Environmental Status Report
For
Kudag Bauxite Mine
at
Post & Teh.: Samri,(Kusmi)
Dist: Balrampur–Ramanujganj(C.G.)
Duration: October–November–December–2019

Name of Industry

M/s. Hindalco Industries Limited,

Name of Laboratory:-

QCI-NABET Accredited EIA Consultant
MoEF&CC (GOI) and NABL Recognized Laboratory
60, Bajiprabhu Nagar, Nagpur - 440 033, MS
Lab. & Consultancy: FP-34, 35, Food Park,
MIDC, Bulibori, Nagpur - 441122
Ph.: (0712) 2242077, 9373287475
Email: info@anacon.in, ngp@anacon.in
website: www.anaconlaboratories.com

Agent of Mines
Samn Mines Division
Hindalco Industries Ltd
Forword

The protection of environment plays a crucial role in maintaining the local environment quality for any mining industry. Hence compliance of the statutory requirements becomes very important to conserve the ecological balance within and surrounding the mine area. Therefore, environment protection is becoming a prerequisite for sustainable development. In line with this requirement, the management of M/s Hindalco Industries Ltd. has adopted a corporate responsibility of environment protection.

In order to comply with the Environment protection act, to fulfill statutory requirement and to be in tune with Environmental Preservation and sustainable development, M/s Hindalco Industries Ltd. has retained ANACON LABORATORIES PVT. LTD., Nagpur as Environment Consultants and for various Environmental issues related to their mines.

This report presents the Environmental Status for the period October-2019 to December-2019 as compliance to the statutory requirements.

The co-operation extended by the Staff and Management of M/s Hindalco Industries Ltd. during the work execution period is gratefully acknowledged.

For ANACON LABORATORIES PVT. LTD.

Place : Nagpur
Date : December, 2019

Authorized Signature
1.1 Introduction

Hindalco Industries Limited (Hindalco) is one among the flagship companies of the Aditya Birla Group of Industries and is one of the largest corporate groups in India. This group is a leading manufacturer of Aluminum in India, having integrated facilities encompassing bauxite, mining, refining and smelting to achieve Aluminum.

Various processing units of Hindalco are strategically located in different parts of the nation to achieve optimum benifits. Over the past few decades the group has grown multifold in its production capacities, product mix and diversification in mining. The Chhattisgarh Environment Conservation Board (CECB) granted permission for establishing the Bauxite Mine to Hindalco at block Tatijharia, Kudag and Samri mines in Balrampur District of Chhattisgarh State.

HINDALCO INDUSTRIES LTD., awarded the work to M/s ANACON LABORATORIES PVT. LTD. Nagpur(ALPL) for carrying out Environmental monitoring of parameters for assessing pollution levels and preparation of monthly reports (October-November-December-2019) as per the requirement of Chhattisgarh Environment Conservation Board (CECB) and Ministry of Environment, Forest and Climate Change (MoEF&CC) for Kudag mining lease in Balrampur District, Chhattisgarh State.

1.2 Background Information of Kudag Mine

Hindalco was granted Kudag Bauxite mining lease over an area of 377.116 hec. in Kudag village, Post office-Dumarkholi, Tehsil-Samri (Kusmi) of Balrampur district, Chhattisgarh on 24/12/1996 for a period of 20 years. As per the Mines and Mineral (Development and Regulation) Amendment Act, 2015, Kudag lease has been extended up to another 30 years i.e 23/12/2046. The mining operations were started on 02/07/1997. The production capacity of Bauxite is 0.6 Lakh Tonnes Per Annum (LTPA).

1.3 Salient Features of Kudag Bauxite Mine

The deposits occur in Kudag block, Post office Dumarkholi, Tehsil-Samri (Kusmi) of Balrampur district. This deposit has been identified as one of the resources to cater the raw material requirements of the Hindalco Alumina refinery at Renukoot, Uttar Pradesh. The salient features of the project are presented below in Table1.
### Table 1

**Salient Features of Kudag Bauxite Mines**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Particulars</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Survey of India Toposheet No.</td>
<td>64 M /15</td>
</tr>
<tr>
<td>2.</td>
<td>Latitude</td>
<td>23° 26' 02&quot;N to 23° 29' 00&quot;N</td>
</tr>
<tr>
<td>3.</td>
<td>Longitude</td>
<td>83° 51' 00&quot;E to 83° 59' 00&quot;E</td>
</tr>
<tr>
<td>4.</td>
<td>Elevation</td>
<td>1145-m above Mean Sea Level</td>
</tr>
</tbody>
</table>
| 5.      | Climatic Conditions (as per IMD, Ambikapur) | Annual maximum temperature : 30.3°C  
           |                                           | Annual minimum temperature : 17.7°C  
           |                                           | Average annual rainfall : 1401.1 mm |
| 7.      | Method of mining                         | Open cast (Semi-Mechanized)                       |
| 8.      | Mode of transportation                   | Trucks                                            |
| 9.      | Land use                                  | Agricultural and Barren land                      |
| 10.     | Nearest Road                              | Samri to Kusmi (17 km)                            |
| 11.     | Nearest Airport                           | Ranchi Airport (151.09 Km)                        |
| 12.     | Nearest Town                              | Ambikapur (127 km, SW)                            |

### 1.4 Environmental Monitoring

Regular monitoring of environmental parameters is of immense importance to assess the status of environment during mining operation. With the knowledge of baseline conditions, the monitoring program will serve as an indicator for any deterioration in environmental conditions due to mining operation of the project. Suitable mitigation steps will be taken in time to safeguard the environment based on monitoring reports. Monitoring is important in the control of pollution since the efficiency of control measures can only be determined by monitoring.

In order to find out the impact of mining activity on sensitive receptors, it is necessary to monitor Environmental Quality to know the level of concentrations of pollutants within and around the mining lease area. Accordingly Hindalco Industries through ALPL has been monitoring air, water and noise quality on monthly basis during these months (Table-2).
1.5 Air Environment

1.5.1 Ambient Air Quality Monitoring:

Ambient Air Quality and Fugitive emission monitored at 8 following locations with reference to Kudag mine lease area shown in (Fig.-1).

Table 2

Locations of Ambient Air Quality Monitoring (AAQM) (377.116 hec.)

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Core Zone</th>
<th>Sr. No.</th>
<th>Buffer Zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sairaihd Campus</td>
<td>5</td>
<td>Kutku Village</td>
</tr>
<tr>
<td>2</td>
<td>New Kudag/Nr.Weigh Bridge</td>
<td>6</td>
<td>Rajendrapur</td>
</tr>
<tr>
<td>3</td>
<td>Old Kudag/Mining Area</td>
<td>7</td>
<td>Tatijharia Village</td>
</tr>
<tr>
<td>4</td>
<td>Samri Gopatu/Nr. Weigh Bridge</td>
<td>8</td>
<td>Virhorepat</td>
</tr>
</tbody>
</table>

The sampling stations are selected at the above mentioned locations, in downwind and upwind directions of the mining site. ALPL is carrying out regular monitoring for PM\textsubscript{10}, PM\textsubscript{2.5}, SO\textsubscript{2}, NO\textsubscript{x} and Pb, Hg, As and Cr at above Ambient Air Quality Monitoring (AAQM) locations. The dust fall rate was measured in the mining area and Khas kudag during October-November-December-2019. The AAQM sampling sites are selected considering seasonal variation in wind speed and wind direction.

