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# Evaluation of $SO_2$, CO and Nitrogen oxides from different monitoring stations in Bengaluru, India and mapping with breakpoint values of proposed IND: AQI

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**Abstract:**
Continuous Ambient Air Quality Monitoring Stations plays a major role in capturing the real time data of pollutants which were released into the atmosphere. An Experimental analysis were carried out to find out the amount of primary pollutants Viz. $SO_2$, CO, $NO_2$ and NO from different air quality monitoring stations situated at BTM, PEENYA, BWSSB (Karnataka-Bangalore).Observations were noticed for Annual 24 hours for $SO_2$,Nitrogen oxides (µg/m3)and for CO at 8 hours( mg/m3) from Sep01,2014 to Dec 01,2014. The observations are mapped with newly proposed IND: AQI breakpoint values. Average of three months data reveals for Station BTM –$SO_2$: 426µg/$m^3$(Moderately polluted),CO:0.0033mg/$m^3$(Good),$NO_2$:23µg/$m^3$(Good),station PEENYA- $SO_2$:330µg/$m^3$ (Satisfactory),CO:8.66mg/$m^3$(Satisfactory),$NO_2$:26.56µg/$m^3$(Good) and station BSWWB-$SO_2$:321.5µg/$m^3$ (Satisfactory),CO:6.66mg/$m^3$(Satisfactory) and $NO_2$:29.3µg/$m^3$(Good).From this analysis it is concluded that SO2>CO>NO2 in case of risk.

**Keywords:** Ambient Air Quality, Primary pollutants, IND: AQI (India: Air Quality Index), Breakpoint values.

## I. INTRODUCTION:

Air pollution is a chemical, physical or biological agent that modifies the natural characteristics of atmosphere. The atmosphere is a complex, dynamic, natural gaseous system that is essential to support life on planet Earth. Air pollution is a major environmental risk to health. By reducing air pollution levels, countries can reduce the burden of disease from stroke, heart disease, lung cancer, and both chronic and acute respiratory diseases, including asthma. There are many substances in the air, which may impair the health of plants and animal or reduce visibility. They are referred to as 'Pollutant'. These Pollutants are classified into two types namely:
**1)** Primary pollutants and **2)** Secondary pollutants. Primary pollutants are the substances which are directly released into the atmosphere by anthropogenic activities whereas secondary pollutants are released through chemical reaction between primary pollutants. Ambient (outdoor air pollution) in both cities and rural areas was estimated to cause 3.7 million premature deaths worldwide in 2012.Some 88% of those premature deaths occurred in low- and middle-income countries, and the greatest number in the WHO Western Pacific and South-East Asia regions. Reducing outdoor air pollution also reduces emissions of $CO_2$ and short-lived climate pollutants such as black carbon particles and methane, thus contributing to the near- and long-term mitigation of climate change.
In this paper we mainly focused on analyzing the levels of 4 primary pollutants like $SO_2$, CO, $NO_2$ and NO.

**Sulphur dioxide ($So_2$):** $So_2$ is a colourless, toxic gas that gives off a characteristic bad odour.Thermal power plant which burns sulphur-containing coal and diesel emits maximum amount of $SO_2$ into the air. The oxidation of $SO_2$ turns into sulphur trioxide, which is a starting point for sulphuric acid, the major component of acid rain.

$SO_2+H_2O \rightarrow H_2SO_3$ (Sulphurous acid)
$SO_3+H_2O \rightarrow H_2SO_4$ (Sulphuric acid)
It causes adverse effects on plants like cell membrane damage, chlorophyll destruction, and metabolism inhibition and growth reduction.

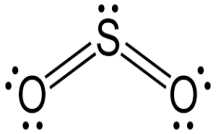


**Fig: I (a) Chemical structure of $SO_2$**

**Carbon monoxide:** An odourless, colourlessgas, inhalation of CO blocks the blood ability to carry oxygen. Because, of its chemical structure, it can easily attach to hemoglobin, the oxygen carrying

pigment in RBC.High levels of CO results in dizziness, severe headache and nausea.

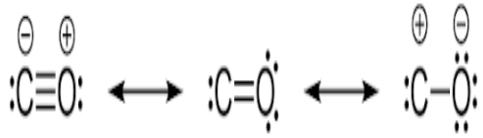

**Fig: I (b) Carbon monoxide**

**Nitrogen oxides:** It is unpleasant in odour and cause eye irritation. It causes breathing trouble, asthma and bronchitis.$NO_2$ reacts with hemoglobin and leads to a condition called Methemoglobinemia. This is also known as Blue baby syndrome. It reduces the oxygen carrying capacity of blood. These oxides also form Smog.

