

## **1.0 INTRODUCTION**

Mining is a site specific and ecologically sensitive industry. For sustaining national development, mining of coal and minerals is of paramount importance for developed as well as developing countries. To meet the energy requirements of the country, increased coal production has been possible due to large-scale surface mining activities. Surface mining causes environmental disturbance in the form of land degradation, removal of OB material stress on air and water regime and finally interferes in the balance of the ecosystem. To meet these problems, sound environmental management system for pre-mining, active mining and post mining stages in the form of Environmental Impact Assessment, Environmental Management Practice for concurrent mining and Environmental Audit has been made necessary by the regulating state and central authorities. Regular monitoring of the different components of environment is made necessary for evaluating the requirements of environmental management system and its impact in the society. This report presents such study conducted by CSIR-Central Institute of Mining and Fuel Research (CSIR-CIMFR), Dhanbad for **Kathautia Open Cast Coal Mine** belonging to **M/S Hindalco Industries Ltd.**

### **i) LOCATION**

The lease area of KOCCM covers land in villages: Kathautia, Kajari, Garikhas, Palhekhurd, Sakhui, Sikka and Batsara in Patan and Pandwa Blocks of district Palamau (Jharkhand). Kathautia Open Cast Coal Mines (KOCCM), is located in southern boundary of the block is about 10 KM from Daltonganj. The project area is situated between the latitude  $24^{\circ} 07' 02''$  N and  $24^{\circ} 08' 52''$  N and longitude  $84^{\circ} 03' 42''$  E &  $84^{\circ} 06' 52''$  E. The site is well connected by road and 15 km away from Daltonganj. The project came into operation in the year 2008.

M/S Hindalco Industries Ltd; approached CSIR-Central Institute of Mining and Fuel Research (CSIR-CIMFR), Dhanbad for doing the following work for one year i.e. 2016-2017.

- Environmental monitoring of Air, Water, Soil, Noise, Flora & fauna of the core and buffer zone.
- The Environmental monitoring will be conducted on seasonal basis.
- Preparation of Environmental Statement as stipulated in consent to operate of JSPCB.

The detailed studies with respect to air, water and noise will be carried on four times in the year 2016-17 while soil and dump samples, for the adjoining mining area, will be collected once in a year and analyzed in the CSIR-CIMFR laboratory.

## **2.0 (i) MINING SCENARIO**

Presently the mine is not in operation. At KOCCM, Pandwa Top & Rajhara B seams have been worked out by opencast mining with shovel and dumper combinations. Shovels of different capacities such as 3.0 cubic meters, 2.7 cubic meters and 2.1 cubic meters are used along with 25 T Volvo Dumpers.

The coal seams in this OCP are as follows:

- |       |                 |    |                       |
|-------|-----------------|----|-----------------------|
| (i)   | Rajhara A seam  | -> | 0.4 – 2.67 mts thick  |
| (ii)  | Rajhara B seam  | -> | 0.42 – 2.60 mts thick |
| (iii) | Pandwa Top seam | -> | 0.25 – 3.11 mts thick |

The average grade of coal is 'B' & 'D'. The open cast mine is worked by Shovel-Dumper combination with an average stripping ratio of 1:9.66. OB was dumped outside the quarry during initial years. Till the bottom most seams are worked out and quarry benches advance sufficiently, backfilling will be allowed and backfilling of Overburden has already been started.

The working area by opencast method is having the seams Pandwa Top, Rajhara B & Rajhara A. The grades of coal of the seams are mostly found as B & D. The total Block area of this block is approximately 938.27 ha out of which, 687.93 ha is granted for Mining Lease.

**(ii) REGIONAL GEOLOGY**

The Daltonganj coalfield occupies an elongated area of 250 sq km along a narrow east west trend north of Daltonganj (24° 02' 00"; 84° 04' 00") and falls between latitude 24° 00' 00" and 24° 12' 00" N and longitudes 83° 59' 00" and 84° 15' 00" E. However, the lower Gondwana coal seams underlie only 95 sq km, the Talchir Formation occupying the entire remaining area. Sequence of Karharbari seam is given below:-

**SEQUENCE OF KARHARBARI COAL SEAMS, DALTONGANJ COALFIELD**

<b>S. N.</b>	<b>Particulars</b>	<b>Thickness range (meters)</b>
1	<i>Major coal seams</i>	
	a) Top cover over Rajhara A seam	10.25 – 44.75
	Rajhara A seam	0.4 – 2.67
	b) Parting cover over Rajhara B seam	4.20 – 15.30
	Rajhara B seam	0.42 – 2.60
	(c) Parting cover over Pandwa Top seam	4.70 – 13.87
	Pandwa Top seam	0.25 – 3.11
2	<i>Gradient of strata (degree)</i>	<i>1 in 22.16 (2° 35' 1.67")</i>
3	Category of excavation :	
	(a) Weathered rock (cat)	
	(b) Overburden rock (cat)	
	(c) Coal (cat)	

### 3.0 ENVIRONMENTAL SCENARIO IN THE MINING AREA

#### 3.1 AIR ENVIRONMENT

##### 3.1.1 SOURCES OF AIR POLLUTION

Coal transportation, OB removal, drilling, blasting, haul road and movements of mining equipments are the major sources of air pollution in the area. Generally, dust generation is of major concern. NO<sub>2</sub> is liberated in the time of blasting and during the movement of mining machineries. This coal contains very less sulphur and as such the concentration of SO<sub>2</sub>. In Indian coal, it is low, except Assam where sulphur content is high.