Sampling Duration and Frequency

Ambient air quality monitoring was carried out for the parameters PM\textsubscript{10}, PM\textsubscript{2.5}, SO\textsubscript{2}, NO\textsubscript{x} and Pb, Hg, As and Cr from October-November-December-2019 as per CPCB norms.

Data is compared with the standards mentioned in the Gazette Notification of the Central Pollution Control Board (CPCB) (Nov-18, 2009) and as per consent conditions mentioned in consent letter.
1.6 Meteorology: Wind Pattern

Meteorology: Wind Pattern

The data of wind pattern collected during the study period (October-November-December-2019) indicates that the wind was blowing predominantly from (S and SW) directions, during study period.

Wind Frequency Distribution Data

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Directions / Wind Classes (m/s)</th>
<th>0.5 - 2.1</th>
<th>2.1 - 3.6</th>
<th>3.6 - 5.7</th>
<th>5.7 - 8.8</th>
<th>8.8 - 11.1</th>
<th>&gt;= 11.1</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>348.75 - 11.25</td>
<td>0.004082</td>
<td>0.008163</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.012245</td>
</tr>
<tr>
<td>2</td>
<td>11.25 - 33.75</td>
<td>0.019048</td>
<td>0.008163</td>
<td>0.001361</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.028571</td>
</tr>
<tr>
<td>3</td>
<td>33.75 - 56.25</td>
<td>0.034014</td>
<td>0.012245</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.046259</td>
</tr>
<tr>
<td>4</td>
<td>56.25 - 78.75</td>
<td>0.029932</td>
<td>0.019048</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.049890</td>
</tr>
<tr>
<td>5</td>
<td>78.75 - 101.25</td>
<td>0.019048</td>
<td>0.004082</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.023129</td>
</tr>
<tr>
<td>6</td>
<td>101.25 - 123.75</td>
<td>0.061224</td>
<td>0.006803</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.068027</td>
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<tr>
<td>7</td>
<td>123.75 - 146.25</td>
<td>0.051701</td>
<td>0.002721</td>
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<td>0.000000</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.054422</td>
</tr>
<tr>
<td>8</td>
<td>146.25 - 168.75</td>
<td>0.068027</td>
<td>0.001361</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.069388</td>
</tr>
<tr>
<td>9</td>
<td>168.75 - 191.25</td>
<td>0.118367</td>
<td>0.002721</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.121088</td>
</tr>
<tr>
<td>10</td>
<td>191.25 - 213.75</td>
<td>0.115646</td>
<td>0.001361</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.117007</td>
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<tr>
<td>11</td>
<td>213.75 - 236.25</td>
<td>0.089796</td>
<td>0.005442</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.095238</td>
</tr>
<tr>
<td>12</td>
<td>236.25 - 258.75</td>
<td>0.058503</td>
<td>0.014966</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.073469</td>
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<tr>
<td>13</td>
<td>258.75 - 281.25</td>
<td>0.055782</td>
<td>0.012245</td>
<td>0.001361</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.069388</td>
</tr>
<tr>
<td>14</td>
<td>281.25 - 303.75</td>
<td>0.039456</td>
<td>0.014966</td>
<td>0.004082</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.058503</td>
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<tr>
<td>15</td>
<td>303.75 - 326.25</td>
<td>0.019048</td>
<td>0.035374</td>
<td>0.001361</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.055782</td>
</tr>
<tr>
<td>16</td>
<td>326.25 - 348.75</td>
<td>0.031293</td>
<td>0.009524</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.000000</td>
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<td>0.040816</td>
</tr>
<tr>
<td><strong>Sub-Total</strong></td>
<td>0.814966</td>
<td>0.159184</td>
<td>0.008163</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.000000</td>
<td>0.980978</td>
<td></td>
</tr>
</tbody>
</table>

Calms                               | 0.017663 |
Missing/Incomplete                   | 0.001359 |
Total                                | 1.000000 |

Summary of Wind Pattern

<table>
<thead>
<tr>
<th>Season</th>
<th>First Predominant Wind Direction</th>
<th>Second Predominant Wind Direction</th>
<th>Calm Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>October-November-December-2019</td>
<td>S (12.1%)</td>
<td>SW (11.7%)</td>
<td>1.7%</td>
</tr>
</tbody>
</table>
Figure.01: Wind Rose Diagram (Oct-Nov-Dec-2019)

Figure.02: Wind Class Frequency Distribution (Oct-Nov-Dec-2019).
1.7 MONITORED PARAMETERS AND FREQUENCY OF SAMPLING

Methods and Instruments used for Sampling

The air samples were analyzed as per methods specified by Central Pollution Control Board (CPCB).

The levels of Particulate Matter (PM$_{10}$), Particulate Matter (PM$_{2.5}$), Sulphur Dioxide (SO$_2$), Oxides of Nitrogen (NO$_x$), Pb, Hg, As and Cr were monitored for establishing the baseline status. PM$_{10}$ was collected with the help of Respirable Particulate Sampler operating 24 hours by drawing air which passes through the cyclone at the rate of 1.0 -1.3 m$^3$/min which collects the particles less than 10 μm diameter over glass fiber filter paper. The dust deposited over the filter paper is measured as PM$_{10}$ and the smaller particulates from 2.5 μm are collected into the Membrane Filter Paper. The dust fall rate was measured using dust fall jar. The jar was exposed for one month in the mining area and Samri Chowk during pre and post monsoon period. The jar was filled with 2 lit of distilled water. The water in the jar is mixed with copper sulphate solution (0.02 N solutions) to prevent any growth of algae. The water level in the jar is constantly maintained in such a way that 2 lit of water is always retained. The measurement techniques used for various pollutants and other details are given in (Table 3).

Earmarked samples were collected for Particulate Matter-PM$_{10}$, Particulate Matter-PM$_{2.5}$, SO$_2$ and NO$_x$ for 24 hourly. Collected samples were sent to Laboratories for analysis.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Parameter</th>
<th>Technique</th>
<th>Technical Protocol</th>
<th>Minimum Reportable Value (μg/m$^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Respirable Particulate Matter</td>
<td>Respirable Dust Sampler (Gravimetric Method)</td>
<td>IS-5182 (Part-23)</td>
<td>5</td>
</tr>
<tr>
<td>2.</td>
<td>Particulate Matter 2.5</td>
<td>Respirable Dust Sampler (Gravimetric Method)</td>
<td>Gravimetric Method</td>
<td>5</td>
</tr>
<tr>
<td>3.</td>
<td>Sulphur Dioxide</td>
<td>Modified West and Gaeke</td>
<td>IS-5182 (Part - II)</td>
<td>4</td>
</tr>
<tr>
<td>4.</td>
<td>Oxide of Nitrogen</td>
<td>Jacob &amp; Hochheiser Method</td>
<td>IS-5182 (Part - VI)</td>
<td>4</td>
</tr>
<tr>
<td>5.</td>
<td>Pb, As, Hg, Cr</td>
<td>Acid Digestion Method</td>
<td>EPA Method</td>
<td>0.1</td>
</tr>
<tr>
<td>6.</td>
<td>Dust Full</td>
<td>Gravimetric</td>
<td>IS-5182 (Part-I)</td>
<td>–</td>
</tr>
</tbody>
</table>
## Table 4

