



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 benefits. 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 monitoring of parameters for assessing pollution levels and preparation of monthly report (Jan-Feb-March-2018) as per the requirement of Chhattisgarh Environment Conservation Board (CECB) and Ministry of Environment and Forest (MoEF) for Tatijharia mining lease in Balrampur District, Chhattisgarh State.

1.2 Background Information of Tatijharia Mine

Hindalco was granted Tatijharia Bauxite mining lease over an area of 1218.762hec.inTatijharia, Post Jamira, Tehsil Samri of Balrampur district, Chhattisgarh on 25/06/1998 for a period of 20 years. The mining operations were started on 01/04/2004. The production capacity of bauxite is 4.0 Lakh Tonnes Per Annum (LTPA).

1.3 Salient Features of Tatijharia Bauxite Mine

The deposits occur in Tatijharia block, Post JamiraTehsil Samri 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: (**Table 1**)

Table 1
Salient Features of Tatijharia Bauxite Mines

S.No.	Particulars	Details
1.	Survey of India Toposheet No.	64 M /15
2.	Latitude	23 ⁰ 21' 02"N to 23 ⁰ 24' 15"N
3.	Longitude	83 ⁰ 54' 50"E to 83 ⁰ 56' 30"E
4.	Elevation	1282-m above Mean Sea Level
5.	Climatic Conditions (as per IMD, Ambikapur)	Annual maximum temperature : 30.3 ⁰ C Annual minimum temperature : 17.7 ⁰ C Average annual rainfall : 1401.1 mm
6.	Mining lease area	1218.762hec.
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 (143.56 km, E)
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 environment 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 impact of mining activity on sensitive receptors, it is necessary to monitor Environmental Quality to know ground level concentrations of pollutants within and around the mining lease area, accordingly Hindalco Industries through ALPL has been monitoring at the following locations 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 monitored at 8 locations in the core zone and buffer zone with reference to Tatijharia mine lease area shown in **(Fig. 1)**.

Table 2
Locations of Ambient Air Quality Monitoring (AAQM) & Fugitive Emission (1218.762 hec.)

S.No.	Fugitive Emission (Core Zone)	S.No	Buffer Zone
1	Piprapat/Nr.Mining Area	5	Kutku Village/Nr.V.T.Center
2	Betpani	6	Sairaidh Campus
3	Virhorepat	7	Rajendrapur/Nr.Mining Area
4	Tatijharia Village/Nr.Weigh Bridge	8	Dumerkholi/Nr.Mining Area

The sampling stations are selected at the above mentioned locations, in downwind and upwind directions of the mining site in the core zone and buffer zone. ALPL is carrying out regular monitoring for PM_{2.5}, RPM(PM₁₀), SO₂, NO_x and SPM, RSPM, SO₂, NO_x, Pb, Hg, As and Cr above Ambient Air Quality Monitoring (AAQM) locations. The dust fall rate was measured in the mining area (BKB campus) and Tatijharia village during January to March-2018. 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_{2.5}, RPM(PM₁₀),SO₂, NO_x and SPM, RSPM, SO₂, NO_x, Pb, Hg, As and Cr from January to March-2018 as per CPCB norms. Sampling Frequency is given in **Table-3**.

Data is compared with the present revised standards mentioned in the latest Gazette Notification of the Central Pollution Control Board (CPCB) (August-20, 1994), and as per consent conditions mentioned in consent letter.



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 Suspended Particulate Matter (SPM), Respirable Particulate Matter (RPM), Sulphur Dioxide (SO₂), Oxides of Nitrogen (NO_x), Pb, Hg, As and Cr were monitored for establishing the baseline status. SPM and RPM 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 m³/min which collects the particles less than 10 µm diameter over glass fiber filter paper and the bigger particulates from 10 to 100 µm are collected into the cup provided at the bottom of the cyclone. The dust deposited over the filter paper is measured as RPM, PM_{2.5} collected with the help of Fine Dust sampler operating 24 hours Due to the high flow rate of air. The dust fall rate was measured using dust fall jar. The jar was exposed for one month in the mining area and (BKB campus) Tatijharia village during Jan to March-2018. 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 4)**.

Table 3

MONITORED PARAMETERS AND FREQUENCY OF SAMPLING

Parameters	Sampling frequency
Suspended Particulate Matter	24 hourly sample twice a week for Three months
Respirable Particulate Matter	24 hourly sample twice a week for Three months
Particulate Matter 2.5	24 hourly sample twice a week for Three months
Sulphur dioxide (So2)	24 hourly sample twice a week for Three months
Oxides of Nitrogen (NOx)	24 hourly sample twice a week for Three months
Pb,Hg,As,Cr	8 hourly samples for 24 hour twice a week for three months



Table 4.0
Measurement Techniques for various pollutants

S.No.	Parameter	Technique	Technical Protocol	Minimum Reportable Value ($\mu\text{g}/\text{m}^3$)
1.	Suspended Particulate Matter	Respirable Dust Sampler (Gravimetric Method)	IS-5182 (Part - 23)	5
2.	Respirable Particulate Matter	Respirable Dust Sampler (Gravimetric Method)	IS-5182 (Part-23)	5
3.	Particulate Matter 2.5	Respirable Dust Sampler (Gravimetric Method)	Gravimetric Method	5
4.	Sulphur Dioxide	Modified West and Gaeke	IS-5182 (Part - II)	4
5.	Oxide of Nitrogen	Jacob & Hochheiser Method	IS-5182 (Part - VI)	4
6.	Pb, As, Hg, Cr	Acid Digestion Method	EPA Method	0.1
7.	Dust Full	Gravimetric	IS-5182 (Part-I)	—

1.6 Fugitive Emission Monitoring (Core Zone)

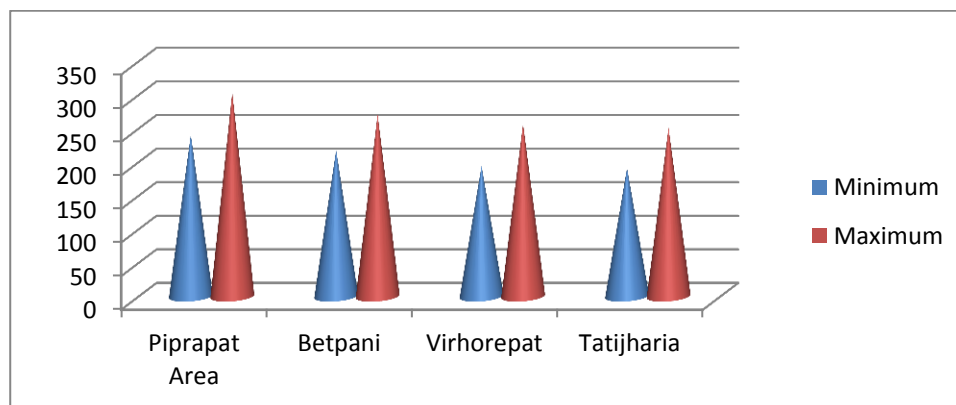
The summary of Fugitive Emission monitoring results for the month of January to March-2018 are presented in detail in **Table 3.0**. 98th percentile; maximum and minimum values etc. have been computed from the collected raw data for all the Fugitive monitoring station. The data has been compared with the standards prescribed by Central Pollution Control Board (CPCB)/NAAQS for residential and rural zone.

1.6.1 Presentation of Results.

Suspended Particulate Matter-SPM

The minimum and maximum concentrations for Suspended Particulate Matter-SPM were recorded as 194 $\mu\text{g}/\text{m}^3$ and 304 $\mu\text{g}/\text{m}^3$ respectively. The average concentrations were ranged between 205 to 282 $\mu\text{g}/\text{m}^3$. and 98th percentile values ranged between 217 to 303 $\mu\text{g}/\text{m}^3$ in the study area (**Table 6**).

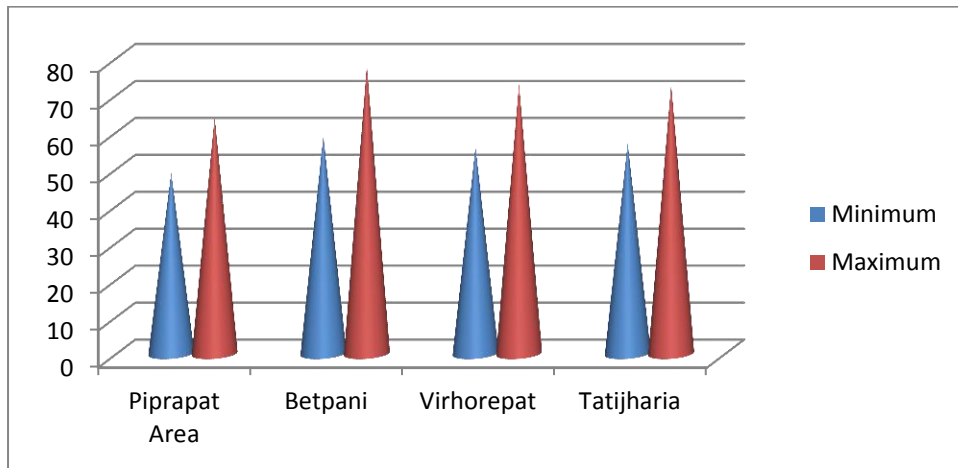
Graphical Presentation of SPM Fugitive Emission Monitoring



Respirable Suspended Particulate Matter –RSPM

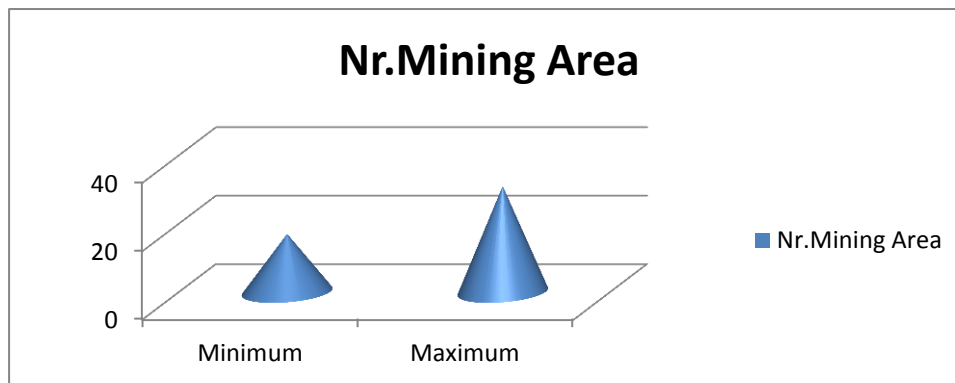
The minimum and maximum concentrations for RSPM were recorded as $49\mu\text{g}/\text{m}^3$ and $73\mu\text{g}/\text{m}^3$ respectively. The average values were observed to be in the range of 53 to $71\mu\text{g}/\text{m}^3$ and 98th percentile values ranged between 57 to $78\mu\text{g}/\text{m}^3$ in the study area (**Table 7**).

Graphical Presentation of RSPM Fugitive Emission Monitoring



Particulate Matter -PM_{2.5}

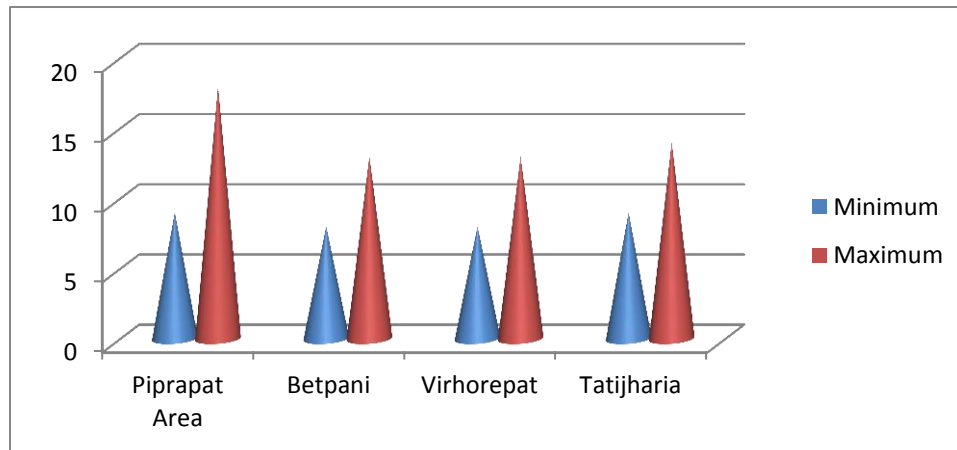
The minimum and maximum values of PM_{2.5} concentrations varied between 17 to $31\mu\text{g}/\text{m}^3$ respectively. The average values range between 22 to $26\mu\text{g}/\text{m}^3$ and 98th percentile values varied between 26 to $31\mu\text{g}/\text{m}^3$ (**Table 8**).



Sulphur Dioxide (SO₂)

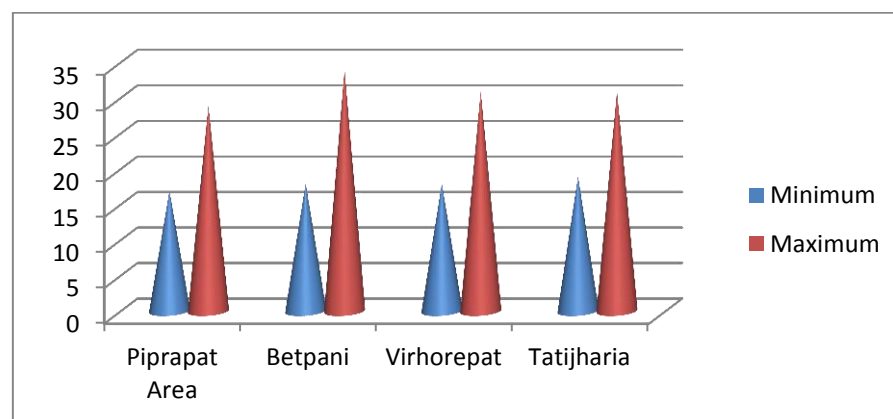
The minimum and maximum SO₂ concentrations were recorded as 8µg/m³ and 18µg/m³ respectively. The average values were observed to be in the range of 10 to 16µg/m³ and 98th percentile values varied between 11 to 18µg/m³ (**Table 9**).

Graphical Presentation of SO₂ Fugitive Emission Monitoring



Nitrogen Oxide (NO_x)

The minimum and maximum NO_x concentrations were recorded as 18µg/m³ and 34µg/m³. The average concentrations were ranged between 19 to 30µg/m³ and 98th percentile values varied between 21 to 34µg/m³ (**Table 10**).





Lead (Pb)

The minimum and maximum Lead detected between 0.016 to 0.052 $\mu\text{g}/\text{m}^3$ respectively. The average Lead detected between 0.022 to 0.047 $\mu\text{g}/\text{m}^3$ & 98th percentile values varied between 0.026 to 0.052 $\mu\text{g}/\text{m}^3$ in the study region **(Table 11)**.

Mercury (Hg)

Mercury was not detected at any of the locations in SPM samples as well as RSPM Samples **(Table 12)**.

Arsenic (As)

Arsenic was not detected at any of the locations in SPM samples as well as RSPM Samples **(Table 13)**.

Chromium (Cr)

Chromium was not detected at any of the locations in SPM samples as well as RSPM Samples

1.7 Ambient Air Quality (Buffer Zone)

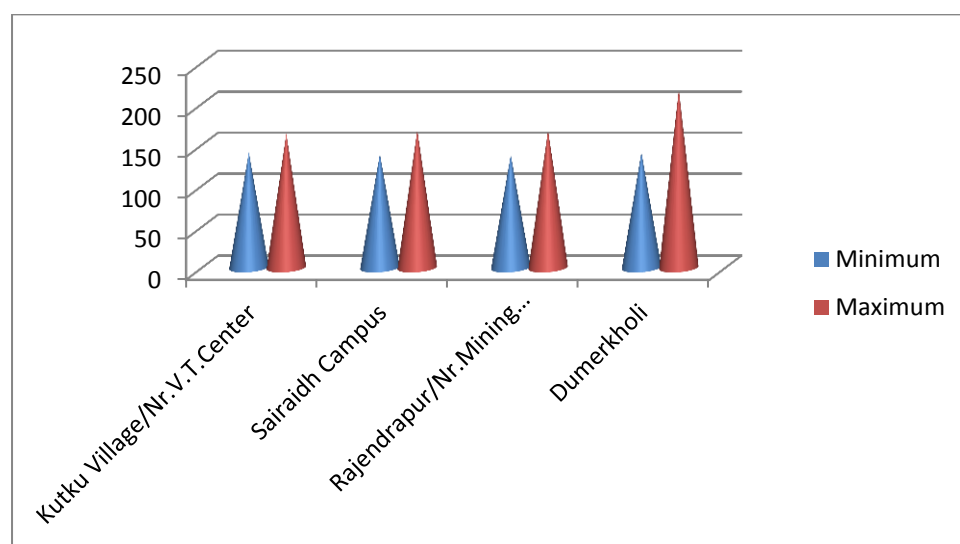
The background levels of SPM, RPM(PM₁₀), PM_{2.5}, SO₂, NO_x, Pb, Hg, As and Cr measured are required to compute Ambient Air Quality. The sampling locations are selected at the above mentioned locations in downwind and upwind directions of the mine. The Minimum, Maximum concentration, Arithmetic mean (AM), Geometric mean (GM) and 98 Percentile are presented in tabular form (**Table 6**).

1.7.1 Presentation of Results.

The summary of Ambient Air Quality monitoring results for the month of January to March-2018 are presented in detail in **Table 3**. 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)/NAAQ for residential and rural zone.

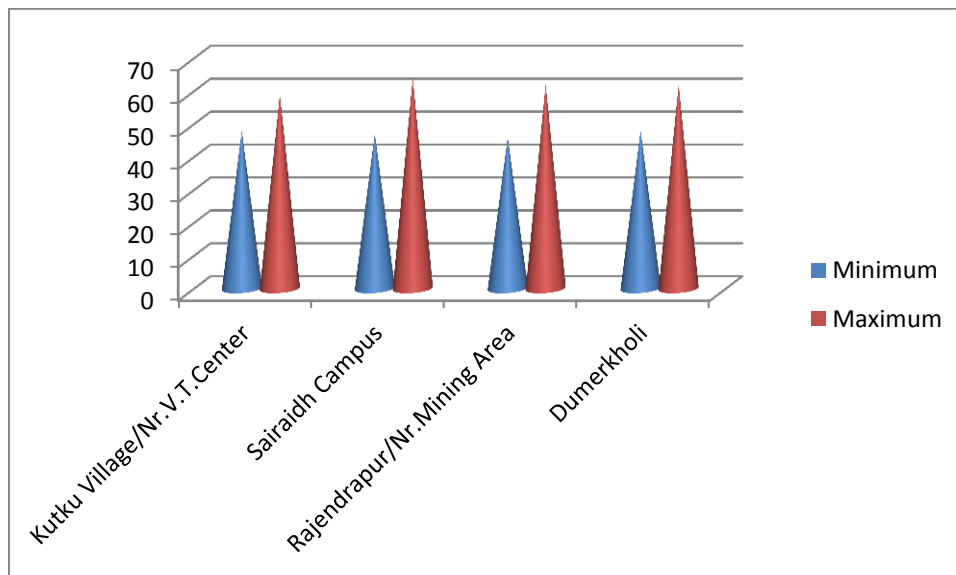
Suspended Particulate Matter-SPM

The statistical analysis of SPM is presented in **Table 6** for the mining area. The minimum and maximum values varied between 132 to 204 μg/m³ respectively during study period at all the 4 locations. The average values ranged between 147 to 193 μg/m³ and 98th percentile values ranged between 152 to 217 μg/m³ in the study area.



