

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, Ranchi**.

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, Ranchi; 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 study 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 seasonal basis 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

S. N.	Particulars	Thickness range (meters)
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. NO₂ 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 SO₂. 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 _{2.5}	IS-5182 (Part 23):2006 Gravimetric Method Beta attenuation Method	Fine Particulate Sampler
PM ₁₀	IS-5182 (Part 23):2006 Gravimetric Method Beta attenuation Method	Respirable Dust Sampler (RDS)
SO ₂	IS-5182 (Part 2):2001 (Improved West & Gaeke method)	RDS with gaseous attachment
NO _x	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 Post-monsoon and winter seasons for the year 2016-17 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
CORE ZONE		
CA ₁	Near Mine Site Office	Mining area, Kachha road, vehicular movement.
CA ₂	Near Haul Road	Mining area and vehicular movement.
CA ₃	Near Stockyard	Mining area and vehicular movement.
BUFFER ZONE		
BA ₁	Kajari Village	Household coal burning and vehicular movement, etc.
BA ₂	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 (µg/m ³)				Remarks
				PM _{2.5}	PM ₁₀	SO ₂	NO ₂	
CA ₁	Near Mine Site Office	Post-monsoon	20-10-2016	52.5	71.9	16.2	24.9	
			03-12-2016	53.9	65.1	14.5	25.9	
			27-12-2016	55.4	75.5	15.9	26.5	
		Winter	17-01-2017	54.6	80.2	16.4	28.1	
			23-02-2017	51.8	69.4	17.6	32.5	
			29-03-2017	57.4	75.2	20.7	40.0	
CA ₂	Near Haul Road	Post-monsoon	21-10-2016	47.2	64.1	13.9	20.1	
			03-12-2016	40.9	56.5	15.1	24.5	
			28-12-2016	44.5	62.9	13.1	22.9	
		Winter	17-01-2017	46.2	68.5	17.5	29.8	
			25-02-2017	49.2	65.0	18.2	31.0	
			29-03-2017	54.2	68.6	19.0	35.7	
CA ₃	Near Stockyard	Post-monsoon	22-10-2016	44.5	55.2	15.5	22.1	
			04-12-2016	35.5	59.9	14.5	23.9	
			28-12-2016	46.1	54.5	14.2	25.1	
		Winter	18-01-2017	50.5	65.0	16.2	28.5	
			24-02-2017	44.6	60.3	15.8	26.6	
			30-03-2017	51.1	66.9	17.1	28.2	
Standards as per NAAQS-2009				60	100	80	80	

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 _{2.5}	PM ₁₀	SO ₂	NO ₂	
BA ₁	Kajari Village	Post-monsoon	22-10-2016	40.9	60.1	18.9	28.5	
			05-12-2016	40.5	56.1	17.1	25.5	
			29-12-2016	50.9	64.8	18.5	26.9	
		Winter	18-01-2017	49.0	64.6	20.8	27.2	
			26-02-2017	48.6	60.8	24.6	26.5	
			30-03-2017	52.1	67.2	25.2	28.0	
BA ₂	Batsara Village	Post-monsoon	23-10-2016	44.8	61.9	17.5	26.9	
			06-12-2016	41.5	58.1	16.8	26.1	
			30-12-2016	46.5	60.9	22.1	25.5	
		Winter	19-01-2017	50.5	62.6	21.5	26.1	
			27-02-2017	48.9	60.5	20.8	27.7	
			31-03-2017	51.3	65.2	23.6	30.4	
Standards as per NAAQS-2009				60	100	80	80	

3.1.4 RESULTS AND DISCUSSIONS

During post-monsoon season (October to December), PM_{2.5} concentration level at Near Mine Office in core zone varies from 52.5 $\mu\text{g}/\text{m}^3$ to 55.4 $\mu\text{g}/\text{m}^3$ and PM₁₀ from 65.1 $\mu\text{g}/\text{m}^3$ to 75.5 $\mu\text{g}/\text{m}^3$. At Haul Road concentration level of PM_{2.5} varies from 40.9 $\mu\text{g}/\text{m}^3$ to 47.2 $\mu\text{g}/\text{m}^3$ and PM₁₀ from 58.9 $\mu\text{g}/\text{m}^3$ to 64.1 $\mu\text{g}/\text{m}^3$. Near Stockyard concentration level of PM_{2.5} varies from 35.5 $\mu\text{g}/\text{m}^3$ to 46.1 $\mu\text{g}/\text{m}^3$ and PM₁₀ from 55.2 $\mu\text{g}/\text{m}^3$ to 62.9 $\mu\text{g}/\text{m}^3$. In the core zone the PM_{2.5} and PM₁₀ values are within the threshold value i.e. 60 $\mu\text{g}/\text{m}^3$ for PM_{2.5} and 100 $\mu\text{g}/\text{m}^3$ for PM₁₀ as per the guideline of NAAQS around the entire sampling site. Concentration of SO₂ and NO₂ 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. The PM_{2.5}, PM₁₀, SO₂ and NO₂ in the working zone of the mine are in lower concentration because the mine is not in operation.