### Statistical Analysis

<table>
<thead>
<tr>
<th>Location</th>
<th>Month &amp; Year</th>
<th>PM-10 (µg/m³)</th>
<th>PM-2.5 (µg/m³)</th>
<th>SO₂ (µg/m³)</th>
<th>NO₂ (µg/m³)</th>
<th>Pb (µg/m³)</th>
<th>Hg (µg/m³)</th>
<th>As (ng/m³)</th>
<th>Cr (µg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Core Zone</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sairadhi Campus</td>
<td>Oct-2019</td>
<td>54.6</td>
<td>21.7</td>
<td>7.6</td>
<td>18.3</td>
<td>0.017</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td></td>
<td>Nov-2019</td>
<td>61.7</td>
<td>23.2</td>
<td>9.4</td>
<td>20.6</td>
<td>0.020</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td></td>
<td>Dec-2019</td>
<td>67.7</td>
<td>24.7</td>
<td>8.2</td>
<td>18.5</td>
<td>0.018</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>New Kudag/Nr. Weigh Bridge</td>
<td>Oct-2019</td>
<td>61.8</td>
<td>26.3</td>
<td>8.5</td>
<td>22.1</td>
<td>0.016</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
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<tr>
<td></td>
<td>Nov-2019</td>
<td>64.9</td>
<td>25.2</td>
<td>8.7</td>
<td>19.6</td>
<td>0.021</td>
<td>ND</td>
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<td>Dec-2019</td>
<td>60.8</td>
<td>22.8</td>
<td>7.4</td>
<td>17.9</td>
<td>0.017</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
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<tr>
<td>Old Kudag/Mining Area</td>
<td>Oct-2019</td>
<td>57.3</td>
<td>22.5</td>
<td>7.2</td>
<td>18.7</td>
<td>0.010</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
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<tr>
<td></td>
<td>Nov-2019</td>
<td>56.1</td>
<td>20.1</td>
<td>8.5</td>
<td>18.5</td>
<td>0.016</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
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<tr>
<td></td>
<td>Dec-2019</td>
<td>61.6</td>
<td>27.2</td>
<td>8.5</td>
<td>19.3</td>
<td>0.014</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>Samri Gopatu/Nr. Weigh Bridge</td>
<td>Oct-2019</td>
<td>60.4</td>
<td>24.1</td>
<td>8.4</td>
<td>21.6</td>
<td>0.015</td>
<td>ND</td>
<td>ND</td>
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<td>Nov-2019</td>
<td>59.8</td>
<td>23.9</td>
<td>7.6</td>
<td>17.9</td>
<td>0.018</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
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<tr>
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<td>Dec-2019</td>
<td>63.2</td>
<td>24.8</td>
<td>9.3</td>
<td>18.5</td>
<td>0.012</td>
<td>ND</td>
<td>ND</td>
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<tr>
<td><strong>CPCB Standards</strong></td>
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<td>98% le</td>
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</tbody>
</table>

- The Average Concentration of PM₁₀ within the Core Zone of Kudag Lease is 60.8 µg/m³.
- The Average Concentration of PM₂.₅ within the Core Zone of Kudag Lease is 23.9 µg/m³.
- The Average Concentration of SO₂ within the Core Zone of Kudag Lease is 8.3 µg/m³.
- The Average Concentration of NO₂ within the Core Zone of Kudag Lease is 19.3 µg/m³.
- The Average Concentration of Pb within the Core Zone of Kudag Lease is 0.016 µg/m³.

**Conclusion:**
The Average Concentration within the Core Zone of Kudag Lease during this period (October-November-December-2019), it is within permissible limits as per CPCB Standards.
<table>
<thead>
<tr>
<th>Location</th>
<th>Month &amp; Year</th>
<th>PM-10 (µg/m³)</th>
<th>PM-2.5 (µg/m³)</th>
<th>SO₂ (µg/m³)</th>
<th>NOₓ (µg/m³)</th>
<th>Pb (µg/m³)</th>
<th>Hg (ng/m³)</th>
<th>As (ng/m³)</th>
<th>Cr (µg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Buffer Zone</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kutku Village</td>
<td>Oct-2019</td>
<td>59.8</td>
<td>23.9</td>
<td>7.6</td>
<td>17.9</td>
<td>0.019</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td></td>
<td>Nov-2019</td>
<td>57.0</td>
<td>22.5</td>
<td>7.1</td>
<td>17.9</td>
<td>0.017</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td></td>
<td>Dec-2019</td>
<td>62.4</td>
<td>22.7</td>
<td>8.6</td>
<td>19.3</td>
<td>0.015</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>Rajendrapur</td>
<td>Oct-2019</td>
<td>56.1</td>
<td>20.1</td>
<td>8.5</td>
<td>18.5</td>
<td>0.021</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td></td>
<td>Nov-2019</td>
<td>60.6</td>
<td>21.6</td>
<td>8.4</td>
<td>23.7</td>
<td>0.024</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td></td>
<td>Dec-2019</td>
<td>59.4</td>
<td>21.2</td>
<td>7.9</td>
<td>17.6</td>
<td>0.017</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>Tatijhania Village</td>
<td>Oct-2019</td>
<td>61.2</td>
<td>22.7</td>
<td>7.9</td>
<td>19.3</td>
<td>0.026</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td></td>
<td>Nov-2019</td>
<td>65.5</td>
<td>33.4</td>
<td>12.2</td>
<td>25.4</td>
<td>0.025</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
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<tr>
<td></td>
<td>Dec-2019</td>
<td>64.2</td>
<td>24.7</td>
<td>9.3</td>
<td>21.6</td>
<td>0.020</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>Virhorepat</td>
<td>Oct-2019</td>
<td>62.4</td>
<td>18.1</td>
<td>6.9</td>
<td>20.6</td>
<td>0.019</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td></td>
<td>Nov-2019</td>
<td>56.0</td>
<td>20.5</td>
<td>8.3</td>
<td>18.2</td>
<td>0.023</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td></td>
<td>Dec-2019</td>
<td>57.9</td>
<td>20.8</td>
<td>8.5</td>
<td>19.5</td>
<td>0.019</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td><strong>CPCB Standards</strong></td>
<td></td>
<td>100 (24 hrs)</td>
<td>60 (24 hrs)</td>
<td>80 (24 hrs)</td>
<td>80 (24 hrs)</td>
<td>1.0 (24 hrs)</td>
<td>6.0 (annual)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum</td>
<td></td>
<td>56.0</td>
<td>18.1</td>
<td>6.9</td>
<td>17.6</td>
<td>0.015</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum</td>
<td></td>
<td>65.5</td>
<td>33.4</td>
<td>12.2</td>
<td>25.4</td>
<td>0.026</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td>60.2</td>
<td>22.7</td>
<td>8.4</td>
<td>20.0</td>
<td>0.020</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>98% le</td>
<td></td>
<td>65.2</td>
<td>31.5</td>
<td>11.6</td>
<td>25.0</td>
<td>0.026</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- The Average Concentration of PM₁₀ within the Buffer Zone of Kudag Lease is 60.2 µg/m³.
- The Average Concentration of PM₂.₅ within the Buffer Zone of Kudag Lease is 22.7 µg/m³.
- The Average Concentration of SO₂ within the Buffer Zone of Kudag Lease is 8.4 µg/m³.
- The Average Concentration of NOₓ within the Buffer Zone of Kudag Lease is 20.0 µg/m³.
- The Average Concentration of Pb within the Buffer Zone of Kudag Lease is 0.020 µg/m³.