##### 3.1.2 METHODOLOGY & INSTRUMENTS USED:

The methodology and instruments used for air monitoring and analysis are given in **Table 1** as below:

**Table 1: Methodology and Instrument Used for Air Quality Analysis**

Parameters	Method	Instrument
PM <sub>2.5</sub>	IS-5182 (Part 23):2006 Gravimetric Method Beta attenuation Method	Fine Particulate Sampler
PM <sub>10</sub>	IS-5182 (Part 23):2006 Gravimetric Method Beta attenuation Method	Respirable Dust Sampler (RDS)
SO <sub>2</sub>	IS-5182 (Part 2):2001 (Improved West & Gaeke method)	RDS with gaseous attachment
NO <sub>x</sub>	IS-5182 (Part 6):2006 (Jacob & Hochheiser modified method)	RDS with gaseous attachment

##### 3.1.3 AIR QUALITY

Air quality monitoring in core and buffer zone of the Kathautia Open Cast mine has been carried out in Pre-monsoon and monsoon seasons for the year 2016 to assess the impact of mining activities on the ambient air quality. During the study, two sampling locations for ambient air quality had been fixed in buffer zone and three in core zone area. Details of sampling stations along with the source of air pollution are given in **Table 2**. The air quality at these locations is presented from **Tables 3-4**. The results

show that the ambient air quality of the villages, in and around the mining site, is least affected as the mine is not in operation during the study period.

**Table 2: Details of Sampling Locations**

Stn. Code	Location	Source of Air Pollution
<b>CORE ZONE</b>		
CA <sub>1</sub>	Near Mine Site Office	Mining area, Kachha road, vehicular movement.
CA <sub>2</sub>	Near Haul Road	Mining area and vehicular movement.
CA <sub>3</sub>	Near Stockyard	Mining area and vehicular movement.
<b>BUFFER ZONE</b>		
BA <sub>1</sub>	Kajari Village	Household coal burning and vehicular movement, etc.
BA <sub>2</sub>	Batsara Village	Household coal burning and vehicular movement, etc.

**Table 3: Ambient Air Quality Report for Core Zone**

Sampling Code	Sampling Location	Season	Date of Sampling	Parameters ( $\mu\text{g}/\text{m}^3$ )				Remarks
				PM <sub>2.5</sub>	PM <sub>10</sub>	SO <sub>2</sub>	NO <sub>2</sub>	
CA <sub>1</sub>	Near Mine Site Office	Pre-monsoon	26-04-2016	55.5	76.8	18.2	29.5	
			24-05-2016	56.8	82.5	17.5	32.2	
			24-06-2016	49.2	65.8	16.5	27.8	
		Monsoon	26-07-2016	45.5	55.6	11.1	18.5	
			25-08-2016	40.8	52.2	12.2	14.5	
			27-09-2016	51.8	60.5	14.1	17.5	
CA <sub>2</sub>	Near Haul Road	Pre-monsoon	26-04-2016	51.8	69.5	16.2	22.5	
			25-05-2016	52.5	63.8	18.5	25.2	
			25-06-2016	45.9	58.5	16.8	20.5	
		Monsoon	26-07-2016	41.8	49.5	10.2	12.5	
			27-08-2016	42.5	50.2	11.5	15.5	
			26-09-2016	46.4	52.8	13.6	14.5	
CA <sub>3</sub>	Near Stockyard	Pre-monsoon	27-04-2016	41.5	64.8	17.5	25.2	
			26-05-2016	43.8	58.9	19.2	23.5	
			22-06-2016	40.2	52.5	17.5	21.1	
		Monsoon	27-07-2016	31.5	53.2	11.5	15.2	
			26-08-2016	30.8	48.5	12.2	13.0	
			28-09-2016	45.2	53.5	14.9	18.1	
<b>Standards as per NAAQS-2009</b>				<b>60</b>	<b>100</b>	<b>80</b>	<b>80</b>	

**Table 4: Ambient Air Quality Report for Buffer Zone**

Sampling Code	Sampling Location	Season	Date of Sampling	Parameters ( $\mu\text{g}/\text{m}^3$ )				Remarks
				PM <sub>2.5</sub>	PM <sub>10</sub>	SO <sub>2</sub>	NO <sub>2</sub>	
BA <sub>1</sub>	Kajari Village	Pre-monsoon	27-04-2016	48.5	58.2	18.5	28.2	
			26-05-2016	45.8	58.1	16.8	22.6	
			27-06-2016	41.2	55.8	14.2	20.5	
		Monsoon	28-07-2016	35.2	48.9	10.5	12.5	
			27-08-2016	30.9	45.1	14.5	14.6	
			26-09-2016	44.2	50.5	18.1	20.2	
BA <sub>2</sub>	Batsara Village	Pre-monsoon	28-04-2016	46.2	61.5	17.9	25.6	
			26-05-2016	43.5	57.8	18.5	27.2	
			27-06-2016	39.2	54.5	15.5	21.5	
		Monsoon	28-07-2016	35.5	50.5	11.5	12.6	
			26-08-2016	32.9	48.5	14.5	17.5	
			27-09-2016	40.5	55.2	20.5	22.1	
<b>Standards as per NAAQS-2009</b>				<b>60</b>	<b>100</b>	<b>80</b>	<b>80</b>	

### 3.1.3 RESULTS AND DISCUSSIONS

During pre-monsoon season (April to June), PM<sub>2.5</sub> concentration level at Near Mine Office in core zone varies from 49.2  $\mu\text{g}/\text{m}^3$  to 56.8  $\mu\text{g}/\text{m}^3$  and PM<sub>10</sub> from 65.8  $\mu\text{g}/\text{m}^3$  to 82.5  $\mu\text{g}/\text{m}^3$ . At Haul Road concentration level of PM<sub>2.5</sub> varies from 45.9  $\mu\text{g}/\text{m}^3$  to 52.5  $\mu\text{g}/\text{m}^3$  and PM<sub>10</sub> from 58.5  $\mu\text{g}/\text{m}^3$  to 69.5  $\mu\text{g}/\text{m}^3$ . Near Stockyard concentration level of PM<sub>2.5</sub> varies from 40.2  $\mu\text{g}/\text{m}^3$  to 43.8  $\mu\text{g}/\text{m}^3$  and PM<sub>10</sub> from 52.5  $\mu\text{g}/\text{m}^3$  to 64.8  $\mu\text{g}/\text{m}^3$ . In the core zone the PM<sub>2.5</sub> and PM<sub>10</sub> values are within the threshold value i.e. 60  $\mu\text{g}/\text{m}^3$  for PM<sub>2.5</sub> and 100  $\mu\text{g}/\text{m}^3$  for PM<sub>10</sub> as per the guideline of NAAQS around the entire sampling site. Concentration of SO<sub>2</sub> and NO<sub>2</sub> are also found within the limit of 80  $\mu\text{g}/\text{m}^3$  as per the guideline of NAAQS in all the sampling sites of core zone of the mine.