During Post-monsoon season, the PM_{2.5} concentration at Kajari Village in buffer zone is in the range of 40.5 $\mu\text{g}/\text{m}^3$ to 50.9 $\mu\text{g}/\text{m}^3$ and the concentration of PM₁₀ ranges from 56.1 $\mu\text{g}/\text{m}^3$ to 64.8 $\mu\text{g}/\text{m}^3$. The PM_{2.5} concentration at Batsara Village is in the range of 41.5 $\mu\text{g}/\text{m}^3$ to 46.5 $\mu\text{g}/\text{m}^3$ and the concentration of PM₁₀ ranges from 58.1 $\mu\text{g}/\text{m}^3$ to 61.9 $\mu\text{g}/\text{m}^3$. In the buffer zone both the values are within the threshold value i.e.

60 $\mu\text{g}/\text{m}^3$ for $\text{PM}_{2.5}$ & 100 $\mu\text{g}/\text{m}^3$ for PM_{10} as per the guideline of NAAQS. Concentration of SO_2 and NO_2 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 winter season (January to March), $\text{PM}_{2.5}$ concentration level at Near Mine Office in core zone varies from 51.8 $\mu\text{g}/\text{m}^3$ to 57.4 $\mu\text{g}/\text{m}^3$ and PM_{10} from 69.4 $\mu\text{g}/\text{m}^3$ to 80.2 $\mu\text{g}/\text{m}^3$. At Haul Road site concentration level of $\text{PM}_{2.5}$ varies from 46.2 $\mu\text{g}/\text{m}^3$ to 54.2 $\mu\text{g}/\text{m}^3$ and PM_{10} from 65.0 $\mu\text{g}/\text{m}^3$ to 68.6 $\mu\text{g}/\text{m}^3$. Near Stockyard concentration level of $\text{PM}_{2.5}$ varies from 44.6 $\mu\text{g}/\text{m}^3$ to 51.1 $\mu\text{g}/\text{m}^3$ and PM_{10} from 60.3 $\mu\text{g}/\text{m}^3$ to 66.9 $\mu\text{g}/\text{m}^3$. In the core zone both the values i.e. $\text{PM}_{2.5}$ and PM_{10} are within the threshold value i.e. 60 $\mu\text{g}/\text{m}^3$ for $\text{PM}_{2.5}$ & 100 $\mu\text{g}/\text{m}^3$ for PM_{10} respectively as per NAAQS guideline. Concentration of SO_2 and NO_2 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 winter season the $\text{PM}_{2.5}$ concentration at Kajari Village in buffer zone is in the range of 48.6 $\mu\text{g}/\text{m}^3$ to 52.1 $\mu\text{g}/\text{m}^3$ and the concentration of PM_{10} ranges from 60.8 $\mu\text{g}/\text{m}^3$ to 67.2 $\mu\text{g}/\text{m}^3$. The $\text{PM}_{2.5}$ concentration at Batsara Village is in the range of 48.9 $\mu\text{g}/\text{m}^3$ to 51.3 $\mu\text{g}/\text{m}^3$ and the concentration of PM_{10} range from 60.5 $\mu\text{g}/\text{m}^3$ to 65.2 $\mu\text{g}/\text{m}^3$. In the buffer zone both the values are within the threshold value i.e. 60 $\mu\text{g}/\text{m}^3$ for $\text{PM}_{2.5}$ & 100 $\mu\text{g}/\text{m}^3$ for PM_{10} as per the guideline of NAAQS. Concentration of SO_2 and NO_2 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.