$N_2 + O2 \rightarrow 2NO$
$2NO + O_2 \rightarrow 2NO_2$
$NO_2 \rightarrow NO + (O)$
$(O) + O_2 \rightarrow O_3$
$NO+O_3 \rightarrow NO_2+O_2$
$NO_2+O_2+$unburnt hydrocarbons$\rightarrow CH_3COOONA$
(Peroxy Acetyl Nitrate)

## II. MATERIALS AND METHODS:

**Study Area**: Bengaluru is India's fifth - largest and fastest - growing city. It is Asia's Silicon Valley because of its thriving information technology industry. Bangalore is the capital and the largest city of the Indian state of Karnataka. It is also
called "Garden City" for its beautiful gardens, flowers and trees which flourish in each and every street.Location: 12.97° N 77.56° Altitude: 920 meters, Area: 1280 km².

**Climate:** Bengaluru receives about 900 mm of rain annually, the wettest months being September, October and May in that order. The summer heat is moderated by fairly frequent thunderstorms and occasional squalls cause power outages and local flooding. Most of the rainfall occurs during late afternoon/evening or night and rain before noon is infrequent.

**Sample Collection**: Real time air quality data were taken from database of Central pollution control board(MoEF).We have selected Bengaluru densely populated area which is having four air quality monitoring stations out of which we have chosen station BTM, PEENYA and BWSSB.The observations are taken Annual 24-hours for period of three months Sep 01,2014 to Dec 01,2014 to find out which station is recorded high levels of pollutants and are mapped with recently proposed individual IND:AQI breakpoint values of $SO_2$,$NO_2$ and CO to find out which is in major concentration out of all the four pollutants. Methods for collecting online data are UV Fluorescence ($So_2$), Chemiluminiscence ($NO_2$) and Non-Dispersive Infrared Spectroscopy (CO). *(Air laboratory CPCB, May2011)*

## III. RESULTS AND DISCUSSIONS:

The comparison tables for three different stations BTM, PEENYA, and BSWWB for four parameters from Sep1, 2014 to Dec 1, 2014 is shown below:

Comparison of BTM($SO_2$,CO,$NO_2$,NO),Peenya($SO_2$,CO,$NO_2$,NO),BWSSB($SO_2$,CO,$NO_2$,NO)