**Conclusion:**
The Average Concentration within the Buffer Zone of Kudag Lease during this period (October-November-December-2019) is within permissible limits as per CPCB Standards.
Kudag Lease (Core Zone):

3.1 Ambient Air Quality:
Ambient air quality has been generated as per NAAQS 2009 for the month of October-2019 to December-2019. PM$_{10}$, PM$_{2.5}$, SO$_2$ & NO$_x$. The values obtained were then compared vis-a-vis the standards prescribed by CPCB for Industrial/Rural/Residential uses.

3.2 Presentation of Results:
The summary of Ambient Air Quality monitoring results from October-2019 to December-2019 are presented in detail in Table 4.0. 98th percentile; maximum and minimum values etc. have been computed from the collected raw data for all the AAQ monitoring station. The data has been compared with the standards prescribed by Central Pollution Control Board (CPCB)/NAAQS for residential and rural zone.

A. Particulate Matter-PM$_{10}$:
The minimum and maximum concentrations for Particulate Matter-PM$_{10}$ were recorded as 54.6µg/m$^3$ and 67.7µg/m$^3$ respectively. The minimum concentration was recorded at Sairalidh Campus. The maximum concentration was also recorded at Sairalidh Campus. The average concentration of PM$_{10}$ was 60.8µg/m$^3$.

B. Particulate Matter-PM$_{2.5}$:
The minimum and maximum concentrations for Particulate Matter-PM$_{2.5}$ were recorded as 20.1µg/m$^3$ & 27.2µg/m$^3$ respectively. The minimum concentration was recorded at Old Kudag/Mining Area. The maximum concentration was also recorded at Old Kudag/Mining Area. The average concentration of PM$_{2.5}$ was 23.9µg/m$^3$.

C. Sulphur Dioxide (SO$_2$):
The minimum and maximum for SO$_2$ concentrations were recorded as 7.2µg/m$^3$ and 9.4µg/m$^3$ at respectively. The minimum concentration was recorded at Old Kudag. The maximum concentration was also recorded at Sairalidh Campus. The average concentration of SO$_2$ was 8.3µg/m$^3$.

D. Nitrogen Oxide (NO$_x$):
The minimum and maximum for NO\textsubscript{x} concentrations were recorded as 17.9\,\mu g/m\textsuperscript{3} and 22.1\,\mu g/m\textsuperscript{3}. The minimum concentration was recorded at Samri-Gopatu and the maximum concentration was recorded at New Kudag/Nr Weigh Bridge. The average concentration of NO\textsubscript{x} was 19.3\,\mu g/m\textsuperscript{3}.

E. **Lead (Pb):**
Maximum Lead detected in PM\textsubscript{10} samples was 0.021\,\mu g/m\textsuperscript{3} at New Kudag/Nr. Weigh Bridge location and the minimum lead in PM\textsubscript{10} sample was 0.010\,\mu g/m\textsuperscript{3} detected at Old Kudag location.

No lead could be detected in PM\textsubscript{2.5} samples at any of the Ambient Air samples at any of the locations.

F. **Mercury (Hg):**
Mercury was not detected at any of the locations in PM\textsubscript{10} samples as well as PM\textsubscript{2.5} Samples.

G. **Arsenic (As):**
Arsenic was not detected at any of the locations in PM\textsubscript{10} samples as well as PM\textsubscript{2.5} Samples.

H. **Chromium (Cr):**
Chromium was not detected at any of the locations in PM\textsubscript{10} samples as well as PM\textsubscript{2.5} Samples.
Kudag Lease (Buffer Zone):

3.3 Ambient Air Quality:
Ambient air quality has been generated as per NAAQS 2009 for the month of October-2019 to December-2019. PM_{10}, PM_{2.5}, \text{SO}_2 & \text{NO}_x. The values obtained were then compared vis-a-vis the standards prescribed by CPCB for Industrial/Rural/Residential uses.

3.3.1 Presentation of Results:
The summary of Ambient Air Quality monitoring results from October-2019 to December-2019 are presented in detail in Table 4.0. 98th percentile; maximum and minimum values etc. have been computed from the collected raw data for all the AAQ monitoring station. The data has been compared with the standards prescribed by Central Pollution Control Board (CPCB)/NAAQS for residential and rural zone.

A. Particulate Matter-PM_{10}:
The minimum and maximum concentrations for Particulate Matter-PM_{10} were recorded as 56.0\mu g/m^3 and 65.5\mu g/m^3 respectively. The minimum concentration was recorded at Virhorepat. The maximum concentration was also recorded at Tatijhara village. The average concentration of PM10 was 60.2\mu g/m^3.

B. Particulate Matter-PM_{2.5}:
The minimum and maximum concentrations for Particulate Matter-PM_{2.5} were recorded as 18.1\mu g/m^3 & 33.4\mu g/m^3 respectively. The minimum concentration was recorded at Virhorepat. The maximum concentration was also recorded at Tatijhara village. The average concentration of PM_{2.5} was 22.7\mu g/m^3.

C. Sulphur Dioxide (SO_2):
The minimum and maximum for SO_2 concentrations were recorded as 6.9\mu g/m^3 and 12.2\mu g/m^3 at respectively. The minimum concentration was recorded at Virhorepat. The maximum concentration was also recorded at Tatijhara village. The average concentration of SO_2 was 8.4\mu g/m^3.
D. **Nitrogen Oxide (NO₂):**

The minimum and maximum for NOₓ concentrations were recorded as 17.6µg/m³ and 25.4µg/m³. The minimum concentration was recorded at Rajendrapur location and the maximum concentration was recorded at Tatijhara village. The average concentration of NOₓ was 20.0µg/m³.

E. **Lead (Pb):**

Maximum Lead detected in PM₁₀ samples was 0.026µg/m³ at Tatijhara village location and the minimum lead in PM₁₀ sample was 0.015µg/m³ detected at Kutku village location.

No lead could be detected in PM₂.₅ samples at any of the Ambient Air samples at any of the locations.

F. **Mercury (Hg):**

Mercury was not detected at any of the locations in PM₁₀ samples as well as PM₂.₅ Samples.

G. **Arsenic (As):**

Arsenic was not detected at any of the locations in PM₁₀ samples as well as PM₂.₅ Samples.

H. **Chromium (Cr):**

Chromium was not detected at any of the locations in PM₁₀ samples as well as PM₂.₅ Samples.
Hinalco Industries Limited
Kudag Mining Environmental Status Report
for October-2019 to December-2019

Details of Salient Features

- PM-10 (µg/m³)
  - CPCB Standards
  - Sainauli Campus
  - New Kudag/Nr. weigh
  - Old Kudag/Minin Area
  - Sani Gopaul/Nr.

