

## भारत कोकिंग कोल लिमिटेड

एक मिनिरतन कम्पनी

(कोल इंडिया लिमिटेड का एक अंग)

महाप्रबंधक का कार्यालय, पूर्वी झरिया क्षेत्र

पो.ओ. - भौरा, जिला - धनबाद (झारखण्ड)

पिन - 828302 दूरभाष - 0326-2230050,

ईमेल - [cgmej@bccl.gov.in](mailto:cgmej@bccl.gov.in)

पंजीकृत कार्यालय: कोयला भवन, कोयला नगर, धनबाद-

828004, (झारखण्ड)

CIN: U10101JH1972GOI000918

दूरभाष-0326-2230050/फैक्स-0326-2230050, ईमेल-

[cos@bccl.gov.in](mailto:cos@bccl.gov.in)



## Bharat Coking Coal Limited

A MINI RATNA Co.

(A Subsidiary of Coal India Ltd)

Office of the General Manager, Eastern Jharia Area

P.O. Bhowra, Dist: Dhanbad (Jharkhand), PIN- 828302

Tel.: 0326-2320077, Email-[cgmej@bccl.gov.in](mailto:cgmej@bccl.gov.in)

Regd.Off: Koyla Bhawan, Koyla Nagar, Dhanbad-825005,

CIN: U10101JH1972GOI000918,

Tel.: 0326-2230190/FAX: 0326-2230050, Email - [cos@bccl.gov.in](mailto:cos@bccl.gov.in)

Ref. No.: BCCL/EJ/GM/Env./2021/ 88

Date: 29/11/2021

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

**Sub.:** Six monthly compliance report of the conditions of Environmental Clearance granted to Cluster X group of mines of BCCL for the period from April 2021 to September 2021.  
(Ref.: EC Order No.- J-11015/380/2010-IA.II(M) dated 06.02.2013 & EC amended Vide letter no.- J-11015/380/2010-IA.II(M) dated 12.06.2019)

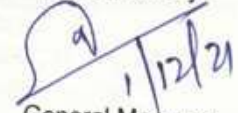
Dear Sir,

Kindly find the enclosed here with the six monthly compliance report of the conditions of Environmental Clearance for the period from April 2021 to September 2021 in respect of Cluster X group of mines of BCCL.

Thanking You.

Encl.: Six monthly compliance report with annexure

Yours faithfully

  
1/12/21  
General Manager  
Eastern Jharia Area, BCCL  
Cluster X

CC to:

1. Director, 1A Monitoring Cell, Paryavaran Bhawan, CGO Complex, New delhi-110003.
2. Member Secretary, JSPCB, Ranchi
3. Dy. GM / HOD (Env.), BCCL, Koyla Bhawan, Dhanbad
4. AGM, E.J. Area, Bhowra, BCCL
5. Area Manager (Env.), E.J. Area
6. Master File

## ENVIRONMENTAL CLEARANCE COMPLIANCE OF CLUSTER-X

**(GRANTED VIDE J-11015/380/2010-IA.II (M) Dated 06.02.2013 and  
EC AMENDED DATED 12.06.2019)**

**(Period: April 2021 to Sept. 2021)**

Sl. No.	A. Specific Conditions by MOEF:	Compliance																																																																																																															
I.	The maximum production from the opencast and underground section in the cluster shall not exceed beyond that for which environmental clearance has been granted for the cluster X as below:	<p>The production from the cluster is within the limit for which environmental clearance has been granted. The year wise and colliery wise production of coal in MTPA is as follows:</p> <p style="text-align: center;"><b><u>COAL PRODUCTION DATA (IN MT) OF CLUSTER X SINCE GRANT OF EC</u></b></p> <table border="1"> <thead> <tr> <th>Mine Name</th> <th>EC Capacity (Peak)</th> <th>2013-14</th> <th>2014-15</th> <th>2015-16</th> <th>2016-17</th> <th>2017-18</th> <th>2018-19</th> <th>2019-20</th> <th>2020-21</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Bhowra North</td> <td>UG</td> <td>0.143</td> <td>0.024</td> <td>0.032</td> <td>0.028</td> <td>0.023</td> <td>0.012</td> <td>0.006</td> <td>0.00015</td> </tr> <tr> <td>OC</td> <td>0.546</td> <td>0.143</td> <td>0.01</td> <td>0.028</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td rowspan="2">Bhowra South</td> <td>UG</td> <td>0.377</td> <td>0.037</td> <td>0.032</td> <td>0.025</td> <td>0.022</td> <td>0.01</td> <td>0.007</td> <td>0.0003</td> </tr> <tr> <td>OC</td> <td>1.2</td> <td>0.185</td> <td>0.11</td> <td>0.28</td> <td>0.413</td> <td>0.458</td> <td>0.892</td> <td>0.318</td> </tr> <tr> <td>ASP Colliery</td> <td>OCP</td> <td>0.709</td> <td>0.139</td> <td>0.085</td> <td>0.219</td> <td>0.267</td> <td>0.277</td> <td>0.239</td> <td>0.175</td> </tr> <tr> <td>Sudamdih Shaft</td> <td>UG</td> <td>0.24</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>Amlabad UG</td> <td>UG</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td colspan="2"><b>Total (Cluster X)</b></td> <td><b>2.289*</b></td> <td><b>0.528</b></td> <td><b>0.269</b></td> <td><b>0.580</b></td> <td><b>0.725</b></td> <td><b>0.757</b></td> <td><b>1.145</b></td> <td><b>0.600</b></td> </tr> </tbody> </table>	Mine Name	EC Capacity (Peak)	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	Bhowra North	UG	0.143	0.024	0.032	0.028	0.023	0.012	0.006	0.00015	OC	0.546	0.143	0.01	0.028	0	0	0	0	Bhowra South	UG	0.377	0.037	0.032	0.025	0.022	0.01	0.007	0.0003	OC	1.2	0.185	0.11	0.28	0.413	0.458	0.892	0.318	ASP Colliery	OCP	0.709	0.139	0.085	0.219	0.267	0.277	0.239	0.175	Sudamdih Shaft	UG	0.24	0	0	0	0	0	0	0	Amlabad UG	UG	0	0	0	0	0	0	0	0	<b>Total (Cluster X)</b>		<b>2.289*</b>	<b>0.528</b>	<b>0.269</b>	<b>0.580</b>	<b>0.725</b>	<b>0.757</b>	<b>1.145</b>	<b>0.600</b>																							
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II.	All the void /water bodies should be backfilled up to Ground level and no OB dump at the end of mining.	<p>This activity is post closure mining activity and will be done as per approved mine closure plan. However, progressive backfilling is done, the year wise data of backfilling in Ha. is as follows:</p> <p style="text-align: center;"><b><u>UNIT WISE BACKFILLING DATA (IN HA) OF CLUSTER X</u></b></p> <table border="1"> <thead> <tr> <th>Mine Name</th> <th>2013-14</th> <th>2014-15</th> <th>2015-16</th> <th>2016-17</th> <th>2017-18</th> <th>2018-19</th> <th>2019-20</th> </tr> </thead> <tbody> <tr> <td>Bhowra North-Mix</td> <td>1.76</td> <td>3.17</td> <td>0.00</td> <td>0.00</td> <td>0.00</td> <td>0.00</td> <td>0.00</td> </tr> <tr> <td>Bhowra South- Mix</td> <td>4.10</td> <td>6.50</td> <td>6.50</td> <td>5.24</td> <td>5.24</td> <td>-</td> <td>-</td> </tr> <tr> <td>ASP Colliery - OC</td> <td>1.93</td> <td>0.96</td> <td>0.6</td> <td>0.58</td> <td>0.51</td> <td colspan="2">16.4</td> </tr> <tr> <td>Sudamdih Shaft</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> </tr> <tr> <td>Amlabad UG</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> </tr> </tbody> </table> <p>After physical reclamation/backfilling, biological reclamation has been done which is as follows:</p> <p style="text-align: center;"><b><u>AREA OF ECOLOGICAL RESTORATION SITES / PLANTATION / BIOLOGICAL RECLAMATION (in Ha.)</u></b></p> <table border="1"> <thead> <tr> <th>Colliery / Mine Name</th> <th>2013-14</th> <th>2014-15</th> <th>2015-16</th> <th>2016-17</th> <th>2017-18</th> <th>2018-19</th> <th>2019-20</th> <th>2020-21</th> </tr> </thead> <tbody> <tr> <td>Bhowra North</td> <td>-</td> <td>-</td> <td>-</td> <td>5.20</td> <td>3.10</td> <td>-</td> <td>-</td> <td>-</td> </tr> <tr> <td>Bhowra South</td> <td>-</td> <td>4.78</td> <td>-</td> <td>-</td> <td>-</td> <td>4.50</td> <td>-</td> <td>-</td> </tr> <tr> <td>ASP Colliery</td> <td>-</td> <td>3.95</td> <td>5.71</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>22.10</td> </tr> <tr> <td>Sudamdih Shaft</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> </tr> <tr> <td>Amlabad UG</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> </tr> <tr> <td><b>Total (in Ha.)</b></td> <td><b>-</b></td> <td><b>8.73</b></td> <td><b>5.71</b></td> <td><b>5.20</b></td> <td><b>3.10</b></td> <td><b>4.50</b></td> <td><b>-</b></td> <td><b>22.10</b></td> </tr> </tbody> </table>	Mine Name	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	Bhowra North-Mix	1.76	3.17	0.00	0.00	0.00	0.00	0.00	Bhowra South- Mix	4.10	6.50	6.50	5.24	5.24	-	-	ASP Colliery - OC	1.93	0.96	0.6	0.58	0.51	16.4		Sudamdih Shaft	-	-	-	-	-	-	-	Amlabad UG	-	-	-	-	-	-	-	Colliery / Mine Name	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	Bhowra North	-	-	-	5.20	3.10	-	-	-	Bhowra South	-	4.78	-	-	-	4.50	-	-	ASP Colliery	-	3.95	5.71	-	-	-	-	22.10	Sudamdih Shaft	-	-	-	-	-	-	-	-	Amlabad UG	-	-	-	-	-	-	-	-	<b>Total (in Ha.)</b>	<b>-</b>	<b>8.73</b>	<b>5.71</b>	<b>5.20</b>	<b>3.10</b>	<b>4.50</b>	<b>-</b>	<b>22.10</b>
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III.	Extensive plantation should be provided on either side of Damodar River.	<p>Extensive plantation is present along the Damodar river which is under cluster X. In addition to this, area of 22.10 Ha. (19.5 Ha + 2.6 Ha) were identified near Damodar river in consultation with District Forest Officer, Dhanbad for plantation under Riverside plantation scheme and work orders were issued for plantation near Damodar River.</p> <p>List of plant species present along the bank of Damodar river are given below:</p>																																																																																																															



List of the plants species

S. No.	Botanical Name	Local Name	Hindi Name
1	<i>Acacia arabica</i>	Babul	Babul
2	<i>Adina cordifolia</i>	Karam	Karam
3	<i>Ailanthus excelsa</i>	Ghorkarani/ Ghorkaram	Ghorkarani/ Ghorkaram
4	<i>Alangium Lamarckii</i>	Dhela	Dhela
5	<i>Albizia lebbek</i>	Siris	Siris
6	<i>Albizia procera</i>	Safed Siris	Safed Siris
7	<i>Alstonia scholaris</i>	Chatni	Chatni
8	<i>Azadirachta indica</i>	Neem	Neem
9	<i>Bombax ceiba</i>	Semal	Semal
10	<i>Butea frondosa</i>	Palas	Palas
11	<i>Casearia tomentosa</i>	Beri	Beri
12	<i>Cassia fistula</i>	Dhanraj/Amaltas	Dhanraj/Amaltas
13	<i>Dalbergia sissoo</i>	Shisham	Shisham
14	<i>Eugenia jamb</i>	Jamun	Jamun
15	<i>Ficus religiosa</i>	Pipal	Pipal
16	<i>Lagerstroemia parviflora</i>	Sidha	Sidha
17	<i>Mitragyna parviflora</i>	Guri/Gurikaram	Guri/Gurikaram
18	<i>Terminalia arjuna</i>	Arjun	Arjun
19	<i>Phoenix acaulis</i>	Khejur	Khejur
20	<i>Ficus racemosa</i>	Gular	Gular
21	<i>Calotropis procera</i>	Calotropis	Calotropis
22	<i>Ricinus communis</i>	Castor	Castor

In addition to this, Action has been taken for the plantation or eco-restoration work as per the Road Map prepared by Forest Research Institute (FRI), Dehradun.

#### Details of Plantation in EJ Area (Cluster X)

Colliery	Site Name	Area (Ha)	Taken up in	Plantation (No.)							Total	
				2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21		
Bh (N)	Bh N/BLA OB Site	5.2	2016-17	-	-	13000	2850					17710
	New BLA Site	3.1	2017-18	-	-	-	4725		616	500		5841
Bh (S)	3 Pit OB Site	4.78	2014-15	12189		1000	2200				1500	16889
	Bhowra Chandan OB Site	4.5	2018-19	-	-	-	-	11500	1728	2000		15228
ASP Colliery	COCP/ Vindavan Site	5.71	2015-16	-	6125	8150	3000		2650	250		20175
	Kamini Kalyan Herbal Garden	3.32	1980 (old)	375 (planted before 2014)		40	50		150	150		615
	Mohalbari OB Site	3.95	2014-15	10874		1000	1200					13074
	Plantation at other locations								1246	2380		3626
<b>Total</b>		<b>30.56</b>		<b>23063</b>	<b>6125</b>	<b>23190</b>	<b>14025</b>	<b>11500</b>	<b>7750</b>	<b>7280</b>		<b>92933</b>

IV. Details of impact of mining on Damodar River should be assessed and provided;

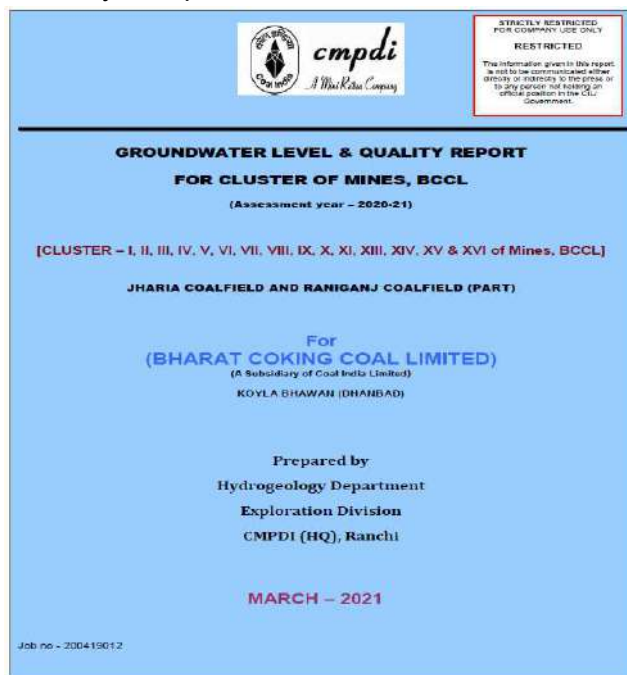
CMPDI is carrying out the Environment Monitoring which comprises of sampling and analysis of water from Damodar River (SW 21 & SW 22) under surface water analysis. Result of upstream and downstream samples showing no major changes in water quality of Damodar river (report enclosed as Annexure -I).

WATER QUALITY (SURFACE WATER- 17 PARAMETERS)							
Name of the Company: <b>Bharat Coking Coal Limited</b> Year : <b>2021-22.</b>							
Name of the Cluster: <b>Cluster - X</b> Period: <b>Q.E. JUNE 2021</b>							
Stations:							
1. Upstream in Damodar river SW-21							
2. Downstream in Damodar river SW-22							
Date of Sampling: 07/06/2021							
07/06/2021							
Sl.No	Parameter	Sampling Stations				Detection Limit	BIS Standard & Method
		SW21	SW22		IS: 2296		
1	Arsenic (as As), mg/l, Max	<0.006	<0.006		0.2	0.006	IS-3025 part 37:1988, R-2019; APHA 21 <sup>st</sup> Edition AAS-VOA
2	BCOD (3 days 27°C), mg/l, Max	<2.0	<2.0		3.00	2.00	IS 3025 ( Part 44 ) : 1993 Reaffirmed 2019, 3 day incubation at 27°C
3	Colour	<1	<1		1-100.0 Hazen Units	1	APHA, 21 <sup>st</sup> Edition, 2120-B-2017
4	Chloride (as Cl), mg/l, Max	17	17		600	2.00	IS-3025:32:1988, R-2019
5	Copper (as Cu), mg/l, Max	<0.2	<0.2		1.5	0.2	IS 3025:42: 1992 R.: 2019, AAS-Flame
6	Dissolved Oxygen, min.	5.1	5.0		4	0.10	IS 3025 (Part 38) : 1989, Reaffirmed 2019 Modified Winkler Azide Method
7	Fluoride (as F) mg/l, Max	0.45	0.37		1.5	0.02	APHA, 21 <sup>st</sup> Edition, Page 4-60 - ASO - F - D SPADNS Method
8	Hexavalent Chromium, mg/l, Max	<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		50	0.2	IS 3025:53: 2003 R.: 2019, AAS-Flame Method
10	Lead (as Pb), mg/l, Max	<0.005	<0.005		0.1	0.005	APHA, 21 <sup>st</sup> Edition, AAS-DTA
11	Nitrate (as NO <sub>3</sub> ), mg/l, Max	5.68	3.4		50	0.50	APHA, 21 <sup>st</sup> Edition, Pub-127, 4500 - NO <sub>3</sub> - B, UV- Spectrophotometric Screening Method
12	pH value	6.95	7.11		6.5-8.5	2.5	IS 3025, Part 11 : 1983 R 2017 Electrode method
13	Phenolic compounds (as C <sub>6</sub> H <sub>5</sub> OH), mg/l, Max	<0.002	<0.002		0.005	0.002	APHA, 22 <sup>nd</sup> Edition 4-Amin Antipyrine
14	Selenium, mg/l, Max	<0.007	<0.007		0.05	0.007	IS-3025 part 56:2003, R-2019; APHA 21 <sup>st</sup> Edition, AAS-VIA
15	Sulphate (as SO <sub>4</sub> ), mg/l, Max	42	44		400	10	APHA - 21 <sup>st</sup> Edition, P-4-189, 4500 SO <sub>4</sub> <sup>2-</sup> E
16	Total Dissolved Solids, mg/l, Max	152	154		1500	25.00	IS 3025, Part 16: 1983 R 2017 Gravimetric method
17	Zinc (as Zn), mg/l, Max	<0.1	<0.1		15	0.1	IS 3025/49 : 1994, R.: 2019, AAS-Flame

All values are expressed in mg/lit unless specified.

V. Impact of mining on ground water of the area (Impact Zone) should be provided;

Ground water monitoring is being carried out by CMPDI and the ground water analysis report is enclosed as Annexure – II.






VI. A Garland drain should be provided and the drain water should not be discharged into Damodar River;

Toe wall & retaining wall and Garland drain along the stabilized OB dump is present. OB dump is being stabilized through biological reclamation/ ecological restoration technique which can be seen in Picture attached. No mine water is being discharged into Damodar river.



<p>VII. Excess water from mine after treatment should be supplied to the villagers;</p>	<p>An action plan for the utilization and treatment of surplus mine water has been prepared. In this regard 26 mines have been identified for implementation of the Phase-I of the action Plan. However, at present, surplus mine water is being supplied to nearby villages / locality for domestic purpose (non-drinking purpose). List of villages for supplied water is as follows:</p>	<table border="1"> <thead> <tr> <th>S. No.</th> <th>Colliery/Mine Name</th> <th>Village list for supply of water</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>ASP Colliery</td> <td>Sudamdih colony, Patherdih colony, Patherdih Basti, Patherdih Basti, Supkar Basti, Hattala basti, etc</td> </tr> <tr> <td>2</td> <td>Bhowra Group of mines (Bhowra North &amp; Bhowra South)</td> <td>Gaurkhuti, 12 no. basti, 13 no. basti, 35 no. basti; 6 no. Bhowra, Manjhi Basti, Gandhi Nagar, 19 no. Basti upar, 19 no. Basti niche, Bhowra 16 no., Bhowra 9 no. etc.</td> </tr> <tr> <td>3</td> <td>Amlabad colliery</td> <td>Amlabad colony and nearby basti</td> </tr> </tbody> </table>	S. No.	Colliery/Mine Name	Village list for supply of water	1	ASP Colliery	Sudamdih colony, Patherdih colony, Patherdih Basti, Patherdih Basti, Supkar Basti, Hattala basti, etc	2	Bhowra Group of mines (Bhowra North & Bhowra South)	Gaurkhuti, 12 no. basti, 13 no. basti, 35 no. basti; 6 no. Bhowra, Manjhi Basti, Gandhi Nagar, 19 no. Basti upar, 19 no. Basti niche, Bhowra 16 no., Bhowra 9 no. etc.	3	Amlabad colliery	Amlabad colony and nearby basti		
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3	Amlabad colliery	Amlabad colony and nearby basti														
<p>VIII. Rejects of washery along with dry carbon slurry should be utilized in power plant and other recognized vendors;</p>	<p>Rejects of washery along with dry carbon slurry is being sale to power plants and other vendors through local sales. At present, Sudamdih Washery is non-operating. Year wise produced dry carbon slurry is given below:</p>	<table border="1"> <thead> <tr> <th>Year</th> <th>Dry Carbon Slurry Produced (in metric Ton)</th> </tr> </thead> <tbody> <tr> <td>2013-14</td> <td>43488</td> </tr> <tr> <td>2014-15</td> <td>6775</td> </tr> <tr> <td>2015-16</td> <td>9880</td> </tr> <tr> <td>2016-17</td> <td>12609</td> </tr> <tr> <td>2017-18</td> <td>6513</td> </tr> <tr> <td>2018-19</td> <td>4405</td> </tr> </tbody> </table>	Year	Dry Carbon Slurry Produced (in metric Ton)	2013-14	43488	2014-15	6775	2015-16	9880	2016-17	12609	2017-18	6513	2018-19	4405
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			2019-20	2255
			2020-21	Nil
			2021-22	Nil
IX.	There should be no discharge from the Washery (Slurry) in to the Damodar River. The entire washery water should be recycled;	<p>All the washeries of BCCL are designed on Closed Circuit System to ensure no discharge from the washery premises.</p>  <p style="text-align: center;">Zero Discharge System at Sudamdih Washery</p>		
X.	Damodar River should be protected by plantation on both sides;	<p>Extensive plantation is present along the Damodar river which is under cluster X. In addition to this, area of 22.10 Ha. (19.5 Ha + 2.6 Ha) were identified near Damodar river in consultation with District Forest Officer, Dhanbad for plantation under Riverside plantation scheme and work orders were issued for plantation near Damodar River. List of plant species present along the bank of Damodar river are given in condition no. III.</p> <p>In addition to this, Action has been taken for the plantation or eco-restoration work as per the Road Map prepared by Forest Research Institute (FRI), Dehradun.</p> <div style="border: 1px solid black; padding: 10px; text-align: center;"> <p><i>"To act as technical advisor/expert for the ecological restoration works being undertaken by BCCL on OB dumps/mined out areas (44.0 ha)"</i></p> <p><i>of</i></p> <p><b>Ecological Restoration site: Bhowra (South) (8.73), EJ (Bhowra &amp; Sudamdih) Area</b></p> <p>Submitted to</p>  <p><b>Bharat Coking Coal Limited, Dhanbad</b> <i>A subsidiary of Coal India Limited</i></p> <p>by</p>  <p><b>Forest Ecology &amp; Environment Division Forest Research Institute Dehradun- Uttarakhand</b> October, 2015</p> </div>		
XI.	A herbal garden with medicinal plants be developed;	<p>Kamini Kalyan Herbal Garden with 3.32 Ha. area has been taken up and developed, it will be further enriched as thematic medicinal plants garden for conservation of germplasm and public awareness. Medicinal/ herbal plants have been planted as per BCCL Env. Dept. HQ guidelines.</p>		



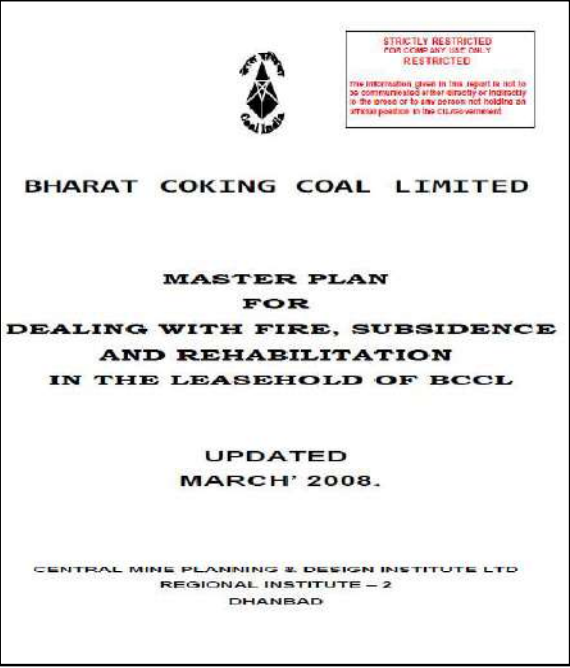
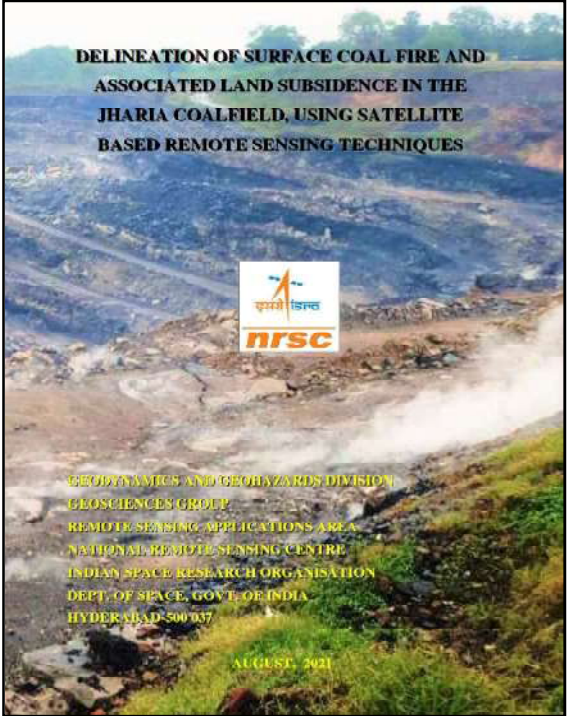
List of medicinal plants present in Kamini Kalyan herbal garden is:


S. No.	Biological Names	Local Names	Hindi Names
1	Aegle marmelos	Bel	Bel
2	Alangium Lamarckii	Dhela	Dhela
3	Albizzia lebbek	Siris	Siris
4	Alstonia scholaris	Chatni	Chatni
5	Azadirachta indica	Neem	Neem
6	Bombax ceiba	Semal	Semal
7	Butea frondosa	Palas	Palas
8	Casearia tomentosa	Beri	Beri
9	Dalbergia sissoo	Shisham	Shisham
10	Emblica officinalis	Amla	Amla
11	Eugenia jamb	Jamun	Jamun
12	Arotocarpus integrifolia	Kathal	Kathal
13	Ficus religiosa	Pipal	Pipal
14	Gmelina arborea	Gamhar	Gamhar
15	Mangifera indica	Mango	Mango
16	Pongamia glabra	Karanj	Karanj
17	Tectona grandis	Sagwan/Teak	Sagwan/Teak
18	Terminalia arjuna	Arjun	Arjun
19	Terminalia belerica	Bahera	Bahera
20	Dendro calamus strictus	Bans/Bamboo	Bans/Bamboo
21	Spondias mangifera	Amra	Amra
22	Saraca asoca	ashok	ashok
23	Cocos nucifera	Nariyal	Nariyal
24	Annona reticulata	Sarifaa	Sarifaa
25	Psidium guajava	amrud	amrud
26	Citrus limon	Nimboo	Nimboo
27	Ficus racemosa	Gular	Gular
28	Eucalyptus globulus	safeda	safeda
29	Neolamarckia cadamba	Kadamba	Kadamba
30	Alstonia scholaris	Chatri	Chatri
31	Araucaria heterophylla	Christmas tree	Christmas tree

List of medicinal herbs and shurbs present at Kamini Kalyan Garden

S. No.	Biological Names	Local Names	Hindi Names
1	<i>Ocimum tenuiflorum</i>	Tulsi	Tulsi
2	<i>Catharanthus roseus</i>	Sadabahr	Sadabahr
3	<i>Aloe vera</i>	Aloe vera	Aloe vera
4	<i>Jatropha curcas</i>	Ratanjot	Ratanjot
5	<i>Murraya koenigii</i>	Kari patta	Kari patta
6	<i>Sansevieria trifasciata</i>	Nagdaman	Nagdaman
7	<i>Euphorbia tithymaloides</i>	Nagdon	Nagdon
8	<i>Allium bisceptrum</i>	Janglee Pyaaj	Janglee Pyaaj

<p>XII.</p>	<p>A time schedule for filling of existing and abandoned quarries be done.</p>	<p>Existing &amp; abandoned quarries are being filled as per approved progressive mine closure plan of the colliery. Mining Plan and Mine Closure Plan of Amalgamated Sudamdih Patherdih and Bhowra (South) mines has been approved in 348<sup>th</sup> BCCL Board meeting dated 29.01.2019. Time schedule as per approved mine closure plan is attached as Annexure – III.</p> <div style="display: flex; justify-content: space-around;"> <div> </div> <div> </div> </div>
<p>XIII.</p>	<p>Of the total water bodies area of 286.54 ha in the post mining land use, consist of 243.97 ha of natural water bodies like Damodar river and no. of water ponds. Only 42.57 ha of mine voids were proposed to be converted to artificial water bodies for catering to domestic use of local villagers. Keeping in view the Damodar river in the vicinity, there should be no additional water bodies are created from mine.</p>	<p>This is post mining closure activities and will be done as per approved mining plan &amp; mine closure plan. Mining Plan and Mine Closure Plan of Amalgamated Sudamdih Patherdih and Bhowra (South) mines has been approved in 348<sup>th</sup> BCCL Board meeting dated 29.01.2019.</p> <div style="display: flex; justify-content: space-around;"> <div> </div> <div> </div> </div>
<p>XIV.</p>	<p>The measure identified in the environmental plan for cluster X groups of mine and the conditions given in this environmental clearance letter shall be dovetailed to the implementation of the Jharia action plan.</p>	<p>Master plan/Jharia Action Plan is dovetailed with environmental clearance conditions. Jharia Master Plan is attached as Annexure-IV.</p>

		
<p>XV.</p>	<p>As there is no fire in cluster X but the measure should be adopted by proponent to control the spread of neighboring fire to the cluster X. The proponent shall prepare time series maps of the Jharia Coalfields through NRSA to monitor and prevent fire problems in the Jharia Coalfield 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 XIV shall be undertaken.</p>	<p>The Work Order for “Delineation of Surface Fire and associated land subsidence in Jharia Coal Field using satellite based remote sensing techniques” has been awarded to NRSC under the MoU signed with NRSC. NRSC has submitted the final report, in which Coal Mine fire map has been prepared based on the Satellite data of Landsat-8 and attached as Annexure V.</p>  <p>Measure to prevent ingress of air (ventilation) is being taken as specified in EMP and as per Jharia Master Plan. Further fire patches are under operation to dig out the fiery coal and combustible materials to save the coal from burning and to stop further spread of the fire. Once the fiery coal is dug-out/excavated there will be no more chance</p>

		of re-starting of fresh/ spreading of fire into other areas.
XVI.	Underground mining should be taken up after completion of reclamation of Opencast mine area after 2 years.	All OC Mines are in developing stage and Mining is being done as per the Coal Mines Regulation (CMR) Act 1957.
XVII.	No mining shall be undertaken where underground fires continue. Measure shall be taken to prevent/check such fire including in old OB dump.	It is being complied. Action is being taken to control, mine fires including old OB dump areas as specified in Jharia Master Plan and the mining is being done as per the Coal Mines Regulation (CMR) Act.
XVIII.	A part of cluster X is under River Damodar. It was clarified that although the mine is underground, there is no coal underneath River Damodar, which would be mined. The Committee desired that the data of bore wells near River Damodar require to be monitored for permeability and seepage of water of River Damodar.	CMPDI has prepared a report for design location and construction of 23 nos. of Piezometer covering all the 17 clusters of BCCL. BCCL floated the Tender for awarding the work for Drilling and installation of 23 nos of piezometric wells in the command area of BCCL on 28.03.2017; 22.12.2017; and 14.02.2019. However, no Bidder qualified for final award of work in the above concluded E-tenders floated by BCCL. Accordingly, the proposal cost estimate was completely revised and tender was floated on 05.07.2021 (Copy of eNIT Notice attached as Annexure - VI). The tender has opened on 28.07.2021 and four bidders have participated. Tender committee has concluded the technical scrutiny, opened the price bid and the recommended L1 Bidder for award of work. The proposal is under competent approval and letter of acceptance/ Work order will be issued tentatively by January 2022 with timeline of six months for completion.
		 <p>The image is a tender notice from Bharat Coking Coal Limited (BCCL), a subsidiary of Coal India Limited. It is titled 'Notice inviting Tender' and is dated 05.07.2021. The notice describes the work of drilling and installation of 23 piezometric wells in the command area of BCCL, Dhanbad. The estimated cost of the work is ₹2,16,19,923.33, and the period of completion is 175 days. The notice also mentions that a provident fund is applicable for this work and provides contact information for the tendering authority (GM/Civil/Industrial, BCCL) and the tender dealing officer (Sri Sunil Nigam, GM/Geology, and Preeti Priya, Assistant Manager/Civil, OED, HD, BCCL).</p>
XIX.	The rejects of washeries in Cluster –X should be send to FBC based plant.	At present Sudamdih washery is non operational. Previously, the Rejects generation was very low in operation of Sudamdih Washery as maximum portion was generated as middling. Rejects once significant in quantity will be checked for grade and auctioned to the users.
XX.	There shall be no external OB dumps. OB produce from the whole cluster will be 29.01 Mm3. OB from	Action is being taken as specified in EMP. O.B. removed from mine/ collieries are back filled in old/ abandoned quarry/voids. At the end of the mining, there shall not be voids and area will be re-vegetated and reclaimed with the proper eco-restoration techniques suggested by

One Patch OCP mine shall be backfilled. At the end of the mining there shall be no void and the entire mined out area shall be re-vegetated. Areas where opencast mining was carried out and completed shall be reclaimed immediately thereafter.

the experts available in BCCL and in external agencies i.e. FRI Dehradun, CEMDE Delhi.

Year wise data of OB removal & excavated area is given below:

**UNIT WISE OB REMOVED (IN M3) OF CLUSTER X**

Mine Name	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
Bhowra North	502538	1172570	321554	0	0	0	0	0
Bhowra South	581650	318400	6222675	4491830	3488184	2205725	3854237	3993684
ASP Colliery	260443	77444	1364138	1535176	1126630	923629	585637	2170162
Sudamdih Shaft	-	-	-	-	-	-	-	-
Amlabad UG	-	-	-	-	-	-	-	-
<b>Total (Cluster X)</b>	<b>1344631</b>	<b>1568414</b>	<b>7908367</b>	<b>6027006</b>	<b>4614814</b>	<b>3129354</b>	<b>4439875</b>	<b>6163847</b>

**UNIT WISE EXCAVATED AREA (IN Ha) OF CLUSTER X**

Mine Name	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
Bhowra North - Mix	12.50	10.42	0.00	0.00	0.00	0.00	0	0
Bhowra South - Mix	29.97*					16.44*		
ASP Colliery	0.96	0.60	0.58	0.51	0.52			
Sudamdih Shaft	-	-	-	-	-	-	-	-
Amlabad UG	-	-	-	-	-	-	-	-

\* Data showing cumulative excavated area of Bhowra south (mix) from 2013-14 to 2017-18 & 2018-19 to 2020-21

XXI. 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- X shall be drawn up and implemented.


Calendar year plan of coal production as per EMP / revised EC is given below:

Name of mine		Peak (MTY)	18-19	19-20	20-21	21-22	22-23
Bhowrah North	OC	<b>0.546</b>	0.3	0.3	0.3	0.3	0.35
	UG	<b>0.143</b>	0.03	0.03	0.03	0.03	0.03
Bhowrah South	UG	<b>0.377</b>	0.03	0.03	0.03	0.03	0.03
	OC	<b>1.2</b>	0.8	0.93	0.93	0.93	1.17
<b>Amalgamated Sudamdih Patherdih Mine</b>		<b>0.709</b>	0.6	0.6	0.6	0.7	0.709
Sudamdih Shaft (UG)	UG	<b>0.24</b>	0	0	0	0	0
Amlabad (UG) (Closed)	UG	<b>0</b>	0	0	0	0	0
<b>Total</b>		<b>2.289</b>	<b>1.73</b>	<b>1.86</b>	<b>1.86</b>	<b>1.96</b>	<b>2.289</b>
<b>Sanctioned Peak Capacity as per Existing EC</b>			<b>2.289</b>	<b>2.289</b>	<b>2.289</b>	<b>2.289</b>	<b>2.289</b>

Mine closure plan as per the guidelines of Ministry of Coal have been prepared by Central Mine Planning and Design Institute (CMPDI) and it is being implemented.

XXII. The void in 5 ha area shall be converted into a water reservoir of a maximum depth of 15-20 m in post mining stage and shall be gently sloped and the upper benches of the reservoir shall be recognized with plantation and the periphery of the reservoir fenced. The abandoned pits and voids should be backfilled with OB and biologically reclaimed

This is post mine closure activity. A part of the void will be converted into the water body as specified in EMP at post mining stage and plantation, sitting arrangement etc. will be provided around the periphery of the reservoir & will be developed as water recreational park.

	with plantation and or may be used for pisciculture	
XXIII.	Mining shall be carried out as per statuette from the streams/nalas flowing within the lease and maintaining a safe distance from the Nalas flowing along the lease boundary. A safety barrier of a minimum 60 m width shall be maintained along 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.	Mining operation is being done as per Coal Mines Regulation Act. Action for construction of embankment has been taken as specified in EMP. Every year monsoon preparation programme is carried out by colliery / mines before the onset of monsoon for protection of mines from rain water flow and to maintain a safe distance from nalas flowing or small water bodies protection in the lease boundary.
XXIV.	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.	No OB is being dumped near water bodies. The OB dumps created earlier already stabilized & further action has been taken for their eco-restoration work as per Road Map prepared by FRI, Dehradun.
XXV.	Thick green belt shall be developed along undisturbed areas, mine boundary and in mine reclamation. During post mining stage, a total of 47.63 ha area would be reclaimed by planting native species in consultation with the local DFO/Agriculture Department/institution with the relevant discipline. The density of the trees shall be around 2500 plants per ha.	<p>Eco-restoration sites covering an area of 30.56 Ha have also been developed in consultations with institutes like FRI which was duly visited and appreciated during their visit.</p>  <p>In 2020-21 year, approx. 7280 plants were planted under different programs like Env. Day Celebration, Jal Shakti Abhiyan, Independence day Celebration, Eco-restoration sites, Swachh Bharat Abhiyan etc.</p> <p>Green belt is developed at available places and after the remaining area is decoaled, plantation will speed up in a time bound manner as per the EC conditions.</p> <p>Details of plantation in EJ Area is shown in point no. III.</p>

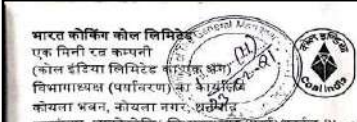


XXVI. The road should be provided with avenue plantation on both side as trees act as sink of carbon and other pollutant.

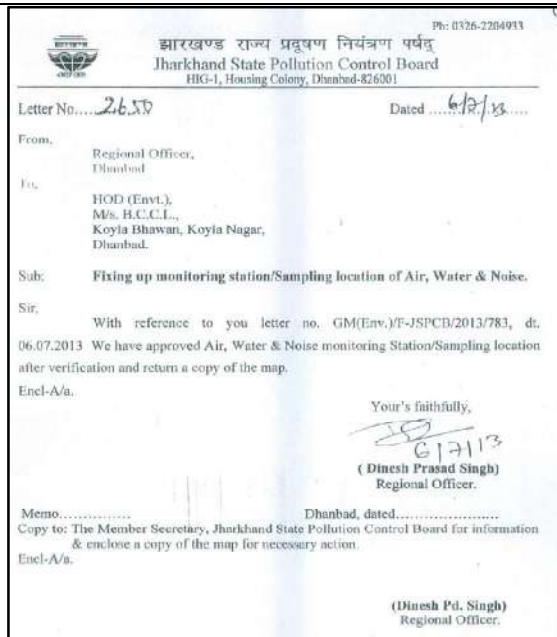
Avenue plantation will be made along the permanent road and near permanent structures to minimize the pollution. Approx 2500 plants have been planted as Avenue Plantation from Panchait dam to Ambona Jamkudur and in BIT Campus by DFO, Dhanbad. In 2020-21, approx 2380 plants were planted in different colonies, schools, office premises and free saplings were distributed to local residents for awareness towards environment and plantation.



DFO was requested through a letter regarding need based survey for plantation (Block plantation / gabion/ avenue plantation) under the leasehold area of Cluster X. A Team from DFO, Dhanbad has visited the Cluster X and identified the area of 22.10 Ha. (19.5 Ha + 2.6 Ha) near Damodar river in joint field visit and work orders were issued for plantation under Riverside plantation scheme near Damodar River. Copy of the work order is enclosed Annexure – VII.

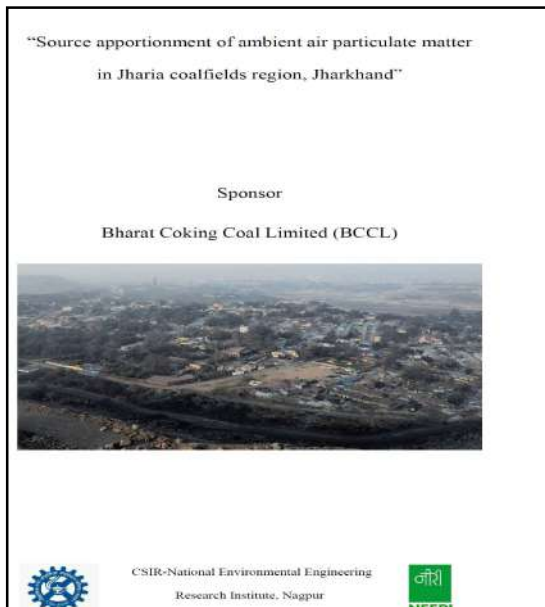
		 <p><b>Bharat Coking Coal Limited</b> A Mini Ratna Company (A Subsidiary of Coal India Limited) Office of the HoD (Environment) Koyla Bhawan, Koyla Nagar, Dhanbad</p> <p>पत्रसंख्या: भाकोकोलि/ विभागावरस (पर्या)/कार्वेल-Plantation/B-3/2021/44-23 दिनांक: 18.02.2021</p> <p>सेवा में, वन प्रमंडल पदाधिकारी, धनबाद</p> <p><b>विषय : Work Order for carrying afforestation over 42.5 ha of OB dumps/physically reclaimed land of BCCL.</b></p> <p>संदर्भ: (i) Our letter no.भाकोकोलि/उपग्रहावरस(पर्या)/कार्वेल-B-3/2020/1529-1534(H) dt 10.12.2020 (ii) भाकोकोलि/उपग्रहावरस(पर्या)/कार्वेल-B-3/2021/19-13/ (H) dt 06.01.2021. (iii) Your letter no.84 dated 12.01.2021</p> <p>माननीय महोदय, This has reference to above mentioned letters, competent authority has approved for carrying afforestation over 42.5 ha of OB dumps/ physically reclaimed land of BCCL, through DFO, Dhanbad, for a total estimated value of ₹ 1,19,75,665.00 (Rupees One crore nineteen lakhs seventy five thousand six hundred sixty five only) for four years with the following terms and conditions in respect of above mentioned work:-</p> <ol style="list-style-type: none"> <li>The Period of work will be 04 years as per the estimate provided by Forest Department.</li> <li>The aforesaid work is to be carried out at below mentioned sites: <table border="1"> <thead> <tr> <th>S No</th> <th>Name of the site</th> <th>Type</th> <th>Ha</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>NAKC, Govindpur</td> <td>O3 Dump</td> <td>23.0</td> </tr> <tr> <td>2</td> <td>ASP, EJ Area</td> <td>Physically reclaimed land</td> <td>19.5</td> </tr> <tr> <td colspan="3">TOTAL</td> <td>42.5</td> </tr> </tbody> </table> </li> <li>The Forest department shall conduct all its afforestation activities subject to all laws, rules, statutory orders and regulations applicable to the site and the nature of the work.</li> <li>The Forest department shall take up afforestation works on company's land with due expertise and supervision as per the scheme &amp; estimates duly sanctioned as per the estimate submitted by forest department.</li> <li>The estimate has been submitted by Forest Department considering 15% enhancement every year in labour wages of preceding year. However, the payment of completion work, first year maintenance work and second year maintenance work will be made as per the actual labour wages prevailing in the corresponding year.</li> <li>The Forest department shall exercise precautions on the aid and advice of the mine management for the safety of all lives and properties involved in the afforestation activities.</li> <li><b>SCOPE OF WORK</b> This work shall be done with the following attributes: <ol style="list-style-type: none"> <li>Self-sustaining / healthy plantation at the end of project period/ at the handover of the site.</li> </ol> </li> </ol>	S No	Name of the site	Type	Ha	1	NAKC, Govindpur	O3 Dump	23.0	2	ASP, EJ Area	Physically reclaimed land	19.5	TOTAL			42.5
S No	Name of the site	Type	Ha															
1	NAKC, Govindpur	O3 Dump	23.0															
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TOTAL			42.5															
XXVII.	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 –XIV shall be implemented.	<p>A meeting was called by Chairman, Jharkhand Pollution control Board on 11.06.2019 and JSPCB directed to prepare an Environmental Action Plan which will be implemented by BCCL. Action Plan has been prepared in consultation with Jharkhand Pollution Control Board for entire BCCL and approved by Competent Authority of BCCL. It is being implemented comprehensively for all the mines of BCCL. Some of the salient steps of this action plan are as under:</p> <ol style="list-style-type: none"> <li>Covered Transportation</li> <li>Permanent Pucca Transportation Road</li> <li>Fixed &amp; Overhead Sprinklers and Mobile Sprinklers</li> <li>AAQ &amp; CQAAQMS Monitoring</li> <li>Online PM10 Analyzer</li> <li>Source Apportionment Study.</li> </ol>																
XXVIII.	The locations of monitoring stations in the Jharia Coalfields should be finalized in consultation with the Jharkhand State Pollution Control Board. The Committee stated that smoke/dust emission vary from source to source (fuel wood, coal, fly ash from TPPs, silica from natural dust, etc) and a Source Apportionment Study should be got carried out for the entire Jharia Coalfields. Mineralogical composition	<p>The locations of monitoring stations had been finalized in consultation with JSPCB.</p> <p>The monitoring work of ambient environment quality is being carried out by Central Mine Planning &amp; Design Institute Limited (CMPDIL) which is having CSIR laboratory recognized under the EP Rules. Report of Regular Environmental Monitoring is enclosed as Annexure – VIII.</p>																

study should be undertaken on the composition of the suspended particulate matter (PM10 and PM2.5) in Jharia Coalfields and also quantified. These studies would help ascertain source and extent of the air pollution, based on which appropriate mitigative measures could be taken.



BCCL had awarded the work order for the Project “Source Apportionment of ambient air particulate matter in Jharia coalfields region, Jharkhand” to CSIR-NEERI, Nagpur vide Ref no. भाकोकोलि/उप महाप्रबंधक/पर्या/ SOURCE APPORTIONMENT (MoU) /NEERI /2018/ dated 12.05.2018.

NEERI, Nagpur had submitted the draft final report on the source apportionment study and the mineralogical composition study in the Jharia Coalfields on 23rd August 2021 (Copy Enclosed as Annexure IX). The report is being examined by BCCL in reference with all terms and conditions and scope of work for the work order awarded.



XXIX. No groundwater shall be used for the mining activities. Additional water required, if any, shall be met

No groundwater is drawn for mining activities however cutting of aquifer is integral part of mining. Mine water is being used for the industrial purpose like water sprinkling to suppress dust generation, etc. Further Mine water is also utilized for the community purposes.

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 to dewatering of mine.

Following action has been taken by the company:

- Installation of Pressure filters for utilization of mine water.

In cluster X, there is three nos. of Rapid Gravity Pressure Filter plant of total 1.72 MGD capacity, which is used for supply of water in nearby colonies, houses, quarters.

Detail of Water Treatment Plant/ Filter Plant in E.J. Area					
S. No.	Location of source of water	Treatment method	Capacity	In use	Supply of water
			(MGD)	(MGD)	
1	Sudamdih	Rapid gravity filter	0.8	0.47	Sudamdih colony, Patherdih colony, Patherdih Basti, Patherdih Basti, Supkar Basti, Hattala basti, etc
2	Bhowra	Rapid gravity filter	0.66	0.39	Gaurkhuti, 12 no. basti, 13 no. basti, 35 no. basti; 6 no. dhowra, Manjhi Basti, Gandhi Nagar, 19 no. Basti upar, 19 no. Basti niche, etc.
3	Amlabad	Rapid gravity filter	0.26	0.02	Amlabad colony and nearby basti



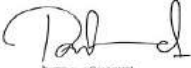
Report on Rain water harvesting and artificial recharge system in cluster X prepared by CMPDIL and attached as Annexure – X. Ponds & old quarries are being used for rain water harvesting & artificial recharge system in the area.


A proposal has been moved for construction of two (2) nos. Rooftop Rain Water Harvesting Structures in EJ Area under “Jal Shakti Abhiyan” program.

XXX. 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

Regular monitoring of Ground water quality is being carried out by CMPDIL. The Ground water Level and Quality report for Clusters of mines of BCCL (including Cluster X), have been submitted by CMPDIL & attached as Annexure II. Establishment of new piezometers is under process. CMPDI has prepared a report for design location and construction of 23 Nos of Piezometer covering all the 17 clusters of BCCL. Tender and procurement process for establishing and construction of a network of piezometer well system is under process.

	<p>including Arsenic and Fluoride during the month of May. Data thus collected shall be submitted to the Ministry of Environment &amp; Forest and to the Central Pollution Control Board/SPCB quarterly within one month of monitoring. Rainwater harvesting measures shall be undertaken in case monitoring of water table indicates a declining trend.</p>																																								
<p>XXXI.</p>	<p>Mine discharge water shall be treated to meet standards prescribed standards before discharge into natural water courses/agriculture. The quality of the water discharged shall be monitored at the outlet points and proper records maintained thereof and uploaded regularly on the company website.</p>	<p>Mine discharge water is being allowed to settle down in the mine sumps before disposal into storage reservoirs. The monitoring of mine water quality parameters is being done by CMPDIL and parameters are well within the prescribed limit provided by CPCB.</p> <div> <p style="text-align: center;"><b>WATER QUALITY MONITORING</b></p> <p>3.1 <b>Location of sampling sites</b> (Refer Plate No. - II)</p> <p>i) <b>Mine Discharge of Bhowrah North (MW10)</b> A sampling point is fixed to assess the effluent quality of Mine discharge. This location is selected to monitor effluent discharge in to Koldi pond.</p> <p>3.2 <b>Methodology of sampling and analysis</b> Water samples were collected as per standard practice. The effluent samples were collected and analyzed for four parameters on fortnightly basis at the Environmental Laboratory of CMPDI R-II, Dhanbad.</p> <p>3.3 <b>Results &amp; Interpretations</b> The results are given in tabular form along with the applicable standards. Results are compared with Schedule - VI, effluent standards by MoEF/CPCB. Results show that most of the parameters are within the permissible limits.</p> <p style="text-align: center;"><b>WATER QUALITY DATA</b> (EFFLUENT WATER-FOUR PARAMETERS)</p> <table border="1"> <thead> <tr> <th rowspan="2">Sl. No.</th> <th rowspan="2">Parameters</th> <th colspan="2">Name of the Cluster: Cluster -X</th> <th colspan="2">Name of the Station: Mine Discharge of Bhowrah North</th> <th rowspan="2">As per MCEEF General Standards for Schedule VI</th> </tr> <tr> <th>Month: AUGUST 2021</th> <th>MW10</th> <th>MW10</th> <th>Second Fortnight</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Total Suspended Solids</td> <td>02.08.2021</td> <td>38</td> <td>30.08.2021</td> <td>37</td> <td>100 (Max)</td> </tr> <tr> <td>2</td> <td>pH</td> <td></td> <td>8.1</td> <td></td> <td>8.11</td> <td>8.5 - 9.0</td> </tr> <tr> <td>3</td> <td>Oil &amp; Grease</td> <td></td> <td>&lt;2.0</td> <td></td> <td>&lt;2.0</td> <td>10 (Max)</td> </tr> <tr> <td>4</td> <td>COD</td> <td></td> <td>16</td> <td></td> <td>20</td> <td>250 (Max)</td> </tr> </tbody> </table> <p style="text-align: right;">*All values are expressed in mg/l except pH.</p> <p style="text-align: center;">JOB NO. 200316628      Cluster -X, BCL Environmental Monitoring Report</p> </div>	Sl. No.	Parameters	Name of the Cluster: Cluster -X		Name of the Station: Mine Discharge of Bhowrah North		As per MCEEF General Standards for Schedule VI	Month: AUGUST 2021	MW10	MW10	Second Fortnight	1	Total Suspended Solids	02.08.2021	38	30.08.2021	37	100 (Max)	2	pH		8.1		8.11	8.5 - 9.0	3	Oil & Grease		<2.0		<2.0	10 (Max)	4	COD		16		20	250 (Max)
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<p>XXXII.</p>	<p>ETP shall also be provided for workshop, and CHP, if any. Effluents shall be treated to conform to prescribe standards in case discharge into the natural water course.</p>	<p>There is no CHP in Cluster X. A proposal has been moved for the installation of Oil &amp; Grease trap system at workshop under EJ Area.</p>																																							
<p>XXXIII.</p>	<p>Regular monitoring of subsidence movement on the surface over and around the working area and impact on natural drainage pattern, water bodies, vegetation, structure, roads, and surroundings shall be continued till movement ceases completely. In case of observation of any high</p>	<p>As per CMR, regular monitoring of subsidence movement on the surface over and around the working area and impact on natural drainage pattern, water bodies, vegetation, structure, roads, and surroundings is done. Currently there is no depillaring operation going on in underground mines of cluster X.</p>																																							

	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.																																																																															
XXXIV.	Sufficient coal pillars shall be left unextracted around the air shaft (within the subsidence influence area) to protect from any damage from subsidence, if any.	Sufficient coal pillars have been left around air shafts as per the statutes and DGMS guidelines.																																																																														
XXXV.	High root density tree species shall be selected and planted over areas likely to be affected by subsidence.	A list of high root density Plant species certified by FRI and its plantation in subsidence prone area will be taken-up at the time of depillaring operations. Nursery of high root density is also developed under EJ Area. List of high root density plant species is given below. <div> <p style="text-align: center;"><b>Certificate of high root density plant for controlling subsidence</b></p> <p>This is to certify that BCCL has been doing plantation/ecological restoration under the guidelines of Forest Research Institute. The various species selected for the restoration are having a tap root system with branches which serve the purpose. These species have high root density and are already being planted at all the re-vegetation/plantation sites of BCCL. The various species having tap root system are given below.</p> <table border="1"> <thead> <tr> <th>S.No.</th> <th>Species</th> <th>Common name</th> </tr> </thead> <tbody> <tr><td>1.</td><td><i>Acacia nilotica</i></td><td>Kikkar</td></tr> <tr><td>2.</td><td><i>Albizia odoratissima</i></td><td>Kala miris</td></tr> <tr><td>3.</td><td><i>Bauhinia variegata</i></td><td>Kachnar</td></tr> <tr><td>4.</td><td><i>Cassia fistula</i></td><td>Amaltas</td></tr> <tr><td>5.</td><td><i>Ficus bengalensis</i></td><td>Banyan /bargad</td></tr> <tr><td>6.</td><td><i>Ficus racemosa</i></td><td>Gulor</td></tr> <tr><td>7.</td><td><i>Ficus religiosa</i></td><td>Pipal</td></tr> <tr><td>8.</td><td><i>Gmelina arborea</i></td><td>Ghamar</td></tr> <tr><td>9.</td><td><i> Lagerstroemia parviflora</i></td><td>Jarul</td></tr> <tr><td>10.</td><td><i>Lantana camara/indica</i></td><td>Zingari</td></tr> <tr><td>11.</td><td><i>Mathuca latifolia</i></td><td>Mahua</td></tr> <tr><td>12.</td><td><i>Mangifera indica</i></td><td>Aam</td></tr> <tr><td>13.</td><td><i>Morus alba</i></td><td>Shahroot</td></tr> <tr><td>14.</td><td><i>Phyllanthus emblica</i></td><td>Acacia</td></tr> <tr><td>15.</td><td><i>Pithecellobium dulce</i></td><td>Jangal jalebi</td></tr> <tr><td>16.</td><td><i>Pongamia pinnata</i></td><td>Karanj</td></tr> <tr><td>17.</td><td><i>Tamarindus indica</i></td><td>Imli</td></tr> <tr><td>18.</td><td><i>Trema orientalis</i></td><td>Tree</td></tr> <tr><td>19.</td><td><i>Terminalia arjuna</i></td><td>Arjun</td></tr> <tr><td>20.</td><td><i>Terminalia bellerica</i></td><td>Bahera</td></tr> <tr><td>21.</td><td><i>Dalbergia sissoo</i></td><td>Shisham</td></tr> <tr><td>22.</td><td><i>Syzizium cumini</i></td><td>Jamun</td></tr> <tr><td>23.</td><td><i>Azadirachta indica</i></td><td>Neem</td></tr> <tr><td>24.</td><td><i>Haloptelea integrifolia</i></td><td>Indiar elm</td></tr> <tr><td>25.</td><td><i>Butea monosperma</i></td><td>Palash/dhak</td></tr> </tbody> </table> <p style="text-align: center;">   Director  Forest Research Institute, Dehradun-248001, India  Forest Research Institute, Dehradun-248001 </p> </div>	S.No.	Species	Common name	1.	<i>Acacia nilotica</i>	Kikkar	2.	<i>Albizia odoratissima</i>	Kala miris	3.	<i>Bauhinia variegata</i>	Kachnar	4.	<i>Cassia fistula</i>	Amaltas	5.	<i>Ficus bengalensis</i>	Banyan /bargad	6.	<i>Ficus racemosa</i>	Gulor	7.	<i>Ficus religiosa</i>	Pipal	8.	<i>Gmelina arborea</i>	Ghamar	9.	<i> Lagerstroemia parviflora</i>	Jarul	10.	<i>Lantana camara/indica</i>	Zingari	11.	<i>Mathuca latifolia</i>	Mahua	12.	<i>Mangifera indica</i>	Aam	13.	<i>Morus alba</i>	Shahroot	14.	<i>Phyllanthus emblica</i>	Acacia	15.	<i>Pithecellobium dulce</i>	Jangal jalebi	16.	<i>Pongamia pinnata</i>	Karanj	17.	<i>Tamarindus indica</i>	Imli	18.	<i>Trema orientalis</i>	Tree	19.	<i>Terminalia arjuna</i>	Arjun	20.	<i>Terminalia bellerica</i>	Bahera	21.	<i>Dalbergia sissoo</i>	Shisham	22.	<i>Syzizium cumini</i>	Jamun	23.	<i>Azadirachta indica</i>	Neem	24.	<i>Haloptelea integrifolia</i>	Indiar elm	25.	<i>Butea monosperma</i>	Palash/dhak
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XXXVI.	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, where ever applicable. However, regular monitoring is being done through pit safety meeting and bipartite & tripartite safety meeting at area and HQ level.																																																																														
XXXVII.	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 CMR guidelines.																																																																														
XXXVIII.	No depillaring operation shall be carried out below the township/colony.	It is being followed.																																																																														

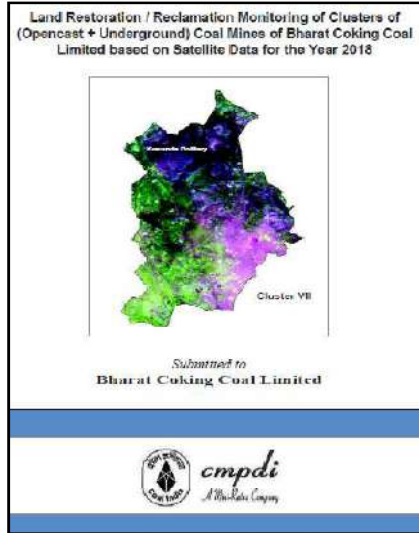
XXXIX.	<p>The Transportation Plan for conveyor-cum-rail for Cluster- X should be dovetailed with Jharia Action Plan. Road transportation of coal during Phase-I should be by mechanically covered trucks, which should be introduced at the earliest. The Plan for conveyor-cum-rail for Cluster-XIV should be dovetailed with Jharia Action Plan. The road transportation of coal during phase-I should be by mechanically covered trucks.</p>	<p>Vehicles engaged in transportation are duly checked at Security Check-Post (CISF Check-Post) where security personnel also ensure proper covering of Trucks.</p> <p>No OEM is providing mechanically covered trucks. A communication in this regard has been made to Coal India Ltd for taking up with OEM.</p> <p>In absence of availability of approved OEM of mechanically covered trucks, BCCL is ensuring trucks are covered with tarpaulin through mandatory clause of covering in transportation contracts.</p> <p>The transport Plan for conveyor-cum-rail for Cluster X is to be implemented in the Phase II of the Jharia Master Plan. At present, Phase -1 is under implementation and after completion of Pre-implementation (1st &amp; 2nd Yr.) and Phase 1 (3rd to 7th year) and Phase 2 (8th to 12<sup>th</sup> year). The plan shall be prepared after the completion of the above said phases to have conveyor-cum-rail transportation as informed by CMPDIL to whom the said work of preparation of Rail-cum-conveyor plan has been awarded (Annexure XI).</p> <p>During Phase- 1 &amp; 2, covering of trucks by tarpaulin covers is being ensured as can be seen in Picture attached.</p>
XL.	<p>A study should be initiated to analyze extent of reduction in pollution load every year by reducing road transport.</p>	<p>CMPDI had carried out the study to analyze extent of reduction in pollution load every year by reducing road transport. Pollution load study report for Cluster X is attached in annexure XII.</p> <div style="border: 1px solid black; padding: 10px; text-align: center;">  <div style="float: right; border: 1px solid black; padding: 2px; font-size: 8px;"> <p>STRICTLY RESTRICTED FOR COMPANY USE ONLY</p> <p>RESTRICTED</p> <p>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/Department.</p> </div> <p><b>Study to Analyze the Extent of Reduction of Pollution Load Every Year by reducing Coal Transportation by Road</b></p> <p><b>CLUSTER X GROUP OF MINES</b></p> <p>Bhowrah North (UG),Bhowrah North (OC),Bhowrah South (UG), 3 PIT OCP,Chandan OCP(Bhowrah),Patherdih (UG),Chandan OCP (Patherdih),Sudamdih Incline (UG),Sudamdih Shaft (UG),Amiabad (UG) Closed,Sudamdih Coal Washery(WITHin the lease hold of Sudamdih Shaft Mine)</p> <p>Normative Production : 1.762 MTPA Peak Production : 2.289MTPA Lease Hold Area : 2057.47Ha</p> <p><b>Bharat Coking Coal Limited</b> (July,2019)</p> <p>Prepared by</p> <p><b>Environment Division</b> <b>Central Mine Planning &amp; Design Institute Limited</b> <b>CMPDI (HQ)</b> <b>Gondwana Place</b> <b>Kanke Road, Ranchi-834008</b></p> </div>
XLI.	R&R of 1670 nos of PAF's	Implementation of master plan has already been started through

	involved. They should be rehabilitated at cost of Rs 7087.75 Lakhs as per the approved Jharia Action Plan.	<p>Jharkhand Rehabilitation and Development Authority (JRDA), Dhanbad to a well-established Jharia Vihar Township located at Belgoria. The rehabilitation data for EJ area is as follows:</p> <table border="1"> <thead> <tr> <th colspan="2">No. of Households</th> <th>Shifted</th> </tr> <tr> <th>Non LTH</th> <th>LTH</th> <th>Non LTH + LTH</th> </tr> </thead> <tbody> <tr> <td>3125</td> <td>528</td> <td>81</td> </tr> </tbody> </table>	No. of Households		Shifted	Non LTH	LTH	Non LTH + LTH	3125	528	81
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XLII.	Details of transportation, CSR, R&R and implementation of environmental action plan for each of the 17 clusters should be brought out in a booklet for and submitted to Ministry.	A separate booklet comprising of CSR activities has been prepared and attached as annexure XIII (A) – Detail of CSR activity of Cluster X.									
XLIII.	A detailed CSR Action Plan shall be prepared for Cluster X group of mines. Specific activities shall be identified for CSR of Rs 20.25/annum @ of Rs 5/ton of coal production. As recurring expenditure. The 47.63 ha of area within Cluster XIV 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	<p>It being complied. CSR action plan of BCCL is centralized and BCCL is implementing CSR Activities. CSR action plan of BCCL including CSR budget and expenditure is enclosed as Annexure XIII (B). A separate CSR committee has been formed at Area level for cluster-X, who will look after the works being executed under CSR. A booklet comprising of CSR activities conducted by E.J. area has been prepared and attached as annexure XIII (A) – Detail of CSR activity of Cluster X.</p> <div style="border: 1px solid black; padding: 10px; text-align: center;"> <p>CSR ACTIVITY PLAN OF CLUSTER – X</p> <p>AS PER</p> <p>EC CONDITION (SPECIFIC CONDITION-XLII): Details of transportation, CSR, R&amp;R and implementation of environmental action plan for each of the 17 clusters should be brought out in a booklet for and submitted to Ministry.</p> <p>MAY, 2017</p> </div>									

building both within the company and to the local youth, who are motivated to carry out the work in future.

XLIV. 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.

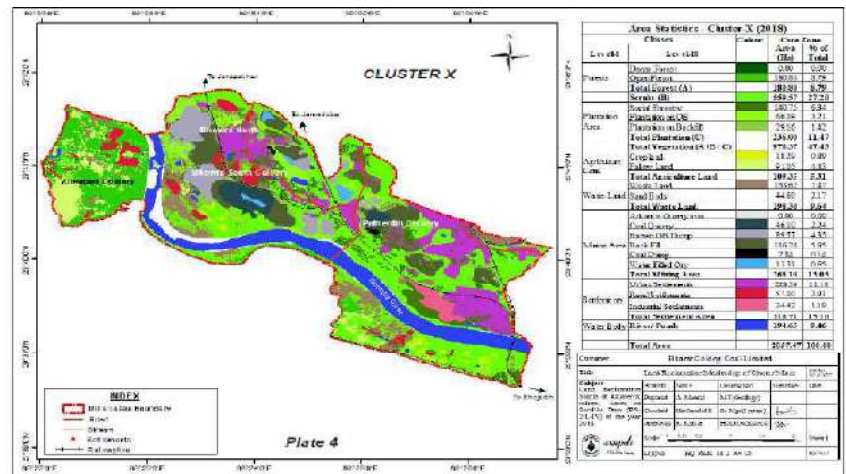
Presently a time series map of vegetation cover in the Jharia Coal Field has been carried out through CMPDI, Ranchi using satellite imagery for every 3 years.