| Date | BTM(Karnataka-Bangalore) | | | | Peenya (Karnataka-Bangalore) | | | | BWSSB(Karnataka-Bangalore) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $SO_2$ | CO | $NO_2$ | NO | $SO_2$ | CO | $NO_2$ | NO | $SO_2$ | CO | $NO_2$ | NO |
| 1/9/2014 | 925.67 | 0.02 | 2.72 | 0.29 | 375.26 | 0 | 20.22 | 13.15 | 568.55 | 0.02 | 17.17 | 25.66 |
| 2/9/2014 | 156.01 | 0.02 | 2.8 | 0.2 | 304.39 | 0 | 20.22 | 13.15 | 386.46 | 0.01 | 16.88 | 22.62 |
| 3/9/2014 | 272.61 | 0.08 | 2.53 | 0.83 | 387.73 | 0 | 18.15 | 13.11 | 445.37 | 0.01 | 16.36 | 21.8 |
| 4/9/2014 | 392.06 | 0.02 | 3.4 | 3.03 | 362.32 | - | 16.23 | 13.15 | 678.85 | 0.02 | 18.11 | 19.1 |
| 5/9/2014 | 0 | 0.02 | 2.92 | 5.94 | 309.73 | - | 16.23 | 13.15 | 0 | 0.01 | 19.07 | 21.57 |
| 6/9/2014 | 1,406.54 | 0.02 | 2.97 | 5.95 | 366.39 | - | 16.23 | 13.15 | 979.24 | 0.01 | 15.39 | 14.51 |
| 7/9/2014 | 1,435.82 | 0.03 | 3.12 | 5.99 | 0 | 0.03 | 16.23 | 18.61 | 754.34 | 0.02 | 2.09 | 1.69 |
| 8/9/2014 | 1,735.21 | 0.02 | 7.95 | 8.82 | 868.08 | 0.05 | - | 72.47 | 0 | 0.02 | 3.52 | 4.98 |
| 9/9/2014 | 0 | 0.03 | 13.24 | 10.98 | 762 | 0.04 | - | - | 842.87 | 0.02 | 12.96 | 6.09 |
| 10/9/2014 | 1,755.18 | 0.02 | 11.5 | 9.44 | 0 | 0.03 | - | - | 0 | 0.02 | 34.86 | 13.97 |
| 11/9/2014 | 1,720.99 | 0.02 | 27.15 | 25.22 | 0 | 0.03 | - | - | 0 | 0.05 | 2.38 | 2.35 |
| 12/9/2014 | 0 | 0.03 | 16.65 | 20.09 | 650.58 | 0.04 | - | - | 820.52 | 0.04 | 1.92 | 1.76 |
| 13/9/2014 | 1,495.52 | 0.03 | 16.48 | 21.27 | 380.99 | 0.04 | - | - | 781.23 | 0.04 | 1.93 | 1.78 |
| 14/9/2014 | 0 | 0.02 | 13.63 | 18.34 | 833.71 | 0.02 | - | - | 646.53 | 0.04 | 2.48 | 2.32 |
| 15/9/2014 | 0 | 0.02 | 17.39 | 25.75 | 750.29 | 0.02 | - | - | 768.04 | 0.03 | 5.99 | 8.04 |
| 16/9/2014 | 1,615.35 | 0.03 | 16.55 | 22.27 | 304.6 | 0.04 | - | - | 634.62 | 0.01 | 8.24 | 11.3 |
| 17/9/2014 | 567.17 | 0.62 | 27.09 | 19.82 | - | - | - | - | 764.8 | 0.01 | 8.88 | 12.5 |
| 18/9/2014 | 1.8 | 1.16 | 32.77 | 16.06 | - | - | - | - | 697.55 | 0.01 | 8.81 | 12.32 |
| 19/9/2014 | 2.21 | 1.11 | 28.43 | 10.48 | - | - | - | - | 714.84 | 0.01 | 8.71 | 12.23 |
| 20/9/2014 | 1.17 | 7.4 | 32.79 | 14.74 | - | - | - | - | 768.51 | 0.01 | 8.69 | 12.24 |
| 21/09/2014 | 1.12 | 1.49 | 37.98 | 12.05 | - | - | - | - | 626.81 | 0.01 | 7.95 | 10.87 |
| 22/09/2014 | 1.5 | 1.67 | 52.94 | 22.37 | - | - | - | - | - | - | - | - |
| 23/09/2014 | 1.46 | 2.15 | 53.25 | 17.34 | - | - | - | - | 0 | 0.04 | 9.52 | 12.12 |
| 24/09/2014 | 3.55 | 3.12 | 54.61 | 18.27 | - | - | - | - | 785.84 | 0.03 | 10.66 | 12.95 |
| 25/09/2014 | 1.48 | 5.45 | 50.32 | 8.75 | - | - | - | - | 965.7 | 0.02 | 14.64 | 18.74 |
| 26/09/2014 | 1.65 | 3.96 | 34.21 | 3.5 | - | - | - | - | - | - | - | - |