During Pre-monsoon season, the PM<sub>2.5</sub> concentration at Kajari Village in buffer zone is in the range of 41.2  $\mu\text{g}/\text{m}^3$  to 48.5  $\mu\text{g}/\text{m}^3$  and the concentration of PM<sub>10</sub> ranges from 55.8  $\mu\text{g}/\text{m}^3$  to 58.2  $\mu\text{g}/\text{m}^3$ . The PM<sub>2.5</sub> concentration at Batsara Village is in the range of 40.2  $\mu\text{g}/\text{m}^3$  to 46.2  $\mu\text{g}/\text{m}^3$  and the concentration of PM<sub>10</sub> ranges from 54.5  $\mu\text{g}/\text{m}^3$  to 61.5  $\mu\text{g}/\text{m}^3$ . In the buffer zone both the values are within the threshold value i.e. 60  $\mu\text{g}/\text{m}^3$  for PM<sub>2.5</sub> & 100  $\mu\text{g}/\text{m}^3$  for PM<sub>10</sub> as per the guideline of NAAQS. Concentration of SO<sub>2</sub> and NO<sub>2</sub> are also found within the limit 80  $\mu\text{g}/\text{m}^3$  as per the guideline of NAAQS in all the sampling sites of core zone of the mine.

During Monsoon season (July to September), PM<sub>2.5</sub> concentration level at Near Mine Office in core zone varies from 40.8 µg/m<sup>3</sup> to 51.8 µg/m<sup>3</sup> and PM<sub>10</sub> from 52.2 µg/m<sup>3</sup> to 60.5 µg/m<sup>3</sup>. At Haul Road concentration level of PM<sub>2.5</sub> varies from 41.8 µg/m<sup>3</sup> to 46.4 µg/m<sup>3</sup> and PM<sub>10</sub> from 49.5 µg/m<sup>3</sup> to 52.8 µg/m<sup>3</sup>. Near Stockyard concentration level of PM<sub>2.5</sub> varies from 30.8 µg/m<sup>3</sup> to 45.2 µg/m<sup>3</sup> and PM<sub>10</sub> from 48.5 µg/m<sup>3</sup> to 53.5 µg/m<sup>3</sup>. In the core zone the PM<sub>2.5</sub> and PM<sub>10</sub> values are within the threshold value i.e. 60 µg/m<sup>3</sup> for PM<sub>2.5</sub> and 100 µg/m<sup>3</sup> for PM<sub>10</sub> as per the guideline of NAAQS around the entire sampling site. Concentration of SO<sub>2</sub> and NO<sub>2</sub> are also found within the limit of 80 µg/m<sup>3</sup> as per the guideline of NAAQS in all the sampling sites of core zone of the mine.

During monsoon season, the PM<sub>2.5</sub> concentration at Kajari Village in buffer zone is in the range of 30.9 µg/m<sup>3</sup> to 44.2 µg/m<sup>3</sup> and the concentration of PM<sub>10</sub> ranges from 45.1 µg/m<sup>3</sup> to 50.5 µg/m<sup>3</sup>. The PM<sub>2.5</sub> concentration at Batsara Village is in the range of 32.9 µg/m<sup>3</sup> to 40.5 µg/m<sup>3</sup> and the concentration of PM<sub>10</sub> ranges from 50.5 µg/m<sup>3</sup> to 55.2 µg/m<sup>3</sup>. In the buffer zone both the values are within the threshold value i.e. 60 µg/m<sup>3</sup> for PM<sub>2.5</sub> & 100 µg/m<sup>3</sup> for PM<sub>10</sub> as per the guideline of NAAQS. Concentration of SO<sub>2</sub> and NO<sub>2</sub> are also found within the limit 80 µg/m<sup>3</sup> as per the guideline of NAAQS in all the sampling sites of core zone of the mine.

## **3.2 WATER ENVIRONMENT**

### **3.2.1. SOURCES OF WATER POLLUTION**

#### **Mine Water**

No adverse impact on surface water is anticipated as the main surface water regime is not proposed to be disturbed except for the drainage having their catchment within the ML area. The mine water, which is mainly rain water & ground water seepage, is used for industrial purposes after settling in the settling pond and the balance released into Durgawati Nalla by which the downstream consumers are benefited. Since, the water is of good quality after settling, there are no any possibility of water pollution in the area.

### **Domestic Effluents/Sewage**

There are minimum housing facilities within the ML area for essential services comprising about 100 inhabitants. The domestic wastes from these houses are led to septic tanks. As the domestic waste water is minimum, the possibility of pollution is remote/insignificant. However, proper care has been taken up in the shelters area of inhabitants for sewage discharge.

### **3.2.2 INSTRUMENTS USED**

- a) pH and Conductivity meter
- b) Ion Meter,
- c) COD Analyser,
- d) BOD Analyser,
- e) Water Analysis Kit, (Hach, DR - 2000)
- f) UV-VIS Spectrophotometer (Simazdo)
- g) Atomic Absorption Spectrophotometer (Varian)
- h) Ion Chromatograph (Dionex)
- i) ICP-MS (Perkin Elmer)

### **3.2.3 WATER QUALITY OF THE AREA**

To assess the water quality of the area mine water, ground water and surface water were collected and analysed. During the lean periods, mine water is used for water spraying on haul roads, plantation and other mining activities. To assess the water quality of the area water samples from eight locations (mine pit water, Effluent water from Settling pond, tube well near mine office, Tube Well Water near Shelter, tube well water of Kajari village, tube well water of Batsara village and upstream as well as downstream of Koyal river water to the mine site) were collected during pre-monsoon and monsoon seasons. The analysis was carried out in the field as well as CSIR-CIMFR Laboratory and results are presented from **Tables 5 to 10**.