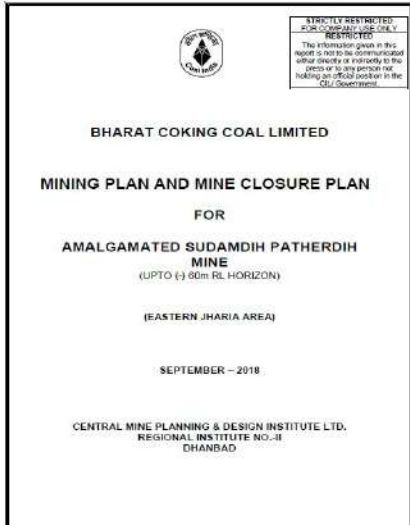

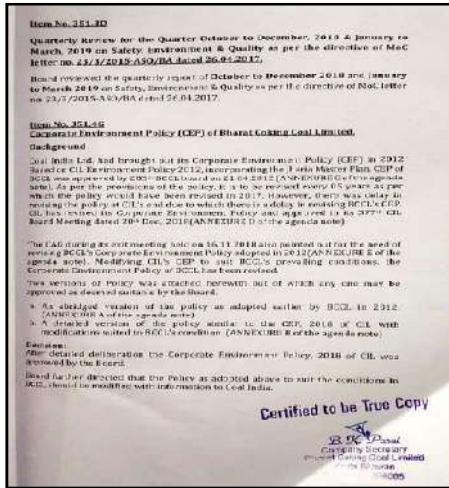
Time series of land use maps based on satellite imagery of the core zone and buffer zone is attached as Annexure – XIV. Details of vegetation cover under Cluster X is given below, As per the time series map of vegetation cover report:

Land use / Reclamation status	Area (in Ha)	%
a.) Plantation on OB dump	66.09	3.21
b.) Plantation on Backfill area (Biological Reclamation)	29.16	1.42
c.) Social Forestry / Avenue Plantation	140.75	6.84
d.) Shrubs	559.57	27.2
e.) Other Plantation area	180.8	8.79
<b>Total area under Vegetation</b>	<b>976.37</b>	<b>47.45</b>



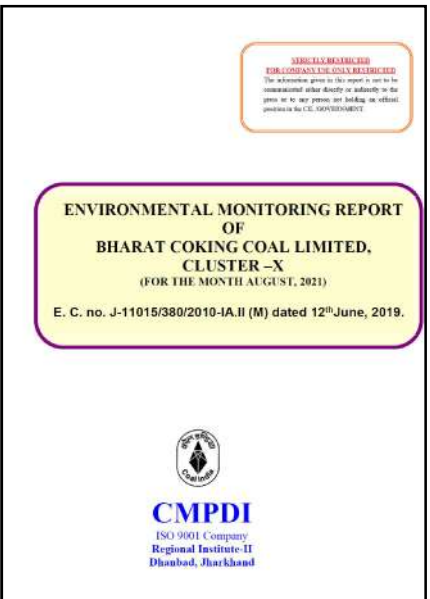
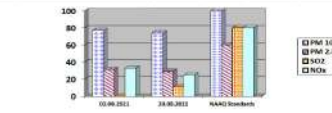
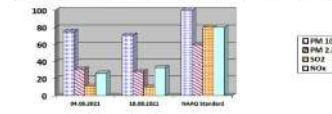
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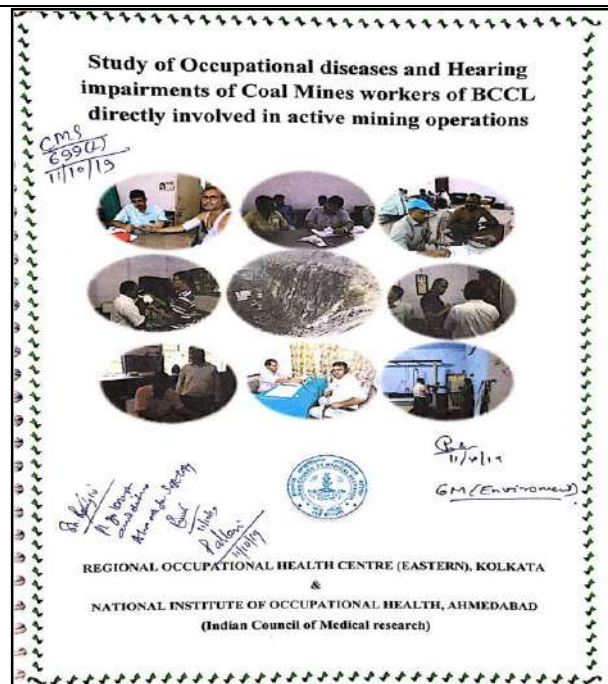
<p>XLV.</p>	<p>A Final Mine Closure Plan along with details of Corpus Fund shall be submitted to the Ministry of Environment &amp; Forests five year before mine closure for approval. Habitat Restoration Plan of the mine area shall be carried out using a mix of native species found in the original ecosystem, which were conserved in-situ and ex-situ in an identified area within the lease for reintroduction in the mine during mine reclamation and at the post mining stage for habitat restoration.</p>	<p>Mining Plan and Mine Closure Plan of Amalgamated Sudamdih Patherdih and Bhowra (South) mines has been approved in 348<sup>th</sup> BCCL Board meeting dated 29.01.2019. Approval copy is attached in Specific condition no. XIII.</p> <p>Mine Closure Cost of different mine have been deposited every year in the Escrow account and Cluster X of BCCL had deposited the amount of Rs. 3656.16 lakh (including interest) to the escrow account till 31<sup>st</sup> March 2021. Details of the fund deposited till 31.03.2021 in the escrow account is given below:</p> <p style="text-align: center;"><b>Statement showing Mine Closure Cost (Escrow Account) Details</b></p> <table border="1"> <thead> <tr> <th rowspan="2">S. No.</th> <th rowspan="2">Name of Mine</th> <th rowspan="2">Escrow account</th> <th colspan="2">Amount deposited in Escrow account till 31st March 2021 (in Rs. Lakh)</th> <th rowspan="2">Total amount in Escrow Fund</th> </tr> <tr> <th>Deposited in Escrow account from 2013-14 to 2020-21</th> <th>Interest incurred from 2013-14 to 2020-21</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Bhowra (N) Grp of Mines (UG+OC)</td> <td>150100008868</td> <td>532.28</td> <td>218.37</td> <td>750.66</td> </tr> <tr> <td>2</td> <td>Bhowra (S) Grp of Mines (UG+OC)</td> <td>150100008830</td> <td>1406.74</td> <td>577.74</td> <td>1984.48</td> </tr> <tr> <td>3</td> <td>Sudamdih Incline Mine</td> <td>150100008868</td> <td>93.74</td> <td>52.66</td> <td>146.4</td> </tr> <tr> <td>4</td> <td>Patherdih Grp of Mines</td> <td>150100008872</td> <td>389.22</td> <td>136</td> <td>525.22</td> </tr> <tr> <td>5</td> <td>Amalgamated Sudamdih-Patherdih Colliery</td> <td>150100011524</td> <td>63.68</td> <td>0.86</td> <td>64.55</td> </tr> <tr> <td>6</td> <td>Sudamdih Shaft Mine</td> <td>150100011673</td> <td>174.22</td> <td>10.63</td> <td>184.85</td> </tr> <tr> <td colspan="3"><b>Total Eastern Jharia Area (Cluster X)</b></td> <td><b>2659.88</b></td> <td><b>996.26</b></td> <td><b>3656.16</b></td> </tr> </tbody> </table>	S. No.	Name of Mine	Escrow account	Amount deposited in Escrow account till 31st March 2021 (in Rs. Lakh)		Total amount in Escrow Fund	Deposited in Escrow account from 2013-14 to 2020-21	Interest incurred from 2013-14 to 2020-21	1	Bhowra (N) Grp of Mines (UG+OC)	150100008868	532.28	218.37	750.66	2	Bhowra (S) Grp of Mines (UG+OC)	150100008830	1406.74	577.74	1984.48	3	Sudamdih Incline Mine	150100008868	93.74	52.66	146.4	4	Patherdih Grp of Mines	150100008872	389.22	136	525.22	5	Amalgamated Sudamdih-Patherdih Colliery	150100011524	63.68	0.86	64.55	6	Sudamdih Shaft Mine	150100011673	174.22	10.63	184.85	<b>Total Eastern Jharia Area (Cluster X)</b>			<b>2659.88</b>	<b>996.26</b>	<b>3656.16</b>
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<p>XLVI.</p>	<p>A separate environmental management cell with suitable qualified personnel shall be set up under the control of a Senior Executive, who will report directly to the Head of the company for implementing environment policy and socioeconomic issues and the capacity building required in this regard.</p>	<p>A full-fledged Environment Department, headed by a HoD (Environment) along with a suitable qualified multidisciplinary team of executives which includes Environment, Mining, Excavation, Civil executives and technicians has been established in Headquarters. They are also trained in ecological restoration, sustainable development, rainwater harvesting methods etc.</p> <p>The team is multidisciplinary and very much motivated under the guidance of company's Director (Technical) and CMD. Further capacity building at both corporate and operating level is being done.</p> <p>At the project level, two Executives in each area have been appointed as Environment Officer and are also entrusted with the responsibility of compliance and observance of the environmental acts/ laws including environment protection measures. The activities are monitored on regular basis at Area and at Head quarter levels. GM (Environment) at head quarter level, co-ordinates with all the Areas and reports to the Director (Technical) and in turn he reports to the CMD of the company.</p> <p>Environment Management Cell at area level has been constituted for the management of Environment and monitoring of compliance of EC conditions.</p> <div> <p><b>Bharat Coking Coal Limited</b> A MINERALS CO. Office of the General Manager, Eastern Jharia Area P.O. Bhowra, Dist. West Singhbhum, Jharkhand INDIA</p> <p><b>OFFICE ORDER</b></p> <p>An Environment Management Cell (EMC) of Eastern Jharia Area is hereby constituted with following members:</p> <ol style="list-style-type: none"> <li>1. General Manager, E.J. Area - Chairman</li> <li>2. Area Director, E.J. Area - Vice Chairman</li> <li>3. Area Manager, Environment, E.J. Area - Member</li> <li>4. Area Safety Officer, E.J. Area - Member</li> <li>5. Area Manager, Planning, E.J. Area - Member</li> <li>6. Area Finance Manager, E.J. Area - Member</li> <li>7. Area Personnel Manager, E.J. Area - Member</li> <li>8. Area Manager (Stores), E.J. Area - Member</li> <li>9. Area Manager (HRM), E.J. Area - Member</li> <li>10. Area Manager (Production), E.J. Area - Member</li> <li>11. Area Manager (Maintenance), E.J. Area - Member</li> <li>12. District Officer - Bhowra &amp; Patherdih - Member</li> </ol> <p>Environment Management Cell will monitor &amp; coordinate with project teams to initiate the compliance of conditions imposed by Environment Clearance granted by Ministry of Environment, Forest &amp; Climate Change.</p> <p>Yours faithfully, General Manager Eastern Jharia Area</p> <p>Copy to: 1. ECOM, HOD (Env), BCCL 2. All Project Offices, E.J. Area 3. EAM/SAO concerned 4. Office files</p> </div>																																																		

<p>XLVII.</p>	<p>Implementation of final mine closure plan for Cluster X, subject to obtaining prior approval of the DGMS in regard to mine safety issues</p>	<p>Final Mine Closure Plan has been prepared for each Mine in this cluster. Mining Plan and Mine Closure Plan of ASP Colliery is attached as Annexure – XV. Before implementation of final mine closure plan, prior permission from DGMS has been taken in regard to mine safety issues. Safety Management Plan (SMP) for each colliery has been prepared as per Coal Mines Regulation Act for the Safety of the mine and mining operations.</p> <div style="display: flex; justify-content: space-around;">   </div>
<p>XLVIII.</p>	<p>Corporate Environment Responsibility:</p> <p>A. The Company shall have a well laid down Environment Policy approved by the Board of Directors.</p> <p>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.</p> <p>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.</p> <p>D. To have proper checks</p>	<p>A revised Corporate Environment Policy 351.4(G) has already been laid down and approved in 377<sup>th</sup> Board meeting by the Board of Directors. This is also posted on BCCL website link- <a href="http://www.bcclweb.in/environment/CEP_04.11.2019.pdf">http://www.bcclweb.in/environment/CEP_04.11.2019.pdf</a></p> <p>Complied. And attached as Annexure - XVI</p> <div style="text-align: center;">  </div> <p>A hierarchical system of the company to deal with environmental issues from corporate level to mine level already exists.</p> <p>Being complied.</p>

	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.	There is apex Committee constituted at Ministry of Coal & CIL level and an Environment Advisory Committee has been also formulated at BCCL level comprising of the HODs of different disciplinary, chaired by DT(P&P), for implementation and monitoring of compliances of EC Conditions of all the areas of BCCL.																																																																						
<b>B.</b>	<b>General Conditions by MOEF:</b>																																																																							
I.	No change in mining technology and scope of working shall be made without prior approval of the Ministry of Environment and Forests.	<p>For change in scope of working of cluster X, amended EC has been obtained vide letter no.J-11015/380/2010-IA-II(M) dated 12<sup>th</sup> June 2019. Copy of amended EC is attached as Annexure XVII.</p> <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center;">No J-11015/380/2010-IA-II(M) Government of India Ministry of Environment, Forest and Climate Change IA Division Indira Park, Yamuna Bhawan, Jorbagh Road, N Delhi-3 Dated: 12<sup>th</sup> June, 2019</p> <p>To, The General Manager (E&amp;F) M/s Bharat Coking Coal Ltd, Koyala Bhawan, District Dhanbad (Jharkhand) Email: gmvbncil@gmail.com</p> <p><b>Sub: Cluster X Coal Mining Project of capacity 2,289 MTPA and Coal Washery of 2.08 MTPA of M/s Bharat Coking Coal Limited in an area of 2057.47 ha located in District Dhanbad (Jharkhand) - Amendment in Environmental Clearance - reg.</b></p> <p>Sir, This refers to your online proposal No IA/JH/CMIN/8812/2010 dated 15<sup>th</sup> September, 2017 and additional information dated 9<sup>th</sup> February, 2019 on the above mentioned subject.</p> <p>2. The Ministry of Environment, Forest and Climate Change has considered the proposal for amendment in environmental clearance dated 09<sup>th</sup> February, 2019 granted by the Ministry in favour of M/s Bharat Coking Coal Ltd for Cluster X Coal Mining Project (comprising six mine lease holds) of total capacity 2,289 MTPA (peak) and coal washery of 2.08 MTPA in a total area of 2057.47 ha in Jharia Coalfields, District Dhanbad (Jharkhand).</p> <p>3. The amendment in said environmental clearance has been sought due to the proposed restructuring/re-appropriation of individual mines in the Cluster for implementation of the Master Plan dealing with fire and subsidence, with the revised details as under:-</p> <table border="1"> <thead> <tr> <th>S. No.</th> <th>Mine</th> <th>Type of Mine</th> <th>Production Capacity (MTPA)</th> <th>Area (ha)</th> <th>Lease Life (Years)</th> <th></th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Bhowrah North</td> <td>UC</td> <td>0.143</td> <td>208.83</td> <td>20</td> <td></td> </tr> <tr> <td></td> <td>Bhowrah North</td> <td>UC</td> <td>0.541</td> <td>8</td> <td>30</td> <td></td> </tr> <tr> <td></td> <td>Bhowrah South</td> <td>UC</td> <td>0.377</td> <td>43</td> <td>30</td> <td>Fire dishing</td> </tr> <tr> <td>2</td> <td>Bhowrah South</td> <td>UC</td> <td>1.2</td> <td>571.58</td> <td>43</td> <td>Fire dishing</td> </tr> <tr> <td>3</td> <td>Amalgamated Sudamdih Patherdih Mine</td> <td>UC</td> <td>0.709</td> <td>418.51</td> <td>33</td> <td>Amalgamation of mines for fire dishing</td> </tr> <tr> <td>4</td> <td>Sunamdihi Shaft</td> <td>UC</td> <td>0.24</td> <td>311.5</td> <td>30</td> <td></td> </tr> <tr> <td>5</td> <td>Amalabad Cluster</td> <td>UC</td> <td>0</td> <td>386.95</td> <td>NA</td> <td></td> </tr> <tr> <td></td> <td>Sudamdih Coal Washery (Within lease hold of Sudamdih Shaft Mine)</td> <td>UC</td> <td>2.08</td> <td>18</td> <td>18</td> <td></td> </tr> <tr> <td></td> <td><b>TOTAL</b></td> <td></td> <td><b>2.289</b></td> <td><b>2057.47</b></td> <td></td> <td></td> </tr> </tbody> </table> <p>With the proposed restructuring, combined production capacity of the Cluster would remain at 2,289 MTPA (peak) in the same total area of 2057.47 ha.</p> </div>	S. No.	Mine	Type of Mine	Production Capacity (MTPA)	Area (ha)	Lease Life (Years)		1	Bhowrah North	UC	0.143	208.83	20			Bhowrah North	UC	0.541	8	30			Bhowrah South	UC	0.377	43	30	Fire dishing	2	Bhowrah South	UC	1.2	571.58	43	Fire dishing	3	Amalgamated Sudamdih Patherdih Mine	UC	0.709	418.51	33	Amalgamation of mines for fire dishing	4	Sunamdihi Shaft	UC	0.24	311.5	30		5	Amalabad Cluster	UC	0	386.95	NA			Sudamdih Coal Washery (Within lease hold of Sudamdih Shaft Mine)	UC	2.08	18	18			<b>TOTAL</b>		<b>2.289</b>	<b>2057.47</b>		
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II.	No change in the calendar plan of production for quantum of mineral coal shall be made	Being followed. Production is being done well within production capacity of this cluster as per EC.																																																																						
III.	Four ambient air quality monitoring stations shall be established in the core zone as well as in the buffer zone for PM10, PM2.5, SO2 and NOx monitoring. Location of the stations shall be decided based on the meteorological data, topographical features and environmentally and ecologically sensitive targets	<p>The optimum location of monitoring stations in Jharia Coal Field finalized in consultation with the Jharkhand State Pollution Control Board.</p> <p>Ambient air quality is being regularly monitored by CMPDIL. Report is enclosed as Annexure VIII – Environmental Monitoring Report for cluster X.</p> <p>Water Sprinkling in Mine Premises has been regularly done to reduce PM10 and PM2.5 level. Picture showing water sprinkling is attached.</p>																																																																						

	<p>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.</p>																																																																															
<p>IV.</p>	<p>Data on ambient air quality (PM10, PM 2.5, SO2 and NOx) 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.</p>	<p>Ambient air quality data (PM10, PM2.5, SO2 and NOx) and other monitoring data have been regularly monitored and analyzed by CMPDIL and submitted the report, which is attached as Annexure VIII.</p> <div>  <p style="text-align: center;"><b>ENVIRONMENTAL MONITORING REPORT OF BHARAT COKING COAL LIMITED, CLUSTER - X (FOR THE MONTH AUGUST, 2021)</b></p> <p style="text-align: center;">E. C. no. J-11015/380/2010-IA.II (M) dated 12<sup>th</sup> June, 2019.</p> <p style="text-align: center;"><b>CMPDI</b> ISO 9001 Company Regional Institute-II Dhanbad, Jharkhand</p> </div>	<div> <p style="text-align: center;"><b>AMBIENT AIR QUALITY DATA</b></p> <p>Cluster - X, Bharat Coking Coal limited Month: AUGUST 2021 Year: 2021-22.</p> <table border="1"> <thead> <tr> <th>Station Name: A14-Bhowrah North</th> <th>Zone: Core</th> <th>Category: Industrial</th> </tr> </thead> <tbody> <tr> <td>Sl. No.</td> <td>Dates of sampling</td> <td>PM 10</td> <td>PM 2.5</td> <td>SO<sub>2</sub></td> <td>NO<sub>x</sub></td> </tr> <tr> <td>1</td> <td>02.08.2021</td> <td>77</td> <td>31</td> <td>10</td> <td>33</td> </tr> <tr> <td>2</td> <td>20.08.2021</td> <td>74</td> <td>29</td> <td>11</td> <td>25</td> </tr> <tr> <td colspan="2"></td> <td>NAAQ Standards</td> <td>100</td> <td>60</td> <td>80</td> <td>80</td> </tr> </tbody> </table>  <table border="1"> <thead> <tr> <th>Station Name: A15-Sudamdih Washery</th> <th>Zone: Core</th> <th>Category: Industrial</th> </tr> </thead> <tbody> <tr> <td>Sl. No.</td> <td>Dates of sampling</td> <td>PM 10</td> <td>PM 2.5</td> <td>SO<sub>2</sub></td> <td>NO<sub>x</sub></td> </tr> <tr> <td>1</td> <td>04.08.2021</td> <td>75</td> <td>31</td> <td>11</td> <td>26</td> </tr> <tr> <td>2</td> <td>18.08.2021</td> <td>71</td> <td>29</td> <td>18</td> <td>33</td> </tr> <tr> <td colspan="2"></td> <td>NAAQ Standard</td> <td>100</td> <td>60</td> <td>80</td> <td>80</td> </tr> </tbody> </table>  <p style="text-align: center;">JOB NO. 200318028 Cluster - X, BCCL Environmental Monitoring Report</p> </div>	Station Name: A14-Bhowrah North	Zone: Core	Category: Industrial	Sl. No.	Dates of sampling	PM 10	PM 2.5	SO <sub>2</sub>	NO <sub>x</sub>	1	02.08.2021	77	31	10	33	2	20.08.2021	74	29	11	25			NAAQ Standards	100	60	80	80	Station Name: A15-Sudamdih Washery	Zone: Core	Category: Industrial	Sl. No.	Dates of sampling	PM 10	PM 2.5	SO <sub>2</sub>	NO <sub>x</sub>	1	04.08.2021	75	31	11	26	2	18.08.2021	71	29	18	33			NAAQ Standard	100	60	80	80																					
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<p>V.</p>	<p>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.</p>	<p>It is being complied in mines and also the Noise levels are below the Ambient Noise Standard (Day time 75 dB &amp; Night Time (70 dB for Industrial Area). However, ear muffs / ear plugs are provided to the workers engaged in blasting and drilling operations, HEMM operations etc.</p> <div> <p style="text-align: center;"><b>NOISE LEVEL DATA</b></p> <table border="1"> <thead> <tr> <th>Sl. No.</th> <th>Name of the Project</th> <th>Station Name/Code</th> <th>Category of area</th> <th>Date</th> <th>Noise level dB(A)IEQ</th> <th>Permissible Limit of Noise level in dB(A)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Jeeenagora (N13)</td> <td>Jeeenagora (N13)</td> <td>Industrial area</td> <td>12.08.2021</td> <td>57.6</td> <td>75</td> </tr> <tr> <td>2</td> <td>Jeeenagora (N13)</td> <td>Jeeenagora (N13)</td> <td>Industrial area</td> <td>27.08.2021</td> <td>57.5</td> <td>75</td> </tr> <tr> <td>3</td> <td>BhowrahNorth(N14)</td> <td>BhowrahNorth(N14)</td> <td>Industrial area</td> <td>02.08.2021</td> <td>55.9</td> <td>75</td> </tr> <tr> <td>4</td> <td>BhowrahNorth(N14)</td> <td>BhowrahNorth(N14)</td> <td>Industrial area</td> <td>19.08.2021</td> <td>56.2</td> <td>75</td> </tr> <tr> <td>5</td> <td>SudamdihWashery (N15)</td> <td>SudamdihWashery (N15)</td> <td>Industrial area</td> <td>04.08.2021</td> <td>62.4</td> <td>75</td> </tr> <tr> <td>6</td> <td>SudamdihWashery (N15)</td> <td>SudamdihWashery (N15)</td> <td>Industrial area</td> <td>18.08.2021</td> <td>63.6</td> <td>75</td> </tr> <tr> <td>7</td> <td>Sitanala (N30)</td> <td>Sitanala (N30)</td> <td>Residential area</td> <td>04.08.2021</td> <td>54.3</td> <td>55</td> </tr> <tr> <td>8</td> <td>Sitanala (N30)</td> <td>Sitanala (N30)</td> <td>Residential area</td> <td>18.08.2021</td> <td>53.7</td> <td>55</td> </tr> <tr> <td>9</td> <td>Sudamdih Mine shaft</td> <td>Sudamdih Mine shaft</td> <td>Industrial area</td> <td>04.08.2021</td> <td>65.7</td> <td>75</td> </tr> <tr> <td>10</td> <td>Sudamdih Mine shaft</td> <td>Sudamdih Mine shaft</td> <td>Industrial area</td> <td>18.08.2021</td> <td>65.5</td> <td>75</td> </tr> </tbody> </table> <p style="text-align: center;">JOB NO. 200318028 Cluster - X, BCCL Environmental Monitoring Report</p> </div>	Sl. No.	Name of the Project	Station Name/Code	Category of area	Date	Noise level dB(A)IEQ	Permissible Limit of Noise level in dB(A)	1	Jeeenagora (N13)	Jeeenagora (N13)	Industrial area	12.08.2021	57.6	75	2	Jeeenagora (N13)	Jeeenagora (N13)	Industrial area	27.08.2021	57.5	75	3	BhowrahNorth(N14)	BhowrahNorth(N14)	Industrial area	02.08.2021	55.9	75	4	BhowrahNorth(N14)	BhowrahNorth(N14)	Industrial area	19.08.2021	56.2	75	5	SudamdihWashery (N15)	SudamdihWashery (N15)	Industrial area	04.08.2021	62.4	75	6	SudamdihWashery (N15)	SudamdihWashery (N15)	Industrial area	18.08.2021	63.6	75	7	Sitanala (N30)	Sitanala (N30)	Residential area	04.08.2021	54.3	55	8	Sitanala (N30)	Sitanala (N30)	Residential area	18.08.2021	53.7	55	9	Sudamdih Mine shaft	Sudamdih Mine shaft	Industrial area	04.08.2021	65.7	75	10	Sudamdih Mine shaft	Sudamdih Mine shaft	Industrial area	18.08.2021	65.5	75	
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<p>VI.</p>	<p>Industrial wastewater (workshop and wastewater from the mine) shall be properly collected, treated so as to conform to the</p>	<p>The optimum location of monitoring stations in Jharia Coal Field finalized in consultation with the Jharkhand State Pollution Control Board. Mine water &amp; ground water quality is being regularly monitored by CMPDIL.</p>	<p>Physico-Chemical characteristics of effluents are well within the</p>																																																																													

	standards prescribed under GSR 422 (E) dated 19th May 1993 and 31 <sup>st</sup> December 1993 or as amended from time to time before discharge. Oil and grease trap shall be installed before discharge of workshop effluents.	prescribed limit. A proposal has been moved for the installation of Oil & Grease trap system at workshop under EJ Area and it is under process for approval.																
VII.	Vehicular emissions shall be kept under control and regularly monitored. Vehicles used for transporting the mineral shall be covered with tarpaulins and optimally loaded.	Vehicular emissions are being under control and the Pollution under control certificate has been attached as Annexure – XVIII. All the vehicles used for coal transportation are covered with tarpaulins.																
VIII.	Monitoring of environmental quality parameters shall be carried out through establishment of adequate number and type of pollution monitoring and analysis equipment in consultation with the State Pollution Control Board and data got analyzed through a laboratory recognized under EPA Rules, 1986.	Monitoring of Environmental quality parameters have been regularly done by CMPDIL with proper analysis equipment.																
IX.	Personnel working in dusty areas shall wear protective respiratory devices and they shall also be provided with adequate training and information on safety and health aspects.	<p>It is being complied. All Personnel working in mines are provided with respiratory masks and safety eyeglass to protect the dust ingestion. Year wise details of protective respiratory devices / dust m ask issued is given below:</p> <p style="text-align: center;"><b><u>YEARWISE DETAIL OF PROTECTIVE RESPIRATORY DEVICES / DUST MASK ISSUED</u></b></p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Colliery Name</th> <th>2016</th> <th>2017</th> <th>2018</th> </tr> </thead> <tbody> <tr> <td>Bhowra North</td> <td>200</td> <td>180</td> <td>70</td> </tr> <tr> <td>Bhowra South</td> <td>38</td> <td>119</td> <td>80</td> </tr> <tr> <td>Amalgamated Sudamdih - Patherdih (ASP) Colliery</td> <td>65</td> <td>68</td> <td>72</td> </tr> </tbody> </table> <p>National Institute of Occupational Health (NIOH) has conducted a study on Occupational disease and Hearing impairments of Coal Mines workers of BCCL directly involved in active mining operations and submitted their final report which has already been scrutinized by Medical Department, BCCL. NIOH report is enclosed as Annexure - XIX.</p>	Colliery Name	2016	2017	2018	Bhowra North	200	180	70	Bhowra South	38	119	80	Amalgamated Sudamdih - Patherdih (ASP) Colliery	65	68	72
Colliery Name	2016	2017	2018															
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A separate full-fledged Human Resource Development (HRD) Department is conducting regular training programs on safety and health issues. Apart from this, Vocational Training Center exist in E.J. area (cluster X), which provides periodical training on the safety and occupational health issue to workers working in the mines.

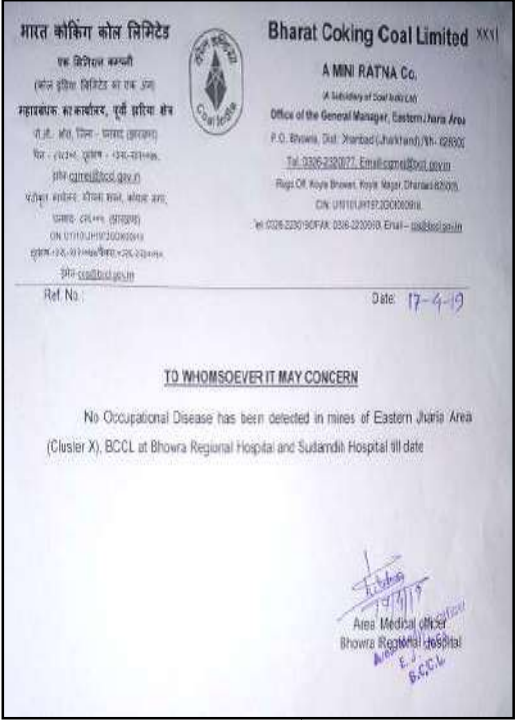
X. Occupational health surveillance programs of the workers shall be undertaken periodically to observe any contractions due to exposure to dust and to take corrective measures, if needed and records maintained thereof. The quality of environment due to outsourcing and the health and safety issues of the outsourced manpower should be addressed by the company while outsourcing.

Initial Medical Examination (IME) and Periodical Medical Examination (PME) of all the personnel are carried out as per the Statutes and Director General of Mines Safety (DGMS) guideline. IME, PME and VTC details are given below:

	Year	Target	Actual
PME	2016	951	993
	2017	891	927
	2018	385	464
	2019	1073	896
	2020	1221	1036
VTC	2016-17	472	488
	2017-18	338	392
	2018-19	343	386
	2019-20	414	455
	2020-21	461	557

Contractual Workers:	Training	IME	
2014-15	15	2014-15	15
2015-16	78	2015-16	74
2016-17	78	2016-17	62
2017-18	163	2017-18	124
2018-19	111	2018-19	111

Certificate of the area medical officer showing no occupational disease has been detected in the Cluster X group of mines is attached.

		
<p>XI.</p>	<p>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.</p>	<p>Environment Management Cell at area level has been constituted for the management of Environment and monitoring of compliance of EC conditions.</p>
<p>XII.</p>	<p>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.</p>	<p>Year wise and item wise expenditure made on environment protection measures is enclosed as Annexure – XX.</p>
<p>XIII.</p>	<p>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</p>	<p>It has been complied. Advertisement in local newspaper has also been done.</p>

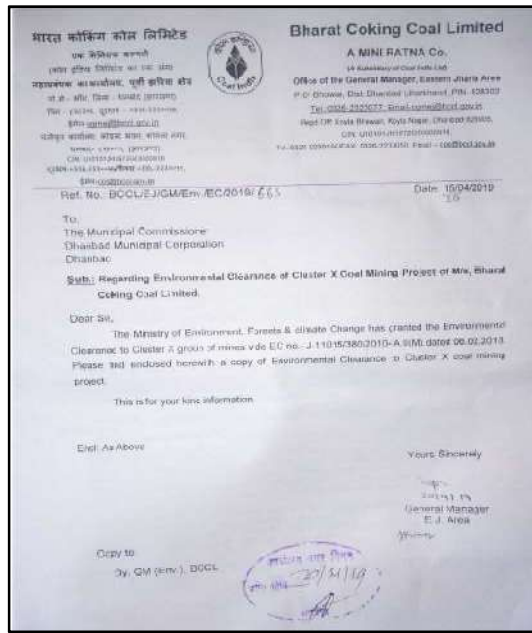
environmental clearance and a copy of the clearance letter is available with the State Pollution control Board and may also be seen at the website of the ministry of Environment & Forests at <http://envfor.nic.in>.



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.

Copy of EC letter of cluster X has been displayed on BCCL website. Link- <http://www.bcclweb.in/Environment%20Clearance/ECX.pdf> Amended Environment clearance (New) letter link- <http://www.bcclweb.in/Environment%20Clearance/ClusterX%20amendment.pdf>

A copy of EC letter sent to Municipal corporation / panchyat is attached.



XV. A copy of the environmental clearance letter shall be displayed on the website of the concerned State Pollution Control Board. The EC letter shall also be displayed at

Complied. Copy of EC letter and amended Environment clearance (New) letter of cluster X has been displayed on BCCL website.

	the Regional Office, District Industry Sector and Collector's Office/Tehsildar's Office for 30 days.	
XVI.	The clearance letter shall be uploaded on the company's website. The compliance status of the stipulated environmental clearance conditions shall also be uploaded by the project authorities on their website and updated at least once every six months so as to bring the same in public domain. The monitoring data of environmental quality parameter (air, water, noise and soil) and critical pollutant such as PM10, PM2.5, SO2 and NOx (ambient) and critical sectoral parameters shall also be displayed at the entrance of the project premises and mine office and in corporate office and on company's website.	<p>Complied.</p> <p>The clearance letter has been uploaded on the BCCL website. Link-<a href="http://www.bcclweb.in/Environment%20Clearance/ECX.pdf">http://www.bcclweb.in/Environment%20Clearance/ECX.pdf</a></p> <p>Amended Environment clearance (New) letter link-<a href="http://www.bcclweb.in/Environment%20Clearance/ClusterX%20amendment.pdf">http://www.bcclweb.in/Environment%20Clearance/ClusterX%20amendment.pdf</a></p> <p>The compliance status of the stipulated environmental clearance conditions has been uploaded on BCCL website, link-<a href="https://www.bcclweb.in/?page_id=4731&amp;lang=en">https://www.bcclweb.in/?page_id=4731&amp;lang=en</a></p>
XVII.	The project proponent shall submit six monthly compliance reports on status of compliance of the stipulated environmental clearance conditions (both in hard copy and in e-mail) to the respective Regional Office of the Ministry, respective Zonal Offices of CPCB and the SPCB.	<p>Being complied.</p> <p>Six monthly compliance report of Cluster X has been regularly submitted to the MoEFCC portal Parivesh <a href="https://parivesh.nic.in/">https://parivesh.nic.in/</a> and also a copy of the report is being submitted to Jharkhand SPCB office.</p>
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/	Project authority is ready to extend its full cooperation for any kind of visit and inspection conducted by Regional Office in connection with EC Conditions Compliance.

	information/monitoring reports.	
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 MoEF by E-mail.	Environmental Statement (Form-V) has been regularly submitted for each financial year to Jharkhand State Pollution Control Board. Annexure XXI – Environmental statement (Form-V) of projects/collieries of E.J. Area attached.
<b>C.</b>	<b>Other Conditions by MOEF:</b>	
i.	The Ministry or any other Competent Authority may stipulate any further condition(s) for environmental protection.	Agreed.
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.	Agreed.
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	It is being complied.

	up remedial measures in case of soil contamination, contamination of groundwater and surface water, and occupational and other diseases due to the mining operations.	
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.	Agreed.

*[Signature]*  
25/11/2021  
Area Manager (Env.)  
EJ Area

*[Signature]*  
29/11/21  
Project Officer  
ASP,  
EJ Area

*[Signature]*  
01/12/21  
Project Officer  
Bhowra (South),  
EJ Area

*[Signature]*  
11/12/21  
Project Officer  
Bhowra (North),  
EJ Area

*[Signature]*  
1/12/21  
Addl. General Manager  
EJ Area, BCCL  
Cluster X

*[Signature]*  
1/12/21  
General Manager  
EJ Area, BCCL  
Cluster X

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

**(FOR THE Q.E. JUNE 2021)**

**E. C. no. J-11015/380/2010-IA.II (M) dated 12<sup>th</sup> June, 2019.**



**CMPDI**

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

# CLUSTER - X

(FOR THE Q.E. JUNE 2021)

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2.	CHAPTER - I	INTRODUCTION
3.	CHAPTER-II	WATER SAMPLING & ANALYSIS
4.	<b>Plates:</b> Plate NO. - I	SURFACE PLAN SHOWING WATER MONITORING LOCATIONS

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

## 2.0 Sampling location and rationale

### 2.1 Water sampling stations

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

## 3.0 Methodology of sampling and analysis

### 3.1 Water quality

Water samples were collected as per standard practice. Effluent samples were analyzed for 25 parameters on quarterly basis & for 27 parameters on half yearly basis. The drinking and Surface water samples were collected and analyzed for 25 and 17 parameters respectively, on quarterly basis. Thereafter the samples were preserved and analyzed at the Environmental Laboratory at CMPDI 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, Forests and Climate Change (MoEF&CC), Govt. of India.

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

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

- 1.1 The Cluster-X is in the Eastern part of the Jharia coalfield. It includes a group of 6 Mines (viz. Amlabad UG, Bhowra north UG/OC, Bhowra South UG/OC , Amalgamated Sudamdih Patherdih Mine, Sudamdih Shaft, Sudamdih Coal Washery The Cluster-X is situated about 25 - 30 kms from Dhanbad Railway Station. The mines of this Cluster-X are operating since pre nationalization period (prior to 1972-73). It is connected by both Railway and Road. The drainage of the area is governed by Damodar River.
- 1.2 The Cluster-X is designed to produce 1.762 MTPA (normative) and 2.289 MTPA (peak) capacity of coal and coal washery of 2.08 MTPA.

The Project has Environmental Clearance from Ministry of Environment, Forests and Climate Change (MoEF&CC) for a rated capacity 1.762 MTPA (normative) and 2.289 MTPA (peak) capacity of coal production vide letter no. J-11015/380/2010-IA.II (M) dated 12<sup>th</sup> June, 2019.

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

## CHAPTER – II

# WATER QUALITY MONITORING

### 2.1 Location of sampling sites

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

- i) Drinking Water quality at **Bhowrah North (DW10)**
- ii) Surface Water quality at **U/S of Damodar River (SW21)**
- iii) Surface Water quality at **D/S of Damodar River (SW22)**
- iv) Mine Effluent quality at **Bhowrah North (MW10)**

### 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 & 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 show that most of the parameters are within the permissible limits.

# WATER QUALITY

## (SURFACE WATER- 17 PARAMETERS)

Name of the Company: **Bharat Coking Coal Limited** Year : **2021-22.**

Name of the Cluster: **Cluster - X**

Period: **Q.E. JUNE 2021**

Stations:

1. Upstream in Damodar river SW-21
2. Downstream in Damodar river SW-22

Date of  
Sampling:  
07/06/2021  
07/06/2021

Sl.No	Parameter	Sampling Stations				IS: 2296	Detection Limit	BIS Standard & Method
		SW21	SW22					
1	Arsenic (as As), mg/l, Max	<0.006	<0.006			0.2	0.006	IS-3025,part 37:1988, R-2019/ APHA 23 <sup>rd</sup> Edition AAS-VGA
2	BOD (3 days 27°C), mg/l, Max	<2.0	<2.0			3.00	2.00	IS 3025 ( Part 44 ) : 1993 Reaffirmed 2019 , 3 day incubation at 27°C
3	Colour	<1	<1			1-100.0 Hazen Units	1	APHA,23 <sup>RD</sup> Edition ,2120-B:-2017
4	Chlorides (as Cl), mg/l, Max	17	17			600	2.00	IS-3025/32:1988, R-2019 Argentometric
5	Copper (as Cu), mg/l, Max	<0.2	<0.2			1.5	0.2	IS 3025/42 : 1992 R : 2019, AAS-Flame
6	Dissolved Oxygen, min.	5.1	5.0			4	0.10	IS 3025 (Part 38) : 1989, Reaffirmed 2019 Modified Winkler Azide Method
7	Fluoride (as F) mg/l, Max	0.45	0.37			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			0.05	0.01	IS 3025 (Part 52) : 2003,Reaffirmed 2019
9	Iron (as Fe), mg/l, Max	<0.2	<0.2			50	0.2	IS 3025 /53 : 2003,R : 2019 , AAS-Flame Method
10	Lead (as Pb), mg/l, Max	<0.005	<0.005			0.1	0.005	APHA, 23 <sup>rd</sup> Edition, AAS-GTA
11	Nitrate (as NO <sub>3</sub> ), mg/l, Max	5.68	3.4			50	0.50	APHA, 23rd Edition, P-4-127, 4500 - NO <sub>3</sub> <sup>-</sup> B , UV-Spectrophotometric Screening Method
12	pH value	6.95	7.11			6.5-8.5	2.5	IS 3025, Part 11 : 1983 R 2017 Electrometric method
13	Phenolic compounds (as C <sub>6</sub> H <sub>5</sub> OH), mg/l, Max	<0.002	<0.002			0.005	0.002	APHA, 22 <sup>nd</sup> Edition 4-Amino Antipyrine
14	Selenium, mg/l, Max	<0.007	<0.007			0.05	0.007	IS-3025,part 56:2003, R-2019/ APHA 23 <sup>rd</sup> Edition, AAS-VGA
15	Sulphate (as SO <sub>4</sub> ) mg/l, Max	42	44			400	10	APHA -23rd Edition. P-4-199, 4500 SO <sub>4</sub> <sup>2-</sup> E
16	Total Dissolved Solids, mg/l, Max	152	154			1500	25.00	IS 3025, Part 16: 1984 R 2017 Gravimetric method
17	Zinc (as Zn), mg/l, Max	<0.1	<0.1			15	0.1	IS 3025/ 49 : 1994, R : 2019, AAS-Flame

All values are expressed in mg/lit unless specified.

  
 Analysed By  
 JS/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- 25 PARAMETERS)**

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

Year : **2021-22.**

Name of the Cluster: **Cluster - X**

Period: **Q.E. JUNE 2021**

**Stations:**

1. Drinking Water from Bhowrah South DW-10

**Date of Sampling:**

31.05.2021

Sl. No	Parameter	Sampling Stations			Detection Limit	IS:10500 Drinking Water Standards	Standard / Test Method
		DW10					
1	Boron (as B), mg/l, Max	<0.2			0.2	0.5	APHA, 23 <sup>rd</sup> Edition ,Carmine
2	Colour,in Hazen Units	3			1	5	APHA, 23 <sup>rd</sup> Edition ,Pt.-Co. Method
3	Calcium (as Ca), mg/l, Max	80			1.6	75	IS 3025, Part 40: 1991 R 2019 EDTA Method
4	Chloride (as Cl), mg/l, Max	133			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 APHA,23 <sup>rd</sup> Edition, AAS-GTA
6	Fluoride (as F) mg/l, Max	0.39			0.2	1.0	APHA, 23 <sup>rd</sup> Edition, Page 4-90 to , 4500 -F- D (SPADNS Method)
7	Free Residual Chlorine, mg/l, Min	<0.04			0.04	0.2	APHA, 23 <sup>rd</sup> 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, 23 <sup>rd</sup> Edition, AAS-GTA
10	Manganese (as Mn), mg/l, Max	0.03			0.02	0.1	APHA, 23 <sup>rd</sup> Edition, 3111B, Direct Air Acetylene Flame AAS-Flame
11	Nitrate (as NO <sub>3</sub> ), mg/l, Max	37.48			0.5	45	APHA, 23 <sup>rd</sup> Edition, P-4-127, 4500 - NO <sub>3</sub> - B , UV-Spectrophotometric Screening Method
12	Odour	Agreeable			Qualitative	Agreeable	APHA, 23 <sup>rd</sup> Edition, , 2150-C
13	pH value	7.02			0.2	6.5-8.5	IS 3025, Part 11 : 1983 R 2017 Electrometric method
14	Phenolic compounds (as C <sub>6</sub> H <sub>5</sub> OH), mg/l, Max	<0.001			0.001	0.002	APHA, 22 <sup>nd</sup> Edition,4-Amino Antipyrine
15	Selenium, mg/l, Max	<0.007			0.007	0.01	IS -3025,part 56:2003,R-2019/APHA 23 <sup>rd</sup> Edition, AAS-VGA
16	Sulphate (as SO <sub>4</sub> ) mg/l, Max	132			10	200	APHA -23 <sup>rd</sup> Edition. P-4-199, 4500 SO <sub>4</sub> <sup>2-</sup> E
17	Taste	Acceptable			Qualitative	Acceptable	APHA,23 <sup>rd</sup> Edition, 2160-C Flavour Rating Assesment
18	Total Alkalinity (c <sub>a</sub> co <sub>3</sub> ), mg/l, Max	192			4	200	IS 3025, Part 23: 1986 R 2019 Titration Method
19	Total Arsenic (as As), mg/l,Max	<0.006			0.006	0.01	IS-3025, part 37:1988,R-2019/APHA23 <sup>rd</sup> Edition AAS-VGA
20	Total Chromium (as Cr), mg/l, Max	<0.04			0.04	0.05	IS-3025 Part 52:2003, R:2019,AAS-Flame APHA, 23 <sup>rd</sup> Edition, AAS-GTA
21	Total Dissolved Solids, mg/l, Max	613			25	500	IS 3025, Part 16: 1984 R 2017 Gravimetric method
22	Total Hardness (c <sub>a</sub> co <sub>3</sub> ), mg/l, Max	514			4	200	IS 3025, Part 21, 2009 R 2019 EDTA Method
23	Turbidity, NTU, Max	2			1	5	IS 3025, Part 10 : 1984 R 2017 Nephelometric Method
24	Zinc (as Zn), mg/l, Max	<0.1			0.1	5	IS 3025 Part 49 : 1994,R : 2019, AAS-Flame
25	Nickel as Ni, mg/l Max	<0.01			0.01	0.02	IS 3025 Pat 54 : 2003,R : 2019, AAS-Flame APHA 23 <sup>rd</sup> Edition, AAS-GTA

**अनुमान रक्षक राबुन**  
Analysed By  
JSA/SA/SSA

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

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

# WATER QUALITY

## (MINE EFFLUENT - 27 PARAMETERS)

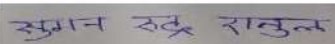
Name of the Company: **Bharat Coking Coal Limited**

Year : **2021-22.**

Name of the Cluster: **Cluster - X**

Period: **Q.E. JUNE 2021**

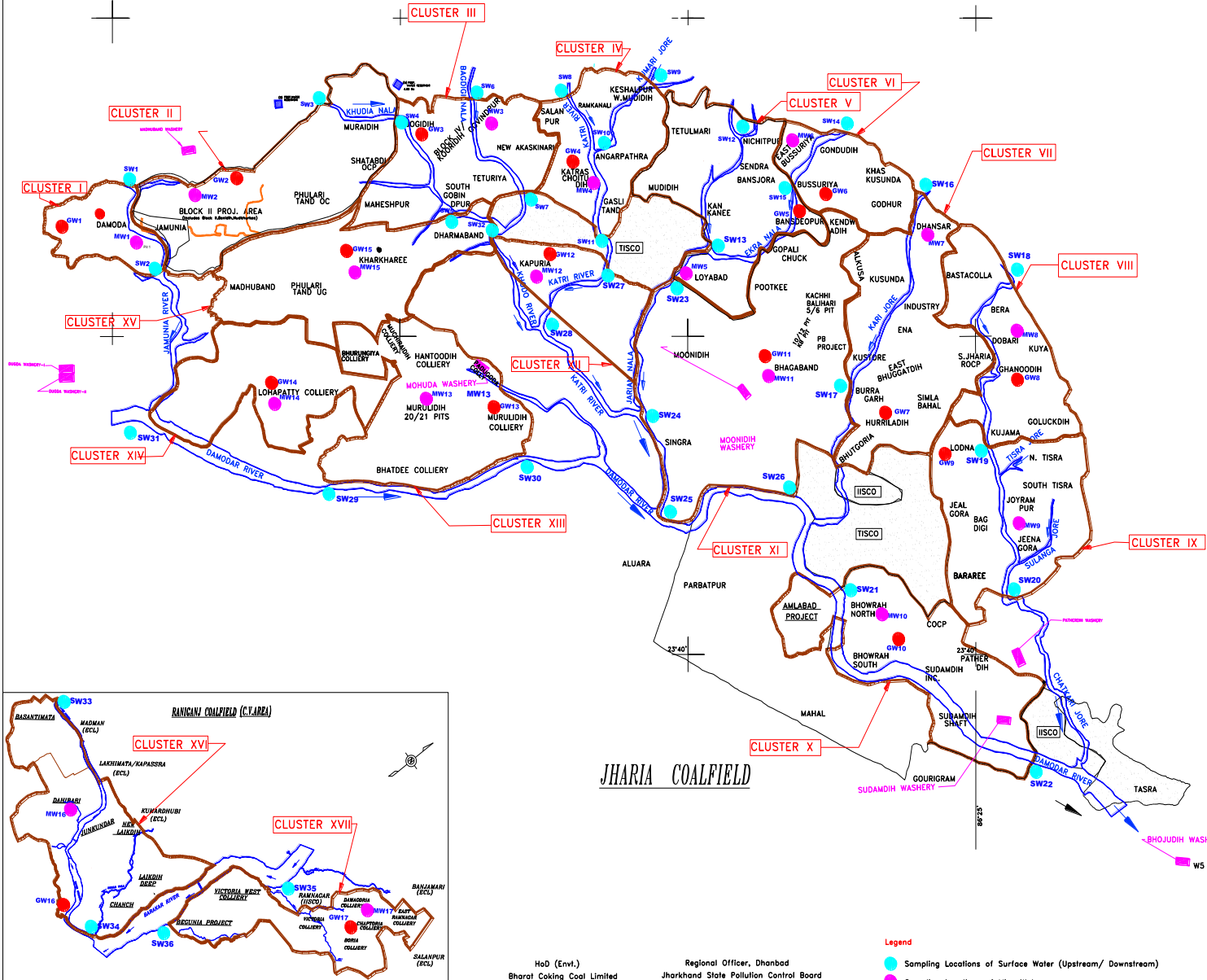
Effluent water of BCCL Mines					Date of Sampling:
Sample Code :MW 10					07.06.2021
Sl.No.	Parameter	MW-10	Detection Limit	MOEF -SCH-VI STANDARDS Class 'A'	BIS Standard & Method
1	Ammonical Nitrogen, mg/l, Max	<0.02	0.02	50.0	IS 3025/34:1988, R : 2009, Nessler's
2	Arsenic (as As), mg/l, Max	<0.006	0.006	0.2	IS 3025, part 37:1988, R-2019/ APHA 23 <sup>rd</sup> Edition AAS-VGA
3	B.O.D (3 days 27°C), mg/l, Max	<2.0	2.00	30.0	IS 3025 /44:1993,R:2003 3 day incubation at 27°C
4	Colour	<1	Quantitative	Quantitative	APHA 23 <sup>rd</sup> Edition, 2120B 2017
5	COD, mg/l, Max	20	4.00	250.0	APHA 23 <sup>rd</sup> 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	<0.1	0.10	5.0	IS 3025/ 31, 1988 R 2019
8	Fluoride (as F) mg/l, Max	0.71	0.2	2.0	APHA, 23 <sup>rd</sup> 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, Nessler's
10	Hexavalent Chromium, mg/l, Max	<0.01	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, 23 <sup>rd</sup> 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, 23 <sup>rd</sup> 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	0.68	0.50	10.0	APHA, 23 <sup>rd</sup> Edition, UV-Spectrophotometric
16	Oil & Grease, mg/l, Max	<2.0	2.00	10.0	IS 3025/39:1991, R : 2019, Partition Gravimetric
17	pH value	7.78	2.5	5.5 to 9.0	IS-3025/11:1983, R-2017, Electrometric
18	Phenolic compounds (as C <sub>6</sub> H <sub>5</sub> OH),mg/l, Max	<0.002	0.002	1.0	APHA, 23 <sup>rd</sup> Edition 4-Amino Antipyrine
19	Selenium, mg/l, Max	<0.007	0.007	0.05	IS 3025, part 56:2003, R-2019/APHA 23 <sup>rd</sup> Edition, AAS-VGA
20	Sulphide (as S <sup>2-</sup> ) mg/l Max.	<0.005	0.005	2.0	APHA 23 <sup>rd</sup> Edition Methylene Blue Method
21	Temperature (°C)	32	Shall not exceed 5° C above the receiving temp.		IS-3025/09:1984, Thermometric
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	<1.0	1.00	100.0	IS:3025/34:1988, Nessler's
24	Total Residual Chlorine, mg/l, Max	<0.04	0.04	1.0	APHA, 23 <sup>rd</sup> Edition, , 4500-Cl B. (Iodometric Method-I)
25	Total Suspended Solids, mg/l, Max	38	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		Qualitative	APHA, 23 <sup>rd</sup> Edition, , 2150-C

  
 Analysed By  
 JSA/SA/SSA

  
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 RI-2, CMPDI, Dhanbad

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

# Water Sampling Locations in BCCL



## INDEX

Cluster	Surface Water (US, DS)	Name of River/Nala / Jore	Mined Effluent Water	Sampling Location	Ground Water	Sampling Location
I	SW1, SW2	Jamunia River	MW1	Damoda Area	GW1	Chuhway Village
II	SW3, SW4	Khudia Nala	MW2	Block II OCP	GW2	Joyrampur Village
III	SW4, SW5, SW6, SW7	Khudia Nala, Bagdigi Nala	MW3	Govindpur Colliery	GW3	Jogdih Village
IV	SW8, SW11, SW9, SW10	Kari River, Kurnari Jore	MW4	Chotudih	GW4	Kankanee Village
V	SW12, SW13, SW15	Jarian Nala, Ekra Nala	MW5	Muddih	GW5	Nichitpur
VI	SW14, SW15	Ekra Nala	MW6	East Bassuria UGP	GW6	Bansjora Borewell
VII	SW16, SW17	Kari Jore	MW7	Dhansar UGP	GW7	Humliadih
VIII	SW18, SW19	Kashi Jore	MW8	Dobari UGP	GW8	Gharudih
IX	SW19, SW20	Kashi Jore	MW9	Jeenagore	GW9	Lodna
X	SW21, SW22	Damodar River	MW10	Bhowrah North	GW10	Bhowrah South
XI	SW23, SW24, SW25, SW26	Khudia Nala, Damodar River	MW11	Bhagaband UGP	GW11	Bhagabandh
XII	SW27, SW28	Kari River	MW12	Kapunia	GW12	Kapunia
XIII	SW29, SW30	Damodar River	MW13	Muruidih (OCP)	GW13	Muruidih
XIV	SW31, SW29	Damodar River	MW14	Lohapatti	GW14	Lohapatti
XV	SW5, SW32	Khudia Nala	MW15	Kharkhane UGP	GW15	Kharkhane
XVI	SW33, SW34	Khudia River	MW16	Sahbani OCP	GW16	Patlabani Village
XVII	SW35, SW36	Sankar River	MW17	Dhansgaria Colliery	GW17	Chaptana

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

Client: BHARAT COKING COAL LIMITED  
Title: WATER SAMPLING LOCATIONS  
Subject: MONITORING STATIONS



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FOR COMPANY USE ONLY**

**RESTRICTED**

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## **GROUNDWATER LEVEL & QUALITY REPORT**

### **FOR CLUSTER OF MINES, BCCL**

**(Assessment year – 2020-21)**

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

**JHARIA COALFIELD AND RANIGANJ COALFIELD (PART)**

**For  
(BHARAT COKING COAL LIMITED)**

**(A Subsidiary of Coal India Limited)**

**KOYLA BHAWAN (DHANBAD)**

**Prepared by**

**Hydrogeology Department**

**Exploration Division**

**CMPDI (HQ), Ranchi**

**MARCH – 2021**

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## **CMPDIL**

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**(Accredited Groundwater Professional Institutions by CGWB/CGWA)**

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

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

## J. GROUND WATER LEVEL OF CLUSTER-X

Cluster-X consists of Bhowrah North OC & UG, Bhowrah South OC & UG, Amalgamated Sudamdih Patherdih, Sudamdih Shaft, Amlabad UG (Closed) and Sudamdih Coal Washery comes under the administrative control of Eastern Jharia Area of Bharat Coking Coal Limited (B.C.C.L - A Subsidiary of Coal India Limited). This cluster of mines is located in eastern part of Jharia Coalfield in Dhanbad district of Jharkhand. The life of the project works out is more than 30 years considering annual target production of 2.289 MTY.

Cluster-X mine involves leasehold area of about 2057.47 Ha of land. It covered in Survey of India toposheet no. 73 I/6. The area of Bhowrah North OC & UG, Bhowrah South OC & UG, Amalgamated Sudamdih Patherdih, Sudamdih Shaft, Amlabad UG (Closed) are 280.83 Ha, 571.58 Ha, 498.61 Ha, 391.50 Ha and 386.95 Ha respectively.

The present leasehold area of Cluster-X is 2057.47 Ha. The area has an undulating topography with gentle slope towards south and south east. The RL varies from 185 m to 150.0 m AMSL. Gaurkuthi Nala and few seasonal streams are controlling the drainage pattern of the area. The area comes under the watershed of Damodar River.

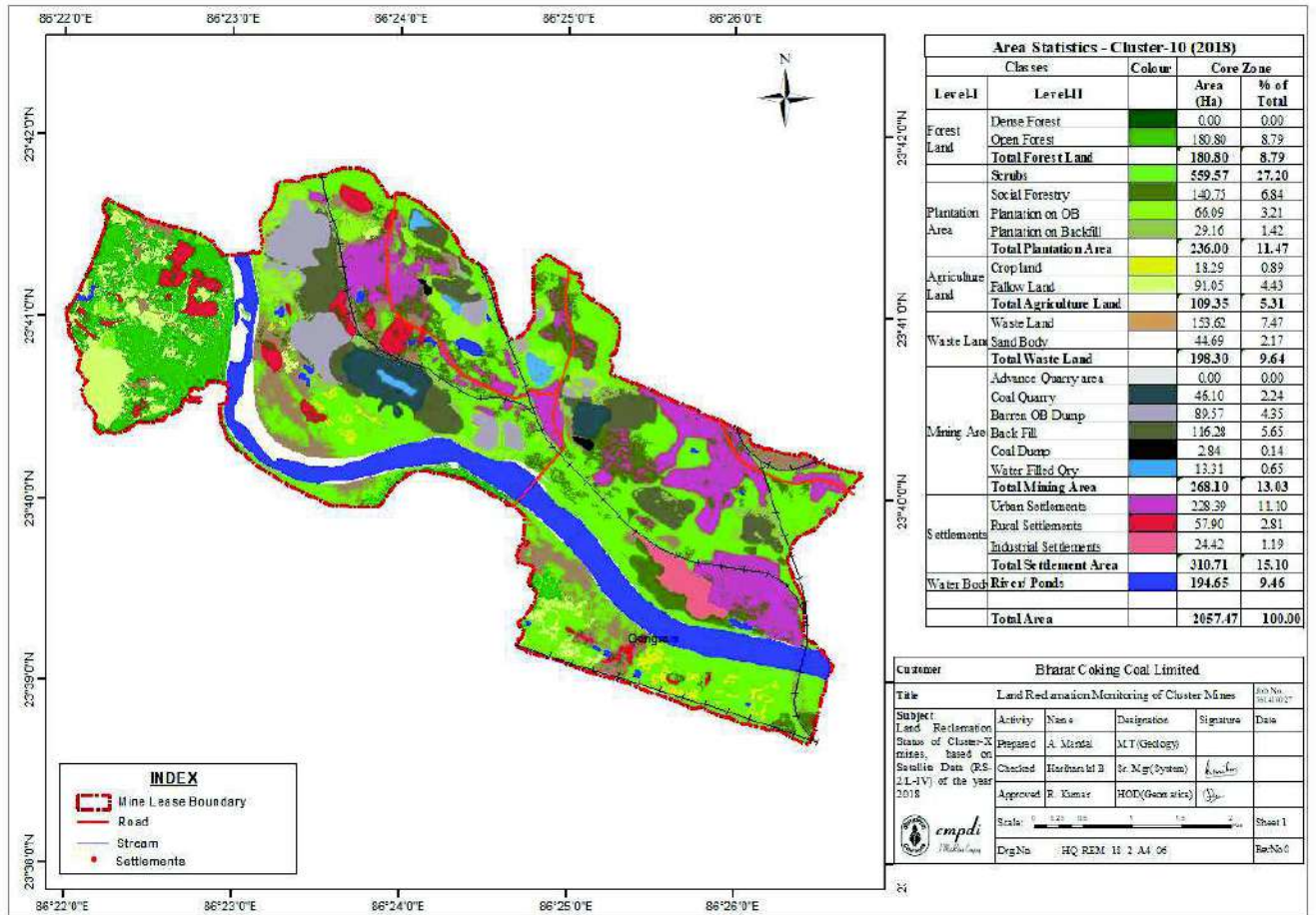
Monitoring stations (**A-19, D-35, D-36 and D-77**) are located in the core zone of the mine area. Water level monitoring in these monitoring stations has done in the months of May'20, August'20, and Nov'20 and January'21, the Ground water level data enclosed in the table below:

Sl No.	Well No.	Location	Water level (bgl in meters)											
			2020-21				2019-20				2018-19			
			May	Aug	Nov	Jan	May	Aug	Nov	Jan	Feb	May	Aug	Nov
1	A-19	Bhowrah	6.05	2.30	3.25	3.70	4.85	0.95	3.43	4.95	2.95	5.55	1.85	2.45
2	D-35	Patherdih	8.20	2.98	5.40	5.62	8.00	3.15	3.80	5.90	6.58	8.40	3.58	4.45
3	D-36	Sudamdih	2.10	0.06	1.00	1.15	1.20	0.10	0.55	0.65	1.00	1.20	0.45	0.60
4	D-77	Amlabad	6.40	5.90	3.50	4.25	6.40	2.80	3.20	4.50	3.63	6.30	4.00	5.20
<b>Average WL (bgl)</b>			5.69	2.81	3.29	3.68	5.11	1.75	2.75	4.00	3.54	5.36	2.47	3.18

### LAST THREE-YEAR ASSESSMENT:

Pre-monsoon GW Level (m): Min – 1.20 m      Max – 8.40 m  
 Post-monsoon GW Level (m): Min – 0.55 m      Max – 5.40 m

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



Sl no	Land Use Details	Existing (sq. meter)	Proposed (sq. meter)	Grand Total (sq. meter)
1	Green Belt Area	1085.72 x 10 <sup>4</sup>	1085.72 x 10 <sup>4</sup>	1085.72 x 10 <sup>4</sup>
2	Open Land	661.04 x 10 <sup>4</sup>	661.04 x 10 <sup>4</sup>	661.04 x 10 <sup>4</sup>
3	Road/ Paved Area	228.39 x 10 <sup>4</sup>	228.39 x 10 <sup>4</sup>	228.39 x 10 <sup>4</sup>
4	Rooftop area of building/ sheds	82.32 x 10 <sup>4</sup>	82.32 x 10 <sup>4</sup>	82.32 x 10 <sup>4</sup>
5	<b>Total</b>	<b>2057.47 x 10<sup>4</sup></b>	<b>2057.47 x 10<sup>4</sup></b>	<b>2057.47 x 10<sup>4</sup></b>

#### 4.0 GROUND WATER LEVEL SCENARIO

The summarized water level data of all clusters given in **Table – 7**.

**Table –7: Groundwater level data Cluster-wise**

Sl. No.	Cluster of BCCL	No. of Monitoring Wells	Water level fluctuation Below ground level (May, Aug, Nov'20 & Jan'21)	Avg. Fluctuation (in meters) during 2020-21	Geological Formation
1	I	4 nos.	0.15 to 10.00 m	2.76 m	Barakar
2	II	5 nos.	0.67 to 10.33 m	3.66 m	Barakar
3	III	5 nos.	0.32 to 10.33 m	2.95 m	Barakar
4	IV	4 nos.	0.03 to 9.25 m	3.27 m	Barakar
5	V	4 nos.	0.02 to 5.60 m	2.51 m	Barakar
6	VI	2 nos.	1.65 to 10.50 m	4.02 m	Barakar
7	VII	7 nos.	0.48 to 9.45 m	2.26 m	Barakar
8	VIII	4 nos.	1.41 to 8.45 m	2.87 m	Barakar
9	IX	6 nos.	0.30 to 9.40 m	1.53 m	Barakar
10	X	4 nos.	0.06 to 6.40 m	2.40 m	Barakar
11	XI	4 nos.	0.36 to 8.47 m	1.50 m	Barakar & Barren Measure
12	XIII	6 nos.	0.20 to 8.92 m	3.60 m	Raniganj
13	XIV	3 nos.	0.77 to 7.55 m	2.35 m	Raniganj
14	XV	3 nos.	0.85 to 4.88 m	1.20 m	Barakar & Barren Measure
15	XVI	3 nos.	0.70 to 5.90 m	0.75 m	Barakar

Depth to water level (in bgl) values described that water level goes down to maximum 10.50 m during pre-monsoon'2020 and maximum upto 8.60 m during post-monsoon'2020. Un-confined aquifer 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–VII**. Water Table contour map and Depth to water level map shown in **Plate-IV & V**.

Monitoring groundwater (quantity & quality) to assess the present condition and resource has done regularly in the coalfield areas. Well hydrographs (**Annexure–VI and VII**) are prepared and studied to identify potentially adverse trends so that appropriate action can protect groundwater resource. Hydrograph trend analysis of CGWB monitoring wells and CMPDI observation wells, reveals decline

trends in both Pre and Post-monsoon GW level trends (max. upto 0.55 cm/year in Cluster-I, Cluster-V and Cluster-VII) 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 (**Plate-II**) with collection points details (dug wells) given in **Annexure-V** and Quality is given in **Annexure-VII**.

## 5.0 GROUND WATER QUALITY

The ground water sample of the study area (15 nos. of Cluster of mines, BCCL) collected from dug wells and analyzed. Fifteen ground water samples (GW-1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 15 & 16) analyzed during the month of June'2020 at CMPDI, RI-II, Dhanbad. The water sampling details given in **Annexure-V** and Water sample locations shown in **Plate-II**. The water quality data enclosed in **Annexure-VII**.

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

The pH of the groundwater samples varies between 7.81 (GW-6) to 8.21 (GW-3), the pH is within the IS 10500 limit of drinking water standard.

The mineral constituents dissolved in water constitute the dissolved solids. The total dissolve solids vary from 178 (GW-11) to 764 mg/l (GW-5), the TDS values are above the IS 10500 standards of drinking water.

The alkalinity of the water samples varies from 76 (GW-6) to 152 mg/l (GW-11) and are within the stipulated standard of (200 mg/l) drinking water. The concentrations of calcium in the water samples vary from 32 (GW-11) to 180 mg/l (GW-15) and are **slightly above** the permissible limit (75 mg/l) of drinking water standards. The total hardness ranges between 148 (GW-8) to 680 mg/l (GW-5) and the value of total hardness in water samples are **above** the permissible limit (200 mg/l). The sulphate ranges between 38 (GW-8) to 178 mg/l (GW-13) 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 found to be below the upper ISI limits for drinking water.

## **7.0 IMPACT OF MINING ON GROUND WATER REGIME**

### **7.1 GENERAL CONSEQUENCES OF COAL MINES ON AMBIENT HYDROGEOLOGICAL REGIME**

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

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

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

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

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

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

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

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

### 7.3 ESTIMATION OF RADIUS OF MINE INFLUENCE ZONE

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

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

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

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

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

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

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

### 8.0 CONSERVATION MEASURES & FUTURE STRATEGY

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

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

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

9.0 EXISTING/PROPOSED RAINWATER HARVESTING STRUCTURES IN BCCL COAL MINES

Fig-3 to 4.