- PM-2.5 (µg/m³)
  - CPCB Standards
  - Kuru Village
  - Rajendrapur Village
  - Talijaria Village
  - Vihorepat Village

- SO2 (µg/m³)
  - CPCB Standards
  - Kuru Village
  - Rajendrapur Village
  - Talijaria Village
  - Vihorepat Village
Hinalco Industries Limited
Kudag Mining Environmental Status Report for October-2019 to December-2019

Details of Salient Features

NOx (μg /m3)

Pb (μg /m3)

PM-10 (μg /m3)
PM-2.5 (μg /m3)
SO2 (μg /m3)
NOx (μg /m3)

CPCB Standards
Ketku Village
Rajendrapur Village
Tatiharua Village
Vihompur Village

Minimum
Maximum
Average
98% le
CPCB Standards
1.8 Noise Environment

The Director General of Mines Safety in its circular No. DG (Tech)/18 of 1975, has prescribed the noise level in mining occupations (TLV) for workers, in an 8 hour shift period with unprotected ear as 90 dB(A) or less. There will be some noise sources in mines, which produce noise levels above 90 dB(A), however; the workers are not expected to be exposed continuously for 8 hours. In order to maintain this statutory requirement noise monitoring has been carried out in and around the mining lease area.

Work zone noise level in the mining area shall increase due to blasting excavation and transportation. The impacts due to the mining activities on the noise levels shall be negligible, if all the precautions for the elimination of the noise are taken. The mining activities will be undertaken during daytime only. The daytime equivalent noise levels, when all the machineries are in operation, shall be minimized as the machineries have been provided with control equipment. Noise monitoring carried out on monthly basis at mining site; Core Zone and Buffer Zone areas shown in Fig. 3.

Identification of sampling locations

Noise at different noise generating sources has been identified based on the activities in the village area and ambient noise due to traffic.

The noise monitoring has been conducted for determination of ambient noise levels in the mining area and villages. The noise levels at each location were recorded for 24 hours.

Instrument used for monitoring

Noise levels were measured using integrated sound level meter Model no. HTC-SL-1352. This instrument is capable of measuring the Sound Pressure Level (SPL), Leq.

Method of Monitoring

Sound Pressure Level (SPL) measurements were monitored at eight locations. The readings were taken for every hour for 24 hours. The day noise levels have been monitored during 6 am to 10 pm and night levels during 10 pm to 6 am at eight locations within 10-km radius of the study area.

Noise level monitoring was carried out continuously for 24 hours with one hour interval starting at 06.00 hrs to 06.00 hrs next day.
Noise levels monitored during day and night at Four locations are found to be below in the Mining Area than the stipulated standard of CPCB for Industrial area as 75dB(A) and 70dB(A) for day and night respectively as given in (Table 5).

**Table 5**

### Noise Emission Monitoring Report

<table>
<thead>
<tr>
<th>SR. NO.</th>
<th>LOCATION</th>
<th>Month</th>
<th>Noise-dB(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Day Time</td>
</tr>
<tr>
<td><strong>Core Zone</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>New Kudag/Nr. Weigh Bridge</td>
<td>October-2019</td>
<td>61.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>November-2019</td>
<td>62.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>December-2019</td>
<td>63.2</td>
</tr>
<tr>
<td>2.</td>
<td>Old Kudag/Mining Area</td>
<td>October-2019</td>
<td>58.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>November-2019</td>
<td>60.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>December-2019</td>
<td>56.8</td>
</tr>
<tr>
<td><strong>Buffer Zone</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Rajendrapur</td>
<td>October-2019</td>
<td>56.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>November-2019</td>
<td>53.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>December-2019</td>
<td>54.9</td>
</tr>
<tr>
<td>2.</td>
<td>Tatijharia Village</td>
<td>October-2019</td>
<td>63.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>November-2019</td>
<td>62.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>December-2019</td>
<td>59.4</td>
</tr>
</tbody>
</table>

**CPCB Standards**

- **Industrial Area**: 75
- **Residential area**: 55

**Conclusion** :- The Noise Monitoring Results at Kudag Lease during this period (October-November-December-2019), it is within permissible limits as per CPCB Standards.

**Table 6**

### HEMM Spot Noise Level Monitoring

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Location</th>
<th>October-2019</th>
<th></th>
<th>November-2019</th>
<th></th>
<th>December-2019</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Nr. Weigh Bridge</td>
<td>61.8</td>
<td>72.5</td>
<td>62.2</td>
<td>72.9</td>
<td>61.9</td>
<td>70.8</td>
</tr>
<tr>
<td>2.</td>
<td>Mining Area</td>
<td>65.6</td>
<td>75.4</td>
<td>64.9</td>
<td>76.2</td>
<td>63.5</td>
<td>75.2</td>
</tr>
</tbody>
</table>
Table 7

Dust fall Rate

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Location</th>
<th>December-2019 Rate (MT/km²/Month)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Old Kudag/Mining Area</td>
<td>16.32</td>
</tr>
</tbody>
</table>

2.0 Water Quality Monitoring

The existing status of water quality for ground water was assessed by collecting the water samples from underground wells from the mining area/old kudag.

The purpose of the study is to assess the water quality characteristics for critical parameters, evaluate the impacts on agricultural productivity, habitat conditions, recreational resources and aesthetics in the vicinity and identification of impact on water quality by this project and related activities.

The physico-chemical analysis of water samples collected during the study period is given in **Table-8 and Fig.5**. The overall water quality found to be below the stipulated standards of IS 10500-2012 for ground water & found to be fit for drinking purpose for tested parameters. Thus the impacts due to mining activities have been found to be insignificant.

The drinking water is supplied by the tankers from far-away sources. Hence, additional care now be taken to chlorinate the tankers before leaving the supply source.
Table 8
Report on Chemical Examination of Ground Water Quality
(December-2019)

Location: GW1 | Saraidih (Hindalco Campus)
            Sample Source: Borewell Water

