetric Method	36	40	7.69	7.81		

\*\*All units in mg/L unless specified otherwise. \*LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,

\*\*Grab sampling carried out for water samples.

**ANALYSED BY**

(Kumar Vaibhav)

**REVIEWED BY**

(Amit Raj Mishra)

**Authorised Signatory**

Note: The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env), CMPDI, RI-II.

---- End of Report ----

## **NOISE LEVEL QUALITY MONITORING**

### **4.1 Location of sampling sites**

- i) **Lohapatti (N20)**
- ii) **Kharkharee CISF Office (N21)**
- iii) **Telmacho Bridge (N32)**
- iv) **Madhuband UGP (N33)**

**4.2** Noise level measurements in form of 'L<sub>EQ</sub>' were taken using Integrated Data Logging Sound Level Meter during day time & night time. Noise levels were measured for the complete day & night time, the Intergration time taken was one hour or 3600 seconds. 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 & night time and the observed values were compared with standards prescribed by MoEF&CC. The results of Noise levels recorded during day & night time on fortnightly basis are presented in tabular form along with the applicable standard permissible limits. The observed values in terms of L<sub>EQ</sub> are presented. The observed values at all the monitoring locations are found to be within permissible limits.



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**Ambient Noise Level Test Report**

CMPDIL, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmpdi@coalindia.in

Month & Year	12/2024	Cluster	Cluster XIV			ULR No.	TC101222400001408F		
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)					Date of Issue	27.01.2025		
Project		Sample Ref. No.	REM/BCCL/2024/12		Sampling Method	CMPDI/RI-II/LPM 22			
Sampling Stations	i	Lohapatti	Date of Sampling	05.12.2024	19.12.2024	Zone Category of Station:	CORE Zone		
Sl. No.	Parameter	Hour / Time of day	Observed Values ( in Leq dB(A) )	Observed Values ( in Leq dB(A) )	Method of Analysis	Range Of Testing	LDL	NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 Standards	
			First Fortnight	Second Fortnight				Zones	Limits in dB
1	Noise Level dB(A)Leq - Day	06:00 - 07:00	36	36.5	CPCB, Protocol for Ambient Level Noise Monitoring - 2015	35 dB-135 dB	35 Db (A)	Industrial Commercial Residential Silence	75 65 55 50
2		07:00 - 08:00	46.3	45.6					
3		08:00 - 09:00	41.1	46.1					
4		09:00 - 10:00	38.5	40.9					
5		10:00 - 11:00	41.1	42.6					
6		11:00 - 12:00	39.8	44.8					
7		12:00 - 13:00	40.9	43.5					
8		13:00 - 14:00	42.2	45					
9		14:00 - 15:00	41.5	42.8					
10		15:00 - 16:00	44.1	44.4					
11		16:00 - 17:00	44.2	44.3					
12		17:00 - 18:00	44	45					
13		18:00 - 19:00	44	47.2					
14		19:00 - 20:00	43.5	43					
15		20:00 - 21:00	43.3	43.1					
16		21:00 - 22:00	43.1	43					
		<b>Leq Day</b>	<b>42.7</b>	<b>44.1</b>					
1	Noise Level dB(A)Leq -Night	22:00-23:00	38.6	38.6	CPCB, Protocol for Ambient Level Noise Monitoring - 2015	35 dB-135 dB	35 dB (A)	Industrial Commercial Residential Silence	70 55 45 50
2		23:00- 00:00	34.6	34.2					
3		00:00- 01:00	34.4	34.3					
4		01.00-02.00	34	34.7					
5		02.00-03.00	34	34.2					
6		03.00-04.00	37.7	37.8					
7		04.00-05.00	37.3	39.2					
8		05:00-06:00	38.1	38.3					
		<b>Leq Day</b>	<b>35.1</b>	<b>35.7</b>					

\*\*All noise measurements are integrated for a 01 hour period, All units in dB(A) \*LDL indicates Lower Detection Limit

Sampling Assistants

(Gaurav Kant)

(Amit Raj Mishra)

ANALYSED BY

**REVIEWED BY**

**Authorised Signatory**



Note: The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----

Page -1 of 1

Month & Year		12/2024	Cluster		Cluster XIV			ULR No.	TC10122400001408F	
Customer		Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)					Date of Issue	27.01.2025		
Project		Sample Ref. No.		REM/BCCL/2024/12		Sampling Method		CMPDI/RI-II/LPM 22		
Sampling Stations		i		Kharkharee UGP		Date of Sampling		04.12.2024 18.12.2024		
Sl. No.		Parameter		Hour / Time of day		Observed Values (in Leq dB(A))		Method of Analysis		
						First Fortnight		Second Fortnight		
								Range Of Testing		
								LDL		
								NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 Standards		
								Zones		
								Limits in dB		
1	Noise Level dB(A)Leq - Day	06:00 - 07:00	43	43.9	CPCB, Protocol for Ambient Level Noise Monitoring -2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	75 65 55 50	
2		07:00 - 08:00	58.2	58.1						
3		08:00 - 09:00	64.2	69.5						
4		09:00 - 10:00	69.9	69.2						
5		10:00 - 11:00	65.6	64.5						
6		11:00 - 12:00	62.8	62.3						
7		12:00 - 13:00	60.3	61.3						
8		13:00 - 14:00	58.8	58						
9		14:00 - 15:00	56.5	55.9						
10		15:00 - 16:00	55	55.4						
11		16:00 - 17:00	58.2	56						
12		17:00 - 18:00	55.1	55.7						
13		18:00 - 19:00	52.6	52.6						
14		19:00 - 20:00	50.9	51						
15		20:00 - 21:00	48.9	49.1						
16		21:00 - 22:00	48.2	48.7						
		<b>Leq Day</b>	<b>61.5</b>	<b>62.2</b>						
1	Noise Level dB(A)Leq -Night	22:00-23:00	41	39.1	CPCB, Protocol for Ambient Level Noise Monitoring -2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	70 55 45 50	
2		23:00-00:00	34.6	35.1						
3		00:00-01:00	34.7	35.1						
4		01:00-02:00	33.3	34.3						
5		02:00-03:00	33	30.5						
6		03:00-04:00	36.3	37.5						
7		04:00-05:00	36.1	35.2						
8		05:00-06:00	35	34						
		<b>Leq Day</b>	<b>33.9</b>	<b>34.1</b>						

\*\*All noise measurements are integrated for a 01 hour period, All units in dB(A) \*LDL indicates Lower Detection Limit

Sampling Assistants <b>ANALYSED BY</b>	 (Gaurav Kant) <b>REVIEWED BY</b>	 (Amit Raj Mishra) <b>Authorised Signatory</b>
---	---	---

Note: The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----  
Page -1 of 1



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**Ambient Noise Level Test Report**

**CMPDI, RI-II**  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmpdi@coalindia.in

Month & Year	12/2024	Cluster	Cluster XIV				ULR No.	TC1012224000001408F		
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)						Date of Issue	27.01.2025		
Project		Sample Ref. No.	REM/BCCL/2024/12			Sampling Method	CMPDI/RI-II/LPM 22			
Sampling Stations	i	Telmacho Bridge		Date of Sampling	04.12.2024	18.12.2024	Zone Category of Station:	Buffer Zone		
Sl. No.	Parameter	Hour / Time of day	Observed Values ( in Leq dB(A) )		Method of Analysis	Range Of Testing	LD L	NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 Standards		
			First Fortnight	Second Fortnight				Zones	Limits in dB	
1	Noise Level dB(A)Leq - Day	06:00 - 07:00	40.8	43.6	CPCB, Protocol for Ambient Level Noise Monitoring -2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	75 65 55 50	
2		07:00 - 08:00	51.7	52.4						
3		08:00 - 09:00	55.1	52.3						
4		09:00 - 10:00	60	60.8						
5		10:00 - 11:00	59.3	58.1						
6		11:00 - 12:00	60.2	59.5						
7		12:00 - 13:00	61.8	64						
8		13:00 - 14:00	60	65.3						
9		14:00 - 15:00	58.2	59.6						
10		15:00 - 16:00	56.5	58.8						
11		16:00 - 17:00	55	53.9						
12		17:00 - 18:00	51	51.3						
13		18:00 - 19:00	47.6	51.7						
14		19:00 - 20:00	46.1	45						
15		20:00 - 21:00	43	43.1						
16		21:00 - 22:00	42.5	42.1						
		<b>Leq Day</b>	<b>56.8</b>	<b>58.5</b>						
1	Noise Level dB(A)Leq -Night	22:00-23:00	36.9	36.5	CPCB, Protocol for Ambient Level Noise Monitoring -2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	70 55 45 50	
2		23:00- 00:00	32.5	32.5						
3		00:00- 01:00	32.4	32.4						
4		01:00-02:00	32.4	33						
5		02:00-03:00	32.9	34.2						
6		03:00-04:00	36.9	36.9						
7		04:00-05:00	39.2	37.1						
8		05:00-06:00	37.1	37.2						
		<b>Leq Day</b>	<b>34.7</b>	<b>34.1</b>						

*\*\*All noise measurements are integrated for a 01 hour period, All units in dB(A) \*LDL indicates Lower Detection Limit*

Analysed by  
 Sampling Assistants

*Gaurav Kant*  
 (Gaurav Kant)  
**REVIEWED BY**

*Amit Raj Mishra*  
 (Amit Raj Mishra)  
**Authorised Signatory**

Note: The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**Ambient Noise Level Test Report**

CMPDIL, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmpdi@coalindia.in

Month & Year	12/2024	Cluster	Cluster XIV				ULR No.	TC1012224000001408F	
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)						Date of Issue	27.01.2025	
Project		Sample Ref. No.	REM/BCCL/2024/12			Sampling Method	CMPDI/RI-II/LPM 22		
Sampling Stations	i	Madhuband UGP		Date of Sampling	05.12.2024	19.12.2024	Zone Category of Station:	Buffer Zone	
Sl. No.	Parameter	Hour / Time of day	Observed Values (in Leq dB(A))		Method of Analysis	Range Of Testing	LDL	NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 Standards	
			First Fortnight	Second Fortnight				Zones	Limits in dB
1	Noise Level dB(A)Leq - Day	06:00 - 07:00	40.4	41	CPCB, Protocol for Ambient Level Noise Monitoring - 2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	75 65 55 50
2		07:00 - 08:00	43.1	42.5					
3		08:00 - 09:00	46.4	46.9					
4		09:00 - 10:00	47.7	47.5					
5		10:00 - 11:00	47.5	47.6					
6		11:00 - 12:00	47.2	46.9					
7		12:00 - 13:00	48	47.7					
8		13:00 - 14:00	51.3	54.9					
9		14:00 - 15:00	52.6	52.6					
10		15:00 - 16:00	53	49.7					
11		16:00 - 17:00	46.1	46.1					
12		17:00 - 18:00	44.9	44.8					
13		18:00 - 19:00	44.4	44.4					
14		19:00 - 20:00	44.3	43.9					
15		20:00 - 21:00	44.1	43.5					
16		21:00 - 22:00	42.8	43					
		<b>Leq Day</b>	<b>47.9</b>	<b>48.2</b>					
1	Noise Level dB(A)Leq - Night	22:00-23:00	37.9	38.3	CPCB, Protocol for Ambient Level Noise Monitoring - 2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	70 55 45 50
2		23:00- 00:00	34	34.5					
3		00:00- 01:00	33.9	34					
4		01:00-02:00	33.3	33.7					
5		02:00-03:00	33	33.5					
6		03:00-04:00	38.1	38.3					
7		04:00-05:00	38.3	38.5					
8		05:00-06:00	38.6	38.4					
		<b>Leq Day</b>	<b>35.4</b>	<b>35.5</b>					

\*\*All noise measurements are integrated for a 01 hour period, All units in dB(A) \*LDL indicates Lower Detection Limit

Sampling Assistants  
ANALYSED BY

*Gaurav Kant*  
(Gaurav Kant)  
**REVIEWED BY**

*Amit Raj Mishra*  
(Amit Raj Mishra)  
**Authorised Signatory**

Note: The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----  
Page -1 of 1



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

Category	Pollutant	Time weighted average	Concentration in Ambient Air	Method of Measurement
1	2	3	4	5
<b>III</b> Coal mines located in the coal fields of <ul style="list-style-type: none"> <li>• Jharia</li> <li>• Raniganj</li> <li>• Bokaro</li> </ul>	Suspended Particulate Matter (SPM)	Annual Average * 24 hours **	500 $\mu\text{g}/\text{m}^3$  700 $\mu\text{g}/\text{m}^3$	- High Volume Sampling (Average flow rate not less than 1.1)
	Respirable Particulate Matter (size less than 10 $\mu\text{m}$ ) (RPM)	Annual Average * 24 hours **	250 $\mu\text{g}/\text{m}^3$  300 $\mu\text{g}/\text{m}^3$	Respirable Particulate Matter sampling and analysis
	Sulphur Dioxide ( $\text{SO}_2$ )	Annual Average * 24 hours **	80 $\mu\text{g}/\text{m}^3$  120 $\mu\text{g}/\text{m}^3$	1.Improvedwest and Gaeke method 2.Ultraviolet fluorescene
	Oxide of Nitrogen as $\text{NO}_2$	Annual Average * 24 hours **	80 $\mu\text{g}/\text{m}^3$  120 $\mu\text{g}/\text{m}^3$	1. Jacob & Hochheiser Modified (Na-Arsenic) Method 2. Gas phase Chemilumine-scence

**Note:**

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

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

## NATIONAL AMBIENT AIR QUALITY STANDARDS

New Delhi the 18<sup>th</sup> November 2009

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

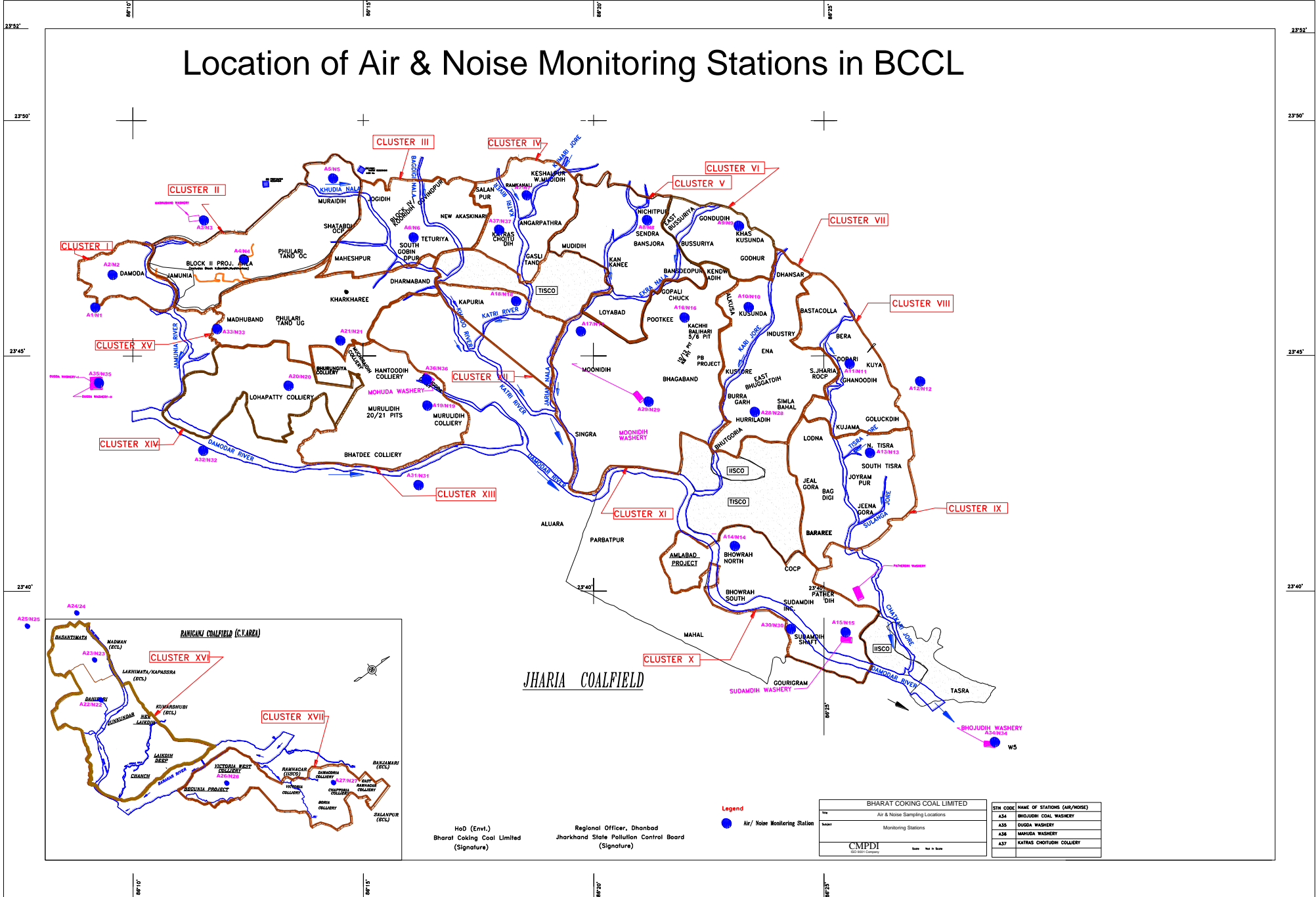
Pollutant	Time Weighted Average	Concentration in Ambient Air		Methods of Measurement
		Industrial, Residential, Rural and other Areas	Ecologically Sensitive Area (Notified by Central Government)	
<b>Sulphur Dioxide (SO<sub>2</sub>), µg/m<sup>3</sup></b>	Annual * 24 Hours **	50 80	20 80	-Improved West and Gaeke Method -Ultraviolet Fluorescence
<b>Nitrogen dioxide (NO<sub>2</sub>), µg/m<sup>3</sup></b>	Annual * 24 Hours **	40 80	30 80	-Jacob & Hochheiser modified (NaOH-NaAsO <sub>2</sub> ) Method -Gas Phase Chemiluminescence
<b>Particulate Matter (Size less than 10µm) or PM<sub>10</sub>, µg/m<sup>3</sup></b>	Annual * 24 Hours **	60 100	60 100	-Gravimetric -TEOM -Beta attenuation
<b>Particulate Matter (Size less than 2.5µm) or PM<sub>2.5</sub>, µg/m<sup>3</sup></b>	Annual * 24 Hours **	40 60	40 60	-Gravimetric -TEOM -Beta attenuation
<b>Ozone (O<sub>3</sub>), µg/m<sup>3</sup></b>	8 Hours * 1 Hour **	100 180	100 180	-UV Photometric -Chemiluminescence -Chemical Method
<b>Lead (Pb), µg/m<sup>3</sup></b>	Annual * 24 Hours **	0.50 1.0	0.50 1.0	-AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper -ED-XRF using Teflon filter
<b>Carbon Monoxide (CO), mg/m<sup>3</sup></b>	8 Hours ** 1 Hour **	02 04	02 04	-Non dispersive Infrared (NDIR) Spectroscopy
<b>Ammonia (NH<sub>3</sub>), µg/m<sup>3</sup></b>	Annual * 24 Hours **	100 400	100 400	-Chemiluminescence -Indophenol blue method
<b>Benzene (C<sub>6</sub>H<sub>6</sub>), µg/m<sup>3</sup></b>	Annual *	05	05	-Gas Chromatography (GC) based continuous analyzer -Adsorption and desorption followed by GC analysis
<b>Benzo(a)Pyrene (BaP) Particulate phase only, ng/m<sup>3</sup></b>	Annual *	01	01	-Solvent extraction followed by HPLC/GC analysis
<b>Arsenic (As), ng/m<sup>3</sup></b>	Annual *	06	06	-AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper
<b>Nickel (Ni), ng/m<sup>3</sup></b>	Annual *	20	20	-AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper

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

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

**NOTE:** Whenever and wherever monitoring results on two consecutive days of monitoring exceed the limits specified above for the respective category