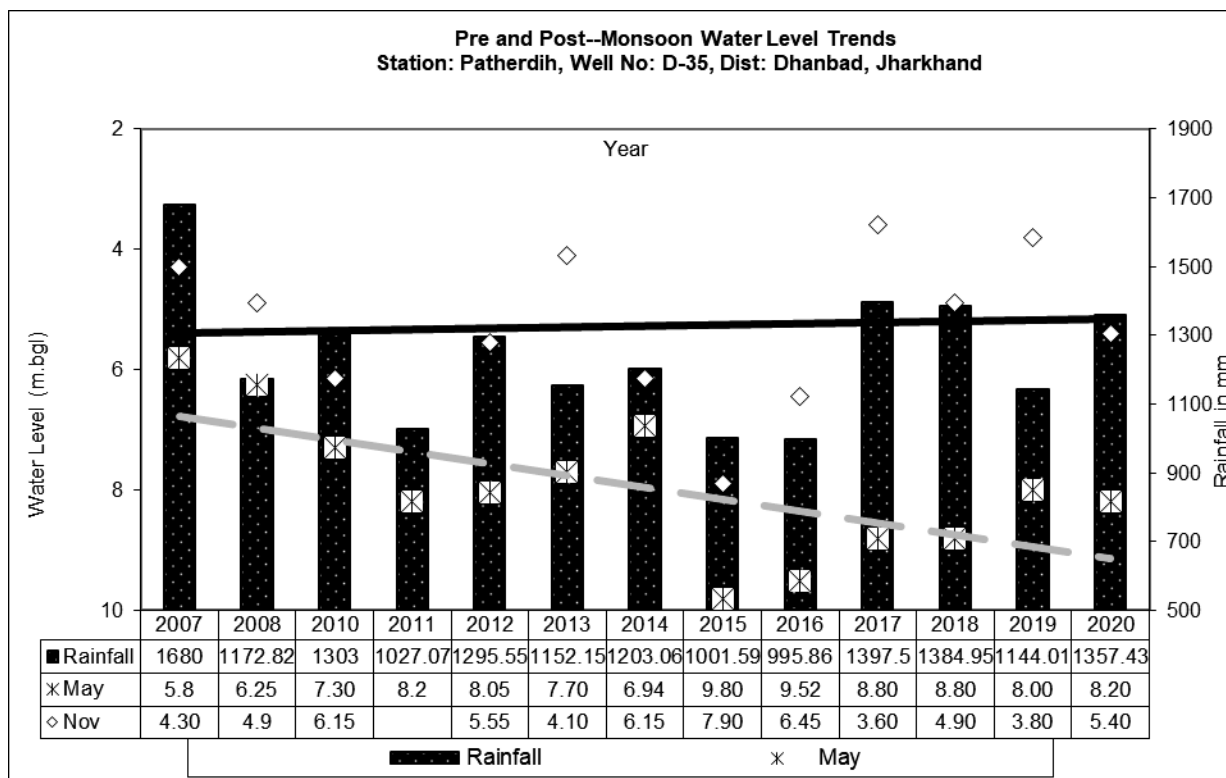
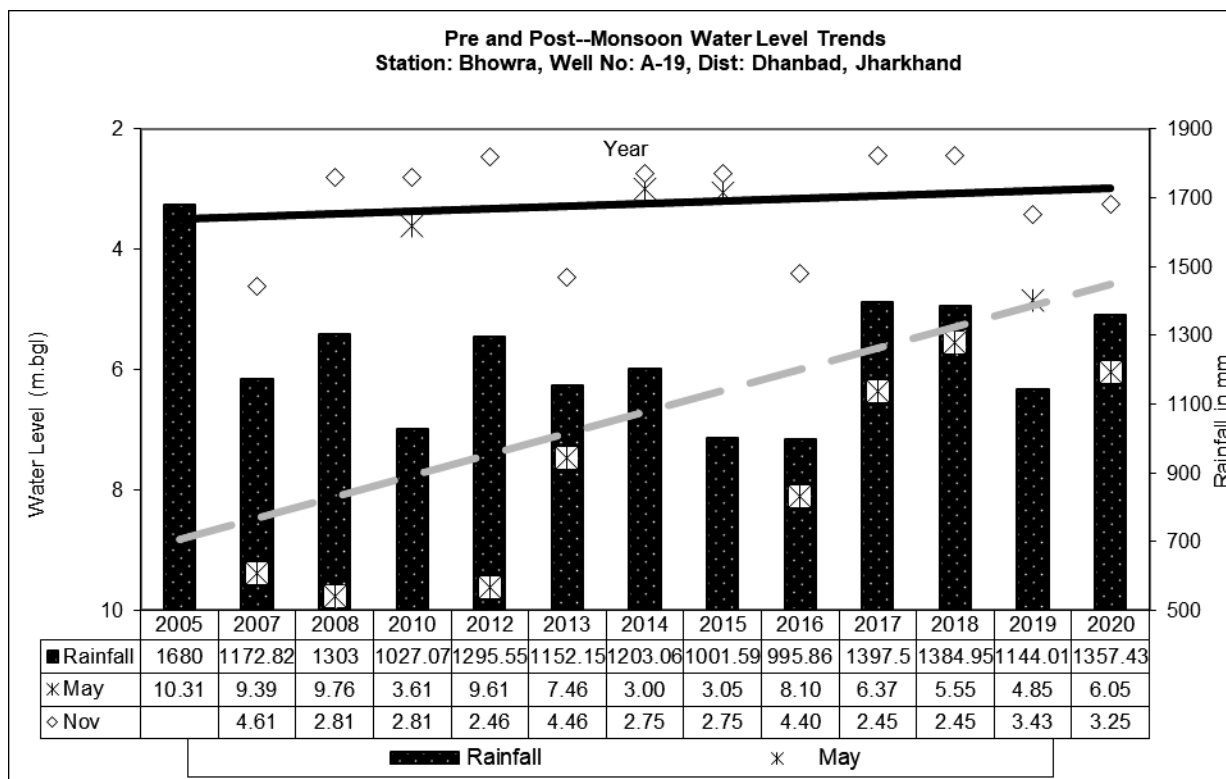


Proposed Rain Water Harvesting Site GVTC, Cluster-I, Barora Area

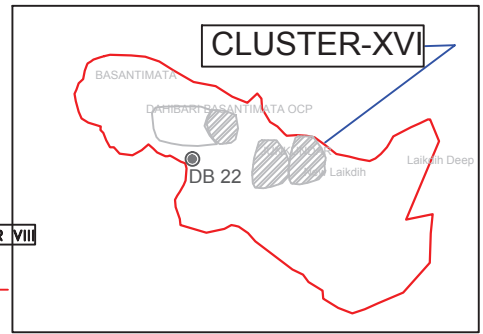
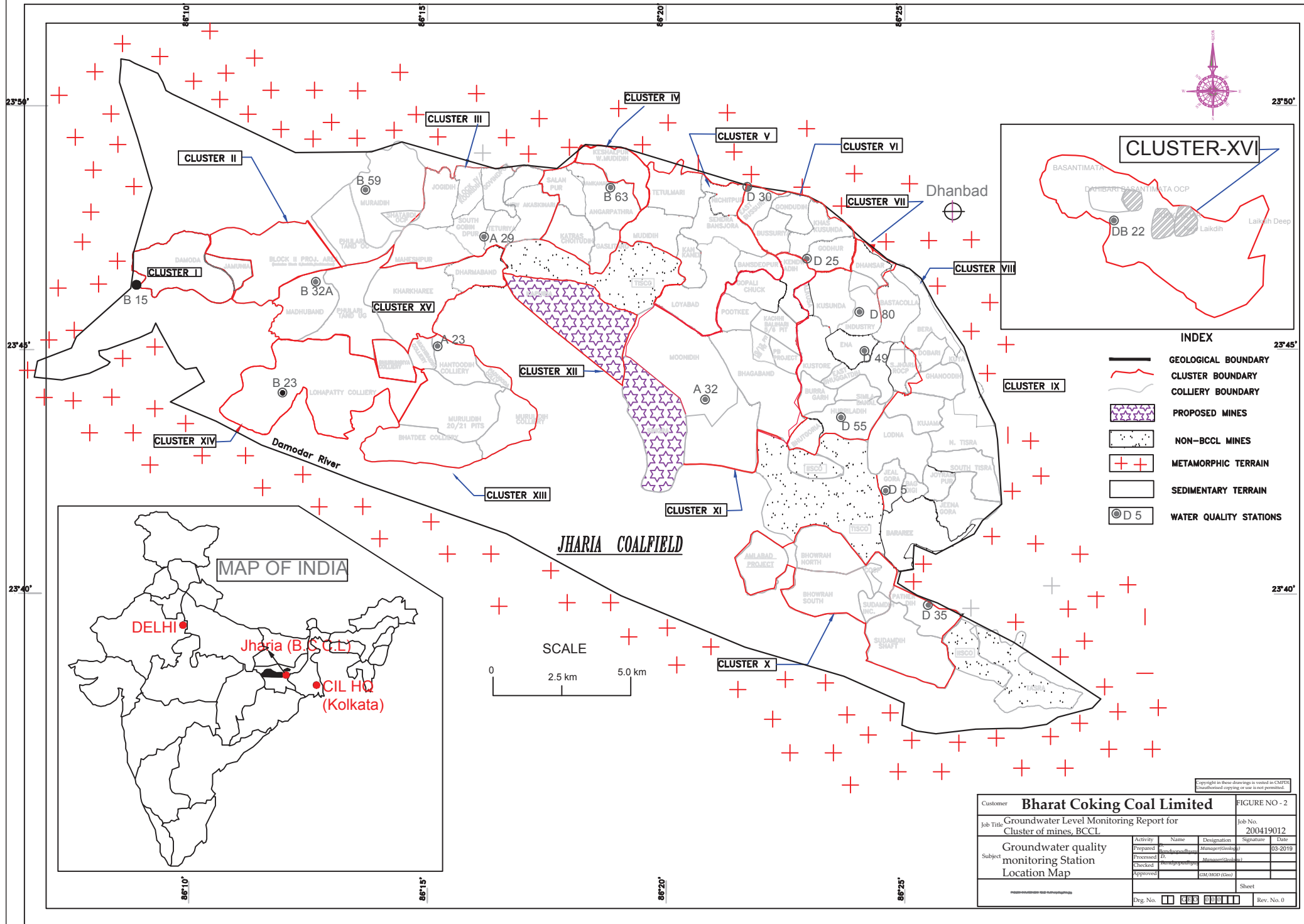


Proposed Rain Water Harvesting Site Nehru Balika Vidhalaya, Cluster-I, Barora Area

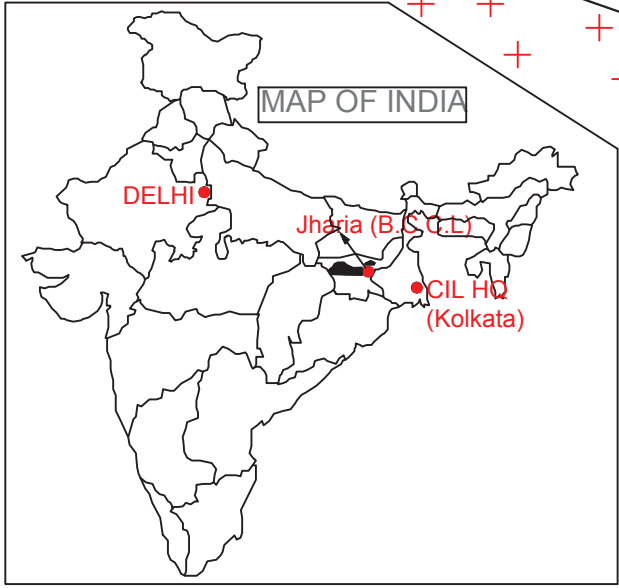
HYDROGRAPHS OF CLUSTER-X



# GROUNDWATER QUALITY MONITORING STATION LOCATION MAP



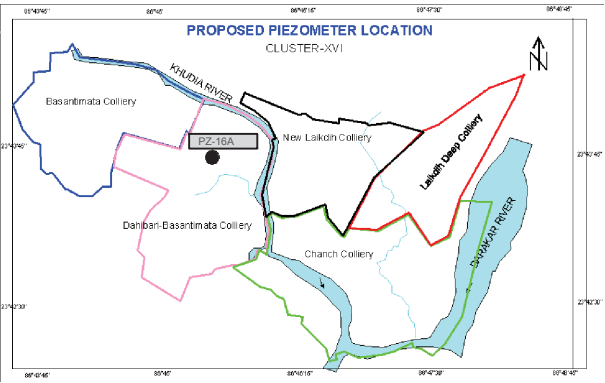
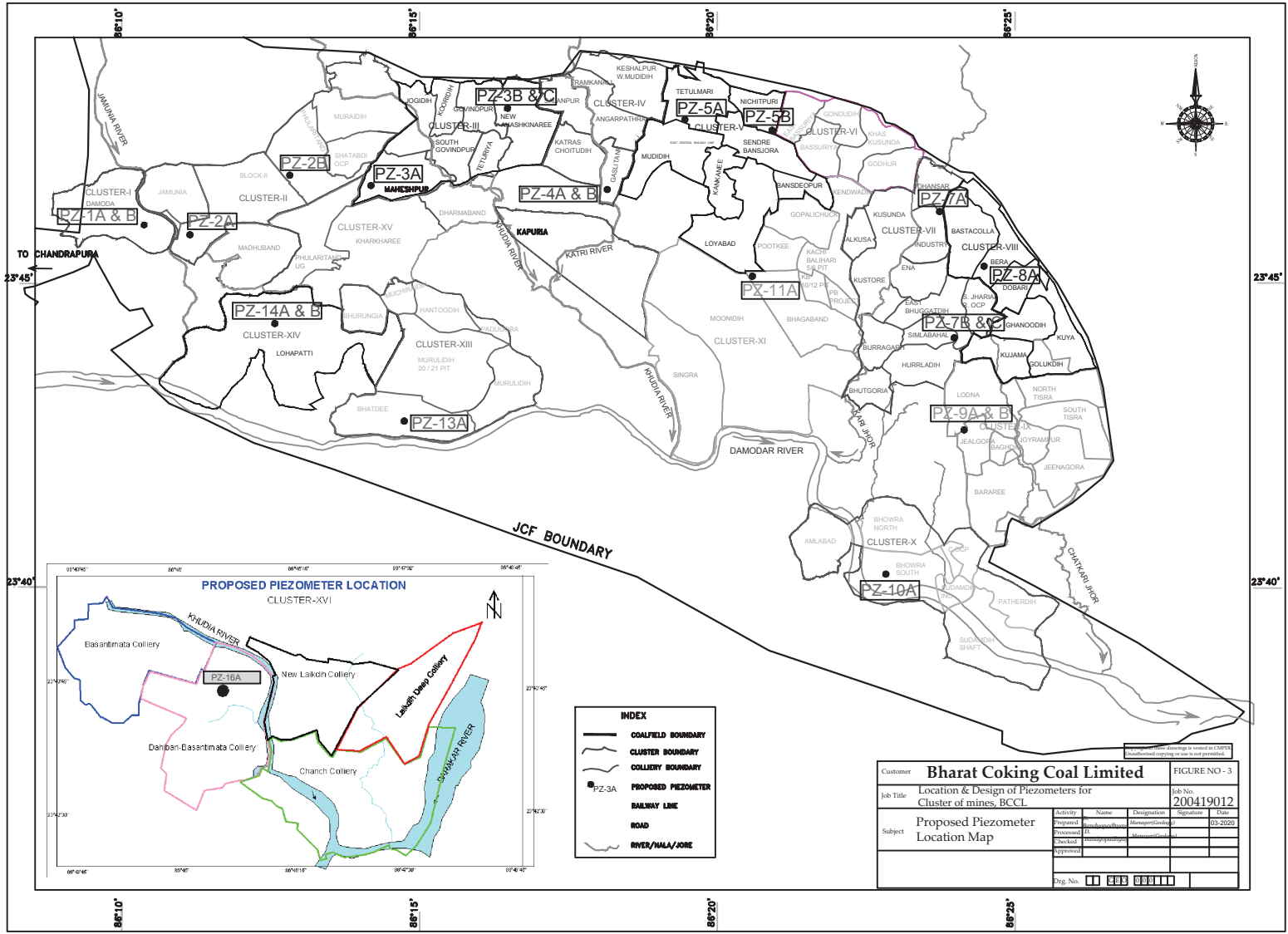
- INDEX**
- GEOLOGICAL BOUNDARY
  - CLUSTER BOUNDARY
  - COLLIERY BOUNDARY
  - PROPOSED MINES
  - NON-BCCL MINES
  - METAMORPHIC TERRAIN
  - SEDIMENTARY TERRAIN
  - WATER QUALITY STATIONS



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Customer <b>Bharat Coking Coal Limited</b>		FIGURE NO - 2	
Job Title <b>Groundwater Level Monitoring Report for Cluster of mines, BCCL</b>		Job No. <b>200419012</b>	
Subject <b>Groundwater quality monitoring Station Location Map</b>	Activity	Name	Designation
	Prepared	<i>[Signature]</i>	Manager (Geology)
	Processed	<i>[Signature]</i>	Manager (Geology)
	Checked	<i>[Signature]</i>	Manager (Geology)
Approved	<i>[Signature]</i> (GM/HRD) (Geo)		Date
			Sheet
Dwg. No. <b>000 000 000</b>			Rev. No. 0

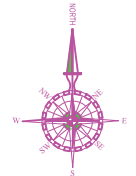
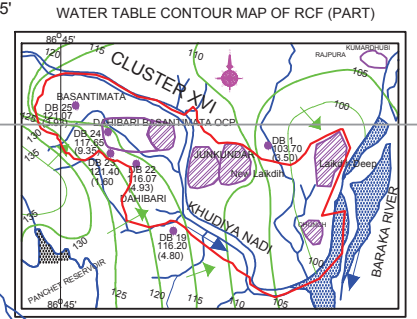
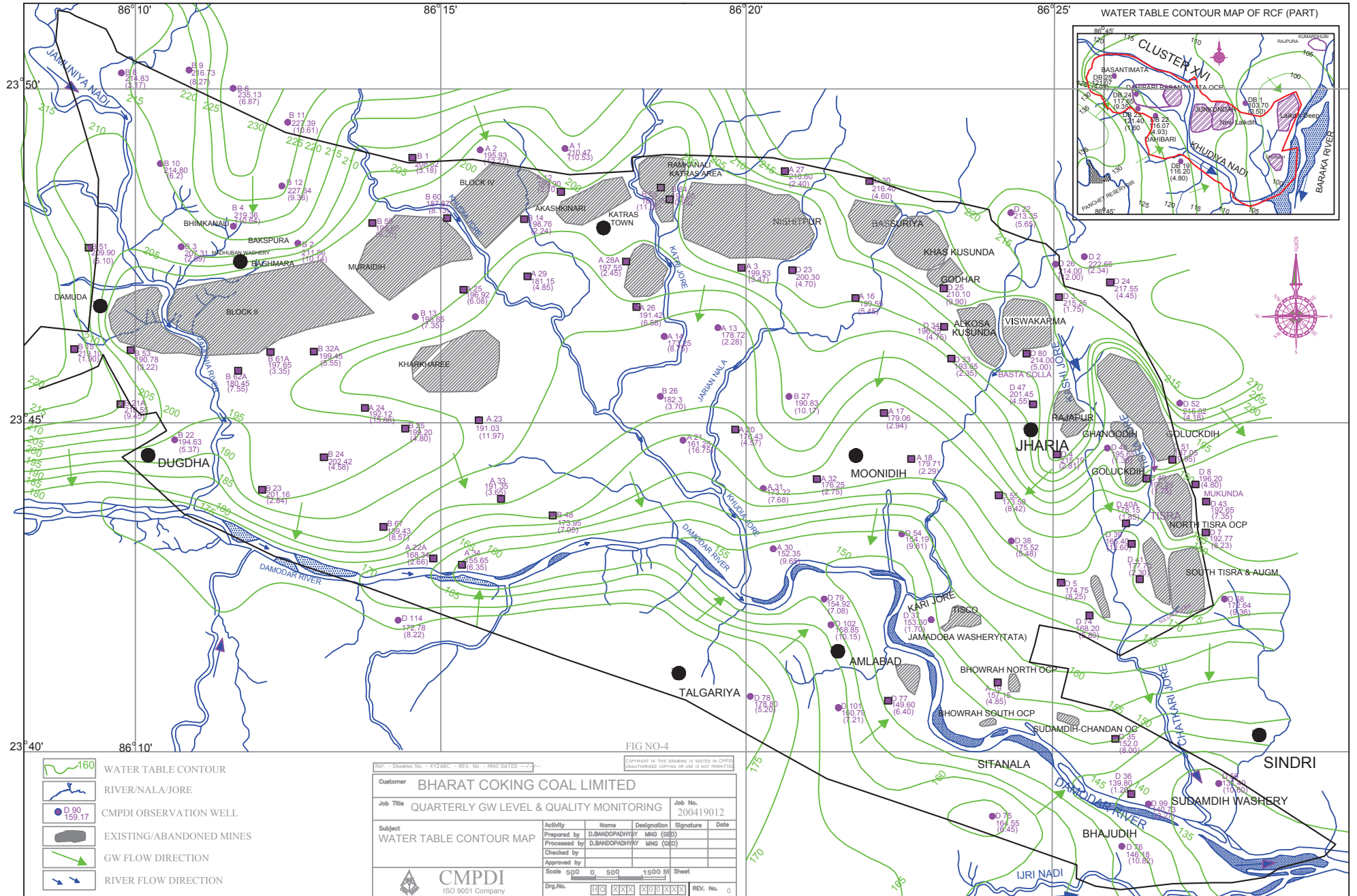
# PROPOSED PIEZOMETER LOCATION MAP, JCF & RCF (part)



INDEX	
	COALFIELD BOUNDARY
	CLUSTER BOUNDARY
	COLLIERY BOUNDARY
	PROPOSED PIEZOMETER
	RAILWAY LINE
	ROAD
	RIVER/HALA/JOBE

Customer: <b>Bharat Coking Coal Limited</b>		FIGURE NO - 3	
Job Title: Location & Design of Piezometers for Cluster of mines, BCCL		Job No. 200419012	
Subject: Proposed Piezometer Location Map		Date: 03-2020	
Address:	Name:	Designation:	Signature:
Prepared:	DR	Management/Geology:	
Checked:	Geology/Management:		
Approved:			
Prog. No. <b>003 00011</b>			

# WATER TABLE CONTOUR MAP OF PRE-MONSOON 2020



	160	WATER TABLE CONTOUR
		RIVER/NALA/JORE
	D 90 159.17	CMPDI OBSERVATION WELL
		EXISTING/ABANDONED MINES
		GW FLOW DIRECTION
		RIVER FLOW DIRECTION

FIG NO-4

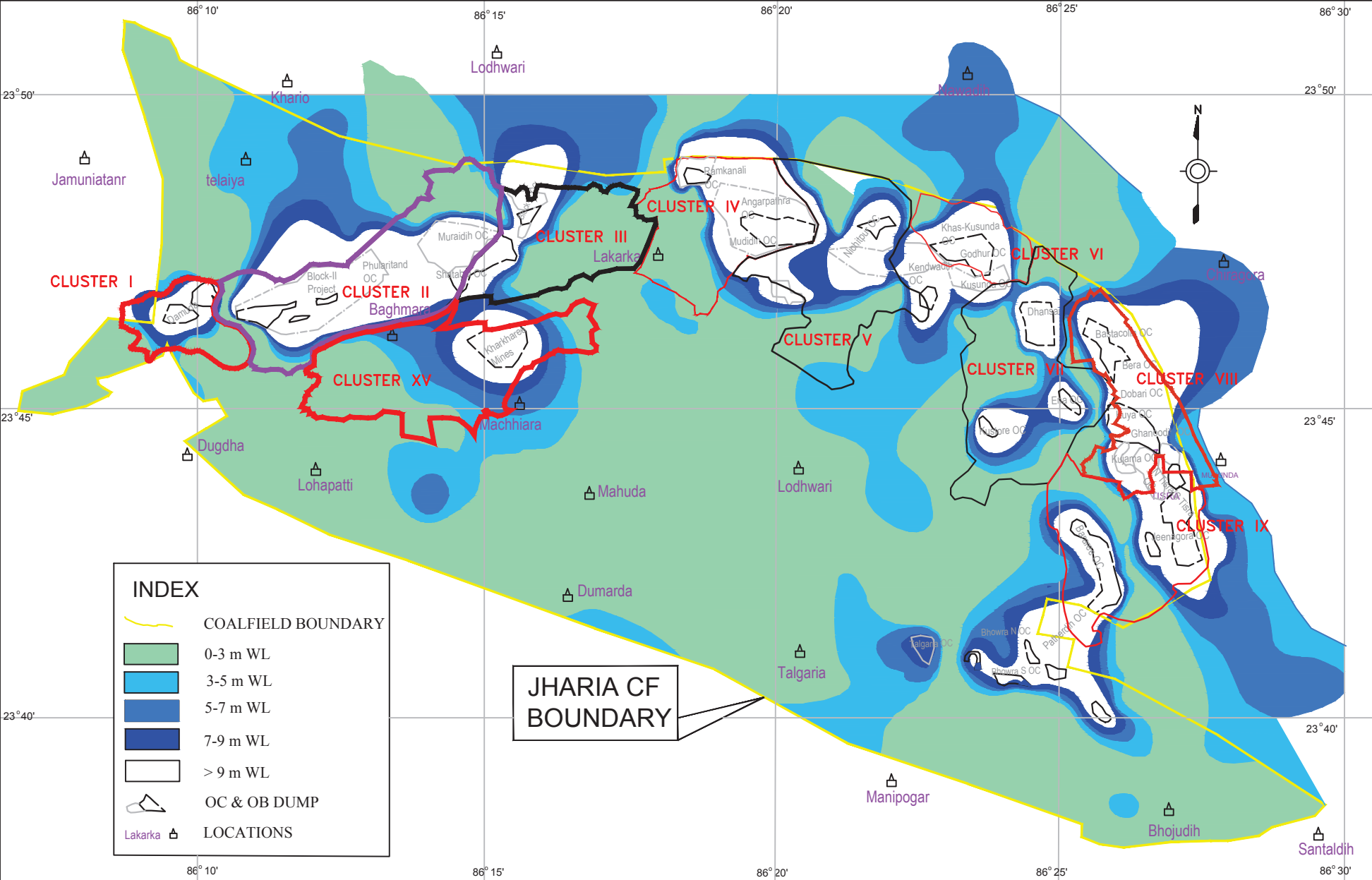
REF. - Drawing No. - XYZABC - REV. No. - MVO DATED - / / -

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Customer		<b>BHARAT COKING COAL LIMITED</b>	
Job Title		QUARTERLY GW LEVEL & QUALITY MONITORING	
Job No.		200419012	
Subject	Activity	Name	Designation
WATER TABLE CONTOUR MAP	Prepared by	D.BANDOPADHYAY	MNG (GEO)
	Processed by	D.BANDOPADHYAY	MNG (GEO)
	Checked by		
Approved by			
Scale	Scale 500 0 500 1500 M Sheet		
Dwg.No.	REV. No. 0		



# DEPTH TO WATER LEVEL MAP OF JHARIA COALFIELD



INDEX	
	COALFIELD BOUNDARY
	0-3 m WL
	3-5 m WL
	5-7 m WL
	7-9 m WL
	> 9 m WL
	OC & OB DUMP
	LOCATIONS

JHARIA CF BOUNDARY

Customer: **BHARAT COKING COAL LIMITED** Job No. \_\_\_\_\_

Job Title: **HYDROGEOLOGICAL STUDIES FOR BCCL CLUSTERS**

Subject: **DEPTH TO WATER LEVEL MAP**

Prepared by: **D. S. BHARADWAJ** Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Processed by: **CHANDRANATHAN**

Checked by: \_\_\_\_\_

Scale: 500 0 500 1500m Sheet \_\_\_\_\_

Drawn by: \_\_\_\_\_

Rev. No. 0

Customer: **CMPDI** ISO 9001 Company

REP - DRAWING No. - XYZABC - REV. No. - PNO DATED - / /

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**BHARAT COKING COAL LIMITED**

**DRAFT**

**MINING PLAN AND MINE CLOSURE PLAN**

**FOR**

**BHOWRAH SOUTH COLLIERY**

(UPTO {-} 115m RL HORIZON)

(EASTERN JHARIA AREA)

NOVEMBER – 2018

**CENTRAL MINE PLANNING & DESIGN INSTITUTE LTD.  
REGIONAL INSTITUTE NO.-II  
DHANBAD**

## CHAPTER - XII

### PROGRESSIVE AND FINAL MINE CLOSURE PLAN

#### 12.0 MINE CLOSURE PLANNING

##### 12.1 OBJECTIVES OF CLOSURE PLANNING

Mine closure planning has to be carried out at the starting of the mine and needs periodic reviewing and revision during its life cycle to cope with the geo-technical constraints, safety and economic risks, social and environmental challenges. Various other objectives are as follows.

- ❖ To allow a productive and sustainable after-use of the site which is acceptable to the mine owner and the regulatory authority.
- ❖ To protect public health and safety.
- ❖ To alleviate or eliminate environmental damage and thereby encourage environmental sustainability.
- ❖ To minimize adverse socio-economic impacts.

##### 12.2 DIFFERENT ASPECTS OF MINE CLOSURE PLANNING

The mine closure planning broadly involves the following aspects:

(a) Technical aspects;

The following technical aspects would be reviewed in the final mine closure planning. Details can be worked in closure plans envisaged to be prepared.

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

## 12.6 CLOSURE ACTION PLAN

Closure planning is a whole-of-life exercise that begins at the start of a mine and continues till post-closure. The dynamic nature of closure planning requires regular and critical review to reflect changing circumstances as a result of any operational change, new regulation, and new technology and remain flexible enough to cope with unexpected events.

The following steps have to be undertaken in relation to Mine Closure Planning:

Prior to the surface demolition/restoration a surface audit should be undertaken on all surface structures, spoil heaps, lagoons, etc. to assess whether there are any hazardous materials that could cause problems; viz. explosives, chemicals, etc. A list of surface assets should be prepared and made available to potential purchasers, prospective purchasers could be invited and asked to submit sealed bids, this could ensure that the sale of assets give better financial gain.

In order to identify potential impact, necessary hydro-geological studies into post-mining ground water recharge have to be done.

Work force on roll of BCCL may be re-deployed for gainful utilization in the same or other mines of BCCL.

As a detailed component of the Closure Plan, a Decommissioning Plan is to be developed towards the final stages preferably 5 years prior to tentative closure of the mine. Once established, it may be updated annually.

## 12.7 PROTECTIVE MEASURES TO BE TAKEN

Protective measures must include the following :

- The protection of mine Entries , building and other structure on the project site against access by unauthorized persons;

Mining Plan and Mine Closure Plan for Bhowrah South Colliery CMPDI  
**IMPLEMENTATION SCHEDULE FOR MINE CLOSURE IN BHOWRAH SOUTH COLLIERY**  
(LIFE OF THE MINE: 43 YEARS)

S.N	Activity	Time Frame	YEAR								
			Operational Phase			Post Closure Phase					
			1 <sup>st</sup> - 10 <sup>th</sup>	11 <sup>th</sup> - 20 <sup>th</sup>	21 <sup>th</sup> - 43 <sup>th</sup>	PC1	PC2	PC3			
A	Dismantling of Structures										
	Service Buildings	2 years									
	Residential Buildings	2 & ½ years									
	Industrial structures like CHP, Workshop, field sub-station, etc.	2 & ½ years									
B	Permanent Fencing of mine void and other dangerous area										
	Random rubble masonry of height 1.2 metre including leveling up in cement concrete 1:6:12 in mud mortar	2 years									
C	Grading of highwall slopes										
	Levelling and grading of highwall slopes	2 years									
D	OB Dump Reclamation										
	*Handling/Dozing of OB Dump and backfilling	Throughout the life of the mine including 3 years after cessation of mining operation									
	*Technical and Bio-reclamation including plantation and post care	Throughout the life of the mine including 3 years after cessation of mining operation									
E	Landscaping										
	Landscaping of the open space in the leasehold area for improving its esthetics and eco value	Throughout the life of the mine including 3 years after cessation of mining operation									
F	Plantation										
	Plantation over cleared area obtained after dismantling	2 years									

Mining Plan and Mine Closure Plan for Bhowrah South Colliery

CMPDI

S.N	Activity	Time Frame	YEAR					
			Operational Phase		Post Closure Phase			
			1 <sup>st</sup> - 10 <sup>th</sup>	11 <sup>th</sup> - 20 <sup>th</sup>	21 <sup>st</sup> - 43 <sup>rd</sup>	PC1 PC2 PC3		
	*Plantation around the quarry area and in safety zone	Throughout the life of the mine including 3 years after cessation of mining operation						
	*Plantation over the OB Dump	Throughout the life of the mine						
G	Post Closure Env Monitoring / testing of parameters for three years							
	Air Quality	3 years						
	Water Quality	3 years						
H	*Entrepreneurship Development (Vocational/skill development training for sustainable income of affected people	Throughout the life of the mine						
I	*Miscellaneous and other mitigative measures	Throughout the life of the mine including 3 years after cessation of mining operation						
J	Post Closure Manpower cost for supervision	3 years						

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

**NOTE:** The progressive mine closure will be done as per the provisions made out in the Mining Plan and as per the situation/requirement that may arise in course of execution of the Mining Plan



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**BHARAT COKING COAL LIMITED**

**MASTER PLAN  
FOR  
DEALING WITH FIRE, SUBSIDENCE  
AND REHABILITATION  
IN THE LEASEHOLD OF BCCL**

**UPDATED  
MARCH' 2008.**

**CENTRAL MINE PLANNING & DESIGN INSTITUTE LTD  
REGIONAL INSTITUTE – 2  
DHANBAD**

- I) As the manpower in BCCL is continuously reducing due to super -annuation, only 25000 BCCL houses shall be constructed against 42650 houses as proposed in the Master Plan. Therefore fund for construction of only 25000 houses shall be considered in the Master Plan.
- II) The cost estimate of the fire projects should be reduced to the extent possible. Whenever fire is handled by direct removal of coal and OB, the cost shall be set off considering that 50% of coal will be available for selling.
- III) A sample survey should be carried out for private (Pucca & Kutcha) for ascertaining suitable fund provision as compensation in the Master Plan.
- IV) For the purpose of income generation scheme, it has been decided that head of every displaced house shall be paid wage of 250 days in a year for two years as per minimum wage rate of respective state Govts.

The Master plan, July'2006 has been prepared considering the above decision and was submitted to State Govt. of Jharkhand for their acceptance vide letter no.GM (ENV)/F-rhab/2007/138 dated 6.3.2007. Jharkhand state Govt. has not given acceptance as yet.

Cost up-dation of the Master Plan July'o6 has been done up to Feb'08 considering the increase in WPI and Civil Cost Index.. Increase in WPI was about 7% and Civil cost index was 14.28%

## 5.0 SCOPE OF WORK OF MASTER PLAN '2008

Master Plan now covers only following two aspects:

- i) **Dealing with fire**, which includes identification of fire areas, selection of technologies to deal with the fires, prioritization for implementation and assessment of tentative fund requirement.
- ii) **Rehabilitation & Resettlement** of the affected people from the areas affected by fire & subsidence including identification of affected sites, identification of resettlement sites and assessment of tentative fund requirement.

**Note:** "BCCL vide letter no GM(Env)/F- /06 dated 22<sup>nd</sup> April, 2006 suggested that diversion of railway lines and NH 32 road passing through coal bearing areas of JCF should also be included in the Master Plan'2006.

Diversion of rails and roads passing over the coal bearing areas are affected by fire and subsidence at many places and may further be affected. As the diversion will affect the operation of other coal producing companies like TISCO & SAIL, other industries operating in the coalfield and State Govt. as well as Railway, a joint decision is to be taken involving all the above stakeholders.

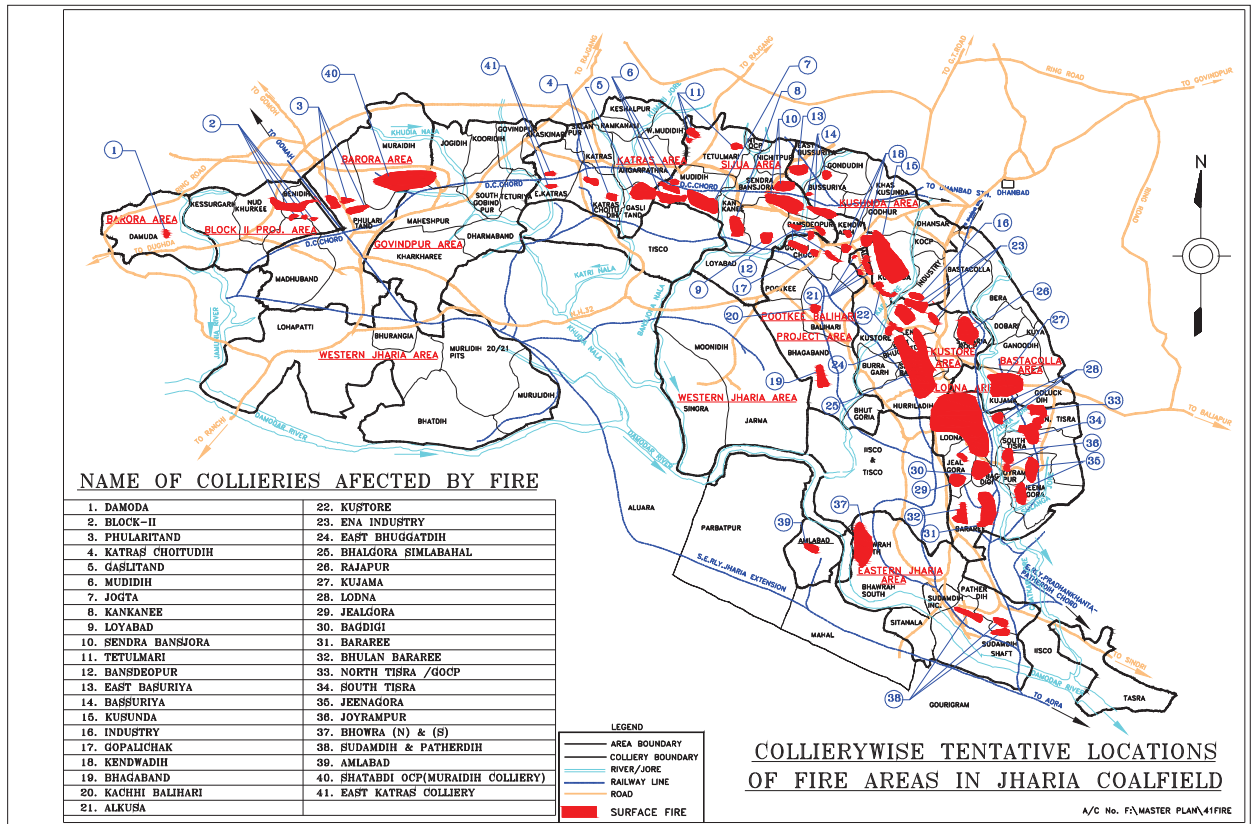
Moreover, the diversion of rail and road requires survey of the alternative routes, detail layout planning by expert agencies like RITES and likely to take about two years time.

Therefore, in this Master Plan, a lump sum provision of Rs.20 Crs has been kept for survey and planning only as an advance action. The detail proposal for diversion may be taken up as a separate Master Plan in future. “

As per the recommendation of the committee constituted by DGMS, all the sites proposed for stabilization in the Master Plan '99, have now been considered for rehabilitation. The time frame for implementation of Revised Master Plan has been considered as 10 years proposed to be implemented in two Phases (Phase – I & II each of 5 years duration), excluding 2 years of pre-implementation period.

Implementation of the Fire control measures and rehabilitation of BCCL houses from the endangered area will be the responsibility of BCCL, where as rehabilitation of Non-BCCL houses/structures from the endangered areas will be the responsibility of State Govt. of Jharkhand and West Bengal. Land acquisition for BCCL employees shall be done in association with State Govt. of Jharkhand.

Rehabilitation sites will be located on non-coal bearing area along the fringe / periphery of Jharia coalfield. The sites will have the basic infrastructural facilities like Water & Electricity, School, Banks, Hospitals, Market Complex, Play Ground, and Community Center etc.



**TABLE -1****LIST OF FIRES IN THE LEASEHOLD OF BCCL**

<b>Sl. No.</b>	<b>Name of the fire</b>	<b>Fire Status</b>
1	Ganeshpur X, XI , XII & XIII seam fire	Active
2	Burwabera X seam fire	Active
3	Phularitand X, XI, XII seam fire	Active
4	Angarpathra XII, XI, X, IX Spl. seam fire	Extinguished
5	Gaslitand XVT, XVB seam fire	Active
6	Jogta XV, XIV, XIII, XII, XI seam fire	Active
7	Kankanee XIII & XIV seam fire	Active
8	Ekra XI & XII seam fire	Active
9	Ekra XIII & XIV seam fire	Active
10	Loyabad XV, XIV, XIII seam fire	Active
11	Bassuriya XIV, XIII & XII, XI and X seam fire	Active
12	Sendra Bansjora XIV, XIII, XII, XI seam fire	Active
13	Bansdeopur XIV, XII seam fire	Active
14	Gopalichak XVI, XV, XIV, XIII, XII, XI seam fire	Active
15	Industry XII, XI seam fire	Active
16	Kusunda XII, XI seam fire	Active
17	Alkusa XII, XIV seam fire	Active
18	Kustore XIV, XIII, XII, XI seam fire	Active
19	Ena XII, XI seam fire	Active
20	Pure jharia X seam fire	Active
21	K.P. Dobari X, V/VI/VII/VIII/VIIA seam fire	Active
22	Rajapur X seam fire	Active
23	Kujama XII, XI seam fire	Active
24	Kujama IX, X seam fire	Active
25	Bhalgora XIV seam fire	Dormant
26	Bhalgora XV seam fire	Dormant
27	East Bhuggatdih XV, XIV seam fire	Active
28	Ena XIV seam fire	Active
29	Ena XV seam fire	Active
30	Simlabahal XIV seam fire	Dormant
31	N.S. Lodna XIII, XIII A, XIV seam fire	Active
32	Bagdigi XIV, XIA, XV seam fire	Active
33	Baniahar XV, XIVA, XIV seam fire	Active
34	Bhaga XV seam fire	Active
35	South Tisra VII, VIII, IX, X seam fire	Active
36	Bhowra XIII, XIV seam fire	Active
37	Bararee XV, XIVA, XIV seam fire	Active
38	Bhulan Bararee XIII, XIV seam fire	Active
39	Bhulan Bararee XVI, XV seam fire	Active
40	Sudamdih IX to XIV seam fire	Active
41	Patherdih IX to XIII seam fire	Active

<b>Sl. No.</b>	<b>Name of the fire</b>	<b>Fire Status</b>
42	Bhowra IX , X seam fire	Active
43	Block –II XII, XI/XII, X Spl. seam fire	Active
44	Katras-Choitudih XIII seam fire	Active
45	Katras-Choitudih XIV, XV seam fire	Active
46	Tetulmari IV seam fire	Active
47	Tetulmari VI/VII seam fire	Active
48	Kendwadih XIII seam fire	Dormant
49	Kendwadih XIV, XIII seam fire	Dormant
50	Pootkee XV seam fire	Extinguished
51	East Bassuriya V/VI seam fire	Active
52	East Bassuriya VIII seam fire	Active
53	Kessurgarh V, VI, VII seam fire	Extinguished
54	Bhagaband XVI seam fire	Dormant
55	Amlabad XIV seam fire	Dormant
56	Sudamdih XV seam fire	Extinguished
57	Moonidih XVII seam fire	Extinguished
58	Damoda V, VI, VII seam fire	Dormant
59	Mudidih fire	Dormant
60	Jogidih X seam fire	Extinguished
61	Kooridih X seam fire	Extinguished
62	Nudkharkee X seam fire	Extinguished
63	West Mudidih IX/X seam fire	Extinguished
64	East Katras XIV seam fire	Extinguished
65	North Tisra VII, VIII, IX seam fire	Active
66	North Tisra X seam fire	Active
67	Jeenagora IX, X, XI seam fire	Active
68	Jeenagora IX, X, XI, XII seam fire	Active
69	Joyrampur XI, XII, XIII seam fire	Active
70	Jealgora XV, XIV, XIII B, XIII A seam fire	Dormant
71	Bassuriya IX, I X Spl. seam	Active
72	Industry X seam	Active
73	Kachhi Balihari XV seam	Dormant
74	Kendwadih XI, XII seam	Active
75	Shatabdi V/VI/VII seam	Active
76	Sendra Bansjora X seam	Active
77	East Katras XI, XIII & XIV seam fire	Active

## 7.0 MASTER PLAN FOR REHABILITATION OF INHABITED FIRE & SUBSIDENCE PRONE AREAS.

### 7.1 Introduction:

In the updated Master Plan of April'04, altogether 532 sites (271 in full & 261 in part) were considered for rehabilitation as the houses over these sites were declared unstable & uncontrollable (UU) as ground movement can not be controlled by stowing. Total no. of houses proposed to be evacuated from 532 sites were 65300 which includes

BCCL houses	:	36208
Non-BCCL : Private houses	:	15571
Non- BCCL : Un-authorized houses (Encroacher)	:	12719
Others :		
(Religious places, schools, Hospitals, Post offices, Police stations etc).	:	802

Apart from these 532 sites, 121 sites were considered unstable but controllable (UC) i.e where ground movement could be controlled by stowing.

In accordance with the directive of Supreme court of India, on 3<sup>rd</sup> May, 2005, Director General of Mines Safety (DGMS) constituted a Committee to go through the Action Plan and subsequent affidavit/ATR filed by UOI and to verify the same in connection with PIL case filed by Sri Haradhan Roy, Ex MP.

The Committee concluded that as there are no scientific methods available to check long term stability, it might not be possible to certify that the areas thus stabilized. The present stabilization work may restrict the effect of subsidence and allow some time. The final and permanent solution is evacuation of the affected area and rehabilitation.

In view of the above, 121 sites which were proposed for stabilization have now been considered for rehabilitation.

### 7.2 Total no. of houses in the endangered areas

Over the period of time from original Master Plan of March'1999 to date, 24 Nos. of sites have been demolished and shifted to other places by BCCL management. These sites have been deleted from this Master Plan.

Where fire dealing has been proposed by excavation method some stable parts are necessarily to be evacuated for digging out the fire. Such stable parts have now been

- 10 The community facilities like primary schools, community centre, small dispensary and shopping centre will also be included in the town planning. These common facilities will be constructed as per the plan under the proposed compensation package. However, the running cost of all the facilities, i.e. water supply, power supply, schools, dispensary etc. shall not be the part of compensation package and will have to be looked after by the Panchayat and other bodies of the State Government.
- 11 Common structures such as religious places etc. shall be built at resettlement site on mutual agreement basis from Rehabilitation fund of Master Plan.
- 12 The proposed location of resettlement site is guided by the following considerations:-
  - a) Preferably the proposed resettlement site should be either land owned by BCCL or vested to the state Government.
  - b) In case such land are not available, then the required land may be purchased from private owner by State Govt.
13. No employment shall be offered for any rehabilitation under the Master Plan

#### **7.4.2 BCCL Houses:**

BCCL houses from the endangered areas are proposed to be rehabilitated in four Satellite Township in non-coal bearing areas along the periphery of JCF. The houses over endangered houses will be rehabilitated with equivalent type of house in satellite township in triple storied building having all basic infrastructural facilities. As soon as an employee residing in the identified endangered area retires, the house shall be demolished.

It is proposed that Rehabilitation/resettlement work of BCCL houses shall be the responsibility of BCCL whereas the same for Non BCCL houses including encroachers shall be the responsibility of concerned state Govt. However acquisition of land for rehabilitation of BCCL employees shall be done in association with State Govts of Jharkhand/West Bengal.

#### **7.5 Amenities & Infrastructures:**

The resettlement sites of the affected population for BCCL & Non-BCCL has been identified exclusively on non coal bearing areas sufficiently away from the impact of future mining. For this purpose, it is proposed that satellite township should be constructed along the fringe of Jharia Coal Field. The size of township should be large enough to accommodate at least 12500 Non-BCCL families and 6000 BCCL families. In each locality, there will be separate town ship for BCCL houses and Non-BCCL (both private & encroachers) adjacent to each other. In each township the following amenities will be provided as per BPE norm.

40	E. Jharia	Sudamdih Inc.	Main Colony Miners house/05	19200
41	E. Jharia	Sudamdih Inc.	Main Colony/ O3	16000
42	E. Jharia	Sudamdih Inc.	Old Incline Colony/06	4800
43	E. Jharia	Sudamdih S.M.	New Miners colony/02	33600
44	E. Jharia	Sudamdih S.M.	River side colony/01	30400
45	<b>Gobindpur</b>	Akashkinaree	Akashkinare Colony/ O6	3837
46	Gobindpur	Akashkinaree	Labour Qtrs. Along PWD Road/ O2	19139
47	Gobindpur	Akashkinaree	Part of Bhatmurna Basteer/O3	6996
48	Gobindpur	Akashkinaree	Qtrs. Along office compound/O4	37973
49	Gobindpur	Akashkinaree	Qtrs.on South side of Akashkinaree/O5	32070
50	Gobindpur	Block-IV / Kooridih	Kooridih 3 seam Area Hutment/ O4	1870
51	Gobindpur	Block-IV / Kooridih	LCH Dhowrah Govindpur/18	720
52	Gobindpur	Block-IV / Kooridih	Near Block-IV Office/15	26846
53	Gobindpur	Block-IV / Kooridih	Near Gobindpur Hospital/14	24280
54	Gobindpur	Block-IV / Kooridih	NHS Qtrs/12	1400
55	Gobindpur	Block-IV / Kooridih	South Gobindpur Basteer/16	7040
56	Gobindpur	Block-IV / Kooridih	South Gobindpur Dhowra/17	1562
57	Gobindpur	Gobindpur	Agardih Labour Qtrs/O7	17580
58	Gobindpur	Gobindpur	Darpan Basteer/O5	132
59	Gobindpur	Gobindpur	Imli Dhowrah/O3	31145
60	Gobindpur	Gobindpur	IV Seam Colony/O1	57408
61	Gobindpur	Gobindpur	Labour Qtrs./O6	1174
62	Gobindpur	Gobindpur	Mehtadih Colony & Bunglow/O4	31145
63	Gobindpur	Jogidih	Baihardih Colony 'B'/ 1B	8365
64	Gobindpur	Jogidih	Baihardih Village/1A	5118
65	Gobindpur	Kharkharee	Nawagarh More & Phularitand Village/ O3	14400
66	Gobindpur	Kharkharee	Part of Phularitand Village/ 3A	24000
67	Gobindpur	Maheshpur	Maheshpur Basteer/O1	33309
68	Gobindpur	Maheshpur	NHS Qtrs. & House North of DB Road/11	43823
69	Gobindpur	Maheshpur	Premnagar Colony Basteer etc./ 14	13418
70	Gobindpur	Maheshpur	Staff Qtrs. & Hutment/O4	2806
71	Gobindpur	S.Gobindpur	Bilbera - C/13	8000
72	Gobindpur	S.Gobindpur	Bilbera 'A'/ O7	1600
73	Gobindpur	S.Gobindpur	Kali Nagar Bilbera/12	8000
74	Gobindpur	S.Gobindpur	South Govindpur 'B'/O6	2400
75	Gobindpur	S.Gobindpur	Tandabari-A/O1	18400
76	Gobindpur	Teturia	Colliery Office Area/O3	22400
77	Gobindpur	Teturia	NHS Qtrs.& Hutment/O1	43600
78	Gobindpur	Teturia	No.2 Locality/O2	32800
79	<b>Katras</b>	Angarpathra	AP Section-2 /O2	16800
80	Katras	Angarpathra	JK Khas/O4	2200
81	Katras	Angarpathra	JK Section/O3	62400
82	Katras	Angarpathra	National Angarpathra-2/O6	6500
83	Katras	East Katras	Akashkinaree 04/06	2800
84	Katras	East Katras	Akashkinaree -2/O2	400
85	Katras	East Katras	Akashkinaree 3/O4	3840
86	Katras	East Katras	Akashkinaree 5/O7	1000
87	Katras	East Katras	Akashkinaree-6/O8	4350
88	Katras	East Katras	Bhandardih 2 /11	2500
89	Katras	East Katras	Koiludih 01/03	3900
90	Katras	East Katras	Koiludih 3/10	40180
91	Katras	East Katras	Koiludih 4/15	65752

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



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

**AUGUST, 2021**

data is difficult as it requires visible signatures of subsidence in the form of cracks on the ground and damage to anthropogenic structures. In this study, data analysis and consequent field verification resulted in identification of 4 subsidence areas, within the BCCL mine boundary. Of these, the major area where considerable ground subsidence is occurring is the Moonidih UG project. Long term underground mining has resulted in continuous subsidence in the area. Apart from this, the other three areas are south of South Govindpur, Bagdigi and Bhagaband mines, however, the field evidences of the same are not conclusive. No quantitative estimates of the subsidence have been carried out in the study.

## 7.2 Conclusions

The following conclusions can be made:

1. As of the date of study in the year 2020 and in comparison with the previous study done in 2017, there has been a change in areal extent and disposition of the fire affected areas. On the other hand, persistent subsidence is seen in the Moonidih area due to underground mining activities.
2. Compared to 2012, the eastern flanks (Lodna, Tisra, Bhulanbarai areas) show considerable decrease in fire disposition and the western flank (Shatabdi and Block II area) show diminished fire presence.
3. The fires are continuation of existing fire affected areas as seen in the 2017 study.
4. The mines in Kusunda remain to be the worst affected with maximum presence of active fires.
5. There is a decrease in areal extent of the fire from 2017 to 2020. As compared 2017, when the total fire affected extent of the JCF was about 3.28 km<sup>2</sup>; in 2020 total fire affected extent is about 1.89 km<sup>2</sup> (including TISCO mines). Within the mining lease of BCCL (excluding TISCO) in comparison 2017, when the total fire affected extent of the JCF was about 3.27 km<sup>2</sup>; in 2020 total fire affected extent is about 1.86 km<sup>2</sup>.

*Note: The minimum mapable unit from satellite image is 30m by 30m or 0.0009 km<sup>2</sup>. Estimations of fire extent (in terms of sq.km.) both in 2017 and in the present 2020 study are pixel based. They may differ from the actual ground area under fire. These estimations are made for comparative purpose only, to indicate the increase or decrease of areal disposition of fire. Hence, they should not be quoted as fire area on the ground.*

	<p><b>भारत कोकिंग कोल लिमिटेड</b> (कोल इंडिया लिमिटेड का एक अंग) <b>BHARAT COKING COAL LIMITED</b> (A Subsidiary of Coal India Limited) <b>Civil Engineering Department, Koyla Nagar, Dhanbad – 826 005 (JH)</b> Corporate Identity No. (CIN): U10101JH1972GOI000918 <b>GSTIN: 20AAACB7934MFZB (JH), 19AAACB7934M2Z7 (WB)</b> e-mail: <a href="mailto:gmcivil.bccl@coalindia.in">gmcivil.bccl@coalindia.in</a>; Website – <a href="http://www.bcclweb.in">www.bcclweb.in</a></p>
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NIT Ref. BCCL/CED/TC/eNIT-12/2021-22/225;

dated: 05.07.2021

**Notice Inviting Tender**

1. Tenders are invited on-line under two part system on the website <https://coalindiatenders.nic.in> from the eligible bidders having Digital Signature Certificate (DSC) issued from any agency authorized by Controller of Certifying Authority (CCA), Govt. of India and which can be traced up to the chain of trust to the Root Certificate of CCA, for the following work:

Description of work	Location	Estimated Cost of Work (Including GST) (In Rs.)	Period of Completion (In Days)
Drilling and installation of 23 nos of piezometric wells in the command area of BCCL	BCCL Dhanbad	2,16,19,913.33	175 days

**Provident fund is applicable for this work.**

- (i). For Site visit of location of work, the prospective bidder(s) may contact .....

Tender inviting authority	Contact Person(s)/Tender Dealing Officer(s)	
GM(Civil/Industrial), BCCL	Sri Sunil Nigam GM(Geology) Contact : 9470596404	Preety Priya Assistant Manager(Civil) CED, HQ, BCCL

## 2. Time Schedule of Tender:

Sl. No	Particulars	Date	Time
a.	Tender e-Publication date	09.07.2021	15:00
b.	Document download start date	09.07.2021	15:00
c.	Document download end date	27.07.2021	15:00
d.	Bid Submission start date	10.07.2021	15:00
e.	Bid submission end date	27.07.2021	15:00
f.	Start date for seeking Clarification on-line	09.07.2021	15:00
g.	Last date for seeking Clarification on-line	20.07.2021	15:00
h.	Technical Bid (Cover I) opening date	28.07.2021	16:00
i.	Price Bid (Cover II) opening date(tentative)	28.08.2021	11:00

**Note:** The auto extension of submission of bid shall be applicable as per details mentioned in clause No.14 of NIT.

## 3. Bid Securing Declaration:

3.1 In place of a bid security/EMD, Bidders shall have to sign a Bid securing declaration accepting that if they withdraw or modify their bids during the period of validity, or if they are awarded the contract and they fail to sign the contract, or to submit a performance security before the deadline or any other default which attracts forfeiture of EMD (as prescribed in the existing Manuals) as defined in the request for bid document/Tender Document, they will be banned for two years from being eligible to submit bids in CIL and its subsidiaries. This banning shall be done under the provisions of NIT with the approval of Tender Accepting Authority by Application Admin of CIL e-Procurement Portal.(In case of a JV/Consortium all partners will be banned)

3.2 Micro and Small Enterprises (MSEs) as defined in MSE Procurement Policy issued by Department of Micro, Small and Medium Enterprises (MSME) will be exempt from the payment of earnest money (applicable only for Services tenders).

Such exempted MSE bidders shall upload the scanned copy of document (attested by notary public) in support of exemption will have to be uploaded by the bidder during bid submission. However, this option is to be enabled only in those cases where the exemption of EMD to some bidders is allowed as per NIT.

Bid Securing Declaration in **the Undertaking at Annexure II** shall be **accepted by bidder unconditionally in GTE (General Technical Evaluation)**.

## 4. Pre-bid Meeting:

The pre-bid meeting if applicable shall be held in the office of Tender Inviting Authority, on the scheduled date & time, if specified in the NIT. The purpose of the pre-bid meeting is to clarify the issues and to answer the questions on any matter that may be raised at that stage. Non-attendance at the pre-bid meeting will not be a cause for disqualification of bidder and it shall

be presumed that the bidder does not require any clarification. The management shall circulate proceedings of the pre-bid meeting, if held.

**5. Clarification of Bid:**

The bidder may seek clarification on-line within the specified period. However, the management will clarify as far as possible to the relevant queries.

**6. User Portal Agreement:**

The bidders have to accept the on-line user portal agreement which contains the acceptance of all the Terms and Conditions of NIT and tender document, undertakings and the e-Procurement system through <https://coalindiatenders.nic.in> in order to become an eligible bidder. This will be a part of the agreement.

**7. Eligible Bidders:**

The invitation for bid is open to all bidders including an individual, proprietorship firm, partnership firm, company, Joint Venture having eligibility to participate as per eligibility criteria stipulated in clause No.8 of NIT and having Digital Signature Certificate (DSC) issued from any agency authorized by Controller of Certifying Authority (CCA), Govt. of India and which can be traced up to the chain of trust to the Root Certificate of CCA.

*Note: Joint Venture shall not be allowed for participation in the bid with estimated cost of work put to tender up to Rs. 2.00 (two) crores.*

**8. Eligibility Criteria:**

**A. Work Experience:**

The Intending bidder must have in its name or proportionate share as a member of Joint Venture/Partnership firm experience of having successfully **completed similar** works, as a prime contractor, during last 7(seven) years ending last day of month previous to the one in which bid applications are invited (i.e. eligibility period) should be any of the following :-

Three similar **completed works** each costing not less than the amount equal to 40% of the estimated cost put to tender.

Or

Two similar **completed works** each costing not less than the amount equal to 50% of the estimated cost put to tender.

Or

One similar **completed work** costing not less than the amount equal to 80% of the estimated cost put to tender.

Experience for those works only shall be considered for evaluation purposes, which match eligibility requirement stipulated above, on or before the last day of month previous to one in which tender has been invited(publication date of NIT). The experience of incomplete/ongoing works as on last date of eligibility period will not be considered for evaluation. If the referred work includes construction as well as maintenance after construction, the experience of such work may be considered as 'acceptable' if the construction part is completed as on the last date of 'eligibility period', even if maintenance work is ongoing, and the certificate issued clearly stipulates the same .

In all the above cases, while considering the value of completed works, the full value of completed work be considered whether or not the date of commencement is within the said 7(seven) years period. The date of completion of work should be during last

7(seven) years ending last day of month previous to the one in which bid applications are invited.

Cost of previous completed works shall be given a simple weightage of 5% per year to bring them at current price level, while evaluating the qualification requirement of the bidder. Such weightage shall be considered after end date of completion. Updating will be considered for full or part of the year (total no. of days / 365) i.e. considering 365 days in a year, till the last day of month previous to one in which bid has been invited.

In case the bidder is not a prime contractor, but a sub-contractor, the bidder's experience as sub-contractor will be taken into account, against suitable document that the contract in support of qualification is a sub-contract in compliance with the provision of such sub-contracts in the original contract awarded to prime contractor. The document may be issued by owner/Govt. department on behalf of the owner.

**Joint Venture shall be allowed for participation in the bid with estimated cost above Rs. 2.0 Crores.**

**The above qualification criteria shall be fulfilled by JV in the following manner:**

The qualifying criteria parameter e.g. experience of the individual partners of the J.V will be as deliberated hereinafter towards fulfilment of qualification criteria related to experience.

a) In case of completion of single work of similar nature costing, not less than the amount equal to 80% of the estimated cost put to tender:-

Any of the JV partner shall have the experience of having completed successfully a single work of similar nature equal to 80% of the estimated cost put to tender.

Or

b) In case of completion of two works of similar nature each costing not less than the amount equal to 50% of the estimated cost put to tender :-

i) Any one partner can match the above requirement.

Or

ii) At least two partners should each have completed at least one work of similar nature each costing not less than the amount equal to 50% of the estimated cost put to tender.

Or

c) In case of completion of three works of similar nature, each costing not less than the amount equal 40% of the estimated cost put to tender:-

i) Any one partner can match the above requirement.

Or

ii) Any two partners shall match the above requirement through completion of at least two work by one partner and one work by other partner of similar nature each costing not less than the amount equal 40% of the estimated cost put to tender.

Or

iii) All the three partners shall match the above requirement through completion of at least one work of similar nature each costing not less than the amount equal 40% of the estimated cost put to tender.

**However, the participating share of JV partners shall be as below:**

**i) Lead Partner shall have at least 50% participating share in JV**

ii) Other partner(s) shall have at least 20% participating share in JV

Works of similar nature may be suitably defined by respective subsidiaries based on its own necessity.

**The definition of Similar work shall be as follows:**

**“Drilling of 250 mm or more borehole for installation of Piezometer.”**

In respect of the above eligibility criteria the bidders are required to furnish the following information on-line:

- i) Description of qualifying experience (similar nature)
- ii) Work order Number /Agreement Number of each experience
- iii) Name & address of Employer/Work Order Issuing authority of each experience
- iv) Percentage (%) share of each experience (in case the experience has been earned by the bidder as a partner in a joint venture firm/partnership firm then the proportionate value of experience in proportion to actual share of bidder in that joint venture firm/partnership firm will be considered against eligibility else it shall be taken as 100%).
- v) Executed Value of work against each experience
- vi) Start date & end date of each qualifying experience (similar nature)

Note:

- a. In case the bidder is a Joint Venture, work experience as above may be furnished as the work experience of the bidder. If a bidder participates as a Joint Venture(JV), the benefits as per Public Procurement Policy for MSEs order-2012 shall not be applicable for them (for Service nature of works).
- b. Confirmation in the form of Yes/No regarding submission of similar work experience as defined in the NIT.

- B. Financial Turnover:** Average annual financial turnover during the last 3 (three) years ending 31<sup>st</sup> March of the previous financial year should be at least 30% of the estimated cost put to tender.

(The “Previous Financial Year” shall be computed with respect to the e-Publication date of NIT).

If any bidder does not furnish the turnover value for any financial year out of the last 3 financial years, the turnover for that financial year shall be taken as ‘Zero’ and the average annual financial turnover shall be calculated accordingly.

Financial turnover shall be given a weightage to bring them at current price level by adding 5% for each completed year (total number of days/365) after the end of respective financial year (i.e. 31<sup>st</sup> March) till the last day of month previous to one in which e-tender has been invited.

In respect of the above eligibility criteria the bidders are required to furnish the following information on-line :

- i) Annual turnover of each of the last 3 (three) years ending 31<sup>st</sup> March of the previous financial year.
- ii) Name of the Chartered Accountant issuing the Profit and Loss A/c or the Turnover certificate.
- iii) Membership Number of the Chartered Accountant.
- iv) Date of certificate issued by Chartered Accountant.

Note:

- a. In case the bidder is a Joint Venture, the turnover of the individual partners of the JV will be added together for each financial year and is to be furnished as the turnover of

the bidder for that particular financial year. However, the information against Sl.No.(ii) & (iii) above will be given w.r.t. the lead partner of JV only. If a bidder participates as a Joint Venture(JV), the benefits as per Public Procurement Policy for MSEs order-2012 shall not be applicable for them (for Service nature of works).

- b. In case of JV, if financial turnover of all the partners is not submitted; the JV will not be disqualified and instead the required turnover will be calculated assuming zero value for partner/partners who has/have not submitted the financial turn over certificate.

**C. Permanent Account Number(PAN)** : The bidder should possess valid Permanent Account Number (PAN) issued by Income Tax department, Govt. of India.

In respect of the above eligibility criteria the bidders are required to furnish the following information on-line :

- i) Confirmation regarding possessing of Permanent Account Number(PAN) issued by Income Tax department, Govt. of India in the form of Yes / No.

**Note** : In case of JV, PAN card for each Indian partner of JV and Verifiable Tax Residency Certificate of respective country for each foreign partner or JV itself. If a bidder participates as a Joint Venture(JV), the benefits as per Public Procurement Policy for MSEs order-2012 shall not be applicable for them (for Service nature of works).

**Scanned copy of documents to be uploaded by bidders in bidder space (Other Important Document): PAN CARD of the bidder.**

**D. Goods and Services Tax (Not Applicable for Exempted Services)**

The bidder should be either GST Registered Bidder under regular scheme

**OR**

GST Registered Bidder under composition scheme

**OR**

GST unregistered Bidder

**In respect of the above eligibility criteria the bidder is required to furnish the following information online:**

- i). Confirmation in the form of Yes/No regarding possessing of required document as enlisted in NIT with respect to GST status of the bidder.

**Note:**

*i). In case of JV a Certificate from a practicing Chartered Accountant having membership number with Institute of Chartered Accountants of India confirming the status of JV w.r.to GST in compliance with relevant GST rules or GST Registration Certificate of JV. If a bidder participates as a Joint Venture(JV), the benefits as per Public Procurement Policy for MSEs order-2012 shall not be applicable for them (for Service nature of works).*

ii). In case the work/service is awarded to a Joint Venture participating in the tender they have to submit PAN, GST registration ( as applicable in the tender and for the bidder status) etc. in the name of the Joint Venture after Award of Work/Service before the payment of first running on account bill.

iii) If turnover of bidder exceeds exemption/threshold limit, the bidder must have GST registration as per GST Act and rules.

iv) During the execution of the contract if the GST status of the bidder changes, then the payment of GST, if any, to the contractor will be made as per the GST status declared by the bidder during tender stage based on which cost to company has been ascertained or at actuals, whichever is lower.

**Scanned copy of documents to be uploaded by bidder(s) in bidder space (Other Important Document)**

**E. Purchase Preference under 'Make in India' Policy for "Local supplier".**

Preference to Make in India (as applicable) vide Order No. P-45021/2/2017-PP (BE-II) dated 04.06.2020, issued by Govt. of India as amended from time to time shall be applicable.

**In terms of the above said policy, purchase preference shall be given to Class-I local supplier.**

**In terms with the above said policy, Class-I local suppliers and Class-II local suppliers shall be eligible to bid.**

The definitions of Class-I *Local Supplier*, Class-II local supplier, Non-Local supplier, *Local Content* and Margin of Purchase Preference as per above mentioned Order are as follows:-

- A. 'Class-I local supplier' means a supplier or service provider, whose goods, services or works offered for procurement, has local content equal to or more than 50%, as defined under said order.
- B. 'Class-II local supplier' means a supplier or service provider, whose goods, services or works offered for procurement, has local content more than 20% but less than 50%, as defined under said order.
- C. 'Non-Local supplier' means a supplier or service provider, whose goods, services or works offered for procurement, has local content less than or equal to 20% as defined under said order
- D. '*Local Content*' means the amount of value added in India which shall be the total value of the item procured (excluding net domestic indirect taxes) minus the value of imported content in the item (including all customs duties) as a proportion of the total value, in percent.
- E. 'Margin of Purchase Preference' means the maximum extent to which the price quoted by a Class-I local supplier may be above the L1 for the purpose of purchase preference. The margin of purchase preference is 20%.

**In respect of the above eligibility criteria the bidder is required to furnish the following information online:**

i). Confirmation in the form of Yes/No regarding possessing of required document indicating percentage of local content as enlisted in NIT.

**Note:-**

- I. If the estimated value of Procurement is less than Rs. 10 crores, all the Bidders at the time of bidding shall submit either self-certification indicating the percentage of local content in the offered items **as per format in Annexure- II.**
- II. If the estimated value of procurement is more than Rs. 10 crores, all the Bidders shall submit along with its bid a certificate from the statutory auditor or cost auditor of the company (in case of companies) or from a practicing cost accountant or practicing chartered account (in respect of suppliers other than companies) giving the percentage of local content. Scanned copy of documents to be uploaded by bidder(s) in support of information / declara-

tion furnished online by the bidder against Eligibility Criteria **as Other Important Documents in Bidder Space.**

#### **9. Submission of Bid:**

a. (i). In order to submit the Bid, the bidders have to get themselves registered online on the e-Procurement portal of CIL (<https://coalindiatenders.nic.in>) with valid Digital Signature Certificate (DSC) issued from any agency authorized by Controller of Certifying Authority (CCA), Govt. of India and which can be traced up to the chain of trust to the Root Certificate of CCA. The online Registration of the Bidders on the portal will be free of cost and one time activity only. The registration should be in the name of bidder, whereas DSC holder may be either bidder himself or his duly authorized person. The bidder is one whose name will appear as bidder in the e-Procurement Portal.

(ii). The bidders have to accept unconditionally the online user portal agreement which contains the acceptance of all the Terms and Conditions of NIT including General and Special Terms & Conditions, Integrity Pact and other conditions, if any, along with on-line undertaking in support of the authenticity of the declarations regarding the facts, figures, information and documents furnished by the Bidder on-line in order to become an eligible bidder. No conditional bid shall be allowed/accepted.

(iii). The bidders have to accept unconditionally in GTE (General Technical Evaluation) the Undertaking at **Annexure II** regarding Genuineness of the information furnished by him on-line & authenticity of the scanned copy of documents uploaded by him on-line in support of his eligibility criteria, Bid Security Declaration, declaration w.r.t Make in India order dated 16.09.2020, and compliance w.r.t procurement from bidder of a country which shares a border with India etc., **Annexure I** (Letter of Bid), **Annexure-X** (Integrity pact).

Moreover, the **Bidders** are required to upload following Other Important Documents (OID) in the Bidder space and no recycling will be done for these documents i.e. no further clarification will be sought from bidder :

	Eligibility Criteria	Scanned copy of documents to be uploaded by bidder(s) in support of information/declaration furnished online by the bidder in <b>Other Important Documents (OID) in the Bidder space</b>
1	2	3
1	Financial Turnover (Ref. Clause No.8(B) of NIT)	Financial Turnover certificate <b>having a Unique Document Identification Number (UDIN) with Institute of Chartered Accountants of India</b> for last 3 (three) financial years issued by a Practicing Chartered Accountant having a membership number with Institute of Chartered Accountants of India. <i>(In case of JV, turnover certificate for each individual partner of JV. If a bidder participates as a Joint Venture(JV), the benefits as per Public Procurement Policy for MSEs order-2012 shall not be applicable for them (for Service nature of works).)</i>
2	Permanent Account Number (Ref. Clause No.8(C) of NIT)	PAN card issued by Income Tax department, Govt. of India. <i>(In case of JV, PAN card for each Indian partner of JV and Verifiable Tax Residency Certificate of respective country for each foreign partner or JV itself. If a bidder participates as a Joint Venture(JV), the benefits as per Public Procurement Policy for MSEs order-2012 shall not be applicable for them (for Service nature of works))</i>
3	Goods and Ser-	The following documents depending upon the status w.r.to GST as de-

	<p>ices Tax (GST) Status of Bidder <b><u>(Not Applicable for Exempted Services)</u></b> (Ref. Clause No.8(D) of NIT and BOQ)</p>	<p>clared by Bidder in the BOQ sheet:</p> <p>a) Status: <u>GST Registered Bidder under regular scheme</u></p> <p>Document: GST Registration Certificate (i.e. GST identification Number) issued by appropriate authority of India.</p> <p>b) Status: <u>GST Registered Bidder under composition scheme</u></p> <p>Document: GST Registration Certificate (i.e. GST identification Number) issued by appropriate authority of India.</p> <p>c) Status: GST unregistered bidder:</p> <p>Document: A Certificate from a practicing Chartered Accountant having membership number with Institute of Chartered Accountants of India certifying that the bidder is GST unregistered bidder in compliance with the relevant GST rules of India.</p> <p>[In case of JV a Certificate from a practicing Chartered Accountant having membership number with Institute of Chartered Accountants of India confirming the status of JV w.r.t GST in compliance with relevant GST rules or GST Registration Certificate of JV. If a bidder participates as a Joint Venture(JV), the benefits as per Public Procurement Policy for MSEs order-2012 shall not be applicable for them (for Service nature of works).]</p> <p><b>Note:</b></p> <p><i>i) If turnover of bidder exceeds exemption/threshold limit, the bidder must have GST registration as per GST Act and rules.</i></p>
4	<p>Legal Status of the bidder</p>	<p><u>Document(s) covered under any one of the following sub-head(s):</u></p> <ol style="list-style-type: none"> <li>1. Affidavit or any other document to prove proprietorship/Individual status of the bidder.</li> </ol> <p>Note : <b><u>Affidavit for legal status of a proprietorship firm should contain the NIT Ref. &amp; Name of work, Purpose of affidavit, deponent Identification document no like Aadhar No, enrolment no of identifying advocate.</u></b></p> <ol style="list-style-type: none"> <li>2. Partnership deed containing name of partners.</li> <li>3. Memorandum &amp; Article of Association with certificate of incorporation containing name of bidder.</li> <li>4. Joint Venture agreement as per format in Annexure-IX containing name of partners and lead partner, Power of Attorney to the Lead Partner and share of each partner.</li> <li>5. In case of Co-operative societies formed by Project Affected Persons (PAPs), following documents to be submitted: <ol style="list-style-type: none"> <li>i. Certificate of Registration issued by Registrar of the Cooperative Society.</li> <li>ii. Copy of Rules and Bye Laws of Cooperative Societies.</li> </ol> </li> </ol>

5	Local supplier status of the Bidder	If the estimated value of procurement is more than Rs. 10 crores, all the Bidders shall submit along with its bid a certificate from the statutory auditor or cost auditor of the company (in case of companies) or from a practicing cost accountant or practicing chartered account (in respect of suppliers other than companies) giving the percentage of local content.
<p>Note: Only one file in .pdf format can be uploaded against each eligibility criteria. Any additional/ other relevant documents to support the information/declaration furnished by bidder online against eligibility criteria may also be attached by the bidder in the same file to be uploaded against respective eligibility criteria.</p>		

**b. Confirmatory Documents:** All the confirmatory documents as enlisted in the NIT in support of online information submitted by the bidder are to be uploaded in Cover-I by the bidder while submitting his/her/their bid.

	Eligibility Criteria	Scanned copy of documents to be uploaded by bidder(s) in support of information/declaration furnished online by the bidder against Eligibility Criteria (CONFIRMATORY DOCUMENTS)
1	2	3
1	Work Experience (Ref. Clause No.8(A) of NIT)	<p>Satisfactory Work Completion Certificate issued by the employer against the experience of similar work containing all the information furnished by bidder on-line. In case of Sub-contractor suitable document as per provision of eligibility, if applicable.</p> <p>Work order, BOQ and/or TDS may be sought during clarification or along with deficient documents as per clause 13(B).</p> <p><i>(In case of JV, Satisfactory Work Completion Certificate against individual partner(s) including Lead Partner of JV as applicable as per details mentioned in clause No. 8. If a bidder participates as a Joint Venture(JV), the benefits as per Public Procurement Policy for MSEs order-2012 shall not be applicable for them (for Service nature of works))</i></p>
2	Digital Signature Certificate (DSC)	<p>If the bidder himself is the DSC holder bidding on-line then no document is required.</p> <p>However, if the DSC holder is bidding online on behalf of the bidder then the Power of Attorney or any sort of legally acceptable document for the authority to bid on behalf of the bidder.</p>
4	Undertakings	<p>Undertaking as per Annexure –II to be submitted by Bidder/s on his/her/their Letter Head regarding :</p> <ol style="list-style-type: none"> <li>Genuineness of the information furnished by him on-line and authenticity of the scanned copy of documents uploaded by him on-line in support of his eligibility &amp; Bid Security Declaration.</li> <li>Local Supplier status: self-certification indicating the percentage of local content in the offered items (As per Clause No.8(C) of NIT).</li> </ol> <p>Note : Only Class-I local suppliers and Class-II local suppliers shall be eligible to bid. Non-local supplier is not eligible to bid.</p> <ol style="list-style-type: none"> <li>Undertaking for CONSENT TO ARBITRATION CLAUSE 16 and 16A</li> </ol>

		<p>OF GTC, to be submitted by Partnership/JV firm.</p> <p>d. Performa for certificate regarding Restrictions under Rule 144 (xi) of the GFRs.</p>
<p>Note: Only one file in .pdf format can be uploaded against each eligibility criteria. Any additional/ other relevant documents to support the information/declaration furnished by bidder online against eligibility criteria may also be attached by the bidder in the same file to be uploaded against respective eligibility criteria.</p>		

**c. Letter of Bid(LoB):** The bidders have to accept unconditionally the Letter of Bid in GTE (General Technical Evaluation) at the time of bid submission. No recycling will be done for this document i.e. no further clarification will be sought from bidder.

**d. Price bid:** The Price bid containing the Bill of Quantity will be in Excel format and will be downloaded by the bidder and bidder will quote the rates for all items on this Excel file. Prior to quoting the rates in the BOQ file, the bidder will select the appropriate status from the following drop down list given in the BOQ:-

- I. Status: GST Registered Bidder under regular scheme
- II. Status: GST Registered Bidder under composition scheme
- III. Status: GST unregistered bidder

The rates quoted by the bidder will be excluding GST and GST component (to be paid by CIL / Subsidiary and/or the bidder) will appear as a separate entity. The component of GST will be taken by the system based on the status of bidder selected by the bidder during bid submission and with the pre-defined business logic given in the BOQ file by the department. This file will be digitally signed and uploaded by the bidder after ascertaining the correctness of facts and figures.

Thereafter, the bidder will upload the same Excel file during bid submission in cover-II. The Price-bid (excluding GST) will be in Item Rate or Percentage Rate or Mixed Rate[combination of Item Rate and Percentage Rate] BOQ format and the bidder will have to quote for all the tendered items. The Price Bid of the tenderers will have no condition. The price bid which is incomplete and not submitted as per instruction given in this document is liable for rejection.

