भारत कोकिंग कोल लिमिटेड
एक मिनी रत्न कम्पनी
(महारत्न कम्पनी कोल इंडिया का एक उपक्रम)
पंजीकृत कार्यालय : कोयला भवन, कोयला नगर,
धनबाद–826005
सीआइएन : U10101JH1972GOI000918
महाप्रबंधक का कार्यालय
पश्चिमी झरिया क्षेत्र
पो. मुनीडीह, जिला: धनबाद (झारखण्ड)-828129
फोन नं. 0326 2273483; फैक्स: 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 GENERAL MANAGER
WESTERN JHARIA AREA
PO: MOONIDIH, DISTT: DHANBAD (JHARKHAND) - 828129
PHONE NO: 0326 2273483, FAX NO: 0326 2273445, e-mail : gmwj.bccl@coalindia.in

Ref: - BCCL/WJA/ENV/2021/28(A) **Date:- 29/05/2021**

To,
The 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 Clearence for the period from **October'2020 to March'2021** in respect **Cluster-XI** group of mines of BCCL.

Ref: EC Order No. – J-11015/77/2011-IA.II (M) Dated: - 26.08.2013.

Dear Sir,

Please find enclosed herewith the six-monthly reports on compliance of Environment Clearances for the period from **October'2020 to March'2021** in respect of **Cluster XI** group of mines of BCCL. We hope you will find in order.

Thanking you,
Encl: - As Above

Yours faithfully,

29-05-2021

General Manager
W.J.Area, BCCL

CC to:-

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

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

ENVIRONMENTAL CLEARANCE COMPLIANCE OF CLUSTER-XI (GRANTED VIDE EC No. J-11015/77/2011-IA.IIM Dated 26.08.2013)

(From **October'20 - March'21)**

Sl. No	A. Specific Conditions by MOEF:	Compliance
i.	**No mining shall be undertaken in/under the forestland until prior forestry clearance has been obtained under the provisions of FC Act 1980.**	Application for forest clearance has been submitted online for Moonidih mine with reference number FP/JH/MIN/9699/2015 in Feb'2019, it is presently under process. At present there is no mining activity undertaken in/under the forestland.
ii.	**You will need to seek and obtain approval under the FC Act for diversion of the entire forest land located within the mining lease within a period of two years from 1.2.2013 i.e. date of issue of FC Division's guidelines vide no. 11-362/2012-FC, failing which the mining lease area will be reduced to the non-forest area plus the forest area for which you have been able to obtain the FC at the end of this time period. In the case of reduction in mine lease area, you will need to get a revised mining plan approved from the Competent Authority for reduced area and enter into a new mining lease as per reduced lease area. The EC will be construed to be available for the mining lease area as per the revised mining lease deed.**	Amendment in EC is granted for 1982.90 Ha. Leasehold area of Moonidih UG mine on 26th July 2019 for Cluster XI group of mines.
iii.	**The maximum production in the cluster shall not exceed beyond that for which environmental clearance has been granted for the cluster XI.**	**It is being complied.** The production from the cluster is within the limit for which environmental clearance has been granted. Moonidih washery is operating within the permissible limit of 1.6 MTPA. Enclosed as **ANNEXURE I.**
iv.	**The open cast quarries of the abandoned mines should be backfilled to the ground level and restored with native species.**	Agreed.
v.	**All coal from smaller UG mines should be transported by high capacity and mechanically covered trucks/ tippers.**	**Complied.** Various mechanically covered trucks Manufacturers for the transportation of Coal and OB in India have been contacted and things are under process. At present coal transportation has been done by trucks with tarpaulin cover. Covering of truck has been made mandatory in the transportation contract.
vi.	**Green belts shall be developed on both sides of the roads.**	**Complied.** Time to time plantation is done either departmental or with the help of Forest Department Dhanbad.
vii.	**Action plan for quenching of fires and rehabilitation along with the details of master plan be submitted to the MoEF for monitoring purpose.**	**Complied.** Master Plan is already uploaded on BCCL website and under implementation.

viii.	**Presently coal to Moonidih washery from other mines of the cluster is taking place through NH.** **An alternate route for coal transportation may be explored.**	Coal from P.B. Area is direct feed coal and hence washing is not required. Presently coal from Moonidih mine transported to Moonidih washery through conveyor belt.
ix.	**For understanding the composition of emissions from coal mine fires, BCCL may**	Agreed.
x.	**Initiate action as proposed in the visit report of the EAC to Dhanbad.**	Action as proposed in the visit report of EAC has been initiated.
xi.	**The approved mining plan be submitted to the MoEF.**	Mining Plan of Gopalichcuk OC and Kendwadih OC is submitted and Feasibility report of other mines is also submitted. Revised Mining plan along with Mine closure plan of Moonidih colliery of Cluster XI was approved by the Board empowered sub-committee meeting of BCCL held on 29.01.2019.
xii.	**The measure to identify in the Environmental Plan for Cluster- XI groups of mine and the conditions given in this environmental clearance letter shall be dovetailed to the implementation of the Jharia Action Plan.**	Environmental plan for Custer XI group of mines and the condition given on the environment clearance has been dovetailed.
xiii.	**The proponent shall prepare time -series maps of the Jharia Coalfields through NRSC to monitor and prevent fire problems in the Jharia Coalfields by Isothermal mapping /imaging and monitoring temperatures of the coal seams (whether they are close to spontaneous ignition temperatures) and based on which, areas with potential fire problems shall be identified.** **Measures to prevent ingress of air (Ventilation) in such areas, to prevent restart fresh/spread fires in other areas including in mines of cluster II shall be undertaken. Expertise available internationally could also be utilized for control of fire in Jharia Coalfields and for their reclamation and to further minimize time for fire and subsidence control. Isothermal mapping using thermal imaging has been got done by NRSC. Measures would be taken to prevent ingress of air (ventilation) in such areas, which may re-start fresh fires.**	**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 January 2018 in which the area of fire has been reduced from 9.00 Km^2 to 3.28 km^2. NRSC report is enclosed as **ANNEXURE II.**
xiv.	**The embankment constructed along the river boundary shall be of suitable dimensions and critical patches shall be strengthened by stone pitching on the river front side and stabilized with plantation so as to withstand the peak water flow and prevent mine inundation.**	Not applicable. Reason for same is enclosed as **ANNEXURE III.**

xv.	**No mining shall be undertaken where underground fires continue. Measure shall be taken to prevent/check such fire including in old OB dump areas where the fire could start due to presence of coal/shale with sufficient carbon content.**	It is being complied
xvi.	**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.**	Complied as per statute.
xvii.	**Thick green belt shall be developed along undisturbed areas, mine boundary and in mine reclamation. A total area of 254.67 ha shall be reclaimed and afforested.**	Plantation work on 12 Ha OB dump has been completed with the help of Forest Department (Approx.30000 saplings have been planted) 400 bamboo saplings planted along the boundary of Gopalichuck OC mine. 20 Ha site for compensatory afforestation (32760 trees) is provided to Forest department, Dhanbad. Work has been started.800 sapling are planted at various location at Moonidih mine for FY 2020-21.
xviii	**Details of transportation, CSR, R&R and implementation of environmental action plan for the clusters-XI should be brought out in a booklet form within a year and regularly updated.**	**Complied. Enclosed as Annexure IV**
xix.	**Specific mitigative measures identified for the Jharia Coalfields in the Environmental Action Plan prepared for Dhanbad as a critically polluted area and relevant for Cluster XI shall be implemented.**	**It is being complied** in the name of Dhanbad Action Plan. It has been prepared in consultation with Jharkhand Pollution Control Board for entire BCCL and not on cluster basis. It is being implemented comprehensively for all the mines of BCCL. Some of the salient actions of this cluster are as under: **Enclosed as Annexure V**
xx.	**The locations of monitoring stations in the Jharia Coalfields should be finalized in consultation with the Jharkhand State Pollution Control Board. The Committee stated that smoke/dust emission vary from source to source (fuel wood, coal, fly ash from TPPs, silica from natural dust, etc.) and a Source Apportionment Study should be got carried out for the entire Jharia Coalfields. Mineralogical composition study should be undertaken on the composition of the suspended particulate matter (PM_{10} and $PM_{2.5}$) 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.**	**It is being complied.** Establishment of ambient environment quality monitoring stations has been finalized with the consultation of Jharkhand State Pollution Control Board. Draft Final Report of Source Apportionment Study has been submitted by NEERI, Nagpur and under examination at BCCL for final comments. Progress report of Source Apportionment study is **Enclosed as Annexure VI**

xxi.	**The proponent will continue the existing Road-Rail transport network system in view of the implementation of the Master Plan (for 10 years) and another 5 years, gestation period after the completion of Master Plan for consolidation of the backfilled dug out fire areas and unstable areas is required. All mitigation measures (like covered trucks, green belting on either sides of the roads, enhanced water sprinkling, strengthening and maintaining the roads etc.) shall be adopted up to 15 years (Phase-I) with the existing road-rail transport system. In phase-II, BCCL shall implement conveyor-cum-rail transport to avoid movement of trucks within the cluster for coal transportation in Phase-II which shall start after 15 years. Transportation of coal shall be by Rail and Conveyor belt, minimizing the existing road transport system in all the mines of the cluster and shall continue after 15 years. Loading of coal by pay loaders shall be discontinued. Adequate number of suitably designed off-take points shall be provided.**	Action has been taken for conveyor-cum-rail transport system. Meanwhile transportation is being done by covering vehicle with tarpaulin cover. **Enclosed as Annexure VII**
xxii.	**16944 nos of PAFs should be rehabilitated at cost of Rs 53776.60 Lakhs as per the approved Jharia Action Plan.**	Implementation of master plan has already been started through Jharia Rehabilitation and Development Authority (JRDA), Dhanbad.
xxiii	**Regular monitoring of subsidence movement on the surface over and around the working area and impact on natural drainage pattern, water bodies, vegetation, structure, roads, and surroundings shall be continued till movement ceases completely. In case of observation of any high rate of subsidence movement, appropriate effective corrective measures shall be taken to avoid loss of life and material. Cracks shall be effectively plugged with ballast and clayey soil/suitable material.**	It is being complied and will be implemented as the case may be. Regular subsidence monitoring is done at underground mines.
xxiv	**Coal Extraction shall also be optimized in areas where agricultural production is continuing. Some pillars shall be left below the agricultural land. No depillaring & coal extraction should be carried out below habitation, H.T. Lines & beneath road, water bodies.**	It is being complied. Being implemented as per statute.
xxv.	**Subsidence shall be monitored closely and if subsidence is found exceeding the permitted limits, then the landowners shall be adequately compensated with mutual agreement with the landowners.**	It is being complied.
xxvi.	**3-tier plantation should be developed 2 km stretch of road from the mine using native species.**	**It is being complied.** Plantation is being done on roadside in non-coal bearing areas and colonies.

xxvii.	**Water sprinkling system shall be provided to check fugitive emissions from loading operations, conveyor system, haulage roads, transfer points, etc. Major approach roads shall be black topped and properly maintained.**	**It is being complied.** Mobile water tankers are used for spraying water. Sprinkler arrangement provided in respect of Moonidih washery and Moonidih mine. Water sprinkler are provided at Moonidih Underground at transfer and coal cutting points to reduce coal dust.At Moonidh washery some new sprinkler arrangement near loading point and washery gate to VIP office is provided for dust suppression.
xxviii	**A progressive afforestation plan shall be prepared and implemented over the mine lease area acquired and shall include areas under green belt development, areas along roads, infrastructure, along ML boundary and township etc., by planting native species in consultation with the local DFO/Agriculture Department.**	**It is being complied.** **1.** 400 saplings planted around mine boundary. **2.** 600 around weigh bridge and area office boundary. **3.** 30000 saplings planted (FY 2019-20) at OB Dump (compensatory afforestation by Forest Department, Dhanbad) **4.** 20 Ha site is given to forest department for plantation work in FY 2020-21. **5.** 200 saplings are planted at XV seam mine boundary, shaft shrinking and 500 at Dhobni Plantation Site of Moonidih mine in FY 2020-21. **6.** 600 Sapling distributed to local public and employees in FY 2020-21 by WJA.
xxix.	**Acid Water Treatment Plant, volume of water to be treated and disposal of brine should be provided.**	Presently there is no acid water mines in Cluster-XI.
xxx.	**Mine discharge water outside the ML shall be monitored, particularly for TDS and treated to conform to prescribed levels before discharge into the natural environment.**	**It is being complied.** Being monitored. Moonidih washery is operating under closed water circuit system. Pilot scale Mine Water Treatment Plant is installed at P.B. Area to convert mine water into drinking water. 1 No Pressure Filter is installed near P.B. Project and 2 nos. of pressure filters are installed at Moonidih mine to supply clean water.
xxxi.	**The Company shall put up artificial groundwater recharge measures for augmentation of groundwater resource, in case water table shows a declining trend. The project authorities shall meet water requirement of nearby village(s) in case the village wells go dry due to dewatering of mine.**	**It is being complied.** Mine water is being used for the industrial as well as domestic non drinking purpose. Mine water is also utilized for the community and irrigation purposes.
xxxii.	**Besides carrying out regular periodic health checkup of their workers, 10% of the workers identified from workforce engaged in active mining operations shall be subjected to health checkup for occupational diseases and hearing impairment, if any, through an agency such as NIOH, Ahmadabad within a period of one year and the results reported to this Ministry and to DGMS.**	**It is being complied.** Draft report submitted by NIOH has been scrutinized by Medical department, BCCL. NIOH have been requested to arrange a final closure presentation at BCCL and to submit the final report as well. NIOH also done an Awareness workshop on occupational disease. Enclosed as Annexure VIII

xxxiii.	**The mining in the existing mines would be phased out after expiry of the current mining lease and after reclamation of mined over area. The operating mines may be analyzed and monitored for compliance of conditions, having bearing with movement of wild life until such time they are closed/phased out.**	**Complied**
xxxiv.	**Sufficient coal pillars shall be left unextracted around the air shaft (within the subsidence influence area) to protect from any damage from subsidence, if any.**	Complied. Already implemented in case of Moonidih Mine. Complied in respect of all mines of P.B.Area.
xxxv.	**High root density tree species shall be selected and planted over areas likely to be affected by subsidence.**	Plantation in BCCL is being done on 3-tier basis, in which both, Monocotyledonae (Monocots) such as grasses, bamboo etc and Dicotyledonae (Dicots) such as sheesham, mango etc are being planted for developing an extensive root system. The Monocots having fibrous root system. The Monocots having fibrous root system helps in developing roots density at the topsoil level while, Diocots having the tap root system have a distributed root density topsoil, subsoil and regolith layer of soil. These two root system together forms the high root density system.
xxxvi.	**Depression due to subsidence resulting in water accumulating within the low lying areas shall be filled up or drained out by cutting drains.**	**Being Complied.**
xxxvii.	**Solid barriers shall be left below the roads falling within the blocks to avoid any damage to the roads.**	**Being Complied.**
xxxviii.	**The CSR Action Plan shall consist of need-based CSR Action Plan, CSR Auditing and monitoring mechanism etc. The proponent will spend 5 % of the retained earnings of the previous year subject to a minimum of Rs. 5/- per ton of coal production which should be adjusted as per the annual inflation The progress made thereon shall be uploaded on the company annually on the company website. Monitoring of the impacts of activities under CSR shall be carried out periodically.**	**Complied.** CSR work is handled at Headquarter level and every area is assigned work. CSR work carried out from Oct'20 till March'21 is enclosed as **Annexure –IV**
xxxix.	**Third party evaluation shall be got carried out regularly for the proper implementation of activities undertaken in the project area under CSR. Issue raised in the Public Hearing shall also be integrated with activities being taken up under CSR. The details of CSR undertaken along with budgetary provisions for the village-wise various activities and expenditure thereon**	**It is being complied.**

	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. The gap/space available between the entire mine area should be suitably planted with native species. Plantation should also be made in vacant area and along the road side so as to reduce dust pollution.	
xl.	**Central recreation park with herbal garden should be developed for use of all inhabitants.**	Sneh-Smriti Upvan is constructed at P.B. Area Office and near Moonidih Guest house consisting of flowering, fruit, medicinal and ornamental saplings.
xli.	**The mine water should be treated properly before supply to the villager.**	**It is being complied.** An action plan for the utilization and treatment of surplus Mine Water has been prepared by Environment, Civil and CSR department conjointly. In this regard, 26 Mines have been identified for the implementation of scheme in the Phase-I. A pilot scale mine water treatment plant in collaboration with CSIR, CIMFR is installed at P.B. Area office to convert mine water into drinking water. 2 number of pressure filter (1500 gph each capacity) are installed for treating mine water. Two number of pressure filters are also installed in Moonidih mine for mine water treatment.
xlii	**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.**	**Complied.** Mine discharge water is being allowed to settle down in the mine sumps before passing through sedimentation tank. The monitoring of water quality parameters is being carried out by CMPDIL.
xliii	**The void shall be converted into a water reservoir of a maximum depth of 15-20 m and shall be gently sloped and the upper benches of the reservoir shall be stabilized with plantation and the periphery of the reservoir fenced. The abandoned pits and voids should be backfilled with OB and reclaimed with plantation and or may be used for pisciculture.**	As working in P.B. Area does not approached combined seam therefore water reservoir cannot be formed. In due course we will be able to comply this point in future
xliv	**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 piezometers. The monitoring for quantity shall be done four times a year in pre-monsoon (May), monsoon (August), post-monsoon (November) and winter (January) seasons and for quality including Arsenic and Fluoride during the month of May. Data thus collected shall be submitted to the Ministry of Environment & Forest and to the Central Pollution Control**	**Complied.** CMPDI RI-II has prepared a report for Location and design of Piezometers. Groundwater monitoring data has been enclosed as **Annexure IX**

	Board/SPCB quarterly within one month of monitoring. Rainwater harvesting measures shall be undertaken in case monitoring of water table indicates a declining trend.	
xlv	**ETP shall also be provided for workshop, and CHP, if any. Effluents shall be treated to confirm to prescribe standards in case discharge into the natural water course.**	There is no CHP under of Cluster XI. Effluents from mine is treated before discharge. ETP is provided at compressor house.
xlvi	**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 Ranchi.**	**Complied.** Presently a time series map of vegetation cover in the Jharia Coal Field is being carried out through CMPDI, Ranchi using satellite imagery. Further CMPDI has been requested to prepare "Time series of land use maps based on satellite imagery of the core zone and buffer zone.
xlvii.	**A Final Mine Closure Plan along with details of Corpus Fund shall be submitted to the Ministry of Environment & Forests five year before mine closure for approval. Habitat Restoration Plan of the mine area shall be carried out using a mix of native species found in the original ecosystem, which were conserved in-situ and ex-situ in an identified area within the lease for reintroduction in the mine during mine reclamation and at the post mining stage for habitat restoration. the mining plan and post- mining plan, closure plan should be prepared and submitted to the Ministry;**	**It shall be complied.** It will be complied when mine life will reach its final phase. Mine closure plan of Moonidih Colliery is approved.
xlviii.	**A separate management structure for implementing environment policy and socio-economic issues and the capacity building required in this regard.**	Agreed
xlix.	**The raw coal, washed coal and coal wastes (rejects) shall be stacked properly at earmarked**	Agreed. Being Complied.
l	**Site(s) within stockyards fitted with wind breakers/shields. Adequate measures shall be taken to ensure that the stored minerals do not catch fire.**	Being Complied
li.	**Hoppers of the coal crushing unit and washery unit shall be fitted with high efficiency bag filters and mist spray water sprinkling system shall be installed and operated effectively at all times of operation to check fugitive emissions from crushing operations, transfer points of closed belt**	Being Complied. Some more water sprinkler have been added nearby Hopper of Coal Crushing unit and loading points for water spraying and also mobile water tanker are used for spraying and also mobile water tanker are used for spraying water spraying water in transportation road.

	conveyor systems and from transportation roads.	
li.	**All approach roads shall be black topped and internal roads shall be concreted. The roads shall be regularly cleaned with mechanical sweepers.**	**Compliance under process.** Different agencies are contacted for mechanical sweepers. Presently cleaning of roads done manually.
lii.	**Green belt of 3 ha shall be developed all along the periphery of the site, along the areas such as the washery unit, crushing unit, and stockyard.** **A 3-tier avenue plantation would be developed along vacant areas, near washery, storage yards, loading points and transfer points and along internal roads and main approach roads and on the road upto the railway siding and at the siding. The road between the coal washery and the main -road shall be black topped and thick 3-tier vegetation between the washery and villages/habitations shall be developed. In addition, a 10m thick green avenue plantation in the transportation route from washery to Majhri Railway Siding (of WCL) shall be provided in consultation with and approval of WCL under CSR.**	**Under Compliance.** There is no Majhri Railway siding (of WCL). Plantation work has been done along mine boundaries, overburden dump, weighbridge and along roads.
liii.	**Trucks engaged for mineral transportation outside the washery up to the railway siding shall be optimally loaded. The trucks shall be properly maintained and emissions shall be below notified limits. Facilities for parking of trucks carrying raw coal from the linked coalmines shall be created within the Unit.**	**Complied.** Certificate of Vehicle Fitness (Form 38) under Motor Vehicle Rules 1989 issued by DTO, Dhanbad.
liv.	**Records of quantum of coal (in TPD) and ash content of raw coal being washed, clean coal and coal rejects produced from every batch of washing shall be maintained and details thereof uploaded on the company website.**	Records of Coal fines/Slurry are Maintained and are regularly updated in the Website.
lv.	**The washery unit shall be a zero-discharge facility and no wastewater shall be discharged from the washery into the drains/natural watercourses. Recycled water shall be used for development and maintenance of green belt and in the Plant Operations.**	There is a Zero discharge from the washery and the water are recycled for the plant operations and for the development of the Green belts, inside the Washery premises.
lvi.	**Coal fines shall be recovered from the coal slurry, washery discharge and used in power generation and records of quantum of coal fines collected and used shall be properly maintained.**	Stock of slurry is maintained, Records of Coal Fines are Maintained.
lvii.	**No additional groundwater shall be used for the Plant Operations. Any additional water requirement envisaged shall be obtained by recycle/reuse to the maximum extent and from rainwater harvesting measures.**	**Complied.**

lviii	**Heavy metal content in raw coal, and washed coal shall be analyzed once in a year and records maintained thereof.**	Agreed. Proposal has been sent to IIT(ISM), Dhanbad for analysis.
lix	**Corporate Environment Responsibility:**	**Enclosed as Annexure-X**
a	**The Company shall have a well laid down Environment Policy approved by the Board of Directors.**	Agreed
b	**The Environment Policy shall prescribe for standard operating process/procedures to bring into focus any infringements/deviation/violation of the environmental or forest norms/conditions.**	Agreed
c	**The hierarchical system or Administrative Order of the company to deal with environmental issues and for ensuring compliance with the environmental clearance conditions shall be furnished.**	Agreed
d	**To have proper checks and balances, the company shall have a well laid down system of reporting of non-compliances/violations of environmental norms to the Board of Directors of the company and/or shareholders or stakeholders at large.**	Agreed
Sl.No	**B. General Conditions by MOEF:**	**Compliance**
i.	**No change in mining technology and scope of working shall be made without prior approval of the Ministry of Environment and Forests.**	**Complied**
ii.	**No change in the calendar plan of production for quantum of mineral coal shall be made.**	**Being Followed.**
iii.	**Four ambient air quality monitoring stations shall be established in the core zone as well as in the buffer zone for PM_{10}, $PM_{2.5}$, SO_2 and NO_x monitoring.**	The fixing up of locations of monitoring stations in the Jharia Coalfields has been taken up with the Jharkhand State Pollution Control Board. **Enclosed as Annexure XI** The work of monitoring of ambient environment has been done through CMPDI, Regional Institute Dhanbad having laboratory recognized under EPA Rules.
iv.	**Data on ambient air quality (PM_{10}, $PM_{2.5}$, SO_2 and NO_x) and heavy metals such as Hg, As, Ni, Cd, Cr and other monitoring data shall be regularly submitted to the Ministry including its Regional Office at Ranchi 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.**	**Complied.** Monitoring for the same is done by CMPDI having own laboratory recognized under EPA Rules. Monitoring data is **Enclosed as Annexure XI**

v.	**Adequate measures shall be taken for control of noise levels below 85 dBA in the work environment. Workers engaged in blasting and drilling operations, operation of HEMM, etc. shall be provided with ear plugs/muffs.**	**Being Complied.**
vi.	**Industrial wastewater (workshop and wastewater from the mine) shall be properly collected, treated so as to conform to the standards prescribed under GSR 422 (E) dated 19th May 1993 and 31st December 1993 or as amended from time to time before discharge. Oil and grease trap shall be installed before discharge of workshop effluents.**	CMPDI Dhanbad is carrying out monitoring of environment quality work. There is arrangement for treatment of effluent discharge to prescribed standards.
vii.	**Vehicular emissions shall be kept under control and regularly monitored. Vehicles used for transporting the mineral shall be covered with tarpaulins and optimally loaded.**	**Complied.** Vehicles used for transportation are covered with tarpaulin covers.
viii.	**Monitoring of environmental quality parameters shall be carried out through establishment of adequate number and type of pollution monitoring and analysis equipment in consultation with the State Pollution Control Board and data got analyzed through a laboratory recognized under EPA Rules, 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.**	Presently, CMPDI Dhanbad is carrying out regular monitoring of environmental quality work.
ix.	**Personnel working in dusty areas shall wear protective respiratory devices and they shall also be provided with adequate training and information on safety and health aspects.**	**Complied.** Vocational training Centers under Separate Human Resource Development Dept. is Conducting regular training program on these issues. Due to COVID-19 pandemics VTC under separate HRD deptt. is NOT conducting regular training programme on these issues till date. VTC training details is enclosed as **Annexure XII**
x.	**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.**	Due to COVID-19 pandemics, Initial Medical Examination (IME) and Periodical Medical Examination (PME) of all the personnel are changed. Details of IME and PME Enclosed as **Annexure XII**

xi.	**A separate environmental management cell with suitable qualified personnel shall be set up under the control of a Senior Executive, who will report directly to the Head of the company.**	A full-fledged Environment Department, headed by a HOD (Environment) along with a suitable qualified multidisciplinary team of executives which includes Environment, Mining, Excavation, Civil, Survey, Electrical & mechanical, Forestry disciplines executives and technicians (4 nos.) has been established in Headquarters. They are also trained in ecological restoration, sustainable development, rainwater harvesting methods etc. At the project level, on 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.
xii.	**The funds earmarked for environmental protection measures shall be kept in separate account and shall not be diverted for other purpose. Year-wise expenditure shall be reported to this Ministry and its Regional Office at Ranchi.**	It is being complied. Agreed to report the same.
xiii.	**The Project authorities shall advertise at least in two local newspapers widely circulated around the project, one of which shall be in the vernacular language of the locality concerned within seven days of the clearance letter informing that the project has been accorded environmental clearance and a copy of the clearance letter is available with the State Pollution control Board and may also be seen at the website of the ministry of Environment & Forests at http://envfor.nic.in.**	**Complied.**
xiv.	**A copy of the environmental clearance letter shall be marked to concern Panchayat/Zila Parishad, Municipal Corporation or Urban local body and local NGO, if any, from whom any suggestion/representation has been received while processing the proposal. A copy of the clearance letter shall also be displayed on company's website.**	**Complied.**

xv.	**A copy of the environmental clearance letter shall also be displayed on the website of the concerned State Pollution Control Board. The EC letter shall also be displayed at the Regional Office, District Industry Sector and Collector's Office/Tehsildar's Office for 30 days.**	**Complied.**
xvi.	**The clearance letter shall be uploaded on the company's website. The compliance status of the stipulated environmental clearance conditions shall also be uploaded by the project authorities on their website and updated at least once every six months so as to bring the same in public domain.** **The monitoring data of environmental quality parameter (air, water, noise and soil) and critical pollutant. Such as PM_{10}, $PM_{2.5}$, SO_2 and NOx (ambient) and critical sectoral parameters shall also be displayed at the entrance of the project premises and mine office and in corporate office and on company's website.**	**Complied.**
xvii.	**The project proponent shall submit six monthly compliance reports on status of compliance of the stipulated environmental clearance conditions (both in hard copy and in e-mail) to the respective Regional Office of the Ministry, respective Zonal Office (s) of CPCB and the SPCB.**	**Complied.**
xviii.	**The Regional Office of this Ministry located at Ranchi 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.**	**Complied.**
x.	**The Environmental statement for each financial year ending 31 March in Form –V is mandated to be submitted by the project proponent to the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently, shall also be uploaded on the company's website along with the status of compliance of EC conditions and shall be sent to the respective Regional Offices of the MoEF&CC by e-mail.**	**Complied.**
xx	**The proponent shall abide by all the commitments and recommendations made in the EIA/EMP report so also during their presentation to the EAC.**	**Complied.**

xxi	The proponent is required to obtain all necessary clearances/approvals that may be required before the start of the project.	Complied.
xxii	The Ministry or any other competent authority may stipulate any further condition for environmental protection.	Complied.
xxiii	Failure to comply with any of the conditions mentioned above may result in withdrawal of this clearance and attract the provisions of the Environment (Protection) Act, 1986.	Complied.
xxiv	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.	Complied.
xxv	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.*	Complied.

28.5.2021
Additional General Manager
P.B. Area

Additional General Manager
PUTKEE BALIHARI AREA
B.C.C.L. DHANBAD

28/05/2021
Project Officer
Moonidih Washery

PROJECT OFFICER
MOONIDIH CC...

29/05/21
Project Officer
Moonidih Colliery

PROJECT OFFICER/A
MOONIDIH COLLIE
B.C.C. LTD.

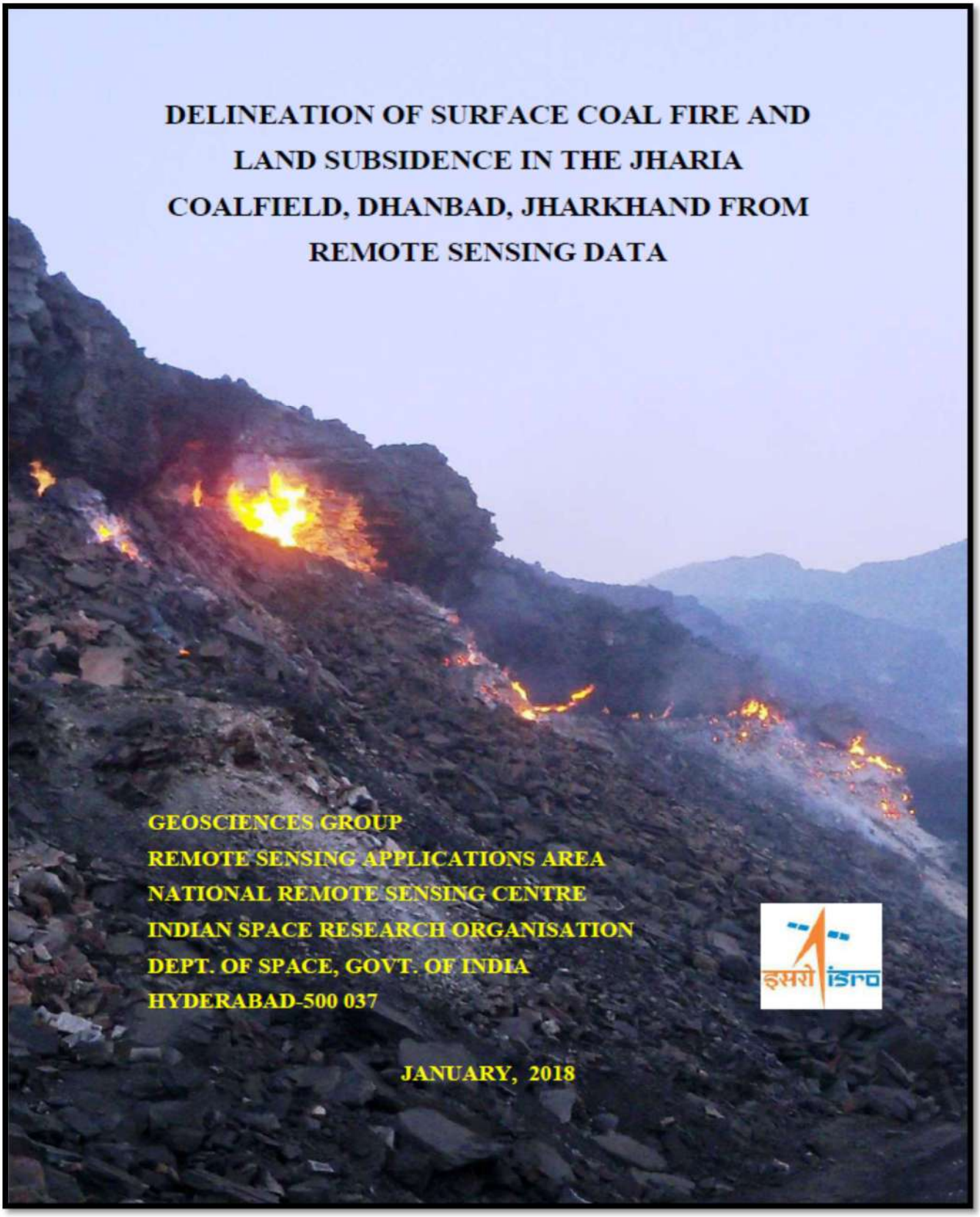
ANNEXURE- I

EC grant for cluster XI is 6.474 MTPA (Peak Production)**.** The production from area is 0.294 MT for six months, which is well within the limits.