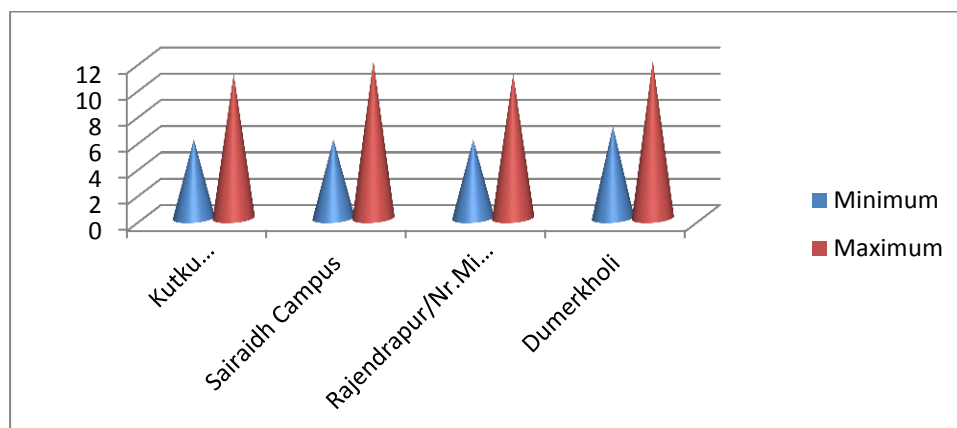
Particulate Matter-RSPM

The minimum and maximum values of RSPM varied between 46 to 64µg/m³ respectively (**Table 7**). The average values varied between 54 to 61µg/m³. The 98th percentile values varied between 58 to 69µg/m³ in the mining area. The overall values of SPM and RSPM were well within the CPCB limits prescribe for industrial and residential area in the study area during the study period.



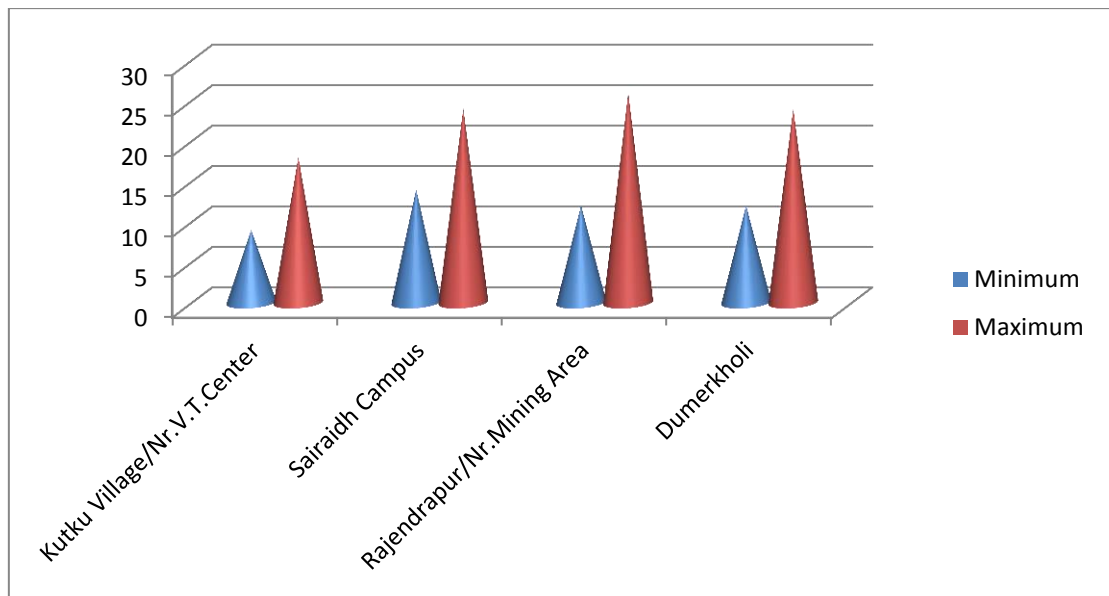
Sulphur Dioxide (SO₂)

The minimum and maximum values of SO₂ concentrations varied between 6 to 12µg/m³ respectively. The average values range between 7 to 10µg/m³ and 98th percentile values varied between 8 to 12µg/m³ (**Table 9**).



Nitrogen Oxide (NO)

The minimum and maximum values of NO_x concentrations varied between 9 to 26µg/m³ respectively. The average values range between 13 to 21µg/m³ and 98th percentile values varied between 16 to 26µg/m³ (**Table 10**).



Lead (Pb)

Lead (Pb) was not detected at any of the locations in SPM samples as well as RSPM Samples (**Table 11**).

Mercury (Hg)

Mercury (Hg) was not detected at any of the locations in SPM samples as well as RSPM Samples (**Table 12**).

Arsenic (As)

Arsenic (As) was not detected at any of the locations in SPM samples as well as RSPM Samples (**Table 13**).

Chromium (Cr)

Chromium was not detected at any of the locations in SPM samples as well as RSPM Samples.

The Dust fall rate during the month of January to March-2018 was observed 21.8 and 18.1 month MT/km²/month in the Piprapat/Near Mining Area and Tatijharia Village respectively. **(Table14)**.

Overall the ambient air concentrations of SPM, PM 10(RPM), PM2.5, SO₂, NO_x, Pb, Hg, and As were well within the limits of concentrations promulgated by CPCB, New Delhi in the study area.

1.8 Meteorology: Wind Pattern

The data of wind pattern collected during the study period (Jan-Feb-March-2018) indicates that the wind was blowing predominantly from (ENE and NNE) directions, during study period, for 2.08% wind was found to be calm. The details of wind pattern in the form of wind frequency distribution are presented in table-1. The graphical illustration and wind rose diagram is presented in Figures-1 & 2 respectively.

Table.1

Wind Frequency Distribution Data

Sr.No .	Directions / Wind Classes (m/s)	0.5 - 2.1	2.1 - 3.6	3.6 - 5.7	5.7 - 8.8	8.8 - 11.1	>= 11.1	Total
1	348.75 - 11.25	0.002782	0.002782	0.001391	0.000000	0.000000	0.000000	0.006954
2	11.25 - 33.75	0.030598	0.055633	0.006954	0.000000	0.000000	0.000000	0.093185
3	33.75 - 56.25	0.066759	0.034771	0.000000	0.000000	0.000000	0.000000	0.101530
4	56.25 - 78.75	0.108484	0.019471	0.000000	0.000000	0.000000	0.000000	0.127955
5	78.75 - 101.25	0.034771	0.008345	0.000000	0.000000	0.000000	0.000000	0.043115
6	101.25 - 123.75	0.037552	0.013908	0.000000	0.000000	0.000000	0.000000	0.051460
7	123.75 - 146.25	0.036161	0.020862	0.001391	0.000000	0.000000	0.000000	0.058414
8	146.25 - 168.75	0.029207	0.008345	0.001391	0.000000	0.000000	0.000000	0.038943
9	168.75 - 191.25	0.012517	0.015299	0.001391	0.000000	0.000000	0.000000	0.029207
10	191.25 - 213.75	0.020862	0.013908	0.002782	0.002782	0.000000	0.000000	0.040334
11	213.75 - 236.25	0.015299	0.040334	0.018081	0.001391	0.000000	0.000000	0.075104
12	236.25 - 258.75	0.025035	0.026426	0.011127	0.000000	0.000000	0.000000	0.062587
13	258.75 - 281.25	0.006954	0.015299	0.004172	0.002782	0.000000	0.000000	0.029207
14	281.25 - 303.75	0.005563	0.016690	0.036161	0.002782	0.000000	0.000000	0.061196
15	303.75 - 326.25	0.005563	0.029207	0.048679	0.001391	0.000000	0.000000	0.084840
16	326.25 - 348.75	0.008345	0.027816	0.027816	0.011127	0.000000	0.000000	0.075104
	Sub-Total	0.446453	0.349096	0.161335	0.022253	0.000000	0.000000	0.977778
	Calms							0.020833
	Missing/Incomplete							0.001389
	Total							1.000000

SUMMARY OF WIND PATTERN

Season	First Predominant Wind Direction	Second Predominant Wind Direction	Calm Condition
Jan-Feb-March-2018	ENE (12.79%)	NNE (10.15%)	2.09 %

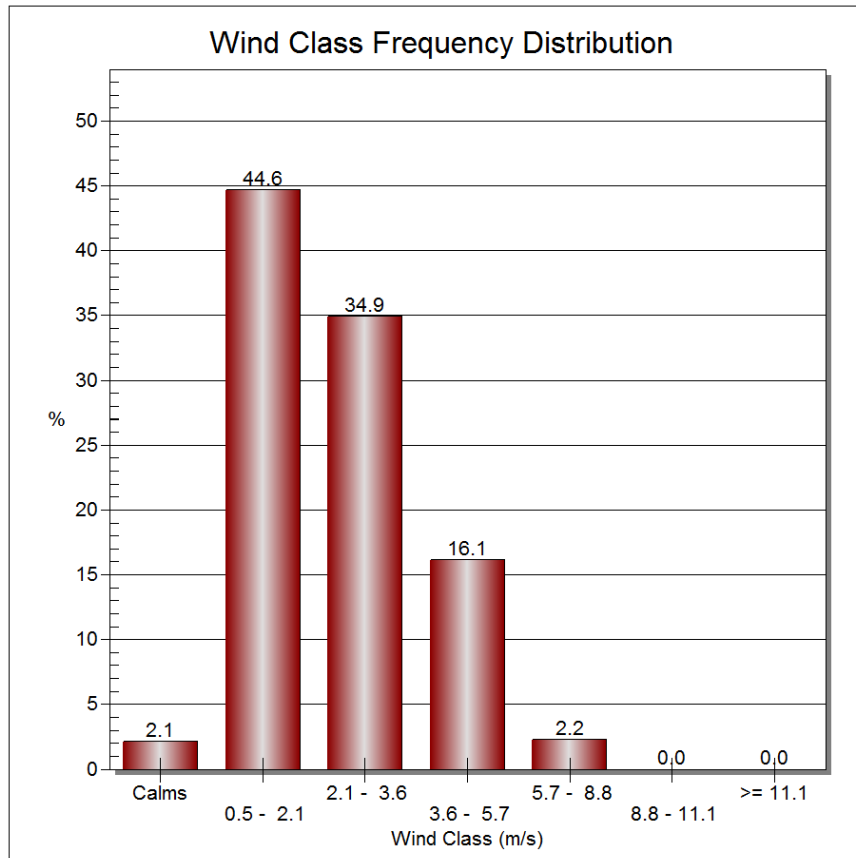


Figure.01: Wind Class Frequency Distribution (Jan-Feb-March-2018).

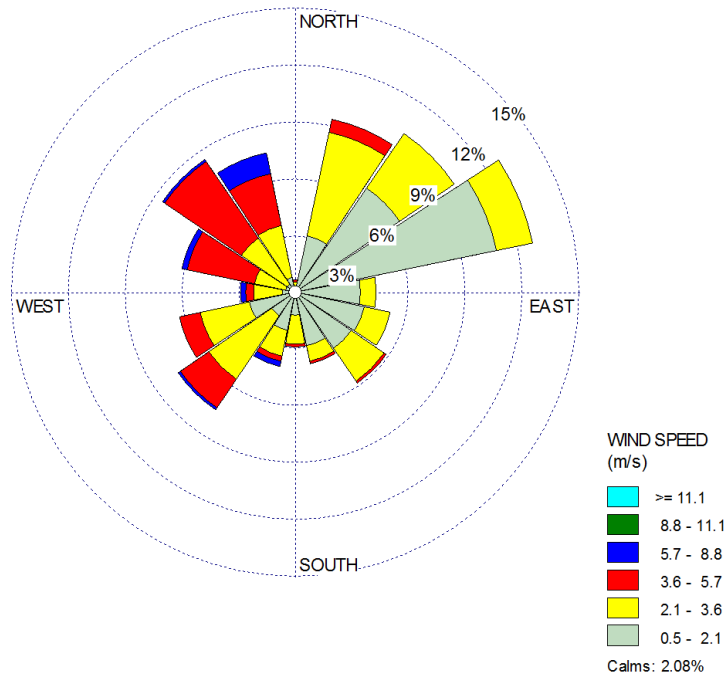


Figure.02: Wind Rose Diagram (Jan-Feb-March-2018)

1.6 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 noise control equipment. Noise monitoring carried out on monthly basis at eight locations namely core and buffer zone is 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.

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 8 locations are found to be below the stipulated standard of CPCB as for Industrial area as 75dB(A) and 70dB(A) for day and night respectively as given in **(Table 15)**.

Instrument used for monitoring

Noise levels were measured using integrated sound level meter manufactured by Envirotech made in India (Model no. SLM-100). This instrument is capable of measuring the Sound Pressure Level (SPL), Leq.

1.7 Water Quality

The existing status of water quality for groundwater and surface water was assessed by collecting the water samples from underground wells from the piprapat/Nr.mining area and surface water sample from nallahs nearby mining area. The physico-chemical analysis of ground and surface water samples collected during study period reported as average of three month given in (Table 16 & 17). The overall water quality found to be below the stipulated standards of IS 10500-2012 for ground water and found to be fit for drinking purpose for tested parameters. Surface water quality is satisfactory as per IS 10500-2012 for

surface water. Thus the impacts due to mining activities in each month have been found to be insignificant.

Table 6
Statistical analysis of SPM

Unit: $\mu\text{g}/\text{m}^3$

Location	Month & Year	Min.	Max.	A.M.	G.M.	98%
Fugitive Emission (Core Zone):-						
Piprapat/ Nr.Mining Area	January-2018	249	277	263	263	276
	February-2018	267	313	290	290	312
	March-2018	255	290	273	273	289
Betpani	January-2018	226	277	252	252	276
	February-2018	247	280	264	264	279
	March-2018	249	277	263	263	276
Virhorepat	January-2018	217	266	242	242	265
	February-2018	246	260	253	253	260
	March-2018	202	227	215	215	227
Tatijharia Village/Nr.Weigh Bridge	January-2018	212	248	230	230	247
	February-2018	226	260	243	243	259
	March-2018	199	227	213	213	226
Fugitive Emission (Buffer Zone):						
Kutku Village/ Nr.V.T.Center	January-2018	146	173	160	160	172
	February-2018	149	168	159	159	168
	March-2018	140	170	155	155	169
Sairaidh Campus	January-2018	155	177	166	166	177
	February-2018	147	161	154	154	161
	March-2018	154	170	162	162	170
Rajendrapur/ Nr.Mining Area	January-2018	160	177	169	169	177
	February-2018	157	162	160	160	162
	March-2018	146	170	158	158	170
Dumerkholi/ Nr.Mining Area	January-2018	149	168	159	159	168
	February-2018	169	213	191	191	212
	March-2018	176	227	202	202	226

Conclusion (A):-

- 1) Piprapat /Nr.Mining Lease Area Core Zone:** For the Months of Oct-Nov-Dec -2017 Average of SPM is $267\mu\text{g}/\text{m}^3$.
- 2) Betpani Lease Area Core Zone:-** For the Months of Oct-Nov-Dec -2017 Average of SPM is $251\mu\text{g}/\text{m}^3$.
- 3) Virhorepat Lease Area Core Zone:-** For the Months of Oct-Nov-Dec -2017 Average of SPM is $228\mu\text{g}/\text{m}^3$.
- 4) Tatijharia Village/Nr.Weigh Bridge Lease Area Core Zone:-**For the Months of Oct-Nov-Dec -2017 Avg of SPM is $221\mu\text{g}/\text{m}^3$.
 - The Average Concentration of SPM within the Core Zone of Tatijharia Lease is $242\mu\text{g}/\text{m}^3$.

Conclusion (B):-

- 1)Kutku Village/ Nr.V.T.CenterLease Area Buffer Zone:-** For the Months of Oct-Nov-Dec -2017 Average of SPM is $149\mu\text{g}/\text{m}^3$.
- 2) Sairaidh Campus Lease Area Buffer Zone:-** For the Months of Oct-Nov-Dec -2017 Average of SPM is $153\mu\text{g}/\text{m}^3$.
- 3) Rajendrapur/ Nr.Mining Lease Area Buffer Zone:-**For the Months of Oct-Nov-Dec -2017 Average of SPM is $154\mu\text{g}/\text{m}^3$.
- 4) Dumerkholi/ Nr.Mining Lease Area Buffer Zone:-**For the Months of Oct-Nov-Dec -2017 Average of SPM is $175\mu\text{g}/\text{m}^3$.

- The Average Concentration of SPM within the Buffer Zone of Tatijharia Lease is $158 \mu\text{g}/\text{m}^3$.

Month-wise Summary of Statistical Analysis of SPM

1.8 Fugitive Emission (Core Zone):-

1.8.1 Presentation of Results.

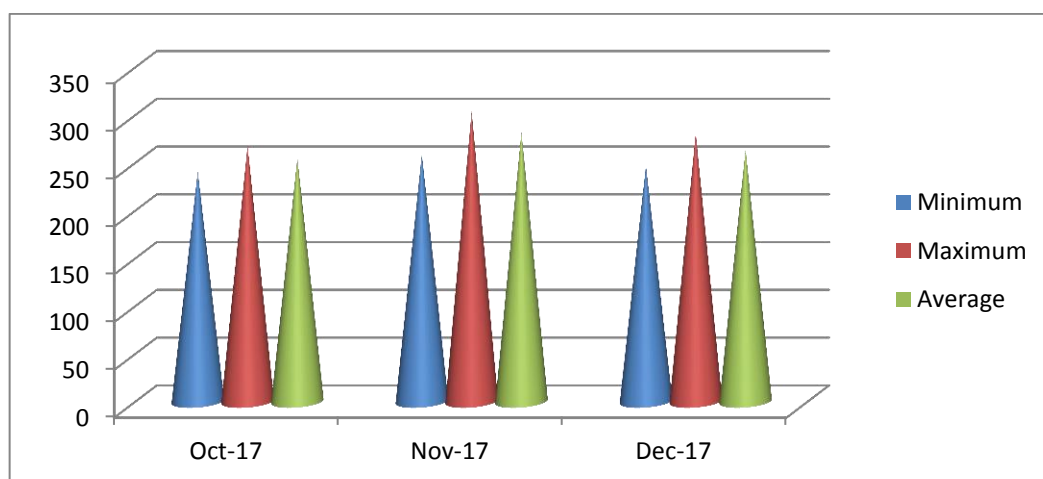
The summary of Statistical Analysis of SPM results for the month of October to December-2017 are presented in detail in **Table 6**. 98th percentile; maximum, minimum and average values etc. have been computed from the collected raw data for all the Fugitive emission monitoring station.

