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AIR ENVIRONMENT ASSOCIATED WITH COAL MINING ACTIVITY : A CASE STUDY

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ABSTARCT

The Chasnalla block within the Jharia Basin is specially important for the coal mining activities. Consequence of mining activities involving drilling, blasting, crushing, transportation of coal etc. are the major concern for environmental pollution in the area. Mining and associated activities affect air, noise and water environment & degrades land and drainage system of the area.

In this paper, an attempt has been made to study the impact of mining operation on air environment as per TOR out at different pre-selected sites along with regular monitoring meteorological parameters at the selected site. The Environmental Management Plan **(**EMP) with respect to air environment is based on the base line environmental status, mining methodology and environmental impact assessment and has been a successful tool for assessing the impact of environmental pollution so far the air environment is concerned.

Key words: Drilling, Blasting, Crushing, Environmental pollution, TOR (Term of Reference), Meteorological parameter, Environmental management plan (EMP).

INTRODUCTION

Environmental pollution is a consequence of mining activities involving drilling, blasting, crushing, transportation of ore/coal etc. Mining and associated activities not only affect air, noise and water environment but it also degrades land and drainage system of the area[1]. Air pollution is a major environmental health problem affecting everyone in developed and developing countries alike. WHO[2] is designed to offer global guidance on reducing the health impacts of air pollution.

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Chasnalla Block lies in the South Eastern extremity of Jharia Coalfield (JCF) in the Dhanbad district of Jharkhand state. It covers an area of 4.5 Km^2. The area is roughly defined by north latitudes 23°38'25'' and 23''40'00'' and East longitudes 86°27'12'' & 86° 29'15''. It is included in the survey of India Topo sheet No. 73 I/6 and in Sheet No. 8 of the geological map of JCF. Figure 1 shows the regional location of the area. Chasnalla Block is located about 15 Km from Jharia town and about 23 Km from Dhanbad town. Dhanbad - Sindri Road passes through its northern boundary.

Air environment

Air pollution includes one or more contaminants (pollutants), in the outdoor atmosphere in such quantities and of such duration that may be injurious to human, plant or animal life. Once these contaminants enter in the atmosphere, either in gaseous form or as particulate matter, these cannot escape and keep circulating and deteriorating the air quality. Air pollution effects encompass those that are health related as well as those associated with damage to property or which cause decreases in atmospheric aesthetic feature. Examples of air pollution effects on human health include eye irritation, headaches and aggravation of respiratory problems. Plants and crops have been subjected to the undesirable consequences of air pollution, including abnormal growth pattern, leaf decolouration and death. Dispersion of air pollutants from the source depends on micro-meteorological parameters of the area. Micro-meteorological parameter is essential to assess the pollution level in the area as well as helpful in taking precautionary measures to control, the levels.

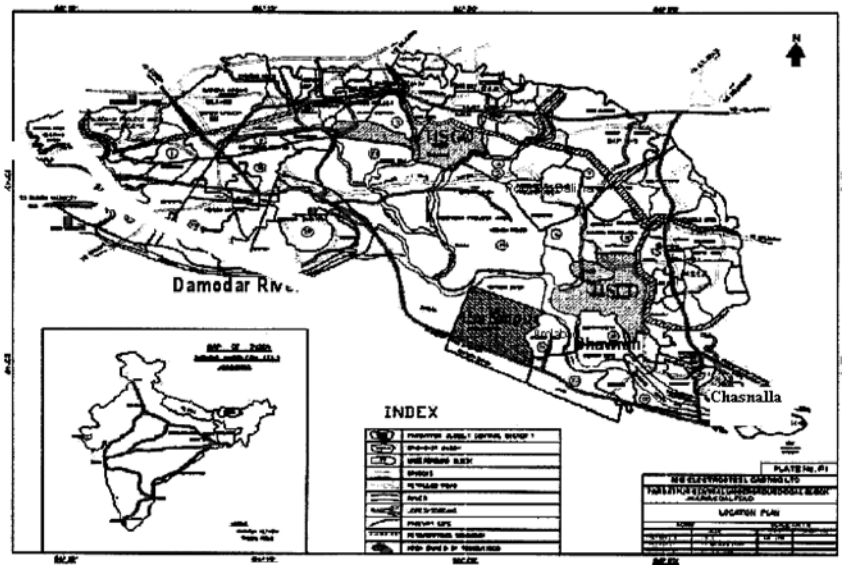

Fig. 1: Location map of the Jharia Coal field and Chasnalla Block

Micro-meteorology

Micro-meteorological properties of the atmosphere, govern the concentration of pollutants and its variation with time and location, with respect to the emission source. The severity of the pollution depends on the various meteorological variables. This includes wind speed and direction, atmospheric diffusion, variation of temperature with height and mixing height. Meteorological data for one-year duration has been collected from the secondary sources for nearby station and summary of the data is given in Table 1.

