BHARAT COKING COAL LIMITED
(A Subsidiary of Coal India Ltd.)
Regd. Office: Koyla Bhawan, Koyla Nagar,Dhanbad-826005
CIN No. U10101JH1972GO1000918
OFFICE OF THE GENERAL MANAGER
Govindpur Area No. III
PO- Sonardih, DHANBAD – 828125
Contact No: 0326-2392162
Email- gmgovindpur.bccl@coalindia.in

Ref No: BCCL/Ar. III/GM/2020/4415

Dated: 02.05.2020

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

Sub: Six monthly reports on implementation of Environmental measures for the period from October 2019 to March 2020 in respect of Cluster –III groups of mines, BCCL.

Ref: -EC Order No. J-11015/213/2010-IA.II (M) dated 06.02.2013

Dear Sir,

Kindly find herewith the enclosed six monthly report on implementation of environmental measures for the period from **October 2019 to March 2020** in respect of Cluster-III groups of mines, BCCL.

Yours faithfully,

2/5/2020

General Manager
Govindpur Area, BCCL

Encl: As above

Copy to:

1. Director, IA monitoring cell, ParyavaranBhawan CGO Complex, New Delhi-110003
2. HOD (Environment) BCCL, KoylaBhawan, Dhanbad.
3. AGM/ Nodal Officer(Environment) Govindpur Area, BCCL.

Scanned by CamScanner

COMPLIANCE OF EC CONDITIONS: - CLUSTER-III GROUP OF MINES, BCCL

EC Letter No. J – 11015/213/2010- IA. II (M), Dated 06.02.2013

<table>
<tr><th>Sl. No</th><th>EC Conditions (Specific)</th><th>EC compliance status</th></tr>
<tr><td></td><td>A. Specific Conditions by MOEF:</td><td>Compliance</td></tr>
<tr><td>i</td><td>The maximum production from the two opencast sections in the cluster shall not exceed beyond that for which environmental clearance has been granted</td><td>Being Complied. The production from two opencast sections of the cluster is within limit for which the environmental clearance has been granted. Details of production from two opencast sections is given below:
<table>
<tr><td rowspan="2">Mine</td><td colspan="2">EC capacity (MTY)</td><td colspan="2">Actual Production (Te)</td></tr>
<tr><td>Normative</td><td>Peak</td><td>FY 2018-19</td><td>FY 2019-20</td></tr>
<tr><td>New Akashkinaree Colliery</td><td>1.000</td><td>1.300</td><td>1299890</td><td>1203965</td></tr>
<tr><td>Block-IV/Kooridih Colliery</td><td>1.100</td><td>1.430</td><td>413518</td><td>576038</td></tr>
</table></td></tr>
<tr><td>ii</td><td>The measure to identify in the Environmental Plan for Cluster- III groups of mine and the conditions given in this environmental clearance letter shall be dovetailed to the implementation of the Jharia Action Plan.</td><td>Being Complied. Master Plan activities are dovetailed with compliance of environmental clearance conditions.</td></tr>
<tr><td>iii</td><td>The proponent shall prepare time-series maps of the Jharia Coalfields through NRSA to monitor and prevent fire problems in the Jharia Coalfields by Isothermal mapping /imaging and monitoring temperatures of the coal seams (whether they are close to spontaneous ignition temperatures) and based on which, areas with potential fire problems shall be identified.
Measures to prevent ingress of air (Ventilation) in such areas, to prevent restart fresh/spread fires in other areas including in mines of cluster III 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 NRSA. Measures would be taken to prevent ingress of air (ventilation) in such areas, which may re-start fresh fires.</td><td>Being Complied. NRSC is conducting thermal Infra-Red Survey periodically. Report for 2014 and 2018 are submitted and action are being taken accordingly (Report for year 2018 is attached herewith as Annexure-I)</td></tr>
</table>

iv	Underground mining should be taken up after completion of reclamation of Opencast mine area.	Being complied. No UG operation is being done below Opencast sections of the mines.
v	The OB material should be crushed like sand and be used for stowing in underground mines.	At present there is no requirement of stowing in cluster III.
vi	A detailed calendar plan of production with plan for OB dumping and backfilling (for OC mines) and reclamation and final mine closure plan for each mine of cluster-III shall be drawn up and implemented. The schedule of backfilling should be clearly brought out and submit the same to MoEFCC.	Being complied. Mine closure plan as per the guidelines of Ministry of Coal has already been prepared by Central Mine planning and Design Institute, Dhanbad and approved by BCCL Board on 21.09.2013. The financial provisions required for the implementation of mine closure plan are being kept in escrow accounts. Details of amount kept in escrow account are attached as **Annexure-II.**
vii	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.	Being Complied. Embankments have been constructed as specified in EC and stone pitching has been done. Photographs of the stone pitching are attached as **Annexure-III.**
viii	The rejects of washeries in Cluster –III should be send to FBC based plant.	Coal washery does not exist in cluster-III at present.
ix	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.	Being complied. Mining is being done as per the guidelines and permissions of Directorate General of Mines Safety (DGMS).
x	There shall be no external OB dumps. OB produce from the whole cluster will be 80Mm^3. OB from 2 OCP in mixed mines shall be backfilled. At the end of the mining there shall be no void and The entire mined out area shall be re-vegetated. Areas where opencast mining was carried out and completed shall be reclaimed immediately thereafter. It was observed that most of the OBs are not reclaimed and abandoned. The proponent should dump all the OB material in abandoned mines.	Being Complied. Action is being taken as specified in EMP for regular backfilling of OB concurrent with and reclaimed. Stabilized OB sites have been changed into ecological restoration sites (Photographs of biological reclaimed site are attached as **Annexure-IV**). Year wise data of OB generated and backfilling is attached as **Annexure-V**.
xi	Number of voids present in cluster – III at the end of mining should be backfilled up to ground level and no void should be left at the end of mining.	Includes Post mining condition. Being complied.
xii	A detailed calendar plan Of production with the plan for OB dumping and backfilling (for O/C mines) and reclamation and final mine closure plan for each mine of cluster-III shall be drawn up and implemented. The schedule of backfilling should be clearly bought out and submit the same to MoEFCC.	Being complied. Mine closure plan as per the guidelines of Ministry of Coal has already been prepared by Central Mine planning and Design Institute, Dhanbad and approved by BCCL Board on 21.09.2013. The financial provisions required for the implementation of mine closure plan

		are being kept in escrow accounts. Details of amount kept in escrow account are attached as **Annexure-II.** Year wise data of OB generated and backfilling is attached as **Annexure-V**. Details of proposed coal production, OB, backfilling and biological reclamation area for FY 2020-21 is attached as **Annexure-VI**.
xiii	Mining shall be carried out as per statute from the streams/nalas flowing within the lease and maintaining a safe distance from the Nalas flowing along the lease boundary. A safety barrier of a minimum 60m width shall be maintained along the nalas/water bodies. The small water bodies in OC shall be protected to the extent feasible and the embankment proposed along water body shall be strengthened with stone pitching.	Being Complied. Embankments have been constructed as specified in EC and stone pitching has been done. Photographs of the stone pitching are attached as **Annexure-III.**
xiv	Active OB dumps near water bodies and rivers should be rehandled for backfilling abandoned mine voids. However, those which have been biologically reclaimed need not be disturbed.	Being Complied. Old OB dump near water bodies is stabilized.
xv	Thick green belt shall be developed along undisturbed areas, mine boundary and in mine reclamation. A total area of 854.72 ha shall be reclaimed and afforested.	Includes post mining requirement and it shall be complied. Yearly plantation is being done for development of green belts as per EC. Apart from this avenue/block plantation is being done at railway siding and other spaces available. (Photographs of biological reclaimed site are attached as **Annexure-IV**). Details of year wise plantation and proposed plantation for FY 2020-21 are attached as **Annexure-VII**)
xvi	Details of transportation, CSR, R&R and implementation of environmental action plan for the clusters-III should be brought out in a booklet form within a year and regularly updated.	Being Complied. The booklet is maintained at cluster level.
xvii	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 III shall be implemented.	Being Complied. Dhanbad Action Plan has been prepared in consultation with Jharkhand Pollution Control Board for entire BCCL and not cluster wise. It is being implemented comprehensively for all the mines of BCCL. Some of the salient actions of this cluster are as under: 1. Construction of pucca road 2. Construction of water reservoir for mine water utilization 3. Plantation. 4. Transportation of coal in covered vehicles.

		5. Regular water sprinkling in dust prone areas. (Photographs of ponds, roads constructed within colliery, fixed type water sprinkler are attached as **Annexure-VIII)**
xviii	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 Poll 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.	Being Complied. The locations of monitoring stations are approved by Jharkhand Pollution Control Board. Work Order had already been issued to NEERI Nagpur on 12.05.2018. And work has been started in September 2018. Field data collection for Summer season has been done. Winter data collection is in process. The progress report sent by NEERI is attached as **Annexure- IX**
xix	The Plan for conveyor-cum–rail for Cluster-III should be dovetailed with Jharia Action Plan. The Committee desired that road transportation of coal during Phase–I should be by mechanically covered trucks, which should be introduced at the earliest. Coal dispatch shall be diverted from the present rail sidings to Rapid Loading System (RLS) soon after the construction and commissioning of the RLS at Maheshpur is completed. The railway siding order issued and same would come in 3 years. The details of same should be provided to ministry. The mode of transportation of coal by truck till Railway Siding should be by mechanically covered trucks	Being Complied. At present transportation is being done by covered vehicle with a tarpaulin cover. The feasibility of mechanically covered trucks is being studied. Construction of Rapid Loading System at Maheshpur is completed and will be operational after railway connectivity.
xx	3756 nos. of PAF's should be rehabilitated at cost of Rs 27012.66 Lakhs as per the approved Jharia Action Plan.	It is being followed as per the approved Jharia action plan.
xxi	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 Board/SPCB quarterly within one month of monitoring. Rainwater harvesting measures shall be undertaken in case monitoring of water table indicates a declining trend.	Being Complied. The work of monitoring of ambient environment including ground water monitoring is being done by Central Mine Planning and Design institute (CMPDI). (Ground Water report is attached as **Annexure-X**) The Location and design of Piezometers to be installed have been finalized by CMPDI. Piezometer Installation: 3rd time Tender was done on 01.03.2019. No bidder participated in the tender. Hence, the tender was cancelled. The estimate is being revised in association with CMPDI for re-tendering.
xxi	Regular monitoring of subsidence movement on the surface over and around	It is being complied and regular monitoring of subsidence over depillared area

i	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.	is being done as per stipulation.
xxiii	Sufficient coal pillars shall be left un-extracted around the air shaft (within the subsidence influence area) to protect from any damage from subsidence, if any.	Being Complied. Sufficient coal pillars have been left around air shafts as per the statutes and DGMS guidelines.
xxiv	High root density tree species shall be selected and planted over areas likely to be affected by subsidence.	It is being complied.
xxv	Depression due to subsidence resulting in water accumulating within the low lying areas shall be filled up or drained out by cutting drains.	It shall be complied.
xxvi	Solid barriers shall be left below the roads falling within the blocks to avoid any damage to the roads.	It is being followed. Sufficient barriers are left for saving the surface installation and infra structures as per the statute and DGMS guidelines.
xxvii	No depillaring operation shall be carried out below the township/colony.	It is being followed.
xxviii	A detailed CSR Action Plan shall be prepared for Cluster III group of mines. Specific activities shall be identified for CSR for the budget of Rs 139 Lakhs per year@ Rs 5/T of coal provided for CSR for 2012-2013 and Rs. 5/T of coal as recurring expenditure. The 491.91ha of area within Cluster III ML existing as waste land and not being acquired shall be put to productive use under CSR and developed with fruit bearing and other useful species for the local communities. Third party evaluation shall be got carried out regularly for the proper implementation of activities undertaken in the project area under CSR. Issue raised in the Public Hearing shall also be integrated with activities being taken up under CSR. The details of CSR undertaken along with budgetary provisions for the village-wise various activities and expenditure thereon shall be uploaded on the company website every year. The company must give priority to capacity building both within the company and to the local youth, who are motivated to carry out the work in future. 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	Being Complied. BCCL is implementing CSR activities. A separate CSR/Welfare committee has been formed at area level that will look after the works being executed under CSR. CSR dept. is established at the Headquarter level and area level for Executing the CSR Activities. All welfare/ CSR activities are also uploaded in Company web site (http://www.bcclweb.in/?page_id=265). TISS has conducted survey to frame CSR policy for better implementation and monitoring of the CSR activities. CSR activities have not been dealt at cluster level. However, expenditure was allotted and made at corporate level, i.e. M/s BCCL level and cluster III is

	to reduce dust pollution.	contributor for the same. Details of CSR expenditure done at BCCL level is attached as **Annexure-XI.**
xxix	Central recreation park with herbal garden should be developed for use of all inhabitants.	It is being complied. Herbal garden has been developed in cluster-III at New Akashkinaree Colliery.
xxx	The mine water should be treated properly before supply to the villager.	Being Complied. Mine water is being supplied to nearby villages for drinking and other purpose after being filtered through filter plants. Details of beneficiaries are attached as **Annexure-XII.**
xxxi	Details of transportation, CSR, R&R and implementation of environmental action plan for each of the clusters-III should be brought out in a booklet form within a year and regularly updated.	Complied. CSR Booklet is being maintained at Cluster level.
xxxii	Central recreation park with herbal garden should be developed for use of all inhabitants.	It is being complied. Herbal garden has been developed in cluster-III at New Akashkinaree Colliery.
xxxiii	The mine water should be treated properly before supply to the villager.	Being Complied. Mine water is being supplied to nearby villages for drinking and other purpose after being filtered through filter plants. Details of beneficiaries are attached as **Annexure-XII.**
xxxiv	Details of transportation, CSR, R&R and implementation of environmental action plan for each of the clusters-III should be brought out in a booklet form within a year and regularly updated.	Being Complied. CSR Booklet is being maintained at Cluster level.
xxxv	Mine discharge water shall be treated to meet standards prescribed 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.	Being Complied. Monitoring is being done by Central Mine Planning and Design institute (CMPDIL). The quality of water is within prescribed standards. Monitoring reports of Air (including heavy metal analysis), Water (drinking, surface) and Noise is attached as **Annexure-XIII.**
xxxvi	No groundwater shall be used for the mining activities. Additional water required, if any, shall be met from mine water or by recycling/reuse of the water from the existing activities and from rainwater harvesting measures. The project authorities shall meet water requirement of nearby village(s) in case the village wells go dry due to dewatering of mine.	Being Complied. No ground water is being utilized for the purposes of industrial use of the water. Mine water is being supplied to nearby villages for drinking and other purpose after being filtered through filter plants. Details of beneficiaries are attached as **Annexure-XII.**
xxxvii	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	Post mining requirement. Continuous process of the backfilling has been adopted. A part of the void will be converted into the water body as specified in EC.

	abandoned pits and voids should be backfilled with OB and reclaimed with plantation and or may be used for pisciculture.	
xxxvii	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 Board/SPCB quarterly within one month of monitoring. Rainwater harvesting measures shall be undertaken in case monitoring of water table indicates a declining trend.	Being Complied. The work of monitoring of ambient environment including ground water monitoring is being done by Central Mine Planning and Design institute (CMPDI). (Ground Water quality report is attached as **Annexure-X**) Monitoring stations have been set up and Central Mine Planning and Design institute (CMPDI) has been keeping a constant check. The Location and design of Piezometers to be installed have been finalized by CMPDI. Piezometer Installation: 3rd time Tender was done on 01.03.2019. No bidder participated in the tender. Hence, the tender was cancelled. The estimate is being revised in association with CMPDI for re-tendering.
xxxix	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.	It is being complied.
xl	The location of monitoring stations in the Jharia coalfield should be finalized in consultation with Jharkhand State Pollution Control Board.	It is being complied.
xli	For monitoring land use pattern and for post mining land use, a time series of land use maps, based on satellite imagery (on a scale of 1: 5000) of the core zone and buffer zone, from the start of the project until end of mine life shall be prepared once in 3 years (for any one particular season which is consistent in the time series), and the report submitted to MOEF and its Regional office at Bhubaneswar.	Being Complied. CMPDI is conducting "Time series of land use maps based on satellite imagery of the core zone and buffer zone in the scale 1:5000 on cluster basis every 03 year. Land use map for cluster-III is attached as **Annexure-XIV**
xlii	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.	Being complied. Mine closure plan as per the guidelines of Ministry of Coal has already been prepared by Central Mine planning and Design Institute, Dhanbad and approved by BCCL Board on 21.09.2013. The financial provisions required for the implementation of mine closure plan are being kept in accounts. Details of amount kept in escrow account are attached as **Annexure-II.**
xliv	A separate management structure for implementing environment policy and socio-economic issues and the capacity building required in this regard.	Being Complied. Environment Engineers provided at Mine and Area level. Environment Management cell has been constituted at Area level with GM as Chairman.

<table>
<tr><td></td><td></td><td>A full-fledged Environment Department, headed by a HOD (Environment) along with a suitable qualified multidisciplinary team of executives has been established in Headquarters. Community Development executives support capacity building.</td></tr>
<tr><td>xlv</td><td>Corporate Environment Responsibility:

a) The Company shall have a well laid down Environment Policy approved by the Board of Directors.

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.

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.

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.</td><td>Being Complied.

A well-defined Corporate Environment Policy has already been laid down and approved by the Board of Directors. This is also posted on BCCL website.(http://www.bcclweb.in/environment/CEP_04.11.2019.pdf)

Complied.

A hierarchical system of the company to deal with environmental issues from corporate level to mine level already exists.

Environment Management cell has been constituted at Area level with GM as Chairman.
Internal Monitoring Mechanism is in place.</td></tr>
<tr><td>B</td><td>EC Conditions (General):</td><td></td></tr>
<tr><td>i</td><td>No change in mining technology and scope of working shall be made without prior approval of the Ministry of Environment and Forests.</td><td>Being Complied.</td></tr>
<tr><td>ii</td><td>No change in the calendar plan of production for quantum of mineral coal shall be made.</td><td>Being Complied. Production is being done well within the peak production capacity as per EC. Details of production from cluster-III is given below:
<table>
<tr><th colspan="2">EC capacity (MTY)</th><th colspan="3">Actual Production (MTe)</th></tr>
<tr><td>Normative</td><td>Peak</td><td>FY 2017-18</td><td>FY 2018-19</td><td>FY 2019-20</td></tr>
<tr><td>2.769</td><td>3.600</td><td>1.801</td><td>1.811</td><td>1.841</td></tr>
</table></td></tr>
<tr><td>iii</td><td>Four ambient air quality monitoring stations shall be established</td><td>Being Complied. Location of Four ambient air quality monitoring stations for</td></tr>
</table>

<table>
<tr><td></td><td>in the core zone as well as in the buffer zone for PM_{10}, $PM_{2.5}$, SO_2 and NO_x monitoring. Location of the stations shall be decided based on the meteorological data, topographical features and environmentally and ecologically sensitive targets in consultation with the State Pollution Control Board. Monitoring of heavy metals such as Hg, As, Ni, Cd, Cr, etc. carried out at least once in six months.</td><td>the cluster is approved by Jharkhand pollution control Board.
The work for monitoring of ambient environment is being done by Central Mine Planning and Design institute (CMPDIL).
Monitoring reports of Air (including heavy metal analysis), Water (drinking, surface) and Noise is attached as Annexure-XIII.</td></tr>
<tr><td>iv</td><td>Data on ambient air quality (PM_{10}, $PM_{2.5}$, SO_2 and NO_x) and heavy metals such as Hg, As, Ni, Cd, Cr and other monitoring data shall be regularly submitted to the Ministry including its Regional Office at Bhubaneswar and to the State Pollution Control Board and the Central Pollution Control Board once in six months. Random verification of samples through analysis from independent laboratories recognized under the EPA rules, 1986 shall be furnished as part of compliance report.</td><td>Being Complied. The work for monitoring of ambient environment is being done by Central Mine Planning and Design institute (CMPDIL).
Monitoring reports of Air (including heavy metal analysis), Water (drinking, surface) and Noise is attached as Annexure-XIII.
Random verification is being taken up by IIT(ISM) Dhanbad.</td></tr>
<tr><td>v</td><td>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.</td><td>Being Complied. Details of ear plugs/muffs and dust masks distributed is as below:
<table><tr><th>Year</th><th>Dust masks (nos.)</th><th>Ear plugs (nos.)</th></tr><tr><td>2019-20</td><td>990</td><td>145</td></tr></table></td></tr>
<tr><td>vi</td><td>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.</td><td>Being Complied. Discharge of water confirms to applicable standards. Oil & grease trap exists at Sinidih workshop (Water quality report is attached as Annexure-XIII).</td></tr>
<tr><td>vii</td><td>Vehicular emissions shall be kept under control and regularly monitored. Vehicles used for transporting the mineral shall be covered with tarpaulins and optimally loaded.</td><td>Being Complied. Regular maintenance of vehicles is being done. Vehicles with valid Pollution under control certificates are being used for coal transportation. Covered transportation is in practice. (Copies of PUC certificate of coal transportation vehicles are attached as Annexure-XVII)</td></tr>
<tr><td>viii</td><td>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.</td><td>Being Complied. The locations of monitoring stations are approved by Jharkhand Pollution Control Board. Monitoring is being done by CMPDI.
Monitoring reports of Air (including heavy metal analysis), Water (drinking, surface) and Noise is attached as Annexure-XIII.</td></tr>
<tr><td>ix</td><td>Personnel working in dusty areas shall wear protective respiratory devices and they shall also be provided with adequate training and information on safety</td><td>Being Complied. A separate full-fledged Human Resource Development Department Is conducting regular training programme on these issues. Apart</td></tr>
</table>

<table>
<tr><td></td><td>and health aspects.</td><td>from this Vocational Training Centers are existing in Cluster-III which provides periodical training on the safety and occupational health issue to each of the workers working in the mines. Details of training conducted at VTC for FY 2019-20 are given below:

<table><tr><th>Type of Training</th><th>Number of Persons</th></tr><tr><td>Basic</td><td>29</td></tr><tr><td>Refresher</td><td>693</td></tr><tr><td>Mine Vocational Training</td><td>203</td></tr><tr><td>Safety Committee Recommendation</td><td>235</td></tr><tr><td>Contractor Workers</td><td>92</td></tr><tr><td>Total</td><td>1252</td></tr></table>Details of protective devices distributed to workers engaged in mining activities are as below:

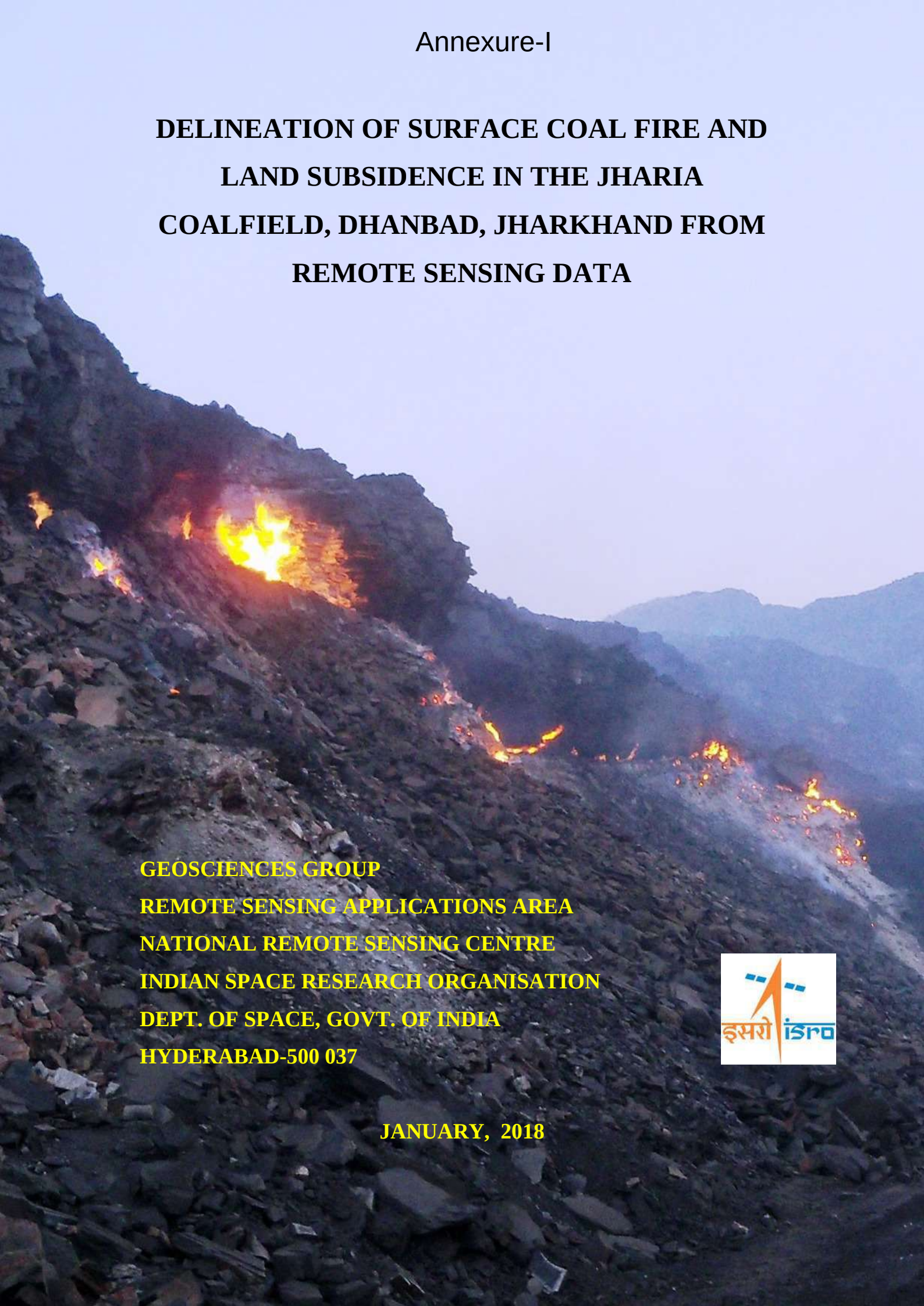
<table><tr><th>Year</th><th>Dust masks</th><th>Ear plugs</th></tr><tr><td>FY 2019-20</td><td>990</td><td>145</td></tr></table></td></tr>
<tr><td>x</td><td>Occupational health surveillance programme of the workers shall be undertaken periodically to observe any contractions due to exposure to dust and to take corrective 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.</td><td>Being Complied. Initial Medical Examination (IME) and Periodical Medical Examination (PME) of all the personnel is carried out as per the Statutes and Director General of Mines Safety (DGMS) guideline. Details of PME’s conducted for FY 2019-20 are given below:
<table><tr><th>Name of Colliery</th><th>PME’s conducted</th></tr><tr><td>New Akashkinaree Colliery</td><td>465</td></tr><tr><td>Block-IV/Kooridih Colliery</td><td>339</td></tr><tr><td>Maheshpur Colliery</td><td>116</td></tr><tr><td>Jogidih Colliery</td><td>152</td></tr></table></td></tr>
<tr><td>xi</td><td>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.</td><td>Being Complied. Environment Engineer provided at Mine and Area level. Environment Management cell has been constituted at Area level with GM as Chairman.
A full-fledged Environment Department, headed by a HOD (Environment) along with a suitable qualified multidisciplinary team of executives has been</td></tr>
</table>

		established in Headquarters. Community Development executives support capacity building.
xii	The funds earmarked for environmental protection measures shall be kept in separate account and shall not be diverted for other purpose. Year-wise expenditure shall be reported to this Ministry and its Regional Office at Bhubaneswar.	Being Complied. A separate fund under the environmental protection measures has already been allocated. Expenditure details for FY 2019-20 are enclosed as **Annexure-XV**
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.	Advertised timely, Complied. Advertisements published and EC letter circulated to concerned panchayats have been attached as **Annexure-XVI.**
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. EC on receipt circulated to all concerned authorities (EC letter circulated to concerned panchayats have been attached as **Annexure-XVI).**
xv	A copy of the environmental clearance letter shall be shall also be displayed on the website of the concerned State Pollution Control Board. The EC letter shall also be displayed at the Regional Office, District Industry Sector and Collector's Office/Tehsildar's Office for 30 days.	Complied.
xvi	The clearance letter shall be uploaded on the company's website. The compliance status of the stipulated environmental clearance conditions shall also be uploaded by the project authorities on their website and updated at least once every six months so as to bring the same in public domain. The monitoring data of environmental quality parameter (air, water, noise and soil) and critical pollutant such as PM_{10}, $PM_{2.5}$, SO_2 and NO_x (ambient) and critical sectoral parameters shall also be displayed at the entrance of the project premises and mine office and in corporate office and on company's website.	Complied. Environmental Clearance and Six monthly compliance of Environmental Clearance along with monitoring reports are uploaded on BCCL website.
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,	Being complied.

	respective Zonal Office s of CPCB and the SPCB.	
xviii	The Regional Office of this Ministry located at Bhubaneswar shall monitor compliance of the stipulated conditions. The Project authorities shall extend full cooperation to the office(s) of the Regional Office by furnishing the requisite data/ information/monitoring reports.	Shall be complied.
xix	The Environmental statement for each financial year ending 31 March in Form –V is mandated to be submitted by the project proponent for the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules,1986,as amended subsequently, shall also be uploaded on the company's website along with the status of compliance of EC conditions and shall be sent to the respective Regional Offices of the MoEFCC by E-mail	Being Complied. Environmental Statement is regularly submitted.
C	**EC Conditions (Other):**	
i	The Ministry or any other competent authority may stipulate any further condition for environmental protection.	Conditions of CTO are being complied.
ii	Failure to comply with any of the conditions mentioned above may result in withdrawal of this clearance and attract the provisions of the Environment (Protection) Act, 1986.	All condition complied to avoid this condition.
iii	The above conditions will be enforced *inter-alia*, under the provisions of the Water (Prevention & Control of Pollution) Act, 1974, the Air (Prevention & Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986 and the Public Liability Insurance Act, 1991 along with their amendments and Rules. The proponent shall ensure to undertake and provide for the costs incurred for taking up remedial measures in case of soil contamination, contamination of groundwater and surface water, and occupational and other diseases due to the mining operations.	It is being complied. Conditions of CTO are being complied. The storage of material is below threshold attracting Public Liability Insurance Act, 1991.
iv	The Environmental Clearance is subject to the outcome of the Writ Petition filed by M/S Bharat Coking Coal Limited (BCCL) in response to the closure orders issued by the Jharkhand State Pollution Control Board which is pending in the Jharkhand High Court.	Agree.

Annexure-I

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



GEOSCIENCES GROUP

REMOTE SENSING APPLICATIONS AREA

NATIONAL REMOTE SENSING CENTRE

INDIAN SPACE RESEARCH ORGANISATION

DEPT. OF SPACE, GOVT. OF INDIA

HYDERABAD-500 037

JANUARY, 2018

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

Report for

BHARAT COKING COAL LIMITED (BCCL)

(A SUBSIDIARY OF COAL INDIA LTD.)

ENVIRONMENT DEPARTMENT, KOYLA BHAWAN

KOYLA NAGAR, DHANBAD – 826 005, JHARKHAND

GEOSCIENCES GROUP

REMOTE SENSING APPLICATIONS AREA

NATIONAL REMOTE SENSING CENTRE

INDIAN SPACE RESEARCH ORGANISATION

DEPT. OF SPACE, GOVT. OF INDIA

HYDERABAD-500 037

JANUARY, 2018

PROJECT TEAM

1. **Dr. K VINOD KUMAR**, Group Head, Geosciences Group
   Project formulation and coordination
2. **Dr. Tapas R. Martha**, Scientist 'SF'
   Field survey and report preparation
3. **Shri Priyom Roy,** Scientist 'SD'
   Image processing, interpretation, field survey, maps and report preparation

CONTENTS

ACKNOWLEDGEMENTS i

EXECUTIVE SUMMARY ii

LIST OF FIGURES AND TABLES iii

CHAPTER – I INTRODUCTION 1

1.1 BACKGROUND 2

1.2 OBJECTIVES 2

1.3 STUDY AREA 3

CHAPTER – II GENERAL DESCRIPTION OF THE STUDY AREA 4

2.1 LOCATION AND ACCESSIBILITY 4

2.2 PHYSIOGRAPHY, DRAINAGE AND CLIMATE 4

2.3 GENERAL GEOLOGY 4

CHAPTER – III DATA REQUIREMENTS 7

3.1 REMOTE SENSING DATA 7

3.2 ANCILLARY DATA 7

CHAPTER – IV REMOTE SENSING DATA ANALYSIS 8

4.1 METHODOLOGY 8

4.1.1 PROCESSING OF LANDSAT 8 DATA 8

4.1.2 THRESHOLDING OF RADIANT TEMPERATURE IMAGE 9

4.2 METHODOLOGY FOR SUBSIDENCE DETECTION 12

4.2.1 PROCESSING OF ALOS-PALSAR-2 DATA 12

CHAPTER – V FIELDWORK 17

CHAPTER – VI POST FIELD WORK ANALYSIS 19

CHAPTER – VII DISCUSSIONS AND CONCLUSIONS 20

7.1 DISCUSSION 20

7.2 CONCLUSIONS 22

CHAPTER – VIII LIMITATIONS 24

REFERENCES 26

Annexure – I 27

Annexure - II 29

Annexure - III 31

Annexure - IV 34

ACKNOWLEDGEMENTS

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

EXECUTIVE SUMMARY

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

LIST OF FIGURES AND TABLES

Figure 1 : Study area map of Jharia Coalfield, Jharkhand

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

Figure 3 : False colour composite image of Jharia Coalfield (VNIR 3N,2,1) , with subset blocks (in red) to obtain temperature values (from radiant temperature image) within the Barakar formation across the Jharia coalfield.

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

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

Figure 6 : DInSAR acquisition scheme

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

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

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

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

Figure 11 : Subsidence map of Jharia coal field, Dhanbad

Figure 12 : Total fire area statistics

Figure 13 : Field data points for coal fire verification

Figure 14 : Field data points for subsidence verification

Field Photographs

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

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

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

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

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

Figure 20 : Fume cracks in the Bhulanbarari area.

List of Tables

Table 1 : Generalised stratigraphy of JCF

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

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

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

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

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

CHAPTER I

INTRODUCTION

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

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

1.1 Background

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

1.2 Objectives

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

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

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

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

1.3 Study Area

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

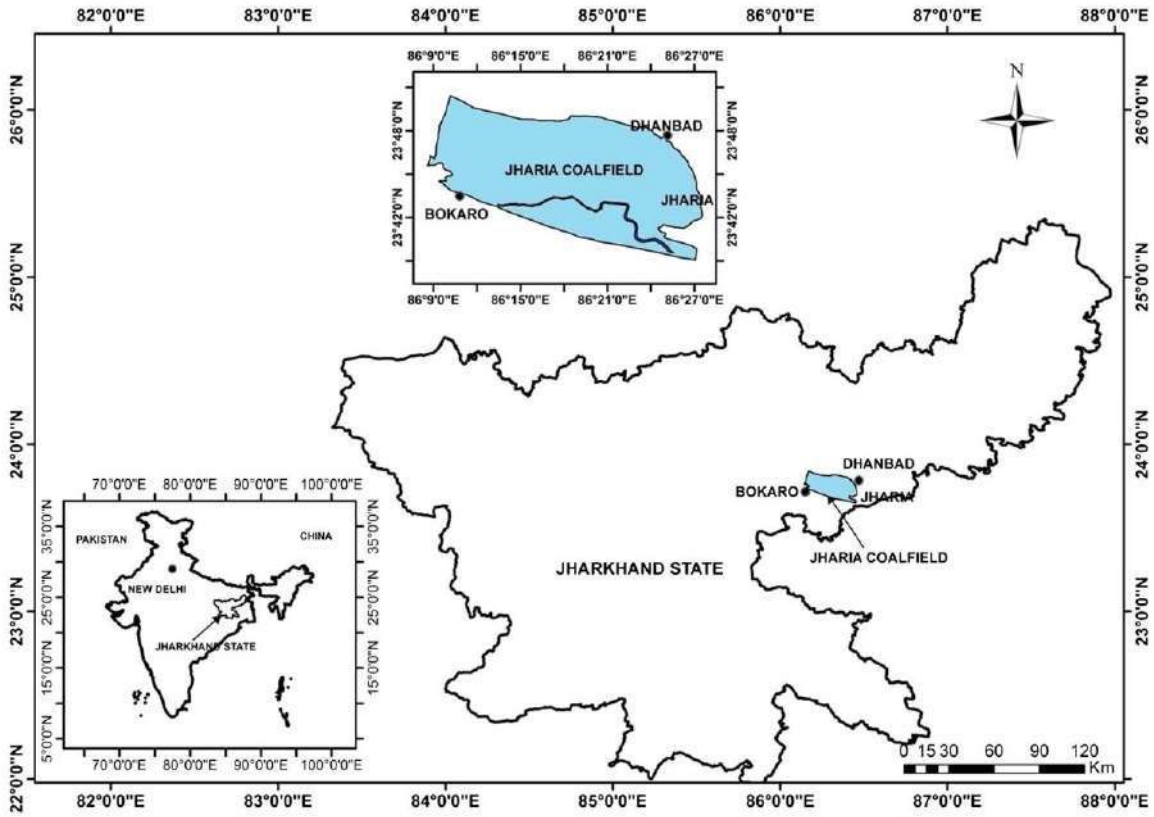


Figure 1: Study area map of Jharia Coalfied, Jharkhand

CHAPTER II

GENERAL DESCRIPTION OF THE STUDY AREA

2.1 Location and Accessibility

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

2.2 Physiography, Drainage and Climate

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

2.3 General Geology

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

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

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

Table 1: Generalised stratigraphy of JCF.

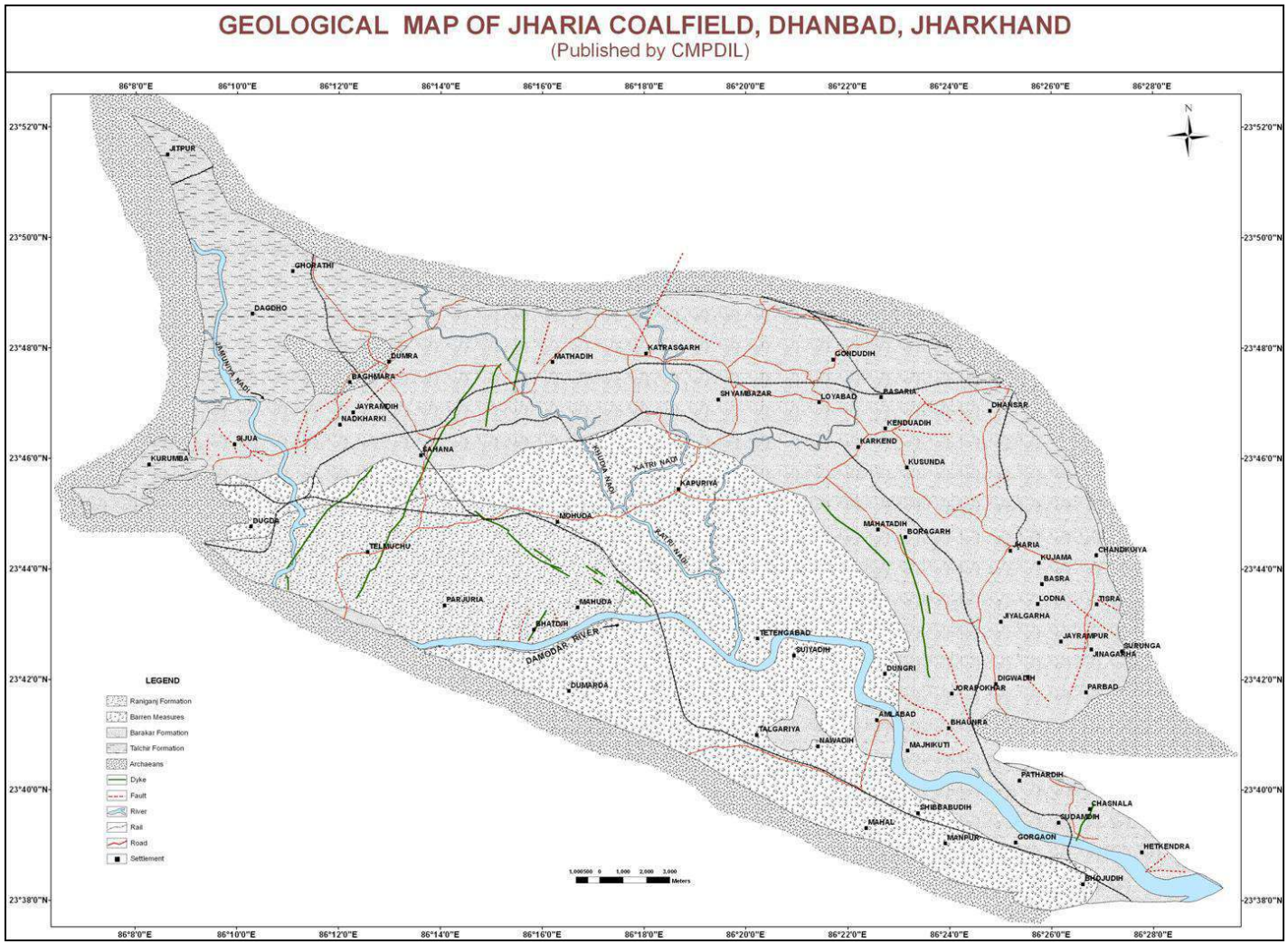


Figure 2 : Geological map of Jharia coal field, Dhanbad, Jharkhand (published by CMPIDL)

CHAPTER III

DATA REQUIREMENTS

3.1 Remote Sensing Data

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

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

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

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

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

3.2 Ancillary data

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

CHAPTER IV

REMOTE SENSING DATA ANALYSIS

4.1 Methodology

4.1.1 Processing of Landsat 8 Data

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

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

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

Where:

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

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

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

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

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

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

T_R = Radiant (brightness) temperature,

K_1 = Calibration constant (1260.56 K),

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

L_λ = Spectral radiance

4.1.2 Thresholding of radiant temperature image

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

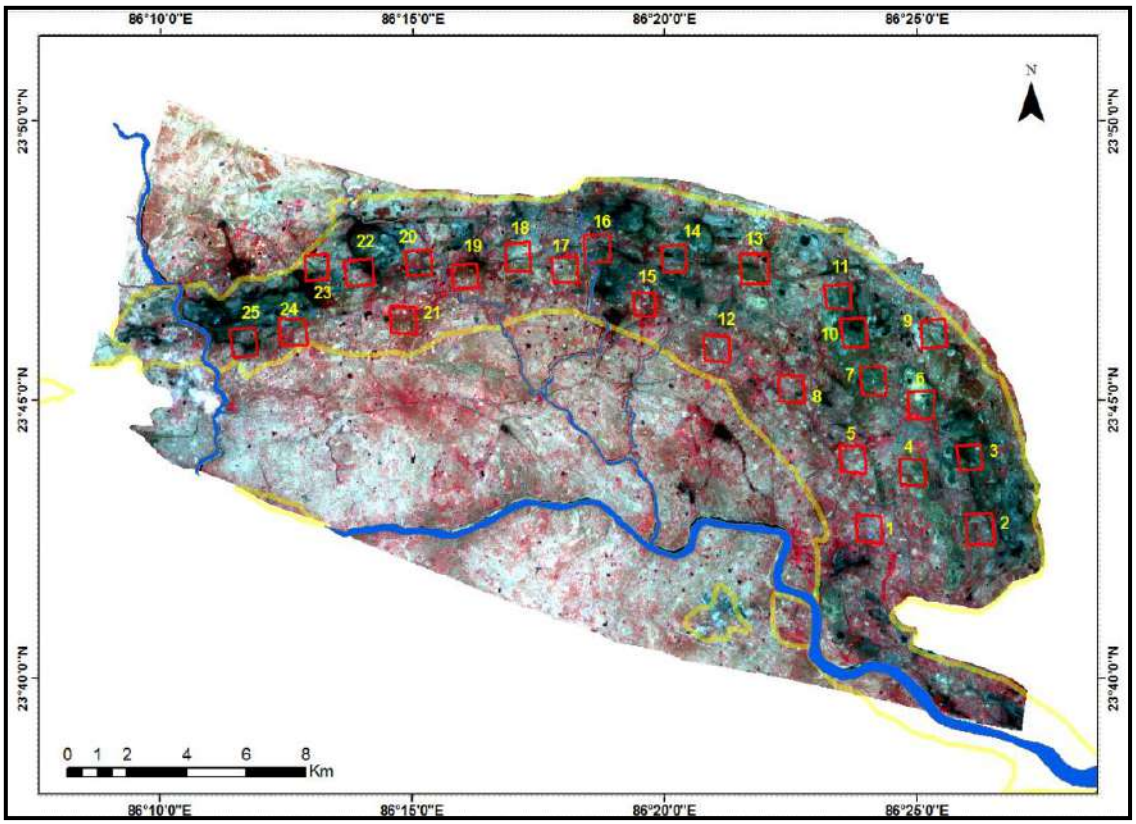


Figure 3. False colour composite image of Jharia Coalfield, with subset blocks (in red boxes) to obtain temperature values (from radiant temperature image) within the Barakar formation across the Jharia coalfield.

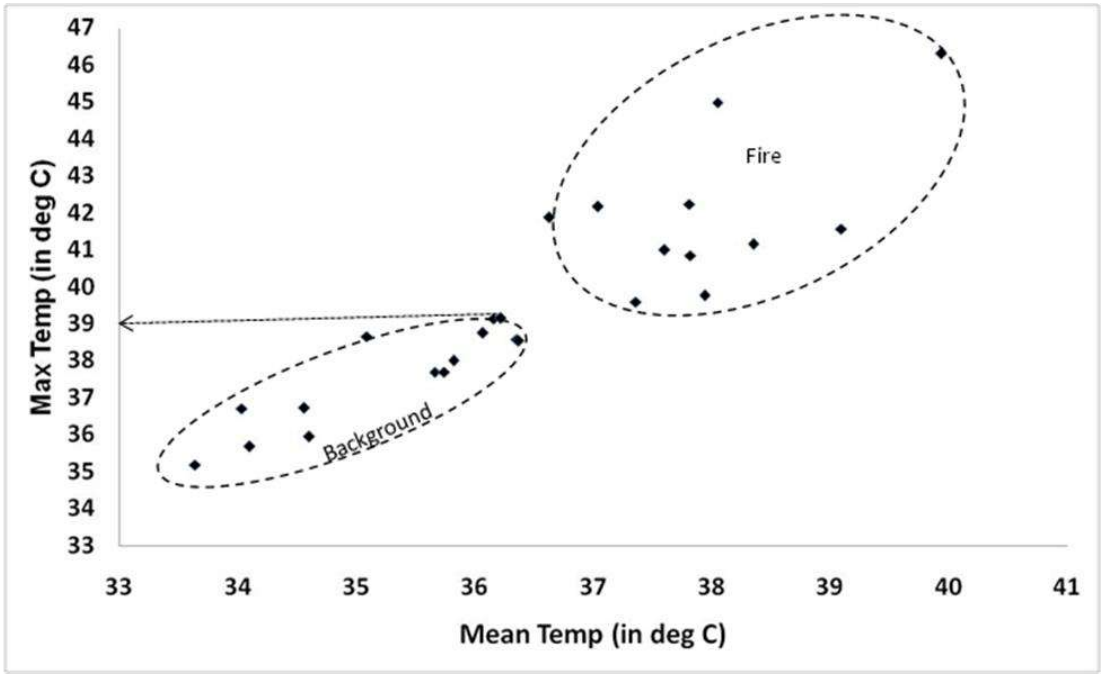


Figure 4. Maximum temperature plotted against mean temperature for various locations; cluster separation observed around 39 °C (marked with arrow)

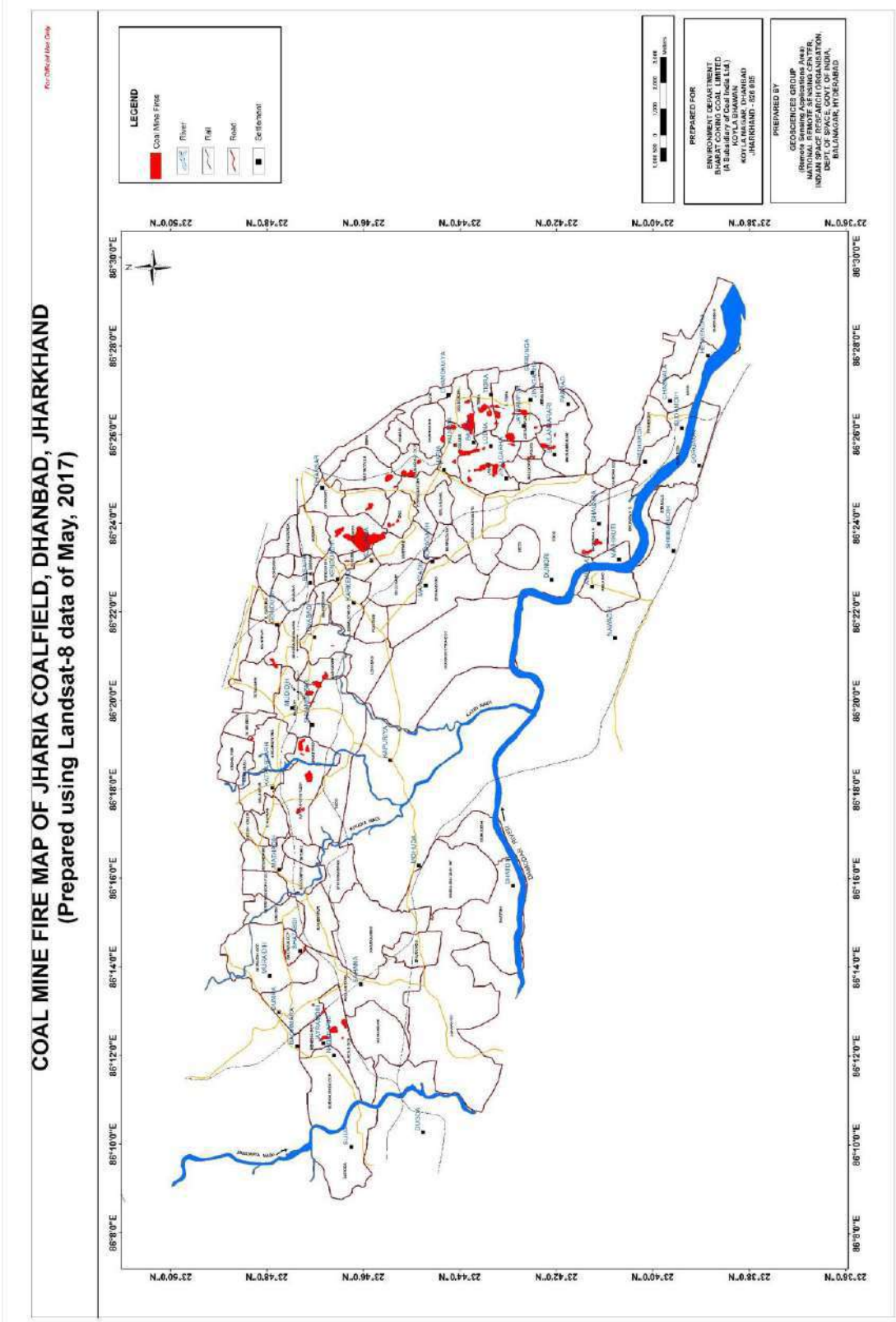


Figure 5: Coal mine fire map (May, 2017) of Jharia coal field, Dhanbad. The fire areas shown in this map have been verified in the field as per field points in figure 13.

4.2 Methodology For Subsidence Detection

4.2.1 Processing of ALOS-PALSAR 2 Data

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

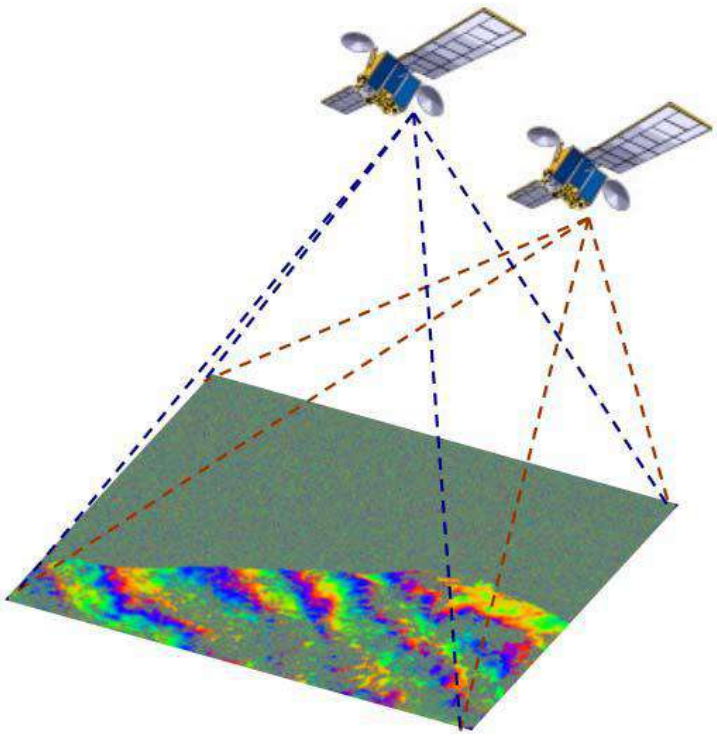


Figure 6. DInSAR acquisition scheme.

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

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

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

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

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

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

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

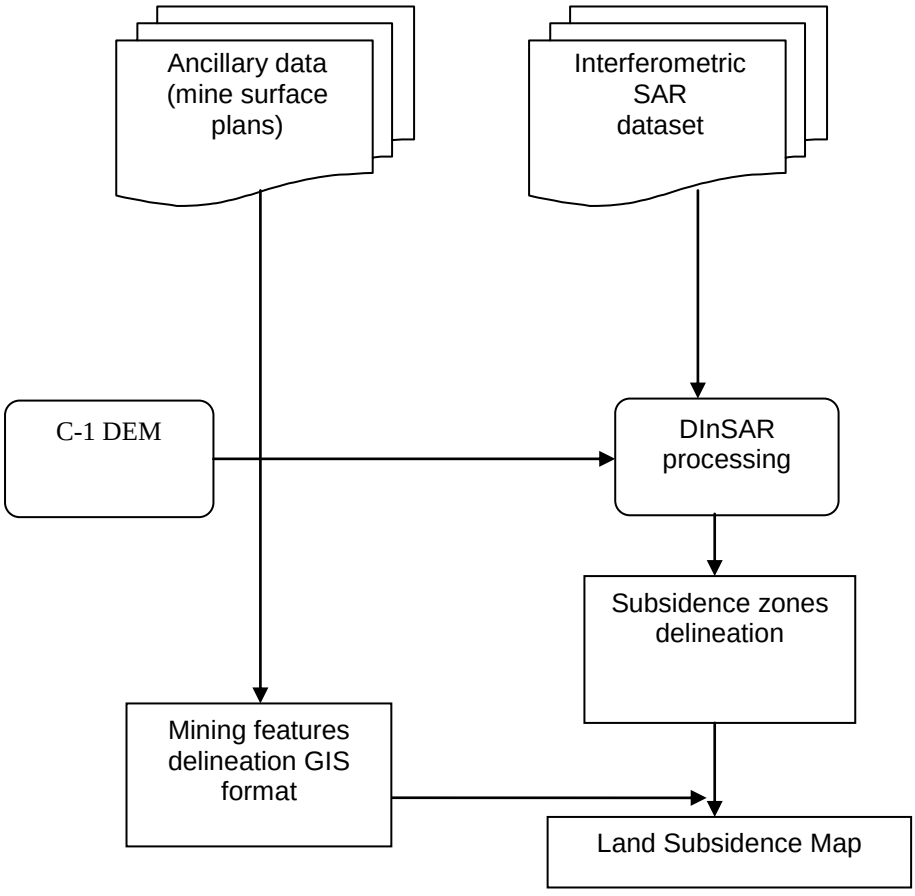


Figure 7. Work flow diagram for generating land subsidence map using DInSAR technique.

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

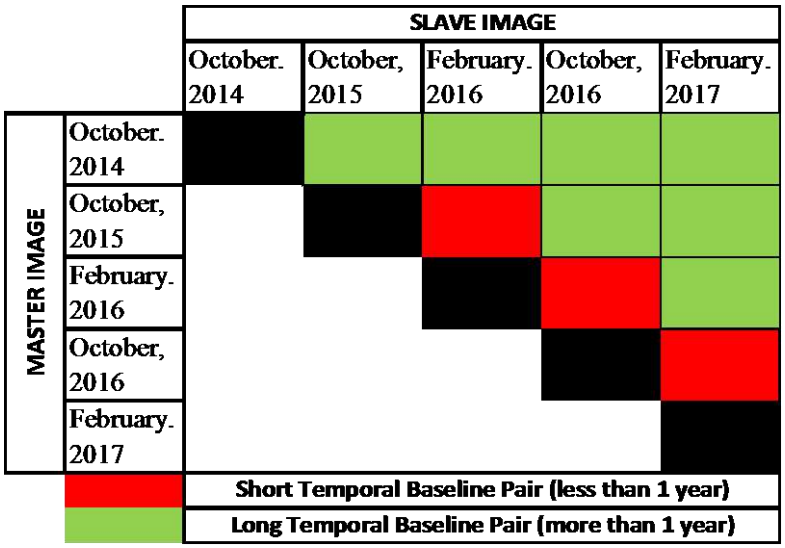


Figure 8. ALOS-PALSAR - 2 Master-Slave pairs for short and long temporal base line processing

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

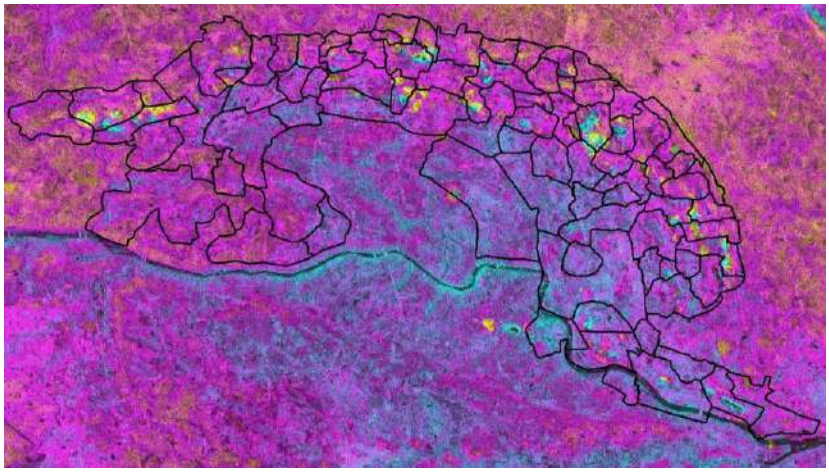


Figure 9. Fringe patterns generated from short baseline processing (e.g. Master: Oct, 16, Slave: Feb, 17).