Production From October ’20 to March'21 (Tonne)	
Cluster XI	**Production**
Total Production from Cluster is	**294281**

ANNEXURE-II

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.



Annexure –I

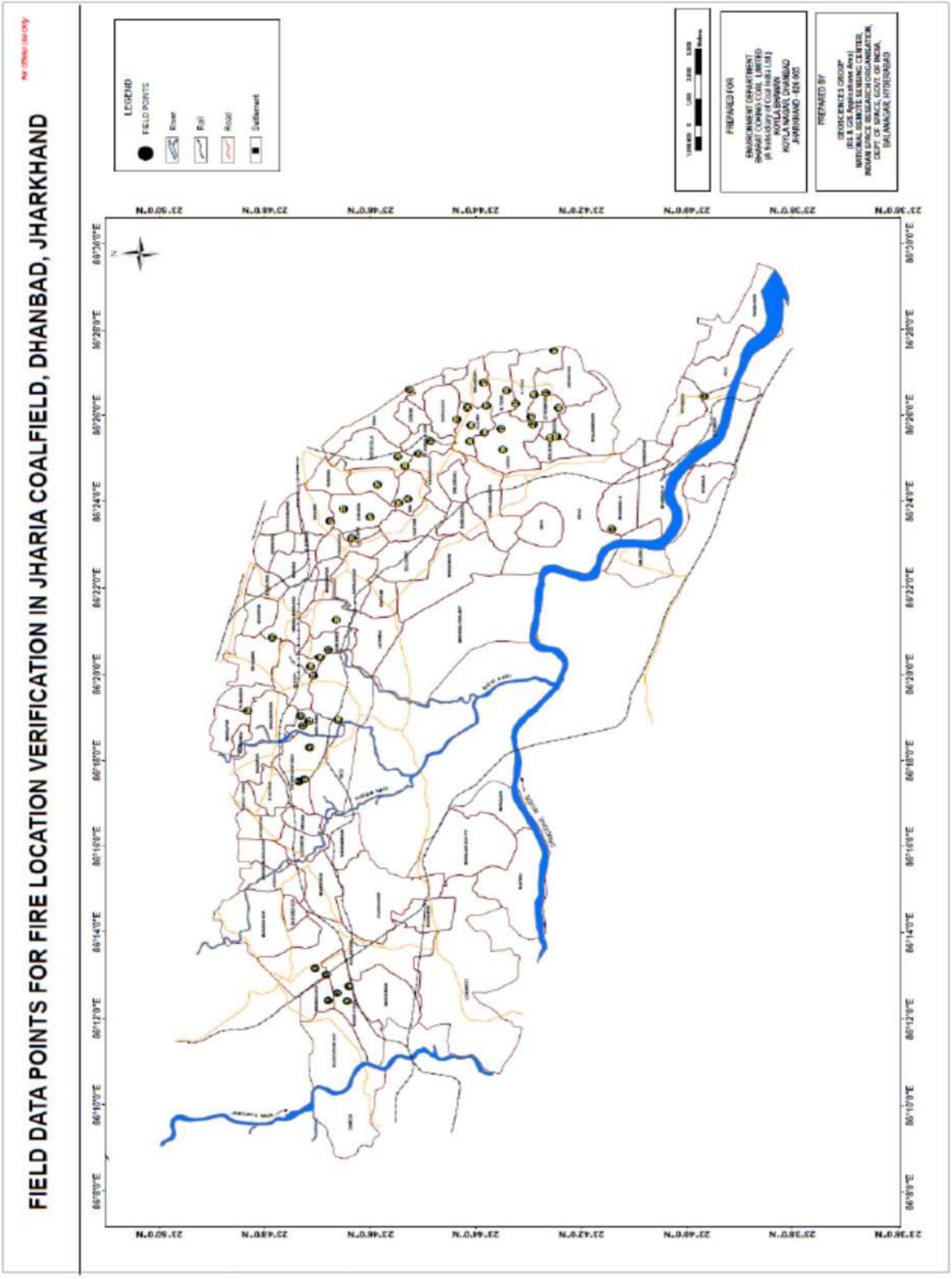


Figure 13. Field data points for coal fire verification

Annexure –III

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

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

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

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

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

NRSC/RSAA/GSG/BCCL/Project Report/JAN2018

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

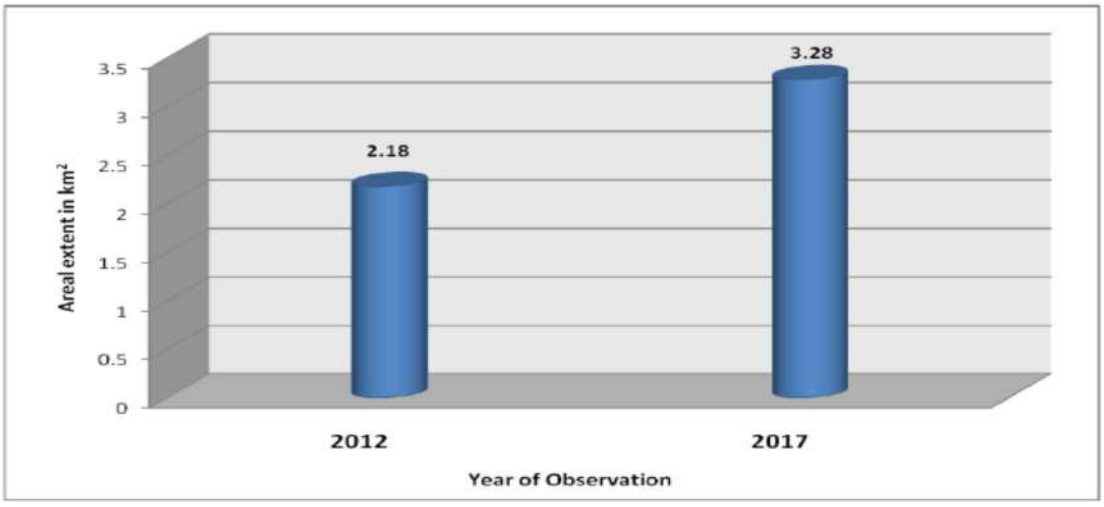


Figure 12: Total fire area statistics

Annexure- III

भारत कोकिंग कोल लिमिटेड
एक मिनी रत्न कम्पनी
(महारत्न कम्पनी कोल इंडिया का एक उपक्रम)
पंजीकृत कार्यालय : कोयला भवन, कोयला नगर
धनबाद–826005
सी आई एन : U10101JH1972GOI000918
महाप्रबंधक का कार्यालय
पश्चिमी झरिया क्षेत्र
पो. मुनीडीह, जिला: धनबाद (झारखण्ड)-828129
फोन नं. 0326 2273483, फैक्स: 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 GENERAL MANAGER
WESTERN JHARIA AREA
PO: MOONIDIH, DISTT: DHANBAD (JHARKHAND) - 828129
PHONE NO: 0326 2273483, FAX NO: 0326 2273445, e-mail : gmwj.bcd@coalindia.in

EC Cluster-XI Specific Condition no. (xiv) by MoEF –

The embankment constructed along the river boundary shall be of suitable dimension and critical patches shall be strengthened by stone pitching on the river front side and stabilized with plantation so as to withstand the peak water flow and prevent mine inundation.

BCCL Submission –

Moonidih Mine of Bharat coking coal limited is an underground mine. The current underground working are situated at a depth of more than 500 m from surface. The mine working have been designed in such a way that there is no effect of subsidence on the surface.

Damodar River is situated in the south edge of the mine leasehold boundary of Moonidih mine. The underground working of Moonidih mine are situated at a horizontal distance of more than 500 m from the river. There is no opencast mine within the leasehold of Moonidih mine. So there is no danger of inundation of the mine from Damadar River hence this condition is presently not applicable.

13/01/21
AGM
W.J.Area

13-1-2021
GM
W.J.Area

ANNEXURE-IV

CSR, R&R and Transportation Plan of Cluster XI

As per EC Condition

(Specific Condition No XVIII)

Details of transportation, CSR, R&R and implementation of environmental action plan for each of the 17 clusters should be brought out in a booklet form

Bharat Coking Coal Limited

(A Mini Ratna Company)

P.B Area

Dhanbad

UNDERSTANDING THE SCOPE OF CSR INTERVENTION

(BASELINE STUDY REPORT)

FOR

BHARAT COKING COAL LTD. (BCCL)

DHANBAD

BY-

NATIONAL CORPORATE SOCIAL RESPONSIBILITY HUB

TISS, MUMBAI

25th NOVEMBER 2013

CIL'S POLICY FOR CORPORATE SOCIAL RESPONSIBILITY (CSR)

Introduction

Mining of coal has profound impact on the people living in and around the areas where the mines are established. The obvious impact of the introduction of any production activity in such areas change the traditional lifestyle of the original inhabitants and indigenous communities and also change the socio-economic profile of the Area. Hence, the primary beneficiaries of CSR for the company are:

- Land oustees
- PAPs and
- Those staying within the radius of 25 Kms of the Project.

Poor and needy section of the society living in different parts of India are the second beneficiaries.
In the aforesaid backdrop, policy on Corporate Social Responsibility of CIL has been framed after incorporating the features of the Companies Act 2013 and as per notification issued by Ministry of Corporate Affairs, Govt. of India on 27.02.2014 as well as DPEs guidelines and broadly covers the following: -

a) Welfare measures for the community at large, so as to ensure the poorer section of the Society derived the maximum benefits.
b) Contribution to the society at large by way of social and cultural development, imparting education, training and social awareness especially with regard to the economically backward class for their development and generation of income to avoid any liability of employment.
c) Protection and safeguard of environment and maintaining ecological balance.

Objectives

The main objective of CSR policy is to lay down guidelines for the coal companies to make CSR a key business process for sustainable development for the society. It aims at supplementing the role of the Govt. in enhancing welfare measures of the society based on the immediate and long term social and environmental consequences of their activities. CIL will act as a good Corporate Citizen, subscribing to the principles of Global Compact for implementation.

Areas Covered under CSR

- The poor and needy Section of the Society living in different parts of India are covered.
- The CSR Programme also covers the existing components of Special Component Plan (SCP) and Tribal Sub Plan (TSP) for development of the SC and ST population besides development components for the entire population.

80% of the budgeted amount is spent within the radius of 25 Km of the Project Site/Mines/Area HQ/Company HQ and 20% of the budget is spent within the State.

Allocation of Fund

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

Scope

As per Schedule VII of New Companies Act 2013, the following are the Scope of Activities under Corporate Social Activities:

i) Eradicating hunger, poverty and malnutrition, promoting healthcare including preventive health care and sanitation and making available safe drinking water.

ii) Promoting education, including special education and employment enhancing vocation skills especially among children, women, elderly, and differently abled and livelihood enhancement projects;

iii) Promoting gender equality, empowering women, setting up homes and hostels for women and orphans, setting up old age homes, day care centers and such other facilities for senior citizens and measures for reducing inequalities faced by socially and economically backward groups;

iv) Ensuring environmental sustainability, ecological balance, protection of Flora and Fauna, animal welfare, agro-forestry, conservation of natural resources and maintaining quality of soil, air and water;

v) Protection of national heritage, art and culture including restoration of buildings and sites of historical importance and works of art; setting up public libraries, promotion and development of traditional arts and handicrafts;

vi) Measures for the benefit of armed forces veterans, war widows and their dependents

vii) Training to promote rural sports, nationally recognized sports, Paralympics sports and Olympic sports;

viii) Contribution to the Prime Minister's National Relief Fund or any other fund set up by the Central Government for socio-economic development and relief and welfare of the Scheduled Castes, the Scheduled Tribes, other backward classes, minorities and women;

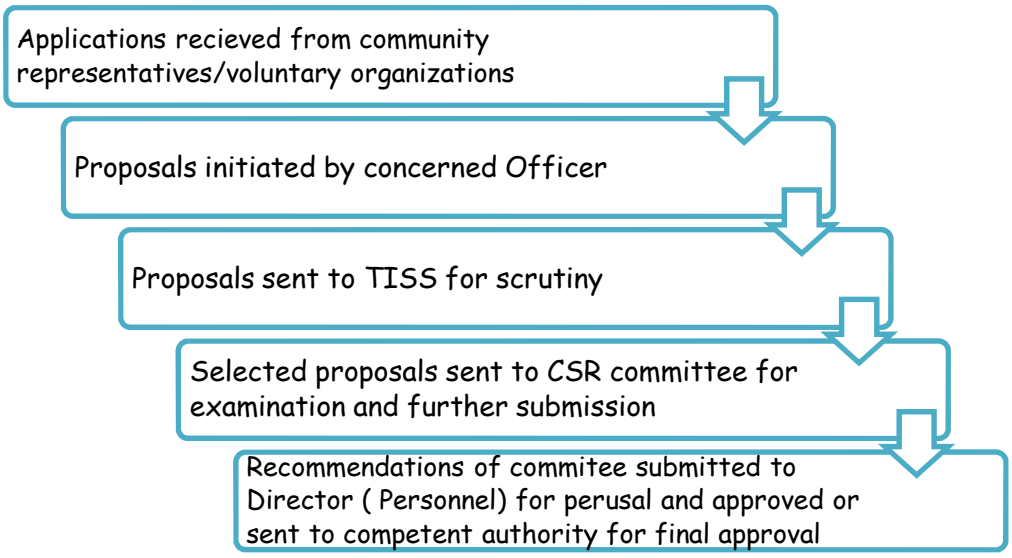
ix) Contributions or funds provided to technology incubators located within academic institutions which are approved by the Central Government;

x) Rural development projects

Implementation

- The investment in CSR is project based and for every project time framed periodic mile stones should be finalized at the outset.
- Project activities identified under CSR are implemented by Specialized Agencies. Specialized Agencies are made to work singly or in tandem with other agencies. Specialized agencies that are included presently for implementation of CSR projects in Cluster VII are through Contracted agencies for civil works.

Institutional Arrangement



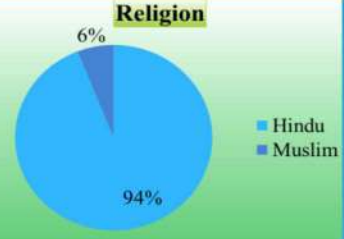
Baseline study done by TISS (Putki Balihari Area)

KENDUAHDIH

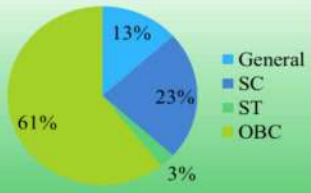
Tola: Kenduahdih (Ward 12) | Panchayat: Kenduahdih | Block: Dhanbad | District: Dhanbad

Census Year	2001
Households	150
Population	1300

Religion



Caste



Source of water

Irrigation	None
Drinking Purpose	Tank, Public and private tap

Migration Pattern

Location	Status
Outside State (Agri Labour)	Few

Sources of Livelihood

Own farm activities
Agricultural labour
Non-agri labour (rural)
Salaried employment
Petty business/trade
Collect & sale forest/mining products, factory labor
Rent/pension/remittance

Crop Grown

Paddy
Maize
Wheat
vegetables

Recreation / Common Facilities

Playground
Samaaj Mandir
Cremation Place, community hall

Accessibility to Forest/Mining Produce

Coal Collection, Firewood
Cultivation

Common Transport Facilities

Motor Cycle
Bicycle

Facilities Located in Villages

Cemented tar road
PDS Shop
Grocery Shop
Pre-Pri/Nursery School
Govt Primary School
Pvt. Primary School
Govt Secondary School
Higher Sec School
Pvt Clinic (RMP+)
Asha worker
Dai

Facilities Located More Than 5 Kms

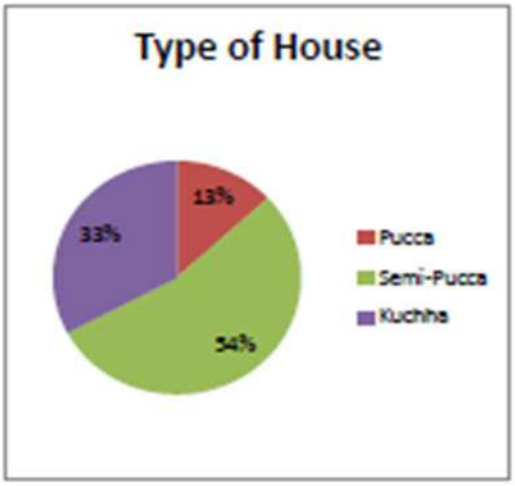
Weekly Market
Block Development Office (Dhanbad)
District Headquarters (Dhanbad)
Warehouse (Dhanbad)
APMC/Mandi (Dhanbad)
ITI/Polytechnic(Dhanbad)
Health Sub – Centre (Karkend Mor)
Primary Health Centre(Dhanbad)
Veterinary Clinic(Karkend Mor)

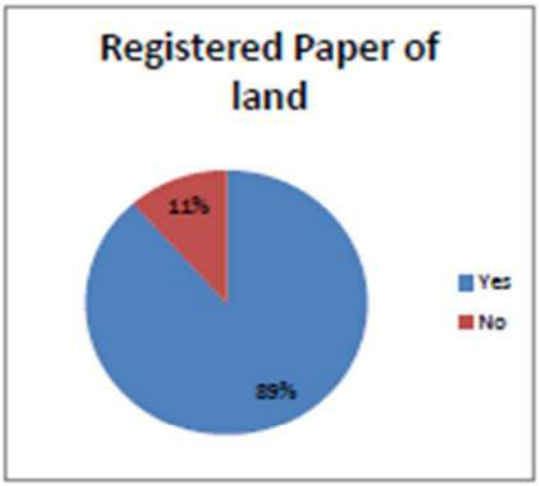
Facilities Located Within 5 Kms

Bus Stop (Putki)
Daily Evening Market (Boragarh)
DTP/Xerox (Bhagabandh)
Post Office (Bhagabandh)
Railway Station (Bhagabandh)
Police Station (Putki)
Gram Panchayat Office (South Balihari)
Cooperative Society (Putki)
Bank for S/B account (Bhagabandh)
Degree College(Jharia)
CHC Govt /Gen Hospital (Bhagabandh)
Private Hospital (Bhagabandh)
Medical Shop/Chemist (Bhagabandh)

HOUSEHOLD STATUS

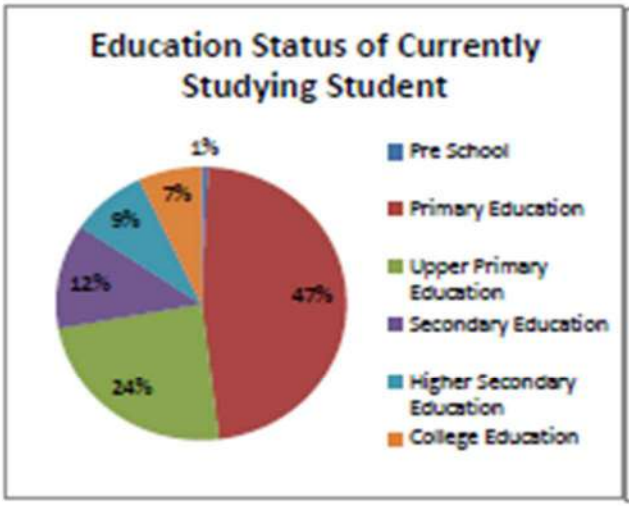
4.10.1.1 HOUSEHOLD STATUS

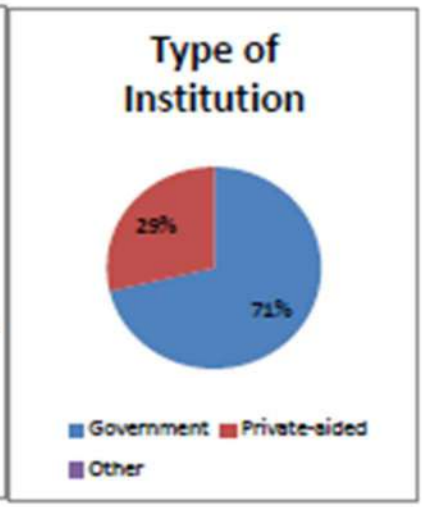




In Kenduahdih Basti, 40% of the households are found to be Semi- Pucca while 48% are Kuchha and 12% are Pucca. 95% of the houses are registered while only 5% was found to be non-registered. Nearly 85% of the houses in this village are electrified.

4.10.1.2 EDUCATION





In Kenduahdih Basti, it has been found that 35% of the students are enrolled in Primary education followed by 28% in Upper primary, 10% in secondary education, and 5% in higher secondary, 3% in college. Education after 12th standard is found comparatively less with any

Major Problems and Recomendations

Area	Major problems and Recommendations
Education	There is no road which can join schools to main working road
	No electricity and in-house circuiting of lights and fans in the class room of primary school
	Shakti Nath Mehto School needs school boundary and toilet in school premises
Water Supply	Pipeline already exists in this village. More number of pipelines are required in Harijan Basti of Kenduahdih
Health Care	Mobile medical Van should treat children every month in primary school
	Maternity health camp should be initiated through MMV
Social Empowerment	Nearly 5-6 SHG has been identified in this village. SHG *(Ma Saraswati Mahila Samuh)* already exist in the village. They need are trained in agriculture. They need support of land to start collective farming of horticultural crops. They are also trained in preparation *Agarbatti* and bangles made from lac.
	Vocational training school for girls and boys is needed in this village. School building of Shakti Nath Mehto School can be used for providing vocation al training center in the weekends or after the school hours with prior permission of the school administration. Not only that the training center for women to start small enterprise can be establish in the same school premises.
Sanitation	No toilets in any of the households. Toilets is needed to construct
Infrastructural Development	There *Kuccha* road in the village which creates problem during rainy season
	On hand pump/tap point is needed in ICDC
	One kitchen room is required in primary school
	Playground boundary in needed with gate in primary school

Bhagabandh

4.10.2 BHAGABANDH

Tola: Bhagabandh(Ward 12) | Panchayat:Bhagabandh| Block: Dhanbad | District: Dhanbad

Census Year	2001
Households	720
Population	4409

Religion

Caste

Source of water

Irrigation	None
Drinking Purpose	Tank, public and private tap

Migration Pattern

Location	Status
Outside State (Agri Labour)	Rarely

Sources of Livelihood

Own farm activities
Cattle rearing
Non-agri labour (rural)
Salaried employment
Petty business/trade
Collect & sale forest/mining products, factory labor
Rent/pension/remittance

Crop grown

Paddy
Maize
Vegetables

Accessibility to Forest/Mining Produce

Coal Collection, fire wood
Cultivation

Common Transport Facilities

Motor Cycle, Share Auto
Bicycle

Recreation / Common Facilities

Playground
Samaaj Mandir
Cremation Place

Facilities Located Within the village

Cemented tar road
Grocery Shop
DTP/Asfrik
PDS Shop
Post Office
Bank for S/B account
Pre-Pri/Nursery School
Govt Primary School
Govt Secondary School
Pvt. Secondary School
CHC Govt /Gen Hospital
Pvt Clinic (MBBS/BAMS+)
Medical Shop/Chemist
Asha worker
Dai(Trained/Untrained)
Pvt Clinic (RMP+)

Facilities Located with 5 kms

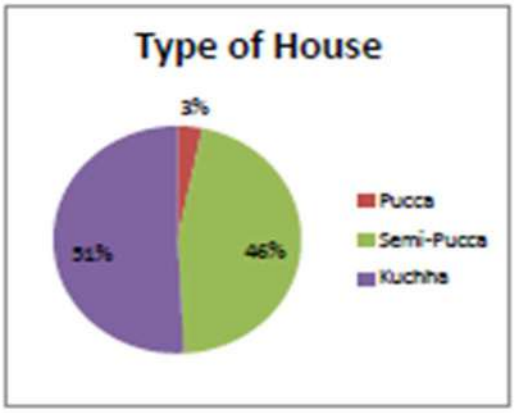
Bus Stop (Putki)
Daily Evening Market (Putki)
Weekly Market (Putki)
Police Station (Putki)
Veterinary Clinic (Putki)
Health Sub – Centre (Putki)

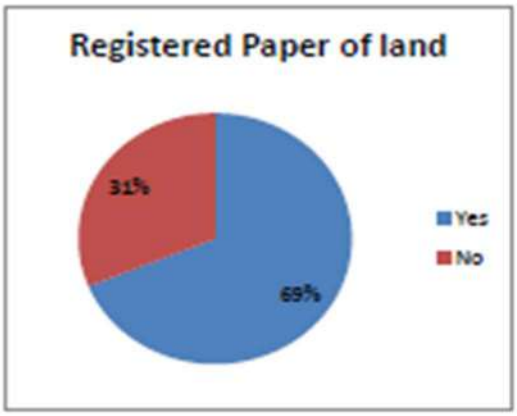
Facilities Located more than 5 kms

Railway Station (Dhanabd)
Block Development Office (Dhanabd)
District Headquarters (Dhanabd)
Warehouse (Dhanabd)
APMC/Mandi (Dhanabd)
Degree College (Dhanabd)
Primary Health Centre (Dhanabd)

Household Status

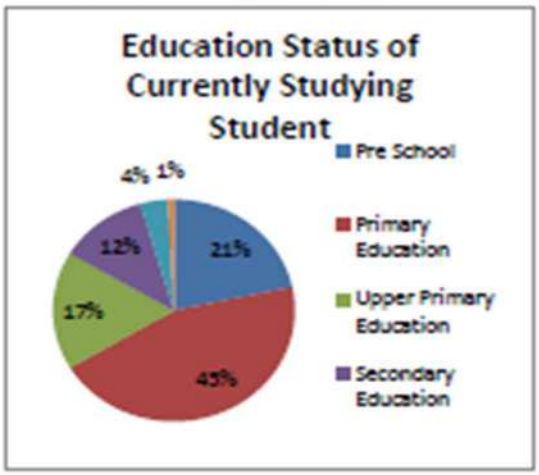
4.10.2.1 HOUSEHOLD STATUS

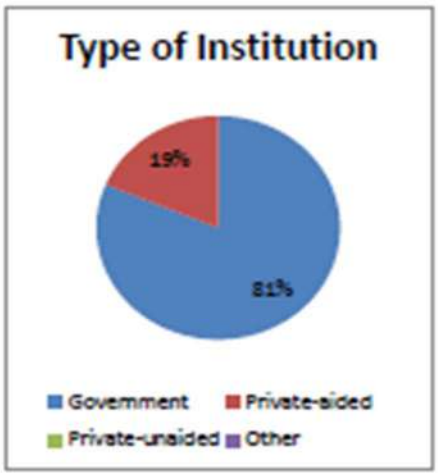




In Bhagabandh Village, 3% of the sample is living in pucca house and 51% were having kuccha house while 46% were having semi -pucca house. Among the sample 69% of the people have registered paper of land while 31% of them do not have registered paper of land. 94% of the sample is living in electrified.

4.10.2.2 EDUCATION





In Bhagabandh Village, status of education does not seem positive as far as college education is considered, only 1% of the children among sample households are found at the time of data collection enrolled in higher education. Among the students of sample households who are currently studying, 45% are currently studying in primary school, 17% are in upper primary school, 12% in secondary school and another 4% is studying in

295

Major Problems and Recommendations

AREA	MAJOR PROBLEMS AND RECOMMENDATIONS
Education	There should scholarship for the children belongin to underprivileged section of the society who is going for education after matriculation to schools of Dhanbad by BCCL
	Library is required in this village
	Evening school has been requested by the people
Water Supply	More number of tap points are required in Manjhi Tola of Bhagabandh Basti
Health Care	Maternity health ccmpa
	Regular check-up of primary school children
Rural Electrification	School should have in-house electric fitting of fans and light
Sports & Culture	Sports equipment should be provided to the sports club
Sanitation	No toilets in houses.
	There should be provision for garbage disposal By BCCL at regular interval along with fumigation
	Ponds should be cleaned with involving community by providing them daily wage as followed in MNREGS
Social Empowerment	SHG for women and men should be formed to start Income Generation activity
	Group activity on Piggery and poultry has been requested by the people. But for that a formal group has to be formed who have to register in the local bank
	Women who are not getting widow pension should be supported with livestock's like poultry, duckery and goatry
Infrastructural Development	Playground for children with boundary
	Repair of damage road should be done so that medical vans or ambulance should reach at the door step for pregnant women
	Playground with boundary should be constructed
	There is requirement of High school covering students from nearby villages like Bhagabandh. It can be done constructing additional school building in government secondary school in the village itself

CSR Activities (April, 2020 to March, 2021)

Relief work during Lockdown:

P.B Area through its CSR initiative carried out relief work within peripheral villages/wards in the form of distribution of dry ration and hygiene kits since phase one of Coronavirus induced lockdown.

The kits were distributed to the poor needy families of the community affected due to Covid-19 lockdown. Both ration kit and hygiene kit consisted of basic items; while ration kit had Sattu, Chana, Gur, Chura and Biscuits, hygiene kit included mask and soap. Covid-19 awareness sessions were also organized on social distancing, hand washing techniques and wearing mask in crowded places. Total 1000 ration kits distributed among needy families and 500 hygiene kits distributed among communities residing nearby villages of P.B Area office and Collieries.