Water quality of nearby well and tube well show that there is no significant impact of mining on water quality of region. TSS, TDS, Oil & Grease, COD, trace metals and other parameters are found within their respective threshold limits. During winter the TDS and hardness values in well water of Batsara village is slightly higher than their desirable limit of 500mg/l and 300mg/l respectively. Mine water quality also does not show any high value as it remains within the pit, where the contaminants settle before the mine water discharge. As far as Koyal river water is concerned, its quality shows its acceptability as is not affected by Kathautia mine effluents. The level of TSS, TDS and DO in the river water were found within threshold limit.

**Table 5: Mine Discharge Water Quality Data**

<b>Area: Core Zone</b>	<b>Season: Pre-monsoon</b>
<b>Project: Kathautia OC Mine</b>	<b>Date of Sampling: 26.05.2016</b>
<b>Name of the Sampling Station:</b>	
<b>W<sub>1</sub>- Mine Pit Water</b>	<b>W<sub>2</sub>- Effluent water from Settling Pond No.-2;</b>

Sl. No.	Parameters	Station Code		MoEF Sch.-VI Standard
		W <sub>1</sub>	W <sub>2</sub>	
1	Colour, Hazen units, Max	<5	Sample not available.	5
2	Odour	Unobjectionable		Unobjectionable
3	Total suspended solids, mg/l, Max	48		100
4	pH	8.09		6.5-8.5
5	Temperature (°C)	25.2		\$
6	Oil & Grease, mg/l, Max	1.8		10
7	Total Residual Chlorine, mg/l, Max	<0.1		1.0
8	Ammonical Nitrogen, (as N) mg/l, Max	1.167		50
9	Total Kjeldahl Nitrogen, (as NH <sub>3</sub> ) mg/l, Max	1.143		100
10	Free Ammonia (as NH <sub>3</sub> ) mg/l, Max	0.258		5.0
11	BOD (3days at 27°C), mg/l, Max	1.8		30
12	COD, mg/l, Max	46.8		250
13	Phenolic compounds (as C <sub>6</sub> H <sub>5</sub> OH), mg/l, Max	<0.001		1.0
14	Arsenic (as AS), mg/l, Max	<0.001		0.2
15	Lead (as Pb), mg/l, Max	<0.001		0.1
16	Cadmium (as Cd), mg/l, Max	<0.001		2.0
17	Hexavalent Chromium (as Cr <sup>6+</sup> ), mg/l, Max	0.001		0.1
18	Total Chromium (as Cr), mg/l, Max	0.003		2.0
19	Copper (as Cu), mg/l, Max	0.002		3.0
20	Zinc (as Zn), mg/l, Max	0.002		5.0
21	Selenium (as Se), mg/l, Max	<0.001		0.05
22	Nickel (as Ni), mg/l, Max	0.004		3.0
23	Fluorides (as F), mg/l, Max	0.97		2.0
24	Dissolved Phosphate (as P), mg/l, Max	<0.1		5.0
25	Sulphide (as S), mg/l, Max	0.34		2.0
26	Manganese (as Mn), mg/l, Max	0.001		2.0
27	Iron (as Fe), mg/l, Max	0.28		3.0
28	Nitrate (as N), mg/l, Max	0.13		10

\$: Temperature shall not exceed 5°C above the receiving water temp.

**Table 6: Ground Water Quality Data**

Area: Core Zone/Buffer Zone		Season: Pre-monsoon					
Project: Kathautia OC Mine		Date of Sampling: 26.05.2016					
Name of the Sampling Station:							
W <sub>3</sub> - Tube Well Water Mine office;				W <sub>4</sub> - Tube Well Water near Shelter;			
W <sub>5</sub> - Tube Well Water Kajari Village;				W <sub>6</sub> - Tube Well Water Batsara Village;			
Sl. No.	Parameters	Station Code				IS : 10500	
		W <sub>3</sub>	W <sub>4</sub>	W <sub>5</sub>	W <sub>6</sub>	Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate Source
1	Colour, Hazen units, Max	<5	<5	<5	<5	5	15
2	Odour	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
3	Taste	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
4	Turbidity, NTU, Max	1.18	1.62	1.58	1.42	1	5
5	pH	7.23	7.07	7.05	6.91	6.5-8.5	NR
6	Total Hardness (as CaCO <sub>3</sub> )	252	242	116	269	200	600
7	Iron (as Fe), mg/l, Max	0.265	0.284	0.326	0.315	0.3	NR
8	Chloride (as Cl <sup>-</sup> ), mg/l, Max	37.1	23.4	2.5	29.9	250	1000
9	Total Dissolved Solid, mg/l, Max	752	604	287	622	500	2000
10	Calcium (as Ca), mg/l, Max	60.5	62.1	33.2	68.9	75	200
11	Magnesium (as Mg), mg/l, Max	24.5	21.1	8.0	23.5	30	100
12	Manganese (as Mn), mg/l, Max	0.010	0.001	0.001	0.015	0.1	0.3
13	Sulphates (as SO <sub>4</sub> <sup>2-</sup> ), mg/l, Max	24.9	31.3	1.9	16.3	200	400
14	Nitrate (as NO <sub>3</sub> ), mg/l, Max	7.75	6.8	3.88	11.83	45	NR
15	Fluorides (as F), mg/l, Max	1.52	1.28	0.84	1.57	1.0	1.5
16	Boron (as B), mg/l, Max	<0.001	<0.001	<0.001	<0.001	0.5	1.0
17	Arsenic (as AS), mg/l, Max	<0.001	<0.001	<0.001	<0.001	0.01	0.05
18	Cadmium (as Cd), mg/l, Max	<0.001	<0.001	<0.001	<0.001	0.003	NR
19	Lead (as Pb), mg/l, Max	0.025	<0.001	<0.001	<0.001	0.1	NR
20	Copper (as Cu), mg/l, Max	0.006	0.004	0.004	0.002	0.05	1.5
21	Hexavalent Chromium (as Cr <sup>6+</sup> ), mg/l, Max	0.001	0.001	0.001	0.001	0.05	NR
22	Selenium (as Se), mg/l, Max	<0.001	0.001	<0.001	<0.001	0.01	NR
23	Silver (as Ag), mg/l, Max	<0.001	<0.001	<0.001	<0.001	0.1	NR
24	Zinc (as Zn), mg/l, Max	0.340	0.004	0.040	0.108	5.0	15
25	Alkalinity, mg/l, Max	417	357	188	361	NS	NS
26	Mineral Oil, mg/l, Max	<0.001	<0.001	<0.001	<0.001	0.5	NR
27	Coliform Organism (MPN/100ml)	Absent	Absent	Absent	Absent	Absent	Absent