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Test Parameter</th>
<th>Measurement Unit</th>
<th>Test Method</th>
<th>As per IS 10500 : 2012 (Drinking Water - Specification)</th>
<th>Test Result</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Acceptable Limit</td>
<td>Permissible Limit</td>
</tr>
<tr>
<td>1.</td>
<td>pH value</td>
<td>-</td>
<td>IS 3025 (Part 11)</td>
<td>6.5 to 8.6</td>
<td>No relaxation</td>
</tr>
<tr>
<td>2.</td>
<td>Turbidity</td>
<td>NTU</td>
<td>IS 3025 (Part 10)</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>3.</td>
<td>Colour</td>
<td>Hzen units</td>
<td>IS 3025 (Part 4)</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>4.</td>
<td>Odour</td>
<td>-</td>
<td>IS 3025 (Part 5)</td>
<td>Agreeable</td>
<td>Agreeable</td>
</tr>
<tr>
<td>5.</td>
<td>Taste</td>
<td>-</td>
<td>IS 3025 (Part 8)</td>
<td>Agreeable</td>
<td>Agreeable</td>
</tr>
<tr>
<td>6.</td>
<td>Iron (as Fe)</td>
<td>mg/l</td>
<td>IS 3025 (Part 2)</td>
<td>1.0</td>
<td>No relaxation</td>
</tr>
<tr>
<td>7.</td>
<td>Free residual chlorine</td>
<td>mg/l</td>
<td>IS 3025 (Part 26)</td>
<td>Min. 0.2</td>
<td>1</td>
</tr>
<tr>
<td>8.</td>
<td>Total dissolved solids</td>
<td>mg/l</td>
<td>IS 3025 (Part 16)</td>
<td>500</td>
<td>2000</td>
</tr>
<tr>
<td>9.</td>
<td>Fluoride (as F)</td>
<td>mg/l</td>
<td>IS 3025 (Part 80)</td>
<td>1.0</td>
<td>1.5</td>
</tr>
<tr>
<td>10.</td>
<td>Cyanide (as CN)</td>
<td>mg/l</td>
<td>IS 3025 (Part 27)</td>
<td>0.05</td>
<td>No relaxation</td>
</tr>
<tr>
<td>11.</td>
<td>Chloride (as Cl)</td>
<td>mg/l</td>
<td>IS 3025 (Part 32)</td>
<td>250</td>
<td>1000</td>
</tr>
<tr>
<td>12.</td>
<td>Total Alkalinity (as CaCO₃)</td>
<td>mg/l</td>
<td>IS 3025 (Part 23)</td>
<td>200</td>
<td>600</td>
</tr>
<tr>
<td>13.</td>
<td>Total hardness (as CaCO₃)</td>
<td>mg/l</td>
<td>IS 3025 (Part 21)</td>
<td>200</td>
<td>600</td>
</tr>
<tr>
<td>14.</td>
<td>Calcium (as Ca)</td>
<td>mg/l</td>
<td>IS 3025 (Part 40)</td>
<td>75</td>
<td>200</td>
</tr>
<tr>
<td>15.</td>
<td>Magnesium (as Mg)</td>
<td>mg/l</td>
<td>IS 3025 (Part 46)</td>
<td>30</td>
<td>100</td>
</tr>
<tr>
<td>16.</td>
<td>Sulphate (as SO₄)</td>
<td>mg/l</td>
<td>IS 3025 (Part 24)</td>
<td>200</td>
<td>400</td>
</tr>
<tr>
<td>17.</td>
<td>Nitrate (as NO₃)</td>
<td>mg/l</td>
<td>APHA Method</td>
<td>45</td>
<td>No relaxation</td>
</tr>
<tr>
<td>18.</td>
<td>Copper (as Cu)</td>
<td>mg/l</td>
<td>IS 3025 (Part 2)</td>
<td>0.05</td>
<td>1.5</td>
</tr>
<tr>
<td>19.</td>
<td>Manganese (as Mn)</td>
<td>mg/l</td>
<td>IS 3025 (Part 2)</td>
<td>0.1</td>
<td>0.3</td>
</tr>
<tr>
<td>20.</td>
<td>Mercury (as Hg)</td>
<td>mg/l</td>
<td>IS : 3025 (Part 48)</td>
<td>0.001</td>
<td>No relaxation</td>
</tr>
<tr>
<td>21.</td>
<td>Cadmium (as Cd)</td>
<td>mg/l</td>
<td>IS : 3025 (Part 41)</td>
<td>0.003</td>
<td>No relaxation</td>
</tr>
<tr>
<td>22.</td>
<td>Selenium (as Se)</td>
<td>mg/l</td>
<td>IS : 3025 (Part 56)</td>
<td>0.01</td>
<td>No relaxation</td>
</tr>
<tr>
<td>23.</td>
<td>Arsenic (as As)</td>
<td>mg/l</td>
<td>IS : 3025 (Part 37)</td>
<td>0.01</td>
<td>No relaxation</td>
</tr>
<tr>
<td>24.</td>
<td>Aluminium (as Al)</td>
<td>mg/l</td>
<td>IS : 15362</td>
<td>0.03</td>
<td>0.2</td>
</tr>
<tr>
<td>25.</td>
<td>Lead (as Pb)</td>
<td>mg/l</td>
<td>IS : 3025 (Part 47)</td>
<td>0.01</td>
<td>No relaxation</td>
</tr>
<tr>
<td>26.</td>
<td>Zinc (as Zn)</td>
<td>mg/l</td>
<td>IS 3025 (Part 2)</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>Sr. No</td>
<td>Test Parameter</td>
<td>Measurement Unit</td>
<td>Test Method</td>
<td>As per IS 10500 : 2012 (Drinking Water - Specification)</td>
<td>Test Result</td>
</tr>
<tr>
<td>-------</td>
<td>--------------------------------</td>
<td>------------------</td>
<td>------------------------------</td>
<td>-------------------------------------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>27</td>
<td>Nickel (as Ni)</td>
<td>mg/l</td>
<td>IS 3025 (Part 2)</td>
<td>Acceptable Limit 0.02</td>
<td>No relaxation</td>
</tr>
<tr>
<td>28</td>
<td>Total Chromium (as Cr)</td>
<td>mg/l</td>
<td>IS 3025 (Part 2)</td>
<td>Acceptable Limit 0.05</td>
<td>No relaxation</td>
</tr>
<tr>
<td>29</td>
<td>Barium (as Ba)</td>
<td>mg/l</td>
<td>Annexure F of IS 13428</td>
<td>Acceptable Limit 0.7</td>
<td>No relaxation</td>
</tr>
<tr>
<td>30</td>
<td>Ammonia (as N)</td>
<td>mg/l</td>
<td>IS 3025 (Part 34)</td>
<td>Acceptable Limit 0.5</td>
<td>No relaxation</td>
</tr>
<tr>
<td>31</td>
<td>Sulphide (as H₂S)</td>
<td>mg/l</td>
<td>IS 3025 (Part 29)</td>
<td>Acceptable Limit 0.05</td>
<td>No relaxation</td>
</tr>
<tr>
<td>32</td>
<td>Chloramines (as Cl₂)</td>
<td>mg/l</td>
<td>IS 3025 (Part 26)</td>
<td>Acceptable Limit 4.0</td>
<td>No relaxation</td>
</tr>
<tr>
<td>33</td>
<td>Molybdenum (as Mo)</td>
<td>mg/l</td>
<td>IS 3025 (Part 2)</td>
<td>Acceptable Limit 0.07</td>
<td>No relaxation</td>
</tr>
<tr>
<td>34</td>
<td>Silver (as Ag)</td>
<td>mg/l</td>
<td>Annexure J of IS 13428</td>
<td>Acceptable Limit 0.1</td>
<td>No relaxation</td>
</tr>
<tr>
<td>35</td>
<td>Polychlorinated Biphenyls (PCB)</td>
<td>µg/l</td>
<td>USEPA 508</td>
<td>Acceptable Limit 0.5</td>
<td>No relaxation</td>
</tr>
<tr>
<td>36</td>
<td>Boron (as B)</td>
<td>mg/l</td>
<td>IS 3025 (Part 2)</td>
<td>Acceptable Limit 0.5</td>
<td>2.4</td>
</tr>
<tr>
<td>37</td>
<td>Mineral Oil</td>
<td>mg/l</td>
<td>IS 3025 (Part 39)</td>
<td>Acceptable Limit 0.5</td>
<td>No relaxation</td>
</tr>
<tr>
<td>38</td>
<td>Tri Halo Methane</td>
<td></td>
<td></td>
<td>Acceptable Limit 0.1</td>
<td>No relaxation</td>
</tr>
<tr>
<td>39</td>
<td>Phenolic compounds (as C₆H₆O₆)</td>
<td>mg/l</td>
<td>IS 3025 (Part 43): 1001</td>
<td>Acceptable Limit 0.001</td>
<td>0.002</td>
</tr>
<tr>
<td>40</td>
<td>Anionic detergents (as MBAS)</td>
<td>mg/l</td>
<td>IS 13428: 2005 (Annex K)</td>
<td>Acceptable Limit 0.2</td>
<td>1.0</td>
</tr>
<tr>
<td>41</td>
<td>Polynuclear aromatic hydrocarbon (PAH)</td>
<td>µg/l</td>
<td>USEPA : 550</td>
<td>Acceptable Limit 0.1</td>
<td>No relaxation</td>
</tr>
<tr>
<td>42</td>
<td>Total coliform</td>
<td>Per 100 ml</td>
<td>IS 15185</td>
<td>Absent</td>
<td>Absent</td>
</tr>
<tr>
<td>43</td>
<td>Escherichia coli</td>
<td>Per 100 ml</td>
<td>IS 15185 : 2016</td>
<td>Absent</td>
<td>Absent</td>
</tr>
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</table>
## Pesticides residues