# Location of Air & Noise Monitoring Stations in BCCL



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

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

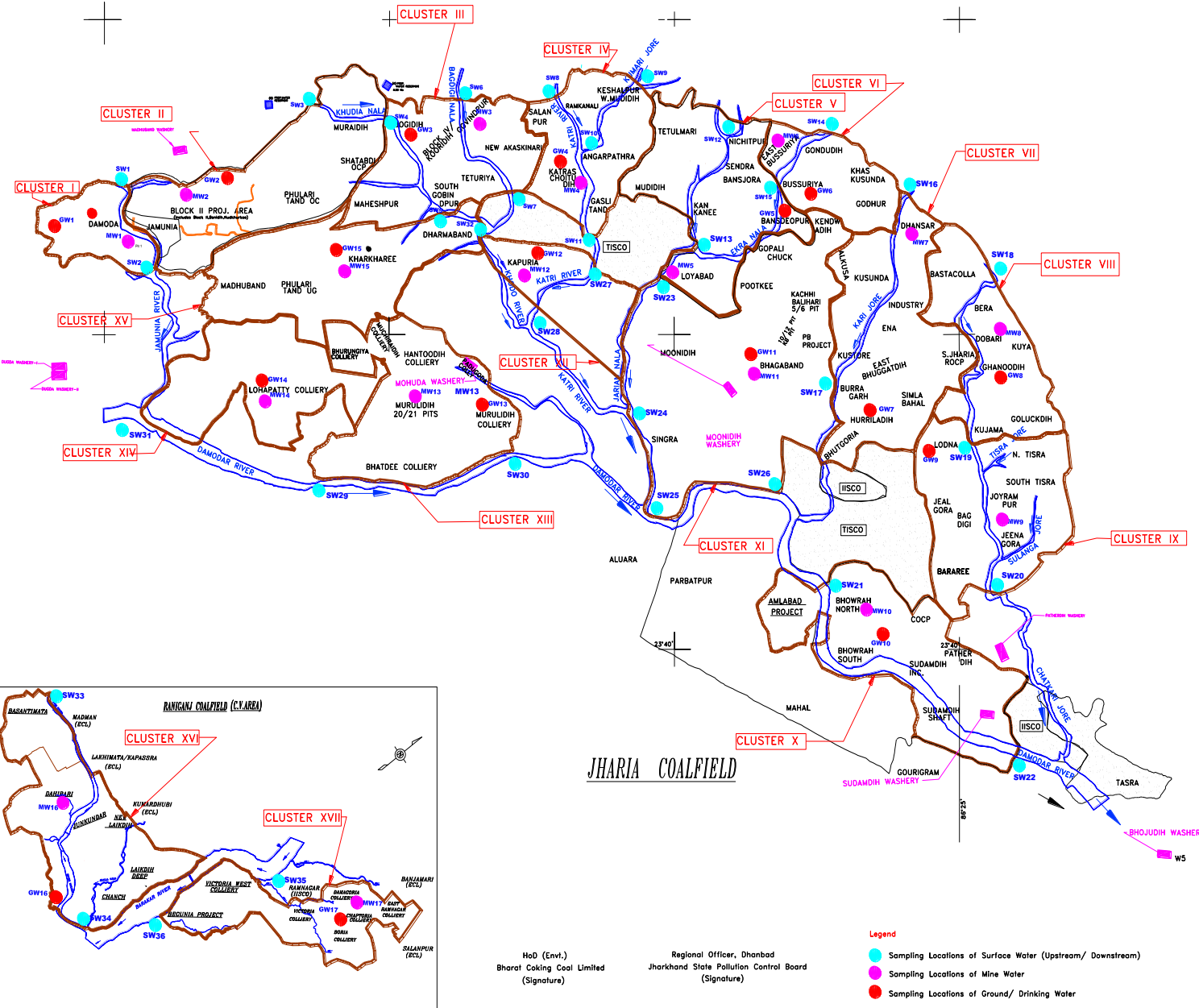
**Legend**

- Air / Noise Monitoring Station

BHARAT COKING COAL LIMITED	
For	Air & Noise Sampling Locations
Scale	Monitoring Stations
Date: Not in Scale	

STN CODE	NAME OF STATIONS (AIR/NOISE)
A34	BHOJUDIH COAL WASHERY
A33	DUGGA WASHERY
A36	MARUDA WASHERY
A37	KATRAS CHOTUDIH COLLIERY

# Water Sampling Locations in BCCL



**INDEX**

Cluster	Surface Water (US, DS)	Name of River/ Nala/ Effluent Water	Mineral Effluent Location	Sampling Location	Ground Water	Sampling Location
I	SW1, SW2	Baramuni River	MW1	Damoda Area	GW1	Chutway Village
II	SW3, SW4	Khudia Nala	MW2	Block II OCP	GW2	Joyrampur Village
III	SW4, SW5, SW6, SW7	Khudia Nala, Bagdigi Nala	MW3	Govindpur Colliery	GW3	Jogdih Village
IV	SW8, SW11, SW9, SW10	Kahi River, Kuman Jore	MW4	Chotudih	GW4	Kankanees Village
V	SW12, SW13, SW15	Jarian Nala, Ekra Nala	MW5	Mudidih	GW5	Nichitpur
VI	SW14, SW15	Ekra Nala	MW6	East Bassuria UGP	GW6	Bansjora Borewell
VII	SW16, SW17	Kari Jore	MW7	Bansjora UGP	GW7	Hurmidih
VIII	SW18, SW19	Kashi Jore	MW8	Doban UGP	GW8	Qharudih
IX	SW19, SW20	Kashi Jore	MW9	Jeenagora	GW9	Lodna
X	SW21, SW22	Damodar River	MW10	Bhowrah North	GW10	Bhowrah South
XI	SW23, SW24, SW25, SW26	Jarian Nala, Damodar River	MW11	Bhagaband UGP	GW11	Bhagaband
XII	SW27, SW28	Kahi River	MW12	Kapuria	GW12	Kapuria
XIII	SW29, SW30	Damodar River	MW13	Muridih	GW13	Muridih
XIV	SW31, SW32	Damodar River	MW14	Lohapatti	GW14	Lohapatti
XV	SW5, SW32	Khudhanees Nala	MW15	Kharkhanees UGP	GW15	Kharkhanees
XVI	SW33, SW34	Khudia River	MW16	Dahaban OCP	GW16	Falabani Village
XVII	SW35, SW36	Barakar River	MW17	Damagoria Colliery	GW17	Chaptora

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

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

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

**STRICTLY RESTRICTED**  
**FOR COMPANY USE ONLY RESTRICTED**

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

**ENVIRONMENTAL MONITORING REPORT  
OF  
BHARAT COKING COAL LIMITED,  
CLUSTER – XIV**

**(FOR THE MONTH JANUARY, 2025)**

**E. C. no. J-11015/10/2010-IA.II (M) dated 06.06.2013.**



**CMPDI**

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

# CONTENTS

<b>SL. NO.</b>	<b>CHAPTER</b>	<b>PARTICULARS</b>	<b>PAGE NO.</b>
1.	CHAPTER - I	EXECUTIVE SUMMARY	3-5
2.	CHAPTER-II	INTRODUCTION	6
3.	CHAPTER-III	RESULTS	7-19
4.	CHAPTER-IV	STANDARDS AND PLANS	20-21

## **EXECUTIVE SUMMARY**

### **1.0 Introduction**

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

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

### **2.0 Sampling location and rationale**

#### **2.1 Ambient air sampling locations**

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

#### **2.2 Water sampling stations**

The Water sampling stations were selected for mine sump water.

#### **2.3 Noise level monitoring locations**

Noise levels vary depending on the various activities in mining areas. The monitoring of noise level in different locations will be helpful to take appropriate mitigating measures. The noise levels were recorded in mining areas, washeryareas and in residential areas.

### **3.0 Methodology of sampling and analysis**

#### **3.1 Ambient air quality**

Parameters chosen for assessment of ambient air quality were Particulate Matter (PM<sub>10</sub>), Fine Particulate Matter (PM<sub>2.5</sub>), Sulphur Di-oxide (SO<sub>2</sub>) and Nitrogen Oxides (NO<sub>x</sub>). Respirable Dust Samplers (RDS) and Fine Dust

Sampler (PM<sub>2.5</sub> sampler) were used for sampling of PM<sub>10</sub>, SO<sub>2</sub>, & NO<sub>x</sub> and Fine Dust Sampler (PM<sub>2.5</sub> sampler) were used for sampling of PM<sub>2.5</sub> at 24 hours interval once in a fortnight and the same for the gaseous pollutants. The samples were analyzed in Environmental Laboratory of CMPDI, RI-II, Dhanbad.

### **3.2 Water quality**

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

### **3.3 Noise level monitoring**

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

## **4.0 Results and interpretations**

### **4.1 Air quality**

It has been seen from the analysis results that the 24 hours average concentration parameters like PM<sub>10</sub>, PM<sub>2.5</sub>, SO<sub>2</sub> and NO<sub>x</sub> are mostly within the permissible limits in all sampling locations as per MoEF&CC Gazette Notification No. GSR 742(E) dt 25.09.2000 Standards for Coal Mines and National Ambient Air Quality Standard -2009. Sometimes the concentration of PM<sub>10</sub>& PM<sub>2.5</sub> exceeds the limits due to heavy public traffic, poor road condition, coke oven plants, burning of coal by surrounding habitants, brick making, municipal waste dumps and industries like Steel Plant, thermal Plants including their fly ash etc.

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

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

#### **4.2 Water quality**

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

#### **4.3 Noise Level**

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

## INTRODUCTION

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

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-XIV is in the Western part of the Jharia coalfield and situated in the Western Jharia area of BCCL. It includes 1 Mine (viz. Lohapatti (UG & OC). The Cluster – XIV is situated about 25 - 30 kms from Dhanbad Railway Station. The mines of this Cluster – XIV 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 Damodar River.
- 1.2 The Cluster-XIV is designed to produce 0.405 MTPA (normative) and 0.526 MTPA (peak) capacity of coal.

The Project has Environmental Clearance from Ministry of Environment, Forest and Climate Change (MoEF&CC) for a rated capacity 0.405 MTPA (normative) and 0.526 MTPA (peak) capacity of coal production vide letter no. J-11015/10/2010-IA.II (M) dated 06<sup>th</sup> June, 2013.

Ministry of Environment, Forest and Climate Change while granting environmental clearance has given one of the General conditions that “ Four ambient air quality monitoring stations should be established in the core zone as well as in the buffer zone for PM<sub>10</sub>, PM<sub>2.5</sub>, SO<sub>2</sub>, NO<sub>x</sub> monitoring. Location of the stations should be decided based on the meteorological data, topographical features and environmentally and ecologically sensitive targets in consultation with the State Pollution Control Board.” And other conditions regarding water / effluent and noise level monitoring.

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

## AMBIENT AIR QUALITY MONITORING

### 2.1 Location of sampling station and their rationale:

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

#### 2.1.1 Ambient Air Quality Sampling Locations

##### I. CORE ZONE Monitoring Location

###### i) Lohapatti (A20): Industrial Area

The location of the sampling station is 23° 44' 29.42" N & 86° 12' 49.96" E. The sampler was placed at a height of approx. 1.5m above ground level at Project Office.

##### II. BUFFER ZONE Monitoring Location

###### i) Kharkharee CISF Office (A21): Industrial Area

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 Safety Office.

###### ii) Telmachho Bridge (A32): Industrial Area

The location of the sampling station is 23° 44' 14.90" N & 86° 12' 21.20" E. The location was selected for studying the impact of the mining activity on the Telmachho Bridge area as it lies in the buffer zone for the Cluster XIV.

###### iii) Madhuband UGP Office (A33): Industrial Area

The location of the sampling station is 23° 45'24.48" N & 86°11'59.44"E. The sampler was placed at a height of approx. 1.5m above ground level at Safety Office.

## AMBIENT AIR QUALITY DATA



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**Ambient Air Quality Test Report**


CMPDIL, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmpdi@coalindia.in

### Test Report for Ambient Air Samples

Month & Year	01/2025	Cluster	Cluster XIV			ULR No.	TC1012224000001428F	
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)					Date of Issue	18.02.2025	
Project	Lohapatti	Sample Ref. No.	REM/BCCL/2025/01	Sampling Method		CMPDI/RI-II/LPM 11, ( IS 5182)		
Date of Sampling	08.01.2025	22.01.2025	Period of Analysis	08.01.2025	15.02.2025	Zone of Station:	Buffer Zone	
Sl. No.	Parameter	Method Analysis	Observed Values ( in $\mu\text{g}/\text{m}^3$ )		Range Of Testing	LDL	MoEF Standards Notification dated 25th September,2000 (GSR 742 E)	NAAQS, 2009
			1st FN A3263	2nd FN A3336				
1	PM <sub>10</sub>	IS -5182(Part 23):2006, R-2017	128	94	10 $\mu\text{g}/\text{m}^3$ - 1000 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	300	100
2	PM <sub>2.5</sub>	IS -5182(Part 24):2019	62	55	10 $\mu\text{g}/\text{m}^3$ - 400 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	Not Specified	60
3	SO <sub>2</sub>	IS-5182(Part-2): 2001, R-2017	<10	<10	10 $\mu\text{g}/\text{m}^3$ - 1050 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	120	80
4	NO <sub>2</sub>	IS-5182 (Part-6): 2006, R-2017	28	26	06 $\mu\text{g}/\text{m}^3$ - 420 $\mu\text{g}/\text{m}^3$	06 $\mu\text{g}/\text{m}^3$	120	80

\* LDL indicates Lower Detection Limit,

\*\*All units are in  $\mu\text{g}/\text{m}^3$ , 24 hourly Average,

  
**ANALYSED BY**

  
 (Gaurav Kant)  
**REVIEWED BY**

  
 (Amit Raj Mishra)  
**Authorised Signatory**

**Note:** The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----

Page -1 of 1



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**Ambient Air Quality Test Report**

CMPDI, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmpdi@coalindia.in

**Test Report for Ambient Air Samples**

Month & Year	01/2025	Cluster	Cluste XIV			ULR No.	TC1012224000001428F	
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)				Date of Issue	18.02.2025		
Project	Kharkharee	Sample Ref. No.	REM/BCCL/2024/12	Sampling Method		CMPDI/RI-II/LPM 11, ( IS 5182)		
Date of Sampling	03.01.2025	18.01.2025	Period of Analysis	03.01.2025	15.02.2025	Zone of Station:	Core Zone	
Sl. No.	Parameter	Method Analysis of	Observed Values ( in $\mu\text{g}/\text{m}^3$ )		Range Of Testing	LDL	MoEF Standards Notification dated 25th September,2000 (GSR 742 E )	NAAQS, 2009
			1st FN A3239	2nd FN A3317				
1	PM <sub>10</sub>	IS -5182(Part 23):2006, R-2017	87	81	10 $\mu\text{g}/\text{m}^3$ - 1000 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	300	100
2	PM <sub>2.5</sub>	IS -5182(Part 24):2019	46	40	10 $\mu\text{g}/\text{m}^3$ - 400 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	Not Specified	60
3	SO <sub>2</sub>	IS-5182(Part-2): 2001, R-2017	<10	<10	10 $\mu\text{g}/\text{m}^3$ - 1050 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	120	80
4	NO <sub>2</sub>	IS-5182 (Part-6): 2006, R-2017	26	29	06 $\mu\text{g}/\text{m}^3$ - 420 $\mu\text{g}/\text{m}^3$	06 $\mu\text{g}/\text{m}^3$	120	80

\* LDL indicates Lower Detection Limit,

\*\*All units are in  $\mu\text{g}/\text{m}^3$ , 24 hourly Average,

*(Signature)*

**ANALYSED BY**

*(Signature)*

**REVIEWED BY**

*(Signature)*

**Authorised Signatory**

**Note:** The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----

Page -1 of 1

**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**Ambient Air Quality Test Report**



**cmpdi**  
A Mini Ratna Company

CMPDI, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmpdi@coalindia.in

**Test Report for Ambient Air Samples**

<b>Month &amp; Year</b>	01/2025	<b>Cluster</b>	CLUSTER XIV			<b>ULR No.</b>	TC1012224000001428F	
<b>Customer</b>	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)				<b>Date of Issue</b>	18.02.2025		
<b>Project</b>	Telmacho Bridge	<b>Sample Ref. No.</b>	REM/BCCL/2025/01	<b>Sampling Method</b>		CMPDI/RI-II/LPM 11 , ( IS 5182)		
<b>Date of Sampling</b>	07.01.2025	22.01.2025	<b>Period of Analysis</b>	07.01.2025	15.02.2025	<b>Zone of Station:</b>	<b>Buffer Zone</b>	
<b>Sl. No.</b>	<b>Parameter</b>	<b>Method of Analysis</b>	<b>Observed Values ( in <math>\mu\text{g}/\text{m}^3</math>)</b>		<b>Range Of Testing</b>	<b>LDL</b>	<b>MoEF Standards Notification dated 25th September,2000 (GSR 742 E )</b>	<b>NAAQS, 2009</b>
			<b>1st FN A3258</b>	<b>2nd FN A3335</b>				
1	PM <sub>10</sub>	IS -5182(Part 23):2006, R-2017	100	87	10 $\mu\text{g}/\text{m}^3$ - 1000 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	300	100
2	PM <sub>2.5</sub>	IS -5182(Part 24):2019	58	47	10 $\mu\text{g}/\text{m}^3$ - 400 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	Not Specified	60
3	SO <sub>2</sub>	IS-5182(Part-2): 2001 , R-2017	<10	<10	10 $\mu\text{g}/\text{m}^3$ - 1050 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	120	80
4	NO <sub>2</sub>	IS-5182 (Part-6): 2006 , R-2017	<b>28</b>	<b>32</b>	06 $\mu\text{g}/\text{m}^3$ - 420 $\mu\text{g}/\text{m}^3$	06 $\mu\text{g}/\text{m}^3$	120	80

\*\*All units are in  $\mu\text{g}/\text{m}^3$ , 24 hourly Average \* LDL indicates Lower Detection Limit,

*(Signature)*  
**ANALYSED BY**

*(Signature)*  
 (Gaurav Kant)  
**REVIEWED BY**

*(Signature)*  
 (Amit Raj Mishra)  
**Authorised Signatory**

**Note:** The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----

Page -1 of 1



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**Ambient Air Quality Test Report**

**CMPDIL, RI-II**  
**KOYLA BHAWAN COMPLEX**  
**DHANBAD. -826005**  
**Phone:0326-223-850**  
**email: rdri2cmpdi@coalindia.in**

**Test Report for Ambient Air Samples**

<b>Month &amp; Year</b>	01/2025	<b>Cluster</b>	Cluster XIV			<b>ULR No.</b>	TC1012224000001428F	
<b>Customer</b>	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)					<b>Date of Issue</b>	18.02.2025	
<b>Project</b>	Madhuband UGP	<b>Sample Ref. No.</b>	REM/BCCL/2025/01	<b>Sampling Method</b>		CMPDI/RI-II/LPM 11 , ( IS 5182)		
<b>Date of Sampling</b>	04.01.2025		<b>Period of Analysis</b>	04.01.2025	15.02.2025	<b>Zone of Station:</b>	Core Zone	
<b>Sl. No.</b>	<b>Parameter</b>	<b>Method of Analysis</b>	<b>Observed Values ( in <math>\mu\text{g}/\text{m}^3</math>)</b>		<b>Range Of Testing</b>	<b>LDL</b>	<b>MoEF Standards Notification dated 25th September,2000 (GSR 742 E )</b>	<b>NAAQS, 2009</b>
			<b>1st FN A3245</b>	<b>2nd FN A3316</b>				
1	PM <sub>10</sub>	IS -5182(Part 23):2006, R-2017	76	83	10 $\mu\text{g}/\text{m}^3$ - 1000 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	300	100
2	PM <sub>2.5</sub>	IS -5182(Part 24):2019	42	47	10 $\mu\text{g}/\text{m}^3$ - 400 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	Not Specified	60
3	SO <sub>2</sub>	IS-5182(Part-2): 2001 , R-2017	<10	<10	10 $\mu\text{g}/\text{m}^3$ - 1050 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	120	80
4	NO <sub>2</sub>	IS-5182 (Part-6): 2006 , R-2017	<b>26</b>	<b>28</b>	06 $\mu\text{g}/\text{m}^3$ - 420 $\mu\text{g}/\text{m}^3$	06 $\mu\text{g}/\text{m}^3$	120	80

\* LDL indicates Lower Detection Limit,

\*\*All units are in  $\mu\text{g}/\text{m}^3$ , 24 hourly Average,

*[Signature]*

**ANALYSED BY**

*[Signature]*

(Gaurav Kant)  
**REVIEWED BY**

*[Signature]*

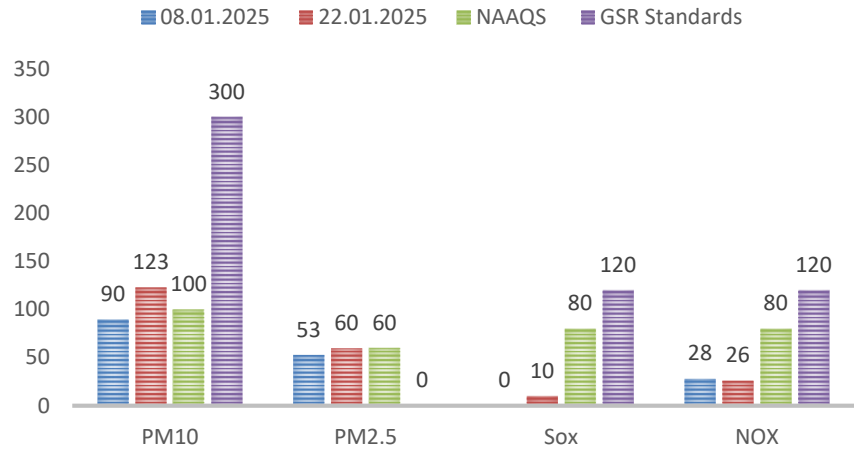
(Amit Raj Mishra)  
**Authorised Signatory**