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) Microwave Digestion
- g) UV-VIS Spectrophotometer (Simazdo)
- h) Atomic Absorption Spectrophotometer (Varian)
- i) Ion Chromatograph (Dionex)
- j) Flame Photometer
- k) 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 post-monsoon and winter seasons. The analysis was carried out in the field as well as CSIR-CIMFR Laboratory and results are presented from **Table 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 post-monsoon season the TDS and alkalinity values in tube well water of mine office and Batsara village are slightly higher than their desirable limit of 500mg/l and 200mg/l respectively. During winter season TDS and alkalinity values are well the desirable limit in all the collected water samples. 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 mine is not in working condition. 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

Area: Core Zone	Season: Post-monsoon
Project: Kathautia OC Mine	Date of Sampling: 03.12.2016
Name of the Sampling Station:	
W₁- Mine Pit Water	W₂- Effluent water from Settling Pond No.-2;

Sl. No.	Parameters	Station Code		MoEF Sch.-VI Standard
		W ₁	W ₂	
1	Colour, Hazen units, Max	<5	Sample not available	5
2	Odour	Unobjectionable		Unobjectionable
3	Total suspended solids, mg/l, Max	45		100
4	pH	7.72		6.5-8.5
5	Temperature (°C)	24.2		\$
6	Oil & Grease, mg/l, Max	2.8		10
7	Total Residual Chlorine, mg/l, Max	<0.1		1.0
8	Ammonical Nitrogen, (as N) mg/l, Max	1.528		50
9	Total Kjeldahl Nitrogen, (as NH ₃) mg/l, Max	1.852		100
10	Free Ammonia (as NH ₃) mg/l, Max	0.257		5.0
11	BOD (3days at 27°C), mg/l, Max	2.4		30
12	COD, mg/l, Max	47.1		250
13	Phenolic compounds (as C ₆ H ₅ 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 ⁶⁺), mg/l, Max	0.006		0.1
18	Total Chromium (as Cr), mg/l, Max	0.010		2.0
19	Copper (as Cu), mg/l, Max	0.008		3.0
20	Zinc (as Zn), mg/l, Max	0.018		5.0
21	Selenium (as Se), mg/l, Max	<0.001		0.05
22	Nickel (as Ni), mg/l, Max	0.009		3.0
23	Fluorides (as F), mg/l, Max	0.35		2.0
24	Dissolved Phosphate (as P), mg/l, Max	<0.1		5.0
25	Sulphide (as S), mg/l, Max	0.27		2.0
26	Manganese (as Mn), mg/l, Max	0.011		2.0
27	Iron (as Fe), mg/l, Max	0.35		3.0
28	Nitrate (as N), mg/l, Max	0.18		10

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

Table 6: Ground Water Quality Data

Area: Core Zone/Buffer Zone	Season: Post-monsoon
Project: Kathautia OC Mine	Date of Sampling: 03.12.2016
Name of the Sampling Station:	
W₃ - Tube Well Water Mine office;	W₄ - Tube Well Water near Shelter;
W₅ - Tube Well Water Kajari Village;	W₆ - Tube Well Water Batsara Village;

Sl. No.	Parameters	Station Code				IS: 10500 (Desirable Limit)
		W ₃	W ₄	W ₅	W ₆	
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	1.24	1.32	0.71	1.56	5.0
5	pH	7.44	7.51	6.99	7.17	6.5-8.5
6	Total Hardness (as CaCO ₃)	184	180	160	234	300
7	Iron (as Fe), mg/l, Max	0.112	0.143	0.110	0.114	0.3
8	Chloride (as Cl ⁻), mg/l, Max	8.9	5.4	6.3	15.8	250
9	Total Dissolved Solid, mg/l, Max	584	429	310	304	500
10	Calcium (as Ca), mg/l, Max	23.5	34.5	38.7	68.1	75
11	Magnesium (as Mg), mg/l, Max	30.4	22.8	15.4	15.5	30
12	Manganese (as Mn), mg/l, Max	0.011	0.017	0.022	0.012	0.10
13	Sulphates (as SO ₄ ²⁻), mg/l, Max	12.8	2.4	3.8	102.5	150
14	Nitrate (as NO ₃), mg/l, Max	2.8	1.6	5.2	4.6	45
15	Fluorides (as F), mg/l, Max	0.46	0.36	0.52	0.68	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	<0.001	0.001	<0.001	<0.001	0.05
21	Hexavalent Chromium (as Cr ⁶⁺), mg/l, Max	0.007	0.009	0.012	0.011	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	0.156	0.133	0.109	0.151	5
25	Alkalinity, mg/l, Max	235	248	198	270	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 7: Surface Water Quality Data