The area experiences tropical climate and is characterized by very hot summer and cold winters. The months of May and June are very hot and dry; December and January are very cold. The mean monthly temperature varies from 7.0^{o}C in January to 36^{o}C in May. However, there are some fluctuations in temperature as in summer shoots to as high as 45^{o}C and likewise in winter it drops to 3^{o}C. Relative humidity (RH) is high in the rainy months being about 80% in August and 68% in January. Thunder storms usually occur in May, accompanied by temporary fall in temperature by few degrees. The area experiences pleasant climate from February to March and from October to November. Fog is not very common except in the industrial coal belts where heavy coal burning smokes hangs over the area.

The area receives annual rainfall of about 1200-1400 mm, out of which 75-80% of the annual rainfall occurs during the three months of July, August and September (Fig. 1) with smaller amounts during winter months. Traditionally, the monsoon is supposed to touch Dhanbad by mid June every year. The wind pattern of the area is presented in the form of windrose during summer, winter, monsoon and post-monsoon seasons (Fig. 2). As the wind rose diagrams indicate, percentage of calm condition was minimum for winter season (17%) followed by monsoon (19%), post-monsoon (38%). Summer (25%) had the maximum percentage of calm condition. West to south-west winds are predominant in winter season while south-westerly winds are dominant during summer season. South-easterly winds are dominant during monsoon season.

During post-monsoon north-west to south westerly winds are predominant. The change in dominant direction in the monsoon months is due to the prevalence of the condition in Bay of Bengal. A regular pre-monsoon feature is hot weather winds locally called andhi, sometimes laden with dust (the dust storm) in the region.

Table 1: Annual micro-meteorological data of the study site

Month	Wind speed (Kmph)				Temperature (^{0}C)			Relative humidity (%)			Rainfall (mm)		
	Mean	Max.	Min.	% of calm.	Mean	Max.	Min.	Mean	Max	Min.	Total (in mm.)	24 hr. high	No. of rainy day
Jan.	6.07	11.60	0.50	33.3	19.0	28.0	10.0	72.4	99	45.7	2.0	1.5	1
Feb.	8.07	16.00	0.10	33.3	22.8	36.1	8.9	61.5	98	25.0	0.0	0.0	0.0
Mar.	9.3	18.30	0.30	12.6	29.7	43.4	27.4	59.3	99	19.6	0.0	0.0	0.0
Apr.	4.65	8.30	1.00	13.6	31.3	39.2	23.4	58.5	95	22.0	18.0	4.2	3
May	6.55	13.00	0.10	14.5	34.1	44.4	23.8	60.0	99	21.0	32.5	7.0	7
June	6.95	13.20	0.70	14.5	31.5	38.9	24.1	71.5	99	44.0	196.0	10.5	17
July	4.55	8.90	0.40	15.9	32.3	37.6	27.0	75.5	94	57.0	218.0	9.5	19
Aug.	4.11	7.80	0.42	31.2	31.7	36.5	26.9	75.0	93	56.9	150.5	8.9	19
Sept.	3.65	7.20	0.10	28.5	30.4	35.0	18.8	79.5	99	59.9	136.0	33.0	14
Oct.	6.45	12.80	0.10	30.3	30.5	34.2	20.7	68.5	99	37.9	104.0	7.0	13
Nov.	3.2	6.30	0.10	26.8	22.7	32.9	12.1	67.2	99	35.3	0.0	0.0	0.0
Dec.	2.95	5.80	0.10	31.3	24.4	31.8	16.0	67.0	99	34.9	8.5	2.5	2