**System for decision of L1 bidder**

The L1 bidder will be decided based on Overall Quoted Value (i.e. cost to the Company). The system for decision of L1 bidder will be as per following 02(two) cases:-

**Case – 1: Supply for which INPUT TAX CREDIT (ITC) is not available to the Company.**

For calculation of Overall Bid Value, the GST [CGST, SGST/UTGST, IGST and GST (compensation to state tax)] to be paid by the bidder **or** by CIL/ Subsidiary taken by the system will be added to decide the L1 i.e the ranking of the Bidders will be decided based on rates quoted by the bidders plus GST. This value of the bidder will be “the Cost to Company”.

Then share of GST to be deposited by CIL/ Subsidiary, if any will be deducted from overall bid value to arrive at the Contract value. The Price-bids of the tenderers shall have no condition. The Price Bid which is incomplete and not submitted as per instruction given above is liable for rejection.

**Case – 2: Supply for which INPUT TAX CREDIT (ITC) is available to the Company.**

For calculation of Overall Bid Value, the GST [CGST, SGST/UTGST, IGST and GST (compensation to state tax)] to be paid by the Bidder **or** by CIL/ Subsidiary taken by the system will be ignored to decide the L1 i.e the ranking of the Bidders will be decided based on rates quoted by the bidders excluding GST. This value of the bidder will be “the cost to Company”.

Then share of GST to be paid by bidder shall be added with overall bid value to arrive at the Contract value. The Price-bids of the tenderers shall have no condition. The Price Bid which is incomplete and not submitted as per instruction given above is liable for rejection.

**Note: The bidder should select their GST category as per clause no. 8.D of NIT.**

#### **10. Bid Submission:**

All bids are to be submitted on-line on the website <https://coalindiatenders.nic.in>. No bid shall be accepted off-line unless otherwise specified.

#### **11. System Requirement:**

It is the bidder's responsibility to comply with the system requirement i.e. hardware, software and internet connectivity at bidder's premises to access the e-tender website. Under any circumstances, CIL/ Subsidiary shall not be liable to the bidders for any direct/indirect loss or damages incurred by them arising out of incorrect use of the e-tender system or internet connectivity failures.

#### **12. Opening of Technical Bid:**

**12.1** The Technical bid (Cover-I) will be opened one day after the Bid submission end date or next working day whichever is later. Technical bid (Cover-I) will be decrypted and opened online by the "Bid Openers" with their Digital Signature Certificates after the prescheduled date & time of Tender Opening.

**12.2** The e-Procurement System will evaluate the Technical bids automatically on the basis of relevant data provided by bidder through a form in an objective and structured manner while submitting bid. If the parameter given by bidder in objective and structured manner does not confirm to required eligibility criteria as specified in the tender document then the bid will be auto rejected.

**12.3** All the documents uploaded by bidder(s) including i.e. Letter of Bid & EMD exemption documents (if any) (Bid Securing declaration/Udyam Registration Certificate" or any other Registration certificate issued to MSEs) and the Evaluation sheets generated by the system online shall be downloaded after opening of Technical bid (Cover-I). After decryption and opening of Technical bid (Cover-I) the "technical bid opening summary" will be uploaded on the same day.

#### **13. Technical Evaluation of Tender:**

- A.** After opening of Technical bid, the documents submitted by bidder(s) in cover I as enlisted in the NIT will be downloaded by the Evaluator and shall be put up to the Tender Committee. The Tender Committee will examine the uploaded documents against information/declarations furnished by the bidder(s) online. If it confirms to all of the information/ declarations furnished by the bidder online and does not change the eligibility status of the bidder then the bidder will be considered eligible for opening of price bid.
- B.** In case the Tender Committee finds that there is some deficiency in uploaded documents (*i.e. with respect to confirmatory documents* ) corresponding to the information furnished online or in case corresponding document have not been uploaded by bidder(s) then the same will be specified online by Evaluator clearly indicating the omissions/shortcomings in the uploaded documents and indicating start date and end date allowing 7 days (7 x 24 hours) time for online re-submission by bidder(s). The bidder(s) will get this information on their personalized dashboard under "Upload confirmatory document" link.
- C.** Additionally, information shall also be sent by system generated email and SMS, but it will be the bidder's responsibility to check the updated status/information on their personalized dash board regularly after opening of bid. No separate communication will be required in this regard. Non-receipt of e- mail and SMS will not be accepted as a reason of non-submission of documents


within prescribed time. The bidder(s) will upload the scanned copy of all those specified documents in support of the information/ declarations furnished by them online within the specified period of 7 days. No further clarification shall be sought from Bidder.

- D. It is responsibility of Bidders to upload legible/clearly readable scanned copy of all the required documents as mentioned above.
- E. The tender will be evaluated on the basis of documents uploaded by bidder(s) online. The bidder(s) is/are not required to submit hard copy of any document through offline mode. Any document submitted offline will not be given any cognizance in the evaluation of tender.
- F. In case the bidder(s) submit(s) requisite documents online as per NIT, then the bidder(s) will be considered eligible for opening of Price Bid.
- G. Seeking clarification shall be restricted to confirmation of submitted document/online information only and it should be only for one time for a period of upto 7 days. The clarification shall be taken in online mode in the e- Procurement portal of CIL only.
- H. In case bidder(s) fails to confirm the online submitted information(s)/ declaration(s) by the submitted documents as (B) above, their/his bid shall be rejected; however, if the confirmatory documents do not change eligibility status of the bidder in connection his submitted online information(s)/declaration(s), then his/their bid will be accepted for opening of Price Bid.
- I. After Technical evaluation of tender, "Technical Evaluation Summary" will be uploaded by the evaluator and price bid shall be opened on/after preschedule date and time mentioned in the NIT online in the e- Procurement portal of CIL. However, in case there is any extension of date and time of price bid opening, it shall be notified online and price bid shall be opened online on e-Procurement portal of CIL after rescheduled date and time.
- J. In case none of the bidder(s) complies the technical eligibility criteria as per NIT, then bidder(s) will be rejected online and re-tender (if required) will be done (with the same or different quantity, as per the instant requirement).
- K. **If L1 bidder backs out (i.e. Techno commercially established L1 bidder, the bidder will be banned for two years from being eligible to submit bids in CIL and its subsidiaries. This banning shall be done under the provisions of NIT with the approval of Tender Accepting Authority by Application Admin of CIL e-Procurement Portal.**

**Note:** In case *If the defaulter L1 bidder is a Joint Venture(JV) firm, penal action against the JV will also be applicable to all the partners of JV.*

- L. **Preference to Make in India (as applicable) vide Order No. P-45021/2/2017-PP (BE-II) dated 04.06.2020, issued by Govt. of India as amended from time to time shall be applicable.**

In terms of the above said policy, purchase preference shall be given to local suppliers in the following manner :

- I. 
  - i) Among all qualified bids, the lowest bid will be termed as L-1. If L-1 is from a Class-I local supplier, the contract for full quantity will be awarded to L-1 at L-1 price by the Purchaser.

- ii) If L-1 is not a Class-I local supplier, 50% of the order quantity shall be awarded to L-1. Thereafter, the lowest bidder among the Class-I local suppliers will be invited to match the L-1 price for the remaining 50% quantity subject to Class-I local supplier's quoted price falling within the margin of purchase preference, and the contract for that quantity shall be awarded to such local supplier subject to his matching the L-1 price. In case such lowest eligible Class-I supplier fails to match the L-1 price or accept less than the offer quantity, the next higher Class-I local supplier within the margin of purchase preference shall be invited to match the L-1 price for remaining quantity and so on, and contract shall be awarded accordingly. In case some quantity is still left uncovered on Class-I local supplier, then such balance quantity may also be ordered on L-1 bidder.

II. 

- i) Among all qualified bids, the lowest bid will be termed as L-1. If L-1 is from a Class-I local supplier, the contract will be awarded to L-1.
- ii) If L-1 is not from a Class-I local supplier, the lowest bidder among the **Class-I** local suppliers, will be invited to match the L-1 price subject to Class-I local supplier's quoted price falling within the margin of purchase preference, and the contract shall be awarded to such Class-I local supplier subject to matching the L-1 price.
- iii) In case such lowest eligible Class-I local supplier fails to match the L-1 price, the Class-I local supplier with the next higher bid within the margin of purchase preference shall be invited to match the L-1 price and so on and contract shall be awarded accordingly. In case none of the Class-I local suppliers within the margin of purchase preference matches the L-1 price, then the contract may be awarded to the L-1 bidder.

Note: The confirmation from the bidder regarding matching of L1 price may be taken in confirmatory document link of e-Procurement portal by recycling 'Any other document' link.

**Verification of local content :**

- I. If the estimated value of Procurement is less than Rs. 10 crores, all the Bidders at the time of bidding shall submit either self-certification indicating the percentage of local content in the offered items.
- II. If the estimated value of procurement is more than Rs. 10 crores, all the Bidders shall submit along with its bid a certificate from the statutory auditor or cost auditor of the company (in case of companies) or from a practicing cost accountant or practicing chartered account (in respect of suppliers other than companies) giving the percentage of local content.
- III. CIL/ Subsidiary may constitute committees with internal and external experts for independent verification of auditor's / accountant's certificates on random basis and in the case of complaints.
- IV. -False declarations will attract banning of business of the bidder for a period up to two year and with process in line with clause 19 of GTC.

- V. A local supplier who has been debarred by any procuring entity for violation of above order shall not be eligible for preference under this Order for procurement by any other procuring entity for the duration of debarment. The debarment for such other procuring entities shall take effect prospectively from the date on which it comes to the notice of other procurement entities.

Note (For departmental users & not to be part of Tender Document):

1. In case of procurement of all goods, services or works in respect of which the Nodal Ministry of department has communicated that there is a sufficient local capacity and local competition, only Class-I local supplier as defined under the said order, shall be eligible to bid irrespective of purchase value.
2. In procurement of all goods, services or works, not covered by sl. No.1 above and with estimated value of purchases less than Rs.200 crore in accordance to Rule 161 (iv) of GFR 2017, Global tender enquiries shall not be issued except with competent approval as designated by Department of Expenditure. Only Class-I local supplier and Class-II local supplier as defined under the order, shall be eligible to bid in procurements undertaken by procuring entities, except when global tender enquiries have been issued. In global tender enquiries, Non-local suppliers shall also be eligible to bid long with Class-I local suppliers and Class-II local suppliers.

**L. Procurement from Micro and Small Enterprises (MSEs) (APPLICABLE FOR SERVICE NATURE OF TENDERS)**

i) Subject to meeting terms and conditions stated in the tender document including but not limiting to prequalification criteria, 25% of the work will be awarded to MSE as defined in MSE Procurement Policy issued by Department of Micro, Small and Medium Enterprises (MSME) for the tendered work/item. Where the tendered work can be split, MSE quoting a price within a price band of L1 + 15% shall be awarded at least 25% of total tendered work provided they match L1 price. In case the tendered work cannot be split, MSE shall be awarded full work provided their quoted price is within a price band of L1 + 15% and they match the L1 price.

ii) In case of more than one such MSEs are in the price band of L1 + 15% and matches the L1 price, the work may be shared proportionately if the job can be split. If the job cannot be split, then the opportunity to match the L-1 rate of the tender shall be given first to MSE who has quoted lowest rate among the MSEs and the total job shall be awarded to them after matching the L-1 price of the tender. If the MSE who have quoted lowest rate among the MSEs in the price band of L1 + 15% do not agree to match the rate of L1 of the tender, then the MSE with next higher quoted rate in the price band of L1 + 15% shall be given chance to match the rate of L1 for award of the complete job. This process to be repeated in till work is awarded to MSE or MSE bidders are exhausted.

iii) Out of the 25% target of annual procurement from micro and small enterprises 3(three) percent shall be earmarked for procurement from micro and small enterprises owned by women. In the event of failure of such MSEs to participate in the tender process or meet the tender requirements and L1 price, 3(three) percent sub-target so earmarked shall be met from other MSEs.

iv) Out of the 25% target of annual procurement from micro and small enterprises 4(four) percent shall be earmarked for procurement from micro and small enterprises owned by Scheduled Caste & Scheduled Tribe entrepreneurs. In the event of failure of such MSEs to participate in the tender

process or meet the tender requirements and L1 price, four percent sub-target so earmarked shall be met from other MSEs.

v) To qualify for entitlement as SC/ST owned MSE, the SC/ST certificate issued by District Authority must be submitted by the bidder in addition to certificate of registration with anyone of the agencies mentioned in paragraph (I) above. The bidder shall be responsible to furnish necessary documentary evidence for enabling CIL/ Subsidiary to ascertain that the MSE is owned by SC/ST. MSE owned by SC/ST is defined as:

- In case of proprietary MSE, proprietor(s) shall be SC /ST
- In case of partnership MSE, The SC/ST partners shall be holding at least 51% shares in the enterprise.
- In case of Private Limited Companies, at least 51% share shall be held by SC/ST promoters.
- In case of Public Limited Companies, at least 51% share shall be held by SC/ST entrepreneurs at any given point of time.

vi) Classification of Micro and Small Enterprise are as under:

a. Micro Enterprise –Enterprise where the investment in plant and machinery or equipment does not exceed one crore Rupees and turnover does not exceed five core rupees.

b. Small Enterprise- Enterprise where the investment in plant and machinery or equipment does not exceed ten crore Rupees and turnover does not exceed fifty core rupees.

vii) The MSEs should be registered with District Industries Centers (DICs)/ Khadi & Village Industries Commission (KVIC)/ Khadi & Village Industries Board (KVIB)/ Coir Board/ NSIC/ Directorate of Handicrafts and Handloom or any other body specified by Ministry of Micro, Small & Medium Enterprises (MoMSME) are eligible for availing benefits under the Public Procurement Policy for Micro and Small Enterprise (MSEs) Order, 2012 as amended from time to time.

viii) The MSEs are required to submit copy of documentary evidence, issued by their registering authority whether they are small enterprise or micro enterprise as per provisions of Public Procurement Policy for Micro and Small Enterprise (MSEs) Order, 2012 with latest guidelines/clarifications provided by MoMSME.

xi) The existing MSE enterprises registered prior to 30<sup>th</sup> June 2020, shall continue to be valid for a period up to 31.03.2021 only. Mandatorily bidders need to have “Udyam Registration Certificate” after 31.03.2021 for availing benefits under the Public Procurement Policy for Micro and Small Enterprise (MSEs) Order, 2012 as amended from time to time.

x) If MSE Bidder withdraws his offers after last date of bid submission or fails to sign the Agreement or commence the work as per Conditions of Contract then such Bidder shall be banned for a minimum period of 2(Two) year in line with provisions of Banning of Business.

#### **14. Auto Extension of Critical Date**

If number of bids received online is found to be less than 03(three) on end date of bid submission then the following critical dates of the Tender will be automatically extended for a period of four days ending at 17.00 hrs:

- Last date of submission of Bid.
- Last date of receipt of Bid Securing Declaration.
- Date of Opening of Tender.

If any of the above extended Dates falls on Holiday i.e. a non-working day as defined in the e-Procurement Portal then the same is to be rescheduled to the next working day.

This extension will be also applicable in case of receipt of zero bid.

**Notes:**

1. The validity period of tender should be decided based on the final end date of submission of bids.
2. The auto extension shall work on the basis of number of bids received only. It may so happen that any of these bids may be eventually rejected during Tender Opening, Technical evaluation or further process of evaluation resulting the total number of valid bids becoming less than 03(three).
3. After extension, the tender shall be opened irrespective of available number of bids on the extended date of opening of tender.

**15. One Bid per Bidder:**

Each Bidder shall submit only one Bid, either individually, or as a partner in a partnership firm or a partner in a Joint Venture or a Public Limited / Private Limited Company. A Bidder who submits or participates in more than one Bid (other than as a sub-contractor or in cases of alternatives that have been permitted or requested) will cause all the proposals with the Bidder's participation to be disqualified.

**Conflict of Interest:**

A bidder may be considered to have a Conflict of Interest with one or more parties in this bidding process, if:

- a) They have controlling partner(s) in common; or
- b) They receive or have received any direct or indirect subsidy/ financial stake from any of them; or
- c) They have the same legal representative/ agent for purposes of this bid; or
- d) They have relationship with each other, directly or through common third parties , that put them in a position to have access to information about or influence on the bid of another bidder; or
- e) A bidder or any of its affiliate participated as a consultant in the preparation of the design or technical specification of the contract that is the subject of the bid; or
- f) In case of a holding company having more than one Subsidiary/ Sister concern having common business ownership/ management only one of them can bid. Bidders must proactively declare such sister/ common business/ management in same/ similar line of Business;

All such bidders having a Conflict of Interest, shall be disqualified.

**16. Deleted**

**17. Site Visit:**

17.1 The bidder, at the Bidder's own responsibilities, cost and risk, is encouraged to visit and examine the Site of Works and it's surrounding, approach road, soil condition, investigation report, existing works, if any, connected to the tendered work, drawings connected to the work, if / as available and obtain all information that may be necessary for preparing the Bid and entering into a contract for execution of the works. The cost of visiting the Site shall be at the Bidder's own expense.

17.2 It shall be deemed that the Bidder has visited the Site/Area and got fully acquainted with the working conditions and other prevalent conditions and fluctuations thereto whether he/she/they actually visits the Site /Area or not and has taken all the factors into account while quoting his/her/their rates.

17.3 The Bidder is expected, before quoting his rate, to go through the requirement of materials/workmanship, specification, requirements and conditions of contract.

17.4 The Bidder, in preparing the bid, shall rely on the site investigation report referred to in the bid document (if available), supplemented by any information available to the Bidder.

**18. Taxes and Duties:**

All duties, taxes (excluding Goods and Services Tax (GST) & GST Compensation Cess (if applicable) only) and other levies, royalty, building and construction workers cess (as applicable in States) payable by the bidder/Contractor under the Contract, or for any other cause as applicable on the last date of submission of Bid, shall be included in the rates, prices and the total Bid Price submitted by the Bidder. Applicable GST, if any, either payable by bidder or by company under reverse charge mechanism shall be computed by system in BOQ sheet as per predefined logic.

All investments, operating expenses, incidentals, overheads, leads, lifts, carriages, tools and plants etc. as may be attendant upon execution and completion of works shall also be included in the rates, prices and total Bid price submitted by the bidder.

However, such duties, taxes, levies etc. which is notified after the last date of submission of Bid and/or any increase over the rate existing on the last date of submission of Bid shall be reimbursed by the company on production of documentary evidence in support of payment actually made to the concerned authorities.

Similarly, if there is any decrease in such duties, taxes and levies the same shall become recoverable from the contractor. The details of such duties, taxes and other levies along with rates shall be declared by the bidder.

The item wise rate quoted by bidder shall be inclusive of all taxes, duties & levies but excluding GST & GST Compensation Cess, if applicable. The payment of GST and GST Compensation Cess by service availer (i.e. CIL/Subsidiary) to bidder/contractor (if GST payable by bidder/contractor) would be made only on the latter submitting a Bill/invoice in accordance with the provision of relevant GST Act and the rules made there under and after online filing of valid return on GST portal. Payment of GST & GST Compensation Cess is responsibility of the service provider/contractor.

Further, any GST credit note required to be issued by the bidder / contractor under the GST provisions should be issued within the time limit prescribed under the GST law.

However, in case bidder/contractor is GST unregistered bidder/dealer or GST registered under composition scheme in compliance with GST rules, the bidder/dealer shall not charge any GST and/or GST Compensation Cess on the bill/invoice. In case of unregistered dealer/bidder, GST, if applicable will be deposited by CIL/Subsidiary directly to concerned authorities in terms with GST provisions.

Input tax credit is to be availed by CIL/Subsidiary as per rule.

If CIL/Subsidiary fails to claim Input Tax Credit(ITC) on eligible Inputs, input services and Capital Goods or the ITC claimed is disallowed due to failure on the part of supplier/vendor of goods and services in incorporating the tax invoice issued to CIL/Subsidiary in its relevant returns under GST, payment of CGST & SGST or IGST, GST (Compensation to State ) Cess shown in tax invoice to the tax authorities, issue of proper tax invoice or any other reason whatsoever, the applicable taxes & cess paid based on such Tax invoice shall be recovered from the current bills or any other dues of the supplier/vendor along with interest and penalty, if any.

The rates and prices quoted by the Bidder shall be fixed for the duration of the contract and shall not be subject to variations on any account except to the extent variations allowed as per the conditions of the contract of the bidding document.

The company reserves the right to deduct/ withhold any amount towards taxes, levies, etc. and to deal with such amount in terms of the provisions of the Statute or in terms of the direction of any statutory authority and the company shall only provide with certificate towards such deduction and shall not be responsible for any reason whatsoever.

In case of collection of minor minerals in area (both virgin and non-virgin), acquired by the Company under the Coal Act, the contractor will have to produce a royalty clearance certificate from the District Authorities before full and final payment.

Further, where any damages or compensation becomes payable by either the Company or the bidder / contractor pursuant to any provision of this Agreement, appropriate GST wherever applicable as per the GST provisions in force shall also apply in addition to such damages or compensation.

**19. Cost of Bidding:**

The bidder shall bear all costs associated with the preparation and submission of his bid and the Employer will in no case be responsible or liable for those costs.

**20. Technical Specifications:**

The tenderer shall closely study all specifications in detail, which govern the rates for which he is tendering.

**21. Currencies of Bid and Payment:**

The unit rates and prices shall be quoted by the Bidder entirely in Indian Rupees only.

**22. Handing Over of Site:**

On completion of the work all rubbish, debris, brick bats etc. shall be removed by the contractor(s) at his/their own expense and the site cleaned and handed over to the company and he/they shall intimate officially of having completed the work as per contract.

**23. Deployment of Manpower and Machineries:**

The tenderer(s) will deploy sufficient number and size of equipments/machineries/vehicles and the technical/ supervisory personnel required for execution of the work.

**24. Change in Constitution of the Contracting Agency:**

Prior approval in writing of the company shall be obtained before any change is made in the constitution of the contracting agency, otherwise it will be treated as a breach of Contract.

**25. Canvassing in Tender:**

Canvassing in connection with the tenders in any shape or form is strictly prohibited and tenders submitted by such tenderers who resort to canvassing shall be liable for rejection.

**26. Letter of Acceptance (LOA)/Work Order/Agreement:**

The Bidder, whose Bid has been accepted, will be notified /communicated by the Employer electronically online on the e-procurement portal of CIL prior to expiration of the Bid validity period. The L-1 bidder will get the information regarding award of work on their personalised dash-board on-line. On receipt of Letter of Acceptance (LOA)/Work Order of the tender issued by the Company, the successful tenderer shall execute contract agreement in the company's prescribed form for the due fulfilment of the contract. Failure to enter into the required contract within the specified period in the work order shall entail cancellation of LOA/work order and the bidder will be banned for two years from being eligible to submit bids in CIL and its subsidiaries. This banning shall be done under the provisions of NIT with the approval of Tender Accepting Authority by Application Admin of CIL e-Procurement Portal.

**27. Bid Validity:**

The validity period of the tenders shall be **120(One Hundred Twenty)** days from the end date of bid submission. The validity period of tender shall be decided based on the final end date of submission of bids.

In exceptional circumstances, prior to expiry of the original time limit, the Employer may request the bidders to extend the period of validity for a specified additional period. The employer's request and the bidder's responses shall be made in writing. A bidder may refuse the request without forfeiting his bid security. A bidder agreeing to the request will not be required or permitted to modify his bid.

The tenderer shall not, during the said period or within the period extended by mutual consent, revoke or cancel his tender or alter the tender or any terms/conditions thereof without consent in writing of the company. In case the tenderer violates to abide by this, the Company will be entitled to take action as per clause No.28 (Modification and Withdrawal of Bid) of NIT.

#### **28. Modification and Withdrawal of Bid:**

Modification of the submitted bid shall be allowed on-line only before the deadline of submission of tender and the bidder may modify and resubmit the bid on-line as many times as he may wish.

Bidders may withdraw their bid online within the end date of bid submission. However, if the bidder once withdraws his bid, he will not be able to resubmit the bid in that particular tender. For withdrawal of bid after the end date of bid submission, the bidder will have to make a request in writing to the Tender Inviting Authority. Withdrawal of bid may be allowed till issue of work order/LOA with the following provision of penal action:

a. If the request of withdrawal is received before online notification for opening of price bid, the bidder will be banned for two years from being eligible to submit bids in CIL and its subsidiaries. The Price-bid of remaining bidders will be opened and the tender process shall go on.

b. If the request of withdrawal is received after online notification for opening of price bid, the bidder will be banned for minimum two years from being eligible to submit bids in CIL and its subsidiaries. The Price-bid of all eligible bidders including this bidder will be opened and action will follow as under:

i. If the bidder withdrawing his bid is other than L 1, the tender process shall go on.

ii. If the bidder withdrawing his bid is L-1, then re-tender will be done.

#### **Note :**

i). In case of clause (a) & (b) above, a letter will be issued to the bidder by Tender Inviting Authority with the approval of Tender Accepting Authority (When TAA is CMD then with the approval of concerned Director and in case the TAA is above CMD (i.e. FDs/Empowered Committee/Board) then with the approval of CMD. In case TAA is below CMD, then approval of respective TAA is required), stating that **the bidder will be banned for two years from being eligible to submit bids in CIL and its subsidiaries. This banning shall be done under the provisions of NIT with the approval of Tender Accepting Authority by Application Admin of CIL e-Procurement Portal.** This letter will be circulated to all Areas of the Subsidiary and the updated list will be maintained by all Tender Inviting Authority/Evaluators.

ii). Penal action against clause (a) & (b) above will be enforced from the date of issue of such order. The standard operating procedure to handle withdrawal of bid after end date of submission shall be as Clause no 14 of Chapter I.

#### **29. Standard Operating Procedure for Withdrawal of Bid:**

##### **I. The Mode of withdrawal: -**

##### **A. Online Withdrawal of Bids:**

- a. The system of online withdrawal is available on the portal up to end date of bid submission, where any bidder can withdraw his/her bid which will attract no penal action from department side.
- b. The system of online withdrawal beyond end date of bid submission and till award of contract is also available but not fully functional and under development stage.

Once it is developed and implemented only online withdrawal shall be considered except for some exceptional cases as mentioned in clause below.

**B. Offline Withdrawal of Bids :**

- a. A partner of bidder (in case of JV and partnership firms) whose DSC is registered on the e-Procurement portal can access the portal for online withdrawal but when there is a split in the business relationship, the partners whose DSC is not registered on the portal do not have the option of online withdrawal of bid. Hence such partners may opt to use offline method of withdrawal of his/her offer (or express his disassociation from the bidder organization).
- b. Till a fully functional system of online withdrawal of bid (beyond end date of bid submission and till award of contract) is not developed and implemented, offline withdrawal shall also be considered.

**II. Acceptance of withdrawal by Tender Committee:**

- A. Every case of withdrawal under Clause I-(A) (b) and Clause I-(B) shall be put up to Tender Committee for deliberation and further course of action.
- B. The Tender Committee shall apply its due diligence to decide:
  - a. Whether the request for withdrawal of offer has been received from right source and authentic. For this purpose a letter is to be sent by registered post/speed post to the bidder on the address as given by him in the enrollment page of e-Procurement portal, allowing 10 days' time to confirm the withdrawal. If the bidder does not confirm the withdrawal within the stipulated period then it should be construed that there is no withdrawal of bid. In case the withdrawal/disassociation from the firm (Joint Venture or Partnership firm) has been submitted by any other partner then also the confirmation has to be sought from the bidder and if bidder wants to deny the withdrawal/disassociation from the JV or the partnership firm then the bidder shall be required to furnish a legally acceptable document signed by all the partners of the firm to substantiate his claim.
  - b. Whether the withdrawal is due to the reason other than to support any mala fide intention of any participating bidder such as participating or supporting a cartel formation etc.
  - c. If the mala fide intentions in the withdrawal are apprehended then the tender should be cancelled apart from other penal action as per e-Procurement Manual for works and services of CIL and other guidelines/manuals of CIL.
  - d. If no mala fide intentions in the withdrawal are apprehended then the penal action in line with the prescriptions of the e-Procurement Manual for works and services of CIL will be applicable.
  - e. The Tender Committee may also obtain the opinion of legal department in order to ascertain the legal course of action in case of Clause II-(B)(b) and II-(B)(c) above.

**30. Postponement of scheduled date(s):**

The Company reserves the right to postpone the date of receipt and opening of tenders or to cancel the tenders without assigning any reason whatsoever.

**31. Public Enterprises preference:**

The Company reserves its right to allow Public Enterprises purchase preference facility as admissible under prevailing policy.

**32. Contract Agreement Document(s):**

This Tender Notice shall be deemed to be part of the Contract Agreement. The "General Terms & Conditions", Additional Terms & Conditions, Special Terms & Conditions (if any), Technical Specifications, drawings (if any) and any other document uploaded on portal as NIT document forms an integral part of this NIT and shall also form a part of the contract agreement as per clause 2 of General Terms and Conditions.

**33. Sub-letting of Work:**

No subletting of work as a whole by the contractor is permissible. Subletting of work in piece rated jobs is permissible with the prior approval of the department.

The Contract Agreement will specify major items of supply or services for which the contractor proposes to engage sub-contractor/sub-vendor. The contractor may from time to time propose

any addition or deletion from any such list and will submit proposals in this regard to the Engineer-in-Charge/Designated Officer-in-charge for approval well in advance so as not to impede the progress of work. Such approval of the Engineer-in-Charge/Designated Officer-in-Charge will not relieve the contractor from any of his obligations, duties and responsibilities under the contract.

**34. Prohibition of Child Labour engagement:**

The contractor/contractual Agencies must not engage any Child Labour during the course of execution of the contract work within the meaning and scope of the Child Labour Prohibition & Regulation Act-1986 and its relevant Act and Rules amended from time to time by the Govt. of India.

**35. Implementation of CMPF/EPF:**

The tenderer shall have to ensure implementation of CMPF/EPF, if applicable, in respect of the workers deployed by him as detailed in the tender document.

**36. Splitting up of the work:**

The Company does not bind itself to accept the lowest tender and reserves the right to reject any or all the tenders without assigning any reasons whatsoever and to split up the work between two or more tenderer(s) or accept the tender in part and not in its entirety.

**37. Settlement of Disputes:**

Matters relating to any dispute or difference arising out of this tender and subsequent contract Awarded based on this tender, shall be dealt as per Clause No. 16- title-‘Settlement of Disputes’ of the ‘General Terms and Conditions’ of ‘Conditions of Contract’ of the tender document.

**38. Integrity Pact (applicable for tenders with estimated cost exceeding Rs. 2.00 Crores).**

The bidders have to accept unconditionally the Integrity Pact (as per Annexure- X ) in GTE (General Technical Evaluation) at the time of bid submission and the same shall be part of Tender document. No recycling will be done for this document i.e. no further clarification will be sought from bidder.

Name, address and contact No. of the Independent External Monitor (IEM) nominated for this tender:

<u>Sl.</u>	<u>Name</u>	<u>Address</u>	<u>email Id</u>
1	Shri Aditya Prakash Mishra , IRSE (Retd.)	Flat No.-24, Aster-1, Vatika City, Sohna Road, Setor -49, Gurugram-122003	apmishra53@gmail.com
2	Shri Gautam Sen, IDAS (Retd.)	Flat no.I-081, Vendanta, Gurugram, Sector-108, Haryana-122001	gautamsen1976@gmail.com

**39. Restrictions on Procurement from a bidder of a country which shares a land border with India and on sub-contracting to contractors from such countries:**

- I. Any bidder from a country which shares a land border with India will be eligible to bid in this tender only if the bidder is registered with the Competent Authority (as per details given in Annexure-XIII)
- II. “Bidder” (including the term ‘tenderer’, ‘consultant’ or ‘service provider’ in certain context) means any person or firm or company, including any member of a Joint venture (that is an association of several persons or firms or companies), every artificial juridical person not falling in any of the descriptions of bidders stated herein before, including any agency, branch or office controlled by such person, participating in a procurement process.

- III. "Bidder from a country which shares a land border with India" means:-
- a. An entity incorporated, established or registered in such a country; **or**
  - b. A subsidiary of an entity incorporated, established or registered in such a country; **or**
  - c. An entity substantially controlled through entities incorporated, established or registered in such a country; **or**
  - d. An entity whose beneficial owner is situated in such a country; **or**
  - e. An Indian (or other) agent of such an entity; **or**
  - f. A natural person who is a citizen of such a country; **or**
  - g. A joint venture where any member of the joint venture falls under any of the above.

- IV. "The beneficial owner" for the purpose of (III) above will be as under:
1. In case of a company or Limited Liability Partnership, the beneficial owner is the natural person(s), who, whether acting alone or together, or through one or more juridical person(s), has a controlling ownership interest or who exercises control through other means.

**Explanation-**

- a. "Controlling ownership interest" means ownership of, or entitlement to more than Twenty Five Percent of shares or capital or profits of the company;
  - b. "Control" shall include the right to appoint the majority of the directors or to control the management or policy decisions, including by virtue of their shareholding or management rights or shareholders agreements or voting agreements;
2. In case of a partnership firm, the beneficial owner is the natural person(s) who, whether acting alone or together, or through one or more juridical person, has ownership of entitlement to more than fifteen percent of capital or profits of the partnership;
  3. In case of an unincorporated association or body of individuals, the beneficial owner is the natural person(s), who, whether acting alone or together, or through one or more juridical person, has ownership of or entitlement to more than fifteen percent of the property or capital or profits of such association or body of individuals.
  4. Where no natural person is identified under (1) or (2) or (3) above, the beneficial owner is the relevant natural person who holds the position of senior managing official.
  5. In case of a trust, the identification of beneficial owner(s) shall include identification of the author of the trust, the trustee, the beneficiaries with fifteen percent or more interest in the trust and any other natural person exercising ultimate effective control over the trust through a chain of control or ownership.
- V. An Agent is a person employed to do any act for another, or to represent another in dealings with third person.
- VI. The successful bidder shall not be allowed to sub-contract works to any contractor from a country which shares a land border with India unless such contractor is registered with the competent Authority.

**Note:**

1. (a) The intending bidders must submit "Certificate" as per the format given at **Annexure-II** in compliance to order no.F.No.6/18/2019-PPD dt 23/7/2020 of Ministry of Finance, Dept of Expenditure, Public Procurement Division with respect to "restrictions on procurement from a bidder of a country which shares a land border with India and on sub-contracting to contractors from such countries"

**AND**

- (b) Valid registration from competent authority (if applicable). Registration should be valid at the time of submission of bid and at the time of acceptance of bids.
2. Regarding registration with Competent Authority, **Annexure-XIII** may please be referred. Regarding exclusion from restriction, **Annexure-XIV** may please be referred.

**Tender Inviting Authority**

भारत कोकिंग कोल लिमिटेड

एक मिनी रत्न कम्पनी

(कोल इंडिया लिमिटेड का एक अंग)

विभागाध्यक्ष (पर्यावरण) का कार्यालय

कोयला भवन, कोयला नगर, धनबाद

पत्रसंख्या: भाकोकोलि/ विभागाध्यक्ष (पर्या)/फाईल-Plantation/B-3/2021/1529-1534(H) दिनांक: 18.02.2021

सेवा में,

वन प्रमंडल पदाधिकारी,

धनबाद

**Bharat Coking Coal Limited**

*A Mini Ratna Company*

(A Subsidiary of Coal India Limited)

Office of the HoD (Environment)

Koyla Bhawan, Koyla Nagar, Dhanbad

**विषय : Work Order for carrying afforestation over 42.5 ha of OB dumps/physically reclaimed land of BCCL.**

- संदर्भ:**
- Our letter no. भाकोकोलि/उपमहाप्रबंधक(पर्या)/फाईल-B-3/2020/1529-1534(H) dt 10.12.2020
  - भाकोकोलि/उपमहाप्रबंधक(पर्या)/फाईल-B-3/2021/10-13/ (H) dt 06.01.2021.
  - Your letter no.84 dated 12.01.2021

माननीय महोदय,

This has reference to above mentioned letters, competent authority has approved for carrying afforestation over 42.5 ha of OB dumps/ physically reclaimed land of BCCL through DFC, Dhanbad, for a total estimated value of ₹ 1,19,75,665.00 (Rupees One crore nineteen lakhs seventy five thousand six hundred sixty five only) for four years with the following terms and conditions in respect of above mentioned work:-

- The Period of work will be 04 years as per the estimate provided by Forest Department.
- The aforesaid work is to be carried out at below mentioned sites:

S No	Name of the site	Type	Ha
1	NAKC, Govindpur	OB Dump	23.0
2	ASP, EJ Area	Physically reclaimed land	19.5
	TOTAL		42.5

- The Forest department shall conduct all its afforestation activities subject to all laws, rules, statutory orders and regulations applicable to the site and the nature of the work.
- The Forest department shall take up afforestation works on company's land with due expertise and supervision as per the scheme & estimates duly sanctioned as per the estimate submitted by forest department.
- The estimate has been submitted by Forest Department considering 15% enhancement every year in labour wages of preceding year. However, the payment of Completion work, first year maintenance work and second year maintenance work will be made as per the actual labour wages prevailing in the corresponding year.
- The Forest department shall exercise precautions on the aid and advice of the mine management for the safety of all lives and properties involved in the afforestation activities.

**7. SCOPE OF WORK**

This work shall be done with the following attributes:

- Self-sustaining / healthy plantation at the end of project period/ at the handover of the site.

- (ii) The plants planted shall be of native species, high root density, soil binding species, thick canopy and/or fruit bearing. The following suggested native species shall preferably but not limited to be planted at the sites:

S.No.	Botanical Name	Common name	S.No.	Botanical Name	Common name
1.	<i>Ailanthus excelsa</i>	Mahanim	2.	<i>Ficus hispida</i>	Kath gular
3.	<i>Albizia lebbek</i>	Siris	4.	<i>Ficus religiosa</i>	Pipal
5.	<i>Alstonia scholaris</i>	Chatni	6.	<i>Albizia Procera</i>	Safed Siris
7.	<i>Azadirachta indica</i>	Neem	8.	<i>Madhuca indica</i>	Mahua
9.	<i>Bombax ceiba</i>	Semal	10.	<i>Melia composita</i>	Bakain
11.	<i>Butea monosperma</i>	Palas	12.	<i>Tamarindus indica</i>	Imli
13.	<i>Cassia fistula</i>	Amaltas	14.	<i>Terminalia arjuna</i>	Arjun
15.	<i>A. Odoratissima</i>	Kala Siris	16.	<i>Aegle marmelos</i>	Bel
17.	<i>Dalbergia sissoo</i>	Shisham	18.	<i>Mangifera indica</i>	Aam
19.	<i>Ehretia laevis</i>	Chamror	20.	<i>Zizyphus nummularia</i>	Ber
21.	<i>Ficus glomerata</i>	Gular	22.	<i>Embilica officianlis</i>	Awala
23.	<i>Syzygium cumini</i>	Jamun	24.	<i>Anthocephalus indicus</i>	Kadamb
25.	<i>Acacia Catechu</i>	Desi Kher	26.	<i>Gmelina arbora</i>	Gamhar
27.	And other fruit bearing native species or the species deemed suitable by the Forest deptt.				

- (iii) Survival of the plantation shall not be less than 80 per cent at the end of the project period.
- Annual Joint Inspection report of the inspection carried out by joint team of Forest Department and BCCL personnel after the completion of each year work should indicate name of the site, year of plantation, number of plants, name of the species present, date of inspection and survival rate.
  - The display boards shall be installed at all the plantation sites indicating, the name of the company, the no. of plantation, species planted, name of site of plantation and plantation year.
  - All the materials & manpower required with regard to the aforesaid work shall be arranged by you at your own cost.
  - The Forest department shall pay wages not less than the minimum wages fixed by the Govt of Jharkhand to the labourers engaged in the execution of the aforesaid work and it will be the responsibility of the Forest department to ensure the compliance of the payment of wages to its workmen/labourers as per law and company shall not be held responsible for the same.
  - In case of revision of minimum wages by the Govt of Jharkhand during the work, a revised estimate of the corresponding year of the scheme as per the work order shall be submitted to the company by Forest Department and claim the amount of difference in wages payable due to increase in labour wages on the basis of man days works on revised wage for which the forest department shall certify.
  - As the afforestation work has been directly monitored by Ministry of Coal, every year on monthly basis; therefore, you will provide the plantation data from June 2021 to October 2021 on monthly basis during the completion year (2021-22).
  - The afforestation sites as mentioned in the this work order shall be handed over to mine management after the Joint inspection at the end of the Maintenance year-2 and having survival rate not less than 80%.

## 15. TERMS OF PAYMENT

Total project cost is ₹ 1,19,75,665.00 (Rupees One crore nineteen lakhs seventy five thousand six hundred sixty five only) as per the estimate submitted by Forest Department. The payment schedule will be as follows: -

S. No	Financial Year	Details of the work	Amount (Rs.)	Remarks
1.	2020-21	Advance Work	44,41,205.00	Wages @ ₹ 295.80 per MD
2.	2021-22	Completion work	46,85,034.00	Wages @ ₹ 340.17 per MD
3.	2022-23	Maintenance work-1	17,03,227.00	Wages @ ₹ 391.19 per MD
4.	2023-24	Maintenance work-2	11,46,199.00	Wages @ ₹ 449.87 per MD
<b>Total</b>			11975665.00	

16. The estimate for the Completion work, Maintenance work-1 and Maintenance work-2 is based on the tentative increase in the labour wages @ 15% of preceding year's wages as submitted in the estimate by the Forest Department. Therefore, the forest department shall certify the rate of labour wages for the corresponding year and demand letter/ bill based on the actual rates of labour wages to that corresponding year.

17. **Paying Authority:** HOD (Pay), Pay Office, BCCL HQ, Koyla Bhawan, Dhanbad.

18. All the payment will be made by ELECTRONIC MODE through bank in the account of DFO, Dhanbad. You are required to fill the format of Electronic Fund Transfer (EFT) in triplicate which is enclosed as annexure-A.

19. For release of the payment, you have to submit

a) The letter of acceptance of the work order along with the Demand letter/Bill for the Advance work.

And for further payments regarding this work order

a) Utilization certificate of the preceding payment made to you, in respect of this work order

b) Joint inspection report of preceding year's work.

c) Demand letter/Bill based on the actual rates of labour wages to that corresponding year for payment.


The utilization certificates along with joint inspection report shall be accepted by the accepting authority i.e. HOD (Env), BCCL.

20. BCCL shall not have any liability in case of any accident etc. towards Forest Department's personnel/ staffs /workers during the execution of the work.

21. Child labour is prohibited under Mines Act, therefore, child labour shall not be deployed in the aforesaid work.

22. All other conditions stipulated in aforementioned reference letters shall be complied.

23. Matter relating to any dispute or difference arising out of this work order shall be subject to the jurisdiction of Dhanbad court only.

  
18/2/21  
विभागाध्यक्ष (पर्यावरण)

Copy to:-

1. TS to D (T) OP/ D(T) PP, BCCL..... for kind information please.

2. GM (Vigilance), BCCL..... for kind information please.

3. GM, Govindpur/ E Area ..... for kind information please

4. Project Officer, NAK Colliery, Govindpur/ ASP Colliery, EJ Area

5. HOD, (Pay)/ In-charge Pay Office, BCCL HQ, Koyla Bhawan, Dhanbad.

6. Master File/Office Copy

  
18/2/21  
विभागाध्यक्ष (पर्यावरण)

**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 -X  
(FOR THE MONTH AUGUST, 2021)**

**E. C. no. J-11015/380/2010-IA.II (M) dated 12<sup>th</sup> June, 2019.**



**CMPDI**

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

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## **EXECUTIVE SUMMARY**

### **1.0 Introduction**

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

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

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

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

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

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

The Water sampling stations were selected for mine sump water.

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

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

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

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

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

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

### **3.2 Water quality**

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

### **3.3 Noise level monitoring**

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

## **4.0 Results and interpretations**

### **4.1 Air quality**

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

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

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

#### **4.2 Water quality**

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

#### **4.3 Noise Level**

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

## INTRODUCTION

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

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

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

- 1.1 The Cluster-X is in the Eastern part of the Jharia coalfield. It includes a group of 6 Mines (viz. Amlabad UG, Bhowra north UG/OC, Bhowra South UG/OC , Amalgamated Sudamdih Patherdih Mine, Sudamdih Shaft, Sudamdih Coal Washery The Cluster-X is situated about 25 - 30 kms from Dhanbad Railway Station. The mines of this Cluster-X are operating since pre nationalization period (prior to 1972-73). It is connected by both Railway and Road. The drainage of the area is governed by Damodar River.
- 1.2 The Cluster-X is designed to produce 1.762 MTPA (normative) and 2.289 MTPA (peak) capacity of coal and coal washery of 2.08 MTPA.

The Project has Environmental Clearance from Ministry of Environment, Forests and Climate Change (MoEF&CC) for a rated capacity 1.762 MTPA (normative) and 2.289 MTPA (peak) capacity of coal production vide letter no. J-11015/380/2010-IA.II (M) dated 12<sup>th</sup> June, 2019.

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

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

## AMBIENT AIR QUALITY MONITORING

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

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

#### 2.1.1 Ambient Air Quality Sampling Locations

##### I. CORE ZONE Monitoring Location

###### i) Bhowrah North (A14): Industrial Area

The location of the sampling station is 23°41'37.00"N 86°23'54.00"E. The sampler was placed at an elevated platform of around 1.5m height from ground level at Guest House of EJ Area.

###### ii) Sudamdih Washery (A15): Industrial Area

The location of the sampling station is 23°39'31.00"N 86°25'48.00"E. The sampler was placed at elevated platform of around 1.5m height from ground level at Coal lab near washery.

###### iii) Sudamdih Mine shaft (A41): Industrial Area

The location of the sampling station is 23°39'37"N 86°25'39"E. The sampler was placed at elevated platform of around 1.5m height from ground level at electric substation of sudamdih shaft mine.

##### II. BUFFER ZONE Monitoring Location

###### i) Jeenagora (A13): Industrial Area

The location of the sampling station is 23°42'31.00"N 86°26'38.00"E. The sampler was placed elevated platform of around 1.5m height from ground level at Safety Office.

###### ii) Sitanala (A30): Industrial Area

This location of the sampling station is 23°41'15.00"N 86°22'39.00"E, at the Amlabad Project office which is currently in-operational. It has been selected to study the impact of Air pollution in the buffer zone on the Cluster.

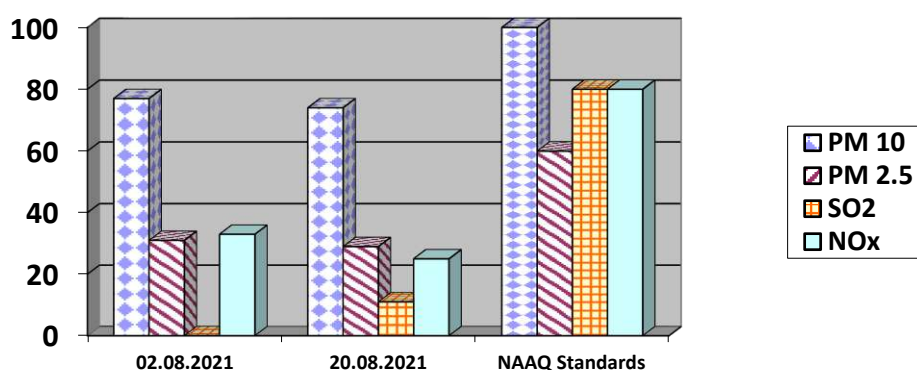
## AMBIENT AIR QUALITY DATA

Cluster – X, Bharat Coking Coal limited

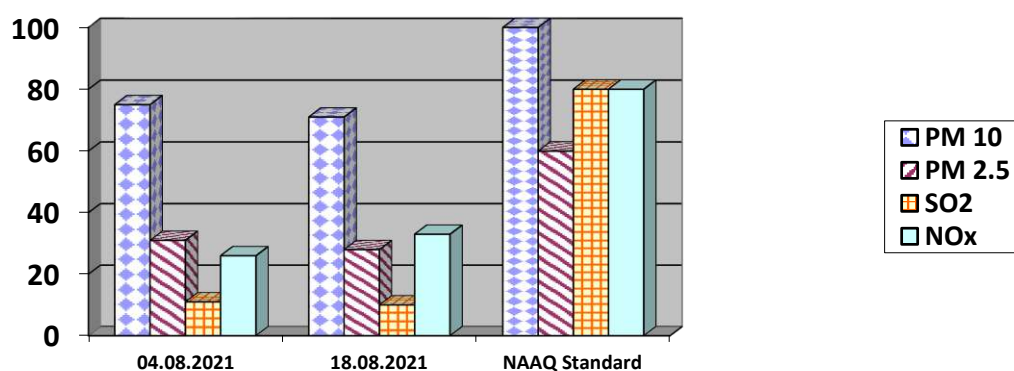
Month: AUGUST 2021

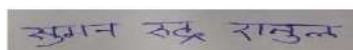
Year: 2021-22.

Station Name:A14-Bhowrah North		Zone: Core		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO <sub>2</sub>	NO <sub>x</sub>
1	02.08.2021	77	31	<10	33
2	20.08.2021	74	29	11	25
	NAAQ Standards	100	60	80	80



StationName:A15-Sudamdih Washery		Zone: Core		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO <sub>2</sub>	NO <sub>x</sub>
1	04.08.2021	75	31	11	26
2	18.08.2021	71	28	10	33
	NAAQ Standard	100	60	80	80

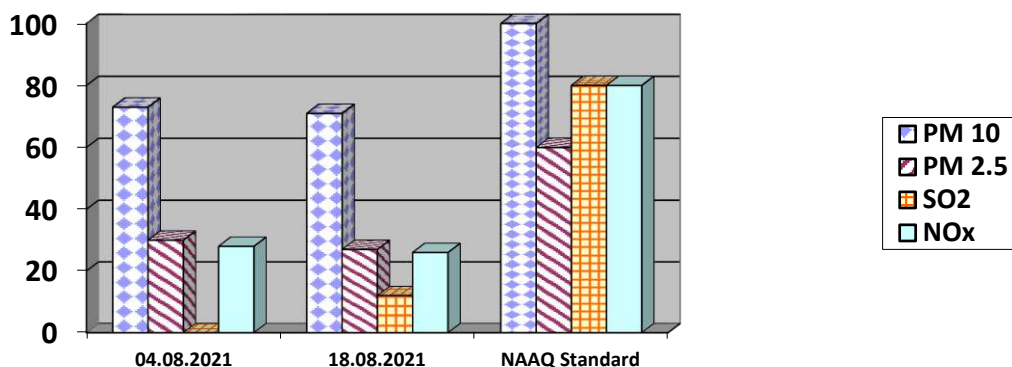


  
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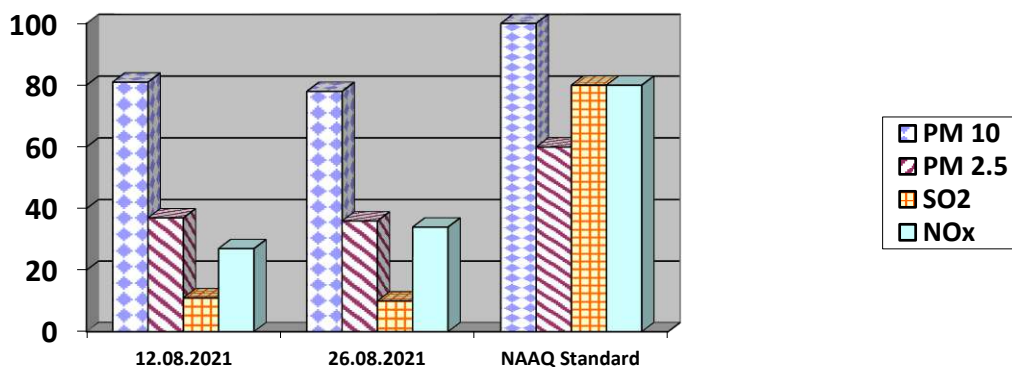
  
 Checked By  
 Lab In Charge  
 RI-2, CMPDI, Dhanbad

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

Station Name: A41-Sudamdih Mine shaft		Zone: Core		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO <sub>2</sub>	NO <sub>x</sub>
1	04.08.2021	73	30	<10	28
2	18.08.2021	71	27	12	26
	NAAQ Standard	100	60	80	80



Station Name: A13 – Jeenagora		Zone: Buffer		Category: industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO <sub>2</sub>	NO <sub>x</sub>
1	12.08.2021	81	37	11	27
2	26.08.2021	78	36	10	34
	NAAQ Standard	100	60	80	80

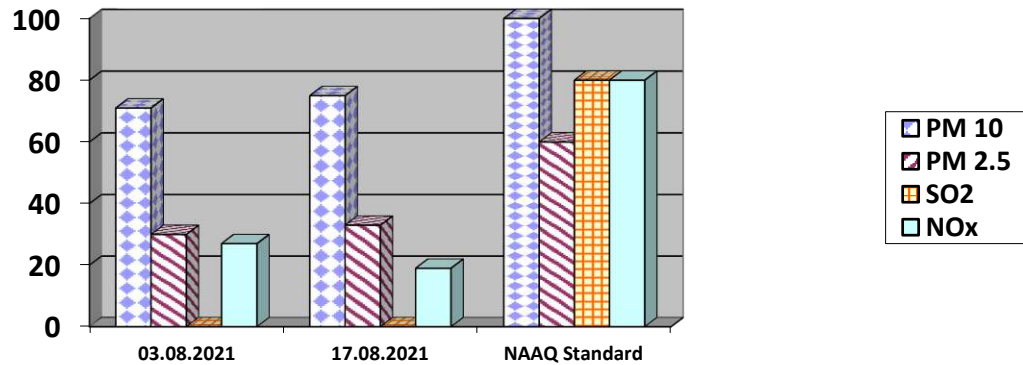


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Lab In Charge  
RI-2, CMPDI, Dhanbad

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

Station Name: A30 – Sitanala		Zone: Buffer		Category: Industrial	
Sl. No.	Dates of sampling	PM 10	PM 2.5	SO2	NOx
1	03.08.2021	71	30	<10	27
2	17.08.2021	75	33	<10	19
	NAAQ Standards	100	60	80	80



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

अमान रंज रावुत  
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Checked By  
Lab In Charge  
RI-2, CMPDI, Dhanbad

अमित  
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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 Bhowrah North (MW10)

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

### 3.2 Methodology of sampling and analysis

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

### 3.3 Results & Interpretations

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

## WATER QUALITY DATA (EFFLUENT WATER- FOUR PARAMETERS)

Name of the Cluster: <b>Cluster -X</b>		Month: <b>AUGUST 2021</b>	Name of the Station: <b>Mine Discharge of Bhowrah North</b>	
Sl. No.	Parameters	MW10 First Fortnight	MW10 Second Fortnight	As per MOEF General Standards for schedule VI
		02.08.2021	30.08.2021	
1	Total Suspended Solids	38	37	100 (Max)
2	pH	8.3	8.15	5.5 - 9.0
3	Oil & Grease	<2.0	<2.0	10 (Max)
4	COD	16	20	250 (Max)

All values are expressed in mg/lit. except pH.

  
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 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

### 4.1 Location of sampling sites

1. Bhowrah North (N14)
2. Sudamdih Washery (N15)
3. Jeenagora (N13)
4. Sitanala (N30)
5. Sudamdih Mine shaft (N41)

### Methodology of sampling and analysis

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

### 4.2 Results & Interpretations

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

## NOISE LEVEL DATA

Name of the Project : <b>Cluster -X</b>			Month: <b>AUGUST 2021</b>		
Sl. No.	Station Name/Code	Category of area	Date	Noise level dB(A)LEQ	*Permissible Limit of Noise level in dB(A)
1	Jeenagora (N13)	Industrial area	12.08.2021	57.6	75
2	Jeenagora (N13)	Industrial area	27.08.2021	57.5	75
3	BhowrahNorth(N14)	Industrial area	02.08.2021	55.3	75
4	BhowrahNorth(N14)	Industrial area	19.08.2021	56.2	75
5	Sudamdih Washery (N15)	Industrial area	04.08.2021	62.4	75
6	Sudamdih Washery (N15)	Industrial area	18.08.2021	63.6	75
7	Sitanala (N30)	Residential area	04.08.2021	54.3	55
8	Sitanala (N30)	Residential area	18.08.2021	53.7	55
9	<b>Sudamdih Mine shaft</b>	Industrial area	04.08.2021	65.7	75
10	<b>Sudamdih Mine shaft</b>	Industrial area	18.08.2021	65.5	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.*

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

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

**Note:**

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

\*\* 24hourly/8hourlyvalueshallbemet92%ofthetimeinayear.However,8% of the time it may exceed but not on two consecutivedays.

**NATIONAL AMBIENT AIR QUALITY STANDARDS**  
New Delhi the 18<sup>th</sup> FEBRUARY 2009

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

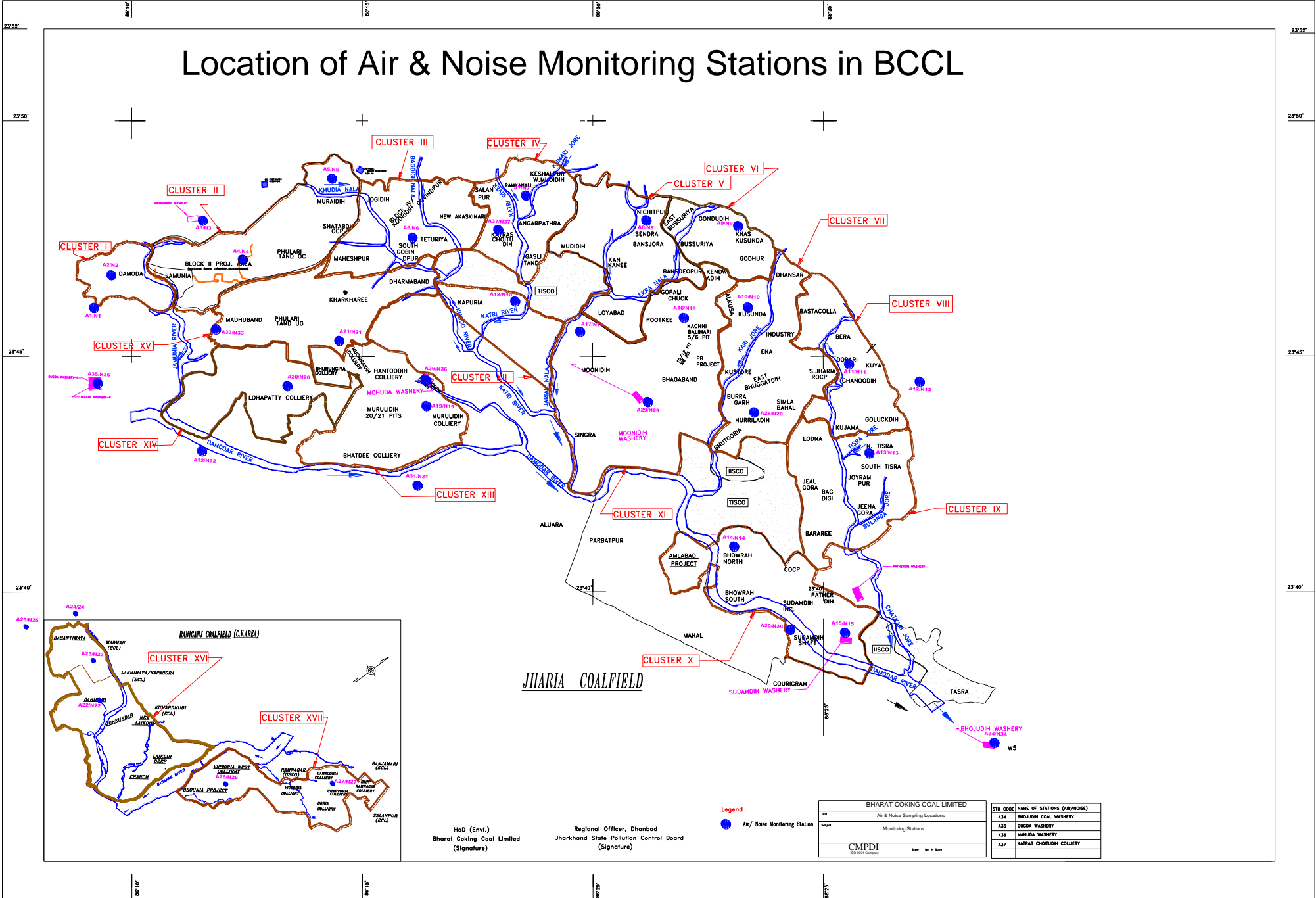
Pollutant	Time Weighted Average	Concentration in Ambient Air		Methods of Measurement
		Industrial, Residential I, Rural and other Areas	Ecologically Sensitive Area (Notified by Central Government)	
Sulphur Dioxide (SO <sub>2</sub> ), µg/m <sup>3</sup>	Annual * 24 Hours **	50 80	20 80	-Improved West and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

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

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

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

# Location of Air & Noise Monitoring Stations in BCCL



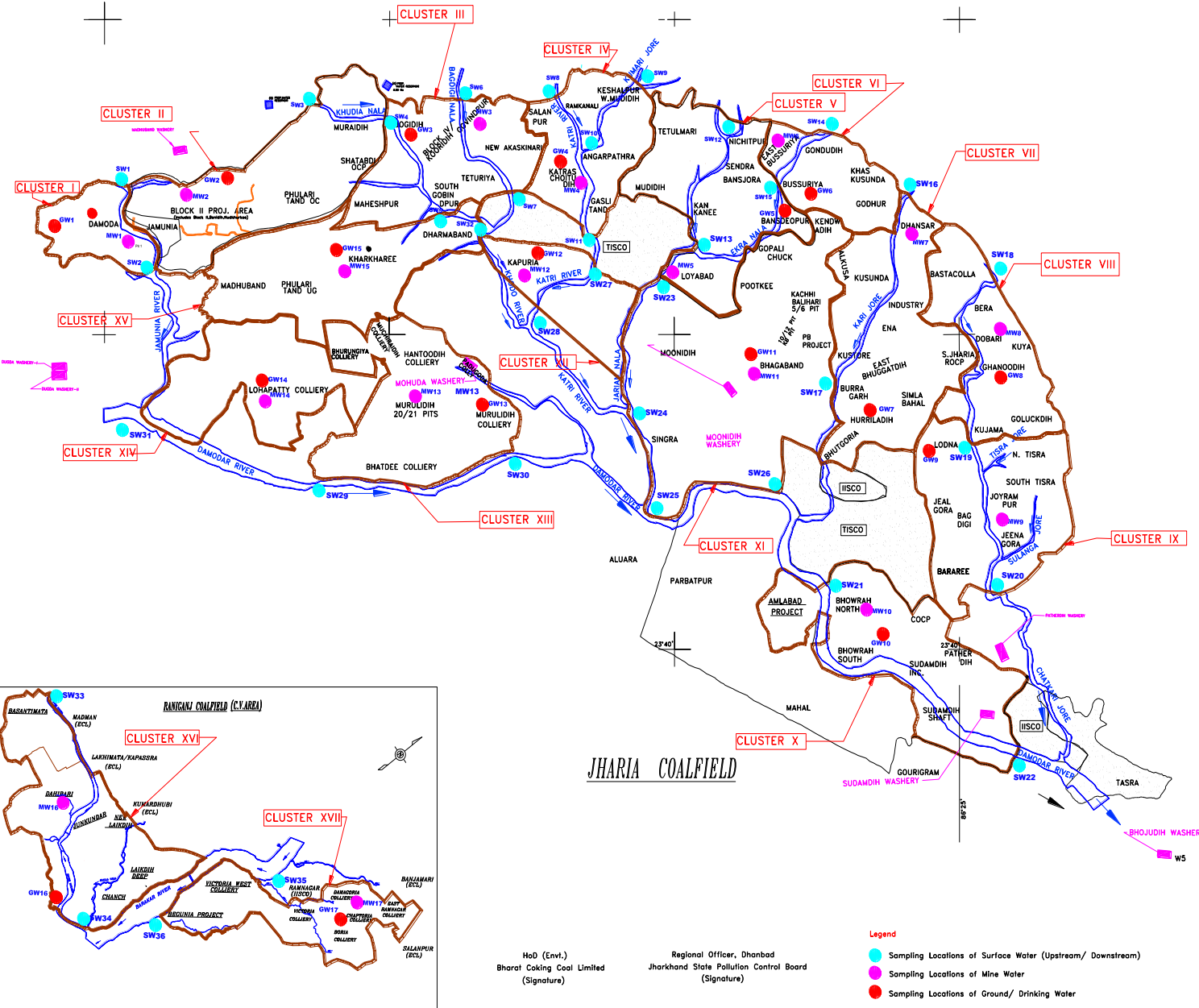
HoD (Envl.)  
Bharat Coking Coal Limited  
(Signature)

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

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

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

# Water Sampling Locations in BCCL



### INDEX

Cluster	Surface Water (US, DS)	Name of River/Nala	Effluent Water	Sampling Location	Ground Water	Sampling Location
I	SW1, SW2	Jamunia River	MW1	Damoda Area	GW1	Chutway Village
II	SW3, SW4	Khudua Nala	MW2	Block II OCP	GW2	Joyrampur Village
III	SW4, SW5, SW6, SW7	Khudua Nala, Bagdigi Nala	MW3	Govindpur Colliery	GW3	Jogdih Village
IV	SW8, SW11, SW9, SW10	Kahi River, Kuman Jore	MW4	Chotudih	GW4	Kankanee Village
V	SW12, SW13, SW15	Jarian Nala, Ekra Nala	MW5	Mudidih	GW5	Nichitpur
VI	SW14, SW15	Ekra Nala	MW6	East Bassuria UGP	GW6	Bansara Borewell
VII	SW16, SW17	Kari Jore	MW7	Bansara UGP	GW7	Hurmidih
VIII	SW18, SW19	Kashi Jore	MW8	Doban UGP	GW8	Qhanudih
IX	SW19, SW20	Kashi Jore	MW9	Jeenagora	GW9	Lodra
X	SW21, SW22	Damodar River	MW10	Bhowrah North	GW10	Bhowrah South
XI	SW23, SW24, SW25, SW26	Jarian Nala, Damodar River	MW11	Bhageband UGP	GW11	Bhagebandh
XII	SW27, SW28	Kahi River	MW12	Kapuria	GW12	Kapuria
XIII	SW29, SW30	Damodar River	MW13	Murudih (20/21)	GW13	Muridih
XIV	SW31, SW32	Damodar River	MW14	Lohapatti	GW14	Lohapatti
XV	SW5, SW32	Kharkhane Nala	MW15	Kharkhane UGP	GW15	Kharkhane
XVI	SW33, SW34	Khudua River	MW16	Dahaban OCP	GW16	Pallabani Village
XVII	SW35, SW36	Barakar River	MW17	Damagoria Colliery	GW17	Chaptana

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

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

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

“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



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## Chapter 1

### Introduction

Dhanbad lies between 23°37'3" N and 24°4' N latitude and between 86°6'30" E and 86°50' E longitude (Figure 1.1). It has an average elevation of 222 m. Its geographical length, extending from North to South, is 43 miles and width 47 miles, stretching across East to West. It shares its boundaries with West-Bengal in the Eastern and Southern part, Dumka and Giridih in the North, Bokaro in the West. It is the administrative headquarter of the district and Dhanbad Municipal Corporation (DMC). Dhanbad comes under Chota-Nagpur plateau. It is mainly known as “the Coal Capital of India” or “Coal City” and is the third largest city in Jharkhand State. Tata Steel, BCCL, ECL and IISCO are some of the companies having coal mines in the district. These companies have developed townships for their employees. Besides, there is a number of rural areas where ethnic people are residing. It comes under the Grand Chord rail line in between Delhi to Kolkata. Road Link is on Grand Trunk road (NH-2), which is now converted into Four Lane Golden Quadrilateral.

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

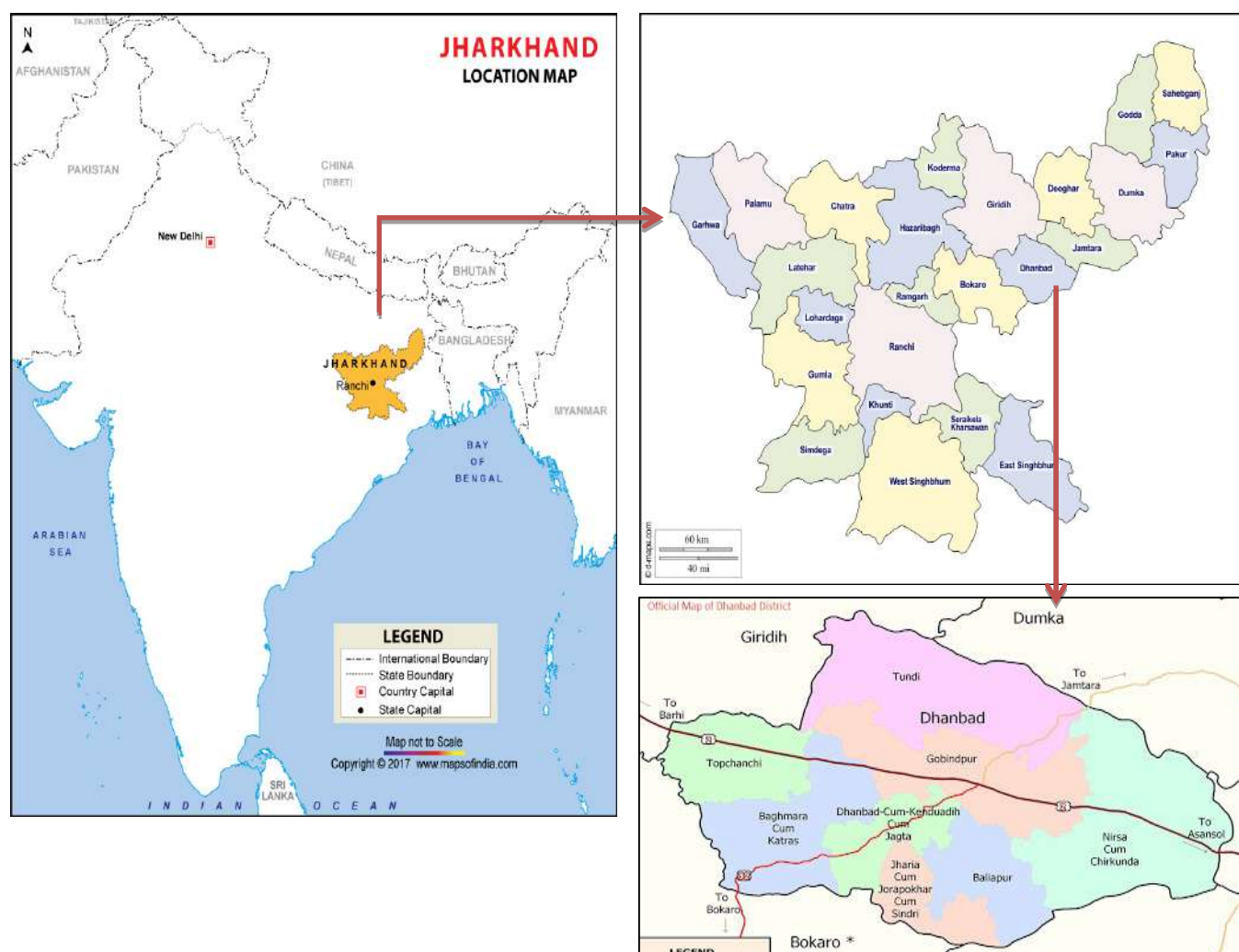


Figure 1.1: Geographical location of Dhanbad in India

## 1.1. Climate

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

## 1.2. Land use & Land cover

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

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

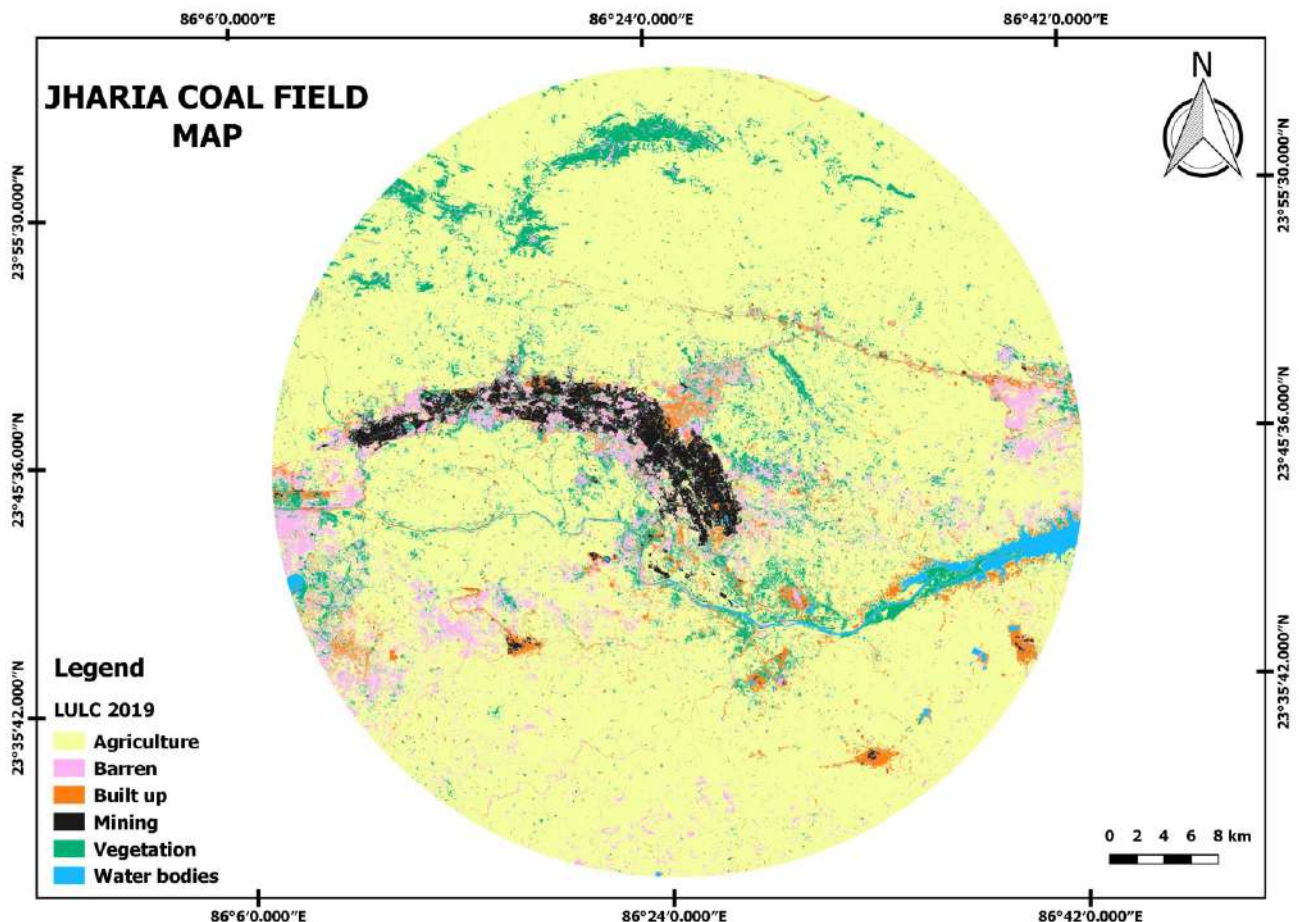


Figure 1.2: Land Use land cover map of Jharia coal field area.