**Note:** The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

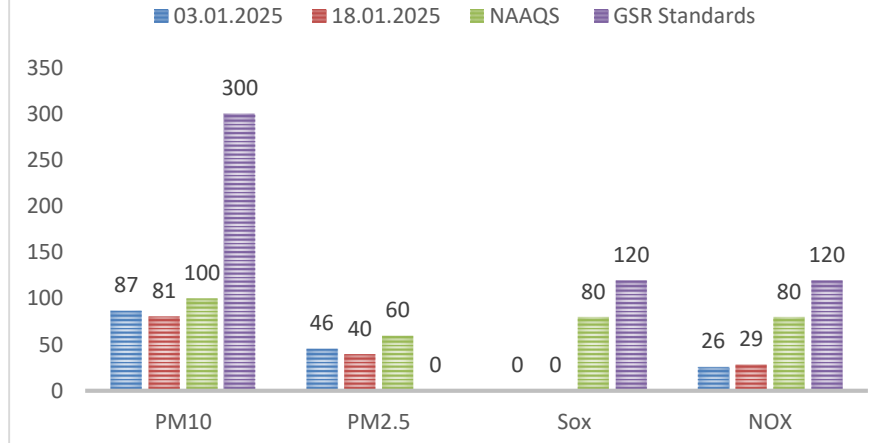
---- End of Report ----

Page -1 of 1

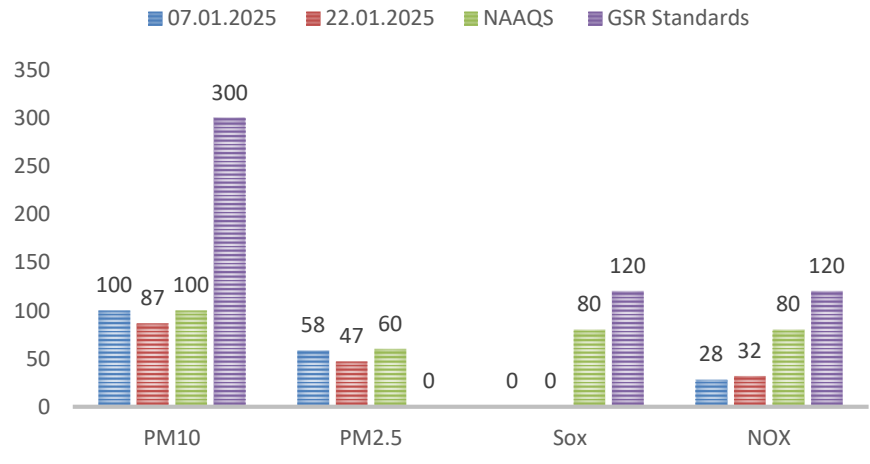
### AMBIENT AIR QUALITY AT LOHAPATTI



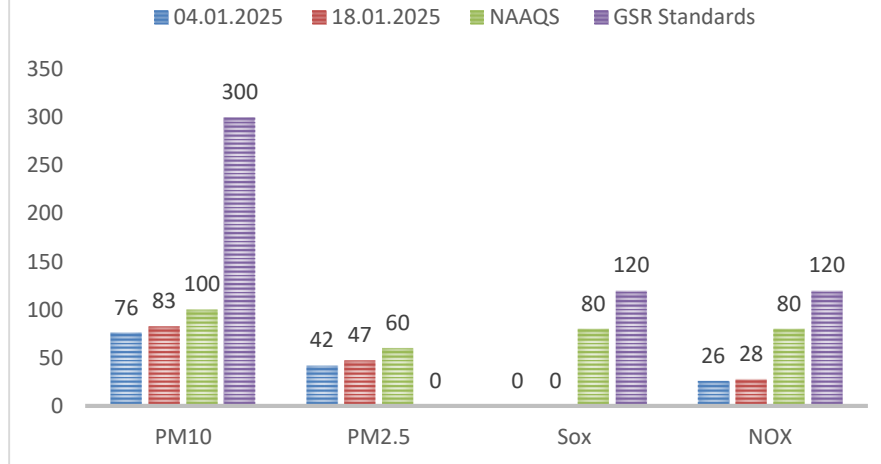
### AMBIENT AIR QUALITY AT KHARKHAREE CISF OFFICE



### AMBIENT AIR QUALITY AT TELMACHHO BRIDGE



### AMBIENT AIR QUALITY AT MADHUBAND UGP OFFICE



## **WATER QUALITY MONITORING**

### **3.1 Location of sampling sites**

(Refer **Plate No. – II**)

#### **i) Mine Discharge of Block II (MW14)**

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

### **3.2 Methodology of sampling and analysis**

Water samples were collected as per standard practice. The effluent samples were collected and analysed 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.



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**MINE EFFLUENT TEST REPORT**

CMPDI, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmpdi@coalindia.in

**Test Report for Mine Effluent samples**

<b>Month &amp; Year</b>	01/2025	<b>Cluster</b>	Cluster XIV		<b>ULR No.</b>	TC1012224000001445F	
<b>Customer</b>	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)					<b>Date of Issue</b>	18.02.2025
<b>Project</b>		<b>Sampling Ref. No.</b>	REM/BCCL/2025/01		<b>Sampling Method</b>	IS 3025 (Part-1) CMPDI/RI-II/LPM 13	
<b>Sampling Stations</b>	(i)	<b>Block II</b>	Sample Collected in 2.5 Ltr Jerrycane, Color as observed is transparent			Period of Analysis	
			<b>Date of Sampling</b>		06.01.25	20.01.25	06.01.25 to 31.01.25
<b>Sl. No.</b>	<b>Parameter</b>	<b>Method of Analysis</b>	<b>Observed Values</b>		<b>STANDARDS FOR COAL MINES</b> (Stipulated by Ministry of Environment and Forests (MoEF), Vide Notification No. GSR 742(E), Dt: 25.09.2000)		<b>LDL</b>
			<b>First Fortnight</b> M1292	<b>Second Fortnight</b> M1318			
1	Total Suspended Solids	IS 3025/17:1984, R :2017, Gravimetric	39	40	100 (Max)		10
2	pH	IS-3025/11:1983, R-2017, Electrometric	7.26	7.27	5.5 - 9.0		0.2
3	Oil & Grease	IS 3025/39:1991, R : 2019, Partition Gravimetric	<2.0	<2.0	34		33
4	COD	APHA 23rd Edition 5220 C Titrimetric Method	44	40	7.69		7.81

\*\*All units in mg/L unless specified otherwise. \*LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,

\*\*Grab sampling carried out for water samples.

**ANALYSED BY**

(Kumar Vaibhav)  
**REVIEWED BY**

(Amit Raj Mishra)  
**Authorised Signatory**

Note: The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env), CMPDI, RI-II.

---- End of Report ----

## **NOISE LEVEL QUALITY MONITORING**

### **4.1 Location of sampling sites**

- i) **Lohapatti (N20)**
- ii) **Kharkharee CISF Office (N21)**
- iii) **Telmacho Bridge (N32)**
- iv) **Madhuband UGP (N33)**

**4.2** Noise level measurements in form of 'L<sub>EQ</sub>' were taken using Integrated Data Logging Sound Level Meter during day time & night time. Noise levels were measured for the complete day & night time, the Intergration time taken was one hour or 3600 seconds. 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 & night time and the observed values were compared with standards prescribed by MoEF&CC. The results of Noise levels recorded during day & night time on fortnightly basis are presented in tabular form along with the applicable standard permissible limits. The observed values in terms of L<sub>EQ</sub> are presented. The observed values at all the monitoring locations are found to be within permissible limits.



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**Ambient Noise Level Test Report**

CMPDIL, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmpdi@coalindia.in

Month & Year	01/2025	Cluster	Cluster XIV				ULR No.	TC1012224000001462F	
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)						Date of Issue	18.02.2025	
Project		Sample Ref. No.	REM/BCCL/2025/01			Sampling Method	CMPDI/RI-II/LPM 22		
Sampling Stations	i	Lohapatti		Date of Sampling	08.01.2025	22.01.2025	Zone Category of Station:	CORE Zone	
Sl. No.	Parameter	Hour / Time of day	Observed Values ( in Leq dB(A) )		Method of Analysis	Range Of Testing	LDL	NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 Standards	
			First Fortnight	Second Fortnight				Zones	Limits in dB
1	Noise Level dB(A)Leq - Day	06:00 - 07:00	35.1	35.7	CPCB, Protocol for Ambient Level Noise Monitoring - 2015	35 dB-135 dB	35 Db (A)	Industrial Commercial Residential Silence	75 65 55 50
2		07:00 - 08:00	45.3	44.5					
3		08:00 - 09:00	40.1	45					
4		09:00 - 10:00	37.5	39.9					
5		10:00 - 11:00	40.1	41.6					
6		11:00 - 12:00	38.9	40					
7		12:00 - 13:00	39.9	42.4					
8		13:00 - 14:00	41.2	43.9					
9		14:00 - 15:00	40.5	42					
10		15:00 - 16:00	43	43.4					
11		16:00 - 17:00	43.1	43.2					
12		17:00 - 18:00	42.9	43.9					
13		18:00 - 19:00	42.9	46					
14		19:00 - 20:00	42.4	42					
15		20:00 - 21:00	42.3	42.1					
16		21:00 - 22:00	42.1	42					
		<b>Leq Day</b>	41.7	42.9					
1	Noise Level dB(A)Leq -Night	22:00-23:00	40.1	40.1	CPCB, Protocol for Ambient Level Noise Monitoring - 2015	35 dB-135 dB	35 dB (A)	Industrial Commercial Residential Silence	70 55 45 50
2		23:00- 00:00	40	39.5					
3		00:00- 01:00	39.7	39.6					
4		01:00-02.00	39.3	40.2					
5		02.00-03.00	39.2	39.5					
6		03.00-04.00	39.1	39.2					
7		04.00-05.00	38.8	39.3					
8		05:00-06:00	39.5	39.8					
		<b>Leq Day</b>	39.5	39.7					

\*\*All noise measurements are integrated for a 01 hour period, All units in dB(A) \*LDL indicates Lower Detection Limit

Sampling Assistants

(Gaurav Kant)

**REVIEWED BY**

(Amit Raj Mishra)

**Authorised Signatory**

ANALYSED BY

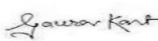

Note: The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----

Page -1 of 1

Month & Year		Cluster		ULR No.					
01/2025		Cluster XIV		TC101222400001462F					
Customer				Date of Issue					
Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)				18.02.2025					
Project		Sample Ref. No.		Sampling Method					
		REM/BCCL/2025/01		CMPDI/RI-II/LPM 22					
Sampling Stations		Date of Sampling		Zone Category of Station:					
i		03.01.2025		Core Zone					
		18.01.2025							
Sl. No.		Parameter		Method of Analysis					
		Hour / Time of day		Range Of Testing					
		Observed Values (in Leq dB(A))		LDL					
		First Fortnight		NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 Standards					
		Second Fortnight		Zones					
				Limits in dB					
1	Noise Level dB(A)Leq - Day	06:00 - 07:00	42	CPCB, Protocol for Ambient Level Noise Monitoring -2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	75 65 55 50	
2		07:00 - 08:00	56.8						
3		08:00 - 09:00	67.6						
4		09:00 - 10:00	69						
5		10:00 - 11:00	64						
6		11:00 - 12:00	61.3						
7		12:00 - 13:00	58.9						
8		13:00 - 14:00	57.4						
9		14:00 - 15:00	55.2						
10		15:00 - 16:00	53.7						
11		16:00 - 17:00	53.1						
12		17:00 - 18:00	53.8						
13		18:00 - 19:00	51.3						
14		19:00 - 20:00	49.6						
15		20:00 - 21:00	45.3						
16		21:00 - 22:00	45						
		<b>Leq Day</b>							
1	Noise Level dB(A)Leq -Night	22:00-23:00	42.7	CPCB, Protocol for Ambient Level Noise Monitoring -2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	70 55 45 50	
2		23:00-00:00	40.1						
3		00:00-01:00	40.2						
4		01:00-02:00	38.5						
5		02:00-03:00	38.3						
6		03:00-04:00	37.8						
7		04:00-05:00	37.6						
8		05:00-06:00	36.3						
		<b>Leq Day</b>							
		39.4							

\*\*All noise measurements are integrated for a 01 hour period, All units in dB(A) \*LDL indicates Lower Detection Limit

Sampling Assistants <b>ANALYSED BY</b>	 (Gaurav Kant) <b>REVIEWED BY</b>	 (Amit Raj Mishra) <b>Authorised Signatory</b>
---	---	---

Note: The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env), CMPDI, RI-II.

---- End of Report ----  
Page -1 of 1



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**Ambient Noise Level Test Report**

CMPDIL, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmpdi@coalindia.in

Month & Year	01/2025	Cluster	Cluster XIV				ULR No.	TC1012224000001462F	
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)						Date of Issue	18.02.2025	
Project		Sample Ref. No.	REM/BCCL/2025/01			Sampling Method	CMPDI/RI-II/LPM 22		
Sampling Stations	i	Telmacho Bridge		Date of Sampling	07.01.2025	22.01.2025	Zone Category of Station:	Buffer Zone	
Sl. No.	Parameter	Hour / Time of day	Observed Values (in Leq dB(A))		Method of Analysis	Range Of Testing	LD L	NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 Standards	
			First Fortnight	Second Fortnight				Zones	Limits in dB
1	Noise Level dB(A)Leq - Day	06:00 - 07:00	39.8	42.5	CPCB, Protocol for Ambient Level Noise Monitoring -2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	75 65 55 50
2		07:00 - 08:00	50.5	51.1					
3		08:00 - 09:00	53.8	51					
4		09:00 - 10:00	58.6	59.3					
5		10:00 - 11:00	57.9	56.7					
6		11:00 - 12:00	58.8	58.1					
7		12:00 - 13:00	60.3	62.4					
8		13:00 - 14:00	58.6	63.7					
9		14:00 - 15:00	56.8	58.2					
10		15:00 - 16:00	56.1	57.4					
11		16:00 - 17:00	53.7	52.6					
12		17:00 - 18:00	49.7	50.1					
13		18:00 - 19:00	46.4	50.5					
14		19:00 - 20:00	45	43.9					
15		20:00 - 21:00	42	42.1					
16		21:00 - 22:00	41.5	41.1					
		<b>Leq Day</b>	55.4	57.0					
1	Noise Level dB(A)Leq -Night	22:00-23:00	38.3	38	CPCB, Protocol for Ambient Level Noise Monitoring -2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	70 55 45 50
2		23:00- 00:00	37.5	37.5					
3		00:00- 01:00	37.4	37.4					
4		01:00-02:00	37.4	38.3					
5		02:00-03:00	38.2	38.3					
6		03:00-04:00	38.3	38.3					
7		04:00-05:00	38.5	38.5					
8		05:00-06:00	38.6	38.7					
		<b>Leq Day</b>	38.1	38.1					

\*\*All noise measurements are integrated for a 01 hour period, All units in dB(A) \*LDL indicates Lower Detection Limit

Sampling Assistants  
 ANALYSED BY

*Gaurav Kant*  
 (Gaurav Kant)  
 REVIEWED BY

*Amit Raj Mishra*  
 (Amit Raj Mishra)  
 Authorised Signatory

Note: The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**Ambient Noise Level Test Report**

CMPDIL, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmpdi@coalindia.in

Month & Year	01/2025	Cluster	Cluster XIV				ULR No.	TC101222400001462F	
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)						Date of Issue	18.02.2024	
Project		Sample Ref. No.	REM/BCCL/2025/01			Sampling Method	CMPDI/RI-II/LPM 22		
Sampling Stations	i	Madhuband UGP		Date of Sampling	04.01.2025	18.01.2025	Zone Category of Station:	Buffer Zone	
Sl. No.	Parameter	Hour / Time of day	Observed Values (in Leq dB(A))	Observed Values (in Leq dB(A))	Method of Analysis	Range Of Testing	LDL	NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 Standards	
			First Fortnight	Second Fortnight				Zones	Limits in dB
1	Noise Level dB(A)Leq - Day	06:00 - 07:00	39.4	40	CPCB, Protocol for Ambient Level Noise Monitoring - 2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	75 65 55 50
2		07:00 - 08:00	42.1	41.5					
3		08:00 - 09:00	45.4	45.7					
4		09:00 - 10:00	46.5	46.3					
5		10:00 - 11:00	46.3	46.4					
6		11:00 - 12:00	46	45.7					
7		12:00 - 13:00	46.9	46.6					
8		13:00 - 14:00	50.1	53.6					
9		14:00 - 15:00	51.3	51.3					
10		15:00 - 16:00	51.8	48.6					
11		16:00 - 17:00	45	45.1					
12		17:00 - 18:00	43.8	43.7					
13		18:00 - 19:00	43.4	43.3					
14		19:00 - 20:00	43.2	42.8					
15		20:00 - 21:00	43	42.4					
16		21:00 - 22:00	41.9	42					
		<b>Leq Day</b>	46.8	47.0					
1	Noise Level dB(A)Leq -Night	22:00-23:00	39.3	39.8	CPCB, Protocol for Ambient Level Noise Monitoring - 2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	70 55 45 50
2		23:00- 00:00	39.2	39.9					
3		00:00- 01:00	39.1	39.2					
4		01:00-02:00	38.5	38.9					
5		02:00-03:00	38.3	38.7					
6		03:00-04:00	39.5	39.8					
7		04:00-05:00	39.8	40					
8		05:00-06:00	40.1	39.9					
		<b>Leq Day</b>	39.3	39.6					

\*\*All noise measurements are integrated for a 01 hour period, All units in dB(A) \*LDL indicates Lower Detection Limit

Sampling Assistants  
 ANALYSED BY

*Gaurav Kant*  
 (Gaurav Kant)  
**REVIEWED BY**

*Amit Raj Mishra*  
 (Amit Raj Mishra)  
**Authorised Signatory**

Note: The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----

Page -1 of 1



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

Category	Pollutant	Time weighted average	Concentration in Ambient Air	Method of Measurement
1	2	3	4	5
<b>III</b> Coal mines located in the coal fields of <ul style="list-style-type: none"> <li>• Jharia</li> <li>• Raniganj</li> <li>• Bokaro</li> </ul>	Suspended Particulate Matter (SPM)	Annual Average * 24 hours **	500 $\mu\text{g}/\text{m}^3$  700 $\mu\text{g}/\text{m}^3$	- High Volume Sampling (Average flow rate not less than 1.1)
	Respirable Particulate Matter (size less than 10 $\mu\text{m}$ ) (RPM)	Annual Average * 24 hours **	250 $\mu\text{g}/\text{m}^3$  300 $\mu\text{g}/\text{m}^3$	Respirable Particulate Matter sampling and analysis
	Sulphur Dioxide ( $\text{SO}_2$ )	Annual Average * 24 hours **	80 $\mu\text{g}/\text{m}^3$  120 $\mu\text{g}/\text{m}^3$	1.Improvedwest and Gaeke method 2.Ultraviolet fluorescene
	Oxide of Nitrogen as $\text{NO}_2$	Annual Average * 24 hours **	80 $\mu\text{g}/\text{m}^3$  120 $\mu\text{g}/\text{m}^3$	1. Jacob & Hochheiser Modified (Na-Arsenic) Method 2. Gas phase Chemiluminescence

**Note:**

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

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

## NATIONAL AMBIENT AIR QUALITY STANDARDS

New Delhi the 18<sup>th</sup> November 2009

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

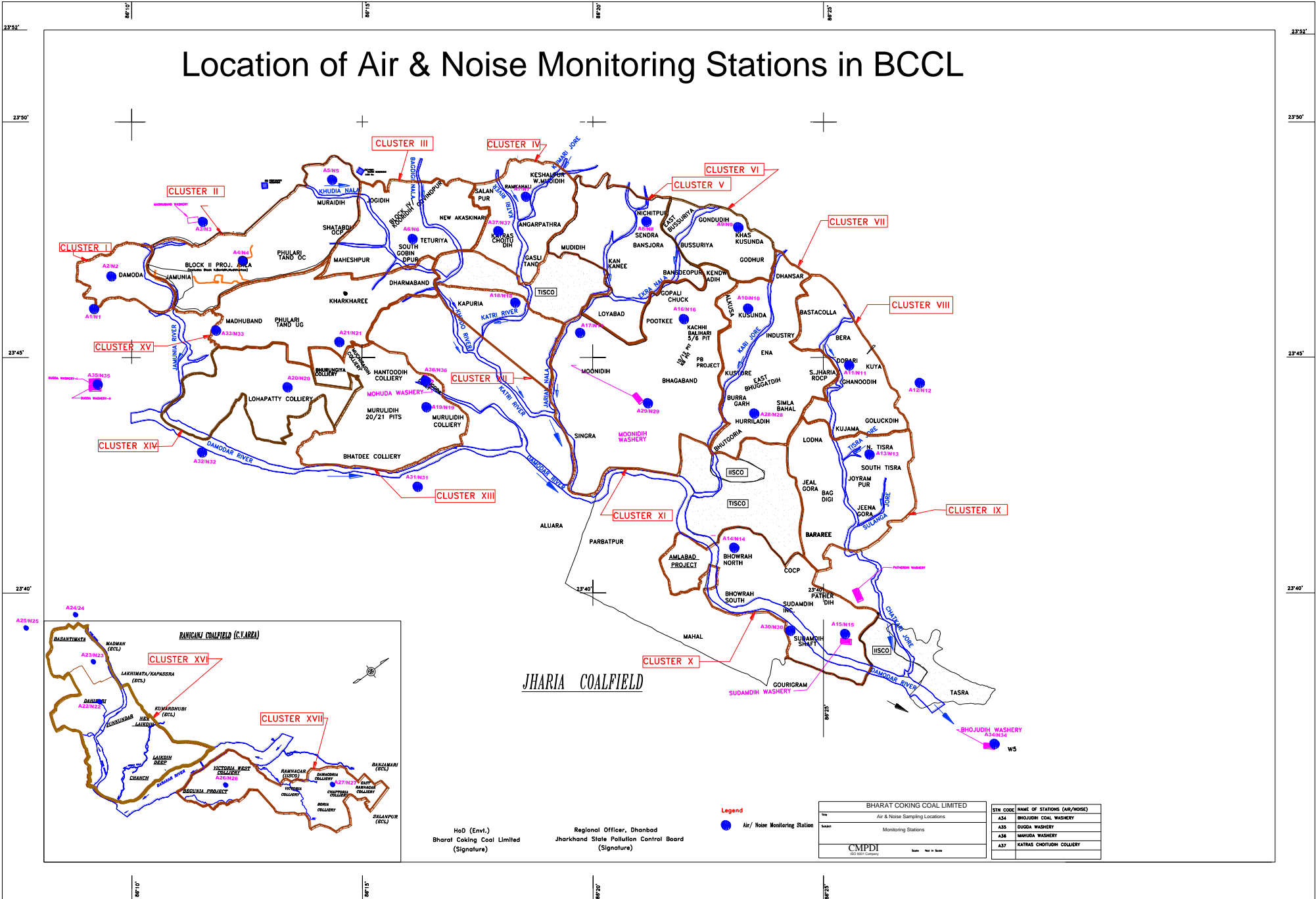
Pollutant	Time Weighted Average	Concentration in Ambient Air		Methods of Measurement
		Industrial, Residential, Rural and other Areas	Ecologically Sensitive Area (Notified by Central Government)	
<b>Sulphur Dioxide (SO<sub>2</sub>), µg/m<sup>3</sup></b>	Annual * 24 Hours **	50 80	20 80	-Improved West and Gaeke Method -Ultraviolet Fluorescence
<b>Nitrogen dioxide (NO<sub>2</sub>), µg/m<sup>3</sup></b>	Annual * 24 Hours **	40 80	30 80	-Jacob & Hochheiser modified (NaOH-NaAsO <sub>2</sub> ) Method -Gas Phase Chemiluminescence
<b>Particulate Matter (Size less than 10µm) or PM<sub>10</sub>, µg/m<sup>3</sup></b>	Annual * 24 Hours **	60 100	60 100	-Gravimetric -TEOM -Beta attenuation
<b>Particulate Matter (Size less than 2.5µm) or PM<sub>2.5</sub>, µg/m<sup>3</sup></b>	Annual * 24 Hours **	40 60	40 60	-Gravimetric -TEOM -Beta attenuation
<b>Ozone (O<sub>3</sub>), µg/m<sup>3</sup></b>	8 Hours * 1 Hour **	100 180	100 180	-UV Photometric -Chemiluminescence -Chemical Method
<b>Lead (Pb), µg/m<sup>3</sup></b>	Annual * 24 Hours **	0.50 1.0	0.50 1.0	-AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper -ED-XRF using Teflon filter
<b>Carbon Monoxide (CO), mg/m<sup>3</sup></b>	8 Hours ** 1 Hour **	02 04	02 04	-Non dispersive Infrared (NDIR) Spectroscopy
<b>Ammonia (NH<sub>3</sub>), µg/m<sup>3</sup></b>	Annual * 24 Hours **	100 400	100 400	-Chemiluminescence -Indophenol blue method
<b>Benzene (C<sub>6</sub>H<sub>6</sub>), µg/m<sup>3</sup></b>	Annual *	05	05	-Gas Chromatography (GC) based continuous analyzer -Adsorption and desorption followed by GC analysis
<b>Benzo(a)Pyrene (BaP) Particulate phase only, ng/m<sup>3</sup></b>	Annual *	01	01	-Solvent extraction followed by HPLC/GC analysis
<b>Arsenic (As), ng/m<sup>3</sup></b>	Annual *	06	06	-AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper
<b>Nickel (Ni), ng/m<sup>3</sup></b>	Annual *	20	20	-AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper

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

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

**NOTE:** Whenever and wherever monitoring results on two consecutive days of monitoring exceed the limits specified above for the respective category

# Location of Air & Noise Monitoring Stations in BCCL



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

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

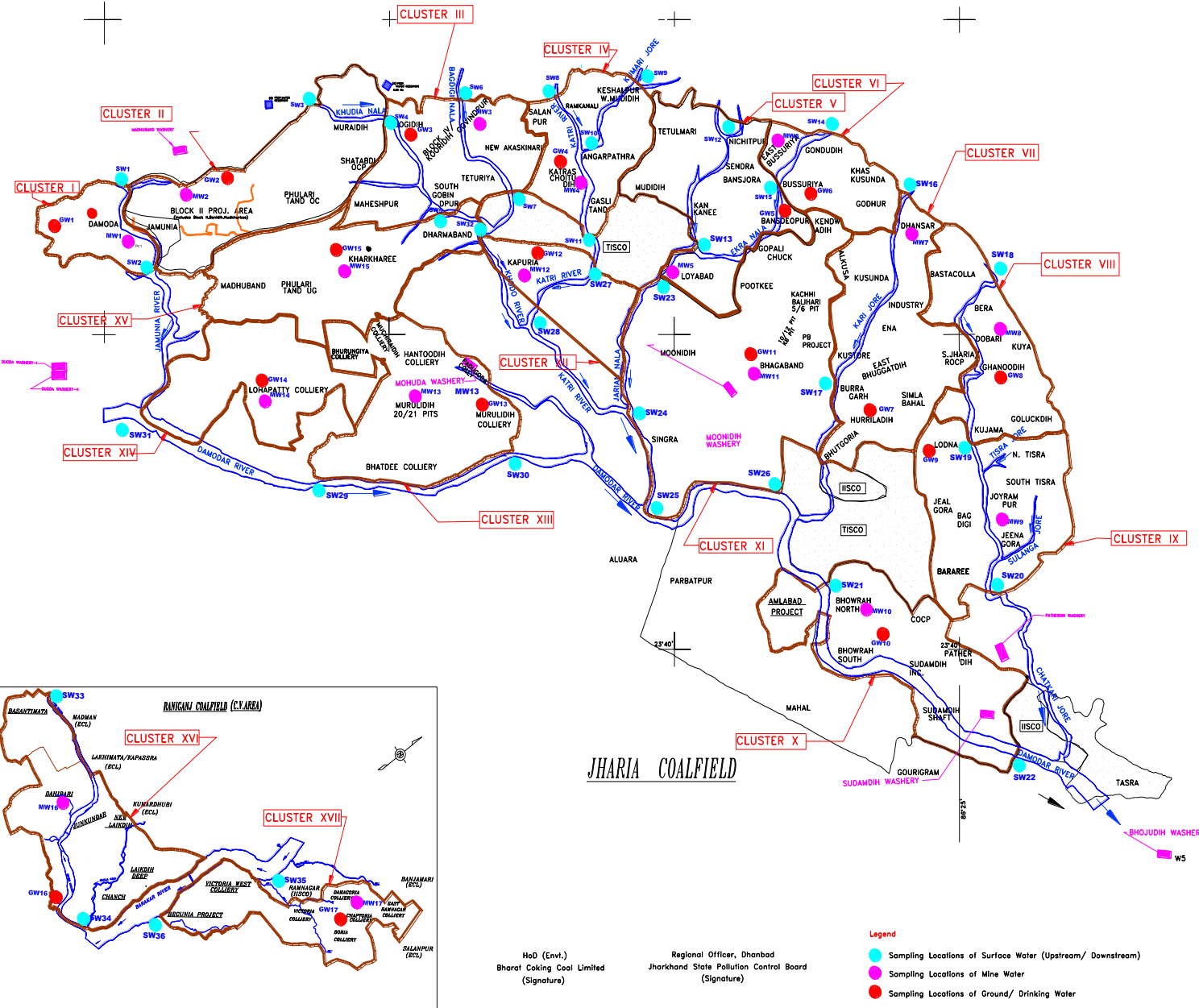
Legend

● Air / Noise Monitoring Station

BHARAT COKING COAL LIMITED	
For	Air & Noise Sampling Locations
Scale	Monitoring Stations
CMPDI Coal Monitoring & Pollution Data Institute	
Date	Not to Scale

STN CODE	NAME OF STATIONS (AIR/NOISE)
A34	BHOJUDIH COAL WASHERY
A35	DUGGA WASHERY
A36	MARUDA WASHERY
A37	KATRAS CHOTUDIH COLLIERY

# Water Sampling Locations in BCCL



### INDEX

Cluster	Surface Water (US, DS)	Name of River/ Nala/ Effluent Water	Mineral Effluent Location	Sampling Location	Ground Water	Sampling Location
I	SW1, SW2	Jamunia River	MW1	Damoda Area	GW1	Chutway Village
II	SW3, SW4	Khudia Nala	MW2	Block II OCP	GW2	Joyrampur Village
III	SW4, SW5, SW6, SW7	Khudia Nala, Bagdigi Nala	MW3	Govindpur Colliery	GW3	Jogdih Village
IV	SW8, SW11, SW9, SW10	Kasi River, Kuman Jore	MW4	Chotudih	GW4	Kankanees Village
V	SW12, SW13, SW15	Jarian Nala, Ekra Nala	MW5	Mudidih	GW5	Nichitpur
VI	SW14, SW15	Ekra Nala	MW6	East Bassuria UGP	GW6	Bansara Borewell
VII	SW16, SW17	Kari Jore	MW7	Dhanbar UGP	GW7	Hurmidih
VIII	SW18, SW19	Kashi Jore	MW8	Doban UGP	GW8	Gharudih
IX	SW19, SW20	Kashi Jore	MW9	Jeenagora	GW9	Lodna
X	SW21, SW22	Damodar River	MW10	Bhowrah North	GW10	Bhowrah South
XI	SW23, SW24, SW25, SW26	Jarian Nala, Damodar River	MW11	Bhagaband UGP	GW11	Bhagaband
XII	SW27, SW28	Kashi River	MW12	Kapuria	GW12	Kapuria
XIII	SW29, SW30	Damodar River	MW13	Muridih	GW13	Muridih
XIV	SW31, SW32	Damodar River	MW14	Lohapatty	GW14	Lohapatty
XV	SW5, SW32	Khudhanees Nala	MW15	Kharkhanees UGP	GW15	Kharkhanees
XVI	SW33, SW34	Khudia River	MW16	Dahaban OCP	GW16	Pallabani Village
XVII	SW35, SW36	Barakar River	MW17	Damagoria Colliery	GW17	Chaptora

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

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

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

**STRICTLY RESTRICTED**  
**FOR COMPANY USE ONLY RESTRICTED**

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

**ENVIRONMENTAL MONITORING REPORT  
OF  
BHARAT COKING COAL LIMITED,  
CLUSTER – XIV**

**(FOR THE MONTH FEBRUARY, 2025)**

**E. C. no. J-11015/10/2010-IA.II (M) dated 06.06.2013.**



**CMPDI**

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

# CONTENTS

<b>SL. NO.</b>	<b>CHAPTER</b>	<b>PARTICULARS</b>	<b>PAGE NO.</b>
1.	CHAPTER - I	EXECUTIVE SUMMARY	3-5
2.	CHAPTER-II	INTRODUCTION	6
3.	CHAPTER-III	RESULTS	7-19
4.	CHAPTER-IV	STANDARDS AND PLANS	20-21

## **EXECUTIVE SUMMARY**

### **1.0 Introduction**

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

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

### **2.0 Sampling location and rationale**

#### **2.1 Ambient air sampling locations**

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

#### **2.2 Water sampling stations**

The Water sampling stations were selected for mine sump water.

#### **2.3 Noise level monitoring locations**

Noise levels vary depending on the various activities in mining areas. The monitoring of noise level in different locations will be helpful to take appropriate mitigating measures. The noise levels were recorded in mining areas, washeryareas and in residential areas.

### **3.0 Methodology of sampling and analysis**

#### **3.1 Ambient air quality**

Parameters chosen for assessment of ambient air quality were Particulate Matter (PM<sub>10</sub>), Fine Particulate Matter (PM<sub>2.5</sub>), Sulphur Di-oxide (SO<sub>2</sub>) and Nitrogen Oxides (NO<sub>x</sub>). Respirable Dust Samplers (RDS) and Fine Dust

Sampler (PM<sub>2.5</sub> sampler) were used for sampling of PM<sub>10</sub>, SO<sub>2</sub>, & NO<sub>x</sub> and Fine Dust Sampler (PM<sub>2.5</sub> sampler) were used for sampling of PM<sub>2.5</sub> at 24 hours interval once in a fortnight and the same for the gaseous pollutants. The samples were analyzed in Environmental Laboratory of CMPDI, RI-II, Dhanbad.

### **3.2 Water quality**

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

### **3.3 Noise level monitoring**

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

## **4.0 Results and interpretations**

### **4.1 Air quality**

It has been seen from the analysis results that the 24 hours average concentration parameters like PM<sub>10</sub>, PM<sub>2.5</sub>, SO<sub>2</sub> and NO<sub>x</sub> are mostly within the permissible limits in all sampling locations as per MoEF&CC Gazette Notification No. GSR 742(E) dt 25.09.2000 Standards for Coal Mines and National Ambient Air Quality Standard -2009. Sometimes the concentration of PM<sub>10</sub>& PM<sub>2.5</sub> exceeds the limits due to heavy public traffic, poor road condition, coke oven plants, burning of coal by surrounding habitants, brick making, municipal waste dumps and industries like Steel Plant, thermal Plants including their fly ash etc.

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

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

#### **4.2 Water quality**

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

#### **4.3 Noise Level**

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

## INTRODUCTION

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

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-XIV is in the Western part of the Jharia coalfield and situated in the Western Jharia area of BCCL. It includes 1 Mine (viz. Lohapatti (UG & OC). The Cluster – XIV is situated about 25 - 30 kms from Dhanbad Railway Station. The mines of this Cluster – XIV 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 Damodar River.
- 1.2 The Cluster-XIV is designed to produce 0.405 MTPA (normative) and 0.526 MTPA (peak) capacity of coal.

The Project has Environmental Clearance from Ministry of Environment, Forest and Climate Change (MoEF&CC) for a rated capacity 0.405 MTPA (normative) and 0.526 MTPA (peak) capacity of coal production vide letter no. J-11015/10/2010-IA.II (M) dated 06<sup>th</sup> June, 2013.

Ministry of Environment, Forest and Climate Change while granting environmental clearance has given one of the General conditions that “ Four ambient air quality monitoring stations should be established in the core zone as well as in the buffer zone for PM<sub>10</sub>, PM<sub>2.5</sub>, SO<sub>2</sub>, NO<sub>x</sub> monitoring. Location of the stations should be decided based on the meteorological data, topographical features and environmentally and ecologically sensitive targets in consultation with the State Pollution Control Board.” And other conditions regarding water / effluent and noise level monitoring.

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

## AMBIENT AIR QUALITY MONITORING

### 2.1 Location of sampling station and their rationale:

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

#### 2.1.1 Ambient Air Quality Sampling Locations

##### I. CORE ZONE Monitoring Location

###### i) Lohapatti (A20): Industrial Area

The location of the sampling station is 23° 44' 29.42" N & 86° 12' 49.96" E. The sampler was placed at a height of approx. 1.5m above ground level at Project Office.

##### II. BUFFER ZONE Monitoring Location

###### i) Kharkharee CISF Office (A21): Industrial Area

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 Safety Office.

###### ii) Telmachho Bridge (A32): Industrial Area

The location of the sampling station is 23° 44' 14.90" N & 86° 12' 21.20" E. The location was selected for studying the impact of the mining activity on the Telmachho Bridge area as it lies in the buffer zone for the Cluster XIV.

###### iii) Madhuband UGP Office (A33): Industrial Area

The location of the sampling station is 23° 45'24.48" N & 86°11'59.44"E. The sampler was placed at a height of approx. 1.5m above ground level at Safety Office.

## AMBIENT AIR QUALITY DATA



TC-14321



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**Ambient Air Quality Test Report**

CMPDIL, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmpdi@coalindia.in

### Test Report for Ambient Air Samples

Month & Year	02/2025	Cluster	Cluster XIV			ULR No.	TC1432125000001544F	
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)					Date of Issue	04.03.2025	
Project	Lohapatti	Sample Ref. No.	REM/BCCL/2025/02	Sampling Method		CMPDI/RI-II/LPM 11, ( IS 5182)		
Date of Sampling	06.02..25	20.02.25	Period of Analysis	06.02..25	03.03.2025	Zone of Station:	Buffer Zone	
Sl. No.	Parameter	Method Analysis of	Observed Values ( in $\mu\text{g}/\text{m}^3$ )		Range Of Testing	LDL	MoEF Standards Notification dated 25th September,2000 (GSR 742 E )	NAAQS, 2009
			1st FN A3404	2nd FN A3481				
1	PM <sub>10</sub>	IS -5182(Part 23):2006, R-2017	118	94	10 $\mu\text{g}/\text{m}^3$ - 1000 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	300	100
2	PM <sub>2.5</sub>	IS -5182(Part 24):2019	64	52	10 $\mu\text{g}/\text{m}^3$ - 400 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	Not Specified	60
3	SO <sub>2</sub>	IS-5182(Part-2): 2001, R-2017	11	<10	10 $\mu\text{g}/\text{m}^3$ - 1050 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	120	80
4	NO <sub>2</sub>	IS-5182 (Part-6): 2006, R-2017	29	27	06 $\mu\text{g}/\text{m}^3$ - 420 $\mu\text{g}/\text{m}^3$	06 $\mu\text{g}/\text{m}^3$	120	80

\* LDL indicates Lower Detection Limit,

\*\*All units are in  $\mu\text{g}/\text{m}^3$ , 24 hourly Average,

  
**ANALYSED BY**

  
 (Gaurav Kant)  
**REVIEWED BY**

  
 (Amit Raj Mishra)  
**Authorised Signatory**

**Note:** The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----

Page -1 of 1



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**Ambient Air Quality Test Report**

CMPDI, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmpdi@coalindia.in

**Test Report for Ambient Air Samples**

<b>Month &amp; Year</b>	02/2025	<b>Cluster</b>	Cluste XIV			<b>ULR No.</b>	TC1432125000001544F	
<b>Customer</b>	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)					<b>Date of Issue</b>	04.03.2025	
<b>Project</b>	Kharkharee	<b>Sample Ref. No.</b>	REM/BCCL/2024/02	<b>Sampling Method</b>		CMPDI/RI-II/LPM 11 , ( IS 5182)		
<b>Date of Sampling</b>	05.02.25	24.02.25	<b>Period of Analysis</b>	05.02.25	03.03.2025	<b>Zone of Station:</b>	Core Zone	
<b>Sl. No.</b>	<b>Parameter</b>	<b>Method of Analysis</b>	<b>Observed Values ( in <math>\mu\text{g}/\text{m}^3</math>)</b>		<b>Range Of Testing</b>	<b>LDL</b>	<b>MoEF Standards Notification dated 25th September,2000 (GSR 742 E )</b>	<b>NAAQS, 2009</b>
			<b>1st FN A3398</b>	<b>2nd FN A3505</b>				
1	PM <sub>10</sub>	IS -5182(Part 23):2006, R-2017	93	95	10 $\mu\text{g}/\text{m}^3$ - 1000 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	300	100
2	PM <sub>2.5</sub>	IS -5182(Part 24):2019	46	50	10 $\mu\text{g}/\text{m}^3$ - 400 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	Not Specified	60
3	SO <sub>2</sub>	IS-5182(Part-2): 2001 , R-2017	<10	<10	10 $\mu\text{g}/\text{m}^3$ - 1050 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	120	80
4	NO <sub>2</sub>	IS-5182 (Part-6): 2006 , R-2017	29	27	06 $\mu\text{g}/\text{m}^3$ - 420 $\mu\text{g}/\text{m}^3$	06 $\mu\text{g}/\text{m}^3$	120	80

\* LDL indicates Lower Detection Limit,  
 \*\*All units are in  $\mu\text{g}/\text{m}^3$ , 24 hourly Average,

*[Signature]*

**ANALYSED BY**

*[Signature]*

**REVIEWED BY**

*[Signature]*

**Authorised Signatory**

**Note:** The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----

Page -1 of 1

**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**Ambient Air Quality Test Report**



CMPDI, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmpdi@coalindia.in

**Test Report for Ambient Air Samples**

<b>Month &amp; Year</b>	02/2025	<b>Cluster</b>	CLUSTER XIV			<b>ULR No.</b>	TC1432125000001544F	
<b>Customer</b>	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)				<b>Date of Issue</b>	04.03.2025		
<b>Project</b>	Telmacho Bridge	<b>Sample Ref. No.</b>	REM/BCCL/2025/02	<b>Sampling Method</b>		CMPDI/RI-II/LPM 11 , ( IS 5182)		
<b>Date of Sampling</b>	06.02.25	19.02.25	<b>Period of Analysis</b>	06.02.25	03.03.2025	<b>Zone of Station:</b>	<b>Buffer Zone</b>	
<b>Sl. No.</b>	<b>Parameter</b>	<b>Method of Analysis</b>	<b>Observed Values ( in <math>\mu\text{g}/\text{m}^3</math>)</b>		<b>Range Of Testing</b>	<b>LDL</b>	<b>MoEF Standards Notification dated 25th September,2000 (GSR 742 E)</b>	<b>NAAQS, 2009</b>
			<b>1st FN A3403</b>	<b>2nd FN A3477</b>				
1	PM <sub>10</sub>	IS -5182(Part 23):2006, R-2017	98	89	10 $\mu\text{g}/\text{m}^3$ - 1000 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	300	100
2	PM <sub>2.5</sub>	IS -5182(Part 24):2019	56	50	10 $\mu\text{g}/\text{m}^3$ - 400 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	Not Specified	60
3	SO <sub>2</sub>	IS-5182(Part-2): 2001 , R-2017	<10	<10	10 $\mu\text{g}/\text{m}^3$ - 1050 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	120	80
4	NO <sub>2</sub>	IS-5182 (Part-6): 2006 , R-2017	31	29	06 $\mu\text{g}/\text{m}^3$ - 420 $\mu\text{g}/\text{m}^3$	06 $\mu\text{g}/\text{m}^3$	120	80