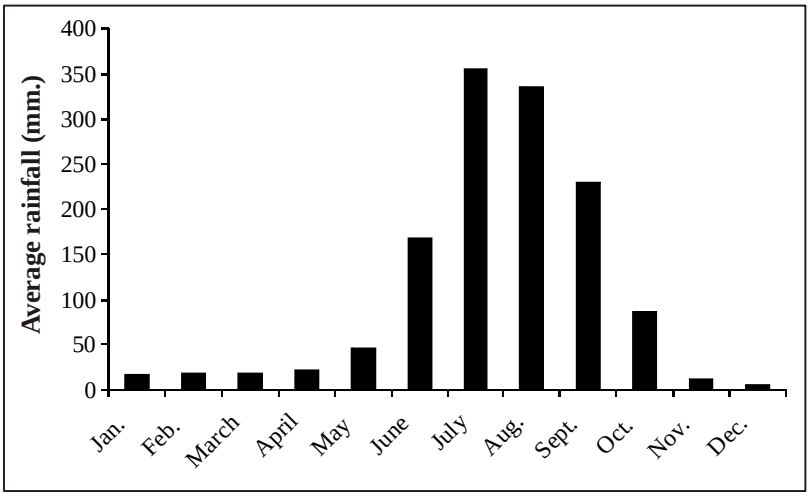

Fig. 1: Variation in average rainfall in different months

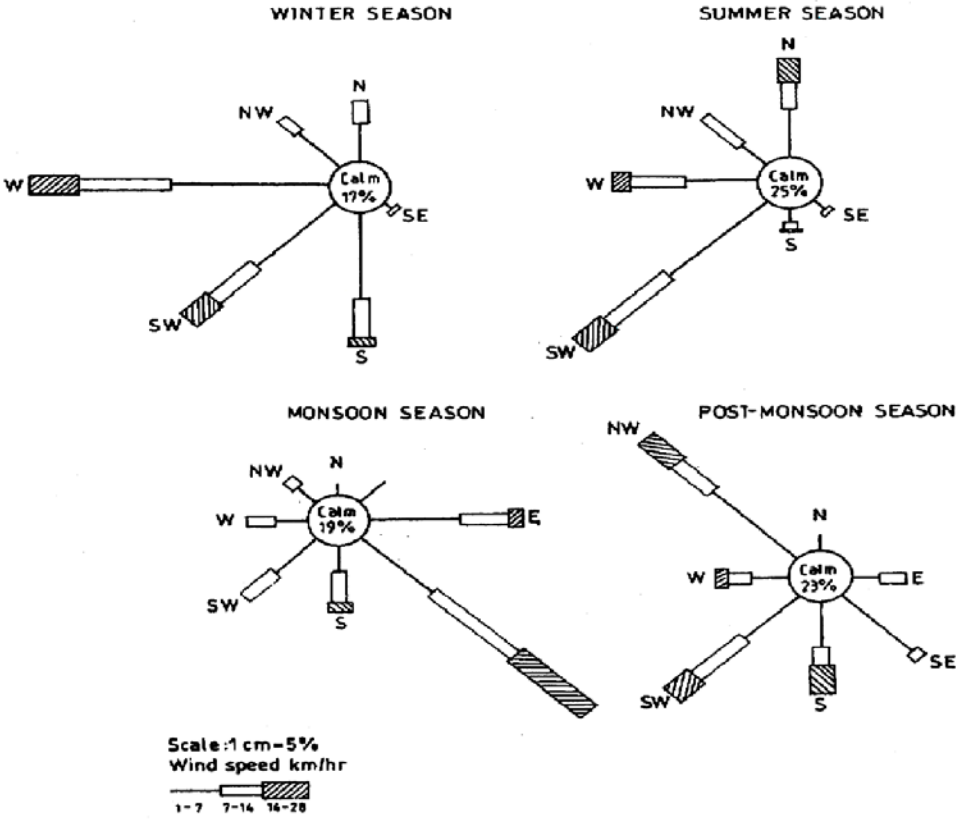

Fig. 2: Windrose diagrams of the area

Air quality

The topographical information of project site as well as of the study area detail about different activities related to the coal mining and associated activities were collected. Different air pollution parameters like SPM, RSPM, SO_2 and NO_x were identified as related to the project activities for representing baseline status of ambient air quality with the study area. To assess the base line ambient quality six air quality monitoring location were selected in core and buffer zone area.

Sampling and analysis

Total six sampling stations have been selected for air quality monitoring on the basis of wind direction and other meteorological parameters. Two air sampling locations have been identified in core zone and four in the buffer zones. Details of sampling stations along with the source of air pollution are given in Table 2. The parameters monitored are Respirable Particulate Matters (RPM), Suspended Particulate Matters (SPM), Sulphur dioxide (SO_2) and Nitrogen oxides (NO_x). The sampling locations of air are depicted in Figure 3. Methods and instrument used for air pollutant analysis are given in Table 3.

Table 2: Details of sampling locations

Stn. code	Location	Distance and direction with reference to core zone	Selection criteria
Core zone			
C-1	Tasra village	In the center of the mining lease area	To assess existing baseline level at the pre-mining stage
C-2	Kandra village	In the north-west corner of the lease area adjacent to Chasnala working mine	To assess the baseline level during the pre-mining stage and to assess the pollution level from the Chasnala working mine
Buffer zone			
B-3	Digwadih	4.0 km north-west of the mining lease area in the buffer zone	To assess the pollution level and possible impacts due to mining activities due to wind from south and south-east direction
B-4	Bhaghmara	7.0 km north east of the mining lease boundary in the buffer zone	To assess the pollution level in the buffer zone and its likely impact due to mining activities

Cont…

Stn. code	Location	Distance and direction with reference to core zone	Selection criteria
B-5	Bhojudih	2.5 km south-west of mining lease in the buffer zone	To assess the pollution level at this site and likely impacts on the air quality due to wind from north and North-East direction
B-6	Joradih village	5.2 km south from the mining lease boundary	To assess the pollution level in this village in buffer zone