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

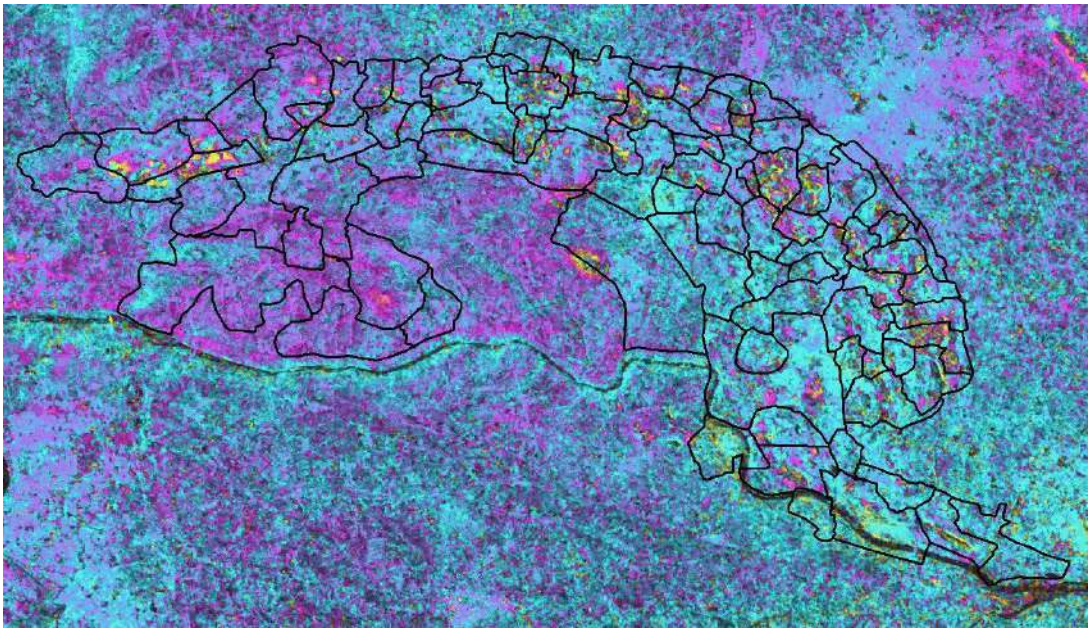


Figure 10. Fringe patterns generated from long baseline processing (e.g. Master: Oct, 15, Slave: Feb, 17).

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

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

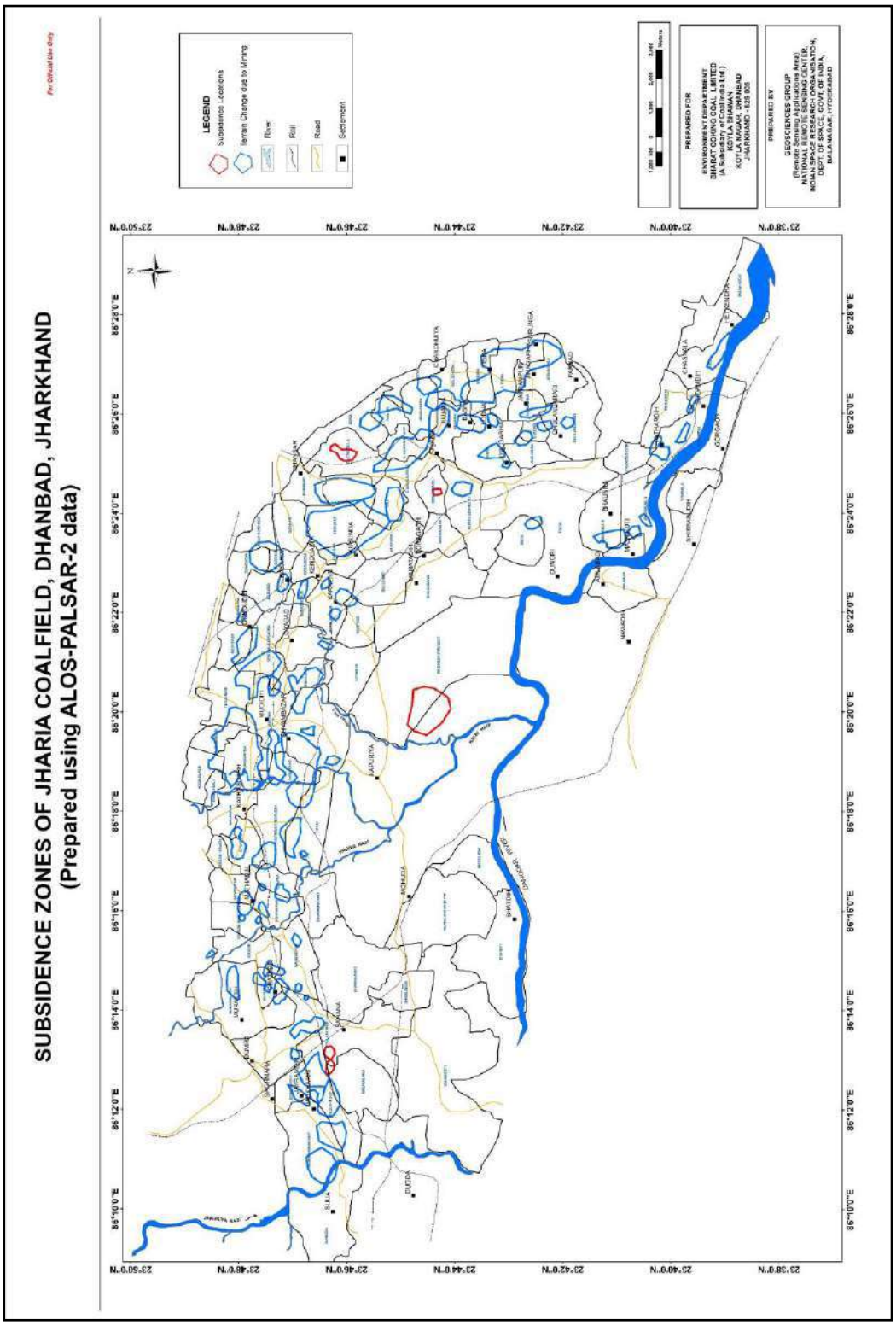


Figure 11: Subsidence map of Jharia coal field, Dhanbad.

CHAPTER V

FIELD WORK

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

The salient overview of the field observations are as follows:

Coal-fire observations:

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

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

Subsidence location observations:

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

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

CHAPTER VI

POST FIELDWORK ANALYSIS

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

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

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

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

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

CHAPTER VII

DISCUSSIONS AND CONCLUSIONS

7.1 Discussions

7.1.1 Coal fire analysis

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

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

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

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

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

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

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

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

7.1.2 Subsidence analysis

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

7.2 Conclusions

The following conclusions can be made:

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

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

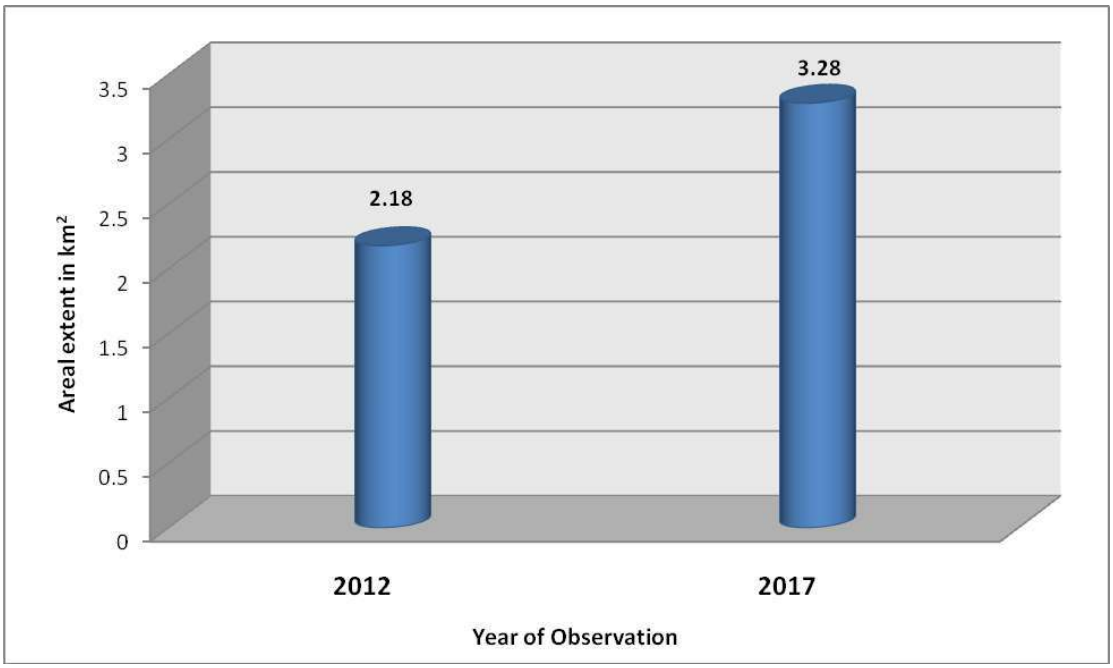


Figure 12: Total fire area statistics

CHAPTER VIII

LIMITATIONS

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

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

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

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

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

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

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

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

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

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

References

1. Gangopadhyay, P.K., Lahiri-dutt, K., Saha, K. (2005): "Application of remote Sensing to identify coal fires in the Raniganj coal belt, India." *Int. Jour of Applied Earth Observation and Geoinformation.*
2. Gangopadhyay, P.K., Malthuis.B, Van Dink (2005): "Aster Derived emissivity and coal-fire related surface temperature anomaly a case study in Wuda, North China," *Int. Jour. of Remote Sensing*, vol-26, No.-24, pp-5555-5571.
3. Schmugge, T., French, Ritchie, J.C., Rango, A., Pelgrum, H. (2002): "Temperature and emissivity separation from multispectral thermal infrared observation," *Remote Sensing of Environment*, 79, pp-189-198.
4. Saraf A.K., Prakash A., Sengupta, S., Gupta, R.P (1995): "Landsat-TM data for estimating ground temperature and depth of sub-surface coal fire in the Jharia coalfiled, India," *Int. Jour. Remote sensing vol-16, no-12*, 2111-2124.
5. Gangopadhyay P.K., (2003): "Coalfire detection and monitoring in Wuda, North China, A multispectral and multi-sensor approach:-Ph.D. Thesis, ITC Netherland.
6. Gupta, R.P. (2003): "Remote Sensing Geology", *Springer-Verlag.Third ed.*pp-183-216.
7. Kealey, P.S and Hook S.J(1993): "Separating temperature and emissivity in thermal infrared Multispectral Scanner Data: Implication for recovering land surface temperatures", *IEE Transaction on Geoscience and Remote Sensing,vol,31,no-6,*pp-1155-1164
8. Zhang, J., Wagner, W., Prakash, A., Mehl,H. and Voigt,S.(2004): "Detecting coal fires using remote sensing techniques,*" Int. Jour. Remote sensing, vol-25, no-6,* pp3193-3220.
9. Bhattacharya, A. and Reddy, C.S.S. (1995): Inventory and monitoring of underground and surface coal mine fire in Jharia coalfield, Bihar using thematic mapper thermal IR data: *Geosciences Group, Official report, NRSA.*
10. Coal mine fire delineation and surface features mapping using satellite data in Jharia coal field, Dhanbad, Jharkhand. Geology and Geophysics division. *Official report, NRSA, 2006*
11. Coal mine fire delineation and surface features mapping using satellite data in Jharia coal field, Dhanbad, Jharkhand. Geosciences Group. *Official report, NRSC, 2014*

Annexure –I

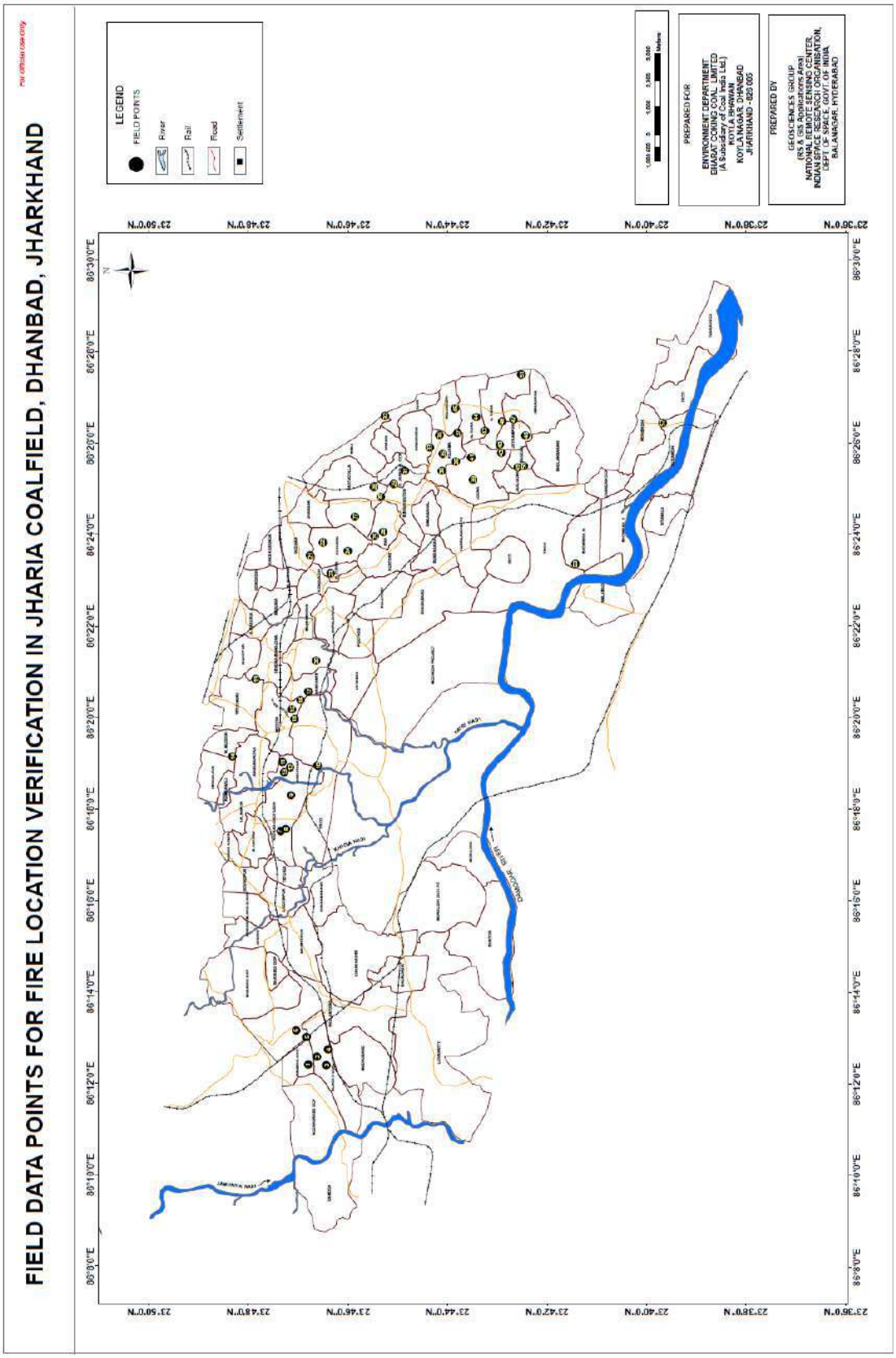


Figure 13. Field data points for coal fire verification

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

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

Annexure –II

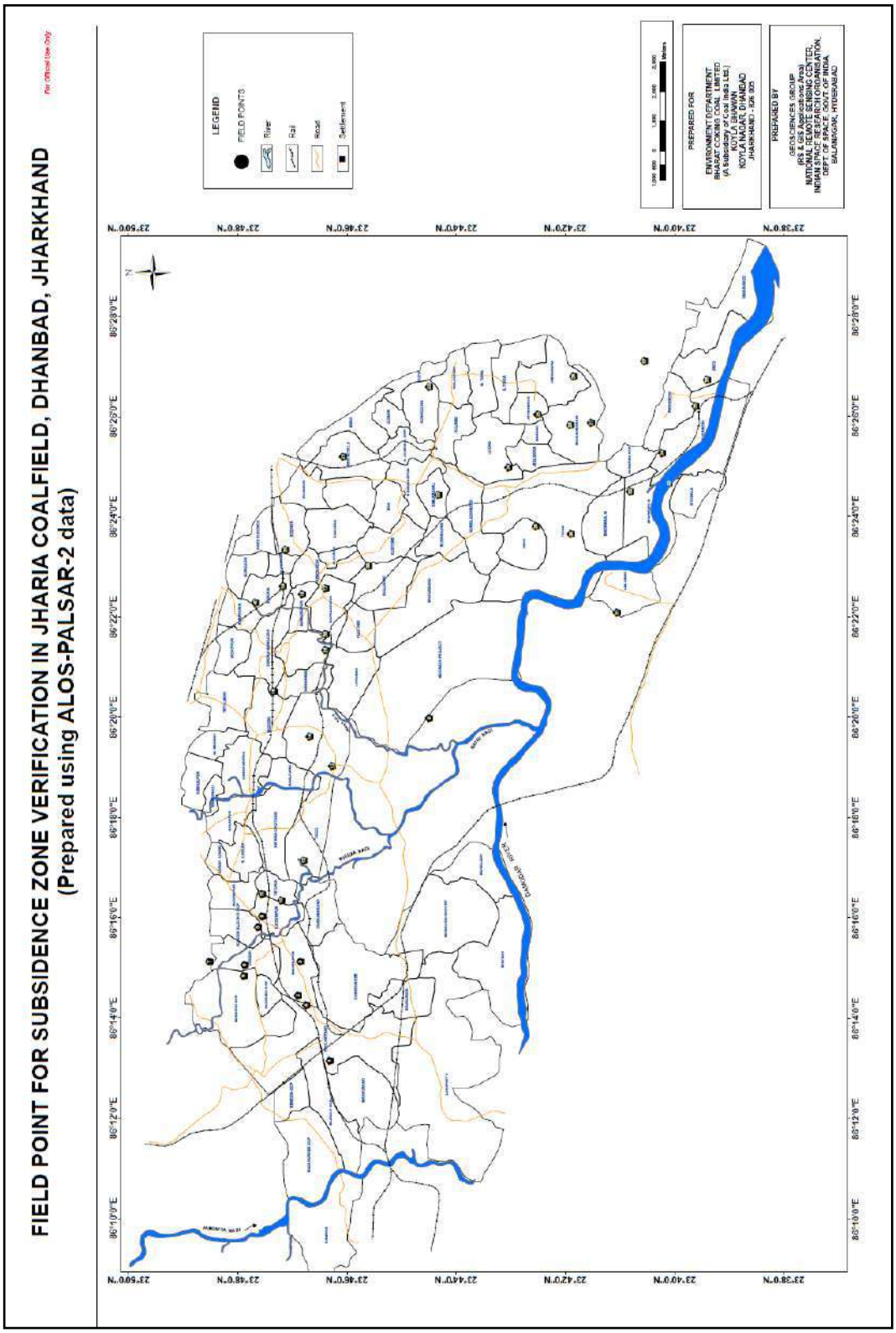


Figure 14. Field data points for subsidence verification

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

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

Annexure –III

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

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

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

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

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

Annexure –IV

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

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

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

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

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

Figure 20: Fume cracks in the Bhulanbarari area.

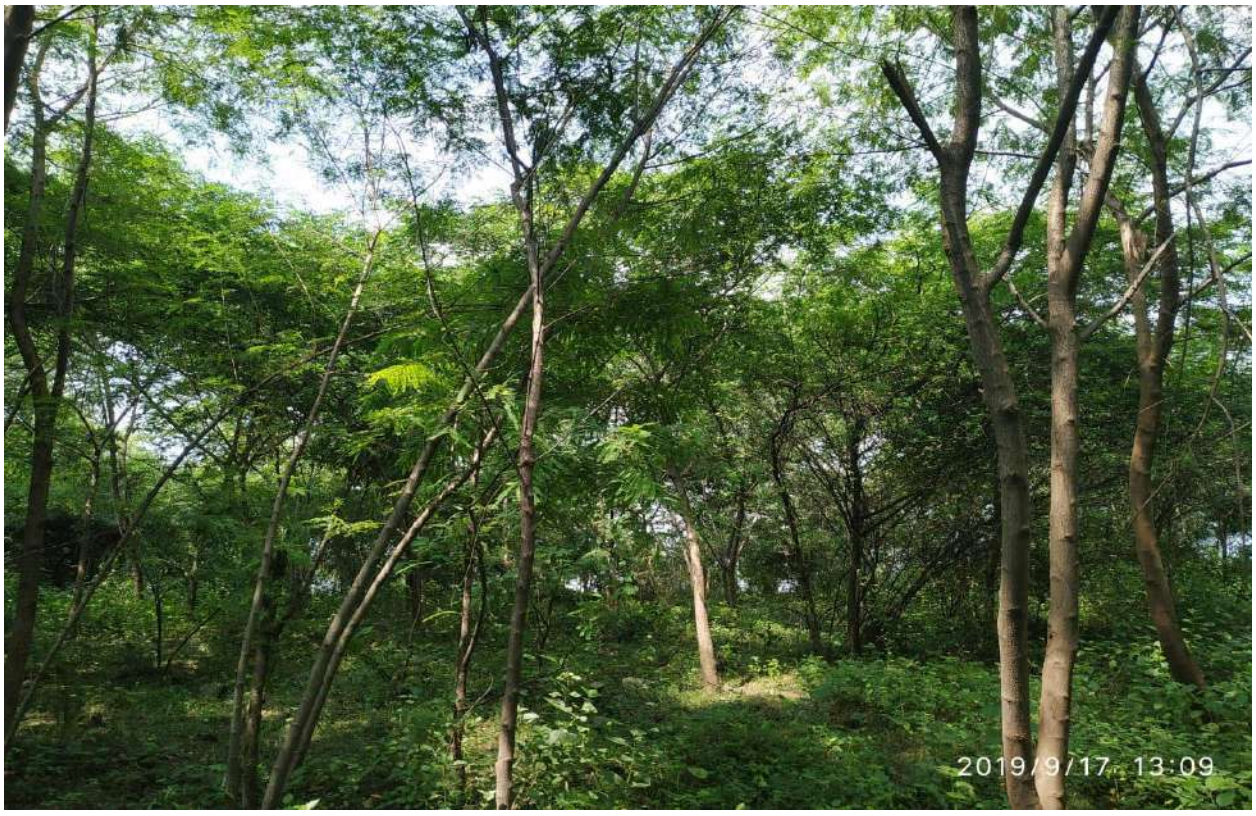
Annexure-II

		Deposit in Escrow Accounts with Bank of Baroda																
ESCROW ACCOUNT AT BOB	**A/C No**	**Deposit (Rs. In Lakhs)**								**Interest (Rs. In Lakhs)**								
		2013-14	**2014-15**	**2015-16**	**2016-17**	**2017-18**	**2018-19**	**2019-20**	**Total**	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**	**2018-19**	**2019-20**	**Total**	**G Total**
MAHESHPUR COLLIERY	**00150100008836**	38.40	15.84	16.63	17.46	18.34	19.25	**20.22**	**146.14**	1.46	3.73	5.09	5.47	6.46	8.18	**10.16**	**10.54**	**186.68**
JOGIDIH COLLIERY	**00150100008823**	39.85	8.58	9.01	9.46	9.94	10.43	**10.96**	**98.23**	1.52	3.87	4.61	4.55	5.05	6.12	**7.34**	**33.06**	**131.29**
GOVINDPUR UG	**00150100008835**	20.58	21.61	22.68	23.82	25.01	26.26	**27.58**	**167.54**	0.78	2.00	3.85	4.82	6.21	8.34	**10.79**	**36.79**	**204.33**
BLOCK IV /KOORIDIH MINE	**00150100008834**	100.83	105.87	111.16	116.72	122.56	128.68	**135.12**	**820.94**	3.84	9.80	18.85	23.62	30.45	40.85	**52.86**	**180.27**	**1001.21**
NAKC	**00150100008831**	60.59	63.62	66.80	70.14	73.65	77.34	**81.19**	**493.33**	2.31	5.89	11.33	14.19	18.30	24.55	**31.77**	**108.33**	**601.66**

Annexure-III

Stone pitching along the water body

Annexure-IV



Biological reclamation of stabilized OB dumps in New Akashkinaree Colliery

Annexure-V

Details of OB generated

Colliery Name	OB generated (cum)						
	FY 2013-14	FY 2014-15	FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	FY 2019-20
New Akashkinaree Colliery	1001014	2810951	5942051	3615412	3811560	1726961	2754293
Block-IV Colliery	1725116	1837296	1780795	4319287	3479501	2072033	2789974

Details of backfilling

Colliery Name	Backfilled Area (Ha)						
	FY 2013-14	FY 2014-15	FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	FY 2019-20
New Akashkinaree Colliery	3.6	3.8	13	8.0	4.0	4	5
Block-IV Colliery	7.38	5.23	7.54	2.50	3.70	2.7	4.9

Above data is as per colliery records.

Annexure-VI

Proposed Coal Production, OB generation, backfilling and biological reclamation for FY 2020-21

FY 2020-21	New Akashkinaree Colliery (Mixed)	Block-IV Colliery (Mixed)	Maheshpur Colliery (UG)	Jogidih Colliery (UG)
Coal Production (Te)	10,00,000	8,50,000	30,000	40,000
OB (cum)	30,00,000	25,50,000	NA	NA
Backfilling (Ha)	5	2	NA	NA
Biological reclamation (Ha)	5	4.5	Nil	Nil

Annexure-VII

Details of Plantation

Year of plantation	Total Area Covered (Ha)	Species	Survival rate
FY 2014-15	4	Gamhar, Siris, Subabool, Bel, Kachnar, Kher,Amaltas, Mehandi, Sheesham etc.	80 %
FY 2015-16	4.5		
FY 2016-17	5		
FY 2017-18	4		
FY 2018-19	5		
FY 2019-20	1		

Proposed Plantation for FY 2020-21

Type of Plantation	Area Covered	Executing Agency	Cost (Rs)
OB dump biological reclamation	9.5	DFO, Dhanbad	25,46,482.84
Bamboo gabion plantation	388 nos.	DFO, Dhanbad	8,69,969.74

Annexure-VIII

Sedimentation ponds and settling tanks for mine water utilization

Roads constructed within colliery premises

Fixed type water sprinkler system at Railway siding

Annexure-IX

Progress Report

1st Phase Air Monitoring report for

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

Sponsor

Bharat Coking Coal Limited (BCCL)

CSIR-National Environmental Engineering Research Institute, Nagpur

2019

Contents

1. Introduction 3

1.1 Project Background 4

1.2 Project objectives 4

2. Field visit 5

2.1 Jharia coalfield maps: 5

2.2 Site Identification: 7

3. Sampler Selection and Procurement 8

4. Monitoring parameters 9

4.1 Monitoring Frequency 10

4.2 Filter handling and Weighing: 12

5. Ambient Air Quality Monitoring 12

List of Figures

Figure 2.1 Identified air monitoring station in Jharia Coalfield 8

Figure 4.1 Glimpses of air monitoring of some locations 11

List of Tables

Table 2.1 Jharia coalfields Site visit on cluster-base 6

Table 3.1 Samplers Procured for Monitoring 8

Table 4.1 Ambient Air Quality Sampling/Analysis Methodology for Target Pollutants 9

Table 4.1.1 Frequency of Air pollutants sampling in Jharia Coalfield 10

Table 5.1 Physical and Chemical components for characterization of Particulate matter 15

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.

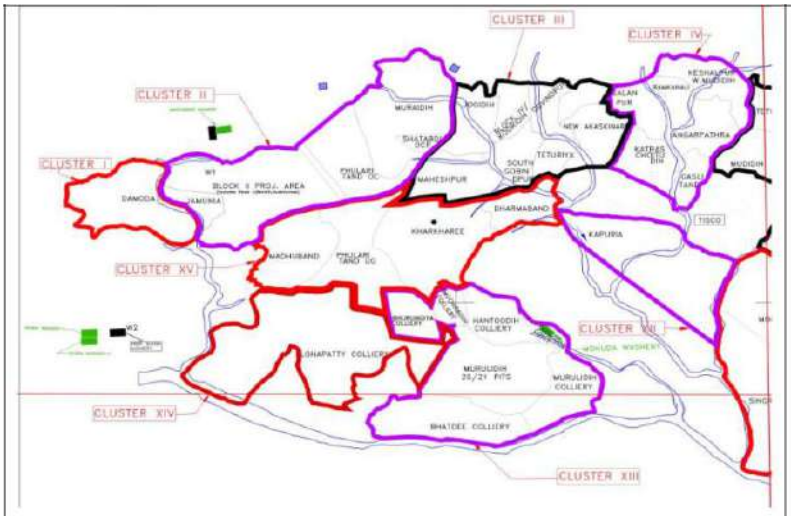
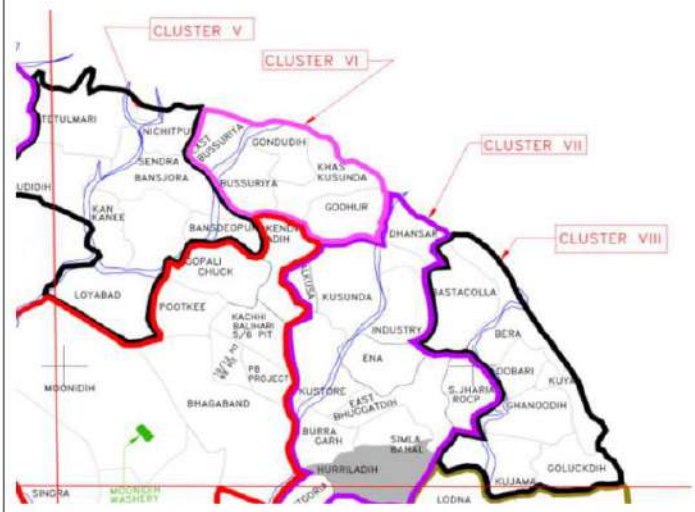
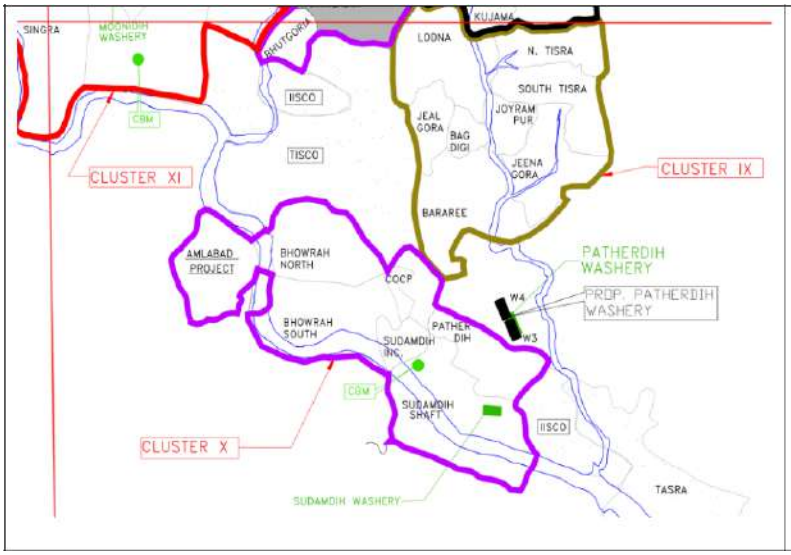
 	**Part 1:** Cluster VI, VII, VIII, and X **Part 2:** I, II,III, IV, V, XI, XII, XIII, and XV
	**Part 3:** Cluster IX

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.

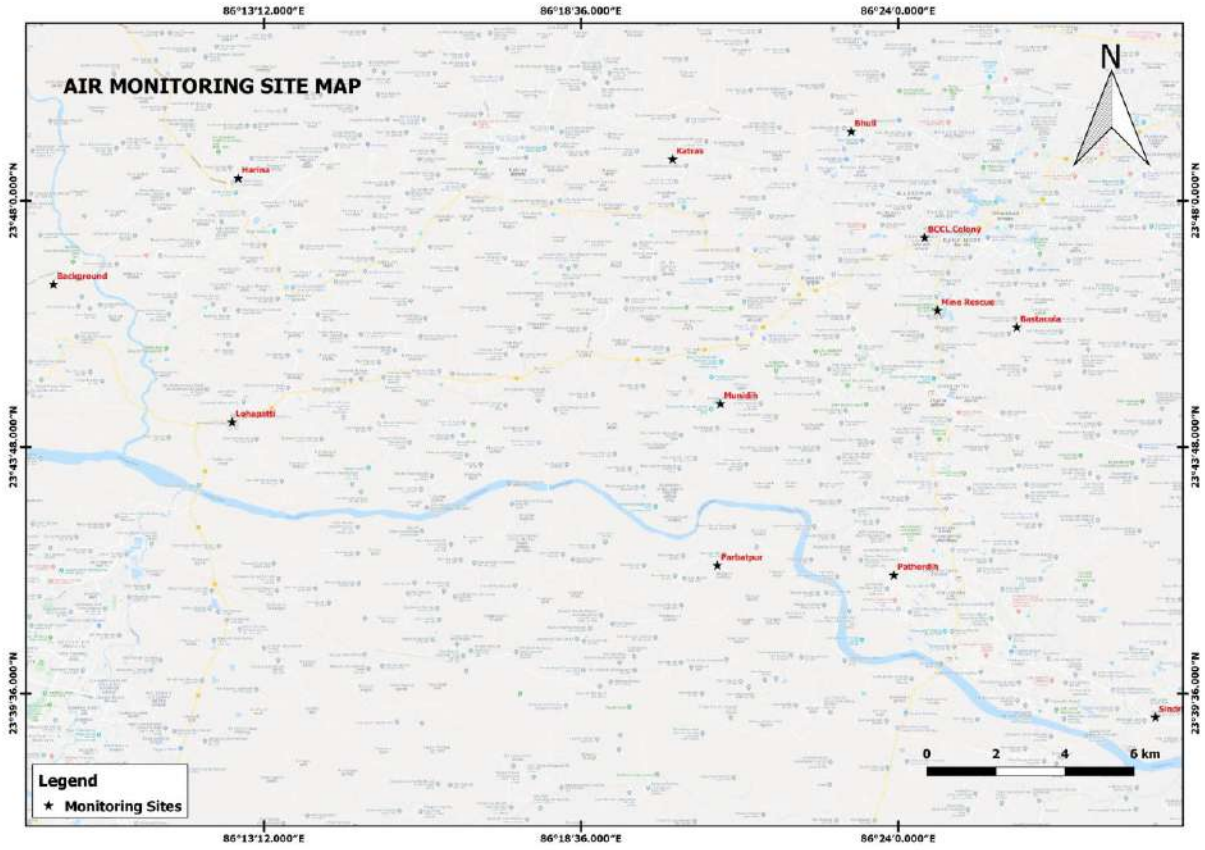


Figure2.1 Identified air monitoring station in Jharia Coalfield

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 µg/m^3	5 µg/m^3	9 µg/m^3	4 µg/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-X

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/

GROUNDWATER LEVEL & QUALITY REPORT

FOR CLUSTER OF MINES, BCCL

(Assessment year – 2019-20)

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

JHARIA COALFIELD AND RANIGANJ COALFIELD (PART)

For

(BHARAT COKING COAL LIMITED)

(A Subsidiary of Coal India Limited)

KOYLA BHAWAN (DHANBAD)

Prepared by

Hydrogeology Department

Exploration Division

CMPDI (HQ), Ranchi

MARCH – 2020

Job no-200419012

GROUNDWATER LEVEL & QUALITY REPORT

FOR CLUSTER OF MINES, BCCL

(Assessment year – 2019-20)

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

JHARIA COALFIELD AND RANIGANJ COALFIELD (PART)

For

(BHARAT COKING COAL LIMITED)

(A Subsidiary of Coal India Limited)

KOYLA BHAWAN (DHANBAD)

Prepared by

Hydrogeology Department

Exploration Division

CMPDI (HQ), Ranchi

MARCH – 2020

PERSONNEL ASSOCIATED

FIELD EXERTION

Debasis Bandyopadhyay Manager (Geology)

HYDROGEOLOGICAL DOCUMENTATION

Debasis Bandyopadhyay Manager (Geology)

OVERALL GUIDANCE

Dr. A.K. Panda General Manager (Exploration)

CONTENT

			Page No.
	DETAILS OF THE REPORT		1
1.0	Introduction		2 - 3
	1.1	Climate, Temperature & Rainfall	2
	1.2	Geomorphology	2
	1.3	Drainage	3
2.0	Groundwater system		3 - 5
	2.1	Geology of the area	3
	2.2	Hydrogeology of the study area	4
	2.3	Aquifer Description	5
	2.4	Aquifer parameters	5
3.0	Groundwater level monitoring		6 - 24
	3.1	Historical groundwater level	7
	3.2	Groundwater level scenario (mining/non-mining)	8
	3.3	Quarterly groundwater level, Cluster of mines	09
	A	Monitoring of Ground Water Levels of Cluster-I	09
	B.	Monitoring of Ground Water Levels of Cluster-II	10
	C.	Monitoring of Ground Water Levels of Cluster-III	11
	D.	Monitoring of Ground Water Levels of Cluster-IV	12
	E.	Monitoring of Ground Water Levels of Cluster-V	13
	F.	Monitoring of Ground Water Levels of Cluster-VI	14
	G.	Monitoring of Ground Water Levels of Cluster-VII	15
	H.	Monitoring of Ground Water Levels of Cluster-VIII	16
	I.	Monitoring of Ground Water Levels of Cluster-IX	17
	J.	Monitoring of Ground Water Levels of Cluster-X	18
	K.	Monitoring of Ground Water Levels of Cluster-XI	19
	L.	Monitoring of Ground Water Levels of Cluster-XIII	20
	M.	Monitoring of Ground Water Levels of Cluster-XIV	21
	N.	Monitoring of Ground Water Levels of Cluster-XV	22
	O.	Monitoring of Ground Water Levels of Cluster-XVI	23
4.0	Ground water level scenario		24 – 25
5.0	Groundwater Quality		26
6.0	Stage of Groundwater Extraction		27-28
7.0	Conservation measures & future strategy		29 – 30

Annexure-I:	Location of Hydrograph Stations	31
Annexure-IIA:	Details of Hydrograph Stations	32 - 33
Annexure-IIB:	Historical water level data	34 - 35
Annexure-III:	CGWB well Hydrographs	36 - 37
Annexure-IV:	Groundwater sample location details	38
Annexure-V (A-D):	Groundwater sample quality analysis	39 – 43
Annexure-VI:	Hydrographs of Cluster-I to XVI	44 – 58

Abbreviations 59

LIST OF TABLES

Table No	Description	Page No.
Table No – 1	Historical Groundwater Level	8
Table No – 2	Depth to water table	9
Table No – 3	Average hydraulic gradient	9
Table No – 4	GW level data Cluster wise	26
Table No – 5	Block wise Stage of GW Development	29
Table No – 6	Cluster wise GW Development scenario	30

LIST OF FIGURES

Nos.	Description
Figure No - 1	Groundwater monitoring station location map
Figure No - 2	Groundwater Quality sample location map
Figure No – 3	Proposed Piezometers location map
Figure No – 4	Water Table Contour Map: Pre-monsoon 2018

LIST OF ANNEXURES

Nos.	Description	Annexure No
1.	Location details of Monitoring stations	Annexure-I
2.	Details of Hydrograph Stations	Annexure-IIA
3.	Historical Water Level data	Annexure-IIB
4.	Hydrographs of CGWB observation stations	Annexure-III
5.	Groundwater sample location details	Annexure-IV
6.	Groundwater sample quality analysis	Annexure-V (A-D)
7.	Hydrographs of Cluster-I to XVI	Annexure-VI

DETAILS OF THE REPORT

Sl No.	ITEMS	INFORMATIONS
1	Geographical Area	Jharia Coalfield (JCF): 453 sq. km. Raniganj Coalfield (RCF part): 19.64 sq. km. (Cluster-XVI area only)
2	Major Physiographic Units	Dissected Pediplain with surface Reduced Level (RL) varies from 160 m to 220 m above mean sea level (AMSL) in JCF and 100 m to 140 m AMSL in RCF.
3	Drainage System	Damodar River is the master drainage flowing along western boundary of the JCF. Jamunia River, Khudia River, Katri River, Jarian Nala, Ekra Jore, Kari Jore, Kashi Jore, Chatkari Jore and their tributaries are flowing through the JCF area. Damodar River, Barakar River is the master drainage of the part of RCF area (CV Area).
4	Annual Rainfall	Jharkhand State – 1264.0 mm Dhanbad District - 1271.60 mm (Source: Rainfall Statistics of India-2018, IMD, Ministry of Earth Sciences) Normal Rainfall – 1296.30 mm Dhansar Mine Rescue Station – 1315 mm (2018)
5	Geological Formations	Gondwana Formation (Talchir Formation, Barakar Formation, Barren Measure & Raniganj Formation)
6	Aquifer System	Top Unconfined/Phreatic Aquifer – average thickness 25 m Semi-confined to confined Aquifer – average thickness 50–200 m
7	Hydrogeological properties	Unconfined Aquifer (Damoda BJ Section & Block-III): Hydraulic Conductivity – upto 0.50 m/day Transmissivity – 10 - 42 m^2/day Semi-confined to confined Aquifer (Sitanala & Kumari Block): Hydraulic Conductivity – 0.0006-1.44 & 0.05-0.0027 m/day Transmissivity – 0.06 – 0.573 m^2/day
8	Groundwater Level Monitoring Network	Out of total 254 no of monitoring stations 63 nos located within core mining area and rest comes within Buffers zone. 60 Nos. of Groundwater monitoring well (Dug Wells) network is established by CMPDI to record groundwater level data in and around the Core Zone of JCF and 3 Nos. of Groundwater monitoring well (Dug Wells) in RCF (CV Area).
9	Groundwater Levels Below Ground Level (bgl)	JCF area: Pre-monsoon – 0.95 to 15.88 m (Avg. 5.46 m bgl) in '2019 Post-monsoon – 0.45 to 05.95 m (Avg. 2.34 m bgl) in '2019 RCF area (part): Pre-monsoon – 1.60 to 9.35 m (Avg. 5.29 m bgl) in '2019 Post-monsoon – 0.80 to 3.88 m (Avg. 2.10 m bgl) in '2019
10	Groundwater Quality	Potable (Annexure- IV)
11	Proposed Piezometers	New piezometers (23 nos.) have been proposed to monitor impact of coal mining on groundwater regime within the coalfield area (JCF & part of RCF) for maximum depth upto 290 m to monitor deeper aquifers.
12	Stage of Groundwater Development (CGWB)	Dhanbad District-76.30% (GWRE-2017)

1.0 INTRODUCTION

1.1 CLIMATE, TEMPERATURE & RAINFALL

The Jharia Coalfield (JCF) and part of Raniganj Coalfield (RCF) area in Dhanbad District belongs to sub-humid tropical climatic region. The maximum temperature during summer shoots upto 45° C and falls between 10° C to 5° C in winter. The maximum rainfall occurs during the period between June and September.

The annual rainfall in the Dhanbad District is 1240.70 mm (Rainfall Statistics of India-2017, IMD (Ministry of Earth Sciences), has been considered. The non-monsoon rainfall in the District is 259.50 mm (Winter-9.50 mm, Pre-monsoon-73.80 mm and Post-monsoon-176.20 mm) and the monsoon rainfall is 981.30 mm of total annual rainfall. Monsoon Rainfall is around 80% of total annual rainfall in 2017 in Dhanbad District. Rainfall is the primary source of groundwater recharge. The normal rainfall of Jharkhand is 1296.30 mm (2015) as documented in MOSPI, Govt. of India.

1.2 GEOMORPHOLOGY

Northern part of the JCF area is covered with hills and thin forest. In general, the altitude varies from 220 m AMSL in Barora area (Cluster-I) to 160 m above mean sea level (AMSL) in Sudamdih area (Cluster-X). Pediplains are developed over sedimentary rocks or Gondwana formation consisting of Sandstone, Shale, coal, etc. Dissected pediplains are developed over Gondwana formations found in Jharia, Baghmara, Katras areas etc. However, in RCF (part) areas the altitude varies from 100 m to 140 m AMSL (Cluster-XVI). The general slope of the topography is towards south, i.e. Damodar River.

1.3 DRAINAGE

The drainage pattern of the area is dendritic in nature. The drainage system of the area is the part of Damodar sub-basin. All the rivers that originate or flow through the coalfield area have an easterly or south easterly course and ultimately joins Damodar River, the master drainage. The drainage of the JCF is mainly controlled by Jamuniya River (5th order), Khudia nala (3rd order), Katri River (4th) and Chatkari nala (3rd order) flowing from north to south and joins Damodar River. Whereas, Barakar River and Khudia River are controlling the drainage pattern of RCF (part) and joins Damodar River in the south. Damodar River is the main drainage channel and flows from west to east along the southern boundary of JCF and RCF.

The drainage map of the JCF and part of RCF has been prepared on topographic map of scale 1:50,000 (**Figure No-1**). The watershed of all tributary rivers (Jamuniya River to Barakar River) falls within the north-western part of Damodar sub-basin which comes under Lower Ganga Basin.

Besides, a large number of ponds/tanks are distributed in and around JCF, out of which one prominent lake is located at Topchanchi in the north-west part. Two reservoirs, Maithon dam in Barakar River and Panchet dam in Damodar River near to Chanch Victoria Area of BCCL (part of RCF) are the main source of water supply to the nearby area. Jharia Water Board, Damodar Water Supply Scheme and Mineral Area Development Authority (MADA) are supplying water.

2.0 GROUNDWATER SYSTEM

2.1 GEOLOGY OF THE AREA

The Jharia Coalfield covers an area of 453 sq. km. located in Dhanbad District, Jharkhand. The non-coal bearing Talchir Formation is exposed in patches along the northern fringe of the Coalfield. The Barakar Formation which overlies the Talchir is covering the most part of the Jharia Coalfield and having an area of 218 sq. km. This is successively overlain by the non-coal bearing Barren Formation which is mainly exposed in the central part of the Coalfield. This, in turn, is overlain by the Raniganj formation (Coal Bearing horizon) in the south-western part of the Coalfield and covers an area of 54 sq. km.

Chanch-Victoria Area which is located in the western part of Raniganj Coalfield. The Raniganj coalfield represents the eastern most coal basin in the Damodar Valley Region and located in Burdwan District, West Bengal. The Coalfield is almost elliptical in shape and covers an area of about 1530 sq. km. out of which only 35 sq. km. comes under leasehold area of BCCL out of which 19.64 sq. km is the study area (Cluster-XVI only). The coal bearing formations of the area belongs to Barakar Formation of the Lower Gondwana.

2.2 HYDROGEOLOGY OF THE STUDY AREA

The permeable formations mainly composed of sandstone behave as aquifer units. The coal seam and shales developed in the area act as impermeable beds i.e. aquiclude. The aquifer materials of Gondwana Formation are constituted of fine to coarse grained sandstone having primary porosity of intergranular void space. The secondary porosity formed due to presence of faults, fracture, joints, etc. Sandstone of Gondwana formations in JCF and RCF are very hard, compact and cemented sandstone and forming less potential aquifer, particularly the deeper aquifer system. The secondary porosity along with primary porosity forms a conduit system making these formations good aquifers for movement and storage of ground water.

2.3 AQUIFER DISPOSITION

The aquifer system for shallow and deeper aquifer has been established through hydrogeological studies, exploration, surface and subsurface geophysical studies in the JCF and RCF (part) covering all geological formations. The aquifer can be divided into two zones – Un-confined/Phreatic (shallow) and Semi-confined to confined (deeper) aquifer.

PHREATIC/UN-CONFINED AQUIFER

The top aquifer occurred above the top most coal seam/shale bed is called un-confined or water table aquifer and it consists of relatively permeable formation such as weathered sandstone and loose soil. The thickness of the un-confined aquifer is varying from few meters to 50 m. This un-confined aquifer is more potential than deep seated semi-confined to confined aquifer.

SEMI-CONFINED TO CONFINED AQUIFER

The semi-confined to confined aquifer consisting of sandstone bed is sandwiched with coal seams/shale beds and multiple aquifer system developed due to presence of multiple numbers of coal seams/shale beds. With the presence of intercalated shale and carbonaceous shale beds and reduction in permeability with depth, the lower aquifers are poor in potential.

2.4 AQUIFER PARAMETERS

PHREATIC/UN-CONFINED AQUIFER – The wells are tested by CMPDI for determination of aquifer parameters in Damuda (BJ Section) and Block-III area of JCF. The hydraulic conductivity of the un-confined aquifer is 0.50 m/day as computed from pumping tests on the wells. The transmissivity of the unconfined aquifer ranges from 10.68 m^2 /day to 41.48 m^2 /day.

SEMI-CONFINED TO CONFINED AQUIFER – Below the un-confined aquifer, the sandstone partings in-between impervious layers of shale and coal seams is designated as semi-confined / confined aquifers. The sandstones in these aquifers are fine to coarse grained, hard and compact with very low porosity. Mostly groundwater occurs in the weak zones formed due to weathering, fracture, faults, which create the secondary porosity. The hydrogeological parameter has been determined by CMPDI in Sitanala Block by conducting aquifer performance test (APT). The hydraulic conductivity (K) of semi-confined aquifer in Barakar Formation ranges from 0.0006 m/day to 1.44 m/day. The hydrogeological parameter has also been determined at Kumari OCP Block in the central JCF by conducting aquifer performance test. The hydraulic conductivity (K) of semi-confined aquifer in Barakar Formation in this area ranges from 0.0027 m/day to 0.05 m/day.

Aquifer Type	Hydraulic Conductivity (m/day)	Transmissivity (m^2 /day)	Remarks
Unconfined	0.50	10.68 – 41.48	Site: Damuda (BJ Section) and Block-III area
Semi-confined	0.0006 – 1.44 (1) 0.0027 – 0.05 (2)	-	Site: (1): Sitanala Block (2): Kumari Block

3.0 GROUNDWATER LEVEL MONITORING

To collect the representative groundwater levels in the study area, CMPDI has established a monitoring network of total 254 monitoring stations out of which 64 located within core zone and rest comes within Buffer zone. 60 dug wells within JCF and 04 dug wells within RCF (part) area (Details of the Hydrograph stations & water level are given in **Annexure-I, IIA** & **IIB**) spread over the entire BCCL leasehold area, **Figure No-1**. Water level monitoring in 254 hydrograph stations has been done in pre-monsoon as well as in post monsoon whereas in 64 stations monitoring done in quarterly (March, May, August and November month of 2018) basis.

Depth to water level of the water table depict the inequalities in the position of water table with respect to ground surface and is useful in delineating recharge / discharge areas, planning of artificial recharge structure and shows the overall status of the groundwater level in the area. Historical groundwater level (GWL) of entire JCF and part of RCF with fluctuation, GWL of Non-mining / Mining areas and GWL of the Cluster of Mines of BCCL are shown in this report to assess the effect of Coal mining activity in the groundwater regime in and around the Coalfield area.

Mining is a dynamic phenomenon. The mining activity creates dis-equilibrium in environmental scenario of the area and disturbs the groundwater conditions/regime in particular. The impact on shallow water regime due to mining activity can be broadly viewed as under:

- Historical GWL with annual fluctuation over the years
- GWL scenario in Non-mining and Mining area (OC/UG mines)
- GWL scenario of Cluster of mines of BCCL

**Construction of piezometers within Jharia Coalfield and part of Raniganj Coalfield to monitor groundwater level of deeper aquifers is already in progress.*

3.1 HISTORICAL GROUNDWATER LEVEL

Historical GWL of JCF and part of RCF are given from 2005 to 2019 of CMPDI monitoring stations (total 63 stations within Coalfield area). Pre-monsoon and Post-monsoon GWL with Fluctuation has been mentioned below in the table.

Table No – 1: Historical Groundwater Level

Period		(Water level in metre below ground level)								
		Pre-Monsoon (April/May)			Post-Monsoon (Nov/Dec)			Fluctuation		
		From	To	Average	From	To	Average	From	To	Average
JCF	2005	0.07	19.08	6.29	0.84	12.13	3.20	0.12	12.45	3.21
	2007	0.40	19.27	5.66	0.35	8.21	2.87	0.02	16.15	2.96
	2008	0.45	18.35	5.42	0.35	14.20	3.62	0.03	9.22	2.45
	2010	0.85	14.47	5.24	0.10	15.88	4.48	0.02	5.55	1.54
	2012	1.27	18.68	5.58	0.15	7.80	2.72	0.08	13.45	2.96
	2013	0.70	19.20	5.65	0.45	8.35	2.77	0.29	15.88	3.17
	2014	0.70	16.28	4.92	0.75	14.98	3.27	0.25	10.15	2.17
	2015	1.38	17.20	6.00	0.45	14.58	3.92	0.28	7.62	2.15
	2016	0.78	16.73	5.64	0.30	12.43	3.19	0.23	6.35	2.88
	2017	0.67	16.28	5.61	0.15	6.97	2.41	0.10	12.10	3.25
	2018	1.20	14.58	5.55	0.40	7.17	2.83	0.20	9.45	2.68
	2019	0.95	15.88	5.46	0.45	5.95	2.34	0.20	13.40	3.05
RCF (part)	2008	5.02	10.50	7.59	2.85	4.90	3.71	1.82	6.60	3.87
	2010	2.20	8.85	4.74	2.78	9.58	4.63	0.68	1.10	0.89
	2011	3.57	8.02	4.98	2.50	6.21	3.75	0.55	1.90	1.23
	2012	3.10	7.34	4.59	1.55	7.00	3.66	0.05	2.78	0.94
	2013	1.70	9.87	6.54	2.90	8.85	4.71	1.02	5.54	2.84
	2014	3.27	6.48	4.57	2.13	3.03	2.63	0.54	3.45	1.94
	2015	3.38	9.52	5.33	2.68	8.20	5.11	1.06	1.32	1.81
	2016	3.61	10.65	6.24	0.90	6.50	3.18	1.63	4.40	3.06
	2017	1.93	5.80	3.25	1.63	3.78	2.47	1.63	3.78	0.78
	2018	2.34	8.70	4.35	1.75	5.70	2.75	0.41	2.55	1.59
	2019	1.60	9.35	5.29	0.80	3.88	2.10	0.80	5.47	3.20

3.2 GROUNDWATER LEVEL SCENARIO IN NON-MINING/MINING AREA

Depth to water level (DTW) range in different formations with respect of mining and non-mining areas is summarized in the Table No-2.

Table No – 2: Depth to water table

Formation	***Area***		***DTW (bgl, m)*** ***[Year-2019]***		***Average GWL (m)***	
			Pre-monsoon (Apr/May)	***Post-monsoon (Nov/Dec)***	***Pre-monsoon***	***Post-monsoon***
Sedimentary (Gondwana)	Non-mining		1.30-11.22	0.65-4.52	5.50	2.50
	Mining	OC	0.95-12.60	0.45-5.95	5.16	2.21
		UG	1.20-15.88	0.55-4.57	5.95	2.74
Metamorphics	Peripheral part of the Coalfield		0.45-15.10	0.35-9.20	7.15	3.95

The study revealed that water table is in shallow depth and there is no significant stress in the water table due to coal mining activity. Mining and Non-mining areas shows barely any difference in water table condition in the JCF and RCF (part) area. The average hydraulic gradient of the water table within mining and non-mining areas is given in Table No-3. There is no significant change in hydraulic gradient has been observed. Relatively steep gradient near active opencast mining areas w.r.t., Non-Mining, Underground mines and Metamorphics areas is observed.

Table No – 3: Average hydraulic gradient

Sl. No	***Formation***	***Area***		***Average hydraulic gradient***
1	Sedimentary (Gondwana)	Non-Mining		1.5×10^{-3} to 2.0×10^{-3}
2		Mining	OC	5.0×10^{-2} to 4.0×10^{-3}
3			UG	2.0×10^{-2} to 3.0×10^{-3}
4	Metamorphics	Peripheral part of the Coalfield		1.0×10^{-3} to 2.0×10^{-3}

3.3 C Monitoring of Ground Water Levels of Cluster-III

Cluster-III consists of nine mines namely, Jogidih UG, Maheshpur UG, South Govindpur UG, Teturiya UG, Govindpur UG, New Akashkinaree mixed mine (OC & UG) and Kooridih/Block-IV mixed mine (OC & UG) under the administrative control of Govindpur Area of BCCL. This Cluster of mines is located in western part of Jharia Coalfield in Dhanbad district of Jharkhand.

The present leasehold area of Cluster-III is 1420.0 Ha. The area is plain with gentle undulation with RL varies from 160 m to 208.80 m AMSL. The general slope of the area is towards south. Khudia River, Baghdihi Jore, Katri River and its tributaries are controlling the drainage system of the area. The area comes under the watershed of Khudia River.

5 hydrograph stations (**A-12, A-25, A-29, B-14 and B-60**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has been done in the months of May, August, November'2019 and January'2020, the Ground water level data is enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)			
			May'19	Aug'19	Nov'19	Jan'20
1	A-12	Jamua	2.10	0.29	0.45	0.75
2	A-25	Sinidih	6.08	1.43	1.93	2.48
3	A-29	Dharmaband	4.85	1.20	3.40	3.65
4	B-14	Mathadih	2.24	0.54	0.94	2.04
5	B-60	Sonardih	8.13	1.23	3.23	4.93
Average WL (bgl)			4.68	0.94	1.99	2.77

Ground Water Level (in bgl) varies from 2.10 to 8.13 m during May'19, 0.29 to 1.43 m during August'19, 0.45 to 3.40 m during November'19 and 0.75 to 4.93 m during January'20 within the Core Zone of Cluster-III area.

4.0 GROUNDWATER LEVEL SCENARIO

During the month of May'2019 the depth to water level (in bgl) within 15 nos Cluster of mines varies from 0.95 m to 15.88 m with an average of 5.46 m. During the month of August'2019 the depth to water level varies from 0.10 m to 8.05 m with an average of 1.77 m. During the month of November'2019 the depth to water level varies from 0.45 m to 5.95 m with an average of 2.34 m. During the month of January'2020 the depth to water level varies from 0.62 m to 12.45 m with an average of 3.30 m. The summarized water level data of all clusters are given in **Table No – 4**.

Depth to water level (in bgl) values described that water level goes down to maximum 15.88 m during pre-monsoon'2019 and maximum upto 9.35 m during post-monsoon'2019. Un-confined aquifer is affected around 20 m to 30 m maximum close to active opencast mining areas, showing steep gradient towards mine void. Other than that, there is no mining effect in the water level within JCF area and RCF area (part). Historical water level data and hydrograph of permanent observation stations from CGWB shown in **Annexure–III**.