Expenditure incurred in distribution of Ration Packet, Face Mask & Soap under CSR:

Sl. No.	Item	No. of Units Distributed	Expenditure (in Rs.)	Sanctioned Amount from HQ	Remarks
1.	Ration Packet	1000	1,99,500	2,00,000	
2.	Face Mask	500	11,025	15,000	Remaining amount returned to HQ CSR Fund
3.	Soap	500	12,375	34,840	

Details of ward/ panchayat wise No. of Beneficiaries covered for Food Packets

Area of BCCL	Name of Panchayat/Ward No.	Name of Village/ward	No. of Beneficiaries covered for Food Packet (APPROX.)
P.B Area	Aralgaria	Aralgaria	40
P.B Area	Ward No. 10	Bhagabandh	73
P.B Area	Ward No. 10	Kenduadih Basti	47
P.B Area	Ward No. 12	Kendua Bazar	58
P.B Area	Ward No. 09	Kerkend	33
P.B Area	Ward No. 35	Burragarh	25
P.B Area	Ward No. 35	Surrendranagar	45
P.B Area	Ward No. 11	Khaira	54
P.B Area	Ward No. 11	Kenduadih	68
P.B Area	Ward No. 09	Gopalichak	30
P.B Area	Aralgaria	Bauri Basti	70
P.B Area	Ward No. 12	Kendua Bazar/EB Section	100
P.B Area	Ward No. 10	South Balihari	50
P.B Area	Ward No. 10	Khapra Dhowra	28
P.B Area	Ward No. 10	Tina Dhowra	25
P.B Area	Ward No. 11	BNR Kustore	27
P.B Area	Aralgaria	Singh Tola	20
P.B Area	Pandarkanali	Dhobni, Parasia, Pandarkanali	77
P.B Area	Sialgudri	Sialgudri	80
P.B Area	Ward No. 12	Kendua No. 4	50
Total			**1000**

Details of ward/ panchayat wise No. of Beneficiaries covered for Face mask & Hand Wash/Soap				
Area of BCCL	**Name of Panchayat/Ward No.**	**Name of Village/ward**	**No. of Beneficiaries for face masks**	**No. of Beneficiaries for Dettol soap**
P.B Area	Aralgaria	Aralgaria	47	47
P.B Area	Ward No. 10	Bhagabandh, Kenduadih basti & Station Dhawra	100	100
P.B Area	Ward No. 10	Bihibari & Orao Patti	46	46
P.B Area	Ward No. 12	Kendua Bazar & EB Section	65	65
P.B Area	Ward No. 11	Khaira & Kenduadih	82	82
P.B Area	Pandarkanali	Dhobni, Parasia & Pandarkanali	85	85
P.B Area	Sialgudri	Sialgudri	75	75
Total			**500**	**500**

Transportation Route

Sl. No.	Mine	Existing siding	Other Transport Sites	Existing Transport distance (in KM)	Avg. Capacity of Dumper (T)
1.	Gopalichuck OC	Burragarh		5.9	25
			Belatand Tata Washery	9-10	28.5
			Jamadobha Tata Washery	9-10	28.5
*It includes departmental and contractual transportation					

ब्रीफ न्यूज

आंचल महिला समिति ने बांटी सामग्री

पुटकी. डब्लूजे एरिया मुनीडीह की आंचल महिला समिति ने मुनीडीह ऑफिसर क्लब में शुक्रवार को महिलाओं के बीच मच्छरदानी, मास्क व साबुन का वितरण किया. अध्यक्ष सह जीएम की पत्नी भारती महापात्रा ने कहा कि दैनिक मजदूरी करने वाली करीब 60 महिलाओं के बीच सामग्री वितरित की गयी. मौके पर द्युति मुस्तफी, झूलन पांजा, आकांक्षा करण, ममता चंद्रपुरी, सविता राउत व बबीता वर्णवाल आदि मौजूद थी.

डब्ल्यूजे एरिया मुनीडीह ने बांटी खाद्य सामग्री

पुटकी. बीसीसीएल डब्ल्यूजे एरिया मुनीडीह की ओर से सीएसआर गतिविधि के तहत शुक्रवार को जीएम जेएस महापात्रा के नेतृत्व में पेटिया पंचायत के विभिन्न पिछड़े इलाकों के दर्जनों परिवारों के बीच खाद्यान्न सामग्री बांटी गयी. मौके पर पेटिया पंचायत के मुखिया आनंद गोराईं, सलाहकार समिति के सदस्य बिनोद मिश्रा, बीपी चौधरी, रमेश कुमार सिंह, क्षेत्रीय कार्मिक प्रबंधक एसके सिंह, क्षेत्रीय प्रबंधक (प्रशासन) बीआर टुडू, उप प्रबंधक (कार्मिक) अभिषेक मिश्रा, क्षेत्रीय प्रबंधक (सामुदायिक विकास) पवन प्रताप लकड़ा, बिनोद सिन्हा, सुमित सिंह चौधरी एवं विभागीय सुरक्षाकर्मी मौजूद थे.

Area of BCCL	Allotted no. of food packets	Name of Panchayat covered	Name of villages covered	No. of beneficiaries covered for food packets
WJ Area	1000	Pethia	Sawaldih, Jatudih, Gansadih & Jerma	112
		Gopinathdih	Dhobni, Dhandabar, Gopinathdih Basti	161
		Dubrajdih	Majhladih, Tetangabad, Jogidih	128
		Bardubhi	Bardubhi Basti	55
		Samsikhra	Moonidih, Samsikhra Basti	189
		D. Pandarkanali	Saraidaha Basti	55
		Lohapatty	Jamdiha, Andhari Basti	54
		Kandra	Kandra Basti	46
		Mahuda	Gulgulia patty, Mahuda Basti	92
		Tetuliya	Belakhonda	53
		Chattrutand	Murulidih	55
		11	**21**	**1000**

ANNEXURE-V

COMPLIANCE OF DHANBAD ACTION PLAN

(1) Covering of loaded transport vehicles

It has been complied. The clause of covering of loaded coal transport vehicle has also been incorporated in the transport agreement/ contract.

(2) Coal transport roads shall be made pucca

Coal transport route are made pucca and also work for wheel washing arrangement has been proposed.

(3) All drillings to be done with dust containment and suppression systems. Sprinklers will be installed including at all coal stock & sidings

Complied. At present mobile water sprinklers are used. Proposal for installation of fixed sprinklers has been initiated by Civil Department vide ref. no. P.B. Area office/Spraying water/2017-18/683 dated 12.10.2019

(4) Mobile Sprinklers

Sl. no.	Mine/Workshop	No. of Fixed Sprinklers	No. of Mobile Sprinklers	Total Capacity(KL)	Trips per day
1	Bhagabandh UG Mine	1 (At coal Unloading Site)	0	N.A	N.A
2	P.B. project Colliery UG Mine	1 (At coal Unloading Site)	1	70	2
3	Central Auto Workshop	Nil	2	8 and 12	2
4	Kendwadih Workshop	Nil	1	45	2

(5) The direction of surface run-off of the premises of collieries shall be diverted to created water bodies. Creation of water bodies in coal bearing area will pose safety threats to nearby mine and it will be violation of mines act. However, artificial ponds have been created where, there are no chances of future coal extraction.

Pond Constructed for Villagers at KB 10/12 Colliery

Pond Created for Villagers at Kendwadih

(6) Dealing of mine fires

A Master plan for Dealing with fires and subsidence and rehabilitation in the Leasehold of BCCL has been approved by Govt. of India vide letter no- 22020/1/2005-CRC dated 12 08 09. In fire patch of V/VI/VII/VIII seam of Gareria Secn. At East Bassuriya about 1, 70,000 cu.m. mitti and non-combustible material has been filled, rest will be filled by quarry OB.

(7) The waste water shall be passed through oil separator-cum-filtration system

Complied. 1 number of Oil Separator has been constructed at P.B. Project Colliery and MoonidIh Colliery.

(8) The removed OBs shall be utilized for low land filling or for making roads

It is backfilled and then reclaimed by plantation of native species

(9) Tree plantation on the dumps

Complied.

2500 Gabion Plantation done with the help of Forest Deptt., Dhanbad (compensatory afforestation)

500 tree plantation was done in and around P.B Area office premises

400 bamboo plantation along mine boundary (Gopalichuck OC colliery)

150 mixed sapling plantation around weighbridge

200 saplings are planted at XV seam mine boundary, shaft shrinking and 500 at Dhobni Plantation Site of Moonidih mine in FY 2020-21.

600 Sapling distributed to local public and employees in FY 2020-21 by WJA.

Work awarded to Forest Department, Dhanbad for 32760 compensatory afforestation.

(10) **All hazardous wastes shall be disposed off**

Complied.

a. All working units have applied for authorization as per Hazardous Wastes (Management, Handling and Trans boundary Movement) Rules.

b. Burnt/used oil is disposed of as per rule.

c. Disposal of Hazardous waste, burnt Oil / batteries is being done through E-auctioning to authorized recycler/ re-processor having valid authorization from CPCB/ SPCB. Return are also being filed.

(11) Monitoring and Reporting six monthly

Complied. Monitoring work is being done by CMPDI, Dhanbad as per work order issued by BCCL HQ.

(12) Introduction of GIS/ GPS

GPS installed vehicles are used for transportation of coal. CMPDI, HQ has been given the job of satellite surveillance of the Jharia coal field through NRSA Hyderabad and the information is being uploaded in the website.

(7)

Ph: 0326-2204933

झारखण्ड राज्य प्रदूषण नियंत्रण पर्षद्
Jharkhand State Pollution Control Board
HIG-1, Housing Colony, Dhanbad-826001

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

From,

Regional Officer,
Dhanbad

To,

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

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

Sir,

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

Encl-A/a.

Your's faithfully,

6/7/13

(Dinesh Prasad Singh)
Regional Officer.

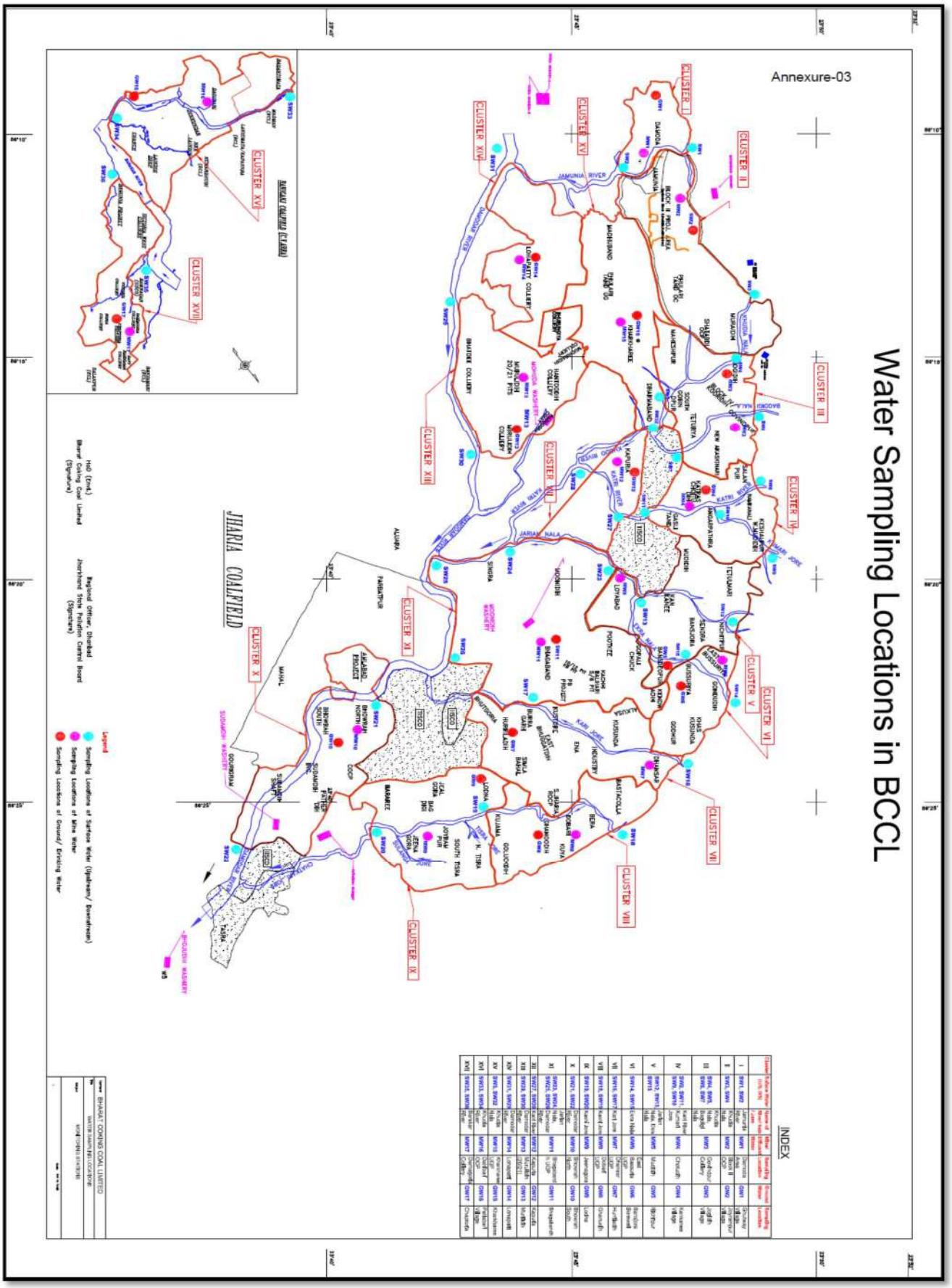
Memo..... Dhanbad, dated.....

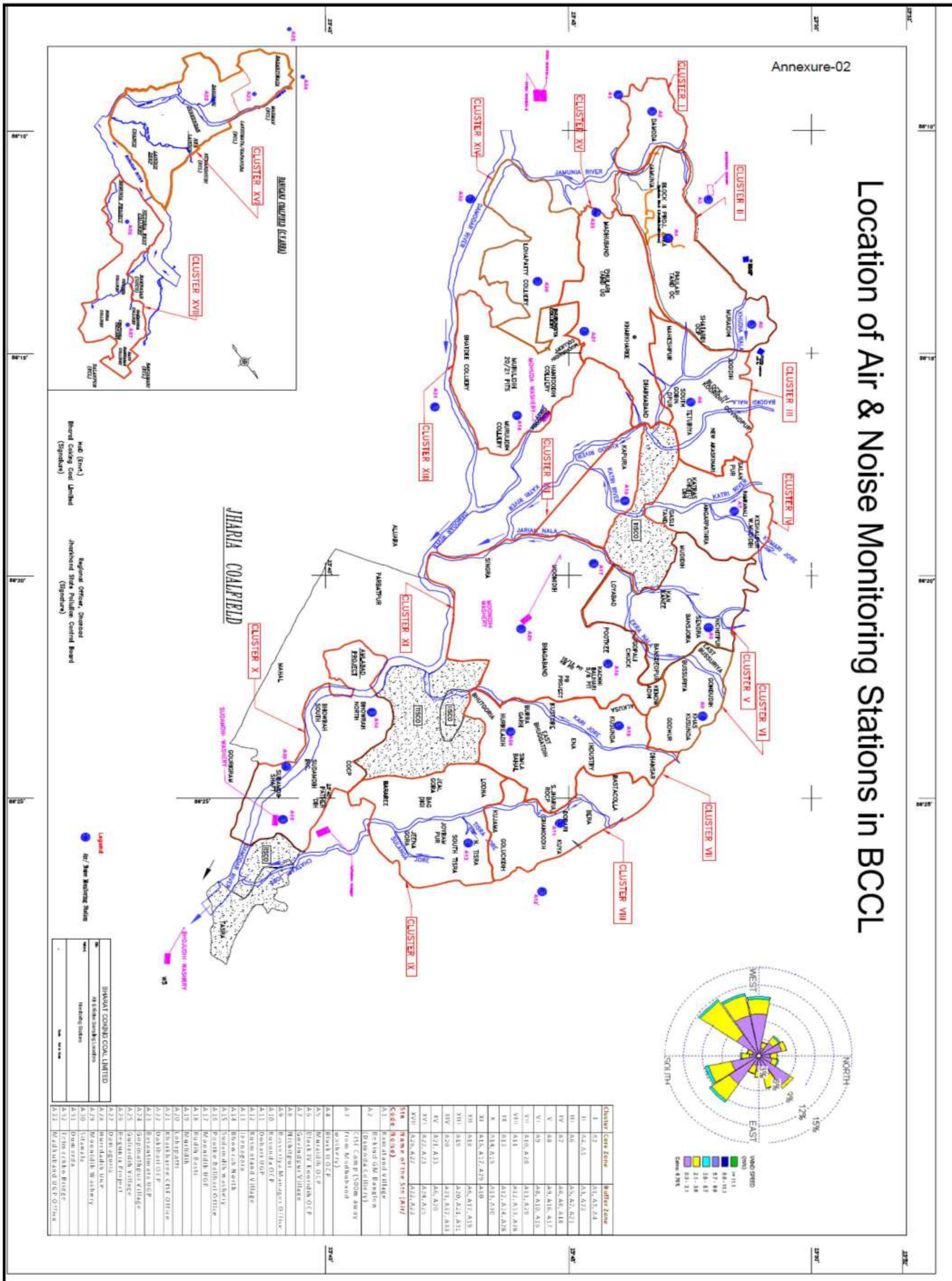
Copy to: The Member Secretary, Jharkhand State Pollution Control Board for information & enclose a copy of the map for necessary action.

Encl-A/a.

(Dinesh Pd. Singh)
Regional Officer.

Printed by Sandip


Annexure-03
Water Sampling Locations in BCCL
JHARIA COALFIELD
CLUSTER I
CLUSTER II
CLUSTER III
CLUSTER IV
CLUSTER V
CLUSTER VI
CLUSTER VII
CLUSTER VIII
CLUSTER IX
CLUSTER X
CLUSTER XI
CLUSTER XII
CLUSTER XIII
CLUSTER XIV
CLUSTER XV
CLUSTER XVI
CLUSTER XVII
JAMUNIA RIVER
BARAKAR RIVER
KATRI RIVER
JARIAN NALA
KUSUNDA
BHAGABAND
LOYABAD
BASSURIYA
GODHAR
BHARASAR
BHATDIHRA
HARIDIH
MURLIDIH
MOHUDA
KUSUNDA
BARORA
SIMLA BAHAL
KUMARDHUBI
BHOWRAH NORTH
BHOWRAH SOUTH
SUDAMDIH
GOURIDIH
PATHERDIH
DHANBAD
BARWADIH
BARORA
KENDWADIH
MADHUBAND
BHATDIHRA COLLERY
HARIDIH COLLERY
MURLIDIH COLLERY
LOYABAD COLLERY
KUSUNDA
BHAGABAND
BASSURIYA
GODHAR
BHARASAR
BHATDIHRA
HARIDIH
MURLIDIH
MOHUDA
KUSUNDA
BARORA
SIMLA BAHAL
KUMARDHUBI
BHOWRAH NORTH
BHOWRAH SOUTH
SUDAMDIH
GOURIDIH
PATHERDIH
DHANBAD
BARWADIH
BARORA
KENDWADIH
MADHUBAND
BHATDIHRA COLLERY
HARIDIH COLLERY
MURLIDIH COLLERY
LOYABAD COLLERY
Legend
Sampling Locations of Surface Water (Upstream/ Downstream)
Sampling Locations of Mine Water
Sampling Locations of Ground/ Drinking Water
Regional Officer, Dhanbad
Jharkhand State Pollution Control Board
(Signature)
HoD (Envt.)
Bharat Coking Coal Limited
(Signature)
INDEX
BHARAT COKING COAL LIMITED
WATER QUALITY MONITORING


Annexure-02
Location of Air & Noise Monitoring Stations in BCCL
JHARIA COALFIELD
BHARAT COKING COAL LIMITED

Progress Report

1st Phase Air Monitoring report for

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

Sponsor

Bharat Coking Coal Limited (BCCL)

CSIR-National Environmental Engineering Research Institute, Nagpur

2019

1. Introduction

1.1 Project Background

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

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

1.2 Project objectives

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

The detailed objectives are as following:

i. Ambient Air Monitoring

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

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

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

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

iii. Source apportionment related

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

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

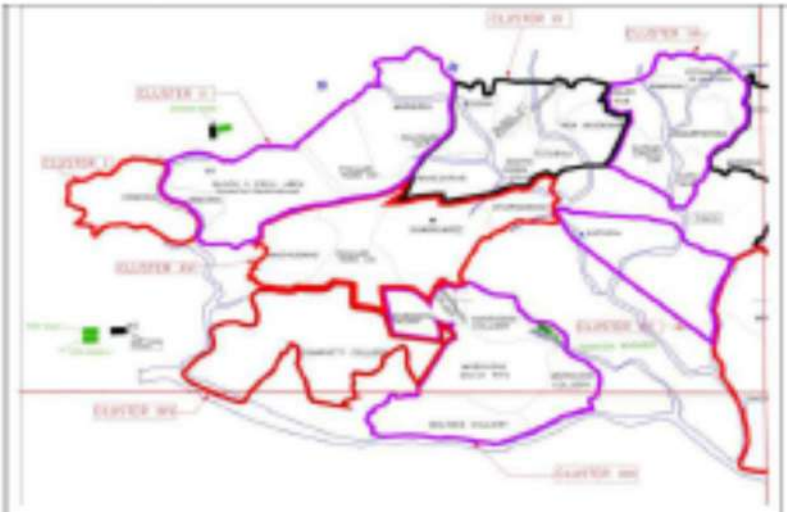
2. Field visit

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

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

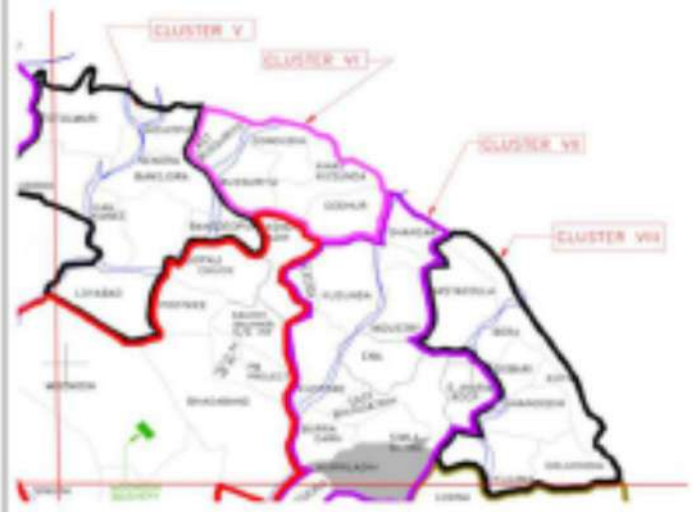
2.1 Jharia coalfield maps:

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

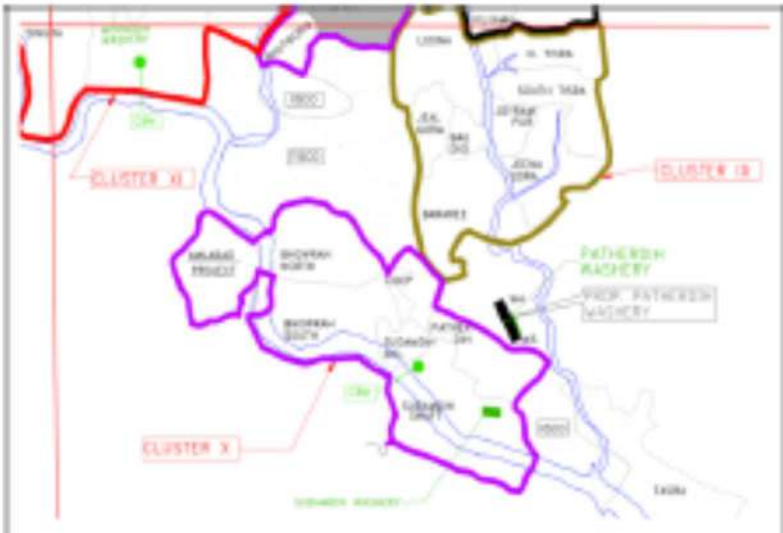


Part 1:

Cluster VI, VII, VIII, and X



Part 2: I, II,III, IV, V, XI, XII, XIII, and XV



Part 3: Cluster IX

Table 2.1 Jharia coalfields Site visit on cluster-base

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

2.2 Site Identification:

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

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

Core Zone

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

Buffer Zone

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

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

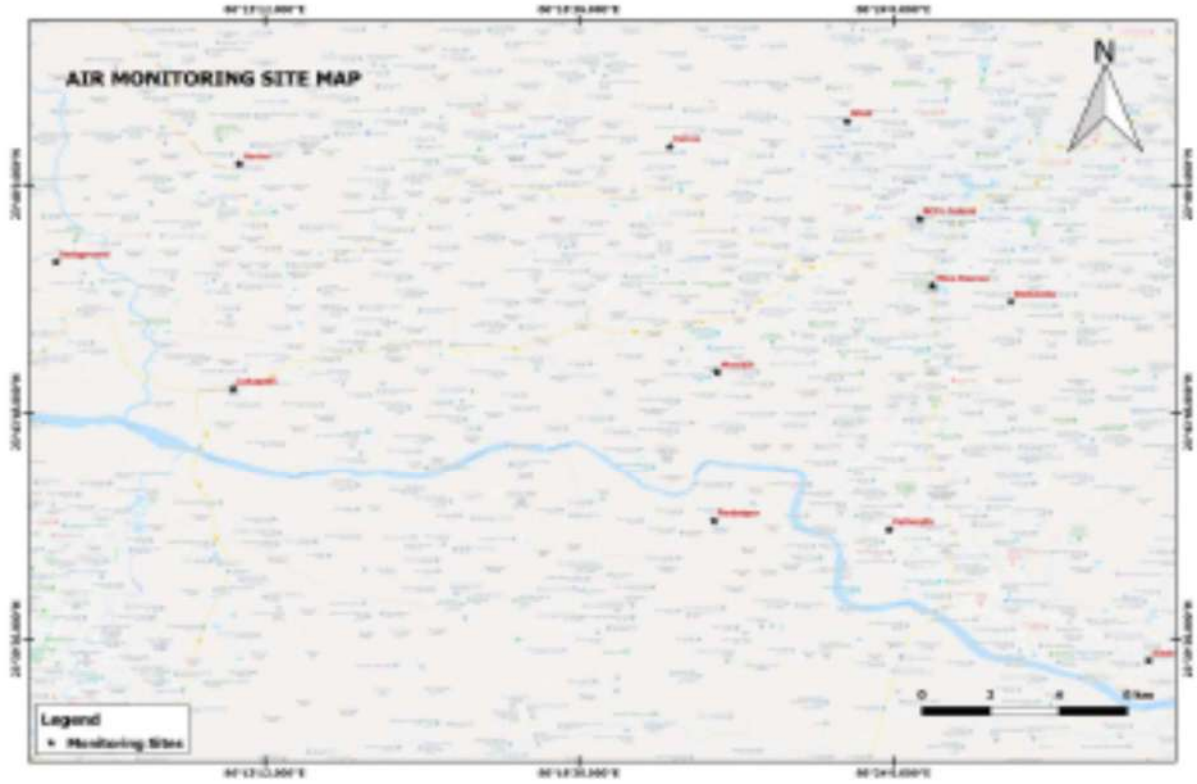


Figure2.1 Identified air monitoring station in Jharia Coalfield

3. Sampler Selection and Procurement

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

Table 3.1 Samplers Procured for Monitoring

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

4. Monitoring parameters

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

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

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

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

4.1 Monitoring Frequency

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

Table 4.1.1 Frequency of Air pollutants sampling in Jharia Coalfield

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

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

Kataras

Lodhana

Moonidih

Patherdiha

Bastacola

Sindri

Figure 4.1 Glimpses of air monitoring of some locations

4.2 Filter handling and Weighing:

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

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

Methods of Chemical characterization:

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

5. Ambient Air Quality Monitoring

Core Zone

Site 1: Cluster XIV (Lohapatty)

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

Site 2: Cluster VII Mine rescue Station

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

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

Site 3: Cluster V Katras

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

Site 4: Cluster IX (Lodhana)

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

Site 5: Cluster XI (Moonidih)

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

Site 6: Cluster X (Patherdih)

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

Site 7: Cluster VIII (Bastacola)

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

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

Buffer zone

Site 8: Bank More (BCCL Colony)

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

Site 9: Harina

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

Site 10: Bhuli

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

Site 11: Sindri

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

Site 12: Parbatpur

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

Site 13: Background

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

Sample collection Transportation and Preservation

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

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

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

ANNEXURE-VII

Point XVI

Sr-16

सेंट्रल माईन प्लानिंग एण्ड डिज़ाइन इंस्टीच्यूट लिमिटेड
(कोल इंडिया लिमिटेड की अनुषंगी कम्पनी / भारत सरकार की एक लोक उपक्रम)
पंजीकृत कार्यालय : गोन्दवाना प्लेस, काँके रोड, राँची - 834031 (झारखण्ड) भारत
क्षेत्रीय संस्थान-2, पत्रा. बीसीसीएल टाउनशीप, कोयला नगर, धनबाद 826005 (झारखण्ड) भारत

cmpdi
A Mini Ratna Company

Central Mine Planning & Design Institute Limited
(A Subsidiary of Coal India Limited / Govt. of India Public Sector Undertaking)
Registered Office : Gondwana Place, Kanke Road, Ranchi –834031(Jharkhand)
Regional Institute-II, P.O. BCCL Township, Koylanagar, Dhanbad 826005(Jharkhand) India
Corporate Identity No. U14292JH1975GOI001223

पत्रांकः आर.आई.-2/पर्यावरण/एम-30/ 1150

दिनांकः 20.06.2015

(Stamp: GM (Envt.) Env. Dept. BCCL — Sl. No. 402(?) Date 22/6/15)

सेवा में,
उप महाप्रबंधक (पर्यावरण)
बी. सी. सी. एल.
कोयला भवन
धनबाद ।

विषयः Study of installation of Rail-cum-Conveyor System in BCCL for transportation of coal.

महोदय,

This has reference to your letter no. BCCL/GM(Env.)/F-EC/13/622, dated 25.05.2013 for conducting the study and preparation of plan for installation of Rail-cum-Conveyor System for coal transportation in BCCL as a part of compliance of environmental clearance (EC) conditions stipulated by MoEF & CC in EC orders of different clusters. In this regard, we would like to inform you the following:

a. As per EC clearance order transportation plan for Rail-cum-Conveyor system should dovetailed with Jharia Action Plan (Master Plan). The system of transportation is required to be installed in 2nd phase of EC implementation i.e. after completion of Master Plan (10 years) and 5 years of gestation period.

b. JRDA has issued direction to RITES for traffic survey and data collection to initiate feasibility study regarding Diversion of Railway lines from fire affected and subsidence prone areas

c. Coal transportation route / conveyor installation layout will be finalized after liquidation of coal mine fire, rehabilitation of 595 unstable sites, road and rail route alignment and location of Rly. Sidings of BCCL.

CMPDI will be able to submit the plan / study for installation of Rail-cum-Conveyor System in BCCL for transportation of coal only after diversions and re-alignments of roads and railway lines and relocation of railway sidings

This is for your kind information.

भवदीय

(वि. कु. सिन्हा) 20/6/15
क्षेत्रीय निदेशक

Sri Amalanshu Sb.
For compliance purpose.
23/6/15 22/6

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Study of Occupational diseases and Hearing impairments of Coal Mines workers of BCCL directly involved in active mining operations

CMS
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11/10/19

11/10/19
GM (Environment)

REGIONAL OCCUPATIONAL HEALTH CENTRE (EASTERN), KOLKATA

&

NATIONAL INSTITUTE OF OCCUPATIONAL HEALTH, AHMEDABAD

(Indian Council of Medical research)

Study of Occupational diseases and Hearing impairments of Coal Mines workers of BCCL directly involved in active mining operations

REGIONAL OCCUPATIONAL HEALTH CENTRE (EASTERN), KOLKATA

&

NATIONAL INSTITUTE OF OCCUPATIONAL HEALTH, AHMEDABAD

(Indian Council of Medical research)

CONTENTS

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Dr D S Munda, Scientist D

Dr R R Tiwari, Ex- Scientist E (Involvement in initial planning and framing the project, write up)

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Mr. S. Meena, Technician C

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Mr. B. B. Patel, Technician B

BACKGROUND

Although coal remains a major energy resource worldwide, coal mining causes environmental problems, whereas the inhaled coal particles at the work place may lead to the development of coal workers' pneumoconiosis (CWP). Typically, coal workers pneumoconiosis takes many years to develop and to be manifested. Further, once initiated the disease is progressive in nature, often leading to lungfunction impairment, disability. The workers' exposure to coal dust generally occurs during mining operations. Coal mining can also increase the risk of developing asthma and chronic obstructive pulmonary disease (COPD), such as emphysema and chronic bronchitis. It is suggested that coal mining operations may also induce noise induced hearing impairment among the workers.