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Test Parameter</th>
<th>Measurement Unit</th>
<th>Test Method</th>
<th>As per IS 10500 : 2012 (Drinking Water - Specification)</th>
<th>Test Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>i.</td>
<td>Alpha-HCH</td>
<td>µg/l</td>
<td>USEPA 508</td>
<td>0.01</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>ii.</td>
<td>Beta HCH</td>
<td>µg/l</td>
<td>USEPA 508</td>
<td>0.04</td>
<td>&lt; 0.03</td>
</tr>
<tr>
<td>iii.</td>
<td>Delta- HCH</td>
<td>µg/l</td>
<td>USEPA 508</td>
<td>0.04</td>
<td>&lt; 0.03</td>
</tr>
<tr>
<td>iv.</td>
<td>Alachlor</td>
<td>µg/l</td>
<td>USEPA 508</td>
<td>20</td>
<td>&lt; 0.03</td>
</tr>
<tr>
<td>v.</td>
<td>Aldrin /Dieldrin</td>
<td>µg/l</td>
<td>USEPA 508</td>
<td>0.03</td>
<td>&lt; 0.03</td>
</tr>
<tr>
<td>vi.</td>
<td>Atrazine</td>
<td>µg/l</td>
<td>USEPA 1657</td>
<td>2</td>
<td>&lt; 0.03</td>
</tr>
<tr>
<td>vii.</td>
<td>Butachlor</td>
<td>µg/l</td>
<td>USEPA 508</td>
<td>125</td>
<td>&lt; 0.03</td>
</tr>
<tr>
<td>viii.</td>
<td>Chlorpyrifos</td>
<td>µg/l</td>
<td>USEPA 1657</td>
<td>30</td>
<td>&lt; 0.03</td>
</tr>
<tr>
<td>ix.</td>
<td>DDT and its Isomers</td>
<td>µg/l</td>
<td>USEPA 508</td>
<td>1</td>
<td>&lt; 0.03</td>
</tr>
<tr>
<td>x.</td>
<td>Gamma - HCH (Lindane)</td>
<td>µg/l</td>
<td>USEPA 508</td>
<td>2</td>
<td>&lt; 0.03</td>
</tr>
<tr>
<td>xi.</td>
<td>2,4-Dichlorophenoxyacetic acid</td>
<td>µg/l</td>
<td>USEPA 1657</td>
<td>30</td>
<td>&lt; 0.03</td>
</tr>
<tr>
<td>xii.</td>
<td>Endosulfan</td>
<td>µg/l</td>
<td>USEPA 508</td>
<td>0.4</td>
<td>&lt; 0.03</td>
</tr>
<tr>
<td>xiii.</td>
<td>Ethion</td>
<td>µg/l</td>
<td>USEPA 1657</td>
<td>3</td>
<td>&lt; 0.03</td>
</tr>
<tr>
<td>xiv.</td>
<td>Isoproturon</td>
<td>µg/l</td>
<td>USEPA 1657</td>
<td>9</td>
<td>&lt; 0.03</td>
</tr>
<tr>
<td>xv.</td>
<td>Malathion</td>
<td>µg/l</td>
<td>USEPA 1657</td>
<td>190</td>
<td>&lt; 0.03</td>
</tr>
<tr>
<td>xvi.</td>
<td>Methyl Parathion</td>
<td>µg/l</td>
<td>USEPA 1657</td>
<td>0.3</td>
<td>&lt; 0.03</td>
</tr>
<tr>
<td>xvii.</td>
<td>Monocrotophos</td>
<td>µg/l</td>
<td>USEPA 1657</td>
<td>1</td>
<td>&lt; 0.03</td>
</tr>
<tr>
<td>xviii.</td>
<td>Phorate</td>
<td>µg/l</td>
<td>USEPA 1657</td>
<td>2</td>
<td>&lt; 0.03</td>
</tr>
</tbody>
</table>

## Remarks:

Based upon request of the party, sample was tested for above mentioned parameters only. Sample complies with IS:10500:2012, for test conducted, indicating that it is fit for drinking purpose with respect to tested parameters.
## Table 9