Piprapat / Nr.Mining Area

For the Month of October-2017 the minimum and maximum concentrations for SPM were recorded as $241 \mu\text{g}/\text{m}^3$ and $268 \mu\text{g}/\text{m}^3$ respectively and average concentration of $255 \mu\text{g}/\text{m}^3$.

For the Month of November-2017 the minimum and maximum concentrations for SPM were recorded as $259 \mu\text{g}/\text{m}^3$ and $304 \mu\text{g}/\text{m}^3$ respectively and average concentration of $282 \mu\text{g}/\text{m}^3$.

For the Month of December-2017 the minimum and maximum concentrations for SPM were recorded as $247 \mu\text{g}/\text{m}^3$ and $281 \mu\text{g}/\text{m}^3$ respectively and average concentration of $264 \mu\text{g}/\text{m}^3$.



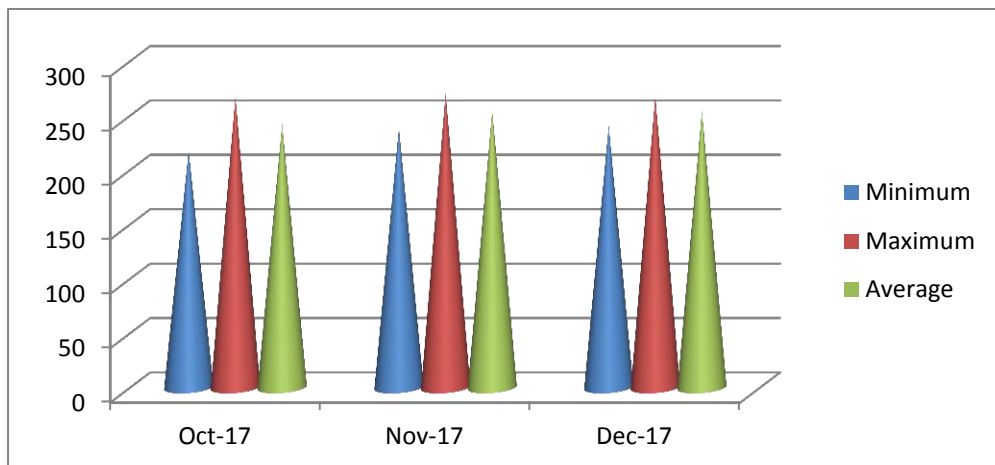
Graph :- Piprapat / Nr.Mining Area

Betpani

For the Month of October-2017 the minimum and maximum concentrations for SPM were recorded as $218\mu\text{g}/\text{m}^3$ and $268\mu\text{g}/\text{m}^3$ respectively and average concentration of $243\mu\text{g}/\text{m}^3$.

For the Month of November-2017 the minimum and maximum concentrations for SPM were recorded as $239\mu\text{g}/\text{m}^3$ and $271\mu\text{g}/\text{m}^3$ respectively and average concentration of $255\mu\text{g}/\text{m}^3$.

For the Month of December-2017 the minimum and maximum concentrations for SPM were recorded as $241\mu\text{g}/\text{m}^3$ and $268\mu\text{g}/\text{m}^3$ respectively and average concentration of $255\mu\text{g}/\text{m}^3$.



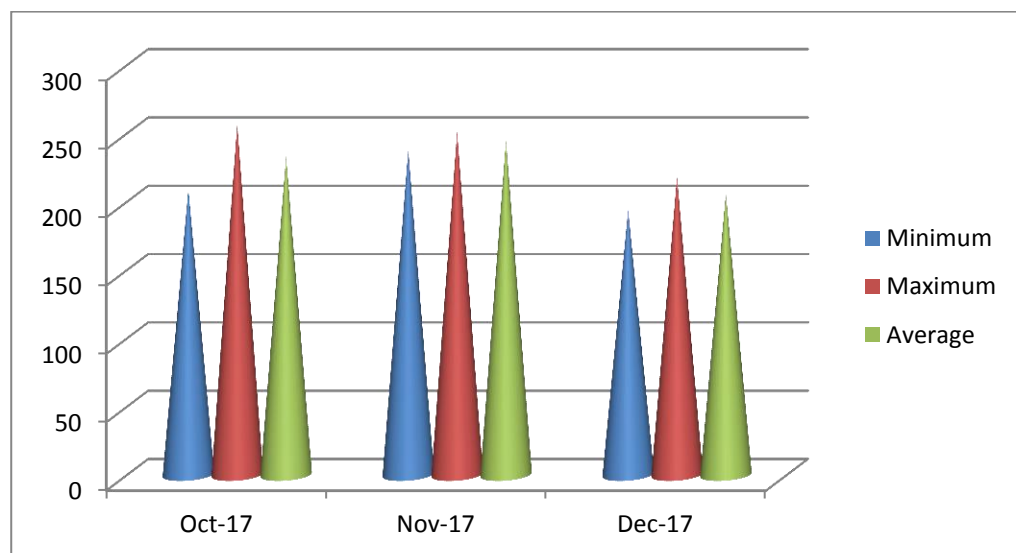
Graph:-Betpani

Virhorepat

For the Month of October-2017 the minimum and maximum concentrations for SPM were recorded as $209\mu\text{g}/\text{m}^3$ and $257\mu\text{g}/\text{m}^3$ respectively and average concentration of $233\mu\text{g}/\text{m}^3$.

For the Month of November-2017 the minimum and maximum concentrations for SPM were recorded as $238\mu\text{g}/\text{m}^3$ and $251\mu\text{g}/\text{m}^3$ respectively and average concentration of $245\mu\text{g}/\text{m}^3$.

For the Month of December-2017 the minimum and maximum concentrations for SPM were recorded as $194\mu\text{g}/\text{m}^3$ and $218\mu\text{g}/\text{m}^3$ respectively and average concentration of $206\mu\text{g}/\text{m}^3$.



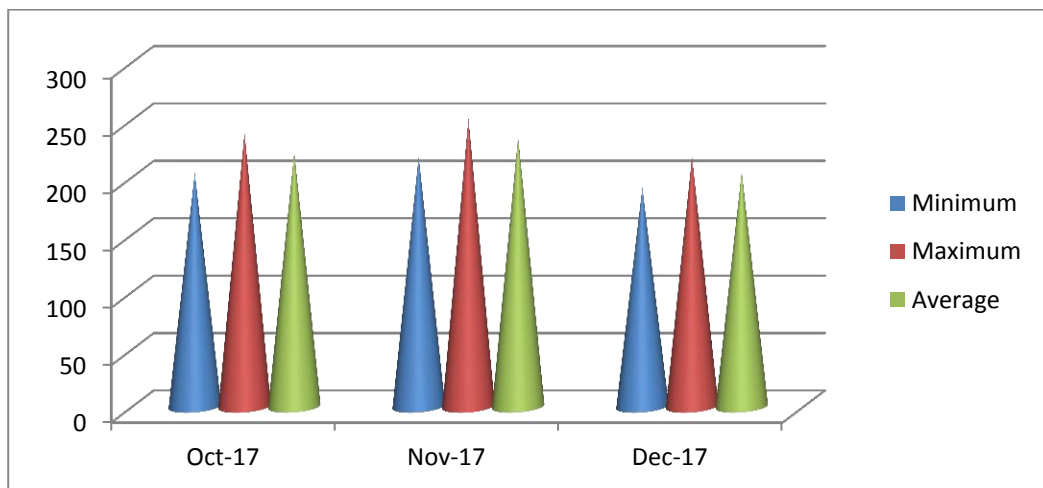
Graph:- Virhorepat

Tatijharia Village/Nr.Weigh Bridge

For the Month of October-2017 the minimum and maximum concentrations for SPM were recorded as $204\mu\text{g}/\text{m}^3$ and $239\mu\text{g}/\text{m}^3$ respectively and average concentration of $222\mu\text{g}/\text{m}^3$.

For the Month of November-2017 the minimum and maximum concentrations for SPM were recorded as $218\mu\text{g}/\text{m}^3$ and $251\mu\text{g}/\text{m}^3$ respectively and average concentration of $235\mu\text{g}/\text{m}^3$.

For the Month of December-2017 the minimum and maximum concentrations for SPM were recorded as $191\mu\text{g}/\text{m}^3$ and $218\mu\text{g}/\text{m}^3$ respectively and average concentration of $205\mu\text{g}/\text{m}^3$.



Graph:-Tatijharia Village/Nr.Weigh Bridge

1.9 Fugitive Emission (Buffer Zone):-

1.9.1 Presentation of Results.

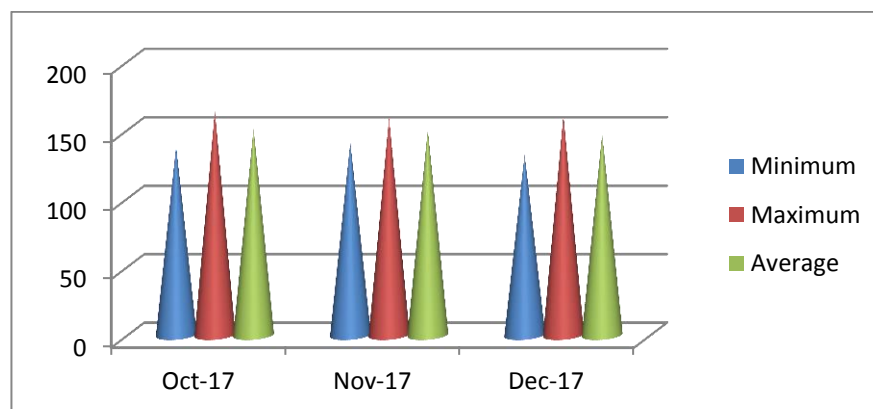
The summary of Statistical Analysis of SPM results for the month of October to December-2017 are presented in detail in **Table 6**. 98th percentile; maximum, minimum and average values etc. have been computed from the collected raw data for all the Fugitive emission monitoring station.

Kutku Village / Nr.V.T.Center

For the Month of October-2017 the minimum and maximum concentrations for SPM were recorded as $138\mu\text{g}/\text{m}^3$ and $164\mu\text{g}/\text{m}^3$ respectively and average concentration of $151\mu\text{g}/\text{m}^3$.

For the Month of November-2017 the minimum and maximum concentrations for SPM were recorded as $141\mu\text{g}/\text{m}^3$ and $159\mu\text{g}/\text{m}^3$ respectively and average concentration of $150\mu\text{g}/\text{m}^3$.

For the Month of December-2017 the minimum and maximum concentrations for SPM were recorded as $132\mu\text{g}/\text{m}^3$ and $161\mu\text{g}/\text{m}^3$ respectively and average concentration of $147\mu\text{g}/\text{m}^3$.



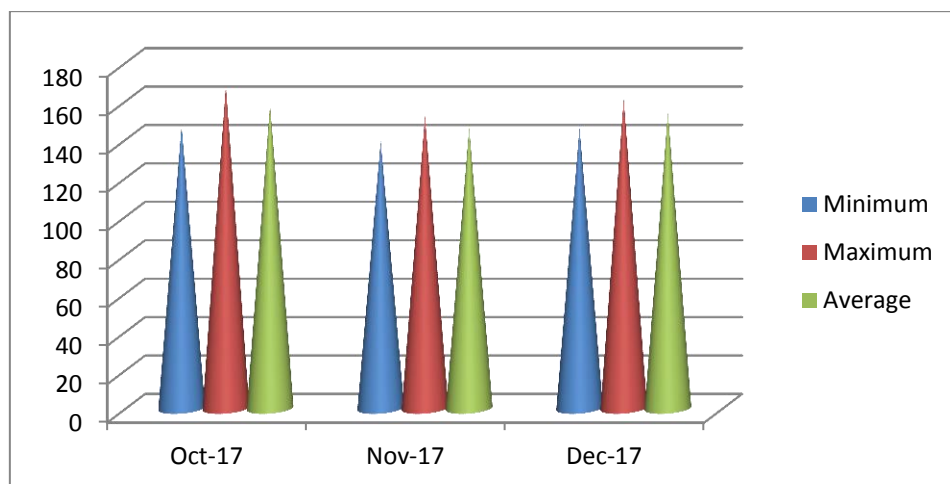
Graph:-Kutku Village / Nr.V.T.Center

Sairaidh Campus

For the Month of October-2017 the minimum and maximum concentrations for SPM were recorded as 147 $\mu\text{g}/\text{m}^3$ and 168 $\mu\text{g}/\text{m}^3$ respectively and average concentration of 158 $\mu\text{g}/\text{m}^3$.

For the Month of November-2017 the minimum and maximum concentrations for SPM were recorded as 139 $\mu\text{g}/\text{m}^3$ and 152 $\mu\text{g}/\text{m}^3$ respectively and average concentration of 146 $\mu\text{g}/\text{m}^3$.

For the Month of December-2017 the minimum and maximum concentrations for SPM were recorded as 146 $\mu\text{g}/\text{m}^3$ and 161 $\mu\text{g}/\text{m}^3$ respectively and average concentration of 154 $\mu\text{g}/\text{m}^3$.



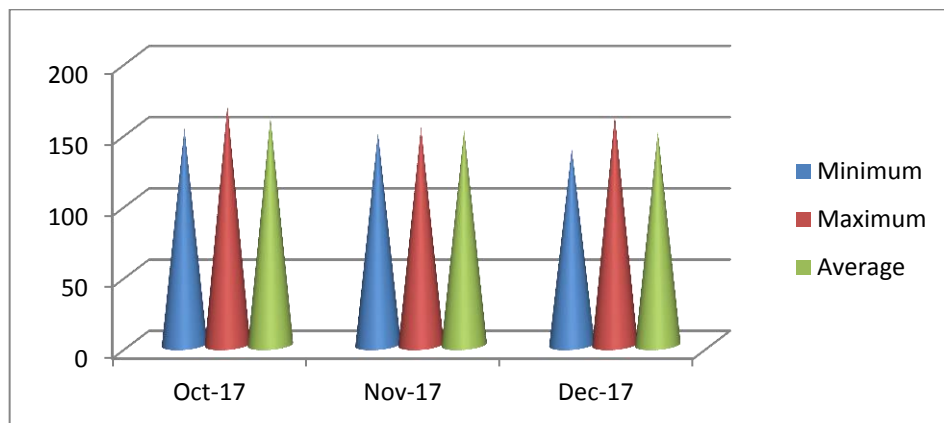
Graph:-Sairaidh Campus

Rajendrapur / Nr.Mining Area

For the Month of October-2017 the minimum and maximum concentrations for SPM were recorded as $152\mu\text{g}/\text{m}^3$ and $168\mu\text{g}/\text{m}^3$ respectively and average concentration of $160\mu\text{g}/\text{m}^3$.

For the Month of November-2017 the minimum and maximum concentrations for SPM were recorded as $149\mu\text{g}/\text{m}^3$ and $153\mu\text{g}/\text{m}^3$ respectively and average concentration of $151\mu\text{g}/\text{m}^3$.

For the Month of December-2017 the minimum and maximum concentrations for SPM were recorded as $138\mu\text{g}/\text{m}^3$ and $161\mu\text{g}/\text{m}^3$ respectively and average concentration of $150\mu\text{g}/\text{m}^3$.



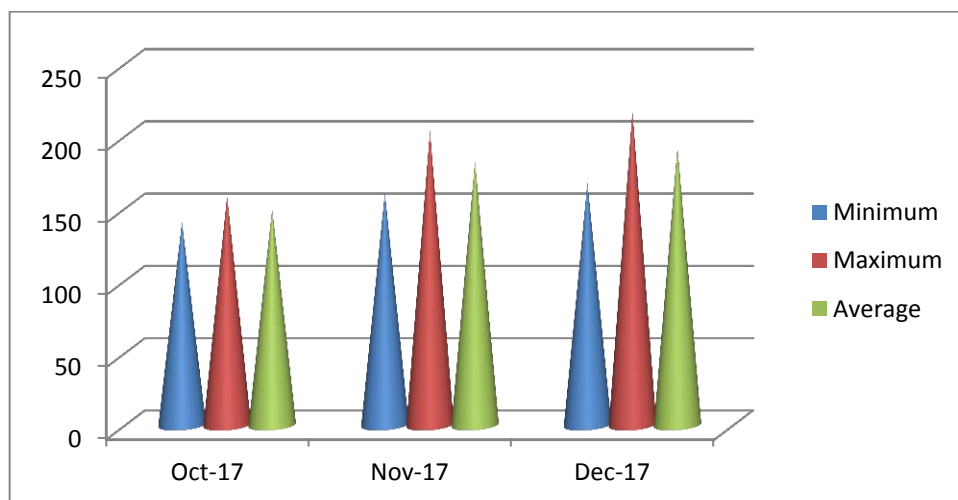
Graph:-Rajendrapur / Nr.Mining Area

Dumerkholi / Nr.Mining Area

For the Month of October-2017 the minimum and maximum concentrations for SPM were recorded as $141\mu\text{g}/\text{m}^3$ and $159\mu\text{g}/\text{m}^3$ respectively and average concentration of $150\mu\text{g}/\text{m}^3$.

For the Month of November-2017 the minimum and maximum concentrations for SPM were recorded as $161\mu\text{g}/\text{m}^3$ and $204\mu\text{g}/\text{m}^3$ respectively and average concentration of $183\mu\text{g}/\text{m}^3$.

For the Month of December-2017 the minimum and maximum concentrations for SPM were recorded as $168\mu\text{g}/\text{m}^3$ and $218\mu\text{g}/\text{m}^3$ respectively and average concentration of $193\mu\text{g}/\text{m}^3$.