A request was received from Bharat Coking Coal Limited, Dhanbad to assess the health status of their workers involved in the mining activities in Cluster 11 and 15 areas around Dhanbad. About 10% of the subjects involved in mining activities were to be included in this study. The workers were to be assessed for their health status, presence of any occupational disease and hearing impairments. Under this circumstance, in consultation of the scientists of National Institute of Occupational Health (NIOH) and the concerned officers of Bharat Coking Coal Limited, it was decided that an epidemiological study would be carried out involving workers involved in mining activities.

INTRODUCTION

Coal is an aggregate of heterogeneous substances composed of organic and inorganic materials. The four major coal types ranked in order of increasing heat value are lignite, sub-bituminous, bituminous, and anthracite. The inorganic portion of coal can range from a few percent to >50% (by weight) and is composed of phylio-silicates (kaolinite, illite, etc.), quartz, carbonates, sulfides, sulfates, and other minerals. In general, aluminum and iron are the main metals in the coals. Arsenic, nickel, zinc, cadmium, cobalt, and copper are trace metals that represent only a very small fraction of the mineral matter[1].

Coal mining in India has a long history of commercial exploitation covering nearly 220 years starting in 1774 in the Raniganj Coalfield along the Western bank of river Damodar. However, for about a century the growth of Indian coal mining remained sluggish for want of demand but the introduction of steam locomotives in 1853 gave a fillip to it. As on 2011, India had 285 billion tonnes of resource. The production of coal was 532.69 million tonnes in 2010-11. The production of lignite was 37.73 million tonnes in 2010-11. As on 2011, India ranked 3rd in world coal production.[2]

Coal remains a major energy resource worldwide. In the United States, > 50% of electricity is generated in coal-fired power plants. However, coal mining causes environmental problems such as acid mine drainage, whereas the inhaled coal particles at the work place may lead to the development of coal workers' pneumoconiosis (CWP).[3,4]Typically, coal workers pneumoconiosis takes many years to develop and be manifested requiring a surveillance for a longer duration. Further once initiated the disease is progressive in nature often leading to lung function impairment, disability, and premature death.

Coal mining can also increase the risk of developing asthma and chronic obstructive pulmonary disease (COPD), such as emphysema and chronic bronchitis.[5-7]It is suggested that coal dust stimulates the recruitment of neutrophils to the lungs and both these neutrophils and resident alveolar macrophages show evidence of activation, secreting free radicals and proteolytic enzymes, plausible mediators of tissue injury in emphysema[8-10].

Considering the environmental – occupational hazards involved, regular and periodic monitoring of environmental conditions and the health status of the workers is always advised and recommended. A request was received from Bharat Coking Coal Limited, Dhanbad to assess the health status of their workers involved in the mining activities in Cluster 11 and 15 areas around Dhanbad. The workers were to be assessed for their health status, presence of any occupational disease and hearing impairments. Under this background the present project is developed with the aim of studying the coal mining as well as coal dust related health effects in the mining workers.

AIM AND OBJECTIVES

AIMS

To study the coal mining as well as coal dust related health effects in the coal mining workers.

OBJECTIVES

1. To understand health status of workers through questionnaire survey, health examination.
2. To study respiratory health in coal field mining workers.
3. To assess ventilatory functions of coal field mining workers.
4. To analyze hearing ability through audiometric evaluation.

METHODOLOGY

An occupational health study was conducted involving different mines of Cluster 11 and 15 of Bharat coking Coal Limited, Dhanbad. This study was undertaken among the exposed workers mainly from active mining activity. Representative sample from workers working in such occupations is included in this study. Initially the aim of the study was explained to the workers, informed consent was obtained after which they were enrolled for this study. Every individual subject was interviewed with a pre-designed questionnaire to collect information in relation to personal, occupational and morbidity details of the workers. The participants of this study were subjected to following interview/examination/investigations:

- Detailed personal, occupational and medical history.
- Clinical examination with special emphasis on examination of respiratory system.
- Haematological examination.
- Lung function test.
- Audiometry.
- Ophthalmological assessment.

Study design: Cross sectional study

Study subjects: This study covered 351 subjects from Kustore sector and 140 subjects from Bagmara sector of BCCL Collieries. Among the subjects of Kustore sector 49 were from Kachi Balihari mines, 51 from Bhagabandh mines, 40 from Gopali Chawk mines and 100 from Munidi mines. PB project mines contributed 111 subjects. Similarly among the subjects of Bagmara sector, Kharkharee mines and Phularitand mines contributed 75 subjects and 65 subjects respectively. Workers actively involved in mining actively were mainly included in this study. However, few subjects of this study were enrolled from supervisory staffs in order to have a complete and comprehensive understanding of the occupational health condition. These workers were randomly selected from the total workforce in the selected clusters and mines.

Data collection: The information regarding demographic, occupational and clinical history was collected on a pre-designed and pre-tested proforma through interview of subject. This was followed by complete clinical examination, spirometry, audiometry and chest radiography of each subject. The audiometer and spirometer were brought by NIOH team while for chest radiography the facilities at BCCL hospitals were used. The processing of exposed films was done by the technicians at BCCL hospital. The ophthalmological examination and haematological – biochemical estimations were also done using facilities and expertise at BCCL hospitals.

Data analysis: Data entry and analysis were done in standard statistical software. The statistical analysis included calculation of differences, proportions and application of tests of significance etc, to ascertain health effects especially respiratory health conditions.

Lung function test was carried out in all subjects. Forced vital capacity (FVC), and Peak Expiratory Flow Rate (PEFR) were recorded by Spirovit-sp-10 (Schiller Health Care Ltd, Switzerland). Three successive recording of FVC and PEFR were made in standing posture and the nose clip was used. The best of the three performances was considered for calculation purpose. The different flow volumes like FEV_1, FEV_1% was calculated from the same tracings. All volumes

obtained were expressed in body temperature on atmospheric pressure of air saturated with water vapour (BTPS). Body height and body weight were measured in bare feet on a standard scale. Pulmonary function test values were predicted from the standard prediction equation. The instrument was calibrated every day before starting the experiment.

Blood was collected from each worker by venipuncture taking all aseptic precautions. Hematological and biochemical analysis was carried out using standard procedure.

Audiometric Evaluation of Hearing:

The following criteria were maintained for non- inclusion of workers as subjects in audiometry:

- Whose present hearing level was not amenable to quantitative description, who had served in the armed forces, or had been exposed to gunfire, or whose past noise exposure was different from that of their present occupation.
- Who were known to have existing or previous ear disease or abnormality.
- Head injury with history of unconsciousness or skull fracture.

Criteria for acceptance (inclusion criteria) as test subjects:

The following criteria were applied for categorizing ears as acceptable for the test

- Tympanic membrane intact
- No history of congenital or acquired conditions associated with sensory neural hearing loss e.g. congenital deafness, meningitis, unconsciousness, treatment with ototoxic drugs, vertigo, etc.

Criteria for normal hearing:

Hearing impairment is considered to occur when the average of the hearing threshold levels at audiometric frequencies of both ears exceed 25 dBA. Pure tone air conduction hearing threshold

was obtained in a quiet room. Threshold of hearing is defined as the minimum decibel level (dB) at which the subjects respond at least two times on ascending trial. The data for each subject was obtained. Pure tone threshold were obtained using descending- ascending threshold crossing technique. The data was analyzed for each ear of the subjects for all test frequencies. Hearing threshold at test frequencies was averaged for all subjects to assess hearing sensitivity.

Measurement of hearing:

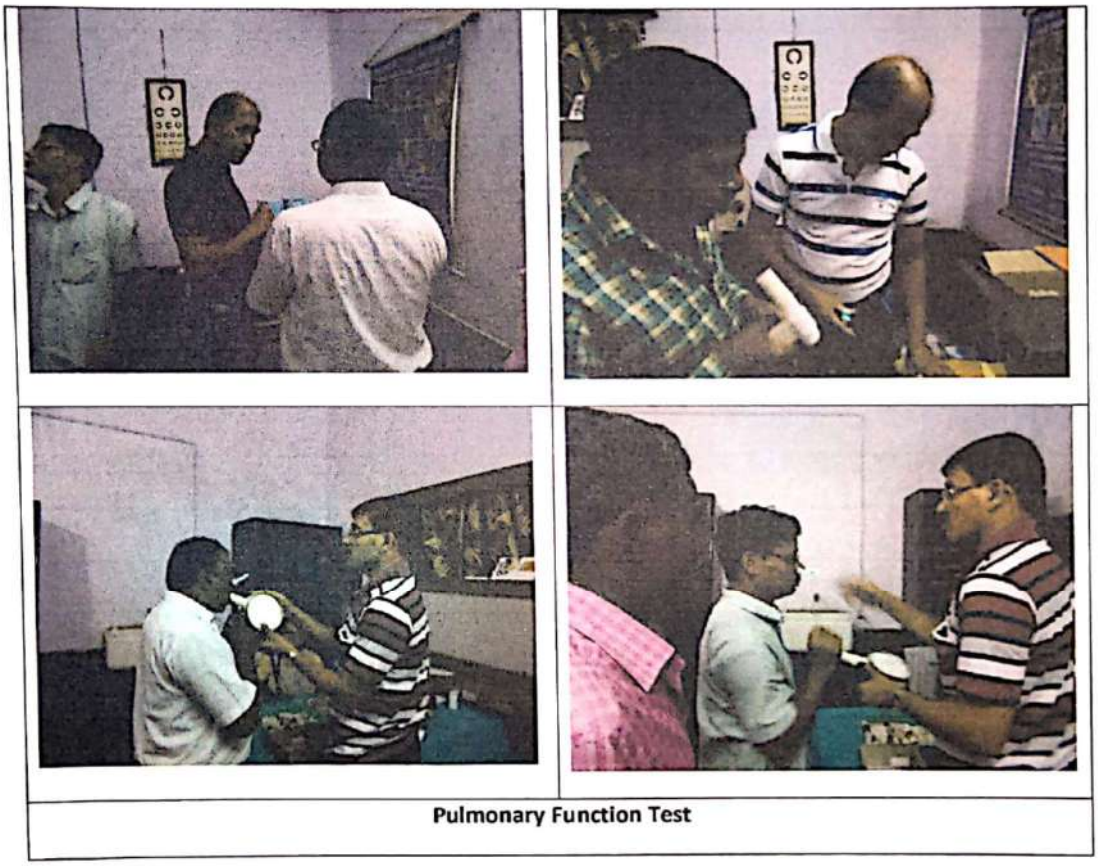
Pure tone audiometry was carried out for the present investigation. In the individual experiment, subjects were briefed about the nature and purpose of the study. He was then seated in a chair, the earphones were fitted on his ears, and the door of the room was closed. They were instructed to respond by raising their fingers when they could just hear the tone lasting for 2 sec. The pulsing of the tone was set at 0.5/ sec. The intensity of the tone was raised by 5 dB until the threshold of hearing was determined at each test frequency viz 125Hz, 250Hz, 500Hz, 1KHz, 1.5KHz, 2KHz, 3KHz, 4KHz, 6KHz.and 8KHz. The actual measurement was started following a brief practice trial session. The better ear followed by the other ear was tested. The right ear was tested first in cases where both the ears were reported to be nearly equal in hearing sensitivity. It was ensured that the subject would fully cooperate. Care was taken to ensure reliable reporting of the subjects' 'just audible sound'. Misses (error of omission) and false alarms (error of commission) were avoided.

Equipment (Audiometer):

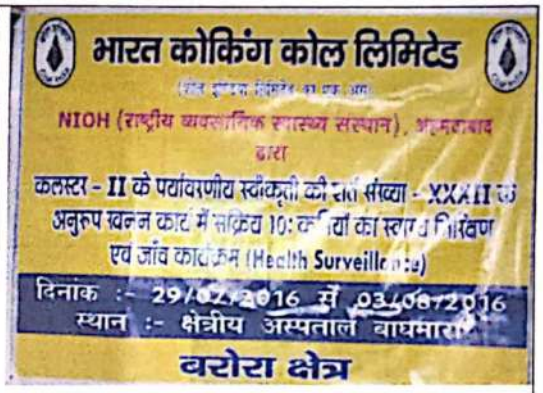
An audiometer was used as the source of pure tone audiometry. It has all the facilities of mask attenuation, frequency setting (125-8000 Hz.), decibel setting of pure tone and pulse setting. It has also a pair of earphone attachment. The audiometer is calibrated periodically as per the specification of International Standards Organization.


Questionnaire survey

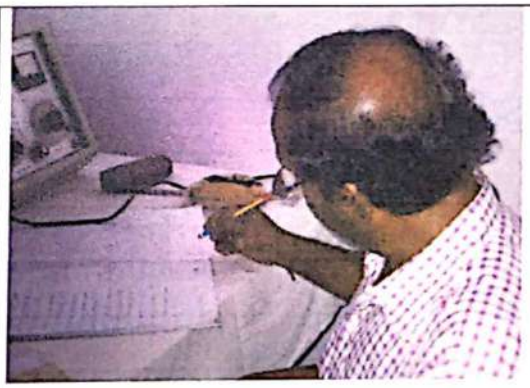

Medical Examination



Pulmonary Function Test



Information- Communication



Audiometry

Haematology & Radiology Examination

RESULT

&

DISCUSSION

(Total subjects)

This study covered 351 subjects from Kustore sector and 140 subjects from Baghmara sector of BCCL Collieries. Among the subjects of Kustore sector 49 were from Kachi Balihari mines, 51 from Bhagabandh mines, 40 from Gopali Chawk mines and 100 from Munidi mines. PB project mines contributed 111 subjects (Table 1). Similarly among the subjects of Baghmara sector, Kharkharee mines and Phularitand mines contributed 75 subjects and 65 subjects respectively. Workers actively involved in mining activity were mainly included in this study. However, about 10% subjects of this study were enrolled from supervisory staffs in order to have a complete and comprehensive understanding of the occupational health condition.

Table 1: Distribution of Supervisory workers and coal miners according to the name of the mine

Sector	Mine Name	Supervisory workers	Coal Miners	Total
		N (%)	N (%)	N (%)
Kustore	10/12 KACHI BALIHARI PITS	8 (2)	41 (12)	49 (14)
	BHAGABANDH COLLIARY	10 (3)	41 (12)	51 (15)
	GOPALI CHAWK COLLIARY	7 (2)	33 (9)	40 (11)
	MUNIDI COLLIARY	17 (5)	83 (24)	100 (29)
	P.B.PROJECT COLLIARY	5 (1)	106 (30)	111 (31)
Total		47 (13)	304 (87)	351
Baghmara	KHARKHAREE COLLIARY	5 (4)	70 (50)	75 (54)
	PHULARITAND COLLIARY	1 (1)	64 (45)	65 (46)
Total		6 (5)	134 (95)	140
Grand Total		**53 (10)**	**438 (90)**	**491 (100)**

Mean age of the workers was 45.9 ± 8.36 years. Most of the workers were between 35-54 years age group. Mean age of supervisory staffs was slightly higher than that of miners. About 98% workers were married. As far as education is concerned majority (56%) had middle school education. Only 4% subjects had graduate level education or higher (Table 2).

Table 2: Demographic characteristics of the study subjects

Demographic characteristics	Supervisory workers	Coal Miners	Total
Age group (in years)	**N (%)**	**N (%)**	**N (%)**
<25	0(0)	4(1)	4(1)
25 - 34	5(1)	34(7)	39(8)
35 - 44	9(2)	148(30)	157(32)
45 - 54	18(4)	175(36)	193(40)
≥55	16(3)	77(16)	93(19)
Mean age (in years)	**48.31 ± 9.47**	**45.55 ± 8.189**	**45.9 ± 8.36**
Marital status			
Single	2(0.5)	6(1.5)	8(2)
Married	46(8.5)	432(89.5)	478(98)
Education status			
Illiterate	0(0)	102(21)	102(21)
Primary schooling	1(0)	15(3)	16(3)
Middle schooling	18(4)	256(53)	274(56)
Secondary schooling	19(4)	56(12)	75(15)
Graduate and above	10(2)	9(2)	19(4)

So far as personal habits are concerned, 86% of subjects were non-smokers, 10% were smokers and 3% were ex-smokers. Tobacco chewing habit was present in 61% subjects and occasional alcohol intake history was found in 39% workers (Table 3).

Table 3: Personal habits of the study subjects

Demographic characteristics	Supervisory workers	Coal Miners	Total
Smoking habits	N (%)	N (%)	N (%)
Non-smoker	38(8)	382(79)	420(86)
Smoker	9(2)	40(8)	49(10)
Ex-smoker	1(0)	16(3)	17(3)
Tobacco chewer			
No	27(6)	160(33)	187(39)
Yes	21(4)	283(57)	304(61)
Alcohol drinking habit			
No	34(7)	264(54)	298(61)
Yes	14(3)	174(36)	188(39)

Mean job experience was 11.72 ± 8.49 years. About 83% workers had job experience of up to 20 years, 3% workers had experience more than 30 years (Table 4). Mean experience was a little higher in supervisory employee group than miners group.

Table 4: Occupational characteristics of Supervisory workers & Coal miners

Demographic characteristics	Supervisory workers	Coal Miners	Total
Duration of job (in years)	N (%)	N (%)	N (%)
<10	23(5)	241(49)	264(54)
10 - 20	12(2)	129(26)	141(29)
21 - 30	13(3)	60(12)	73(15)
>30	0(0)	13(3)	13(3)
Mean duration of job (years)	**12.65 ± 9.31**	**11.61 ± 8.39**	**11.72 ± 8.49**

Most common symptoms complained by study subjects were musculoskeletal pain (34%) (Table 5). Other complaints were Cough, difficulty in breathing, chest pain, loose teeth, and soreness of mouth and colicky pain in abdomen. Headache, sleep disturbance, weakness, tremor in fingers was also experienced by some subjects.

Table 5: Distribution of symptoms among study subjects

Symptoms	Supervisory workers	Coal Miners	Total
	N (%)	N (%)	N (%)
Cough	1 (0.5)	23 (4.5)	24 (5)
Cough with Phlegm	0 (0)	7 (1)	7 (1)
Difficulty in Breathing	2 (0.5)	27 (5.5)	29 (6)
Chest Pain	2 (0.5)	23 (4.5)	25 (5)
Colicky pain	1 (0.5)	14 (2.5)	15 (3)
Loose Teeth	5 (1)	36 (7)	41 (8)
Soreness of mouth/throat	3 (1)	21 (4)	24 (5)
Urinary problems	1 (0.25)	5 (0.75)	6 (1)
Musculoskeletal pain	21 (4)	146 (30)	167 (34)
Headache/sleep difficulty /weakness/dizziness/tremor	6 (2)	46 (9)	52 (11)

Table 8: Pulmonary function impairments among study subjects

Pulmonary function category	Supervisory workers	Coal Miners	Total
	N (%)	N (%)	N (%)
FVC/PFVC			
<80%	0 (0.0)	15 (3.0)	15 (3.0)
≥80%	53 (11.0)	423 (86.0)	476 (97.0)
$FEV_{1\%}$			
< 70 %	2 (0.5)	29 (6.0)	31 (6.5)
70- 79.99 %	21 (4.5)	158 (32.0)	179 (36.5)
≥ 80 %	30 (6.0)	251 (51.0)	281 (57.0)
FVC/PFVC <80% + $FEV_{1\%}$ <70%	0 (0.0)	3 (0.6)	3 (0.6)

FVC – Forced Vital Capacity; PFVC – Predicted Forced Vital Capacity; FEV_1 – Forced Expiratory Volume in first second

Table 9: Forced Vital Capacity according to study variables among study subjects

Study variables	Forced Vital Capacity [Mean ± SD (litres)]		
	Supervisory workers	Coal Miners	Total
Age group (in years)	**Mean ± SD (litres)**	**Mean ± SD (litres)**	**Mean ± SD (litres)**
< 45	3.85 ± 0.585	3.71 ± 0.646	3.72 ± 0.641
≥ 45	3.53 ± 0.576	3.36 ± 0.64	3.38 ± 0.634
	t = 3.120;df =1;p=0.083	t=30.586;df=1;p=0.00	t=32.016;df=1;p=0.00
Duration of exposure (yrs)			
< 20	3.64 ± 0.562	3.52 ± 0.65	3.53 ± 0.643
≥ 20	3.55 ± 0.672	3.47 ± 0.71	3.48 ± 0.702
	t=0.264;df=1;p=0.610	t=0.430;df=1;p=0.512	t=0.519;df=1;p=0.472
Smoking habit			
Never smoker	3.6 ± 0.587	3.5 ± 0.655	3.51 ± 0.649
Ever smoker	3.76 ± 0.613	3.49 ± 0.616	3.54 ± 0.619
	t=0.210;df=1;p=0.649	t=0.115;df=1;p=0.735	t=0.317;df=1;p=0.574

Similar trend was observed in case of FEV1 values also (Table 10). Significant difference was observed between subject of less than 45 years and rest of the workers. This difference was more prominent in miners than supervisory staffs. No such remarkable difference was observed when compared in relation to job experience and smoking habit.

Table 10: Forced Expiratory Volume in first second according to study variables among study subjects

Study variables	Forced Expiratory Volume in first second [Mean ± SD (litres)]		
	Supervisory workers	Coal Miners	Total
Age group (in years)	**Mean ± SD (litres)**	**Mean ± SD (litres)**	**Mean ± SD (litres)**
< 45	3.073 ± 0.3887	3.028 ± 0.5229	3.031 ± 0.5139
≥ 45	2.837 ± 0.4553	2.685 ± 0.5597	2.705 ± 0.5486
	t=2.95;df=1;p=0.092	t=42.02;df=1;p=0.001	t=43.53;df=1;p=0.001
Duration of exposure (yrs)			
< 20	2.945 ± 0.4025	2.844 ± 0.5556	2.854 ± 0.5427
≥ 20	2.791 ± 0.5426	2.769 ± 0.6072	2.772 ± 0.5962
	t=1.259;df=1;p=0.267	t=1.319;df=1;p=0.25	t=1.872;df=1;p=0.172
Smoking habit			
Never smoker	2.886 ± 0.4428	2.836 ± 0.5617	2.841 ± 0.5509
Ever smoker	2.972 ± 0.5042	2.763 ± 0.5127	2.805 ± 0.5129
	t=0.208;df=1;p=0.650	t=0.131;df=1;p=0.72	t=0.018;df=1;p=0.895

Same pattern could be found in case of Peak Expiratory Flow Rate also (Table 11). Significant difference was present in relation to age (more so in miners than supervisor), however, smoking and duration of exposure wise classification did not show any significant difference.

Table 11: Peak Expiratory Flow Rate according to study variables among study subjects

Study variables	Peak Expiratory Flow Rate [Mean ± SD (litres/minute)]		
	Supervisory workers	Coal Miners	Total
Age group (in years)	Mean±SD (litres/minute)	Mean±SD (litres/minute)	Mean ± SD (litres/minute)
< 45	465 ± 63.579	473.23 ± 65.358	472.65 ± 65.113
≥ 45	479.47 ± 60.402	444.83 ± 85.172	449.4 ± 83.078
	t=0.571;df=1;p=0.458	t=14.37;df=1;p=0.00	t=10.97;df=1;p=0.001
Duration of exposure (yrs)			
< 20	474.86 ± 59.704	458.15 ± 75.028	459.79 ± 73.769
≥ 20	477.33 ± 66.167	450.2 ± 89.349	453.97 ± 86.752
	t=0.01;df=1;p=0.896	t=0.785;df=1;p=0.376	t=0.506;df=1;p=0.477
Smoking habit			
Never smoker	475.37 ± 61.851	456.31 ± 78.316	458.17 ± 77.012
Ever smoker	475 ± 63.64	461.75 ± 76.691	464.4 ± 73.849
	t=0.002;df=1;p=0.962	t=0.193;df=1;p=0.661	t=0.301;df=1;p=0.583

So far as chest radiographic findings are concerned, 93% subjects (Table 12) had findings within normal limits. 3% subjects showed findings suggestive of opacities in lung and almost 1.5% had other features on chest X-ray (mostly suggestive of Koch's infection of lung).

Table 12: Chest radiographic findings among the study subjects

Chest X ray findings	Supervisory workers	Coal Miners	Total
	N (%)	N (%)	N (%)
Within normal limit	50 (10)	408 (83)	458 (93)
Pulmonary Opacities	1 (0.5)	12 (2.5)	13 (3)
Koch's infection	0 (0)	7 (1.5)	7 (1.5)
Not Done	2 (0.5)	11(2.0)	13(2.5)
Total	**53 (11)**	**438 (89)**	**491 (100)**

Haematological and biochemical findings of the subjects were mostly within normal limits. Almost 11% workers had random blood sugar level >140. Mean Hemoglobin level in 13.1±0.8 gm%. Mean ESR was 7.0±2.1 unit. Random Blood sugar, blood urea and creatinine was 114.7±36.4 unit, 22.7±3.6 unit and 0.8±0.1unit respectively (Table 13).

Table 13: Haematological & Biochemical findings of study subjects

Parameter	Minimum	Maximum	Mean ± SD
Haemoglobin (g/dL)	10	15	13.15 ± 0.845
Erythrocyte Sedimentation Rate (mm/h)	3	20	7.046 ± 2.144
Total Leucocyte Count (mcL)	5500	12600	9064.61 ± 1167.13
Neutrophil	46	89	61.77 ± 5.826
Lymphocyte	20	62	31.97 ± 6.013
Eosinophil	2	13	5.62 ± 1.77
Monocyte	0	8	0.80 ± 0.905
Besophil	0	0	0.00
Random Blood Sugar (mg/dL)	55	300	114.74 ± 36.46
Blood Urea (mg/dL)	14	38	22.75 ± 3.63
Serum Creatinine (mg/dL)	.30	7.00	0.83 ± 0.32

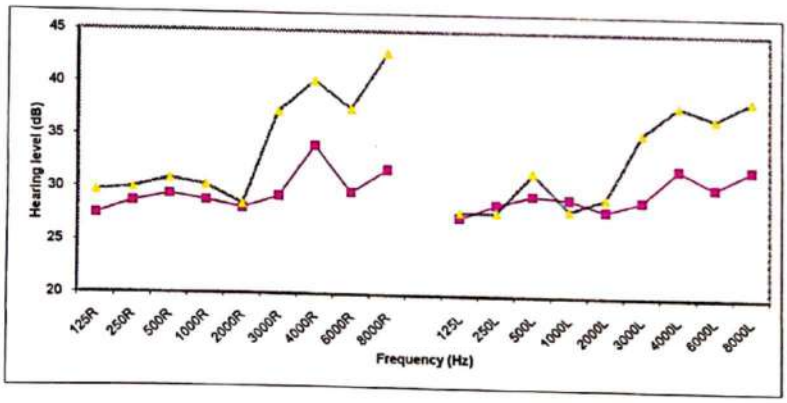
As far as ophthalmological findings are concerned, 5% subjects had uncorrected vision (although using spectacles) and 9% subjects had Cataract in eyes. Colour blindness was also observed in few subjects (Table 14).

Table 14: Ophthalmological findings of study subjects

	Supervisory workers	Coal Miners	Total
	N (%)	N (%)	N (%)
People having uncorrected vision after correction	1 (0.5)	24 (4.5)	25 (5)
Colour Blindness	0	6 (1)	6 (1)
Cataract	4 (1)	29 (8)	33 (9)
Glaucoma	0 (0)	2 (1)	2 (1)
Muscular Pathology	0	1	1
Pterygium	0	1	1

Figure 1 describes hearing ability of workers examined by audiometry. Two curves depict the median hearing ability of subjects with <10 years (lower curve), and ≥ 10 years (higher curve) of job experience. On preliminary observation, decreased hearing ability at high frequency was observed in some workers. Difference of hearing ability with increasing duration of exposure was also observed at higher frequency; however, this observation also is subject to adjustment for age and other probable factors that can affect hearing ability. Moreover, hearing assessment was done in field condition where despite best efforts ideal experimental chamber condition could not be achieved, which may also be a contributing factor.

Figure 1: Distribution of hearing ability according to job experience



RESULT

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DISCUSSION

(Kustore area subjects)

This study covered 351 subjects from Kustore sector of BCCL Collieries. Among the subjects of Kustore sector 49 were from Kachi Balihari mines, 51 from Bhagabandh mines, 40 from Gopali Chawk mines and 100 from Munidi mines. PB project mines contributed 111 subjects (Table 15). Workers actively involved in mining activity were mainly included in this study.

Table 15: Distribution of Supervisory workers and coal miners of Kustore area

Sector	Mine Name	Supervisory workers	Coal Miners	Total
		N (%)	N (%)	N (%)
Kustore	10/12 KACHI BALIHARI PITS	8 (2)	41 (12)	49 (14)
	BHAGABANDH COLLIARY	10 (3)	41 (12)	51 (15)
	GOPALI CHAWK COLLIARY	7 (2)	33 (9)	40 (11)
	MUNIDI COLLIARY	17 (5)	83 (24)	100 (29)
	P.B.PROJECT COLLIARY	5 (1)	106 (30)	111 (31)
	Total	47 (13)	304 (87)	351

Mean age of the workers was 46.3 ± 8.36 years. Most of the workers were between 35-54 years age group. Mean age of supervisory staffs was slightly higher than that of miners. About 98% workers were married. As far as education is concerned majority (53%) had middle school education. Only 5% subjects had graduate level education or higher (Table 16).

Table 16: Demographic characteristics of the study subjects of Kustore area

Demographic characteristics	Supervisory workers	Coal Miners	Total
Age group (in years)	N (%)	N (%)	N (%)
< 25	0 (0)	2 (1)	2 (1)
25-34	4 (1)	22 (6)	26 (7)
35-44	8 (2)	104 (30)	112 (32)
45-54	18 (5)	118 (34)	136 (39)
≥ 55	17 (5)	58 (17)	75 (21)
Mean age (in years)	49.06 ± 8.928	48.87 ± 8.21	46.30 ± 8.368
Marital status			
Single	2 (1)	5 (1)	7 (2)
Married	45 (13)	299 (85)	344 (98)
Education status			
Illiterate	0 (0)	72 (20)	72 (20)
Primary schooling	1 (0.5)	12 (3.5)	13 (4)
Middle schooling	17 (5)	169 (48)	186 (53)
Secondary schooling	18 (5)	44 (13)	62 (18)
Graduate and above	11 (3)	7 (2)	18 (5)

So far as personal habits are concerned (Table 17), 83% of subjects were non-smokers, 12% were smokers and 5% were ex-smokers. Tobacco chewing habit was present in 61% subjects and occasional alcohol intake history was found in 38% workers.

Table 17: Personal habits of the study subjects of Kustore area

Demographic characteristics	Supervisory workers	Coal Miners	Total
Smoking habits	**N (%)**	**N (%)**	**N (%)**
Non-smoker	38 (11)	254 (72)	292 (83)
Smoker	8 (2)	34 (10)	42 (12)
Ex-smoker	1 (0.5)	16 (4.5)	17 (5)
Tobacco chewer			
Yes	22 (6)	193 (55)	215 (61)
No	25 (7)	111 (32)	136 (39)
Alcohol drinking habit			
No	35 (10)	183 (52)	218 (62)
Yes	12 (3)	121 (34)	133 (38)

Mean job experience was 12.68 ± 8.9 years. About 78% workers had job experience of up to 20 years, 3% workers had experience more than 30 years. Mean experience was a little higher in supervisory employee group than miners group (Table 18).