**Table 1.1: LULC classification of Dhanbad study area.**

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

### 1.3. Population

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

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

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

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

### 1.4. Purpose of Study

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

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

Jharia coal mines having low ash content and high calorific value coals are subjected to intensive mining activities because of the easy availability of coal at shallow depths in thick seams. Therefore, they are often used directly in iron and steel plants for metal oxide reduction after washing. Although these coal mines are highly priced for their high-quality coal, they are notorious for their mine fires, which cause a lot of fugitive gaseous and PM emissions. Hence, the Jharia region has been under scrutiny by various public authorities and the common public with a vision to improve the ambient air quality.

Various sources contribute to high particular matter concentration in the Jharia region: vehicles, mining activities, re-suspended dust, fugitive emissions, fuel oils, household LPG, etc. The percentage contribution of these factors in the ambient depends exclusively on particular region's economic activities. 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 MoEFCC has directed BCCL to conduct a source apportionment study for particulate matter. In this context, BCCL has approached CSIR-NEERI to conduct a source apportionment study of ambient air particulate matter in the Jharia coalfields region in order to quantify the various sources of PM emissions and suggest an effective environmental management plan.

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

The detailed objectives are as following:

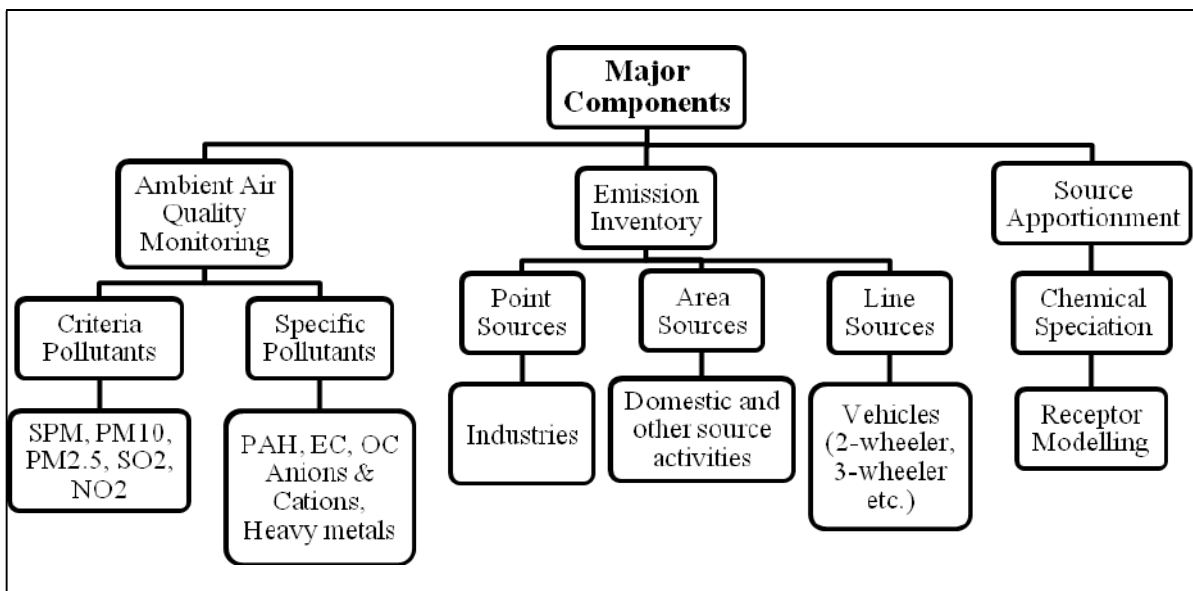
i. Ambient Air Monitoring

- Monitoring of ambient air quality at selected receptor locations for pollutants including PM<sub>10</sub>, PM<sub>2.5</sub>(limited), SO<sub>2</sub>, NO<sub>x</sub>, PAHs to establish the status of the air quality in Jharia Coalfields and an area up to 10 K.M from the periphery/boundary of BCCL mines. Also, review of the available air quality monitoring data from Central Pollution Control Board (CPCB) /Jharkhand State Pollution Control Board (JSPCB).
- To validate dispersion modelling predictions using measured air quality parameters
- To draw supportive data through specific site -related monitoring regarding impact causing sources such as kerbside monitoring
- To establish the impact of meteorological conditions on a few select indicator pollutants in different micrometeorological conditions of the Jharia Coalfields

- Emission Inventory related to Jharia Coalfields along with area up to 10 Km from the periphery/boundary of BCCL mines
- ii. To identify the pollution load grid wise for point, line and area source
- To establish possibilities of receptor level concentrations of air pollutants by matching dispersion modelling and air quality monitoring data
  - Source apportionment
  - To identify and apportion the pollution load at receptor level to various sources in the Jharia Coalfields along with an area up to 10 Km from the periphery/boundary of BCCL mines
  - To carry out the source apportionment using molecular markers for a limited number of samples through a time-resolved sample collection at various periods of the day and day-of-the-week.
  - Any other item in consensus between both BCCL/CIL & NEERI evolved during the study.

**1.5. Approach of study**

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



**Figure 1.3: Air quality Monitoring & emission source apportionment studies**

provides fundamental information for air quality modelling and air pollution control strategy development. In the coal mining area, mining, non-mining, industrial, vehicular and other sources are contributing. Air quality monitoring includes, the suitable location selected based on the metrological conditions, chemical characterization for identification of the source, CMB model to estimate the source apportionment to PM<sub>2.5</sub>.

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

### **2.1. Inventory of Point Sources**

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

### **2.2. Inventory of Area Sources**

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

### **2.3. Inventory of Line Sources**

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

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

**Table 2.1: Daily average vehicle activity on different road network considered during the field survey**

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

The vehicle utilization factors (km traveled per day per vehicle type) were adapted from the Auto Fuel Policy Report (Table 2.2). Two-to-four-wheelers Emission factors were taken from various project reports conducted by CPCB and Indian Clean Air Programmed (ICAP) (CPCB 2010; ARAI 2007).

**Table 2.2: Utilization Factors for different types of vehicle**

Vehicle Type	km per day
--------------	------------

VKT is the vehicle km traveled

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

**Table 2.3: Emission estimate for road transport**

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

Re-suspension of the unpaved and paved roads depends on the ‘silt loading’ factor and ‘vehicles weight’ roaming on the road (Table 2.4). The silt loading ( $S_L$ ) is the mass of the silt-sized material per unit area of the road surface. The amount of dust produces by vehicles movement on a paved road can be appraised by the following equation:

**(2.2)**

Where, ‘E’ = emission rate of PMs (Table 2.3);

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

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

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

**Table 2.4: Emission rate for the paved and unpaved road**

Emission loads by point source are depicted in Table 2.5 as per emission inventory.

**Table 2.5: Emission factor for coal**

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

**Table 2.6: Emission load from Industrial sector in Dhanbad**

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

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

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

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

A survey of 20 non-slum household areas was conducted in randomly selected areas of Dhanbad to understand which fuels are being used in these households and their quantities. The survey results indicated that Liquefied Petroleum Gas (LPG) was the fuel of choice in all the households and that each household used about 1 cylinder per month on average. It was assumed that LPG use remains the same for all 365 days of the year. The results obtained are presented in Table 2.7.

**Table 2.7: Emissions from the use of LPG in non-slum households in Dhanbad**

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

➤ **Cooking operations in slum households**

A survey of 15 areas having slum households was conducted, spread in Jharia Coalfield which was known to have significant slum populations, to understand which fuels are being used in these households and their quantities. It was seen that a majority of the slum households use coal as a cooking fuel (Table 2.8).

**Table 2.8: Emission from coal**

Pollutant	SPM	SO <sub>2</sub>	NO <sub>2</sub>	CO	HC
Emission Factor (g/kg)	20	13.3	3.99	24.92	0.5

➤ **Emissions from bakeries**

Data were collected from 34 bakeries operating in Dhanbad in which 12 bakeries were using electrical ovens. The emissions from such bakeries were not considered. All the other bakeries were using coal as fuel. Emissions from such bakeries are given in Table 2.10.

**Table 2.10: Emission from Bakeries using Coal as fuel**

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

➤ **Emissions from hotels and restaurants**

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

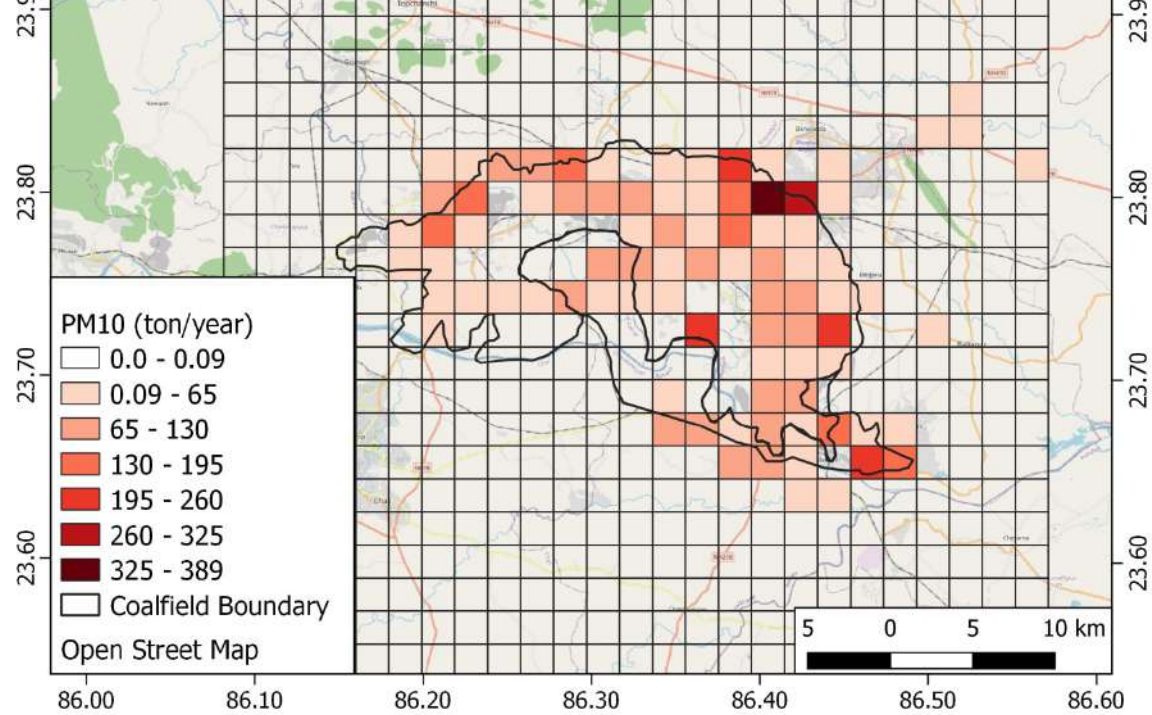
Table 2.11 and Table 2.12.

**Table 2.11: Emission from Hotel & Restaurants using Coal**

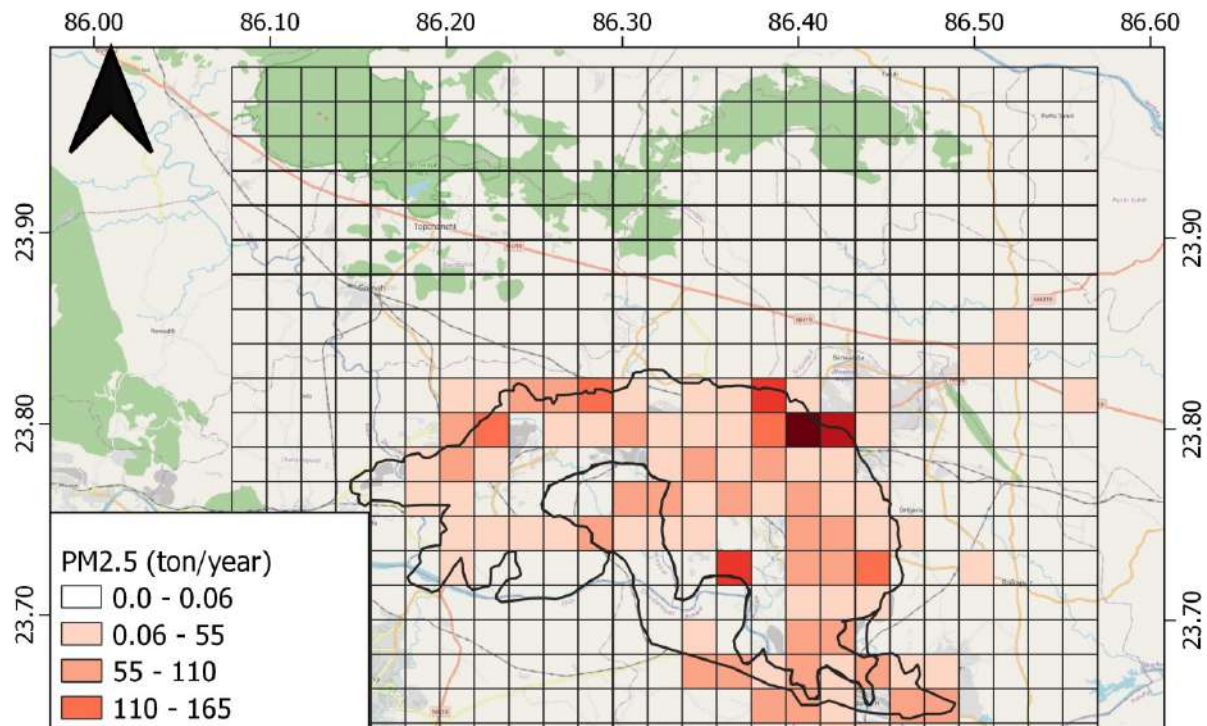
<b>Pollutant</b>	<b>SPM</b>	<b>SO<sub>2</sub></b>	<b>NO<sub>2</sub></b>	<b>CO</b>	<b>HC</b>
<b>Emission Factor (g/kg)</b>	20	13.3	3.99	24.92	0.5
<b>Emission (T/Year)</b>	8.110	5.393	1.618	10.105	0.203

**Table 2.12: Emission from Hotel & Restaurants using LPG**

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

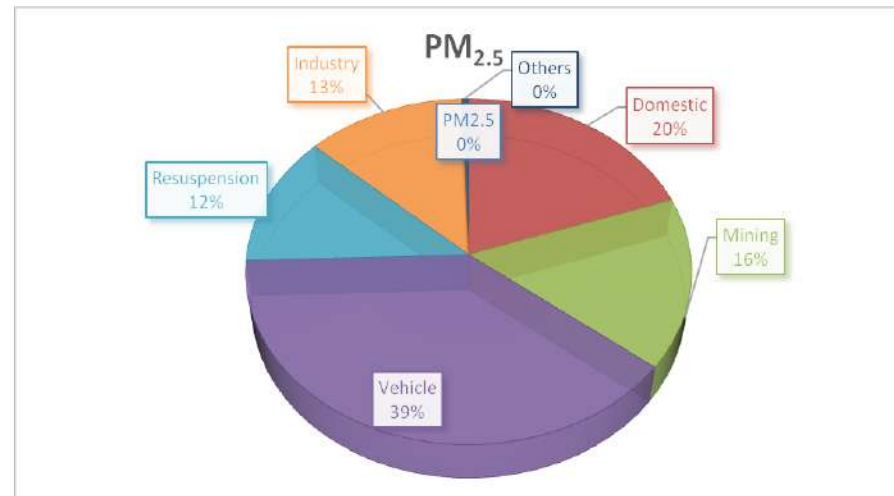


**Figure 2.1: Grid-wise emission inventory of PM10 in tons/year over the study area**





(a)



(b)

**Figure 2.3: (a) and (b) represents emission load from various sectors over JCF region for PM<sub>10</sub> and PM<sub>2.5</sub> respective**

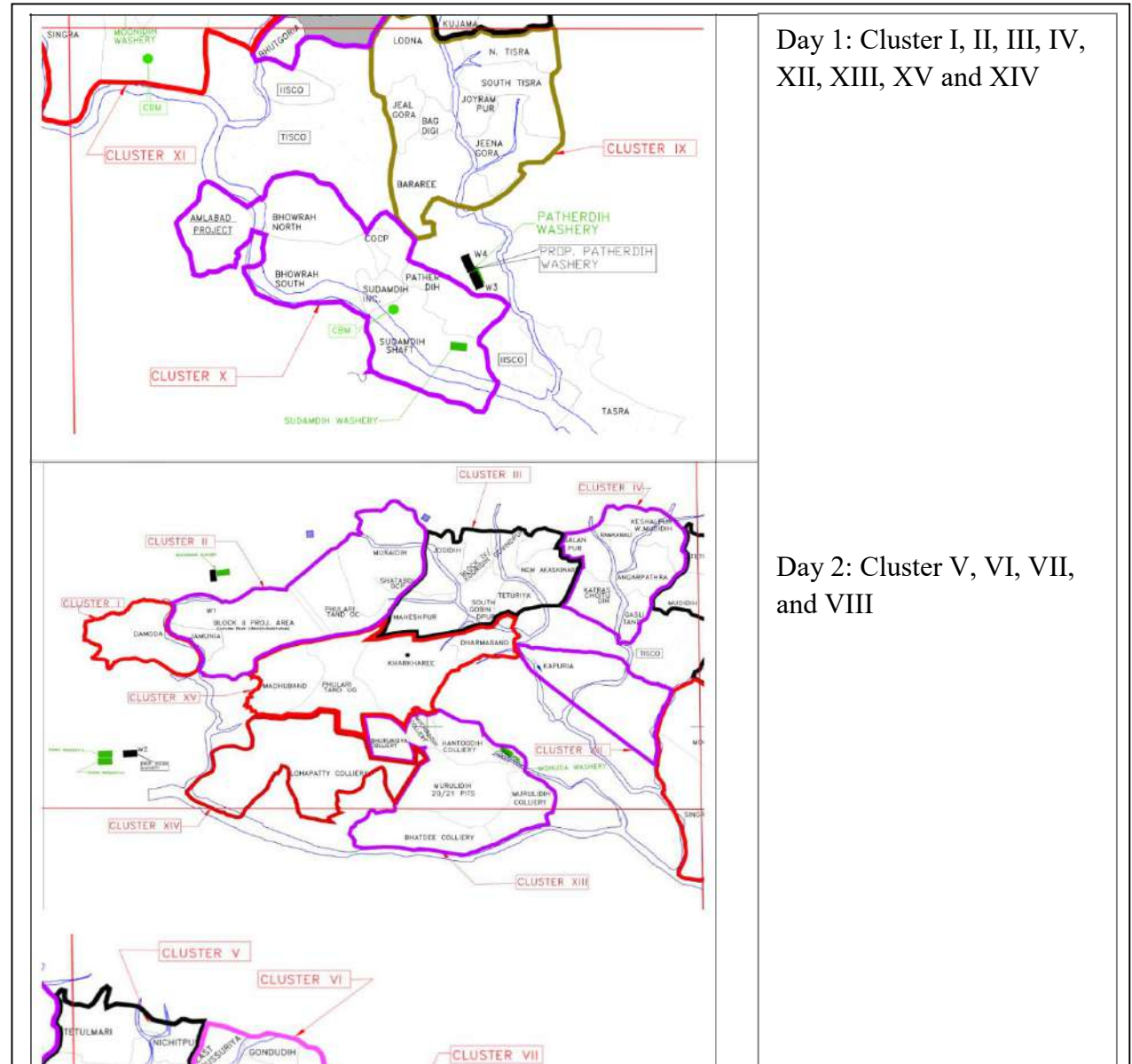
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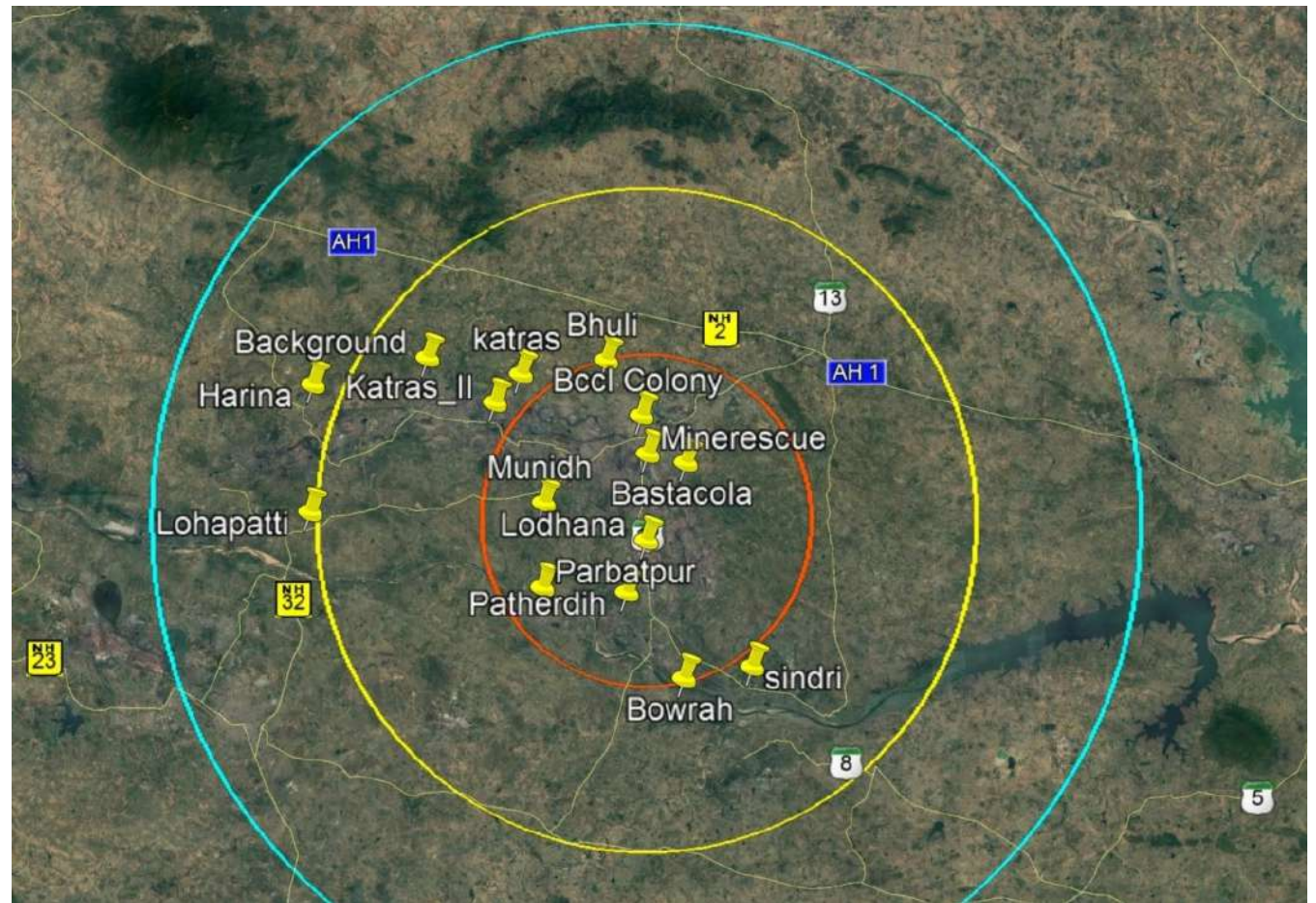
Central Pollution Control Board, Delhi, India. (2008–2010). Air quality monitoring, emission inventory and source apportionment studies for Indian cities. [https://cpcb.nic](https://cpcb.nic.in)

mines are operational in JCF. Standard mining operations like drilling, blasting, hauling, accumulation, and transfer are the major sources of emissions and air pollution. Apart from that, a typical emission source, mine fire, is prevailing at JCF. Besides, JCF encompasses large non-mining regions with their 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.

**Table 0.1: The details of mine cluster in Jharia Coalfield**



4. Cluster IX Lodhna
5. Cluster XI Moonidih nearby sources: Coal Mine
6. Cluster X Patherdih: nearby sources: Coal Mine, Steel Industry
7. Cluster VIII Bastacola nearby sources: Coal Mine
  - **Buffer Zone**
8. Bank More
9. Harina
10. Bhuli
11. Sindri
12. Parbatpur Electro steel/ Bhaga
13. Background



temperature of  $27 \pm 3^\circ\text{C}$  and at a relative humidity (RH) of  $55 \pm 2\%$  to remove the moisture present in them. The  $\text{PM}_{10}$  and  $\text{PM}_{2.5}$  field samples were collected periodically throughout the sampling period. The sampling frequency and types of equipment used for monitoring are described in Table 0.2 and Table 0.3. National Ambient Air Quality Standards (2009) and Standard for coal mines are presented in Table 0.4 and Table 3.5.

**Table 0.2: Frequency of Air pollutants sampling in Jharia Coalfields**

Parameter	Number of Days	Change of Filter/ absorbing media	Reporting
$\text{PM}_{10}$	10	24 hourly, Teflon: 5 Days Quartz: 5 Days	24 hourly
$\text{PM}_{2.5}$	10	24 hourly Teflon: 5 Days Quartz: 5 Days	24 hourly
$\text{NO}_2$	10	8 hourly	8 hourly
$\text{SO}_2$	10	8 hourly	8 hourly

**Table 0.3: Ambient Air Quality Sampling/Analysis Methodology for Target Pollutants**

Particulars	Parameters			
	$\text{PM}_{10}$	$\text{PM}_{2.5}$	$\text{NO}_2$	$\text{SO}_2$
<b>Sampling Instrument</b>	INSTUMEX and ARA-N-FRM Sampler	INSTUMEX and ARA-N-FRM Sampler	APM sampler	APM sampler
<b>Sampling Principle</b>	Cyclonic Flow Technique	Cyclonic Flow Technique	Chemical absorption in suitable media	Chemical absorption in suitable media
<b>Flow rate</b>	16.7 LPM	16.7 LPM	0.5 LPM	0.5 LPM
<b>Sampling Period</b>	24 hourly	24 hourly	8 hourly	8 hourly
<b>Sampling Frequency</b>	7 days continuous, Teflon and quartz on alternate days	7 days continuous, Teflon and quartz on alternate days	7 days continuous	7 days continuous
<b>Analytical Instrument</b>	Electronic Micro Balance	Electronic Micro Balance	Spectrophotometer	Spectrophotometer

	Dioxide (SO <sub>2</sub> )	24Hours**	80	80	Ultraviolet fluorescence
2	Nitrogen Dioxide (NO <sub>2</sub> )	Annual*	40	30	Modified Jacob & Hochheiser (Na-Arsenite) Chemiluminescence
		24Hours**	80	80	
3	Particulate matter (Size less than 10µm) or PM10	Annual*	60	60	Gravimetric,TOEM,Beta attenuation
		24Hours**	100	100	
4	Particulate matter (Size less than 2.5µm) or PM2.5	Annual*	40	40	Gravimetric, TOEM, Beta attenuation
		24Hours**	60	60	
5	Ozone (O <sub>3</sub> )	8 Hours*	100	100	UV photometric, Chemiluminescence chemical method
		1 Hour	180	180	
6	Lead (Pb)	Annual*	0.5	0.5	ASS / ISP method after sampling on EPM 2000 or equivalent filter paper ED-XRF using Teflon filter
		24Hours**	1	1	
7	Carbon Monoxide (CO)	Annual*	0.2	0.2	Non-dispersive Infra Red (NDIR) Spectroscopy
		24Hours**	0.4	0.4	
8	Ammonia (NH <sub>3</sub> )	Annual*	100	100	Chemiluminescence,Indophenol's blue method
		24Hours**	400	400	
9	Benzene (C <sub>6</sub> H <sub>6</sub> )	Annual*	0.5	0.5	Gas Chromatography based continuous analyzer. Adsorption and desorption followed by GC analysis
10	Benzo (a) Pyene (BaP)-particulate phase only	Annual*	0.1	0.1	Solvent extraction followed by HPLC / GC analysis
11	Arsenic (As)	Annual*	0.6	0.6	AAS/ ICP method after sampling on EPM 2000 or equivalent filter paper
12	Nickel (Ni)	Annual*	20	20	

<b>Suspended Particulates Matter (SPM)</b>	Annual Average	360 µg/m <sup>3</sup>	430 µg/m <sup>3</sup>
	24 hours	500 µg/m <sup>3</sup>	600 µg/m <sup>3</sup>
<b>Respirable Particulate Matter (size less than 10 µm) (RPM)</b>	Annual Average	180 µg/m <sup>3</sup>	215 µg/m <sup>3</sup>
	24 hours	250 µg/m <sup>3</sup>	300 µg/m <sup>3</sup>
<b>Sulphur Dioxide (SO<sub>2</sub>)</b>	Annual Average	80 µg/m <sup>3</sup>	80µg/m <sup>3</sup>
	24 hours	120 µg/m <sup>3</sup>	120 µg/m <sup>3</sup>
<b>Oxides of Nitrogen as NO<sub>2</sub></b>	Annual Average	80 µg/m <sup>3</sup>	80µg/m <sup>3</sup>
	24 hours	120 µg/m <sup>3</sup>	120 µg/m <sup>3</sup>

### 3.2. Chemical Analysis

#### 3.2.1. Gravimetric analysis

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

#### 3.2.2. Elemental analysis

PM<sub>10</sub> samples collected on glass fibre filters were digested in a microwave digester. The samples were made up to 50 ml using deionized distilled water. Similarly, the exposed filters containing PM<sub>2.5</sub> particles were cut equally into 2 halves. A part of the exposed filter was used

the intensely colored pararosaniline methylsulphonic acid. The absorbance of the solution was measured by means of a suitable spectrophotometer.

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

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

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

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

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

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

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

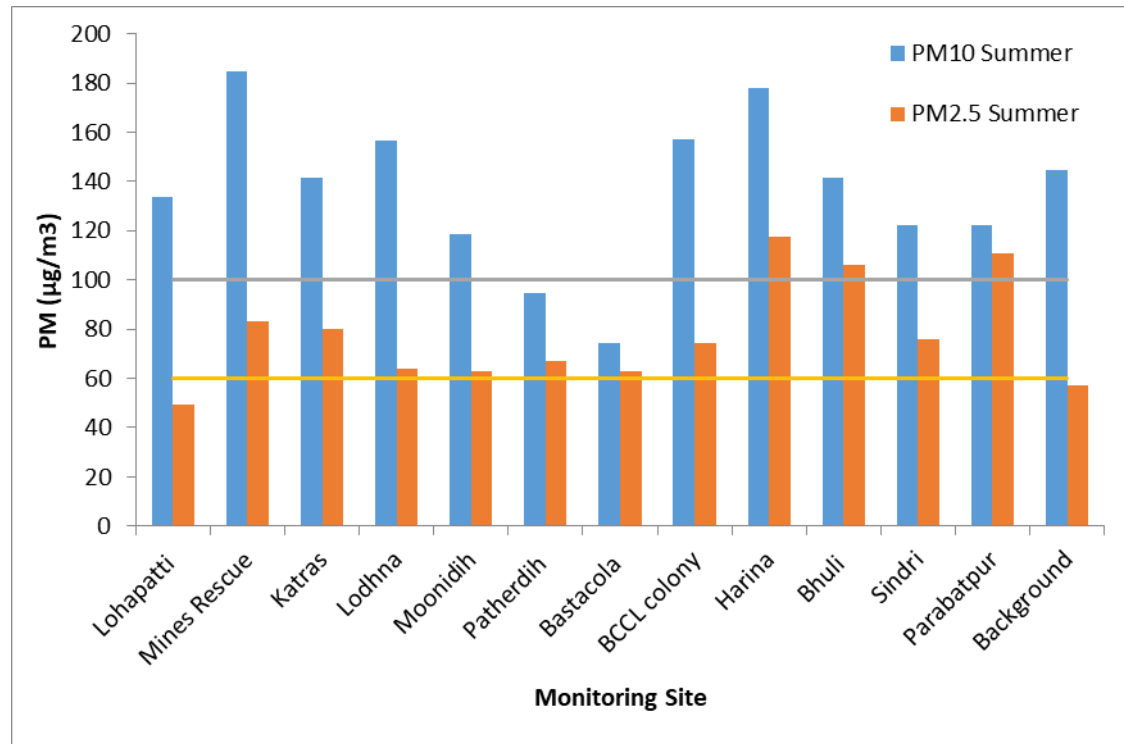
In summer monitoring, the mean mass concentrations of PM<sub>10</sub> particles in all 13 sampling sites were found to be in the range of 74-184 µg/m<sup>3</sup> with the highest concentration of 184 µg/m<sup>3</sup> at Mine rescue site and lowest concentration of 74 µg/m<sup>3</sup> at Bastacola site.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

The average concentration of PM<sub>10</sub> and PM<sub>2.5</sub> in two seasons are described in Table 0.6 and

Table 0.7. Results revealed that the average concentrations of PM<sub>10</sub> are within the prescribed limits of MoEF notification guidelines for coal mine area. In the case of PM<sub>2.5</sub>, there is no Govt. notified standard for mining area but in case of buffer zones, National Ambient Air Quality Standard, NAAQS, 2009 may be applicable. The highest PM<sub>10</sub> and PM<sub>2.5</sub> concentrations were found in Mine rescue and Harina (Figure 0.2 and Figure 0.3).

**Table 0.6: Average concentration of PM<sub>10</sub> and PM<sub>2.5</sub> in Summer of Jharia Coalfield**

Monitoring Sites	Site Description	Average Concentration (µg/m <sup>3</sup> )-Summer		
		PM <sub>10</sub> (µg/m <sup>3</sup> )	PM <sub>2.5</sub> (µg/m <sup>3</sup> )	
Lohapatti	Core Zone	133.7	49.42	
		(83-203)	(44-83)	
Mines Rescue	Core Zone	184.8	83.43	
		(124-255)	(55-205)	
Katras	Core Zone	141.4	80.01	
		(100-216)	(42-150)	
Lodhna	Core Zone	156.8	63.98	
		(100-303)	(32-99)	
Moonidih	Core Zone	118.4	62.84	
		(80-153)	(34-94)	
Patherdih	Core Zone	94.7	67.22	



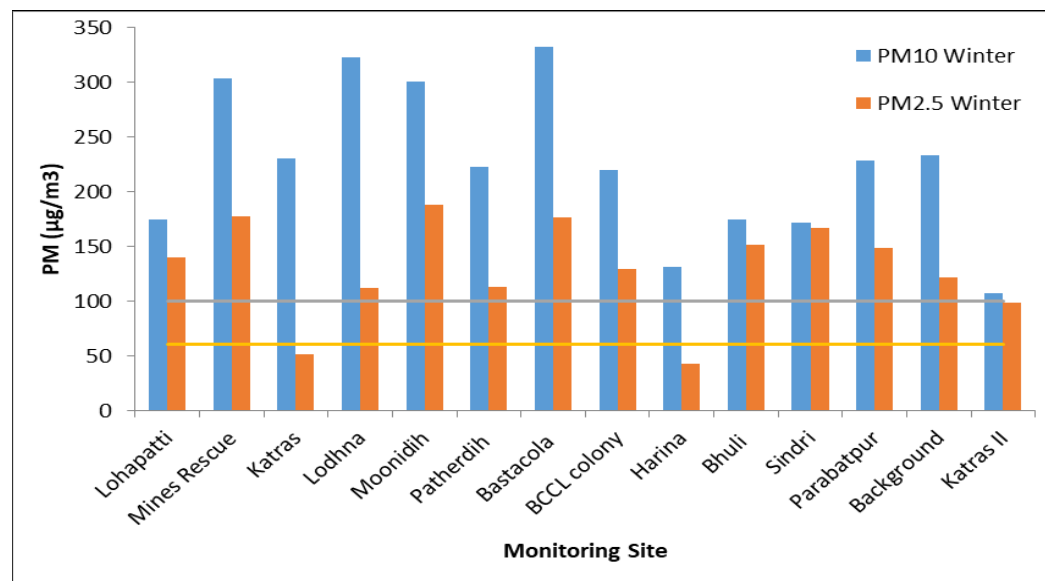
**Figure 0.2: Average concentration of PM<sub>10</sub> and PM<sub>2.5</sub> in JCF region in Summer compared to NAAQS (2009)**

Whereas in winter monitoring, highest PM<sub>10</sub> mass concentration was found to be 332 µg/m<sup>3</sup> at Bastacola site (exceeding the prescribed limit of **GSR 742(E)**) along with other core mining zones like Mines Rescue, Moonidih. The lowest PM<sub>10</sub> average concentration was found in Katras II (107 µg/m<sup>3</sup>).

**Table 0.7: Average concentration of PM<sub>10</sub> and PM<sub>2.5</sub> in winter of Jharia Coalfield.**

Monitoring Sites	Site Description	Average Concentration (µg/m <sup>3</sup> )-Winter	
		PM <sub>10</sub> (µg/m <sup>3</sup> )	PM <sub>2.5</sub> (µg/m <sup>3</sup> )
Lohapatti	Core Zone	174.28	139.59
		(122-241)	(114-236)
	Core Zone	203.40	176.07

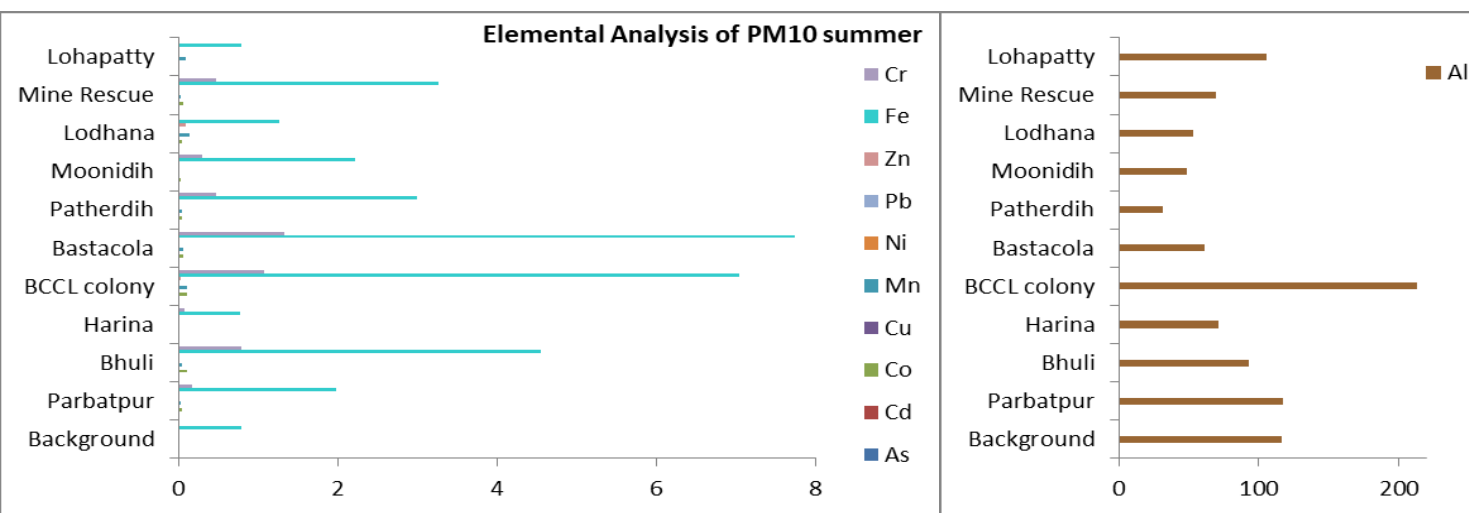
Harina		(65-215)	(44-98)
Bhuli	Buffer Zone	174.75	151.66
		(150-200)	(89-180)
Sindri	Buffer Zone	171.82	167.07
		(81-210)	(142-184)
Parabatpur	Buffer Zone	228.76	148.16
		(75-660)	(101-192)
Background	Buffer Zone	233	121.18
		(195-254)	(63-170)
Katras II		107.13	98.42
	Core Zone	(128-181)	(94-104)



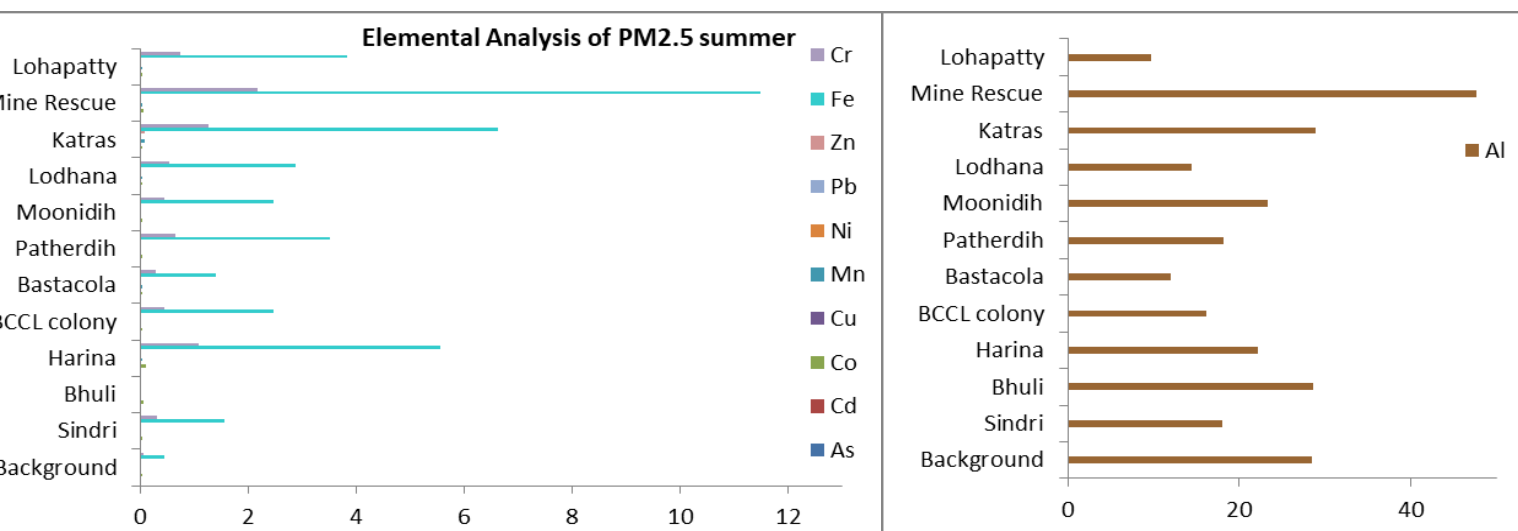
**Figure 0.3: Average concentration of PM<sub>10</sub> and PM<sub>2.5</sub> in JCF region during Winter compared to NAAQS (2009)**

most abundant element. The concentration of Al was detected in the range of 31.60-213.01  $\mu\text{g}/\text{m}^3$ . Maximum Al concentration was found at BCCL colony i.e. 213.01  $\mu\text{g}/\text{m}^3$ . The concentrations of Fe and Cr were estimated as 0.78-7.74  $\mu\text{g}/\text{m}^3$  and 0.075-1.32  $\mu\text{g}/\text{m}^3$  respectively. The highest concentrations of both Fe (7.74  $\mu\text{g}/\text{m}^3$ ) & Cr (1.32  $\mu\text{g}/\text{m}^3$ ) were found at the Bastacola site Figure 0.4.

Similarly, in case of  $\text{PM}_{2.5}$  particles the concentrations of Al (9.74-47.59  $\mu\text{g}/\text{m}^3$ ), Fe (0.44-11.77  $\mu\text{g}/\text{m}^3$ ) and Cr (0.066-2.17  $\mu\text{g}/\text{m}^3$ ) were found higher than other elements. For  $\text{PM}_{2.5}$  particles, maximum concentrations of all the three elements i.e. Al (47.59  $\mu\text{g}/\text{m}^3$ ), Fe (11.77  $\mu\text{g}/\text{m}^3$ ) and Cr (2.17  $\mu\text{g}/\text{m}^3$ ) were obtained as at the Mine Rescue site. Since, the elements such as Al, Fe and Cr possess higher concentrations in the  $\text{PM}_{10}$  elemental composition, Al would have been emitted from road dust, whereas Fe would have been emitted from the resuspension of dust containing deposits from the emissions of vehicular and other anthropogenic activities Figure 0.5.



Concentration of PM<sub>10</sub> in the summer season



Concentration of PM<sub>2.5</sub> in the summer season

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

The elemental analysis was performed using inductively coupled plasma optical emission spectroscopy (ICP-OES). For the air quality assessment, the concentrations of 11 elements i.e. Al, As, Cd, Cr, Cu, Fe, K, Mn, Ni, Pb, and Zn in PM<sub>10</sub> and PM<sub>2.5</sub> samples, were measured. Among all the elements, Al, Fe, and K concentrations were found considerably higher for PM<sub>10</sub> samples in the winter season. Al was observed in the range of 2.02-10.77 µg/m<sup>3</sup> followed by Fe (0.79-9.26 µg/m<sup>3</sup>) and K (0.90-4.19 µg/m<sup>3</sup>). Maximum Al concentration (10.77 µg/m<sup>3</sup>) was observed at the BCCL colony, followed by Lodhna (10.29 µg/m<sup>3</sup>). The Highest Fe concentration (9.26 µg/m<sup>3</sup>) was observed at Bastacola while K (4.19 µg/m<sup>3</sup>) at the Lodhna site. This may be due to vehicular emissions, paved roads, construction dust, coal combustion, soil dust, etc. The concentration of As, Ni, Pb were found within the limits of CPCB standards. The remaining elements i.e. Cd, Cr, Cu, Mn, and Zn were found very low (Figure 0.6).

Similarly, in the case of PM<sub>2.5</sub> samples concentrations of Al, Fe and K were detected higher than other elements. The concentration of Al, Fe, and K was obtained as 0.11-2.91 µg/m<sup>3</sup>, 0.05-1.93 µg/m<sup>3</sup> and 0.08-2.12 µg/m<sup>3</sup>. For PM<sub>2.5</sub> particles, maximum Al and K were found at the Munidih site, which was 2.91 µg/m<sup>3</sup> and 2.12 µg/m<sup>3</sup>, respectively. The highest concentration of Fe i.e. 1.93 µg/m<sup>3</sup> was detected at Lodhna. The concentrations of all other analysed elements were low (Figure 0.7).

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

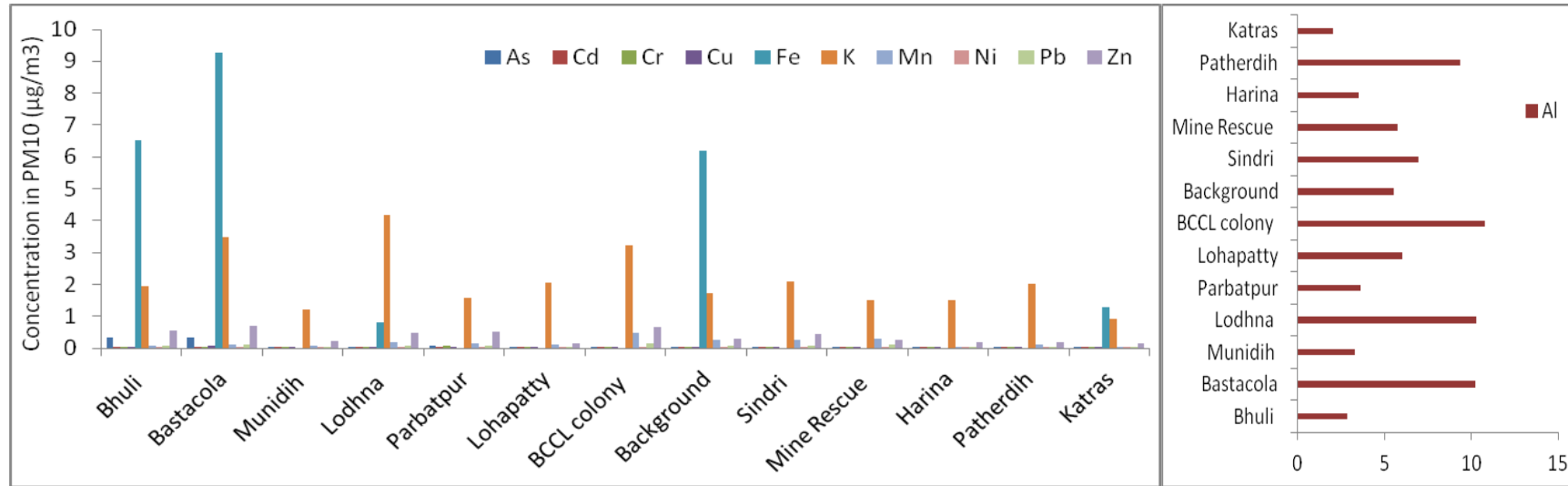


Figure 0.6: Metal concentration of PM<sub>10</sub> in winter season

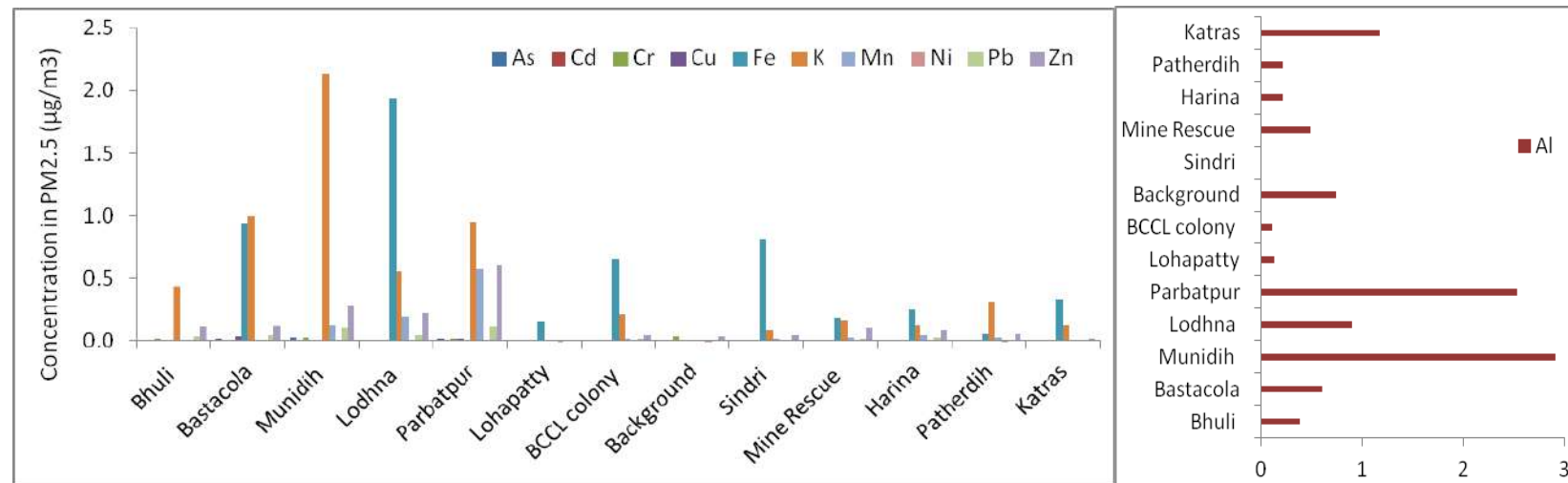


Figure 0.7: Metal concentration of PM 2.5 in winter season

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

The mean average SO<sub>2</sub> concentration in the summer season among all the monitoring stations ranged between 11 µg/m<sup>3</sup> (Harina & Bastacola) and 24.5 µg/m<sup>3</sup> (Moonidih), being well below the threshold limits of 80 µg/m<sup>3</sup> (residential or industrial). The 8-hour average NO<sub>2</sub> concentrations were between 10.3 µg/m<sup>3</sup> (Background) and 40.9 µg/m<sup>3</sup> (Lodhana), well within the standard limits of 80 µg/m<sup>3</sup> (residential or industrial) Figure 0.8. The SO<sub>2</sub> in the residential areas may be received from the open burning of raw coal and other domestic and commercial activities.

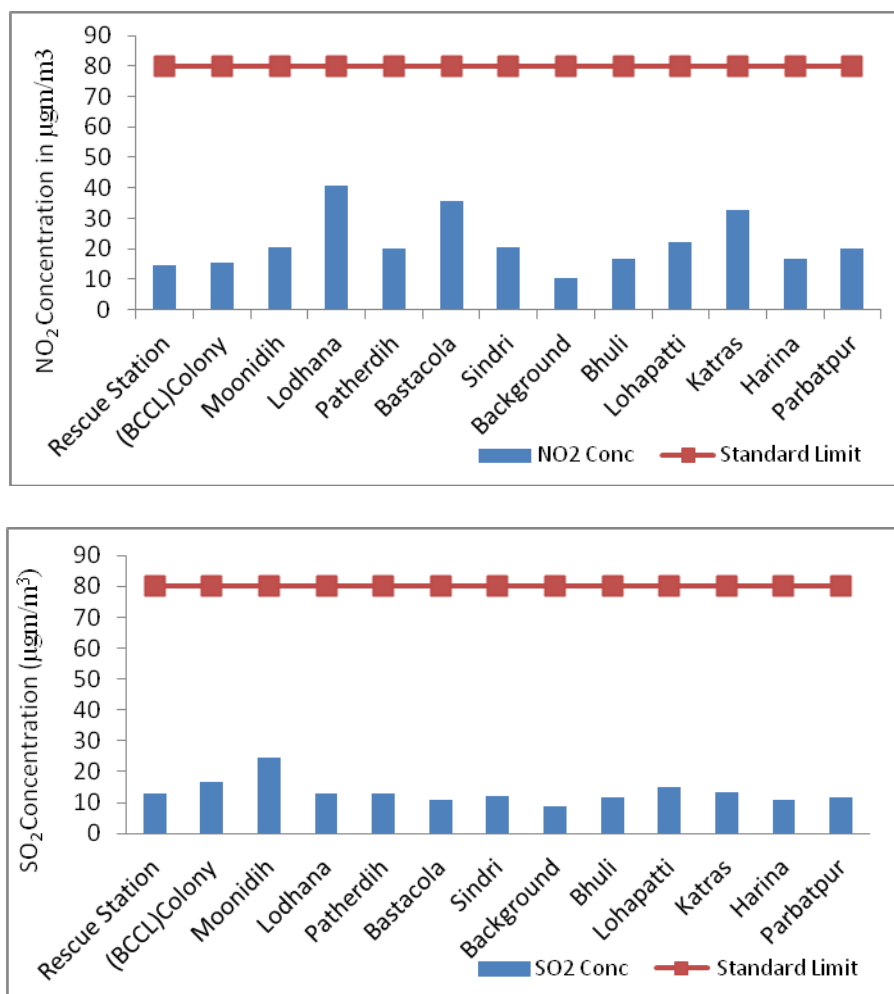
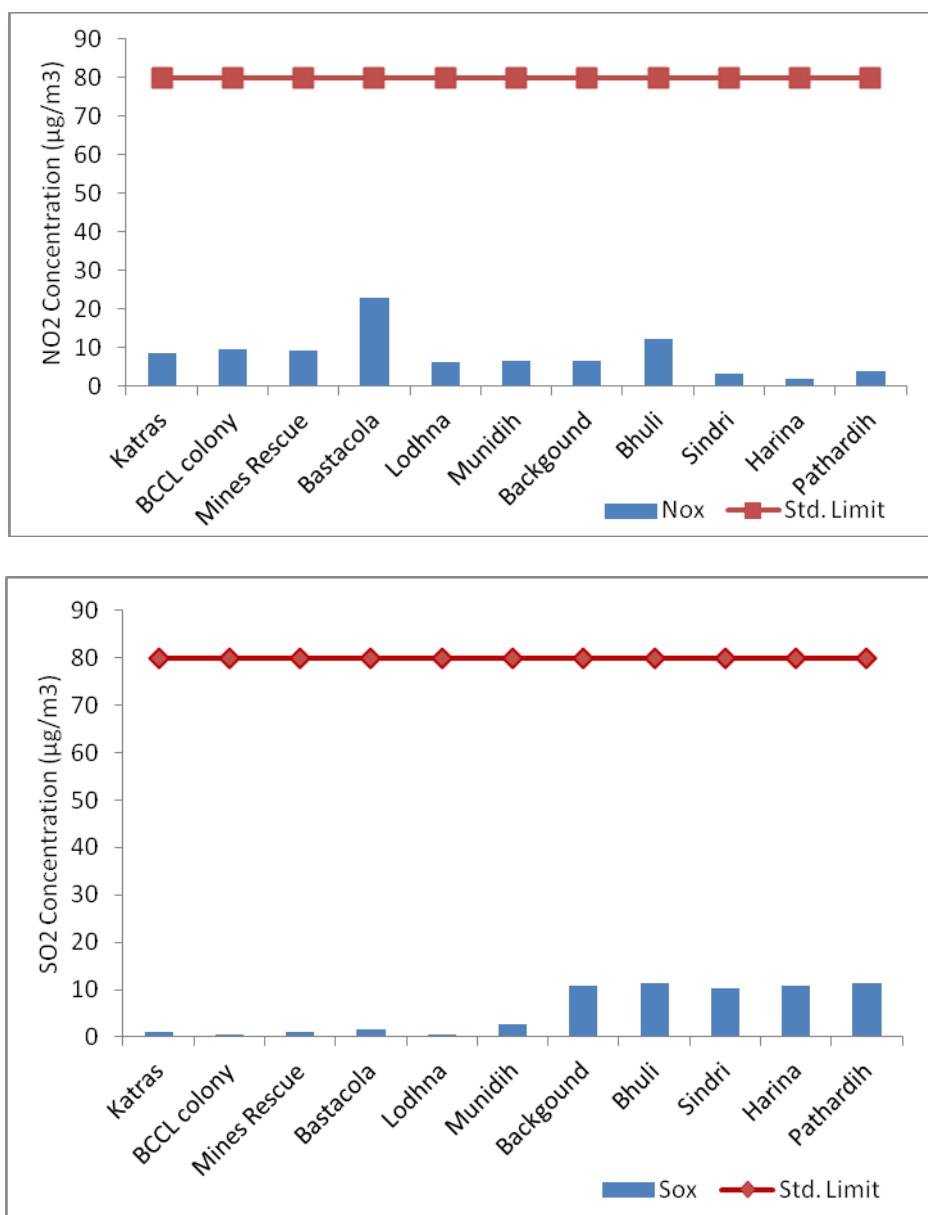


Figure 0.8: NO<sub>2</sub> and SO<sub>2</sub> Concentration of all monitoring sites in summer season

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

The mean concentration of NO<sub>2</sub> and SO<sub>2</sub> in the winter season was found below the threshold limit i.e. 80 µg/m<sup>3</sup>. The concentration of SO<sub>2</sub> was below 10 µg/m<sup>3</sup> in Katra, BCCL colony, Mine Rescue, Bastacola, Lodhana and Munidih. Bastacola and Bhuli site has a concentration of NO<sub>2</sub> above 10 µg/m<sup>3</sup> (Figure 0.9)

It has been observed that concentration of NO<sub>2</sub> and SO<sub>2</sub> in winter and summer season were below the standard limit. But the average concentration of NO<sub>2</sub> and SO<sub>2</sub> in summer season was higher than the winter season.



**Figure 0.9: NO<sub>2</sub> and SO<sub>2</sub> Concentration of all monitoring sites in Winter season**

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

Data were obtained for four OC fractions (OC1, OC2, OC3 and OC4 in He atmosphere at 140, 280, 480 and 580°C, respectively) and three EC fractions (EC1, EC2, and EC3 in a 2% O<sub>2</sub>/98% He atmosphere at 580, 740 and 840°C, respectively). The IMPROV protocol defines OC as OC1 + OC2 + OC3 + OC4 and EC as EC1 + EC2 + EC3. The mass concentration of organic matter (OM) in the atmosphere was estimated by multiplying OC by 1.6 (conversion factor for urban aerosol). The total carbonaceous aerosol (TCA) was calculated as the sum of OM and EC. The highest concentration of OC and EC in PM<sub>2.5</sub> was found in the BCCL colony site i.e. 37.85 and 42.33 µg/m<sup>3</sup>, respectively, and the lowest OC concentration was 15.36 µg/m<sup>3</sup> and EC was 13.08 µg/m<sup>3</sup> in Sindri site. In comparison, the concentration of OC (67.35 µg/m<sup>3</sup>) and EC (81.67 µg/m<sup>3</sup>) in PM<sub>10</sub> were higher in the BCCL colony among all the sites. The lowest OC concentration as 17.95 µg/m<sup>3</sup> was in Bastacola and EC in Parbatpur i.e. 15.44 µg/m<sup>3</sup> (Figure 0.10)

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

The mass concentration of EC and OC in PM<sub>10</sub> and PM<sub>2.5</sub> are more significant than 100 µg/m<sup>3</sup> and 70 µg/m<sup>3</sup>, respectively in Bastacola, Katras, Mine Rescue, Background, and Sindri. The highest concentration of EC in PM<sub>10</sub> and PM<sub>2.5</sub> was observed in the Sindri site, whereas OC was found higher in Sindri and Bastacola. OC contributing to PM<sub>10</sub> mass concentration was lowest in Harina followed by Lohapatti and Patherdih. In the case of PM<sub>2.5</sub>, Parbatpur was found to have the lowest concentration among other sites.

The higher mean concentration of EC and OC in winter were likely related to the influence of emissions from residential heating (in addition to traffic source) and, on the other hand, to the unfavorable meteorological conditions leading to more excellent dispersion of pollutants in the atmosphere during this season. Elemental carbon is emitted directly into the atmosphere during incomplete combustion emissions, such as motor vehicle exhaust, fuel burning, and biomass burning (Figure 0.11).

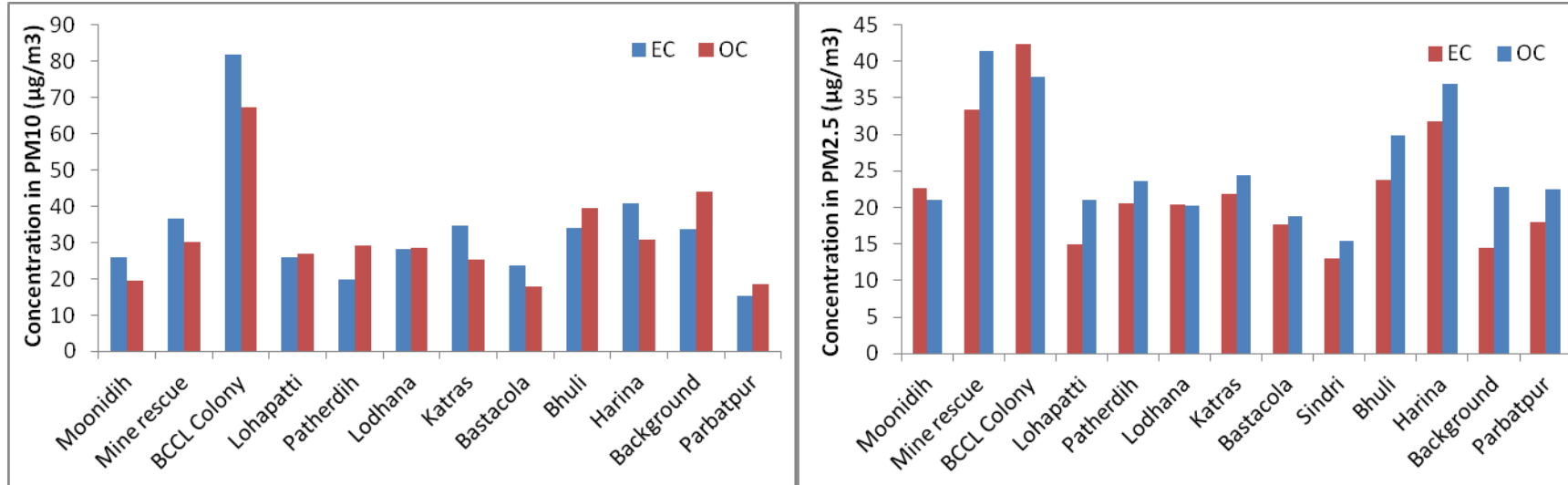


Figure 0.10: EC & OC concentration in PM<sub>10</sub> and PM<sub>2.5</sub> in Summer season

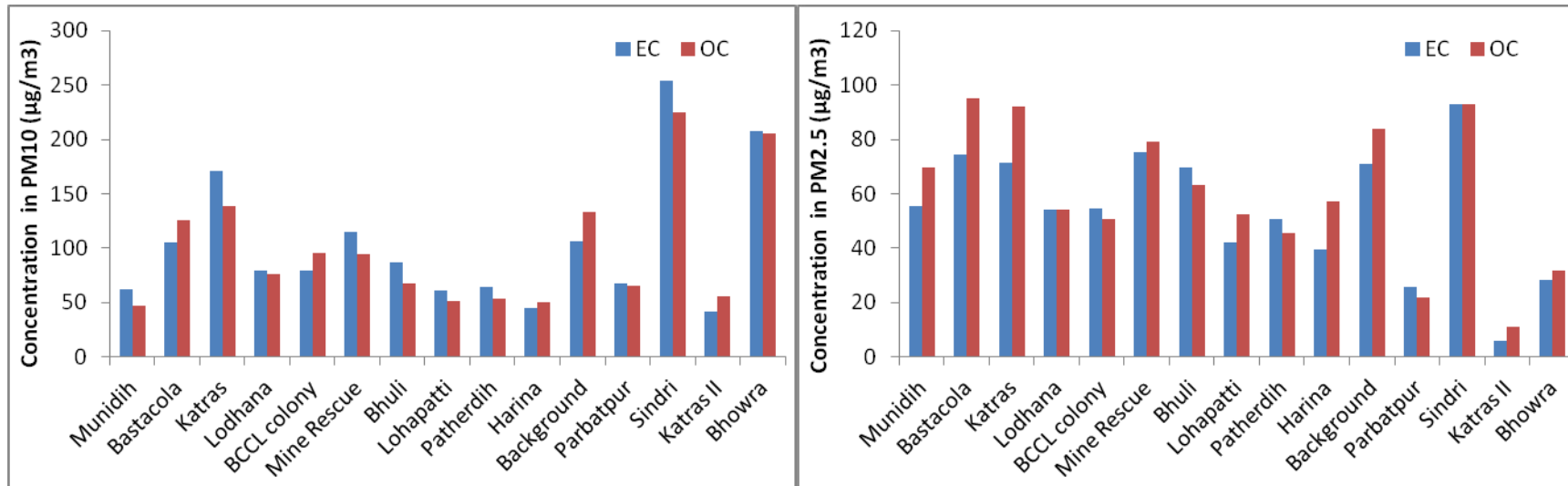


Figure 0.11: EC & OC concentration in PM<sub>10</sub> and PM<sub>2.5</sub> in Winter Season

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

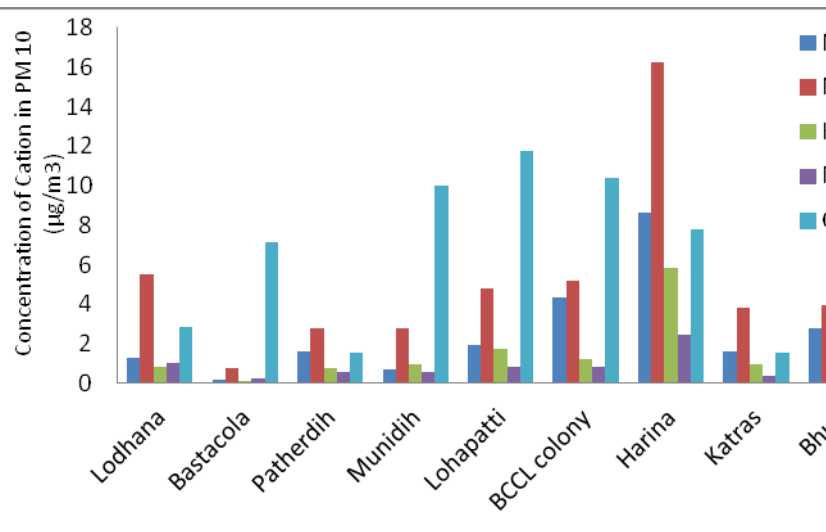
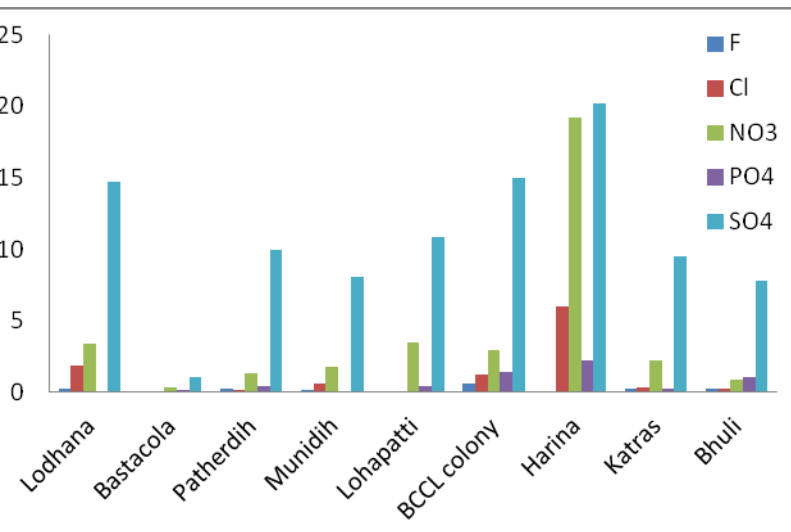
The anions (SO<sub>4</sub><sup>2-</sup>, NO<sub>3</sub><sup>-</sup> and Cl<sup>-</sup>) and cations (NH<sub>4</sub><sup>+</sup>, Na<sup>+</sup>, Ca<sup>2+</sup>, K<sup>+</sup>) are the water-soluble inorganic ions found in abundance. In summer, the mass concentration of SO<sub>4</sub><sup>2-</sup> in PM<sub>10</sub> was in the range of 1.06-20.17 µg/m<sup>3</sup> where higher concentration was observed in Harina, BCCL colony, and Lodhana sites. Likewise, NO<sub>3</sub><sup>-</sup> was in the range of 0.32-19.2 µg/m<sup>3</sup> with the highest in Harina site. PO<sub>4</sub><sup>3-</sup> and Cl<sup>-</sup> concentration was highest in Harina and <2 µg/m<sup>3</sup> in other locations. NH<sub>4</sub><sup>+</sup> was in the range of 0.75-16.24 µg/m<sup>3</sup>, Harina with the highest concentration, and Bastacola with the lowest concentration. Na<sup>+</sup> concentration (0.18-8.6 µg/m<sup>3</sup>) was highest in Harina followed by BCCL colony and less than 2 µg/m<sup>3</sup> in remaining sites. Ca<sup>2+</sup> concentration (1.5-11.77 µg/m<sup>3</sup>) highest in Lohapatti and BCCL colony while lowest in Katras. K<sup>+</sup> ion was also observed in the Harina site with a concentration of 5.85 µg/m<sup>3</sup> (Figure 0.12)

The mass concentration of SO<sub>4</sub><sup>2-</sup> in PM<sub>2.5</sub> was highest in Patherdih with a concentration of 15.13 µg/m<sup>3</sup> and lowest in Bhuli. In Bastacola site, the concentration of NO<sub>3</sub><sup>-</sup> (2.85 µg/m<sup>3</sup>), Cl<sup>-</sup> (2.04 µg/m<sup>3</sup>), K<sup>+</sup> (1.84 µg/m<sup>3</sup>) was the highest among the other sites. Ca<sup>2+</sup> (6.17 µg/m<sup>3</sup>) and Mg<sup>2+</sup> (0.57 µg/m<sup>3</sup>) concentration was highest in Lohapatti site (Figure 0.13).