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

Table No–4: Groundwater level data Cluster-wise

Sl. No.	Cluster of BCCL	No. of Monitoring Wells	Water level fluctuation Below ground level (May, Aug, Nov'19 & Jan'20)	Avg. Fluctuation (in meters)	Formation
1	I	4 nos.	0.45 to 9.45 m	3.00 m	Barakar
2	II	5 nos.	0.80 to 8.13 m	2.85 m	Barakar
3	III	5 nos.	0.29 to 6.08 m	2.70 m	Barakar
4	IV	4 nos.	0.30 to 11.05 m	3.30 m	Barakar
5	V	4 nos.	0.15 to 4.70 m	2.80 m	Barakar
6	VI	2 nos.	0.38 to 9.90 m	4.20 m	Barakar
7	VII	7 nos.	0.25 to 8.62 m	1.50 m	Barakar
8	VIII	4 nos.	0.60 to 9.95 m	2.75 m	Barakar
9	IX	6 nos.	0.70 to 12.60 m	3.10 m	Barakar
10	X	4 nos.	0.10 to 8.00 m	2.35 m	Barakar
11	XI	4 nos.	0.34 to 4.57 m	1.70 m	Barakar & Barren Measure
12	XIII	6 nos.	0.55 to 11.93 m	3.30 m	Raniganj
13	XIV	3 nos.	1.12 to 8.57 m	2.65 m	Raniganj
14	XV	3 nos.	0.52 to 15.88 m	6.70 m	Barakar & Barren Measure
15	XVI	3 nos.	0.80 to 9.35 m	3.20 m	Barakar

Maximum water level fluctuation observed in Cluster-XV (6.70 m) and minimum fluctuation observed in Cluster-VII (1.50 m). However, 3-5 m water level fluctuation observed in Cluster-I, IV, VI, IX, XIII, XV and XVI, 5-7 m water level fluctuation observed in Cluster-XV, 7-9 m water level fluctuation and beyond 9 m is not observed in any of the Cluster of mines of BCCL.

5.0 GROUNDWATER QUALITY

The ground water sample of the study area (15 nos. of Cluster of mines, BCCL) have been collected from dug wells and analysed. Fifteen ground water samples (GW-1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 15 & 16) were analysed during the month of May'2019 at CMPDI, RI-II, Dhanbad. The water sampling details are given in **Annexure–IV** and Water sample locations are shown in **Figure No-2**. The water quality data are enclosed in **Annexure–V.**

The study of the variations in water quality parameters are described below:

The pH of the groundwater samples varies between 7.64 (GW-6) to 8.14 (GW-7) in May 2019, the pH is within the ISI limit of drinking water standard.

The mineral constituents dissolved in water constitute the dissolved solids. The total dissolve solids vary from 366 (GW-5) to 796 mg/l (GW-6) in May 2019, the TDS values are above the IS 10500 standards of drinking water.

During the month of May'19 the alkalinity of the water samples varies from 66 (GW-11) to 124 mg/l (GW-7) and are within the stipulated standard of (200 mg/l) drinking water. The concentrations of calcium in the water samples vary from 28 (GW-16) to 84 mg/l (GW-6) and are ***slightly above*** the permissible limit (75 mg/l) of drinking water standards. The total hardness ranges between 170 (GW-16) to 420 mg/l (GW-3) and the value of total hardness in water samples are ***above*** the permissible limit (200 mg/l). The sulphate ranges between 68 (GW-14) to 136 mg/l (GW-3) and the value of sulphate in water sample are within the permissible limit (200 mg/l). The Iron, Copper, Manganese, Lead, Zinc and Chromium concentration in the water samples are found to be below the upper ISI limits for drinking water.

6.0 STAGE OF GROUNDWATER EXTRACTION

The groundwater is mainly utilized for domestic needs and for irrigation purposes. The groundwater abstraction is mainly through dug wells and bore wells. The stage of groundwater development in Dhanbad District is 76.30% (as per 2017 GWRE). The highest stage of development is in Jharia Block (127.0%) & Dhanbad Block (107.50%) and lowest stage of development is in Baliapur Block (78.24%) as per GWRE-2013. The Gondwana sandstones in general, are known to constitute good aquifers at many places. However, the yield potential of the area adjoining to active mines in the coal belt is poor. The active mines often act as groundwater “sinks”. In contrast, the water logged abandoned mines and pits act as potential sources of groundwater. As per the assessment done by Central Ground Water Board (CGWB), Patna in 2017, the Block wise data of Dhanbad District is given below:

Table No–5: Block-wise Stage of Groundwater development

Sl No.	Administrative Unit		Stage of GW Development	Category (GWRE-2013)	Category (GWRE-2017)
	District	Block			
1	Bokaro	Bermo	156.30%	**Over- exploited**	**Over- exploited**
2	Dhanbad	Baghmara	91.74%	Critical	Critical
3	Dhanbad	Baliapur	78.24%	Semi- Critical	Semi- Critical
4	Dhanbad	Dhanbad	107.50%	**Over- exploited**	**Over- exploited**
5	Dhanbad	Jharia	127.0%	**Over- exploited**	**Over- exploited**
6	Dhanbad	Topchachi	98.45%	Critical	Critical

- **Dynamic Groundwater Resource Assessment, CGWB as per 2013 & 2017.**

Table No–6: Cluster-wise Groundwater development scenario

Cluster/ Area	Adminis-trative Blocks/Stage Of GW Develo-Pment (SOD)	Total Water demand (Lakh cum/year)				Avg. GW level (bgl in m) 2019		GW level declining trend 2005-2019		Quantity Storage / future use (Lakh Cum/ Year)
		Mine Discharge (GW + Rainwater)	Surface Water Source	Total Use (Domestic + Industrial)	Excess Or other use	Pre-monsoon	Post-monsoon	Pre-monsoon	Post-monsoon	
Cluster-I	Bermo (SOD: Over-exploited)	9.56	NIL	7.42	2.14	4.92	1.92	YES	YES	NIL
Cluster-II	Baghmara (SOD: Critical)	170.17	Jamunia river	22.55	23.83	5.68	1.93	NO	NO	123.75
Cluster-III		58.18	NIL	2.58	12.65	4.68	1.99	NO	NO	42.95
Cluster-IV		68.84	MADA (Damodar river)	18.47	12.31	5.26	1.97	NO	NO	38.06
Cluster-V		127.29	MADA	77.92	31.02	4.01	1.19	YES	YES	18.35
Cluster-VI	Dhanbad (SOD: Over-exploited)	3.86	MADA (Damodar river)	3.69	0.0	7.25	3.07	YES	YES	NIL (loss due to FF)
Cluster-VII		93.33	MADA	27.70	6.87	4.23	2.85	NO	NO	58.76
Cluster-VIII	Jharia (SOD: Over-exploited)	29.27	MADA	24.04	1.18	5.96	3.20	NO	NO	4.05
Cluster-IX		310.34	MADA	160.28	45.05	6.51	3.39	NO	NO	105.01
Cluster-X		59.38	Damodar river	11.47	0.0	5.11	2.75	YES	NO	47.91
Cluster-XI	Dhanbad (SOD: Over-exploited)	249.67	MADA & DVC	19.86	43.92	3.14	1.43	NO	NO	185.89
Cluster-XIII	Baghmara (SOD: Critical)	64.61	Damodar river	10.09	9.86	6.07	2.79	NO	NO	44.66
Cluster-XIV		NA	NA	NA	NA	5.33	2.67	NO	NO	NA
Cluster-XV		5.11	Jamunia river	0.0	5.11	8.25	1.57	NO	NO	0.0
Cluster-XVI	Nirsa (SOD:Safe)	29.78	DVC (Barakar river)	14.60	6.57	5.29	2.10	NO	NO	8.61

Annexure – I

Location of Hydrograph Stations (Dug Wells)

Well No	Latitude	Longitude	Well No	Latitude	Longitude
A-3	23^{0}47'53.35" N	86^{0}19'55.14" E	**B-63**	Abandoned due to OCP	
A-12	23^{0}48'20.31" N	86^{0}16'51.64" E	**B-64**	23^{0}48'43.14" N	86^{0}18'44.25" E
A-16	23^{0}46'57.00" N	86^{0}21'38.57" E	**B-65A**	23^{0}48'53.65" N	86^{0}18'11.82" E
A-17	23^{0}45'09.44" N	86^{0}22'16.35" E	**B-67**	23^{0}43'30.70" N	86^{0}14'01.45" E
A-18	23^{0}44'37.65" N	86^{0}22'58.90" E	**D-3**	23^{0}46'46.31" N	86^{0}24'49.30" E
A-19	23^{0}41'12.86" N	86^{0}23'55.27" E	**D-4**	23^{0}44'29.37" N	86^{0}24'42.88" E
A-20	23^{0}44'56.64" N	86^{0}19'55.35" E	**D-5**	23^{0}42'20.05" N	86^{0}24'86.06" E
A-22	23^{0}43'06.65" N	86^{0}14'48.53" E	**D-7**	23^{0}43'12.08" N	86^{0}27'11.89" E
A-23	23^{0}45'06.38" N	86^{0}15'12.69" E	**D-8**	23^{0}44'06.13" N	86^{0}27'20.72" E
A-24	23^{0}45'20.44" N	86^{0}13'45.12" E	**D-23**	23^{0}47'20.89" N	86^{0}20'09.96" E
A-25	23^{0}47'06.20" N	86^{0}15'27.79" E	**D-25**	23^{0}47'03.28" N	86^{0}23'29.56" E
A-26	23^{0}46'49.24" N	86^{0}18'12.12" E	**D-30**	23^{0}48'36.10" N	86^{0}21'50.07" E
A-27	23^{0}48'42.55" N	86^{0}20'21.80" E	**D-33**	23^{0}45'34.62" N	86^{0}23'18.50" E
A-28A	23^{0}47'34.74" N	86^{0}18'04.18" E	**D-34**	23^{0}45'36.50" N	86^{0}23'02.45" E
A-29	23^{0}47'08.02" N	86^{0}16'02.72" E	**D-35**	23^{0}40'46.54" N	86^{0}25'46.33" E
A-32	23^{0}44'15.56" N	86^{0}20'43.80" E	**D-36**	23^{0}40'19.26" N	86^{0}25'18.98" E
A-33	23^{0}44'32.58" N	86^{0}16'58.28" E	**D-39**	23^{0}43'28.50" N	86^{0}26'0.10" E
A-34	23^{0}42'58.63" N	86^{0}15'19.31" E	**D-40A**	23^{0}43'20.18" N	86^{0}25'45.70" E
B-1	23^{0}48'48.06" N	86^{0}14'16.87" E	**D-41**	23^{0}42'40.00" N	86^{0}26'17.20" E
B-14	23^{0}48'00.81" N	86^{0}16'25.88" E	**D-43***	NA	NA
B-15	23^{0}46'06.92" N	86^{0}08'59.30" E	**D-47**	23^{0}45'20.59" N	86^{0}24'34.86" E
B-21A	23^{0}45'10.50" N	86^{0}09'36.38" E	**D-49**	23^{0}44'08.96" N	86^{0}26'32.71" E
B-23	23^{0}44'13.05" N	86^{0}11'46.56" E	**D-51**	23^{0}44'20.86" N	86^{0}27'11.37" E
B-24	23^{0}44'26.80" N	86^{0}13'09.38" E	**D-55**	23^{0}43'58.37" N	86^{0}24'07.45" E
B-25	23^{0}44'44.98" N	86^{0}13'57.80" E	**D-74**	23^{0}41'33.66" N	86^{0}25'06.10" E
B-32A	23^{0}45'49.18" N	86^{0}13'03.64" E	**D-77**	23^{0}41'00.74" N	86^{0}22'25.55" E
B-48	23^{03}4'35.09" N	86^{0}16'38.30" E	**D-80**	23^{0}46'09.46" N	86^{0}24'33.08" E
B-51	23^{0}47'40.20" N	86^{0}09'11.90" E	**DB-22**	23^{0}43'38.81" N	86^{0}45'09.00" E
B-53	23^{0}45'55.25" N	86^{0}09'35.44" E	**DB-23**	23^{0}43'44.24" N	86^{0}45'06.39" E
B-53A	DO	DO	**DB-24**	23^{0}43'53.00" N	86^{0}45'03.88" E
B-59	23^{0}47'59.87" N	86^{0}13'37.97" E	**DB-25**	23^{0}44'10.75" N	86^{0}44'35.84" E
B-60	23^{0}48'7.87" N	86^{0}15'37.12" E			
B-61A	23^{0}45'59.85" N	86^{0}11'40.80" E			
B-62A	23^{0}45'44.15" N	86^{0}11'27.80" E			

Annexure – IIA

Details of Hydrograph Stations (Dug Wells)

Well No	Location	M.P. (agl) in m	Well Dia in m	Well Depth (m bmp)	R.L. (G.L) (m)	Formation	Owner	Utility
A-3	Sijua	0.53	3.00	5.20	203	Barakar	Govt.	Domestic
A-12	Jamua	0.80	1.90	3.30	202	Barakar	Govt.	Domestic
A-16	Ekra, Kalali More	0.45	3.10	6.50	205	Barakar	Govt.	Domestic
A-17	Kachi Balihari	0.56	1.60	5.30	182	Barakar	Govt.	Domestic
A-18	Bhagabandh	0.61	1.45	3.37	182	Barakar	Govt.	Domestic
A-19	Bhaura	0.54	3.15	11.65	162	Barakar	Govt.	Domestic
A-20	Gorbhudih	0.43	3.30	8.30	181	BM	Govt.	Domestic
A-22	Nagdah, Niche tola	0.00	1.40	9.50	171	Raniganj	Govt	Irrigation
A-23	Machhyara	0.43	1.85	12.40	203	Raniganj	Govt	Domestic
A-24	Pipra Tanr	0.22	1.80	19.55	208	Raniganj	Govt	Domestic
A-25	Sinidih	0.22	2.00	11.30	203	Barakar	Govt	Domestic
A-26	Pasitanr (Malkera)	0.32	1.80	9.65	198	Barakar	Govt	Domestic
A-27	Chandor	0.60	2.50	5.50	221	Barakar	Govt	Domestic
A-28A	Lakarka 6 no.	0.65	1.30	5.25	199	Barakar	BCCL	Domestic
A-29	Aambagan (Gobindpur)	0.10	2.60	9.15	186	Barakar	Govt	Domestic
A-32	Baludih	0.55	2.30	6.85	182	BM	Govt	Domestic
A-33	Mahuda	0.75	2.00	10.80	195	BM	BCCL	Domestic
A-34	Bhatdih	0.55	3.50	24.50	162	Raniganj	BCCL	Domestic
B-1	Muraidih	0.47	1.80	5.35	212	Talchir	Govt	Domestic
B-14	Mathadih	0.76	2.15	3.75	201	Barakar	Govt	Domestic
B-15	Bera Basti	0.55	1.60	2.50	221	Talchir	Dhanu Roy	Domestic
B-21A	Dugdha	0.55	2.10	10.35	220	Metamorphics	Govt	Domestic
B-23	Lohapati	0.26	3.60	10.85	204	Raniganj	Govt	Domestic
B-24	Telmuchu	0.67	4.35	10.83	207	Raniganj	Govt	Domestic
B-25	Mahuda More	0.10	2.45	8.45	205	Raniganj	Govt	Domestic
B-32A	Madhuband	0.80	4.30	8.60	205	Barakar	BCCL	Domestic
B-48	Mahuda	0.65	2.10	11.50	181	Raniganj	Mosque	Domestic
B-51	Taranga	0.00	2.50	5.75	215	Metamorphics	Bisun	Irrigation
B-53	Karmatanr	0.58	2.70	13.25	195	Barakar	Govt	Domestic
B-53A	Karmatanr-Damoda OCP							
B-59	Khodovaly	0.60	2.40	9.30	202	Barakar	BCCL	Domestic
B-60	Bahiyardih	0.77	3.00	15.60	196	Barakar	BCCL	Domestic
B-61A	Kesargora	0.48	2.00	11.20	201	Barakar	BCCL	Domestic
B-62A	Sadariyadih	0.15	3.10	9.50	188	Barakar	Govt	Domestic

Annexure – IIA

Details of Hydrograph Stations (Dug Wells)

Well No	Location	M.P. (agl) in m	Well Dia in m	Well Depth (m bmp)	R.L. (G.L) (m)	Formation	Owner	Utility
B-63	West Mudidih	0.60	1.70	3.35	196	Barakar	BCCL	Domestic
B-64	Keshalpur	0.65	1.10	3.40	195	Barakar	BCCL	Domestic
B-65A	Jhinjipahari	0.95	2.20	12.40	196	Barakar	Shiv Temple	Domestic
B-67	Simatanr	0.55	2.20	11.80	198	Raniganj	Govt	Domestic
D-3	Dhansar	0.60	1.70	8.70	217	Barakar	Govt	Domestic
D-4	Jharia	0.59	1.90	5.73	218	Barakar	Govt	Domestic
D-5	Jiyalgora	0.70	2.80	10.55	183	Barakar	Govt	Domestic
D-7	Golden Pahari	0.67	2.85	10.05	201	Barakar	BCCL	Domestic
D-8	Alokdiha	0.35	1.75	7.57	201	Metamorphics	BCCL	Domestic
D-23	Jogta (Sindra)	0.40	3.10	7.25	205	Barakar	BCCL	Domestic
D-25	Godhar More	0.60	2.75	5.60	219	Barakar	Govt	Domestic
D-30	Borkiboa	0.70	2.00	5.60	221	Talchir	H.Kumbhakar	Domestic
D-33	Kustore-4	0.55	1.85	3.45	196	Barakar	BCCL	Domestic
D-34	Kusunda-7	0.60	1.50	3.45	201	Barakar	BCCL	Domestic
D-35	Patherdih	0.40	2.00	11.20	160	Barakar	BCCL	Domestic
D-36	Sudamdih	0.90	2.00	6.20	141	Barakar	BCCL	Domestic
D-39	Tilabani	0.85	2.00	5.90	178	Barakar	BCCL	Domestic
D-40A	Khapra Dhaora	0.55	1.95	3.70	180	Barakar	Panchayat	Domestic
D-41	Joyrampur	0.50	1.80	4.00	180	Barakar	BCCL	Domestic
D-43	Alagdih	0.45	2.20	8.90	200	Metamorphics	Govt	Domestic
D-47	Parastanr	0.45	3.20	23.80	206	Barakar	BCCL	Domestic
D-49	Goluckdih	0.55	1.80	6.15	192	Barakar	BCCL	Domestic
D-51	Chankuiya	0.55	3.70	11.90	197	Barakar	BCCL	Domestic
D-55	Hariladih	0.48	2.80	11.80	184	Barakar	Govt	Domestic
D-74	Bhulan Barari	0.10	1.60	12.80	173	Barakar	Govt	Domestic
D-77	Rohoniatanr	0.40	3.15	6.70	156	Barakar	Govt	Domestic
D-80	Bastacolla	0.70	2.50	24.95	219	Barakar	Govt	Domestic
DB-22	Nichebasti	0.67	2.40	10.65	121	Barakar	Govt	Domestic
DB-23	Dahibari OC	0.70	2.30	8.00	-	Barakar	BCCL	Domestic
DB-24	Dahibari	0.60	3.60	13.70	125	Barakar	BCCL	Domestic
DB-25	Palasya	0.37	1.55	5.25	127	Barakar	Govt	Domestic

MP: Measuring Point **R.L.: Reduced Level** **W.L.: Water Level m: Meter**

Abn.: Abandoned **b.g.l.: Below Ground Level** **a.g.l.: Above Ground Level**

G.L.: Ground Level **bmp: Below Measuring Point** **BM: Barren Measure**

Annexure – IIB

Historical Water Level data of Hydrograph Stations

Well No	Water level below ground level (bgl) in meters																
	May, 11	May, 12	Nov 12	May, 13	Nov 13	May, 14	Nov, 14	May 15	Nov 15	May, 16	Nov, 16	May, 17	Nov 17	May, 18	Nov 18	May 19	Nov 19
A-3	4.77	4.25	1.87	4.47	4.45	4.67	2.37	3.70	3.42	4.87	0.47	0.67	0.77	1.27	0.47	3.47	0.47
A-12	2.80	2.80	1.30	3.00	1.17	2.45	1.4	3.00	2.68	2.50	0.70	2.55	0.85	2.80	1.0	2.10	0.45
A-16	5.80	3.53	1.60	3.80	3.35	5.5	2.9	5.55	4.17	5.85	3.15	3.65	2.20	4.30	3.65	5.45	1.95
A-17	2.24	2.52	2.34	2.32	1.54	2.19	1.91	3.79	2.64	2.44	2.69	2.44	2.24	3.34	2.84	2.94	2.24
A-18	2.49	2.59	0.90	2.87	0.91	1.76	1.19	2.84	1.29	1.14	0.89	1.29	0.99	1.24	0.99	2.29	0.69
A-19		9.61	2.46	7.46	4.46	3.00	2.75	3.05	2.75	7.81	4.11	6.37	2.45	5.55	2.45	4.85	3.43
A-20	7.87	7.17	1.57	6.47	0.67	3.97	2.55	4.59	2.93	7.49	3.50	4.27	1.77	4.57	2.57	4.57	1.82
A22A		1.90	1.05	1.79	1.00	1.50	2.0	3.20	1.96	3.25	1.75	4.27	1.77	3.35	1.30	2.60	2.00
A-23	11.92	9.87	4.75	10.57	5.82	8.76	6.82	11.3	9.37	11.87	8.13	6.40	1.50	11.15	7.17	11.97	3.77
A-24	18.28	18.68	5.23	16.01	3.25	16.28	14.98	17.2	14.5	16.62	12.43	11.87	6.97	14.58	6.88	15.88	2.48
A-25	6.83	10.23	4.43	10.23	2.98	7.03	5.28	7.78	5.85	7.43	4.58	6.38	2.88	6.63	3.13	6.08	1.93
A-26	9.18	8.76	4.28	7.56	4.28	7.71	4.58	7.73	3.18	8.93	4.48	5.28	2.53	6.23	3.88	6.58	3.33
A-27	3.00	2.13	1.10	1.62	1.25	1.63	1.55	4.40	3.95	4.85	1.80	2.90	1.25	2.90	1.0	2.40	0.92
A28A	3.90	2.90	2.45	3.35	2.45	3.29	1.91	4.35	3.60	3.35	1.47	4.30	1.55	4.15	2.51	2.45	3.15
A-29	5.50	9.30	1.42	6.95	1.67	3.3	2.35	4.55	4.60	5.92	6.96	4.40	1.30	6.45	2.10	4.85	3.40
A-32	2.30	2.19	1.10	2.45	1.95	3.15	2.45	4.41	2.13	4.75	2.10	3.15	1.55	2.80	0.70	2.75	0.95
A-33	3.07	5.25	1.25	4.13	1.80	4.08	1.57	4.91	1.97	5.75	2.60	6.45	1.55	4.07	2.35	3.65	1.25
A-34	2.90	6.95	2.90	6.21	2.50	4.45	4.45	8.40	4.81	4.75	4.45	12.45	4.45	5.90	3.70	6.35	3.95
B-1	1.78	2.08	1.73	1.53	1.83	2.43	1.81	3.28	2.75	3.58	1.93	2.33	0.85	2.88	2.08	3.18	1.73
B-14	2.49	1.34	1.42	1.74	1.45	3.24	4.44	2.94	2.29	2.44	0.47	2.94	1.84	3.64	2.84	2.24	0.94
B-15	1.37	1.27	0.45	1.20	0.55	0.95	1.45	1.50	0.45	1.85	0.55	4.85	0.15	1.85	0.85	1.90	1.65
B21A	7.60	9.00	5.05	8.01	4.95	9.54	3.7	7.37	4.65	5.55	4.50	8.85	5.65	9.65	2.65	9.45	-
B-23	9.14	3.71	1.74	5.27	1.39	6.57	2.74	7.86	4.29	6.81	2.41	7.74	2.14	6.64	2.14	2.84	1.34
B-24	10.33	-	3.09	8.88	2.83	9.40	2.21	10.0	5.78	10.63	4.28	10.03	4.03	9.28	4.33	4.58	2.33
B-25	8.35	8.35	2.60	7.08	2.15	5.82	5.15	6.88	-	7.05	1.70	6.70	1.40	5.90	3.70	4.80	1.40
B32A	7.80	7.75	3.22	6.25	2.68	8.33	2.05	7.55	3.32	6.95	3.07	6.95	2.80	6.75	3.90	5.55	1.70
B-48	5.75	5.43	3.85	4.69	3.20	6.38	4.35	7.90	5.42	9.35	4.60	7.70	4.15	7.33	3.97	7.05	4.35
B-51	3.95	3.60	2.05	3.35	2.49	2.09	1.98	4.65	3.40	4.90	3.18	4.98	2.55	5.02	2.42	5.10	2.70
B-53	1.67	6.97	1.42	4.15	1.12	3.39	-	5.58	2.82	4.70	1.45	4.02	1.92	3.92	1.42	3.22	1.42
B-59	8.25	6.90	0.60	7.56	0.30	2.65	1.0	4.12	1.60	4.40	0.50	5.40	0.60	5.47	1.10	6.20	0.90
B-60	11.44	10.18	5.13	11.29	5.23	9.82	4.59	9.21	5.28	10.33	5.03	13.23	3.18	13.68	4.23	8.13	3.23
B61A	10.72	5.42	2.40	8.17	2.02	6.93	3.57	6.15	4.52	6.58	3.87	2.57	0.82	2.57	2.02	3.32	0.52
B62A	8.85	7.85	4.90	7.73	4.63	8.83	5.85	9.10	5.21	9.30	4.95	8.15	4.35	8.27	4.78	7.55	3.25

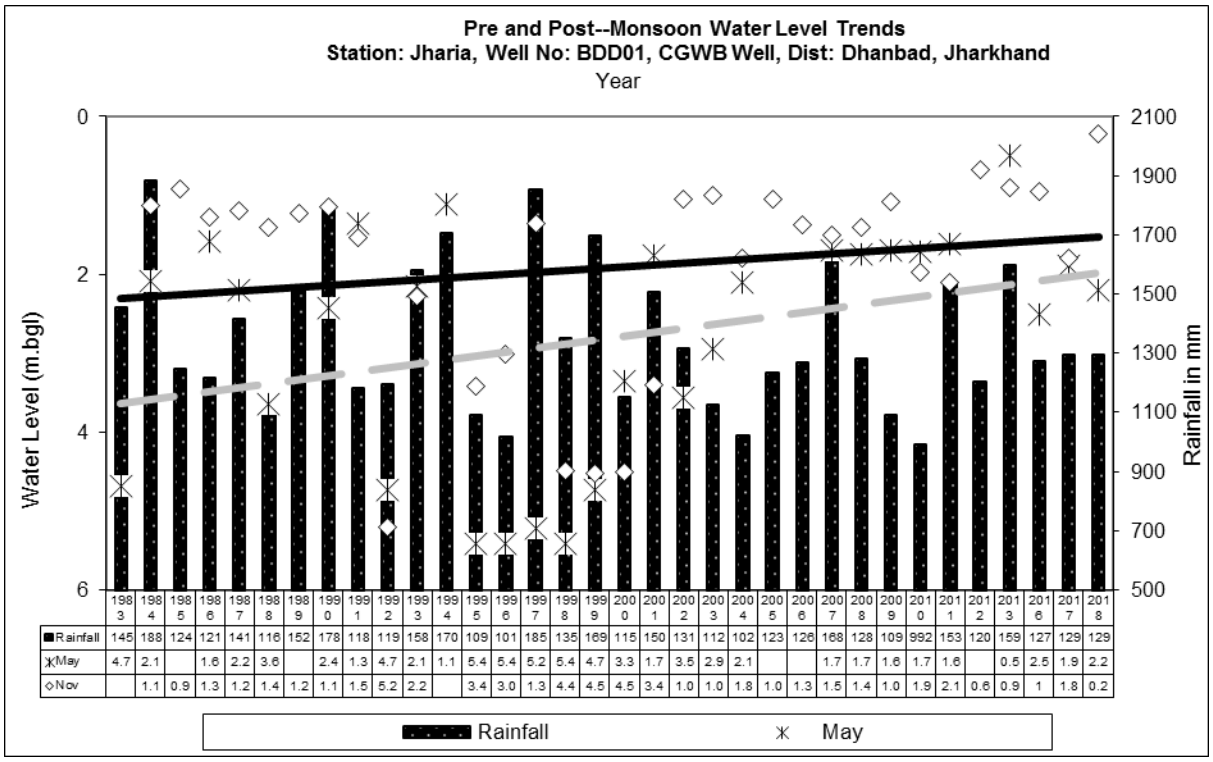
Annexure – IIB

Historical Water Level data of Hydrograph Stations

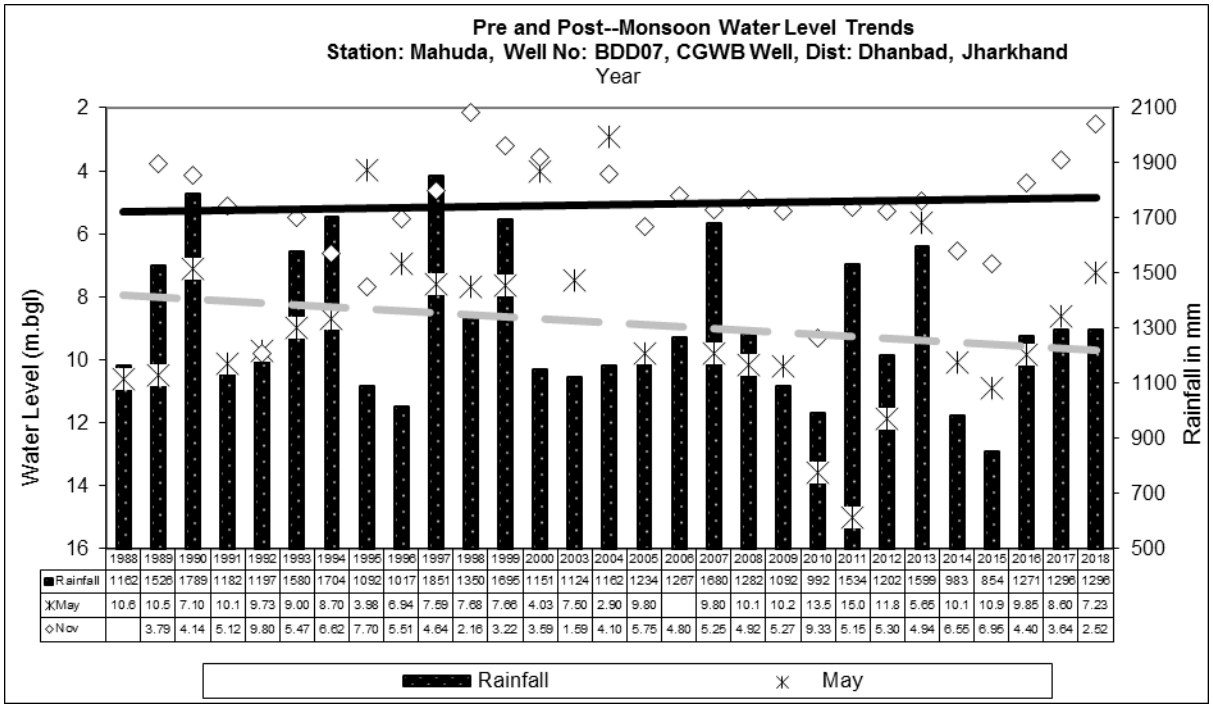
Well No	Water level below ground level (bgl) in meters																
	May, 11	May, 12	Nov, 12	May, 13	Nov, 13	May, 14	Nov, 14	May, 15	Nov, 15	May, 16	Nov, 16	May, 17	Nov, 17	May, 18	Nov, 18	May 19	Nov 19
B-64	0.85	1.05	1.00	1.35	0.85	0.7	1.15	1.38	0.95	2.35	0.55	1.25	0.85	2.15	1.85	0.95	0.45
B65A	9.65	11.45	1.73	10.11	1.82	10.45	2.4	7.82	5.87	7.15	2.68	9.05	1.25	10.03	2.40	11.05	0.95
B-67	11.25	8.55	6.50	9.73	5.31	9.80	3.72	9.23	5.53	9.53	4.30	10.00	2.15	9.55	4.0	8.57	4.35
D-3	2.55	2.93	1.80	3.45	1.68	2.54	2.11	4.25	2.25	2.35	1.90	2.15	2.30	3.43	2.45	1.75	1.30
D-4	1.51	1.94	0.91	2.41	0.98	1.23	0.91	2.41	1.27	1.21	1.36	1.21	1.46	1.91	1.56	2.81	1.71
D-5	9.05	9.50	6.45	9.32	4.59	9.0	7.8	9.37	8.33	9.40	6.40	7.90	5.20	7.80	5.30	8.25	4.85
D-7	9.33	6.08	5.83	7.19	4.63	5.28	5.53	8.25	5.61	7.53	4.03	7.33	2.88	7.53	2.83	8.23	3.28
D-8	7.75	6.15	3.75	6.65	2.85	7.73	-	6.24	4.38	8.00	3.43	5.15	1.85	5.65	1.85	4.80	2.85
D-23	6.80	6.00	3.30	6.60	1.20	6.38	2.4	6.55	3.48	5.70	1.63	2.80	2.98	4.40	3.40	4.70	1.40
D-25	4.70	5.20	3.65	4.26	3.45	4.42	2.9	4.48	2.45	2.40	1.90	2.40	1.20	2.60	2.40	*9.90	*5.38
D-30	5.10	3.88	1.80	4.38	3.08	4.17	3.3	4.55	3.15	4.45	3.20	4.40	1.25	4.58	1.10	4.60	0.75
D-33	0.95	2.85	0.35	1.80	0.45	1.72	0.35	2.25	1.10	2.50	1.95	0.75	0.75	2.85	0.95	2.35	1.65
D-34	2.85	2.35	2.50	2.50	2.13	2.80	0.30	2.55	1.45	2.30	0.30	0.80	0.55	2.80	0.45	4.75	2.40
D-35	8.20	8.05	5.55	7.70	4.10	6.94	6.15	9.80	7.90	9.52	6.45	8.80	3.60	8.40	4.45	8.00	3.80
D-36	1.95	1.55	0.15	1.28	0.80	1.82	0.75	1.66	1.13	0.78	0.95	1.30	0.70	1.20	0.60	1.20	0.55
D-39	5.05	5.05	3.65	3.98	2.50	5.03	2.25	5.00	2.61	2.18	2.65	6.17	4.75	4.95	4.35	*12.60	*5.95
D40A	1.95	2.45	1.70		2.25	2.35	2.45	3.07	2.45	1.40	0.85	1.45	1.35	2.10	1.40	1.85	1.45
D-41	1.55	1.50	1.50	1.72	1.35	3.20	1.35	2.65	2.32	1.30	1.52	1.40	1.20	1.59	1.32	2.30	1.25
D-43	7.65	7.05	4.00	6.23	4.05	6.0	4.75	6.61	5.05	8.20	3.35	7.50	3.60	7.15	3.45	7.35	2.70
D-47	4.35	1.95	2.12	2.60	2.97	8.0	2.37	9.60	3.60	3.18	2.95	3.15	2.85	5.33	2.55	4.55	4.35
D-49	1.55	1.60	1.65	1.30	1.45	2.51	1.65	3.55	2.35	2.45	1.72	2.70	2.05	3.45	2.45	1.75	1.50
D-51	10.85	10.00	7.85	8.94	8.35	9.60	9.05	10.48	9.15	11.15	6.45	10.45	5.43	10.93	7.10	9.95	5.75
D-55	5.97	1.93	1.82	3.90	1.45	1.95	2.07	6.15	1.57	2.52	3.62	6.42	2.37	8.42	1.57	8.42	5.47
D-74	4.05	4.95	3.60	4.55	3.41	5.0	4.0	10.05	7.20	7.73	5.00	9.25	3.85	8.60	4.80	5.80	3.57
D-77	6.30	6.50	4.75	4.79	5.10	6.23	6.0	6.44	5.60	4.60	2.90	6.50	4.90	6.30	5.20	6.40	3.20
D-80	17.45	14.20	3.35	15.25	3.32	13.3	3.15	10.97	3.35	6.55	4.15	8.65	3.70	9.35	4.20	5.00	3.05
RCF (part)		May, 12	Nov, 12	May, 13	Nov, 13	May, 14	Nov, 14	May, 15	Nov, 15	May, 16	Nov, 16	May, 17	Nov, 17	May, 18	Nov, 18	May 19	Nov 19
DB22		2.43	2.38	8.18	2.64	6.48	3.03	4.59	3.53	5.38	3.33	1.93	1.63	2.34	1.93	4.93	1.63
DB23		2.90	2.33	5.05	3.10	3.95	2.13	3.38	6.04	5.30	0.90	2.05	1.90	2.85	1.75	1.60	0.80
DB24		-	-	-	8.25	-	8.45	9.52	8.20	10.65	6.50	5.80	3.78	8.25	5.70	9.35	3.88
DB25		3.96	1.18	1.33	2.53	3.27	2.73	3.83	2.68	3.61	1.98	3.23	2.58	3.93	1.63	-	-

Annexure – III

HYDROGRAPHS OF CGWB PERMANENT OBSERVATION STATIONS



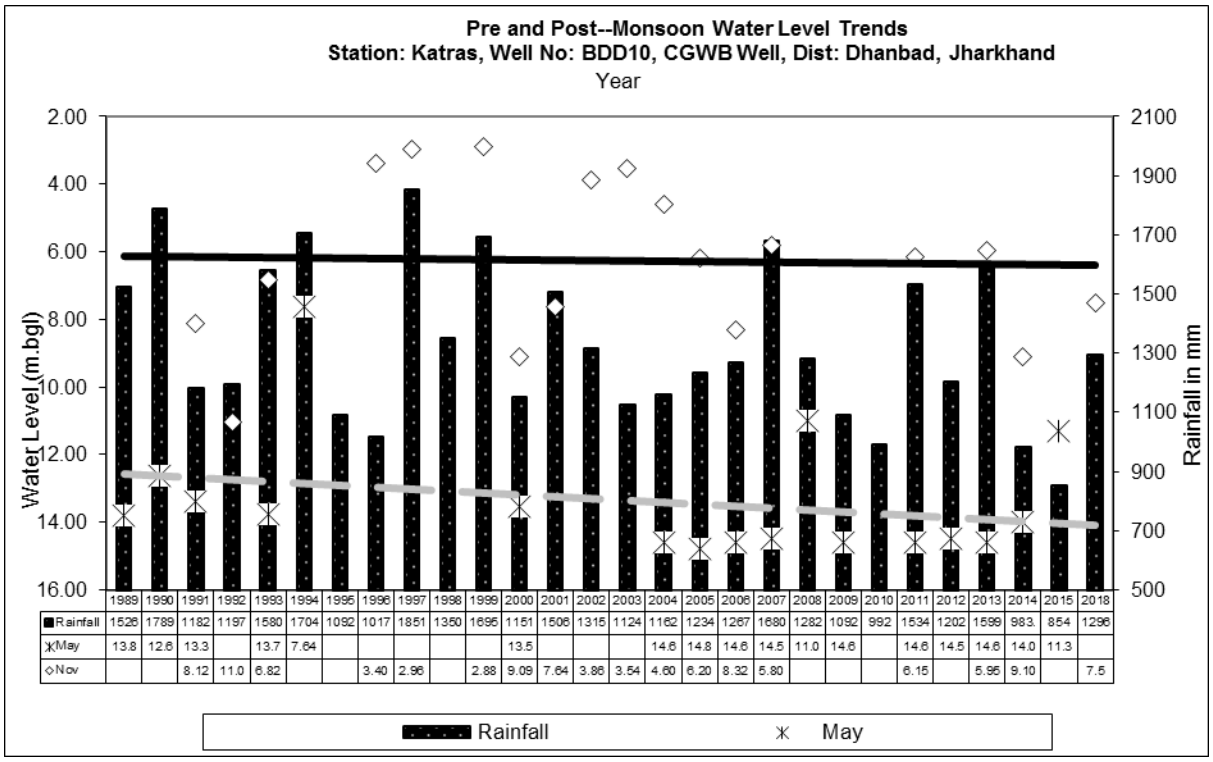
	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2016	2017	2018
Rainfall	145	188	124	121	141	116	152	178	118	119	158	170	109	101	185	135	169	115	150	131	112	102	123	126	168	128	109	992	153	120	159	127	129	129
May	4.7	2.1		1.6	2.2	3.6		2.4	1.3	4.7	2.1	1.1	5.4	5.4	5.2	5.4	4.7	3.3	1.7	3.5	2.9	2.1			1.7	1.7	1.6	1.7	1.6		0.5	2.5	1.9	2.2
Nov		1.1	0.9	1.3	1.2	1.4	1.2	1.1	1.5	5.2	2.2		3.4	3.0	1.3	4.4	4.5	4.5	3.4	1.0	1.0	1.8	1.0	1.3	1.5	1.4	1.0	1.9	2.1	0.6	0.9	1	1.8	0.2



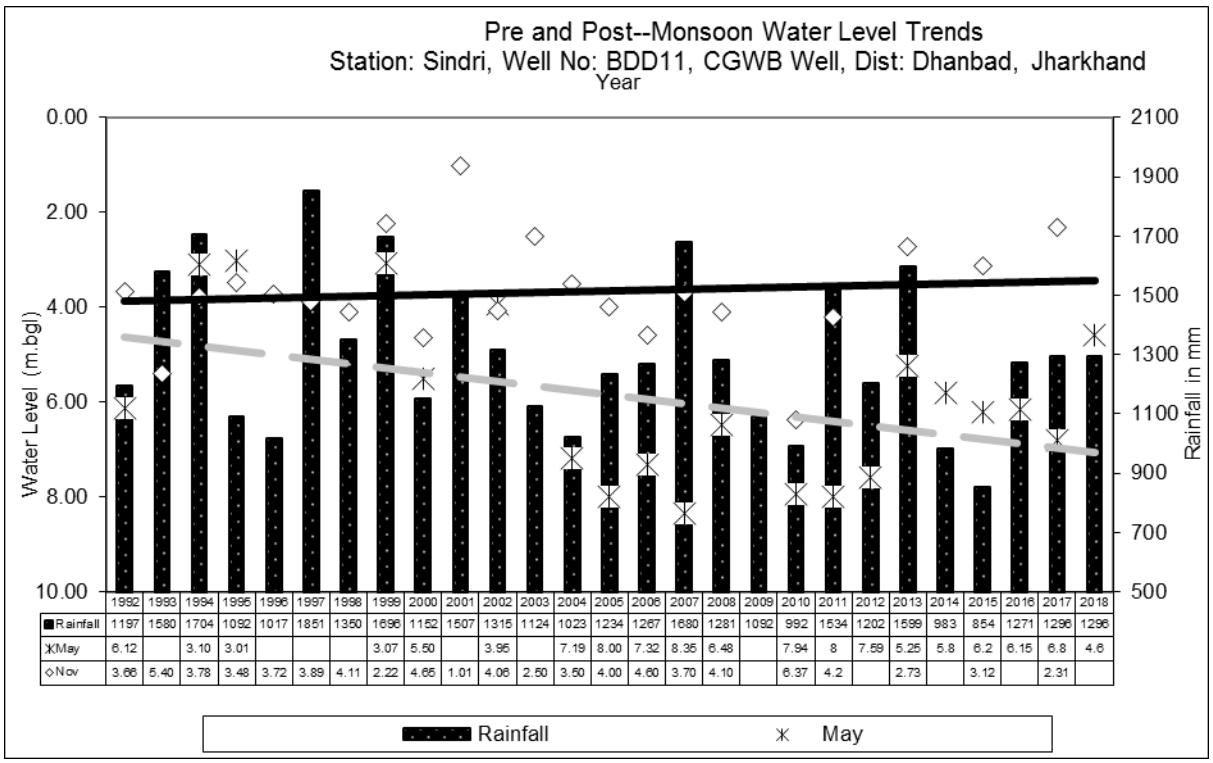
	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Rainfall	1162	1526	1789	1182	1197	1580	1704	1092	1017	1851	1350	1695	1151	1124	1162	1234	1267	1680	1282	1092	992	1534	1202	1599	983	854	1271	1296	1296
May	10.6	10.5	7.10	10.1	9.73	9.00	8.70	3.98	6.94	7.59	7.68	7.66	4.03	7.50	2.90	9.80		9.80	10.1	10.2	13.5	15.0	11.8	5.65	10.1	10.9	9.85	8.60	7.23
Nov		3.79	4.14	5.12	9.80	5.47	6.62	7.70	5.51	4.64	2.16	3.22	3.59	1.59	4.10	5.75	4.80	5.25	4.92	5.27	9.33	5.15	5.30	4.94	6.55	6.95	4.40	3.64	2.52

Annexure – III

HYDROGRAPHS OF CGWB PERMANENT OBSERVATION STATIONS



	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2018
Rainfall	1526	1789	1182	1197	1580	1704	1092	1017	1851	1350	1695	1151	1506	1315	1124	1162	1234	1267	1680	1282	1092	992	1534	1202	1599	983	854	1296
May	13.8	12.6	13.3		13.7	7.64						13.5				14.6	14.8	14.6	14.5	11.0	14.6		14.6	14.5	14.6	14.0	11.3	
Nov			8.12	11.0	6.82			3.40	2.96		2.88	9.09	7.64	3.86	3.54	4.60	6.20	8.32	5.80				6.15		5.95	9.10		7.5



	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Rainfall	1197	1580	1704	1092	1017	1851	1350	1696	1152	1507	1315	1124	1023	1234	1267	1680	1281	1092	992	1534	1202	1599	983	854	1271	1296	1296
May	6.12		3.10	3.01				3.07	5.50		3.95		7.19	8.00	7.32	8.35	6.48		7.94	8	7.59	5.25	5.8	6.2	6.15	6.8	4.6
Nov	3.66	5.40	3.78	3.48	3.72	3.89	4.11	2.22	4.65	1.01	4.06	2.50	3.50	4.00	4.60	3.70	4.10		6.37	4.2		2.73		3.12		2.31	

Annexure – IV

GROUNDWATER SAMPLE LOCATION DETAILS

Sampling month: May month of the assessment year of 2019

Sl No	Name of Cluster	Ground Water Sample	Dug well (CMPDI)	Location	Sampling Date
					May'2019
1	CLUSTER-I	GW-1	B-15	BERA VILLAGE	28.05.2019
2	CLUSTER-II	GW-2	B-59	KHODOVALY VILLAGE	28.05.2019
3	CLUSTER-III	GW-3	A-29	GOVINDPUR,AMBAGAN VILLAGE	28.05.2019
4	CLUSTER-IV	GW-4	B-63	KESHALPUR, BATIGHAR	28.05.2019
5	CLUSTER-V	GW-5	D-30	BORKIBOA VILLAGE	28.05.2019
6	CLUSTER-VI	GW-6	D-25	GODHUR MORE	28.05.2019
7	CLUSTER-VII	GW-7	D-80	DHANSAR MINE RESCUE STN.	29.05.2019
8	CLUSTER-VIII	GW-8	D-49	NEAR GHANOODIH OC	29.05.2019
9	CLUSTER-IX	GW-9	D-5	JEALGORA, NEAR P.O.	29.05.2019
10	CLUSTER-X	GW-10	D-35	PATHERDIH RLY. COLONY	29.05.2019
11	CLUSTER-XI	GW-11	A-32	MONNIDIH BAZAR	29.05.2019
12	CLUSTER-XIII	GW-13	A-23	MACHHAYARA	28.05.2019
13	CLUSTER-XIV	GW-14	B-23	LOHAPATTI VILLAGE	28.05.2019
14	CLUSTER-XV	GW-15	B-32A	MADHUBAND VILLAGE	28.05.2019
15	CLUSTER-XVI	GW-16	DB-22	DAHIBARI,NICHE BASTI	28.05.2019

Annexure – V

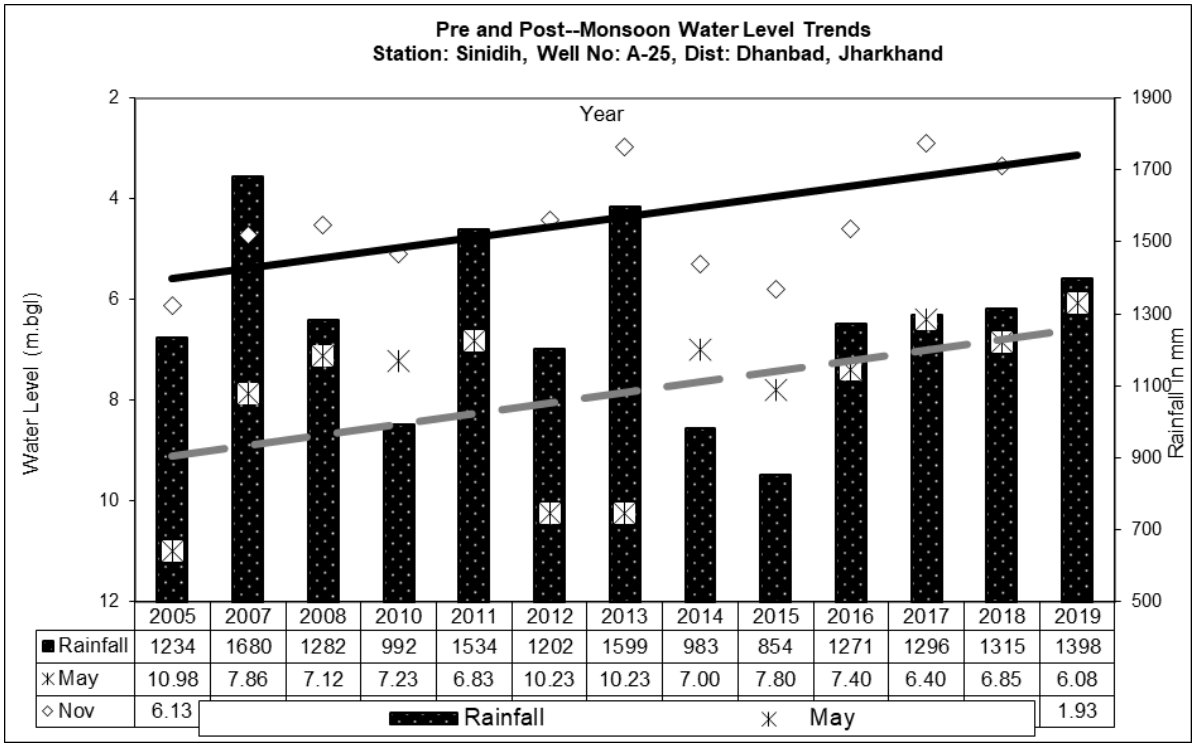
GROUNDWATER QUALITY DATA (DUG WELLS)
Month: May 2019

Sampling details is given in Annexure-IV.

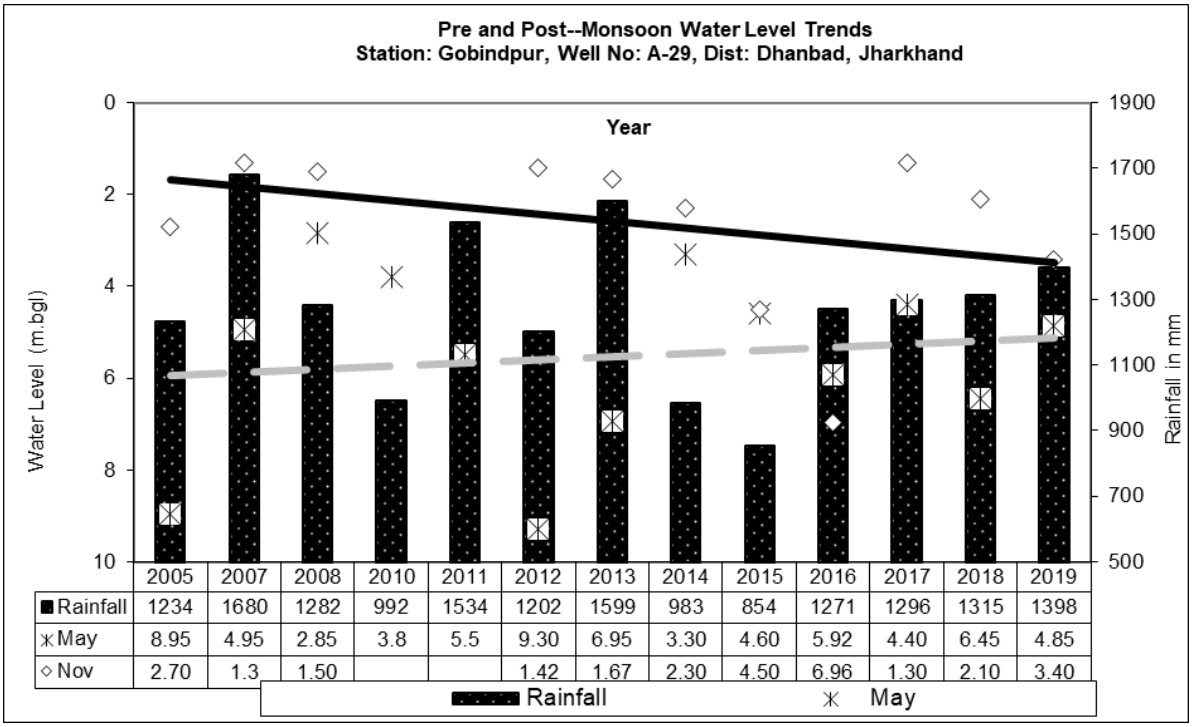
Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		GW 1 28.05.19	GW-2 28.05.19	GW-3 28.05.19			
1	Boron (as B), mg/l, Max	<0.2	<0.2	<0.2	0.2	0.5	APHA, 23rd Edition ,Carmine
2	Colour,in Hazen Units	3	2	4	1	5	APHA, 23rd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	40	64	76	1.6	75	IS-3025/40:1991, EDTA
4	Chloride (as Cl), mg/l, Max	24	28	18	2	250	IS-3025/32:1988, R-2007, Argentometric
5	Copper (as Cu), mg/l, Max	<0.03	0.03	<0.03	0.03	0.05	IS 3025/42 : 1992 R : 2009, AAS-Flame
6	Fluoride (as F) mg/l, Max	0.64	0.49	0.52	0.02	1.0	APHA, 23rd Edition , SPADNS
7	Free Residual Chlorine, mg/l, Min	<0.02	<0.02	<0.02	0.02	0.2	APHA, 23rd Edition , DPD
8	Iron (as Fe), mg/l, Max	0.15	0.12	0.06	0.06	1.0	IS 3025 /53 : 2003, R : 2009 , AAS-Flame
9	Lead (as Pb), mg/l, Max	<0.005	<0.005	<0.005	0.005	0.01	APHA, 23rd Edition ,AAS-GTA
10	Manganese (as Mn), mg/l, Max	<0.02	<0.02	<0.02	0.02	0.1	IS-3025/59:2006, AAS-Flame
11	Nitrate (as NO_3), mg/l, Max	9.62	15.33	12.82	0.5	45	APHA, 23rd Edition., UV-Spectrphotometric
12	Odour	Agreeable	Agreeable	Agreeable	Qualitative	Agreeable	IS 3025 /05:1983, R-2012, Qualitative
13	pH value	7.83	8.03	7.98	2.5	6.5 to 8.5	IS-3025/11:1983, R-1996, Electrometric
14	Phenolic compounds (as C_6H_5OH), mg/l, Max	<0.001	<0.001	<0.001	0.001	0.001	APHA, 23rd Edition.,4-Amino Autipyrine
15	Selenium (as Se), mg/l, Max	<0.002	<0.002	<0.002	0.002	0.01	IS 3025/ 56:2003, AAS-VGA
16	Sulphate (as SO_4) mg/l, Max	98	112	136	2.00	200	APHA, 23rd Edition.
17	Taste	Acceptable	Acceptable	Acceptable	Qualitative	Acceptable	APHA, 23rd Edition. Taste
18	Total Alkalinity ($c_ac_{O_3}$),, mg/l, Max	102	94	116	4.00	200	IS-3025/23:1986, Titration
19	Total Arsenic (as As), mg/l, Max	<0.002	<0.002	<0.002	0.002	0.01	IS 3025/ 37:1988 R : 2003, AAS-VGA
20	Total Chromium (as Cr), mg/l, Max	<0.04	<0.04	<0.04	0.04	0.05	IS-3025/52:2003, AAS-Flame
21	Total Dissolved Solids, mg/l, Max	462	536	642	25.00	500	IS 3025 /16:1984 R : 2006, Gravimetric
22	Total Hardness ($c_ac_{O_3}$), mg/l, Max	210	360	420	4.00	200	IS-3025/21:1983, R-2002, EDTA
23	Turbidity, NTU, Max	2	1	2	1.0	5.0	IS-3025/10:1984 R-1996, Nephelometric
24	Zinc (as Zn), mg/l, Max	0.06	0.14	0.03	0.01	5.0	IS 3025/ 49 : 1994, R : 2009, AAS-Flame
25	Nickel as Ni, mg/l Max	<0.01	<0.01	<0.01	0.01	0.02	IS 3025/ 54 : 2003, AAS-Flame

Annexure – VI

HYDROGRAPHS OF CLUSTER-III



	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Rainfall	1234	1680	1282	992	1534	1202	1599	983	854	1271	1296	1315	1398
May	10.98	7.86	7.12	7.23	6.83	10.23	10.23	7.00	7.80	7.40	6.40	6.85	6.08
Nov	6.13												1.93



	2005	2007	2008	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Rainfall	1234	1680	1282	992	1534	1202	1599	983	854	1271	1296	1315	1398
May	8.95	4.95	2.85	3.8	5.5	9.30	6.95	3.30	4.60	5.92	4.40	6.45	4.85
Nov	2.70	1.3	1.50			1.42	1.67	2.30	4.50	6.96	1.30	2.10	3.40

AMSL: Above mean sea level

Avg.: Average

APT: Aquifer Pumping Test

BCCL: Bharat Coking Coal Ltd.

bgl: Below Ground Level

Buffer zone: periphery of the 10 km radius from the project boundary

Core zone: Project / mine / colliery boundary (leasehold area)

CMPDI: Central Mine Plan & Design Institute

DVC: Damodar Valley Corporation

DTW: Depth to water level

GW: Groundwater

IMD: Indian Meteorological Division

JCF: Jharia Coalfield

RCF: Raniganj Coalfield

MADA: Mineral Area Development Authority

MCM: Million Cubic Meter

MGD: Million Gallon per day

NTU: Nephlometric Turbidity unit

OC / UG: Opencast / Underground

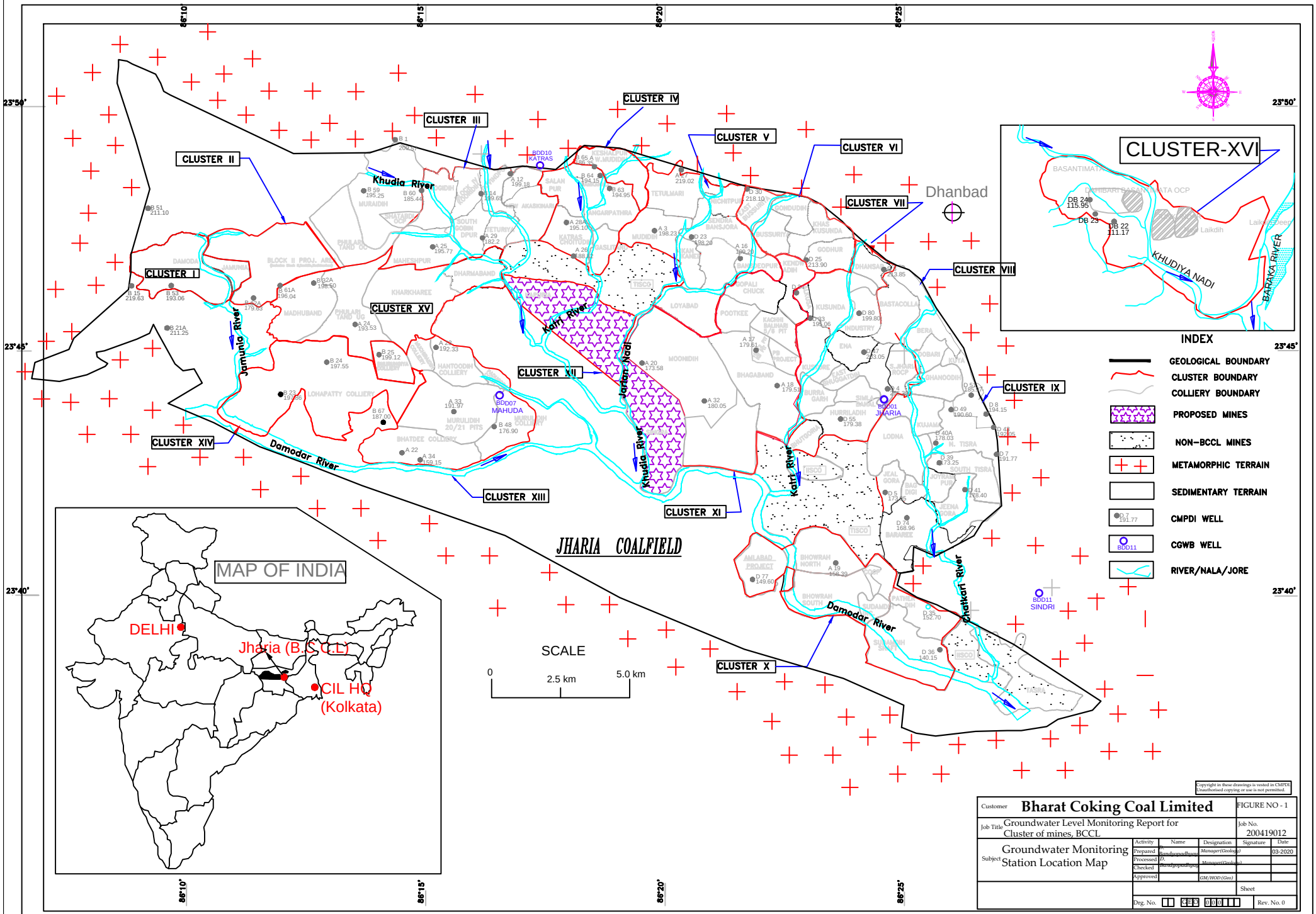
OCP / UGP: Opencast Project / Underground Project

RL: Reduced Level

RWH: Rainwater Harvesting

FF: Fire Fighting

GROUNDWATER MONITORING STATION LOCATION MAP



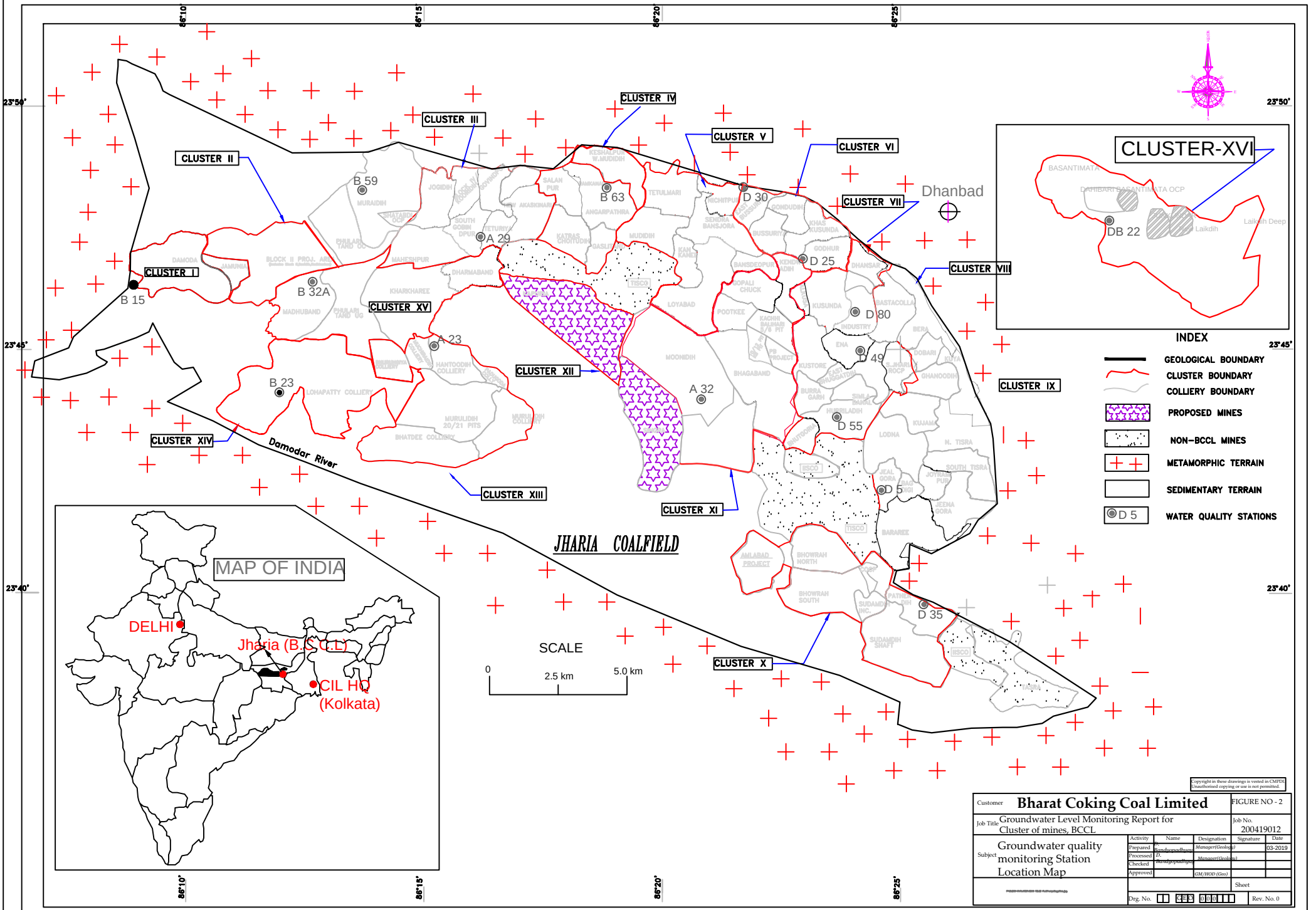
Copyright in these drawings is vested in CMPDI. Unauthorised copying or use is not permitted.