Graph:-Dumerkholi / Nr.Mining Area



Table 7
Statistical analysis of RSPM

Unit: $\mu\text{g}/\text{m}^3$

Location	Month & Year	Min.	Max.	A.M.	G.M.	98%
Fugitive Emission (Core Zone):-						
Piprapat/Nr.Mining Area	January-2018	61	67	64	64	67
	February-2018	57	65	61	61	65
	March-2018	52	60	56	56	60
Betpani	January-2018	65	76	71	71	76
	February-2018	67	81	74	74	81
	March-2018	62	71	67	67	71
Virhorepat	January-2018	59	65	62	62	65
	February-2018	64	76	70	70	76
	March-2018	61	72	67	67	72
Tatijharia Village/Nr.Weigh Bridge	January-2018	65	71	68	68	71
	February-2018	60	74	67	67	74
	March-2018	62	76	69	69	76
		100 $\mu\text{g}/\text{m}^3$ (24 hrs)				

Location	Month & Year	Min.	Max.	A.M.	G.M.	98%
Buffer Zone :-						
Kutku Village/ Nr.V.T.Center	January-2018	51	65	58	58	65
	February-2018	45	61	53	53	61
	March-2018	54	63	59	59	63
Sairaidh Campus	January-2018	48	60	54	54	60
	February-2018	52	66	59	59	66
	March-2018	49	71	60	60	71
Rajendrapur/ Nr.Mining Area	January-2018	51	64	58	58	64
	February-2018	43	53	48	48	53
	March-2018	48	60	54	54	60
Dumerkholi/ Nr.Mining Area	January-2018	51	63	57	57	63
	February-2018	45	64	55	55	64
	March-2018	48	61	55	55	61
CPCB Standard		100 $\mu\text{g}/\text{m}^3$ (24 hrs)				

Conclusion (A):-

- 1** Piprapat /Nr.Mining Lease Area Core Zone: For the Months of Oct-Nov-Dec -2017 Average of RSPM is $57\mu\text{g}/\text{m}^3$.
- 2** Betpani Lease Area Core Zone:- For the Months of Oct-Nov-Dec -2017 Average of RSPM is $68\mu\text{g}/\text{m}^3$.
- 3** Virhorepat Lease Area Core Zone:- For the Months of Oct-Nov-Dec -2017 Average of RSPM is $63\mu\text{g}/\text{m}^3$.
- 4** Tatijharia Village/Nr.Weigh Bridge Lease Area Core Zone:-For the Months of Oct-Nov-Dec -2017 Avg of RSPM is $65\mu\text{g}/\text{m}^3$.
 - The Average Concentration of SPM within the Core Zone of Tatijharia Lease is $63\mu\text{g}/\text{m}^3$.

Conclusion (B):-

- 1)** Kutku Village/ Nr.V.T.CenterLease Area Buffer Zone:- For the Months of Oct-Nov-Dec -2017 Average of RSPM is $57\mu\text{g}/\text{m}^3$.
- 2)** Sairaidh Campus Lease Area Buffer Zone:- For the Months of Oct-Nov-Dec -2017 Average of RSPM is $57\mu\text{g}/\text{m}^3$.
- 3)** Rajendrapur/ Nr.Mining Lease Area Buffer Zone:-For the Months of Oct-Nov-Dec -2017 Average of RSPM is $55\mu\text{g}/\text{m}^3$.
- 4)** Dumerkholi/ Nr.Mining Lease Area Buffer Zone:-For the Months of Oct-Nov-Dec -2017 Average of RSPM is $56\mu\text{g}/\text{m}^3$.
 - The Average Concentration of SPM within the Buffer Zone of Tatijharia Lease is $56\mu\text{g}/\text{m}^3$.

Month-wise Summary of Statistical Analysis of RSPM

2.0 Fugitive Emission (Core Zone):-

2.0.1 Presentation of Results.

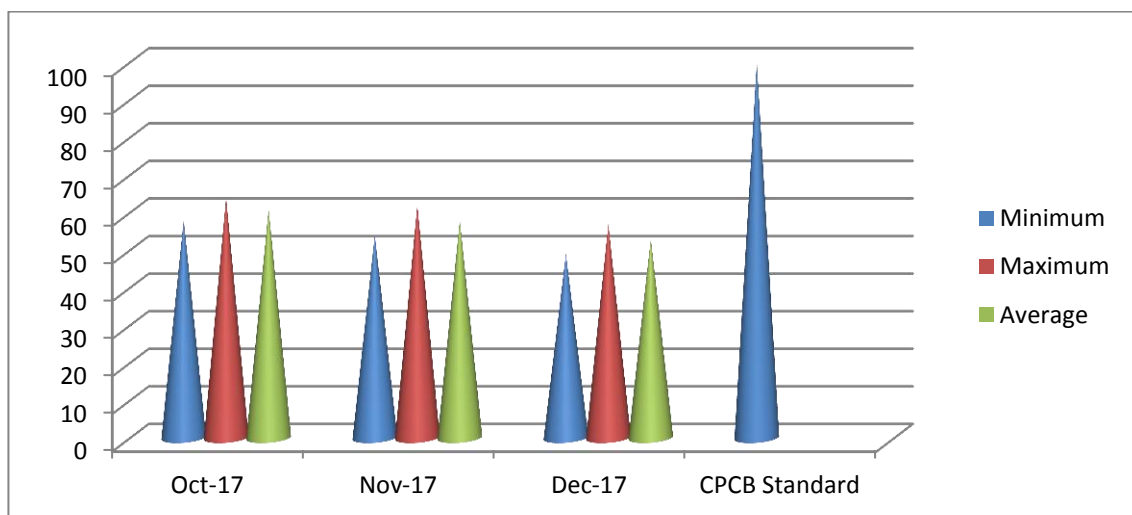
The summary of Statistical Analysis of RSPM results for the month of October-November-December-2017 are presented in detail in **Table 7**. 98th percentile; maximum, minimum and average values etc. have been computed from the collected raw data for all the Fugitive emission monitoring station.

Piprapat / Nr.Mining Area

For the Month of October-2017 the minimum and maximum concentrations for RSPM were recorded as 58µg/m³ and 64µg/m³ respectively and average concentration of 61µg/m³.

For the Month of November-2017 the minimum and maximum concentrations for RSPM were recorded as 54µg/m³ and 62µg/m³ respectively and average concentration of 58µg/m³.

For the Month of December-2017 the minimum and maximum concentrations for RSPM were recorded as 49µg/m³ and 57µg/m³ respectively and average concentration of 53µg/m³.



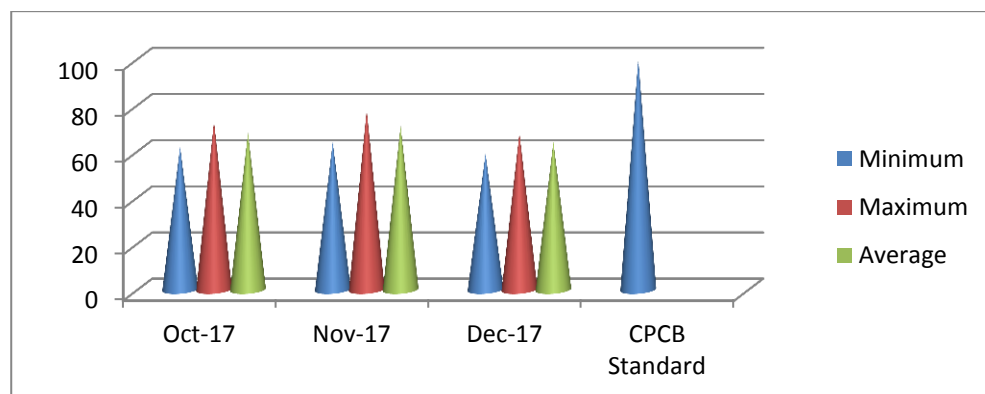
Graph :- Piprapat / Nr.Mining Area

Betpani

For the Month of October-2017 the minimum and maximum concentrations for RSPM were recorded as $62\mu\text{g}/\text{m}^3$ and $73\mu\text{g}/\text{m}^3$ respectively and average concentration of $68\mu\text{g}/\text{m}^3$.

For the Month of November-2017 the minimum and maximum concentrations for RSPM were recorded as $64\mu\text{g}/\text{m}^3$ and $78\mu\text{g}/\text{m}^3$ respectively and average concentration of $71\mu\text{g}/\text{m}^3$.

For the Month of December-2017 the minimum and maximum concentrations for RSPM were recorded as $59\mu\text{g}/\text{m}^3$ and $68\mu\text{g}/\text{m}^3$ respectively and average concentration of $64\mu\text{g}/\text{m}^3$.



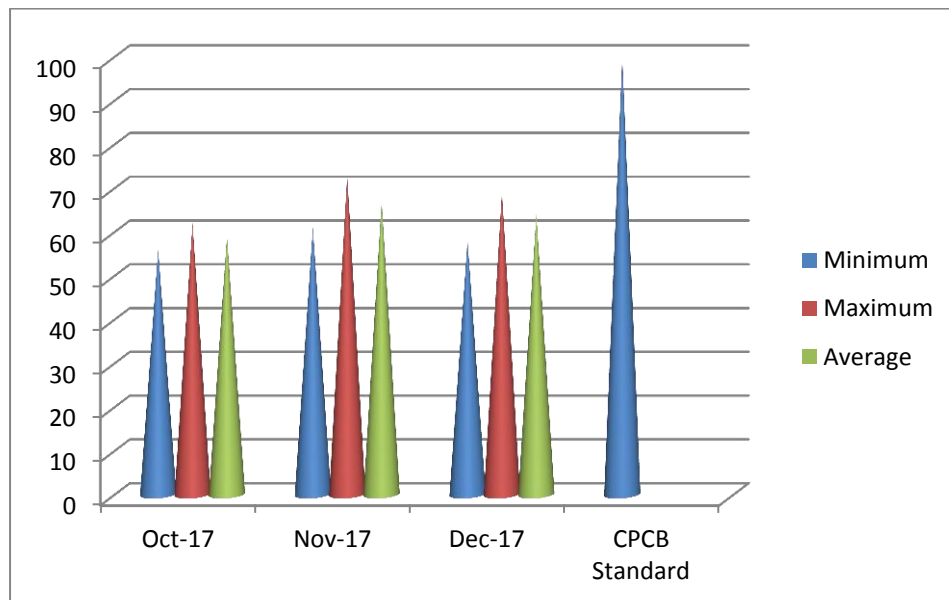
Graph:-Betpani

Virhorepat

For the Month of October-2017 the minimum and maximum concentrations for RSPM were recorded as $56\mu\text{g}/\text{m}^3$ and $62\mu\text{g}/\text{m}^3$ respectively and average concentration of $59\mu\text{g}/\text{m}^3$.

For the Month of November-2017 the minimum and maximum concentrations for RSPM were recorded as $61\mu\text{g}/\text{m}^3$ and $73\mu\text{g}/\text{m}^3$ respectively and average concentration of $67\mu\text{g}/\text{m}^3$.

For the Month of December-2017 the minimum and maximum concentrations for RSPM were recorded as $58\mu\text{g}/\text{m}^3$ and $69\mu\text{g}/\text{m}^3$ respectively and average concentration of $64\mu\text{g}/\text{m}^3$.



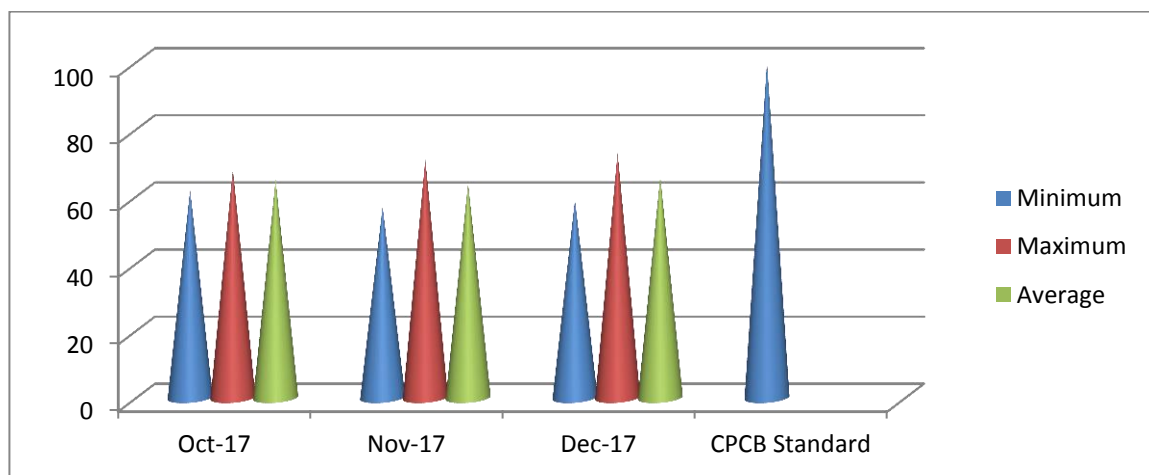
Graph:- Virhorepat

Tatijharia Village/Nr.Weigh Bridge

For the Month of October-2017 the minimum and maximum concentrations for RSPM were recorded as $62\mu\text{g}/\text{m}^3$ and $68\mu\text{g}/\text{m}^3$ respectively and average concentration of $65\mu\text{g}/\text{m}^3$.

For the Month of November-2017 the minimum and maximum concentrations for RSPM were recorded as $57\mu\text{g}/\text{m}^3$ and $71\mu\text{g}/\text{m}^3$ respectively and average concentration of $64\mu\text{g}/\text{m}^3$.

For the Month of December-2017 the minimum and maximum concentrations for RSPM were recorded as $59\mu\text{g}/\text{m}^3$ and $73\mu\text{g}/\text{m}^3$ respectively and average concentration of $66\mu\text{g}/\text{m}^3$.



Graph:-Tatijharia Village/Nr.Weigh Bridge

2.1 Fugitive Emission (Buffer Zone):

2.1.1 Presentation of Results.

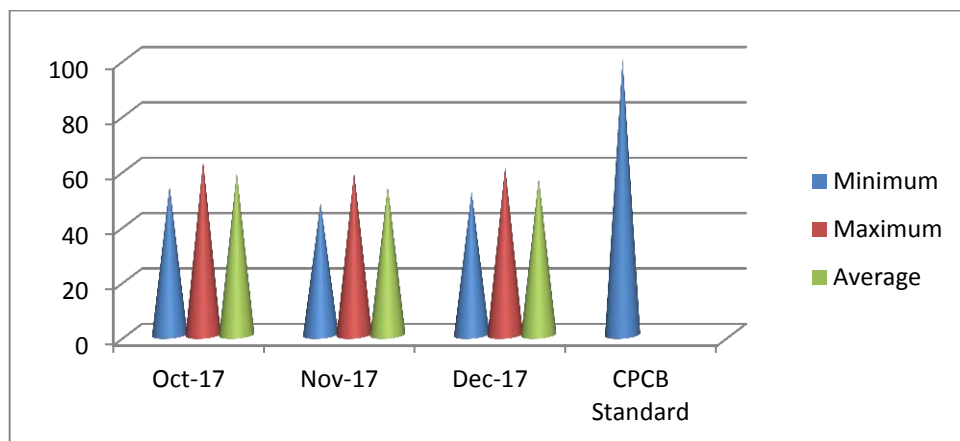
The summary of Statistical Analysis of RSPM results for the month of October-November-December-2017 are presented in detail in **Table 7**. 98th percentile; maximum, minimum and average values etc. have been computed from the collected raw data for all the Fugitive emission monitoring station.

Kutku Village / Nr.V.T.Center

For the Month of October-2017 the minimum and maximum concentrations for RSPM were recorded as 54µg/m³ and 63µg/m³ respectively and average concentration of 59µg/m³.

For the Month of November-2017 the minimum and maximum concentrations for RSPM were recorded as 48µg/m³ and 59µg/m³ respectively and average concentration of 54µg/m³.

For the Month of December-2017 the minimum and maximum concentrations for RSPM were recorded as 52µg/m³ and 61µg/m³ respectively and average concentration of 57µg/m³.



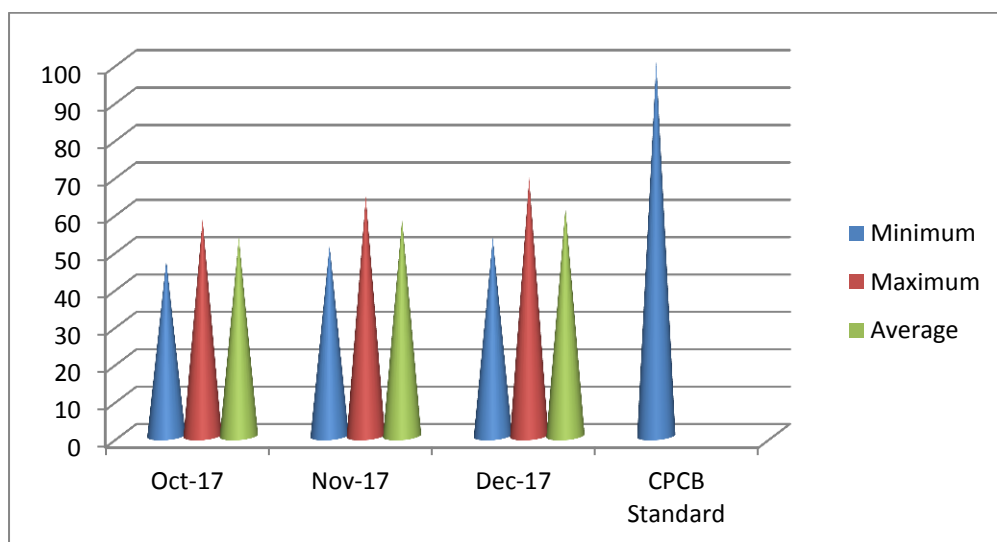
Graph:-Kutku Village / Nr.V.T.Center

Sairaidh Campus

For the Month of October-2017 the minimum and maximum concentrations for RSPM were recorded as $47\mu\text{g}/\text{m}^3$ and $58\mu\text{g}/\text{m}^3$ respectively and average concentration of $53\mu\text{g}/\text{m}^3$.

For the Month of November-2017 the minimum and maximum concentrations for RSPM were recorded as $51\mu\text{g}/\text{m}^3$ and $64\mu\text{g}/\text{m}^3$ respectively and average concentration of $58\mu\text{g}/\text{m}^3$.

For the Month of December-2017 the minimum and maximum concentrations for RSPM were recorded as $53\mu\text{g}/\text{m}^3$ and $69\mu\text{g}/\text{m}^3$ respectively and average concentration of $61\mu\text{g}/\text{m}^3$.