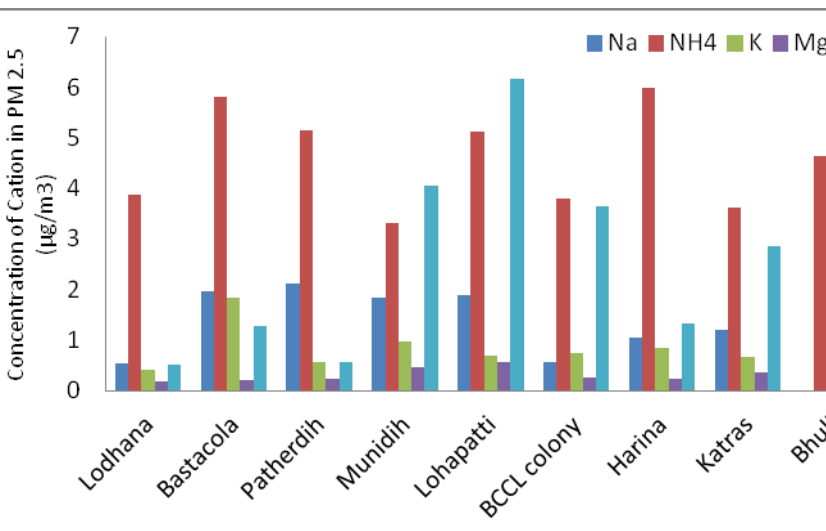
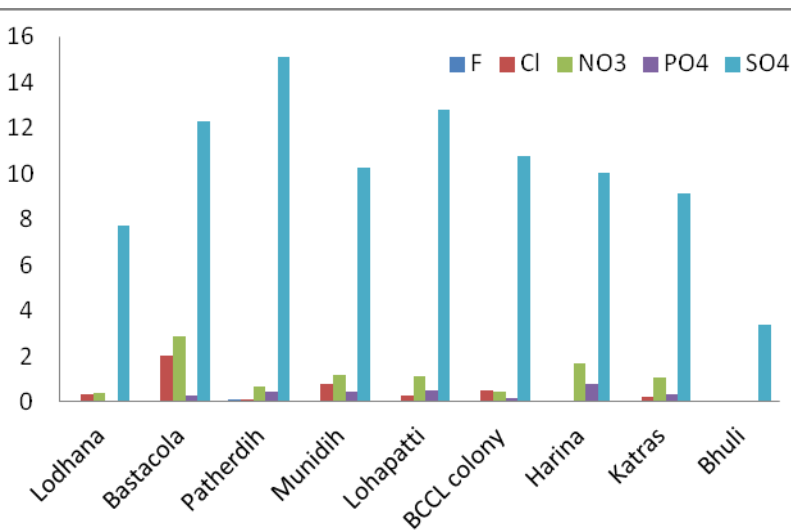
### 3.3.9. Ionic composition of PM<sub>10</sub> and PM<sub>2.5</sub> in Winter season

PM<sub>10</sub> ions concentration in Bastacola and Background were highest among all the monitoring sites which followed the increasing order of Na<sup>+</sup> < Mg<sup>2+</sup> < F<sup>-</sup> < K<sup>+</sup> < Ca<sup>2+</sup> < Cl<sup>-</sup> < NH<sub>4</sub><sup>+</sup> < SO<sub>4</sub><sup>2-</sup> < NO<sub>3</sub><sup>-</sup>. It has been observed that SO<sub>4</sub><sup>2-</sup>, NO<sub>3</sub><sup>-</sup> and NH<sub>4</sub><sup>+</sup> ions were present in abundant in PM<sub>10</sub> mass concentration, and concentration of NO<sub>3</sub><sup>-</sup> in these sites contributes majorly to PM<sub>10</sub>. Ions concentration in Katras, Lohapatti, and Bhuli sites were observed having lower ionic concentration Figure 0.14.

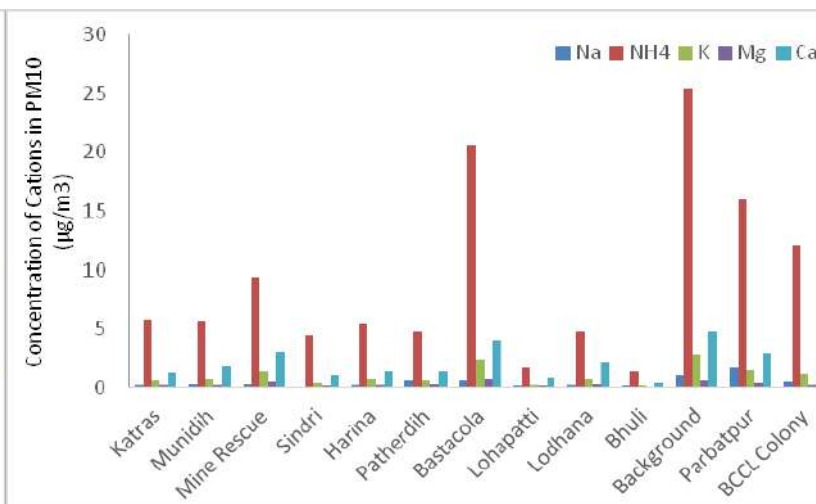
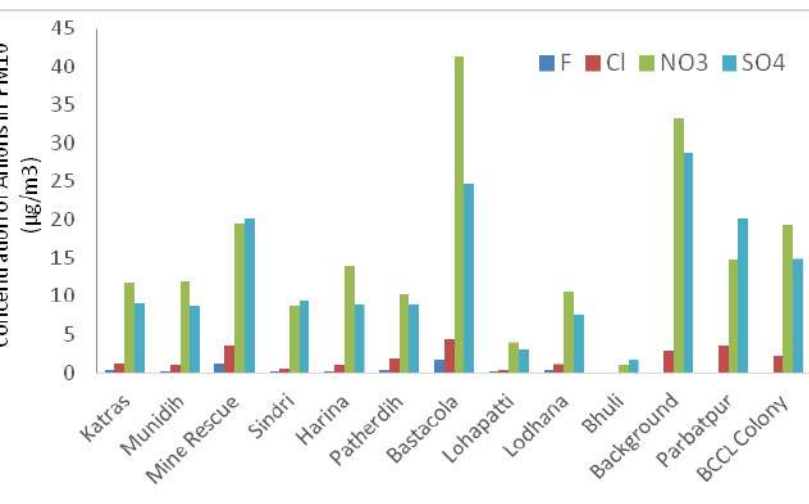
The ionic composition of PM<sub>2.5</sub> comprises mainly of SO<sub>4</sub><sup>2-</sup>, NO<sub>3</sub><sup>-</sup>, Cl<sup>-</sup>, NH<sub>4</sub><sup>+</sup>, Ca<sup>2+</sup> and K<sup>+</sup> ions. Locations such as Bastacola and Parbatpur have higher concentration of ions compared to remaining sites in following order: Mg<sup>2+</sup> < Na<sup>+</sup> < Ca<sup>2+</sup> < K<sup>+</sup> < Cl<sup>-</sup> < NH<sub>4</sub><sup>+</sup> < SO<sub>4</sub><sup>2-</sup> < NO<sub>3</sub><sup>-</sup>. The same trend has been observed i.e. SO<sub>4</sub><sup>2-</sup>, NO<sub>3</sub><sup>-</sup> and NH<sub>4</sub><sup>+</sup> ions contribute mainly in PM<sub>2.5</sub> mass concentration. The average concentration of SO<sub>4</sub><sup>2-</sup> and NO<sub>3</sub><sup>-</sup> in winter was higher than in summer Figure 0.15.



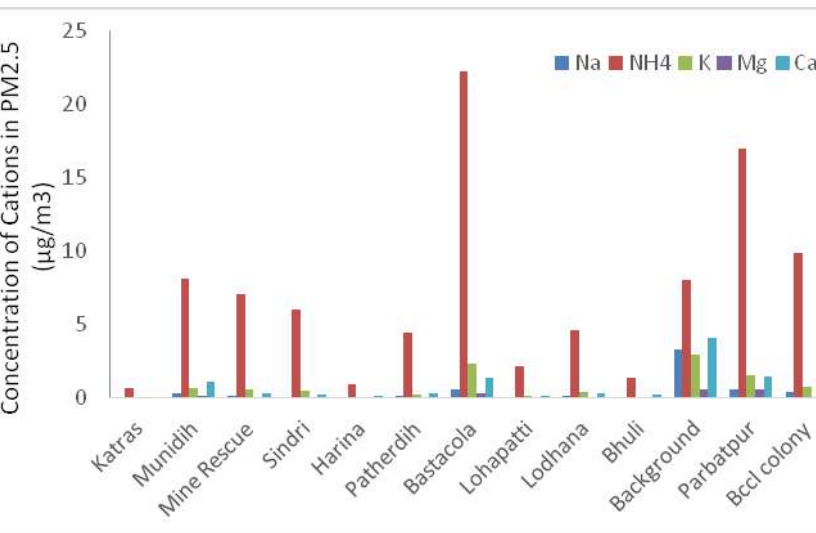
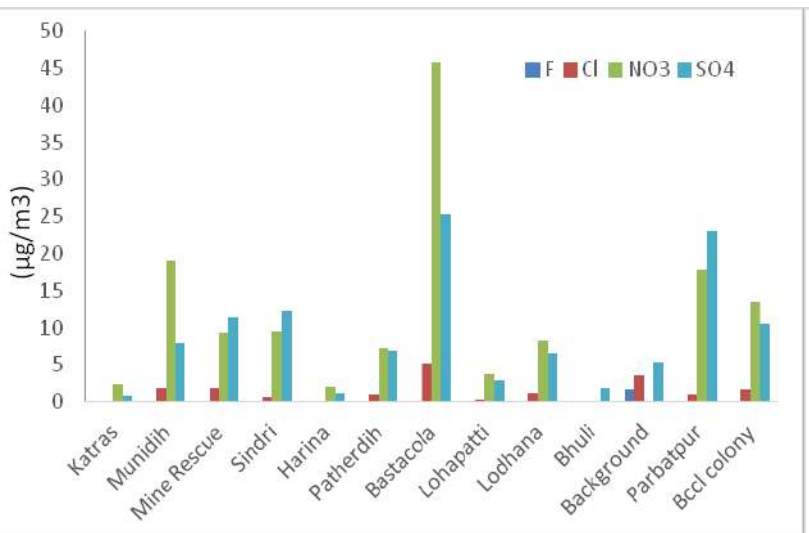
Cation concentration in PM<sub>10</sub> in summer



Cation concentration in PM<sub>2.5</sub> in summer



**Cation concentration in PM<sub>10</sub> in winter**



**Cation concentration in PM<sub>2.5</sub> in winter**

## Chapter 4

### Receptor modelling

#### 4.1. Source Apportionment

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

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

The air quality status is determined by dividing the study area into background, core, and buffer zones. Thirteen sites were selected to represent various regions, including two references or background sites. The sampling locations are shown in the Figure 0.1.

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

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

4.1

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

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

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

The CMB model assumptions are:

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

The following steps are followed for running the CMB model:

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

For source apportionment of  $PM_{10}$ , CMB 8.2 software (USEPA 1997) provides much goodness of fit tests to verify the accuracy of the model. The normal checks, as specified in the manual by USEPA (1997) to accept the model are; t-statistics i.e., source contribution divided by the error of source contribution should be greater than 2,  $\chi^2$  (chi-square) is the weighted sum of squares of the differences between calculated and measured fitting species concentrations divided by the effective variance and the degrees of freedom, it should be less than 4. The weighting is inversely proportional to the squares of the precision in the source profiles and ambient data for each species. Ideally,  $\chi^2$  would be zero, there would be no difference between calculated and measured species concentrations. The  $\chi^2$  less than one indicates a very good fit to the data. Values greater than 4 indicate that one or more of the fitting species concentrations are

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

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

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

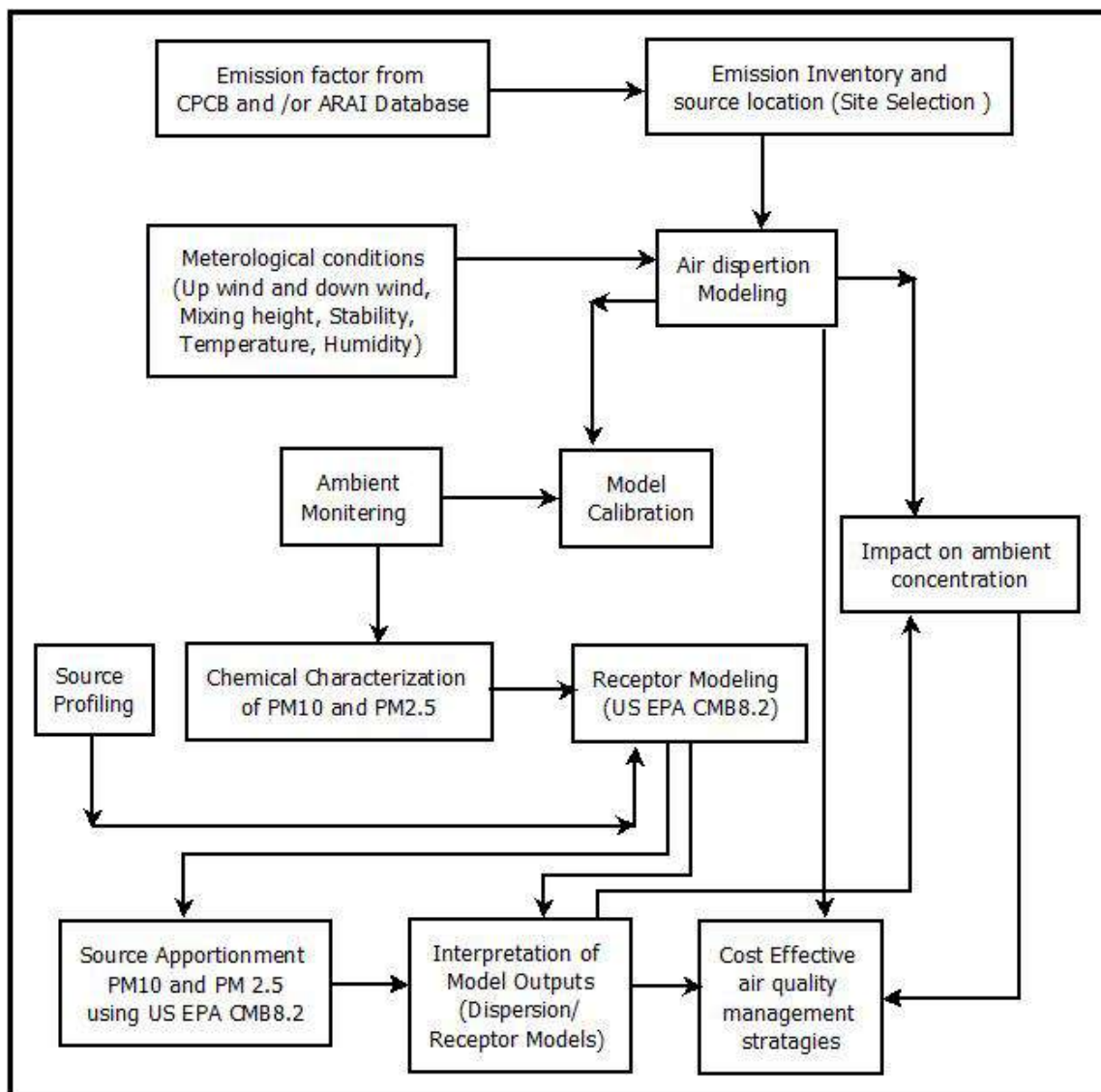
The Chemical profile needs to be developed for the air-polluting source as input to the receptor-oriented source apportionment models like CMB8.2 (chemical mass balance). The U.S Environmental Protection Agency's (EPA) SPECIATE database and several studies carried out in other parts of the world provide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

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

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

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

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



**Figure 4.1: General methodology followed in the source apportionment studies**

## 4.2. Results of the Chemical Mass Balance

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

### 4.2.1. Domestic combustion

In the summer season, the foremost emission source was domestic combustion for PM<sub>10</sub> and PM<sub>2.5</sub>. The domestic combustion percentage observed 22% and 25% for PM<sub>10</sub> and PM<sub>2.5</sub> in the summer season. In the winter season, domestic combustion contribution was the second most percentage contributor for PM<sub>10</sub> and PM<sub>2.5</sub>. The PM<sub>10</sub> percentage was 23% while the PM<sub>2.5</sub> percentage contribution was 28% in this season. The higher concentration of Cl<sup>-</sup>, F<sup>-</sup>, Cr, and Br. Cl<sup>-</sup> and F<sup>-</sup> are the markers of coal-burning and wood-burning (Jain et al., 2020). High Br along with Cl<sup>-</sup> suggests the contributions from coal combustion.

#### 4.2.2. Industrial Emission

The industrial combustion percentage contribution observed 16% in PM<sub>10</sub> and 13% in PM<sub>2.5</sub> in the summer season. In the winter season, contribution to industries is determined to be 15% in PM<sub>10</sub> and 24% in PM<sub>2.5</sub>.

The abundances of elements like As, Zn, Fe, Cu, Cr, Pb, and S indicate the industrial source's emissions. Kumar et al. (2001 ) used Cu, Mn, and Ni as tracers for industrial emissions in Mumbai; Sharma et al. (2014b) used Cu, Cr, Mn, Ni, Co, and Zn as industrial emission tracers for metal manufacturing plants in Delhi; Kulshrestha et al. (2009 ) used a combination of Ni, Cu, Fe, and Cr as a marker for construction activities in Agra; and Karet al. (2010 ) used Zn, Cu, and Ni as tracers of galvanizing, metallurgy, and electroplating industries while Cr from tannery industry in Kolkata.

#### 4.2.3. Coal Mining

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

#### 4.2.4. Transportation

The overall transportation contribution is 25% for PM<sub>10</sub> and 32% for PM<sub>2.5</sub> in the summer season. In the winter season, the transportation emission contribution is examined 16% for PM<sub>10</sub> and 18% for PM<sub>2.5</sub>.

The OC/EC ratio is a convenient diagnostic tool for investigating the sampling site and its emission sources. In the present study, the OC/EC ratio shows significant seasonal variations for a coarser fraction of PM than for a finer fraction. It is well established that OC/EC ratio values between 1.4 and 4 indicate emissions from gasoline catalyst vehicles and from 0.3 to 1 suggest diesel vehicle emissions (Amato et al., 2016; Cesari et al., 2018). Assessing the ratio of nss-K<sup>+</sup>/EC is another diagnostic check for estimating the relative loading of vehicular emissions, where nss-K<sup>+</sup> is a non-sea-salt water-soluble potassium ion (calculated as K<sup>+</sup>- 0.129Na<sup>+</sup>) (Andreae and Merlet, 2001).

#### 4.2.5. Secondary Inorganic Aerosol

During summer, the secondary inorganic aerosol contribution to PM<sub>10</sub> and PM<sub>2.5</sub> is about 8% and 16%, respectively. Secondary inorganic aerosols contribution found in winter is about 14% and 17%, respectively for PM<sub>10</sub> and PM<sub>2.5</sub>.

The secondary inorganic aerosol source is a high concentration of nitrate (NO<sub>3</sub><sup>-</sup>), sulphate (SO<sub>4</sub><sup>2-</sup>), and ammonium ((NH<sub>4</sub><sup>+</sup>). These secondary products are formed in the atmosphere, being emitted either by natural or anthropogenic sources. The oxidation of NO<sub>x</sub> forms the secondary nitrate. It is favored by low temperature (Li et al.2004), while high temperature and strong solar radiations favour the formation of secondary sulfates through photochemical reactions (Seinfeldand Pandis, 2016). Secondary inorganic aerosol formation from precursors (SO<sub>2</sub> and

NO<sub>x</sub>) enhances the pollution burden over the vicinity. Biomass burning, presence for metal traces (Fe, Al, Mn, Zn, Cr etc.) from vehicular or industrial emission play key role to neutralise the oxides of nitrogen and sulphur and thus raises the amount of secondary inorganic aerosols in the atmosphere.

#### **4.2.6. Agriculture**

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

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

The contribution of open burning in the summer season is 5% for both PM<sub>10</sub> and PM<sub>2.5</sub>. In Winter, the garbage burning contribution is 6% and 2% for PM<sub>10</sub> and PM<sub>2.5</sub> respectively during study time.

The abundance of tracers like K<sup>+</sup>, Pb, Br and consider-able Cl<sup>-</sup> marks this garbage/biomass burning source. K<sup>+</sup> and levoglucosan are globally employed as biomass burning markers. Biomass consists of residential and agricultural wastes, post-harvest residue, cow dung, dry leaves, fuelwood, and wildfires (Almeida et al., 2006; Khare and Baruah, 2010; Shridhar et al., 2010). The OC and EC are also traced insignificant amount along with K<sup>+</sup>, indicate the biomass burning emanations (Cesari et al., 2018; Sharma et al., 2014; Jain et al., 2018).

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

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

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

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

### 4.3 Inferences

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

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

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

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

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

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

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

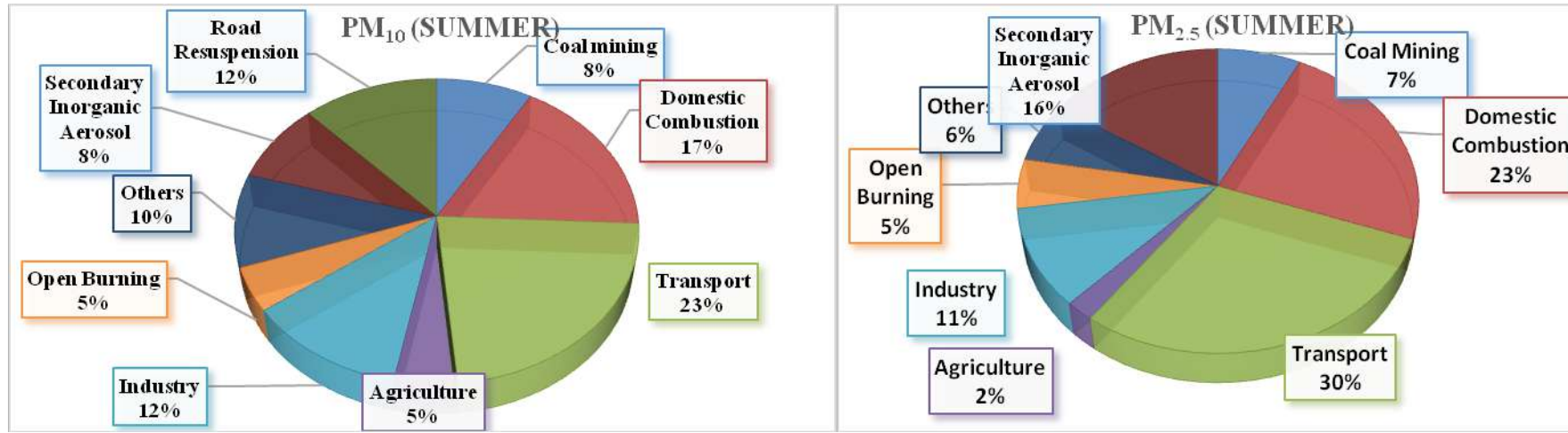


Figure 4.2: Source contribution at receptor locations of PM<sub>10</sub> and PM<sub>2.5</sub> in summer

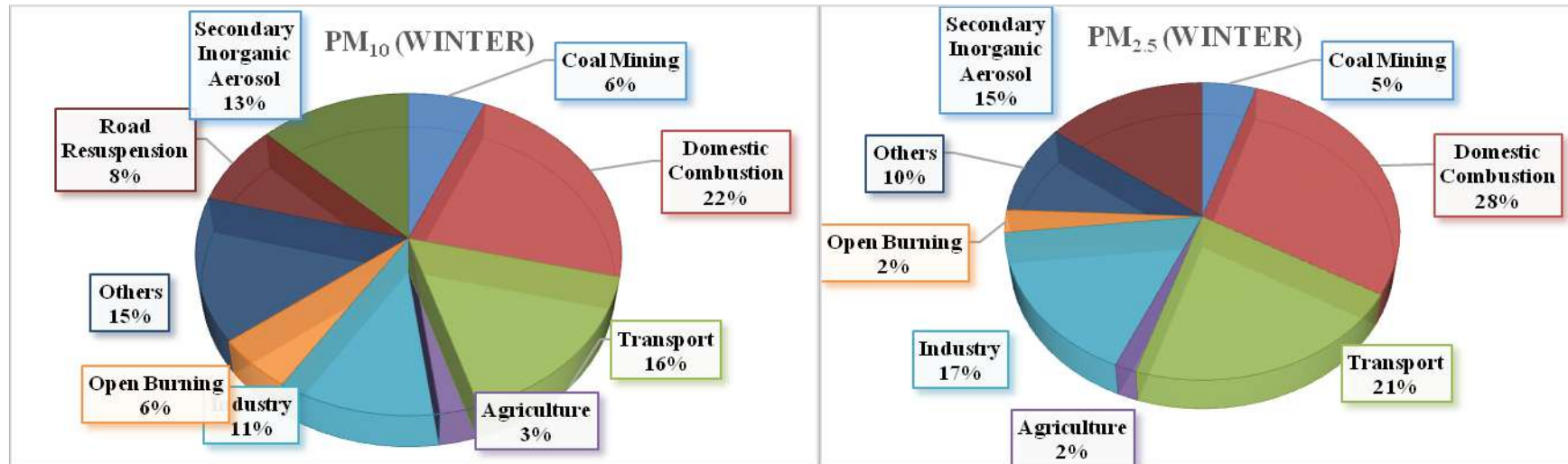


Figure 4.3: Source contribution at receptor locations of PM<sub>10</sub> and PM<sub>2.5</sub> in winter

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

Area/Location	Particle size	Sources	Elements and Ions	References
Delhi	PM10 and PM2.5	Secondary Nitrate, Secondary Sulfate, Vehicular emission, Biomass burning, Soil dust, Fossil fuel combustion, Sodium and magnesium salt, Industrial emission	Al, Mg, Ca, Ti, Fe, Cr, Mn, Zn, As, Pb, Br, M, F <sup>-</sup> , Cl <sup>-</sup> , NO <sub>3</sub> <sup>-</sup> , SO <sub>4</sub> <sup>2-</sup> , K <sup>+</sup> , NH <sub>4</sub> <sup>+</sup> , and Na <sup>+</sup>	Jain et. Al., 2020
Mangalore	PM10 and PM2.5	Construction dust, Diesel generator, Tyre wear emission, Brake lining emission, Sand dust emission, gasoline vehicle emission, Diesel vehicle emission, Unpaved and paved road emission, Biomass burning, LPG stove emission, Solid fuel emission, Ferrous and steel industries emission, Fabrication and welding emission, Kerosene stove emission	As, Ba, Cd, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sr, Zn, F <sup>-</sup> , Cl <sup>-</sup> , NO <sub>3</sub> <sup>-</sup> , PO <sub>4</sub> <sup>3-</sup> , SO <sub>4</sub> <sup>2-</sup> , Na <sup>+</sup> , K <sup>+</sup> , Mg <sup>2+</sup> and Ca <sup>2+</sup>	G. Kalaiarasan et al. 2018
Delhi NCR	PM10 and PM2.5	Dust construction, Vehicle emission, Biomass Burning, Industrial emission, Secondary Pollutants, DG sets emission,	Al, Si, P, S, Cl, Br, V, Mn, Fe, Co, Ni, Cu, Zn, As, Ti, Ca, F <sup>-</sup> , Cl <sup>-</sup> , NO <sub>3</sub> <sup>-</sup> , Br <sup>-</sup> , NO <sub>2</sub> <sup>-</sup> , SO <sub>4</sub> <sup>2-</sup> , Na <sup>+</sup> , K <sup>+</sup> , Mg <sup>2+</sup> and Ca <sup>2+</sup>	Report No. ARAI/16- 17/DHI-SA- NCR/Final Report August 2018
Delhi	PM2.5	Secondary Aerosol, Vehicular emission, Biomass burning, Soil dust, Fossil fuel combustion, Sea salt, Industrial emission	Al, Mg, S, Si, Cl, K, Ca, Ti, Cu, Mn, Fe, Zn, Br, Cr, As, Pb, F <sup>-</sup> , Cl <sup>-</sup> , NO <sub>3</sub> <sup>-</sup> , SO <sub>4</sub> <sup>2-</sup> , K <sup>+</sup> , NH <sub>4</sub> <sup>+</sup> , and Na <sup>+</sup>	Jain et. Al., 2017
Nagpur	PM2.5	DG sets, biomass burning, resuspended dust, secondary aerosol and mobile sources.	Al, Ba, Cd, Cr, Cu, Fe, Mg, Mn, Ni, Pb, Si, Zn. F <sup>-</sup> , Cl <sup>-</sup> , NO <sub>3</sub> <sup>-</sup> , PO <sub>4</sub> <sup>3-</sup> , SO <sub>4</sub> <sup>2-</sup> , Na <sup>+</sup> , K <sup>+</sup> , Mg <sup>2+</sup> and Ca <sup>2+</sup>	Pipalatkhar et al., 2014
Raipur	PM2.5	Brick kiln process, steel re- rolling mills, steel processing  industries, biomass burning, metallurgical industrial emissions and coal burning	Al, As, Ca, Cd, Co, Cr, Cu, Fe, Hg, K, Mg, Mn, Mo, Na, Ni, Pb, S, Sb, Se, V, Zn, Na <sup>+</sup> , K <sup>+</sup> , Mg <sup>2+</sup> NH <sub>4</sub> <sup>+</sup> , F <sup>-</sup> , Cl <sup>-</sup> , NO <sub>3</sub> <sup>-</sup> , SO <sub>4</sub> <sup>2-</sup> , and Ca <sup>2+</sup>	Matawle et al., 2014
Hyderabad	PM10 and PM2.5	Vehicles exhaust, resuspension of dust, secondary sulfates, secondary nitrates, biomass	Na, Mg, K, Al, Si, Ca, Fe, Cl, SO <sub>4</sub> , NO <sub>3</sub> , NH <sub>4</sub> <sup>+</sup>	Guttikunda et al., 2013

		burning, coal burning.		
Pune	PM10 and PM2.5	Vehicles, DG sets, construction dust, solid fuels emissions, resuspended dust	Al, Pb, Cu, Zn, As, Se, Br, Ni, Fe, Mn, Mg, Cr, Ti, Ca, Cd, S, Si, Na, Ba, Sb, Cd, Sr, Cl <sup>-</sup> , NO <sub>3</sub> <sup>-</sup> , SO <sub>4</sub> <sup>2-</sup> , K <sup>+</sup> , NH <sub>4</sub> <sup>+</sup>	ARAI, 2010
Kanpur	PM10 and PM2.5	Vehicles, open burn, road dust, domestic wood, coal and LPG, metal smelting, DG sets.	Cl <sup>-</sup> , NO <sub>3</sub> <sup>-</sup> , SO <sub>4</sub> <sup>2-</sup> , K <sup>+</sup> , NH <sub>4</sub> <sup>+</sup> , Na <sup>+</sup> , Ca <sup>2+</sup> , Mg <sup>2+</sup> , Si, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Se, Cd, Sn, Sb, Pb	CPCB, 2010b
Mumbai	PM10 and PM2.5	Wood combustion, Fuel oil combustion, kerosene combustion, biomass burning, LPG, ammonium sulfate, ammonium nitrate, heavy duty diesel vehicles emissions, soil dust.	Na, Mg, Al, Si, P, S, Cl, Ca, Br, V, Mn, Fe, Co, Ni, Cu, Zn, As, Ti, Ga, Rb, Y, Zr, Pd, Ag, In, Sn, La, Se, Sr, Mo, Cr, Cd, Sb, Ba, Hg, and Pb. F <sup>-</sup> , Cl <sup>-</sup> , Br <sup>-</sup> , NO <sub>2</sub> <sup>-</sup> , NO <sub>3</sub> <sup>-</sup> , SO <sub>4</sub> <sup>2-</sup> , K <sup>+</sup> , NH <sub>4</sub> <sup>+</sup> , Na <sup>+</sup> , Ca <sup>2+</sup> , Mg <sup>2+</sup>	CPCB, 2010a
Chennai	PM10 and PM2.5	Vehicles, DG sets, bakeries, soil dust, construction dust, paved road dust, kerosene and LPG emissions.	As, Ag, Ca, Na, Fe, Mg, Cu, Zn and other metals. Cl <sup>-</sup> , NO <sub>3</sub> <sup>-</sup> , SO <sub>4</sub> <sup>2-</sup> , K <sup>+</sup> , NH <sub>4</sub> <sup>+</sup> , Na <sup>+</sup> , Mg <sup>2+</sup>	IIT Madras, 2010
Bangalore	PM10 and PM2.5	Petrol vehicles, diesel vehicles, secondary particulates, fuel oil burning, wood domestic wood burning, DG set, kerosene generator set, paved road dust re suspension, soil dust.	Na, Mg, Al, Si, P, S, Cl, Ca, Br, V, Mn, Fe, Co, Ni, Cu, Zn, As, Ti, Ga, Rb, Y, Zr, Pd, Ag, In, Sn, La, Se, Sr, Mo, Cr, Cd, Sb, Ba, Hg, and Pb. F <sup>-</sup> , Cl <sup>-</sup> , Br <sup>-</sup> , NO <sub>2</sub> <sup>-</sup> , NO <sub>3</sub> <sup>-</sup> , SO <sub>4</sub> <sup>2-</sup> , Na <sup>+</sup> , K <sup>+</sup> , Mg <sup>2+</sup> and Ca <sup>2+</sup>	TERI, 2010

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

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## Chapter 5

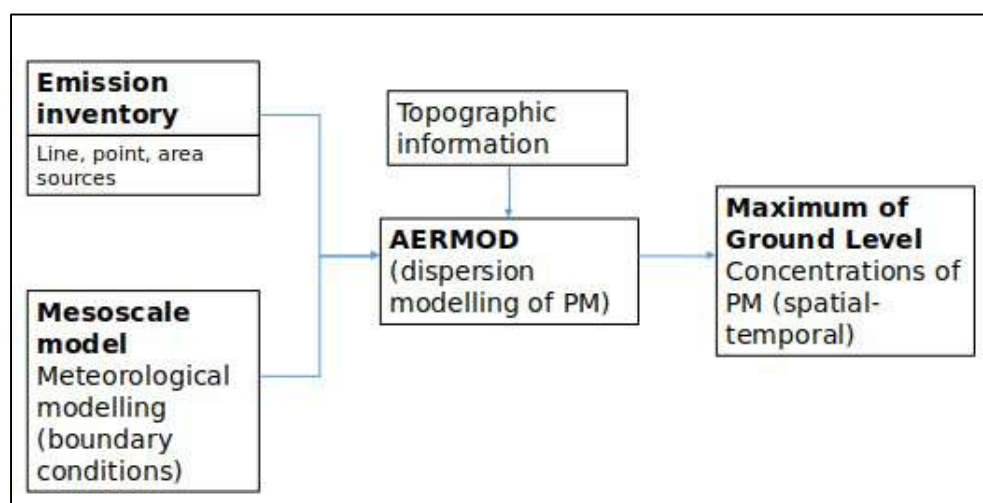
### Dispersion Modelling

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

#### 5.1. Wind data analysis

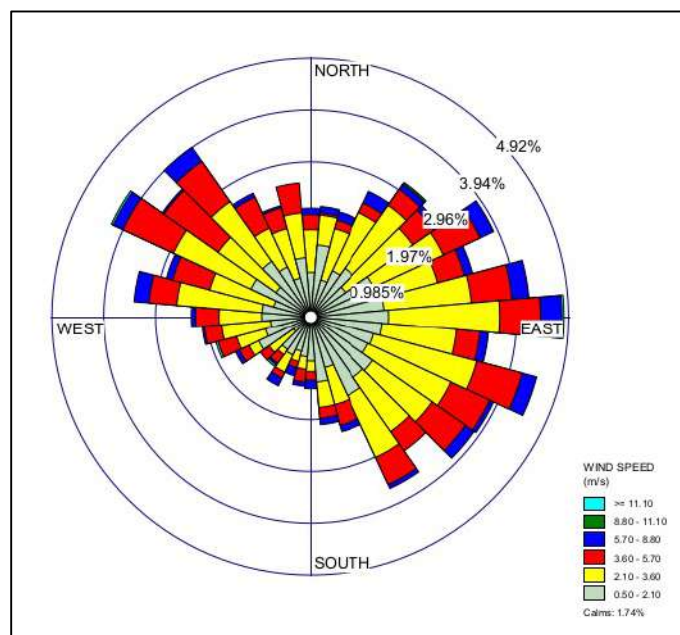
The nearest IMD (India Meteorological Department) observations are at Patna and Kolkata, which are approximately >150 km from the study area. Hence, hourly meteorological observations required for the study for AERMOD dispersion model were simulated through the Weather Research and Forecast, version-3.9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

**Figure 5.1: Methodology followed in the study.**

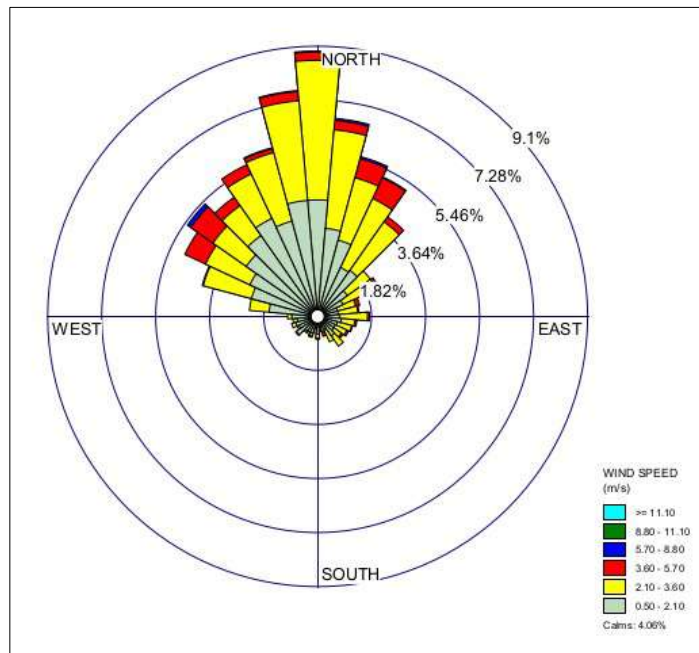


The mesoscale model interface program MMIF (<https://www.epa.gov/>) converter tool was used to convert the inner domain's gridded WRF model simulated meteorological data into a format suitable for the AERMOD model. The AERMOD receptor grid covering the study area is shown in Figure 5.3. A Cartesian receptor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

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



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



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

## 5.2. Dispersion of Particulate matter

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

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

Analysis of WRF model simulated wind speed and direction data shows that the wind is predominantly flowing from south-east direction to north-west direction, followed by the reversal in the direction, during the monitoring in summer, representing pre-monsoon conditions

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

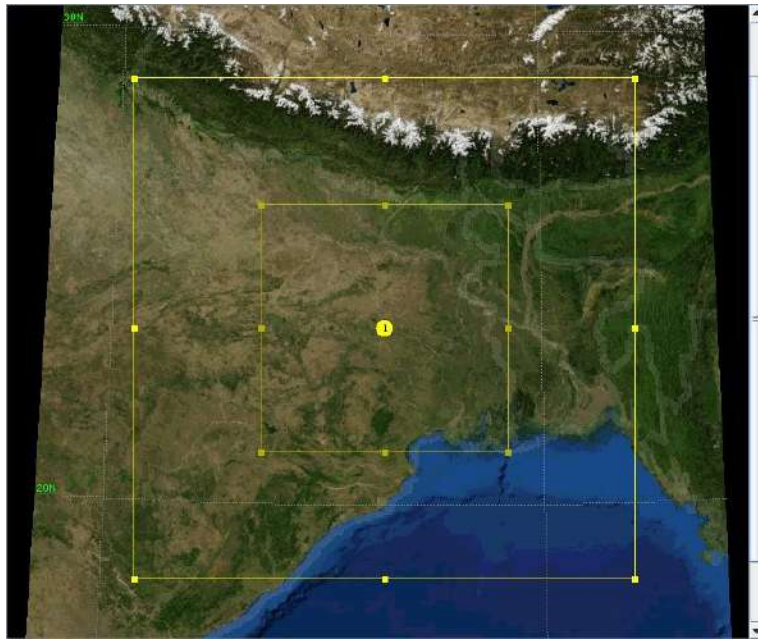
The wind blowing from different directions in the study area determines the direction of pollution dispersion. The Gaussian plume equation used in the AERMOD model estimates the diffusion and advection of the pollutants with respect to the emission rates and meteorology (wind speed, direction and atmospheric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

The analysis of the PM<sub>10</sub> and its maximum GLC simulated by the AERMOD model for winter season also follows a similar pattern as of summer. The contribution of line sources, open cast mines, and all sources included are 1565, 597, and 1679  $\mu\text{g}/\text{m}^3$ , respectively. The PM<sub>2.5</sub> maximum GLCs during the winter are 1004, 299, 1167  $\mu\text{g}/\text{m}^3$  as contributed by line, open cast mines, and all sources including, respectively. Based on the emission inventory and the prevailing meteorological conditions during winter season have in general contributed to the higher particulate matter than that of summer season.

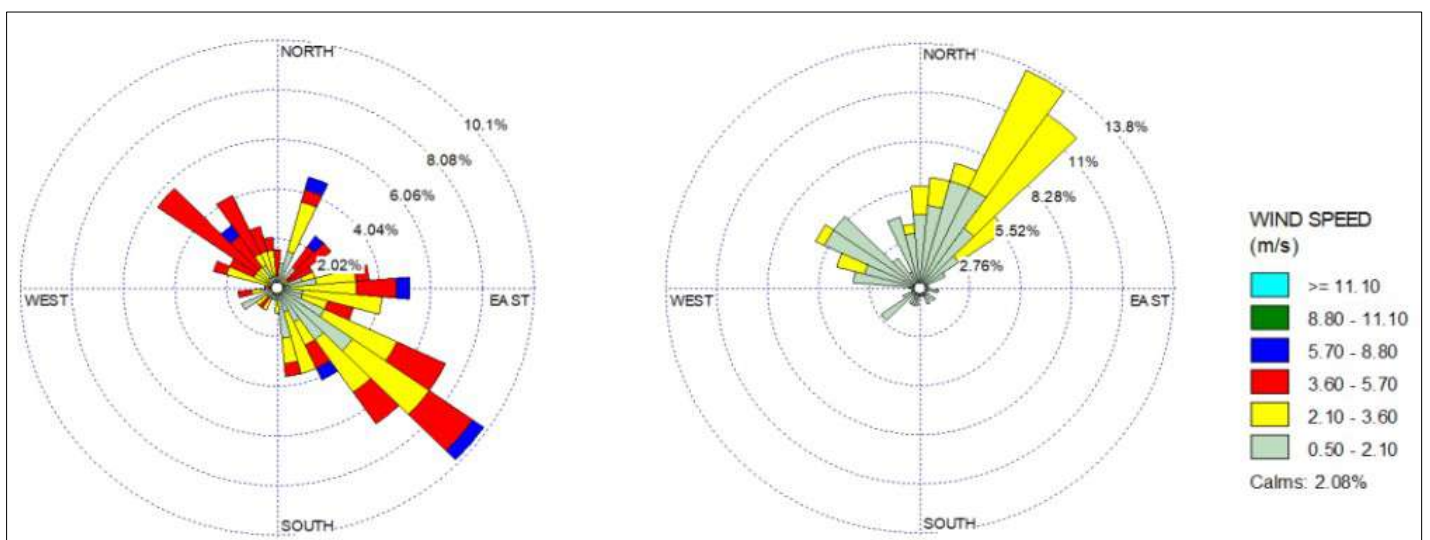
Pockets of maximum concentrations of PM<sub>10</sub> (200-1000  $\mu\text{g}/\text{m}^3$  and above) are observed in the vicinity to roads that nearer to the open cast mines south of Dhanbad City during the winter **(Figure 5.5)**. The localities of the high concentrations of PM<sub>10</sub> are Sabji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

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

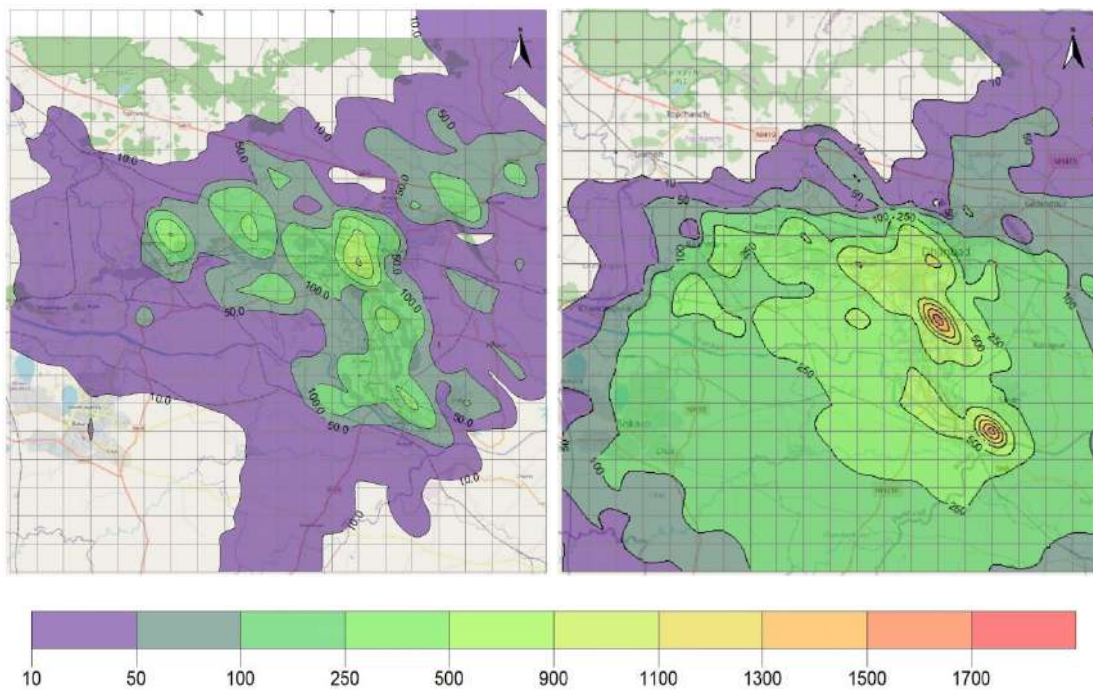
is nearly similar. High concentrations of  $PM_{2.5}$  ( $100-500 \mu\text{g}/\text{m}^3$ ) are observed in the south-west direction of Dhanbad City (**Figure 5.6**). The maximum GLC of  $PM_{10}$  is found to be higher than  $PM_{2.5}$  during both the monitoring seasons, and higher concentrations are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



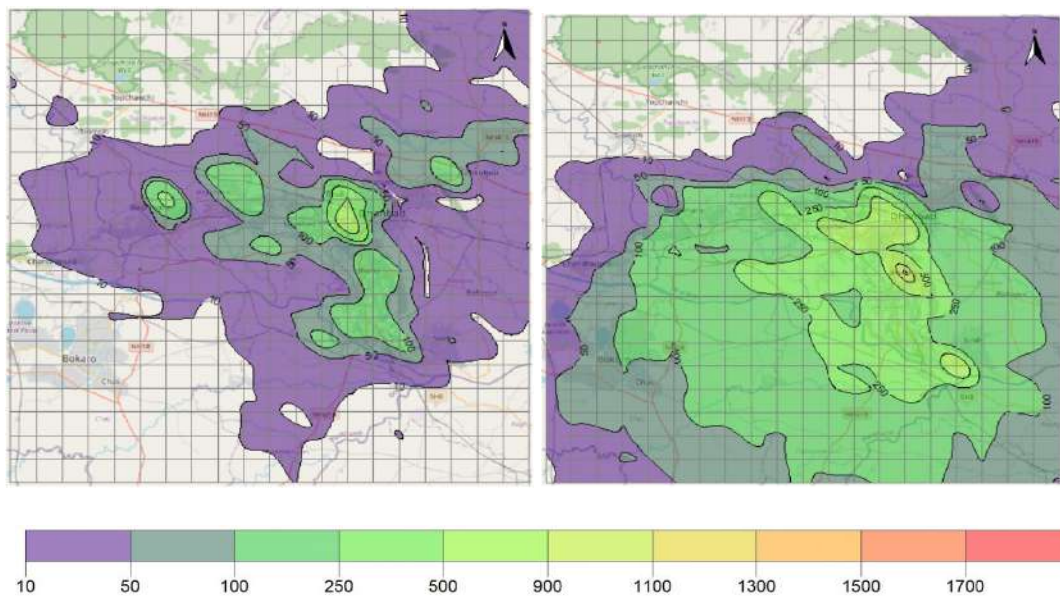
**Figure 5.1: AERMOD grid covering the Jharia Coal Fields (JCF). The line, area, and point sources covered in the study are indicated in red color. The UTM coordinates of the left bottom point are  $x=406111$  and  $y=2603492$ , and the coordinates of the right top point are  $x=456248$  and  $y=2653417$ .**



**Figure 5.2 :** Windrose diagram for the summer (left) and winter seasons (right) at Jharia Coal Fields during the sampling period. Wind direction is flowing towards the center.



**Figure 5.3 (a):** 24-hour average maximum ground level concentration of  $PM_{10}$  ( $\mu g/m^3$ ) contours in the study area simulated during the study periods in summer (left) and winter (right) seasons.



**Figure 5.6 (b):** 24 hour average maximum ground level concentration of  $PM_{2.5}$  ( $\mu g/m^3$ ) contours in the study area simulated during the study periods in summer (left) and winter (right) seasons.

## Chapter 6: Recommendation

### Mine industries

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

### Area Sources

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

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

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

### **Line Source**

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

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

### **Others:**

- There is a need to explore various options for controlling air pollutants to tackle increased emissions in future.

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

Annexure-

## **WATER HARVESTING & ARTIFICIAL RECHARGE**

Coal mining is the major industrial activity in the area. Ground water pumping is an integral part of mine management for safe and efficient coal extraction. Pumping from both underground and opencast mines may affect groundwater table near the mine area. In coal mining area the impact is observed to be mostly limited to 500 m from the mine boundary. Mining activity also creates high permeability aquifer zones during backfilling activities in opencast mines and depillaring/caving activities in underground mines. Besides this, groundwater utilization is mainly for domestic and irrigation use in the study area.

To minimize the impact of mining on ground water system, the project/mine authority has been adopting all possible measure to increase the ground water recharge potential.

The stage of ground water development in the buffer zone (10 km from the periphery of the core zone) of Cluster-X mines comes to about 40.15%. As per the data collected from the Central Ground Water Board, Ranchi, the stage of ground water development in the Jharia Block in which Cluster-X project and its buffer zone located is 53.62% in year 2004 and 105.63% in year 2008-09. CGWB observation well located at Jharia does not show any declining trend. The area falls within the "Critical" to "Overexploited category but both pre monsoon and post monsoon ground water level do not show any significant long term declining trend. Rather the pre-monsoon water level shows a rising trend. Again, core zone of cluster X is located in the discharge area near Damodar River. Therefore artificial recharge can be done in the buffer zone of the Cluster-X.

Artificial recharge has to be done to check the lowering of water level in the study area using rainwater harvesting and surplus mine water.

Groundwater inflow (11825 m<sup>3</sup>/day) and mine influence area (maximum 500 m from the mine edge) have been estimated and the groundwater monitoring would be undertaken as corrective measure to avoid adverse effects. The mine discharge after passing through sedimentation tank is being discharged onto local jore / nala with check dams at suitable locations so that the groundwater gets additional recharge by the return flow.

The impact on ground water level will be minimized by artificial recharge by spreading of pumped out water, creation and filling of ponds with mine water and construction of rainwater harvesting structure.

Rain Water harvesting is a deliberate collection and storage of rain water that runs off on natural and man-made catchment area. The amount of water harvested depends on the frequency and intensity of the rain fall and characteristics of the catchment to allow the precipitate to infiltrate through the sub-soil and percolate down to recharge aquifers.

It is therefore proposed that during mining operation the rain water within the mining area will be accumulated in earthen water pool developed on the surface which will not only be helpful in re-charging the ground water of the area but will fulfil the non-drinking water demand of nearby inhabitants also.

Necessary check dams (Figure No-2) have been/will be made in the nala for recharging ground water aquifer. Roof-top rainwater harvesting (Figure No-3) will be taken up in the project area using the administrative buildings if required. Rainwater harvesting and artificial recharge will also take place through abandoned dug-wells and final voids of old mines for increasing ground water potential and check water level lowering.

**Check dams / Nala bunds** – Runoff conservation structures like check dams, nala bunds are constructed over the stream / nala bed thereby increasing the contact period of rainwater with the underlying formation. It is commonly

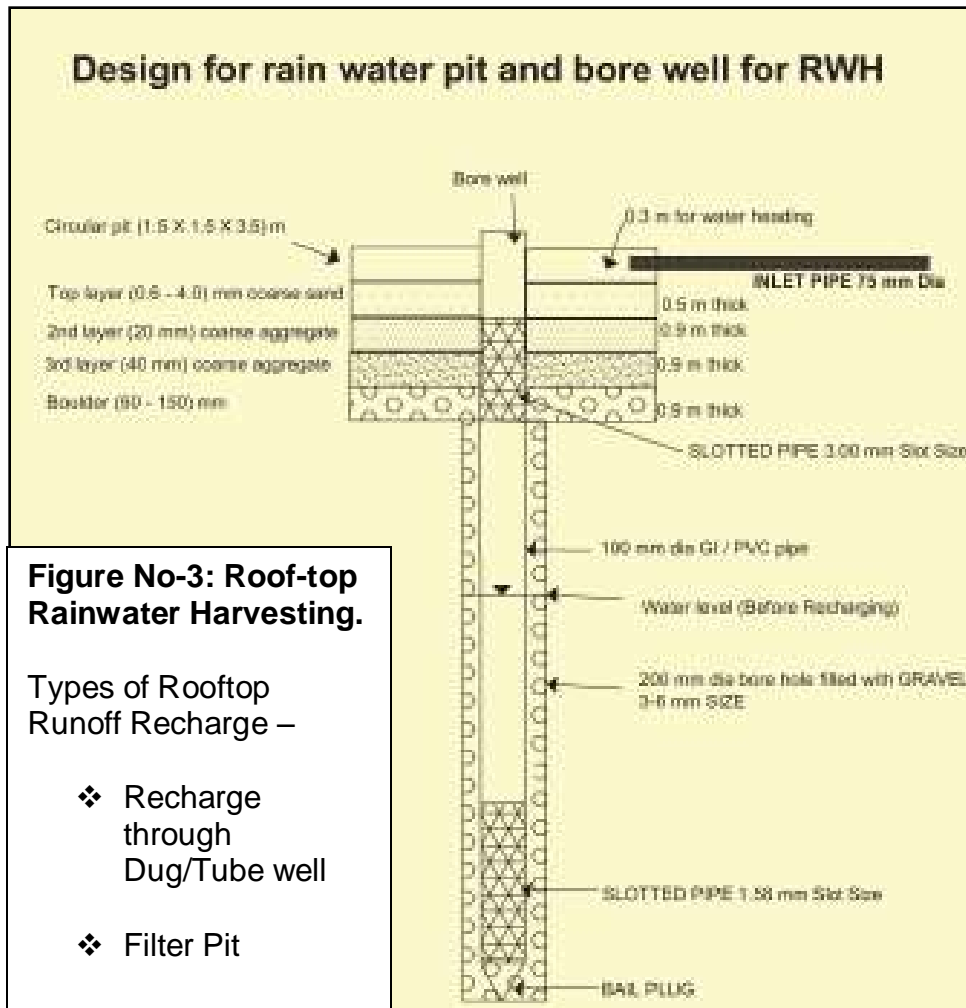
constructed across small streams with gentle slope and there is no submergence beyond stream course. The site selected should have sufficient thickness of permeable bed / weathered formation to facilitate recharge within short span of time. A check dams in Kari jore near Dhansar Colliery (western part) and another one at Nagri jore near Jogta/Nischitpur OC is provided to facilitate groundwater recharge.



**Figure No-2: Check Dams / Nala bunds.**

### **Rooftop Runoff Recharge –**

- ❖ **Recharge through existing Dug/Tube well –** In areas where shallow aquifers have dried up and existing Dug/Tube wells are tapping deeper aquifer, rooftop rainwater harvesting through existing wells can be adopted to recharge the aquifers.
- ❖ **Filter Pit –** If the roof area is more, to accommodate excess rainwater a filter pit may be constructed. The shape and size of the filter pit is depending upon available runoff.



**Recharge Pit** – The abandoned underground mine workings can be used as recharge pit which can act as artificial recharge structure to augment the recharge of deeper aquifers. It behaves as huge ground water reservoirs and contains groundwater runoff (i.e. planned recharge). After mine closure, voids of opencast and underground workings will be waterlogged. This will help in maintaining the water table in the surrounding areas and may become a source of water supply to the community. Out of 115.15 Ha of abandoned quarry in the core zone of Cluster-X, 46.15 Ha has already been backfilled. Remaining area of 69.00 Ha will be act as water body to recharge the groundwater.

**Recharge through Dug well** – Existing dug wells may also be used as recharge wells, as and when source water become available. In areas where

considerable de-saturation of aquifers have already taken place due to over-exploitation of groundwater resources resulting in the drying up of dug wells and lowering of piezometric head in bore/tube wells. Existing groundwater abstraction structures can be used as cost-effective mechanism for artificial recharge of the phreatic or deeper aquifer zones. Dug well has been made near or within the small streams / nala / jore to augment the groundwater recharge. Water is percolating from flowing stream into groundwater systems through dug wells.

**Water harvesting through Settling tank and Percolation tank** -These is an artificially created surface water body, submerging in its reservoir a highly permeable land so that surface runoff is made to percolate and recharge the ground water storage. Percolation tank should be located on highly fractured and weathered rock with lateral continuity. The size of the tank should be governed by the percolation capacity of strata in the tank bed.

The surplus mine water will be given to the local people for irrigation. Utilization of mine water for irrigation use will also enhance the ground water recharge potential through artificial recharge in the area.

The pond, tanks, stop dams etc constructed in the rehabilitated and affected villages also augment the groundwater recharge.

Efforts are being made to construct more recharge structures at suitable sites in the nearby villages in consultation with Central Ground Water Board.

Creation of awareness among workers and local peoples about rain water harvesting and artificial recharge will be given priority. This aspect is usually covered during the Environmental Week celebrated every year (5 to 12 June).



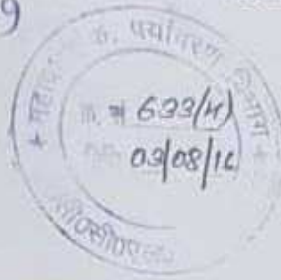
**cmpdi**  
A Mini Ratna Company

सटल माइन प्लानिंग एण्ड डिजाइन इंस्टीट्यूट लिमिटेड  
( कोल इंडिया लिमिटेड की अनुषंगी कम्पनी / भारत सरकार की एक लोक उपक्रम )  
पंजीकृत कार्यालय : गोनदवना प्लेस, कान्के रोड, राँची - 834031 ( झारखण्ड ) भारत  
क्षेत्रीय संस्थान-2, पत्रा. बीसीसीएल टाउनशिप, कोयला नगर, धनबाद 826005 (झारखण्ड) भारत  
**Central Mine Planning & Design Institute Limited**  
( A Subsidiary of Coal India Limited / Govt of India Public Sector Undertaking )  
Registered Office : Gondwana Place, Kanke Road, Ranchi -834031(Jharkhand)  
Regional Institute-II, P.O. BCCL Township, Koytanagar, Dhanbad 826005(Jharkhand) India  
Corporate Identity No. U14292JH1975GOI001223

पत्रांक: आर.आई.-2/पर्यावरण/एम-30/1967-69

दिनांक: 02.08.2016  
03.

सेवा में,  
✓ विभागाध्यक्ष (पर्यावरण)  
बी. सी. सी. एल.  
कोयला भवन  
धनबाद



विषय: Study of Installation of Rail-cum-Conveyor System in BCCL for transportation of coal.

- संदर्भ: पत्र संख्या: 1. सी.एम.पी.डी.आई./पर्यावरण /2016/663, दिनांक: 14.07.2016,  
2. BCCL/Dy.GM (Env)/F-EMP/16/1314-15 (M), Dated: 23.06.2016,  
3. आर.आई.- 2/पर्यावरण / एम-30/1150, दिनांक : 20.06.2015.  
4. E-17719

महोदय,

In reference to your letter no. BCCL/Dy.GM (Env)/F-EMP/16/1314-15 (M), Dated: 23.06.2016, to GM (Env), CMPDI-HQ, it has already been indicated in letter no.आर.आई.-2/पर्यावरण / एम-30/1150, दिनांक : 20.06.2015 that study for installation of Rail-cum-Conveyor System in BCCL for transportation of coal can be started only after the liquidation of coal mine fire, rehabilitation of 595 unstable sites, road realignment and relocation of railway sidings of BCCL and final report of RITES in regard to realignment of railway lines.

This is for your kind information.

Sri Anand Kumar Act Mgr (Env)  
for record  
4.8.16.

Sri. M. Kumar  
3/8/16

भवदीय  
(वि.कु. सिन्हा) 16  
क्षेत्रीय निदेशक

प्रतिलिपि:

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

### CLUSTER X GROUP OF MINES

**Bhowrah North (UG), Bhowrah North (OC), Bhowrah South (UG),  
3 Pit OCP, Chandan OCP (Bhowrah), Patherdih (UG), Chandan OCP  
(Patherdih), Sudamdih Incline (UG), Sudamdih Shaft (UG), Amlabad  
(UG) Closed, Sudamdih Coal Washery (Within the lease hold of  
Sudamdih Shaft Mine)**

Normative Production : 1.762 MTPA  
Peak Production : 2.289 MTPA  
Lease Hold Area : 2057.47 Ha

**Bharat Coking Coal Limited**

(July, 2019)

Prepared by

**Environment Division  
Central Mine Planning & Design Institute Limited  
CMPDI (HQ)  
Gondwana Place  
Kanke Road, Ranchi-834008**

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## **Chapter – I**

### **Introduction**

#### **1.1 Genesis:**

MOEF provided Environmental Clearance to the various mines of the Cluster J-11015/380/2010-IA.II (M) Dated 06.02.2013 As per the Environmental Clearance Conditions given by the Ministry of Environment & Forest “A study should be initiated to analyse extent of reduction in pollution load every year by reducing road transport of coal”. Therefore the present study has been carried out to quantify the pollution load due to coal transportation.

#### **1.2 Methodology:**

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

#### **1.3 General Information about the Cluster:**

##### **1.3.1 Brief Description:**

Cluster X mines of BCCL consists of six mines, Bhowrah North (Mixed UG and OC), Bhowrah South (Mixed UG and OC that are 3 Pit OCP Chandan OCP), Patherdih (Mixed UG and OC that is Chandan OCP), Sudamdih Incline (UG), Sudamdih Shaft (UG) are operating mines and one closed Amlabad (UG) mine . There is also one existing Sudamdih coal washery. This cluster is located in the Eastern part of the Jharia coalfield. These mines are taken over by BCCL from private mine owners after nationalization through Coal Mines Nationalization Act, 1972-73. BCCL is the proponent of the cluster and it is under the administrative control of Coal India Limited.

### 1.3.2 Nature and Size of the Cluster:

(Mixed UG and OC), Bhowrah South (Mixed UG and OC that are 3 Pit OCP Chandan OCP), Patherdih (Mixed UG and OC that is Chandan OCP), Sudamdih Incline (UG), Sudamdih Shaft (UG) are operating mines . There is one closed Amlabad (UG) mine. There is also one existing Sudamdih coal washery. The cluster falls in Eastern Jharia Area of Jharia Coalfield part of the Bharat Coking Coal Limited in the Dhanbad District of Jharkhand state. BCCL is the proponent of the cluster and it is under the administrative control of Coal India Limited. Coal India Limited is a Public Sector Undertaking of Government of India and functioning under the Ministry of Coal, Govt. of India.

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

**Table 1.1: Details of the Mines of Cluster –X**

SI No	Name of Mines	Production Capacity (MTY)		Lease Hold Area (Ha)
		Normative	Peak	
1	Bhowrah North (UG)	0.11	0.143	208.83
2	Bhowrah North (OC)	0.42	0.546	
3	Bhowrah South (UG)	0.29	0.377	571.58
4	3 Pit OCP	0.235	0.305	
5	Chandan OCP(Bhowrah)	0.158	0.205	
6	Patherdih (UG)	0.054	0.070	244.34
7	Chandan OCP (Patherdih)	0.22	0.286	
8	Sudamdih Incline (UG)	0.09	0.117	254.27
9	Sudamdih Shaft (UG)	0.185	0.240	391.50
10	Amlabad (UG) Closed	0	0	386.95
	<b>Total</b>	<b>1.762</b>	<b>2.289</b>	<b>2057.47</b>
11	Sudamdih Coal Washery (Within the lease hold of Sudamdih Shaft Mine)	1.6	2.08	18

### **1.3.3 Impact of Fire Control on Ambient Air Quality:**

Due to unscientific mining prior to nationalization there are unstable sites identified in the BCCL. Out of 595 unstable sites identified in the Master Plan, 15 sites consisting of 2187 no. of houses/families are affected. The affected families will be rehabilitated in adjacent non coal bearing area at a cost of Rs. 11199.89 lakhs

### **1.3.4 Impact of Resettlement on Ambient Air Quality:**

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

## **1.4 Meteorological Data**

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

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

The analysis of wind pattern during the season showed that the predominant wind directions were from North-West & West followed by North-East having frequencies 15.71%, 11.45% & 4.67% respectively. The receptors located in the Downwind directions i.e. SE and East from the dust generating sources are likely

to be affected. The dispersion of air borne dust during calm period (45% of time) will be very poor and buildup of pollutant concentration during this period will occur.

The maximum temperature recorded was 39.3<sup>0</sup>C and the minimum was 6.2<sup>0</sup>C. The daily average relative humidity values were in the range of 32.2 to 65.0%. The sky was mostly clear during the study period. The average atmospheric pressure value has been found to be around 732.3 mm Hg. Total 94.5mm rainfall was recorded during the study period. The average rainfall during the season was found to be 1.04 mm.

**Table 1.2: SEASONAL WIND DISTRIBUTION**

Period: 01<sup>st</sup> JAN.'2016 – 31<sup>st</sup>MAR.'2016

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

Wind Direction	Wind Velocity (m/s) & Duration (%)				
	< 0.5	0.6 -1.5	1.6 -3.5	>3.5	Total
CALM	44.97	-	-	-	44.97
Total	44.97	37.32	17.56	0.15	100

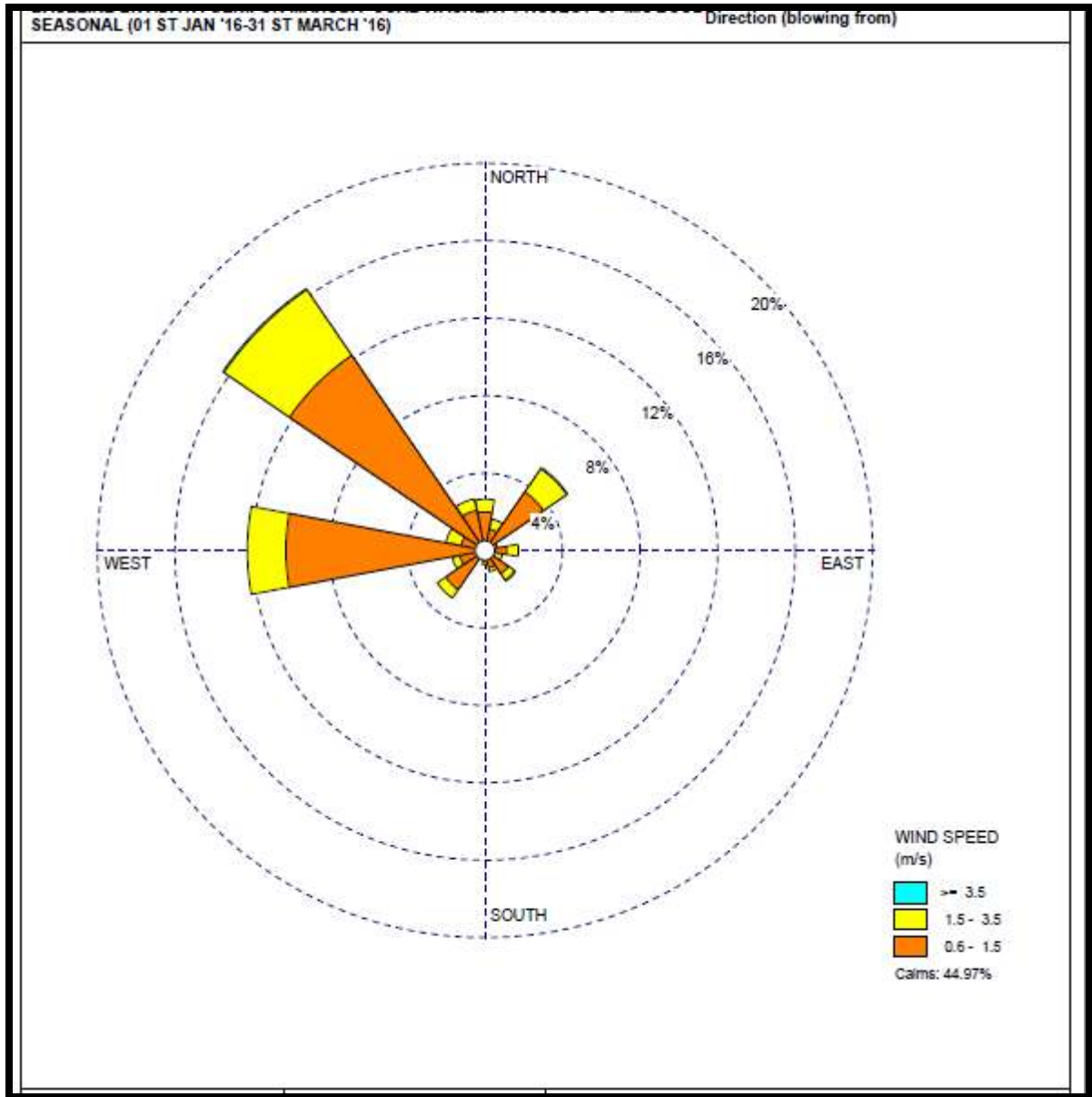


Figure No.-1.1 Wind Rose diagram for the period 1<sup>st</sup> Jan to 31<sup>st</sup> March 2016

## Chapter – II

### Fugitive Dust Generation Due To Movement of Coal

#### 2.1 Introduction

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

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

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

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

#### 2.2 Movement of Coal

Distance travelled by coal and subsequent release of fugitive dust during its journey towards the consumer end has been described and dust load has been worked out for the year 2013-14, 2014-15 and 2015-16.