### Report on Soil Analysis, Kudag

**Sampling Duration:** Post-Monsoon  
**Sample Location:** (Old Kudag/Mining Area)

<table>
<thead>
<tr>
<th>S.N.</th>
<th>Test Parameter</th>
<th>Measurement Unit</th>
<th>Test Method</th>
<th>Test Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Infiltration rate</td>
<td>mm/hr</td>
<td>ASTM D 3385</td>
<td>19.27</td>
</tr>
<tr>
<td>2</td>
<td>Bulk density</td>
<td>g/cm³</td>
<td>IS 2720 (Part 29)</td>
<td>1.304</td>
</tr>
<tr>
<td>3</td>
<td>Water holding capacity</td>
<td>%</td>
<td>Method Manual, Soil testing in India (Department of agriculture &amp; corporation, Govt of India)</td>
<td>24.52</td>
</tr>
<tr>
<td>4</td>
<td>Particle size distribution</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sand</td>
<td>%</td>
<td>Method Manual, Soil testing in India (Department of agriculture &amp; corporation, Govt of India)</td>
<td>32.64</td>
</tr>
<tr>
<td></td>
<td>Silt</td>
<td>%</td>
<td>Method Manual, Soil testing in India (Department of agriculture &amp; corporation, Govt of India)</td>
<td>28.16</td>
</tr>
<tr>
<td></td>
<td>Clay</td>
<td>%</td>
<td>Method Manual, Soil testing in India (Department of agriculture &amp; corporation, Govt of India)</td>
<td>39.2</td>
</tr>
<tr>
<td>5</td>
<td>Texture</td>
<td></td>
<td>Method Manual, Soil testing in India (Department of agriculture &amp; corporation, Govt of India)</td>
<td>Clay Loam</td>
</tr>
<tr>
<td>6</td>
<td>pH (1:2.5 Aq. Extract) at 25°C</td>
<td>-</td>
<td>Method Manual, Soil testing in India (Department of agriculture &amp; corporation, Govt of India)</td>
<td>7.92 at 25°C</td>
</tr>
<tr>
<td>7</td>
<td>Electrical Conductivity (1:2.5 Aq. Extract)</td>
<td>µs/cm</td>
<td>Method Manual, Soil testing in India (Department of agriculture &amp; corporation, Govt of India)</td>
<td>416.7</td>
</tr>
<tr>
<td>8</td>
<td>Water soluble Calcium (as Ca)</td>
<td>mg/Kg</td>
<td>Method Manual, Soil testing in India (Department of agriculture &amp; corporation, Govt of India)</td>
<td>516.28</td>
</tr>
<tr>
<td>9</td>
<td>Water soluble Magnesium (as Mg)</td>
<td>mg/Kg</td>
<td>Method Manual, Soil testing in India (Department of agriculture &amp; corporation, Govt of India)</td>
<td>147.39</td>
</tr>
<tr>
<td>10</td>
<td>Water soluble Sodium (as Na)</td>
<td>mg/Kg</td>
<td>Method Manual, Soil testing in India (Department of agriculture &amp; corporation, Govt of India)</td>
<td>182.54</td>
</tr>
<tr>
<td>11</td>
<td>Water soluble Potassium (as K)</td>
<td>mg/Kg</td>
<td>Method Manual, Soil testing in India (Department of agriculture &amp; corporation, Govt of India)</td>
<td>38.2</td>
</tr>
<tr>
<td>12</td>
<td>Water soluble Chloride (as Cl)</td>
<td>mg/Kg</td>
<td>Method Manual, Soil testing in India (Department of agriculture &amp; corporation, Govt of India)</td>
<td>459.16</td>
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<tr>
<td>13</td>
<td>Water soluble Sulphate (as SO₃)</td>
<td>mg/Kg</td>
<td>Method Manual, Soil testing in India (Department of agriculture &amp; corporation, Govt of India)</td>
<td>182.72</td>
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<tr>
<td>14</td>
<td>Exchangeable Sodium (as Na)</td>
<td>mg/Kg</td>
<td>Method Manual, Soil testing in India (Department of agriculture &amp; corporation, Govt of India)</td>
<td>86.24</td>
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<tr>
<td>15</td>
<td>Exchangeable Potassium (as K)</td>
<td>mg/Kg</td>
<td>Method Manual, Soil testing in India (Department of agriculture &amp; corporation, Govt of India)</td>
<td>16.52</td>
</tr>
<tr>
<td>16</td>
<td>Exchangeable Calcium (as Ca)</td>
<td>mg/Kg</td>
<td>Method Manual, Soil testing in India (Department of agriculture &amp; corporation, Govt of India)</td>
<td>252.81</td>
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<tr>
<td>17</td>
<td>Exchangeable Magnesium (as Mg)</td>
<td>mg/Kg</td>
<td>Method Manual, Soil testing in India (Department of agriculture &amp; corporation, Govt of India)</td>
<td>73.98</td>
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<tr>
<td>18</td>
<td>Sodium adsorption ratio</td>
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<td>By Calculation</td>
<td>11.2</td>
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<tr>
<td>19</td>
<td>Total Organic matter</td>
<td>%</td>
<td>Method Manual, Soil testing in India (Department of agriculture &amp; corporation, Govt of India)</td>
<td>0.87</td>
</tr>
<tr>
<td>S.N.</td>
<td>Test Parameter</td>
<td>Measurement Unit</td>
<td>Test Method</td>
<td>Test Result</td>
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<tr>
<td>------</td>
<td>-------------------------</td>
<td>------------------</td>
<td>------------------------------------------------------------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>20</td>
<td>Total Organic Carbon</td>
<td>%</td>
<td>Method Manual, Soil testing in India (Department of agriculture &amp; corporation, Govt of India)</td>
<td>0.46</td>
</tr>
<tr>
<td>21</td>
<td>Available Nitrogen (as N)</td>
<td>Kg/hec</td>
<td>Method Manual, Soil testing in India (Department of agriculture &amp; corporation, Govt of India)</td>
<td>121.59</td>
</tr>
<tr>
<td>22</td>
<td>Available Phosphorus (as P)</td>
<td>Kg/hec</td>
<td>Method Manual, Soil testing in India (Department of agriculture &amp; corporation, Govt of India)</td>
<td>7.16</td>
</tr>
<tr>
<td>23</td>
<td>Available Potassium (as K)</td>
<td>Kg/hec</td>
<td>Method Manual, Soil testing in India (Department of agriculture &amp; corporation, Govt of India)</td>
<td>569.27</td>
</tr>
<tr>
<td>24</td>
<td>CEC</td>
<td>meq/100g</td>
<td>Method Manual, Soil testing in India (Department of agriculture &amp; corporation, Govt of India)</td>
<td>12.4</td>
</tr>
<tr>
<td>25</td>
<td>Arsenic (As)</td>
<td>mg/Kg</td>
<td>Method Manual, Soil testing in India (Department of agriculture &amp; corporation, Govt of India)</td>
<td>Absent</td>
</tr>
<tr>
<td>26</td>
<td>Boron (B)</td>
<td>mg/Kg</td>
<td>Method Manual, Soil testing in India (Department of agriculture &amp; corporation, Govt of India)</td>
<td>0.14</td>
</tr>
<tr>
<td>27</td>
<td>Cadmium (Cd)</td>
<td>mg/Kg</td>
<td>Method Manual, Soil testing in India (Department of agriculture &amp; corporation, Govt of India)</td>
<td>Absent</td>
</tr>
<tr>
<td>28</td>
<td>Chromium (Cr)</td>
<td>mg/Kg</td>
<td>Method Manual, Soil testing in India (Department of agriculture &amp; corporation, Govt of India)</td>
<td>Absent</td>
</tr>
<tr>
<td>29</td>
<td>Copper (Cu)</td>
<td>mg/Kg</td>
<td>Method Manual, Soil testing in India (Department of agriculture &amp; corporation, Govt of India)</td>
<td>3.17</td>
</tr>
<tr>
<td>30</td>
<td>Lead (Pb)</td>
<td>mg/Kg</td>
<td>Method Manual, Soil testing in India (Department of agriculture &amp; corporation, Govt of India)</td>
<td>Absent</td>
</tr>
<tr>
<td>31</td>
<td>Nickel (Ni)</td>
<td>mg/Kg</td>
<td>Method Manual, Soil testing in India (Department of agriculture &amp; corporation, Govt of India)</td>
<td>Absent</td>
</tr>
<tr>
<td>32</td>
<td>Cobalt (Co)</td>
<td>mg/Kg</td>
<td>Method Manual, Soil testing in India (Department of agriculture &amp; corporation, Govt of India)</td>
<td>0.18</td>
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<tr>
<td>33</td>
<td>Iron (Fe)</td>
<td>mg/Kg</td>
<td>Method Manual, Soil testing in India (Department of agriculture &amp; corporation, Govt of India)</td>
<td>7.17</td>
</tr>
<tr>
<td>34</td>
<td>Manganese (Mn)</td>
<td>mg/Kg</td>
<td>Method Manual, Soil testing in India (Department of agriculture &amp; corporation, Govt of India)</td>
<td>16.28</td>
</tr>
<tr>
<td>35</td>
<td>Zinc (Zn)</td>
<td>mg/Kg</td>
<td>Method Manual, Soil testing in India (Department of agriculture &amp; corporation, Govt of India)</td>
<td>0.39</td>
</tr>
<tr>
<td>36</td>
<td>Selenium (Se)</td>
<td>mg/Kg</td>
<td>Method Manual, Soil testing in India (Department of agriculture &amp; corporation, Govt of India)</td>
<td>Absent</td>
</tr>
</tbody>
</table>

**Note:** 1. Results relate to tested sample only. 2. Test report should not be reproduced partially. 3. 'mg/Kg' is equivalent to ‘ppm’. 4. 'g/100g' is equivalent to '%w/w'. 5. All parameters are in 1:5 water extract.

**REMARKS:** Based upon request of party, sample was tested for above mentioned parameter only.
Fig 5: Sampling Locations for Water