\*\*All units are in  $\mu\text{g}/\text{m}^3$ , 24 hourly Average \* LDL indicates Lower Detection Limit,

**ANALYSED BY**

(Gaurav Kant)  
**REVIEWED BY**

(Amit Raj Mishra)  
**Authorised Signatory**

**Note:** The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----

Page -1 of 1



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**Ambient Air Quality Test Report**

**CMPDIL, RI-II**  
**KOYLA BHAWAN COMPLEX**  
**DHANBAD. -826005**  
**Phone:0326-223-850**  
**email: rdri2cmpdi@coalindia.in**

**Test Report for Ambient Air Samples**

<b>Month &amp; Year</b>	02/2025	<b>Cluster</b>	Cluster XIV			<b>ULR No.</b>	TC143212500001544F	
<b>Customer</b>	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)				<b>Date of Issue</b>	04.03.2025		
<b>Project</b>	Madhuband UGP	<b>Sample Ref. No.</b>	REM/BCCL/2025/02	<b>Sampling Method</b>	CMPDI/RI-II/LPM 11, ( IS 5182)			
<b>Date of Sampling</b>	05.02.25	19.02.25	<b>Period of Analysis</b>	05.02.25	03.03.2025	<b>Zone of Station:</b>	Core Zone	
<b>Sl. No.</b>	<b>Parameter</b>	<b>Method of Analysis</b>	<b>Observed Values ( in <math>\mu\text{g}/\text{m}^3</math>)</b>		<b>Range Of Testing</b>	<b>LDL</b>	<b>MoEF Standards Notification dated 25th September,2000 (GSR 742 E )</b>	<b>NAAQS, 2009</b>
			<b>1st FN A3397</b>	<b>2nd FN A3476</b>				
1	PM <sub>10</sub>	IS -5182(Part 23):2006, R-2017	90	80	10 $\mu\text{g}/\text{m}^3$ - 1000 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	300	100
2	PM <sub>2.5</sub>	IS -5182(Part 24):2019	45	38	10 $\mu\text{g}/\text{m}^3$ - 400 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	Not Specified	60
3	SO <sub>2</sub>	IS-5182(Part-2): 2001 , R-2017	<10	10	10 $\mu\text{g}/\text{m}^3$ - 1050 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	120	80
4	NO <sub>2</sub>	IS-5182 (Part-6): 2006 , R-2017	27	27	06 $\mu\text{g}/\text{m}^3$ - 420 $\mu\text{g}/\text{m}^3$	06 $\mu\text{g}/\text{m}^3$	120	80

\* LDL indicates Lower Detection Limit,

\*\*All units are in  $\mu\text{g}/\text{m}^3$ , 24 hourly Average,

ANALYSED BY

(Gaurav Kant)  
REVIEWED BY

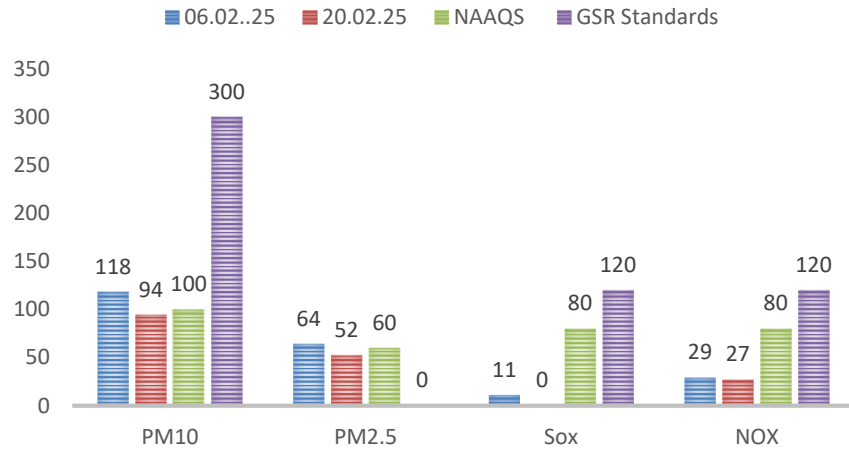
(Amit Raj Mishra)  
Authorised Signatory

**Note:** The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

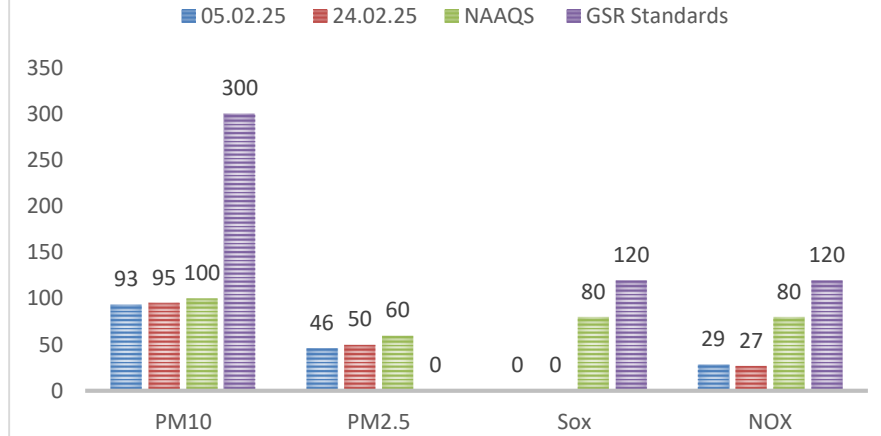
---- End of Report ----

Page -1 of 1

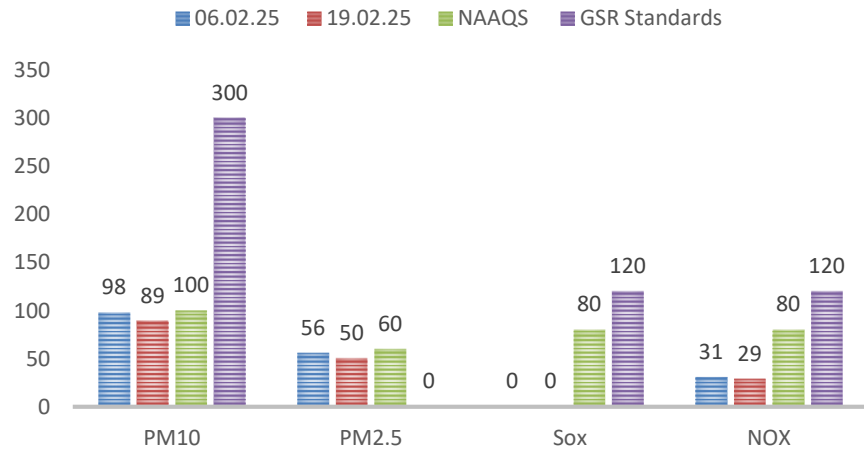
### AMBIENT AIR QUALITY AT LOHAPATTI



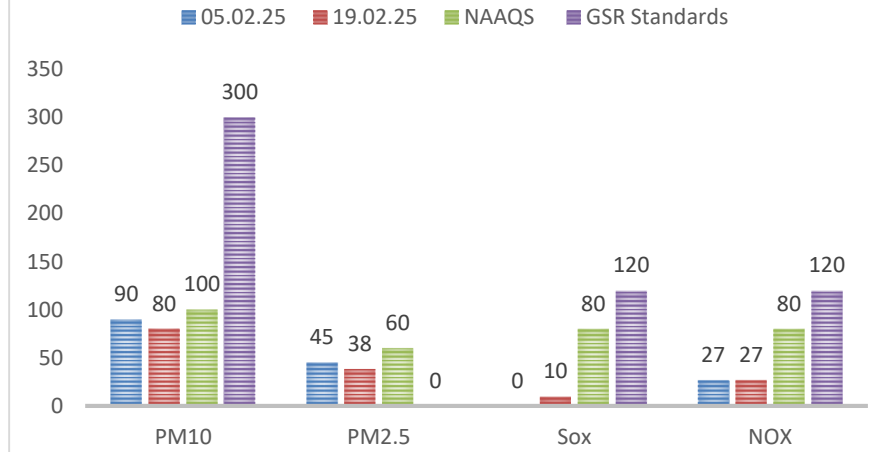
### AMBIENT AIR QUALITY AT KHARKHAREE CISF OFFICE



### AMBIENT AIR QUALITY AT TELMACHHO BRIDGE



### AMBIENT AIR QUALITY AT MADHUBAND UGP OFFICE



## **WATER QUALITY MONITORING**

### **3.1 Location of sampling sites**

(Refer **Plate No. – II**)

#### **i) Mine Discharge of Block II (MW14)**

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

### **3.2 Methodology of sampling and analysis**

Water samples were collected as per standard practice. The effluent samples were collected and analysed 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.



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**MINE EFFLUENT TEST REPORT**

CMPDIL, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmpdi@coalindia.in

**Test Report for Mine Effluent samples**

<b>Month &amp; Year</b>	02/2025	<b>Cluster</b>	Cluster XIV		<b>ULR No.</b>	TC1432125000001561F			
<b>Customer</b>	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)					<b>Date of Issue</b>	04.03.2025		
<b>Project</b>		<b>Sampling Ref. No.</b>	REM/BCCL/2025/02		<b>Sampling Method</b>	IS 3025 (Part-1) CMPDI/RI-II/LPM 13			
<b>Sampling Stations</b>	(i)	<b>Block II</b>	Sample Collected in 2.5 Ltr Jerricane , Color as observed is transparent			Period of Analysis			
			<b>Date of Sampling</b>		03.02.25	24.02.25	03.02.25 TO 28.02.2025		
<b>Sl. No.</b>	<b>Parameter</b>	<b>Method of Analysis</b>	<b>Observed Values</b>		<b>STANDARDS FOR COAL MINES</b> (Stipulated by Ministry of Environment and Forests (MoEF), Vide Notification No. GSR 742(E), Dt: 25.09.2000)	<b>LDL</b>			
			<b>First Fortnight M1352</b>	<b>Second Fortnight M1352</b>					
1	Total Suspended Solids	IS 3025/17:1984, R :2017, Gravimetric	41	44				100 (Max)	10
2	pH	IS-3025/11:1983, R-2017, Electrometric	8.02	8.03				5.5 - 9.0	0.2
3	Oil & Grease	IS 3025/39:1991, R : 2019, Partition Gravimetric	<4.0	<4.0				34	33
4	COD	APHA 23rd Edition 5220 C Titrimetric Method	32	36	7.69	7.81			

\*\*All units in mg/L unless specified otherwise. \*LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,

\*\*Grab sampling carried out for water samples.

**ANALYSED BY**

(Kumar Vaibhav)

**REVIEWED BY**

(Amit Raj Mishra)

**Authorised Signatory**

Note: The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----

## **NOISE LEVEL QUALITY MONITORING**

### **4.1 Location of sampling sites**

- i) **Lohapatti (N20)**
- ii) **Kharkharee CISF Office (N21)**
- iii) **Telmacho Bridge (N32)**
- iv) **Madhuband UGP (N33)**

**4.2** Noise level measurements in form of 'L<sub>EQ</sub>' were taken using Integrated Data Logging Sound Level Meter during day time & night time. Noise levels were measured for the complete day & night time, the Intergration time taken was one hour or 3600 seconds. 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 & night time and the observed values were compared with standards prescribed by MoEF&CC. The results of Noise levels recorded during day & night time on fortnightly basis are presented in tabular form along with the applicable standard permissible limits. The observed values in terms of L<sub>EQ</sub> are presented. The observed values at all the monitoring locations are found to be within permissible limits.



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**Ambient Noise Level Test Report**

CMPDIL, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmpdi@coalindia.in

Month & Year	02/2025	Cluster	Cluster XIV				ULR No.	TC143212500001578F	
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)						Date of Issue	04.03.2025	
Project		Sample Ref. No.	REM/BCCL/2025/02			Sampling Method	CMPDI/RI-II/LPM 22		
Sampling Stations	i	Lohapatti		Date of Sampling	06.02..25	20.02.25	Zone Category of Station:	CORE Zone	
Sl. No.	Parameter	Hour / Time of day	Observed Values ( in Leq dB(A) )		Method of Analysis	Range Of Testing	LDL	NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 Standards	
			First Fortnight	Second Fortnight				Zones	Limits in dB
1	Noise Level dB(A)Leq - Day	06:00 - 07:00	33.6	34.2	CPCB, Protocol for Ambient Level Noise Monitoring - 2015	35 dB-135 dB	35 Db (A)	Industrial Commercial Residential Silence	75 65 55 50
2		07:00 - 08:00	43.4	42.6					
3		08:00 - 09:00	38.5	43.1					
4		09:00 - 10:00	36	38.2					
5		10:00 - 11:00	38.5	39.8					
6		11:00 - 12:00	37.3	42					
7		12:00 - 13:00	38.2	40.7					
8		13:00 - 14:00	39.4	42.2					
9		14:00 - 15:00	38.9	40.1					
10		15:00 - 16:00	41.2	41.6					
11		16:00 - 17:00	41.3	41.4					
12		17:00 - 18:00	41.1	42.2					
13		18:00 - 19:00	41.1	42					
14		19:00 - 20:00	40.7	40.3					
15		20:00 - 21:00	40.6	40.4					
16		21:00 - 22:00	40.4	40.3					
		<b>Leq Day</b>	<b>39.9</b>	<b>41.1</b>					
1	Noise Level dB(A)Leq -Night	22:00-23:00	41.9	41.9	CPCB, Protocol for Ambient Level Noise Monitoring - 2015	35 dB-135 dB	35 dB (A)	Industrial Commercial Residential Silence	70 55 45 50
2		23:00- 00:00	41.8	41.3					
3		00:00- 01:00	41.5	41.4					
4		01:00-02:00	41.1	42					
5		02:00-03:00	41	41.3					
6		03:00-04:00	40.9	41					
7		04:00-05:00	40.5	41.1					
8		05:00-06:00	41.3	41.6					
		<b>Leq Day</b>	<b>41.3</b>	<b>41.5</b>					

\*\*All noise measurements are integrated for a 01 hour period, All units in dB(A) \*LDL indicates Lower Detection Limit

Analysed By: Sampling Assistants

*Gaurav Kant*  
(Gaurav Kant)

*Amit Raj Mishra*  
(Amit Raj Mishra)

ANALYSED BY

REVIEWED BY

Authorised Signatory

Note: The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**Ambient Noise Level Test Report**

CMPDIL, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rrdri2cmpdi@coalindia.in

Month & Year	02/2025	Cluster	Cluster XIV			ULR No.	TC1432125000001578F		
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)					Date of Issue	04.03.2025		
Project		Sample Ref. No.	REM/BCCL/2025/02		Sampling Method	CMPDI/RI-II/LPM 22			
Sampling Stations	i	Kharkharee UGP		Date of Sampling	05.02.25	24.02.25	Zone Category of Station:	Core Zone	
Sl. No.	Parameter	Hour / Time of day	Observed Values (in Leq dB(A))	Observed Values (in Leq dB(A))	Method of Analysis	Range Of Testing	LDL	NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 Standards	
			First Fortnight	Second Fortnight				Zones	Limits in dB
1	Noise Level dB(A)Leq - Day	06:00 - 07:00	40.3	41	CPCB, Protocol for Ambient Level Noise Monitoring -2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	75 65 55 50
2		07:00 - 08:00	54.5	54.4					
3		08:00 - 09:00	64.7	64.9					
4		09:00 - 10:00	64.6	64.4					
5		10:00 - 11:00	61.4	60.3					
6		11:00 - 12:00	58.7	58.3					
7		12:00 - 13:00	56.5	57.4					
8		13:00 - 14:00	55	54.3					
9		14:00 - 15:00	52.9	52.3					
10		15:00 - 16:00	51.5	51.8					
11		16:00 - 17:00	51.8	52.4					
12		17:00 - 18:00	51.6	52.1					
13		18:00 - 19:00	49.2	49.2					
14		19:00 - 20:00	47.6	47.7					
15		20:00 - 21:00	45.7	45.9					
16		21:00 - 22:00	45.2	45.5					
		<b>Leq Day</b>	<b>57.9</b>	<b>57.8</b>					
1	Noise Level dB(A)Leq -Night	22:00-23:00	44.6	42.4	CPCB, Protocol for Ambient Level Noise Monitoring -2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	70 55 45 50
2		23:00-00:00	41.9	42.3					
3		00:00-01:00	42	42.3					
4		01:00-02:00	40.2	41.4					
5		02:00-03:00	39.9	36.9					
6		03:00-04:00	39.4	40.7					
7		04:00-05:00	39.2	38.2					
8		05:00-06:00	38	35.9					
		<b>Leq Day</b>	<b>41.1</b>	<b>40.6</b>					

\*\*All noise measurements are integrated for a 01 hour period, All units in dB(A) \*LDL indicates Lower Detection Limit

Sampling Assistants  
 ANALYSED BY

*Gaurav Kant*  
 (Gaurav Kant)  
 REVIEWED BY

*Amit Raj Mishra*  
 (Amit Raj Mishra)  
 Authorised Signatory

Note: The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----

Page -1 of 1



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**Ambient Noise Level Test Report**

CMPDIL, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmpdi@coalindia.in

Month & Year	02/2025	Cluster	Cluster XIV				ULR No.	TC1432125000001578F	
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)						Date of Issue	04.03.2025	
Project		Sample Ref. No.	REM/BCCL/2025/02			Sampling Method	CMPDI/RI-II/LPM 22		
Sampling Stations	i	Telmacho Bridge		Date of Sampling	06.02.25	19.02.25	Zone Category of Station:	Buffer Zone	
Sl. No.	Parameter	Hour / Time of day	Observed Values (in Leq dB(A)) First Fortnight	Observed Values (in Leq dB(A)) Second Fortnight	Method of Analysis	Range Of Testing	LD L	NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 Standards Zones Limits in dB	
1	Noise Level dB(A)Leq - Day	06:00 - 07:00	38.1	40.8	CPCB, Protocol for Ambient Level Noise Monitoring -2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence 75 65 55 50	
2		07:00 - 08:00	48.4	49					
3		08:00 - 09:00	51.6	48.9					
4		09:00 - 10:00	56.2	56.9					
5		10:00 - 11:00	55.5	54.4					
6		11:00 - 12:00	56.4	55.7					
7		12:00 - 13:00	57.9	59.9					
8		13:00 - 14:00	56.2	61.2					
9		14:00 - 15:00	54.5	55.8					
10		15:00 - 16:00	53.8	55					
11		16:00 - 17:00	51.5	50.4					
12		17:00 - 18:00	47.7	48.1					
13		18:00 - 19:00	44.5	48.4					
14		19:00 - 20:00	43.1	42.2					
15		20:00 - 21:00	40.3	40.4					
16		21:00 - 22:00	39.7	39.3					
		<b>Leq Day</b>	<b>53.1</b>	<b>54.6</b>					
1	Noise Level dB(A)Leq -Night	22:00-23:00	40	39.6	CPCB, Protocol for Ambient Level Noise Monitoring -2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence 70 55 45 50	
2		23:00- 00:00	39.1	39.1					
3		00:00- 01:00	39	39					
4		01:00-02.00	39	39.9					
5		02.00-03.00	39.8	39.9					
6		03.00-04.00	40	40					
7		04.00-05.00	40.2	40.2					
8		05:00-06:00	40.3	40.4					
		<b>Leq Day</b>	<b>39.7</b>	<b>39.8</b>					

\*\*All noise measurements are integrated for a 01 hour period, All units in dB(A) \*LDL indicates Lower Detection Limit

Sampling Assistants  
ANALYSED BY

(Gaurav Kant)  
**REVIEWED BY**

(Amit Raj Mishra)  
**Authorised Signatory**

Note: The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----  
Page -1 of 1



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**Ambient Noise Level Test Report**

CMPDIL, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmpdi@coalindia.in

Month & Year	02/2025	Cluster	Cluster XIV	ULR No.	TC143212500001578F				
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)			Date of Issue	04.03.2025				
Project		Sample Ref. No.	REM/BCCL/2025/02	Sampling Method	CMPDI/RI-II/LPM 22				
Sampling Stations	i	Madhuband UGP		Date of Sampling	05.02.25 19.02.25				
Sl. No.	Parameter	Hour / Time of day	Observed Values ( in Leq dB(A) )	Observed Values ( in Leq dB(A) )	Method of Analysis	Range Of Testing	LDL	NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 Standards	
			First Fortnight	Second Fortnight				Zones	Limits in dB
1	Noise Level dB(A)Leq - Day	06:00 - 07:00	37.8	38.3	CPCB, Protocol for Ambient Level Noise Monitoring - 2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	75 65 55 50
2		07:00 - 08:00	40.4	39.7					
3		08:00 - 09:00	43.5	43.8					
4		09:00 - 10:00	44.6	44.4					
5		10:00 - 11:00	44.4	44.5					
6		11:00 - 12:00	44.1	43.8					
7		12:00 - 13:00	45	44.7					
8		13:00 - 14:00	48.1	51.4					
9		14:00 - 15:00	49.2	49.2					
10		15:00 - 16:00	49.7	46.6					
11		16:00 - 17:00	43.1	43.2					
12		17:00 - 18:00	42.1	42					
13		18:00 - 19:00	41.6	41.5					
14		19:00 - 20:00	41.4	41					
15		20:00 - 21:00	41.2	40.7					
16		21:00 - 22:00	40.1	40.3					
		<b>Leq Day</b>	<b>44.8</b>	<b>45.0</b>					
1	Noise Level dB(A)Leq -Night	22:00-23:00	41.1	41.6	CPCB, Protocol for Ambient Level Noise Monitoring - 2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	70 55 45 50
2		23:00- 00:00	41	41.7					
3		00:00- 01:00	40.9	41					
4		01:00-02.00	40.2	40.6					
5		02.00-03.00	39.9	40.4					
6		03.00-04.00	41.3	41.6					
7		04.00-05.00	41.6	41.8					
8		05:00-06:00	41.9	41.7					
		<b>Leq Day</b>	<b>41.0</b>	<b>41.3</b>					