**NR: No Relaxation**

**Table 7: Surface Water Quality Data**

Area: Buffer Zone		Season: Pre-monsoon		
Project: Kathautia OC Mine		Date of Sampling: 26.05.2016		
Name of the Sampling Station:				
W <sub>7</sub> - Koyal River, U/S of Mine;		W <sub>8</sub> - Koyal River, D/S of Mine;		
Sl. No.	Parameters	Station Code		(IS: 2296)# Surface Waters Class "C" Tolerance Limits
		W <sub>7</sub>	W <sub>8</sub>	
1	Colour, Hazen units, Max	<5	<5	300
2	Odour	Unobjectionable	Unobjectionable	Unobjectionable
3	Dissolved Oxygen, mg/l, Min.	5.9	5.7	4
4	pH	7.26	8.25	6.5-8.5
5	BOD (3days at 27°C), mg/l, Max	2.8	3.2	3
6	Phenolic compounds (as C <sub>6</sub> H <sub>5</sub> OH), mg/l, Max	<0.001	<0.001	0.005
7	Total Hardness (as CaCO <sub>3</sub> ), mg/l, Max	119	103	NS
8	Iron (as Fe), mg/l, Max	0.20	0.19	50
9	Chloride (as Cl <sup>-</sup> ), mg/l, Max	14.84	5.95	600
10	Total Dissolved Solid, mg/l, Max	209	180	1500
11	Calcium (as Ca), mg/l, Max	14.6	14.0	NS
12	Magnesium (as Mg), mg/l, Max	20.1	16.5	NS
13	Manganese (as Mn), mg/l, Max	0.001	<0.001	NS
14	Sulphates (as SO <sub>4</sub> <sup>-</sup> ), mg/l, Max	11.29	6.57	400
15	Nitrate (as NO <sub>3</sub> ), mg/l, Max	7.31	0.13	50
16	Fluorides (as F), mg/l, Max	0.73	0.80	1.5
17	Arsenic (as AS), mg/l, Max	<0.001	<0.001	0.2
18	Cadmium (as Cd), mg/l, Max	<0.001	<0.001	0.01
19	Lead (as Pb), mg/l, Max	<0.001	<0.001	0.1
20	Copper (as Cu), mg/l, Max	0.002	<0.001	1.5
21	Hexavalent Chromium (as Cr <sup>6+</sup> ), mg/l, Max	<0.001	<0.001	0.05
22	Selenium (as Se), mg/l, Max	<0.001	<0.001	0.05
23	Zinc (as Zn), mg/l, Max	0.008	0.002	15
24	Coliform Organism (MPN/100ml)	55	62	5000

# : Class "C"- Drinking water source with conventional treatment followed by disinfection.  
NS: Not Specified.

**Table 8: Mine Discharge Water Quality Data**

<b>Area: Core Zone</b>	<b>Season: Monsoon</b>
<b>Project: Kathautia OC Mine</b>	<b>Date of Sampling: 25.08.2016</b>
<b>Name of the Sampling Station:</b>	
<b>W<sub>1</sub>- Mine Pit Water</b>	<b>W<sub>2</sub>- Effluent water from Settling Pond No.-2;</b>

Sl. No.	Parameters	Station Code		MoEF Sch.-VI Standard
		W <sub>1</sub>	W <sub>2</sub>	
1	Colour, Hazen units, Max	<5	Sample not available	5
2	Odour	Unobjectionable		Unobjectionable
3	Total suspended solids, mg/l, Max	56		100
4	pH	8.00		6.5-8.5
5	Temperature (°C)	22.7		§
6	Oil & Grease, mg/l, Max	1.1		10
7	Total Residual Chlorine, mg/l, Max	<0.1		1.0
8	Ammonical Nitrogen, (as N) mg/l, Max	1.083		50
9	Total Kjeldahl Nitrogen, (as NH <sub>3</sub> ) mg/l, Max	1.041		100
10	Free Ammonia (as NH <sub>3</sub> ) mg/l, Max	0.092		5.0
11	BOD (3days at 27°C), mg/l, Max	3.8		30
12	COD, mg/l, Max	31.0		250
13	Phenolic compounds (as C <sub>6</sub> H <sub>5</sub> OH), mg/l, Max	<0.001		1.0
14	Arsenic (as AS), mg/l, Max	<0.001		0.2
15	Lead (as Pb), mg/l, Max	<0.001		0.1
16	Cadmium (as Cd), mg/l, Max	<0.001		2.0
17	Hexavalent Chromium (as Cr <sup>6+</sup> ), mg/l, Max	<0.001		0.1
18	Total Chromium (as Cr), mg/l, Max	<0.001		2.0
19	Copper (as Cu), mg/l, Max	0.001		3.0
20	Zinc (as Zn), mg/l, Max	0.004		5.0
21	Selenium (as Se), mg/l, Max	<0.001		0.05
22	Nickel (as Ni), mg/l, Max	0.004		3.0
23	Fluorides (as F), mg/l, Max	0.75		2.0
24	Dissolved Phosphate (as P), mg/l, Max	<0.1		5.0
25	Sulphide (as S), mg/l, Max	0.12		2.0
26	Manganese (as Mn), mg/l, Max	0.008		2.0
27	Iron (as Fe), mg/l, Max	0.556		3.0
28	Nitrate (as N), mg/l, Max	1.13		10

§: Temperature shall not exceed 5°C above the receiving water temp.