| 27/09/2014 | 2.96 | 6.42 | 17.35 | 1.81 | - | - | - | - | - | - | - | - |
| 28/09/2014 | 2.7 | 0.6 | 27.49 | 3.96 | - | - | - | - | - | - | - | - |
| 29/09/2014 | 2.78 | 2.89 | 36.3 | 9.17 | - | - | - | - | 0 | 0.05 | 13.74 | 15.77 |
| 30/09/2014 | 2.56 | 1.22 | 35.2 | 5.4 | - | - | - | - | 0 | 0.03 | 10.44 | 12.59 |
| 1/10/2014 | 1.9 | 1.53 | 25.99 | 2.45 | 883.93 | 0.04 | - | - | 639.34 | 0.03 | 11.52 | 13.68 |
| 2/10/2014 | 2.05 | 1.73 | 36.09 | 3.98 | 632.62 | 0.06 | - | - | 490.24 | 0.02 | 11.27 | 13.86 |
| 3/10/2014 | 1.9 | 2.24 | 24.88 | 0.95 | 0 | 0.05 | - | - | 809.96 | 0.03 | 10.36 | 12.89 |
| 4/10/2014 | 1.89 | 2 | 28.86 | 2.79 | 976.24 | 0.04 | - | - | 0 | 0.04 | 10.5 | 12.6 |
| 5/10/2014 | 2.13 | 2.39 | 64.53 | 9.5 | 691.04 | 0.05 | - | - | 749.47 | 0.03 | 10.22 | 12.22 |
| 6/10/2014 | 1.83 | 1.95 | 188.81 | 36.8 | 837.48 | 0.04 | - | - | 606.89 | 0.03 | 9.66 | 11.26 |
| 7/10/2014 | 0 | 9.1 | 51.34 | 76.84 | 829.96 | 0.02 | - | - | 554.6 | 0.03 | 10.53 | 12.87 |
| 8/10/2014 | 0 | 0.04 | 64.27 | 103.82 | 868.56 | 0.02 | - | - | 489.14 | 0.03 | 8.37 | 10.95 |
| 9/10/2014 | 1,707.64 | 0.08 | 26.57 | 36.4 | 0 | 0.03 | 135.75 | 3.96 | 492.44 | 0.04 | 6.08 | 10.93 |
| 10/10/2014 | 603.2 | 0.04 | 23.2 | 29.02 | 705.71 | 0.04 | 417.75 | 636.32 | 322.93 | 0.03 | 4.51 | 7.67 |
| 11/10/2014 | 612.94 | 0.06 | 16.69 | 25.74 | 615.57 | 0.04 | 321.07 | 486.9 | 287.65 | 0.03 | 3.57 | 6 |
| 12/10/2014 | 1,262.81 | 0.08 | 12.62 | 26.05 | 375.11 | 0.02 | 50.8 | 79.63 | 280.74 | 0.03 | 2.53 | 4.12 |
| 13/10/2014 | 0 | 0.09 | 9.92 | 21.15 | 549.55 | 0.05 | 14.22 | 50.22 | 408.78 | 0.04 | 5.74 | 8.47 |
| 14/10/2014 | 748.09 | 0.1 | 9.58 | 15.99 | 884.27 | 0.09 | 5.36 | 60.5 | 401.72 | 0.03 | 7.61 | 11.14 |
| 15/10/2014 | 369.92 | 0.08 | 14.25 | 21.61 | 632.18 | 0.06 | 9.87 | 13.72 | 675.78 | 0.03 | 6.16 | 10.51 |
| 16/10/2014 | 347.77 | 0.06 | 15.15 | 18.41 | 385.68 | 0.04 | 8.56 | 7.09 | 473.28 | 0.03 | 4.17 | 7.2 |
| 17/10/2014 | 0 | 0.07 | 85.52 | 93.8 | 362.51 | 0.04 | 11.15 | 9.18 | 811.76 | 0.05 | 3.69 | 5.75 |
| 18/10/2014 | 633.85 | 0.06 | 34.75 | 43.22 | 526.86 | 0.03 | 8.44 | 12.87 | 293.94 | 0.02 | 3.98 | 5.31 |
| 19/10/2014 | 0 | 0.04 | 34.56 | 41.52 | 505.96 | 0.02 | 8.44 | 12.92 | 315.78 | 0.03 | 3.21 | 4.16 |
| 20/10/2014 | 186.2 | 0.03 | 8.36 | 9.64 | 498.55 | 0.03 | 0 | 0 | 267.34 | 0.01 | 3.56 | 3.24 |
| 21/10/2014 | 235.37 | 0.07 | 8.39 | 11.32 | 512.72 | 0.03 | 4.96 | 8.7 | 289.84 | 0.02 | 3.33 | 4.15 |
| 22/10/2014 | 228.8 | 0.09 | 8.88 | 12.19 | 458.37 | 0.06 | 6.23 | 10.63 | 297.31 | 0.02 | 62.23 | 81.53 |
| 23/10/2014 | 580.42 | 0.06 | 7.6 | 10.77 | 563.97 | 0.04 | 7.83 | 13.1 | 294.91 | 0.01 | 101.95 | 126.42 |