Table 18: Occupational characteristics of Supervisory workers & Coal miners of Kustore area

Demographic characteristics	Supervisory workers	Coal Miners	Total
Duration of job (in years)	N (%)	N (%)	N (%)
<10	21 (6)	153 (43)	174 (49)
10 - 20	13 (4)	88 (25)	101 (29)
21 - 30	13 (4)	52 (15)	65 (19)
>30	0 (0)	11 (3)	11 (3)
Mean duration of job (years)	13.48 ± 9.28	12.56 ± 8.85	12.68 ± 8.90

Most common symptoms complained by study subjects were musculoskeletal pain (34%). Other complaints were Cough, difficulty in breathing, and loose teeth. Headache, sleep disturbance, weakness, tremor in fingers was also experienced by some subjects (9%) (Table 19).

Table 19: Distribution of symptoms among study subjects of Kustore area

Symptoms	Supervisory workers	Coal Miners	Total
	N (%)	N (%)	N (%)
Cough	2 (1)	18 (5)	20 (6)
Cough with Phlegm	1 (0.5)	4 (1)	5 (1.5)
Difficulty in Breathing	3 (1)	18 (5)	21 (6)
Chest Pain	2 (1)	12 (3)	14 (4)
Colicky pain	1 (0.5)	10 (2.5)	11 (3)
Loose Teeth	5 (1)	30 (9)	35 (10)
Soreness of mouth/throat	3 (1)	8 (2)	11 (3)
Urinary problems	0 (0)	3 (1)	3 (1)
Musculoskletal pain	19 (5)	99 (28)	118 (34)
Headache/sleep difficulty/weakness/dizziness/tremor	5 (2)	26 (7)	31 (9)

Mean height was 160.8 ± 6.3 cm and mean weight was 66.1 ± 11.9 kg for miners. Mean height was slightly higher in supervisory staffs whereas mean weight was considerably higher. This may be result of sedentary lifestyle and relative lack of exercise. Mean systolic and diastolic blood pressure of miners was 131.4±19.1 and 85.0± 10.6 mm of Mercury (Table 20). About 19% subjects had systolic blood pressure >140 as well as diastolic blood pressure > 90 mm of Mercury. 10% workers had only higher systolic blood pressure and 13% had only higher diastolic blood pressure (Table 21).

Table 20: Distribution of salient clinical findings among study subjects of Kustore area

Clinical examination findings	Supervisory workers	Coal Miners	Total
	Mean ± SD	Mean ± SD	Mean ± SD
Mean Height (cm)	162.53 ± 5.88	160.84 ± 6.37	161.07 ± 6.33
Mean Weight (Kgs)	71.94 ± 9.78	66.19 ± 11.93	66.96 ± 11.81
MSBP (mm Hg)	131.11 ± 15.79	131.42 ± 19.11	131.37 ± 18.68
MDBP (mm Hg)	85.57 ± 8.78	85.02 ± 10.62	85.10 ± 10.38

MSBP - Mean Systolic Blood Pressure; MDBP - Mean Diastolic Blood Pressure

Table 21: Distribution of Blood pressure among study subjects of Kustore area

	Supervisory workers	Coal Miners	Total
	N (%)	N (%)	N (%)
Blood Pressure (mm Hg) >140 & <90	4 (1)	32 (9)	36 (10)
Blood Pressure (mm Hg) <140 & >90	8 (2)	37 (11)	45 (13)
Blood Pressure (mm Hg) <140 & <90	26 (7)	179 (51)	205 (58)
Blood Pressure (mm Hg) >140 & >90	9 (3)	56 (16)	65 (19)

As far as pulmonary functional status of study subjects in concerned, about 3 % subjects had restrictive type of abnormality (FVC/PFVC < 80%) and 0.3% subjects had combined type of abnormality (FVC/PFVC <80 % and $FEV_{1\%}$ <70%). A good number of subjects (40.5%) had $FEV_{1\%}$ values between 70% and 80% (Table 22).

Table 22: Pulmonary function impairments among study subjects of Kustore area

Pulmonary function category	Supervisory workers	Coal Miners	Total
	N (%)	N (%)	N (%)
FVC/PFVC			
<80%	0 (0.0)	10 (3.0)	10 (3.0)
≥80%	47 (13.0)	294 (84.0)	341 (97.0)
$FEV_{1\%}$			
< 70 %	2 (0.5)	17 (5.0)	19 (5.5)
70- 79.99 %	17 (5.0)	125 (35.5)	142 (40.5)
≥ 80 %	28 (8.0)	162 (46.0)	190 (54.0)
FVC/PFVC <80% + $FEV_{1\%}$ <70%	0 (0.0)	1 (0.3)	1 (0.3)

FVC – Forced Vital Capacity; PFVC – Predicted Forced Vital Capacity; FEV_1 – Forced Expiratory Volume in first second

Mean FVC values were lower among the subjects of age 45 years or above. The difference was significant among the miners but not significant statistically among the supervisory staffs. Such significant difference of FVC values was not observed when compared between higher and lower job experience groups. Similarly difference was not prominent in relation to smoking habit of the subjects (Table 23).

Table 23: Forced Vital Capacity according to study variables among study subjects of Kustore area

Study variables	Forced Vital Capacity [Mean ± SD (litres)]		
	Supervisory workers	Coal Miners	Total
Age group (in years)	Mean ± SD (litres)	Mean ± SD (litres)	Mean ± SD (litres)
< 45	3.86 ± 0.60	3.82 ± 0.66	3.82 ± 0.65
≥ 45	3.61 ± 0.55	3.46 ± 0.67	3.48 ± 0.65
	t=0.192;df=1;p=0.19	t=21.85;df=1;p= 0.00	t=0.344;df=1;p=0.558
Duration of exposure (yrs)			
< 20	3.69 ± 0.56	3.63 ± 0.67	3.64 ± 0.66
≥ 20	3.64 ± 0.61	3.52 ± 0.72	3.54 ± 0.70
	t =0.071;df=1;p=0.791	t=1.536;df=1;p=0.216	t=1.533;df=1;p=0.217
Smoking habit			
Never smoker	3.67 ± 0.56	3.63 ± 0.68	3.63 ± 0.66
Ever smoker	3.67 ± 0.65	3.52 ± 0.75	3.55 ± 0.73
	t=0.000;df=1;p=0.996	t=0.905;df=1;p=0.342	t=0.768;df=1;p=0.381

Similar trend was observed in case of FEV1 values also (Table 24). Significant difference was observed between subject of less than 45 years and rest of the workers. This difference was more prominent in miners than supervisory staffs. No such remarkable difference was observed when compared in relation to job experience and smoking habit.

Table 24: Forced Expiratory Volume in first second according to study variables among study subjects of Kustore area

Study variables	Forced Expiratory Volume in first second [Mean ± SD (litres)]		
	Supervisory workers	Coal Miners	Total
Age group (in years)	Mean ± SD (litres)	Mean ± SD (litres)	Mean ± SD (litres)
< 45	3.075 ± 0.40	3.10 ± 0.52	3.09 ± 0.51
≥ 45	2.91 ± 0.41	2.75 ± 0.58	2.78 ± 0.56
	t=1.388;df=1;p=0.245	t=28.214;df=1;p=0.00	t=28.69;df=1;p= 0.00
Duration of exposure (yrs)			
< 20	2.99 ± 0.37	2.93 ± 0.56	2.93 ± 0.54
≥ 20	2.86 ± 0.48	2.82 ± 0.63	2.82 ± 0.60
	t=1.025;df=1;p=0.317	t=2.033;df=1;p=0.155	t=2.64;df=1;p=0.105
Smoking habit			
Never smoker	2.95 ± 0.40	2.92 ± 0.57	2.93 ± 0.55
Ever smoker	2.98 ± 0.47	2.79 ± 0.63	2.82 ± 0.61
	t=0.035;df=1;p=0.853	t=2.156;df=1;p=0.143	t=1.769;df=1;p=0.184

Same pattern could be found in case of Peak Expiratory Flow Rate also (Table 25). Significant difference was present in relation to age (more so in miners than supervisor), however, smoking and duration of exposure wise classification did not show any significant difference.

Table 25: Peak Expiratory Flow Rate according to study variables among study subjects of Kustore area

Study variables	Peak Expiratory Flow Rate [Mean ± SD (litres/minute)]		
	Supervisory workers	Coal Miners	Total
Age group (in years)	Mean ± SD (litres/minute)	Mean ± SD (litres/minute)	Mean ± SD (litres/minute)
< 45	460 ± 67.42	474.38 ± 65.54	473.14 ± 65.58
≥ 45	486.18 ± 57.74	447.8 ± 87.25	454.02 ± 84.27
	t=1.671;df=1;p=0.20	t=8.416;df=1;p=0.004	t=5.137;df=1;p= 0.02
Duration of exposure (yrs)			
< 20	476.56 ± 61.88	460.98 ± 74.17	462.93 ± 72.82
≥ 20	485.71 ± 59.83	451.31 ± 92.80	456.49 ± 89.22
	t=0.217;df=1;p=0.64	t=0.867;df=1;p=0.353	t=0.471;df=1;p=0.493
Smoking habit			
Never smoker	478.92 ± 60.50	458.56 ± 79.93	461.15 ± 77.94
Ever smoker	481.11 ± 65.47	461.2 ± 79.94	464.24 ± 77.73
	t=0.009;df=1;p=0.92	t=0.046;df=1;p=0.83	t=0.077;df=1;p=0.781

So far as chest radiographic findings are concerned, about 94% subjects had findings within normal limits. About 2.5% subjects showed findings suggestive of opacities in lung and almost 1% had other features on chest X-ray (mostly suggestive of Koch's infection of lung) (Table 26).

Table 26: Chest radiographic findings among the study subjects of Kustore area

Chest X ray findings	Supervisory workers	Coal Miners	Total
	N (%)	N (%)	N (%)
Within normal limit	44 (13)	285 (81)	329 (94)
Pulmonary Opacities	1 (0.5)	7 (2.0)	8 (2.5)
Koch's infection	0 (0)	4 (1)	4 (1)
Not Done	2 (0.5)	8 (2.0)	10 (2.5)
Total	**47 (14)**	**304 (86)**	**351 (100)**

Haematological and biochemical findings of the subjects were mostly within normal limits. 9% workers had random blood sugar level >140. Mean Hemoglobin level in 13.4±0.4 gm%. Mean ESR was 7.0±2.1 mm/h. Random Blood sugar, Blood urea and Serum creatinine was 117.6±35.3 mg/dl, 23.5±2.7 mg/dl and 0.9±0.05 mg/dl respectively (Table 27).

Table 27: Haematological & Biochemical findings of study participants of Kustore area

Parameters	Minimum	Maximum	Mean ± SD
Haemoglobin (g/dL)	12	14	13.47 ± 0.483
Erythrocyte Sedimentation Rate (mm/h)	3	20	7.046 ± 2.14
Total Leucocyte Count (mcL)	6100	12600	9509.86 ± 838.53
Neutrophil	50	72	61.48 ± 5.60
Lymphocyte	23	62	33.072 ± 5.15
Eosinophil	3	9	5.01 ± 0.91
Monocyte	0	2	0.56 ± 0.65
Besophil	0	0	0.00
Random Blood Sugar (mg/dL)	75	270	117.64 ± 35.35
Blood Urea (mg/dL)	18	36	23.57 ± 2.77
Serum Creatinine (mg/dL)	.71	1.00	0.90 ± 0.05

Table 28: Ophthalmological findings of study participants of Kustore area

Findings	Supervisory workers	Coal Miners	Total
	N (%)	N (%)	N (%)
People having uncorrected vision after correction	1 (0.5)	16 (4.5)	17 (5)
Cataract	4 (1)	29 (8)	33 (9)
Glaucoma	0 (0)	2 (1)	2 (1)
Mascular Pathology	0	1	1
Pterygium	0	1	1

As far as ophthalmological findings are concerned, 5% subjects had uncorrected vision (although using spectacles) and 9% subjects had Cataract in eyes (Table 28).

RESULT

&

DISCUSSION

(Baghmara area subjects)

This study covered 140 subjects from Baghmara sector of BCCL Collieries (Table 29). Among the subjects of Baghmara sector, Kharkharee mines and Phularitand mines contributed 75 subjects and 65 subjects respectively. Workers actively involved in mining activity were mainly included in this study. However, about 5% subjects of this study were enrolled from supervisory staffs in order to have a complete and comprehensive understanding of the occupational health condition.

Table 29: Distribution of Supervisory workers and coal miners of Baghmara area

Sector	Mine Name	Supervisory workers	Coal Miners	Total
		N (%)	N (%)	N (%)
Baghmara	KHARKHAREE COLLIARY	5(4)	70(50)	75(54)
	PHULARITAND COLLIARY	1(1)	64(45)	65(46)
Total		6 (5)	134 (95)	140 (100)

Mean age of the workers was 44.9 ± 8.2 years. Most of the workers were between 35-54 years age group. Mean age of supervisory staffs was slightly higher than that of miners. About 99% workers were married. As far as education is concerned majority (66%) had middle school education. Only 1% subjects had graduate level education or higher (Table 30).

Mean job experience was 9.4 ± 6.8 years. About 93% workers had job experience of up to 20 years. Mean experience was a little higher in supervisory employee group than miners group (Table 32).

Table 32: Occupational characteristics of Supervisory workers & Coal miners of Baghmara area

Demographic characteristics	Supervisory workers	Coal Miners	Total
Duration of job (in years)			
<10	5 (3)	85 (61)	90 (64)
10 - 20	1 (1)	39 (28)	40 (29)
21-30	0 (0)	8 (6)	8 (6)
>30	0 (0)	2 (1)	2 (1)
Mean duration of job (years)	**6.17 ± 7.17**	**9.56 ± 6.83**	**9.41 ± 6.85**

Most common symptoms complained by study subjects were musculoskeletal pain (36%). Other complaints were difficulty in breathing, chest pain and soreness of mouth. Headache, sleep disturbance, weakness, tremor in fingers was also experienced by good number of subjects (15%) (Table 33).

Table 33: Distribution of symptoms among study subjects of Baghmara area

Symptoms	Supervisory workers	Coal Miners	Total
	N (%)	N (%)	N (%)
Cough	0 (0)	5 (4)	5 (4)
Cough with Phlegm	0 (0)	3 (2)	3 (2)
Difficulty in Breathing	0 (0)	9 (6)	9 (6)
Chest Pain	0 (0)	11 (8)	11 (8)
Colicky pain	0 (0)	4 (3)	4 (3)
Loose Teeth	0 (0)	6 (4)	6 (4)
Soreness of mouth/throat	0 (0)	13 (9)	13 (9)
Urinary problems	1 (1)	2 (1)	3 (2)
Musculoskletal pain	4 (2)	47 (34)	51 (36)
Headache/sleep dificulty/weakness/dizziness/tremor	1 (1)	20 (14)	21 (15)

Mean highly was 159.3 ± 6.7 cm and mean weight was 61.9 ± 11.5 kg. Mean systolic and diastolic blood pressure was 130.1± 19.2 and 82.9± 10.7 mm of Mercury (Table -34).

Table 34: Distribution of salient clinical findings among study subjects of Baghmara area

Clinical examination findings	Supervisory workers	Coal Miners	Total
	Mean ± SD	Mean ± SD	Mean ± SD
Mean Height (cm)	163.67 ± 6.28	159.18 ± 6.72	159.37 ± 6.74
Mean Weight (Kgs)	67.83 ± 11.0	61.70 ± 11.50	61.96 ± 11.51
MSBP (mm Hg)	134.33 ± 19.16	129.97 ± 19.26	130.16 ± 19.21
MDBP (mm Hg)	80.67 ± 9.35	83.01 ± 10.86	82.91 ± 10.78

MSBP – Mean Systolic Blood Pressure; MDBP - Mean Diastolic Blood Pressure

About 23% subjects had systolic blood pressure >140 as well as diastolic blood pressure > 90 mm of Mercury. 6% workers had only higher systolic blood pressure and 6% had only higher diastolic blood pressure (Table 35).

Table 35: Distribution of Blood pressure among study subjects of Baghmara area

	Supervisory workers	Coal Miners	Total
	N (%)	N (%)	N (%)
Blood Pressure (mm Hg) >140 & <90	3 (2)	6 (4)	9 (6)
Blood Pressure (mm Hg) <140 & >90	0 (0)	9 (6)	9 (6)
Blood Pressure (mm Hg) <140 & <90	2 (1)	88 (63)	90 (64)
Blood Pressure (mm Hg) >140 & >90	1 (1)	31 (22)	32 (23)

As far as pulmonary functional status of study subjects in concerned, about 3.5 % subjects had restrictive type of abnormality (FVC/PFVC < 80%) and 1.43% subjects had combined type of abnormality (FVC/PFVC <80 % and $FEV_{1\%}$ <70%). A good number of subjects (26.5%) had $FEV_{1\%}$ values between 70% and 80% (Table 36).

Similar trend was observed in case of FEV1 values also. Significant difference was observed between subject of less than 45 years and rest of the workers. This difference was prominent in miners and supervisory staffs. No such remarkable difference was observed when compared in relation to job experience and smoking habit (Table 38).

Table 38: Forced Expiratory Volume in first second according to study variables among study subjects of Baghmara area

Study variables	Forced Expiratory Volume in first second [Mean ± SD (litres)]		
	Supervisory workers	Coal Miners	Total
Age group (in years)	Mean ± SD (litres)	Mean ± SD (litres)	Mean ± SD (litres)
< 45	3.06 ± 0.44	2.87 ± 0.49	2.87 ± 0.49
≥ 45	2.18 ± 0.27	2.52 ± 0.46	2.50 ± 0.46
	t=9.88;df=1;p=0.035	t=17.48;df=1;p=0.00	t=21.13;df=1;p=0.00
Duration of exposure (yrs)			
< 20	2.614 ± 0.46	2.69 ± 0.51	2.69 ± 0.51
≥ 20	1.780	2.5 ± 0.41	2.45 ± 0.43
	t=2.687;df=1;p=0.176	t=1.863;df=1,p=0.175	t=3.03;df=1;p=0.084
Smoking habit			
Never smoker	2.29 ± 0.40	2.66 ± 0.50	2.65 ± 0.50
Ever smoker	2.85 ± 0.74	2.94 ± 0.61	2.92 ± 0.59
	t=1.654;df=1;p=0.268	t=1.77;df=1;p=0.186	t=2.152;df=1;p=0.145

Same pattern could be found in case of Peak Expiratory Flow Rate also (Table 39). Significant difference was present in relation to age (more so in miners than supervisor), however, smoking and duration of exposure wise classification did not show any significant difference.

Table 36: Pulmonary function impairments among study subjects of Baghmara area

Pulmonary function category	Supervisory workers	Coal Miners	Total
	N (%)	N (%)	N (%)
FVC/PFVC			
<80%	0 (0.0)	5 (3.5)	5 (3.5)
≥80%	6 (4.5)	129 (92.0)	135 (96.5)
$FEV_{1\%}$			
< 70 %	0 (0.0)	12 (8.5)	12 (8.5)
70- 79.99 %	4 (3.0)	33 (23.5)	37 (26.5)
≥ 80 %	2 (1.0)	89 (64.0)	91 (65.0)
FVC/PFVC <80% + $FEV_{1\%}$ <70%	0 (0.0)	2 (1.43)	2 (1.43)

FVC – Forced Vital Capacity; PFVC – Predicted Forced Vital Capacity; FEV_1 – Forced Expiratory Volume in first second

Mean FVC values were significantly lower among the subjects of age 45 years or above (Table 37). The difference was more prominent among the miners in comparison to supervisory staffs. Such significant difference of FVC values was not observed when compared between higher and lower job experience groups. Similarly difference was not prominent in relation to smoking habit of the subjects.

Table 37: Forced Vital Capacity according to study variables among study subjects of Baghmara area

Study variables	Forced Vital Capacity [Mean ± SD (litres)]		
	Supervisory workers	Coal Miners	Total
Age group (in years)	**Mean ± SD (litres)**	**Mean ± SD (litres)**	**Mean ± SD (litres)**
< 45	3.82 ± 0.68	3.46 ± 0.53	3.47 ± 0.53
≥ 45	2.90 ± 0.41	3.13 ± 0.50	3.12 ± 0.50
	df=1;p=0.098	df=1;p= 0.00	df=1;p= 0.00
Duration of exposure (yrs)			
< 20	3.38 ± 0.55	3.29 ± 0.54	3.29 ± 0.54
≥ 20	2.35	3.14 ± 0.55	3.09 ± 0.56
	df=1;p=0.162	df=1;p=0.316	df=1;p=0.158
Smoking habit			
Never smoker	2.99 ± 0.44	3.26 ± 0.53	3.25 ± 0.53
Ever smoker	3.18 ± 0.74	3.34 ± 0.56	3.42 ± 0.55
	df=1;p=0.138	df=1;p=0.187	df=1;p = 0.099

Similar trend was observed in case of FEV1 values also. Significant difference was observed between subject of less than 45 years and rest of the workers. This difference was prominent in miners and supervisory staffs. No such remarkable difference was observed when compared in relation to job experience and smoking habit (Table 38).

Table 38: Forced Expiratory Volume in first second according to study variables among study subjects of Baghmara area

Study variables	Forced Expiratory Volume in first second [Mean ± SD (litres)]		
	Supervisory workers	Coal Miners	Total
Age group (in years)	Mean ± SD (litres)	Mean ± SD (litres)	Mean ± SD (litres)
< 45	3.06 ± 0.44	2.87 ± 0.49	2.87 ± 0.49
≥ 45	2.18 ± 0.27	2.52 ± 0.46	2.50 ± 0.46
	t=9.88;df=1;p=0.035	t=17.48;df=1;p=0.00	t=21.13;df=1;p=0.00
Duration of exposure (yrs)			
< 20	2.614 ± 0.46	2.69 ± 0.51	2.69 ± 0.51
≥ 20	1.780	2.5 ± 0.41	2.45 ± 0.43
	t=2.687;df=1;p=0.176	t=1.863;df=1,p=0.175	t=3.03;df=1;p=0.084
Smoking habit			
Never smoker	2.29 ± 0.40	2.66 ± 0.50	2.65 ± 0.50
Ever smoker	2.85 ± 0.74	2.94 ± 0.61	2.92 ± 0.59
	t=1.654;df=1;p=0.268	t=1.77;df=1;p=0.186	t=2.152;df=1;p=0.145

Same pattern could be found in case of Peak Expiratory Flow Rate also (Table 39). Significant difference was present in relation to age (more so in miners than supervisor), however, smoking and duration of exposure wise classification did not show any significant difference.

Table 39: Peak Expiratory Flow Rate according to study variables among study subjects of Baghmara area

Study variables	Peak Expiratory Flow Rate [Mean ± SD (litres/minute)]		
	Supervisory workers	Coal Miners	Total
Age group (in years)	Mean ± SD (litres/minute)	Mean ± SD (litres/minute)	Mean ± SD (litres/minute)
< 45	495 ± 21.21	470.69 ± 65.45	471.5 ± 64.54
≥ 45	422.5 ± 59.09	437.77 ± 80.15	436.99 ± 78.98
	t=2.566;df=1;p=0.18	t=6.423;df=1;p=0.012	t=7.56;df=1;p=0.007
Duration of exposure (yrs)			
< 20	464 ± 47.22	453.22 ± 76.53	453.66 ± 75.46
≥ 20	360.00	443.93 ± 69.12	438.33 ± 70.04
	t=4.042;df=1;p=0.115	t=0.188;df=1;p=0.665	t=0.559;df=1;p=0.456
Smoking habit			
Never smoker	442.5 ± 74.11	451.79 ± 75.05	451.5 ± 74.76
Ever smoker	455 ± 35.36	461.67 ± 93.47	460 ± 80.18
	t=0.047;df=1;p=0.839	t=0.09;df=1;p=0.756	t=0.097;df=1;p=0.756

So far as chest radiographic findings are concerned, about 92% subjects had findings within normal limits. 4% subjects showed findings suggestive of opacities in lung and almost 2% had other features on chest X-ray (mostly suggestive of Koch's infection of lung) (Table 40).

Table 40: Chest radiographic findings among the study participants of Baghmara area

Chest X ray findings	Supervisory workers	Coal Miners	Total
	N (%)	N (%)	N (%)
Within normal limit	6 (4)	123 (88)	129 (92)
Pulmonary Opacities	0 (0)	5 (4)	5 (4)
Koch's infection	0 (0)	3 (2)	3 (2)
Not Done	0 (0)	3 (2)	3 (2)
Total	**6 (4)**	**134 (96)**	**140 (100)**

Haematological and biochemical findings of the subjects were mostly within normal limits. 15% workers had random blood sugar level >140. Mean hemoglobin level in 11.9±0.8 gm%. Random Blood sugar, blood urea and Serum creatinine was 107.5±38.2 unit, 20.7±4.5 unit and 0.6±0.5 unit respectively (Table 41).

Table 41: Haematological & Biochemical findings of study participants of Baghmara area

Parameters	Minimum	Maximum	Mean
Haemoglobin (g/dL)	10	15	11.98 ± 0.87
Total Leucocyte Count (mcL)	5500	10500	7957.86 ± 1134. 57
Neutrophil	46	89	62.49 ± 7.37
Lymphocyte	20	50	29.24 ± 7.06
Eosinophil	2	13	7.13 ± 2.40
Monocyte	0	8	1.38 ± 1.16
Besophil	0	0	0.00
Random Blood Sugar (mg/dL)	55	300	107.51 ± 38.28
Blood Urea (mg/dL)	14	38	20.7 ± 4.57
Serum Creatinine (mg/dL)	.30	7.00	0.64 ± 0.55

As far as ophthalmological findings are concerned, 6% subjects had uncorrected vision (although using spectacles). Colour blindness was also observed in few subjects (Table 42).

Table 42: Ophthalmological findings of study participants of Baghmara area

	Supervisory workers	Coal Miners	Total
	N (%)	N (%)	N (%)
People having uncorrected vision after correction	0 (0)	8 (6)	8 (6)
Colour Blindness	0 (0)	6 (4)	6 (4)

CONCLUSION

&

RECOMMENDATION

CONCLUSION

- This study covered 351 subjects from Kustore sector and 140 subjects from Baghmara sector of BCCL Collieries. Mean age of the workers was 45.9 ± 8.36 years. Most of the workers were between 35-54 years age. Mean job experience was 11.72 ± 8.49 years.

- Most common symptoms complained by study subjects were musculoskeletal pain (34%). Other complaints were Cough, difficulty in breathing, chest pain, soreness of mouth etc. Headache, sleep disturbance, weakness, tremor in fingers was also experienced by some subjects.

- About 20% subjects had systolic blood pressure >140 as well as diastolic blood pressure > 90 mm of Mercury. 9% workers had only higher systolic blood pressure and 11% had only higher diastolic blood pressure.

- As far as pulmonary functional status of study subjects in concerned, about 3% subjects had restrictive type of abnormality (FVC/PFVC < 80%) and 0.6 % subjects had combined type of abnormality (FVC/PFVC <80 % and FEV1% <70%). A good number of subjects (36.5%) had FEV1% values between 70% and 80%. Mean FVC values were significantly lower among the subjects of age 45 years or above.

- So far as chest radiographic findings are concerned, 93% subjects had findings within normal limits. 3% subjects showed findings suggestive of opacities in lung and almost 1.5% had other features on chest X-ray (mostly suggestive of Koch's infection of lung). Such findings may be due to pneumoconiotic changes in lung, hence these subjects should be properly followed up and necessary medical, ethical, legal, administrative actions may be initiated as necessary.

- Haematological and biochemical findings of the subjects were mostly within normal limits. Almost 11% workers had random blood sugar level more than 140 units. As far as ophthalmological findings are concerned, 5% subjects had uncorrected vision and 9% subjects had Cataract in eyes.

- Decline in hearing ability with increasing duration of exposure was observed more at higher frequency; however, this observation is subject to adjustment for age and other probable factors.

- The subjects for this study are selected from workplaces identified by BCCL, Govt. of India, as required for the purpose of this study. The findings of this study may thus be restricted to the concerned workplaces and may not be generalisable.

RECOMMENDATION

- Prevalence of musculoskeletal pain during work in a good number of workers reflects that manual work of the work processes might be causing some discomfort for the workers. Training on proper method of manual material handling may prove useful of these workers. On the other hand regular proper exercise should be promoted among workers especially supervisory employees to get rid of ill effects of sedentary activities.

- Special emphasis should be given to protection of respiratory health, hearing ability. Periodic relevant examination (lung function test, audiometry) at regular interval is recommended.

- Industrial hygiene survey (periodic monitoring of dust and other environmental hazards) at regular interval should be undertaken including noise level monitoring in different operations.

- Some prevalent symptoms observed may be representation of nervous system effect due to exposures to toxicants. In order to exclude the possibility of exposure from occupational environment, environmental study should include assessment of exposure to metals.

- Measures like using protective appliances (e.g. PPEs), pre-placement- and periodic medical examination, for the control and prevention of relevant health hazards, are to be implemented and maintained by all the mining areas to protect the health of the workers.

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EXECUTIVE SUMMARY

BACKGROUND

Although coal remains a major energy resource worldwide, coal mining causes environment problems, whereas the inhaled coal particles at the work place may lead to the development of coal workers' pneumoconiosis (CWP). Typically, coal workers pneumoconiosis takes many years to develop and to be manifested. Further, once initiated the disease is progressive in nature, often leading to lungfunction impairment, disability.
The workers' exposure to coal dust generally occurs during mining operations.
Coal mining can also increase the risk of developing asthma and chronic obstructive pulmonary disease (COPD), such as emphysema and chronic bronchitis. It is suggested that coal mining operations may also induce noise induced hearing impairment among the workers.

A request was received from Bharat Coking Coal Limited, Dhanbad to assess the health status of their workers involved in the mining activities in Cluster 11 and 15 areas around Dhanbad. About 10% of the subjects involved in mining activities were to be included in this study. The workers were to be assessed for their health status, presence of any occupational disease and hearing impairments. Under this circumstance, in consultation of the scientists of National Institute of Occupational Health (NIOH) and the concerned officers of Bharat Coking Coal Limited, it was decided that an epidemiological study would be carried out involving workers involved in mining activities.

OBJECTIVES

5. To understand health status of workers through questionnaire survey, health examination.
6. To study respiratory health in coal field mining workers.
7. To assess ventilatory functions of coal field mining workers.
8. To analyze hearing ability through audiometric evaluation.

METHODOLOGY

An occupational health study was conducted involving different mines of Cluster 11 and 15 of Bharat coking Coal Limited, Dhanbad. This study was undertaken among the exposed workers mainly from active mining activity. Representative sample from workers working in such occupations is included in this study. Initially the aim of the study was explained to the workers, informed consent was obtained after which they were enrolled for this study. Every individual subject was interviewed with a pre-designed questionnaire to collect information in relation to personal, occupational and morbidity details of the workers. The participants of this study were subjected to following interview/examination/investigations:

- Detailed personal, occupational and medical history.
- Clinical examination with special emphasis on examination of respiratory system.
- Haematological examination.
- Lung function test.
- Audiometry.
- Ophthalmological assessment.

Study design: Cross sectional study

Study subjects: This study covered 351 subjects from Kustore sector and 140 subjects from Bagmara sector of BCCL Collieries. Among the subjects of Kustore sector 49 were from Kachi Balihari mines, 51 from Bhagabandh mines, 40 from Gopali Chawk mines and 100 from Munidi mines. PB project mines contributed 111 subjects. Similarly among the subjects of Bagmara sector, Kharkharee mines and Phularitand mines contributed 75 subjects and 65 subjects respectively. Workers actively involved in mining actively were mainly included in this study. However, few subjects of this study were enrolled from supervisory staffs in order to have a complete and comprehensive understanding of the occupational health condition. These workers were randomly selected from the total workforce in the selected clusters and mines.