**Table 9: Ground Water Quality Data**

<b>Area: Core Zone/Buffer Zone</b>	<b>Season: Monsoon</b>
<b>Project: Kathautia OC Mine</b>	<b>Date of Sampling: 25.08.2016 &amp; 26.08.2016</b>
<b>Name of the Sampling Station:</b>	
<b>W<sub>3</sub> - Tube Well Water Mine office;</b>	<b>W<sub>4</sub> - Tube Well Water near Shelter;</b>
<b>W<sub>5</sub> - Tube Well Water Kajari Village;</b>	<b>W<sub>6</sub> - Tube Well Water Batsara Village;</b>

Sl. No.	Parameters	Station Code				IS: 10500 (Desirable Limit)
		W <sub>3</sub>	W <sub>4</sub>	W <sub>5</sub>	W <sub>6</sub>	
1	Colour, Hazen units, Max	<5	<5	<5	<5	5
2	Odour	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable
3	Taste	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
4	Turbidity, NTU, Max	1.58	1.32	1.12	1.82	5.0
5	pH	7.28	7.51	7.40	7.53	6.5-8.5
6	Total Hardness (as CaCO <sub>3</sub> )	301	345	197	263	300
7	Iron (as Fe), mg/l, Max	0.35	0.32	0.21	0.25	0.3
8	Chloride (as Cl <sup>-</sup> ), mg/l, Max	27.5	2.8	5.9	5.3	250
9	Total Dissolved Solid, mg/l, Max	566	357	324	318	500
10	Calcium (as Ca), mg/l, Max	73.2	108.4	55.1	84.4	75
11	Magnesium (as Mg), mg/l, Max	28.9	18.1	14.5	12.8	30
12	Manganese (as Mn), mg/l, Max	0.017	0.020	0.017	0.008	0.10
13	Sulphates (as SO <sub>4</sub> <sup>-</sup> ), mg/l, Max	20.4	2.4	3.4	3.3	150
14	Nitrate (as NO <sub>3</sub> ), mg/l, Max	10.9	1.5	8.2	10.0	45
15	Fluorides (as F), mg/l, Max	0.53	0.78	0.77	0.37	0.06-1.2
16	Boron (as B), mg/l, Max	<0.001	<0.001	<0.001	<0.001	0.5
17	Arsenic (as AS), mg/l, Max	<0.001	<0.001	<0.001	<0.001	0.05
18	Cadmium (as Cd), mg/l, Max	<0.001	<0.001	<0.001	<0.001	0.01
19	Lead (as Pb), mg/l, Max	<0.001	<0.001	<0.001	<0.001	0.1
20	Copper (as Cu), mg/l, Max	0.002	<0.001	0.020	0.008	0.05
21	Hexavalent Chromium (as Cr <sup>6+</sup> ), mg/l, Max	<0.001	<0.001	<0.001	<0.001	0.05
22	Selenium (as Se), mg/l, Max	<0.001	<0.001	<0.001	<0.001	0.01
23	Silver (as Ag), mg/l, Max	<0.001	<0.001	<0.001	<0.001	-
24	Zinc (as Zn), mg/l, Max	0.039	0.006	0.027	0.960	5
25	Alkalinity, mg/l, Max	210	148	106	148	200
26	Mineral Oil, mg/l, Max	<0.001	<0.001	<0.001	<0.001	0.001
27	Coliform Organism (MPN/100ml)	Absent	Absent	Absent	Absent	Absent

**Table 10: Surface Water Quality Data**

<b>Area: Buffer Zone</b>	<b>Season: Monsoon</b>
<b>Project: Kathautia OC Mine</b>	<b>Date of Sampling: 25.08.2016</b>
<b>Name of the Sampling Station:</b>	
<b>W<sub>7</sub> - Koyal River, U/S of Mine;</b>	<b>W<sub>8</sub> - Koyal River, D/S of Mine;</b>

Sl. No.	Parameters	Station Code		(IS: 2296)# Surface Waters Class "C" Tolerance Limits
		W <sub>7</sub>	W <sub>8</sub>	
1	Colour, Hazen units, Max	<5	<5	300
2	Odour	Unobjectionable	Unobjectionable	Unobjectionable
3	Dissolved Oxygen, mg/l, Min.	6.2	6.1	4
4	pH	7.68	7.79	6.5-8.5
5	BOD (3days at 27°C), mg/l, Max	2.7	2.9	3
6	Phenolic compounds (as C <sub>6</sub> H <sub>5</sub> OH), mg/l, Max	<0.001	<0.001	0.005
7	Total Hardness (as CaCO <sub>3</sub> ), mg/l, Max	36	56	NS
8	Iron (as Fe), mg/l, Max	0.28	0.39	50
9	Chloride (as Cl <sup>-</sup> ), mg/l, Max	2.7	3.2	600
10	Total Dissolved Solid, mg/l, Max	96	129	1500
11	Calcium (as Ca), mg/l, Max	8.3	15.1	NS
12	Magnesium (as Mg), mg/l, Max	3.8	4.5	NS
13	Manganese (as Mn), mg/l, Max	0.004	0.005	NS
14	Sulphates (as SO <sub>4</sub> <sup>-</sup> ), mg/l, Max	6.03	5.61	400
15	Nitrate (as NO <sub>3</sub> ), mg/l, Max	2.91	2.79	50
16	Fluorides (as F), mg/l, Max	0.55	0.67	1.5
17	Arsenic (as AS), mg/l, Max	<0.001	<0.001	0.2
18	Cadmium (as Cd), mg/l, Max	<0.001	<0.001	0.01
19	Lead (as Pb), mg/l, Max	<0.001	<0.001	0.1
20	Copper (as Cu), mg/l, Max	0.003	0.004	1.5
21	Hexavalent Chromium (as Cr <sup>6+</sup> ), mg/l, Max	0.001	0.001	0.05
22	Selenium (as Se), mg/l, Max	<0.001	<0.001	0.05
23	Zinc (as Zn), mg/l, Max	0.06	0.05	15
24	Coliform Organism (MPN/100ml)	115	128	5000

# : Class "C"- Drinking water source with conventional treatment followed by disinfection.  
NS: Not Specified

### 4.3 NOISE ENVIRONNENT

Noise is undesirable and unpleasant sound produced by the vibration of bodies or molecules of the medium and propagates as a pressure perturbation. It disturbs man's work, sleep and communication. It damages hearing and evokes other physiological reactions. Mining is the third largest industry in terms of employment and the recent trends of mechanization has changed the working environment to noisy environment leading to higher sound levels.