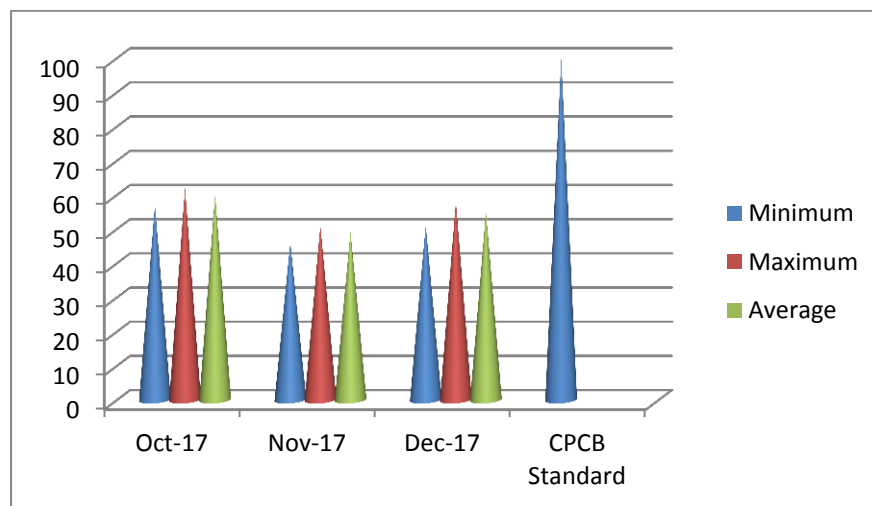
Graph:-Sairaidh Campus

Rajendrapur / Nr.Mining Area

For the Month of October-2017 the minimum and maximum concentrations for RSPM were recorded as 57µg/m³ and 62µg/m³ respectively and average concentration of 60µg/m³.

For the Month of November-2017 the minimum and maximum concentrations for RSPM were recorded as 46µg/m³ and 51µg/m³ respectively and average concentration of 49µg/m³.

For the Month of December-2017 the minimum and maximum concentrations for RSPM were recorded as 51µg/m³ and 58µg/m³ respectively and average concentration of 55µg/m³.



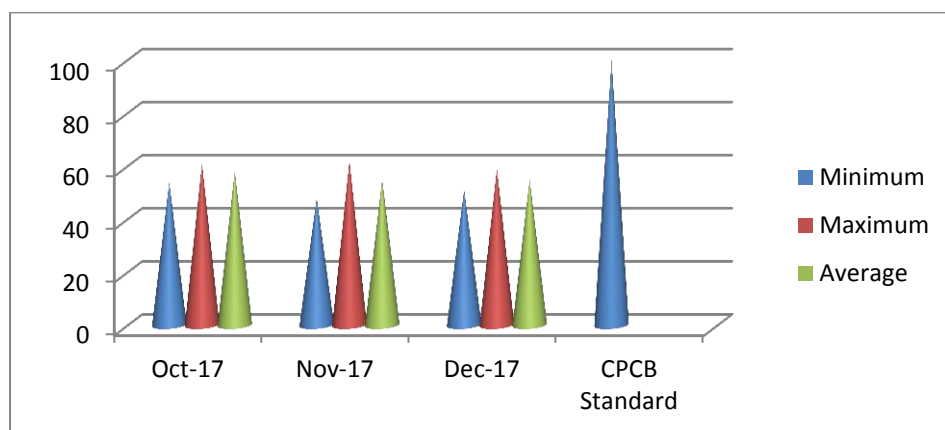
Graph:-Rajendrapur / Nr.Mining Area

Dumerkholi / Nr.Mining Area

For the Month of October-2017 the minimum and maximum concentrations for RSPM were recorded as $54\mu\text{g}/\text{m}^3$ and $61\mu\text{g}/\text{m}^3$ respectively and average concentration of $58\mu\text{g}/\text{m}^3$.

For the Month of November-2017 the minimum and maximum concentrations for RSPM were recorded as $48\mu\text{g}/\text{m}^3$ and $62\mu\text{g}/\text{m}^3$ respectively and average concentration of $55\mu\text{g}/\text{m}^3$.

For the Month of December-2017 the minimum and maximum concentrations for RSPM were recorded as $51\mu\text{g}/\text{m}^3$ and $59\mu\text{g}/\text{m}^3$ respectively and average concentration of $55\mu\text{g}/\text{m}^3$.



Graph:- Dumerkholi / Nr.Mining Area

Table 8
Statistical analysis of PM 2.5

Unit: $\mu\text{g}/\text{m}^3$

Location	Month & Year	Min.	Max.	A.M.	G.M.	98%
Nr.Mining Area	January-2018	16	24	20	20	24
	February-2018	18	27	23	23	27
	March-2018	21	31	26	26	31
CPCB Standard		60 $\mu\text{g}/\text{m}^3$ (24 hrs)				

Note: - All the Values are in CPCB Limit

Conclusion:-The Average Concentration of PM_{2.5} within Tatijharia Lease during this period (Oct-Nov-Dec-2017) is $24\mu\text{g}/\text{m}^3$ and it is within permissible limits as per CPCB Standard.

Month-wise Summary of Statistical Analysis of PM_{2.5}

2.2 Presentation of Results.

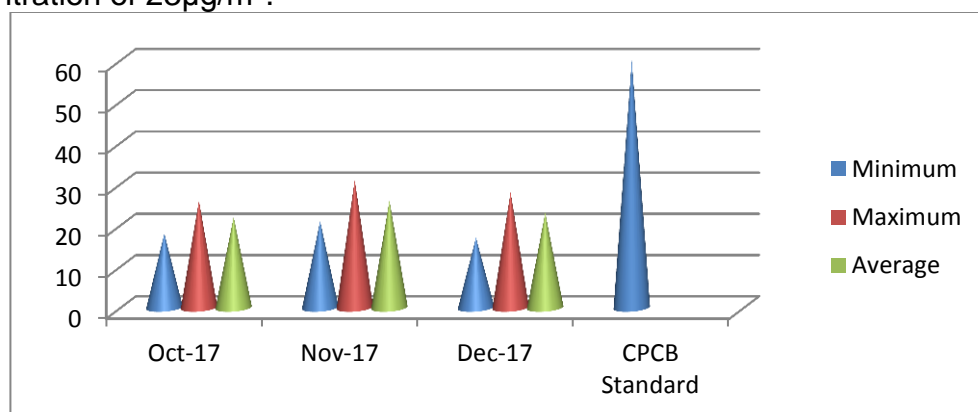
The summary of Statistical Analysis of PM_{2.5} results for the month of October-November-December-2017 are presented in detail in **Table 8**. 98th percentile; maximum, minimum and average values etc. have been computed from the collected raw data.

Nr. Mining Area

For the Month of October-2017 the minimum and maximum concentrations for PM_{2.5} were recorded as $18\mu\text{g}/\text{m}^3$ and $26\mu\text{g}/\text{m}^3$ respectively and average concentration of $22\mu\text{g}/\text{m}^3$.

For the Month of November-2017 the minimum and maximum concentrations for PM_{2.5} were recorded as $21\mu\text{g}/\text{m}^3$ and $31\mu\text{g}/\text{m}^3$ respectively and average concentration of $26\mu\text{g}/\text{m}^3$.

For the Month of December-2017 the minimum and maximum concentrations for PM_{2.5} were recorded as $17\mu\text{g}/\text{m}^3$ and $28\mu\text{g}/\text{m}^3$ respectively and average concentration of $23\mu\text{g}/\text{m}^3$.



Graph :- Nr. Mining Area



Table 9
Statistical Analysis of SO₂

Unit: µg/m³

Location	Month & Year	Min.	Max.	A.M.	G.M.	98%
Fugitive Emission (Core Zone):-						
Piprapat/Nr.Mining Area	January-2018	12	15	14	14	15
	February-2018	14	17	16	16	17
	March-2018	9	11	10	10	11
Betpani	January-2018	8	10	9	9	10
	February-2018	11	13	12	12	13
	March-2018	10	13	12	12	13
Virhorepat	January-2018	9	12	11	11	12
	February-2018	10	13	12	12	13
	March-2018	9	12	11	11	12
Tatijharia Village/Nr.Weigh Bridge	January-2018	11	14	13	13	14
	February-2018	8	10	9	9	10
	March-2018	10	13	12	12	13
Buffer Zone :-						
Kutku Village/ Nr.V.T.Center	January-2018	6	9	8	8	9
	February-2018	7	11	9	9	11
	March-2018	6	8	7	7	8
Sairaidh Campus	January-2018	7	9	8	8	9
	February-2018	6	8	7	7	8
	March-2018	7	11	9	9	11
Rajendrapur/ Nr.Mining Area	January-2018	8	12	10	10	12
	February-2018	7	11	9	9	11
	March-2018	8	12	10	10	12
Dumerkholi/ Nr.Mining Area	January-2018	6	9	8	8	9
	February-2018	7	13	10	10	13
	March-2018	6	8	7	7	8
CPCB Standard		80 µg/m³ (24 hrs)				

Conclusion: (A)

- 1) **Piprapat /Nr.Mining Lease Area Core Zone:** For the Months of Oct-Nov-Dec-2017 Average of SO₂ is 13 µg/m³.
- 2) **Betpani Lease Area Core Zone:** For the Months of Oct-Nov-Dec-2017 Average of SO₂ is 11 µg/m³.
- 3) **Virhorepat Lease Area Core Zone:** For the Months of Oct-Nov-Dec-2017 Average of SO₂ is 10 µg/m³.
- 4) **Tatijharia Village/Nr.Weigh Bridge Lease Area Core Zone :** For the Months of Oct-Nov-Dec-2017 Average of SO₂ is 11 µg/m³.
 The Average Concentration of SO₂ within the Core Zone of Tatijharia Lease during this period (Oct-Nov-Dec-2017) is 12µg/m³ and it is within permissible limits as per CPCB Standard.

Conclusion: (B)

1. **Kutku Village/ Nr.V.T.Center Lease Area Buffer Zone:-** For the Months of Oct-Nov-Dec-2017 Average of SO₂ is 8 µg/m³.
2. **Sairaidh Campus Lease Area Buffer Zone:-** For the Months of Oct-Nov-Dec-2017 Average of SO₂ is 9 µg/m³.
3. **Rajendrapur/ Nr.Mining Lease Area Buffer Zone:-** For the Months of Oct-Nov-Dec-2017 Average of SO₂ is 9µg/m³.

4. Dumerkholi/ Nr.Mining Lease Area Buffer Zone:-For the Months of Oct-Nov-Dec-2017 Average of SO₂ is 9µg/m³.
The Average Concentration of SO₂ within the Buffer Zone of Tatijharia Lease during this period (Oct-Nov-Dec-2017) is 9 µg/m³ and it is within permissible limits as per CPCB Standard.

Month-wise Summary of Statistical Analysis of SO₂

2.3 Fugitive Emission (Core Zone):-

2.3.1 Presentation of Results.

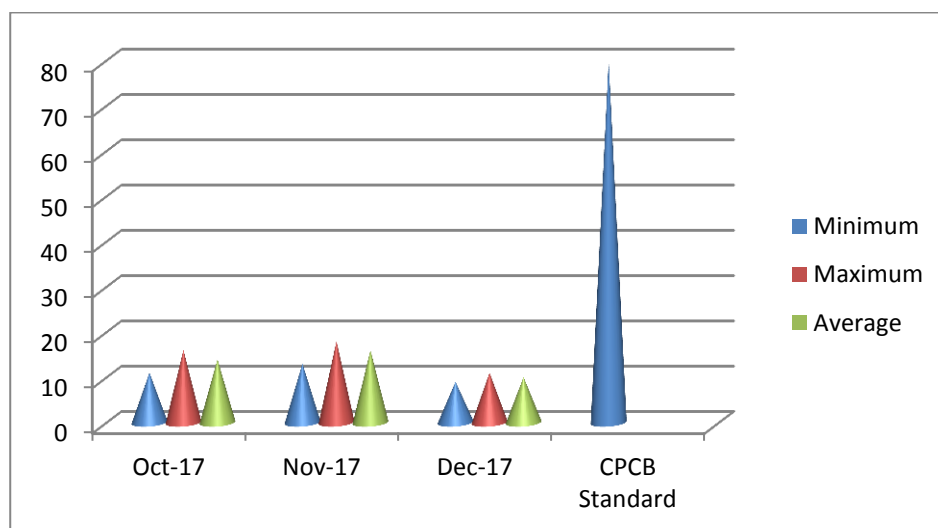
The summary of Statistical Analysis of SO₂ results for the month of January-February-March-2018 are presented in detail in **Table 9**. 98th percentile; maximum, minimum and average values etc. have been computed from the collected raw data for all the Fugitive emission monitoring station.

Piprapat / Nr.Mining Area

For the Month of October-2017 the minimum and maximum concentrations for SO₂ were recorded as 11µg/m³ and 16µg/m³ respectively and average concentration of 14µg/m³.

For the Month of November-2017 the minimum and maximum concentrations for SO₂ were recorded as 13µg/m³ and 18µg/m³ respectively and average concentration of 16µg/m³.

For the Month of December-2017 the minimum and maximum concentrations for SO₂ were recorded as 9µg/m³ and 11µg/m³ respectively and average concentration of 10µg/m³.



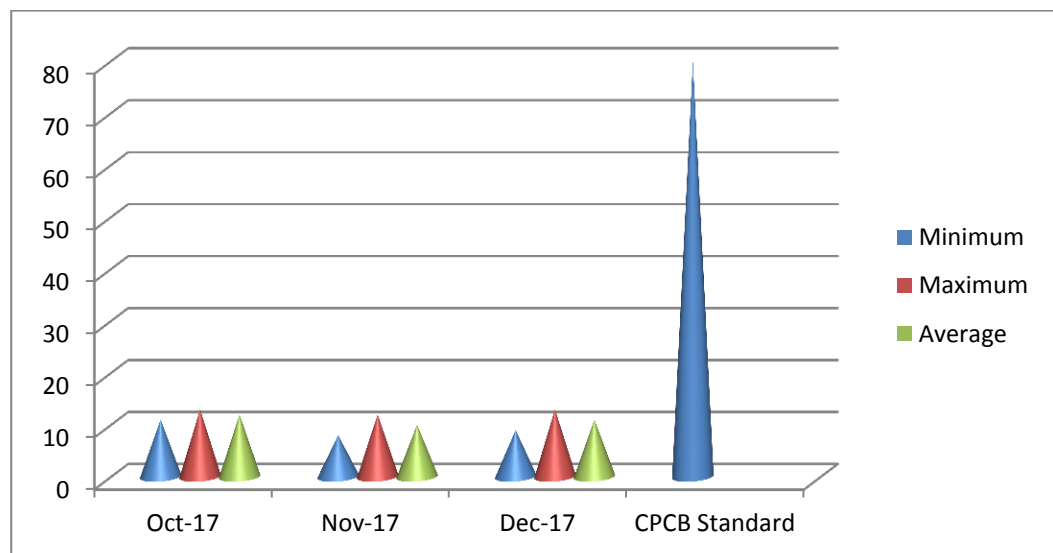
Graph :- Piprapat / Nr.Mining Area

Betpani

For the Month of October-2017 the minimum and maximum concentrations for SO₂ were recorded as 11µg/m³ and 13µg/m³ respectively and average concentration of 12µg/m³.

For the Month of November-2017 the minimum and maximum concentrations for SO₂ were recorded as 8µg/m³ and 12µg/m³ respectively and average concentration of 10µg/m³.

For the Month of December-2017 the minimum and maximum concentrations for SO₂ were recorded as 9µg/m³ and 13µg/m³ respectively and average concentration of 11µg/m³.



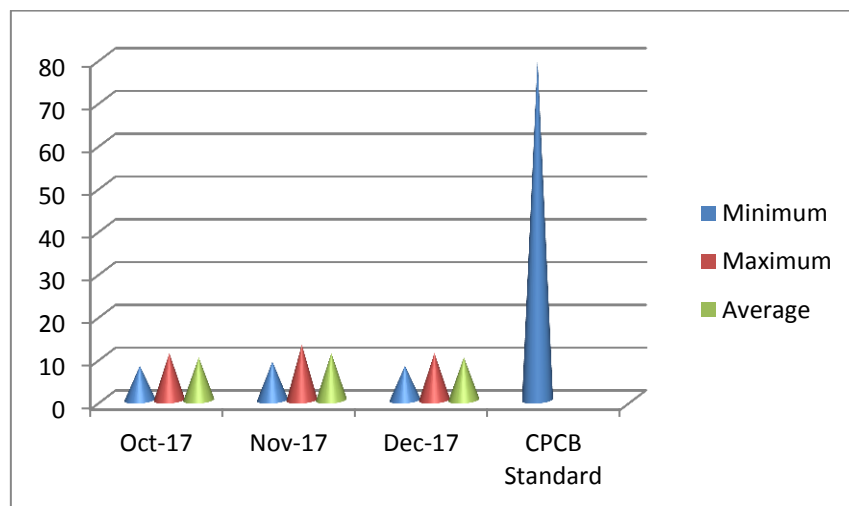
Graph:-Betpani

Virhorepat

For the Month of October-2017 the minimum and maximum concentrations for SO₂ were recorded as 8µg/m³ and 11µg/m³ respectively and average concentration of 10µg/m³.

For the Month of November-2017 the minimum and maximum concentrations for SO₂ were recorded as 9µg/m³ and 13µg/m³ respectively and average concentration of 11µg/m³.

For the Month of December-2017 the minimum and maximum concentrations for SO₂ were recorded as 8µg/m³ and 11µg/m³ respectively and average concentration of 10µg/m³.



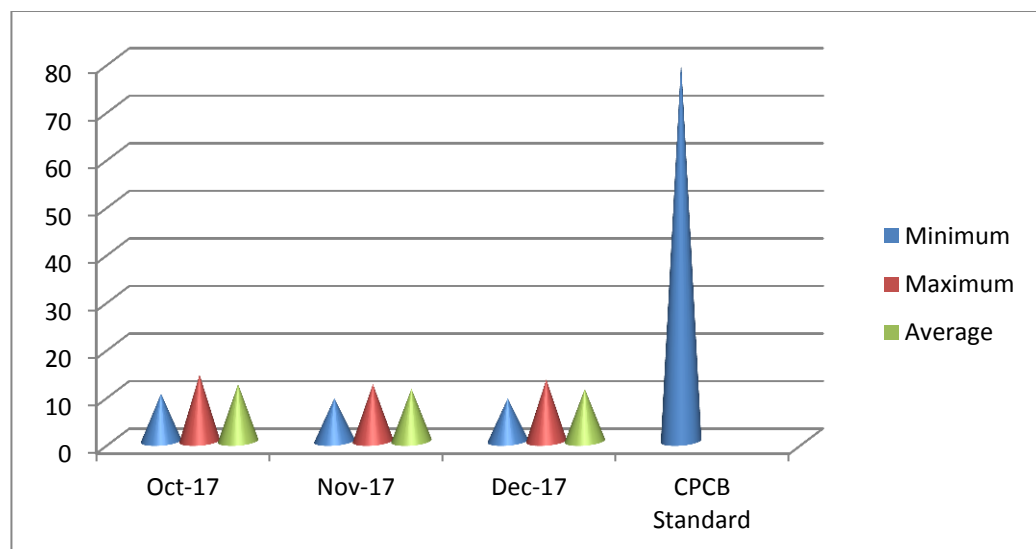
Graph:-Virhorepat

Tatijharia Village/Nr.Weigh Bridge

For the Month of October-2017 the minimum and maximum concentrations for SO₂ were recorded as 10µg/m³ and 14µg/m³ respectively and average concentration of 12µg/m³.