Customer	**Bharat Coking Coal Limited**	FIGURE NO - 1
Job Title	Groundwater Level Monitoring Report for Cluster of mines, BCCL	Job No. 200419012
Subject	Groundwater Monitoring Station Location Map	Drg. No. [ ] CBS 000 [ ] Rev. No. 0

Activity	Name	Designation	Signature	Date
Prepared	S. Ranchanadhwani	Manager(Geology)		03-2020
Processed	D. Bandyopadhyay	Manager(Geology)		
Checked				
Approved		GM/HOD (Geo)		

Sheet

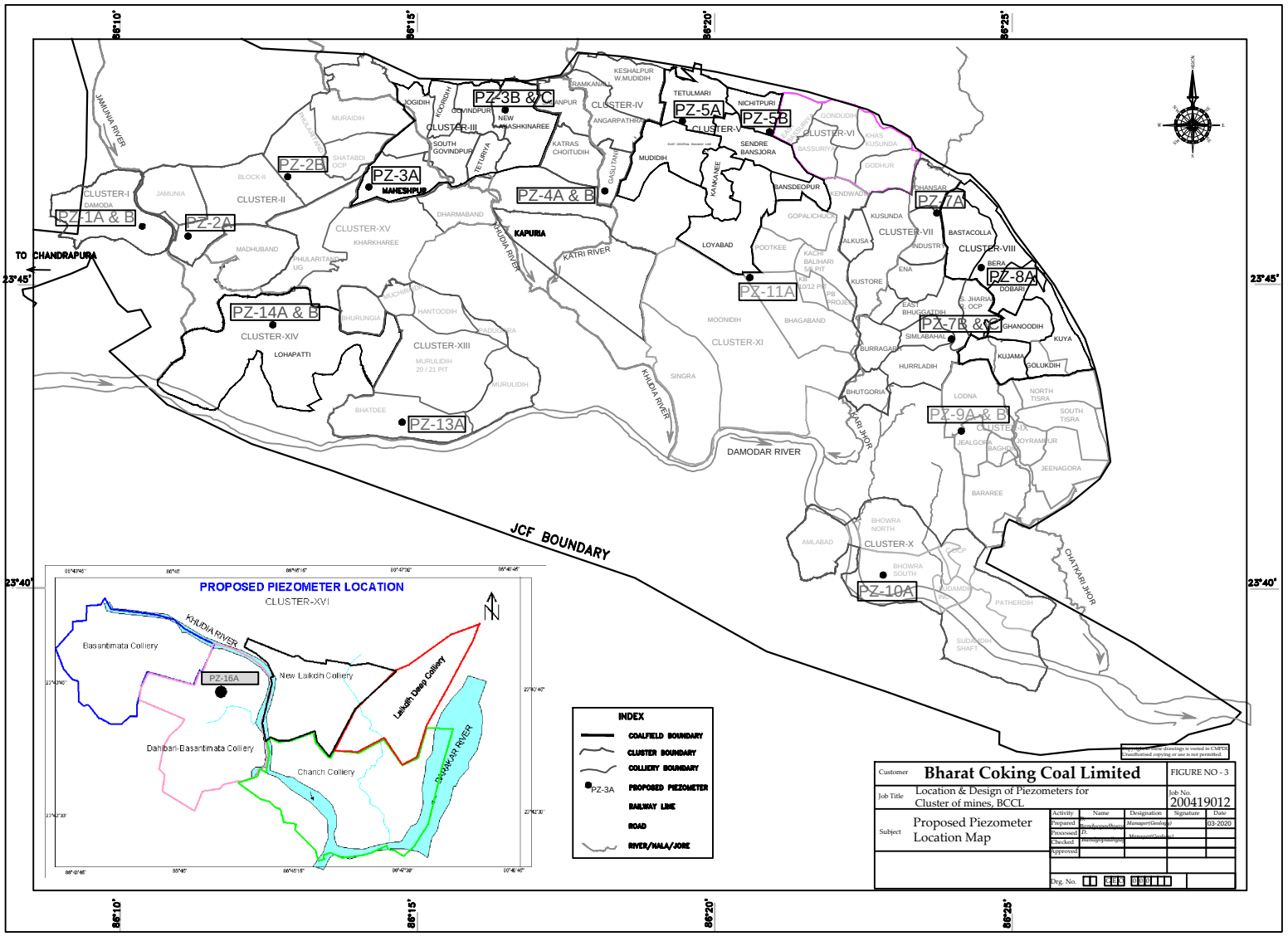
GROUNDWATER QUALITY MONITORING STATION LOCATION MAP



Copyright in these drawings is vested in CMPDI. Unauthorised copying or use is not permitted.

Customer	**Bharat Coking Coal Limited**		FIGURE NO - 2
Job Title	Groundwater Level Monitoring Report for Cluster of mines, BCCL		Job No. 200419012
Subject	Groundwater quality monitoring Station Location Map	Prepared: S. Bandyopadhyay, Manager(Geology), 03-2019	
		Processed: D. Bandyopadhyay, Manager(Geology)	
		Checked	
		Approved: GM/HOD (Geo)	
		Sheet	
		Drg. No. CES 000	Rev. No. 0

PROPOSED PIEZOMETER LOCATION MAP, JCF & RCF (part)



Customer: **Bharat Coking Coal Limited** — FIGURE NO - 3

Job Title: Location & Design of Piezometers for Cluster of mines, BCCL — Job No. 200419012

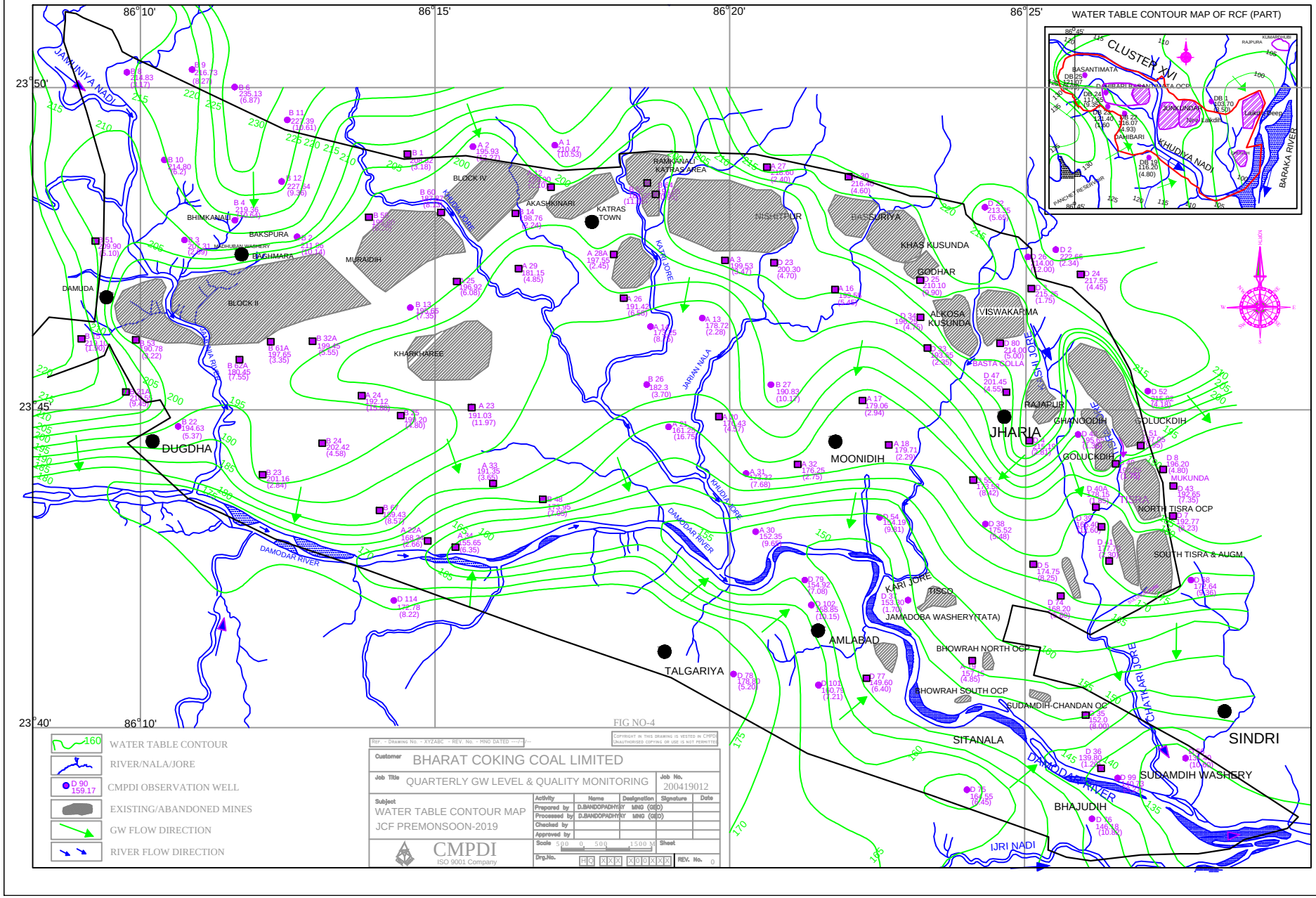
Subject: Proposed Piezometer Location Map

Activity	Name	Designation	Signature	Date
Prepared		Manager(Geology)		03-2020
Processed	D. Bandyopadhyay	Manager(Geology)		
Checked	D. Bhuniya	Manager(Geology)		
Approved				

Org. No. 11 483 00811

Reproduction of these drawings is vested in CMPDI. Unauthorised copying or use is not permitted.

WATER TABLE CONTOUR MAP OF PRE-MONSOON 2019



Annexure-XI

Details of CSR expenditure made at M/s BCCL level:

FY	CSR expenditure (Amount in Cr.)
2019-20	6.46
2018-19	1.43
2017-18	2.74

CSR activities have not been dealt at cluster level. However, expenditure was allotted and made at corporate level, i.e. M/s BCCL level and cluster III is contributor for the same

Annexure-XII

Water Supply to nearby villagers

Treated mine water is being supplied through water pipelines and water tankers to the nearby villagers, from the different collieries of Govindpur Area under Cluster III.

A central water treatment plant exists at Sinidih with a capacity of 1.3MLD. Apart from this; collieries have their own water treatment plants as well to supply the water to nearby villagers. Details of villages, where water is being supplied and corresponding nos. of beneficiaries (Family) are given below:

Sl. No.	Colliery name	Name of beneficiary villages	No. of Beneficiaries (Family)
1.	New Akashkinaree Colliery	Behrakudar, Bahiyardih, Jogidih Basti, Bhatmurna, Maheshpur Basti, Kharkharee Basti, Deoghara, Premnagar, Sinidih village, Mathadih basti, Dharmabandh basti, chanchani colony, majhlitand, khash Tundoo, Narayan Dhowrah, Madhuban thana, Tundoo village, Jogidih village, chitahi basti, barmasiya, Aambagan basti, Kalludih basti etc.	Approx. 6500
2.	Block-IV/Kooridih Colliery		
3.	Maheshpur Colliery		
4.	Jogidih Colliery		
5.	Teturiya Colliery		
6.	South Govindpur Colliery		

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

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

(FOR THE MONTH JANUARY, 2020)

E. C. no. J-11015/213/2010-IA.II (M) dated 06.02.2013.

CMPDI
ISO 9001 Company
Regional Institute-II
Dhanbad, Jharkhand

CONTENTS

SL. NO.	CHAPTER	PARTICULARS	PAGE NO.
1.	CHAPTER - I	EXECUTIVE SUMMARY	3-5
2.	CHAPTER-II	INTRODUCTION	6
3.	CHAPTER-III	RESULTS	7-11
4.	CHAPTER-IV	STANDARDS AND PLANS	12-15

EXECUTIVE SUMMARY

1.0 Introduction

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

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

2.0 Sampling location and rationale

2.1 Ambient air sampling locations

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

2.2 Water sampling stations

The Water sampling stations were selected for mine sump water.

2.3 Noise level monitoring locations

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

3.0 Methodology of sampling and analysis

3.1 Ambient air quality

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

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

3.2 Water quality

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

3.3 Noise level monitoring

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

4.0 Results and interpretations

4.1 Air quality

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

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

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

4.2 Water quality

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

4.3 Noise Level

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

INTRODUCTION

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

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

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

The CLUSTER III is in the westernmost part of the Jharia coalfield. It includes Jogidih Colliery, Maheshpur Colliery, South Govindpur Colliery, Teturiya Colliery, Govindpur Colliery, New Akasshkinaree Mine and Block IV Kooridih Mixed Mine. The cluster – III is situated about 40 - 45 kms from Dhanbad Railway Station. The mines of this cluster - III are operating since pre nationalization period (prior to 1972-73). It is connected by both Railway and Road. The drainage of the area is governed by Khudia and Bagdighi Nala.

The Project has Environmental Clearance from Ministry of Environment, Forest and Climate Change (MoEF&CC) for a rated capacity of 2.769 MTPA (normative) and 3.6 MTPA peak capacity of coal production vide letter no**E. C. no. J-11015/213/2010-IA.II (M) dated 06.02.2013.**

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

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

AMBIENT AIR QUALITY MONITORING

2.1 Location of sampling station and their rationale:

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

2.1.1 Ambient Air Quality Sampling Locations

CORE ZONE Monitoring Location

i) Block IV Kooridih OCP (A6): Industrial Area

The location of the sampling station is at 23°47'54.00"N & 86°16'20.00"E. The sampler was placed at 1.5 m above the ground level near Safety office of Block IV OCP.

BUFFER ZONE Monitoring Location

i) Muraidih OCP (A5) : Industrial Area

The sampler was placed at a height of 1.5 m from the ground level at Muraidih project office.

ii) Govindpur Village (A7) : Industrial area

The location of the sampling station is 23°48'34.00"N & 86°18'22.00"E. The sampler was placed at height of 1.5 m above the ground level at AARC agent Office, Ramkanali.

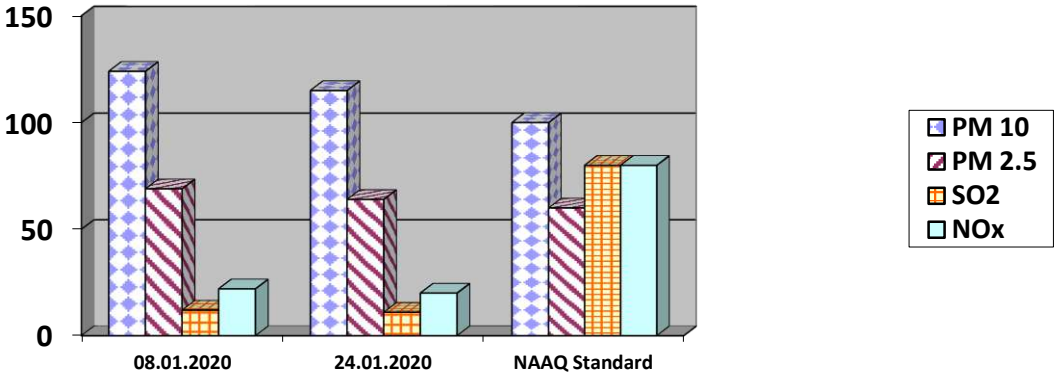
iii)Kharkharee(A21): **Industrial Area**

The location of the sampling station is 23°46'29.00"N & 86°14'37.08"E. The sampler was placed at a height of 1.5 m above the ground level at Kharkharee Colliery.

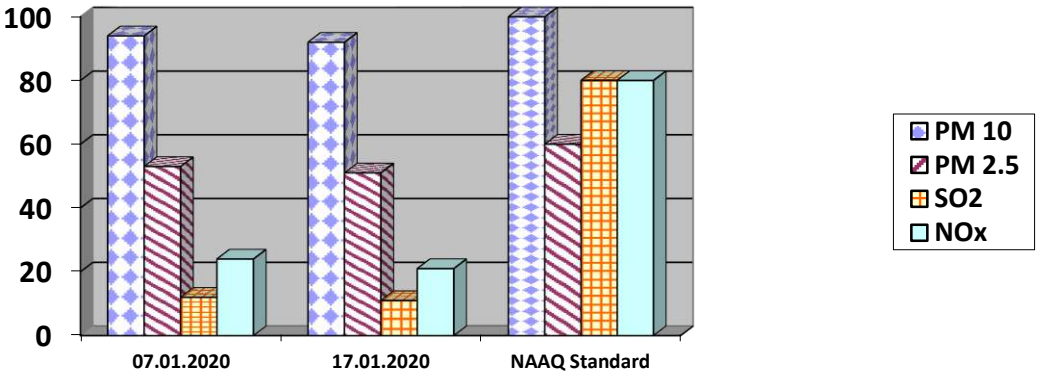
AMBIENT AIR QUALITY DATA

Cluster – III, Bharat Coking Coal limited Month: **JAN.2020** Year : **2019-20.**

Station Name: A6, Block IV		**Zone: Core**		**Category: Industrial**	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO_2**	**NO_X**
1	08.01.2020	124	69	12	22
2	24.01.2020	115	64	11	20
	NAAQ Standard	100	60	80	80



Station Name: A5, Muraidih OCP		**Zone: Buffer**		**Category: Industrial**	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO_2**	**NO_X**
1	07.01.2020	94	53	12	24
2	17.01.2020	92	51	11	21
	NAAQ Standard	100	60	80	80



Note:

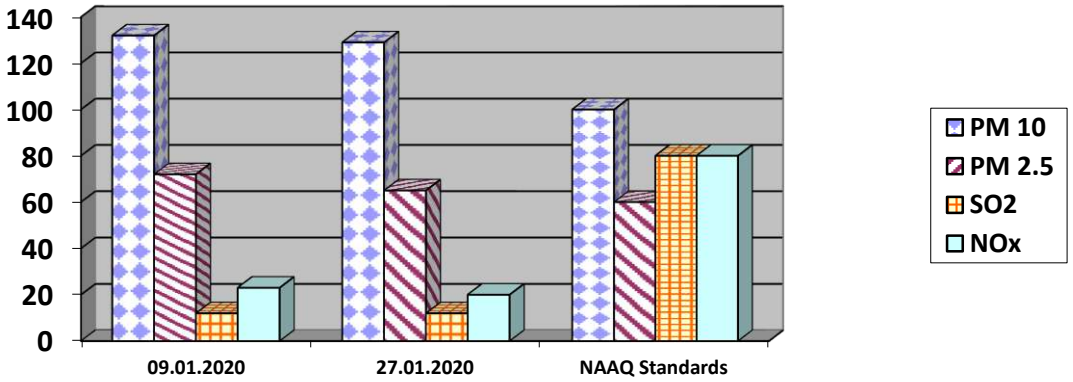
- *All values are expressed in microgram per cubic meter.*
- *24 hours duration*

Analysed By
JSA/SA/SSA

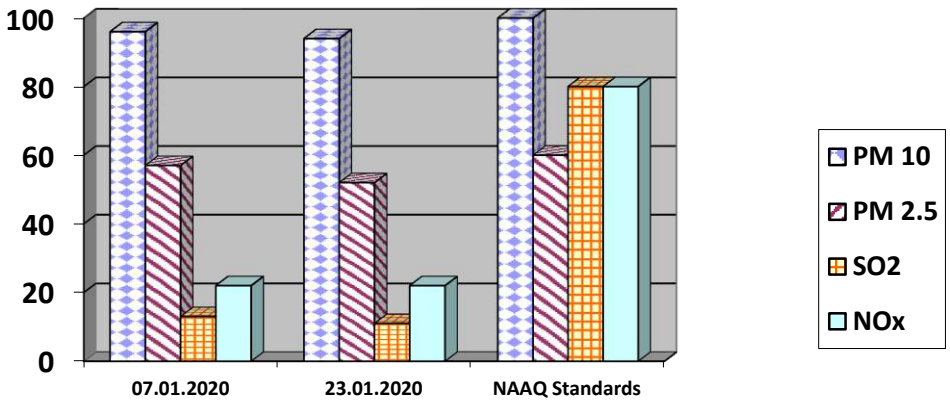
Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

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

Station Name: A7, Govindpur Village		Zone: Buffer		Category: Industrial	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO2**	**NOx**
1	09.01.2020	132	72	12	23
2	27.01.2020	129	65	12	20
	NAAQ Standards	100	60	80	80



Station Name: A21 Kharkharee		Zone: Buffer		Category: Industrial	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO2**	**NOx**
1	07.01.2020	96	57	13	22
2	23.01.2020	94	52	11	22
	NAAQ Standards	100	60	80	80



Note:

- *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 Govindpur (MW3)

A sampling point is fixed to assess the effluent quality of Mine discharge. This location is selected to monitor effluent discharge in to Khudia Nala and Bagdighi Nala.

3.2 Methodology of sampling and analysis

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

3.3 Results & Interpretations

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

WATER QUALITY DATA

(EFFLUENT WATER- FOUR PARAMETERS)

Name of the Cluster: **Cluster -III**		Month: **JAN.2020**	Name of the Station: **Mine Discharge of Govindpur**	
Sl. No.	**Parameters**	**MW3** First Fortnight	**MW3** Second Fortnight	**As per MOEF General Standards for schedule VI**
		08.01.2020	25.01.2020	
1	Total Suspended Solids	29	27	*100 (Max)*
2	pH	7.97	7.94	*5.5 - 9.0*
3	Oil & Grease	<2.0	<2.0	*10 (Max)*
4	COD	28	40	*250 (Max)*

All values are expressed in mg/lit unless specified.

Analysed By
JSA/SA/SSA

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

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

NOISE LEVEL QUALITY MONITORING

4.1Location of sampling sites

i) **Block IV (N6)**
ii) **Muraidih OCP(N5)**
iii) **Govindpur Village(N7)**
iv) **Kharkharee (N21)**

4.2 Methodology of sampling and analysis

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

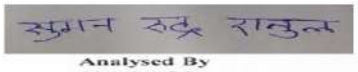
4.3 Results & Interpretations

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

NOISE LEVEL DATA

Name of the Project: **Cluster -III**			Month: **JAN.2020**		
Sl. No.	**Station Name/Code**	**Category of area**	**Date**	**Noise level dB(A)LEQ**	***Permissible Limit of Noise level in dB(A)***
1	Muraidih (N5)	**Industrial area**	07.01.2020	56.2	*75*
2	Muraidih	**Industrial area**	17.01.2020	54.7	*75*
3	Block-IV(N6)	**Industrial area**	08.01.2020	54.6	*75*
4	Block-IV	**Industrial area**	24.01.2020	55.5	*75*
5	Govindpur/Ramkanali(N7)	**Industrial area**	09.01.2020	51.2	*75*
6	Govindpur/Ramkanali	**Industrial area**	27.01.2020	63.3	*75*
7	Kharkharee(N21)	**Industrial area**	07.01.2020	53.2	*75*
8	Kharkharee	**Industrial area**	23.01.2020	54.6	*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

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.

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

NATIONAL AMBIENT AIR QUALITY STANDARDS

New Delhi the 18th November 2009

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

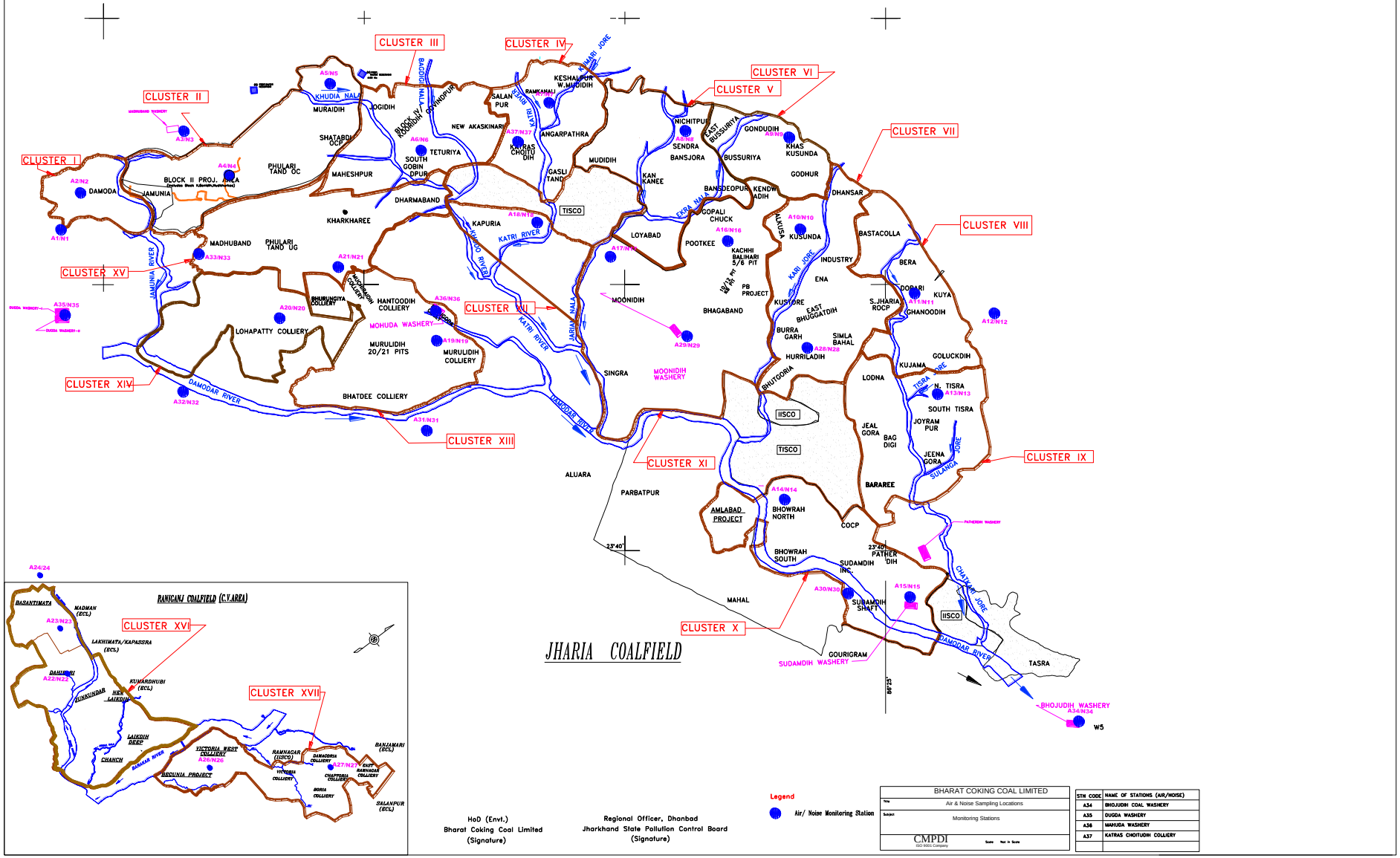
Pollutant	Time Weighted Average	Concentration in Ambient Air		Methods of Measurement
		Industrial, Residential, Rural and other Areas	Ecologically Sensitive Area (Notified by Central Government)	
Sulphur Dioxide (SO_2), µg/m³	Annual * 24 Hours **	50 80	20 80	-Improved West and Gaeke Method -Ultraviolet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

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

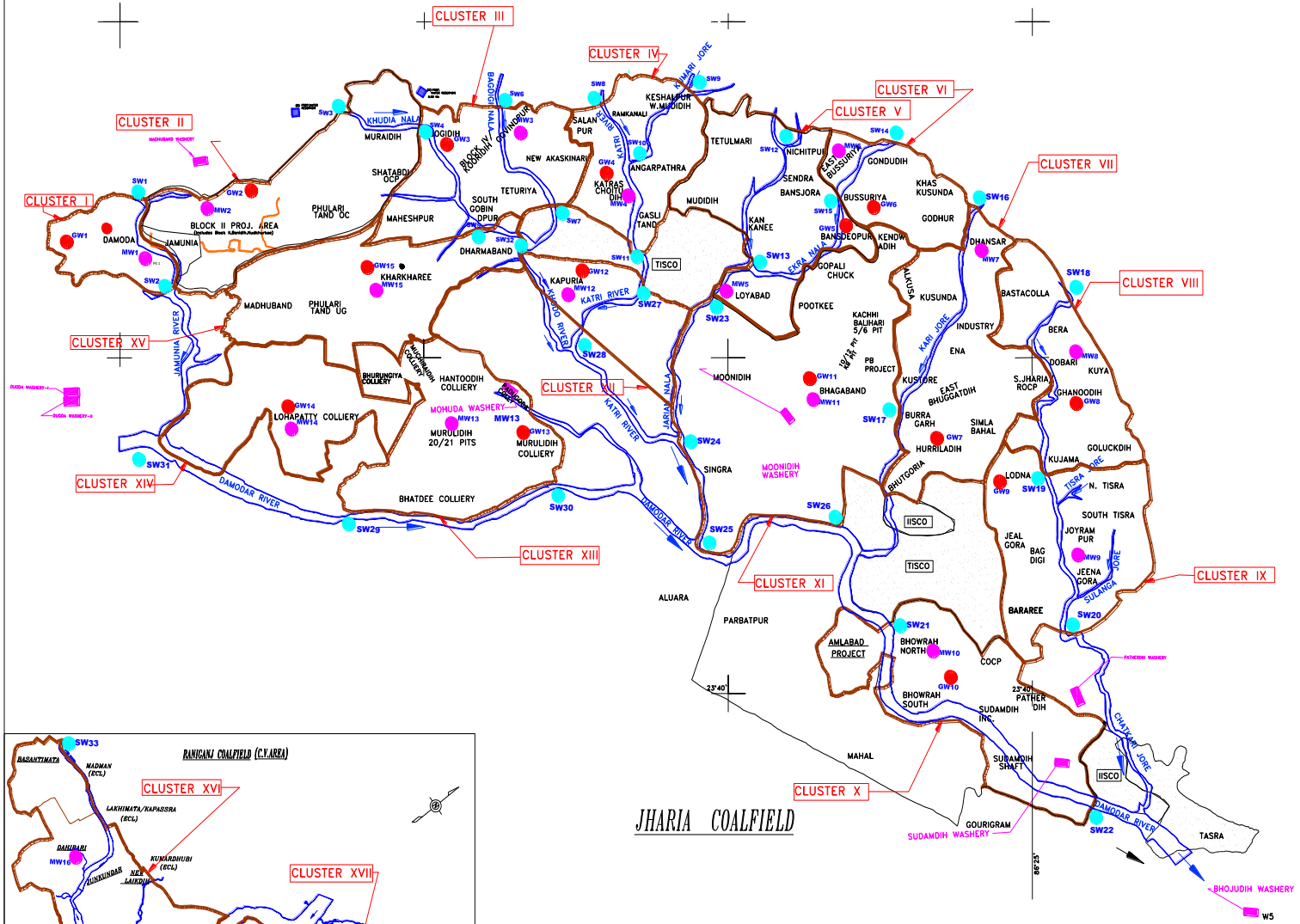
** 24 hourly or 8 hourly or 1 hourly monitored values, as applicable, shall be complied with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

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

Location of Air & Noise Monitoring Stations in BCCL



Water Sampling Locations in BCCL



INDEX

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

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

WATER QUALITY REPORT

OF

BHARAT COKING COAL LIMITED, CLUSTER – III

(FOR THE Q.E. DECEMBER, 2019)

CMPDI
ISO 9001 Company
Regional Institute-II
Dhanbad, Jharkhand

CLUSTER - III

(FOR THE Q.E. DECEMBER, 2019)

CONTENTS

SL. NO.	CHAPTER	PARTICULARS
1.		EXECUTIVE SUMMARY
2.	CHAPTER - I	INTRODUCTION
3.	CHAPTER-II	WATER SAMPLING & ANALYSIS
4.	**Plates:** Plate No. - I	SURFACE PLAN SHOWING WATER MONITORING LOCATIONS

STRICTLY RESTRICTED

FOR COMPANY USE ONLY RESTRICTED

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

WATER QUALITY REPORT

OF

BHARAT COKING COAL LIMITED
CLUSTER – III

(FOR THE Q.E. DECEMBER, 2019)

CMPDI

ISO 9001 Company

Regional Institute-II

Dhanbad, Jharkhand

EXECUTIVE SUMMARY

1.0 Introduction

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

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

2.0 Sampling location and rationale

2.1 Water sampling stations

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

2.2 Ambient air sampling locations

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

3.0 Methodology of sampling and analysis

3.1 Water quality

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

3.2 Heavy Metal in Ambient Air

Parameters chosen for assessment of Heavy metal in Ambient Air Quality were cadmium (Cd), Mercury (Hg), Arsenic (As), Chromium (Cr), Nickel (Ni), and Lead (Pb). Respirable Dust Samplers (RDS) & fine particulates for PM 2.5 sampler were

used for sampling PM 10 & PM 2.5 respectively. These heavy metals are analyzed regularly on half yearly basis. The samples were analyzed in Environmental Laboratory of CMPDI, RI-II, Dhanbad

4.0 Results and interpretations

4.1 Water quality

The test results indicate that the major parameters compared with MoEF&CC Gazette Notification No. GSR 742(E) dt 25.09.2000 Standards for Coal Mines, IS.10500/2012 (Drinking water) and IS: 2296 (Surface water), are with in permissible limits.

4.2 Heavy Metal in Ambient Air

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

CHAPTER - I

INTRODUCTION

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

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

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

1.1 The CLUSTER III is in the westernmost part of the Jharia coalfield. It includes Jogidih Colliery, Maheshpur Colliery, South Govindpur Colliery, Teturiya Colliery, Govindpur Colliery, New Akashkinaree Mine and Block IV Kooridih Mixed Mine. The cluster – III is situated about 40 - 45 kms from Dhanbad Railway Station. The mines of this cluster - III are operating since pre nationalization period (prior to 1972-73). It is connected by both Railway and Road. The drainage of the area is governed by Khudia and Bagdighi Nala.

1.2 The Project has Environmental Clearance from Ministry of Environment, Forest and Climate Change (MoEF&CC) for a rated capacity of 2.769 MTPA (normative) and 3.6 MTPA peak capacity of coal production vide letter no **E. C. no. J-11015/213/2010-IA.II (M) dated 06.02.2013.**

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

CHAPTER – II

AMBIENT AIR QUALITY MONITORING

2.1 Location of sampling station and their rationale:

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

2.2 Ambient Air Quality Sampling Locations

CORE ZONE Monitoring Location

i) Block IV Kooridih OCP (A6): Industrial Area

The location of the sampling station is at 23°47'54.00"N & 86°16'20.00"E.

BUFFER ZONE Monitoring Location

i) Muraidih OCP (A5) : Industrial Area

The sampler was placed at a height of 1.5 m from the ground level at Muraidih project office.

ii) Govindpur Village (A7) : Industrial area

The location of the sampling station is 23°48'34.00"N & 86°18'22.00"E.

iii)Kharkharee(A21): **Industrial Area**

The location of the sampling station is 23°46'29.00"N & 86°14'37.08"E.

2.3 Results and interpretations

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

AMBIENT AIR QUALITY DATA

Name of the Company: **Bharat Coking Coal Limited** Year : **2019-20[1].**

Name of the Cluster : **Cluster -III** PERIOD: **Q. E. DEC- 2019.**

MONTH: December 2019

Heavy Metal Analysis report of Ambient Air Quality

SAMPLE	Cadmium(Cd) (µg/m3)	Mercury(Hg) (µg/m3)	Iron(Fe) (µg/m3)	Chromium(Cr) (µg/m3)	Nickel (Ni) (ng/m3)	Lead (Pb) (µg/m3)
Muraidih OCP (A5)	<0.001	0.005	4.45	<0.01	<0.1	0.025
Block IV Kooridih OCP (A6)	0.001	0.003	4.86	0.01	<0.1	0.023
Govindpur Village (A7)	0.001	0.008	6.23	0.02	<0.1	0.005
Kharkharee(A21)	<0.001	0.002	4.26	0.01	<0.1	0.009

CHAPTER – II

WATER QUALITY MONITORING

3.1 Location of sampling sites

(Refer **Plate No. - I**)

i) Drinking water quality at **Jogidih Village (DW3)**

ii) Surface water quality at **U/S of Khudia Nala (SW4)**

iii) Surface water quality at **D/S of Khudia Nala (SW5)**

iv) Surface water quality at **U/S of Bagdighi Nala (SW6)**

v) Surface water quality at **D/S of Bagdighi Nala (SW7)**

vi) Mine Effluent quality at **Jogidih (MW3)**

3.2 Methodology of sampling and analysis

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

3.3 Results & Interpretations

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

WATER QUALITY

(SURFACE WATER- ALL PARAMETERS)

Name of the Company: **Bharat Coking Coal Limited** Year : **2019-20**

Name of the Cluster : **Cluster - III** Month: **Q. E. DECEMBER , 2019**

Stations:

1. Upstream in Khudia nala SW-4 (wrt Cluster-3)
2. Down stream in Khudia nala SW-5
3. Upstream in Bagdigi Nala SW-6
4. Down stream in Bagdigi Nala SW-7

Date of Sampling:

06/12/2019
10/12/2019
21/12/2019
21/12/2019

Sl. No	Parameter	Sampling Stations				IS: 2296	Detection Limit	BIS Standard & Method
		SW-04 06.12.19	**SW-05** 10.12.19	SW-06 **21.12.19**	SW-07 21.12.19			
1	Manganese (as Mn), mg/l, Max	<0.2	<0.2	<0.2	<0.2	0.5	0.2	APHA,23rd Edition, AAS-Flame
2	BOD (3 days 27°C), mg/l, Max	<2.0	<2.0	<2.0	<2.0	3.00	2.00	**IS 3025 (Part 44) : 1993 Reaffirmed 2019 , 3 day incubation at 27°C**
3	Colour	colourless	colourless	colourless	colourless	300	Qualitative	Physical/Qualitative
4	Chlorides (as Cl), mg/l, Max	30	46	38	72	600	2.00	IS-3025/32:1988, R-2019 Argentometric
5	Copper (as Cu), mg/l, Max	<0.2	<0.2	<0.2	<0.2	1.5	0.2	IS 3025/42 : 1992 R : 2019, AAS-Flame
6	Dissolved Oxygen, min.	8.1	8.0	7.6	7.4	4	0.10	**IS 3025 (Part 38) : 1989, Reaffirmed 2019 Modified Winkler Azide Method**
7	Fluoride (as F) mg/l, Max	0.65	0.83	0.67	0.39	1.5	0.02	APHA, 23RD Edition, Page 4-90 to , 4500 –F- D (SPADNS Method)
8	Hexavalent Chromium, mg/l, Max	<0.01	<0.01	<0.01	<0.01	0.05	0.01	IS 3025 (Part 52) : 2003,Reaffirmed 2019
9	Iron (as Fe), mg/l, Max	0.24	0.20	<0.2	0.28	50	0.2	IS 3025 /53 : 2003,R : 2019 , AAS-Flame Method
10	Lead (as Pb), mg/l, Max	<0.005	<0.005	<0.005	<0.005	0.1	0.005	APHA, 23rd Edition, AAS-GTA
11	Nitrate (as NO_3), mg/l, Max	2.34	10.01	<0.5	2.41	50	0.50	APHA, 23rd Edition, P-4-127, 4500 - NO_3^- B , UV-Spectrophotometric Screening Method
12	pH value	8.26	8.28	8.27	8.20	6.5-8.5	2.5	IS 3025, Part 11 : 1983 R 2017 Electrometric method
13	Phenolic compounds (as C_6H_5OH), mg/l, Max	<0.002	<0.002	<0.002	<0.002	0.005	0.002	APHA, 22nd Edition 4-Amino Antipyrine
14	Total Chromium(as Cr) mg/l, Max	<0.1	<0.1	<0.1	<0.1	2.00	0.1	IS 3025/ 56:2003, R:2019 AAS-Flame
15	Sulphate (as SO_4) mg/l, Max	43	193	25	43	400	2.00	APHA –23rd Edition. P-4-199, 4500 SO_4^{2-} E
16	Total Dissolved Solids, mg/l, Max	295	568	253	362	1500	25.00	IS 3025, Part 16: 1984 R 2017 Gravimetric method
17	Zinc (as Zn), mg/l, Max	<0.1	<0.1	<0.1	<0.1	15	0.1	IS 3025/ 49 : 1994, R : 2019, AAS-Flame

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

(DRINKING WATER- ALL PARAMETERS)

Name of the Company: **Bharat Coking Coal Limited** Year : **2019-20.**

Name of the Cluster : **Cluster - III** Month: **Q. E. December, 2019**

Stations: Jogidih village DW 3 **Year: 2019-20** **Date of sampling: 21.12.19**

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500	Standard / Test Method
		DW 03					
1	Boron (as B), mg/l, Max	<0.2			0.2	0.5	APHA, 23rd Edition ,Carmine
2	Colour,in Hazen Units	1			1	5	APHA, 23rd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	59			1.6	75	IS 3025, Part 40: 1991 R 2019 EDTA Method
4	Chloride (as Cl), mg/l, Max	82			2	250	IS-3025/32:1988, R-2019 Argentometric
5	Copper (as Cu), mg/l, Max	0.09			0.03	0.05	IS 3025 Part 42 : 1992 R : 2019, AAS-Flame
6	Fluoride (as F) mg/l, Max	0.33			0.2	1.0	APHA, 23RD Edition, Page 4-90 to , 4500 –F- D (SPADNS Method)
7	Free Residual Chlorine, mg/l, Min	<0.04			0.04	0.2	APHA, 23rd Edition, , 4500-Cl^- B. (Iodometric Method-I)
8	Iron (as Fe), mg/l, Max	0.2			0.06	1.0	IS 3025 Part 53 : 2003, R : 2019 , AAS-Flame Method
9	Lead (as Pb), mg/l, Max	0.01			0.005	0.01	IS:3025(Part 47):1994 (Reaffirmed 2019) APHA, 23rd Edition, AAS-GTA
10	Manganese (as Mn), mg/l, Max	<0.02			0.02	0.1	IS-3025(Part 59):2006, R 2017 AAS-Flame
11	Nitrate (as NO_3), mg/l, Max	25.48			0.5	45	APHA, 23rd Edition, P-4-127, 4500 - NO_3^- B , UV-Spectrophotometric Screening Method
12	Odour	Agreeable			Qualitative	Agreeable	APHA, 23rd Edition, , 2150-C
13	pH value	7.78			0.2	6.5-8.5	IS 3025, Part 11 : 1983 R 2017 Electrometric method
14	Phenolic compounds (as C_6H_5OH), mg/l, Max	<0.001			0.001	0.002	APHA, 22nd Edition,4-Amino Autipyrine
15	Mercury (as Hg), mg/l, Max	<0.0005			0.0005	0.001	APHA,23rd Edition, AAS-VGA
16	Sulphate (as SO_4) mg/l, Max	272			2	200	APHA –23rd Edition. P-4-199, 4500 SO_4^{2-} E
17	Taste	Acceptable			Qualitative	Acceptable	APHA,23rd Edition, 2160-C Flavour Rating Assesment
18	Total Alkalinity (c_ac_{03}),, mg/l, Max	148			4	200	IS 3025, Part 23: 1986 R 2019 Titration Method
19	Cadmium (as Cd), mg/l, Max	<0.0005			0.0005	0.003	APHA,23rd Edition, AAS-GTA Method
20	Total Chromium (as Cr), mg/l, Max	<0.04			0.04	0.05	IS-3025 Part 52:2003, R:2019,AAS-Flame
21	Total Dissolved Solids, mg/l, Max	890			25	500	IS 3025, Part 16: 1984 R 2017 Gravimetric method
22	Total Hardness (c_ac_{03}), mg/l, Max	564			4	200	IS 3025, Part 21, 2009 R 2019 EDTA Method
23	Turbidity, NTU, Max	1			1	5	IS 3025, Part 10 : 1984 R 2017 Nephelometric Method
24	Zinc (as Zn), mg/l, Max	0.35			0.01	5	IS 3025 Part 49 : 1994,R : 2019, AAS-Flame
25	Nickel as Ni, mg/l Max	0.11			0.01	5	IS 3025 Pat 54 : 2003,R : 2019, AAS-Flame

WATER QUALITY

(MINE EFFLUENT- 27 PARAMETERS)

Name of the Company: **Bharat Coking Coal Limited** Year : **2019-20.**

Name of the Cluster : **Cluster - III** Month: **Q. E. December, 2019**

Effluent water of BCCL Mines					**Date of Sampling:**
Sample Code :MW 03 Govindpur colliery					26.12.2019
Sl.No.	**Parameter**	**Results**	**Detection Limit**	**MOEF -SCH-VI STANDARDS Class 'A'**	**BIS Standard & Method**
1	Ammonical Nitrogen, mg/l, Max	0.08	0.02	50.0	IS 3025/34:1988, R : 2009, Nessler's
2	Mercury (as Hg), mg/l, *Max*	<0.0005	0.0005	0.01	APHA 23rd Edition, AAS-VGA
3	B.O.D (3 days 27°C), mg/l, Max	<2	2.00	30.0	IS 3025 /44:1993,R:2003 3 day incubation at 27°C
4	Colour	Colourless	Qualitative	Qualitative	Physical/Qualitative
5	COD, mg/l, Max	48	4.00	250.0	APHA 23rd Edition 5220 C Titrimetric Method
6	Copper (as Cu), mg/l, *Max*	<0.2	0.2	3.0	IS 3025(Part42): 1992 R : 2019, AAS-Flame
7	Dissolved Phosphate (as P), mg/l, Max	<0.3	0.30	5.0	IS 3025/ 31, 1988 R 2019
8	Fluoride (as F) mg/l, *Max*	0.52	0.02	2.0	APHA, 23RD Edition, Page 4-90 to , 4500 –F- D (SPADNS Method)
9	Free Ammonia, mg/l, Max	<0.01	0.01	5.0	IS:3025/34:1988, Nesseler's
10	Hexavalent Chromium, mg/l, Max	0.018	0.01	0.1	IS 3025 (Part 52) : 2003,Reaffirmed 2019
11	Iron (as Fe), mg/l, *Max*	0.2	0.2	3.0	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame
12	Lead (as Pb), mg/l, *Max*	<0.005	0.005	0.1	APHA, 23rd Edition, AAS-GTA
13	Manganese(as Mn), mg/l, Max	<0.2	0.2	2.0	IS-3025(Part 59):2006, R 2017 AAS-Flame /APHA, 23rd Edition, 3111B, AAS-Flame
14	Nickel (as Ni), mg/l, *Max*	<0.1	0.1	3.0	IS-3025(Part 54):2003, R:2019 AAS-Flame
15	Nitrate Nitrogen, mg/l, *Max*	<0.5	0.50	10.0	APHA, 23 rd Edition,UV-Spectrphotometric
16	Oil & Grease, mg/l, Max	<2.0	2.00	10.0	IS 3025/39:1991, R : 2019, Partition Gravimetric
17	pH value	8.11	2.5	5.5 to 9.0	IS-3025/11:1983, R-2017, Electrometric
18	Phenolic compounds (as C_6H_5OH),mg/l, *Max*	<0.002	0.002	1.0	APHA, 23rd Edition 4-Amino Antipyrine
19	Sodium (as Na), mg/l, Max	<0.005	0.005	-	IS-3025 (Part 45):1993, R:2019 AAS-Flame
20	Sulphide (as S^{2-}) mg/l Max.	<0.005	0.005	2.0	APHA 23rd Edition Methylene Blue Method
21	Temperature (°C)	17.2	Shall not exceed 5^0 C above the receiving temp.		IS-3025/09:1984, Thermometeric
22	Total Chromium (as Cr), mg/l, *Max*	<0.1	0.1	2.0	IS-3025(Part 52):2003, R:2019 AAS-Flame
23	Total Kjeldahl Nitrogen, mg/l, Max	1.4	1.00	100.0	IS:3025/34:1988, Nesseler's
24	Total Residual Chlorine, mg/l, Max	<0.04	0.04	1.0	APHA, 23rd Edition, , 4500-Cl B. (Iodometric Method-I)
25	Total Suspended Solids, mg/l, Max	34	10.00	100.0	IS 3025/17:1984, R :2017, Gravimetric
26	Zinc (as Zn), mg/l, *Max*	0.1	0.1	5.0	IS 3025 /49 : 1994, R : 2019, AAS-Flame
27	Odour	Agreeable	Agreeable	Qualitative	APHA, 23rd Edition, , 2150-C

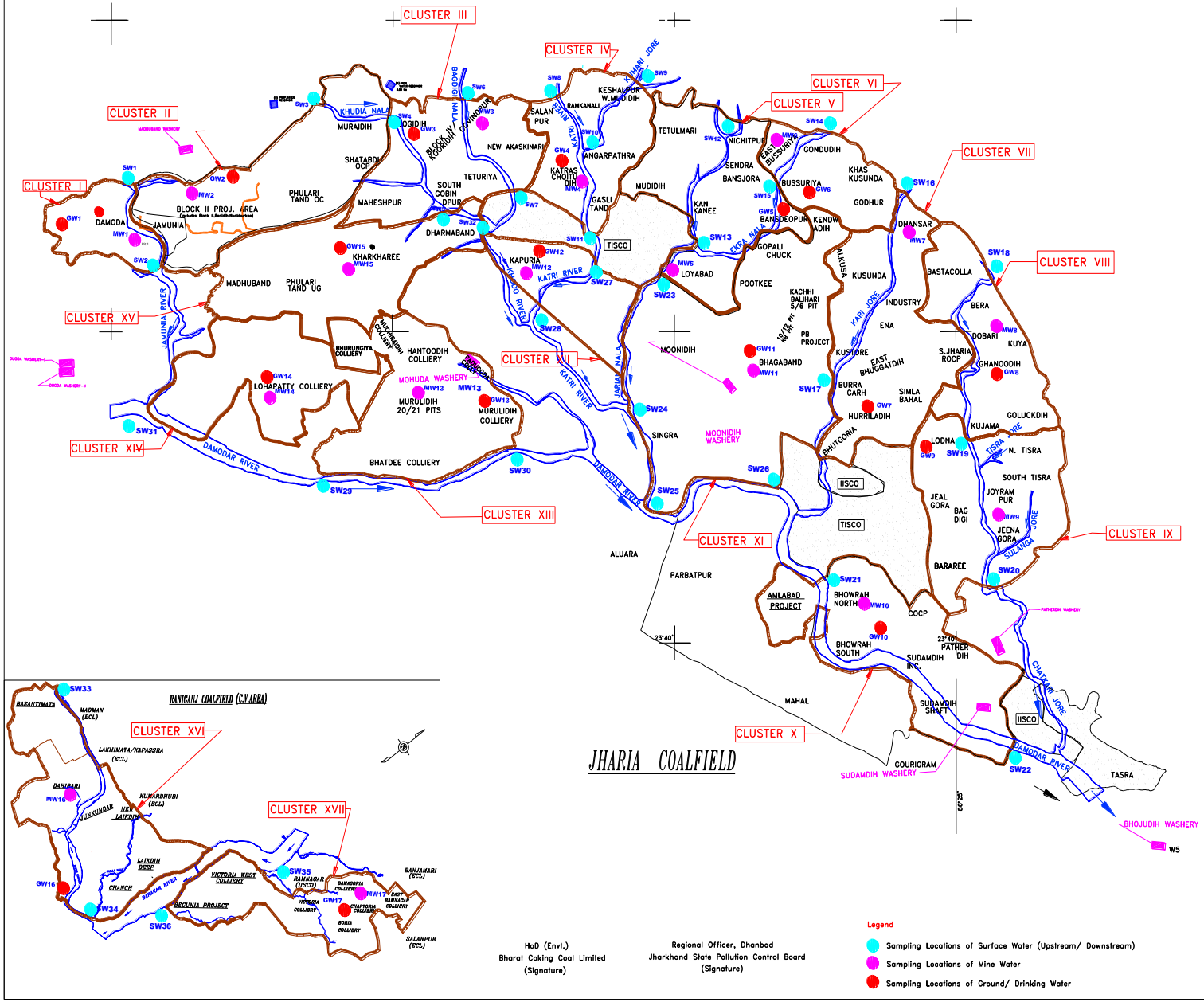
All values are expressed in mg/lit unless specified.