#### 4.3.1 SOURCES OF NOISE

Noise produced at different levels by different equipments in the open cast mine are summarized in the **Table 11**.

**Table 11: Noise Generating Mining Equipments**

S. N.	Equipment / Operation	Noise level dB(A)
1	Feeder breaker	82-100
2	Dumpers	100-115
3	Shovels	80-107
4	Dozers	84-107
5	Front End loader	83-101
6	Electric motors, gear drivers, hoppers, drilling & main pump	85-95
7	Belt conveyer	90-92
8	Drill	110-115

Noise level study at Kathautia Open Cast Coal Mine was carried out in buffer as well as core zone. Five noise level monitoring locations in core zone and two noise level monitoring locations in buffer zone were fixed-up and get representative values during Post-monsoon season.

#### 4.3.2 INSTRUMENTS USED

Sound level study is carried by using Mip-oy Integrated Sound Level Meter Meeting IEC-179A measuring average peak and Low values in Day and Night time.



### 4.3.3 RESULTS & DISCUSSION

Results are shown from **Tables 12 to 23** for ambient noise levels of core and buffer zones during pre-monsoon and monsoon seasons. The average peak values at the nearby villages are found well below the standard values of 55 & 45 dB (A) for day & Night. In core zone maximum noise levels and average noise levels are also well within the prescribed limit of 75 & 70 dB (A) for Day & Night respectively.

**Table 12: Noise Level in Core Zone of the Study Area during Pre-monsoon Season (April, 2016)**

Date of Sampling:		Noise level dB(A) average					
26.04.2016 to 28.04.2016		Day Time			Night Time		
Stn. Code	Location	Min.	Max.	Average	Min.	Max.	Average
N <sub>1</sub>	Near Mine Office	40.9	62.5	51.7	36.4	55.2	45.1
N <sub>2</sub>	Coal Face	35.2	55.3	45.2	31.5	42.9	37.2
N <sub>3</sub>	Near OB dump	36.2	54.0	45.1	31.2	44.7	41.2
N <sub>4</sub>	Stockyard	35.5	60.0	47.7	45.2	37.6	40.5
N <sub>5</sub>	Haul Road	35.3	62.0	48.6	34.4	46.6	40.5
<b>Standards as per CPCB</b>		<b>75</b>			<b>70</b>		

**Table 13: Noise Level in Buffer Zone of the Study Area during Pre-monsoon Season (April, 2016)**

Date of Sampling:		Noise level dB(A) average					
26.04.2016 to 28.04.2016		Day Time			Night Time		
Stn. Code	Location	Min.	Max.	Average	Min.	Max.	Average
N <sub>6</sub>	Kajari Village	35.6	59.5	47.5	30.6	45.7	42.5
N <sub>7</sub>	Batsara Village	42.8	62.8	53.4	30.6	45.7	42.5
<b>Standards as per CPCB</b>		<b>55</b>			<b>45</b>		

**Table 14: Noise Level in Core Zone of the Study Area during Pre-monsoon Season (May, 2016)**

Date of Sampling:		Noise level dB(A) average					
24.05.2016 to 29.05.2016		Day Time			Night Time		
Stn. Code	Location	Min.	Max.	Average	Min.	Max.	Average
N <sub>1</sub>	Near Mine Office	40.5	60.5	50.5	30.5	52.6	41.5
N <sub>2</sub>	Coal Face	38.4	58.6	48.5	32.0	42.6	37.3
N <sub>3</sub>	Near OB dump	36.5	58.0	47.2	30.2	44.6	37.4
N <sub>4</sub>	Stockyard	38.0	60.0	49.0	30.5	44.2	37.3
N <sub>5</sub>	Haul Road	39.5	63.5	51.5	34.4	47.6	42.8
<b>Standards as per CPCB</b>		<b>75</b>			<b>70</b>		

**Table 15: Noise Level in Buffer Zone of the Study Area during Pre-monsoon Season (May, 2016)**

Date of Sampling:		Noise level dB(A) average					
24.05.2016 to 29.05.2016		Day Time			Night Time		
Stn. Code	Location	Min.	Max.	Average	Min.	Max.	Average
N <sub>6</sub>	Kajari Village	35.0	58.0	46.5	30.2	40.6	35.4
N <sub>7</sub>	Batsara Village	40.8	56.8	48.8	30.0	39.6	34.8
<b>Standards as per CPCB</b>		<b>55</b>			<b>45</b>		

**Table 16: Noise Level in Core Zone of the Study Area during Pre-monsoon Season (June, 2016)**

Date of Sampling:		Noise level dB(A) average					
24.06.2016 to 29.06.2016		Day Time			Night Time		
Stn. Code	Location	Min.	Max.	Average	Min.	Max.	Average
N <sub>1</sub>	Near Mine Office	40.5	62.0	51.2	34.2	52.4	43.3
N <sub>2</sub>	Coal Face	38.5	56.3	47.4	32.5	43.6	38.05
N <sub>3</sub>	Near OB dump	36.5	55.0	45.7	31.2	42.4	36.8
N <sub>4</sub>	Stockyard	35.8	62.0	48.9	32.2	43.2	37.7
N <sub>5</sub>	Haul Road	38.3	63.5	50.9	34.4	46.2	40.3