\*\*All noise measurements are integrated for a 01 hour period, All units in dB(A) \*LDL indicates Lower Detection Limit

Sampling Assistants  
ANALYSED BY

*Gaurav Kant*  
(Gaurav Kant)  
**REVIEWED BY**

*Amit Raj Mishra*  
(Amit Raj Mishra)  
**Authorised Signatory**

Note: The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----

Page -1 of 1

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

Category	Pollutant	Time weighted average	Concentration in Ambient Air	Method of Measurement
1	2	3	4	5
<b>III</b> Coal mines located in the coal fields of <ul style="list-style-type: none"> <li>• Jharia</li> <li>• Raniganj</li> <li>• Bokaro</li> </ul>	Suspended Particulate Matter (SPM)	Annual Average * 24 hours **	500 $\mu\text{g}/\text{m}^3$  700 $\mu\text{g}/\text{m}^3$	- High Volume Sampling (Average flow rate not less than 1.1)
	Respirable Particulate Matter (size less than 10 $\mu\text{m}$ ) (RPM)	Annual Average * 24 hours **	250 $\mu\text{g}/\text{m}^3$  300 $\mu\text{g}/\text{m}^3$	Respirable Particulate Matter sampling and analysis
	Sulphur Dioxide ( $\text{SO}_2$ )	Annual Average * 24 hours **	80 $\mu\text{g}/\text{m}^3$  120 $\mu\text{g}/\text{m}^3$	1.Improvedwest and Gaeke method 2.Ultraviolet fluorescene
	Oxide of Nitrogen as $\text{NO}_2$	Annual Average * 24 hours **	80 $\mu\text{g}/\text{m}^3$  120 $\mu\text{g}/\text{m}^3$	1. Jacob & Hochheiser Modified (Na-Arsenic) Method 2. Gas phase Chemiluminescence

**Note:**

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

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

## NATIONAL AMBIENT AIR QUALITY STANDARDS

New Delhi the 18<sup>th</sup> November 2009

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

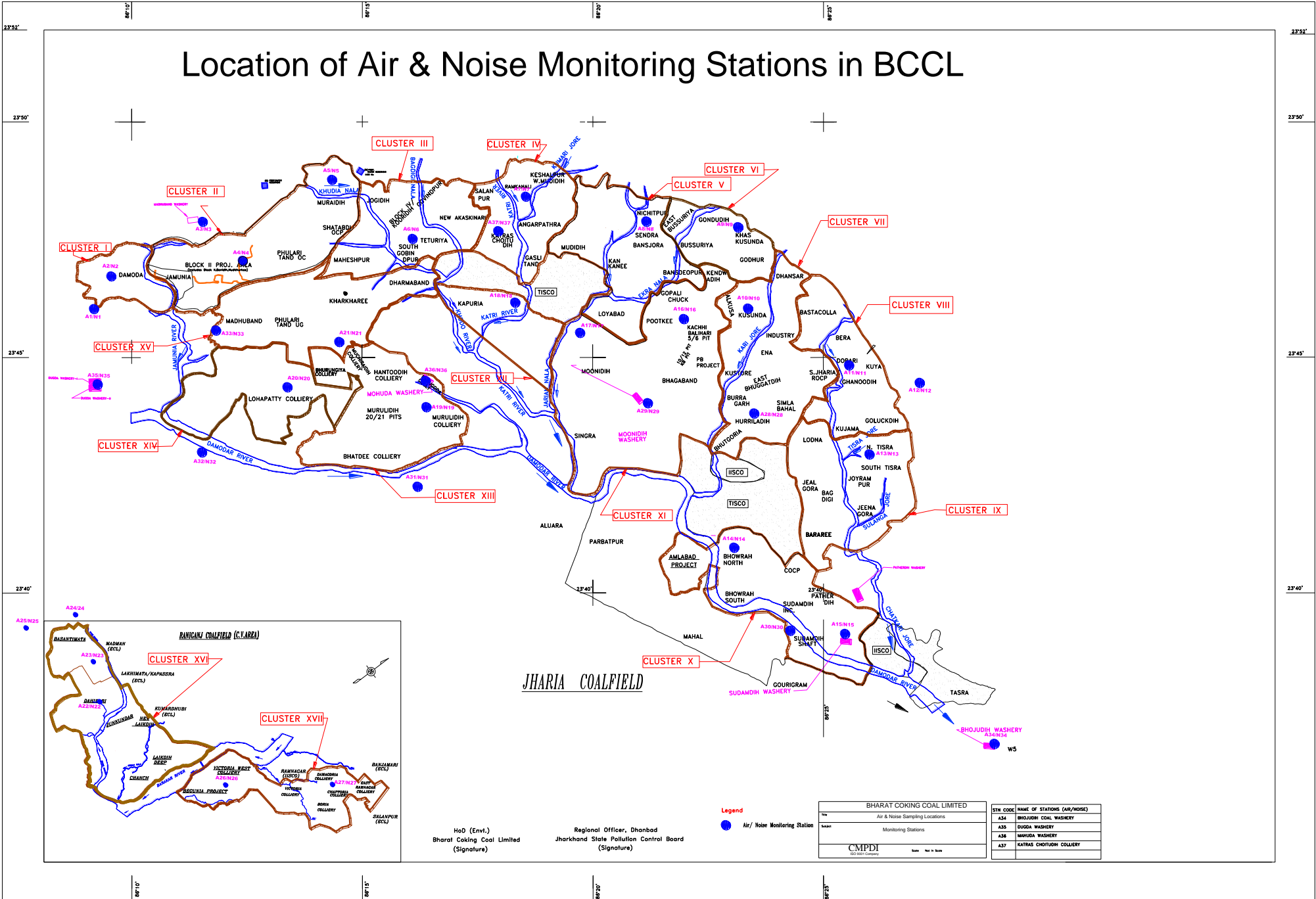
Pollutant	Time Weighted Average	Concentration in Ambient Air		Methods of Measurement
		Industrial, Residential, Rural and other Areas	Ecologically Sensitive Area (Notified by Central Government)	
<b>Sulphur Dioxide (SO<sub>2</sub>), µg/m<sup>3</sup></b>	Annual * 24 Hours **	50 80	20 80	-Improved West and Gaeke Method -Ultraviolet Fluorescence
<b>Nitrogen dioxide (NO<sub>2</sub>), µg/m<sup>3</sup></b>	Annual * 24 Hours **	40 80	30 80	-Jacob & Hochheiser modified (NaOH-NaAsO <sub>2</sub> ) Method -Gas Phase Chemiluminescence
<b>Particulate Matter (Size less than 10µm) or PM<sub>10</sub>, µg/m<sup>3</sup></b>	Annual * 24 Hours **	60 100	60 100	-Gravimetric -TEOM -Beta attenuation
<b>Particulate Matter (Size less than 2.5µm) or PM<sub>2.5</sub>, µg/m<sup>3</sup></b>	Annual * 24 Hours **	40 60	40 60	-Gravimetric -TEOM -Beta attenuation
<b>Ozone (O<sub>3</sub>), µg/m<sup>3</sup></b>	8 Hours * 1 Hour **	100 180	100 180	-UV Photometric -Chemiluminescence -Chemical Method
<b>Lead (Pb), µg/m<sup>3</sup></b>	Annual * 24 Hours **	0.50 1.0	0.50 1.0	-AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper -ED-XRF using Teflon filter
<b>Carbon Monoxide (CO), mg/m<sup>3</sup></b>	8 Hours ** 1 Hour **	02 04	02 04	-Non dispersive Infrared (NDIR) Spectroscopy
<b>Ammonia (NH<sub>3</sub>), µg/m<sup>3</sup></b>	Annual * 24 Hours **	100 400	100 400	-Chemiluminescence -Indophenol blue method
<b>Benzene (C<sub>6</sub>H<sub>6</sub>), µg/m<sup>3</sup></b>	Annual *	05	05	-Gas Chromatography (GC) based continuous analyzer -Adsorption and desorption followed by GC analysis
<b>Benzo(a)Pyrene (BaP) Particulate phase only, ng/m<sup>3</sup></b>	Annual *	01	01	-Solvent extraction followed by HPLC/GC analysis
<b>Arsenic (As), ng/m<sup>3</sup></b>	Annual *	06	06	-AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper
<b>Nickel (Ni), ng/m<sup>3</sup></b>	Annual *	20	20	-AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper

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

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

**NOTE:** Whenever and wherever monitoring results on two consecutive days of monitoring exceed the limits specified above for the respective category

# Location of Air & Noise Monitoring Stations in BCCL



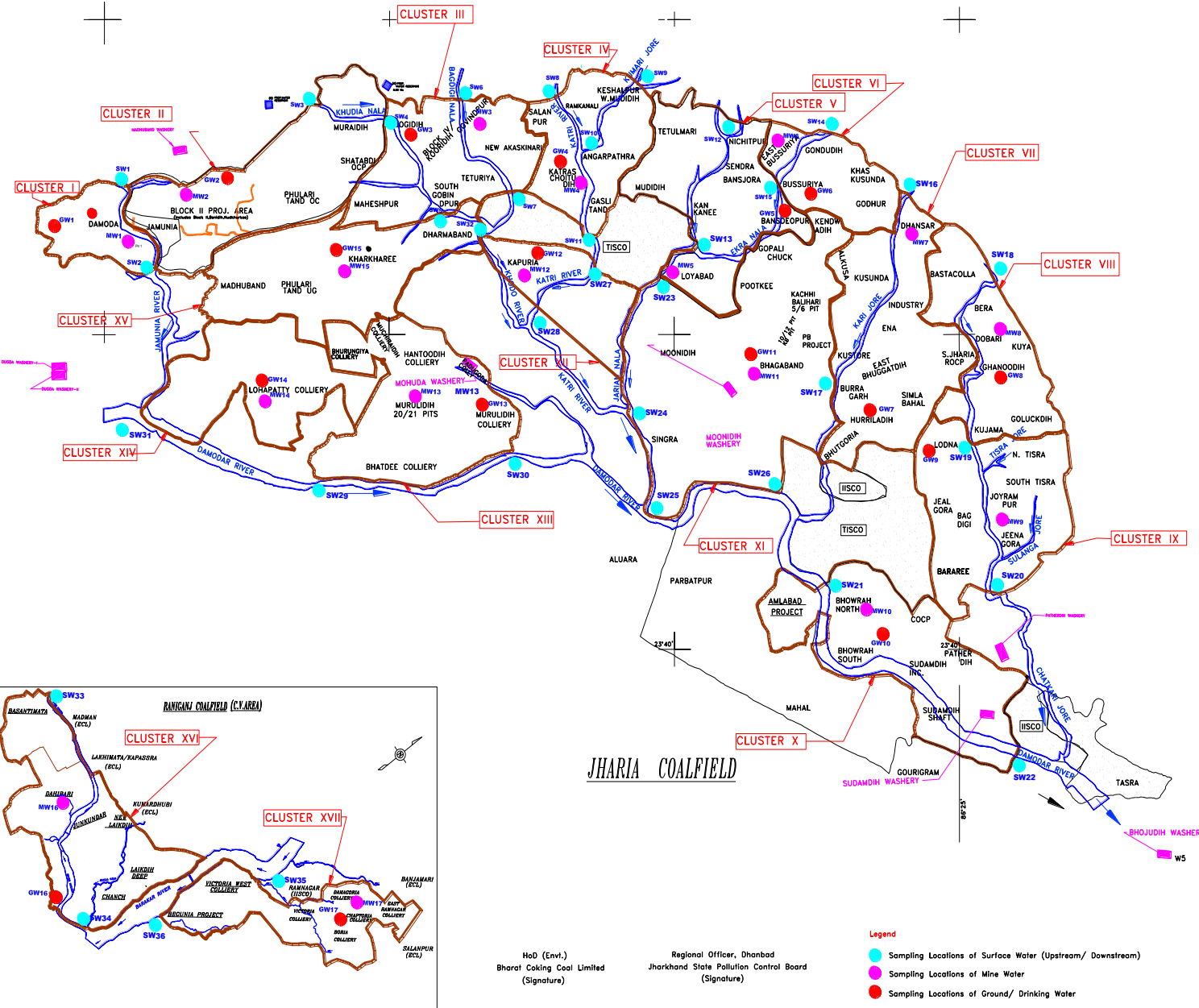
HoD (Envl.)  
Bharat Coking Coal Limited  
(Signature)

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

BHARAT COKING COAL LIMITED	
For	Air & Noise Sampling Locations
Scale	Monitoring Stations
CMPDI Coal Monitoring & Pollution Control Division	
Date	Not to Scale

STN CODE	NAME OF STATIONS (AIR/NOISE)
A34	BHOJUDIH COAL WASHERY
A35	DUGGA WASHERY
A36	MARUSA WASHERY
A37	KATRAS CHOTUDIH COLLIERY

# Water Sampling Locations in BCCL



### INDEX

Cluster	Surface Water (US, DS)	Name of River/ Nala/ Effluent Water	Mineral Effluent Location	Sampling Location	Ground Water	Sampling Location
I	SW1, SW2	Jamunia River	MW1	Damoda Area	GW1	Chutway Village
II	SW3, SW4	Khudia Nala	MW2	Block II OCP	GW2	Joyrampur Village
III	SW4, SW5, SW6, SW7	Khudia Nala, Bagdigi Nala	MW3	Govindpur Colliery	GW3	Jogdih Village
IV	SW8, SW11, SW9, SW10	Kash River, Kuman Jore	MW4	Chotudih	GW4	Kankanees Village
V	SW12, SW13, SW15	Jarian Nala, Ekra Nala	MW5	Mudidih	GW5	Nichitpur
VI	SW14, SW15	Ekra Nala	MW6	East Bassuria UGP	GW6	Bansara Borewell
VII	SW16, SW17	Kash Jore	MW7	Bansara UGP	GW7	Hurmidih
VIII	SW18, SW19	Kash Jore	MW8	Doban UGP	GW8	Qharudih
IX	SW19, SW20	Kash Jore	MW9	Jeenagora	GW9	Lodna
X	SW21, SW22	Damodar River	MW10	Bhowrah North	GW10	Bhowrah South
XI	SW23, SW24, SW25, SW26	Jarian Nala, Damodar River	MW11	Bhagaband UGP	GW11	Bhagaband
XII	SW27, SW28	Kash River	MW12	Kapura	GW12	Kapura
XIII	SW29, SW30	Damodar River	MW13	Muridih	GW13	Muridih
XIV	SW31, SW32	Damodar River	MW14	Lohapatty	GW14	Lohapatty
XV	SW5, SW32	Khudias Nala	MW15	Kharkhanees UGP	GW15	Kharkhanees
XVI	SW33, SW34	Khudia River	MW16	Dahaban OCP	GW16	Falabani Village
XVII	SW35, SW36	Barakar River	MW17	Damagoria Colliery	GW17	Chaptora

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

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

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

**STRICTLY RESTRICTED**  
**FOR COMPANY USE ONLY RESTRICTED**

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

**ENVIRONMENTAL MONITORING REPORT  
OF  
BHARAT COKING COAL LIMITED,  
CLUSTER – XIV**

**(FOR THE MONTH MARCH, 2025)**

**E. C. no. J-11015/10/2010-IA.II (M) dated 06.06.2013.**



**CMPDI**

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

# CONTENTS

<b>SL. NO.</b>	<b>CHAPTER</b>	<b>PARTICULARS</b>	<b>PAGE NO.</b>
1.	CHAPTER - I	EXECUTIVE SUMMARY	3-5
2.	CHAPTER-II	INTRODUCTION	6
3.	CHAPTER-III	RESULTS	7-19
4.	CHAPTER-IV	STANDARDS AND PLANS	20-21

## **EXECUTIVE SUMMARY**

### **1.0 Introduction**

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

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

### **2.0 Sampling location and rationale**

#### **2.1 Ambient air sampling locations**

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

#### **2.2 Water sampling stations**

The Water sampling stations were selected for mine sump water.

#### **2.3 Noise level monitoring locations**

Noise levels vary depending on the various activities in mining areas. The monitoring of noise level in different locations will be helpful to take appropriate mitigating measures. The noise levels were recorded in mining areas, washeryareas and in residential areas.

### **3.0 Methodology of sampling and analysis**

#### **3.1 Ambient air quality**

Parameters chosen for assessment of ambient air quality were Particulate Matter (PM<sub>10</sub>), Fine Particulate Matter (PM<sub>2.5</sub>), Sulphur Di-oxide (SO<sub>2</sub>) and Nitrogen Oxides (NO<sub>x</sub>). Respirable Dust Samplers (RDS) and Fine Dust

Sampler (PM<sub>2.5</sub> sampler) were used for sampling of PM<sub>10</sub>, SO<sub>2</sub>, & NO<sub>x</sub> and Fine Dust Sampler (PM<sub>2.5</sub> sampler) were used for sampling of PM<sub>2.5</sub> at 24 hours interval once in a fortnight and the same for the gaseous pollutants. The samples were analyzed in Environmental Laboratory of CMPDI, RI-II, Dhanbad.

### **3.2 Water quality**

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

### **3.3 Noise level monitoring**

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

## **4.0 Results and interpretations**

### **4.1 Air quality**

It has been seen from the analysis results that the 24 hours average concentration parameters like PM<sub>10</sub>, PM<sub>2.5</sub>, SO<sub>2</sub> and NO<sub>x</sub> are mostly within the permissible limits in all sampling locations as per MoEF&CC Gazette Notification No. GSR 742(E) dt 25.09.2000 Standards for Coal Mines and National Ambient Air Quality Standard -2009. Sometimes the concentration of PM<sub>10</sub>& PM<sub>2.5</sub> exceeds the limits due to heavy public traffic, poor road condition, coke oven plants, burning of coal by surrounding habitants, brick making, municipal waste dumps and industries like Steel Plant, thermal Plants including their fly ash etc.

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

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

#### **4.2 Water quality**

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

#### **4.3 Noise Level**

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

## INTRODUCTION

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

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-XIV is in the Western part of the Jharia coalfield and situated in the Western Jharia area of BCCL. It includes 1 Mine (viz. Lohapatti (UG & OC). The Cluster – XIV is situated about 25 - 30 kms from Dhanbad Railway Station. The mines of this Cluster – XIV 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 Damodar River.
- 1.2 The Cluster-XIV is designed to produce 0.405 MTPA (normative) and 0.526 MTPA (peak) capacity of coal.

The Project has Environmental Clearance from Ministry of Environment, Forest and Climate Change (MoEF&CC) for a rated capacity 0.405 MTPA (normative) and 0.526 MTPA (peak) capacity of coal production vide letter no. J-11015/10/2010-IA.II (M) dated 06<sup>th</sup> June, 2013.

Ministry of Environment, Forest and Climate Change while granting environmental clearance has given one of the General conditions that “ Four ambient air quality monitoring stations should be established in the core zone as well as in the buffer zone for PM<sub>10</sub>, PM<sub>2.5</sub>, SO<sub>2</sub>, NO<sub>x</sub> monitoring. Location of the stations should be decided based on the meteorological data, topographical features and environmentally and ecologically sensitive targets in consultation with the State Pollution Control Board.” And other conditions regarding water / effluent and noise level monitoring.

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

## AMBIENT AIR QUALITY MONITORING

### 2.1 Location of sampling station and their rationale:

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

#### 2.1.1 Ambient Air Quality Sampling Locations

##### I. CORE ZONE Monitoring Location

###### i) Lohapatti (A20): Industrial Area

The location of the sampling station is 23° 44' 29.42" N & 86° 12' 49.96" E. The sampler was placed at a height of approx. 1.5m above ground level at Project Office.

##### II. BUFFER ZONE Monitoring Location

###### i) Kharkharee CISF Office (A21): Industrial Area

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 Safety Office.

###### ii) Telmachho Bridge (A32): Industrial Area

The location of the sampling station is 23° 44' 14.90" N & 86° 12' 21.20" E. The location was selected for studying the impact of the mining activity on the Telmachho Bridge area as it lies in the buffer zone for the Cluster XIV.

###### iii) Madhuband UGP Office (A33): Industrial Area

The location of the sampling station is 23° 45'24.48" N & 86°11'59.44"E. The sampler was placed at a height of approx. 1.5m above ground level at Safety Office.