Area: Buffer Zone	Season: Post-monsoon
Project: Kathautia OC Mine	Date of Sampling: 04.12.2016
Name of the Sampling Station:	
W₇ - Koyal River, U/S of Mine;	W₈ - Koyal River, D/S of Mine;

Sl. No.	Parameters	Station Code		(IS: 2296)# Surface Waters Class "C" Tolerance Limits
		W ₇	W ₈	
1	Colour, Hazen units, Max	<5	<5	300
2	Odour	Unobjectionable	Unobjectionable	Unobjectionable
3	Dissolved Oxygen, mg/l, Min.	6.8	6.5	4
4	pH	7.98	7.55	6.5-8.5
5	BOD (3days at 27°C), mg/l, Max	3.6	3.4	3
6	Phenolic compounds (as C ₆ H ₅ OH), mg/l, Max	<0.001	<0.001	0.005
7	Total Hardness (as CaCO ₃), mg/l, Max	112	146	NS
8	Iron (as Fe), mg/l, Max	0.36	0.42	50
9	Chloride (as Cl ⁻), mg/l, Max	14.2	12.5	600
10	Total Dissolved Solid, mg/l, Max	187	268	1500
11	Calcium (as Ca), mg/l, Max	25.2	36.2	NS
12	Magnesium (as Mg), mg/l, Max	11.9	16.5	NS
13	Manganese (as Mn), mg/l, Max	0.019	0.011	NS
14	Sulphates (as SO ₄ ⁻), mg/l, Max	7.6	12.8	400
15	Nitrate (as NO ₃), mg/l, Max	10.5	8.7	50
16	Fluorides (as F), mg/l, Max	0.79	0.62	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	0.006	0.005	0.1
20	Copper (as Cu), mg/l, Max	0.016	0.018	1.5
21	Hexavalent Chromium (as Cr ⁶⁺), mg/l, Max	0.008	0.007	0.05
22	Selenium (as Se), mg/l, Max	<0.001	<0.001	0.05
23	Zinc (as Zn), mg/l, Max	0.62	0.58	15
24	Coliform Organism (MPN/100ml)	64	78	5000

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

Table 8: Mine Discharge Water Quality Data

Area: Core Zone	Season: Winter
Project: Kathautia OC Mine	Date of Sampling: 25.02.2017
Name of the Sampling Station:	
W₁- Mine Pit Water	W₂- Effluent water from Settling Pond No.-2;

Sl. No.	Parameters	Station Code		MoEF Sch.-VI Standard
		W ₁	W ₂	
1	Colour, Hazen units, Max	<5	Sample not available	5
2	Odour	Unobjectionable		Unobjectionable
3	Total suspended solids, mg/l, Max	54		100
4	pH	8.12		6.5-8.5
5	Temperature (°C)	23.8		\$
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	1.132		50
9	Total Kjeldahl Nitrogen, (as NH ₃) mg/l, Max	1.216		100
10	Free Ammonia (as NH ₃) mg/l, Max	0.128		5.0
11	BOD (3days at 27°C), mg/l, Max	3.6		30
12	COD, mg/l, Max	37.5		250
13	Phenolic compounds (as C ₆ H ₅ 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 ⁶⁺), mg/l, Max	0.002		0.1
18	Total Chromium (as Cr), mg/l, Max	0.005		2.0
19	Copper (as Cu), mg/l, Max	0.003		3.0
20	Zinc (as Zn), mg/l, Max	0.006		5.0
21	Selenium (as Se), mg/l, Max	<0.001		0.05
22	Nickel (as Ni), mg/l, Max	0.005		3.0
23	Fluorides (as F), mg/l, Max	1.12		2.0
24	Dissolved Phosphate (as P), mg/l, Max	<0.1		5.0
25	Sulphide (as S), mg/l, Max	0.22		2.0
26	Manganese (as Mn), mg/l, Max	0.006		2.0
27	Iron (as Fe), mg/l, Max	0.683		3.0
28	Nitrate (as N), mg/l, Max	0.68		10

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

Table 9: Ground Water Quality Data

Area: Core Zone/Buffer Zone	Season: Winter
Project: Kathautia OC Mine	Date of Sampling: 25.02.2017 & 26.02.2017
Name of the Sampling Station:	
W₃ - Tube Well Water Mine office;	W₄ - Tube Well Water near Shelter;
W₅ - Tube Well Water Kajari Village;	W₆ - Tube Well Water Batsara Village;