**Table 17: Noise Level in Buffer Zone of the Study Area during Pre-monsoon Season (June, 2016)**

Date of Sampling:		Noise level dB(A) average					
24.06.2016 to 29.06.2016		Day Time			Night Time		
Stn. Code	Location	Min.	Max.	Average	Min.	Max.	Average
N <sub>6</sub>	Kajari Village	34.0	62.1	48.05	31.5	41.0	36.2
N <sub>7</sub>	Batsara Village	40.8	62.8	51.8	30.6	42.6	36.6
<b>Standards as per CPCB</b>		<b>55</b>			<b>45</b>		

**Table 18: Noise Level in Core Zone of the Study Area during Monsoon Season (July, 2016)**

Date of Sampling:		Noise level dB(A) average					
26.07.2016 - 28.07.2016		Day Time			Night Time		
Stn. Code	Location	Min.	Max.	Average	Min.	Max.	Average
N <sub>1</sub>	Near Mine Office	37.2	60.4	50.5	32.1	55.2	45.5
N <sub>2</sub>	Coal Face	35.0	52.8	46.4	31.6	43.3	38.2
N <sub>3</sub>	Near OB dump	35.5	53.1	44.8	31.2	45.5	40.1
N <sub>4</sub>	Stockyard	36.1	57.2	46.6	31.5	45.2	41.6
N <sub>5</sub>	Haul Road	36.5	60.5	48.0	32.2	52.1	44.4
<b>Standards as per CPCB</b>		<b>75</b>			<b>70</b>		

**Table 19: Noise Level in Buffer Zone of the Study Area during Monsoon Season (July, 2016)**

Date of Sampling:		Noise level dB(A) average					
26.07.2016 - 28.07.2016		Day Time			Night Time		
Stn. Code	Location	Min.	Max.	Average	Min.	Max.	Average
N <sub>6</sub>	Kajari Village	33.6	60.8	51.1	32.5	48.3	44.2
N <sub>7</sub>	Batsara Village	37.7	58.8	50.8	31.8	49.4	42.0
<b>Standards as per CPCB</b>		<b>55</b>			<b>45</b>		

**Table 20: Noise Level in Core Zone of the Study Area during Monsoon Season (August, 2016)**

Date of Sampling:		Noise level dB(A) average					
25.08.2016 - 27.08.2016		Day Time			Night Time		
Stn. Code	Location	Min.	Max.	Average	Min.	Max.	Average
N <sub>1</sub>	Near Mine Office	37.0	62.2	49.5	31.6	51.5	44.6
N <sub>2</sub>	Coal Face	38.2	60.2	47.5	32.6	44.5	41.6
N <sub>3</sub>	Near OB dump	35.8	56.8	46.6	33.5	43.8	40.2
N <sub>4</sub>	Stockyard	37.2	58.8	48.2	31.8	45.9	40.8
N <sub>5</sub>	Haul Road	37.1	61.9	48.5	31.4	47.7	43.5
Standards as per CPCB		75			70		

**Table 21: Noise Level in Buffer Zone of the Study Area during Monsoon Season (August, 2016)**

Date of Sampling:		Noise level dB(A) average					
25.08.2016 - 27.08.2016		Day Time			Night Time		
Stn. Code	Location	Min.	Max.	Average	Min.	Max.	Average
N <sub>6</sub>	Kajari Village	36.5	65.9	52.8	32.0	50.2	42.2
N <sub>7</sub>	Batsara Village	37.1	64.8	53.2	31.7	54.3	43.7
Standards as per CPCB		55			45		

**Table 22: Noise Level in Core Zone of the Study Area during Monsoon Season (September, 2016)**

Date of Sampling:		Noise level dB(A) average					
26.09.2016 - 28.09.2016		Day Time			Night Time		
Stn. Code	Location	Min.	Max.	Average	Min.	Max.	Average
N <sub>1</sub>	Near Mine Office	38.5	64.4	51.8	32.0	53.4	43.6
N <sub>2</sub>	Coal Face	37.2	58.5	47.9	31.8	44.6	40.2
N <sub>3</sub>	Near OB dump	36.4	57.5	46.5	32.6	44.2	38.5
N <sub>4</sub>	Stockyard	36.6	58.7	47.2	32.4	44.0	39.2
N <sub>5</sub>	Haul Road	38.4	62.8	52.2	32.6	46.2	40.4

**Table 23: Noise Level in Buffer Zone of the Study Area during Monsoon Season (September, 2016)**

Date of Sampling:		Noise level dB(A) average					
26.09.2016 - 28.09.2016		Day Time			Night Time		
Stn. Code	Location	Min.	Max.	Average	Min.	Max.	Average
N <sub>6</sub>	Kajari Village	35.8	62.6	51.8	33.6	48.2	43.2
N <sub>7</sub>	Batsara Village	37.6	63.4	52.0	32.5	46.7	42.7
<b>Standards as per CPCB</b>		<b>55</b>			<b>45</b>		

## 5.0 CONCLUSION

On the basis of the data generated it has been found that the environmental scenario in and around mining area of Kathautia Open Cast Mine with respect to air, water and noise are well within the permissible limits.

## 6.0 RECOMMENDATIONS & FOLLOW-UP ACTION

The study indicates that air quality around the Kathautia Open Cast Coal Mine is found to be within the threshold limit as per the guideline of NAAQS, 2009. However, the mine is not in working during the monitoring period. Water quality of the surrounding water resources are also not found polluted by mine effluent. For the best practice of coal mining in future, Environmental Management System should always be considered with following measures:

- ✓ Frequency of spraying of water on the haul roads for controlling the dust to its minimum level may be increased.
- ✓ Regular maintenance of the heavy earth moving machines.
- ✓ Mine water collection in settling tank before its discharge.
- ✓ Garland drainage should be made around the dumps.
- ✓ Reclamation and revegetation of overburden dumps should be done to control soil erosion, denudation of agricultural land and nearby riverine system, wetlands and to improves the aesthetics of the area.
- ✓ Dumps brought under biological reclamation should not be made active.
- ✓ The mine management has been implementing, these measures to make mining operation eco-friendly in this coal mine of Hindalco Industries Ltd.