## 2.2.1 Cluster X Dust Generation (Kg/day):

**Table: 2.1 Dust Generation (Kg/day)**

Dust generated per day (Kg/Day)											
Name of the Mine	Year	Location	Distance from Face to Siding (Km)	Coal Transferred (Te)	Daily Coal Production (Te/Day)	Capacity of the Dumper	Vehicle Kilometer Travelled	Emission Rate for PM 10 ( kg/VKT)	Pollution Load * Dust Generated Per Day (Kg/day)	Dust generated Kg/per tonne	
Bhowra South	13-14	Sudmadih washery	6	11888.66	36.00	14	30.86	0.53	16.354		
	13-14	Other Consumers	20	28226.29	86.00	14	245.71	0.53	130.229		
	13-14	workshop	0.5	120	0.00	14	0.00	0.53	0.000		
		<b>Total for 13-14</b>			<b>122.00</b>					<b>146.583</b>	1.20
	14-15	Sudmadih washery	6	3495.82	11.00	14	9.43	0.53	4.997		
	14-15	Munidih washery	20	2014.34	6.00	14	17.14	0.53	9.086		
	14-15	workshop	0.5	120	0.00	14	0.00	0.53	0.000		
	14-15	Other Consumers	20	26230.52	79.00	14	225.71	0.53	119.629		
		<b>Total for 14-15</b>			<b>96.00</b>					<b>133.711</b>	1.39
	15-16	Sudmadih washery	6	4232.18	13.00	14	11.14	0.53	5.906		
15-16	Other Consumers	20	24238.9	73.00	14	208.57	0.53	110.543			

Dust generated per day (Kg/Day)										
Name of the Mine	Year	Location	Distance from Face to Siding (Km)	Coal Transferred (Te)	Daily Coal Production (Te/Day)	Capacity of the Dumper	Vehicle Kilometer Travelled	Emission Rate for PM 10 ( kg/VKT)	Pollution Load * Dust Generated Per Day (Kg/day)	Dust generated Kg/per tonne
	15-16	workshop	0.5	120	0.00	14	0.00	0.53	0.000	
		<b>Total for 15-16</b>			<b>86.00</b>				<b>116.449</b>	1.35
Bhowra (North) u/g mines	13-14	Sudmadih washery	6	4232.18	13.00	14	11.14	0.53	5.906	
	13-14	Other Consumers	20	24238.9	73.00	14	208.57	0.53	110.543	
	13-14	workshop	0.5	120	0.00	14	0.00	0.53	0.000	
		<b>Total for 13-14</b>			<b>13.00</b>				<b>116.449</b>	8.96
	14-15	Sudmadih washery	6	2366.92	7.00	14	6.00	0.53	3.180	
	14-15	Munidih washery	20	1398.73	4.00	14	11.43	0.53	6.057	
	14-15	workshop	0.5	120	0.00	14	0.00	0.53	0.000	
	14-15	Other Consumers	20	26219.77	79.00	14	225.71	0.53	119.629	
		<b>Total for 14-15</b>			<b>90.00</b>				<b>128.866</b>	1.43
	15-16	Sudmadih washery	6	3092.46	9.00	14	7.71	0.53	4.089	
	15-16	workshop	0.5	120	0.00	14	0.00	0.53	0.000	
	15-16	Other Consumers	20	21299.27	65.00	14	185.71	0.53	98.429	
	<b>Total for 15-16</b>			<b>74.00</b>				<b>102.517</b>	1.39	
Sudam dih incline (ASDI)	13-14	Sudmadih washery	3	14806.94	45.00	14	19.29	0.53	10.221	
	13-	workshop	0.5	29	0.00	14	0.00	0.53	0.000	

Dust generated per day (Kg/Day)										
Name of the Mine	Year	Location	Distance from Face to Siding (Km)	Coal Transferred (Te)	Daily Coal Production (Te/Day)	Capacity of the Dumper	Vehicle Kilometer Travelled	Emission Rate for PM 10 ( kg/VKT)	Pollution Load * Dust Generated Per Day (Kg/day)	Dust generated Kg/per tonne
	14									
		<b>Total for 13-14</b>			<b>45.00</b>				10.221	0.23
	14-15	Sudmadih washery	3	27204.78	82.00	14.00	35.14	0.53	18.626	
	14-15	Munidih washery	20	412.66	1.00	20.00	2.00	0.53	1.060	
	14-15	MPL	20	7862.26	24.00	14.00	68.57	0.53	36.343	
		<b>Total for 14-15</b>				<b>106.00</b>			56.029	0.53
	15-16	Sudmadih washery	3	14263.52	43.00	15.00	17.20	0.53	9.116	
	<b>Total for 15-16</b>				<b>43.00</b>			<b>9.116</b>	0.21	
Patherdih u/g (ASP)	13-14	Sudmadih washery	3	14090.58	43.00	14.00	18.43	0.53	9.767	
	13-14	workshop	4	120	0.00	14.00	0.00	0.53	0.000	
		<b>Total for 13-14</b>				<b>43.00</b>			<b>9.767</b>	0.23
	14-15	Sudmadih washery	3	5128.19	16.00	14.00	6.86	0.53	3.634	
	14-15	workshop	4	20	0.00	14.00	0.00	0.53	0.000	
	14-15	Other Consumers	20	3442.17	10.00	14.00	28.57	0.53	15.143	
		<b>Total for 14-15</b>				<b>26.00</b>			<b>18.777</b>	0.72
COC Patherdih (ASP)	13-14	Sudmadih washery	3	27899.58	85.00	14.00	36.43	0.53	19.307	
	13-14	MPL	20	88044.23	267.00	14.00	762.86	0.53	404.314	
	13-	By Rail (Durgapur	1	1535.81	5.00	14.00	0.71	0.53	0.379	

Dust generated per day (Kg/Day)										
Name of the Mine	Year	Location	Distance from Face to Siding (Km)	Coal Transferred (Te)	Daily Coal Production (Te/Day)	Capacity of the Dumper	Vehicle Kilometer Travelled	Emission Rate for PM 10 ( kg/VKT)	Pollution Load * Dust Generated Per Day (Kg/day)	Dust generated Kg/per tonne
	14	steel plant)								
		<b>Total for 13-14</b>			<b>90.00</b>				<b>424.000</b>	4.71
	14-15	Sudmadih washery	3	11459.74	35.00	14.00	15.00	0.53	7.950	
	14-15	W-III washery	3	24128.06	73.00	14.00	31.29	0.53	16.581	
	14-15	Other Consumers	20	15074	46.00	14.00	131.43	0.53	69.657	
		<b>Total for 14-15</b>			<b>81.00</b>				<b>94.189</b>	1.16
	15-16	Sudmadih washery	3	50234.35	152.00	14.00	65.14	0.53	34.526	
		<b>Total for 15-16</b>			<b>152.00</b>				<b>34.526</b>	0.23

\* In terms of PM 10 expressed as kg/day, \*\* Average distance has been considered .## Emission rate for PM<sub>10</sub> has been taken from the S&T work (funded by MoC) carried out by CMPDI during 2002-2007.

### **2.3 Optimum Coal Transportation scheme in the Present Scenario:**

#### **Phase – I (for 10 + 05 Years)**

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

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

#### **Phase – II (after 15 Years):**

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

During 2015-16, the combined daily coal production of the Cluster was 355 tones resulting in 263 kg of daily fugitive dust generation. The dust (PM-10) generation rate at present is 0.10 kg/te.

As a result of replacement of existing road transportation of coal by Conveyor to railway siding will result in reduction of fugitive dust generation to the extent of 5131 kg/day for daily coal production of 6936 tonnes (2.289 MTY) during Phase –II.

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

<b>Cluster</b>	<b>Production Capacity (MTY)</b>	<b>Proposed Transport Infrastructure in Phase – II</b>
X	2.289	<b>Coal transport by Conveyor to Railway Siding</b>
	6936 tonnes /Day	

## **2.5 Conclusion:**

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

### **Phase – I :( 2013-14 to 2028 -29) :**

1. During Phase – I, business as usual(BAU) scenario will prevail and the existing road cum rail transport network system will be used for coal dispatch to the consumers. During 2015-16, the combined daily coal production of the Cluster was 355 tones resulting in 263 kg of daily fugitive dust generation. The dust (PM-10) generation rate at present is 0.10 kg/te.
2. The generation of fugitive dust due to transportation of coal by road can be further reduced by enforcing covering of loaded trucks, periodical removal of loose materials lying on the road surface and black topping of coal transportation roads.
3. Avenue plantation, effective wetting of the road surface and proper maintenance of roads will further result in mitigation of the impact of road generated dust on ambient air quality.
4. Better road condition, by the use of Mechanical Sweeper or vacuum cleaner dust generation may be minimized.

**Phase – II :( From 2029-30 Onwards):**

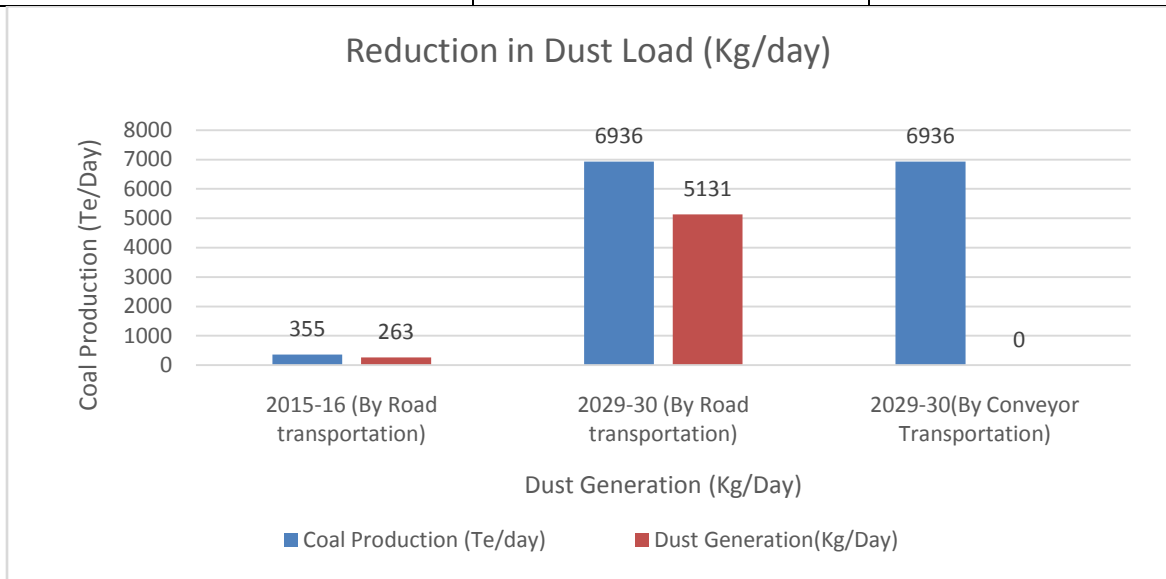
As a result of replacement of existing road transportation of coal by Conveyor to railway siding will result in reduction of fugitive dust generation to the extent of 5131 kg/day for daily coal production of 6936 tonnes (2.289 MTY) during Phase –II.

1. During Phase –II, dust load will further reduce due to quenching of mine fire and domestic coal consumption after resettlement of general population dwelling within the command area of cluster, as a result of implementation of Jharia Action Plan. It will result in significant improvement in ambient air quality.

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

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

Year	Coal Production (Te/day)	Dust Generation(Kg/Day)
2015-16 (By Road transportation)	355	263
2029-30 (Considering peak production and all the coal transported through Road)	6936	5131
2029-30(By Conveyor Transportation)	6936	0



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

**CSR ACTIVITY PLAN  
OF  
CLUSTER – X**

**AS PER**

**EC CONDITION (SPECIFIC CONDITION-XLII): Details of transportation, CSR, R&R and implementation of environmental action plan for each of the 17 clusters should be brought out in a booklet for and submitted to Ministry.**

**MAY, 2017**

## **INTRODUCTION**

Coal India has adopted CSR as a strategic tool for sustainable growth. For Coal India in the present context, CSR means not only investment of funds for Social Activity but also Integration of Business processes with Social processes. Even much before the issue of CSR became global concern; Coal India was aware of its Corporate Social Responsibility and was fulfilling the aspiration of the Society through well-defined “Community Development Policy” within the periphery of 8 Kms. of the Project sites. This has resulted into a harmonious relationship between Coal India and the peripheral Communities.

Coal India has identified land oustees, PAP and those staying within the radius of 25 Kms of the Project as primary beneficiaries. Poor and needy section of the society living in different parts of India are second beneficiaries. For carrying out CSR activities, 80% of the budgeted amount are be spent within the radius of 25 Km of the Project Site/Mines/Area HQ/Company HQ and 20% of the budget to be spent within the States in which operating.

## **SCOPE**

As per Schedule VII Section 135 of New Companies Act 2013 the following should be the Scope of Activities under Corporate Social Activities:

- i. Eradicating hunger, poverty and malnutrition, promoting healthcare including preventive health care and sanitation and making available safe drinking water.
- ii. Promoting education, including special education and employment enhancing vocation skills especially among children, women, elderly, and differently able and livelihood enhancement projects;
- iii. Promoting gender equality, empowering women, setting up homes and hostels for women and orphans, setting up old age homes, day care centers and such other facilities for senior citizens and measures for reducing inequalities faced by socially and economically backward groups;
- iv. Ensuring environmental sustainability, ecological balance, protection of Flora and Fauna, animal welfare, agro-forestry, conservation of natural resources and maintaining quality of soil, air and water;
- v. Protection of national heritage, art and culture including restoration of buildings and sites of historical importance and works of art; setting up public libraries, promotion and development of traditional arts and handicrafts;
- vi. Measures for the benefit of armed forces veterans, war widows and their dependents
- vii. Training to promote rural sports, nationally recognized sports, Paralympics sports and Olympic sports;
- viii. Contribution to the Prime Minister’s National Relief Fund or any other fund set up by the Central Government for socio-economic development and relief and welfare of the Scheduled Castes, the Scheduled Tribes, other backward classes, minorities and women;
- ix. Contributions or funds provided to technology incubators located within academic institutions which are approved by the Central Government;
- x. Rural development projects

## SOURCE OF FUND

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

## CURRENT STATUS

Healthcare: Annual CSR (Healthcare) Expenditure for the year 2015-16 and 2016-17.

### **I. Mobile Medical Van (MMV):**

S. No.	Year (financial year)	No. of Mobile Medical VanCamp	Beneficiaries	Amount (inRs.)	Remarks
1	2015-16	229	7012	215927.76	Till Dec. 2016

### **II. General Medical Camps:**

S. No.	Year (financial year)	Name of Medical Camp	Beneficiaries	Date
1.	2015-16	Family Planning Camp	33	03.02.2016
2.		Family Planning Camp	40	16.02.2016

## Highlights of CSR Work under taken during 2015-16 and 2016-17 at Cluster-X

S. No.	Details	No. of units		Total Amount (in Rs.)	Remarks
		Girls	Boys		
1.	Construction of toilets in various schools in Saraikela-Kharsawan district of Jharkhand under "Swachh Vidyalaya Abhiyaan" under CSR activities of BCCL.	89	89	29,548,000	Work was done by state government.
	<b>Total</b>	178		29,548,000	

## PROPOSED STATUS

### **CSR Work to be under taken during 2017-18 at Cluster- X**

S. No.	Details	Remarks
1.	Construction of Marriage/Multipurpose Hall in Mayurdubhi (मयुरदुभी) village in Amai Nagar (आमाई नगर) Panchayat of Block Chandankyari	Proposed activity

\*\*\*\*\*

**C.S.R. PERFORMANCE REPORT MONTHWISE**  
 April 2015 to December 2016  
 BHowrah REGIONAL HOSPITAL. E.J. AREA.

MOBILE MEDICAL VAN.

Date: 29.04.2016

SL.NO.	MONTH	NO.OF.CAMP	NO.OF.BENEFICIARIES	TOTAL EXPENDITURE
1.	April 15	26	1122	₹ 39,171.33
2.	May	25	937	₹ 35,270.12
3.	June	25	941	₹ 32,950.08
4.	July	27	1028	₹ 38,685.08
5.	August	25	1003	₹ 31,288.24
6.	September	26	634	₹ 17,211.73
7.	October	24	443	₹ 7,963.19
8.	November	24	517	₹ 7870.23
9.	December	27	387	₹ 5,517.76
10.	January 16			
11.	February			
12.	March			
	Total ---	229	7012	₹ 2,15,927.76

Dy.C.M.O. I/C  
 Sudamdih R/ Hospital  
 E.J.Area.

NAME OF VILLAGES COVERED UNDER CSR/MMV PROGRAMME



E.J. AREA - VILLAGES

1. Bhowrah 19 No. Basti.
2. Parghabad Basti
3. Supker Basti
4. Manjhi Basti.
5. Mohubani Basti.
6. Sheobabudih
7. Bhowrah 7No Basti.
8. Bhowrah 4 No Basti.
9. Bhowrah Jahaj Tand.
10. Thana Basti.
11. Manpur Basti.
12. Amlabad Basti.
13. New Riverside Basti.
14. Gourkhutti Basti.
15. Sewardih Basti
16. Hattala Basti.

Dy.C.M.O. /C  
Sudamdih R/Hospital



FAMILY PLANNING CAMP

E.J.AREA

- 1. Sudamdih R/ Hospital    date - 03.02.2016.    Beneficiaries- 33
- 2. Bhowrah R/ Hospital    date - 16.02.2016    Beneficiaries -40

Dy.C.M.O

Sudamdih R/Hospital

**CSR BUDGET & EXPENDITURE**

<b>BHARAT COKING COAL LIMITED</b>			
<b>CSR BUDGET AND EXPENDITURE</b>			
<b>Year</b>	<b>CSR Budget (Rs in lakh)</b>	<b>Projects/ Activities</b>	<b>Expenditure incurred (In Rs. Lakhs)</b>
2013-14	3050	Drinking Water/ Water Supply	278
		Education	20
		Infrastructure Development	351.15
		Skill Development	82
		Medical/Healthcare	49
		Others (Uttarakhand Chief Minister Relief fund)	2000
		<b>Total of 2013-14</b>	<b>2780.15</b>
2014-15	3080	Drinking Water/ Water Supply & Sanitation	4.69
		Education	2.87
		Infrastructure Development	244.9
		Skill Development	55.73
		Medical/Healthcare	32.55
		Forestry & Environment	73.43
		Others	18.29
		PMNRF	1000
		<b>Total of 2014-15</b>	<b>1432.46</b>
2015-16	3300	Drinking Water/ Water Supply & Sanitation	3.33
		Swachh Vidyalaya Abhiyan	5868.51
		Education	17.01
		Infrastructure Development	161.75
		Skill Development	0.12
		Medical/Healthcare	33.06
		Forestry & Environment	2.94
		Conservation of Natural resources	63.76
		Others	13.23
		Transfer of CSR Expenditure spent by BCCL CSR Budget allotted by CIL (CIL the Holding Company has also incurred CSR expenditure to the tune of Rs.10.97 crore through BCCL, which has been borne and accounted for the books of CIL)	-1096.58
<b>Total of 2015-16</b>	<b>5067.13</b>		

**CSR BUDGET AND EXPENDITURE FOR FY 2016-17**

<b>Expenditure under CSR for the year 2016-17</b>				
S. No.	CSR Project or Activity identified	Sector in which the project is covered	Amount spent on the projects or programs Sub-heads:(1) Direct Expenditure on projects or programs(2) Overheads: (in lakhs)	
			Direct	Overheads
1	Construction of toilets in various school in Paschimi Singhbhum District of Jharkhand.	Eradicating hunger, poverty and malnutrition, promoting health care including preventive health care and sanitation including contribution to Swach Bharat Kosh set-up by the Central Government for the promotion of sanitation and making available safe drinking water	389.32	3.00
2	Construction of toilets in various school in Bokaro District of Jharkhand.	Eradicating hunger, poverty and malnutrition, promoting health care including preventive health care and sanitation including contribution to Swach Bharat Kosh set-up by the Central Government for the promotion of sanitation and making available safe drinking water	8.15	
3	Construction of toilet in various school in Dumka District of Jharkhand.	Eradicating hunger, poverty and malnutrition, promoting health care including preventive health care and sanitation including contribution to Swach Bharat Kosh set-up by the Central Government for the promotion of sanitation and making available safe drinking water	341.96	
4	Construction of toilet in various school in Gumla District of Jharkhand.	Eradicating hunger, poverty and malnutrition, promoting health care including preventive health care and sanitation including contribution to Swach Bharat Kosh set-up by the Central Government for the promotion of sanitation and making available safe drinking water	68.77	
5	Construction of toilet in various schools in Dhanbad District	Eradicating hunger, poverty and malnutrition, promoting health care including preventive health care and sanitation including contribution to Swach Bharat Kosh set-up by the Central Government for the promotion of sanitation and making available safe drinking water	1.17	

6	Construction of toilet in various schools in Simdega District of Jharkhand.	Eradicating hunger, poverty and malnutrition, promoting health care including preventive health care and sanitation including contribution to Swach Bharat Kosh set-up by the Central Government for the promotion of sanitation and making available safe drinking water	132.02	
7	Construction of toilets in various schools in Purbi Singhbhum district of Jharkhand.	Eradicating hunger, poverty and malnutrition, promoting health care including preventive health care and sanitation including contribution to Swach Bharat Kosh set-up by the Central Government for the promotion of sanitation and making available safe drinking water	2.00	
8	Constn. of Toilets in various School in Koderma District of Jharkhand.	Eradicating hunger, poverty and malnutrition, promoting health care including preventive health care and sanitation including contribution to Swach Bharat Kosh set-up by the Central Government for the promotion of sanitation and making available safe drinking water	16.91	
9	SVA LIABILITY	Eradicating hunger, poverty and malnutrition, promoting health care including preventive health care and sanitation including contribution to Swach Bharat Kosh set-up by the Central Government for the promotion of sanitation and making available safe drinking water	737.86	
10	SVA LIABILITY reversed	Eradicating hunger, poverty and malnutrition, promoting health care including preventive health care and sanitation including contribution to Swach Bharat Kosh set-up by the Central Government for the promotion of sanitation and making available safe drinking water	(1,022.52)	
Total			675.63	3.00
<b>Grand Total</b>			<b>678.63</b>	

**CSR BUDGET AND EXPENDITURE for FY 2017-18**

<b>SI No</b>	<b>Particulars</b>	<b>Expenditure incurred (in Rs. Lakh)</b>
1	Various health camps & allied activities (Project JYOTI)	2.20
2	Swachh Vidyalaya Abhiyan (toilets bill)	165.60
3	Construction of toilets at SSLNT Mahila Mahavidyalaya and at Bhatinda Pootki	14.30
4	Swachhta Pakhwada activities	0.30
5	Construction of PCC Road in Topchanchi Blocks	4.40
6	Deepening /renovation of ponds in Tundi and East Tundi	11.90
7	Handloom weaving training project	6.00
8	Construction of Community Hall at Johar Asthan, Hirapur, Dhanbad (bill)	0.40
9	BCCL Ke LAAL/BCCL Ki LAADLI	35.40
10	Others (including liability)	33.50
11	<b>Total</b>	<b>273.9</b>

**CSR WORKS AND EXPENDITURE FOR 2018-19**

SI No	CSR Projects identified	Sector	Amt. spent (Rs. lakhs)
<b>Ensuring environmental sustainability, ecological balance, protection of flora and fauna, animal welfare, agroforestry, conservation of natural resources and maintaining quality of soil, air and water including contribution to the Clean Ganga Fund set-up by the Central Government for rejuvenation of river Ganga (04 nos. of pond projects)</b>			
1	Deepening/renovation including construction of steps/ghats for pond at Belardih ,East tundi	Ensuring environmental sustainability, ecological balance, protection of flora and fauna, animal welfare, agroforestry, conservation of natural resources and maintaining quality of soil, air and water including contribution to the Clean Ganga Fund set-up by the Central Government for rejuvenation of river Ganga	4.22
2	Deepening/renovation including construction of steps/ghats at Aam Bandh Sindurpur (Khairabani) village under Sindurpur Panchayat in Baliapur Block	Ensuring environmental sustainability, ecological balance, protection of flora and fauna, animal welfare, agroforestry, conservation of natural resources and maintaining quality of soil, air and water including contribution to the Clean Ganga Fund set-up by the Central Government for rejuvenation of river Ganga	6.06
3	Deepening/renovation including construction of steps/ghats at Aam Bandh at Dardaha village under Dolabhar Panchayat in Baliapur Block	Ensuring environmental sustainability, ecological balance, protection of flora and fauna, animal welfare, agroforestry, conservation of natural resources and maintaining quality of soil, air and water including contribution to the Clean Ganga Fund set-up by the Central Government for rejuvenation of river Ganga	7.09
4	Deepening/Renovation including Construction of steps/ghat for Khas Bandh Pond at Latani under East Tundi by BCCL	Ensuring environmental sustainability, ecological balance, protection of flora and fauna, animal welfare, agroforestry, conservation of natural resources and maintaining quality of soil, air and water including contribution to the Clean Ganga Fund set-up by the Central Government for rejuvenation of river Ganga	0.60
<b>Eradicating hunger, poverty and malnutrition, promoting health care including preventive health care and sanitation including contribution to Swach Bharat Kosh set-up by the Central Government for the promotion of sanitation and making available safe drinking water (Medical camps &amp; Swachhta Pakhwada under sanitation)</b>			
5	Medical camps held under CSR	Eradicating hunger, poverty and malnutrition, promoting health care including preventive health care and sanitation including contribution to Swach Bharat Kosh set-up by the Central Government for the promotion of sanitation and making available safe drinking water	1.68

6	Swachhta Marathon (run for cleanliness) to promote awareness about Swachhta under Swachhta Pakhwada (held under under Ministry instructions)	Eradicating hunger, poverty and malnutrition, promoting health care including preventive health care and sanitation including contribution to Swach Bharat Kosh set-up by the Central Government for the promotion of sanitation and making available safe drinking water	2.21
7	Arrangements for Swachhta Pakhwada (held under under Ministry instructions)	Eradicating hunger, poverty and malnutrition, promoting health care including preventive health care and sanitation including contribution to Swach Bharat Kosh set-up by the Central Government for the promotion of sanitation and making available safe drinking water	0.18
8	05 shows of Nukkad Natak held towards promotion of cleanliness under Swachhta pakhwada (held under under Ministry instructions)	Eradicating hunger, poverty and malnutrition, promoting health care including preventive health care and sanitation including contribution to Swach Bharat Kosh set-up by the Central Government for the promotion of sanitation and making available safe drinking water	0.50
<b>Promoting education,including special education &amp; employment enhancing vocation skills especially among children,women,elderly,and the differently abled &amp; livelihood enhancement projects (03 nos. of projects)</b>			
9	BCCL Le LAAL/BCCL Ki LAALDI	Promoting education,including special education & employment enhancing vocation skills especially among children,women,elderly,and the differently abled & livelihood enhancement projects	26.12
10	Skill development: Providing 100 nos. of sewing machines for training towards empowering SGH women through Jharkhand State Livelihood Promotion Society	Promoting education,including special education & employment enhancing vocation skills especially among children,women,elderly,and the differently abled & livelihood enhancement projects	5.00
11	Training Scheme for preparing "Trainees" for Mining Sirdars	Promoting education,including special education & employment enhancing vocation skills especially among children,women,elderly,and the differently abled & livelihood enhancement projects	16.03
<b>Rural development projects (02 nos. of projects)</b>			
12	Construction of bamboo huts with thatched roof in Barwa village under Green Haat Project	Rural development projects	2.05
13	Construction of Community Centre at Jiramuri village, Ratanpura panchayat under Govindpur Block, Dhanbad	Rural development projects	16.18

<b>Others (Monthly expenditure incurred towards HR expenses of NCSR Hub TISS as per its MoU)</b>			
14	Payment to NCSR Hub TISS Mumbai towards human resource expenses	Others	2.29
<b>Liability</b>			
15	NCSR Hub, TISS Liability for impact assessment study	Rural development projects	3.94
16	BCCL Ke LAAL/BCCL Ki Laadli liability	Promoting education, including special education & employment enhancing vocation skills especially among children, women, elderly, and the differently abled & livelihood enhancement projects	23.44
17	Others including liabilities of CSR works (Swachhta Pakhwada, installation of hand pumps, Various construction works at RBB High School, Rajganj etc.)	Sanitation, safe drinking water, promoting education	25.09
<b>Total</b>			<b>142.69</b>

**CSR BUDGET AND EXPENDITURE FOR FY 2019-20**

SI No	CSR Projects identified	Sector	Amt. Spent (₹ lakhs)
1	Deepening/renovation including construction of steps/ghats for ponds at Tundi, East Tundi & Baliapur	Ensuring environmental sustainability, ecological balance, protection of flora and fauna, animal welfare, agroforestry, <b>conservation of natural resources</b> and maintaining quality of soil, air and water including contribution to the Clean Ganga Fund set-up by the Central Government for rejuvenation of river Ganga	9.53
2	Installation of hand pumps at different locations in Dhanbad district through Dept. of drinking water and Sanitation, Dhanbad via depository mode	Eradicating hunger, poverty and malnutrition, promoting health care including preventive health care and sanitation including contribution to Swach Bharat Kosh set-up by the Central Government for the promotion of sanitation and <b>making available safe drinking water</b>	18.02
3	Medical camps under Block II Area	Eradicating hunger, poverty and malnutrition, <b>promoting health care including preventive health care</b> and sanitation including contribution to Swach Bharat Kosh set-up by the Central Government for the promotion of sanitation and making available safe drinking water	0.42
4	Green Haat project at Barwa village, Govindpur block (under Swachhta Pakhwada)	Eradicating hunger, poverty and malnutrition, promoting health care including preventive health care and <b>sanitation</b> including contribution to Swach Bharat Kosh set-up by the Central Government for the promotion of sanitation and making available safe drinking water	0.81
5	Sanction of the amount to Municipal Commissioner, Dhanbad for procurement of fogging machine and sprayer for Dhanbad Municipal Corporation towards tackling COVID-19, under CSR initiatives of BCCL	Eradicating hunger, poverty and malnutrition, promoting health care including preventive health care and <b>sanitation</b> including contribution to Swach Bharat Kosh set-up by the Central Government for the promotion of sanitation and making available safe drinking water	10
6	Works in Pehla Kadam School- a School for the underprivileged located at Jagjeevan Nagar	Promoting education, <b>including special education</b> & employment enhancing vocation skills especially among children, women, elderly, and the differently abled & livelihood enhancement projects	7.21

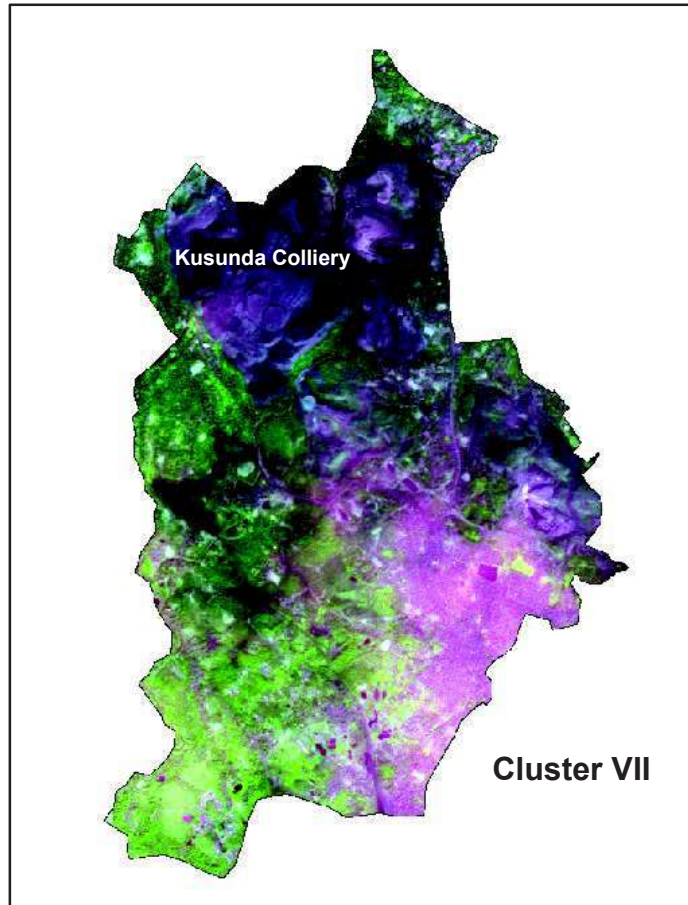
7	Works in RBB School, Rajganj	Promoting education,including <b>special education</b> & employment enhancing vocation skills especially among children,women,elderly,and the differently abled & livelihood enhancement projects	84.39
8	BCCL Ke LAAL/BCCL Ki Laadli	<b>Promoting education</b> , including special education & employment enhancing vocation skills especially among children, women, elderly, and the differently abled & livelihood enhancement projects	4.73
9	Development of smart classes in different high Schools, higher secondary Schools and other Schools in Dhanbad District for a total of 129 schools through District administration via depository mode	<b>Promoting education</b> , including special education & employment enhancing vocation skills especially among children, women, elderly, and the differently abled & livelihood enhancement projects	193.5
10	Mining Sirdars training to SC/ST candidates (preference to PAPs )	Promoting education,including special education & employment enhancing <b>vocation skills</b> especially among children,women,elderly,and the differently abled & <b>livelihood enhancement projects</b>	8.93
11	Construction of PCC road at Topchanchi Block	Rural development projects	2.12
12	Construction of Marriage Hall at Ratanpur Village, Ratanpur Panchayat, Govindpur Block	Rural development projects	33.63
13	Construction of Community Center at Jiramuri Village ,Ratanpur Panchayat, Govindpur Block	Rural development projects	1.25
14	Depository mode transfer to D.C. Dhanbad towards preparatory efforts to tackle COVID-19 situation in Dhanbad”, under CSR initiatives of BCCL	Disaster Management	200
15	Depository mode transfer to Chief Minister's Relief Fund, Jharkhand	Contribution to the Prime Minister's National Relief Fund or any other fund set up by the Central Government for socio-economic development and relief and welfare of the Scheduled Castes, the Scheduled Tribes, other backward classes, minorities and women	50

16	Miscellaneous: Yoga Diwas, Handloom handing over expense, final bill settlement of constructed marriage mandap	Others	0.12
17	Liability reversed	Others	(23.4)
<b>Total</b>			<b>601.22</b>

**CSR BUDGET AND EXPENDITURE FOR FY 2020-21\* (upto Sept., 2020)**

SI No	CSR Projects identified	Expenditure incurred (₹ lakhs)	Status
<b>A.</b>	<b>Non-COVID-19 Expenditures</b>		
1.	Works in RBB School, Rajganj which includes construction of classrooms, toilets, auditorium & cycle stand	27.57	Work completed
2	Construction of marriage hall at Ratanpur Panchayat, Govindpur Block	3.73	Work completed
3.	Miscellaneous Civil Works (construction works in Pehla Kadam School at Jagjeevan Nagar, community hall at Ratanpur etc.)	1.69	Work completed
4	Aspirational district project-Giridih	121.82	Depository mode transfer made
<b>B.</b>	<b>COVID-19 Expenditure</b>		
1	Procurement of bleaching powder- 6.40 Work completed	6.40	Work completed
2	Procurement of face masks	0.16	Work completed
3	Financial assistance to D.C. Dhanbad to combat COVID-19 In Dhanbad	200.0	Fund transferred under depository mode of work execution
4	Lodging and boarding of doctors and paramedical staff deployed in COVID- 19 Hospital	24.50	In Progress; Out of sanctioned amount of Rs. 95.97 lakhs, Rs. 24.50 lakhs has been paid
<b>Total</b>		<b>385.87</b>	

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



*Submitted to*  
**Bharat Coking Coal Limited**



*cmpdi*  
*A Mini-Ratna Company*

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

March-2019



**Remote Sensing Cell  
Geomatics Division  
CMPDI, Ranchi**

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## Executive Summary

1. **Project** Land restoration / reclamation monitoring of clusters of (Opencast + Underground) coal mines of Bharat Coking Coal Ltd. (BCCL), based on satellite data, on every three year basis.
2. **Objective** Objective of the land restoration / reclamation monitoring is to assess the area of backfilled, plantation, social forestry, active mining area, water bodies, and distribution of wasteland, agricultural land and forest in the leasehold area of the project. This will help in assessing the progressive status of mined land reclamation and to take up remedial measures, if any, required for environmental protection.
3. **Salient Findings**
  - Four Clusters viz. I, IV, VII, X were selected in 2018-19 for land reclamation/restoration monitoring. These clusters consist of mainly opencast mines.
  - Out of the total leasehold area of 5883.96 Ha., total mined out area is only 1075.76 Ha., belonging to the OC mines.
  - It is evident from the analysis that 58.11% of excavated area is under technical reclamation and 35.02% of the excavated area is under active mining. Cluster wise details are given in Table-1 & Fig-1.
  - 13.61% of total leasehold area has come under plantation (% green cover)
  - Study reveals that out of total mine leasehold area of 5883.96 Ha. of the above mentioned 04 nos. clusters of BCCL taken up for the land reclamation monitoring during the year 2018-19; total excavated area is 1075.76 Ha. (18.28%) out of which 73.92 Ha. (6.87%) has been planted (*Biologically Reclaimed*), 625.15 Ha. (58.11%) is under backfilling (*Technical Reclamation*) and

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

- This report and the findings will act as the basis for further monitoring and reclamation related activities.
- Out of the four clusters of BCCL, maximum land reclamation has been done in Cluster VII (76.09%) followed by Cluster X (71.00%).

Table 1

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

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

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

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

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

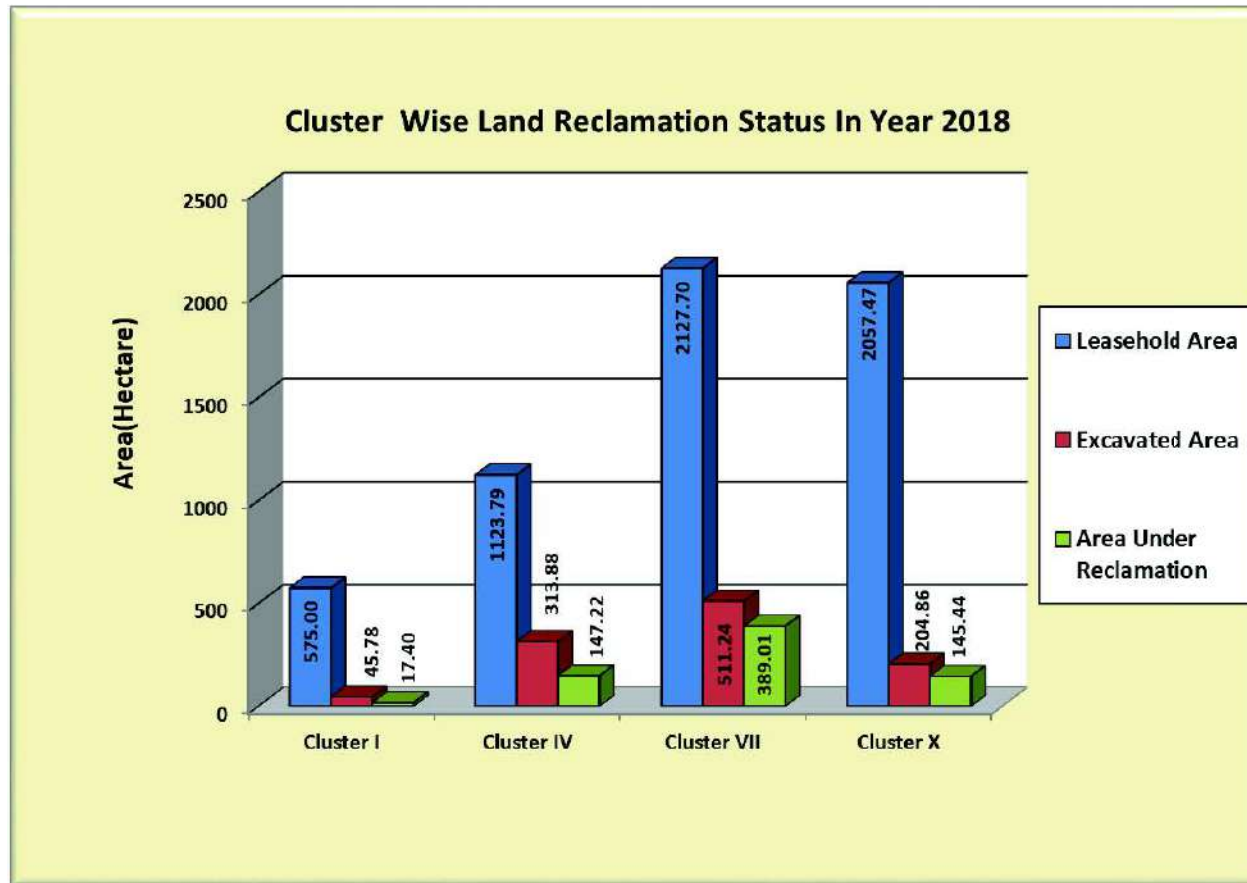


Fig. 1: Cluster wise Land Reclamation Status-2018 (BCCL)

## **4. Land Reclamation Status in Bharat Coking Coal Ltd.**

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

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

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

**4.3** Area statistics of different land use classes present in OC projects till the year 2018 is given in Table 2. Land use maps derived from the satellite data are given in Plate nos.1, 2, 3 & 4. The land use status are shown in Fig. 3, 4, 5 & 6.

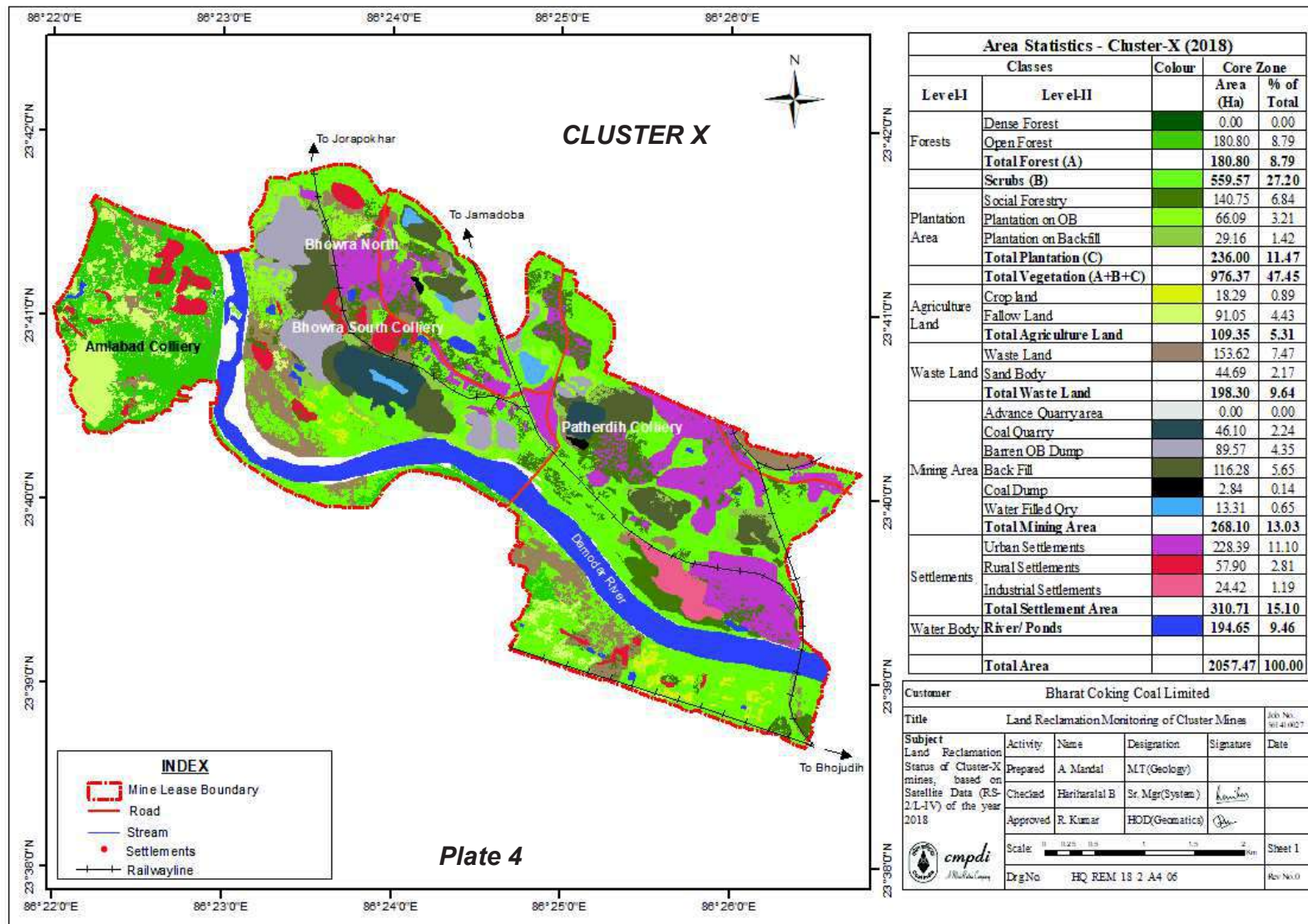
**4.4** Study reveals that majority of the mines under the clusters considered for monitoring are of opencast type. 35.02% of excavated area is under active mining in the opencast mines. 58.11% of the excavated area have come under technical reclamation till 2018

Table 2

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

(Area in Hectare)

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



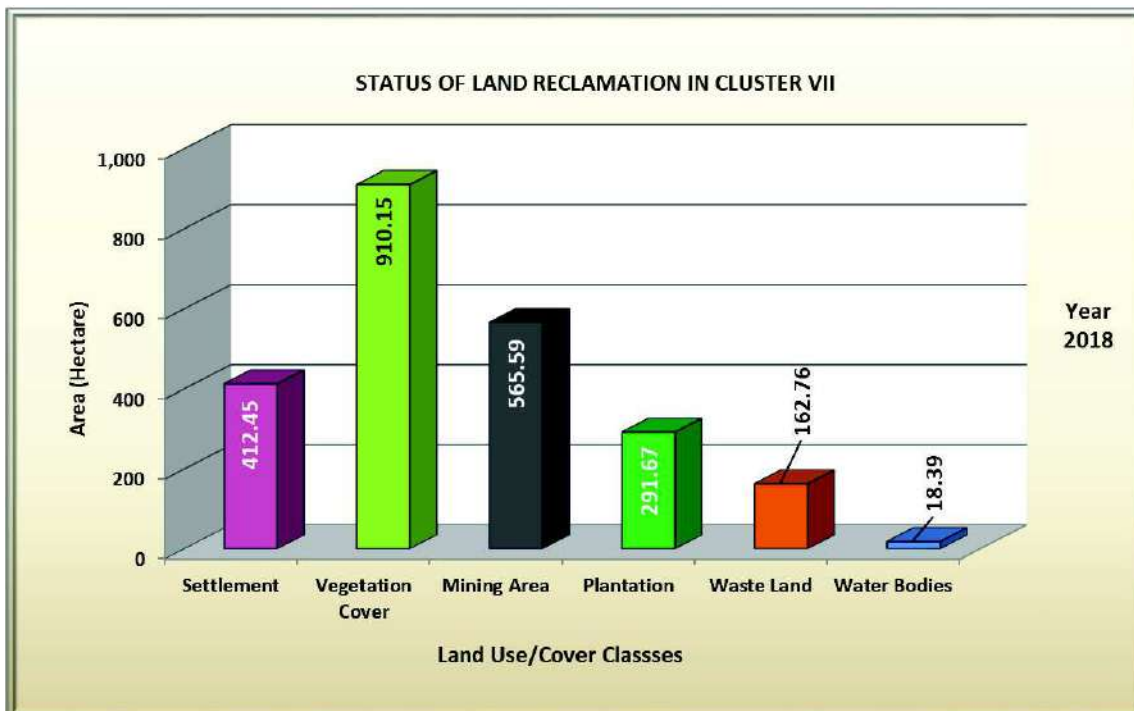


Fig. 5: Land Reclamation status of Cluster VII

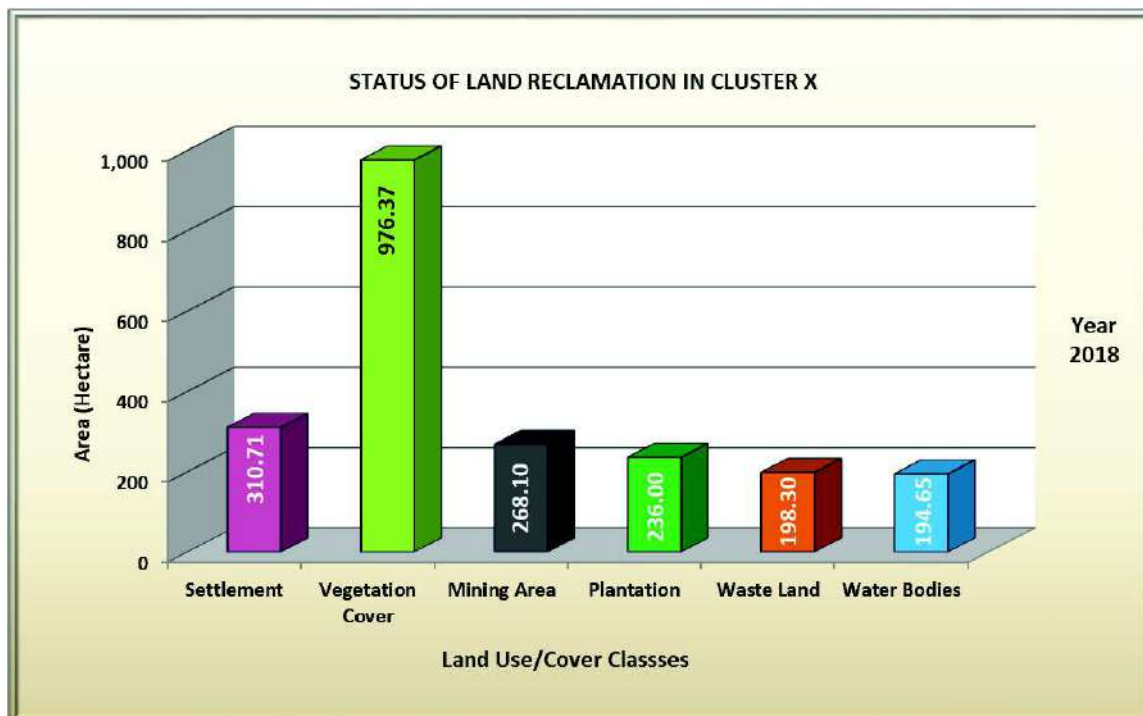


Fig. 6: Land Reclamation status of Cluster X



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



**Photo 2: Ecological Restoration Site in Cluster IV**



**Photo 3: Ecological Restoration Site in Cluster VII**



**Photo 4: Plantation on OB in Cluster X**



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**BHARAT COKING COAL LIMITED**

**MINING PLAN AND MINE CLOSURE PLAN**

**FOR**

**AMALGAMATED SUDAMDIH PATHERDIH  
MINE**

**(UPTO {-} 60m RL HORIZON)**

**(EASTERN JHARIA AREA)**

**SEPTEMBER – 2018**

**CENTRAL MINE PLANNING & DESIGN INSTITUTE LTD.  
REGIONAL INSTITUTE NO.-II  
DHANBAD**

## CHAPTER - XII

# PROGRESSIVE AND FINAL MINE CLOSURE PLAN

## 12.0 MINE CLOSURE PLANNING

### 12.1 OBJECTIVES OF CLOSURE PLANNING

Mine closure planning has to be carried out at the starting of the mine and needs periodic reviewing and revision during its life cycle to cope with the geo-technical constraints, safety and economic risks, social and environmental challenges. Various other objectives are as follows:

- ❖ To allow a productive and sustainable after-use of the site which is acceptable to the mine owner and the regulatory authority;
- ❖ To protect public health and safety;
- ❖ To alleviate or eliminate environmental damage and thereby encourage environmental sustainability;
- ❖ To minimize adverse socio-economic impacts.

### 12.2 DIFFERENT ASPECTS OF MINE CLOSURE PLANNING

The mine closure planning broadly involves the following aspects:

(a) Technical aspects;

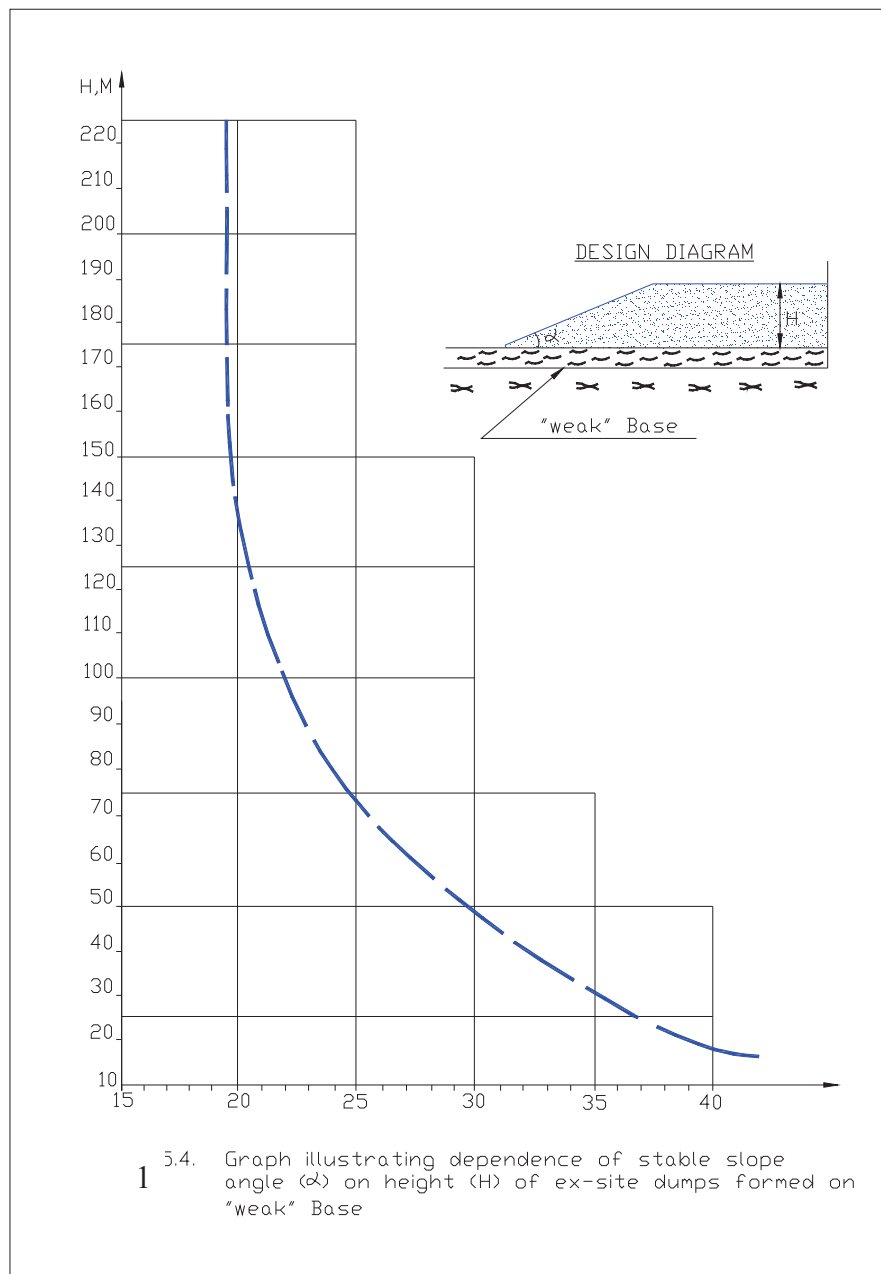
The following technical aspects would be reviewed in the final mine closure planning. Details can be worked in closure plans envisaged to be prepared.

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

**Management of Pit Slopes:** During operation of the mine, overall slope will be maintained at an angle not exceeding 22<sup>0</sup>-28<sup>0</sup>. Vegetation cover will also be provided along the slopes to arrest any failure.

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

During operation, the external and internal OB dump will be developed with 30 m berm width and maximum height of 90m in case of external OB dump and the overall dump slope shall not exceed 22 to 28 degrees. The waste dumps will be provided with toe wall and garland drains. The dump will be technically reclaimed and vegetation will be grown after spreading the top soil. The above measures will prevent slope failure and improve the aesthetic value.



Backfilling will be started in the OCP and the final level of reclaimed backfill will be matched with the levels of surrounding areas leaving a final residual void which will also serve as a lagoon which may be utilised as water reservoir for the locality. Most of the back filled area shall be afforested by selecting proper plant species in consultation with State Forest Department. A part of the back filled area would also be developed for agricultural purpose with the help of the concerned State Authority.

- ❖ **Management of hydrology and hydro-geology:** In the mine closure plan, the surface flow pattern of precipitation and mine water would be clearly developed and water channel suitably laid down so that it does not disturb the general hydrology of the area.

Mining operation may reduce the water table of the area. To recharge the water table, it is proposed that the mine water during operation will be discharged into surface water settling tank over flow of settled water from the tank will be used for water sprinkling, plantation, domestic purpose, etc. Therefore, the excess over flow water will be discharged into the nearby river. After closure of the mine vegetation will be grown on the entire vacant area.

- ❖ **Details of decommissioning of the infrastructures:** The decommissioning of the various infrastructures developed for the mine like office complex, roads, pipelines and transmission line etc. shall be planned in details so that the land occupied by these infrastructures are released. However, before such decommissioning, the possibility of re-use of these infrastructures for the neighboring mines shall be explored.

- i) **Closure of entry to the open-cast mine:** After closure of the mining activities, all the entries to the mine will be effectively sealed off to avoid any accident and to prevent access to any unauthorized person. The area that is not reclaimed shall be properly fenced/ sealed to prevent any

unauthorized entry into the area. However, the guidelines / instructions from DGMS, if any, will be followed.

(b) Environmental aspects

This would include the following:

- ❖ **Management of final voids:** In the mine closure plan, voids due to mining are to be dealt and the final land use plan will include filling of the voids for land reclamation where possible and for hydro reclamation where feasible.
- ❖ **Reclamation of forests/vegetation:** It is to be ensured that in the final land use plan, all vacant land acquired for the project is afforested
- ❖ **Channelisation of available water:** If the mine is having sufficient water and if on closure, the mine water flows into the surface water courses, channelising this water for surrounding community for their irrigational/domestic uses may be taken up. This can be planned by providing structures involving one time costing
- ❖ **Management of Recharge Areas:** The pre-mining and post mining scenario on the hydrogeological recharge system would be included in the closure plan.
- ❖ **Acceptable Surface and Ground Water Flows:** In the final closure plan of the mine, wherever the mine water is likely to flow out to surface and meet the surface water sources; the quality of water from such mines would be assessed and flow pattern designed in the final plan.

(c) Social aspects;

The social aspects of land use planning relating to mine closure would include the following:

- ❖ **Re-deployment of Workforce:** The company employees will be gainfully engaged in the neighboring projects after cessation of mining activities.
  
- ❖ **Management of Community Facilities:** In view of the short life of the project no new community facility will be created. However, the existing facilities of adjoining areas will be strengthened.

(d) **Financial aspects.**

Mine Closure activities would be a constant exercise for the mine which would begin with the commencement of mining operations and continue till post closure. The mine closure activities would naturally entail certain expenditures, which will have to be borne by the mine operator. There are two types of Closure, namely, Progressive Mine Closure (Concurrent) and Final Mine Closure. This would cover the activities which are being executed along with normal mining operation and would continue to be executed in course of execution of the project.

The Final Mine closure cost has to deal with the following:

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

(e) Maintenance of records pertaining to Progressive Mine Closure

The Mine management shall maintain following 2 Nos. of Progressive mine closure plans for every 5 year period:

A Progressive mine closure plan for surface activities

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

Execution of progressive mine closure activities and 5 yearly monitoring

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

The entries into the said register shall be signed by the appropriate authorities from the mine and the area. At the end of each year the said register (along with two plans) shall be placed before HoD (Env)/GM(Env.) of the company for scrutiny and approval.

After observing the necessary administrative/financial formalities, the mine authorities shall execute the identified progressive mine closure activities, whenever and wherever required. The executed activities shall be shown on the above said plans and recorded in the said registers.

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

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

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

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

### 12.3 MINE CLOSURE OBLIGATIONS

There is need to define the liabilities, responsibilities and authorities of the mine management, other regulatory bodies, Central and State Governments after mine closure. Some obligations relating to the Mine Management Companies are as follows :

- (a) **Health & Safety:** Regulation Nos. 6, 61, 106, 112 of Coal Mines Regulations, 2007 and its related DGMS Circulars;
- (b) **Environment :** Water (Prevention & Control of Pollution) Act, 1974; Air (Prevention & Control of Pollution) Act, 1981;

Environmental (Protection) Act, 1986 and  
Environmental Protection (Amendment) Rule, 2000;

DGMS Directives on Noise & Ground Vibration;

(c) **Forest :**

Forest (Conservation) Act, 1980.

(d) **Rehabilitation :**

CIL's policy, however, applicable for land oustees only.

(e) Decommissioning/asset disposal, etc.

#### 12.4 IMPACT ASSESSMENT REMEDIAL MEASURES

Environmental Impact on Landscape, Water Source, air and noise pollution during mine life has been discussed earlier. It is imperative that the environmental monitoring may be continued for 3 years after closure of mines in order to assess corrective measures to be implemented to sustain pre-mining ecosystem and environment in the core and buffer zone (to the extent possible).

#### 12.5 STAKEHOLDERS INVOLVEMENT

Various stakeholders effected due to mine closure need to be identified and they may be as follows :

<b>The Company</b>	:	Employees, Management & Stakeholders
<b>The Community</b>	:	Local business and service providers, landholders, neighbours and nearby residents, local Government and NGOs and Community Groups.
<b>The State</b>	:	The State Government. The Central Government and concerned Government Agencies.

There is need of regular consultations between the stakeholders to evolve the needs of the stakeholders and their involvement in the process.

## **12.6 CLOSURE ACTION PLAN**

Closure planning is a whole-of-life exercise that begins at the start of a mine and continues till post-closure. The dynamic nature of closure planning requires regular and critical review to reflect changing circumstances as a result of any operational change, new regulation, and new technology and remain flexible enough to cope with unexpected events.

The following steps have to be undertaken in relation to Mine Closure Planning:

Prior to the surface demolition/restoration a surface audit should be undertaken on all surface structures, spoil heaps, lagoons, etc. to assess whether there are any hazardous materials that could cause problems; viz. explosives, chemicals, etc. A list of surface assets should be prepared and made available to potential purchasers, prospective purchasers could be invited and asked to submit sealed bids, this could ensure that the sale of assets give better financial gain.

In order to identify potential impact, necessary hydro-geological studies into post-mining ground water recharge have to be done.

Work force on roll of BCCL may be re-deployed for gainful utilization in the same or other mines of BCCL.

As a detailed component of the Closure Plan, a Decommissioning Plan is to be developed towards the final stages preferably 5 years prior to tentative closure of the mine. Once established, it may be updated annually.

## **12.7 PROTECTIVE MEASURES TO BE TAKEN**

Protective measures must include the following :

- The protection of mine Entries , building and other structure on the project site against access by unauthorized persons;
- The maintenance of all mechanical, hydraulic and waste management system;
- The continuation of all monitoring programmes;
- The control of all contaminated effluents;
- The securing of all petroleum products, chemicals and waste;
- The rendering of all tailings, dams and piles of earth, rock and waste resulting from work done on the project site in a stable and safe condition.

## 12.8 CLOSURE COSTS

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

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

It is difficult to conclusively predict the mining parameters on a long term basis owing to rapidly changing mining technology, developments in the field of

clean coal technologies and R&D activities in development of alternative energy sources.

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

Jharia Coalfield is characterized by occurrence of a number of working coal horizons, giving a leverage of extended working life of the mines. Some more seams can come in the lap of workable horizons due to improvement in mining technology in times to come. The underground mines in leasehold of JCF are generally small capacity mines, giving a false impression of very long lives due to small level of current production level. There may be a strategy in future to amalgamate the mines for higher production level to attain the economics of scale. The existing OC Mines working at shallow depth may be worked at a greater depth, In such a situation, the life of the mine arrived at with current level of production for the balance reserve may not be workable in the long run. **In such a situation, it is envisaged that a revised mine closure plan should be prepared as per relevant guidelines and submitted for approval of the competent authority.**

The Mine Closure Plan for Sudamdih Incline Mines and Patherdih Group of Mines was prepared in October, 2013 and was approved by BCCL Board in 301<sup>st</sup> Board meeting held on 30.10.2013. As per the approved Mine Closure Plan, the closure cost was estimated at approximately Rs.396.316 lakhs for Sudamdih Incline Mine and Rs. 831.155 lakhs for Patherdih Group of Mines under the conditions envisaged in the aforesaid closure plan. The amount already deposited in the escrow account (Account no. 00150100008872 and 00150100008871 at Bank of Baroda, Dhanbad Branch) in the name of Sudamdih Incline Mines and Patherdih Group of Mines is Rs. 403.46 Lakhs upto 31.03.2018.

The earlier mine closure plan was prepared considering Sudamdih Incline Mine and Patherdih Group of Mines as mixed mine i.e. running of both underground & opencast operation. However now it has been decided by BCCL management to discontinue underground mining operation and to extract coal only by opencast mining operation in the Amalgamated Sudamdih Patherdih Colliery. Therefore, given the changes in mining parameters of the mine since the preparation of approved Mine Closure Plan, a new Mine Closure Plan is required for this mine. Accordingly this mining plan and mine closure plan is prepared considering only opencast operation at Amalgamated Sudamdih Patherdih Colliery. However a new escrow account may be opened in the name of Amalgamated Sudamdih Patherdih Colliery and the existing two accounts may be discontinued as per the policy decision of BCCL.

In ASP Colliery, the leasehold area after boundary adjustment is 505.85 Ha, as per the plan supplied by the colliery authority, out of which 284.83 Ha is not considered workable area at present, due to Damodar river (52.23 Ha), coal barriers, DGMS restrictions, non-coal bearing area (Barren Area), Railway acquired land and surface built-up. The remaining area of 221.02 Ha is considered as project area, out of which 135.0 Ha area is considered for opencast mining in the near future and 85.39 for OB dump/Phase-II mining. Thus, 221.02 Ha area is considered for calculation of closure cost as per opencast norms.

The overlapping area (where UG & OC operations have been done in different vertical levels) has been considered for calculation of closure cost as per opencast norms.

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

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

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

12.8.2 As per Mine Closure guidelines, the total expenditure to be incurred at the notified rate of the year (August 2009) may be calculated in following manner:

Particulars	OC Unit	Remarks
Area	221.02	Area X Notified Rate
Notified Rate ( Rs.Lakh)	6	
Total Amount (in base year) ( Rs. Lakh)	1326.12	

12.8.4 As per the guidelines *“these rates will stand modified based on whole Price Index as notified by Government of India from time to time”*.

An escalation factor has been calculated based on WPI of June 2018 (119.1). As per the directives from Office of the Economic Adviser, WPI series has been revised. In the revised series, base year has been changed to 2011-12 from 2004-05. To account for the aforesaid change WPI linking factor has been taken as 1.561. Converting WPI of June 2018 to that of base year 2004-05, we arrive at figure of 185.9151. Escalation factor vis-a-vis WPI of August '09 (129.6) comes out to be 1.43453

Particulars	OC Unit	Remarks
<b>Total Amount (in base year) (in Rs. Lakh)</b>	1326.12	Total Amount (in base year) X Escalation Factor
<b>Escalation Factor</b>	1.43453	
<b>Escalated Amount (in Rs. Lakh)</b>	1902.359	

12.8.4 As per the earlier approved Mine Closure Plan the total deposited amount in Escrow Account till 31.3.2018 was Rs. 403.46 Lakhs. Out of which 104.25 lakh deposited in OC Unit and 299.21 lakh were deposited in UG unit. The

amount already accrued in the escrow account shall be adjusted against the new closure cost calculated.

<b>Particulars</b>	<b>OC Unit</b>	<b>UG Unit</b>	<b>Remarks</b>
Escalated Amount (Rs. Lakhs)	1902.359	-	
Amount already deposited in escrow account (Rs. Lakhs)	104.25	299.21	
Balance Escalated Amount (Rs. Lakhs)	1498.899		

12.8.5 To arrive at the annual cost to be deposited in each year in an escrow account, the escalated amount shall be divided by the life of the mine.

<b>Particulars</b>	<b>OC Unit</b>	<b>Remarks</b>
<b>Escalated Amount</b>	1498.899	Balance Escalated Amount / Life
<b>Life</b>	33	
<b>Amount per year</b>	45.421	

As per the guidelines, the arrived annual cost has to be escalated by 5% every year for the remaining life of the mine. The amount to be deposited every year after 5% escalation is given below:

**Break-Up cost of Mine Closure of Amalgamated Sudamdih - Patherdih (ASP)  
Colliery Year wise**

<b>Year</b>	<b>OC Unit</b>	<b>Total</b>
1	45.42	45.42
2	47.69	47.69
3	50.08	50.08

4	52.58	52.58
5	55.21	55.21
6	57.97	57.97
7	60.87	60.87
8	63.91	63.91
9	67.11	67.11
10	70.46	70.46
11	73.99	73.99
12	77.69	77.69
13	81.57	81.57
14	85.65	85.65
15	89.93	89.93
16	94.43	94.43
17	99.15	99.15
18	104.11	104.11
19	109.31	109.31
20	114.78	114.78
21	120.52	120.52
22	126.54	126.54
23	132.87	132.87
24	139.51	139.51
25	146.49	146.49
26	153.81	153.81
27	161.50	161.50
28	169.58	169.58
29	178.06	178.06
30	186.96	186.96
	196.31	196.31
	206.12	206.12
	216.43	216.43
<b>TOTAL</b>	<b>3636.591</b>	<b>3636.591</b>

The amount calculated above shall be deposited every year by BCCL in the Escrow Account in the name of Amalganated Sudamdih Patherdih Colliery.

