

ANNEXURE 1

Status of Ambient Air Quality of Bengaluru City, Karnataka



CENTRAL POLLUTION CONTROL BOARD
Zonal Office (South)
Nisarga Bhavan, Thimmaiah Road
Shivanagar, Bengaluru - 560 079

1. ABOUT BENGALURU CITY

State	Karnataka
Location	12.9667°00"N 77.5667°00" E
Area	741 Sq.km with 198 municipal wards
Elevation	920 m (3,020 ft.)
Population	Bengaluru holds 4 th position among Metropolis with a population of 8,425,970 and 5 th rank among Metros with a population of 8,728,906
Climate	Bengaluru has a tropical Savanna climate with distinct wet and dry seasons. Due to its high elevation, Bengaluru usually enjoys a moderate climate throughout the year. The coolest month is December with an average low temperature of 15.4°C and the hottest month is April with an average high temperature of 36°C. Winter temperatures rarely drop below 12°C and summer temperatures seldom exceed 37°C. Bengaluru receives rainfall from both the northeast and south west monsoons, and the wettest months are September, October and August.
Geography	Bengaluru lies in the southeast of South Indian state of Karnataka. It is in the heart of Mysore plateau at an average elevation of 900m. The topology of Bengaluru is generally flat, though the western parts of the city are hilly. No major rivers run through the city, although the Arkavathi and South Pennar cross paths at the Nandi hills, 60km to the North. The rivers Arkavathi and Vrishabhavathi together carry much of Bengaluru's sewage.
Industries/Companies	The headquarters of several public sector undertakings such as BEL, HAL, NAL, BHEL, BEML and HMT are located in Bengaluru. The city also houses several research and development centers for many firms such as ABB, Airbus, Bosch, Google, Microsoft etc., rendering the city of Bengaluru as the 'Silicon Valley of India'.
Air Quality Stations	Six stations, one at sensitive area, and five stations at industrial, rural and commercial areas

Location of Bengaluru City



2. DETAILS OF NAMP STATIONS

The Bengaluru city has six NAMP stations and they are maintained and regularly monitored by Karnataka SPCB. The stations are located at:

- 1) Export promotion industrial park, ITPL, W.F. Road
- 2) AMCO Batteries, Mysore Road
- 3) KHB Industrial area, Yelahanka
- 4) KSPCB Office premises, Peenya Industrial area
- 5) Victoria Hospital, K. R. Market
- 6) Yeswanthapura Police Station

The monitoring of these stations are carried out by Bengaluru Regional Office, Karnataka SPCB, the monitoring of pollutants is carried out for 24 hours (4- hourly sampling for gaseous pollutants and 8 hourly sampling for particulate matter) with a frequency of twice in a week. The parameters monitored are Sulphur dioxide (SO₂), Nitrogen dioxide (NO₂), Particulate Matter (PM₁₀), Ammonia (NH₃) and Lead (Pb).

3. DATA FOR AQI CALCULATION

The KSPCB on request has sent the NAMP stations data for the month of December, 2015 for six stations. This data is used in preparing the AQI for those stations. The parameters monitored at these stations are Sulphur dioxide (SO₂), Nitrogen dioxide (NO₂), Particulate Matter (PM₁₀), Ammonia (NH₃) and Lead (Pb).

However to start with only three parameters such as Sulphur dioxide (SO₂), Nitrogen dioxide (NO₂) and Particulate Matter (PM₁₀) are considered for calculation of AQI.

4. CALCULATION OF AQI

The AQI is calculated as following:

- The data received from the KSPCB was in 4 hourly concentration for SO₂ and NO₂ and 8 hourly for PM₁₀ parameters. It was converted into 24 hourly average concentrations.
- The Sub-indices for individual pollutants were calculated using its 24 hourly average concentration value and health breakpoint concentration range.
- The formula used for calculation of Sub-indices is:

$$I_p = \left[\frac{(I_{HI} - I_{LO})}{(B_{HI} - B_{LO})} * (C_p - B_{LO}) \right] + I_{LO}$$

Where

B_{HI} = Breakpoint concentration greater or equal to given concentration

B_{LO} = Breakpoint concentration smaller or equal to given concentration

I_{HI} = AQI value corresponding to B_{HI}

I_{LO} = AQI value corresponding to B_{LO}; subtract one from I_{LO}, if I_{LO} is greater than 50

AQI = Max (I_p) (where; p= 1, 2,..., n); denotes n pollutants

- The NAMP data received from the KSPCB was fed into the AQI calculator prepared in the Microsoft Excel sheet and the value of Sub-indices and AQI was calculated.

5. RESULTS

Since manual stations measure PM₁₀, it was suggested that for manual station AQI for monitoring days can be calculated as long as PM₁₀ or PM_{2.5} is measured. It is suggested that for manual station, AQI is reported for at least

three parameters and one of them should be PM₁₀ or PM_{2.5} preferably on weekly basis.