Analysed By
JSA/SA/SSA

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

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

Water Sampling Locations in BCCL

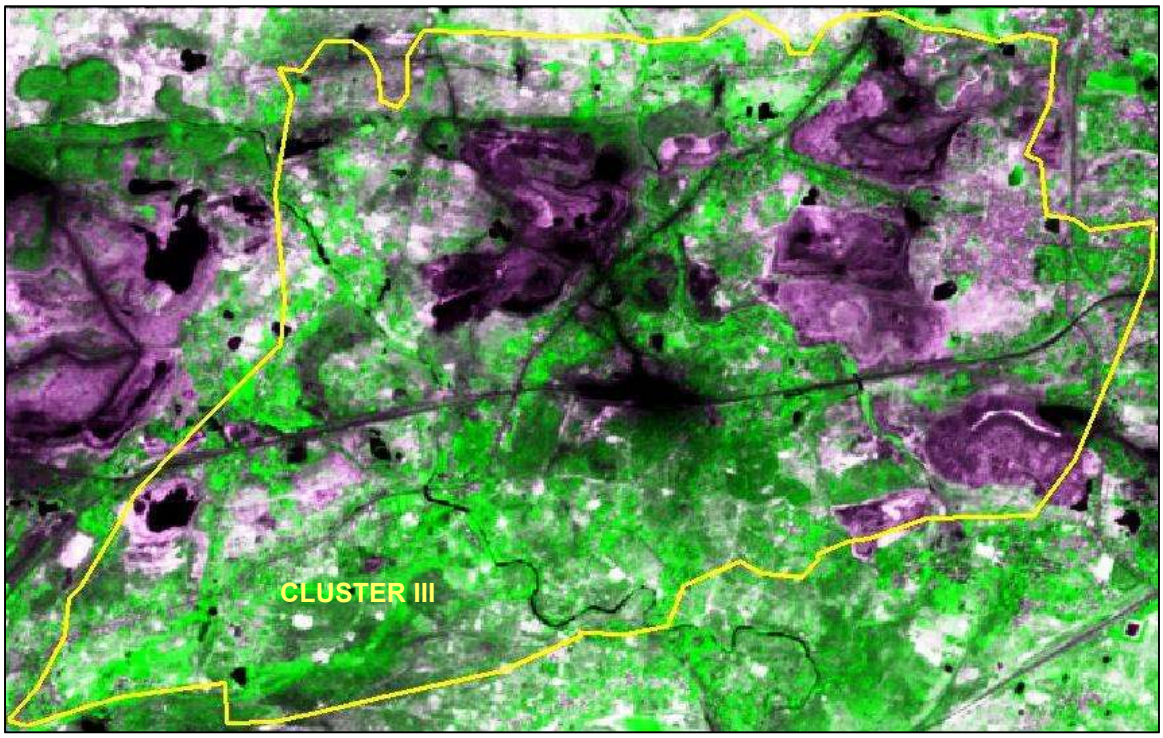


INDEX

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	Murilidih
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

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

Land Restoration / Reclamation Monitoring of 4 Clusters of Opencast Mines of Bharat Coking Coal Limited producing less than 5 m.cu.m. (Coal + OB) based on Satellite Data for the Year 2017



Submitted to:

Bharat Coking Coal Limited

cmpdi
A Mini-Ratna Company

Land Restoration / Reclamation Monitoring of 4 Clusters of Opencast Mines of Bharat Coking Coal Limited producing less than 5 m.cu.m (Coal + OB) based on Satellite Data for the Year 2017

March-2018

Remote Sensing Cell
Geomatics Division
CMPDI, Ranchi

CONTENTS

Executive Summary iii

1.0 Background 01

2.0 Objective 02

3.0 Methodology 02

4.0 Land Reclamation in Bharat Coking Coal Limited 05

List of Tables

Table-1 Cluster wise Land Reclamation Status iv

Table-2 Area Statistics of Land Use Classes in Clusters 06

List of Plates

Plate-1 Land Use Map of Cluster-III 07

Plate -2 Land Use Map of Cluster-V 08

Plate -3 Land Use Map of Cluster-VIII 09

Plate-4 Land Use Map of Cluster-IX 10

List of Figures

Figure-1 Bar-Chart of Cluster wise Land Reclamation Status v

Figure-2 Methodology of Land Reclamation Monitoring 02

Figure-3 Bar-Chart of Land Reclamation Status of Cluster-III 11

Figure-4 Bar-Chart of Land Reclamation Status of Cluster-V 11

Figure-5 Bar-Chart of Land Reclamation Status of Cluster-VIII 12

Figure-6 Bar-Chart of Land Reclamation Status of Cluster-IX 12

List of Photographs

Photo-1 Ecological Restoration Site (Tetulmari Colliery) 13

Photo-2 Eco-Restoration Site (Rajapur OCP) 13

Photo-3 Social Forestry Plantation (Lodna) 14

Executive Summary

1.0 Project

Land restoration / reclamation monitoring of 4 clusters of Opencast Mines of Bharat Coking Coal Ltd. (BCCL) producing less than 5 million cu. m. (Coal + OB) per year based on satellite data of the year 2017 on three year interval.

2.0 Objective

Objective of the land restoration / reclamation monitoring is to assess the area of backfilling, plantation, social forestry, active mining area, water bodies and distribution of wasteland, agricultural land and forest land in the leasehold area of the various projects. This will help in assessing the progressive status of mined out land reclamation and to take up remedial measures, if any, required for environmental protection.

3.0 Salient Findings

- Out of the total mine leasehold area of 6576.22 hectares of the 4 Clusters of mines viz. Cluster III, Cluster V, Cluster VIII & Cluster IX considered for monitoring during year 2017-18; total excavated area is 995.60 ha, out of which 31.60 ha (3.17%) has been planted, 457.35 ha (45.94%) area is under backfilling and 506.65 ha (50.89%) area is under active mining. It is evident from the analysis that 49.11% area of the above clusters is under reclamation (biological and technical) and balance 50.89% area is under active mining. Project wise details are given in Table-1 & Fig -1.

- From the analysis of land reclamation for the year 2017 it is evident that the area under technical reclamation is 457.35 Ha. and area under biological reclamation is 31.60 Ha. Out of 4 clusters of BCCL considered for monitoring, Cluster VIII is on top for land reclamation (61.25%) followed by Cluster V (60.13%) and Cluster III (37.06%).

TABLE-1

Cluster wise Land Reclamation Status in Clusters of Bharat Coking Coal Ltd based on satellite data of the year 2017

(Area in Hectare)

Sl. No.	Project	Total Leasehold Area	Technical Reclamation	Plantation			Area under Active Mining	Total Excavated Area	Total Area under Plantation (% Green Cover Generated in Leasehold)	Total Area under Reclamation
				Biological Reclamation	Other Plantations					
			Area under Backfilling	Plantation on Excavated / Backfilled Area	Plantation on External Over Burden Dumps	Social Forestry, Avanue Plantation Etc.				
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9 (=4+5+8)*	*10 (=5+6+7)*	*11(=4+5)*
			2017	*2017*	*2017*	*2017*	*2017*	*2017*	*2017*	*2017*
1	Cluster III	1552.53	55.87	3.89	21.11	128.07	101.5	161.26	153.07	59.76
			34.65%	2.41%			62.94%		9.86%	37.06%
2	Cluster V	1724.52	162.09	7.19	23.85	105.29	112.24	281.52	136.33	169.28
			57.58%	2.55%			39.87%		7.91%	60.13%
3	Cluster VIII	1331.95	161.86	13.72	21.97	24.70	111.06	286.64	60.39	175.58
			56.47%	4.79%			38.75%		4.53%	61.25%
4	Cluster IX	1967.22	77.53	6.80	41.79	168.58	181.85	266.18	217.17	84.33
			29.13%	2.55%			68.32%		11.04%	31.68%
	TOTAL	**6576.22**	**457.35**	**31.60**	**108.72**	**426.64**	**506.65**	**995.60**	**566.96**	**488.95**
			45.94%	**3.17%**			**50.89%**		**8.62%**	**49.11%**

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

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

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

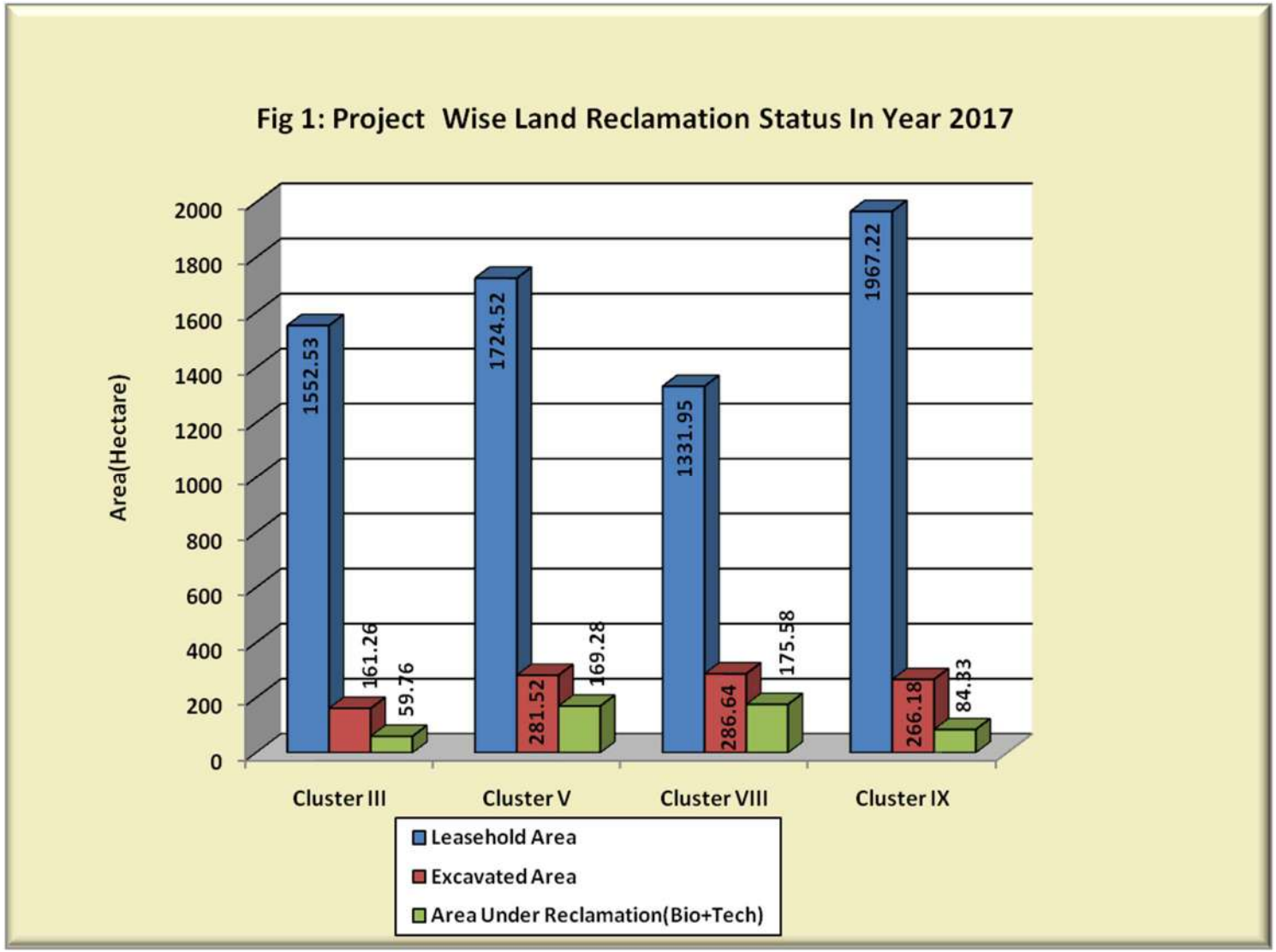


Fig 1: Project Wise Land Reclamation Status In Year 2017
Area(Hectare)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
1552.53
161.26
59.76
1724.52
281.52
169.28
1331.95
286.64
175.58
1967.22
266.18
84.33
Cluster III
Cluster V
Cluster VIII
Cluster IX
Leasehold Area
Excavated Area
Area Under Reclamation(Bio+Tech)

1.0 Background

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

1.2 Keeping above in view, M/s. Coal India Ltd. (CIL) issued a work order vide letter no. CIL/WBP/ENV./2017/DP/8477 dated 21/09/17 for monitoring of opencast mines of less than 5 million m^3 per annum capacity (Coal +OB) for the period 2017-18 to 2021-22 at intervals of three years. The result of land reclamation status of all such mines is uploaded on the website of the concerned coal companies in public domain. Detailed reports are to be submitted to Coal India and respective subsidiaries.

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

1.4 Present report is embodying the finding of the study based on satellite data of the year 2017 carried out for 4 clusters of Bharat Coking Coal Ltd. producing less than 5 mcm (Coal+OB) per annum.

2.0 Objective

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

3.0 Methodology

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

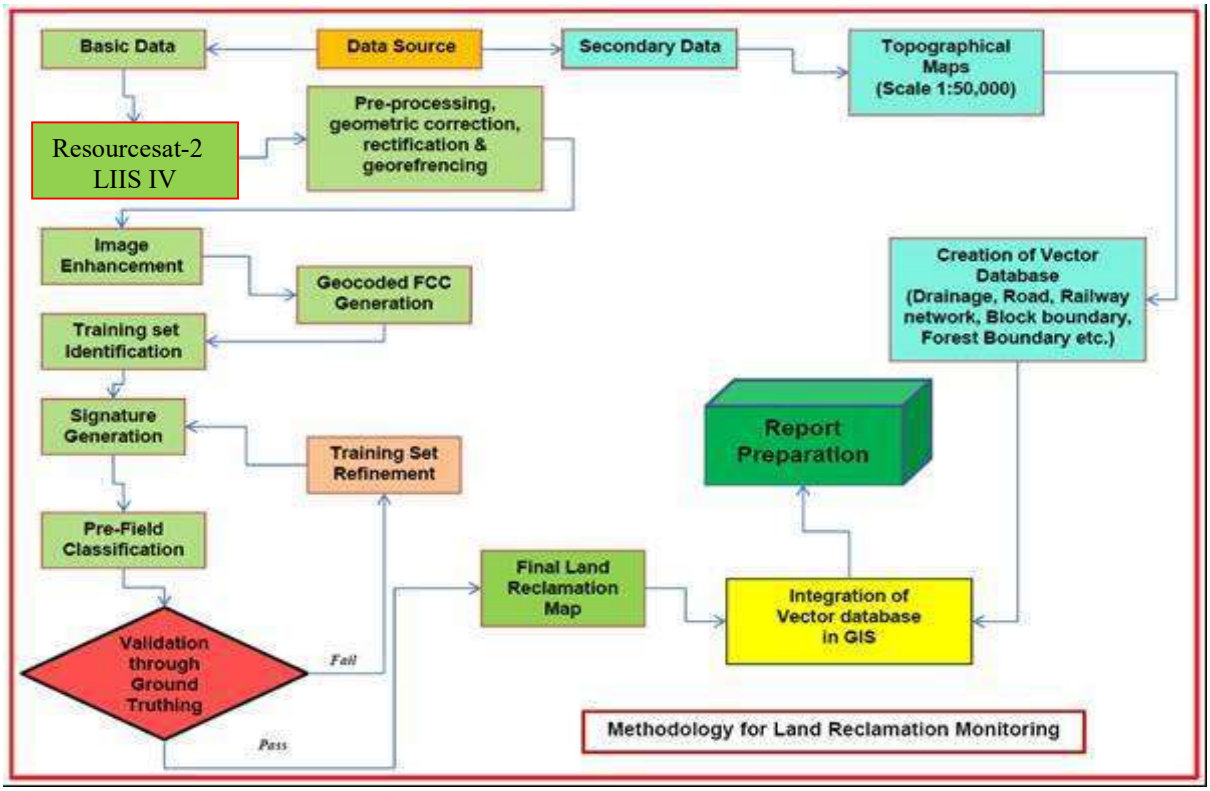


Figure: 2 Methodology for Land Reclamation Monitoring

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

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

- **Rectification & Georeferencing:** Inaccuracies in digital imagery may occur due to 'systematic errors' attributed to earth curvature and rotation as well as 'non-systematic errors' attributed to satellite receiving station itself. Raw digital images contain geometric distortions, which make them unusable as maps. Therefore, georeferencing is required for correction of image data using ground control points (GCP) to make it compatible to SOI topo sheet.

- **Image enhancement:** To improve the interpretability of the raw data, image enhancement is necessary. Local operations modify the value of each pixel based on brightness value of neighbouring pixels using ERDAS IMAGINE 2014 s/w and enhance the image quality for interpretation.

- **Training set selection**

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

- **Classification and Accuracy assessment**

  Image classification is carried out using the maximum likelihood algorithm. The classification proceeds through the following steps: (a) calculation of statistics [i.e. signature generation] for the identified training areas, and (b) the decision boundary of maximum probability based on the mean vector, variance, covariance and correlation matrix of the pixels. After evaluating the statistical parameters of the training sets, reliability test of training sets is conducted by measuring the statistical separation between the classes that resulted from computing divergence matrix. The overall accuracy of the classification was finally assessed with reference to ground truth data.

- **Area calculation**

  The area of each land use class in the leasehold is determined using ERDAS IMAGINE v. 2014 software and given in table 2.

- **Overlay of Vector data base**

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

- **Pre-field map preparation**

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

3.3 Ground Truthing:

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

3.4 Land reclamation database on GIS:

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

4.0 Land Reclamation Status in Bharat Coking Coal Ltd.

4.1 Following 4 clusters of opencast mines producing less than 5 million m^3. (Coal + OB together) of Bharat Coking Coal Ltd. have been taken up during the year 2017-18 for land reclamation monitoring:

- Cluster-III
- Cluster-V
- Cluster-VIII
- Cluster-IX

4.2 Area statistics of different land use classes present in clusters in the year 2017 is given in Table 2. Land use maps derived from the satellite data is given in Plate no. 1 to 4. Land use statuses are shown in Fig. 3 – 6.

4.3 Study reveals that 49.11% of excavated area is under reclamation in the above mentioned clusters of BCCL, out of which 3.17% area has been planted and 45.94% area is under backfilling.

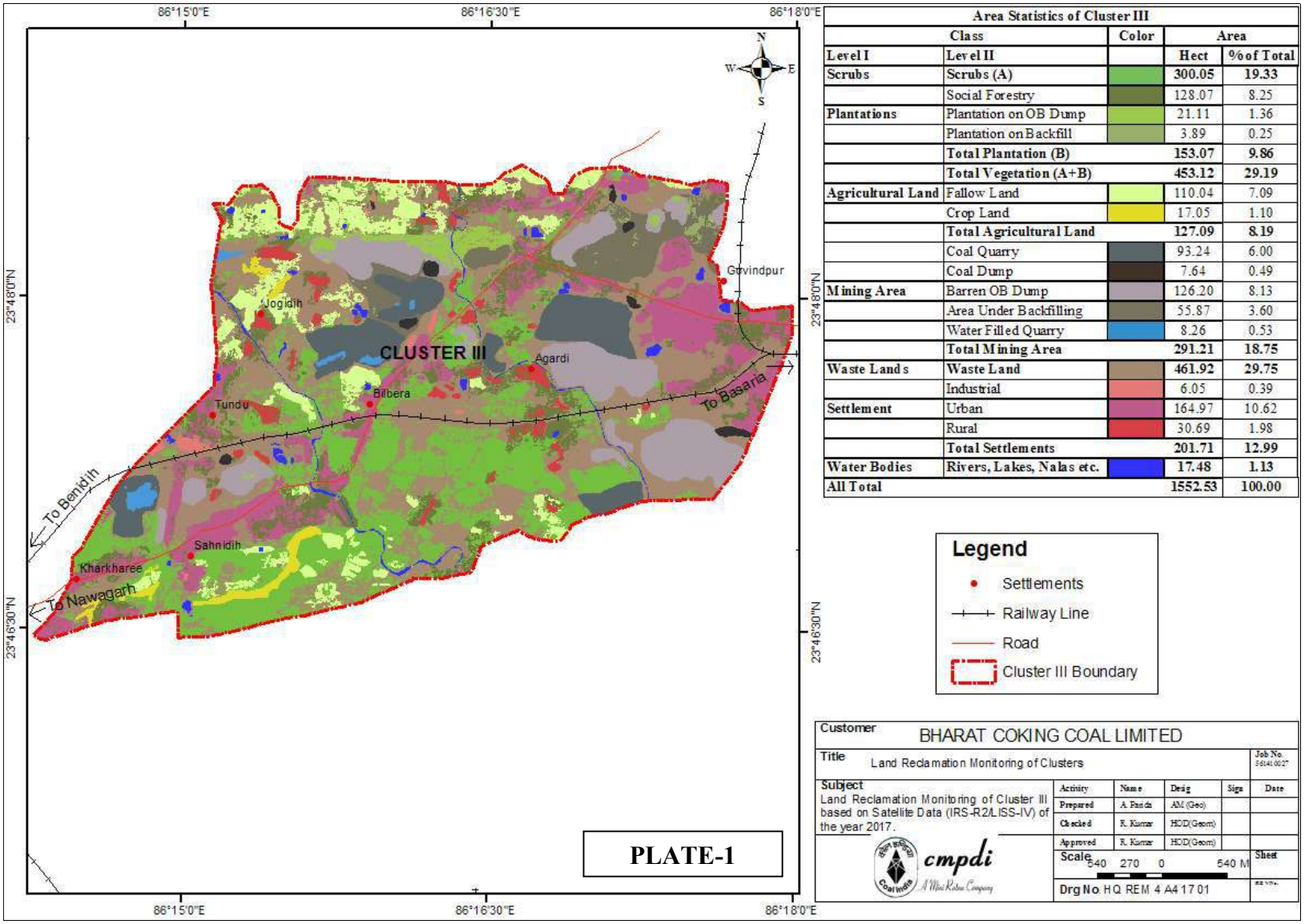
4.4 After analyzing the satellite data of year 2017, it is evident that plantation carried out on backfilled area, OB dumps as well as under social forestry in all the 4 clusters of BCCL taken up for study has reached only 8.62% of the total leasehold area of the above clusters till now. It can also be seen from Table.1 that the total area under reclamation has reached 49.11% of the total excavated area till the year 2017 in the 4 clusters taken up for study.

Table 2

STATUS OF LAND USE/COVER IN CLUSTERS (<5 m cu .m) OF BHARAT COKING COAL LIMITED BASED ON SATELLITE DATA OF THE YEAR 2017

(Area in Hectare)

		Cluster III		Cluster V		Cluster VIII		Cluster IX		TOTAL	
		Area	%	Area	%	Area	%	Area	%	Area	%
FORESTS	Dense Forest	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Open Forest	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total Forest	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SCRUBS	Scrubs	300.05	19.33	344.78	19.99	143.21	10.75	339.86	17.28	1127.90	17.15
PLANTATION	Social Forestry	128.07	8.25	105.29	6.10	24.70	1.85	168.58	8.57	426.64	6.49
	Plantation on OB Dump	21.11	1.36	23.85	1.38	21.97	1.65	41.79	2.12	108.72	1.65
	Plantation on Backfill (Biological Reclamation)	3.89	0.25	7.19	0.42	13.72	1.03	6.80	0.35	31.60	0.48
	Total Plantation	153.07	9.86	136.33	7.90	60.39	4.53	217.17	11.04	566.96	8.62
	Total Vegetation	**453.12**	**29.19**	**481.11**	**27.89**	**203.60**	**15.28**	**557.03**	**28.32**	**1694.86**	**25.77**
	Coal Dump	7.64	0.49	2.55	0.15	7.71	0.58	9.67	0.49	27.57	0.42
ACTIVE MINING	Coal Quarry	93.24	6.00	102.79	5.96	108.02	8.11	178.55	9.08	482.60	7.34
	Advance Quarry Site	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Quarry Filled With Water	8.26	0.53	9.45	0.55	3.04	0.23	3.30	0.17	24.05	0.37
	Total Area under *Active Mining*	**101.50**	**6.53**	**112.24**	**6.51**	**111.06**	**8.34**	**181.85**	**9.25**	**506.65**	**7.70**
	Barren OB Dump	126.20	8.13	151.20	8.77	149.30	11.21	172.19	8.75	598.89	9.11
RECLAIMED	Area Under Backfilling (Technical Reclamation)	55.87	3.60	162.09	9.40	161.86	12.15	77.53	3.94	457.35	6.95
	Total Area under *Technical Reclamation*	**55.87**	**3.60**	**162.09**	**9.40**	**161.86**	**12.15**	**77.53**	**3.94**	**457.35**	**6.95**
	Total Area under Mine Operation	**291.21**	**18.75**	**428.08**	**24.83**	**429.93**	**32.28**	**441.24**	**22.43**	**1590.46**	**24.19**
WATERBODIES	Waste Lands	461.92	29.75	517.23	29.99	443.58	33.30	614.64	31.24	2037.37	30.98
	Fly Ash Pond / Sand Body	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Total Wasteland	**461.92**	**29.75**	**517.23**	**29.99**	**443.58**	**33.30**	**614.64**	**31.24**	**2037.37**	**30.98**
	Reservoir, nallah, ponds	17.48	1.13	10.21	0.59	13.15	0.99	20.59	1.05	61.43	0.93
	Total Waterbodies	**17.48**	**1.13**	**10.21**	**0.59**	**13.15**	**0.99**	**20.59**	**1.05**	**61.43**	**0.93**
AGRICULTURE	Crop Lands	17.05	1.10	8.41	0.49	18.05	1.35	0.00	0.00	43.51	0.66
	Fallow Lands	110.04	7.09	37.74	2.19	58.02	4.36	44.49	2.26	250.29	3.81
	Total Agriculture	**127.09**	**8.19**	**46.15**	**2.68**	**76.07**	**5.71**	**44.49**	**2.26**	**293.80**	**4.47**
SETTLEMENTS	Urban Settlement	164.97	10.62	217.50	12.61	97.19	7.30	232.31	11.81	711.97	10.83
	Rural Settlement	30.69	1.98	13.78	0.80	57.00	4.28	47.79	2.43	149.26	2.27
	Industrial Settlement	6.05	0.39	10.46	0.61	11.43	0.86	9.13	0.46	37.07	0.56
	Total Settlement	**201.71**	**12.99**	**241.74**	**14.02**	**165.62**	**12.44**	**289.23**	**14.70**	**898.30**	**13.66**
	Grand Total	**1552.53**	**100.00**	**1724.52**	**100.00**	**1331.95**	**100.00**	**1967.22**	**100.00**	**6576.22**	**100.00**



Area Statistics of Cluster III

Class		Color	Area	
Level I	**Level II**		**Hect**	**% of Total**
Scrubs	**Scrubs (A)**		**300.05**	**19.33**
	Social Forestry		128.07	8.25
Plantations	Plantation on OB Dump		21.11	1.36
	Plantation on Backfill		3.89	0.25
	Total Plantation (B)		**153.07**	**9.86**
	Total Vegetation (A+B)		**453.12**	**29.19**
Agricultural Land	Fallow Land		110.04	7.09
	Crop Land		17.05	1.10
	Total Agricultural Land		**127.09**	**8.19**
	Coal Quarry		93.24	6.00
	Coal Dump		7.64	0.49
Mining Area	Barren OB Dump		126.20	8.13
	Area Under Backfilling		55.87	3.60
	Water Filled Quarry		8.26	0.53
	Total Mining Area		**291.21**	**18.75**
Waste Lands	**Waste Land**		**461.92**	**29.75**
	Industrial		6.05	0.39
Settlement	Urban		164.97	10.62
	Rural		30.69	1.98
	Total Settlements		**201.71**	**12.99**
Water Bodies	**Rivers, Lakes, Nalas etc.**		**17.48**	**1.13**
All Total			**1552.53**	**100.00**

Legend

- Settlements
- Railway Line
- Road
- Cluster III Boundary

Customer: BHARAT COKING COAL LIMITED

Title: Land Reclamation Monitoring of Clusters

Job No. 561410027

Subject: Land Reclamation Monitoring of Cluster III based on Satellite Data (IRS-R2/LISS-IV) of the year 2017.

Activity	Name	Desig	Sign	Date
Prepared	A. Panda	AM (Geo)		
Checked	R. Kumar	HOD(Geom)		
Approved	R. Kumar	HOD(Geom)		

cmpdi — A Mini Ratna Company

Scale: 540 270 0 540 M

Sheet

Drg No. HQ REM 4 A4 17 01

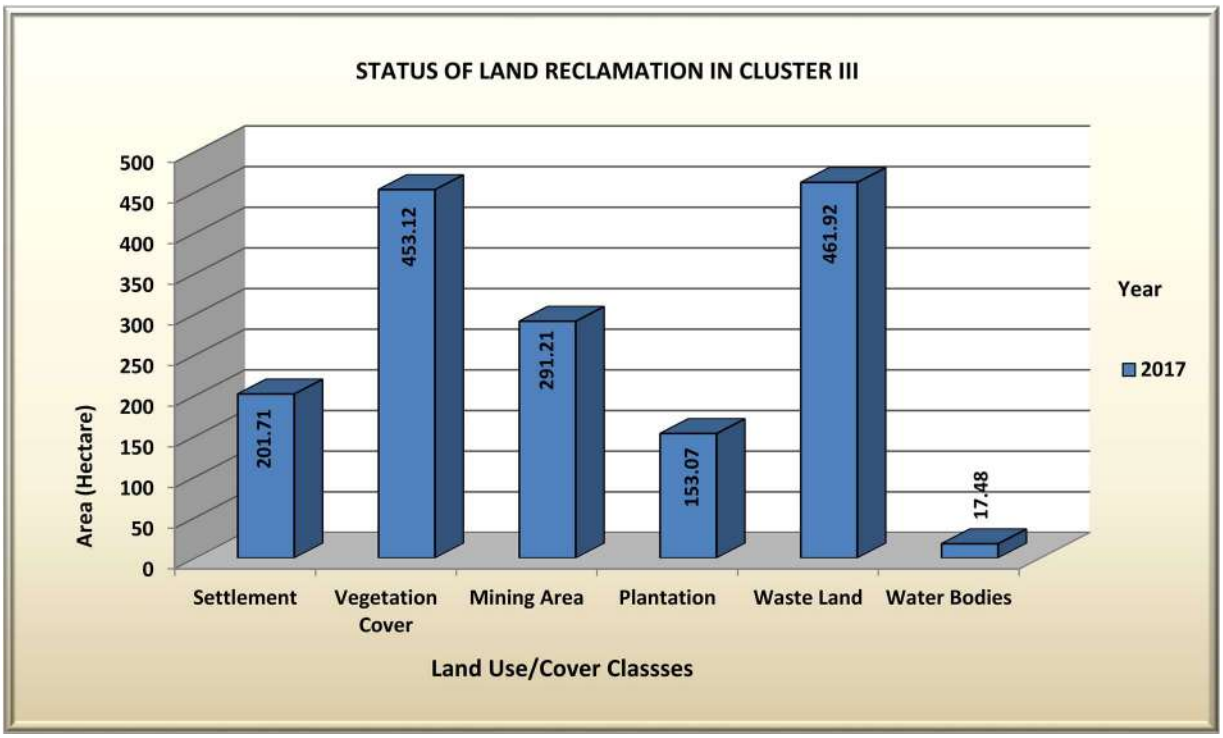


FIGURE - 3

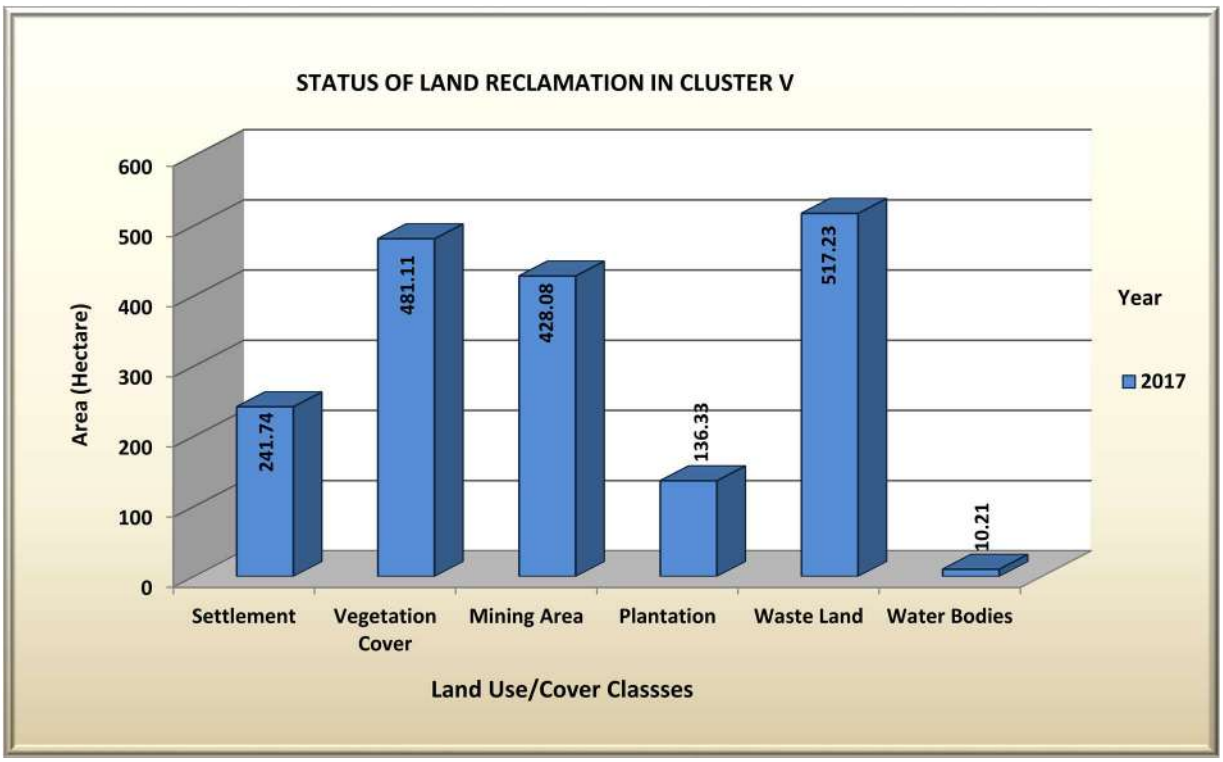


FIGURE - 4

Annexure-XV

Expenditure made for various Environmental activities in Cluster-III for FY 2019-20

Activities	Cost (Rs.)		Remarks
Water Sprinkling	Diesel	Manpower	Regular water sprinkling is done on Haul roads, public roads for dust suppression.
	2052800	1,84,10,322.6 (12 nos.*365 days* @EMS of Rs. 4203.27)	
Environmental monitoring	30,66,343.28		Regular environmental monitoring is done by RI-II, CMPDIL, Dhanbad.
Biological reclamation	Manpower cost: 1,89,14,715 (15 nos.*300 days* @ EMS of Rs. 4203.27)		Biological reclamation of stabilized OB dumps. Block Plantation, Avenue plantation.
Total Cost	**Rs. 4,24,44,180.88 (Four Crore Twenty Four Lakhs Forty Four Thousand One Hundred Eighty Rupees and Eighty Eight Paisa)**		

Annexure-XVI

अमित कुमार झोलिया, सीए | ऑफ कॉमर्स | सुशील नारनोली

झरिया के लोगों ने कहा

आम बजट से जनता को राहत नहीं मिली है। बेरोजगार युवकों को रोजगार का अवसर नहीं मिला है। बजट ने सभी को निराश किया है। इसका खमियाजा चुनाव में कांग्रेस को भुगतना पड़ेगा।

संजीव सिंह, संयुक्त महामंत्री जमसं।

बजट कहीं से संतोषप्रद नहीं है। निराशाजनक बजट है। आम जनता पर बोझ बढ़ेगा। उद्योग खोलने पर कोई ध्यान नहीं दिया गया है।

एसके बख्शी, केंद्रीय उपाध्यक्ष सीटू

आम बजट में बेरोजगारों के लिए कुछ नहीं किया गया। आम लोगों पर बोझा लादा गया

शिवबालक पासवान, माकपा

कांग्रेस ने जनता को निराश किया है। जनता इस बार आम बजट का जवाब बैलेट से देगी।

मुनिलाल राम, झाविमो

आम बजट जनविरोधी और महंगाई बढ़ाने वाला है। आंकड़ों के जाल में यूपीए ने फंसा कर जनता को दिग्भ्रमित किया है।

राजकुमार अग्रवाल, भाजपा नेता

आम बजट से जनता को उतनी राहत नहीं मिलेगी जितना होने वाले चुनाव को रखकर जनता ने उम्मीद लगा रखी थी।

डॉ. जेके सिन्हा, निदेशक आइएसएल

बजट संतुलित है। लेकिन आम जनता को ध्यान में नहीं रखा गया है। जनता को निराशा हाथ लगी है।

अनूप राव, पार्षद

आम बजट का बोझ जनता के सिर पर पड़ा है। जनता को कोई राहत नहीं मिली है।

हरीश जोशी, अधिवक्ता

बजट से महंगाई बढ़ेगी। यह बजट वोट को प्रभावित करनेवाला वित्त मंत्री चिदंबरम का आखिरी बजट कहलाएगा।

कादिर अंसारी, व्यवसायी

बजट में व्यवसायियों पर कोई ध्यान नहीं दिया गया है। लोगों को भी इससे कोई फायदा नहीं है।

मणिशंकरकेसरी, पूर्व जिलाध्यक्ष चैंबर

भारत कोकिंग कोल लिमिटेड
(कोल इण्डिया लिमिटेड का एक अंग)

संदर्भ सं.:- बी सी सी एल/टी ए/चीफ मैनेजर (सी) आई सी/12-13/1498 दिनांक:- 26.02.2013

शुद्धि पत्र

कोयला नगर में विभिन्न कार्यों के लिए आमंत्रित की गई निविदा आमंत्रण सूचना संदर्भ सं०:- बी सी सी एल / टी ए / चीफ मैनेजर (सी) आई सी / टेण्डर - 1/12-13/1477 दिनांक: 21.02.2013 के संदर्भ में कार्य पूर्णता का समय 12 (बारह) महीने होंगे।

निविदा आमंत्रण सूचना के अन्य सभी शर्तें यथावत् रहेगी।

ह0/-
मुख्य प्रबंधक (असीमिका)
प्रभारी कोयला नगर, नगर प्रशासन
I/C (KNTA)

भारत कोकिंग कोल लिमिटेड
(कोल इण्डिया लिमिटेड का एक अंग)

सभी संबंधित व्यक्तियों को यह सूचित किया जाता है कि निम्नलिखित 09 (नौ) भारत कोकिंग कोल लिमिटेड का समूह (Cluster) जिसमें 63 खाने एवं 02 वाशरीज सम्मिलित हैं, को पर्यावरण एवं वन मंत्रालय के द्वारा पर्यावरण सफाया (Environmental Clearance) प्रदान किया जा चुका है।

क्र. सं.	समूह (Cluster) का नाम	स्वीकृति आदेश संख्या एवं तिथि
1.	समूह (Cluster) I : मेसर्स भारत कोकिंग कोल लिमिटेड, झारिया कोलफिल्ड्स में स्थित, ब्लॉक चन्द्रपुर, जिला- धनबाद, झारखंड की दामोदा समूह की 3 खानें- दामोदा (एलबियॉन शाखा) अंगेरीपी, दामोदा बुजीपी एवं दामोदा बीजे मेखान समूह की खानें (575 हेक्टेयर की एक सम्मिलित एम एल क्षेत्र में 0.9 एम टी पी ए सामान्य एवं 1.17 एम टी पी ए (उच्च))	जे-11015/93/2009-1ए. 11 (एम) दिनांक : 6 फरवरी 2013
2.	समूह (Cluster) II : मेसर्स भारत कोकिंग कोल लिमिटेड, झारिया कोलफिल्ड्स में स्थित, जिला- धनबाद, झारखंड की 2025.71 हेक्टेयर की एक सम्मिलित एम एल क्षेत्र में (20.215 एम टी पी ए की उच्च उत्पादन के साथ 15.55 एम टी पी ए सम्मिलित उत्पादन क्षमता की 5 खानें)	जे-11015/35/2011-1ए. 11 (एम) दिनांक : 6 फरवरी 2013
3.	समूह (Cluster) III : मेसर्स भारत कोकिंग कोल लिमिटेड, झारिया कोलफिल्ड्स में स्थित, जिला- धनबाद, झारखंड की 1420.61 हेक्टेयर की एक सम्मिलित एम एल क्षेत्र में 3.6 एम टी पी ए की उच्च उत्पादन की 7 खानें (04.11.2010 को प्रदान की गई टी ओ आर पर आधारित ईसी)	जे-11015/213/2010-1ए. 11 (एम) दिनांक : 6 फरवरी 2013
4.	समूह (Cluster) IV : गरसनीटीड कोलियरी भूमिगत को छोड़कर मेसर्स भारत कोकिंग कोल लिमिटेड, झारिया कोलफिल्ड्स में स्थित, जिला- धनबाद, झारखंड की 1123.79 हेक्टेयर की एक सम्मिलित एम एल क्षेत्र में 2.851 एम टी पी ए (सामान्य) 3.700 एम टी पी ए (उच्च) की उत्पादन क्षमता के साथ 6 खानें।	जे-11015/212/2010-1ए. 11 (एम) दिनांक : 6 फरवरी 2013
5.	समूह (Cluster) V : मेसर्स भारत कोकिंग कोल लिमिटेड, झारिया कोलफिल्ड्स में स्थित, जिला- धनबाद, झारखंड की 1957.08 हेक्टेयर की एक सम्मिलित एम एल क्षेत्र में 4.854 (सामान्य) 6.311 (उच्च) एम टी पी ए के उत्पादन की 7 खानें (16.03.2011 को प्रदान की गई आई टी ओ आर पर आधारित ई सी)	जे-11015/01/2011-1ए. 11 (एम) दिनांक : 11 फरवरी 2013
6.	समूह (Cluster) VII : मेसर्स भारत कोकिंग कोल लिमिटेड, झारिया कोलफिल्ड्स में स्थित, जिला- धनबाद, झारखंड की 2127.7 हेक्टेयर की एक सम्मिलित एम एल क्षेत्र में 8.16 एम टी पी ए की उच्च उत्पादन के साथ 6.227 एम टी पी ए की सम्मिलित क्षमता (09.12.2010 को प्रदान की गई टी ओ आर पर आधारित ईसी) (कुसुंडा भूमिगत एवं पूर्वी धनतडीह को छोड़कर)	जे-11015/238/2010-1ए. 11 (एम) दिनांक : 6 फरवरी 2013
7.	समूह (Cluster) X : मेसर्स भारत कोकिंग कोल लिमिटेड, झारिया कोलफिल्ड्स में स्थित, जिला- धनबाद, झारखंड की (2057.95 हेक्टेयर की एक सम्मिलित एम एल क्षेत्र में 1.762 एम टी पी ए की सामान्य एवं 2.289 एम टी पी ए की उच्च उत्पादन की 6 खानें) एवं 18 हेक्टेयर के एक क्षेत्र के लिए 1.6 एम टी पी ए सामान्य तथा 2.08 एम टी पी ए उच्च उत्पादन की सुदामडीह कोल वाशरी (सुदामडीह लॉफ्ट माईन के लीज होल्ड के अन्दर) (09.02.2011 को प्रदान की गई टी ओ आर पर आधारित ई सी)	जे-11015/380/2010-1ए. 11 (एम) दिनांक : 6 फरवरी 2013
8.	समूह (Cluster) XVI : मेसर्स भारत कोकिंग कोल लिमिटेड, जिला- धनबाद, झारखंड में कोयला खानें (दहीबाड़ी -बरसीमाता ओ सी पी, बरसीमाता भूमिगत खान, नई लायकडीह ओ सी पी (दहीबाड़ी कोल वाशरी सहित), लायकडीह डीप भूमिगत, फॉरेन भूमिगत) (1964.21 हेक्टेयर के एक सम्मिलित एम एल क्षेत्र में 1.51 एम टी पी ए सामान्य तथा 1.963 एम टी पी ए उच्च) तथा 12 हेक्टेयर के क्षेत्र में 1.6 एम टी पी ए की दहीबाड़ी वाशरी (28.05.2010 को प्रदान की गई टी ओ आर पर आधारित ई सी)	जे-11015/185/2010-1ए. 11 (एम) दिनांक : 6 फरवरी 2013
9.	समूह (Cluster) VIII : मेसर्स भारत कोकिंग कोल लिमिटेड, झारिया कोलफिल्ड्स में स्थित, जिला- धनबाद, झारखंड के 10 खानों का समूह (1183.92 हेक्टेयर के एक सम्मिलित एम एल क्षेत्र में 5.603 एम टी पी ए की उच्च उत्पादन के साथ 4.31 एम टी पी ए की सम्मिलित क्षमता (12.0041 हेक्टेयर - 1649 हेक्टेयर - 1183.92 हेक्टेयर)	जे-11015/298/2010-1ए. 11 (एम) दिनांक : 15 फरवरी 2013

सफाया पत्र की प्रतिलिपि झारखंड राज्य प्रदूषण नियंत्रण बोर्ड के पास उपलब्ध है तथा इसे पर्यावरण एवं वन मंत्रालय की वेबसाईट "http://envfor.nic.in" और भा. को. को. लि. के कार्यालय वेबसाईट "http://www.bccl.gov.in" पर भी देखा जा सकता है।

ह0/-

ओएचई

भारत के राष्ट्रपति के लिए तथा उनकी ओ
दक्षिण पूर्व रेलवे द्वारा निम्नलिखित कार्यों के
सं.: टीआरडी/एडीए/ओटी-2013/1/आईएम

कार्य का विवरण

दक्षिण पूर्व रेलवे के आद्रा मंडल में ओवरहे
मॉस्टर्स के इम्प्लेन्टेशन का सुधार साथ में क

निविदा प्रपत्र की कीमत: ₹ 10,000/- । निविद
(टीआरडी)/एडीए के कार्यालय अथवा सीईई
04.03.2013 से 04.04.2013 (अपराह्न 2
की तारीख: 04.04.2013 (अपराह्न 3.3
आद्रा के कार्यालय अथवा सीईई/टीआरडी,
अवधि: एल.ओ.ए. के जारी होने की तारीख
http://tenders.gov.in, दक्षिण पूर्व रेलवे
उपलब्ध है। निविदाप्रदायक उपरोक्त उल्लेखि
को अपराह्न 2.00 बजे तक निविदा दस्तावे
सीईई/टीआरडी/एडीए के कार्यालय की सूचन
अर्थ है "भारतीय रेल में 25 केवी एसी ट्रे
डिजाइन, आपूर्ति, संरचना एवं रखरखाव का

पूर्व
विभिन्न प्रकार के

विद्युत (सामान्य) विभाग के लिये खुली निविदायें
लाईसेंस, तकनीकी विशेषज्ञता, वित्तीय क्षमता
एजेंसियों/संवेदकों से मुहरबंद खुली निविदायें

निविदा सं. : इ.एल./41/खुली/2012-201
धनबाद एवं बरकाकाना के कोचिंग डिपो में प्रका
राशि : रू. 20,16,738/-, क्रम सं. : 3, निविदा प्र
क्रम सं. : 4, अग्रधन राशि : रू. 40,340/-, क्रम

निविदा सं. : इ.एल./42/खुली/2012-2013
एवं क्षय हो गये पाइप लाईन के बदलाव एवं पाइप
के प्रावधान से संबंधित वैद्युतिक कार्य। क्रम सं.
सं. : 3, निविदा प्रपत्र का मूल्य (अप्रतिदेय) : रू.
रू. 3,670/-, क्रम सं. : 5, कार्य समापन अवधि

निविदा सं. : इ.एल./43/खुली/2012-201
अप/3330 डाउन, 3307 अप/3308 डाउन, 33
ए/23348ए में वातानुकूलित कोचों का तीन
प्राक्कलित राशि : रू. 92,33,463/-, क्रम सं. :
हजार केवल), क्रम सं. : 4, अग्रधन राशि : रू. 1
वर्षों के लिए वार्षिक अनुबंध।

क्रम सं. : 6, निविदा प्रपत्र मूल्य का भुगतान : 1.
दौरान किसी भी कार्य दिवस को (शनिवार, रविवा
मंडल खजांची पू.म.रे. धनबाद अथवा बुकिंग अ
डालटेनगंज तथा चोपन से किसी को नकद से
डाउनलोड किये गये निविदा दस्तावेज के साथ
(अप्रतिदेय) का डिमांड ड्राफ्ट, जो वित्त सलाहका
में तथा धनबाद में देय हो, आवश्यक रूप से संल
क्रम सं. : 7, निविदा जमा करने एवं खोलने
03.04.2013 तक की अवधि के दौरान (शनिवार,
भी कार्य दिवस को 10.00 बजे से 16.00 बजे त
सहायक विद्युत अभियन्ता (सा.)/पूर्व मध्य रेल,
खुलने की तिथि: वरीय मंडल विद्युत अभियन्ता (
क्रम सं. : 8, कार्यालय का पता जहाँ से निविदा
) का कार्यालय (दिनांक 11.03.2013 से 03.04.2
को छोड़कर) किसी भी कार्य दिवस को 10.00 ब
क्रम सं. : 9, वेबसाईट का विवरण एवं नोटिस
जा सकता है : वेबसाईट www.ecr.indianrai
: व.म. विद्युत अभियन्ता (सा.), पू.म.रे. धनबाद का
वर्षों (अर्थात् चालू वर्ष तथा तीन पूर्व वित्तीय वर्षों)
निविदा मूल्य का न्यूनतम 35 प्रतिशत हो, संपन्न
वर्षों में प्राप्त कुल अनुबंध राशि विज्ञापित नि
निविदादाताओं के द्वारा इस संबंध में प्रस्तुत प्रमा
द्वारा संस्थापित प्रमाणपत्र अथवा चार्टर्ड एकाउन्टे
है। क्रम सं. : 11, ए.सी. कार्यों की एक्सकोर्टिंग : 1
15 टी. आर. एवं उपर के.ए.सी. प्लांट का अनुरक्षण
की एक्सकोर्टिंग। 4) विद्युत प्रतिष्ठापन की मैनिंग।
रेल प्रशासन बिना किसी सूचना के निविदा को
डाक के द्वारा कोई निविदा कागजात नहीं भेजा जाये
की अंतिम तिथि पर अवकाश घोषित होने के मामले
दिवस माना जायेगा। वेबसाईट से डाउनलोड किये
में उपलब्ध मूल निविदा प्रपत्र की प्रति को ही प्रम
डाउनलोड करने में हुई देरी/कठिनाई के लिए रेल
लिए जी.सी.सी. की धारा- 65, दस करोड़ रूपये से
पीआर/1508/डीएचएन/टी/152

"सभी श्रेणी के आरक्षित टिकट पर रेल
इसमें वास्तविक बाजी को लाभ होगा और

लोक सुनवाई की सूचना

सड़क परिवहन एवं राजमार्ग मंत्रालय, भारत सरकार द्वारा बिहार राज्य के अन्तर्गत राष्ट्रीय उच्चपथ संख्या–30A फतुहा–बाढ़ खण्ड को दो लेन पक्की पटरी सहित चौड़ीकरण परियोजना का प्रस्ताव है। इसकी कुल लम्बाई लगभग 72.390 कि0मी0 है। यह उच्चपथ पटना जिला के फतुहा से प्रारम्भ होकर नौलंदा जिला के घण्डी, हरनौत होते हुए बाढ़ (पटना) तक जायगी। इस राजमार्ग में तीन बाईपास क्रमशः दनेसीया हरनौत एवं बाढ़ में प्रस्तावित है. इसके अतिरिक्त इसमें उपमार्ग, पुल, पुलिया, भूमिगत मार्ग, रूकावट स्थल एवं टोल प्लाजा आदि की व्यवस्था होगी। परियोजना का कुल लागत 420.70 करोड़ है। इस परियोजना मार्ग में कोई राष्ट्रीय उद्यान, वन्य–जीव अभ्यारण्य नहीं है।

पर्यावरण एवं वन मंत्रालय, भारत सरकार के पर्यावरणीय प्रभाव मूल्यांकन (ई.आई.ए.) अधिसूचना, 2006 एवं उसमें संशोधित अधिसूचना के आलोक में प्रस्तावित योजना की पर्यावरणीय स्वीकृति हेतु ई.आई.ए. रिपोर्ट तैयार किया गया है, जिसमें सम्भावित कुप्रभावों के नियंत्रण हेतु उपाय दर्शाये गये है। ई.आई.ए. प्रतिवेदन एवं ई.आई.ए. सार–प्रतिवेदन को स्वीकृत जिलाधिकारी, जिला परिषद, एवं महाप्रबंधक जिला उद्योग केन्द्र के कार्यालयों के साथ–साथ पर्षद मुख्यालय पटना में कार्यालय कार्य दिवस के दौरान देखी जा सकती है। वैसे व्यक्ति जो इस परियोजना से प्रभावित होने वाले हों, अपना सुझाव/प्रतिक्रिया इस सूचना के प्रकाशित होने के 30 दिनों के अन्दर पर्षद को उपलब्ध करा सकते हैं।

स्थानीय जनता की प्रतिक्रिया/सुझाव आमंत्रित करने हेतु लोक सुनवाई कार्यक्रम निम्नवत है :–

दिनांक	समय	लोक–सुनवाई का स्थल
05.04.2013 (शुक्रवार)	3.00 बजे अपराह्न	प्रखंड कार्यालय, हरनौत, नौलंदा
06.04.2013 (शनिवार)	3.00 बजे अपराह्न	प्रखंड कार्यालय, बाढ़, पटना

सभी संबंधित से अनुरोध है कि उपरोक्त कार्यक्रम में उपस्थित होने का कष्ट करेंगे।

सदस्य–सचिव

BIHAR

बिहार राज्य प्रदूषण नियंत्रण पर्षद्

बेल्ट्रॉन भवन, शास्त्रीनगर, पटना – 800 023
दूरभाष नं0–0612–2281250 / 2282265, फैक्स–0612–2281050
वेबसाईट–http://bspcb.bih.nic

क्षेत्रीय कार्यालय फोन नं. 01482-241183

राजस्थान राज्य प्रदूषण नियन्त्रण मण्डल

18, आजाद नगर, पन्नाधाय सर्किल, भीलवाड़ा

राप्रनिम/होका भीम/ वन/ दिनांक

पर्यावरणीय स्वीकृति हेतु लोक सुनवाई के लिए आम सूचना

1. एतद्साधारण को सूचित किया जाता है कि **मैसर्स भारतीय राष्ट्रीय राजमार्ग प्राधिकरण, परियोजना क्रियान्वयन इकाई, ए 11,चन्द्रकिरण, रीको हाउसिंग कॉलोनी, ब्यावर में प्रस्तावित राष्ट्रीय राजमार्ग संख्या 148–बी 109.750 कि.मी. राष्ट्रीय राजमार्ग–8 (जिला–राजसमन्द) से 64.200 कि.मी., राष्ट्रीय राजमार्ग–79 गुलाबपुरा (जिला भीलवाड़ा) तक की भौडार्ड एवं सुदृढ़करण से सम्बन्धित प्रार्थित पत्र मय दस्तावेज** पर्यावरणीय स्वीकृति से पूर्व आवश्यक लोक सुनवाई हेतु प्रस्ताव राजस्थान राज्य प्रदूषण नियंत्रण मण्डल (यहाँ लेख बाद में मण्डल के नाम से अभिलिखित) को प्रस्तुत किया गया है।

2. और चूंकि **मैसर्स भारतीय राष्ट्रीय राजमार्ग प्राधिकरण, परियोजना क्रियान्वयन इकाई, ए 11,चन्द्रकिरण, रीको हाउसिंग कॉलोनी, ब्यावर** ने राजस्थान राज्य प्रदूषण नियंत्रण मण्डल को उक्त परियोजना की पर्यावरणी स्वीकृति से पूर्व आवश्यक लोक सुनवाई हेतु मण्डल को आवेदन प्रस्तुत किया है। उक्त परियोजना हेतु वन एवं पर्यावरण मंत्रालय, भारत सरकार, नई दिल्ली द्वारा जारी अधिसूचना संख्या एस. ओ. 1533 दिनांक 14.09.2006 के अनुसार लोक सुनवाई हेतु इस आशय की सूचना जारी कर 30 दिवस का नोटिस दिया जाना आवश्यक है।

3. उक्त परियोजना से सम्बन्धित EIA/EMP Report एवं संक्षिप्त कार्यपालक सार अग्रलेख निम्न कार्यालयों में अवलोकनार्थ उपलब्ध है :–

(1) जिला कलेक्टर, राजसमन्द।
(2) जिला उद्योग केन्द्र, राजसमन्द।
(3) जिला परिषद, राजसमन्द।
(4) तहसील कार्यालय, भीम, जिला–राजसमन्द।
(5) कार्यालय पंचायत समिति, भीम, तहसील–भीम, जिला–राजसमन्द।
(6) कार्यालय उपखण्ड मजिस्ट्रेट, भीम, तहसील–भीम, जिला–राजसमन्द।
(7) क्षेत्रीय कार्यालय, राजस्थान राज्य प्रदूषण नियंत्रण मण्डल, भीलवाड़ा।
(8) पर्यावरण विभाग, राजस्थान सरकार, सचिवालय, जयपुर।
(9) राजस्थान राज्य प्रदूषण नियन्त्रण मण्डल, 4 पर्यावरण मार्ग, संस्थानिक क्षेत्र, झालाना डूंगरी, जयपुर।
(10) क्षेत्रीय कार्यालय, पर्यावरण एवं वन मंत्रालय, पंचम तल केन्द्रीय भवन, सेक्टर एच, अर्लगंज, लखनऊ।

अतः सर्व सरोकार को नोटिस के माध्यम से एतद् द्वारा सूचित किया जाता है कि दे उक्त परियोजना के पर्यावरणीय स्वीकृति से संबंधित लोक सुनवाई हेतु **दिनांक 02.04.2013 को 11.00 पी.एम. पर कार्यालय उपखण्ड मजिस्ट्रेट, भीम, तहसील–भीम, जिला –राजसमन्द में** उपस्थित होकर अपने लिखित / मौखिक आक्षेप / सुझाव प्रस्तुत कर सकते है।

इस संबंध में लिखित आक्षेप / सुझाव इस सूचना के प्रकाशन की तिथि से 30 दिवस के अन्दर क्षेत्रीय कार्यालय, राजस्थान राज्य प्रदूषण नियंत्रण मण्डल, भीलवाड़ा को भी दिये जा सकते है।

(वी. एस. सांखला) क्षेत्रीय अधिकारी

Friday, March 8, 8:30 pm

Log on to www.loksabhatv.nic.in

INSAT 4A (G.E.), E-BAND, D/L Freq 11170 MHz, Pol-H, S/Rate-6.65 m symbo/sec, FEC 3/4

NORTH EASTERN RAILWAY

Notification No.:-23/2013

IMPORTANT NOTICE FOR THE RAIL PASSENGERS

It is notified for the information of general public that provision of one additional AC-2 Tier coach in train no. 18191/18192 Chhapra-Kanpur Anwarganj Utsarg Express, notified earlier vide this office Notification No. 108/2012 dated 21.12.2012, is being further extended on experimental basis as under:-

Train No. & Name	Station From	Originating Date	Last Date
18191 Chhapra-Kanpur Anwarganj Utsarg Exp.	Chhapra	01-03-13	30-06-13
18192 Kanpur Anwarganj-Chhapra Utsarg Exp.	Kanpur Anwarganj	02-03-13	01-07-13

CPRO/T-104 **Chief Pass Trans., Manager, Gorakhpur**

Railway Vigilance Mobile Helpline No.:0551-/ 68210 (for Complaints regarding Corruptions)

"SERVING CUSTOMERS WITH A SMILE"

Bharat Coking Coal Limited

(A Subsidiary of Coal India Limited)

This is to bring into notice of all concerned that the following 09 (Nine) Clusters of BCCL consisting of 63 Mines and 02 washeries are granted Environmental Clearances by Ministry of Environmental and forests.