Sl. No.	Parameters	Station Code				IS: 10500 (Desirable Limit)
		W ₃	W ₄	W ₅	W ₆	
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	1.11	1.23	1.02	1.42	5.0
5	pH	7.24	7.12	7.06	7.22	6.5-8.5
6	Total Hardness (as CaCO ₃)	226	268	203	293	300
7	Iron (as Fe), mg/l, Max	0.132	0.248	0.211	0.205	0.3
8	Chloride (as Cl ⁻), mg/l, Max	7.6	11.6	7.8	15.4	250
9	Total Dissolved Solid, mg/l, Max	488	459	353	449	500
10	Calcium (as Ca), mg/l, Max	58.5	70.5	55.7	72.2	75
11	Magnesium (as Mg), mg/l, Max	19.5	22.5	15.6	27.5	30
12	Manganese (as Mn), mg/l, Max	0.011	0.007	0.012	0.006	0.10
13	Sulphates (as SO ₄ ⁻), mg/l, Max	12.5	23.2	4.5	12.6	150
14	Nitrate (as NO ₃), mg/l, Max	3.8	3.6	8.9	18.6	45
15	Fluorides (as F), mg/l, Max	0.65	0.60	0.87	0.95	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	<0.001	<0.001	0.007	0.001	0.05
21	Hexavalent Chromium (as Cr ⁶⁺), mg/l, Max	0.004	<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	0.072	0.008	0.318	0.041	5
25	Alkalinity, mg/l, Max	144	154	121	190	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

Area: Buffer Zone	Season: Winter
Project: Kathautia OC Mine	Date of Sampling: 27.02.2017
Name of the Sampling Station:	
W₇ - Koyal River, U/S of Mine;	W₈ - Koyal River, D/S of Mine;

Sl. No.	Parameters	Station Code		(IS: 2296)# Surface Waters Class "C" Tolerance Limits
		W ₇	W ₈	
1	Colour, Hazen units, Max	<5	<5	300
2	Odour	Unobjectionable	Unobjectionable	Unobjectionable
3	Dissolved Oxygen, mg/l, Min.	6.5	6.2	4
4	pH	7.62	8.02	6.5-8.5
5	BOD (3days at 27°C), mg/l, Max	2.6	2.9	3
6	Phenolic compounds (as C ₆ H ₅ OH), mg/l, Max	<0.001	<0.001	0.005
7	Total Hardness (as CaCO ₃), mg/l, Max	101	96	NS
8	Iron (as Fe), mg/l, Max	0.62	0.58	50
9	Chloride (as Cl ⁻), mg/l, Max	14.5	12.6	600
10	Total Dissolved Solid, mg/l, Max	217	256	1500
11	Calcium (as Ca), mg/l, Max	22.5	25.2	NS
12	Magnesium (as Mg), mg/l, Max	10.8	12.6	NS
13	Manganese (as Mn), mg/l, Max	0.019	0.009	NS
14	Sulphates (as SO ₄ ⁻), mg/l, Max	5.45	8.85	400
15	Nitrate (as NO ₃), mg/l, Max	10.6	6.2	50
16	Fluorides (as F), mg/l, Max	0.75	0.92	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	0.005	0.004	1.5
21	Hexavalent Chromium (as Cr ⁶⁺), mg/l, Max	0.002	0.003	0.05
22	Selenium (as Se), mg/l, Max	<0.001	<0.001	0.05
23	Zinc (as Zn), mg/l, Max	0.048	0.037	15
24	Coliform Organism (MPN/100ml)	72	82	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 and winter seasons.

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 **Table 12 & Table 23** for ambient noise levels of core and buffer zones during post-monsoon and winter 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 (Post-monsoon Season)

Date of Sampling:		Noise level dB(A) average					
20.10.2016 to 23.10.2016		Day Time			Night Time		
Stn. Code	Location	Min.	Max.	Average	Min.	Max.	Average
N ₁	Near Mine Office	38.2	65.4	52.2	34.4	58.5	44.2
N ₂	Coal Face	35.6	60.4	47.4	32.4	44.2	41.4
N ₃	Near OB dump	36.0	58.3	46.8	31.8	43.9	40.5
N ₄	Stockyard	35.8	61.5	47.1	32.0	44.6	42.3
N ₅	Haul Road	36.7	62.5	50.5	32.2	46.7	42.0
Standards as per CPCB		75			70		