Data collection: The information regarding demographic, occupational and clinical history was collected on a pre-designed and pre-tested proforma through interview of subject. This was followed by complete clinical examination, spirometry, audiometry and chest radiography of each subject. The audiometer and spirometer were brought by NIOH team while for chest radiography the facilities at BCCL hospitals were used. The processing of exposed films was done by the technicians at BCCL hospital. The ophthalmological examination and haematological – biochemical estimations were also done using facilities and expertise at BCCL hospitals.

Data analysis: Data entry and analysis were done in standard statistical software. The statistical analysis included calculation of differences, proportions and application of tests of significance etc, to ascertain health effects especially respiratory health conditions.

RESULTS

- This study covered 351 subjects from Kustore sector and 140 subjects from Baghmara sector of BCCL Collieries. Mean age of the workers was 45.9 ± 8.36 years. Most of the workers were between 35-54 years age. Mean job experience was 11.72 ± 8.49 years.

- Most common symptoms complained by study subjects were musculoskeletal pain (34%). Other complaints were Cough, difficulty in breathing, chest pain, soreness of mouth etc. Headache, sleep disturbance, weakness, tremor in fingers was also experienced by some subjects.

- About 20% subjects had systolic blood pressure >140 as well as diastolic blood pressure > 90 mm of Mercury. 9% workers had only higher systolic blood pressure and 11% had only higher diastolic blood pressure.

- As far as pulmonary functional status of study subjects in concerned, about 3% subjects had restrictive type of abnormality (FVC/PFVC < 80%) and 0.6 % subjects had combined type of abnormality (FVC/PFVC <80 % and FEV1% <70%). A good number of subjects (36.5%) had FEV1% values between 70% and 80%. Mean FVC values were significantly lower among the subjects of age 45 years or above.

- So far as chest radiographic findings are concerned, 93% subjects had findings within normal limits. 3% subjects showed findings suggestive of opacities in lung and almost 1.5% had other features on chest X-ray (mostly suggestive of Koch's infection of lung). Such findings may be due to pneumoconiotic changes in lung, hence these subjects should be properly followed up and necessary medical, ethical, legal, administrative actions may be initiated as necessary.

- Haematological and biochemical findings of the subjects were mostly within normal limits. Almost 11% workers had random blood sugar level more than 140 units. As far as ophthalmological findings are concerned, 5% subjects had uncorrected vision and 9% subjects had Cataract in eyes.

- Decline in hearing ability with increasing duration of exposure was observed more at higher frequency; however, this observation is subject to adjustment for age and other probable factors.

- The subjects for this study are selected from workplaces identified by BCCL, Govt. of India, as required for the purpose of this study. The findings of this study may thus be restricted to the concerned workplaces and may not be generalisable.

RECOMMENDATION

- Prevalence of musculoskeletal pain during work in a good number of workers reflects that manual work of the work processes might be causing some discomfort for the workers. Training on proper method of manual material handling may prove useful of these workers. On the other hand regular proper exercise should be promoted among workers especially supervisory employees to get rid of ill effects of sedentary activities.

- Special emphasis should be given to protection of respiratory health, hearing ability. Periodic relevant examination (lung function test, audiometry) at regular interval is recommended.

- Industrial hygiene survey (periodic monitoring of dust and other environmental hazards) at regular interval should be undertaken including noise level monitoring in different operations.

- Some prevalent symptoms observed may be representation of nervous system effect due to exposures to toxicants. In order to exclude the possibility of exposure from occupational environment, environmental study should include assessment of exposure to metals.

- Measures like using protective appliances (e.g. PPEs), pre-placement- and periodic medical examination, for the control and prevention of relevant health hazards, are to be implemented and maintained by all the mining areas to protect the health of the workers.

ANNEXURE

(Sample proforma for undertaking occupational health studies)

Study of occupational diseases and hearing impairments of coalmine workers directly involved in active mining operations

Date:□□/□□/□□□□ Code No.□□□

PERSONAL AND RESIDENTIAL INFORMATION

Name: _____

Age (completed years): Sex: 1.Male 2. Female

Marital status: 1. Single 2. Married 3. Divorcee 4. Widow(er)

Education: 1) Illiterate 2) 1-4 3) 5-10 4) 11-12 5) College

Number of family members: Mine Name._____

Residential address: _____

Smoking history: 1) Non-smoker 2) Smoker 3) Past smoker

A. ***Type of smoking***: 1) Beedi 2) Cigarette 3) Other (specify)

B. ***Frequency (Number per day)*** C. ***Duration (years)***

Reason from Abstaining From Smoking: 1. Respiratory Problem 2.Any Other Reason

Do You Chew Tobacco: 1. Yes 2. No If Yes, Duration (Yrs.) Frequency: No/day

Do You Drink Alcohol?: 1. Yes 2. No If yes, Duration (Yrs)

Frequency: 1. Regularly 2. Occasionally

OCCUPATIONAL HISTORY

Since how many years you are working in this job

Present Occupational History

No	Designation	Nature of job	Duration (years)
1.			
2.			
3.			

Past Occupational History

No	Designation	Nature of job	Duration (years)
1.			
2.			
3.			

PAST MEDICALHISTORY:

Have you suffered from any of the following diseases in the past?

PTB☐Chronic bronchitis☐Recurrent cough and cold☐Bronchial asthma☐HT☐Jaundice☐CKD☐

Any other major illness 1. No 2. Yes☐If yes, specify _____

Family history: Has anybody in your family or blood relation suffered from any of the following diseases? (Also mention the relationship)

PTB☐Chronic bronchitis☐Recurrent cough and cold☐Bronchial asthma☐HT☐Jaundice☐CKD☐

Any other major illness 1. No 2. Yes☐If yes, specify _____

PRESENT MEDICAL HISTORY:

Cough:Do you have cough? 1. No 2. Yes☐If 'Yes',Is it Productive☐Non productive☐
If productive go to next symptom

Phlegm:Do you usually bring up phlegm from your chest first thing in the morning? 1. No 2. Yes☐
(If 'Yes, please go to the next question. If 'No', go to the next symptom)

Do you bring up phlegm like this on most days for as much as 3 months per year? 1 No 2.Yes☐
If yes since how many years☐☐
Have you ever coughed up blood in sputum? 1. No 2. Yes☐
If 'Yes', when did you have the last haemoptysis (weeks back)?☐☐

Dyspnoea: Do you suffer from breathlessness? 1. No 2.Yes☐*(If 'Yes', go to next question. If 'No' go to next symptom)*

Are you ever troubled by shortness of breath, while hurrying on the level or walking up a slight hill?
1. No 2. Yes ☐ *(If 'No', grade is 1. If 'Yes', proceed to next question)*

Do you get short of breath while walking with a person of approximately your age and sex?
1. No 2. Yes ☐ *(If 'No', grade is 2. If 'Yes', proceed to next question)*

Do you have to stop for breath when walking at your pace on the level?
1. No 2. Yes ☐ *(If 'No', grade is 3. If 'Yes', proceed to next question)*

Are you short of breath while washing or dressing up or other routine activity?1. No 2 Yes☐
(If 'No', grade is 4. If 'Yes', grade is 5)

Final assessment of the grade of dyspnoea (grade 1-5) ☐
Do you have attacks of breathlessness at night? 1. No 2. Yes☐

Chest pain:Do you have chest pain? 1. No 2. Yes☐*(If 'Yes', go to the next question. If 'No', go to next symptom.)*

Is it increased by deep inspiration/Coughing/Sneezing 1. No 2. Yes☐

Mention the site(s) of chest pain _____
Any other information, specify_____

Do you have following symptoms

Symptom	1.Present/ 2.Absent	Duration (years)	Symptom	1.Present/ 2.Absent	Duration (years)
GENERAL AND SKIN			**D. MUSCULOSKELETAL**		
Tiredness	☐	☐☐	Muscle cramps	☐	☐☐
Weight loss	☐	☐☐	Muscle pains	☐	☐☐
Recurrent infections	☐	☐☐	Backache	☐	☐☐
Skin rashes	☐	☐☐			
Itching	☐	☐☐	**E. CENTRAL NERVOUS SYSTEM**		
ORAL CAVITY AND G.I.TRACT			Headache	☐	☐☐
Excessive salivation	☐	☐☐	Dizziness	☐	☐☐
Loose teeth	☐	☐☐			
Soreness of throat	☐	☐☐	Difficulty in hearing	☐	☐☐
Soreness of mouth	☐	☐☐	Difficulty in speech	☐	☐☐
			Irritability	☐	☐☐
Loss of appetite	☐	☐☐	Inability to concentrate	☐	☐☐
Nausea	☐	☐☐	Forgetfulness	☐	☐☐
Vomiting	☐	☐☐			
Diarrhoea	☐	☐☐	Sleep difficulty / disturbances	☐	☐☐
Colicky pain in abdomen	☐	☐☐	Muscular weakness	☐	☐☐
RENAL			Tingling in extremities	☐	☐☐
Decreased urine	☐	☐☐	Numbness in extremities	☐	☐☐
Hematuria	☐	☐☐			
Edema over face	☐	☐☐	Tremors	☐	☐☐
			Convulsions	☐	☐☐

MEDICAL EXAMINATION

General Examination

Height(cms):_____ Weight (kgs):_____Pulse/min:☐☐☐

BSA (m^2)_____ Pallor: 1.Present 2. Absent☐

B P: Systolic:_____mm/Hg Diastolic: _____ mm/Hg

Nails: 1. Normal 2. Abnormal Specify_____

Cyanosis: 1. Present 2. Absent Others(oedema, LNpathy, varicose etc.): 1. Present 2. Absent

Skin: 1. Normal 2. Abnormal ☐ Specify abnormality _____

Mouth and lips: 1. Normal 2. Angular stomatitis 3.Pigmentation 4.Ulceration 5. Blue line over gums

Systemic Examination

Respiratory System

Inspection: 1. Normal 2. Abnormal ☐ Specify abnormality _____

Palpation: 1. Normal 2. Abnormal ☐ Specify abnormality _____

Percussion: 1. Normal 2. Abnormal ☐ Specify abnormality _____

Auscultation: 1. Normal 2. Abnormal ☐ Specify abnormality _____

Intensity: 1. Normal 2.Increased 3. Decreased ☐

Character: 1. Vesicular 2.Broncho-vesicular 3. Bronchial ☐

Added sounds: 1. Fine crepts 2.Coarse crepts 3.Rhonchi 4. Rub ☐

Basal Crepitations: 1. Present 2. Absent ☐

If present, which side: 1. Right 2. Left ☐

Other Systems

Abdomen: Liver: 1. Normal 2.Enlarged ☐ Spleen: 1. Normal 2.Enlarged

CVS: 1. Normal 2. Abnormal ☐ Specify abnormality _____

CNS: Higher functions: 1. Normal 2. Abnormal ☐ Specify abnormality _____

Tremors: 1. Present 2. Absent ☐ If present, specify_____

Motor system abnormality: 1. Present 2. Absent If present, specify_____

Sensory system abnormality: 1. Present 2. Absent If present, specify_____

Abnormal Reflexes: 1. Present 2. Absent If present, specify_____

Any other abnormality 1. Present 2. Absent If present, specify_____

PULMONARY FUNCTION TESTS

Physical Characteristics:

1. Age: _____Yrs. 2. Height: _____Cm 3. Weight: _____Kg. 4. BSA: _____m^2

Pulmonary Function Test

SVC_____(l) FVC_____(l)
FEV 1.0_____(l) FEV1.0/FVC_____
FEF0.2 – 1.21_____(l/s) FEF 25 -75 %_____(l/s)
FEF 75 – 85 %_____(l/s)
PEFR _____(l/m)

PFT Diagnosis. 1. Normal 2.Obstructive 3.Restrictive 4. Combined ☐

X Ray findings: _____

Final Diagnosis: _____

GROUNDWATER LEVEL & QUALITY REPORT

FOR CLUSTER OF MINES, BCCL

(Assessment year – 2020-21)

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

JHARIA COALFIELD AND RANIGANJ COALFIELD (PART)

For

(BHARAT COKING COAL LIMITED)

(A Subsidiary of Coal India Limited)

KOYLA BHAWAN (DHANBAD)

Prepared by
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(Accredited by NABL, valid upto: 2022)

(Accredited as a FAE in (HG) by QCI-NABET, valid upto: Aug'2021)

CONTENT

LIST OF TABLES

K. GROUND WATER LEVEL OF CLUSTER-XI

Cluster–XI consists of eight coal mines; Moonidih UG, Gopalichak UG Project, Kachi Balihari 10/12 Pit UG, Pootkee Balihari Project UG, Bhagaband UG, Kendwadih UG (closed), Pootkee UG (closed), Kachi Balihari 5/6 Pit UG (closed) are under the administrative control of Western Jharia Area of Bharat Coking Coal Limited (B.C.C.L - A Subsidiary of Coal India Limited). The Cluster- XI is located in central part of Jharia Coalfield in Dhanbad district of Jharkhand. The life of the project works out about upto 50 years considering annual target production of 6.604 MTPA (toposheet no. no. 73 I/5 7 73 I/6).

The present leasehold area of Cluster-XI is 3527.58 Ha. The area has an undulating topography with gentle slope towards south. The RL varies from 201 m to 166 m AMSL. Katri River, Jarian Nala, Ekra Jore and Kari Jore are controlling the drainage of the area. The area comes under the watershed of Katri River and Kari Jore.

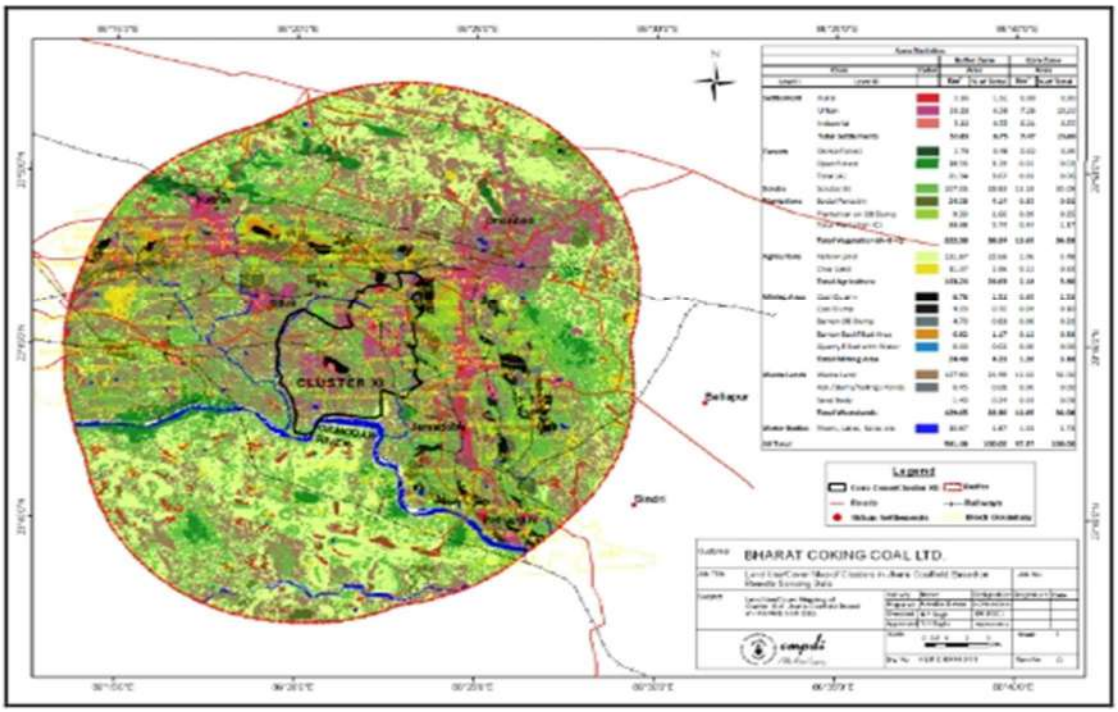
Monitoring stations (**A-17, A-18, A-20 and A-32**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has done in the months of May'20, August'20, and Nov'20 and January'21, the Ground water level data enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2020-21				2019-20				2018-19			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	Feb	May	Aug	Nov
1	A-17	Kachi Balihari	2.14	0.64	1.69	1.79	2.94	0.34	2.24	2.42	2.07	3.34	1.64	2.84
2	A-18	Baghaband	1.09	0.39	0.34	0.89	2.29	1.09	0.69	1.09	0.89	1.24	1.34	0.99
3	A-20	Gorbudih	8.47	1.44	3.87	4.42	4.57	3.32	1.82	4.02	3.59	4.57	1.92	2.57
4	A-32	Baludih	1.90	0.36	1.75	1.80	2.75	0.62	0.95	1.65	0.60	2.80	0.45	0.70
Average WL (bgl)			3.40	0.71	1.91	2.23	3.14	1.34	1.43	2.30	2.26	3.20	1.64	2.16

LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 0.62 m Max – 8.47 m
Post-monsoon GW Level (m): Min – 0.34 m Max – 3.87 m

LAND USE / LAND COVER MAP OF THE CLUSTER-XI MINES, BCCL



Sl no	Land Use Details	Existing (sq. meter)	Proposed (sq. meter)	Grand Total (sq. meter)
1	Green Belt Area	1060.61×10^4	1293.46×10^4	1293.46×10^4
2	Open Land	1518.33×10^4	1509.06×10^4	1509.06×10^4
3	Road/ Paved Area	171.08×10^4	171.08×10^4	171.08×10^4
4	Rooftop area of building/ sheds	777.56×10^4	563.06×10^4	563.06×10^4
5	Total	3527.58×10^4	3527.58×10^4	3527.58×10^4

Table–8B: Cluster wise Groundwater development scenario

Cluster/ Area	Adminis-trative Blocks/Stage Of GW Extraction	Total Water demand (cum/day)				Avg. GW level (bgl in m) 2020		GW level declining trend 2005-2020		Remarks
		Mine Discharge + BH pumping	Surface Water Source	Total Use (Domestic + Industrial)	Excess Or other use	Pre-monsoon	Post-monsoon	Pre-monsoon	Post-monsoon	
Cluster-I	Bermo (SOD: Over-exploited)	2173 (2065+108)	NIL	2112 (1698+414)	61	5.46	2.69	YES	YES	Recharge structure needed
Cluster-II	Baghmara (SOD: Critical)	8350	Jamunia river	6737 (2755+3982)	1613	5.83	2.17	NO	NO	Excess mine water needed to be utilized
Cluster-III		12760 (10960+1800)	NIL	8946 (7849+1097)	3814	4.91	1.96	NO	NO	
Cluster-IV		5900	MADA	5100 (3605+1495)	800	5.52	2.25	NO	NO	
Cluster-V		12690 (11025+1665)	MADA	11063 (5710+5353)	1897	4.18	1.67	YES	YES	
Cluster-VI	Dhanbad (SOD: Over-exploited)	4150	MADA	4150 (1664+2486)	0.0	7.50	3.49	YES	NO	--
Cluster-VII		21565	MADA	20826 (17596+3230)	739	5.56	3.71	YES	YES	Excess mine water needed to be utilized water
Cluster-VIII	Jharia (SOD: Over-exploited)	9320	MADA	5294 (3730+1564)	4026	6.03	3.16	NO	NO	
Cluster-IX		12980	MADA	9358 (4549+4809)	3622	5.81	4.28	NO	NO	
Cluster-X		11825	Damodar river	6201 (4255+1946)	5624	5.69	3.29	YES	NO	
Cluster-XI	Dhanbad (SOD: Over-exploited)	24960	MADA & DVC	19425 (14015+5410)	5535	3.40	1.91	NO	NO	
Cluster-XIII	Baghmara (SOD: Critical)	4815	Damodar river	4815 (4679+136)	0.0	6.80	3.22	NO	NO	--
Cluster-XIV		2600	NA	2550 (2412+138)	50	5.42	3.08	NO	NO	--
Cluster-XV		6200	NA	5941 (4600+1341)	259	3.83	2.63	NO	NO	--
Cluster-XVI	Nirsa (SOD:Safe)	1910	DVC (Barakar river)	1730 (1380+350)	180	3.18	3.13	NO	NO	--

MADA – Mineral Area Development Authority, Jharkhand, Dhanbad (payment basis).

DVC – Damodar Valley Corporation, Maithon/Panchet, Jharkhand (payment basis).

7.0 IMPACT OF MINING ON GROUND WATER REGIME

7.1 GENERAL CONSEQUENCES OF COAL MINES ON AMBIENT HYDROGEOLOGICAL REGIME

Mining of coal either by opencast or underground method is bound to incise one or more water bearing strata (aquifers) which in turn may result in depletion or draw down in water levels and a corresponding inflow of water into the mine workings. The potential effects of coal mining operations on the hydrogeological regime are as under:

- Creates disruption in formation/aquifer
- Dewatering of aquifers
- Change in hydraulic gradient
- Modification of recharge to aquifers
- Change in groundwater flow pattern

The general need in mine planning from the hydrogeological point of view is the estimation of make of water (ground water seepage) into the mine, its rate, the mine pumping capacity to meet the storm rainwater accumulation, extent of depression of water surface and management of mine effluent (mine water). It is also desirable that the consequences of mining operation on the groundwater regime be determined in advance. However, the mine pumping in most of the cases are passive dewatering for the safety of the mine pit, active mine dewatering is done in few cases for very high potential aquifers.

7.2 POTENTIAL CONSEQUENCES OF OPENCAST AND UNDERGROUND COAL MINES OF JHARIA COALFIELD ON HYDROGEOLOGICAL REGIME

Generally, in the opencast and underground mines of Jharia Coalfield, alluvium and overlying weathered mantle are the first to excavate followed by upper Barakar Formation / Aquifer. Since these formations vary in thickness, compaction and their constituents over the area, their aquifer properties also vary.

The porosity and the compactness in the sandstone controls the discharge from these aquifers. The alluvium and weathered Formation wherever loose and fragile possess more porosity and this has high groundwater potential. Due to the mine cut, the depression in the water table created. The initial discharges due to this depression is large in amount due to concentration of flow to that region. In the top zones, water table condition prevails and away from the opening in the stratified section, semi-confined conditions exist. With progress of mine operations, there is an increase in the depth of incision as a result; the semi-confined aquifers are also punctured.

During mining the hydraulic gradients generally, steeps down near mine i.e. within the mine influence area. In the up-dip region, only un-confined aquifer punctured through the mining process and thus only it

affected whereas in the down-dip region both un-confined and semi-confined aquifers may be affected. The confined aquifers of lower Barakar Formation in the mining area not punctured as it lies below the working coal seams and hence normally there is no noticeable effect in the aquifer related to this formation.

7.3 ESTIMATION OF RADIUS OF MINE INFLUENCE ZONE

Radius of Influence can defined as the radial distance from the center of the borehole to the point where there is no lowering of groundwater table/potentiometric surface.

The radius of influence (R) for Opencast and UG Mines within Jharia CF calculated by using Sichardt's formula based on present mining scenario.

$$R_0 = C^*(H-h) * \sqrt{(K)}$$

Where, R_0- Radius of influence (m), C - Constant =3000,

(H-h)- Drawdown (m), K – Hydraulic conductivity (m/s).

Here, K has used for Barakar Formations i.e. 0.05 m/d or 5.7 x 10^{-7} m/sec.

It may be appropriate to mention here that the presence of prominent boundaries/water bodies, faults or interfringing of sandstone and shale beds may restrict propagation of the drawdown cone. With the presence of low permeable beds such as clay/shale and younger coal seams in the formation, laying above the working seams the water level in the phreatic aquifer not directly affected. During the working of board and pillar method, subsidence takes place during the extraction of total coal (depillaring), both the phreatic and semi-confined aquifers get affected. Surface vigilance and filling up subsided zone, if any, has to constantly in view. The effect on groundwater level for most of the coal mine in Jharia coalfield has been observed in the down-dip side, generally within a distance upto 500 m and becomes milder/ negligible thereafter.

8.0 CONSERVATION MEASURES & FUTURE STRATEGY

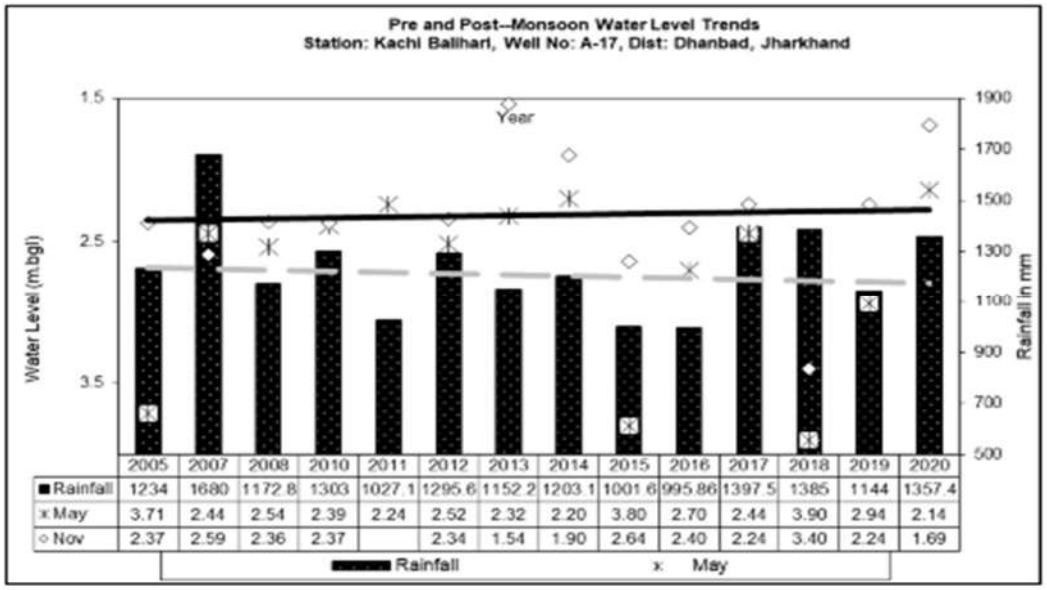
- BCCL has installed 25 Pressure Filter Plant of total capacity of 4.16 MGD to meet drinking water requirement nearby the area. At present 63 Water Treatment Plants are operational having capacity of 16.16 MGD within Jharia Coalfield area. Further installation of 28 more Pressure Filter Plants with the capacity of 5.84 MGD are in progress.

- BCCL participated in development of low cost technology for drinking water in a CSIR project along with CIMFR, Dhanbad and a pilot plant of 4000 Liters/hour is functional at PB Project site of BCCL. Similar plant has proposed at other sites of BCCL.
- A scheme entitled 'Scheme for multi-purpose utilization of surplus mine water of Barora Area, Block II and Govindpur Area of BCCL' was prepared with a view to harness the excess water discharge to take care of the persistence problem of water scarcity in the nearby villages. In the scheme, two water reservoirs of capacity 27 MG and 17 MG have been proposed in the non-coal bearing area for storage of 3250 GPM and 2000 GPM surplus mine water which will be fed through pipe line by mine discharge at mines of Barora, Block-II and Govindpur Area.
- Rooftop rainwater harvesting (RWH) will took up in the project area using the administrative buildings. 138 no. of quarters having roof-top area of about 14950 sq. m. is already prepared to harvest rainwater and around 13150 cum/annum of water is going to be recharged the nearby groundwater system through RWH structures. Proposal already made to facilitate this kind of RWH structure at suitable locations i.e. Lodna Area, Kusunda Area (Jawahar Nagar, Matkuria, Coal Board Colony), Sijua Area (Nichitpur and Tetulmari Colony) within Jharia Coalfield to augment groundwater recharge.
- After cessation of mining, with plenty rainfall and abundant ground water recharge, the water levels will recoup and attain normalcy. Thus, the impact of mining on groundwater system may considered as a temporary phenomenon. The abandoned mine workings (UG) behave as water pool and improves the resources availability in the coalfield area.
- Utilization of treated mine water discharge by both industry and local people in the mine influence area. The excess mine water can be used to recharge groundwater system through connecting pipeline to abandoned dug wells. Utilization of mine water for irrigation use will also enhance the ground water recharge potential through artificial recharge in the area.
- Increase vegetative cover by plantation in the mine area under land amelioration measures. This will contain the surface run-off and increase the groundwater recharge.
- Creation of awareness among workers and local peoples about Rainwater harvesting and artificial recharge will have priority. This aspect usually covered during the Environmental Week celebrated every year (5 to 12 June).
- 23 nos. of Piezometer proposed to install within JCF and RCF to monitor GW level (**Plate-III**).

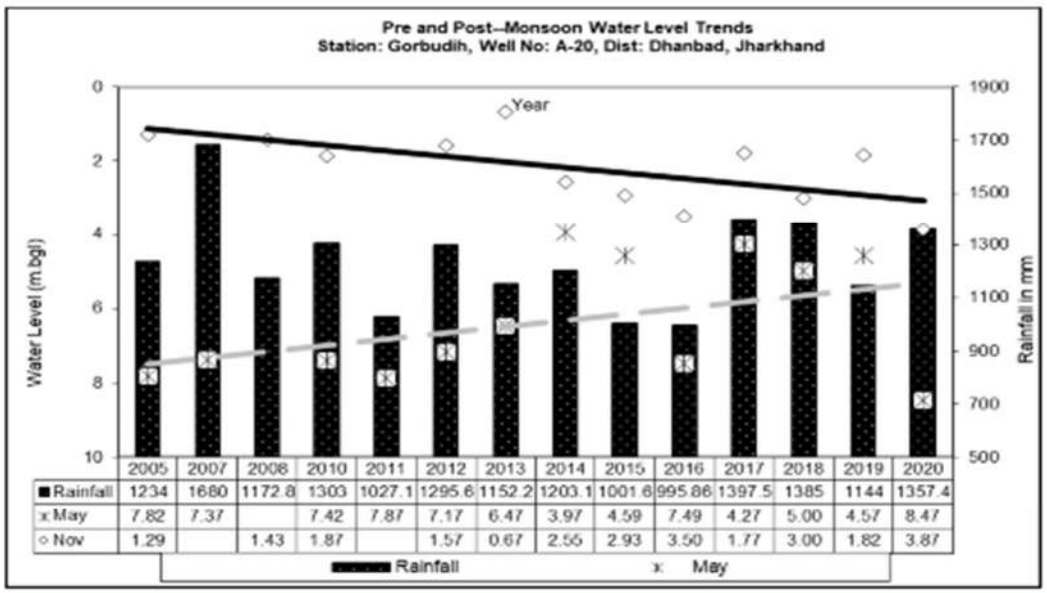
Monitoring of water quality of mine water discharge, local River/nala and domestic water source (dug well/hand pump wells) will continued under routine monitoring (May, August, November & Jan).