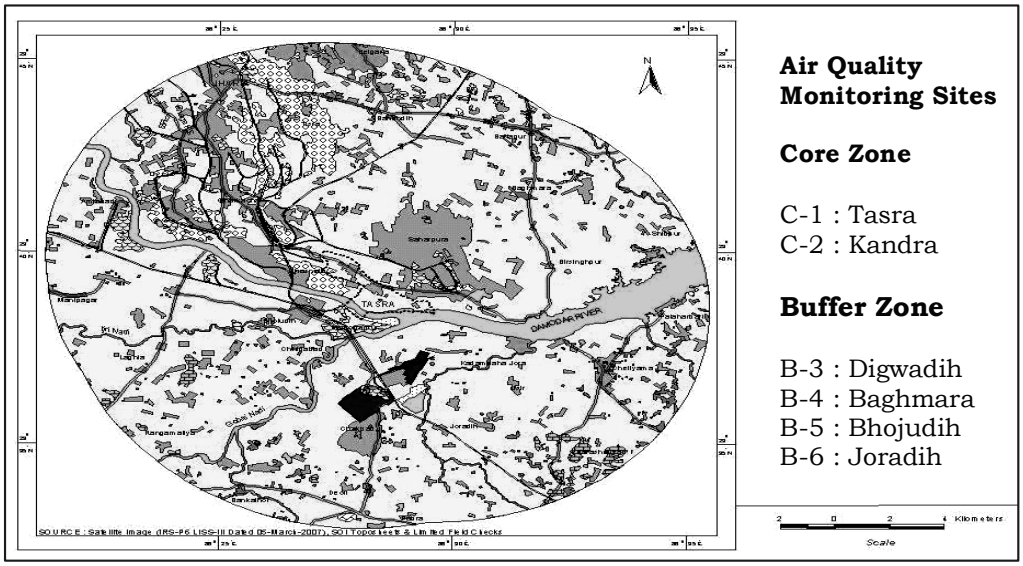

Fig. 3: Air quality monitoring stations

Table 3: Methodology and instrument used for air quality analysis

Parameter	Method	Instrument
SPM & RPM	IS-5182 Part XIV	High volume sampler (HVS) with RPM attachment
SO_2	IS-5182 Part II (Improved West & Gaeke method)	HVS with gaseous attachment
NO_x	IS-5182 Part II (Jacob Hochheiser modified method)	HVS with gaseous attachment

Duration of sampling

At each monitoring stations, samples were collected twice a weak for 12 weeks. 24 hourly sampling has been done for measuring of RPM, SPM, SO_2 and NOx.

RESULTS AND DISCUSSION

The range of various air quality parameters at six sites are summarised in Table 4. The detail result of air quality monitoring is given below in Table 5-10. Air quality monitored data for the Tasra Project show that the SPM values ranges from 139.5 to 635.8 μg/m^3 and RPM from 72.2 to 168.0 μg/m^3 which are below the permissible limit of 700 μg/m^3 and 300 μg/m^3, as per the new guide line of CPCB for Coal mining project. Similarly SO_2 values is ranging from 20.8 to 38.9 μg/m^3 against the permissible limit of 120 μg/m^3 and NOx values range from 33.6 to 72.0 μg/m^3 against the permissible limit of 120 μg/m^3.

Table 4: Air quality at six monitoring sites

Stat. code	RPM		SPM		SO_2		NOx	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Tasra (C-1)	83.1	134.8	193.3	412.9	30.3	38.9	53.1	59.9
Kandra (C-2)	78.7	125.9	139.5	321.7	25.9	32.7	39.8	62.8
Digwadih (B-3)	120.2	168.0	305.4	635.8	22.9	37.9	40.5	72.0
Bhagmara (B-4)	119.3	160.8	294.4	513.8	22.2	35.4	41.0	63.4
Bhojudih (B-5)	98.9	160.9	212.8	418.7	23.8	37.6	43.8	63.0
Joradih (B-6)	72.2	98.6	153.1	198.4	20.8	24.9	33.6	44.1

Concentration of SPM and RPM are found moderately high at sites in buffer zone (Table 7-9). It may be due to aerial diffusion of dust from the adjacent coal mining activities, transportation of coal and road traffic and domestic sources. The higher SPM and RPM value were found at sites near Bhaghmara (B-4) and Digwadih (B-3), which is adjacent to active coal mining area. The major sources of the SPM are coal excavation, coal transportation, fuel burning and domestic activities. SO_2 and NOx concentration are relatively higher but it is well within the permissible range. Level of SPM in the core zone varied from 193.9 – 412.9 μg/m^3 at Tasra (C-1) and 139.5 – 321.7 μg/m^3 at Kandra (C-2) sites (Table 5 and 6).