Thus, total amount that shall be further deposited for final mine closure activities of Amalgamated Sudamdih Patherdih Colliery during the balance life of 33 years stands out to be Rs. 3636.591 lakhs as per the present status of the mine.

The amount already deposited in the escrow account will also be available for mine closure activities and should be included to arrive at the total funds available for mine closure activities.

Particulars	Amount (in Rs. lakhs) OC Unit	Amount (in Rs. lakhs) UG Unit	Total
Amount Already Deposited in Escrow Account	104.25	299.21	403.46
Amount to be Deposited in the Escrow Account in the Future	3636.591	-	3636.591
Total Amount available for Mine Closure Activities			4040.051

12.8.6 Based on the existing mine closure planning norms, the above calculated cost at current WPI of June 2018 on mine closure may be tentatively grouped under different heads as given in Tables below as per guidelines of CMPDI(HQ).

#### Break up Cost of Mine Closure of Amalgamated Sudamdih Patherdih Colliery

Sl. No.	Activity	Mine Closure Cost
<b>A</b>	<b>Dismantling of Structures</b>	
	Service Buildings	7.273
	Residential Buildings	97.097
	Industrial Structures like CHP, Workshop, field sub-station, etc.	10.910
<b>B</b>	<b>Permanent Fencing of Mine Void and other dangerous area</b>	
	Random Ruble masonry of height 1.2 metre including levelling up in cement concrete 1:6:12 in mud mortar	54.549

Sl. No.	Activity	Mine Closure Cost
<b>C</b>	<b>Grading of Highwall slopes</b>	
	Levelling and grading of highwall slopes	64.368
<b>D</b>	<b>*OB Dump Reclamation</b>	
	Handling/Dozing of external OB Dump into mine void	3224.202
	Bio-Reclamation including soil spreading, plantation and maintenance	14.546
<b>E</b>	<b>*LANDSCAPING</b>	
	Landscaping of the cleared land for improving its esthetic	10.910
<b>F</b>	<b>*Plantation</b>	
	Plantation over area obtained after dismantling	18.183
	Plantation around fencing	7.273
	Plantation over the cleared external OB Dump	0.727
<b>G</b>	<b>Monitoring/Testing of parameters for three years</b>	
	Air Quality	8.001
	Water Quality	7.273
<b>H</b>	<b>*Enterpreneurship Development(Vocational/skill development training for sustainable income of affected people</b>	9.455
<b>I</b>	<b>*Miscellaneous and other mitigative measures</b>	72.732
<b>J</b>	<b>Manpower Cost for Supervision</b>	29.093
	<b>TOTAL</b>	<b>3636.591</b>

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

Thus, total amount that shall be deposited for final mine closure activities of Amalgamated Sudamdih Patherdih Colliery (ASPC) mine during the period of 33 years has been estimated as 3636.591 lakhs for OC Units based on OC norms at WPI of June 2018.

*Mining is to be carried out in a phased manner initiating afforestation/reclamation work in the mined out area of the first phase while commencing the mining in the second phase i.e. continuation of mining activities from one phase to other indicating the sequence of operations*

*depending on the geo-mining conditions of the mine. Up to 80% of the total deposited amount including interest accrued in the ESCROW account may be released after every five years in line with the periodic examination of the Closure Plan as per Clause 3.1 of the Annexure of the Guidelines. The amount released should be equal to expenditure incurred on the Progressive mine closure in past five years or 80% whichever is less. The balance amount shall be released to mine owner/leaseholder at the end of the final Mine Closure on compliance of all provisions of Closure Plan. This compliance report should be duly signed by the lessee and certify that said closure of mine complied all statutory rules, regulations, orders made by the Central or State Government, statutory organisations, court etc. and certified by the Coal Controller.*

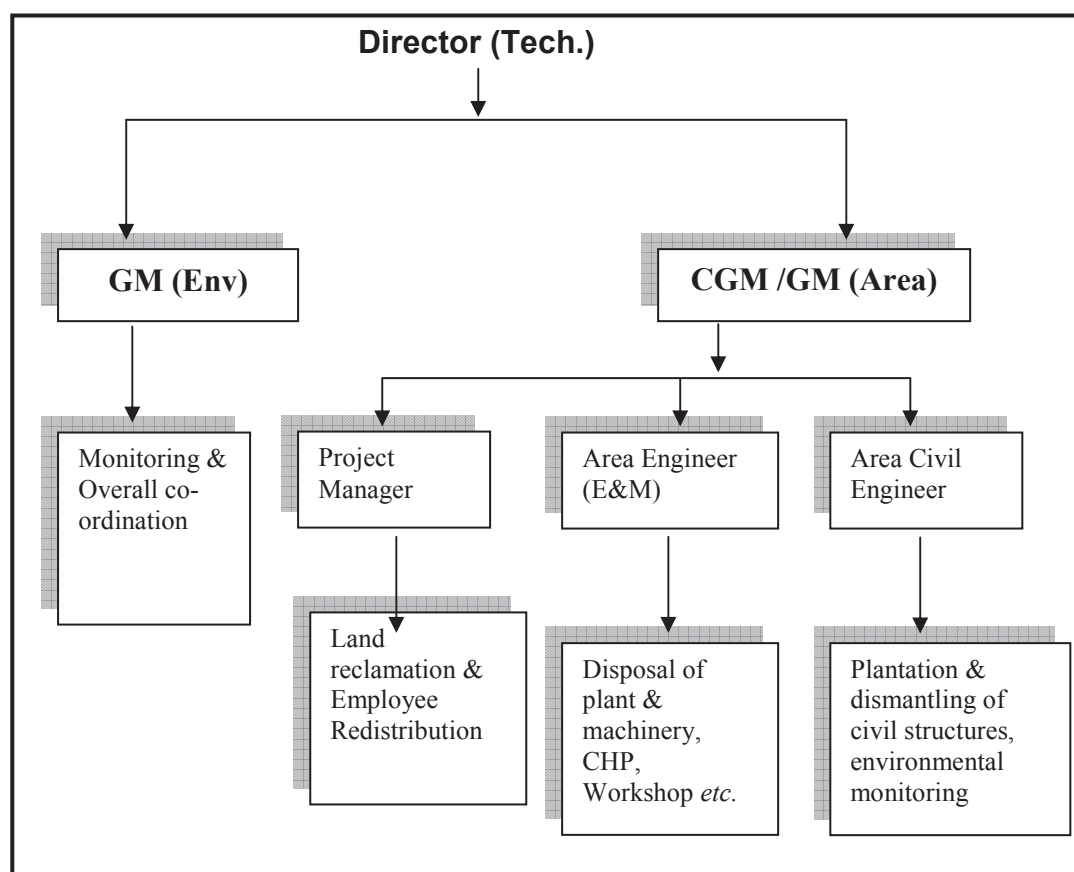
However, the additional amount beyond the escrow account, if any estimated later on, will be provided by the mine operator after estimating the final mine closure cost five years prior to mine closure (as per the mine closure guideline).

## **12.9 IMPLEMENTATION PROTOCOL**

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

Mine closure activities (in opencast section as well as underground section) should be implemented as per implementation schedule given herewith.

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



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

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

**IMPLEMENTATION SCHEDULE FOR MINE CLOSURE IN AMALGAMATED SUDAMDIH PATHERDIH**  
(LIFE OF THE MINE: 33 YEARS)

S.N	Activity	Time Frame	YEAR						
			Operational Phase			Post Closure Phase			
			1 <sup>st</sup> - 10 <sup>th</sup>	11 <sup>th</sup> - 20 <sup>th</sup>	21 <sup>th</sup> - 33 <sup>th</sup>	PC1	PC2	PC3	
<b>A</b>	<b>Dismantling of Structures</b>								
	Service Buildings	2 years							
	Residential Buildings	2 & ½ years							
	Industrial structures like CHP, Workshop, field sub-station, etc.	2 & ½ years							
<b>B</b>	<b>Permanent Fencing of mine void and other dangerous area</b>								
	Random rubble masonry of height 1.2 metre including leveling up in cement concrete 1:6:12 in mud mortar	2 years							
<b>C</b>	<b>Grading of highwall slopes</b>								
	Levelling and grading of highwall slopes	2 years							
<b>D</b>	<b>OB Dump Reclamation</b>								
	*Handling/Dozing of OB Dump and backfilling	Throughout the life of the mine including 3 years after cessation of mining operation							
	*Technical and Bio-reclamation including plantation and post care	Throughout the life of the mine including 3 years after cessation of mining operation							
<b>E</b>	<b>Landscaping</b>								
	Landscaping of the open space in the leasehold area for improving its esthetics and eco value	Throughout the life of the mine including 3 years after cessation of mining operation							
<b>F</b>	<b>Plantation</b>								
	Plantation over cleared area obtained after dismantling	2 years							

S.N	Activity	Time Frame	YEAR					
			Operational Phase			Post Closure Phase		
			1 <sup>st</sup> - 10 <sup>th</sup>	11 <sup>th</sup> - 20 <sup>th</sup>	21 <sup>th</sup> - 33 <sup>th</sup>	PC1	PC2	PC3
	*Plantation around the quarry area and in safety zone	Throughout the life of the mine including 3 years after cessation of mining operation						
	*Plantation over the OB Dump	Throughout the life of the mine						
G	<b>Post Closure Env Monitoring / testing of parameters for three years</b>							
	Air Quality	3 years						
	Water Quality	3 years						
H	<b>*Entrepreneurship Development (Vocational/skill development training for sustainable income of affected people</b>	Throughout the life of the mine						
I	<b>*Miscellaneous and other mitigative measures</b>	Throughout the life of the mine including 3 years after cessation of mining operation						
J	<b>Post Closure Manpower cost for supervision</b>	3 years						

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

**NOTE:** The progressive mine closure will be done as per the provisions made out in the Mining Plan and as per the situation/requirement that may arise in course of execution of the Mining Plan

**Item No. 351.3D**

**Quarterly Review for the Quarter October to December, 2018 & January to March, 2019 on Safety, Environment & Quality as per the directive of MoC letter no. 23/3/2015-ASO/BA dated 26.04.2017.**

Board reviewed the quarterly report of **October to December 2018** and **January to March 2019** on Safety, Environment & Quality as per the directive of MoC letter no. 23/3/2015-ASO/BA dated 26.04.2017.

**Item No. 351.4G****Corporate Environment Policy (CEP) of Bharat Coking Coal Limited.****Background**

Coal India Ltd. had brought out its Corporate Environment Policy (CEP) in 2012 Based on CIL Environment Policy 2012, incorporating the Jharia Master Plan, CEP of BCCL was approved by 285<sup>th</sup> BCCL board on 21.04.2012 (ANNEXURE C of the agenda note). As per the provisions of the policy, it is to be revised every 05 years as per which the policy would have been revised in 2017. However, there was delay in revising the policy at CIL's end due to which there is a delay in revising BCCL's CEP. CIL has revised its Corporate Environment Policy and approved in its 377<sup>th</sup> CIL Board Meeting dated 20<sup>th</sup> Dec., 2018(ANNEXURE D of the agenda note).

The CAG during its exit meeting held on 16.11.2018 also pointed out for the need of revising BCCL's Corporate Environment Policy adopted in 2012(ANNEXURE E of the agenda note). Modifying CIL's CEP to suit BCCL's prevailing conditions, the Corporate Environment Policy of BCCL has been revised.

Two versions of Policy was attached herewith out of which any one may be approved as deemed suitable by the Board.

- a. An abridged version of the policy as adopted earlier by BCCL in 2012. (ANNEXURE A of the agenda note)
- b. A detailed version of the policy similar to the CEP, 2018 of CIL with modifications suited to BCCL's condition. (ANNEXURE B of the agenda note)

**Decision:**

After detailed deliberation the Corporate Environment Policy, 2018 of CIL was approved by the Board.

Board further directed that the Policy as adopted above to suit the conditions in BCCL should be modified with information to Coal India.

**Certified to be True Copy**

  
**B.K. Parul**  
 Company Secretary  
 Bharat Coking Coal Limited  
 Kowla Bhawan  
 20005



## BHARAT COKING COAL LIMITED Corporate Environment Policy



### ENVIRONMENTAL POLICY STATEMENT:

Bharat Coking Coal Limited (BCCL) is committed to promote sustainable development by protecting the environment through integrated project planning & design, prevention / mitigation of pollution, conservation of natural resources, restoration of ecology & biodiversity, recycling/ proper disposal of wastes, addressing climate change and inclusive growth. It also aims to bringing awareness amongst its stakeholders for continual improvement in environmental performances following best practices.

### OBJECTIVES:

Bharat Coking Coal Limited shall endeavour to:

1. Plan & design projects with due consideration to environmental concerns for Sustainable Development.
2. Conduct mining and associated operation in an environmentally responsible manner to comply with applicable laws and other requirements related to environmental aspects.
3. Prevent pollution of surrounding habitation by continuous monitoring and adopting suitable measures for environment protection.
4. Implement Environment Management Plans in all our mines /projects/Clusters effectively to mitigate pollution, conservation of natural resources and restoration of ecology & biodiversity.
5. Ensure compliance of all applicable Environmental Clearance& Forestry Clearance conditions and other statutory conditions issued by regulatory agencies.
6. Recycling of wastes on the principle of REDUCE, REUSE and RECYCLE.
7. Put special thrusts on efficient energy utilization / renewable energy as a measure to reduce carbon foot-print.
8. Strive for continual improvement in our environmental performances by setting targets, measuring progress and taking corrective action.
9. Taking measures to render productive post mining land use.
10. Implementation of activities applicable to BCCL arising out of International Conventions.
11. Create environmental awareness among the employees and the local communities through pro-active communication and training

### STRATEGIES FOR IMPLEMENTATION OF ENVIRONMENTAL POLICY:

#### BackGround:

Bharat Coking Coal Limited subscribes to the view of Sustainable Development. Unless the environment can sustain all the developmental activities, any pursuit of development in isolation can cause irreparable damage to the ecosystem and associated environmental attributes. Keeping this view in mind, Bharat Coking Coal Limited attaches top priority towards sustainable development and approved its 'Corporate Environmental Policy'. Based on CIL Environment Policy 2012, incorporating the Jharia Master Plan, CEP of BCCL was approved by 285th BCCL board on 21.04.2012 and is complimentary to the National Environmental Policy, 2006. The Revised BCCL Policy, 2019 is the outcome of the experience gained since 2012, keeping in view the modifications / amendments made time to time in environmental policies and additional stipulation notified by MoEF&CC (Ministry of Environment, Forest & Climate Change), and other organisations concerning mine closure, reclamation of degraded land, environmental clearance etc. and also with the objective of revisiting the corporate policy. The Policy has a vision of Green Mining and mission of 100% compliance of environmental statutes applicable to coal mining industry. This policy is prepared in line with that of CIL's

policy with incorporation of prevailing local conditions.

**STRATEGIES: Bharat Coking Coal Limited adopts the strategies appended below for effective implementation:**

**1. MINE/ PROJECT PLANNING & DESIGN FOR SUSTAINABLE DEVELOPMENT:**

a) Coal being a non-renewal energy source, extraction shall be planned prudently to meet national requirement in a planned way. The projects shall be designed on the principle of Sustainable Development with due consideration to environment, mine closure, safety and aspirations of the stakeholders at the planning & design stage itself with due regard to mine closure plan.

b) While preparing the Mining plan/project reports, the effort shall be to incorporate latest mining technologies and equipment's with optimal capacity, which are more environment friendly

c) All Mining Plan/ project reports will be provided with detailed provisions for ensuring environmental compliances

**2. ENVIRONMENTAL IMPACT ASSESSMENT (EIA) & ENVIRONMENT MANAGEMENT PLAN (EMP)**

a. All mine planning and design shall be environmentally acceptable and operations shall be carried out in such a way as to facilitate the compliance of stipulated environmental standards.

b. EIA & EMP for all projects/Clusters shall be formulated as per the approved ToR (Terms of Reference) and public consultations for obtaining Environmental Clearance (EC) from MoEF & CC. Similarly, in the existing projects needing enhancement of production capacities with or without increase in land, change of technology, renewal of lease and change in land use etc. fresh EC is required to be sought as per norms. The projects shall be operated after obtaining Consent to Establish (CTE)/Consent to Operate (CTO) from State Pollution Control Boards (SPCB).

c. Detailed Mine Closure Plans shall be prepared for all existing and new mines as per the MoC (Ministry of Coal) guidelines.

**3. COMPLIANCE OF THE STATUTORY REQUIREMENTS:**

The implementation of EMP and fulfilment of all other statutory requirements like conditions of EC, FC and consents to establish & operate, including timely submission of returns to statutory bodies and various agencies, are to be ensured at all levels.

**4. MEASURES TO MITIGATE POLLUTION:**

**a) Air Pollution:**

i) Generation of dust is to be controlled at the source to the possible extent with necessary control measures during drilling, blasting, loading, unloading, CHP transfer points etc

ii) Deployment of eco-friendly mining technologies.

iii) Dust generation is to be minimized along coal / waste transportation routes.

iv) Mechanized transportation of coal to be encouraged.

v) Green belt is to be created around the source of dust

**b) Water pollution:**

i) The mine water and other effluent shall be treated to ensure the discharge norms as per statute. The treated effluent shall be utilized to the extent possible with a view to achieve

maximum water conservation.

ii) Oil & grease from the effluent shall be removed by Oil & Grease Traps for proper disposal.

**c) Noise / ground vibration:**

i) All measures to minimize noise pollution will be taken including maintenance of HEMM, equipment and provision of PPE where required.

ii) Suitable blasting techniques shall be followed to reduce ground vibration as well as noise pollution.

**d) Land reclamation:**

i) Progressive and concurrent reclamation of mined out areas will be carried out as per approved EIA/EMP and Mine Closure Plan (MCP).

ii) Slopes of external dumps are the important area to be suitably graded / terraced for effective reclamation and plantation.

iii) Preservation of top soil is required for future use. Old as well as existing nonactive dumps are to be technically and biologically reclaimed.

iv) Monitoring of reclamation work of all opencast mines will be done through Satellite Surveillance. The outcome shall be put in the websites.

**e) Mine closure plans:**

Mine Closure Plan (MCP) shall be prepared for each mine on which Mine closure guidelines are applicable. MCP are being delineated in two phases viz. progressive and final mine closure. Appropriate funds are set aside and deposited under a special Escrow fund every year as per MoC guidelines, to be utilized for proper and final mine closure.

For mines closed prior to issuance of MoC guidelines (i.e. 27th August, 2009) suitable action to be taken as per provisions of Mines Act 1952.

**f) Mine fire & subsidence**

BCCL shall endeavour to reduce occurrence of mine fire and subsidence due to mining activity for safety and conservation purpose and, shall take steps for prevention and control of coal mine fire. Monthly report shall be submitted to top management of the subsidiary and CIL and Quarterly to company board. Action Plan for mine fire control shall be implemented. Monitoring will be done through Satellite

Surveillance/other suitable technology. Rehabilitation under Master Plan will be expedited to facilitate faster liquidation of fire. During the execution of the Master Plan since 2009, changes have occurred in the fire dealing methodology, the number of affected families and the infrastructure facilities to be provided to them. However, these modifications were executed in cognizance of HPCC committee for JMP.

BCCL is committed for implementation of the GOI approved Master Plan for Dealing with Fire, Subsidence and Rehabilitation in leasehold of BCCL (Jharia Master Plan) which is also required to be dovetailed with the implementation of EC conditions of various clusters of BCCL. Necessary steps shall be taken for implementation of Jharia master plan to deal with the problem of fire and subsidence in JCF along with R&R of affected people.

**g) Monitoring:**

I. All receptors in and around the mining projects/clusters all be monitored regularly to assess the efficacy of the pollution control / mitigation measures within stipulated standards.

II. Effect of mining on the hydrology of the area will be monitored through measurement of water level and quality of nearby wells and bore holes provided for this purpose. Conservation of water through rainwater harvesting shall be taken up.

III. Area and Unit environmental cells shall have regular interaction with the people in and around the coal mines and other allied units on matters related to environment to take necessary and timely corrective actions.

V. Environmental initiatives and monitoring through self and third party environment audit shall be conducted for generating useful data for taking corrective actions and mitigation measures as per guidelines.

## **h) Other measures:**

- I. Special emphasis shall be given to undertake R&D related to various facets of coal mine environmental management in collaboration with Central Mine Planning and Design Institute (CMPDI) and other competent institutions.
- II. Besides ensuring statutory compliance, the BCCL desires to set high standards and continual improvement.
- III. Mines & establishments shall be ISO 14001 certified in phased manner.
- IV. CSR and R&R policies of CIL are to be incorporated by BCCL for better planning and implementation of the socio-economic issues of coal mining areas.
- V. The coal mining environmental issues are complex and require multidisciplinary approach to address the same. BCCL will endeavour to enter into MoUs with expert agencies of repute to assist in environment issues and also help in capacity building of BCCL executives.
- VI. BCCL conduct periodical medical examination (PME) of its work force on routine basis in compliance of the requirement mining rules and regulation, additional test will be done as and when require.

## **5. PRESERVATION OF BIO-DIVERSITY:**

BCCL has made the ecological restoration a flagship programme for restoration of degraded mined areas and adopting 3- tier plantation consisting of native species grasses, bushes and trees under the technical expertise of Forest research institute, Dehradun, a renowned institute in the field of forests and ecology. Ecological restoration has been widely accepted as one of the most effective means to restore the ecology and biodiversity.

BCCL is committed towards the conservation and restoration of the natural biodiversity of the region on the degraded mined out areas and restore back to forest like areas. BCCL will strive to restore the habitats for the native fauna of the region by restoring the areas through ecological restoration.

BCCL is committed towards the wellbeing and betterment of the living standards for the local community through establishment of the eco-parks in the reclaimed mined areas in the coalfield and promoting the eco-mining tourism in the coalfield areas and exploring the new opportunities to the local communities. This will start from mine planning including technically and biologically reclamation of mined out areas in collaboration with State Forest Departments, Wild Life Divisions, NGOs, FRI Dehradun etc. working in the fields of biodiversity conservation.

## **6. COAL BENEFICIATION / COAL WASHERIES:**

- a) For beneficiation of Runoff Mines (ROM) coal, washeries are being set up in a phased manner as per requirement and statutes.
- b) Slurry Management System (SMS) in all washeries shall be organized to ensure collection of fines, gainful utilization of rejects viz. power generation in Fluidized Bed Combustion (FBC) plants, selling to brick manufacturers or adopting other environmental friendly disposal options as feasible.
- c) The reject dumps and tailings shall be suitably handled to avoid any contamination.
- d) The effluent from washeries including tailings pond shall be suitably treated and reused to minimize water consumption with zero discharge concept.

## **7. CONSERVATION AND CLEAN TECHNOLOGY:**

- a) R&D projects shall be taken up to promote clean coal technology and improve the existing technologies.
- b) Energy saved is energy produced. Voluntary energy audit to be done for corrective action to reduce carbon footprint.
- c) Clean Development Mechanisms will be explored for reducing emission of Green House Gases by exploration, identification, preparation of projects reports for extraction of methane from Coal Bed, Coal Mine, Abandoned Mine, Ventilation Air, UG Coal Gasification, generation and utilization of renewable energy etc.

## **8. AWARENESS PROGRAMME:**

- a) Publicity to generate awareness through exchange & communication of information, newsletters and periodicals on environment, seminars, workshops, celebration of

World Environment Day etc, at BCCL HQ, Areas & units to be undertaken. Regular training programs to be organized at various levels to inculcate awareness among employees.

b) Courses on environmental and forestry laws and Environmental Protection Measures and the Corporate Policy to be organized for project executives for improving knowledge.

c) BCCL will felicitate its workers for best practices in eco-restoration, land reclamation, conservation, compliance of statutes and innovative ways of sustaining environment.

### **9. WASTE MANAGEMENT:**

BCCL will undertake appropriate action for safe handling, storage and disposal of solid waste and hazardous waste generated from its industrial set up and colonies as per relevant rules. The biomedical waste generated from hospitals and dispensaries will be collected and disposed in appropriate facilities created as per statutes. E-waste management and handling of various types of e-waste generated in its operations will be done as per rule.

### **10. CORPORATE ENVIRONMENT RESPONSIBILITY:**

Corporate Environment Responsibility (CER) is mandatory for issuing environmental clearance for all the Greenfield and Brownfield projects as per directives of MoEFCC with effect from 1st May, 2018 (O.M.No.22-65/2017- I/III dt. 19.06.2018). Budgetary provisions should be kept for implementation of provisions of CER for all the projects which will be submitted to MoEFCC for grant of environmental clearance.

### **11. INCORPORATION OF VIEWS OF STAKEHOLDERS:**

BCCL will critically examine and incorporate the viewpoints of various stakeholders like PAPs/PAFs, Parliamentary Committees, Standing Sub-Committees, NGOs etc.

### **12. IMPLEMENTATION OF POLICY:**

**i) Manpower:** BCCL shall have environmental divisions at decision making & operational levels in its structure. The environment department shall be set up and strengthened at:

i) BCCL HQ

ii) Areas / Units / Collieries / Workshops / Washeries

**ii) Roles and Responsibilities:** The environmental department, set up at company HQs, Areas and Unit levels with appropriate manpower and resources, shall be responsible for implementation of policy, obtaining EC, FC, consent to establish & operate, statutes requirements and undertaking mitigation measures besides preparation of action plan every year and also to intimate the status of implementation to the management regularly.

**iii) Annual Environment Budget (Revenue & Capital):** The Annual Environment Budget (revenue & capital) shall be prepared based on the action plan including monitoring of various bench marks and the budget utilization. The year wise funds earmarked for environmental protection measures shall be kept in separate accounts with Environmental cost code.

### **REVIEW OF ENVIRONMENTAL POLICY:**

In view of the present fast changing social, economic and environmental scenario, the CIL Policy shall be reviewed every 5 years to incorporate the changes in the legal, technical, environmental, economic and social inputs prevailing at that time.

Whenever, there is change in National Environmental Policy or other National / State relevant policies, Acts etc, the CIL Corporate Environmental Policy would be reviewed and suitably revised. It will be followed by revision of this policy accordingly.

**Place: Dhanbad**

**Date:**

**Chairman-cum-Managing Director**

No.J-11015/380/2010-IA-II(M)  
Government of India  
Ministry of Environment, Forest and Climate Change  
IA Division

Indira Paryavaran Bhawan,  
Jorbagh Road, N Delhi-3  
Dated: 12<sup>th</sup> June, 2019

To,

The General Manager (E&F)  
M/s Bharat Coking Coal Ltd,  
Koyala Bhawan,  
District **Dhanbad** (Jharkhand) Email: [envbccl@gmail.com](mailto:envbccl@gmail.com)

**Sub: Cluster X Coal Mining Project of capacity 2.289 MTPA and Coal Washery of 2.08 MTPA of M/s Bharat Coking Coal Limited in an area of 2057.47 ha located in District Dhanbad (Jharkhand) - Amendment in Environmental Clearance - reg.**

Sir,

This refers to your online proposal No. IA/JH/CMIN/8812/2010 dated 15<sup>th</sup> September, 2017 and additional information dated 9<sup>th</sup> February, 2019 on the above mentioned subject.

2. The Ministry of Environment, Forest and Climate Change has considered the proposal for amendment in environmental clearance dated 6<sup>th</sup> February, 2013 granted by the Ministry in favour of M/s Bharat Coking Coal Ltd for Cluster X Coal Mining Project (comprising six mine lease holds) of total capacity 2.289 MTPA (peak) and coal washery of 2.08 MTPA in a total area of 2057.47 ha in Jharia Coalfields, District Dhanbad (Jharkhand).

3. The amendment in said environmental clearance has been sought due to the proposed restructuring/re-appropriation of individual mines in the Cluster for implementation of the Master Plan dealing with fire and subsidence, with the revised details as under:-

S. No.	Mine	Type of Mine	Production Capacity	Lease Area	Mine Life	
		UG/OC	(MTPA)	(ha)	(Years)	
1	Bhowrah North	UG	0.143	208.83	>20	
	Bhowrah North	OC	0.546		6	
2	Bhowrah South	UG	0.377	571.58	30	
		OC	1.2		43	Fire dealing
3	Amalagamated Sudamdih Patherdih Mine	OC	0.709	498.61	33	Amalgamation of mines for fire dealing
4	Sudamdih Shaft	UG	0.24	391.5	30	
5	Amlabad Closed	UG	0	386.95	NA	
6	Sudamdih Coal Washery (Within lease hold of Sudamdih Shaft Mine)		2.08	18	18	
	<b>TOTAL</b>		<b>2.289</b>	<b>2057.47</b>		

With the proposed restructuring, combined production capacity of the Cluster would remain at 2.289 MTPA (peak) in the same total area of 2057.47 ha.

*SK*

Revised Mining Plan for the changed capacities of individual mines/lease holds namely, Amalgamated Sudamdih Patherdih OCP and Bhowrah South OCP has been approved by the Board of M/s Bharat Coking Coal Ltd on 29<sup>th</sup> January, 2019.

4. The proposal was considered by the sectoral Expert Appraisal Committee in its meeting held on 24-25 April, 2019, wherein the Committee recommended the amendments proposed by the project proponent as stated in para 3 above. Based on recommendations of the EAC, Ministry of Environment, Forest and Climate Change hereby accords approval for amendment in environmental clearance dated 6<sup>th</sup> February, 2013 to effect changes in production capacities of individual mines/lease holds of Cluster X Coal Mining Project of total capacity 2.289 MTPA (peak) and Coal Washery of 2.08 MTPA in an area of 2057.47 ha.

5. All terms and conditions stipulated in the environmental clearance dated 6<sup>th</sup> February, 2013 shall remain unchanged.

*SK*  
12/6/2019

**(S. K. Srivastava)**  
**Scientist E**

**Copy to:**

1. The Secretary, Ministry of Coal, Shastri Bhawan, New Delhi
2. The Additional Principal Chief Conservator of Forests, Regional office (ECZ), Ministry of Environment & Forests, Bungalow No. A-2, Shyamali Colony, Ranchi - 834002
3. The Member Secretary, Central Ground Water Authority, Ministry of Water Resources, Curzon Road Barracks, A-2, W-3 Kasturba Gandhi Marg, New Delhi
4. The Secretary, Department of Environment & Forests, Government of Jharkhand, Secretariat, Ranchi
5. The Advisor, Coal India Limited, SCOPE Minar, Core-I, 4<sup>th</sup> Floor, Vikas Marg, Laxmi Nagar, N Delhi
6. The Member Secretary, Central Pollution Control Board, CBD-cum-Office Complex, East Arjun Nagar, Delhi - 32
7. The Member Secretary, Jharkhand State Pollution Control Board, TA Building, HEC Complex, PO Dhurwa, Ranchi
8. The District Collector, Dhanbad, Government of Jharkhand
9. Monitoring File    10. Guard File    11. Record File    12. Notice Board

# POLLUTION UNDER CONTROL CERTIFICATE

Chassis/Engine Emission Test Certificate

REGISTRATION & MOTOR VEHICLE TAXATION DEPARTMENT  
RAJASTHAN, INDIA

License No: 284/2016

Sl. No: 0000127  
 Vehicle No: JH-01AD-1547  
 Make: TML  
 Model: TIPPER  
 Category: TIPPER  
 Regis Date: 2010  
 Fuel: DIESEL  
 Engine No: 20732  
 Chassis No: 13852  
 Test Date: 15-3-2019

Test Time: 12:14 PM  
 Odometer: NA  
 Owner Name:  
 Remark:



FLUSH		CYCLE		AVERAGE		
RPM Min	RPM Max	Temp	HSU	K-value		
650	4250	43				
DETAIL						
RPM Min	RPM Max	Temp	HSU	K-value		
650	4250	58	20.75	0.54		
610	4280	61	27.88	0.76		
630	4250	62	24.62	0.66		
MEAN			24.42	0.65		
RESULT		PASS				

Result: Pass

Valid Up To:

14-3-2019

This vehicle meets the Emission Standards prescribed by Rule 115 (2) of Central Motor Vehicle Rule-1989.

This Certificate is Valid for Six Months Only.

Seal of Testing Centre

Test Station Code: 284/2016

Authorized Signatory



NOIHOHON

NOIHOHON

Lic No. 397/18 Sea Under Rule 252/01 JH(MVR)

**TRANSPORT DEPT. GOVT. OF JHARKHAND**

Vehicle No. **JH10AG 9659** Type of Vehicle **TIPPER**

**POLLUTION**

**UNDER CONTROL**

DATE OF ISSUE **05/12/2018** VALID UPTO **03/06/2019**

OUR DREAM

INDIA GREEN

उपलब्ध है।

वाहन निचनावली, 2001 के नियम 252 ड।2। के तहत

वाहन निचनावली से अन्तर्गत प्रमाण-पत्र

अनुमति संख्या : 397/18

मोटर वाहन संख्या : **JH10AG 9659**

मैक : **TML** निर्माता की तिथि : **05/12/2018**

मॉडल : **2012** वाहन की श्रेणी : **TIPPER**

निरन्तरण स्तर को जाँच एवं मिल पटन पाया।

CMVR 1989 के नियम 115 (2) के अन्तर्गत निर्धारित मापदण्ड

CO :- 0.2% - 4.8%

HC :- 750-2090

नियम 115 (2) के अन्तर्गत निर्धारित मापदण्ड की पूर्ण शक्ती है।

**03/06/2019**

**ALL INDIA VALID**

**koylanchaipus@gmail.com**



*[Handwritten Signature]*



Government of Punjab

Department of Motor Vehicle Inspection

Office of Motor Vehicle Inspection, Feroz Road, Lahore

Form No. 204/2016

SI No:

20500127

Registration Date:

2010

Test Time:

12:14 PM

Vehicle No:

JH10R-1438

Fuel:

DIESEL

Odometer:

NA

Make:

TAI

Engine No:

20732

Owner Name:

Model:

TIPPER

Chassis No:

14692

Remark:

Category:

TIPPER

Test Date:

15-1-2019

FLUSH CYCLE

AVERAGE

rpm/min RPM/Max Oil Temp

0630 1250 43

rpm/min RPM/Max Temp HCU K value

520	4250	69	20.75	0.54
570	4250	61	27.85	0.75
620	4250	60	24.62	0.66
MEAN			24.42	0.65

MEAN RESULT

PASS

Result Pass

Valid Up To:

14-9-2019

This Vehicle passes the Emission Standard as prescribed by rule 115 (D) of Central Motor Vehicle Rule 1989.

This Certificate is valid for Six Months only.

WITH BY GOVT OF PUNJAB

On 15/1/2019

Seal of the Test Station

Test Station Code: 284/2016

Authorized Signatory



# POLLUTION UNDER CONTROL CERTIFICATE

## COMPUTERIZED EMISSION TEST CERTIFICATE

(Rule 163B(3) of BMV Rules 1992)



Transport Department  
Govt. OF JHARKHAND

License: 440/2015

PUC No. JH1171  
Serial No. 1171  
Vehicle No. JH01AC3505  
Date of Mfg. NA  
Category GVW

Make TATA Motors Ltd.  
Model TPPER  
Fuel Diesel  
Chasis 12160  
Engine 05158

Name GFC PROJECT LTD  
Address NA  
Date 01/03/2019  
Time 02:13:25

Photo of Vehicle

Sl No.	Opacity [1/m]	Opacity [%]	RPM (Max)
1	56	46.13	1209
2	0.59	46.16	1214
3	0.57	46.12	1216
4	0.6	46.14	1212
5	0.56	46.12	1218
--	--	--	--
--	--	--	--
Mean	0.56	46.136	1217.8



Grade PASS Valid Upto 31/07/2019

Certificate of the Vehicle's smoke emission confirms to the standards prescribed under rule 115(2) of central motor vehicle under 1958



Seal of Testing Centre

Test Station Code: 440/2015

*[Signature]*  
Authorised Signatory

PROHIBITION

TRANSPORT DEPT. GOVT. OF JHARKHAND

Lic. No. 397/18 See Under Rule 252(1) JH(MV/R)

# TRANSPORT DEPT. GOVT. OF JHARKHAND

Veh No. **JH22A 1658** Type of Vehicle **TIPPER**

**TIPPER LPT**

DATE OF ISSUE **03/12/2018** VALID UPTO **31/07/2019**

ORDER

INDIA GREEN

**1658**

वहन संख्या : **JH22A 1658** टिपर संख्या : **BC-14513**

मोटर घांटी संख्या : **29/07/2007**

मक : **TML** निर्गत की तिथि : **03/12/2018**

नोडल : **2007** वाहन का प्रकार : **TIPPER LPT 2515**

निस्संकरण स्तर की जांच एवं निम्न पठने योग्य - **मेटल / LPG गैस**

C.M.V.R 1989 के नियम 115 (2) के अन्तर्गत निर्धारित मापदण्ड

CO :- 9.5% - 4.5% वास्तविक पठन

HC :- 730-8000

डीपल वाहन

01/06/2019

**ALL INDIA VALID**

*MKS*

keylanchalpuoc@gmail.com



POHNDHON

DZANM UOZHMOH

Lic No. 397/18 See Under Rule 252/01 JH(MVR)

**TRANSPORT DEPTT. GOVT. OF JHARKHAND**

Veh No. **JH22A 1658**

Type of Vehicle  
**TIPPER**  
**TIPPER LPT**

DATE OF ISSUE  
**03/12/2018**

VALID UPTO  
**01/06/2019**

OUR DREAM

INDIA GREEN

प्रपत्र पी.जी.ई. नं. 2007/18

साइरासि मोटर वाहन लिमिटेड, 2001 के नियम 252 ट 12। देखें

प्रदूषण नियंत्रण के अन्तर्गत प्रत्याग-पत्र

**1658**

प्रदूषण स्तर प्रमाण-पत्र  
जांच केन्द्र का नाम  
**कोयलचल प्रदूषण**  
वाहन प्रदूषण जांच केन्द्र  
बालाजी प्रभुल स्टेशन, मुईफोड़, धनबाद-

अनुसंधि संख्या : 307/18  
मोटर वाहन संख्या : **JH22A 1658**

मंक : 2007 निर्गत की तिथि : 03/12/2018

प्रकार : TIPPER LPT 2515

निस्तरण स्तर की जांच एवं प्रमाण पत्र प्राप्त -  
पेट्रोल / डिजेल वाहन

C/MVR 1989 के नियम 115 |2| के अन्तर्गत निर्धारित मापदण्ड  
CO :- 9.3%-1.5%  
HC :- 7.50-9.000

वास्तविक पठन  
CO  
HC  
डीजल वाहन

नियम 115 |2| के अन्तर्गत निर्धारित मापदण्ड को पूरा करता है/करती है।  
मापदण्ड 21

**कोयलचल सरकार**

01/06/2019

**ALL INDIA VALID**

प्रमाणित प्रपत्र प्रपत्र पी.जी.ई. नं. से एक माह तक वैध है।

कॉयलचल प्रदूषण जांच केन्द्र  
Koylanchal puc@gmail.com

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

CMS  
699(2)  
11/10/19



P. Ghosh  
11/10/19

GM (Environment)

S. Pal  
P. Ghosh  
A. Ghosh  
A. Ghosh  
P. Ghosh  
11/10/19



REGIONAL OCCUPATIONAL HEALTH CENTRE (EASTERN), KOLKATA  
&  
NATIONAL INSTITUTE OF OCCUPATIONAL HEALTH, AHMEDABAD  
(Indian Council of Medical research)

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



**REGIONAL OCCUPATIONAL HEALTH CENTRE (EASTERN), KOLKATA**

**&**

**NATIONAL INSTITUTE OF OCCUPATIONAL HEALTH, AHMEDABAD**

**(Indian Council of Medical research)**

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## **LIST OF PARTICIPANTS**

### **Investigators**

Dr Sunil Kumar, Director

Dr H G Sadhu, Scientist F

Dr Asim Saha, Scientist E

Dr D S Munda, Scientist D

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

### **Technical Staff**

Mr. Sk. J. Alam, Technical Assistant

Mr. M. K. Chakraborty, Technical Assistant

Mr. A. Das, Technician C

Mr. S. Meena, Technician C

Mr. T. K. Dasgupta, Technician B

Mr. B. B. Patel, Technician B

## BACKGROUND

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

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

## INTRODUCTION

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

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

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

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

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

## **AIM AND OBJECTIVES**

### **AIMS**

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

### **OBJECTIVES**

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

## **METHODOLOGY**

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

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

**Study design:** Cross sectional study

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

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

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

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

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

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

#### Audiometric Evaluation of Hearing:

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

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

Criteria for acceptance (inclusion criteria) as test subjects:

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

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

Criteria for normal hearing:

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

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

#### Measurement of hearing:

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

#### Equipment (Audiometer):

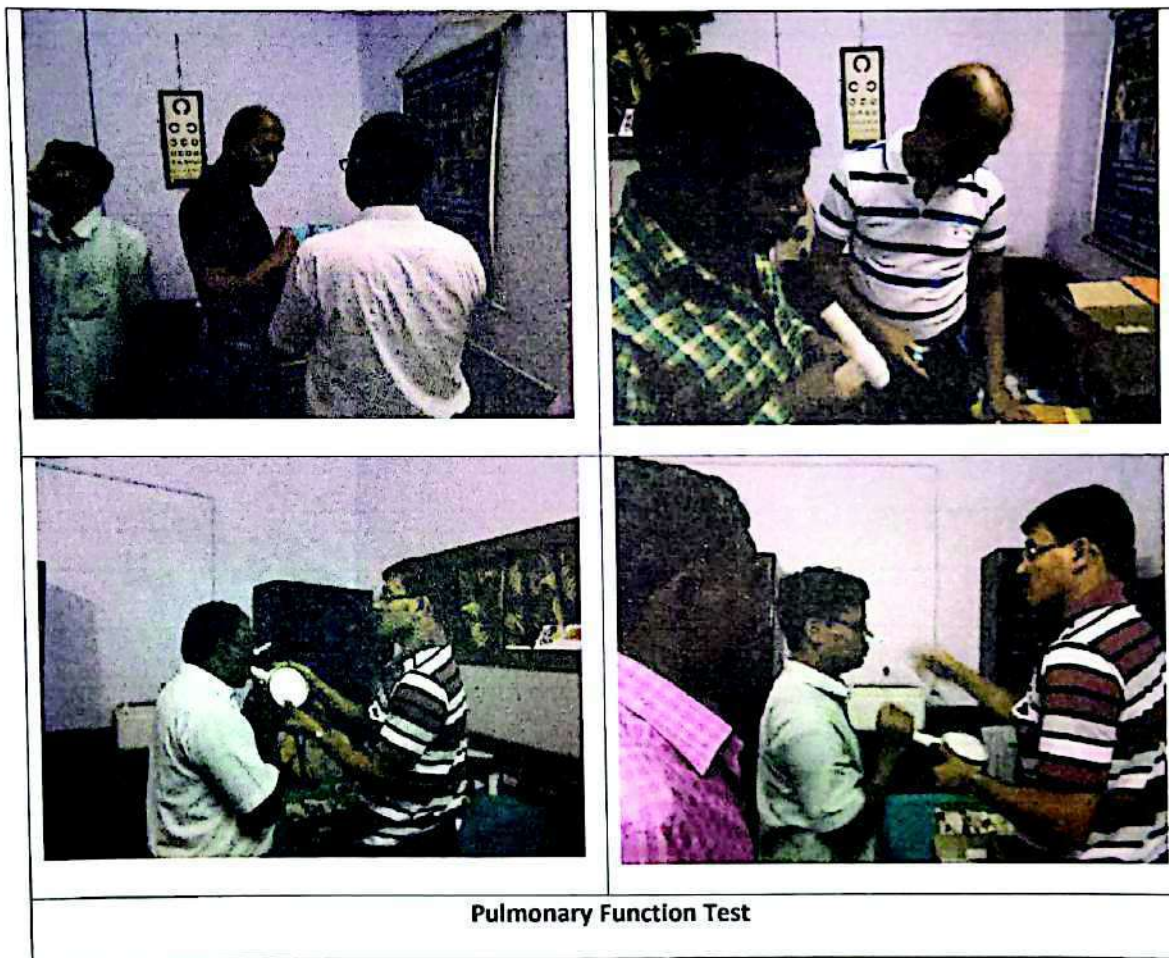
An audiometer was used as the source of pure tone audiometry. It has all the facilities of mask attenuation, frequency setting (125-8000 Hz.), decibel setting of pure tone and pulse setting. It has also a pair of earphone attachment. The audiometer is calibrated periodically as per the specification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



**Questionnaire survey**



**Medical Examination**





Information- Communication



Audiometry



**Haematology & Radiology Examination**

RESULT  
&  
DISCUSSION  
(Total subjects)

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

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

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

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

**Table 2: Demographic characteristics of the study subjects**

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

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

**Table 3: Personal habits of the study subjects**

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

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

**Table 4: Occupational characteristics of Supervisory workers & Coal miners**

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

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

**Table 5: Distribution of symptoms among study subjects**

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

**Table 8: Pulmonary function impairments among study subjects**

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

FVC – Forced Vital Capacity; PFVC – Predicted Forced Vital Capacity; FEV<sub>1</sub> – Forced Expiratory Volume in first second

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

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

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

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

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

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

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

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

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

**Table 12: Chest radiographic findings among the study subjects**

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

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

**Table 13: Haematological & Biochemical findings of study subjects**

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

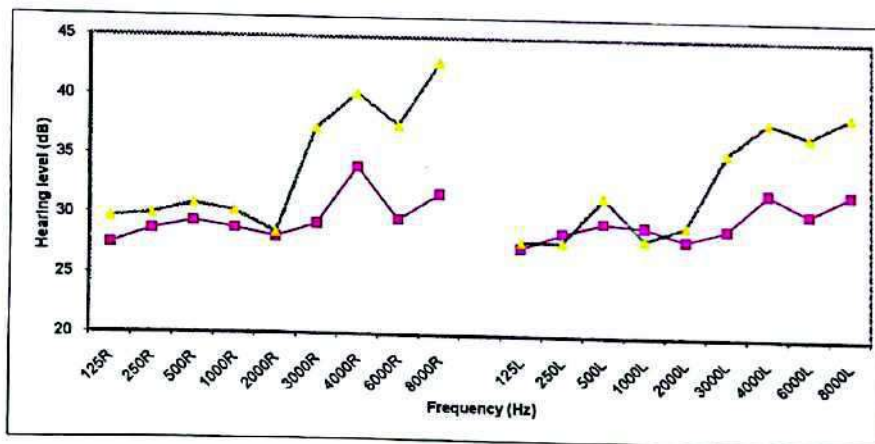
As far as ophthalmological findings are concerned, 5% subjects had uncorrected vision (although using spectacles) and 9% subjects had Cataract in eyes. Colour blindness was also observed in few subjects (Table 14).

**Table 14: Ophthalmological findings of study subjects**

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

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

**Figure 1: Distribution of hearing ability according to job experience**



## CONCLUSION

- This study covered 351 subjects from Kustore sector and 140 subjects from Baghmara sector of BCCL Collieries. Mean age of the workers was  $45.9 \pm 8.36$  years. Most of the workers were between 35-54 years age. Mean job experience was  $11.72 \pm 8.49$  years.
- Most common symptoms complained by study subjects were musculoskeletal pain (34%). Other complaints were Cough, difficulty in breathing, chest pain, soreness of mouth etc. Headache, sleep disturbance, weakness, tremor in fingers was also experienced by some subjects.
- About 20% subjects had systolic blood pressure  $>140$  as well as diastolic blood pressure  $>90$  mm of Mercury. 9% workers had only higher systolic blood pressure and 11% had only higher diastolic blood pressure.
- As far as pulmonary functional status of study subjects is concerned, about 3% subjects had restrictive type of abnormality ( $FVC/PFVC < 80\%$ ) and 0.6 % subjects had combined type of abnormality ( $FVC/PFVC < 80\%$  and  $FEV1\% < 70\%$ ). A good number of subjects (36.5%) had  $FEV1\%$  values between 70% and 80%. Mean FVC values were significantly lower among the subjects of age 45 years or above.
- So far as chest radiographic findings are concerned, 93% subjects had findings within normal limits. 3% subjects showed findings suggestive of opacities in lung and almost 1.5% had other features on chest X-ray (mostly suggestive of Koch's infection of lung). Such findings may be due to pneumoconiotic changes in lung, hence these subjects should be properly followed up and necessary medical, ethical, legal, administrative actions may be initiated as necessary.

- Haematological and biochemical findings of the subjects were mostly within normal limits. Almost 11% workers had random blood sugar level more than 140 units. As far as ophthalmological findings are concerned, 5% subjects had uncorrected vision and 9% subjects had Cataract in eyes.
- Decline in hearing ability with increasing duration of exposure was observed more at higher frequency; however, this observation is subject to adjustment for age and other probable factors.
- The subjects for this study are selected from workplaces identified by BCCL, Govt. of India, as required for the purpose of this study. The findings of this study may thus be restricted to the concerned workplaces and may not be generalisable.

## RECOMMENDATION

- o Prevalence of musculoskeletal pain during work in a good number of workers reflects that manual work of the work processes might be causing some discomfort for the workers. Training on proper method of manual material handling may prove useful of these workers. On the other hand regular proper exercise should be promoted among workers especially supervisory employees to get rid of ill effects of sedentary activities.
- o Special emphasis should be given to protection of respiratory health, hearing ability. Periodic relevant examination (lung function test, audiometry) at regular interval is recommended.
- o Industrial hygiene survey (periodic monitoring of dust and other environmental hazards) at regular interval should be undertaken including noise level monitoring in different operations.
- o Some prevalent symptoms observed may be representation of nervous system effect due to exposures to toxicants. In order to exclude the possibility of exposure from occupational environment, environmental study should include assessment of exposure to metals.
- o Measures like using protective appliances (e.g. PPEs), pre-placement- and periodic medical examination, for the control and prevention of relevant health hazards, are to be implemented and maintained by all the mining areas to protect the health of the workers.

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**EXPENDITURE MADE UNDER VARIOUS HEADS OF  
ENVIRONMENTAL MANAGEMENT PLAN**

**Major Environmental measures cost for the year 2013-14**

Sl. No.	Activity (2013-14)	Cost Incurred (In Lakhs)
1	Environmental Monitoring (through HQ)	4.80
2	Gabion Plantation through DFO	20.41
3	Biological reclamation	93.98
4	EMP Preparation cost	80.00
Total Cost Incurred (Manpower cost and Diesel cost is included)		199.19

**Major Environmental measures cost for the year 2014-15**

Sl. No.	Activity (2014-15)	Cost Incurred (In Lakhs)
1	Environmental Monitoring (through HQ)	4.80
2	Gabion Plantation through DFO	15.11
3	Ecological Restoration	279.86
4	FRI Dehradun Monitoring Cost	0.85
5	Environment Statutory Fee	2.25
Total Cost Incurred (Manpower cost and Diesel cost is included)		302.87

**Major Environmental measures cost for the year 2015-16**

Sl. No.	Activity (2015-16)	Cost Incurred (In Lakhs)
1	Environmental Monitoring (through HQ)	4.80
2	Gabion Plantation through DFO	11.40
3	Ecological Restoration	308.81
4	Statutory Fee including CTO/CTE	11.25
5	FRI Dehradun Monitoring Cost	2.138
Total Cost Incurred (Manpower cost and Diesel cost is included)		338.40

**Major Environmental measures cost for the year 2016-17**

Sl. No.	Major Environment Activity (2016-17)	Cost Incurred (In Lakhs)
1	Environmental Monitoring (through HQ)	4.46
2	Gabion Plantation through DFO	11.16
3	FRI Dehradun Monitoring Cost	0.89
4	Ecological Restoration / Block Plantation	214.43
5	Water Sprinkling	46.20
6	Scientific study for delineation of fire (through HQ)	18.10
Total Cost Incurred (Manpower cost and Diesel cost is included)		295.24

**Major Environmental Measure cost for the year 2017-18**

Sl. No.	Major Environment Activity (2017-18)	Cost Incurred (In Lakhs)
1	Environmental Monitoring (through HQ)	20.55
2	Source Apportionment Study (through HQ)	141.60
3	Ecological Restoration / Block Plantation	221.53
4	FRI Dehradun Monitoring Cost	0.89
5	Water Sprinkling	34.66
Total Cost Incurred (Manpower cost and Diesel cost is included)		419.23

**Major Environmental measures cost for the year 2018-19**

Sl. No.	Major Environment Activity (2017-18)	Cost Incurred (In Lakhs)
1	Routine Environmental Monitoring	32.57
2	Water Quarterly Monitoring Report	3.60
3	FRI Dehradun Monitoring Cost	0.89
4	Ecological Restoration/Block Plantation	38.31
5	Water Sprinkling	31.51
6	Construction of water curtain sprinkler	1.50
7	Statutory Fee including CTO/CTE	3.80
8	Ground water Monitoring	CMPDIL (through HQ)
Total Cost Incurred (Manpower cost and Diesel cost is included)		112.18

**Major Environmental measures cost for the year 2019-20**

Sl. No.	Major Environment Activity (2019-20)	Cost Incurred (In Lakhs)
1	Routine Environmental Monitoring	17.99
2	Water Quarterly Monitoring Report	1.69
3	FRI Dehradun Monitoring Cost	0.85
4	Ecological Restoration/Block Plantation	45.50
5	Water Sprinkling	31.51
6	Statutory Fee including CTO/CTE	3.80
7	Mist water sprinkler (indent) through HQ	45.66
8	Ground water Monitoring	CMPDIL (through HQ)
9	Online PM10 Analyser installation (through HQ)	42.30
Total Cost Incurred (Manpower cost and Diesel cost is included)		189.30

**Major Environmental measures cost for the year 2020-21**

Sl. No.	Major Environment Activity (2020-21)	Cost Incurred (in Lakhs)
1.	Routine Environmental Monitoring	19.50
2.	Water Quarterly Monitoring Cost	1.69
3.	Ecological Restoration (material cost)	0.50
4.	Compensatory Plantation by DFO	13.98
5.	Block Plantation by DFO	20.42
6.	Water sprinkling (Manpower & Diesel Cost included)	30.00 (approx)
7.	Statutory Fee including CTO/CTE	3.80
8.	Ground water monitoring	CMPDIL (through HQ)
9.	Online PM10 Analyser installation (2 Nos.)	through HQ
10.	Construction of Toe Wall Bhowra South	17.34
11.	Mine Closure Cost (deposited in Escrow account)	247.51
<b>Total Cost Incurred</b>		<b>354.74</b>

**Mine Closure Cost Details:**

S. No.	Name of Mine	Escrow account	Amount deposited in Escrow account till 31st March 2021 (in Rs. Lakh)		Total amount in Escrow Fund
			Deposited in Escrow account from 2013-14 to 2020-21	Interest incurred from 2013-14 to 2020-21	Principal & Interest upto 31.03.2021
1	Bhowra (N) Grp of Mines (UG+OC)	150100008868	532.28	218.37	750.66
2	Bhowra (S) Grp of Mines (UG+OC)	150100008830	1406.74	577.74	1984.48
3	Sudamdih Incline Mine	150100008868	93.74	52.66	146.4
4	Patherdih Grp of Mines	150100008872	389.22	136	525.22
5	Amalgamated Sudamdih-Paherdih Colliery	150100011524	63.68	0.86	64.55
6	Sudamidh Shaft Mine	150100011673	174.22	10.63	184.85
<b>Total Eastern Jharia Area (Cluster X)</b>			<b>2659.88</b>	<b>996.26</b>	<b>3656.16</b>

\*Note:- Amount deposited in Escrow account for implementation of progressive mine closure Activity in the mines under cluster X is 36.56 Crores from FY 2013-14 to FY 2020-21.

ok



# Bharat coking coal limited

(A Subsidiary of Coal India Ltd)

Office of the Project Officer, Bhowra (N), Eastern Jharia Area,  
P.O. Bhowra, Dist: Dhanbad (Jharkhand), PIN- 828302

Ref. No:- BCCL/EJA/BH(S)/PO/2021/ 1128

Date:- 16/09/2021

To,  
The Member Secretary,  
Jharkhand State Pollution Control Board  
T. A. Division Building (Ground Floor).  
H. E. C. Dhurva.  
Ranchi - 834004

## Sub:- Submission of Environmental Statement in Form - V

Dear Sir,

Please find enclosed herewith Environmental Statement Form - V for the financial year 2020-21 in respect of Bhowra (S) Colliery.

Enclosures: - As above.

Yours Faithfully

  
16/9/2021  
Project Officer  
Bhowra South Colliery

Distribution:-

1. The Regional Officer, JSPCB Office, HIG Dha
2. The General Manager (Env.), BCCL, Koyla Bh
3. The Area Manager (Env.), E. J. Area
4. Office File.

  
16/09/2021  
आपूर्तिकर्ता  
कोयला इण्डिया लि.  
बोयरा साउथ कोलियरी



E:3405206361N IVR:6974340620938  
SP BHOWRA SO (828302)  
Counter No:1,17/09/2021,11:28  
To:THE MEMBER SE,J S P C B  
PIN:834004, Dhurva SO  
From:PROJECT OFF,BHOWRA S COLLIER  
wt:20gms  
Amt:41.30 (Cash) Tax:6.30  
(Track on www.IndiaPost.gov.in)  
(Dial 1800266888) (Wear Masks, Stay Safe)



(Form - V)

(See rule 14)

Environmental Statement for the financial year ending the 31<sup>st</sup> March 2020 - 21

**PART - A**

- (i) Name and address of the owner/occupier : J. P. Gupta, D.T. (P&P) BCCL,  
of the industry operation or process Koyla Nagar, Dhanbad
- (ii) Industry category : Coal Mining Industry
- (iii) Production capacity : U/G - 0.377 MT/Y  
OCP - 1.2 MT/Y  
(EC No:- J-11015/380/2010-1A-II(M),  
dt: 06/02/13) and EC amended dated  
12.06.2019
- (iv) Year of establishment : Colliery operating since pre nationalization  
period and vested in BCCL through Coal  
Mine Nationalization Act 1972-73
- (v) Date of last environmental Statement submitted : 14.09.2020 (Ref. No: BCCL/EJA/BH(S)/2020/997)

**PART - B**

**Water and River Material Consumption**

Water Consumption	
Process (Dust separation)	2000KLD
Cooling	Nil
Domestic	1000KLD

Name of Products	Process water consumption per unit of product output	
	During the previous financial year	During the current financial year
COAL	-	1.623 KL/T

**Raw Material Consumption**

Name of materials	Name of products	Consumption of raw material per Unit of output	
		During the previous financial year (2019- 20)	During the current financial year (2020-21)
Diesel	Coal	-	4.584L/Te
Explosive	Coal	4.78 Kg/ Te	4.63kg /Te
Timber	Coal	S- 0.0932 nos./Te; P- 0.0189 nos./Te *	NIL

\*S - wooden sleepers, P- wooden props.

### PART - C

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

Pollutants	Quantity of pollutants discharge	Concentrations of pollutants in discharge(mass/volume)	Percentage of variation from prescribed standards with reasons
Water	--	<u>(MW-10, 20.03.21)</u> TSS - 45 PH - 7.97 Oil & Grease - <2.0 COD - 28	Within Limit
Air	-	<u>(as on 22.03.21)</u> PM 10 - 138 PM 2.5 - 72 SO <sub>2</sub> - 10 NO <sub>x</sub> - 29	Within Limit

### PART - D

#### Hazardous Wastes

(as specified under Hazardous waste management and handling rules, 1989)

Hazardous Waste	Total Quantity (Kg.)	
	During the previous financial year (2019-20)	During the current financial year (2020-21)
From process	Burnt oil - 288 Litre	Burnt oil - 698 Litre
From pollution control facilities	N/A	N/A

### PART - E

#### Solid Wastes

Solid Wastes (OB)	Total Quantity	
	During the previous financial year	During the current financial year
(a) Process	-	3993684 M3
(b) Pollution control facility	Nil	Nil
(c) Quantity recycled or re-utilized within the unit	Nil	3993684 M3 (BACKFILLED)

### PART - F

Please specify the characterizations (in terms of composition of quantum) of hazardous as well as solid waste and indicate disposal practice adopted for both these categories of wastes.

- (i) Type of Rocks : - N/A
- (ii) Type of soil : - N/A
- (iii) Chemical properties of soil: - N/A
- (iv) Disposal process for Solid Waste (backfilling practice): - Backfilled in low lying area

### PART - G

Impact of pollution abatement measures taken on conservation of nature resources and on the cost of production

- (i) No. of plants planted : Nil
- (ii) Cost of plants : NA
- (iii) Plantation cost incurred : NA
- (iv) Backfilling cost : NA

### PART - H

Additional measures/investment proposal for environmental protection including abatement of pollution, prevention of pollution

- (i) Water sprinkling is being done in transporting road, coal stock yard, working faces, etc. to reduce dust emission.
- (ii) Proper and timely maintenance of tipper, HEMM's, fan, pumps etc. is being done to control noise pollution.
- (iii) Monitoring of air quality and water quality is being done periodically.
- (iv) Covered coal transportation is being done.
- (v) Pucca road prepared for coal transportation.
- (vi) Maintenance of plants.

### PART - I

Any other particulars for improving the quality of the environment

  
Project officer  
Bhowra (S) Colliery

**BHARAT COKING COAL LIMITED**  
A MINI RATNA COMPANY  
A SUBSIDIARY OF COAL INDIA LIMITED  
OFFICE OF THE PROJECT OFFICER  
ASP COLLIERY (SUDAMDIH)  
P.O.- Sudamdih Dist.-Dhanbad  
Pin - 828126, Jharkhand  
Ref. No. BCCL/EJA/ASP/21/2178



**भारत कोकिंग कोल लिमिटेड**  
(कोल इंडिया लिमिटेड का एक अंग)  
परियोजना पदाधिकारी का कार्यालय  
ए० एस० पी० कोलियरी (सुदामडीह)  
पी०ओ० - सुदामडीह, जिला-धनबाद  
पिन कोड- 828126, झारखंड

Date: 23/09/2021

To,  
The Member Secretary,  
Jharkhand State Pollution Control Board,  
TA. Division Building  
HEC, Dhurwa.  
**RANCHI - 834004.**

Sub. :- **Submission of Environmental Statement (From -V ) for the year 2020-21.**

Dear Sir,

Please find herewith the Environmental Statement duly filled in the financial year 2020-21 in respect of A. S. P. Colliery.

This is for your kind information, Sir.

Encl. - As Above

Yours faithfully

*mil*  
23/9/2021  
Project Officer  
A. S. P. Colliery

Copy to:

1. Regional Officer, J.S.P.C.B, Dhanbad
2. Area Manager (Env.), E.J. Area.
3. Colliery Manager / Safety Officer, A.S. P. Colliery.
4. Office file.

**"FORM - V"**  
(See rule 14)

**Environmental statement for the financial year ending 31<sup>st</sup> March'2021**

**PART - A**

Name and address of the owner / Occupier : Sri J.P. Gupta, D.T, Koyla Bhawan,  
of the industry operation or process Koyla Nagar, BCCL, Dhanbad.  
Industry category primary (STD Code) : Coal Mining Industry (A.S-P. Colliery)  
Production capacity : 0.709 MTPA.  
Year of establishment : 1962  
Date of last environmental statement : Dt. 30.09.2020 (Ref. No. EJA/ASP/SMD/20/2104)  
(submitted)

**PART - B**

**Water and Raw Material consumption:**

Water Consumption	
1. Process (Dust suppression)	1200KL/ Day
2. Cooling	Nil
3. Domestic	300KL/ Day

Name of products	Process water consumption per unit of product point	
	During the current Financial year 2019-20	During the current Financial year 2020-21
N/A	N/A	N/A

**2. Raw material consumption:**

Name of Raw Material	Name of products	Consumption of Raw Materials per unit of product output	
		During the current Financial year 2019-20	During the current Financial year 2020-21
Diesel	Coal	4.04Ltrs./Ton.	7.73Ltrs./Ton
Explosive	Coal	1.893 KG/Ton	0.0955 KG/Ton

Industry may two codes if disclosing details of raw material would violate contractual Obligations otherwise all industries have to name the materials used.

**PART - C**

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

Pollution	Quantity of pollutants discharged (mass/day)	Concentration of Poll in discharges (mass / volume)	Percentage of variation from prescribed stack with reason.
a) Water		Total suspended solid - 44 pH - 7.92 Oil & Grease - <2.0 SS - 28	Within the limit Within the limit Within the limit Within the limit
(b) Air		PM10 - 97 PM 2.5 - 56 SO <sub>2</sub> - 10 NOx - 27	Within the limit Within the limit Within the limit Within the limit

**PART - D**

Hazardous wastes (As specified under Hazardous wastes Management and Handling rules 1989).

Hazardous waste	During the current financial year 2019-20	During the current financial year
(a) From process	Quantity of Burnt Oil - 461 Ltrs. Cotton waste - 5.100 Kg. Oil soaked filters - 17 Nos.	Quantity of Burnt Oil - 3810 Ltrs. Cotton waste - 1465 Kg Oil soaked filters - 367 Nos.
b) From pollution control facilities	N/A	N/A

**PART - E**

Solid wastes

Solid wastes	Total Quantity	
	During the current Financial year 2019-20	During the current Financial year 2020-21
(a) From process	Quantity of Overburden generated - 346282.91 M <sup>3</sup>	Quantity of Overburden generated - 2170162.295 M <sup>3</sup>
b) From Pollution control facilities	Oil & Grease trap's bottom sludge - Nil	Oil & Grease trap's bottom sludge - N/A
c) Quantity of recycle or reutilized with the unit	Quantity of O/B used for back filling - 1313800 M <sup>3</sup>	Quantity of O/B used for back filling - 2170162.295 M <sup>3</sup>
	Nil	Nil
	Nil	Nil

**PART - F**

Please specify the characterization (in terms of composition of quantum) of hazardous as well as solid wastes and indicate disposal practice adopted for both these categories of wastes

Type of rock : Sedimentary

Type of soil : There is no soil. All soil has been removed earlier.

Chemical properties of soil - N/A

Disposal process for solid waste (Back filling practice) - By dumper for back filling of the excavated area.

**PART - G**

Impact of the pollution abatement measures taken on conservation of natural resources and on the cost of production.

Ecological restoration work is going on.

**PART - H**


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

- (i) There are four water tankers (02 departmental & 02 Hired) of total 40 KL Capacity.
- (ii) Fencing of ecological restoration site is being done.
- (iii) There is no pressure filters.
- (iv) Black toping of roads has not been done.
- (v) Monitoring of air quality, water quality and noise levels are being done periodically by CMPDIL.
- (vi) Coal is being transported by covered trucks.

**PART - I**

Any other particulars for improving the quality of the environment.

Carbon sequestration studies done at H.Q. Level /source appointment study and reduction in pollution load by reducing road transport study being done at H.Q. level.

Signature :   
Name : Anil Kumar  
Designation : Project Officer  
Address : A.S.P. Colliery  
Post - Sudamdih, Dist.: Dhanbad  
Jharkhand - 828126



## Bharat coking coal limited

(A Subsidiary of Coal India Ltd)

Office of the Project Officer, Bhowra (N), Eastern Jharia Area,  
P.O. Bhowra, Dist: Dhanbad (Jharkhand), PIN- 828302

Ref. No:- BCCL/EJA/BH(N)/2021/ 547

Date:- 03/06/21

To,  
The Member Secretary,  
Jharkhand State Pollution Control Board  
T. A. Division Building (Ground Floor)  
H. E. C. Dhurva,  
Ranchi - 834004

**Sub:- Submission of Environmental Statement in Form - V**

Dear Sir,

Environmental Statement in Form - V is being submitted to you for financial year 2020-21 in respect of Bhowra (N) U/G Mines.

Enclosures:- As above.

Yours Faithfully

*Am (Env)*  
*A*

*[Signature]*  
3/6/2021  
Project Officer  
Bhowra (N) U/G Mines  
*[Signature]*

Distribution:-

1. The Regional Office, JSPCB Office, HIG Dhanbad
2. The General Manager (Env.), BCCL, Koyla Bhawan.
3. The Area Manager (Env.), E. J. Area, Bhowra.
4. Office File.



(Form - V)

(See rule 14)

Environmental Statement for the financial year ending the 31<sup>st</sup> March 2021

**PART - A**

- (i) Name and address of the owner/occupier : Sri J. P. Gupta, D.T. (P&P) BCCL,  
of the Industry operation or process Koyla Nagar, Dhanbad
- (ii) Industry category : Coal Mining Industry
- (iii) Production capacity : U/G - 0.143 MTY  
OCP - 0.546 MTY  
(EC no:- J-11015/380/2010-1A-II(M),  
dt: 06/02/13)
- (iv) Year of establishment : Colliery operating since pre nationalization  
period and vested in BCCL through Coal  
Mine Nationalisation Act 1972-73
- (v) Date of last environmental  
Statement submitted : 19.06.2020, (Ref. No: BCCL/EJA/BH(N)/2020/444)

**PART - B**

**Water and River Material Consumption**

Water Consumption	
Process (Dust separation)	20 M <sup>3</sup> /day
Cooling	Nil
Domestic	120 M <sup>3</sup> /day

Name of Products	Process water consumption per unit of product output	
	During the previous financial year	During the current financial year
COAL (coal production discontinue from 03.04.2020)	6.577 KL/T	2846.66KL/T

**Raw Material Consumption**

Name of materials	Name of products	Consumption of raw material per Unit of output	
		During the previous financial year (2019-20)	During the current financial year (2020-21)
Diesel	Coal	0.146 L/Te	64 L/Te
Explosive	Coal	0.247 Kg/ Te	0.00 Kg/Te
Timber	Coal	S- 0.0932 nos./Te; P- 0.0189 nos./Te *	S- 0.00 Nos./T; P-0.00 nos./Te

\*S -- wooden sleepers, P- wooden props.

### PART - C

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

Pollutants	Quantity of pollutants discharge	Concentrations of pollutants in discharge(mass/volume)	Percentage of variation from prescribed standards with reasons
Water	--	<u>(MW- 10, 22.03.21)</u> TSS - 45 PH - 7.97 Oil & Grease - <2.0 COD - 28	Within Limit
Air	--	<u>(as on 22.03.21)</u> PM 10 - 138 PM 2.5 - 72 SO <sub>2</sub> - 10 NO <sub>x</sub> - 29	---

### PART - D

#### Hazardous Wastes

(as specified under Hazardous waste management and handling rules, 1989)

Hazardous Waste	Total Quantity (Kg.)	
	During the previous financial year (2019-20)	During the current financial year (2020-21)
From process	Burnt oil - 165 Litre	Burnt oil - 40 Litre
From pollution control facilities	N/A	N/A

### PART - E

#### Solid Wastes

Solid Wastes	Total Quantity	
	During the previous financial year	During the current financial year
(a) Process	Nil	Nil
(b) Pollution control facility	Nil	Nil
(c)	1. Quantity recycled or re-utilized within the unit	Nil
	2. Sold	Nil
	3. Disposed	Nil

### PART - F

Please specify the characterizations (in terms of composition of quantum) of hazardous as well as solid waste and indicate disposal practice adopted for both these categories of wastes.

- (i) Type of Rocks :- N/A
- (ii) Type of soil :- N/A
- (iii) Chemical properties of soil: - N/A
- (iv) Disposal process for Solid Waste (backfilling practice): - N/A

### PART - G

Impact of pollution abatement measures taken on conservation of nature resources and on the cost of production

- (i) No. of plants planted : Nil.
- (ii) Cost of plants : Nil
- (iii) Plantation cost Incurred : Nil
- (iv) Backfilling cost : Nil


### PART - H

Additional measures/Investment proposal for environmental protection including abatement of pollution, prevention of pollution

- (i) Water sprinkling is being done in transporting road to reduce dust emission.
- (ii) Proper and timely maintenance of machinerles like- fan, pumps etc. Is being done to control noise pollution.
- (iii) Monitoring of air quality and water quality is being done periodically.
- (iv) Covered coal transportation is being done.
- (v) Pucca road prepared for coal transportation from 23/8 Incl.
- (vi) Maintenance of plants provided on both side of roads at 23/8 Incl. is being maintained.

### PART - I

Any other particulars for improving the quality of the environment

  
Project officer  
Bhowra (N) U/G Mines