Table 13: Noise Level in Buffer Zone of the Study Area Area (Post-monsoon Season)

Date of Sampling:		Noise level dB(A) average					
20.10.2016 to 23.10.2016		Day Time			Night Time		
Stn. Code	Location	Min.	Max.	Average	Min.	Max.	Average
N ₆	Kajari Village	36.4	64.4	50.5	30.5	46.8	41.7
N ₇	Batsara Village	37.2	63.8	52.6	31.4	48.1	42.2
Standards as per CPCB		55			45		

Table 14: Noise Level in Core Zone of the Study Area (Post-monsoon Season)

Date of Sampling:		Noise level dB(A) average					
03.12.2016 to 06.12.2016		Day Time			Night Time		
Stn. Code	Location	Min.	Max.	Average	Min.	Max.	Average
N ₁	Near Mine Office	37.5	64.7	51.8	32.2	55.5	43.4
N ₂	Coal Face	36.2	59.6	48.0	31.5	42.9	40.6
N ₃	Near OB dump	36.7	58.9	47.5	30.9	44.0	40.2
N ₄	Stockyard	37.1	60.2	49.5	31.2	43.5	41.6
N ₅	Haul Road	37.4	61.8	49.2	32.8	48.9	42.2
Standards as per CPCB		75			70		

Table 15: Noise Level in Buffer Zone of the Study Area (Post-monsoon Season)

Date of Sampling:		Noise level dB(A) average					
03.12.2016 to 06.12.2016		Day Time			Night Time		
Stn. Code	Location	Min.	Max.	Average	Min.	Max.	Average
N ₆	Kajari Village	35.5	62.9	51.2	31.0	47.3	40.8
N ₇	Batsara Village	36.2	63.0	52.0	30.7	47.8	41.5
Standards as per CPCB		55			45		

Table 16: Noise Level in Core Zone of the Study Area (Post-monsoon Season)

Date of Sampling:		Noise level dB(A) average					
27.12.2016 to 29.12.2016		Day Time			Night Time		
Stn. Code	Location	Min.	Max.	Average	Min.	Max.	Average
N ₁	Near Mine Office	36.5	63.2	50.5	31.8	54.8	42.5
N ₂	Coal Face	35.2	57.0	46.6	31.0	43.7	40.0
N ₃	Near OB dump	36.1	58.2	47.4	31.5	43.6	39.6
N ₄	Stockyard	35.8	58.0	46.8	32.2	44.2	39.9
N ₅	Haul Road	36.3	62.2	48.2	32.0	46.6	41.7

Table 17: Noise Level in Buffer Zone of the Study Area (Post-monsoon Season)

Date of Sampling:		Noise level dB(A) average					
27.12.2016 to 30.12.2016		Day Time			Night Time		
Stn. Code	Location	Min.	Max.	Average	Min.	Max.	Average
N ₆	Kajari Village	36.5	64.2	52.1	31.6	45.6	40.9
N ₇	Batsara Village	35.8	63.8	51.6	31.2	46.1	42.4
Standards as per CPCB		55			45		

Table 18: Noise Level in Core Zone of the Study Area (Winter Season)

Date of Sampling:		Noise level dB(A) average					
17.01.2017 to 20.01.2017		Day Time			Night Time		
Stn. Code	Location	Min.	Max.	Average	Min.	Max.	Average
N ₁	Near Mine Office	38.1	68.4	54.5	32.2	60.4	47.2
N ₂	Coal Face	35.2	55.8	45.6	31.4	45.8	41.4
N ₃	Near OB dump	36.4	56.4	45.2	31.2	41.5	41.4
N ₄	Stockyard	35.2	57.6	45.8	31.8	42.6	41.5
N ₅	Haul Road	35.4	63.7	47.4	32.5	45.7	41.4
Standards as per CPCB		75			70		

Table 19: Noise Level in Buffer Zone of the Study Area (Winter Season)

Date of Sampling:		Noise level dB(A) average					
17.01.2017 to 20.01.2017		Day Time			Night Time		
Stn. Code	Location	Min.	Max.	Average	Min.	Max.	Average
N ₆	Kajari Village	35.0	62.8	51.8	31.6	45.9	42.2
N ₇	Batsara Village	36.5	62.6	52.0	31.7	47.5	42.5
Standards as per CPCB		55			45		