Annexure – VI

HYDROGRAPHS OF CLUSTER-XI



	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Rainfall	1234	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4
May	3.71	2.44	2.54	2.39	2.24	2.52	2.32	2.20	3.80	2.70	2.44	3.90	2.94	2.14
Nov	2.37	2.59	2.36	2.37		2.34	1.54	1.90	2.64	2.40	2.24	3.40	2.24	1.69



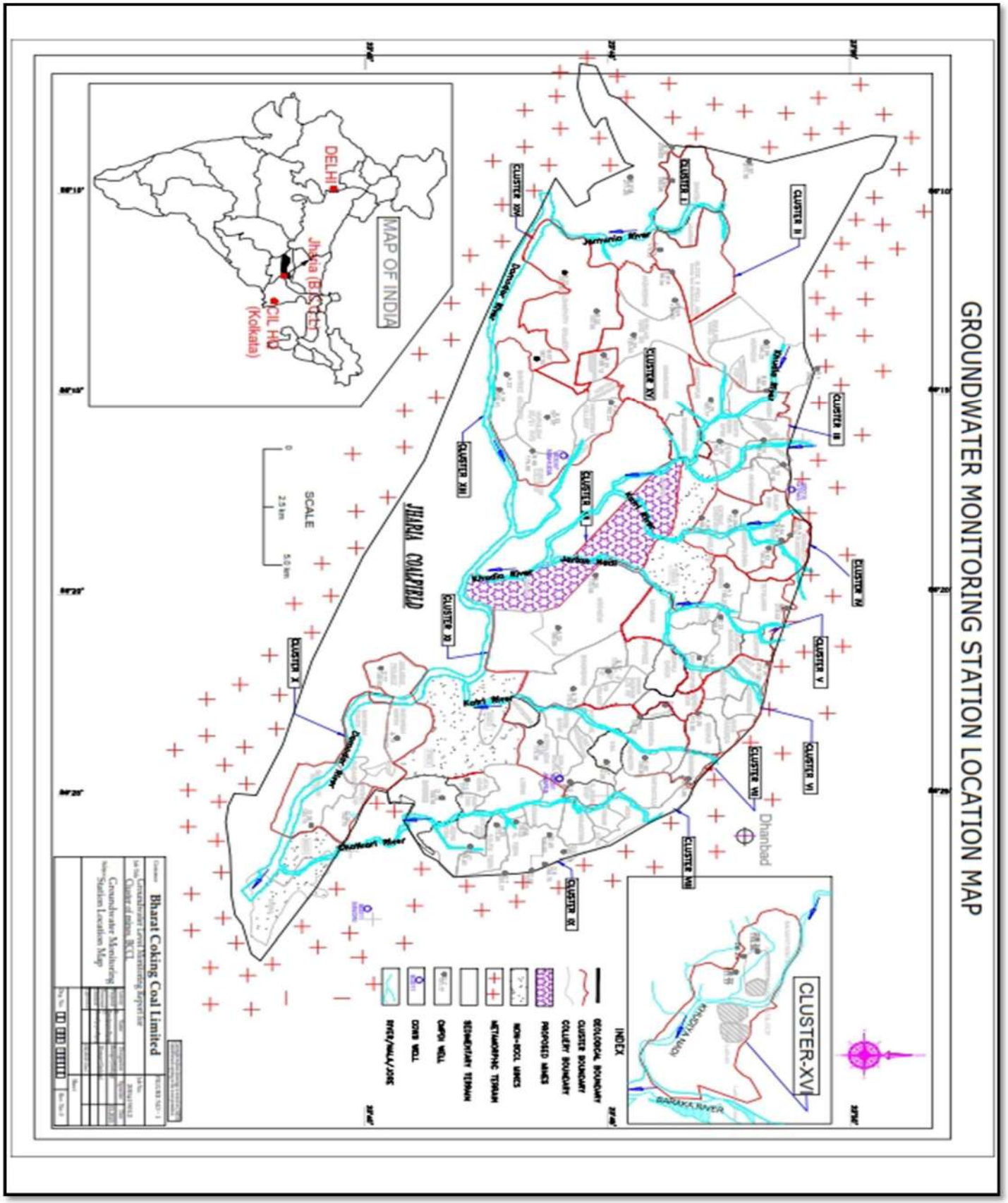
	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Rainfall	1234	1680	1172.8	1303	1027.1	1295.6	1152.2	1203.1	1001.6	995.86	1397.5	1385	1144	1357.4
May	7.82	7.37		7.42	7.87	7.17	6.47	3.97	4.59	7.49	4.27	5.00	4.57	8.47
Nov	1.29		1.43	1.87		1.57	0.67	2.55	2.93	3.50	1.77	3.00	1.82	3.87

Annexure – VIII

GROUNDWATER SAMPLE LOCATION DETAILS

Sampling month: June month of the assessment year of 2020-21

Sl No	Name of Cluster	Ground Water Sample	Dug well (CMPDI)	Location	Sampling Date
					June'2020
1	CLUSTER-I	GW-1	B-15	BERA VILLAGE	01.06.2020
2	CLUSTER-II	GW-2	B-59	KHODOVALY VILLAGE	01.06.2020
3	CLUSTER-III	GW-3	A-29	GOVINDPUR,AMBAGAN VILLAGE	01.06.2020
4	CLUSTER-IV	GW-4	B-63	KESHALPUR, BATIGHAR	01.06.2020
5	CLUSTER-V	GW-5	D-30	BORKIBOA VILLAGE	01.06.2020
6	CLUSTER-VI	GW-6	D-25	GODHUR MORE	01.06.2020
7	CLUSTER-VII	GW-7	D-80	DHANSAR MINE RESCUE STN.	02.06.2020
8	CLUSTER-VIII	GW-8	D-49	NEAR GHANOODIH OC	02.06.2020
9	CLUSTER-IX	GW-9	D-5	JEALGORA, NEAR P.O.	02.06.2020
10	CLUSTER-X	GW-10	D-35	PATHERDIH RLY. COLONY	02.06.2020
11	CLUSTER-XI	GW-11	A-32	MONNIDIH BAZAR	01.06.2020
12	CLUSTER-XIII	GW-13	A-23	MACHHAYARA	01.06.2020
13	CLUSTER-XIV	GW-14	B-23	LOHAPATTI VILLAGE	01.06.2020
14	CLUSTER-XV	GW-15	B-32A	MADHUBAND VILLAGE	01.06.2020
15	CLUSTER-XVI	GW-16	DB-22	DAHIBARI,NICHE BASTI	02.06.2020


GROUNDWATER MONITORING STATION LOCATION MAP
MAP OF INDIA
DELHI
Jharia (BCCL)
CIL HQ (Kolkata)
JHARIA COALFIELD
SCALE
CLUSTER-XVI
Dhanbad
INDEX
Bharat Coking Coal Limited
Groundwater Monitoring Station Location Map

ANNEXURE-X

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

CORPORATE ENVIRONMENTAL POLICY

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

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

- Conduct mining and associated operations in an environmentally responsible manner to comply with applicable laws and other requirements related to environmental aspects.
- Design projects with due consideration of Sustainable Development by integrating sound environmental management practices in all our activities.
- Prevent pollution of surrounding habitation by continuous monitoring and adopting suitable measures for environment protection.
- Ensure compliance of all applicable Environmental and Forest Clearance conditions and other statutory conditions issued by regulatory agencies.
- Implement the Environmental Management Plans in all our mines effectively to mitigate pollutions on air, water and noise; proper disposal of wastes and reclamation and ecological restoration of degraded land; and by also dovetailing the Jharia action/ Master Plan for dealing with Fires, Subsidence and Rehabilitation of affected people with the Environmental Management Plans under the Cluster Concept.
- Strive to conserve Bio-Diversity through Ecological restoration methods.
- Conserve natural resources through recycling of wastes on the principle of Reduce, Recycle and Reuse. Put special thrusts on efficient energy utilization as a measure to reduce carbon foot-print.
- Strive for continual improvement in our environmental performances by setting targets, measuring progress and taking corrective action.
- Create environmental awareness among the employees and the local communities through pro-active communication and training and encourage our business associates to adopt similar approach for environmental protection.

Place: Dhanbad
Date: 25.5.12

Chairman-cum-Managing Director

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

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

(FOR THE MONTH OCTOBER, 2020)

E. C. no. J-11015/77/2011-IA.II (M) dated 26.07.2019

CMPDI

ISO 9001 Company

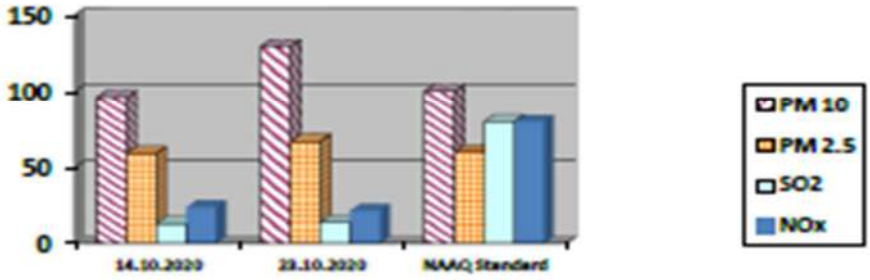
Regional Institute-II

Dhanbad, Jharkhand

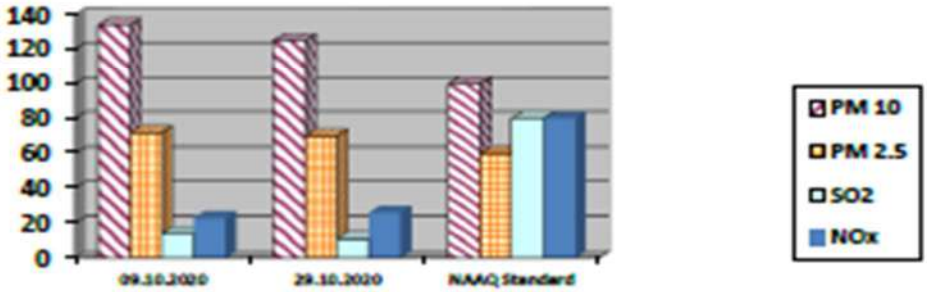
AMBIENT AIR QUALITY DATA

Cluster –XI, Bharat Coking Coal limited Month: OCT ,2020 Year: 2020-21.

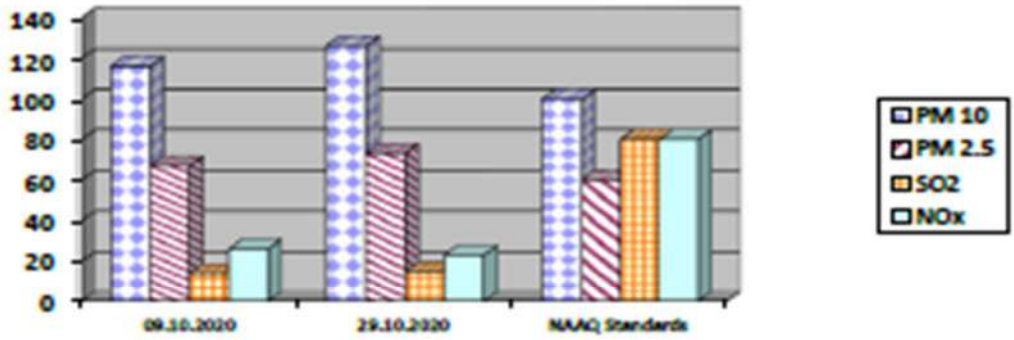
StationNameA16-Pootkee Balihari office		Zone: Core		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_X
1	14.10.2020	96	59	13	24
2	23.10.2020	129	67	14	22
	NAAQ Standard	100	60	80	80



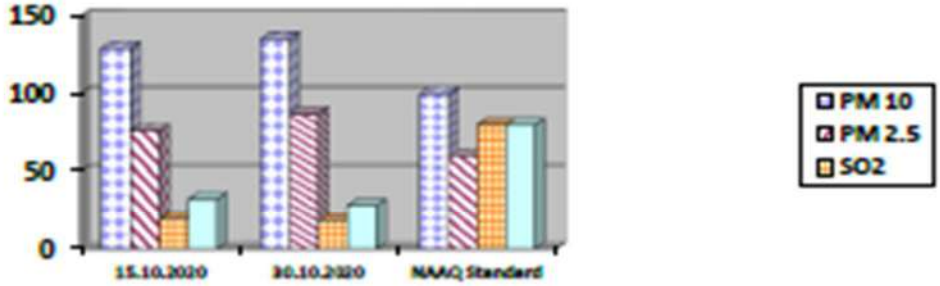
Station Name: A17- Moonidih UGP		Zone: Core		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_X
1	09.10.2020	134	72	14	23
2	29.10.2020	125	70	11	26
	NAAQ Standard	100	60	80	80



Station Washery	Name:A29-Moonidih	Zone: Core		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	09.10.2020	116	67	14	26
2	29.10.2020	126	73	15	23
	NAAQ Standards	100	60	80	80



StationName: Kusunda OCP (A10)		Zone: Buffer		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_X
1	15.10.2020	129	76	19	32
2	30.10.2020	135	87	18	28
	NAAQ Standard	100	60	80	80



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

Analysed By
ASA/SA/SSA

Checked By
Lab In Charge
M.E, CMPDI, Dhanbad

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

WATER QUALITY MONITORING

3.1 Location of sampling sites

(Refer Plate No. – II)

i) **Mine Discharge of Bhagabandh (MW11)**

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

3.2 Methodology of sampling and analysis

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

3.3 Results & Interpretations

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

WATER QUALITY DATA

(EFFLUENT WATER- FOUR PARAMETERS)

Name of the Cluster: Cluster-XI		Month: OCT, 2020	Name of the Station: Mine Discharge of Bhagabandh	
Sl. No.	Parameters	MW11 First Fortnight	MW11 Second Fortnight	As per MOEF General Standards for schedule VI
		05.10.2020	27.10.2020	
1	Total Suspended Solids	39	44	*100 (Max)*
2	pH	7.81	7.99	*5.5 - 9.0*
3	Oil & Grease	<2.0	<2.0	*10 (Max)*
4	COD	32	28	*250 (Max)*

All values are expressed in mg/lit except pH.

NOISE LEVEL QUALITY MONITORING

4.1 Location of sampling sites

1. Pootkee Balihari Office (N16)
2. Moonidih UGP (N17)
3. Moonidih Washery (N29)
4. Kusunda OCP (N10)

Methodology of sampling and analysis

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

4.2 Results & Interpretations

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

NOISE LEVEL DATA

Name of the Project: Cluster -XI			Month: OCT, 2020		
Sl. No.	Station Name/Code	Category of area	Date	Noise level dB(A)LEQ	*Permissible Limit of Noise level in dB(A)
1	Pootkee Balihari Office (N16)	Industrial area	14.10.2020	58.1	75
2	PootkeeBalihari Office (N16)	Industrial area	23.10.2020	55.7	75
3	MoonidihUGP (N17)	Industrial area	09.10.2020	53.2	75
4	MoonidihUGP (N17)	Industrial area	29.10.2020	58.2	75
5	Moonidih Washery (N29)	Industrial area	09.10.2020	60.7	75
6	Moonidih Washery (N29)	Industrial area	29.10.2020	62.6	75
7	KusundaOCP (N10)	Industrial area	15.10.2020	57.7	75
8	KusundaOCP (N10)	Industrial area	30.10.2020	66.1	75

Permissible limits of Noise Level as per MOEF Gazette Notification No. GSR 742(E) dt. 25.09.2000 Standards for Coal Mines and Noise Pollution (Regulation and Control) Rules, 2000.

* Day Time: 6.00 AM to 10.00 PM.

Analysed By
JSA/SAS/SSA

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

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

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

(FOR THE MONTH NOVEMBER, 2020)

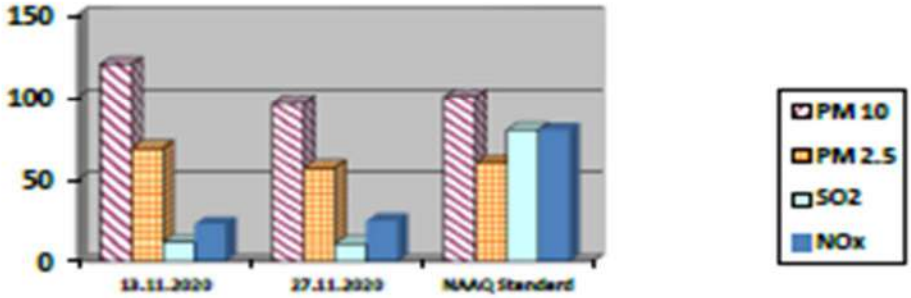
E. C. no. J-11015/77/2011-IA.II (M) dated 26.07.2019

CMPDI
ISO 9001 Company
Regional Institute-II
Dhanbad, Jharkhand

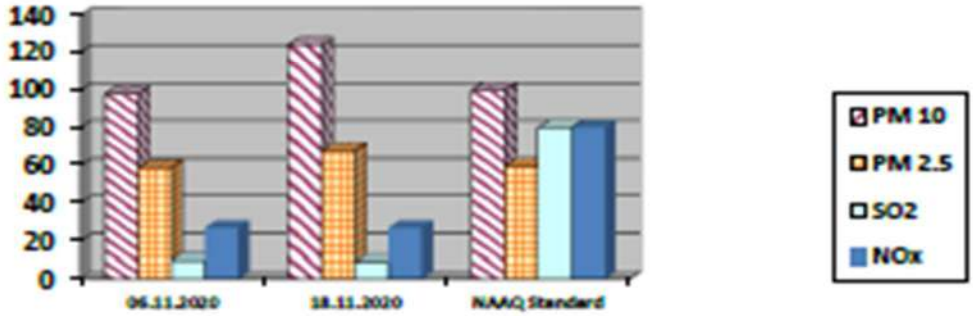
AMBIENT AIR QUALITY DATA

Cluster –XI, Bharat Coking Coal limited Month: NOV ,2020 Year: 2020-21.

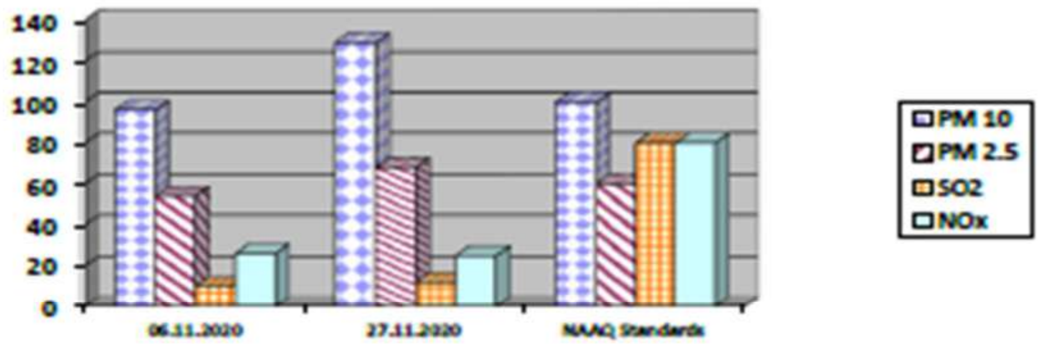
StationNameA16-Pootkee Balihari office		Zone: Core		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_X
1	13.11.2020	120	69	12	23
2	27.11.2020	96	57	11	25
	NAAQ Standard	100	60	80	80



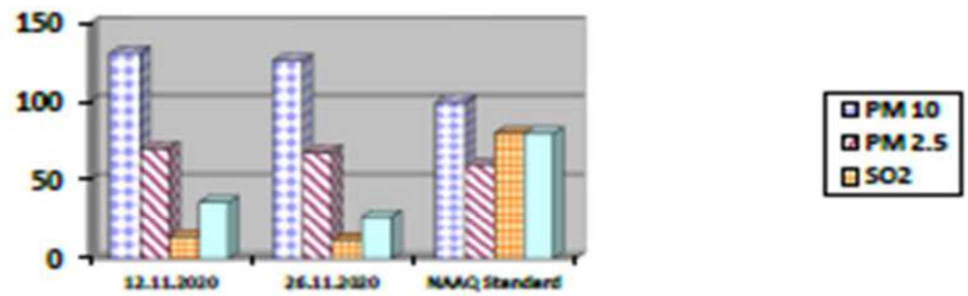
Station Name: A17- Moonidih UGP		Zone: Core		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_X
1	06.11.2020	98	59	10	27
2	18.11.2020	124	68	9	27
	NAAQ Standard	100	60	80	80



Station Washery Name:A29-Moonidih		Zone: Core		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	06.11.2020	96	54	10	26
2	27.11.2020	129	68	12	25
	NAAQ Standards	100	60	80	80



StationName: Kusunda OCP (A10)		Zone: Buffer		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_x
1	12.11.2020	131	70	14	36
2	26.11.2020	126	68	12	27
	NAAQ Standard	100	60	80	80



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

Analysed By JSA/SA/SSA

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

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

JOB NO. 200316028 Cluster –XI, BCCL Environmental Monitoring Report

WATER QUALITY MONITORING

3.1 Location of sampling sites

(Refer Plate No. – II)

i) **Mine Discharge of Bhagabandh (MW11)**

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

3.2 Methodology of sampling and analysis

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

3.3 Results & Interpretations

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

WATER QUALITY DATA

(EFFLUENT WATER- FOUR PARAMETERS)

Name of the Cluster: Cluster-XI		Month: NOV, 2020	Name of the Station: Mine Discharge of Bhagabandh	
Sl. No.	Parameters	MW11 First Fortnight	MW11 Second Fortnight	As per MOEF General Standards for schedule VI
		02.11.2020	16.11.2020	
1	Total Suspended Solids	47	44	*100 (Max)*
2	pH	7.45	8.23	*5.5 - 9.0*
3	Oil & Grease	<2.0	<2.0	*10 (Max)*
4	COD	32	24	*250 (Max)*

All values are expressed in mg/lit except pH.

NOISE LEVEL QUALITY MONITORING

4.1 Location of sampling sites

1. Pootkee Balihari Office (N16)
2. Moonidih UGP (N17)
3. Moonidih Washery (N29)
4. Kusunda OCP (N10)

Methodology of sampling and analysis

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

4.2 Results & Interpretations

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

NOISE LEVEL DATA

Name of the Project: Cluster -XI			Month: NOV, 2020		
Sl. No.	Station Name/Code	Category of area	Date	Noise level dB(A)LEQ	*Permissible Limit of Noise level in dB(A)
1	Pootkee Balihari Office (N16)	Industrial area	13.11.2020	58.1	75
2	PootkeeBalihari Office (N16)	Industrial area	27.11.2020	55.7	75
3	MoonidihUGP (N17)	Industrial area	06.11.2020	53.2	75
4	MoonidihUGP (N17)	Industrial area	18.11.2020	58.2	75
5	Moonidih Washery (N29)	Industrial area	06.11.2020	60.7	75
6	Moonidih Washery (N29)	Industrial area	27.11.2020	62.6	75
7	KusundaOCP (N10)	Industrial area	12.11.2020	57.7	75
8	KusundaOCP (N10)	Industrial area	26.11.2020	66.1	75

Permissible limits of Noise Level as per MOEF Gazette Notification No. GSR 742(E) dt. 25.09.2000 Standards for Coal Mines and Noise Pollution (Regulation and Control) Rules, 2000.

* Day Time: 6.00 AM to 10.00 PM.

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

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

(FOR THE MONTH DECEMBER, 2020)

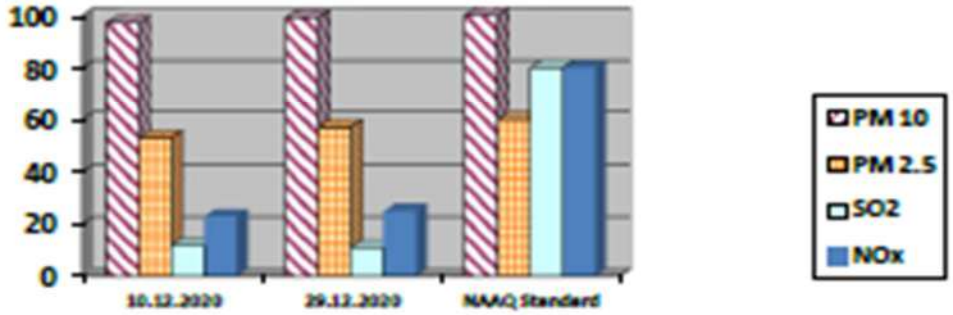
E. C. no. J-11015/77/2011-IA.II (M) dated 26.07.2019

CMPDI
ISO 9001 Company
Regional Institute-II
Dhanbad, Jharkhand

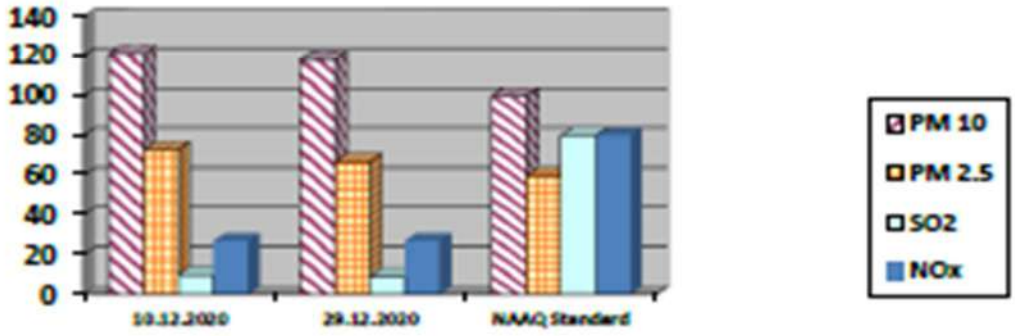
AMBIENT AIR QUALITY DATA

Cluster –XI, Bharat Coking Coal limited Month: DEC,2020 Year: 2020-21.

StationNameA16-Pootkee Balihari office		Zone: Core		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_x
1	10.12.2020	97	53	12	23
2	29.12.2020	99	57	11	25
	NAAQ Standard	100	60	80	80

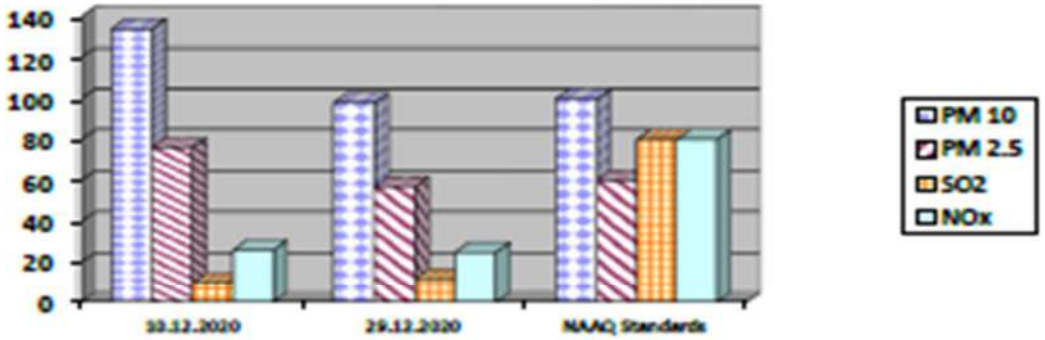


Station Name: A17- Moonidih UGP		Zone: Core		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_x
1	10.12.2020	121	73	10	27
2	29.12.2020	118	67	9	27
	NAAQ Standard	100	60	80	80

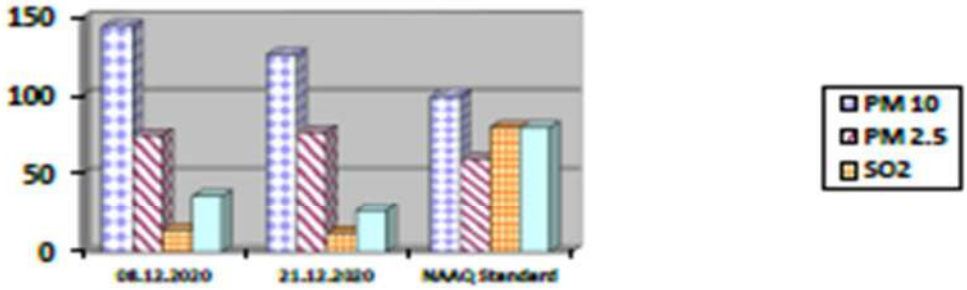


Approved By
HOD(In-charge) Environment
RI-2, CMPDI, Dhanbad

Station Name:A29-Moonidih Washery		Zone: Core		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	10.12.2020	134	76	10	26
2	29.12.2020	98	57	12	25
	NAAQ Standards	100	60	80	80



StationName: Kusunda OCP (A10)		Zone: Buffer		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_X
1	08.12.2020	144	75	14	36
2	21.12.2020	126	77	12	27
	NAAQ Standard	100	60	80	80



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

Analysed By
JSA/SA/RSA

Checked By
Unit In Charge
M.S. CMPDI, Dhanbad

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

WATER QUALITY MONITORING

3.1 Location of sampling sites

(Refer Plate No. – II)

i) **Mine Discharge of Bhagabandh (MW11)**

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

3.2 Methodology of sampling and analysis

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

3.3 Results & Interpretations

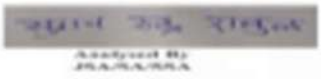
The results are given in tabular form along with the applicable standards. Results are compared with Schedule - VI, effluent prescribed by MoEF&CC. Results show that most of the parameters are within the permissible limits.

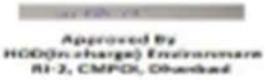
WATER QUALITY DATA

(EFFLUENT WATER- FOUR PARAMETERS)

Name of the Cluster: **Cluster-XI**		Month: **DEC, 2020**	Name of the Station: **Mine Discharge of Bhagabandh**	
Sl. No.	**Parameters**	**MW11** First Fortnight 07.12.2020	**MW11** Second Fortnight 28.12.2020	**As per MOEF General Standards for schedule VI**
1	Total Suspended Solids	33	37	*100 (Max)*
2	pH	8.16	8.15	*5.5 - 9.0*
3	Oil & Grease	<2.0	<2.0	*10 (Max)*
4	COD	36	32	*250 (Max)*

All values are expressed in mg/lit except pH.





NOISE LEVEL QUALITY MONITORING

4.1 Location of sampling sites

1. Pootkee Balihari Office (N16)
2. Moonidih UGP (N17)
3. Moonidih Washery (N29)
4. Kusunda OCP (N10)

Methodology of sampling and analysis

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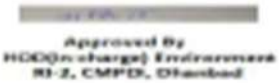
NOISE LEVEL DATA

Name of the Project: Cluster -XI			Month: DEC, 2020		
Sl. No.	Station Name/Code	Category of area	Date	Noise level dB(A)LEQ	*Permissible Limit of Noise level in dB(A)
1	Pootkee Balihari Office (N16)	Industrial area	10.12.2020	59.7	75
2	PootkeeBalihari Office (N16)	Industrial area	29.12.2020	57.6	75
3	MoonidihUGP (N17)	Industrial area	10.12.2020	57.1	75
4	MoonidihUGP (N17)	Industrial area	29.12.2020	59.3	75
5	Moonidih Washery (N29)	Industrial area	10.12.2020	57.2	75
6	Moonidih Washery (N29)	Industrial area	29.12.2020	55.8	75
7	KusundaOCP (N10)	Industrial area	08.12.2020	54.1	75
8	KusundaOCP (N10)	Industrial area	21.12.2020	58.1	75

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

Analysed By
JSA/SA/SSA

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



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

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CMPDI

ISO 9001 Company

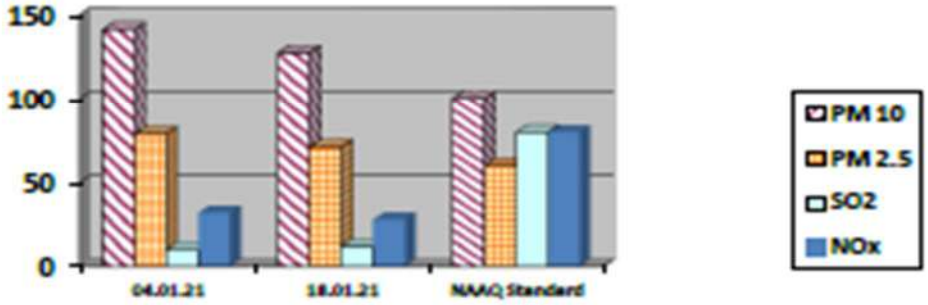
Regional Institute-II

Dhanbad, Jharkhand

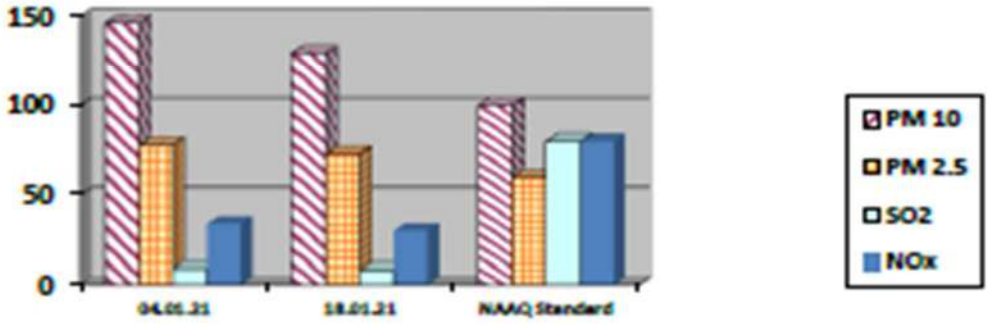
AMBIENT AIR QUALITY DATA

Cluster –XI, Bharat Coking Coal limited Month: JAN,2021 Year: 2020-21.