Sl. No.	Name of the Cluster	Sanction order number and date
1.	**Cluster-I** (Damoda Group of 3 Mines - Damoda (Albion Section) OCP, Damoda UGP and Damuda BJ Section OCP) Group of Mines (of 9.9 MTPA normative and 1.17 MTPA (peak) in a combined ML area of 575 ha) of M/s Bharat Coking Coal Ltd., located in Jharia Coalfields, Block Chandrapur, Dist. Dhanbad, Jharkhand.	J-11015/93/2009-1A.II (M) dated 6th Feb. 2013
2.	**Cluster-II** (5 mines of a combined prod. capacity 15.55 MTPA with a peak production of 20.235 MTPA) in a combined ML area of 2025.71 ha) of M/s Bharat Coking Coal Ltd., located in Jharia Coalfields, Dist. Dhanbad, Jharkhand.	J-11015/35/2011-1A.II (M) dated 6th Feb. 2013
3.	**Cluster-III** (7 mines of a peak production of 3.5 MTPA in a combined ML area of 1420.61 ha) of M/s Bharat Coking Coal Ltd., located in Jharia Coalfields, Dist. Dhanbad, Jharkhand (EC based on TOR granted on 04.11.2010).	J-11015/213/2010-1A.II (M) dated 6th Feb. 2013
4.	**Cluster-IV** (6 mines with production capacity 2.851 MTPA (Normative) 3.766 MTPA (Peak) in a combined ML area of 1123.79 ha) of M/s Bharat Coking Coal Ltd., located in Jharia Coalfields, Dist. Dhanbad, Jharkhand excluding Gaslitand Colliery UG.	J-11015/212/2010-1A.II (M) dated 6th Feb. 2013
5.	**Cluster-V** (7 mines of a 4.854 (Normative) and 6.311 (Peak) production of MTPA in a combined ML area of 1957.08 ha) of M/s Bharat Coking Coal Ltd., located in Jharia Coalfields, Dist. Dhanbad, Jharkhand (EC based on TOR granted on 16.03.2011)	J-11015/01/2011-1A.II (M) dated 11th Feb. 2013
6.	**Cluster-VII** (combined capacity 6.227 MTPA with a peak prodn. of 8.16 MTPA in a combined ML area of 2127.7 ha) of M/s Bharat Coking Coal Ltd., located in Jharia Coalfields, Dist. Dhanbad, Jharkhand (EC based on TOR granted on 09.12.2010) (excluding Kustore UG and East Bhuggatdih)	J-11015/236/2010-1A.II (M) dated 6th Feb. 2013
7.	**Cluster-X** (8 mines of 1.762 MTPA of normative and peak production of 2.289 MTPA in a combined ML area of 2057.96 ha) and Sudamdih Coal Washery (Within the lease hold of Sudamdih Shaft Mine) of 1.6 MTPA of normative and 2.08 MTPA peak production for a area of 18 ha) of M/s Bharat Coking Coal Ltd., located in Jharia Coalfields, Dist. Dhanbad, Jharkhand (EC based on TOR granted on 09.02.2011).	J-11015/380/2010-1A.II (M) dated 6th Feb. 2013
8.	**Cluster-XVI** - Coalmines (Dahibari-Basantimata OCP, Basantimata under Ground Mine, New Laikdih OCP (including Dahibari Coal Washery), Laikdih Deep UG, Chanch UG (normative 1.51 MTPA and 1.963 MTPA peak in a combined ML area of 1984.21 ha) and Dahibari washery of 1.6 MTPA in the area of 12 ha of M/s Bharat Coking Coal Ltd., in Dist. Dhanbad, Jharkhand (EC based on TOR granted on 28.05.2010).	J-11015/185/2010-1A.II (M) dated 6th Feb 2013
9.	**Cluster-VIII** Group of 10 Mines (combined capacity 4.31 MTPA with a peak prodn. of 5.603 MTPA in a combined ML area of 1183.92 ha (1200.41 ha-(649 ha=1183.92 ha) of M/s Bharat Coking Coal Ltd., located in Jharia Coalfields, Dist. Dhanbad, Jharkhand.	J-11015/298/2010-1A.II (M) dated 16th Feb. 2013

The copy of the clearance letter is available with the Jharkhand State Pollution Control Board and may also be seen at the website of the Ministry of Environmental and forests at http://envfor.nic.in and on the official website of BCCL at **http://www.bccl.gov.in**

BHARAT COKING COAL LIMITED
A Mini Ratana Company
(A Subsidiary of Coal India Ltd.)
Office of the General Manager
Govindpur Area No.III
PO- Sonardih, DHANBAD – 828125
Contact No: 0326-2392162 email- cgmgovindpur@bccl.gov.in

Ref: BCCL: AR.III:GM:20: 18

Dated: 13.04.2020

To
Panchayat Sachiwalay,
Tundoo Panchayat,
KalludihPanchayat,
AkashkinareePanchayat,
BahiyardihPanchayat,
Jamua Panchayat

Sub: Copy of Environmental Clearance granted to Cluster-III group of Mines, BCCL by Ministry of Environment & Forest

Dear Sir

Kindly find herewith the attached copy of Environmental Clearance granted to Cluster-III group of Mines, BCCL by Ministry of Environment & Forest.

This is for your kind information.

Encl: As above

Yours faithfully
13/04/2020

Addl. General Manager/ Nodal Officer (Env)
Govindpur Area

Copy to:

1. General Manager, Govindpur Area- for kind information
2. HoD (Env), Koyla Bhawan, BCCL- for kind information

Scanned with CamScanner

Annexure-XVII

GOVERNMENT OF JHARKHAND

State Transport Department
All India Valid

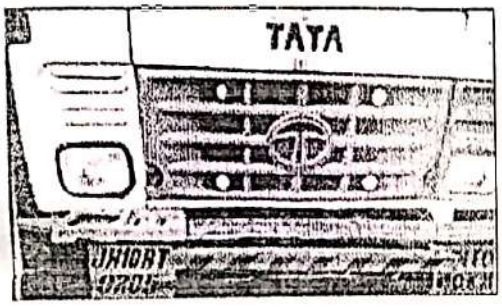
POLLUTION UNDER CONTROL CERTIFICATE

Computerized Emission Test Certificate
(Rule 163E (6) of BMV Rule 1992)

License No.590/2017
ALL INDIA VALID

RUDRA ENTERPRISES
JAMUATAND, HIRAK [illegible] BAGHMARA DHANBAD (JH)

Puccno:	42/201800003369	**Reg. Year:**	2008	**Test Date:**	12:49 PM
Reg. No:	JH10BT 9205	**Fuel:**	DIESEL	**Test Time:**	23-11-2019
Make:	TATA MOTORS	**EngNo:**	69979	**Owner Name:**	KUNAL KUMAR
Model:	LPK2516	**ChassIsNo:**	11291		
Category:	TIPPER	**Engstroke:**			



FLUSH	CYCLE			
		AVERAGE		
	RPM Min	RPM Max	Oil Tmp	
	0750	3970	67	
		DETAIL		
RPM Min	RPM Max	Temp	HSU	K value
750	3930	58	25.55	0.69
700	3960	60	25.50	0.68
770	3970	60	33.81	0.96
MEAN			28.29	0.77
RESULT		PASS		

Test Fee - 300

Valid up to: 22-5-2020

This vehicle meets the standard prescribed By Rule 115(2) of Central Motor Vehicle Rule 1989.
This Certificate is valid for Six Months only.

नियंत्रित प्रदूषण
प्राधिकृत
590/2017
जमुआटांड़ बाघमारा
धनबाद (झारखण्ड)
परिवहन विभाग, द्वारा

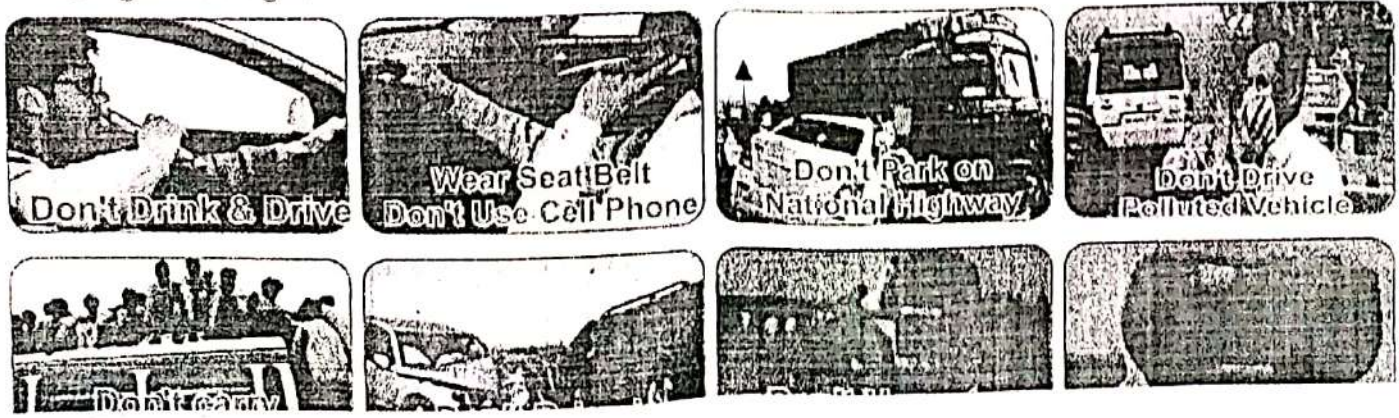
Seal of Testing Centre ★ ★

Test Station Code:590/2017

Authorized Signatory

सड़क सुरक्षा जीवन सुरक्षा

झारखण्ड सरकार परिवहन विभाग द्वारा मान्यता प्राप्त



Scanned with CamScanner

Tipper → 2215

POLLUTION UNDER CONTROL

DATE OF ISSUE [illegible] VALID UP [illegible]

Sl. No [illegible] Licence No.- 10/2019

COMPUTERISED EMISSION TEST CERTIFICATE

AUTHORISED BY : **M/S SRI RAM AUTO POLLUTION CENTER**

TRANSPORT DEPT. GOVT. OF JHARKHAND
BHIKHRAJPUR, KOHARTAND
BALIAPUR, DHANBAD, JHARKHAND

झारखण्ड सरकार

Vehicle Registration No.: JH09AH 2215

Year of Registration : 2012 Date : 08/11/2019

Vehicle Make : TATA MOTORS

Type of Vehicle : TIPPER Vehicle Model : 2012

Valid Upto : 07/05/2020 Vehicle Colour :

JH09AH2215

Test Result : DIESEL Validity : 6 Months

CO	
HC	

HSU	52%
KVAL	

Permissible Limits of CO (Petrol) 3% Vo. for the new four Wheelers and 4.5% Vol. for Vehicles Five Year old or 80000 Kms. whichever is earlier. Permissible Limited of CO for petrol 2-3 wheelers are 4.5% Vol.

From P.C.

(See Rule 252 of J.M.V. Rules, 2002)

ALL INDIA VALID

M/S SRI RAM AUTO POLLUTION CENTRE, BALIAPUR, DHANBAD, JHARKHAND

Seal of [illegible] Ce

Name of Authorised Signature

Scanned with CamScanner

Tipper - 5346

POLLUTION UNDER CONTROL

DATE OF ISSUE
08/11/2019

VALID UP
09/05/2020

Sl. No. 3524

Licence No.- 10/2019

झारखण्ड सरकार

COMPUTERISED EMISSION TEST CERTIFICATE

AUTHORISED BY : **M/S SRI RAM AUTO POLLUTION CENTER**

TRANSPORT DEPT. GOVT. OF JHARKHAND
BHIKHRAJPUR, KONARTAND
BALIAPUR, DHANBAD, JHARKHAND

Vehicle Registration No.: JH10BT 5346

Year of Registration : 2014

Date : 08/11/2019

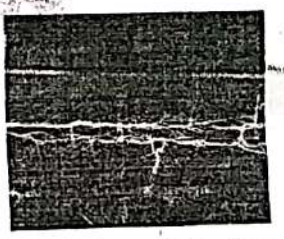
Vehicle Make : TATA MOTORS

Type of Vehicle : TIPPER

Vehicle Model : 2014

Valid Upto : 09/05/2020

Vehicle Colour :



Test Result : IDLING DIESEL

Validity : 6 Months

CO	
HC	

HSU	47%
KVAL	

Permissible Limits of CO (Petrol) 3% Vo. for the new four Wheelers and 4.5% Vol. for Vehicles Five Years old or 80000 Kms. whichever is earlier. Permissible Limited of CO for petrol 2-3 wheelers are 4.5% Vol.

From P.C.

(See Rule 252 of J.M.V. Rules, 2002)

ALL INDIA VALID

M/S SRI RAM AUTO POLLUTION CENTRE JHARKHAND BHIKHRAJPUR, DHANBAD

Seal of the Centre

Name of Authorised Signature

Scanned with CamScanner

Tapper - 7173

POLLUTION UNDER CONTROL CERTIFICATE

Govt. Of jharkhand
Transport Dep.

Computerized Emission Test Certificate
(Rule 163E (6) of BMV Rule 1992)

Licence No.: 590/ 2017
ALL INDIA VALID

RUDRA ENTERPRISES

A-590/201702530 JAMUATAND, HIRAK ROAD, BAGHMARA, DHANBAD(JH) 04-SEP-2019

Puccno: JH 10U 7173
Reg No.: TATA
Make: TRUCK
Model:
Categ

Reg. Year : 10 APR 2010
Fuel : DIESEL
Eng. No.: NA
Chasis No:
Engstoke :

Test Date : 00-00-00
Test Time : GOODS CARRIER (HGV)

C.O. R
HC R
Co2 Act

FINISH	CYCLE			
		AVERAGE		
	RPM Min	RPM Max	Oil Temp	
	910	W	78	
		DETAILS		
RPM Min	RPM Max	Temp	HSU	K Value
870	4880	9	52.93	1.75
940	4890	65	57.08	1.97
920	4890	69	50.63	1.64
MEAN			53.66	1.78
RESULT				

03-MAR-2020

Valid upto
This vehicle meets the standard prescribed by rule 115 (2) of central Motor Vehicle Rule 1989.
This Cetificate is valid for six Months only.

Seals of Testing Centre

Test Station Code : 590/2017

Authorized Signatory

Scanned with CamScanner

Tippers - 5655

GOVERNMENT OF JHARKHAND

State Transport Department
All India Valid

ALL INDIA VALID

Puccno:	42/201800003207	**Reg. Year:**	2013	**Test Date:**	09 22 AM
Reg. No:	JH10AJ 5655	**Fuel:**	DIESEL	**Test Time:**	19-10-2019
Make:	TATA MOTORS	**EngNo:**	28864	**Owner Name:**	SACHIN KR SINGH
Model:	2513 HGV	**ChassisNo:**	06913		
Category:	TIPPER	**Engstroke:**			

FLUSH CYCLE

AVERAGE

RPM Min	RPM Max	Q1 Time	
0760	2030	61	

DETAIL

RPM Min	RPM Max	Temp	HSU	K value
760	2030	44	43.42	1.32
800	1990	48	39.22	1.16
770	2050	44	46.68	1.41
MEAN			42.14	1.30
RESULT		PASS		

Test Fee - 300

Valid up to: 18-4-2020

Scanned with CamScanner

Tipper 7029

POLLUTION UNDER CONTROL

DATE OF ISSUE
22/11/2019

Sl. No. 3618 Licence No. - 10/2019

COMPUTERISED EMISSION TEST CERTIFICATE

AUTHORISED BY : M/S SRI RAM AUTO POLLUTION CENTER
TRANSPORT DEPT. GOVT. OF JHARKHAND
BHIKHRAJPUR, KONARTAND
BALIAPUR, DHANBAD, JHARKHAND

झारखण्ड सरकार

Vehicle Registration No. JH10BK 7029
Year of Registration : 2017 Date : 22/11/2019
Vehicle Make : TATA MOTORS
Type of Vehicle : TIPPER Vehicle Model :
Valid Upto : 23/05/2020 Vehicle Colour :

Test Result : DIESEL Validity : 6 Months

CO	

HSU	48%
KVAL	

Permissible Limits of CO (Petrol) 3% Vo. for the new four Wheelers and 4.5% Vol. for Vehicles Five Years old or 80000 Kms. whichever is earlier. Permissible Limited of CO for petrol 2-3 wheelers are 4.5% Vol.

From P.C.

(See Rule 252 of J.M.V. Rules, 2003)

ALL INDIA VALID

M/S SRI RAM AUTO POLLUTION CENTRE, GARH
JHARKHAND
BALIAPUR, DHANBAD

Seal of Testing Centre

Name of Authorised Signature

Scanned with CamScanner

TIPPER 9018

POLLUTION UNDER CONTROL CERTIFICATE

Govt. of jharkhand
Transport Dep.

Computerized Emission Test Certificate
(Rule 163E (6) of BMV Rule 1992)

Licence No.: 590/ 2017
ALL INDIA VALID

RUDRA ENTERPRISES

A-590/2017000961 JAMUATAND, HIRAK ROAD, BAGHMARA, DHANBAD(JH) 19 JAN 2012

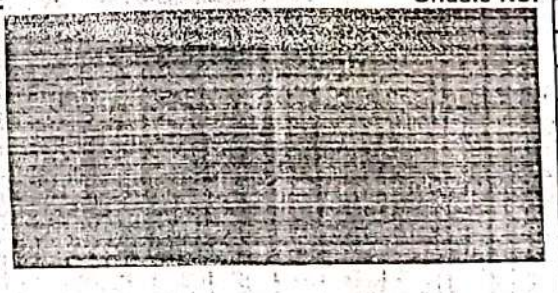
19-JUN-2019
00:00:00

Puccno:
Reg No.:
Make:
Model:

JH 01AQ 9018
TATA
LPK2518 TC 6X4 BSIII

Reg. Year : DIESEL
Fuel : NA
Eng. No.: NA
Chasis No:

Test Date :
Test Time :
Category : GOODS CARRIER (HGV)



FLUSH	CYCLE			
		AVERAGE		
	RPM Min	RPM Max	Oil Temp	
	910	4910	78	
		DETAILS		
RPM Min	RPM Max	Temp	HSU	K Value
870	4880	69	52.93	1.75
940	4890	65	57.08	1.97
920	4890	69	50.63	1.64
MEAN			53.66	1.78
RESULT				

18-DEC-2019

Valid upto :

This vehicle meets the standard prescribed by rule 115 (2) of central Motor Vehicle Rule 1989.

This Cetificate is valid for six Months only.

Seals of Testing Centre

Test Station Code : 590/2017

Authorized Signatory

Scanned with CamScanner

TIPPER- 9136

POLLUTION UNDER CONTROL CERTIFICATE

Govt. Of Jharkhand
Transport Dep.

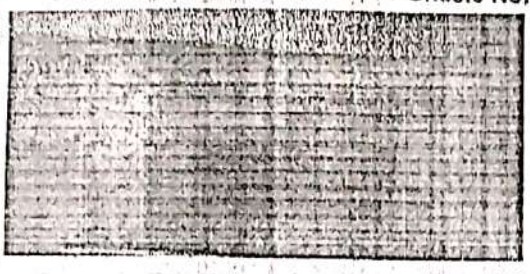
Computorized Emission Test Certificate
(Rule 163E (6) of BMV Rule 1992)

Licence No.: 590/ 2017
ALL INDIA VALID

RUDRA ENTERPRISES

A-590/2017000965 JAMUATAND, HIRAK ROAD, BAGHMARA, DHANBAD(JH) 19-JUN-2019
19 JAN 2017 00:00:00

Puccno:	OR 09N 9136	Reg. Year :	DIESEL	Test Date	GOODS CARRIER (HGV)
Reg No.:	TATA	Fuel :	NA	Test Time :	
Make:	TIPPER	Eng. No.:	NA	Category :	
Model:		Chasis No:			



FLUSH	CYCLE			
		AVERAGE		
	RPM Min	RPM Max	Oil Temp	
	910	4910	78	
		DETAILS		
RPM Min	RPM Max	Temp	HSU	K Value
870	4880	69	52.93	1.75
940	4890	65	57.08	1.97
920	4890	69	50.63	1.64
MEAN			53.66	1.78
RESULT				

18-DEC-2019

Valid upto :
This vehicle meets the standard prescribed by rule 115 (2) of central Motor Vehicle Rule 1989.
This Cetificate is valid for six Months only.

Seals of Testing Centre

Test Station Code : 590/2017

Authorized Signatory

Scanned with CamScanner

Tipper 6322

POLLUTION UNDER CONTROL CERTIFICATE

COMPUTERIZED EMISSION TEST CERTIFICATE
(Rula 163B(3) of BMV Rules 1992)

Transport Department
Govt. Of JHARKHAND

License: 440/2015

PUCC No.	JH3629	Make	TATA Motors Ltd.	Name	S P SONAR
Serial No.	3629	Model	TIPPER	Address	NA
Vehicle No.	CG04JA6322	Fuel	Diesel	Date	26/09/2019
Date of Mfg.	NA	Chasis	27522	Time	11:53:09
Category	GVW	Engine	17386		

Photo of Vehicle

Sl No.	Opacity [1/m]	Opacity [%]	RPM (Max)
1	.89	46.87	1187
2	0.92	46.92	1192
3	0.9	46.88	1194
4	0.93	46.9	1190
5	0.91	46.91	1196
--	--	--	--
--	--	--	--
Mean	0.91	46.896	1191.8

Grade PASS Valid Upto 25/03/2020

Certified that the Vehicle's smoke emission confirms to the standards prescribed under rule 115(2) of central motors vehicle under 1989

वाहन प्रदूषण जाँच केन्द्र Licence No. 440/2015 रांची

Testing Centre

Test Station Code: 440/2015

प्रपत्र प्राधिकार
प्रदूषण जाँच केन्द्र
Authorised Signatory

Scanned with CamScanner

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 – III

(FOR THE MONTH OCTOBER, 2019)

E. C. no. J-11015/213/2010-IA.II (M) dated 06.02.2013.

CMPDI
ISO 9001 Company
Regional Institute-II
Dhanbad, Jharkhand

CONTENTS

SL. NO.	CHAPTER	PARTICULARS	PAGE NO.
1.	CHAPTER - I	EXECUTIVE SUMMARY	3-5
2.	CHAPTER-II	INTRODUCTION	6
3.	CHAPTER-III	RESULTS	7-11
4.	CHAPTER-IV	STANDARDS AND PLANS	12-15

EXECUTIVE SUMMARY

1.0 Introduction

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

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

2.0 Sampling location and rationale

2.1 Ambient air sampling locations

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

2.2 Water sampling stations

The Water sampling stations were selected for mine sump water.

2.3 Noise level monitoring locations

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

3.0 Methodology of sampling and analysis

3.1 Ambient air quality

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

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

3.2 Water quality

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

3.3 Noise level monitoring

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

4.0 Results and interpretations

4.1 Air quality

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

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

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

4.2 Water quality

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

4.3 Noise Level

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

INTRODUCTION

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

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

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

The CLUSTER III is in the westernmost part of the Jharia coalfield. It includes Jogidih Colliery, Maheshpur Colliery, South Govindpur Colliery, Teturiya Colliery, Govindpur Colliery, New Akasshkinaree Mine and Block IV Kooridih Mixed Mine. The cluster – III is situated about 40 - 45 kms from Dhanbad Railway Station. The mines of this cluster - III are operating since pre nationalization period (prior to 1972-73). It is connected by both Railway and Road. The drainage of the area is governed by Khudia and Bagdighi Nala.

The Project has Environmental Clearance from Ministry of Environment, Forest and Climate Change (MoEF&CC) for a rated capacity of 2.769 MTPA (normative) and 3.6 MTPA peak capacity of coal production vide letter no**E. C. no. J-11015/213/2010-IA.II (M) dated 06.02.2013.**

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

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

AMBIENT AIR QUALITY MONITORING

2.1 Location of sampling station and their rationale:

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

2.1.1 Ambient Air Quality Sampling Locations

CORE ZONE Monitoring Location

i) Block IV Kooridih OCP (A6): Industrial Area

The location of the sampling station is at 23°47'54.00"N & 86°16'20.00"E. The sampler was placed at 1.5 m above the ground level near Safety office of Block IV OCP.

BUFFER ZONE Monitoring Location

i) Muraidih OCP (A5) : Industrial Area

The sampler was placed at a height of 1.5 m from the ground level at Muraidih project office.

ii) Govindpur Village (A7) : Industrial area

The location of the sampling station is 23°48'34.00"N & 86°18'22.00"E. The sampler was placed at height of 1.5 m above the ground level at AARC agent Office, Ramkanali.

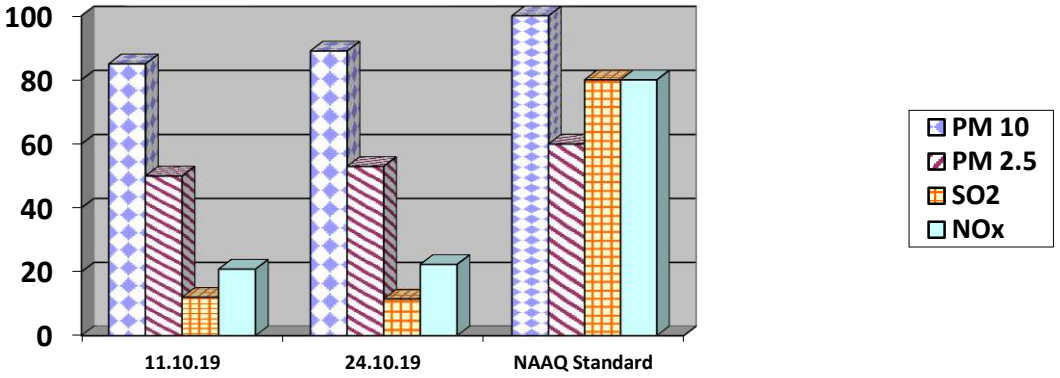
iii)Kharkharee(A21): **Industrial Area**

The location of the sampling station is 23°46'29.00"N & 86°14'37.08"E. The sampler was placed at a height of 1.5 m above the ground level at Kharkharee Colliery.

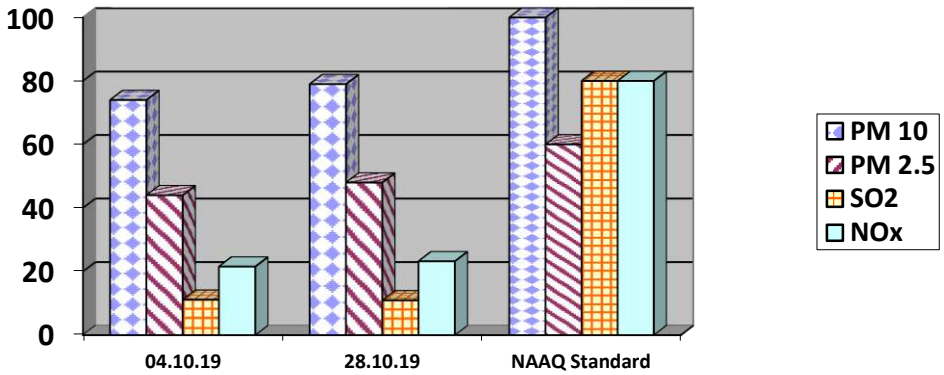
AMBIENT AIR QUALITY DATA

Cluster – III, Bharat Coking Coal limited Month: **OCT.2019** Year : **2019-20.**

Station Name: A6, Block IV		**Zone: Core**		**Category: Industrial**	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO_2**	**NO_X**
1	11.10.19	85	50	12.01	20.84
2	24.10.19	89	53	11.48	22.32
	NAAQ Standard	100	60	80	80



Station Name: A5, Muraidih OCP		**Zone: Buffer**		**Category: Industrial**	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO_2**	**NO_X**
1	04.10.19	74	44	11.14	21.56
2	28.10.19	79	48	10.95	23.23
	NAAQ Standard	100	60	80	80



Note:

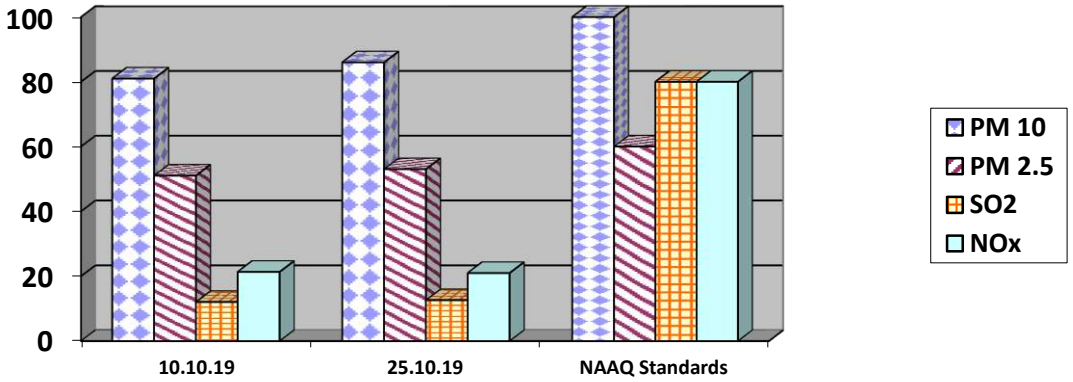
- *All values are expressed in microgram per cubic meter.*
- *24 hours duration*

Analysed By
JSA/SA/SSA

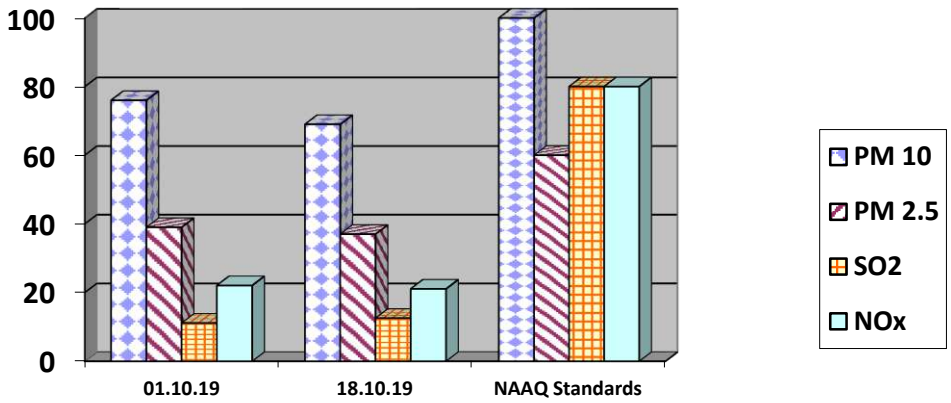
Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

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

Station Name: A7, Govindpur Village		Zone: Buffer		Category: Industrial	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO2**	**NOx**
1	10.10.19	81	51	12.05	21.32
2	25.10.19	86	53	12.61	20.97
	NAAQ Standards	100	60	80	80



Station Name: A21 Kharkharee		Zone: Buffer		Category: Industrial	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO2**	**NOx**
1	01.10.19	76	39	11.13	22.06
2	18.10.19	69	37	12.54	21.06
	NAAQ Standards	100	60	80	80



Note:

- *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 Govindpur (MW3)**

A sampling point is fixed to assess the effluent quality of Mine discharge. This location is selected to monitor effluent discharge in to Khudia Nala and Bagdighi Nala.

3.2 Methodology of sampling and analysis

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

3.3 Results & Interpretations

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

WATER QUALITY DATA

(EFFLUENT WATER- FOUR PARAMETERS)

Name of the Cluster: **Cluster -III**		Month: **OCT.2019**	Name of the Station: **Mine Discharge of Govindpur**	
Sl. No.	**Parameters**	**MW3** First Fortnight	**MW3** Second Fortnight	**As per MOEF General Standards for schedule VI**
		09.10.2019	24.10.2019	
1	Total Suspended Solids	47	42	*100 (Max)*
2	pH	8.11	8.15	*5.5 - 9.0*
3	Oil & Grease	<2.0	<2.0	*10 (Max)*
4	COD	44	40	*250 (Max)*

All values are expressed in mg/lit unless specified.

Analysed By
JSA/SA/SSA

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

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

NOISE LEVEL QUALITY MONITORING

4.1Location of sampling sites

i) **Block IV (N6)**
ii) **Muraidih OCP(N5)**
iii) **Govindpur Village(N7)**
iv) **Kharkharee (N21)**

4.2 Methodology of sampling and analysis

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

4.3 Results & Interpretations

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

NOISE LEVEL DATA

Name of the Project: **Cluster -III**			Month: **OCT.2019**		
Sl. No.	**Station Name/Code**	**Category of area**	**Date**	**Noise level dB(A)LEQ**	***Permissible Limit of Noise level in dB(A)***
1	Muraidih (N5)	**Industrial area**	04.10.19	52.1	*75*
2	Muraidih	**Industrial area**	28.10.19	54.7	*75*
3	Block-IV(N6)	**Industrial area**	11.10.19	52.4	*75*
4	Block-IV	**Industrial area**	24.10.19	53.2	*75*
5	Govindpur/Ramkanali(N7)	**Industrial area**	10.10.19	51.3	*75*
6	Govindpur/Ramkanali	**Industrial area**	25.10.19	63.8	*75*
7	Kharkharee(N21)	**Industrial area**	01.10.19	55.6	*75*
8	Kharkharee	**Industrial area**	18.10.19	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
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.

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

NATIONAL AMBIENT AIR QUALITY STANDARDS

New Delhi the 18th November 2009

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

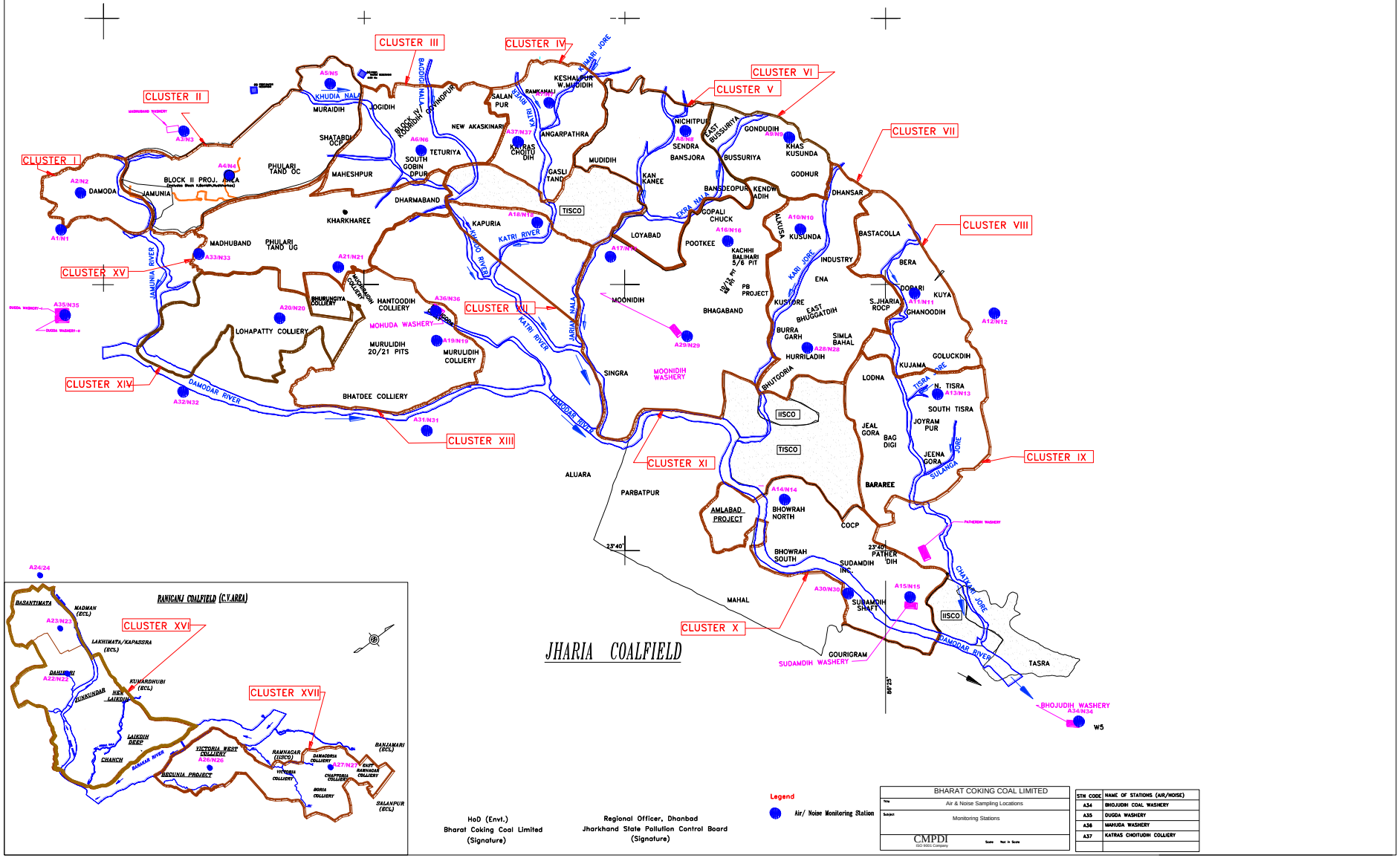
Pollutant	Time Weighted Average	Concentration in Ambient Air		Methods of Measurement
		Industrial, Residential, Rural and other Areas	Ecologically Sensitive Area (Notified by Central Government)	
Sulphur Dioxide (SO_2), µg/m³	Annual * 24 Hours **	50 80	20 80	-Improved West and Gaeke Method -Ultraviolet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

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

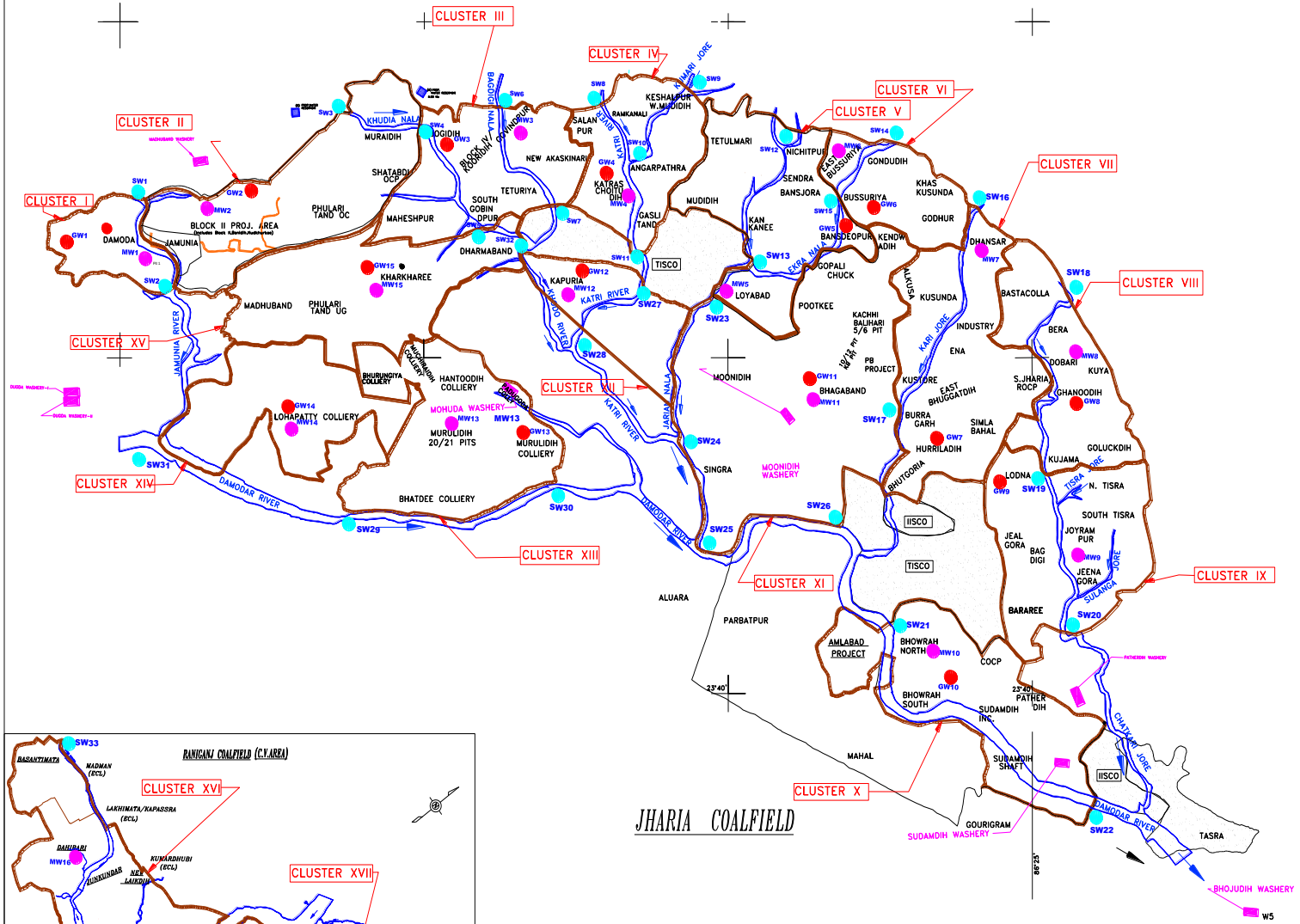
** 24 hourly or 8 hourly or 1 hourly monitored values, as applicable, shall be complied with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

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

Location of Air & Noise Monitoring Stations in BCCL



Water Sampling Locations in BCCL



INDEX

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

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 – III

(FOR THE MONTH NOVEMBER, 2019)

E. C. no. J-11015/213/2010-IA.II (M) dated 06.02.2013.

CMPDI
ISO 9001 Company
Regional Institute-II
Dhanbad, Jharkhand

CONTENTS

SL. NO.	CHAPTER	PARTICULARS	PAGE NO.
1.	CHAPTER - I	EXECUTIVE SUMMARY	3-5
2.	CHAPTER-II	INTRODUCTION	6
3.	CHAPTER-III	RESULTS	7-11
4.	CHAPTER-IV	STANDARDS AND PLANS	12-15

EXECUTIVE SUMMARY

1.0 Introduction

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

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

2.0 Sampling location and rationale

2.1 Ambient air sampling locations

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

2.2 Water sampling stations

The Water sampling stations were selected for mine sump water.

2.3 Noise level monitoring locations

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

3.0 Methodology of sampling and analysis

3.1 Ambient air quality

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

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

3.2 Water quality

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

3.3 Noise level monitoring

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

4.0 Results and interpretations

4.1 Air quality

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

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

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

4.2 Water quality

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

4.3 Noise Level

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

INTRODUCTION

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

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

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

The CLUSTER III is in the westernmost part of the Jharia coalfield. It includes Jogidih Colliery, Maheshpur Colliery, South Govindpur Colliery, Teturiya Colliery, Govindpur Colliery, New Akasshkinaree Mine and Block IV Kooridih Mixed Mine. The cluster – III is situated about 40 - 45 kms from Dhanbad Railway Station. The mines of this cluster - III are operating since pre nationalization period (prior to 1972-73). It is connected by both Railway and Road. The drainage of the area is governed by Khudia and Bagdighi Nala.

The Project has Environmental Clearance from Ministry of Environment, Forest and Climate Change (MoEF&CC) for a rated capacity of 2.769 MTPA (normative) and 3.6 MTPA peak capacity of coal production vide letter no**E. C. no. J-11015/213/2010-IA.II (M) dated 06.02.2013.**

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

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

AMBIENT AIR QUALITY MONITORING

2.1 Location of sampling station and their rationale:

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

2.1.1 Ambient Air Quality Sampling Locations

CORE ZONE Monitoring Location

i) Block IV Kooridih OCP (A6): Industrial Area

The location of the sampling station is at 23°47'54.00"N & 86°16'20.00"E. The sampler was placed at 1.5 m above the ground level near Safety office of Block IV OCP.

BUFFER ZONE Monitoring Location

i) Muraidih OCP (A5) : Industrial Area

The sampler was placed at a height of 1.5 m from the ground level at Muraidih project office.

ii) Govindpur Village (A7) : Industrial area

The location of the sampling station is 23°48'34.00"N & 86°18'22.00"E. The sampler was placed at height of 1.5 m above the ground level at AARC agent Office, Ramkanali.

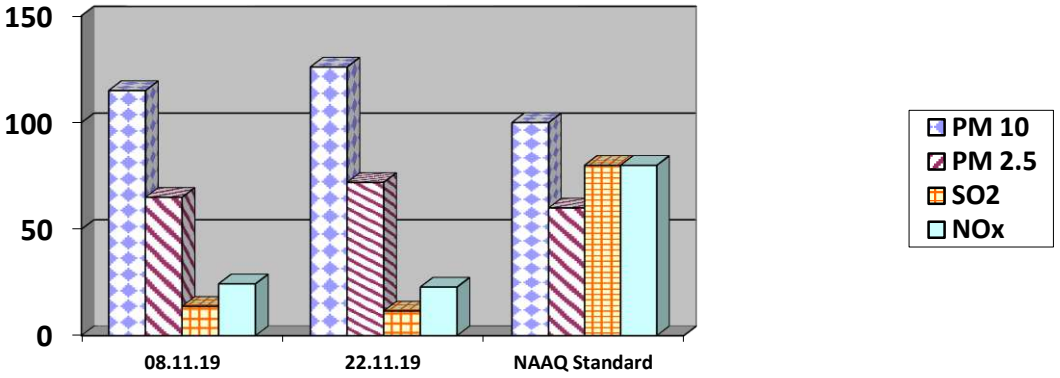
iii)Kharkharee(A21): **Industrial Area**

The location of the sampling station is 23°46'29.00"N & 86°14'37.08"E. The sampler was placed at a height of 1.5 m above the ground level at Kharkharee Colliery.

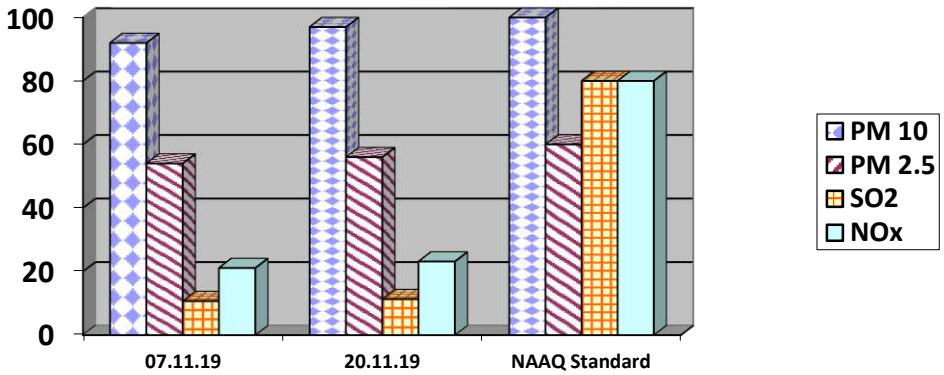
AMBIENT AIR QUALITY DATA

Cluster – III, Bharat Coking Coal limited Month: **NOV.2019** Year : **2019-20.**

Station Name: A6, Block IV		**Zone: Core**		**Category: Industrial**	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO_2**	**NO_X**
1	08.11.19	115	65	13.78	24.37
2	22.11.19	126	72	11.57	22.83
	NAAQ Standard	100	60	80	80



Station Name: A5, Muraidih OCP		**Zone: Buffer**		**Category: Industrial**	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO_2**	**NO_X**
1	07.11.19	92	54	10.73	21.11
2	20.11.19	97	56	11.35	23.15
	NAAQ Standard	100	60	80	80



Note:

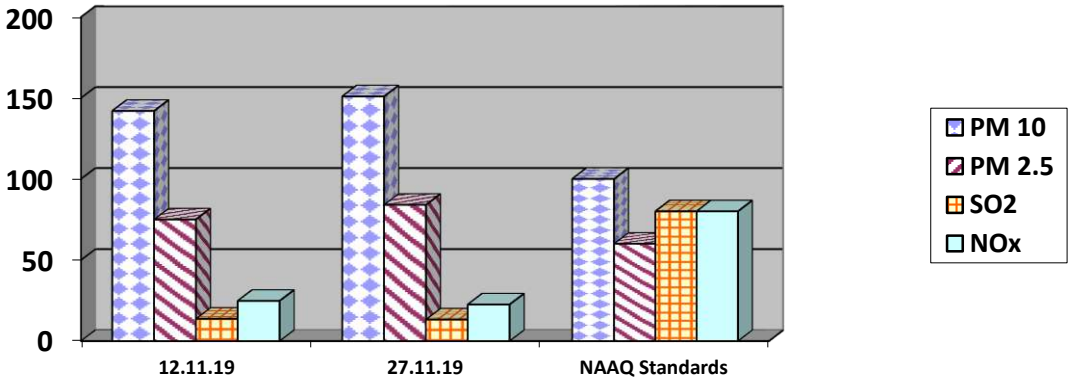
- *All values are expressed in microgram per cubic meter.*
- *24 hours duration*

Analysed By
JSA/SA/SSA

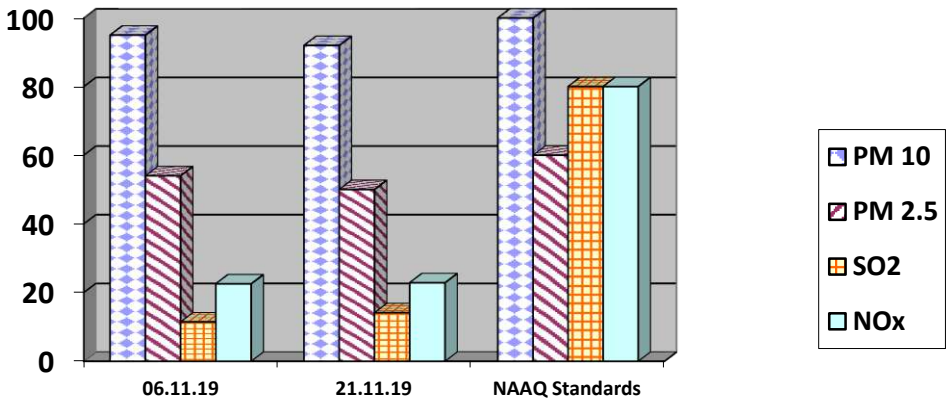
Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

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

Station Name: A7, Govindpur Village		Zone: Buffer		Category: Industrial	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO2**	**NOx**
1	12.11.19	142	75	13.74	24.78
2	27.11.19	151	84	13.31	22.54
	NAAQ Standards	100	60	80	80



Station Name: A21 Kharkharee		Zone: Buffer		Category: Industrial	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO2**	**NOx**
1	06.11.19	95	54	11.44	22.54
2	21.11.19	92	50	14.14	22.86
	NAAQ Standards	100	60	80	80



Note:

- *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 Govindpur (MW3)**

A sampling point is fixed to assess the effluent quality of Mine discharge. This location is selected to monitor effluent discharge in to Khudia Nala and Bagdighi Nala.

3.2 Methodology of sampling and analysis

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

3.3 Results & Interpretations

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

WATER QUALITY DATA

(EFFLUENT WATER- FOUR PARAMETERS)

Name of the Cluster: **Cluster -III**		Month: **NOV.2019**	Name of the Station: **Mine Discharge of Govindpur**	
Sl. No.	**Parameters**	**MW3** First Fortnight	**MW3** Second Fortnight	**As per MOEF General Standards for schedule VI**
		08.11.2019	21.11.2019	
1	Total Suspended Solids	21	41	*100 (Max)*
2	pH	8.21	8.13	*5.5 - 9.0*
3	Oil & Grease	<2.0	<2.0	*10 (Max)*
4	COD	40	48	*250 (Max)*

All values are expressed in mg/lit unless specified.

Analysed By
JSA/SA/SSA

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

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

NOISE LEVEL QUALITY MONITORING

4.1Location of sampling sites

i) **Block IV (N6)**
ii) **Muraidih OCP(N5)**
iii) **Govindpur Village(N7)**
iv) **Kharkharee (N21)**

4.2 Methodology of sampling and analysis

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

4.3 Results & Interpretations

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

NOISE LEVEL DATA

Name of the Project: **Cluster -III**			Month: **NOV.2019**		
Sl. No.	**Station Name/Code**	**Category of area**	**Date**	**Noise level dB(A)LEQ**	***Permissible Limit of Noise level in dB(A)***
1	Muraidih (N5)	**Industrial area**	07.11.19	53.3	*75*
2	Muraidih	**Industrial area**	20.11.19	52.3	*75*
3	Block-IV(N6)	**Industrial area**	08.11.19	54.3	*75*
4	Block-IV	**Industrial area**	22.11.19	51.9	*75*
5	Govindpur/Ramkanali(N7)	**Industrial area**	12.11.19	53.2	*75*
6	Govindpur/Ramkanali	**Industrial area**	27.11.19	62.3	*75*
7	Kharkharee(N21)	**Industrial area**	06.11.19	57.4	*75*
8	Kharkharee	**Industrial area**	21.11.19	57.3	*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
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.

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

NATIONAL AMBIENT AIR QUALITY STANDARDS

New Delhi the 18th November 2009

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

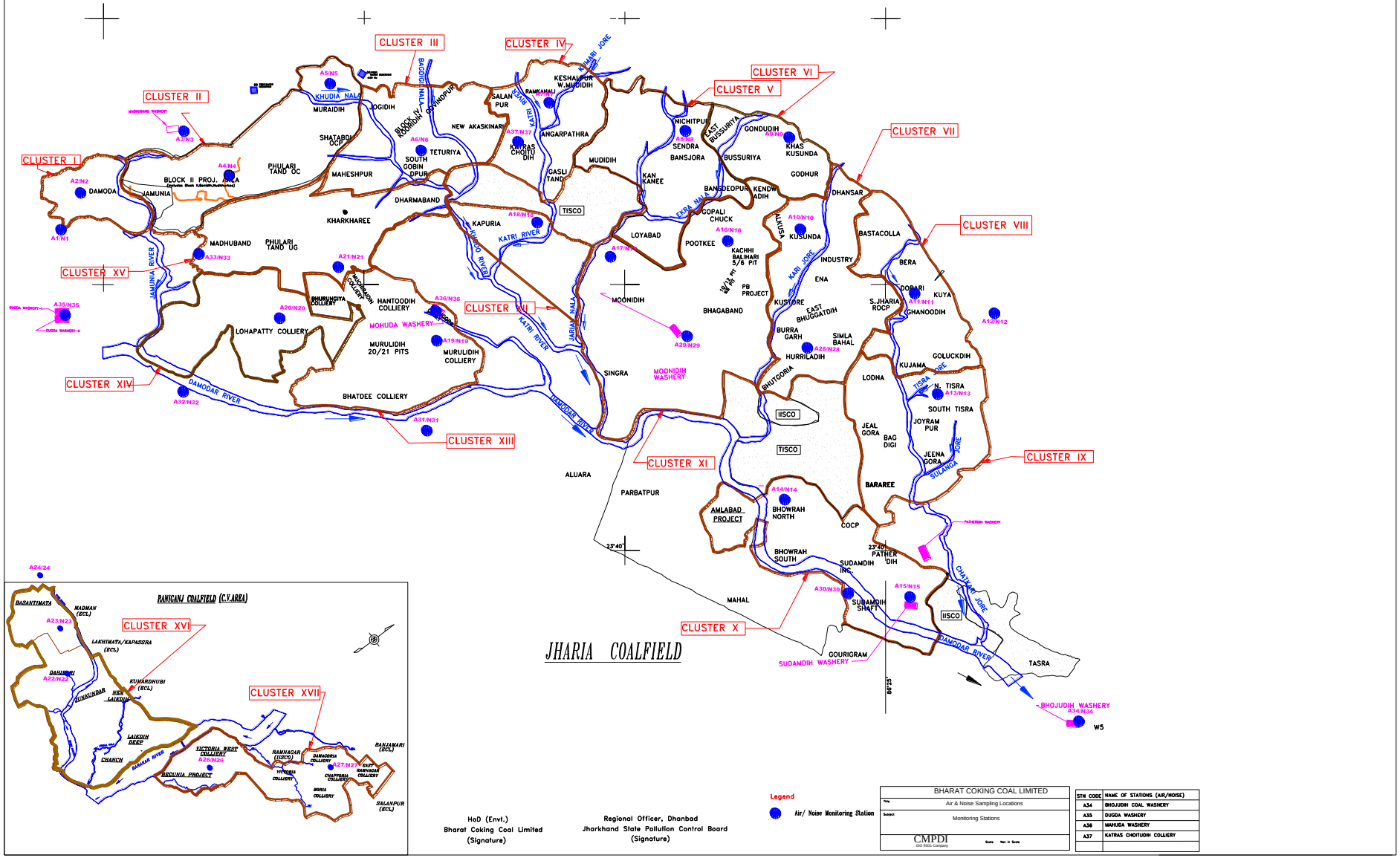
Pollutant	Time Weighted Average	Concentration in Ambient Air		Methods of Measurement
		Industrial, Residential, Rural and other Areas	Ecologically Sensitive Area (Notified by Central Government)	
Sulphur Dioxide (SO_2), µg/m³	Annual * 24 Hours **	50 80	20 80	-Improved West and Gaeke Method -Ultraviolet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

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

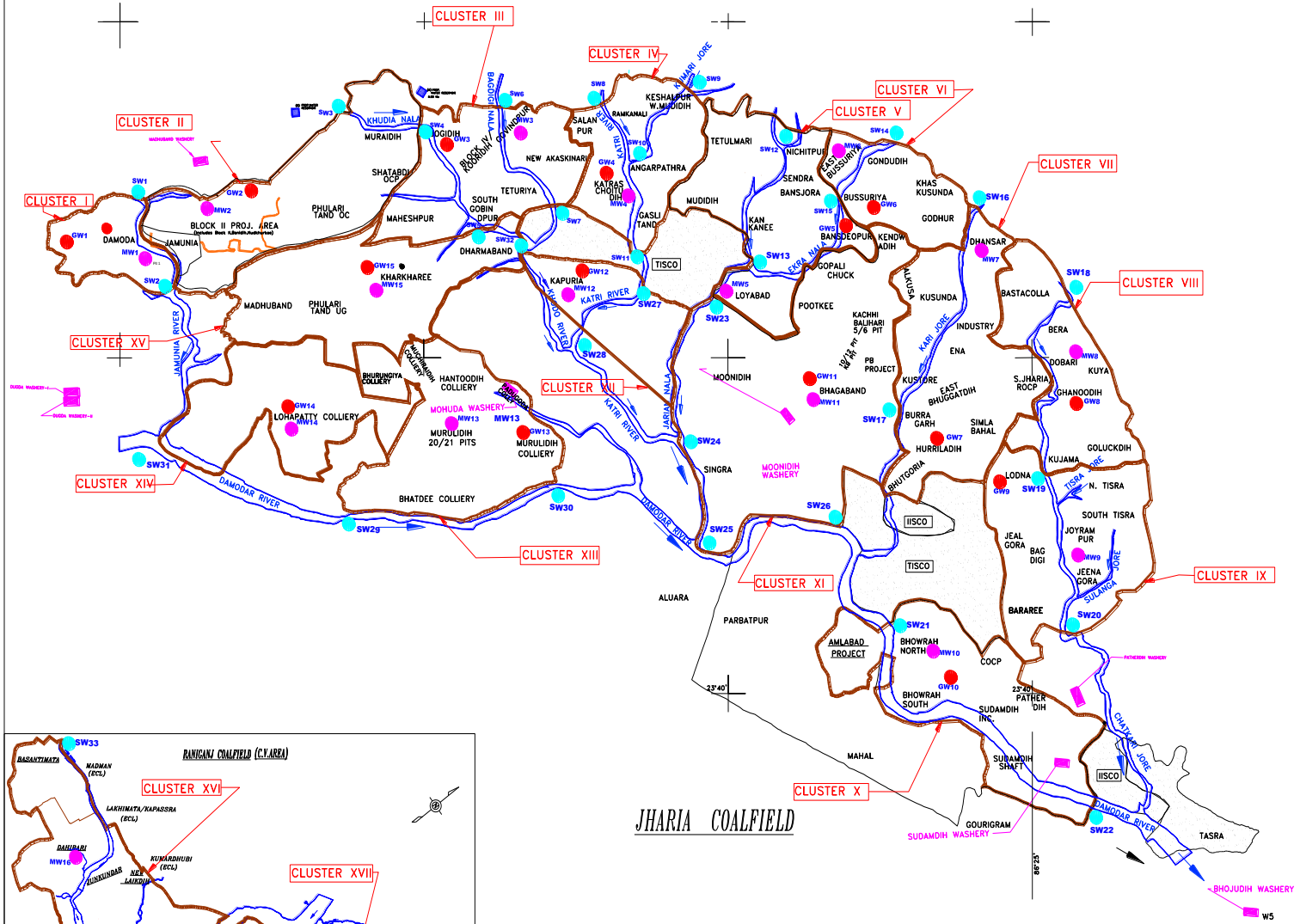
** 24 hourly or 8 hourly or 1 hourly monitored values, as applicable, shall be complied with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

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

Location of Air & Noise Monitoring Stations in BCCL



Water Sampling Locations in BCCL



INDEX

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

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 – III

(FOR THE MONTH DECEMBER, 2019)

E. C. no. J-11015/213/2010-IA.II (M) dated 06.02.2013.

CMPDI
ISO 9001 Company
Regional Institute-II
Dhanbad, Jharkhand

CONTENTS

SL. NO.	CHAPTER	PARTICULARS	PAGE NO.
1.	CHAPTER - I	EXECUTIVE SUMMARY	3-5
2.	CHAPTER-II	INTRODUCTION	6
3.	CHAPTER-III	RESULTS	7-11
4.	CHAPTER-IV	STANDARDS AND PLANS	12-15

EXECUTIVE SUMMARY

1.0 Introduction

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

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

2.0 Sampling location and rationale

2.1 Ambient air sampling locations

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

2.2 Water sampling stations

The Water sampling stations were selected for mine sump water.