Table 5: Ambient air quality in Tasra OCP Area : Core zone – Tasra (C-1)
(Post-monsoon Season : October 2008 to December 2008)

Period			Parameters (µg/m^3)			
Month	**Weeks**	**Date**	**RPM**	**SPM**	**SO_2**	**NOx**
2008-October	1st Week	6/10/2008	103.2	223.3	34.3	59.9
		8/10/2008	101.2	213.4	34.6	55.0
	2nd Week	11/10/2008	96.0	203.1	34.4	56.1
		13/10/2008	92.9	193.3	34.7	57.0
	3rd Week	21/10/2008	94.1	210.1	35.1	59.0
		23/10/2008	102.2	216.1	34.8	54.9
	4th Week	28/10/2008	104.1	224.7	34.5	58.1
		30/10/2008	100.0	235.7	35.2	54.0
2008-November	1st Week	4/11/2008	96.9	242.3	34.5	54.9
		6/11/2008	84.0	232.8	34.2	53.1
	2nd Week	11/11/2008	83.1	244.6	34.0	58.0
		14/11/2008	88.0	223.7	34.2	57.1
	3rd Week	18/11/2008	119.0	252.5	33.4	58.7
		20/11/2008	114.9	253.8	32.5	58.1
	4th Week	25/11/2008	98.0	246.7	32.3	57.1
		27/11/2008	118.0	324.9	36.9	55.1
2008-December	1st Week	5/12/2008	95.1	235.6	31.4	56.1
		7/12/2008	97.2	235.7	32.2	58.8
	2nd Week	11/12/2008	93.2	245.7	34.3	56.7
		13/12/2008	134.8	412.9	38.9	55.8
	3rd Week	19/12/2008	89.2	272.2	31.4	55.0
		22/12/2008	94.2	273.2	31.1	57.0
	4th Week	27/12/2008	93.7	257.3	32.1	57.7
		29/12/2008	94.9	261.1	30.3	56.6
	Maximum		134.8	412.9	38.9	59.9
	Minimum		83.1	193.3	30.3	53.1
	Average		99.5	247.3	33.8	56.6
	Std. Deviation		11.9	44.6	1.9	1.7
	98 Percentile		**98.4**	**232.6**	**29.8**	**42.3**

Table 6: Ambient air quality in Tasra OCP Area : Core zone – Kandra (C-2)
(Post-monsoon Season : October 2008 to December 2008)

Period			Parameters (µg/m^3)			
Month	**Weeks**	**Date**	**RPM**	**SPM**	**SO_2**	**NOx**
2008-October	1st Week	6/10/2008	104.8	223.3	28.2	60.9
		8/10/2008	105.8	213.4	28.9	59.2
	2nd Week	11/10/2008	78.7	148.9	25.9	39.8
		13/10/2008	97.5	193.3	29.1	48.9
	3rd Week	21/10/2008	98.7	210.1	29.2	56.9
		23/10/2008	106.8	216.1	29.2	59.3
	4th Week	28/10/2008	113.7	227.6	29.3	54.1
		30/10/2008	106.5	238.6	28.9	57.1
2008-November	1st Week	4/11/2008	98.7	245.2	28.2	56.0
		6/11/2008	93.6	235.7	26.3	43.9
	2nd Week	11/11/2008	101.1	247.5	29.2	56.3
		14/11/2008	106.0	226.6	29.0	55.1
	3rd Week	18/11/2008	125.1	255.4	29.1	57.7
		20/11/2008	121.0	256.7	27.2	53.0
	4th Week	25/11/2008	116.0	254.6	27.0	50.8
		27/11/2008	124.1	312.9	26.2	55.9
2008-December	1st Week	5/12/2008	113.1	243.5	27.3	58.1
		7/12/2008	118.2	235.6	29.9	57.8
	2nd Week	11/12/2008	88.9	139.5	26.6	40.8
		13/12/2008	97.5	189.4	29.6	47.8
	3rd Week	19/12/2008	110.2	269.2	30.1	60.5
		22/12/2008	115.2	270.2	30.3	58.6
	4th Week	27/12/2008	102.8	254.3	26.9	53.9
		29/12/2008	125.9	321.7	32.7	62.8
	Maximum		125.9	321.7	32.7	62.8
	Minimum		78.7	139.5	25.9	39.8
	Average		107.1	234.6	28.5	54.4
	Std. Deviation		11.8	41.7	1.6	6.1
	98 Percentile		125.5	317.7	31.6	61.9

Table 7: Ambient air quality in Tasra OCP area : Buffer Zone – Digwadih (B-3)
(Post-monsoon Season : October 2008 to December 2008)