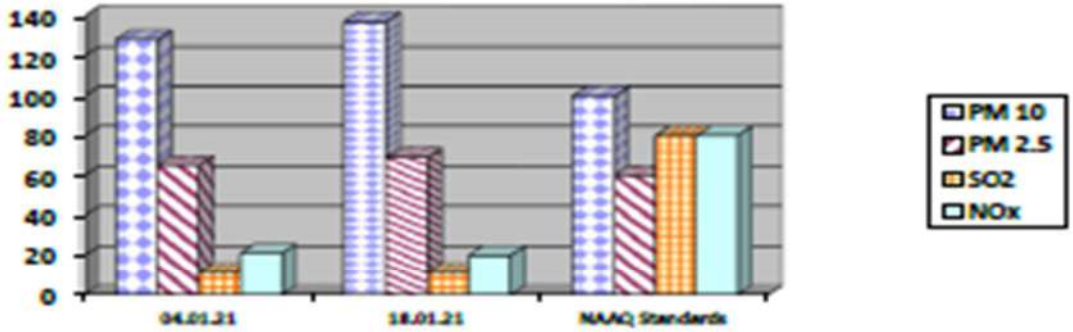
StationNameA16-Pootkee Balihari office		Zone: Core		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_x
1	04.01.21	141	79	10	32
2	18.01.21	127	71	12	28
	NAAQ Standard	100	60	80	80



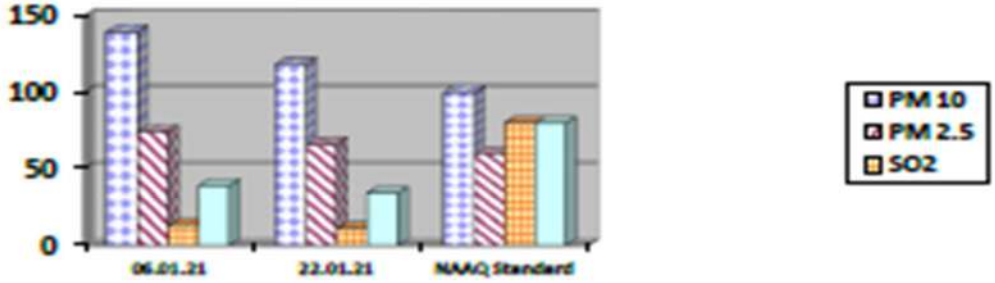
Station Name: A17- Moonidih UGP		Zone: Core		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_x
1	04.01.21	146	78	9	34
2	18.01.21	129	73	8	30
	NAAQ Standard	100	60	80	80



Station Name:A29-Moonidih Washery		Zone: Core		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	04.01.21	128	65	11	21
2	18.01.21	137	69	11	20
	NAAQ Standards	100	60	80	80



StationName: Kusunda OCP (A10)		Zone: Buffer		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_X
1	06.01.21	139	74	13	39
2	22.01.21	118	66	11	34
	NAAQ Standard	100	60	80	80



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

WATER QUALITY MONITORING

3.1 Location of sampling sites

(Refer Plate No. – II)

i) **Mine Discharge of Bhagabandh (MW11)**

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

3.2 Methodology of sampling and analysis

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

3.3 Results & Interpretations

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

WATER QUALITY DATA

(EFFLUENT WATER- FOUR PARAMETERS)

Name of the Cluster: Cluster-XI		Month: JAN,2021	Name of the Station: Mine Discharge of Bhagabandh	
Sl. No.	Parameters	MW11 First Fortnight	MW11 Second Fortnight	As per MOEF General Standards for schedule VI
		04.01.2021	25.01.2021	
1	Total Suspended Solids	36	38	*100 (Max)*
2	pH	8.14	8.08	*5.5 - 9.0*
3	Oil & Grease	<2.0	<2.0	*10 (Max)*
4	COD	16	20	*250 (Max)*

All values are expressed in mg/lit except pH.

Analysed By
JRA/SA/RRA

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

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

NOISE LEVEL QUALITY MONITORING

4.1 Location of sampling sites

1. Pootkee Balihari Office (N16)
2. Moonidih UGP (N17)
3. Moonidih Washery (N29)
4. Kusunda OCP (N10)

Methodology of sampling and analysis

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

4.2 Results & Interpretations

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

NOISE LEVEL DATA

Name of the Project: Cluster -XI			Month: JAN,2021		
Sl. No.	Station Name/Code	Category of area	Date	Noise level dB(A)LEQ	*Permissible Limit of Noise level in dB(A)
1	Pootkee Balihari Offioe (N16)	Industrial area	04.01.21	57.8	75
2	PootkeeBalihari Offioe (N16)	Industrial area	18.01.21	56.8	75
3	MoonidihUGP (N17)	Industrial area	04.01.21	57.2	75
4	MoonidihUGP (N17)	Industrial area	18.01.21	57.8	75
5	Moonidih Washery (N29)	Industrial area	04.01.21	58.3	75
6	Moonidih Washery (N29)	Industrial area	18.01.21	59.2	75
7	KusundaOCP (N10)	Industrial area	06.01.21	65.4	75
8	KusundaOCP (N10)	Industrial area	22.01.21	61.6	75

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

Analysed By
JSA/SA/SSA

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

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

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 –XI

(FOR THE MONTH FEBRUARY, 2021)

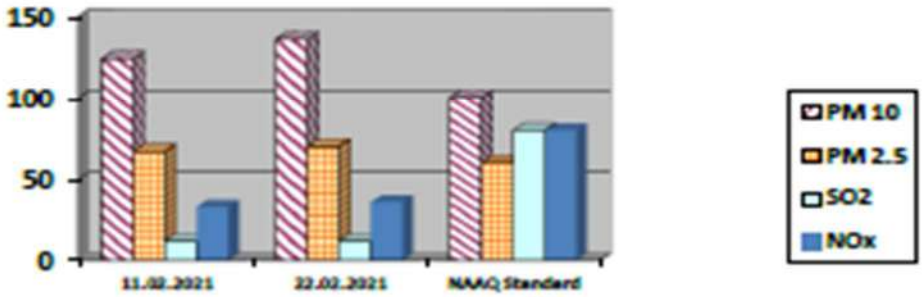
E. C. no. J-11015/77/2011-IA.II (M) dated 26.07.2019

CMPDI
ISO 9001 Company
Regional Institute-II
Dhanbad, Jharkhand

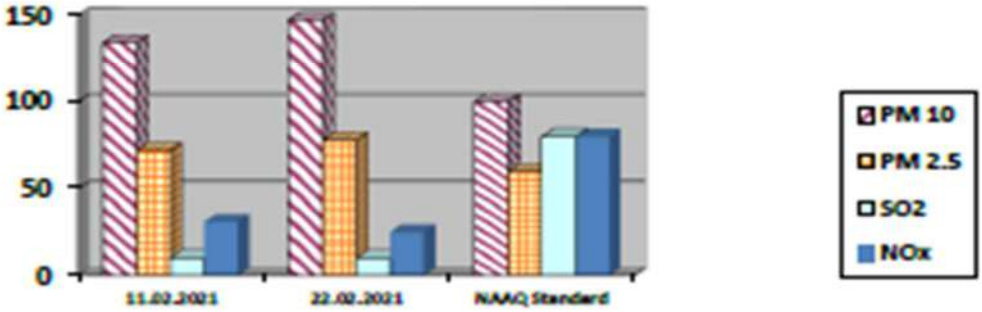
AMBIENT AIR QUALITY DATA

Cluster –XI, Bharat Coking Coal limited Month: FEB,2021 Year: 2020-21.

StationNameA16-Pootkee Balihari office		Zone: Core		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_x
1	11.02.2021	124	67	12	33
2	22.02.2021	136	70	12	36
	NAAQ Standard	100	60	80	80

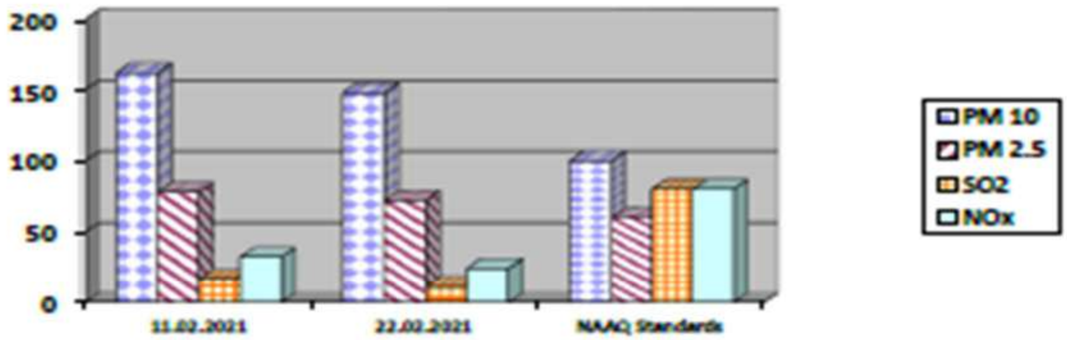


Station Name: A17- Moonidih UGP		Zone: Core		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_x
1	11.02.2021	134	72	10	31
2	22.02.2021	147	78	10	25
	NAAQ Standard	100	60	80	80

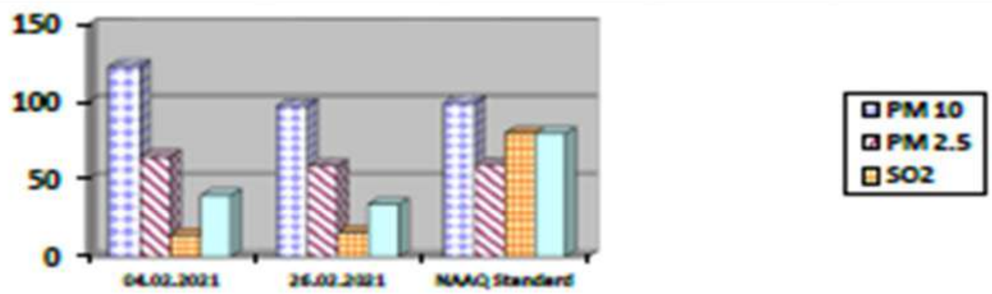


Approved By
HOD(In charge) Environment
RI-2, CMPDI, Dhanbad

Station Name:A29-Moonidih Washery		Zone: Core		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	11.02.2021	162	78	16	32
2	22.02.2021	148	72	11	24
	NAAQ Standards	100	60	80	80



StationName: Kusunda OCP (A10)		Zone: Buffer		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_x
1	04.02.2021	123	65	14	40
2	26.02.2021	98	59	16	34
	NAAQ Standard	100	60	80	80



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

Analysed By JSA/SA/SSA

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

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

WATER QUALITY MONITORING

3.1 Location of sampling sites

(Refer Plate No. – II)

i) **Mine Discharge of Bhagabandh (MW11)**

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

3.2 Methodology of sampling and analysis

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

3.3 Results & Interpretations

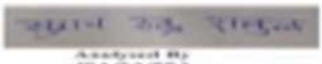
The results are given in tabular form along with the applicable standards. Results are compared with Schedule - VI, effluent prescribed by MoEF&CC. Results show that most of the parameters are within the permissible limits.

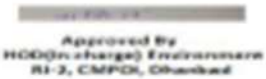
WATER QUALITY DATA

(EFFLUENT WATER- FOUR PARAMETERS)

Name of the Cluster: **Cluster-XI**		Month: **FEB,2021**	Name of the Station: **Mine Discharge of Bhagabandh**	
Sl. No.	**Parameters**	**MW11** First Fortnight	**MW11** Second Fortnight	**As per MOEF General Standards for schedule VI**
		09.02.2021	16.02.2021	
1	Total Suspended Solids	33	34	*100 (Max)*
2	pH	8.04	8.03	*5.5 - 9.0*
3	Oil & Grease	<2.0	<2.0	*10 (Max)*
4	COD	20	20	*250 (Max)*

All values are expressed in mg/lit except pH.





NOISE LEVEL QUALITY MONITORING

4.1 Location of sampling sites

1. Pootkee Balihari Office (N16)
2. Moonidih UGP (N17)
3. Moonidih Washery (N29)
4. Kusunda OCP (N10)

Methodology of sampling and analysis

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

4.2 Results & Interpretations

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

NOISE LEVEL DATA

Name of the Project: Cluster -XI			Month: FEB,2021		
Sl. No.	Station Name/Code	Category of area	Date	Noise level dB(A)LEQ	*Permissible Limit of Noise level in dB(A)
1	Pootkee Balihari Office (N16)	Industrial area	11.02.2021	58.2	75
2	PootkeeBalihari Office (N16)	Industrial area	22.02.2021	58.6	75
3	MoonidihUGP (N17)	Industrial area	11.02.2021	56.5	75
4	MoonidihUGP (N17)	Industrial area	22.02.2021	57.7	75
5	Moonidih Washery (N29)	Industrial area	11.02.2021	59.2	75
6	Moonidih Washery (N29)	Industrial area	22.02.2021	58.3	75
7	KusundaOCP (N10)	Industrial area	04.02.2021	55.9	75
8	KusundaOCP (N10)	Industrial area	26.02.2021	56.3	75

Permissible limits of Noise Level as per MOEF Gazette Notification No. GSR 742(E) dt. 25.09.2000 Standards for Coal Mines and Noise Pollution (Regulation and Control) Rules, 2000.

* Day Time: 6.00 AM to 10.00 PM.

Analysed By

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

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

ANNEXURE-XII

A. Training from (October'2020 - March'21)

No of employees (Departmental & Contractual) received training in Cluster XI (October'2020 - March'21)	
Types of Training	**Numbers**
Refresher Training	452
Special Training	553
Training of Contractual workers	190

B. PME report for cluster XI (P.B. Area and W.J.Area) from October'2020 - March'21

PME - Cluster XI	
Unit	**Numbers**
Gopalichuck, Pootkee, Bhagabandh, KB 10-12, PBP colliery, P.B. Area Office, etc.	486
Moonidih Colliery and W.J.Area (Departmental)	244
Moonidih Colliery (Contractual) IME+PME	113

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

(FOR THE MONTH MARCH, 2021)

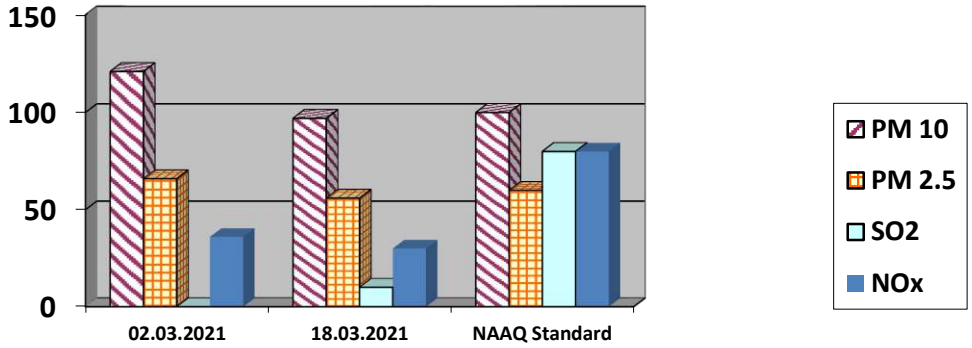
E. C. no. J-11015/77/2011-IA.II (M) dated 26.07.2019.

CMPDI
ISO 9001 Company
Regional Institute-II
Dhanbad, Jharkhand

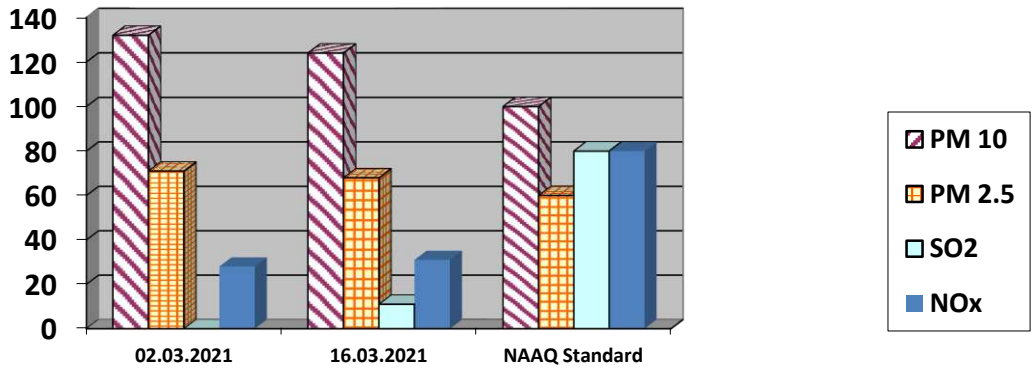
AMBIENT AIR QUALITY DATA

Cluster –XI, Bharat Coking Coal limited Month: **MAR,2021** Year: **2020-21.**

StationNameA16-Pootkee Balihari office		Zone: Core		Category: Industrial	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO_2**	**NO_X**
1	02.03.2021	121	66	<10	36
2	18.03.2021	97	56	10	30
	NAAQ Standard	100	60	80	80



Station Name: A17- Moonidih UGP		Zone: Core		Category: Industrial	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO_2**	**NO_X**
1	02.03.2021	132	71	<10	28
2	16.03.2021	124	68	11	31
	NAAQ Standard	100	60	80	80

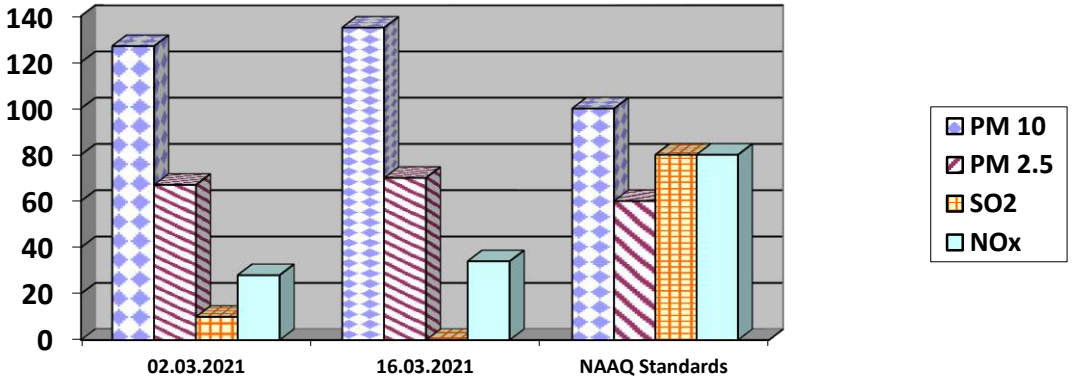


Analysed By
JSA/SA/SSA

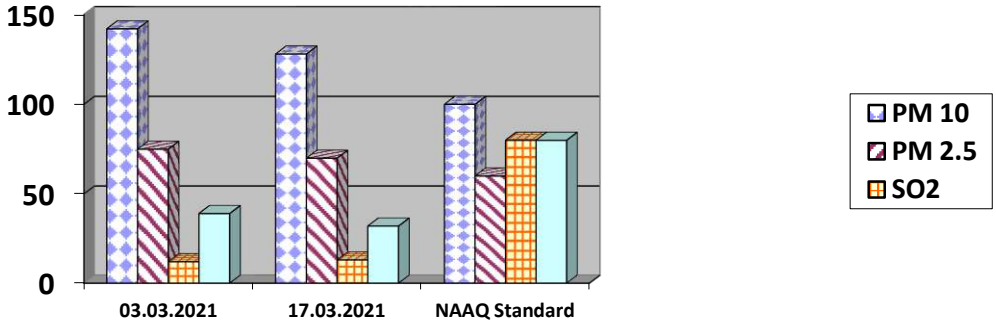
Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

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

Station Name: A29-Moonidih Washery		Zone: Core		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	02.03.2021	127	67	10	28
2	16.03.2021	135	70	<10	34
	NAAQ Standards	100	60	80	80



StationName: Kusunda OCP (A10)		Zone: Buffer		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO_2	NO_X
1	03.03.2021	142	75	12	39
2	17.03.2021	128	70	13	32
	NAAQ Standard	100	60	80	80



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

Analysed By
JSA/SA/SSA

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

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

WATER QUALITY MONITORING

3.1 Location of sampling sites

(Refer **Plate No. – II**)

i) **Mine Discharge of Bhagabandh (MW11)**

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

WATER QUALITY DATA

(EFFLUENT WATER- FOUR PARAMETERS)

Name of the Cluster: **Cluster-XI**		Month: **MAR,2021**	Name of the Station: **Mine Discharge of Bhagabandh**	
Sl. No.	**Parameters**	**MW11** First Fortnight	**MW11** Second Fortnight	**As per MOEF General Standards for schedule VI**
		15.03.2021	22.03.2021	
1	Total Suspended Solids	47	46	*100 (Max)*
2	pH	8.03	8.11	*5.5 - 9.0*
3	Oil & Grease	<2.0	<2.0	*10 (Max)*
4	COD	20	20	*250 (Max)*

All values are expressed in mg/lit except pH.

Analysed By
JSA/SA/SSA

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

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

NOISE LEVEL QUALITY MONITORING

4.1Location of sampling sites

1. **Pootkee Balihari Office (N16)**
2. **Moonidih UGP (N17)**
3. **Moonidih Washery (N29)**
4. **Kusunda OCP (N10)**

Methodology of sampling and analysis

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

4.2 Results & Interpretations

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

NOISE LEVEL DATA

Name of the Project : **Cluster -XI**			Month: **MAR,2021**		
Sl. No.	**Station Name/Code**	**Category of area**	**Date**	**Noise level dB(A)LEQ**	***Permissible Limit of Noise level in dB(A)***
1	Pootkee Balihari Office (N16)	Industrial area	02.03.2021	59	*75*
2	PootkeeBalihari Office (N16)	Industrial area	18.03.2021	57.8	*75*
3	MoonidihUGP (N17)	Industrial area	02.03.2021	62.4	*75*
4	MoonidihUGP (N17)	Industrial area	16.03.2021	62	75
5	Moonidih Washery (N29)	Industrial area	02.03.2021	58.3	*75*
6	Moonidih Washery (N29)	Industrial area	16.03.2021	57.7	75
7	KusundaOCP (N10)	Industrial area	03.03.2021	63.5	*75*
8	KusundaOCP (N10)	Industrial area	17.03.2021	62.5	*75*

Permissible limits of Noise Level as per MOEF Gazette Notification No. GSR 742(E) dt. 25.09.2000 Standards for Coal Mines and Noise Pollution (Regulation and Control) Rules, 2000.

*** Day Time: 6.00 AM to 10.00 PM.**

Analysed By
JSA/SA/SSA

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

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

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

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

Note:

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

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

NATIONAL AMBIENT AIR QUALITY STANDARDS

New Delhi the 18th FEBRUARY 2009

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

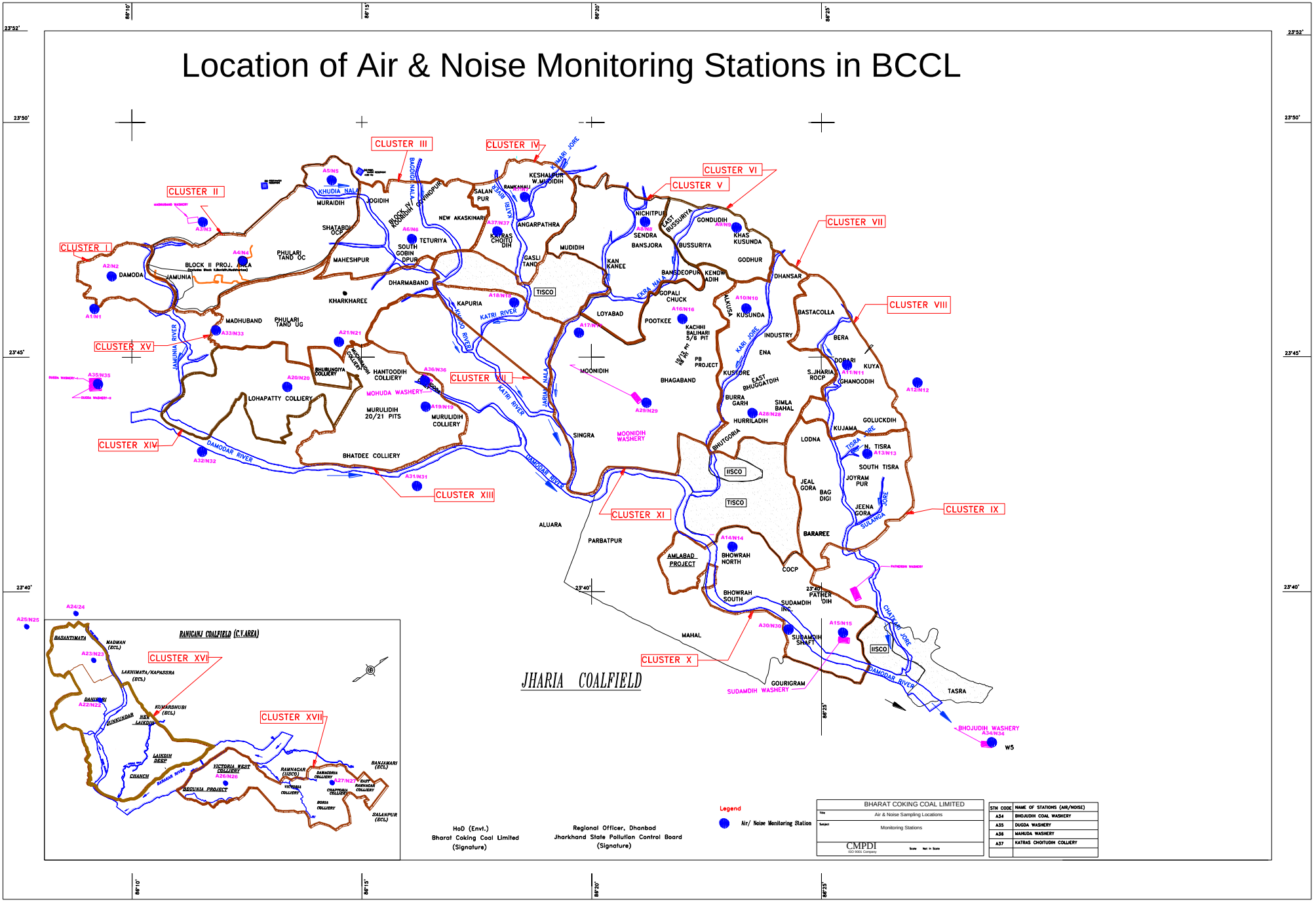
Pollutant	Time Weighted Average	Concentration in Ambient Air		Methods of Measurement
		Industrial, Residential, Rural and other Areas	Ecologically Sensitive Area (Notified by Central Government)	
Sulphur Dioxide (SO_2), µg/m³	Annual * 24 Hours **	50 80	20 80	-Improved West and Gaeke Method -Ultraviolet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

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

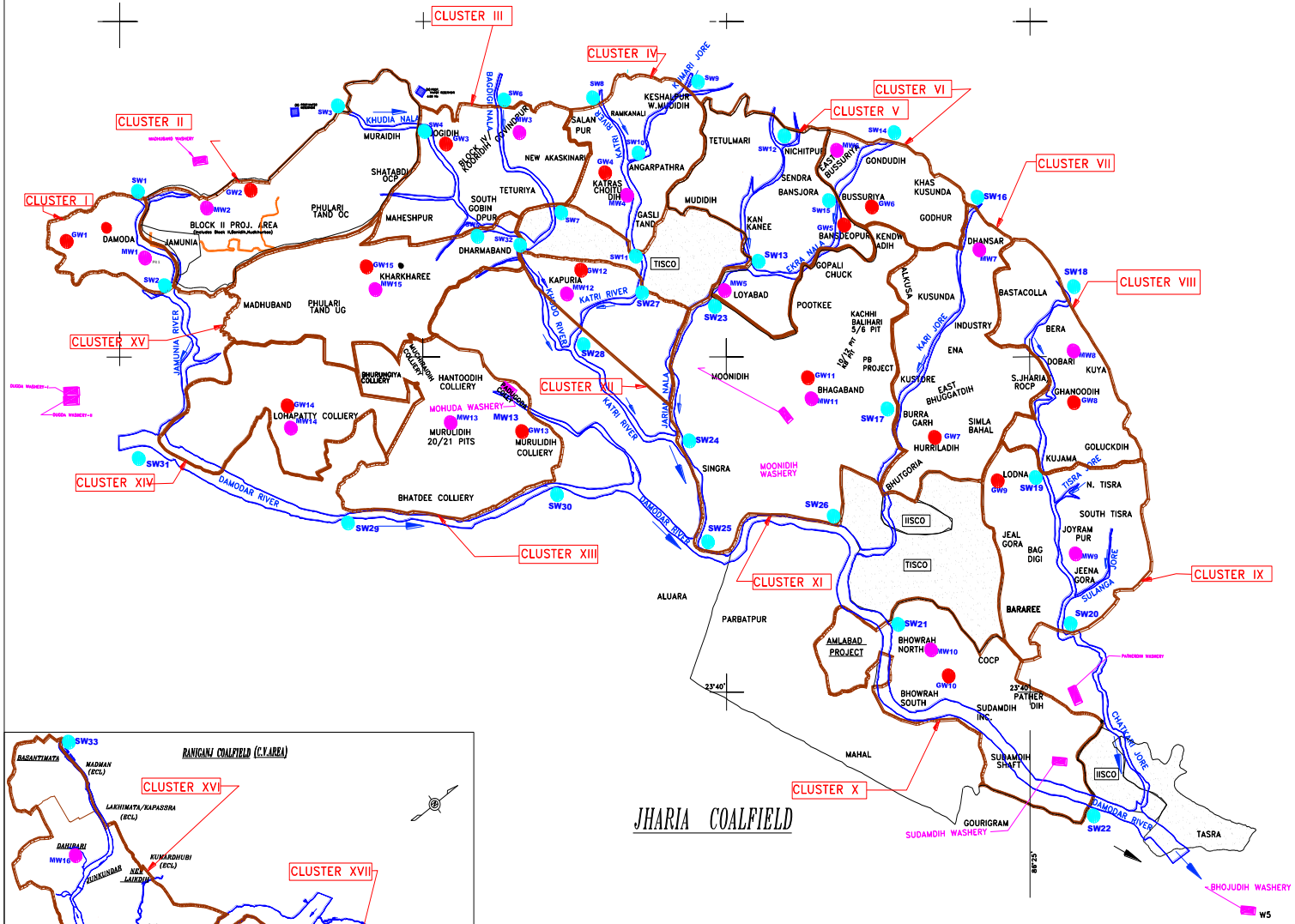
** 24 hourly or 8 hourly or 1 hourly monitored values, as applicable, shall be complied with 98% of the time in a year. 2% of the time, they AUGUST exceed the limits but not on two consecutive days of monitoring.

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

Location of Air & Noise Monitoring Stations in BCCL



Water Sampling Locations in BCCL



INDEX

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

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

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

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

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