2.3 Noise level monitoring locations

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

3.0 Methodology of sampling and analysis

3.1 Ambient air quality

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

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

3.2 Water quality

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

3.3 Noise level monitoring

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

4.0 Results and interpretations

4.1 Air quality

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

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

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

4.2 Water quality

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

4.3 Noise Level

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

INTRODUCTION

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

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

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

The CLUSTER III is in the westernmost part of the Jharia coalfield. It includes Jogidih Colliery, Maheshpur Colliery, South Govindpur Colliery, Teturiya Colliery, Govindpur Colliery, New Akasshkinaree Mine and Block IV Kooridih Mixed Mine. The cluster – III is situated about 40 - 45 kms from Dhanbad Railway Station. The mines of this cluster - III are operating since pre nationalization period (prior to 1972-73). It is connected by both Railway and Road. The drainage of the area is governed by Khudia and Bagdighi Nala.

The Project has Environmental Clearance from Ministry of Environment, Forest and Climate Change (MoEF&CC) for a rated capacity of 2.769 MTPA (normative) and 3.6 MTPA peak capacity of coal production vide letter no**E. C. no. J-11015/213/2010-IA.II (M) dated 06.02.2013.**

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

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

AMBIENT AIR QUALITY MONITORING

2.1 Location of sampling station and their rationale:

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

2.1.1 Ambient Air Quality Sampling Locations

CORE ZONE Monitoring Location

i) Block IV Kooridih OCP (A6): Industrial Area

The location of the sampling station is at 23°47'54.00"N & 86°16'20.00"E. The sampler was placed at 1.5 m above the ground level near Safety office of Block IV OCP.

BUFFER ZONE Monitoring Location

i) Muraidih OCP (A5) : Industrial Area

The sampler was placed at a height of 1.5 m from the ground level at Muraidih project office.

ii) Govindpur Village (A7) : Industrial area

The location of the sampling station is 23°48'34.00"N & 86°18'22.00"E. The sampler was placed at height of 1.5 m above the ground level at AARC agent Office, Ramkanali.

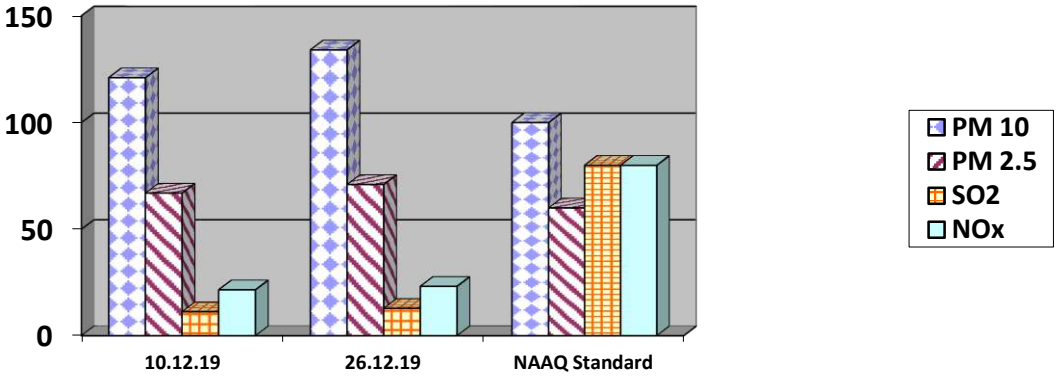
iii)Kharkharee(A21): **Industrial Area**

The location of the sampling station is 23°46'29.00"N & 86°14'37.08"E. The sampler was placed at a height of 1.5 m above the ground level at Kharkharee Colliery.

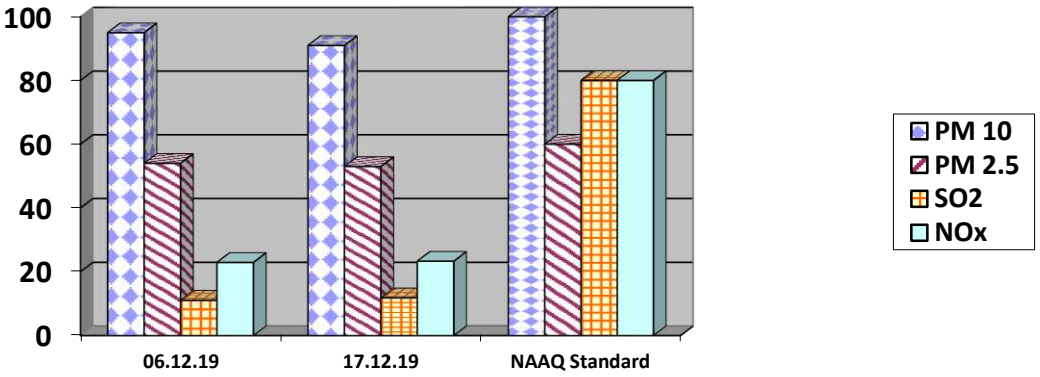
AMBIENT AIR QUALITY DATA

Cluster – III, Bharat Coking Coal limited Month: **DEC.2019** Year : **2019-20.**

Station Name: A6, Block IV		**Zone: Core**		**Category: Industrial**	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO_2**	**NO_X**
1	10.12.19	121	67	11.27	21.56
2	26.12.19	134	71	12.81	23.18
	NAAQ Standard	100	60	80	80



Station Name: A5, Muraidih OCP		**Zone: Buffer**		**Category: Industrial**	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO_2**	**NO_X**
1	06.12.19	95	54	11.09	22.93
2	17.12.19	91	53	11.84	23.32
	NAAQ Standard	100	60	80	80



Note:

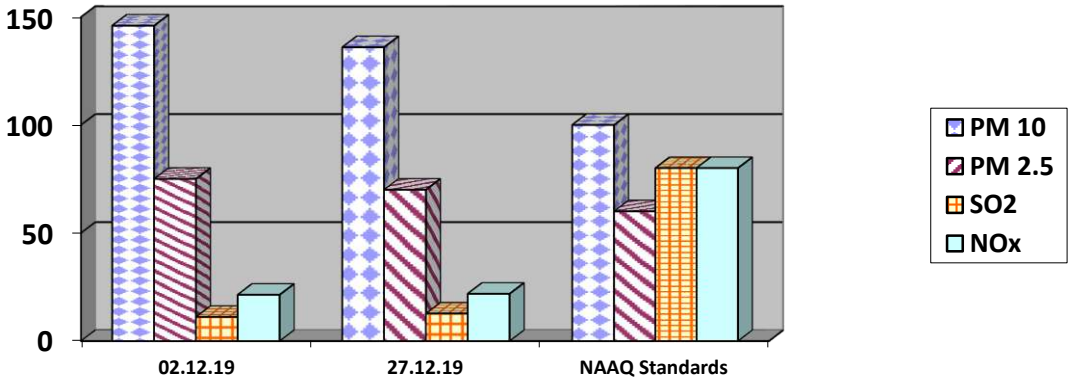
- *All values are expressed in microgram per cubic meter.*
- *24 hours duration*

Analysed By
JSA/SA/SSA

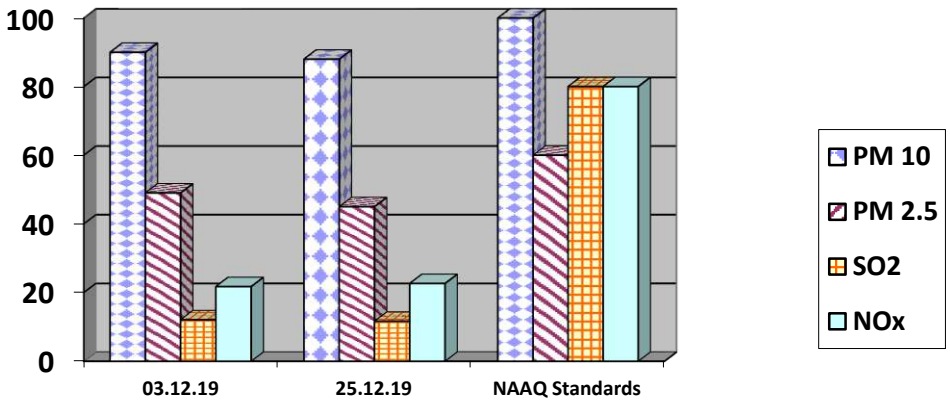
Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

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

Station Name: A7, Govindpur Village		Zone: Buffer		Category: Industrial	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO2**	**NOx**
1	02.12.19	146	75	11.18	21.39
2	27.12.19	136	70	12.75	21.87
	NAAQ Standards	100	60	80	80



Station Name: A21 Kharkharee		Zone: Buffer		Category: Industrial	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO2**	**NOx**
1	03.12.19	90	49	12.08	21.73
2	25.12.19	88	45	11.66	22.63
	NAAQ Standards	100	60	80	80



Note:

- *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 Govindpur (MW3)**

A sampling point is fixed to assess the effluent quality of Mine discharge. This location is selected to monitor effluent discharge in to Khudia Nala and Bagdighi Nala.

3.2 Methodology of sampling and analysis

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

3.3 Results & Interpretations

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

WATER QUALITY DATA

(EFFLUENT WATER- FOUR PARAMETERS)

Name of the Cluster: **Cluster -III**		Month: **DEC.2019**	Name of the Station: **Mine Discharge of Govindpur**	
Sl. No.	**Parameters**	**MW3** First Fortnight	**MW3** Second Fortnight	**As per MOEF General Standards for schedule VI**
		10.12.19	26.12.19	
1	Total Suspended Solids	30	34	*100 (Max)*
2	pH	8.16	8.11	*5.5 - 9.0*
3	Oil & Grease	<2.0	<2.0	*10 (Max)*
4	COD	36	48	*250 (Max)*

All values are expressed in mg/lit unless specified.

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

i) **Block IV (N6)**
ii) **Muraidih OCP(N5)**
iii) **Govindpur Village(N7)**
iv) **Kharkharee (N21)**

4.2 Methodology of sampling and analysis

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

4.3 Results & Interpretations

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

NOISE LEVEL DATA

Name of the Project: **Cluster -III**			Month: **DEC.2019**		
Sl. No.	**Station Name/Code**	**Category of area**	**Date**	**Noise level dB(A)LEQ**	***Permissible Limit of Noise level in dB(A)***
1	Muraidih (N5)	**Industrial area**	06.12.19	49.7	*75*
2	Muraidih	**Industrial area**	17.12.19	54.8	*75*
3	Block-IV(N6)	**Industrial area**	10.12.19	50.3	*75*
4	Block-IV	**Industrial area**	26.12.19	50.9	*75*
5	Govindpur/Ramkanali(N7)	**Industrial area**	02.12.19	54.3	*75*
6	Govindpur/Ramkanali	**Industrial area**	27.12.19	64.1	*75*
7	Kharkharee(N21)	**Industrial area**	03.12.19	54.1	*75*
8	Kharkharee	**Industrial area**	25.12.19	53.4	*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.

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

NATIONAL AMBIENT AIR QUALITY STANDARDS

New Delhi the 18th November 2009

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

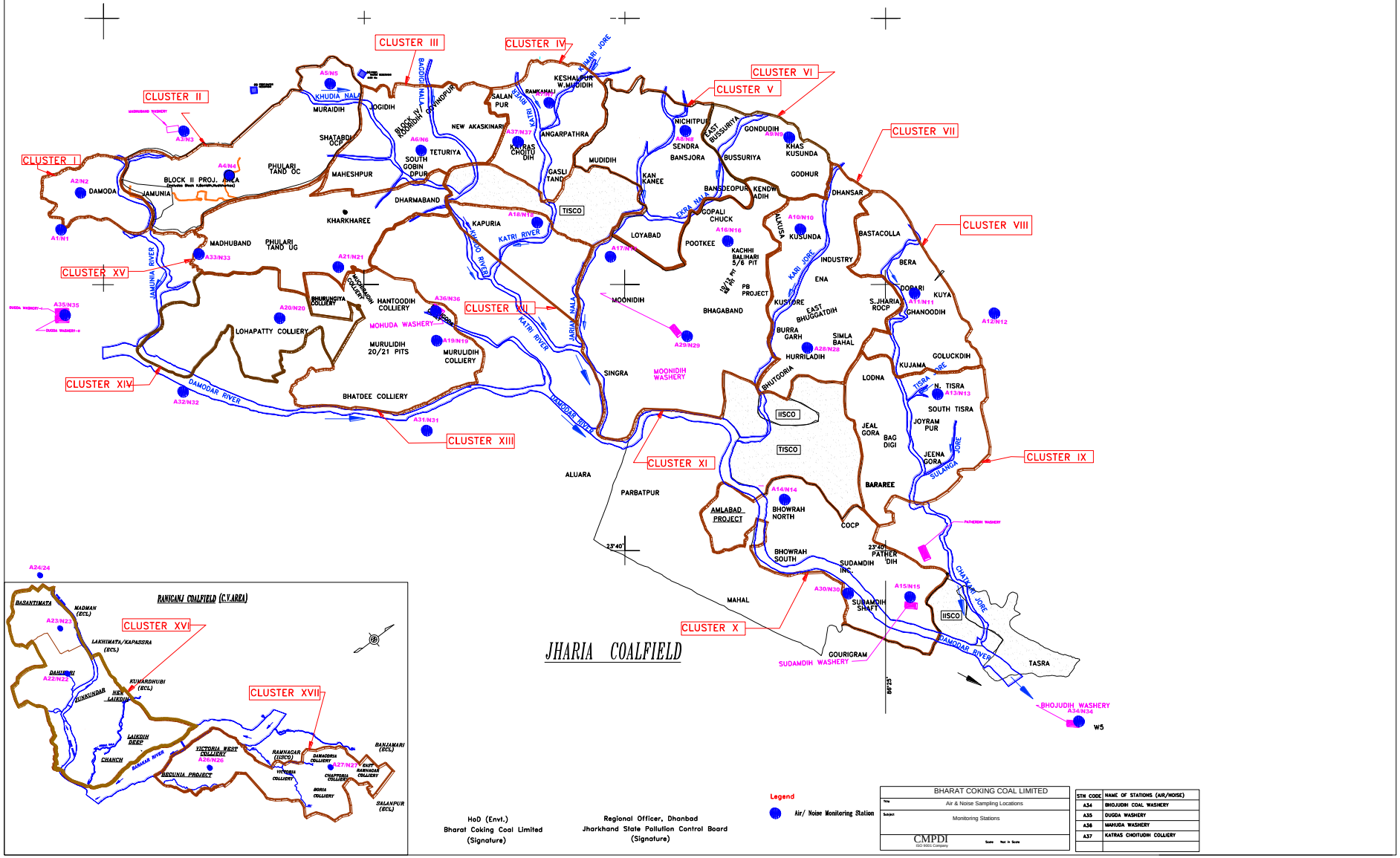
Pollutant	Time Weighted Average	Concentration in Ambient Air		Methods of Measurement
		Industrial, Residential, Rural and other Areas	Ecologically Sensitive Area (Notified by Central Government)	
Sulphur Dioxide (SO_2), µg/m³	Annual * 24 Hours **	50 80	20 80	-Improved West and Gaeke Method -Ultraviolet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

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

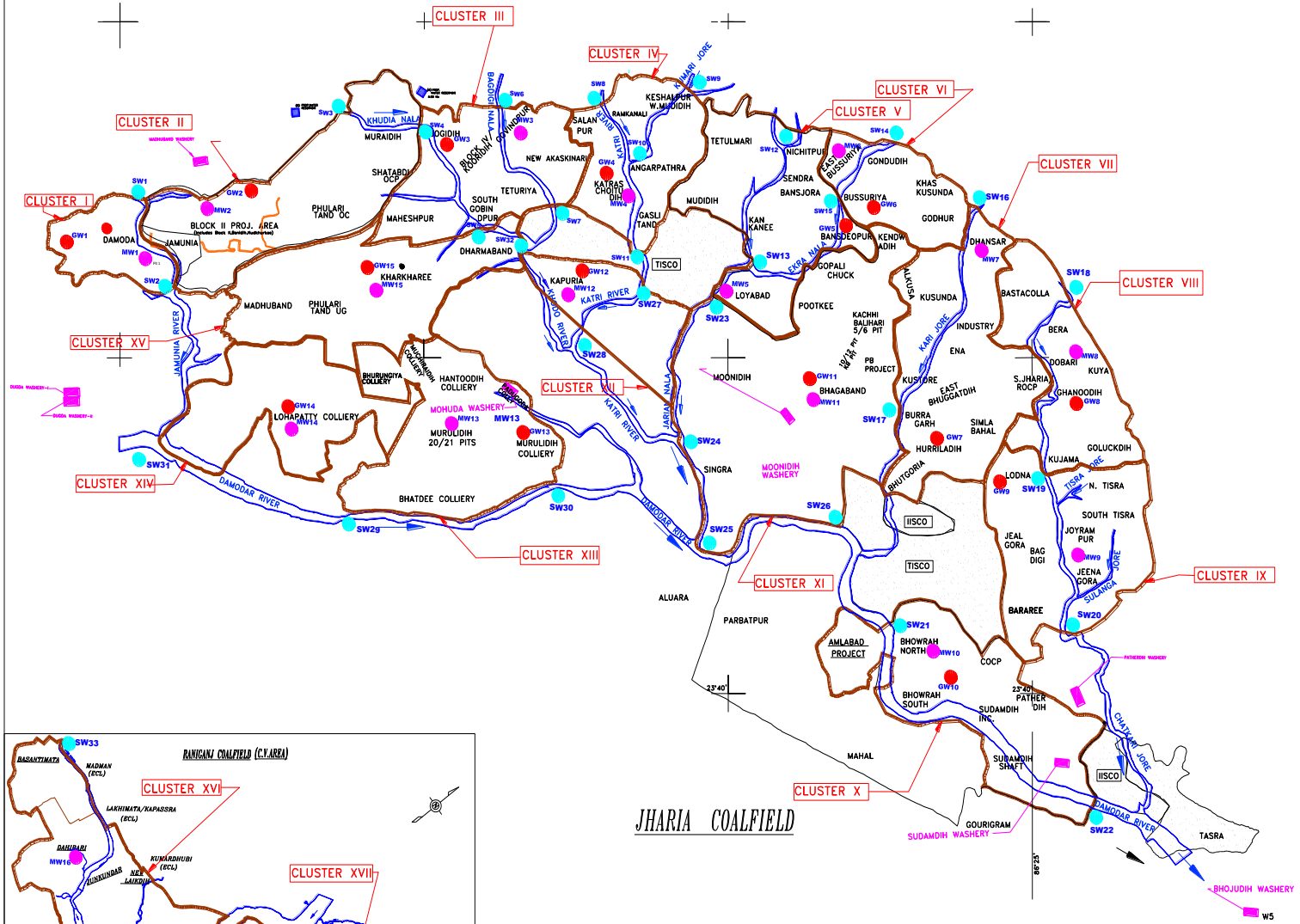
** 24 hourly or 8 hourly or 1 hourly monitored values, as applicable, shall be complied with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

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

Location of Air & Noise Monitoring Stations in BCCL



Water Sampling Locations in BCCL



INDEX

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

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 – III

(FOR THE MONTH JANUARY, 2020)

E. C. no. J-11015/213/2010-IA.II (M) dated 06.02.2013.

CMPDI
ISO 9001 Company
Regional Institute-II
Dhanbad, Jharkhand

CONTENTS

SL. NO.	CHAPTER	PARTICULARS	PAGE NO.
1.	CHAPTER - I	EXECUTIVE SUMMARY	3-5
2.	CHAPTER-II	INTRODUCTION	6
3.	CHAPTER-III	RESULTS	7-11
4.	CHAPTER-IV	STANDARDS AND PLANS	12-15

EXECUTIVE SUMMARY

1.0 Introduction

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

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

2.0 Sampling location and rationale

2.1 Ambient air sampling locations

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

2.2 Water sampling stations

The Water sampling stations were selected for mine sump water.

2.3 Noise level monitoring locations

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

3.0 Methodology of sampling and analysis

3.1 Ambient air quality

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

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

3.2 Water quality

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

3.3 Noise level monitoring

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

4.0 Results and interpretations

4.1 Air quality

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

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

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

4.2 Water quality

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

4.3 Noise Level

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

INTRODUCTION

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

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

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

The CLUSTER III is in the westernmost part of the Jharia coalfield. It includes Jogidih Colliery, Maheshpur Colliery, South Govindpur Colliery, Teturiya Colliery, Govindpur Colliery, New Akasshkinaree Mine and Block IV Kooridih Mixed Mine. The cluster – III is situated about 40 - 45 kms from Dhanbad Railway Station. The mines of this cluster - III are operating since pre nationalization period (prior to 1972-73). It is connected by both Railway and Road. The drainage of the area is governed by Khudia and Bagdighi Nala.

The Project has Environmental Clearance from Ministry of Environment, Forest and Climate Change (MoEF&CC) for a rated capacity of 2.769 MTPA (normative) and 3.6 MTPA peak capacity of coal production vide letter no**E. C. no. J-11015/213/2010-IA.II (M) dated 06.02.2013.**

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

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

AMBIENT AIR QUALITY MONITORING

2.1 Location of sampling station and their rationale:

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

2.1.1 Ambient Air Quality Sampling Locations

CORE ZONE Monitoring Location

i) Block IV Kooridih OCP (A6): Industrial Area

The location of the sampling station is at 23°47'54.00"N & 86°16'20.00"E. The sampler was placed at 1.5 m above the ground level near Safety office of Block IV OCP.

BUFFER ZONE Monitoring Location

i) Muraidih OCP (A5) : Industrial Area

The sampler was placed at a height of 1.5 m from the ground level at Muraidih project office.

ii) Govindpur Village (A7) : Industrial area

The location of the sampling station is 23°48'34.00"N & 86°18'22.00"E. The sampler was placed at height of 1.5 m above the ground level at AARC agent Office, Ramkanali.

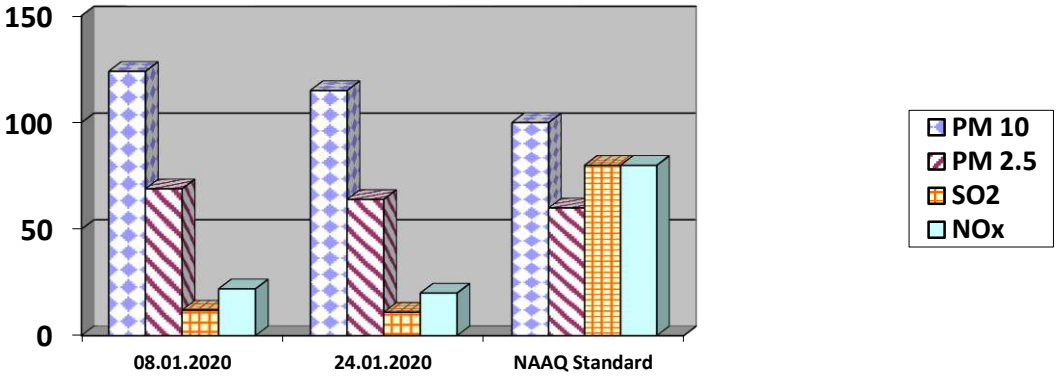
iii)Kharkharee(A21): **Industrial Area**

The location of the sampling station is 23°46'29.00"N & 86°14'37.08"E. The sampler was placed at a height of 1.5 m above the ground level at Kharkharee Colliery.

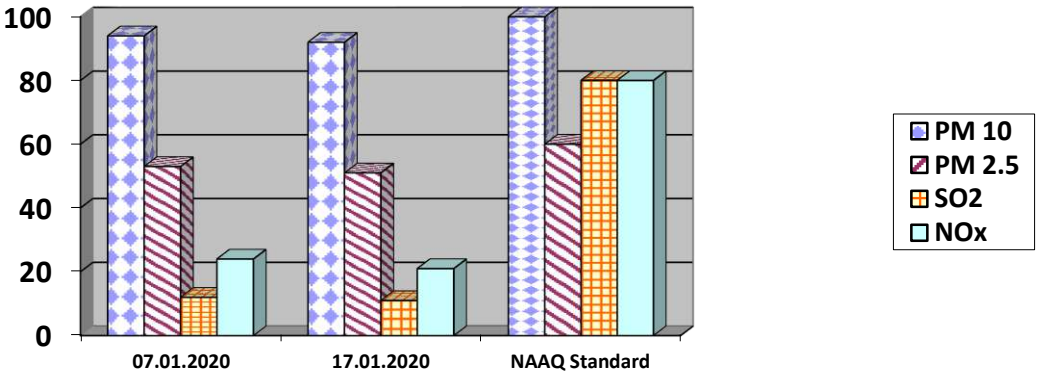
AMBIENT AIR QUALITY DATA

Cluster – III, Bharat Coking Coal limited Month: **JAN.2020** Year : **2019-20.**

Station Name: A6, Block IV		**Zone: Core**		**Category: Industrial**	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO_2**	**NO_X**
1	08.01.2020	124	69	12	22
2	24.01.2020	115	64	11	20
	NAAQ Standard	100	60	80	80



Station Name: A5, Muraidih OCP		**Zone: Buffer**		**Category: Industrial**	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO_2**	**NO_X**
1	07.01.2020	94	53	12	24
2	17.01.2020	92	51	11	21
	NAAQ Standard	100	60	80	80



Note:

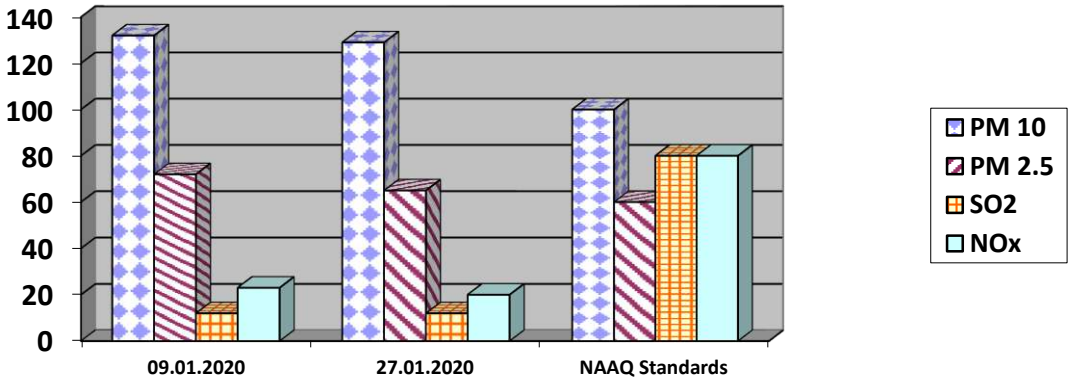
- *All values are expressed in microgram per cubic meter.*
- *24 hours duration*

Analysed By
JSA/SA/SSA

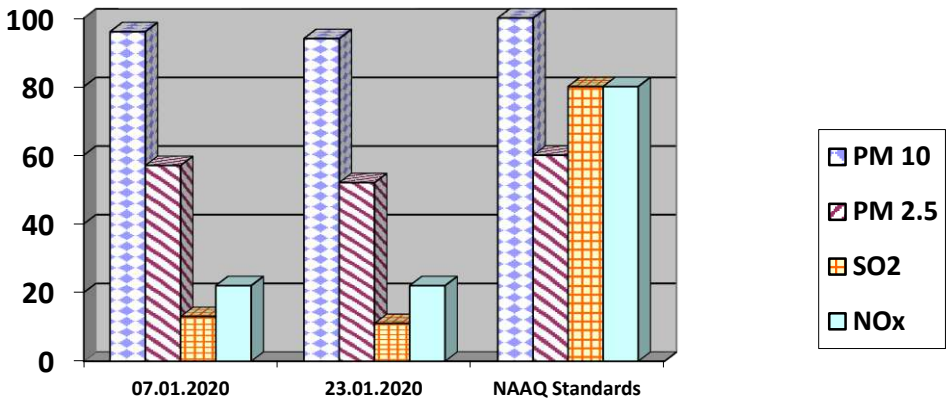
Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

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

Station Name: A7, Govindpur Village		Zone: Buffer		Category: Industrial	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO2**	**NOx**
1	09.01.2020	132	72	12	23
2	27.01.2020	129	65	12	20
	NAAQ Standards	100	60	80	80



Station Name: A21 Kharkharee		Zone: Buffer		Category: Industrial	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO2**	**NOx**
1	07.01.2020	96	57	13	22
2	23.01.2020	94	52	11	22
	NAAQ Standards	100	60	80	80



Note:

- *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 Govindpur (MW3)

A sampling point is fixed to assess the effluent quality of Mine discharge. This location is selected to monitor effluent discharge in to Khudia Nala and Bagdighi Nala.

3.2 Methodology of sampling and analysis

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

3.3 Results & Interpretations

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

WATER QUALITY DATA

(EFFLUENT WATER- FOUR PARAMETERS)

Name of the Cluster: **Cluster -III**		Month: **JAN.2020**	Name of the Station: **Mine Discharge of Govindpur**	
Sl. No.	**Parameters**	**MW3** First Fortnight	**MW3** Second Fortnight	**As per MOEF General Standards for schedule VI**
		08.01.2020	25.01.2020	
1	Total Suspended Solids	29	27	*100 (Max)*
2	pH	7.97	7.94	*5.5 - 9.0*
3	Oil & Grease	<2.0	<2.0	*10 (Max)*
4	COD	28	40	*250 (Max)*

All values are expressed in mg/lit unless specified.

Analysed By
JSA/SA/SSA

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

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

NOISE LEVEL QUALITY MONITORING

4.1Location of sampling sites

i) **Block IV (N6)**
ii) **Muraidih OCP(N5)**
iii) **Govindpur Village(N7)**
iv) **Kharkharee (N21)**

4.2 Methodology of sampling and analysis

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

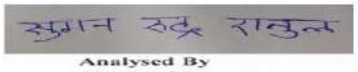
4.3 Results & Interpretations

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

NOISE LEVEL DATA

Name of the Project: **Cluster -III**			Month: **JAN.2020**		
Sl. No.	**Station Name/Code**	**Category of area**	**Date**	**Noise level dB(A)LEQ**	***Permissible Limit of Noise level in dB(A)***
1	Muraidih (N5)	**Industrial area**	07.01.2020	56.2	*75*
2	Muraidih	**Industrial area**	17.01.2020	54.7	*75*
3	Block-IV(N6)	**Industrial area**	08.01.2020	54.6	*75*
4	Block-IV	**Industrial area**	24.01.2020	55.5	*75*
5	Govindpur/Ramkanali(N7)	**Industrial area**	09.01.2020	51.2	*75*
6	Govindpur/Ramkanali	**Industrial area**	27.01.2020	63.3	*75*
7	Kharkharee(N21)	**Industrial area**	07.01.2020	53.2	*75*
8	Kharkharee	**Industrial area**	23.01.2020	54.6	*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

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.

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

NATIONAL AMBIENT AIR QUALITY STANDARDS

New Delhi the 18th November 2009

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

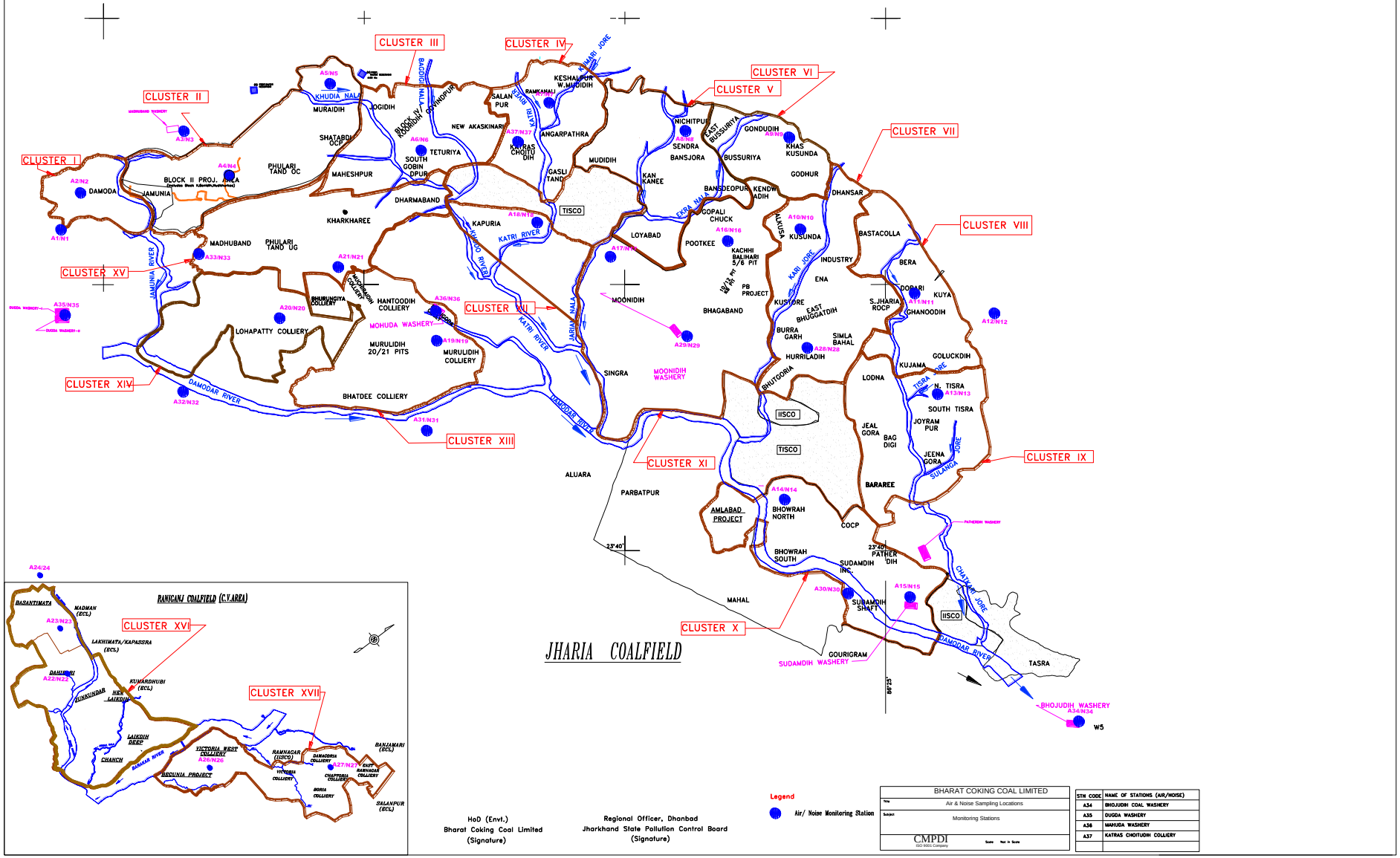
Pollutant	Time Weighted Average	Concentration in Ambient Air		Methods of Measurement
		Industrial, Residential, Rural and other Areas	Ecologically Sensitive Area (Notified by Central Government)	
Sulphur Dioxide (SO_2), µg/m³	Annual * 24 Hours **	50 80	20 80	-Improved West and Gaeke Method -Ultraviolet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

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

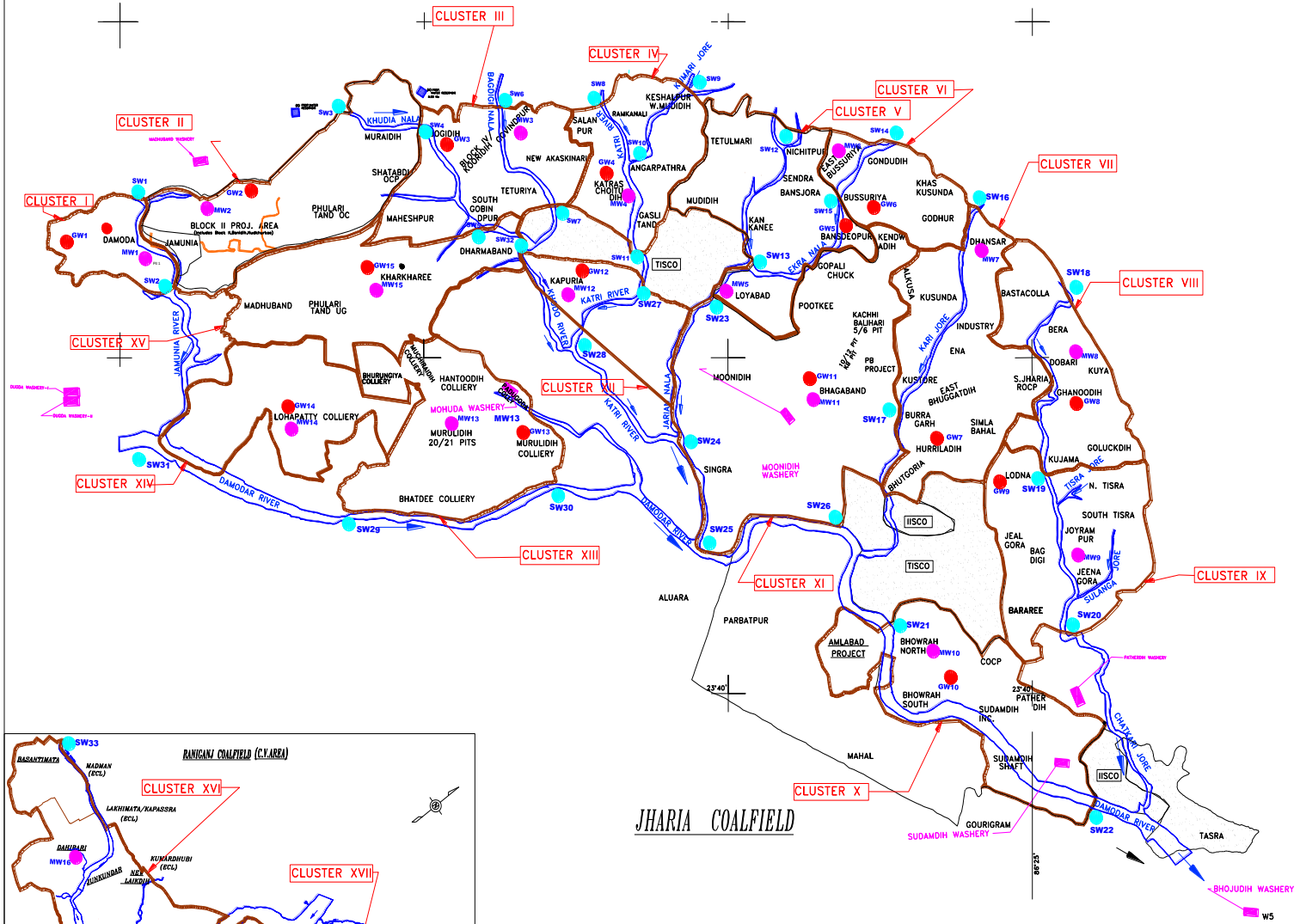
** 24 hourly or 8 hourly or 1 hourly monitored values, as applicable, shall be complied with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

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

Location of Air & Noise Monitoring Stations in BCCL



Water Sampling Locations in BCCL



INDEX

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

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 – III

(FOR THE MONTH FEBRUARY, 2020)

E. C. no. J-11015/213/2010-IA.II (M) dated 06.02.2013.

CMPDI
ISO 9001 Company
Regional Institute-II
Dhanbad, Jharkhand

CONTENTS

SL. NO.	CHAPTER	PARTICULARS	PAGE NO.
1.	CHAPTER - I	EXECUTIVE SUMMARY	3-5
2.	CHAPTER-II	INTRODUCTION	6
3.	CHAPTER-III	RESULTS	7-11
4.	CHAPTER-IV	STANDARDS AND PLANS	12-15

EXECUTIVE SUMMARY

1.0 Introduction

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

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

2.0 Sampling location and rationale

2.1 Ambient air sampling locations

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

2.2 Water sampling stations

The Water sampling stations were selected for mine sump water.

2.3 Noise level monitoring locations

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

3.0 Methodology of sampling and analysis

3.1 Ambient air quality

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

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

3.2 Water quality

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

3.3 Noise level monitoring

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

4.0 Results and interpretations

4.1 Air quality

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

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

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

4.2 Water quality

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

4.3 Noise Level

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

INTRODUCTION

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

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

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

The CLUSTER III is in the westernmost part of the Jharia coalfield. It includes Jogidih Colliery, Maheshpur Colliery, South Govindpur Colliery, Teturiya Colliery, Govindpur Colliery, New Akasshkinaree Mine and Block IV Kooridih Mixed Mine. The cluster – III is situated about 40 - 45 kms from Dhanbad Railway Station. The mines of this cluster - III are operating since pre nationalization period (prior to 1972-73). It is connected by both Railway and Road. The drainage of the area is governed by Khudia and Bagdighi Nala.

The Project has Environmental Clearance from Ministry of Environment, Forest and Climate Change (MoEF&CC) for a rated capacity of 2.769 MTPA (normative) and 3.6 MTPA peak capacity of coal production vide letter no**E. C. no. J-11015/213/2010-IA.II (M) dated 06.02.2013.**

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

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

AMBIENT AIR QUALITY MONITORING

2.1 Location of sampling station and their rationale:

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

2.1.1 Ambient Air Quality Sampling Locations

CORE ZONE Monitoring Location

i) Block IV Kooridih OCP (A6): Industrial Area

The location of the sampling station is at 23°47'54.00"N & 86°16'20.00"E. The sampler was placed at 1.5 m above the ground level near Safety office of Block IV OCP.

BUFFER ZONE Monitoring Location

i) Muraidih OCP (A5) : Industrial Area

The sampler was placed at a height of 1.5 m from the ground level at Muraidih project office.

ii) Govindpur Village (A7) : Industrial area

The location of the sampling station is 23°48'34.00"N & 86°18'22.00"E. The sampler was placed at height of 1.5 m above the ground level at AARC agent Office, Ramkanali.

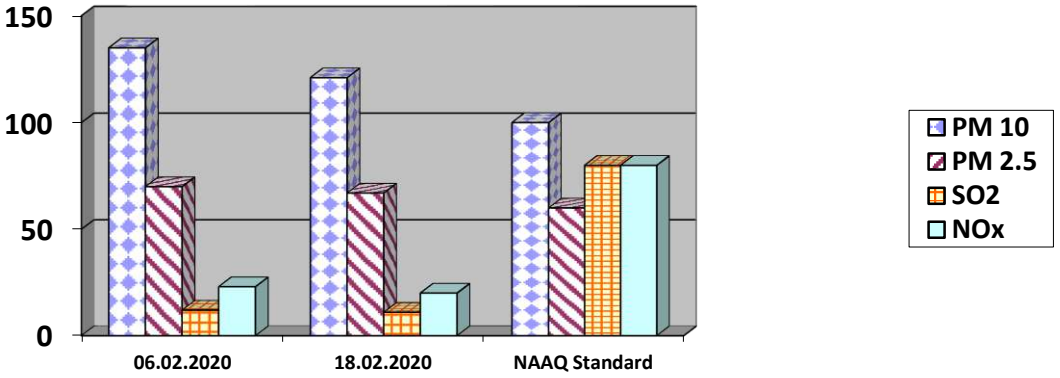
iii)Kharkharee(A21): **Industrial Area**

The location of the sampling station is 23°46'29.00"N & 86°14'37.08"E. The sampler was placed at a height of 1.5 m above the ground level at Kharkharee Colliery.

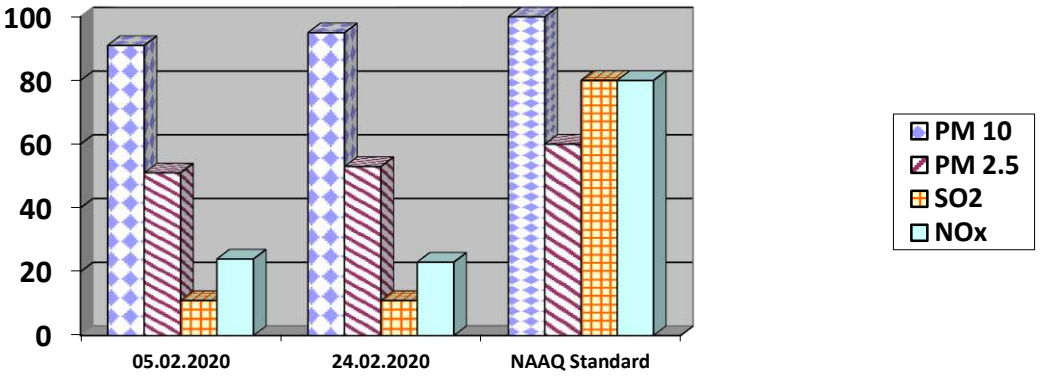
AMBIENT AIR QUALITY DATA

Cluster – III, Bharat Coking Coal limited Month: **FEB.2020** Year : **2019-20.**

Station Name: A6, Block IV		**Zone: Core**		**Category: Industrial**	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO_2**	**NO_X**
1	06.02.2020	135	70	12	23
2	18.02.2020	121	67	11	20
	NAAQ Standard	100	60	80	80



Station Name: A5, Muraidih OCP		**Zone: Buffer**		**Category: Industrial**	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO_2**	**NO_X**
1	05.02.2020	91	51	11	24
2	24.02.2020	95	53	11	23
	NAAQ Standard	100	60	80	80



Note:

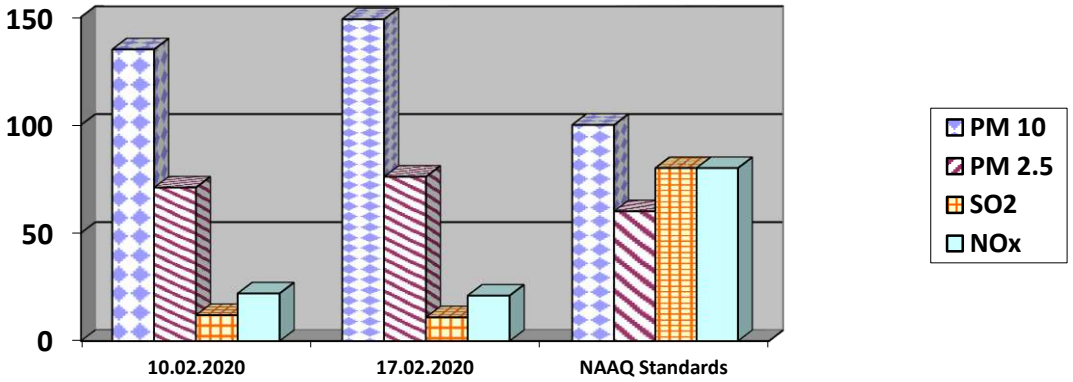
- *All values are expressed in microgram per cubic meter.*
- *24 hours duration*

Analysed By
JSA/SA/SSA

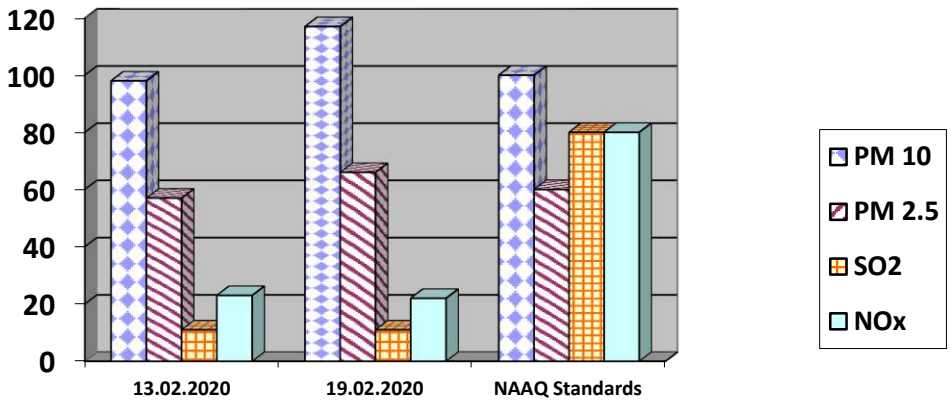
Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

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

Station Name: A7, Govindpur Village		Zone: Buffer		Category: Industrial	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO2**	**NOx**
1	10.02.2020	135	71	12	22
2	17.02.2020	149	76	11	21
	NAAQ Standards	100	60	80	80



Station Name: A21 Kharkharee		Zone: Buffer		Category: Industrial	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO2**	**NOx**
1	13.02.2020	98	57	11	23
2	19.02.2020	117	66	11	22
	NAAQ Standards	100	60	80	80



Note:

- *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 Govindpur (MW3)**

A sampling point is fixed to assess the effluent quality of Mine discharge. This location is selected to monitor effluent discharge in to Khudia Nala and Bagdighi Nala.

3.2 Methodology of sampling and analysis

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

3.3 Results & Interpretations

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

WATER QUALITY DATA

(EFFLUENT WATER- FOUR PARAMETERS)

Name of the Cluster: **Cluster -III**		Month: **FEB.2020**	Name of the Station: **Mine Discharge of Govindpur**	
Sl. No.	**Parameters**	**MW3** First Fortnight 06.02.2020	**MW3** Second Fortnight 18.02.2020	**As per MOEF General Standards for schedule VI**
1	Total Suspended Solids	28	33	*100 (Max)*
2	pH	7.92	8	*5.5 - 9.0*
3	Oil & Grease	<2.0	<2.0	*10 (Max)*
4	COD	32	40	*250 (Max)*

All values are expressed in mg/lit unless specified.

Analysed By
JSA/SA/SSA

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

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

NOISE LEVEL QUALITY MONITORING

4.1Location of sampling sites

i) **Block IV (N6)**
ii) **Muraidih OCP(N5)**
iii) **Govindpur Village(N7)**
iv) **Kharkharee (N21)**

4.2 Methodology of sampling and analysis

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

4.3 Results & Interpretations

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

NOISE LEVEL DATA

Name of the Project: **Cluster -III**			Month: **FEB.2020**		
Sl. No.	**Station Name/Code**	**Category of area**	**Date**	**Noise level dB(A)LEQ**	***Permissible Limit of Noise level in dB(A)***
1	Muraidih (N5)	**Industrial area**	05.02.2020	60.1	*75*
2	Muraidih	**Industrial area**	24.02.2020	52.9	*75*
3	Block-IV(N6)	**Industrial area**	06.02.2020	54.4	*75*
4	Block-IV	**Industrial area**	18.02.2020	53.2	*75*
5	Govindpur/Ramkanali(N7)	**Industrial area**	10.02.2020	52.3	*75*
6	Govindpur/Ramkanali	**Industrial area**	17.02.2020	66.1	*75*
7	Kharkharee(N21)	**Industrial area**	13.02.2020	51.7	*75*
8	Kharkharee	**Industrial area**	19.02.2020	54.2	*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.

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

NATIONAL AMBIENT AIR QUALITY STANDARDS

New Delhi the 18th November 2009

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

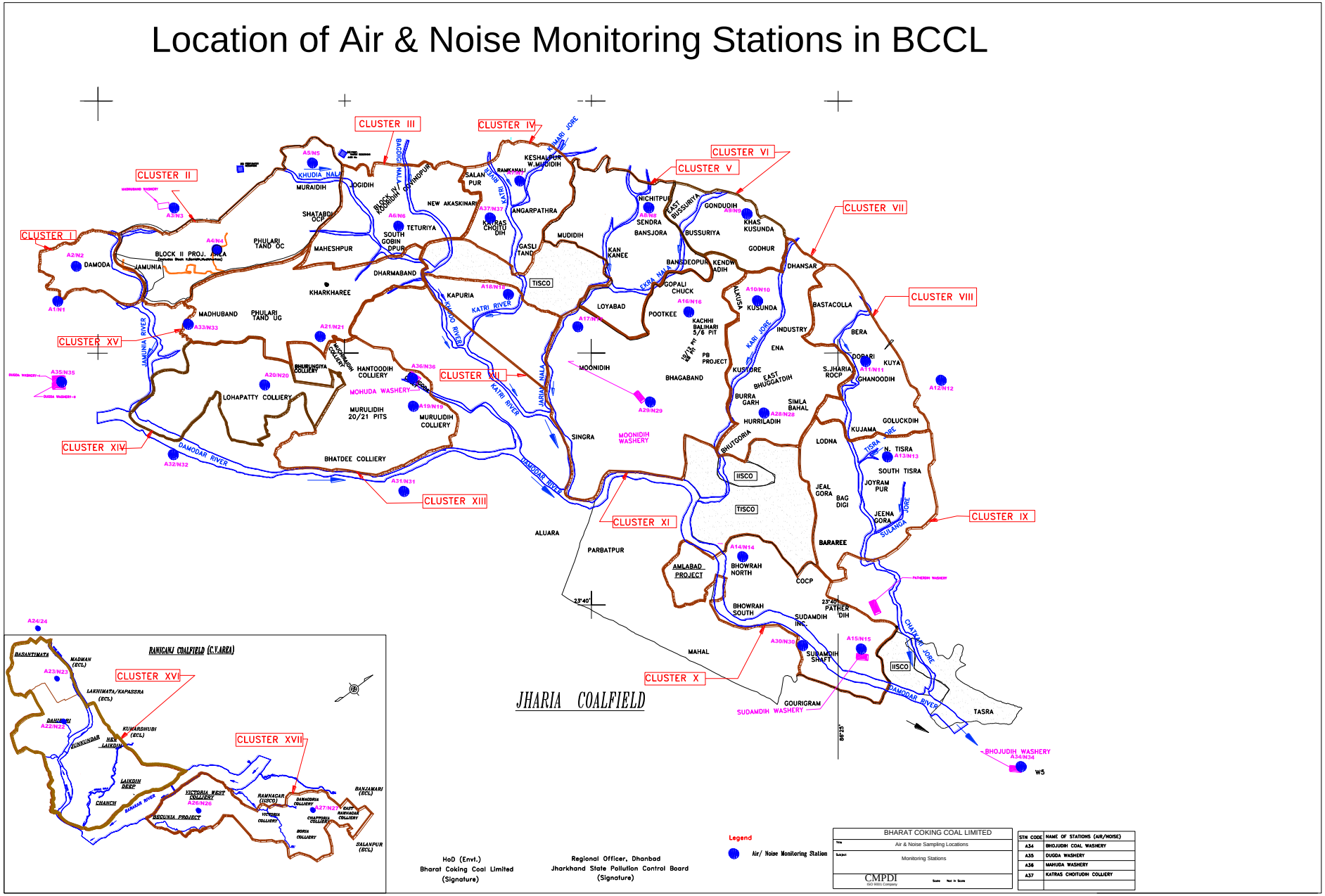
Pollutant	Time Weighted Average	Concentration in Ambient Air		Methods of Measurement
		Industrial, Residential, Rural and other Areas	Ecologically Sensitive Area (Notified by Central Government)	
Sulphur Dioxide (SO_2), µg/m³	Annual * 24 Hours **	50 80	20 80	-Improved West and Gaeke Method -Ultraviolet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

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

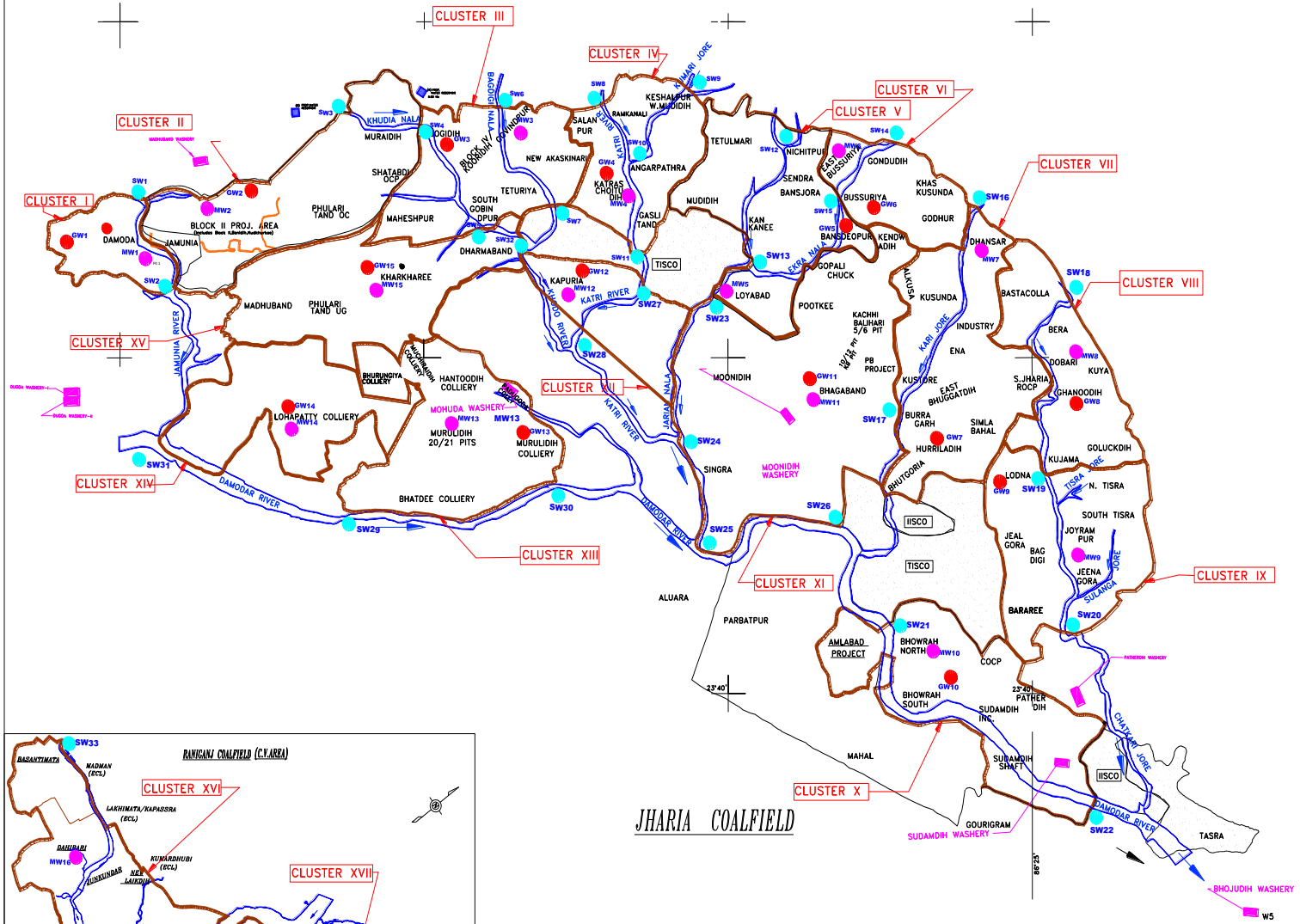
** 24 hourly or 8 hourly or 1 hourly monitored values, as applicable, shall be complied with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

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

Location of Air & Noise Monitoring Stations in BCCL



Water Sampling Locations in BCCL



INDEX

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

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 – III

(FOR THE MONTH MARCH, 2020)

E. C. no. J-11015/213/2010-IA.II (M) dated 06.02.2013.

CMPDI
ISO 9001 Company
Regional Institute-II
Dhanbad, Jharkhand

CONTENTS

SL. NO.	CHAPTER	PARTICULARS	PAGE NO.
1.	CHAPTER - I	EXECUTIVE SUMMARY	3-5
2.	CHAPTER-II	INTRODUCTION	6
3.	CHAPTER-III	RESULTS	7-11
4.	CHAPTER-IV	STANDARDS AND PLANS	12-15

EXECUTIVE SUMMARY

1.0 Introduction

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

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

2.0 Sampling location and rationale

2.1 Ambient air sampling locations

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

2.2 Water sampling stations

The Water sampling stations were selected for mine sump water.