Period			Parameters (µg/m^3)			
Month	**Weeks**	**Date**	**RPM**	**SPM**	**SO_2**	**NOx**
2008-October	1st Week	6/10/2008	151.7	323.9	31.5	58.9
		8/10/2008	161.5	330.8	33.1	58.6
	2nd Week	11/10/2008	129.6	412.8	32.1	56.1
		13/10/2008	151.6	362.2	25.1	43.8
	3rd Week	21/10/2008	121.7	371.4	35.0	51.1
		23/10/2008	130.6	508.5	31.0	61.9
	4th Week	28/10/2008	120.2	413.4	32.6	52.2
		30/10/2008	131.7	499.5	26.4	41.0
2008-November	1st Week	4/11/2008	150.5	305.4	33.5	52.9
		6/11/2008	144.0	421.4	28.2	53.9
	2nd Week	11/11/2008	168.0	497.3	33.1	59.9
		14/11/2008	154.0	528.3	25.1	61.5
	3rd Week	18/11/2008	145.0	441.3	30.4	60.3
		20/11/2008	141.0	635.8	22.2	50.4
	4th Week	25/11/2008	137.7	462.4	28.3	63.4
		27/11/2008	167.9	628.7	27.8	67.6
2008-December	1st Week	5/12/2008	146.1	436.4	30.0	66.8
		7/12/2008	151.1	386.3	29.3	68.5
	2nd Week	11/12/2008	160.8	462.4	31.8	70.4
		13/12/2008	127.8	399.3	27.3	57.6
	3rd Week	19/12/2008	138.0	387.3	37.7	56.3
		22/12/2008	143.0	383.4	37.9	69.3
	4th Week	27/12/2008	148.8	411.4	37.6	72.0
		29/12/2008	159.9	559.4	30.5	68.8
	Maximum		168.0	635.8	37.9	72.0
	Minimum		120.2	305.4	22.2	41.0
	Average		145.1	440.4	30.7	59.3
	Std. Deviation		13.6	87.5	4.1	8.3
	98 Percentile		182.2	580.3	41.7	84.2

Table 8: Ambient air quality in Tasra OCP Area : Buffer Zone – Bhagmara (B-4)
(Post-monsoon Season : October 2008 to December 2008)

Period			Parameters (µg/m^3)			
Month	**Weeks**	**Date**	**RPM**	**SPM**	**SO_2**	**NOx**
2008-October	1st Week	6/10/2008	124.7	323.9	29.1	49.3
		8/10/2008	132.9	330.8	33.1	58.6
	2nd Week	11/10/2008	139.6	337.8	29.7	46.4
		13/10/2008	141.8	362.2	25.1	45.7
	3rd Week	21/10/2008	144.7	371.4	35.0	51.1
		23/10/2008	140.6	341.6	30.1	61.9
	4th Week	28/10/2008	130.2	413.4	30.2	42.5
		30/10/2008	141.7	332.6	26.4	41.0
2008-November	1st Week	4/11/2008	150.5	305.4	29.1	52.9
		6/11/2008	160.8	294.4	28.2	44.2
	2nd Week	11/11/2008	150.6	380.3	30.1	59.9
		14/11/2008	136.6	411.3	25.1	61.5
	3rd Week	18/11/2008	127.6	324.3	28.0	60.3
		20/11/2008	123.6	351.9	22.2	50.4
	4th Week	25/11/2008	120.3	345.4	25.9	63.4
		27/11/2008	119.3	359.8	25.1	58.7
2008-December	1st Week	5/12/2008	128.7	319.4	30.0	57.9
		7/12/2008	146.1	487.9	29.3	59.6
	2nd Week	11/12/2008	133.0	412.4	31.8	61.5
		13/12/2008	122.8	349.3	27.3	57.6
	3rd Week	19/12/2008	133.0	337.3	35.0	56.3
		22/12/2008	154.9	513.8	35.2	60.4
	4th Week	27/12/2008	143.8	490.6	34.9	63.1
		29/12/2008	156.9	510.8	30.5	59.9
	Maximum		160.8	513.8	35.2	63.4
	Minimum		119.3	294.4	22.2	41.0
	Average		137.7	375.3	29.4	55.2
	Std. Deviation		11.9	65.2	3.5	7.0
	98 Percentile		159.0	512.4	35.1	63.2

Table 9: Ambient air quality in Tasra OCP Area : Buffer Zone – Bhojudih (B-5)
(Post-monsoon Season : October 2008 to December 2008)