For the Month of November-2017 the minimum and maximum concentrations for SO₂ were recorded as 9µg/m³ and 12µg/m³ respectively and average concentration of 11µg/m³.

For the Month of December-2017 the minimum and maximum concentrations for SO₂ were recorded as 9µg/m³ and 13µg/m³ respectively and average concentration of 11µg/m³.



Graph:-Tatijharia Village/Nr.Weigh Bridge



2.4 Fugitive Emission (Buffer Zone):-

2.4.1 Presentation of Results.

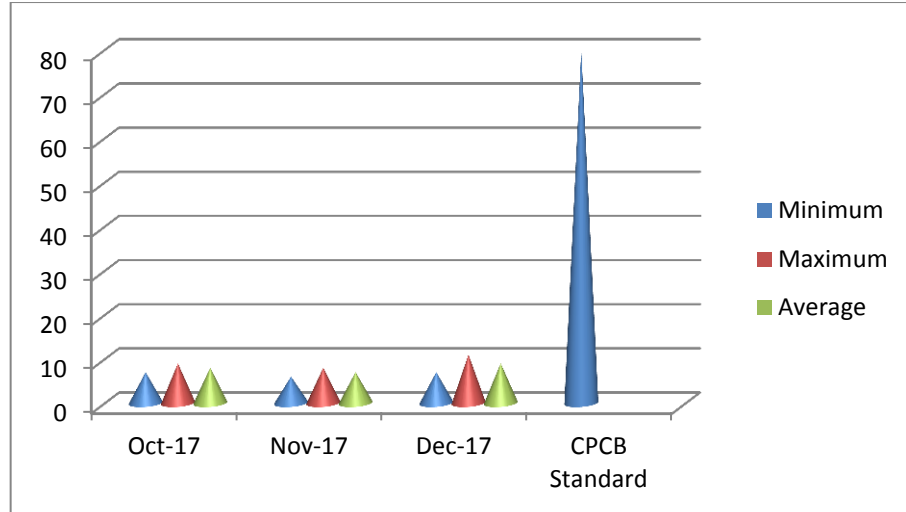
The summary of Statistical Analysis of SO₂ results for the month of October-November-December-2017 are presented in detail in **Table 9**. 98th percentile; maximum, minimum and average values etc. have been computed from the collected raw data for all the Fugitive emission monitoring station.

Kutku Village / Nr.V.T.Center

For the Month of October-2017 the minimum and maximum concentrations for SO₂ were recorded as 7µg/m³ and 9µg/m³ respectively and average concentration of 8µg/m³.

For the Month of November-2017 the minimum and maximum concentrations for SO₂ were recorded as 6µg/m³ and 8µg/m³ respectively and average concentration of 7µg/m³.

For the Month of December-2017 the minimum and maximum concentrations for SO₂ were recorded as 7µg/m³ and 11µg/m³ respectively and average concentration of 9µg/m³.



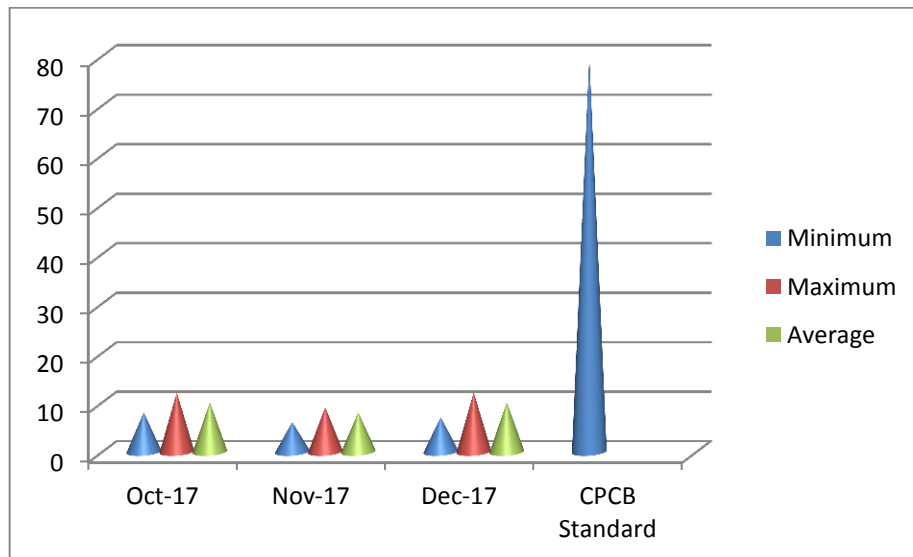
Graph:-Kutku Village / Nr.V.T.Center

Sairaidh Campus

For the Month of October-2017 the minimum and maximum concentrations for SO_2 were recorded as $8\mu\text{g}/\text{m}^3$ and $12\mu\text{g}/\text{m}^3$ respectively and average concentration of $10\mu\text{g}/\text{m}^3$.

For the Month of November-2017 the minimum and maximum concentrations for SO_2 were recorded as $6\mu\text{g}/\text{m}^3$ and $9\mu\text{g}/\text{m}^3$ respectively and average concentration of $8\mu\text{g}/\text{m}^3$.

For the Month of December-2017 the minimum and maximum concentrations for SO_2 were recorded as $7\mu\text{g}/\text{m}^3$ and $12\mu\text{g}/\text{m}^3$ respectively and average concentration of $10\mu\text{g}/\text{m}^3$.



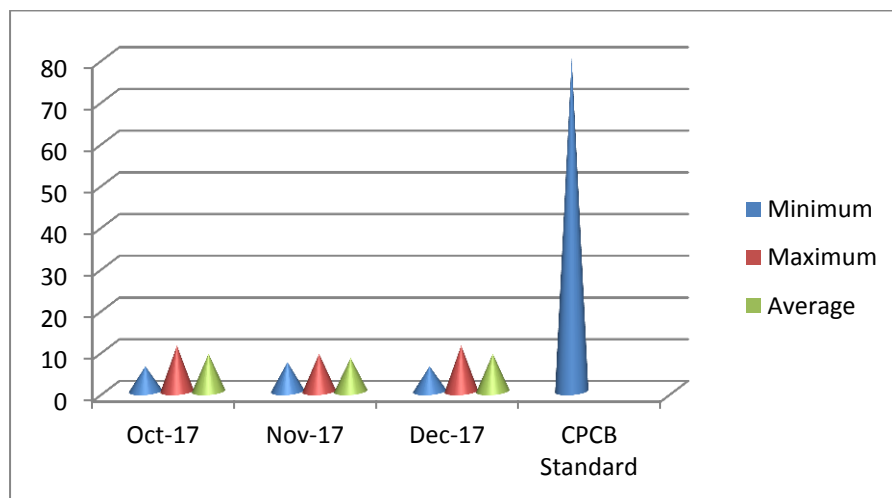
Graph:-Sairaidh Campus

Rajendrapur / Nr.Mining Area

For the Month of October-2017 the minimum and maximum concentrations for SO₂ were recorded as 6µg/m³ and 11µg/m³ respectively and average concentration of 9µg/m³.

For the Month of November-2017 the minimum and maximum concentrations for SO₂ were recorded as 7µg/m³ and 9µg/m³ respectively and average concentration of 8µg/m³.

For the Month of December-2017 the minimum and maximum concentrations for SO₂ were recorded as 6µg/m³ and 11µg/m³ respectively and average concentration of 9µg/m³.



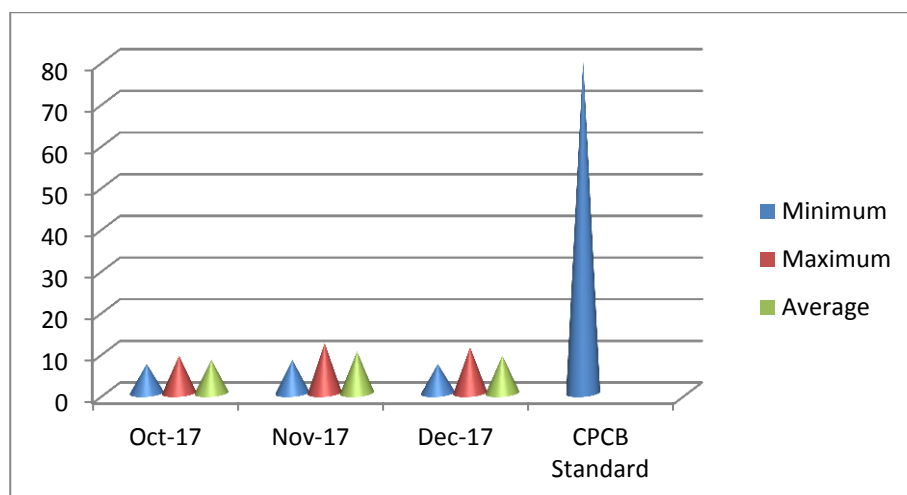
Graph:-Rajendrapur / Nr.Mining Area

Dumerkholi / Nr.Mining Area

For the Month of October-2017 the minimum and maximum concentrations for SO₂ were recorded as 7µg/m³ and 9µg/m³ respectively and average concentration of 8µg/m³.

For the Month of November-2017 the minimum and maximum concentrations for SO₂ were recorded as 8µg/m³ and 12µg/m³ respectively and average concentration of 10µg/m³.

For the Month of December-2017 the minimum and maximum concentrations for SO₂ were recorded as 7µg/m³ and 11µg/m³ respectively and average concentration of 9µg/m³.



Graph:-Dumerkholi / Nr.Mining Area

Table-10
Statistical Analysis of NO_x

Unit: µg/m³

Location	Month & Year	Min.	Max.	A.M.	G.M.	98%
Fugitive Emission (Core Zone):-						
Piprapat/ Nr.Mining Area	January-2018	22	28	25	25	28
	February-2018	25	33	29	29	33
	March-2018	21	25	23	23	25
Betpani	January-2018	28	36	32	32	36
	February-2018	30	38	34	34	38
	March-2018	22	28	25	25	28
Virhorepat	January-2018	26	32	29	29	32
	February-2018	25	35	30	30	35
	March-2018	22	28	25	25	28
Tatijharia Village/Nr.Weigh Bridge	January-2018	23	35	29	29	35
	February-2018	25	32	29	29	32
	March-2018	27	31	29	29	31
Buffer Zone :-						
Kutku Village/ Nr.V.T.Center	January-2018	13	18	16	16	18
	February-2018	14	20	17	17	20
	March-2018	14	19	17	17	19
Sairaidh Campus	January-2018	16	24	20	20	24
	February-2018	14	21	18	18	21
	March-2018	16	21	19	19	21
Rajendrapur/ Nr.Mining Area	January-2018	14	19	17	17	19
	February-2018	16	22	19	19	22
	March-2018	14	18	16	16	18
Dumerkholi/ Nr.Mining Area	January-2018	17	21	19	19	21
	February-2018	16	19	18	18	19



	March-2018	17	23	20	20	
CPCB Standard	80 µg/m³ (24 hrs)					

Conclusion: (A)

- 1. Piprapat /Nr.Mining Lease Area Core Zone:** For the Months of Oct-Nov-Dec-2017 Average of NO_x is 22 µg/m³.
- 2. Betpani Lease Area Core Zone:** For the Months of Oct-Nov-Dec-2017 Average of NO_x is 26 µg/m³.
- 3. Virhorepat Lease Area Core Zone:** For the Months of Oct-Nov-Dec-2017 Average of NO_x is 24 µg/m³.
- 4. Tatijharia Village/Nr.Weigh Bridge Lease Area Core Zone :** For the Months of Oct-Nov-Dec-2017 Average of NO_x is 25 µg/m³.
 The Average Concentration of NO_x within the Core Zone of Tatijharia Lease during this period (Oct-Nov-Dec-2017) is 24 µg/m³ and it is within permissible limits as per CPCB Standard.

Conclusion: (B)

- 1. Kutku Village/ Nr.V.T.Center Lease Area Buffer Zone:-** For the Months of Oct-Nov-Dec-2017 Average of NO_x is 14 µg/m³.
- 2. Sairaidh Campus Lease Area Buffer Zone:-** For the Months of Oct-Nov-Dec-2017 Average of NO_x is 19 µg/m³.
- 3. Rajendrapur/ Nr.Mining Lease Area Buffer Zone:-** For the Months of Oct-Nov-Dec-2017 Average of NO_x is 18 µg/m³.
- 4. Dumerkholi/ Nr.Mining Lease Area Buffer Zone:-** For the Months of Oct-Nov-Dec-2017 Average of NO_x is 17 µg/m³.
 The Average Concentration of NO_x within the Buffer Zone of Tatijharia Lease during this period (Oct-Nov-Dec-2017-2017) is 17 µg/m³ and it is within permissible limits as per CPCB Standard.

Month-wise Summary of Statistical Analysis of NO_x

2.5 Fugitive Emission (Core Zone):-

2.5.1 Presentation of Results.

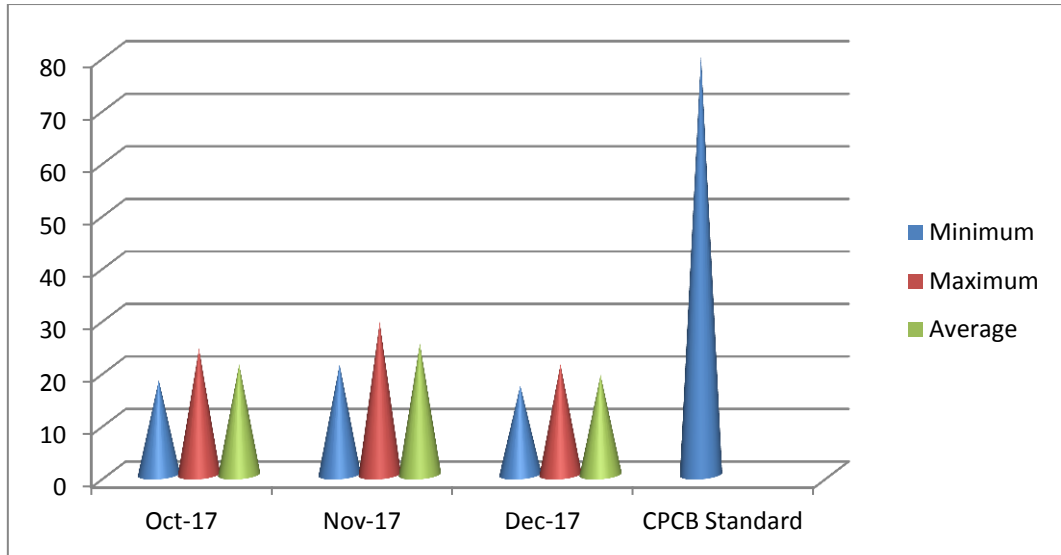
The summary of Statistical Analysis of NO_x results for the month of October-November-December-2017 are presented in detail in **Table 10**. 98th percentile; maximum, minimum and average values etc. have been computed from the collected raw data for all the Fugitive emission monitoring station.

Piprapat / Nr.Mining Area

For the Month of October-2017 the minimum and maximum concentrations for NO_x were recorded as 18µg/m³ and 24µg/m³ respectively and average concentration of 21µg/m³.

For the Month of November-2017 the minimum and maximum concentrations for NO_x were recorded as 21µg/m³ and 29µg/m³ respectively and average concentration of 25µg/m³.

For the Month of December-2017 the minimum and maximum concentrations for NO_x were recorded as 17µg/m³ and 21µg/m³ respectively and average concentration of 19µg/m³.



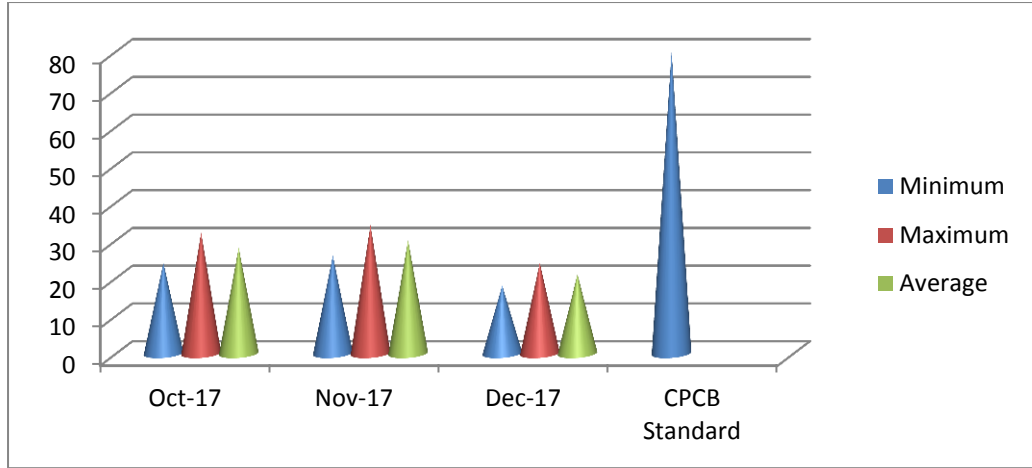
Graph :- Piprapat / Nr.Mining Area

Betpani

For the Month of October-2017 the minimum and maximum concentrations for NO_x were recorded as 24µg/m³ and 32µg/m³ respectively and average concentration of 28µg/m³.

For the Month of November-2017 the minimum and maximum concentrations for NO_x were recorded as 26µg/m³ and 34µg/m³ respectively and average concentration of 30µg/m³.

For the Month of December-2017 the minimum and maximum concentrations for NO_x were recorded as 18µg/m³ and 24µg/m³ respectively and average concentration of 21µg/m³.



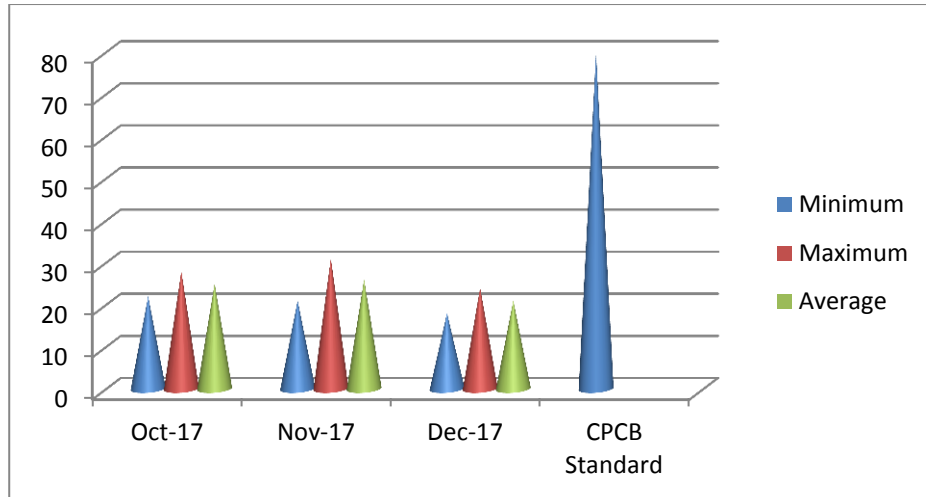
Graph:-Betpani

Virhorepat

For the Month of October-2017 the minimum and maximum concentrations for NO_x were recorded as 22µg/m³ and 28µg/m³ respectively and average concentration of 25µg/m³.