Table 20: Noise Level in Core Zone of the Study Area (Winter Season)

Date of Sampling:		Noise level dB(A) average					
23.02.20117 to 26.02.2017		Day Time			Night Time		
Stn. Code	Location	Min.	Max.	Average	Min.	Max.	Average
N ₁	Near Mine Office	38.2	68.3	55.6	31.8	62.2	48.5
N ₂	Coal Face	36.0	58.6	47.8	31.5	44.6	42.2
N ₃	Near OB dump	36.4	54.8	45.8	31.4	44.9	41.7
N ₄	Stockyard	36.2	56.4	46.2	32.0	44.2	40.8
N ₅	Haul Road	36.6	61.8	47.9	32.2	46.42	41.8
Standards as per CPCB		75			70		

Table 21: Noise Level in Buffer Zone of the Study Area (Winter Season)

Date of Sampling:		Noise level dB(A) average					
23.02.20117 to 26.02.2017		Day Time			Night Time		
Stn. Code	Location	Min.	Max.	Average	Min.	Max.	Average
N ₆	Kajari Village	36.0	64.2	52.3	31.2	47.2	41.0
N ₇	Batsara Village	36.2	65.0	53.1	31.8	48.2	42.0
Standards as per CPCB		55			45		

Table 22: Noise Level in Core Zone of the Study Area (Winter Season)

Date of Sampling:		Noise level dB(A) average					
28.03.20117 to 31.03.2017		Day Time			Night Time		
Stn. Code	Location	Min.	Max.	Average	Min.	Max.	Average
N ₁	Near Mine Office	39.0	70.6	57.0	32.2	64.5	50.2
N ₂	Coal Face	37.5	61.4	50.4	32.5	56.1	44.2
N ₃	Near OB dump	36.6	61.8	48.7	32.0	52.5	44.5
N ₄	Stockyard	36.2	60.5	47.6	32.1	53.2	43.4
N ₅	Haul Road	36.4	62.6	52.4	32.4	58.0	43.2

Table 23: Noise Level in Buffer Zone of the Study Area (Winter Season)

Date of Sampling:		Noise level dB(A) average					
28.03.20117 to 31.03.2017		Day Time			Night Time		
Stn. Code	Location	Min.	Max.	Average	Min.	Max.	Average
N ₆	Kajari Village	36.4	65.5	51.8	31.5	48.2	41.5
N ₇	Batsara Village	36.8	64.8	53.6	32.0	47.8	42.8
Standards as per CPCB		55			45		

4.4 SOIL ENVIRONMENT

During mining huge amount of overburden is being generated and stored as dumps. Apart from these, dust and noxious gases are continuously emitted from the mine site, which are affecting the soil quality of agricultural field of surrounding villages. To know the impact of mining on soils of surrounding area as well as effect of overburden dumping on agricultural field due to run off from soil heaps during rainy season, the soil quality of surrounding area has been evaluated with respect to physico - chemical parameters.

The physical properties of soil, which is important in its utility, are texture, Bulk density, Specific gravity, moisture content and water holding capacity. The chemical properties, which govern the best use of soil for crops and plants, are pH, N, P, K and organic matter. For assessment of soil quality, five sampling points were fixed which comprise of external OB dumps and agricultural field.

4.4.1 SAMPLING LOCATIONS

The soil sampling points are described below:

S ₁	Agricultural Field near first Effluent Treatment Pond
S ₂	Agricultural soil Kajri village
S ₃	Agricultural soil Batsara village
S ₄	External OB dump (Old)
S ₅	External OB dump (Active)

4.4.2 METHODOLOGY

The standard procedure was followed in sampling and all the samples were taken from 0-20 cm depth from all the sites. The sampling was done in the month of February 2017. Standard methods were followed for soil analysis and are appended in **Table 24**. The results reported are average of three replicate analyses.