Period			Parameters (µg/m^3)			
Month	**Weeks**	**Date**	**RPM**	**SPM**	**SO_2**	**NOx**
2008-October	1st Week	6/10/2008	141.1	362.7	29.5	54.2
		8/10/2008	134.9	354.9	28.9	58.4
	2nd Week	11/10/2008	122.9	330.0	27.5	51.3
		13/10/2008	122.5	326.0	24.9	50.6
	3rd Week	21/10/2008	128.9	334.7	23.8	50.2
		23/10/2008	115.9	320.8	33.7	52.6
	4th Week	28/10/2008	118.9	315.6	37.6	47.4
		30/10/2008	114.8	311.8	30.2	50.4
2008-November	1st Week	4/11/2008	123.0	318.3	29.5	49.3
		6/11/2008	125.9	323.4	29.7	49.1
	2nd Week	11/11/2008	124.4	320.9	30.5	49.6
		14/11/2008	123.5	318.9	27.6	48.4
	3rd Week	18/11/2008	135.6	328.7	30.4	54.3
		20/11/2008	120.4	311.1	28.5	49.6
	4th Week	25/11/2008	129.8	342.7	33.7	47.4
		27/11/2008	160.8	418.7	36.3	52.5
2008-December	1st Week	5/12/2008	135.4	362.6	37.4	51.7
		7/12/2008	145.0	383.7	37.2	55.2
	2nd Week	11/12/2008	98.9	212.8	28.9	43.8
		13/12/2008	113.8	276.8	31.5	53.6
	3rd Week	19/12/2008	120.9	361.2	28.6	62.2
		22/12/2008	125.2	392.7	31.6	60.3
	4th Week	27/12/2008	136.8	378.7	30.5	63.0
		29/12/2008	133.8	367.3	32.0	59.8
	Maximum		160.8	418.7	37.6	63.0
	Minimum		98.9	212.8	23.8	43.8
	Average		127.2	336.5	30.9	52.7
	Std. Deviation		12.3	41.3	3.7	5.0
	98 Percentile		153.6	406.8	37.5	62.6

Table 10: Ambient air quality in Tasra OCP Area : Buffer Zone – Joradih (B-6)
(Post-monsoon Season : October 2008 to December 2008)

Period			Parameters (µg/m^3)			
Month	**Weeks**	**Date**	**RPM**	**SPM**	**SO_2**	**NOx**
2008-October	1st Week	6/10/2008	58.2	163.3	22.8	43.7
		8/10/2008	57.5	163.5	23.5	42.0
	2nd Week	11/10/2008	57.4	162.9	23.4	40.8
		13/10/2008	59.6	166.6	23.7	40.1
	3rd Week	21/10/2008	59.6	169.9	23.8	39.7
		23/10/2008	63.0	175.9	23.8	42.1
	4th Week	28/10/2008	66.8	169.2	23.9	36.9
		30/10/2008	66.9	165.4	23.5	39.9
2008-November	1st Week	4/11/2008	76.2	183.1	22.8	38.8
		6/11/2008	79.1	188.1	23.0	38.6
	2nd Week	11/11/2008	77.6	185.7	23.8	39.1
		14/11/2008	76.7	183.7	23.6	37.9
	3rd Week	18/11/2008	78.8	177.9	23.7	40.5
		20/11/2008	73.6	165.9	21.8	35.8
	4th Week	25/11/2008	72.6	173.9	21.6	33.6
		27/11/2008	73.6	178.7	20.8	38.7
2008-December	1st Week	5/12/2008	72.2	175.4	21.9	40.9
		7/12/2008	77.8	183.1	24.5	40.6
	2nd Week	11/12/2008	78.6	180.2	24.4	42.5
		13/12/2008	76.6	174.5	24.2	44.0
	3rd Week	19/12/2008	76.0	182.0	24.7	43.3
		22/12/2008	78.0	182.4	24.9	41.4
	4th Week	27/12/2008	79.6	189.9	24.6	44.1
		29/12/2008	76.6	188.0	23.8	40.9
	Maximum		98.6	198.4	24.9	44.1
	Minimum		72.2	153.1	20.8	33.6
	Average		80.7	179.1	23.4	40.2
	Std. Deviation		7.0	9.7	1.1	2.6
	98 Percentile		95.4	194.5	24.8	44.0

The RPM value in the two core zone monitoring sites varies between 83.1-134.8 μg/m^3 and 78.7-125.9 μg/m^3, respectively at Tasra (C-1) and Kandra (C-2). The SO_2 and NOx concentration in the core zone varies from 25.9-38.9 μg/m^3 and 39.8-62.8 μg/m^3. Summary of the Ambient air quality monitored at six sites are given in Table 4. National Ambient Air Quality Standards has been shown in Table 11.

Table 11(a): National ambient air quality standards

(As per CPCB Notification on 11/4/94[3])