AQI has been calculated for the month of December, 2015 for six monitoring stations.

AMCO Batteries, Mysore Road, (SC-78), December, 2015

AIR QUALITY INDEX (AQI)				AQI	
SUB INDEX					
Date/Month	NO₂	SO₂	PM₁₀		
02-12-15	23	3	133	133	MODERATELY POLLUTED
04-12-15	22	3	102	102	MODERATELY POLLUTED
08-12-15	29	3	100	100	SATISFACTORY
10-12-15	25	3	80	80	SATISFACTORY
14-12-15	28	3	104	104	MODERATELY POLLUTED
17-12-15	23	3	119	119	MODERATELY POLLUTED
22-12-15	38	3	108	108	MODERATELY POLLUTED
26-12-15	26	3	96	96	SATISFACTORY
29-12-15	20	3	154	154	MODERATELY POLLUTED

Export promotion industrial park, ITPL, W.F. Road, (SC-77), December, 2015

AIR QUALITY INDEX (AQI)				AQI	
SUB INDEX					
Date/Month	NO₂	SO₂	PM₁₀		
01-12-15	30	3	215	215	POOR
04-12-15	18	3	126	126	MODERATELY POLLUTED
07-12-15	26	3	341	341	VERY-POOR
10-12-15	35	3	381	381	VERY-POOR
14-12-15	21	3	129	129	MODERATELY POLLUTED
18-12-15	22	3	125	125	MODERATELY POLLUTED
21-12-15	30	3	194	194	MODERATELY POLLUTED

22-12-15	50	3	182	182	MODERATELY POLLUTED
28-12-15	28	3	184	184	MODERATELY POLLUTED
30-12-15	26	3	204	204	POOR

KSPCB Office premises, Peenya Industrial area, (SC-405), December, 2015

AIR QUALITY INDEX (AQI)				AQI	
SUB INDEX					
Date/Month	NO₂	SO₂	PM₁₀		
01-12-15	27	3	80	80	SATISFACTORY
04-12-15	17	3	80	80	SATISFACTORY
07-12-15	35	3	76	76	SATISFACTORY
09-12-15	29	3	107	107	MODERATELY POLLUTED
14-12-15	23	3	121	121	MODERATELY POLLUTED
16-12-15	32	3	111	111	MODERATELY POLLUTED
18-12-15	28	3	106	106	MODERATELY POLLUTED
21-12-15	45	3	94	94	SATISFACTORY
25-12-15	19	3	55	55	SATISFACTORY
29-12-15	32	3	88	88	SATISFACTORY
30-12-15	26	3	112	112	MODERATELY POLLUTED

Victoria Hospital, K. R. Market, (SC-406), December, 2015

AIR QUALITY INDEX (AQI)				AQI	
SUB INDEX					
Date/Month	NO₂	SO₂	PM₁₀		
02-12-15	21	3	54	54	SATISFACTORY
04-12-15	16	3	63	63	SATISFACTORY
08-12-15	29	3	57	57	SATISFACTORY
10-12-15	28	3	71	71	SATISFACTORY
15-12-15	36	3	118	118	MODERATELY POLLUTED
18-12-15	25	3	104	104	MODERATELY POLLUTED

21-12-15	33	6	52	52	SATISFACTORY
22-12-15	64	6	225	225	POOR
28-12-15	46	3	229	229	POOR
30-12-15	49	3	208	208	POOR

Yeswanthapura Police Station, (SC- 457), December, 2015

AIR QUALITY INDEX (AQI)					
SUB INDEX				AQI	
Date/Month	NO₂	SO₂	PM₁₀		
02-12-15	22	3	114	114	MODERATELY POLLUTED
04-12-15	25	3	126	126	MODERATELY POLLUTED
07-12-15	29	3	113	113	MODERATELY POLLUTED
09-12-15	29	3	108	108	MODERATELY POLLUTED
14-12-15	47	3	119	119	MODERATELY POLLUTED
16-12-15	35	3	130	130	MODERATELY POLLUTED
18-12-15	24	3	112	112	MODERATELY POLLUTED
21-12-15	40	3	214	214	POOR
22-12-15	33	3	135	135	MODERATELY POLLUTED
29-12-15	16	3	91	91	SATISFACTORY
30-12-15	30	3	74	74	SATISFACTORY

From the interpretations of AQI for Bengaluru city, the responsible parameter for pollution is PM₁₀. It can be seen from the above tables, that for SO₂ and NO₂, air quality is either good/Satisfactory; however PM₁₀ is moderately polluted in all six stations; very poor in ITPL and poor in Victoria hospital, K.R. market. It is mainly due to vehicular movement in the vicinity.