## AMBIENT AIR QUALITY DATA



TC-14321



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**Ambient Air Quality Test Report**

CMPDI, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmpdi@coalindia.in

### Test Report for Ambient Air Samples

Month & Year	03/2025	Cluster	Cluster XIV			ULR No.	TC1432125000001682F	
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)					Date of Issue	30.04.25	
Project	Lohapatti	Sample Ref. No.	REM/BCCL/2025/03	Sampling Method		CMPDI/RI-II/LPM 11, ( IS 5182)		
Date of Sampling	10.03.25	26.03.25	Period of Analysis	10.03.25	25.04.25	Zone of Station:	Buffer Zone	
Sl. No.	Parameter	Method Analysis	Observed Values ( in $\mu\text{g}/\text{m}^3$ )		Range Of Testing	LDL	MoEF Standards Notification dated 25th September,2000 (GSR 742 E)	NAAQS, 2009
			1st FN A3586	2nd FN A3667				
1	PM <sub>10</sub>	IS -5182(Part 23):2006, R-2017	106	95	10 $\mu\text{g}/\text{m}^3$ - 1000 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	300	100
2	PM <sub>2.5</sub>	IS -5182(Part 24):2019	62	53	10 $\mu\text{g}/\text{m}^3$ - 400 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	Not Specified	60
3	SO <sub>2</sub>	IS-5182(Part-2): 2001, R-2017	<10	<10	10 $\mu\text{g}/\text{m}^3$ - 1050 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	120	80
4	NO <sub>2</sub>	IS-5182 (Part-6): 2006, R-2017	27	30	06 $\mu\text{g}/\text{m}^3$ - 420 $\mu\text{g}/\text{m}^3$	06 $\mu\text{g}/\text{m}^3$	120	80

\* LDL indicates Lower Detection Limit,

\*\*All units are in  $\mu\text{g}/\text{m}^3$ , 24 hourly Average,

  
**ANALYSED BY**

  
 (Gaurav Kant)  
**REVIEWED BY**

  
 (Amit Raj Mishra)  
**Authorised Signatory**

**Note:** The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----

Page -1 of 1



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**Ambient Air Quality Test Report**

CMPDI, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmpdi@coalindia.in

**Test Report for Ambient Air Samples**

<b>Month &amp; Year</b>	03/2025	<b>Cluster</b>	Cluste XIV			<b>ULR No.</b>	TC143212500001682F	
<b>Customer</b>	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)					<b>Date of Issue</b>	30.04.25	
<b>Project</b>	Kharkharee	<b>Sample Ref. No.</b>	REM/BCCL/2024/03	<b>Sampling Method</b>		CMPDI/RI-II/LPM 11 , ( IS 5182)		
<b>Date of Sampling</b>	12.03.25	21.03.25	<b>Period of Analysis</b>	12.03.25	25.04.25	<b>Zone of Station:</b>	Core Zone	
<b>Sl. No.</b>	<b>Parameter</b>	<b>Method of Analysis</b>	<b>Observed Values ( in <math>\mu\text{g}/\text{m}^3</math>)</b>		<b>Range Of Testing</b>	<b>LDL</b>	<b>MoEF Standards Notification dated 25th September,2000 (GSR 742 E )</b>	<b>NAAQS, 2009</b>
			<b>1st FN A3601</b>	<b>2nd FN A3645</b>				
1	PM <sub>10</sub>	IS -5182(Part 23):2006, R-2017	1	96	10 $\mu\text{g}/\text{m}^3$ - 1000 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	300	100
2	PM <sub>2.5</sub>	IS -5182(Part 24):2019	52	51	10 $\mu\text{g}/\text{m}^3$ - 400 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	Not Specified	60
3	SO <sub>2</sub>	IS-5182(Part-2): 2001 , R-2017	<10	<10	10 $\mu\text{g}/\text{m}^3$ - 1050 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	120	80
4	NO <sub>2</sub>	IS-5182 (Part-6): 2006 , R-2017	24	26	06 $\mu\text{g}/\text{m}^3$ - 420 $\mu\text{g}/\text{m}^3$	06 $\mu\text{g}/\text{m}^3$	120	80

\* LDL indicates Lower Detection Limit,

\*\*All units are in  $\mu\text{g}/\text{m}^3$ , 24 hourly Average,

*[Signature]*

**ANALYSED BY**

*[Signature]*

(Gaurav Kant)  
**REVIEWED BY**

*[Signature]*

(Amit Raj Mishra)  
**Authorised Signatory**

**Note:** The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----

Page -1 of 1



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**Ambient Air Quality Test Report**

CMPDI, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmpdi@coalindia.in

**Test Report for Ambient Air Samples**

<b>Month &amp; Year</b>	03/2025	<b>Cluster</b>	CLUSTER XIV			<b>ULR No.</b>	TC1432125000001682F	
<b>Customer</b>	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)					<b>Date of Issue</b>	30.04.25	
<b>Project</b>	Telmacho Bridge	<b>Sample Ref. No.</b>	REM/BCCL/2025/03	<b>Sampling Method</b>		CMPDI/RI-II/LPM 11 , ( IS 5182)		
<b>Date of Sampling</b>	03.03.25	18.03.25	<b>Period of Analysis</b>	03.03.25	25.04.25	<b>Zone of Station:</b>	<b>Buffer Zone</b>	
<b>Sl. No.</b>	<b>Parameter</b>	<b>Method of Analysis</b>	<b>Observed Values ( in <math>\mu\text{g}/\text{m}^3</math>)</b>		<b>Range Of Testing</b>	<b>LDL</b>	<b>MoEF Standards Notification dated 25th September,2000 (GSR 742 E )</b>	<b>NAAQS, 2009</b>
			<b>1st FN A3543</b>	<b>2nd FN A3624</b>				
1	PM <sub>10</sub>	IS -5182(Part 23):2006, R-2017	95	90	10 $\mu\text{g}/\text{m}^3$ - 1000 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	300	100
2	PM <sub>2.5</sub>	IS -5182(Part 24):2019	55	50	10 $\mu\text{g}/\text{m}^3$ - 400 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	Not Specified	60
3	SO <sub>2</sub>	IS-5182(Part-2): 2001 , R-2017	<10	<10	10 $\mu\text{g}/\text{m}^3$ - 1050 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	120	80
4	NO <sub>2</sub>	IS-5182 (Part-6): 2006 , R-2017	26	23	06 $\mu\text{g}/\text{m}^3$ - 420 $\mu\text{g}/\text{m}^3$	06 $\mu\text{g}/\text{m}^3$	120	80

\*\*All units are in  $\mu\text{g}/\text{m}^3$ , 24 hourly Average \* LDL indicates Lower Detection Limit,

**ANALYSED BY**

(Gaurav Kant)  
**REVIEWED BY**

(Amit Raj Mishra)  
**Authorised Signatory**

**Note:** The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----

Page -1 of 1



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**Ambient Air Quality Test Report**

CMPDIL, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmpdi@coalindia.in

**Test Report for Ambient Air Samples**

<b>Month &amp; Year</b>	02/2025	<b>Cluster</b>	Cluster XIV			<b>ULR No.</b>	TC143212500001682F	
<b>Customer</b>	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)					<b>Date of Issue</b>	30.04.25	
<b>Project</b>	Madhuband UGP	<b>Sample Ref. No.</b>	REM/BCCL/2025/03	<b>Sampling Method</b>		CMPDI/RI-II/LPM 11 , ( IS 5182)		
<b>Date of Sampling</b>	06.03.25	24.03.25	<b>Period of Analysis</b>	06.03.25	25.04.25	<b>Zone of Station:</b>	Core Zone	
<b>Sl. No.</b>	<b>Parameter</b>	<b>Method of Analysis</b>	<b>Observed Values ( in <math>\mu\text{g}/\text{m}^3</math>)</b>		<b>Range Of Testing</b>	<b>LDL</b>	<b>MoEF Standards Notification dated 25th September,2000 (GSR 742 E )</b>	<b>NAAQS, 2009</b>
			<b>1st FN A3563</b>	<b>2nd FN A3653</b>				
1	PM <sub>10</sub>	IS -5182(Part 23):2006, R-2017	93	82	10 $\mu\text{g}/\text{m}^3$ - 1000 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	300	100
2	PM <sub>2.5</sub>	IS -5182(Part 24):2019	49	44	10 $\mu\text{g}/\text{m}^3$ - 400 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	Not Specified	60
3	SO <sub>2</sub>	IS-5182(Part-2): 2001 , R-2017	<10	<10	10 $\mu\text{g}/\text{m}^3$ - 1050 $\mu\text{g}/\text{m}^3$	10 $\mu\text{g}/\text{m}^3$	120	80
4	NO <sub>2</sub>	IS-5182 (Part-6): 2006 , R-2017	28	23	06 $\mu\text{g}/\text{m}^3$ - 420 $\mu\text{g}/\text{m}^3$	06 $\mu\text{g}/\text{m}^3$	120	80

\* LDL indicates Lower Detection Limit,

\*\*All units are in  $\mu\text{g}/\text{m}^3$ , 24 hourly Average,

*[Signature]*

**ANALYSED BY**

*[Signature]*

(Gaurav Kant)  
**REVIEWED BY**

*[Signature]*

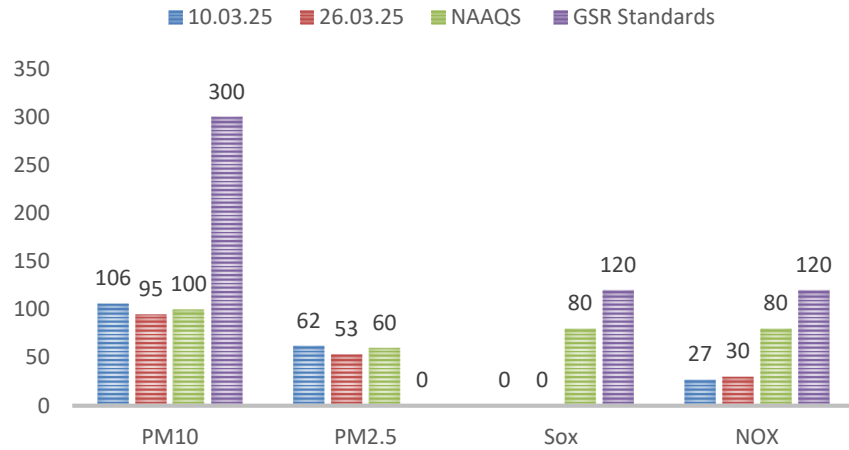
(Amit Raj Mishra)  
**Authorised Signatory**

**Note:** The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

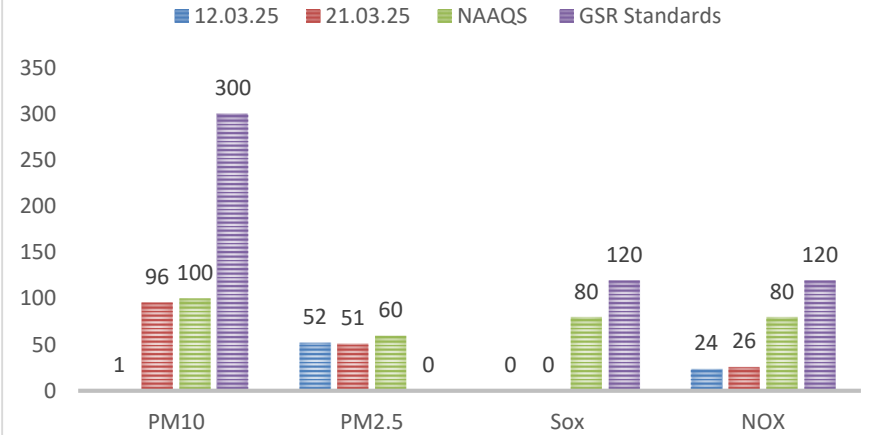
---- End of Report ----

Page -1 of 1

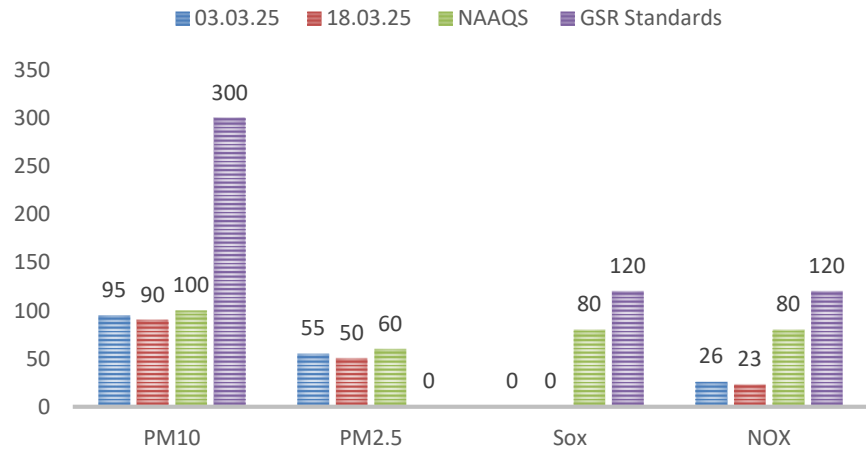
### AMBIENT AIR QUALITY AT LOHAPATTI



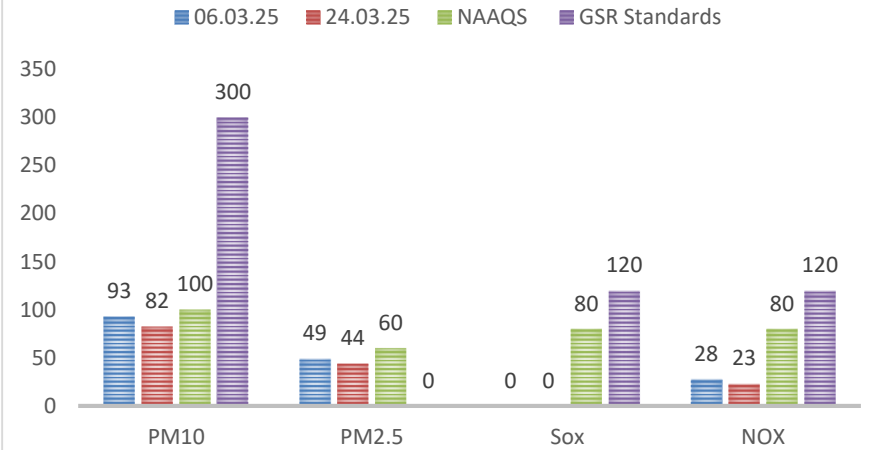
### AMBIENT AIR QUALITY AT KHARKHAREE CISF OFFICE



### AMBIENT AIR QUALITY AT TELMACHHO BRIDGE



### AMBIENT AIR QUALITY AT MADHUBAND UGP OFFICE



## **WATER QUALITY MONITORING**

### **3.1 Location of sampling sites**

(Refer **Plate No. – II**)

#### **i) Mine Discharge of Block II (MW14)**

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

### **3.2 Methodology of sampling and analysis**

Water samples were collected as per standard practice. The effluent samples were collected and analysed 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.



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**MINE EFFLUENT TEST REPORT**

CMPDI, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmpdi@coalindia.in

**Test Report for Mine Effluent samples**

<b>Month &amp; Year</b>	03/2025	<b>Cluster</b>	Cluster XIV		<b>ULR No.</b>	TC1432125000001699F			
<b>Customer</b>	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)					<b>Date of Issue</b>	25.04.2025		
<b>Project</b>		<b>Sampling Ref. No.</b>	REM/BCCL/2025/03		<b>Sampling Method</b>	IS 3025 (Part-1) CMPDI/RI-II/LPM 13			
<b>Sampling Stations</b>	(i)	<b>Block II</b>	Sample Collected in 2.5 Ltr Jerricane , Color as observed is transparent			Period of Analysis			
			<b>Date of Sampling</b>		10.03.2025	17.03.2025			
<b>Sl. No.</b>	<b>Parameter</b>	<b>Method of Analysis</b>	<b>Observed Values</b>		<b>STANDARDS FOR COAL MINES</b> (Stipulated by Ministry of Environment and Forests (MoEF), Vide Notification No. GSR 742(E), Dt: 25.09.2000)	<b>LDL</b>			
			<b>First Fortnight</b> M1399	<b>Second Fortnight</b> M1406					
1	Total Suspended Solids	IS 3025/17:1984, R :2017, Gravimetric	49	41				100 (Max)	10
2	pH	IS-3025/11:1983, R-2017, Electrometric	7.98	8.01				5.5 - 9.0	0.2
3	Oil & Grease	IS 3025/39:1991, R : 2019, Partition Gravimetric	<4.0	<4.0				34	33
4	COD	APHA 23rd Edition 5220 C Titrimetric Method	36	36	7.69	7.81			

\*\*All units in mg/L unless specified otherwise. \*LDL indicates Lower Detection Limit & BDL indicates Below Detection Limit,

\*\*Grab sampling carried out for water samples.

**ANALYSED BY**

(Kumar Vaibhav)  
**REVIEWED BY**

(Amit Raj Mishra)  
**Authorised Signatory**

Note: The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----

## **NOISE LEVEL QUALITY MONITORING**

### **4.1 Location of sampling sites**

- i) **Lohapatti (N20)**
- ii) **Kharkharee CISF Office (N21)**
- iii) **Telmacho Bridge (N32)**
- iv) **Madhuband UGP (N33)**

**4.2** Noise level measurements in form of 'L<sub>EQ</sub>' were taken using Integrated Data Logging Sound Level Meter during day time & night time. Noise levels were measured for the complete day & night time, the Intergration time taken was one hour or 3600 seconds. 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 & night time and the observed values were compared with standards prescribed by MoEF&CC. The results of Noise levels recorded during day & night time on fortnightly basis are presented in tabular form along with the applicable standard permissible limits. The observed values in terms of L<sub>EQ</sub> are presented. The observed values at all the monitoring locations are found to be within permissible limits.



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**Ambient Noise Level Test Report**

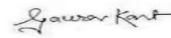
CMPDIL, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmpdi@coalindia.in

Month & Year	03/2025	Cluster	Cluster XIV				ULR No.	TC143212500001716F	
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)						Date of Issue	25.04.2025	
Project		Sample Ref. No.	REM/BCCL/2025/03			Sampling Method	CMPDI/RI-II/LPM 22		
Sampling Stations	i	Lohapatti		Date of Sampling			Zone Category of Station:		CORE Zone
Sl. No.	Parameter	Hour / Time of day	Observed Values ( in Leq dB(A) )		Method of Analysis	Range Of Testing	LDL	NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 Standards	
			First Fortnight	Second Fortnight				Zones	Limits in dB
1	Noise Level dB(A)Leq - Day	06:00 - 07:00	35	35.8	CPCB, Protocol for Ambient Level Noise Monitoring - 2015	35 dB-135 dB	35 Db (A)	Industrial Commercial Residential Silence	75 65 55 50
2		07:00 - 08:00	45.2	44.5					
3		08:00 - 09:00	40.2	45					
4		09:00 - 10:00	37.6	39.9					
5		10:00 - 11:00	40.2	41.6					
6		11:00 - 12:00	38.9	43.8					
7		12:00 - 13:00	39.9	42.4					
8		13:00 - 14:00	41.1	44.1					
9		14:00 - 15:00	40.5	41.9					
10		15:00 - 16:00	43	43.3					
11		16:00 - 17:00	43.1	43.2					
12		17:00 - 18:00	42.9	44.1					
13		18:00 - 19:00	42.9	43.8					
14		19:00 - 20:00	42.4	42.1					
15		20:00 - 21:00	42.3	42.2					
16		21:00 - 22:00	42.2	42.1					
		<b>Leq Day</b>	<b>41.7</b>	<b>42.9</b>					
1	Noise Level dB(A)Leq -Night	22:00-23:00	44.1	44.1	CPCB, Protocol for Ambient Level Noise Monitoring - 2015	35 dB-135 dB	35 dB (A)	Industrial Commercial Residential Silence	70 55 45 50
2		23:00- 00:00	44	43.5					
3		00:00- 01:00	43.7	43.6					
4		01:00-02:00	43.3	44.2					
5		02:00-03:00	43.2	43.5					
6		03:00-04:00	43.1	43.2					
7		04:00-05:00	42.7	43.3					
8		05:00-06:00	43.5	43.8					
		<b>Leq Day</b>	<b>43.5</b>	<b>43.7</b>					

\*\*All noise measurements are integrated for a 01 hour period, All units in dB(A) \*LDL indicates Lower Detection Limit

Sampling Assistants

ANALYSED BY



(Gaurav Kant)

REVIEWED BY

  
(Amit Raj Mishra)

Authorised Signatory

Note: The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**Ambient Noise Level Test Report**

CMPDIL, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmpdi@coalindia.in

Month & Year	03/2025	Cluster	Cluster XIV			ULR No.	TC1432125000001716F		
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)					Date of Issue	25.04.2025		
Project		Sample Ref. No.	REM/BCCL/2025/03		Sampling Method	CMPDI/RI-II/LPM 22			
Sampling Stations	i	Kharkharee UGP		Date of Sampling		Zone Category of Station:	Core Zone		
Sl. No.	Parameter	Hour / Time of day	Observed Values (in Leq dB(A))		Method of Analysis	Range Of Testing	LDL	NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 Standards	
			First Fortnight	Second Fortnight				Zones	Limits in dB
1	Noise Level dB(A)Leq - Day	06:00 - 07:00	42.1	42.8	CPCB, Protocol for Ambient Level Noise Monitoring -2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	75 65 55 50
2		07:00 - 08:00	56.9	56.8					
3		08:00 - 09:00	67.6	67.8					
4		09:00 - 10:00	67.5	67.3					
5		10:00 - 11:00	64	62.9					
6		11:00 - 12:00	61.3	60.8					
7		12:00 - 13:00	59	59.9					
8		13:00 - 14:00	57.3	56.7					
9		14:00 - 15:00	55.2	54.5					
10		15:00 - 16:00	53.7	54					
11		16:00 - 17:00	54	54.6					
12		17:00 - 18:00	53.8	54.4					
13		18:00 - 19:00	51.3	51.3					
14		19:00 - 20:00	49.6	49.8					
15		20:00 - 21:00	47.7	47.9					
16		21:00 - 22:00	47.1	47.5					
		<b>Leq Day</b>	<b>60.6</b>	<b>60.5</b>					
1	Noise Level dB(A)Leq -Night	22:00-23:00	46.9	44.8	CPCB, Protocol for Ambient Level Noise Monitoring -2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	70 55 45 50
2		23:00-00:00	44.1	44.6					
3		00:00-01:00	44.2	44.6					
4		01:00-02:00	42.4	43.6					
5		02:00-03:00	42.1	38.9					
6		03:00-04:00	41.6	42.9					
7		04:00-05:00	41.4	40.2					
8		05:00-06:00	40	37.9					
		<b>Leq Day</b>	<b>43.3</b>	<b>42.9</b>					

\*\*All noise measurements are integrated for a 01 hour period, All units in dB(A) \*LDL indicates Lower Detection Limit

Sampling Assistants  
**ANALYSED BY**

(Gaurav Kant)  
**REVIEWED BY**

(Amit Raj Mishra)  
**Authorised Signatory**

Note: The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env), CMPDI, RI-II.