Pollutant	Time weighted average	Concentration in ambient air			Method of measurement
		Industrial area	Residential rural & other areas	Sensitive area	
Sulphur dioxide (SO_2)	Annual Avg.	80 μg/m^3	60 μg/m^3	15 μg/m^3	Improved west & Gaeke method, ultraviolet fluorescence
	24 hours**	120 μg/m^3	80 μg/m^3	30 μg/m^3	
Oxides of nitrogen (NOx)	Annual Av.*	80 μg/m^3	60 μg/m^3	15 μg/m^3	Jacob Hochheiser modified (Na-Arsenic) method, gas phase chemiluminescence
	24 hours**	120 μg/m^3	80 μg/m^3	30 μg/m^3	
Suspended particulate matter (SPM)	Annual Av.*	360 μg/m^3	140 μg/m^3	70 μg/m^3	High volume sampling (average flow rate not less than 1.1 m^3/mm)
	24 hours**	500 μg/m^3	200 μg/m^3	100 μg/m^3	
Respirable particulate matter (Size < 10 μm) RPM)	Annual Av.*	180 μg/m^3	60 μg/m^3	50 μg/m^3	Respirable particulate matter sampler
	24 hours**	250 μg/m^3	100 μg/m^3	75 μg/m^3	
Lead (Pb)	Annual Av.*	1.0 μg/m^3	0.75 μg/m^3	0.50 μg/m^3	AAS method after sampling using EPM 2000 or equivalent filter paper
	24 hours**	1.5 μg/m^3	1.00 μg/m^3	0.75 μg/m^3	
Carbon Monoxide (CO)	8 Hours**	5 μg/m^3	2 μg/m^3	1 μg/m^3	Non dispersive infrared spectroscopy
	1 Hour	10 μg/m^3	4 μg/m^3	2 μg/m^3	

*Annual arithmetic means of 104 measurements in a year twice a week 24 hourly a uniform interval

**24 Hourly or 8 monthly values should be met 98% of the time in a year. However 2% of the time it may exceed but not on two consecutive days

Note:

1. National Ambient Air quality Standard: The level of air quality necessary with an adequate of safety, to protect the public health, vegetation and property.
2. Whenever and wherever two consecutive values exceed the limit specified above for the respective category, it would be considered adequate reason to institute regular/continuous monitoring and further investigations.
3. The State Government/State Board shall notify the sensitive and other areas in the respective states within a period of six months from the date of Notification of Ambient Air Quality Standards.

Table 11(b): National ambient air quality standards for old coal Mines-Jharia, Raniganj & Bokaro (As per CPCB[3])

Pollutants	Time weighted average	Concentration in ambient air	Method of measurement
Suspended particulate matter (SPM)	Annual Av.*	500 μg/m^3	High volume sampling (average flow rate not less than 1.1 m^3/min)
	24 Hours**	700 μg/m^3	
Respirable particulate matter (RPM)	Annual Av.*	250 μg/m^3	Respirable particulate matter sampler
	24 Hours**	300 μg/m^3	
Sulphur dioxide (SO_2)	Annual Av.*	80 μg/m^3	Improved West & Gaeke method, ultraviolet fluorescence
	24 Hours**	120 μg/m^3	
Oxides of nitrogen (NO_x)	Annual Av.*	80 μg/m^3	Jacob Hochheiser modified (Na-Arsenic) method, gas phase chemiluminescence
	24 Hours**	120 μg/m^3	

Environmental impact study (Air)

In case of air environment the total PIU (Parameter Importance Unit) is 140 units. The parameters considered are RPM, SPM, SO_2, NOx, CO and Pb. The base line EIU is found to be 118 points. Due to mining activities, the concentration of RPM, SPM, NOx and Pb are likely to increase resulting in significant deterioration of air environment[4,5]. If EMP

(Environmental Management Plan) measures are not undertaken, the magnitude of deterioration is likely to -29 points in terms to PIU. However, if EMP measures are implemented, the air environment may substantially be improved by 111 points. Even with implementation of EMP, there would be negative impact of 7 points in terms of baseline EIU (Environmental Impact Unit).

Table 12: Weight to air environment

Parameter	Weight (PIU)	Baseline (EIU) (a)	Without (EMP) (b)	With (EMP) (c)	Change (EIU) (c - b)	Change (EIU) (b - a)	Change (EIU) (c - a)
Air							
RPM	50	39	31	37	6	-8	-2
SPM	40	37	28	31	3	-9	-6
SO_2	15	12	8	14	6	-4	2
NOx	20	15	10	14	4	-5	-1
CO	5	5	4	5	1	-1	0
Pb	10	10	8	10	2	-2	0
Sub-total	**140**	**118**	**89**	**111**	**22**	**-29**	**-7**

CONCLUSION

The impact of mining operation on monitoring of air environment as per TOR has been carried out for at different pre-selected sites. Overall evaluation damage due to mining activity presents the qualitative result of the existing condition with and without EMP. The net environmental changes arising out of proposed mining is beneficial with the guidelines of EMP. In order to mitigate the adverse impacts caused due to coal mining operation at Chasnalla OCP and for overall scientific development of local habitat, Environmental Management Plan (EMP) has been formulated. The EMP with respect to air environment is based on the base line environmental status, mining methodology and environmental impact assessment. The EMP has prescribed environmental monitoring and implementation of environmental protection measures during and after mining operations and has been a successful tool for assessing the impact of environmental pollution so far the air environment is concerned.

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