Table 24: Standard Methods of Soil Analysis

Parameters	Methods
Physical Parameters	
a) Bulk Density	IS: 2720 (Part VII) - 1980
b) Water Holding Capacity	It is determined by the Keen - Raczkowski box experiment using the circular shaped boxes described by Coutts J.R.H. (1930). It is the amount of water taken up by unit weight of dry soil when immersed in water under standardized condition i.e. $\frac{\text{Weight of water held in box}}{\text{Weight of dry soil in box}} \times 100$
c) Specific gravity	It is the ratio of total mass of the soil particles to their total volume excluding pore space .IS 2720 (Part III) - Section 1 & Section 2 -1980
d) Moisture content	IS 2720 (Part II) - 1973, IS 2720 (Part IX) - 1971
e) Texture	IS 1498 - 1970;
Chemical Parameters	
f) pH	It is measured by Systronics Digital pH meter using soil water ratio 1:2.5 IS 2720 (Part XXVI) - 1973
g) Organic carbon	This is measured by Walkleyand Black (1934) rapid titration methods. Organic carbon is oxidized by Potassium dichromate solution i.e. presence of concentrated sulfuric acid. The excess dichromate ion is back titrated and measured. The quality of Organic matter is calculated from the amount of dichromate ion reduced. IS 2720 (Part XXII) - 1972
h) Nitrogen	Micro Kjeldahl method is used for the estimation of total nitrogen (Jackson 1958).
i) Available Phosphorous	Olsen's (1954) methods were followed for the determination of available P in soil.
j) Available Potassium	Ammonium acetate extractable K is determined by Atomic absorption Spectrophotometer.

4.4.3 INSTRUMENTS USED

Following instruments were used for all analysis in the laboratory:

- pH Meter
- Conductivity Meter
- Ion Analyser
- UV-VIS Spectrophotometer
- Air Oven
- Pycnometer
- Microwave Digestion
- Atomic absorption Spectrophotometer.

4.4.4 SOIL QUALITY

Dump and agricultural soil were collected in the month of February 2017 and had been analysed for physico-chemical parameters and results are presented in **Table 25**.

4.4.5 RESULTS AND DISCUSSION

4.4.5.1. Physical Properties of Soil Samples

The bulk density of the soil samples varies in the range of 1.19 gm/cm³ to 1.26 gm/cm³, which indicates favorable physical condition. The particle density varies from 1.55 gm/cm³ to 2.12 gm/cm³. The moisture contents are found to vary from 4.28 to 5.87%. The water holding capacity also varies from 38.64% to 50.52% being maximum in the case of agricultural soil, which may be due to its high clay content.

4.4.5.2. Chemical Properties

All the soil samples are analysed for the chemical parameters namely pH, organic carbon, available nitrogen, phosphorous, potassium content and the results are presented in **Table 25**.

The pH of the soil samples ranged from 6.8 to 7.8, which clearly indicates that soil samples are slightly acidic to slightly basic in nature. Organic carbon content ranges from 0.54% to 0.74%. The available Nitrogen, Phosphorous and Potassium content of the soil samples varies from 112 to 155 Kg/ha; 7.8 to 11.8 Kg/ha and 114 to 150 Kg/ha respectively. The values indicate that the active dump materials are deficient in N, P & K

that requires addition of farmyard manure, bio fertilizer and other soil amendments to make the dump suitable for revegetation. The value for agricultural soil of nearby village clearly indicates that the soil is not polluted with respect to chemical constituents.

Table 25: Physico-chemical Properties of Soil of Mine Area

S. N.	Parameters	S ₁	S ₂	S ₃	S ₄	S ₅
1.	Texture	SCL	SCL	SCL	SL	Sampling not done as mine is not in operation.
2.	Colour	Blackish	Yellowish Brown	Yellowish Brown	Reddish Gray	
3.	pH	7.8	7.6	7.3	6.8	
4.	EC (mmhos/cm)	0.68	0.75	0.84	0.62	
5.	Moisture Content (%)	4.34	5.87	5.40	4.28	
6.	Bulk Density (gm/cm ³)	1.26	1.22	1.19	1.21	
7.	Particle density (gm/cm ³)	1.65	1.58	1.55	2.12	
8.	Water Holding Capacity (%)	42.22	50.52	46.61	38.64	
9.	Organic Carbon (%)	0.65	0.74	0.68	0.54	
10.	Avail N (kg/ha)	155	132	137	112	
11.	Avail P (kg/ha)	10.0	11.8	10.2	7.8	
12.	Avail K (kg/ha)	128	140	150	114	

Note: SCL – Sandy Clay Loam

SL- Sandy Loam

SC – Sandy Clay

Sampling Sites:

S₁- Agricultural soil near first effluent treatment pond

S₂- Agricultural soil at Kajri village

S₃- Agricultural soil at Batsara village

S₄- OB Dump soil (Old)

S₅- OB Dump soil (Active)

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, noise and soil 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, Ranchi.