---- End of Report ----

Page -1 of 1



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**Ambient Noise Level Test Report**

CMPDIL, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmpdi@coalindia.in

Month & Year	03/2025	Cluster	Cluster XIV				ULR No.	TC143212500001716F	
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)						Date of Issue	25.04.2025	
Project			Sample Ref. No.	REM/BCCL/2025/03		Sampling Method	CMPDI/RI-II/LPM 22		
Sampling Stations	i	Telmacho Bridge		Date of Sampling			Zone Category of Station:	Buffer Zone	
Sl. No.	Parameter	Hour / Time of day	Observed Values (in Leq dB(A))		Method of Analysis	Range Of Testing	LD L	NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 Standards	
			First Fortnight	Second Fortnight				Zones	Limits in dB
1	Noise Level dB(A)Leq - Day	06:00 - 07:00	39.8	42.5	CPCB, Protocol for Ambient Level Noise Monitoring -2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	75 65 55 50
2		07:00 - 08:00	50.6	51.1					
3		08:00 - 09:00	53.8	51					
4		09:00 - 10:00	58.7	59.3					
5		10:00 - 11:00	57.8	56.8					
6		11:00 - 12:00	58.9	58.1					
7		12:00 - 13:00	60.3	62.4					
8		13:00 - 14:00	58.7	63.7					
9		14:00 - 15:00	56.9	58.1					
10		15:00 - 16:00	56.1	57.3					
11		16:00 - 17:00	53.7	52.6					
12		17:00 - 18:00	49.8	50.2					
13		18:00 - 19:00	46.4	50.6					
14		19:00 - 20:00	45	44.1					
15		20:00 - 21:00	42.1	42.2					
16		21:00 - 22:00	41.4	41					
		<b>Leq Day</b>	<b>55.5</b>	<b>57.0</b>					
1	Noise Level dB(A)Leq -Night	22:00-23:00	42.2	41.8	CPCB, Protocol for Ambient Level Noise Monitoring -2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	70 55 45 50
2		23:00- 00:00	41.3	41.3					
3		00:00- 01:00	41.2	41.2					
4		01:00-02:00	41.2	42.1					
5		02:00-03:00	42	42.1					
6		03:00-04:00	42.2	42.2					
7		04:00-05:00	42.4	42.4					
8		05:00-06:00	42.5	42.6					
		<b>Leq Day</b>	<b>41.9</b>	<b>42.0</b>					

\*\*All noise measurements are integrated for a 01 hour period, All units in dB(A) \*LDL indicates Lower Detection Limit

Sampling Assistants  
 ANALYSED BY

*Gaurav Kant*  
 (Gaurav Kant)  
 REVIEWED BY

*Amit Raj Mishra*  
 (Amit Raj Mishra)  
 Authorised Signatory

Note: The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env), CMPDI, RI-II.

---- End of Report ----  
 Page -1 of 1



**CENTRAL MINE PLANNING AND DESIGN INSTITUTE LIMITED**  
**Environment Laboratory, Regional Institute-II**  
**Ambient Noise Level Test Report**

CMPDIL, RI-II  
 KOYLA BHAWAN COMPLEX  
 DHANBAD. -826005  
 Phone:0326-223-850  
 email: rdri2cmpdi@coalindia.in

Month & Year	03/2025	Cluster	Cluster XIV				ULR No.	TC143212500001716F	
Customer	Environment Department, Bharat Coking Coal Limited (BCCL), Koyla Bhawan, Dhanbad (E-mail: gmenv.bccl@coalindia.in)						Date of Issue	25.04.2025	
Project		Sample Ref. No.	REM/BCCL/2025/03			Sampling Method	CMPDI/RI-II/LPM 22		
Sampling Stations	i	Madhuband UGP		Date of Sampling			Zone Category of Station:	Buffer Zone	
Sl. No.	Parameter	Hour / Time of day	Observed Values (in Leq dB(A))	Observed Values (in Leq dB(A))	Method of Analysis	Range Of Testing	LDL	NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000 Standards	
			First Fortnight	Second Fortnight				Zones	Limits in dB
1	Noise Level dB(A)Leq - Day	06:00 - 07:00	39.5	40	CPCB, Protocol for Ambient Level Noise Monitoring - 2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	75 65 55 50
2		07:00 - 08:00	42.2	41.4					
3		08:00 - 09:00	45.3	45.7					
4		09:00 - 10:00	46.5	46.3					
5		10:00 - 11:00	46.3	46.4					
6		11:00 - 12:00	46	45.7					
7		12:00 - 13:00	47	46.6					
8		13:00 - 14:00	50.2	53.6					
9		14:00 - 15:00	51.3	51.3					
10		15:00 - 16:00	51.7	48.6					
11		16:00 - 17:00	45	45.1					
12		17:00 - 18:00	43.9	43.8					
13		18:00 - 19:00	43.3	43.2					
14		19:00 - 20:00	43.2	42.8					
15		20:00 - 21:00	43	42.4					
16		21:00 - 22:00	41.9	42.1					
		<b>Leq Day</b>	<b>46.8</b>	<b>47.0</b>					
1	Noise Level dB(A)Leq -Night	22:00-23:00	43.3	43.8	CPCB, Protocol for Ambient Level Noise Monitoring - 2015	35 dB-135 dB	35 dB(A)	Industrial Commercial Residential Silence	70 55 45 50
2		23:00- 00:00	43.2	43.9					
3		00:00- 01:00	43.1	43.2					
4		01:00-02.00	42.4	42.8					
5		02.00-03.00	42.1	42.6					
6		03.00-04.00	43.5	43.8					
7		04.00-05.00	43.8	44					
8		05:00-06:00	44.1	43.9					
		<b>Leq Day</b>	<b>43.2</b>	<b>43.5</b>					

\*\*All noise measurements are integrated for a 01 hour period, All units in dB(A) \*LDL indicates Lower Detection Limit

Sampling Assistants  
 ANALYSED BY

*Gaurav Kant*  
 (Gaurav Kant)  
**REVIEWED BY**

*Amit Raj Mishra*  
 (Amit Raj Mishra)  
**Authorised Signatory**

Note: The results above relate to the samples tested as received. This report can not be reproduced in part or full without the written permission of the HOD(Env) , CMPDI, RI-II.

---- End of Report ----

Page -1 of 1

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

Category	Pollutant	Time weighted average	Concentration in Ambient Air	Method of Measurement
1	2	3	4	5
<b>III</b> Coal mines located in the coal fields of <ul style="list-style-type: none"> <li>• Jharia</li> <li>• Raniganj</li> <li>• Bokaro</li> </ul>	Suspended Particulate Matter (SPM)	Annual Average * 24 hours **	500 $\mu\text{g}/\text{m}^3$  700 $\mu\text{g}/\text{m}^3$	- High Volume Sampling (Average flow rate not less than 1.1)
	Respirable Particulate Matter (size less than 10 $\mu\text{m}$ ) (RPM)	Annual Average * 24 hours **	250 $\mu\text{g}/\text{m}^3$  300 $\mu\text{g}/\text{m}^3$	Respirable Particulate Matter sampling and analysis
	Sulphur Dioxide ( $\text{SO}_2$ )	Annual Average * 24 hours **	80 $\mu\text{g}/\text{m}^3$  120 $\mu\text{g}/\text{m}^3$	1.Improvedwest and Gaeke method 2.Ultraviolet fluorescene
	Oxide of Nitrogen as $\text{NO}_2$	Annual Average * 24 hours **	80 $\mu\text{g}/\text{m}^3$  120 $\mu\text{g}/\text{m}^3$	1. Jacob & Hochheiser Modified (Na-Arsenic) Method 2. Gas phase Chemiluminescence

**Note:**

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

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

## NATIONAL AMBIENT AIR QUALITY STANDARDS

New Delhi the 18<sup>th</sup> November 2009

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

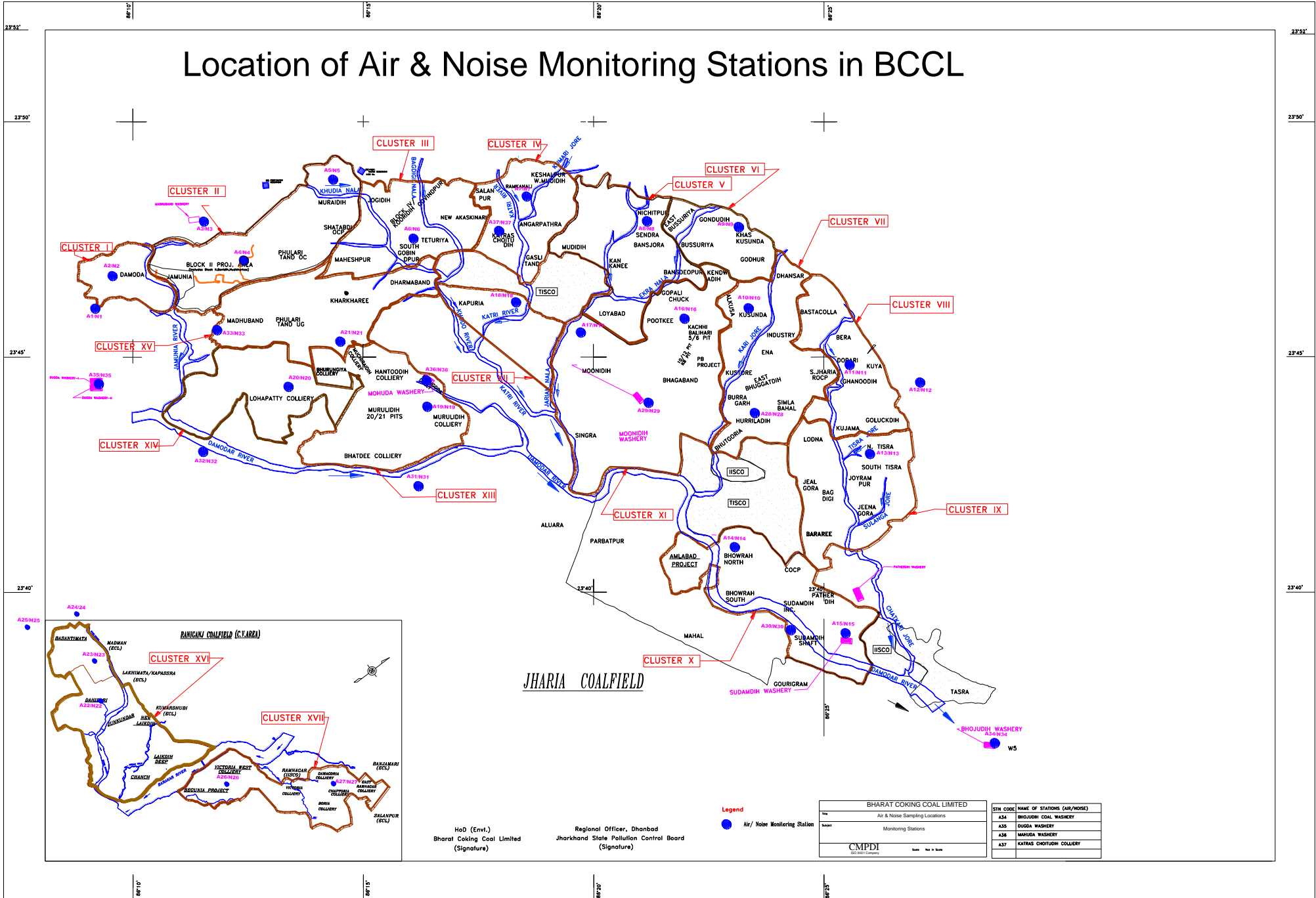
Pollutant	Time Weighted Average	Concentration in Ambient Air		Methods of Measurement
		Industrial, Residential, Rural and other Areas	Ecologically Sensitive Area (Notified by Central Government)	
<b>Sulphur Dioxide (SO<sub>2</sub>), µg/m<sup>3</sup></b>	Annual * 24 Hours **	50 80	20 80	-Improved West and Gaeke Method -Ultraviolet Fluorescence
<b>Nitrogen dioxide (NO<sub>2</sub>), µg/m<sup>3</sup></b>	Annual * 24 Hours **	40 80	30 80	-Jacob & Hochheiser modified (NaOH-NaAsO <sub>2</sub> ) Method -Gas Phase Chemiluminescence
<b>Particulate Matter (Size less than 10µm) or PM<sub>10</sub>, µg/m<sup>3</sup></b>	Annual * 24 Hours **	60 100	60 100	-Gravimetric -TEOM -Beta attenuation
<b>Particulate Matter (Size less than 2.5µm) or PM<sub>2.5</sub>, µg/m<sup>3</sup></b>	Annual * 24 Hours **	40 60	40 60	-Gravimetric -TEOM -Beta attenuation
<b>Ozone (O<sub>3</sub>), µg/m<sup>3</sup></b>	8 Hours * 1 Hour **	100 180	100 180	-UV Photometric -Chemiluminescence -Chemical Method
<b>Lead (Pb), µg/m<sup>3</sup></b>	Annual * 24 Hours **	0.50 1.0	0.50 1.0	-AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper -ED-XRF using Teflon filter
<b>Carbon Monoxide (CO), mg/m<sup>3</sup></b>	8 Hours ** 1 Hour **	02 04	02 04	-Non dispersive Infrared (NDIR) Spectroscopy
<b>Ammonia (NH<sub>3</sub>), µg/m<sup>3</sup></b>	Annual * 24 Hours **	100 400	100 400	-Chemiluminescence -Indophenol blue method
<b>Benzene (C<sub>6</sub>H<sub>6</sub>), µg/m<sup>3</sup></b>	Annual *	05	05	-Gas Chromatography (GC) based continuous analyzer -Adsorption and desorption followed by GC analysis
<b>Benzo(a)Pyrene (BaP) Particulate phase only, ng/m<sup>3</sup></b>	Annual *	01	01	-Solvent extraction followed by HPLC/GC analysis
<b>Arsenic (As), ng/m<sup>3</sup></b>	Annual *	06	06	-AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper
<b>Nickel (Ni), ng/m<sup>3</sup></b>	Annual *	20	20	-AAS/ICP Method after sampling on EPM 2000 or equivalent filter paper

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

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

**NOTE:** Whenever and wherever monitoring results on two consecutive days of monitoring exceed the limits specified above for the respective category,

# Location of Air & Noise Monitoring Stations in BCCL



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

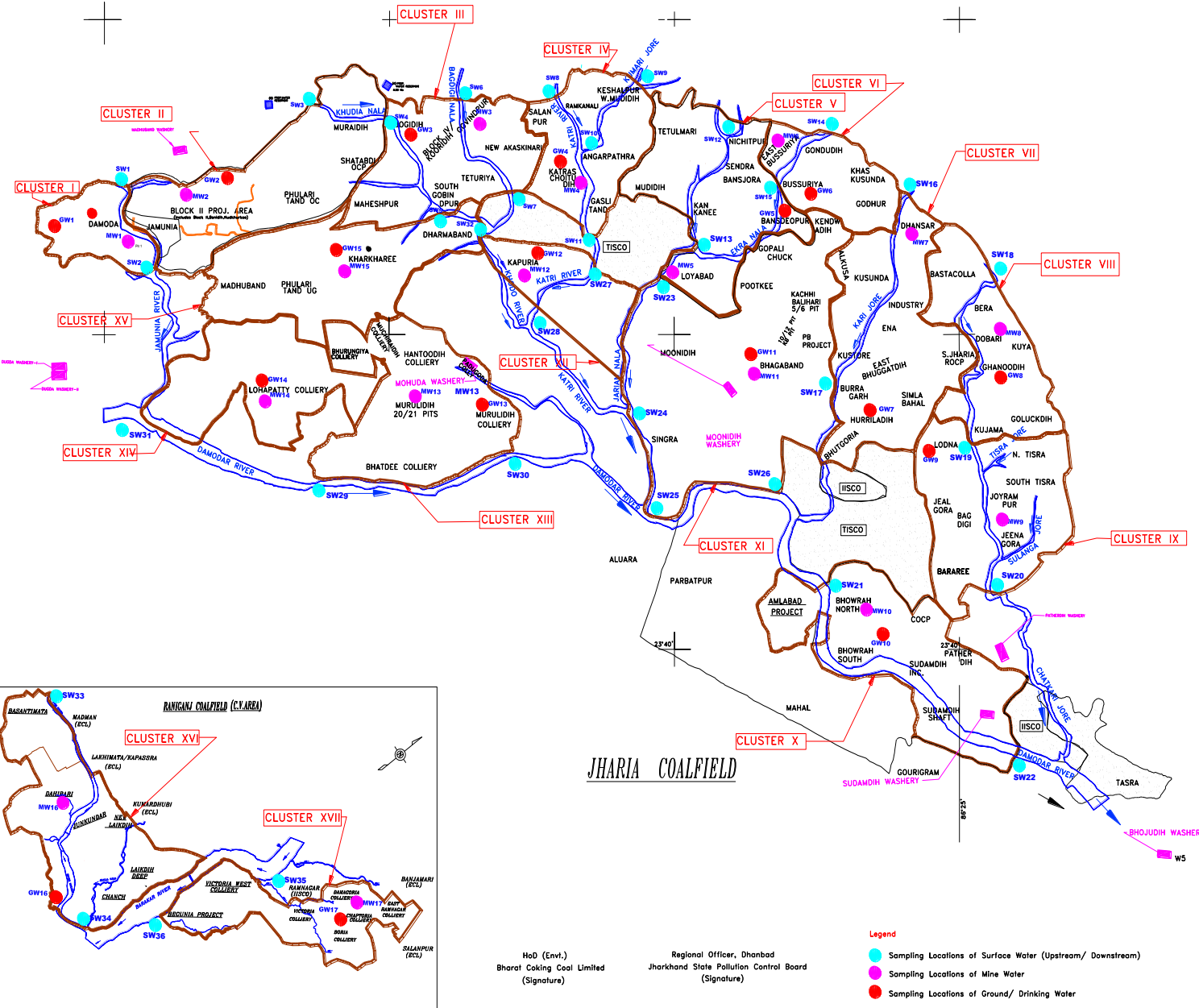
Regional Officer, Dhanbad  
Jharkhand State Pollution Control Board  
(Signature)

Legend  
● Air / Noise Monitoring Station

BHARAT COKING COAL LIMITED	
Area	Air & Noise Sampling Locations
Scale	Monitoring Stations
CMPDI Coal Monitoring & Pollution Diagnostic Institute	
Date	Not to Scale

STN CODE	NAME OF STATIONS (AIR/NOISE)
A34	BHOJUDIH COAL WASHERY
A35	DUGGA WASHERY
A36	MARUDA WASHERY
A37	KAYRAS CHOTUDIH COLLIERY

# Water Sampling Locations in BCCL



### INDEX

Cluster	Surface Water (US, DS)	Name of River/ Nala/ Effluent Water	Mineral Effluent Location	Sampling Location	Ground Water	Sampling Location
I	SW1, SW2	Jamunia River	MW1	Damoda Area	GW1	Ohutway Village
II	SW3, SW4	Khudua Nala	MW2	Block II OCP	GW2	Joyrampur Village
III	SW4, SW5, SW6, SW7	Khudua Nala, Bagdigi Nala	MW3	Govindpur Colliery	GW3	Jogdih Village
IV	SW8, SW11, SW9, SW10	Kahi River, Kuman Jore	MW4	Chotudih	GW4	Kankanee Village
V	SW12, SW13, SW15	Jarian Nala, Ekra Nala	MW5	Mudidih	GW5	Nichitpur
VI	SW14, SW15	Ekra Nala	MW6	East Bassuria UGP	GW6	Bansara Borewell
VII	SW16, SW17	Kari Jore	MW7	Dhanagar UGP	GW7	Hurmidih
VIII	SW18, SW19	Kashi Jore	MW8	Doban UGP	GW8	Qharudih
IX	SW19, SW20	Kashi Jore	MW9	Jeenagora	GW9	Lodra
X	SW21, SW22	Damodar River	MW10	Showrah North	GW10	Showrah South
XI	SW23, SW24, SW25, SW26	Jarian Nala, Damodar River	MW11	Shagaband UGP	GW11	Shagaband
XII	SW27, SW28	Kahi River	MW12	Kapura	GW12	Kapura
XIII	SW29, SW30	Damodar River	MW13	Muridih	GW13	Muridih
XIV	SW31, SW32	Damodar River	MW14	Lohapatti	GW14	Lohapatti
XV	SW5, SW32	Khudua Nala	MW15	Kharkhane UGP	GW15	Kharkhane
XVI	SW33, SW34	Khudua River	MW16	Dahaban OCP	GW16	Pallaban Village
XVII	SW35, SW36	Barakar River	MW17	Damagoria Colliery	GW17	Chaptora

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

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

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