For the Month of November-2017 the minimum and maximum concentrations for NO_x were recorded as 21µg/m³ and 31µg/m³ respectively and average concentration of 26µg/m³.

For the Month of December-2017 the minimum and maximum concentrations for NO_x were recorded as 18µg/m³ and 24µg/m³ respectively and average concentration of 21µg/m³.



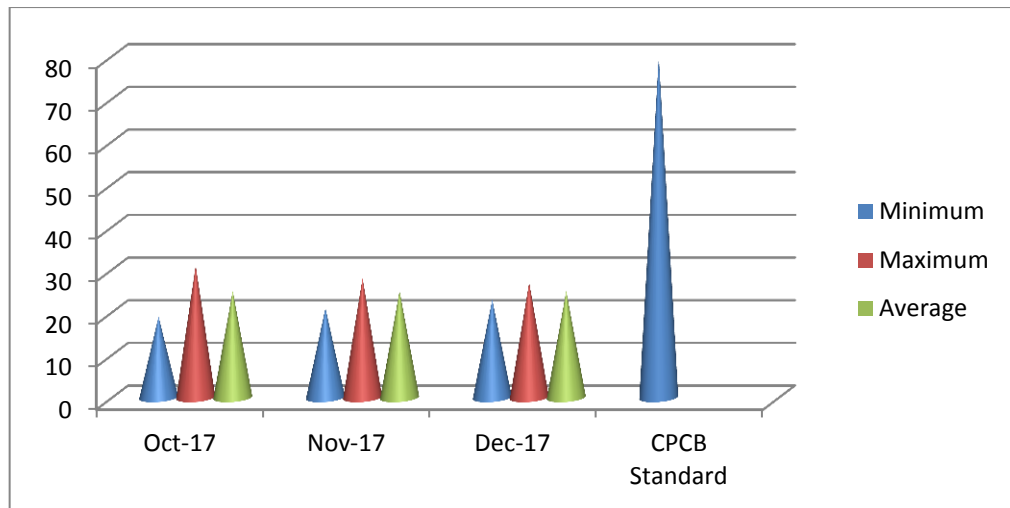
Graph:-Virhorepat

Tatijharia Village/Nr.Weigh Bridge

For the Month of October-2017 the minimum and maximum concentrations for NO_x were recorded as 19µg/m³ and 31µg/m³ respectively and average concentration of 25µg/m³.

For the Month of November-2017 the minimum and maximum concentrations for NO_x were recorded as 21µg/m³ and 28µg/m³ respectively and average concentration of 25µg/m³.

For the Month of December-2017 the minimum and maximum concentrations for NO_x were recorded as 23µg/m³ and 27µg/m³ respectively and average concentration of 25µg/m³.



Graph:-Tatijharia Village/Nr.Weigh Bridge

2.6 Fugitive Emission (Buffer Zone):-

2.6.1 Presentation of Results.

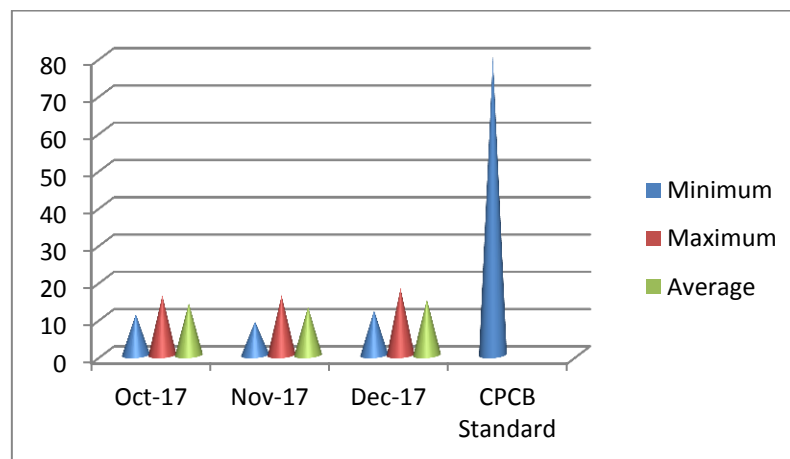
The summary of Statistical Analysis of NO_x results for the month of October-2017 to December-2017 are presented in detail in **Table10**. 98th percentile; maximum, minimum and average values etc. have been computed from the collected raw data for all the Fugitive emission monitoring station.

Kutku Village / Nr.V.T.Center

For the Month of October-2017 the minimum and maximum concentrations for NO_x were recorded as 11µg/m³ and 16µg/m³ respectively and average concentration of 14µg/m³.

For the Month of November-2017 the minimum and maximum concentrations for NO_x were recorded as 9µg/m³ and 16µg/m³ respectively and average concentration of 13µg/m³.

For the Month of December-2017 the minimum and maximum concentrations for NO_x were recorded as 12µg/m³ and 18µg/m³ respectively and average concentration of 15µg/m³.



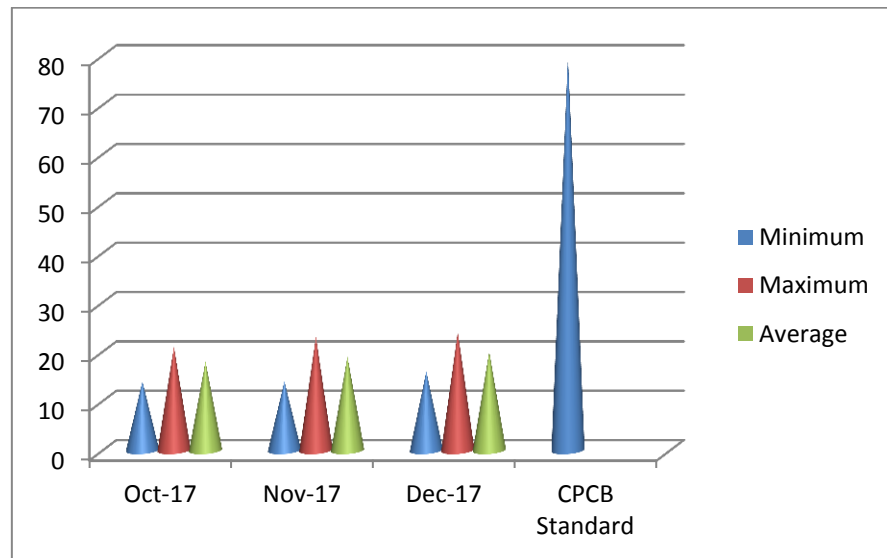
Graph:-Kutku Village / Nr.V.T.Center

Sairaidh Campus

For the Month of October-2017 the minimum and maximum concentrations for NO_x were recorded as 14µg/m³ and 21µg/m³ respectively and average concentration of 18µg/m³.

For the Month of November-2017 the minimum and maximum concentrations for NO_x were recorded as 14µg/m³ and 23µg/m³ respectively and average concentration of 19µg/m³.

For the Month of December-2017 the minimum and maximum concentrations for NO_x were recorded as 16µg/m³ and 24µg/m³ respectively and average concentration of 20µg/m³.



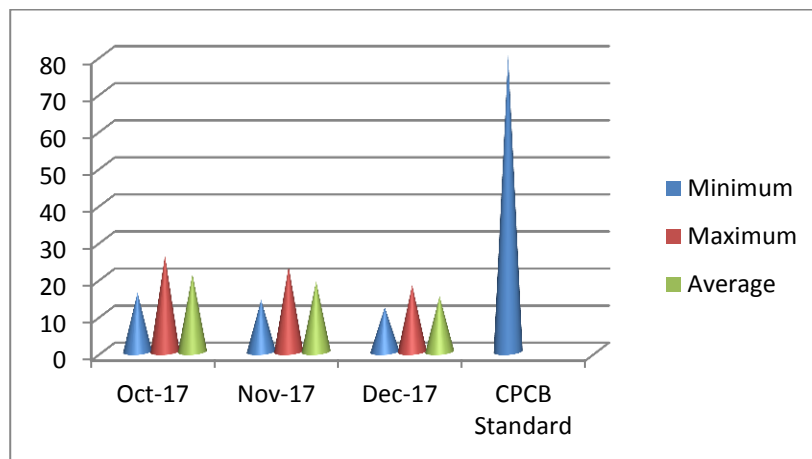
Graph:-Sairaidh Campus

Rajendrapur / Nr.Mining Area

For the Month of October-2017 the minimum and maximum concentrations for NO_x were recorded as 16µg/m³ and 26µg/m³ respectively and average concentration of 21µg/m³.

For the Month of November-2017 the minimum and maximum concentrations for NO_x were recorded as 14µg/m³ and 23µg/m³ respectively and average concentration of 19µg/m³.

For the Month of December-2017 the minimum and maximum concentrations for NO_x were recorded as 12µg/m³ and 18µg/m³ respectively and average concentration of 15µg/m³.



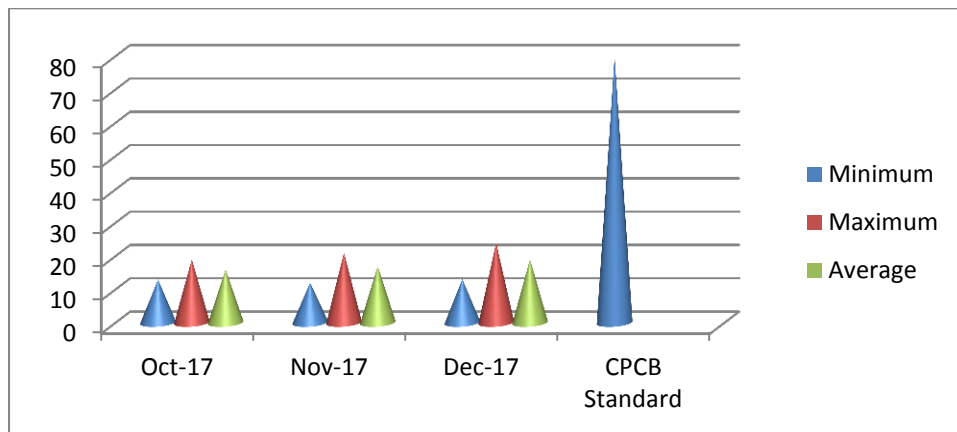
Graph:-Rajendrapur / Nr.Mining Area

Dumerkholi / Nr.Mining Area

For the Month of October-2017 the minimum and maximum concentrations for NO_x were recorded as 13µg/m³ and 19µg/m³ respectively and average concentration of 16µg/m³.

For the Month of November-2017 the minimum and maximum concentrations for NO_x were recorded as 12µg/m³ and 21µg/m³ respectively and average concentration of 17µg/m³.

For the Month of December-2017 the minimum and maximum concentrations for NO_x were recorded as 13µg/m³ and 24µg/m³ respectively and average concentration of 19µg/m³.



Graph:-Dumerkholi / Nr.Mining Area



Table 11
Statistical Analysis of Pb

Unit: $\mu\text{g}/\text{m}^3$

Location	Month & Year	Min.	Max.	A.M.	G.M.	98%ile
Fugitive Emission (Core Zone):-						
Piprapat/ Nr.Mining Area	January-2018	0.020	0.046	0.033	0.033	0.045
	February-2018	0.025	0.055	0.040	0.040	0.054
	March-2018	0.022	0.034	0.028	0.028	0.034
Betpani	January-2018	0.028	0.054	0.041	0.041	0.053
	February-2018	0.025	0.046	0.036	0.036	0.046
	March-2018	0.028	0.045	0.037	0.037	0.045
Virhorepat	January-2018	0.045	0.059	0.052	0.052	0.059
	February-2018	0.042	0.054	0.048	0.048	0.054
	March-2018	0.041	0.049	0.045	0.045	0.049
Tatijharia Village/Nr.Weigh Bridge	January-2018	0.028	0.036	0.032	0.032	0.036
	February-2018	0.022	0.033	0.028	0.028	0.033
	March-2018	0.025	0.039	0.032	0.032	0.039
CPCB Standard		1.0 $\mu\text{g}/\text{m}^3$ (24 hrs)				

Location	Month & Year	Min.	Max.	A.M.	G.M.	98%ile
Buffer Zone :-						
Kutku Village/ Nr.V.T.Center	January-2018	ND	ND	ND	ND	ND
	February-2018	ND	ND	ND	ND	ND
	March-2018	ND	ND	ND	ND	ND
Sairaidh Campus	January-2018	ND	ND	ND	ND	ND
	February-2018	ND	ND	ND	ND	ND
	March-2018	ND	ND	ND	ND	ND
Rajendrapur/ Nr.Mining Area	January-2018	ND	ND	ND	ND	ND
	February-2018	ND	ND	ND	ND	ND
	March-2018	ND	ND	ND	ND	ND
Dumerkholi/ Nr.Mining Area	January-2018	ND	ND	ND	ND	ND
	February-2018	ND	ND	ND	ND	ND
	March-2018	ND	ND	ND	ND	ND
CPCB Standard		1.0 $\mu\text{g}/\text{m}^3$ (24 hrs)				

Conclusion: (A)

The Average concentration of Pb within the Core Zone of Tatijharia Lease during this period (October-November-December-2017) is $0.052\mu\text{g}/\text{m}^3$ and it is within permissible limits as per CPCB Standard.



Conclusion: (B)

The Average Concentration of Pb within the Buffer Zone of Tatijharia Lease during this period (October-November-December-2017) is not detected and it is within permissible limits as per CPCB Standard.

Table 12
Statistical Analysis of Hg

Unit: $\mu\text{g}/\text{m}^3$

Location	Month & Year	Min.	Max.	A.M.	G.M.	98%
Fugitive Emission (Core Zone):-						
Piprapat/ Nr.Mining Area	January-2018	ND	ND	ND	ND	ND
	February-2018	ND	ND	ND	ND	ND
	March-2018	ND	ND	ND	ND	ND
Betpani	January-2018	ND	ND	ND	ND	ND
	February-2018	ND	ND	ND	ND	ND
	March-2018	ND	ND	ND	ND	ND
Virhorepat	January-2018	ND	ND	ND	ND	ND
	February-2018	ND	ND	ND	ND	ND
	March-2018	ND	ND	ND	ND	ND
Tatijharia Village/Nr.Weigh Bridge	January-2018	ND	ND	ND	ND	ND
	February-2018	ND	ND	ND	ND	ND
	March-2018	ND	ND	ND	ND	ND
Buffer Zone :-						
Kutku Village/ Nr.V.T.Center	January-2018	ND	ND	ND	ND	ND
	February-2018	ND	ND	ND	ND	ND
	March-2018	ND	ND	ND	ND	ND
Sairaidh Campus	January-2018	ND	ND	ND	ND	ND
	February-2018	ND	ND	ND	ND	ND
	March-2018	ND	ND	ND	ND	ND
Rajendrapur/ Nr.Mining Area	January-2018	ND	ND	ND	ND	ND
	February-2018	ND	ND	ND	ND	ND
	March-2018	ND	ND	ND	ND	ND
Dumerkholi/ Nr.Mining Area	January-2018	ND	ND	ND	ND	ND
	February-2018	ND	ND	ND	ND	ND
	March-2018	ND	ND	ND	ND	ND
CPCB Standard		---				

Conclusion:

The Average Concentration of Pb within the Core Zone and Buffer Zone of Tatijharia Lease during this period (October-November-December-2017) is not detected and it is within permissible limits as per CPCB Standard.



Table 13
Statistical Analysis of As

Unit: ng/m³

Location	Month & Year	Min.	Max.	A.M.	G.M.	98%
Fugitive Emission (Core Zone):-						
Piprapat/ Nr.Mining Area	January-2018	ND	ND	ND	ND	ND
	February-2018	ND	ND	ND	ND	ND
	March-2018	ND	ND	ND	ND	ND
Betpani	January-2018	ND	ND	ND	ND	ND
	February-2018	ND	ND	ND	ND	ND
	March-2018	ND	ND	ND	ND	ND
Virhorepat	January-2018	ND	ND	ND	ND	ND
	February-2018	ND	ND	ND	ND	ND
	March-2018	ND	ND	ND	ND	ND
Tatijharia Village/Nr.Weigh Bridge	January-2018	ND	ND	ND	ND	ND
	February-2018	ND	ND	ND	ND	ND
	March-2018	ND	ND	ND	ND	ND
Buffer Zone :-						
Kutku Village/ Nr.V.T.Center	January-2018	ND	ND	ND	ND	ND
	February-2018	ND	ND	ND	ND	ND
	March-2018	ND	ND	ND	ND	ND
Sairaidh Campus	January-2018	ND	ND	ND	ND	ND
	February-2018	ND	ND	ND	ND	ND
	March-2018	ND	ND	ND	ND	ND
Rajendrapur/ Nr.Mining Area	January-2018	ND	ND	ND	ND	ND
	February-2018	ND	ND	ND	ND	ND
	March-2018	ND	ND	ND	ND	ND
Dumerkholi/ Nr.Mining Area	January-2018	ND	ND	ND	ND	ND
	February-2018	ND	ND	ND	ND	ND
	March-2018	ND	ND	ND	ND	ND
CPCB Standard		06 ng/m³ (Annual)				

Conclusion:



The Average Concentration of As within the Core Zone and Buffer Zone of Tatijharia Lease during this period (October-November-December-2017) is not detected and it is within permissible limits as per CPCB Standard.