2.3 Noise level monitoring locations

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

3.0 Methodology of sampling and analysis

3.1 Ambient air quality

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

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

3.2 Water quality

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

3.3 Noise level monitoring

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

4.0 Results and interpretations

4.1 Air quality

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

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

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

4.2 Water quality

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

4.3 Noise Level

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

INTRODUCTION

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

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

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

The CLUSTER III is in the westernmost part of the Jharia coalfield. It includes Jogidih Colliery, Maheshpur Colliery, South Govindpur Colliery, Teturiya Colliery, Govindpur Colliery, New Akasshkinaree Mine and Block IV Kooridih Mixed Mine. The cluster – III is situated about 40 - 45 kms from Dhanbad Railway Station. The mines of this cluster - III are operating since pre nationalization period (prior to 1972-73). It is connected by both Railway and Road. The drainage of the area is governed by Khudia and Bagdighi Nala.

The Project has Environmental Clearance from Ministry of Environment, Forest and Climate Change (MoEF&CC) for a rated capacity of 2.769 MTPA (normative) and 3.6 MTPA peak capacity of coal production vide letter no**E. C. no. J-11015/213/2010-IA.II (M) dated 06.02.2013.**

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

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

AMBIENT AIR QUALITY MONITORING

2.1 Location of sampling station and their rationale:

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

2.1.1 Ambient Air Quality Sampling Locations

CORE ZONE Monitoring Location

i) Block IV Kooridih OCP (A6): Industrial Area

The location of the sampling station is at 23°47'54.00"N & 86°16'20.00"E. The sampler was placed at 1.5 m above the ground level near Safety office of Block IV OCP.

BUFFER ZONE Monitoring Location

i) Muraidih OCP (A5) : Industrial Area

The sampler was placed at a height of 1.5 m from the ground level at Muraidih project office.

ii) Govindpur Village (A7) : Industrial area

The location of the sampling station is 23°48'34.00"N & 86°18'22.00"E. The sampler was placed at height of 1.5 m above the ground level at AARC agent Office, Ramkanali.

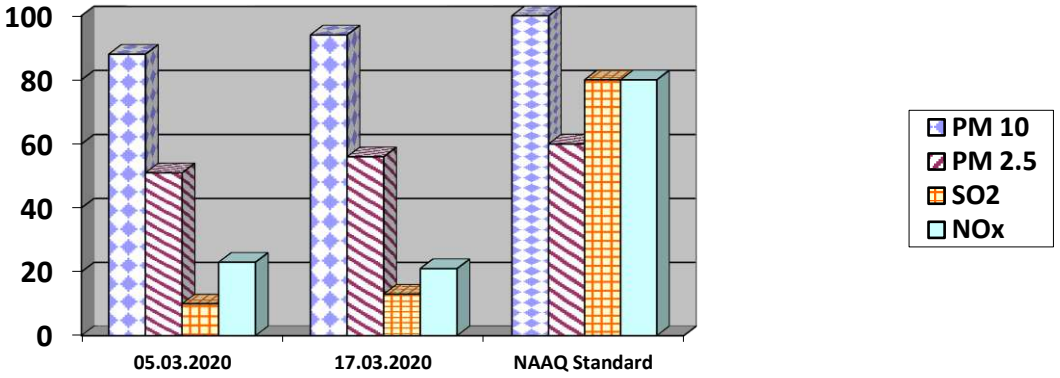
iii)Kharkharee(A21): **Industrial Area**

The location of the sampling station is 23°46'29.00"N & 86°14'37.08"E. The sampler was placed at a height of 1.5 m above the ground level at Kharkharee Colliery.

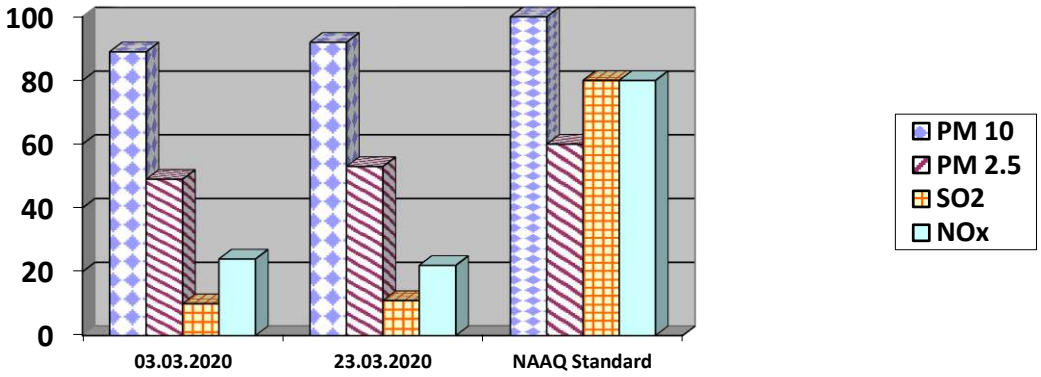
AMBIENT AIR QUALITY DATA

Cluster – III, Bharat Coking Coal limited Month: **MAR.2020** Year : **2019-20.**

Station Name: A6, Block IV		**Zone: Core**		**Category: Industrial**	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO_2**	**NO_X**
1	05.03.2020	88	51	10	23
2	17.03.2020	94	56	13	21
	NAAQ Standard	100	60	80	80



Station Name: A5, Muraidih OCP		**Zone: Buffer**		**Category: Industrial**	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO_2**	**NO_X**
1	03.03.2020	89	49	10	24
2	23.03.2020	92	53	11	22
	NAAQ Standard	100	60	80	80



Note:

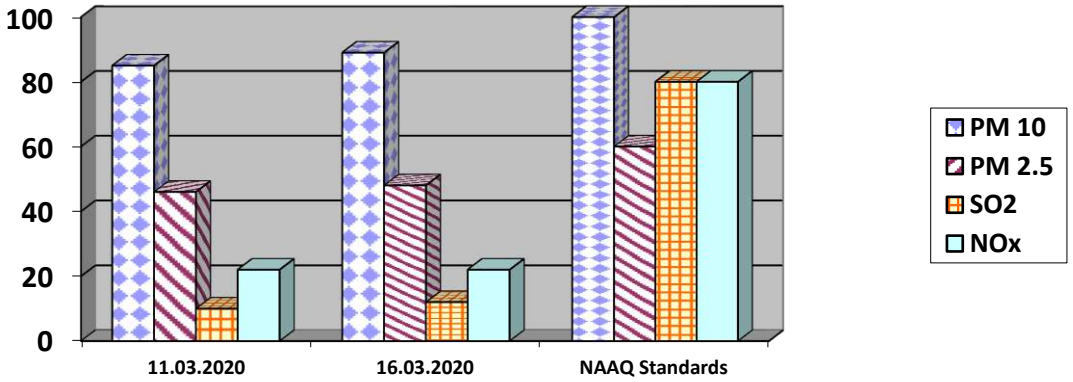
- *All values are expressed in microgram per cubic meter.*
- *24 hours duration*

Analysed By
JSA/SA/SSA

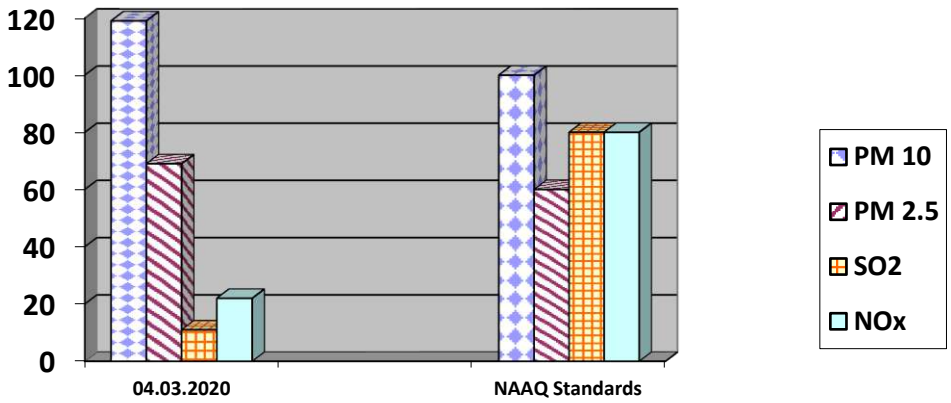
Checked By
Lab In Charge
RI-2, CMPDI, Dhanbad

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

Station Name: A7, Govindpur Village		Zone: Buffer		Category: Industrial	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO2**	**NOx**
1	11.03.2020	85	46	10	22
2	16.03.2020	89	48	12	22
	NAAQ Standards	100	60	80	80



Station Name: A21 Kharkharee		Zone: Buffer		Category: Industrial	
Sl. No.	**Dates of sampling**	**PM 10**	**PM 2.5**	**SO2**	**NOx**
1	04.03.2020	119	69	11	22
2	N/A –Due to Nationwide Lockdown				
	NAAQ Standards	100	60	80	80



Note:

- *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 Govindpur (MW3)

A sampling point is fixed to assess the effluent quality of Mine discharge. This location is selected to monitor effluent discharge in to Khudia Nala and Bagdighi Nala.

3.2 Methodology of sampling and analysis

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

3.3 Results & Interpretations

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

WATER QUALITY DATA

(EFFLUENT WATER- FOUR PARAMETERS)

Name of the Cluster: **Cluster -III**		Month: **MAR.2020**	Name of the Station: **Mine Discharge of Govindpur**	
Sl. No.	**Parameters**	**MW3** First Fortnight	**MW3** Second Fortnight	**As per MOEF General Standards for schedule VI**
		06.03.2020	17.03.2020	
1	Total Suspended Solids	42	35	*100 (Max)*
2	pH	7.85	8.06	*5.5 - 9.0*
3	Oil & Grease	<2.0	<2.0	*10 (Max)*
4	COD	40	36	*250 (Max)*

All values are expressed in mg/lit unless specified.

Analysed By
JSA/SA/SSA

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

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

NOISE LEVEL QUALITY MONITORING

4.1Location of sampling sites

i) **Block IV (N6)**
ii) **Muraidih OCP(N5)**
iii) **Govindpur Village(N7)**
iv) **Kharkharee (N21)**

4.2 Methodology of sampling and analysis

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

4.3 Results & Interpretations

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

NOISE LEVEL DATA

Name of the Project: **Cluster -III**			Month: **MAR.2020**		
Sl. No.	**Station Name/Code**	**Category of area**	**Date**	**Noise level dB(A)LEQ**	***Permissible Limit of Noise level in dB(A)***
1	Muraidih (N5)	**Industrial area**	03.03.2020	62.7	*75*
2	Muraidih	**Industrial area**	23.03.2020	52.9	*75*
3	Block-IV(N6)	**Industrial area**	05.03.2020	56.3	*75*
4	Block-IV	**Industrial area**	17.03.2020	56.8	*75*
5	Govindpur/Ramkanali(N7)	**Industrial area**	11.03.2020	50.8	*75*
6	Govindpur/Ramkanali	**Industrial area**	16.03.2020	65.1	*75*
7	Kharkharee(N21)	**Industrial area**	N/A –Due to Nationwide Lockdown		
8	Kharkharee	**Industrial area**	11.03.2020	66.5	*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.

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

NATIONAL AMBIENT AIR QUALITY STANDARDS

New Delhi the 18th November 2009

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

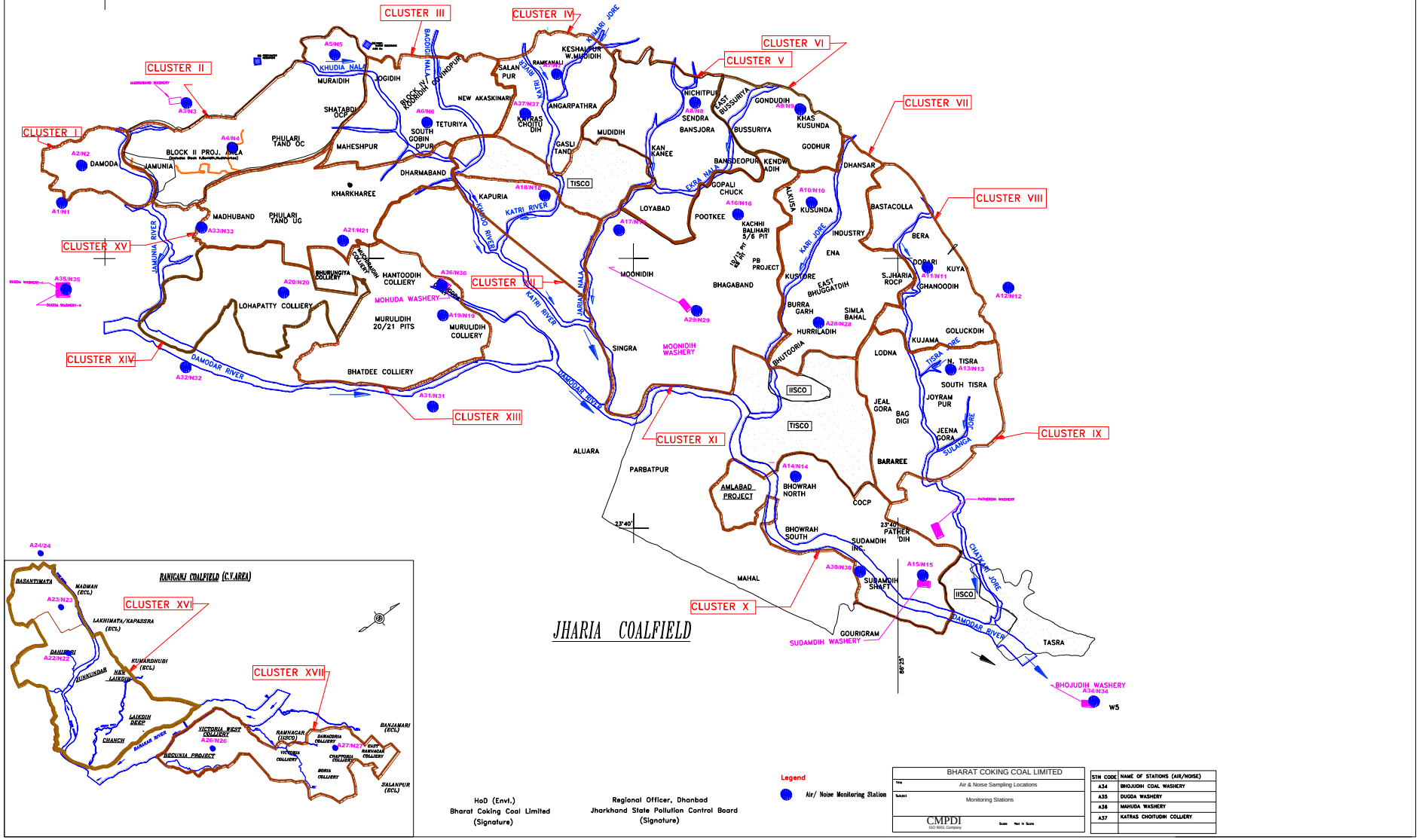
Pollutant	Time Weighted Average	Concentration in Ambient Air		Methods of Measurement
		Industrial, Residential, Rural and other Areas	Ecologically Sensitive Area (Notified by Central Government)	
Sulphur Dioxide (SO_2), µg/m³	Annual * 24 Hours **	50 80	20 80	-Improved West and Gaeke Method -Ultraviolet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

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

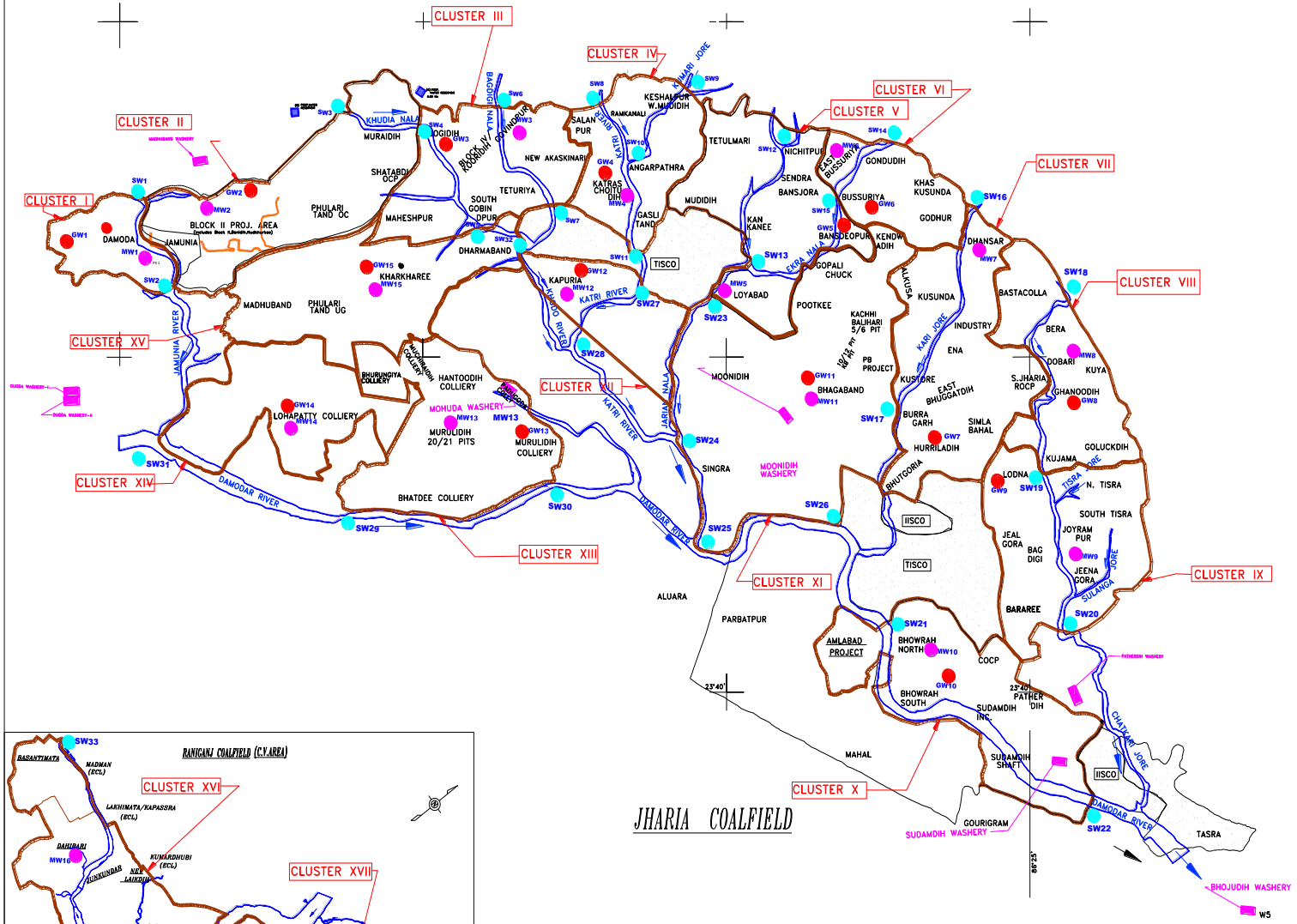
** 24 hourly or 8 hourly or 1 hourly monitored values, as applicable, shall be complied with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

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

Location of Air & Noise Monitoring Stations in BCCL



Water Sampling Locations in BCCL



INDEX

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

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

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

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

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

STRICTLY RESTRICTED
FOR COMPANY USE ONLY RESTRICTED

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

WATER QUALITY REPORT

OF

BHARAT COKING COAL LIMITED, CLUSTER – III

(FOR THE Q.E. MARCH, 2020)

E. C. no. J-11015/213/2010-IA.II (M) dated 06.02.2013

CMPDI

ISO 9001 Company

Regional Institute-II

Dhanbad, Jharkhand

CLUSTER - III

(FOR THE Q.E. MARCH, 2020)

CONTENTS

SL. NO.	CHAPTER	PARTICULARS
1.		EXECUTIVE SUMMARY
2.	CHAPTER - I	INTRODUCTION
3.	CHAPTER-II	WATER SAMPLING & ANALYSIS
4.	**Plates:** Plate No. - I	SURFACE PLAN SHOWING WATER MONITORING LOCATIONS

STRICTLY RESTRICTED

FOR COMPANY USE ONLY RESTRICTED

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

WATER QUALITY REPORT

OF

BHARAT COKING COAL LIMITED
CLUSTER – III

(FOR THE Q.E. MARCH, 2020)

E. C. no. J-11015/213/2010-IA.II (M) dated 06.02.2013

CMPDI

ISO 9001 Company

Regional Institute-II

Dhanbad, Jharkhand

EXECUTIVE SUMMARY

1.0 Introduction

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

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

2.0 Sampling location and rationale

2.1 Water sampling stations

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

3.0 Methodology of sampling and analysis

3.1 Water quality

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

4.0 Results and interpretations

4.1 Water quality

The test results indicate that the major parameters compared with MoEF&CC Gazette Notification No. GSR 742(E) dt 25.09.2000 Standards for Coal Mines, IS.10500/2012 (Drinking water) and IS: 2296 (Surface water), are with in permissible limits

CHAPTER - I

INTRODUCTION

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

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

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

1.1 The CLUSTER III is in the westernmost part of the Jharia coalfield. It includes Jogidih Colliery, Maheshpur Colliery, South Govindpur Colliery, Teturiya Colliery, Govindpur Colliery, New Akashkinaree Mine and Block IV Kooridih Mixed Mine. The cluster – III is situated about 40 - 45 kms from Dhanbad Railway Station. The mines of this cluster - III are operating since pre nationalization period (prior to 1972-73). It is connected by both Railway and Road. The drainage of the area is governed by Khudia and Bagdighi Nala.

1.2 The Project has Environmental Clearance from Ministry of Environment, Forest and Climate Change (MoEF&CC) for a rated capacity of 2.769 MTPA (normative) and 3.6 MTPA peak capacity of coal production vide letter no **E. C. no. J-11015/213/2010-IA.II (M) dated 06.02.2013.**

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

CHAPTER – II

WATER QUALITY MONITORING

2.1 Location of sampling sites

(Refer **Plate No. - I**)

i) Drinking water quality at **Jogidih Village (DW3)**

ii) Surface water quality at **U/S of Khudia Nala (SW4)**

iii) Surface water quality at **D/S of Khudia Nala (SW5)**

iv) Surface water quality at **U/S of Bagdighi Nala (SW6)**

v) Surface water quality at **D/S of Bagdighi Nala (SW7)**

2.2 Methodology of sampling and analysis

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

2.3 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

(SURFACE WATER- ALL PARAMETERS)

Name of the Company: **Bharat Coking Coal Limited** Year : **2019-20**

Name of the Cluster : **Cluster - III** Month: **Q. E. MARCH , 2020**

Stations: **Date of Sampling:**

1. Upstream in Khudia nala SW-4 (wrt Cluster-3) 06/03/2020
2. Down stream in Khudia nala SW-5 13/03/2020
3. Upstream in Bagdigi Nala SW-6 25/03/2020
4. Down stream in Bagdigi Nala SW-7 25/03/2020

Sl. No	Parameter	Sampling Stations				IS: 2296	Detection Limit	BIS Standard & Method
		SW-04 06.03.20	**SW-05** 13.03.20	SW-06 25.03.20	SW-07 25.03.20			
1	Manganese (as Mn), mg/l, Max	<0.2	<0.2	<0.2	<0.2	0.5	0.2	APHA,23rd Edition, AAS-Flame
2	BOD (3 days 27°C), mg/l, Max	<2.0	<2.0	<2.0	2.1	3.00	2.00	**IS 3025 (Part 44) : 1993 Reaffirmed 2019 , 3 day incubation at 27°C**
3	Colour	Colourless	Colourless	Colourless	Colourless	300	Qualitative	Physical/Qualitative
4	Chlorides (as Cl), mg/l, Max	31	47	45	73	600	2.00	IS-3025/32:1988, R-2019 Argentometric
5	Copper (as Cu), mg/l, Max	<0.2	<0.2	<0.2	<0.2	1.5	0.2	IS 3025/42 : 1992 R : 2019, AAS-Flame
6	Dissolved Oxygen, min.	6.0	5.6	5.9	6.9	4	0.10	**IS 3025 (Part 38) : 1989, Reaffirmed 2019 Modified Winkler Azide Method**
7	Fluoride (as F) mg/l, Max	0.64	0.85	0.65	0.72	1.5	0.02	APHA, 23RD Edition, Page 4-90 to , 4500 –F- D (SPADNS Method)
8	Hexavalent Chromium, mg/l, Max	0.013	0.016	<0.01	<0.01	0.05	0.01	IS 3025 (Part 52) : 2003,Reaffirmed 2019
9	Iron (as Fe), mg/l, Max	<0.2	<0.2	<0.2	<0.2	50	0.2	IS 3025 /53 : 2003,R : 2019 , AAS-Flame Method
10	Lead (as Pb), mg/l, Max	0.04	0.06	0.05	0.02	0.1	0.005	APHA, 23rd Edition, AAS-GTA
11	Nitrate (as NO_3), mg/l, Max	12.05	19.29	13.65	3.98	50	0.50	APHA, 23rd Edition, P-4-127, 4500 - NO_3^- B , UV-Spectrophotometric Screening Method
12	pH value	7.60	7.58	7.81	7.35	6.5-8.5	2.5	IS 3025, Part 11 : 1983 R 2017 Electrometric method
13	Phenolic compounds (as C_6H_5OH), mg/l, Max	<0.002	<0.002	<0.002	<0.002	0.005	0.002	APHA, 22nd Edition 4-Amino Antipyrine
14	Total Chromium(as Cr) mg/l, Max	<0.1	<0.1	<0.1	<0.1	2.00	0.1	IS 3025/ 56:2003, R:2019 AAS-Flame
15	Sulphate (as SO_4) mg/l, Max	126	179	181	59	400	2.00	APHA –23rd Edition. P-4-199, 4500 SO_4^{2-} E
16	Total Dissolved Solids, mg/l, Max	448	594	666	411	1500	25.00	IS 3025, Part 16: 1984 R 2017 Gravimetric method
17	Zinc (as Zn), mg/l, Max	<0.1	<0.1	<0.1	<0.1	15	0.1	IS 3025/ 49 : 1994, R : 2019, AAS-Flame

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

(DRINKING WATER- ALL PARAMETERS)

Name of the Company: **Bharat Coking Coal Limited** Year : **2019-20.**

Name of the Cluster : **Cluster - III** Month: **Q. E. MARCH, 2020**

Stations: Jogidih village DW 3 **Year: 2019-20** **Date of sampling: 24.02.2020**

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500	Standard / Test Method
		DW03					
1	Boron (as B), mg/l, Max	<0.2			0.2	0.5	APHA, 23rd Edition ,Carmine
2	Colour,in Hazen Units	1			1	5	APHA, 23rd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	36			1.6	75	IS 3025, Part 40: 1991 R 2019 EDTA Method
4	Chloride (as Cl), mg/l, Max	87			2	250	IS-3025/32:1988, R-2019 Argentometric
5	Copper (as Cu), mg/l, Max	<0.03			0.03	0.05	IS 3025 Part 42 : 1992 R : 2019, AAS-Flame
6	Fluoride (as F) mg/l, Max	<0.2			0.2	1.0	APHA, 23RD Edition, Page 4-90 to , 4500 –F- D (SPADNS Method)
7	Free Residual Chlorine, mg/l, Min	<0.04			0.04	0.2	APHA, 23rd Edition, , 4500-Cl^- B. (Iodometric Method-I)
8	Iron (as Fe), mg/l, Max	<0.2			0.2	1.0	IS 3025 Part 53 : 2003, R : 2019 , AAS-Flame Method
9	Lead (as Pb), mg/l, Max	<0.005			0.005	0.01	IS:3025(Part 47):1994 (Reaffirmed 2019) APHA, 23rd Edition, AAS-GTA
10	Manganese (as Mn), mg/l, Max	<0.02			0.02	0.1	IS-3025(Part 59):2006, R 2017 AAS-Flame
11	Nitrate (as NO3), mg/l, Max	25.9			0.5	45	APHA, 23rd Edition, P-4-127, 4500 - NO_3^- B , UV-Spectrophotometric Screening Method
12	Odour	Agreeable			Qualitative	Agreeable	APHA, 23rd Edition, , 2150-C
13	pH value	7.32			0.2	6.5-8.5	IS 3025, Part 11 : 1983 R 2017 Electrometric method
14	Phenolic compounds (as C6H5OH), mg/l, Max	<0.001			0.001	0.002	APHA, 22nd Edition,4-Amino Autipyrine
15	Mercury (as Hg), mg/l, Max	<0.0005			0.0005	0.001	APHA,23rd Edition, AAS-VGA
16	Sulphate (as SO4) mg/l, Max	310			2	200	APHA –23rd Edition. P-4-199, 4500 SO_4^{2-} E
17	Taste	Acceptable			Qualitative	Acceptable	APHA,23rd Edition, 2160-C Flavour Rating Assesment
18	Total Alkalinity (caco3),, mg/l, Max	155			4	200	IS 3025, Part 23: 1986 R 2019 Titration Method
19	Cadmium (as Cd), mg/l, Max	<0.0005			0.0005	0.003	APHA,23rd Edition, AAS-GTA Method
20	Total Chromium (as Cr), mg/l, Max	<0.04			0.04	0.05	IS-3025 Part 52:2003, R:2019,AAS-Flame
21	Total Dissolved Solids, mg/l, Max	797			25	500	IS 3025, Part 16: 1984 R 2017 Gravimetric method
22	Total Hardness (caco3), mg/l, Max	590			4	200	IS 3025, Part 21, 2009 R 2019 EDTA Method
23	Turbidity, NTU, Max	1			1	5	IS 3025, Part 10 : 1984 R 2017 Nephelometric Method
24	Zinc (as Zn), mg/l, Max	<0.1			0.01	5	IS 3025 Part 49 : 1994,R : 2019, AAS-Flame
25	Nickel as Ni, mg/l Max	<0.01			0.01	5	IS 3025 Pat 54 : 2003,R : 2019, AAS-Flame

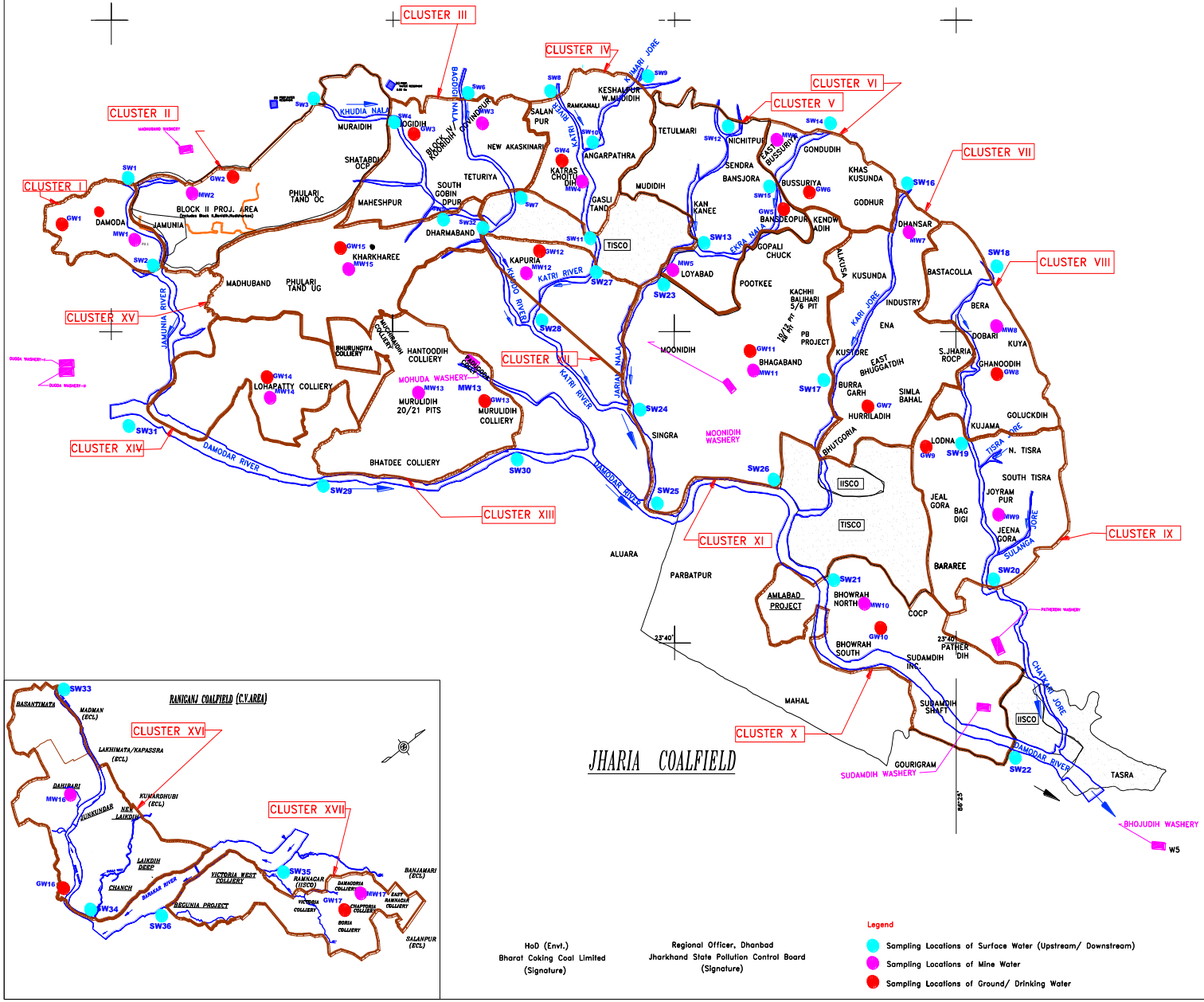
All values are expressed in mg/lit unless specified.

Analysed By
JSA/SA/SSA

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

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

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	Murilidih
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

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

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

WATER QUALITY REPORT

OF

BHARAT COKING COAL LIMITED, CLUSTER – III

(FOR THE Q.E. DECEMBER, 2019)

CMPDI
ISO 9001 Company
Regional Institute-II
Dhanbad, Jharkhand

CLUSTER - III

(FOR THE Q.E. DECEMBER, 2019)

CONTENTS

SL. NO.	CHAPTER	PARTICULARS
1.		EXECUTIVE SUMMARY
2.	CHAPTER - I	INTRODUCTION
3.	CHAPTER-II	WATER SAMPLING & ANALYSIS
4.	**Plates:** Plate No. - I	SURFACE PLAN SHOWING WATER MONITORING LOCATIONS

STRICTLY RESTRICTED

FOR COMPANY USE ONLY RESTRICTED

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

WATER QUALITY REPORT

OF

BHARAT COKING COAL LIMITED
CLUSTER – III

(FOR THE Q.E. DECEMBER, 2019)

CMPDI

ISO 9001 Company

Regional Institute-II

Dhanbad, Jharkhand

EXECUTIVE SUMMARY

1.0 Introduction

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

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

2.0 Sampling location and rationale

2.1 Water sampling stations

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

2.2 Ambient air sampling locations

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

3.0 Methodology of sampling and analysis

3.1 Water quality

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

3.2 Heavy Metal in Ambient Air

Parameters chosen for assessment of Heavy metal in Ambient Air Quality were cadmium (Cd), Mercury (Hg), Arsenic (As), Chromium (Cr), Nickel (Ni), and Lead (Pb). Respirable Dust Samplers (RDS) & fine particulates for PM 2.5 sampler were

used for sampling PM 10 & PM 2.5 respectively. These heavy metals are analyzed regularly on half yearly basis. The samples were analyzed in Environmental Laboratory of CMPDI, RI-II, Dhanbad

4.0 Results and interpretations

4.1 Water quality

The test results indicate that the major parameters compared with MoEF&CC Gazette Notification No. GSR 742(E) dt 25.09.2000 Standards for Coal Mines, IS.10500/2012 (Drinking water) and IS: 2296 (Surface water), are with in permissible limits.

4.2 Heavy Metal in Ambient Air

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

CHAPTER - I

INTRODUCTION

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

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

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

1.1 The CLUSTER III is in the westernmost part of the Jharia coalfield. It includes Jogidih Colliery, Maheshpur Colliery, South Govindpur Colliery, Teturiya Colliery, Govindpur Colliery, New Akashkinaree Mine and Block IV Kooridih Mixed Mine. The cluster – III is situated about 40 - 45 kms from Dhanbad Railway Station. The mines of this cluster - III are operating since pre nationalization period (prior to 1972-73). It is connected by both Railway and Road. The drainage of the area is governed by Khudia and Bagdighi Nala.

1.2 The Project has Environmental Clearance from Ministry of Environment, Forest and Climate Change (MoEF&CC) for a rated capacity of 2.769 MTPA (normative) and 3.6 MTPA peak capacity of coal production vide letter no **E. C. no. J-11015/213/2010-IA.II (M) dated 06.02.2013.**

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

CHAPTER – II

AMBIENT AIR QUALITY MONITORING

2.1 Location of sampling station and their rationale:

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

2.2 Ambient Air Quality Sampling Locations

CORE ZONE Monitoring Location

i) Block IV Kooridih OCP (A6): Industrial Area

The location of the sampling station is at 23°47'54.00"N & 86°16'20.00"E.

BUFFER ZONE Monitoring Location

i) Muraidih OCP (A5) : Industrial Area

The sampler was placed at a height of 1.5 m from the ground level at Muraidih project office.

ii) Govindpur Village (A7) : Industrial area

The location of the sampling station is 23°48'34.00"N & 86°18'22.00"E.

iii)Kharkharee(A21): **Industrial Area**

The location of the sampling station is 23°46'29.00"N & 86°14'37.08"E.

2.3 Results and interpretations

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

AMBIENT AIR QUALITY DATA

Name of the Company: **Bharat Coking Coal Limited** Year : **2019-20[1].**

Name of the Cluster : **Cluster -III** PERIOD: **Q. E. DEC- 2019.**

MONTH: December 2019

Heavy Metal Analysis report of Ambient Air Quality

SAMPLE	Cadmium(Cd) (µg/m3)	Mercury(Hg) (µg/m3)	Iron(Fe) (µg/m3)	Chromium(Cr) (µg/m3)	Nickel (Ni) (ng/m3)	Lead (Pb) (µg/m3)
Muraidih OCP (A5)	<0.001	0.005	4.45	<0.01	<0.1	0.025
Block IV Kooridih OCP (A6)	0.001	0.003	4.86	0.01	<0.1	0.023
Govindpur Village (A7)	0.001	0.008	6.23	0.02	<0.1	0.005
Kharkharee(A21)	<0.001	0.002	4.26	0.01	<0.1	0.009

CHAPTER – II

WATER QUALITY MONITORING

3.1 Location of sampling sites

(Refer **Plate No. - I**)

i) Drinking water quality at **Jogidih Village (DW3)**

ii) Surface water quality at **U/S of Khudia Nala (SW4)**

iii) Surface water quality at **D/S of Khudia Nala (SW5)**

iv) Surface water quality at **U/S of Bagdighi Nala (SW6)**

v) Surface water quality at **D/S of Bagdighi Nala (SW7)**

vi) Mine Effluent quality at **Jogidih (MW3)**

3.2 Methodology of sampling and analysis

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

3.3 Results & Interpretations

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

WATER QUALITY

(SURFACE WATER- ALL PARAMETERS)

Name of the Company: **Bharat Coking Coal Limited** Year : **2019-20**

Name of the Cluster : **Cluster - III** Month: **Q. E. DECEMBER , 2019**

Stations:

1. Upstream in Khudia nala SW-4 (wrt Cluster-3)
2. Down stream in Khudia nala SW-5
3. Upstream in Bagdigi Nala SW-6
4. Down stream in Bagdigi Nala SW-7

Date of Sampling:

06/12/2019
10/12/2019
21/12/2019
21/12/2019

Sl. No	Parameter	Sampling Stations				IS: 2296	Detection Limit	BIS Standard & Method
		SW-04 06.12.19	**SW-05** 10.12.19	SW-06 **21.12.19**	SW-07 21.12.19			
1	Manganese (as Mn), mg/l, Max	<0.2	<0.2	<0.2	<0.2	0.5	0.2	APHA,23rd Edition, AAS-Flame
2	BOD (3 days 27°C), mg/l, Max	<2.0	<2.0	<2.0	<2.0	3.00	2.00	**IS 3025 (Part 44) : 1993 Reaffirmed 2019 , 3 day incubation at 27°C**
3	Colour	colourless	colourless	colourless	colourless	300	Qualitative	Physical/Qualitative
4	Chlorides (as Cl), mg/l, Max	30	46	38	72	600	2.00	IS-3025/32:1988, R-2019 Argentometric
5	Copper (as Cu), mg/l, Max	<0.2	<0.2	<0.2	<0.2	1.5	0.2	IS 3025/42 : 1992 R : 2019, AAS-Flame
6	Dissolved Oxygen, min.	8.1	8.0	7.6	7.4	4	0.10	**IS 3025 (Part 38) : 1989, Reaffirmed 2019 Modified Winkler Azide Method**
7	Fluoride (as F) mg/l, Max	0.65	0.83	0.67	0.39	1.5	0.02	APHA, 23RD Edition, Page 4-90 to , 4500 –F- D (SPADNS Method)
8	Hexavalent Chromium, mg/l, Max	<0.01	<0.01	<0.01	<0.01	0.05	0.01	IS 3025 (Part 52) : 2003,Reaffirmed 2019
9	Iron (as Fe), mg/l, Max	0.24	0.20	<0.2	0.28	50	0.2	IS 3025 /53 : 2003,R : 2019 , AAS-Flame Method
10	Lead (as Pb), mg/l, Max	<0.005	<0.005	<0.005	<0.005	0.1	0.005	APHA, 23rd Edition, AAS-GTA
11	Nitrate (as NO_3), mg/l, Max	2.34	10.01	<0.5	2.41	50	0.50	APHA, 23rd Edition, P-4-127, 4500 - NO_3^- B , UV-Spectrophotometric Screening Method
12	pH value	8.26	8.28	8.27	8.20	6.5-8.5	2.5	IS 3025, Part 11 : 1983 R 2017 Electrometric method
13	Phenolic compounds (as C_6H_5OH), mg/l, Max	<0.002	<0.002	<0.002	<0.002	0.005	0.002	APHA, 22nd Edition 4-Amino Antipyrine
14	Total Chromium(as Cr) mg/l, Max	<0.1	<0.1	<0.1	<0.1	2.00	0.1	IS 3025/ 56:2003, R:2019 AAS-Flame
15	Sulphate (as SO_4) mg/l, Max	43	193	25	43	400	2.00	APHA –23rd Edition. P-4-199, 4500 SO_4^{2-} E
16	Total Dissolved Solids, mg/l, Max	295	568	253	362	1500	25.00	IS 3025, Part 16: 1984 R 2017 Gravimetric method
17	Zinc (as Zn), mg/l, Max	<0.1	<0.1	<0.1	<0.1	15	0.1	IS 3025/ 49 : 1994, R : 2019, AAS-Flame

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

(DRINKING WATER- ALL PARAMETERS)

Name of the Company: **Bharat Coking Coal Limited** Year : **2019-20.**

Name of the Cluster : **Cluster - III** Month: **Q. E. December, 2019**

Stations: Jogidih village DW 3 **Year: 2019-20** **Date of sampling: 21.12.19**

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500	Standard / Test Method
		DW 03					
1	Boron (as B), mg/l, Max	<0.2			0.2	0.5	APHA, 23rd Edition ,Carmine
2	Colour,in Hazen Units	1			1	5	APHA, 23rd Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	59			1.6	75	IS 3025, Part 40: 1991 R 2019 EDTA Method
4	Chloride (as Cl), mg/l, Max	82			2	250	IS-3025/32:1988, R-2019 Argentometric
5	Copper (as Cu), mg/l, Max	0.09			0.03	0.05	IS 3025 Part 42 : 1992 R : 2019, AAS-Flame
6	Fluoride (as F) mg/l, Max	0.33			0.2	1.0	APHA, 23RD Edition, Page 4-90 to , 4500 –F- D (SPADNS Method)
7	Free Residual Chlorine, mg/l, Min	<0.04			0.04	0.2	APHA, 23rd Edition, , 4500-Cl^- B. (Iodometric Method-I)
8	Iron (as Fe), mg/l, Max	0.2			0.06	1.0	IS 3025 Part 53 : 2003, R : 2019 , AAS-Flame Method
9	Lead (as Pb), mg/l, Max	0.01			0.005	0.01	IS:3025(Part 47):1994 (Reaffirmed 2019) APHA, 23rd Edition, AAS-GTA
10	Manganese (as Mn), mg/l, Max	<0.02			0.02	0.1	IS-3025(Part 59):2006, R 2017 AAS-Flame
11	Nitrate (as NO_3), mg/l, Max	25.48			0.5	45	APHA, 23rd Edition, P-4-127, 4500 - NO_3^- B , UV-Spectrophotometric Screening Method
12	Odour	Agreeable			Qualitative	Agreeable	APHA, 23rd Edition, , 2150-C
13	pH value	7.78			0.2	6.5-8.5	IS 3025, Part 11 : 1983 R 2017 Electrometric method
14	Phenolic compounds (as C_6H_5OH), mg/l, Max	<0.001			0.001	0.002	APHA, 22nd Edition,4-Amino Autipyrine
15	Mercury (as Hg), mg/l, Max	<0.0005			0.0005	0.001	APHA,23rd Edition, AAS-VGA
16	Sulphate (as SO_4) mg/l, Max	272			2	200	APHA –23rd Edition. P-4-199, 4500 SO_4^{2-} E
17	Taste	Acceptable			Qualitative	Acceptable	APHA,23rd Edition, 2160-C Flavour Rating Assesment
18	Total Alkalinity (c_ac_{03}),, mg/l, Max	148			4	200	IS 3025, Part 23: 1986 R 2019 Titration Method
19	Cadmium (as Cd), mg/l, Max	<0.0005			0.0005	0.003	APHA,23rd Edition, AAS-GTA Method
20	Total Chromium (as Cr), mg/l, Max	<0.04			0.04	0.05	IS-3025 Part 52:2003, R:2019,AAS-Flame
21	Total Dissolved Solids, mg/l, Max	890			25	500	IS 3025, Part 16: 1984 R 2017 Gravimetric method
22	Total Hardness (c_ac_{03}), mg/l, Max	564			4	200	IS 3025, Part 21, 2009 R 2019 EDTA Method
23	Turbidity, NTU, Max	1			1	5	IS 3025, Part 10 : 1984 R 2017 Nephelometric Method
24	Zinc (as Zn), mg/l, Max	0.35			0.01	5	IS 3025 Part 49 : 1994,R : 2019, AAS-Flame
25	Nickel as Ni, mg/l Max	0.11			0.01	5	IS 3025 Pat 54 : 2003,R : 2019, AAS-Flame

WATER QUALITY

(MINE EFFLUENT- 27 PARAMETERS)

Name of the Company: **Bharat Coking Coal Limited** Year : **2019-20.**

Name of the Cluster : **Cluster - III** Month: **Q. E. December, 2019**

Effluent water of BCCL Mines					**Date of Sampling:**
Sample Code :MW 03 Govindpur colliery					26.12.2019
Sl.No.	**Parameter**	**Results**	**Detection Limit**	**MOEF -SCH-VI STANDARDS Class 'A'**	**BIS Standard & Method**
1	Ammonical Nitrogen, mg/l, Max	0.08	0.02	50.0	IS 3025/34:1988, R : 2009, Nessler's
2	Mercury (as Hg), mg/l, *Max*	<0.0005	0.0005	0.01	APHA 23rd Edition, AAS-VGA
3	B.O.D (3 days 27°C), mg/l, Max	<2	2.00	30.0	IS 3025 /44:1993,R:2003 3 day incubation at 27°C
4	Colour	Colourless	Qualitative	Qualitative	Physical/Qualitative
5	COD, mg/l, Max	48	4.00	250.0	APHA 23rd Edition 5220 C Titrimetric Method
6	Copper (as Cu), mg/l, *Max*	<0.2	0.2	3.0	IS 3025(Part42): 1992 R : 2019, AAS-Flame
7	Dissolved Phosphate (as P), mg/l, Max	<0.3	0.30	5.0	IS 3025/ 31, 1988 R 2019
8	Fluoride (as F) mg/l, *Max*	0.52	0.02	2.0	APHA, 23RD Edition, Page 4-90 to , 4500 –F- D (SPADNS Method)
9	Free Ammonia, mg/l, Max	<0.01	0.01	5.0	IS:3025/34:1988, Nesseler's
10	Hexavalent Chromium, mg/l, Max	0.018	0.01	0.1	IS 3025 (Part 52) : 2003,Reaffirmed 2019
11	Iron (as Fe), mg/l, *Max*	0.2	0.2	3.0	IS 3025 (Part 53) : 2003, R : 2019 , AAS-Flame
12	Lead (as Pb), mg/l, *Max*	<0.005	0.005	0.1	APHA, 23rd Edition, AAS-GTA
13	Manganese(as Mn), mg/l, Max	<0.2	0.2	2.0	IS-3025(Part 59):2006, R 2017 AAS-Flame /APHA, 23rd Edition, 3111B, AAS-Flame
14	Nickel (as Ni), mg/l, *Max*	<0.1	0.1	3.0	IS-3025(Part 54):2003, R:2019 AAS-Flame
15	Nitrate Nitrogen, mg/l, *Max*	<0.5	0.50	10.0	APHA, 23 rd Edition,UV-Spectrphotometric
16	Oil & Grease, mg/l, Max	<2.0	2.00	10.0	IS 3025/39:1991, R : 2019, Partition Gravimetric
17	pH value	8.11	2.5	5.5 to 9.0	IS-3025/11:1983, R-2017, Electrometric
18	Phenolic compounds (as C_6H_5OH),mg/l, *Max*	<0.002	0.002	1.0	APHA, 23rd Edition 4-Amino Antipyrine
19	Sodium (as Na), mg/l, Max	<0.005	0.005	-	IS-3025 (Part 45):1993, R:2019 AAS-Flame
20	Sulphide (as S^{2-}) mg/l Max.	<0.005	0.005	2.0	APHA 23rd Edition Methylene Blue Method
21	Temperature (°C)	17.2	Shall not exceed 5^0 C above the receiving temp.		IS-3025/09:1984, Thermometeric
22	Total Chromium (as Cr), mg/l, *Max*	<0.1	0.1	2.0	IS-3025(Part 52):2003, R:2019 AAS-Flame
23	Total Kjeldahl Nitrogen, mg/l, Max	1.4	1.00	100.0	IS:3025/34:1988, Nesseler's
24	Total Residual Chlorine, mg/l, Max	<0.04	0.04	1.0	APHA, 23rd Edition, , 4500-Cl B. (Iodometric Method-I)
25	Total Suspended Solids, mg/l, Max	34	10.00	100.0	IS 3025/17:1984, R :2017, Gravimetric
26	Zinc (as Zn), mg/l, *Max*	0.1	0.1	5.0	IS 3025 /49 : 1994, R : 2019, AAS-Flame
27	Odour	Agreeable	Agreeable	Qualitative	APHA, 23rd Edition, , 2150-C

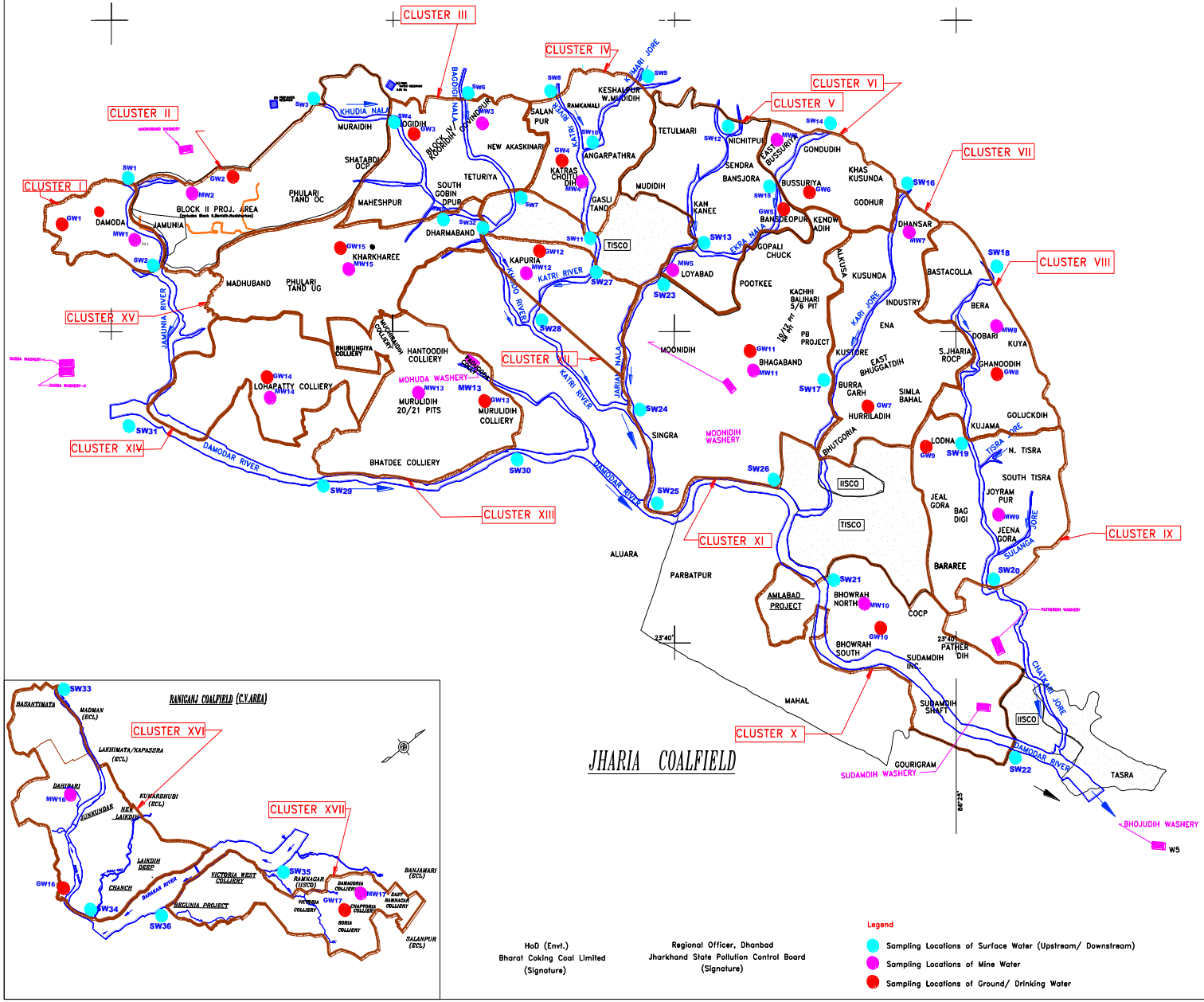
All values are expressed in mg/lit unless specified.

Analysed By
JSA/SA/SSA

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

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

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	Murilidih
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

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