Free Silica:-

Sr. No.	Location	Measurement Unit	January 2018		February 2018		March 2018	
			SPM	RSPM	SPM	RSPM	SPM	RSPM
1.	Piprapat/ Near Mining Area	g/100gm	0.26	0.14	0.31	0.18	0.28	0.16

Table 14
Dust fall Rate

Sr. No.	Location	January 2018	February 2018	March 2018	Average
		Rate (MT/km²/month)			
1	Piprapat/Near Mining Area	18.2	21.7	23.9	21.3
2	Tatijharia Village	14.7	16.4	21.7	17.6



Table 15

Noise Level Monitoring

Unit: dB(A)

Sl. No.	Location	January 2018		February 2018		March 2018	
		Day	Night	Day	Night	Day	Night
Core Zone							
1.	Piprapat/Nr.Mining Area	62.9	51.4	58.3	46.1	58.2	41.7
2.	Betpani	56.1	43.9	61.7	47.3	52.7	42.6
3.	Virhorepat	64.7	54.3	59.1	48.7	61.3	52.8
4.	Tatijharia Village/ Nr.Weigh Bridge	61.3	52.8	57.2	38.9	56.1	41.2
Buffer Zone							
5.	Kutku Village/Nr.V.T.Center	46.9	38.2	51.6	41.3	47.1	38.2
6.	Sairaidh Campus	51.6	41.6	48.7	38.1	52.7	43.6
7.	Rajendrapur/Nr.Mining Area	48.3	36.9	51.2	42.8	49.2	37.3
8.	Dumerkholi/Nr.Mining Area	46.7	37.2	48.3	38.7	51.4	43.9

CPCB Standards for Residential Area: 55 (Day time) 45 (Night time)

Industrial Area: 75 (Day time) 70 (Night time)

Table 15-A

HEMM Spot Noise Level Monitoring

Unit: dB(A)

Sl. No.	Location	January 2018			February 2018			March 2018		
		Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.
1.	Piprapat/Nr.Mining Area	61.8	72.7	67.3	64.3	81.4	72.9	68.1	79.2	73.7



2.7 Ground Water Quality:-Most of the villages in the nearby plant area have hand pumps and wells, as most of the residents of these villages make use of this water for drinking and other domestic uses for TABLE NO.16

Table 16
Report on Chemical Examination of Ground Water

Location: GW1: Piprapat/Near Mining Area
(Average of January-February-March-2018)

TEST RESULTS

Sr. No.	Test Parameter	Measurement Unit	Test Method	As per IS 10500 : 2012 (Drinking Water Specification)		Test Result
				Acceptable Limit	*Permissible Limit	
1.	pH value	-	IS 3025 (Part 11)	6.5 to 8.5	No relaxation	7.16 at 25°C
2.	Turbidity	NTU	IS 3025 (Part 10)	1	5	0.7
3.	Colour	Hazen units	IS 3025 (Part 4)	5	15	1
4.	Odour	-	IS 3025 (Part 5)	Agreeable	Agreeable	Agreeable
5.	Taste	-	IS 3025 (Part 8)	Agreeable	Agreeable	Agreeable
6.	Iron (as Fe)	mg/l	IS 3025 (Part 2)	1.0	No relaxation	0.14
7.	Free residual chlorine	mg/l	IS 3025 (Part 26)	Min. 0.2	Min. 1	< 0.1
8.	Total dissolved solids	mg/l	IS 3025 (Part 16)	500	2000	287
9.	Fluoride (as F)	mg/l	IS 3025 (Part 60)	1.0	1.5	0.21
10.	Cyanide (as CN)	mg/l	IS 3025 (Part 27)	0.05	No relaxation	< 0.005
11.	Chloride (as Cl)	mg/l	IS 3025 (Part 32)	250	1000	61.29
12.	Total Alkalinity (as CaCO ₃)	mg/l	IS 3025 (Part 23)	200	600	118.52
13.	Total hardness (as CaCO ₃)	mg/l	IS 3025 (Part 21)	200	600	180.92
14.	Calcium (as Ca)	mg/l	IS 3025 (Part 40)	75	200	57.14
15.	Magnesium (as Mg)	mg/l	IS 3025 (Part 46)	30	100	9.27
16.	Sulphate (as SO ₄)	mg/l	IS 3025 (Part 24)	200	400	31.52
17.	Nitrate (as NO ₃)	mg/l	APHA Method	45	No relaxation	< 2
18.	Copper (as Cu)	mg/l	IS 3025 (Part 2)	0.05	1.5	< 0.03
19.	Manganese (as Mn)	mg/l	IS 3025 (Part 2)	0.1	0.3	<0.05
20.	Mercury (as Hg)	mg/l	IS 3025 (Part 2)	0.001	No relaxation	< 0.0005
21.	Cadmium (as Cd)	mg/l	IS 3025 (Part 2)	0.003	No relaxation	< 0.001



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22.	Selenium (as Se)	mg/l	IS 3025 (Part 2)	0.01	No relaxation	< 0.001
23.	Arsenic (as As)	mg/l	IS 3025 (Part 2)	0.01	No relaxation	< 0.01
24.	Aluminium (as Al)	mg/l	IS 3025 (Part 2)	0.03	0.2	< 0.005
25.	Lead (as Pb)	mg/l	IS 3025 (Part 2)	0.01	No relaxation	< 0.001
26.	Zinc (as Zn)	mg/l	IS 3025 (Part 2)	5	15	< 0.1
27.	Nickel (as Ni)	mg/l	IS 3025 (Part 2)	0.02	No relaxation	< 0.01
28.	Total Chromium (as Cr)	mg/l	IS 3025 (Part 2)	0.05	No relaxation	< 0.03
29.	Barium (as Ba)	mg/l	Annexure F of IS 13428	0.7	No relaxation	< 0.01
30.	Ammonia (as N)	mg/l	IS 3025 (Part 34)	0.5	No relaxation	< 0.01
31.	Sulphide (as H ₂ S)	mg/l	IS 3025 (Part 29)	0.05	No relaxation	< 0.03
32.	Chloramines (as Cl ₂)	mg/l	APHA 4500-Cl ₂ G	4.0	No relaxation	< 0.01
33.	Molybdenum (as Mo)	mg/l	IS 3025 (Part 2)	0.07	No relaxation	< 0.001
34.	Silver (as Ag)	mg/l	Annexure J of IS 13428	0.1	No relaxation	< 0.001
35.	Polychlorinated Biphenyls (PCB)	µg/l	USEPA 508	0.5	No relaxation	< 0.03
36.	Boron (as B)	mg/l	IS 3025 (Part 2)	0.5	1.0	< 0.1
37.	Mineral Oil	mg/l	IS 3025 (Part 39)	0.5	No relaxation	< 0.001
38.	Tri Halo Methane					
	a. Bromoform			0.1	No relaxation	Absent
	b. Dibromochloromethane			0.1	No relaxation	Absent
	c. Bromodichloromethane			0.06	No relaxation	Absent
	d. Chloroform			0.2	No relaxation	Absent
39.	Phenolic compounds (as C ₆ H ₅ OH)	mg/l	IS 3025 (Part 43) :1001	0.001	0.002	< 0.001
40.	Anionic detergents (as MBAS)	mg/l	IS 13428:2005 (Annex K)	0.2	1.0	< 0.001
41.	Polynuclear aromatic hydrocarbon (PAH)	µg/l	USEPA : 550	0.1	No relaxation	< 0.03
42.	Total coliform	MPN/100 ml	IS 1622	---	---	<2
43.	<i>Escherichia coli</i>	Per100 ml	IS 1622	Absent	Absent	Absent
44.	Pesticides residues					
i.	Alpha-HCH	µg/l	USEPA 508	0.01		< 0.01
ii.	Beta HCH	µg/l	USEPA 508	0.04		< 0.03
iii.	Delta- HCH	µg/l	USEPA 508	0.04		< 0.03
iv.	Alachlor	µg/l	USEPA 508	20		< 0.03
v.	Aldrin / Dieldrin	µg/l	USEPA 508	0.03		< 0.03
vi.	Atrazine	µg/l	USEPA 1657	2		< 0.03
vii.	Butachlor	µg/l	USEPA 508	125		< 0.03
viii.	Chlorpyrifos	µg/l	USEPA 1657	30		< 0.03
ix.	DDT and its Isomers	µg/l	USEPA 508	1		< 0.03
x.	Gamma - HCH (Lindane)	µg/l	USEPA 508	2		< 0.03
xi.	2,4 Dichloro-phenoxyacetic acid	µg/l	USEPA 1657	30		< 0.03
xii.	Endosulphan	µg/l	USEPA 508	0.4		< 0.03
xiii.	Ethion	µg/l	USEPA 1657	3		< 0.03
xiv.	Isoproturon	µg/l	USEPA 1657	9		< 0.03
xv.	Malathion	µg/l	USEPA 1657	190		< 0.03
xvi.	Methyl Parathion	µg/l	USEPA 1657	0.3		< 0.03
xvii.	Monocrotophos	µg/l	USEPA 1657	1		< 0.03
xviii.	Phorate	µg/l	USEPA 1657	2		< 0.03

Note: 1. Results relate to tested sample only. 2. Test report should not be reproduced partially. 3. *Permissible limit in the absence of alternate source. 4. 'mg/l' is equivalent to 'ppm' 5. 'µg/l' is equivalent to 'ppb' 6. '<' indicates detection limit of the laboratory. 7. MPN-Most probable number. 8. Results for test no. 7 are not applicable.

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



Table 17

Monthly Report on Chemical Examination of Surface Water
(Nallah Near Mining Area)

S. No.	Parameters	Unit	IS : 2296 Class 'C'	Results
				March-2018
1	pH Value	-	6.5 to 8.5	7.02
2	Total Hardness (CaCO ₃)	mg / l	§	232.36
3	Iron as (Fe)	mg / l	50	21.42
4	Chlorides as (Cl)	mg / l	600	324.58
5	Electrical Conductivity	µS/cm	§	518
6	Total Dissolved Solids (TDS)	mg / l	1500	304
7	Calcium as (Ca)	mg / l	§	73.92
8	Magnesium as (Mg)	mg / l	§	11.58
9	Sulphate as (SO ₄)	mg / l	400	131.27
10	Nitrates as (NO ₃)	mg / l	§	9.4
11	Fluoride as (F)	mg / l	0.5	0.31
12	Alkalinity	mg / l	§	58.42
13	Chemical Oxygen demand (COD)	mg / l	§	16.2
14	BOD at 27°C for 3days	mg / l	3	4.9
15	Total Suspended Solid (TSS)	mg / l	§	13



\$: Limits not specified

Table 18
Report on Soil Analysis, Tatijharia
Date of collection: March-2018.
Sample Location: Piprapat/Nr.Mining Area

Sr. No	Test Parameters	Measurement Unit	Results
1	pH	-	6.82 at 25°C
2	Electrical Conductivity at 25°C	µs/cm	308
3	Texture	-	Clay Loam
4	Sand	%	43.5
5	Silt	%	26.9
6	Clay	%	29.6
7	Bulk Density	g/cc	1.14
8	Porosity	%	13
9	Water Holding Capacity	%	53
10	Exchangeable Calcium as Ca	mg/kg	64.18
11	Exchangeable Magnesium as Mg	mg/kg	11.3
12	Exchangeable Sodium as Na	mg/kg	43.82
13	Available Potassium as K	kg/hect.	6.1
14	Available Phosphorous as P	kg/hect.	117
15	Available Nitrogen as N	kg/hect.	28.6
16	Organic Matter	%	0.24
17	Organic Carbon	%	0.17
18	Water Soluble Chloride as Cl ⁺	mg/kg	12.4
19	Water Soluble Sulphate as SO ₄	mg/kg	5.9
20	Sodium Absorption Ratio	-	4.03



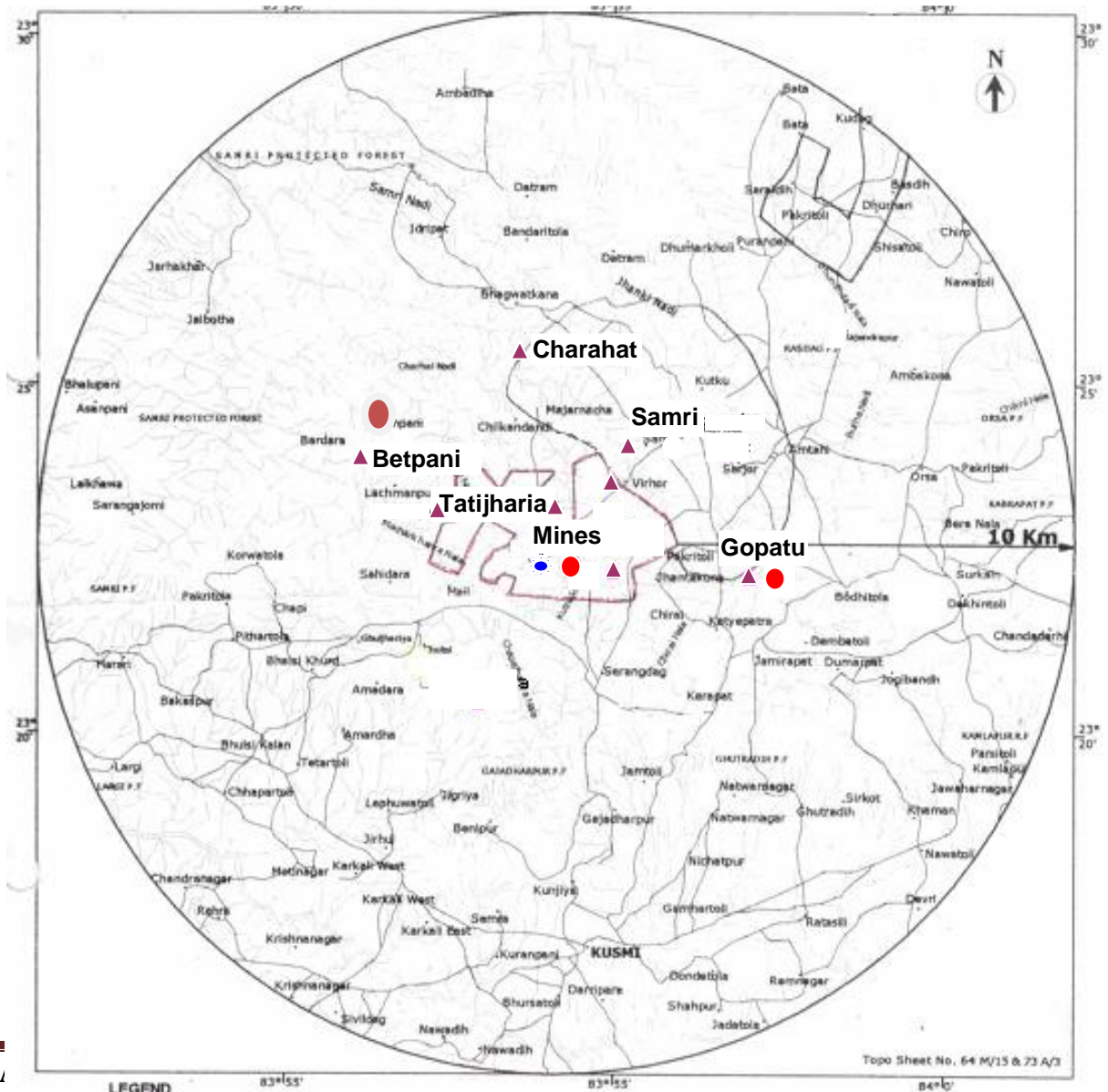
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21	CEC	meq/100 gm	11.8
22	Total Iron	%	3.87
23	Available Manganese	mg/kg	0.0008
24	Available Zinc	mg/kg	0.007
25	Available Boron	mg/kg	0.008

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 parameters only.



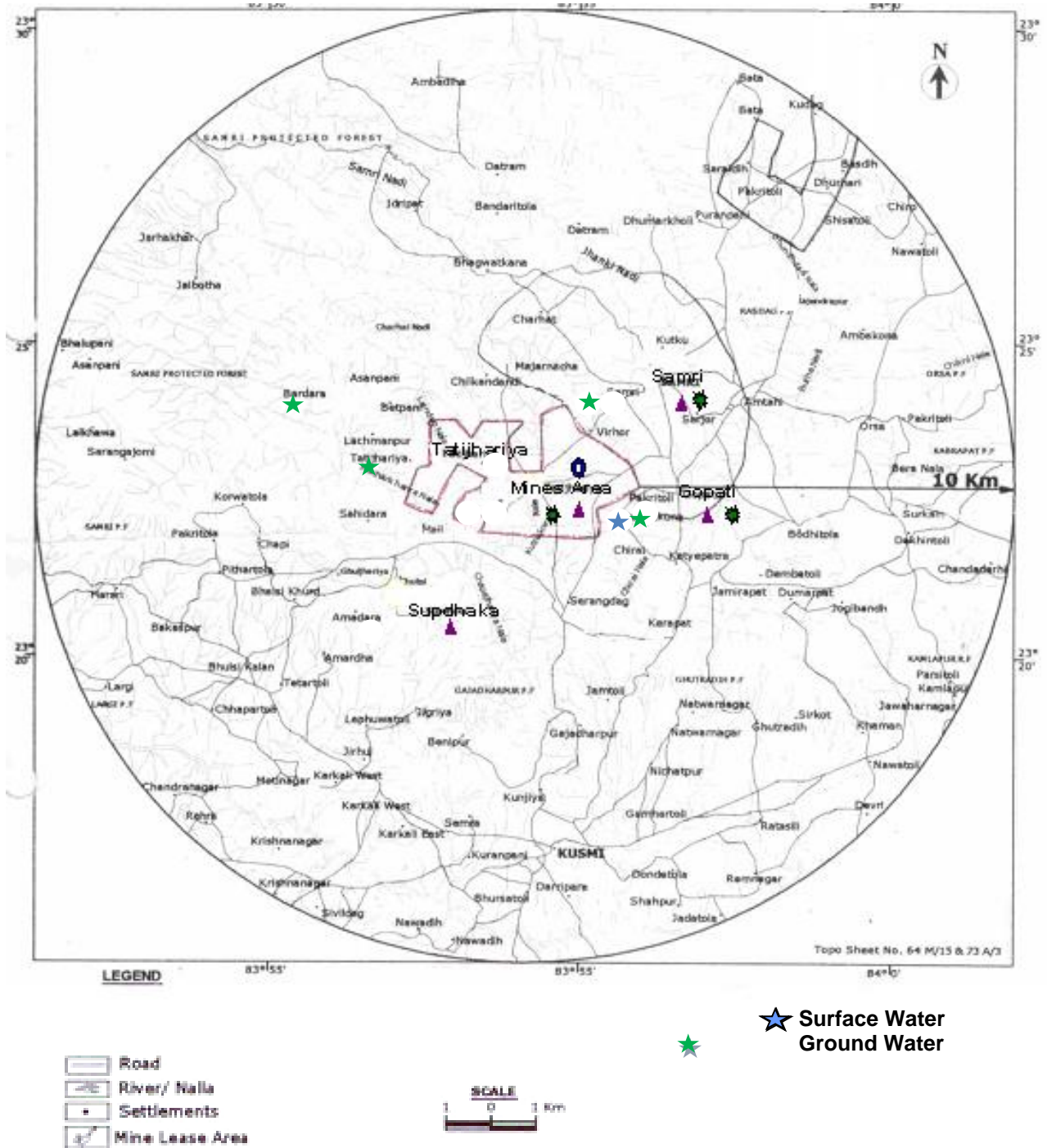


FIG 4: SAMPLING LOCATIONS FOR WATER