| 24/10/2014 | 414.86 | 0.05 | 6.43 | 9.27 | 494.26 | 0.04 | 8.43 | 13.68 | 218.19 | 0.01 | 65.95 | 82.06 |
| 25/10/2014 | 480.91 | 0.04 | 5.88 | 10.02 | - | - | - | - | 327.42 | 0.01 | 65.65 | 81.68 |
| 26/10/2014 | 575.42 | 0.03 | 7.11 | 9.29 | - | - | - | - | 231.93 | 0.01 | 66.18 | 80.1 |
| 27/10/2014 | 785.64 | 0.04 | 7.89 | 10.63 | - | - | - | - | 252.91 | 0.01 | 78.64 | 98.8 |
| 28/10/2014 | 873.18 | 0.03 | 12.88 | 13.99 | - | - | - | - | 243.1 | 0.02 | 72.47 | 94.21 |
| 29/10/2014 | 663.76 | 0.06 | 10.33 | 12.77 | - | - | - | - | 374.4 | 0.02 | 111.14 | 139.47 |
| 30/10/2014 | 666.98 | 0.06 | 9.05 | 12.26 | 41.16 | 1.09 | 17.53 | 5.9 | 312.99 | 0.01 | 134.92 | 155.56 |
| 31/10/2014 | 395.4 | 0.3 | 10.83 | 9.54 | 0.79 | 0.72 | 14.82 | 4.26 | 128.87 | 0.19 | 140.5 | 117.4 |
| 1/11/2014 | 3.82 | 0.75 | 14.14 | 9.26 | 4.63 | 0.52 | 7.57 | 0.51 | 3.85 | 0.25 | 116.52 | 30.94 |
| 2/11/2014 | 3.61 | 0.68 | 21.71 | 13.72 | 1.13 | 0.6 | 9.37 | 0.72 | 3.49 | 0.25 | 118.03 | 44.32 |
| 3/11/2014 | 3.12 | 0.68 | 12.05 | 13.97 | 2.42 | 0.75 | 7.49 | 1.57 | 4.08 | 0.47 | 149.42 | 80.89 |
| 4/11/2014 | - | - | - | - | 0.89 | 0.82 | 1.39 | 1.27 | 5.52 | 0.92 | 93.65 | 58.4 |
| 5/11/2014 | - | - | - | - | 0.55 | 0.8 | 6.4 | 1.27 | 5.77 | 1.28 | 38.24 | 37.69 |
| 6/11/2014 | - | - | - | - | 1.41 | 0.57 | 11.81 | 1.33 | 1.52 | 0.96 | 38.12 | 29.41 |
| 7/11/2014 | - | - | - | - | 0.46 | 0.71 | 12.4 | 0.49 | 1.67 | 0.8 | 35.8 | 27.24 |
| 8/11/2014 | - | - | - | - | - | - | - | - | 4.06 | 0.58 | 34.03 | 6.92 |
| 9/11/2014 | - | - | - | - | - | - | - | - | 3.75 | 0.66 | 30.48 | 6.82 |
| 10/11/2014 | - | - | - | - | - | - | - | - | 2.27 | 0.67 | 31.5 | 6.21 |
| 11/11/2014 | - | - | - | - | - | - | - | - | 2.27 | 0.45 | 18.95 | 5.26 |
| 12/11/2014 | - | - | - | - | 4.4 | 0.58 | 7.52 | 2.53 | 4.49 | 0.52 | 13.28 | 8.3 |
| 13/11/2014 | - | - | - | - | 4.94 | 0.55 | 5.02 | 0.9 | 3.95 | 0.29 | 14.13 | 11.22 |
| 14/11/2014 | - | - | - | - | 3.95 | 0.66 | 3.18 | 1.42 | 0.82 | 0.33 | 8.14 | 6.87 |
| 15/11/2014 | - | - | - | - | 2.08 | 0.66 | 2.18 | 0.35 | - | - | - | - |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16/11/2014 | - | - | - | - | 1.01 | 0.58 | 2.25 | 0.03 | - | - | - | - |
| 17/11/2014 | - | - | - | - | 1.26 | 0.59 | 4.46 | 1.29 | 2.49 | 1.51 | 31.55 | 13.1 |
| 18/11/2014 | - | - | - | - | 3.11 | 0.53 | 3.71 | 4.61 | 3.38 | 0.55 | 29.18 | 6.18 |
| 19/11/2014 | - | - | - | - | 1.04 | 0.68 | 3.58 | 3.35 | 3.59 | 0.92 | 28.7 | 6.78 |
| 20/11/2014 | - | - | - | - | 0.43 | 0.65 | 6.7 | 3.51 | 4.34 | 0.43 | 20.31 | 3.17 |
| 21/11/2014 | - | - | - | - | 0.02 | 0.65 | 6.99 | 3.59 | - | - | - | - |
| 22/11/2014 | - | - | 5.52 | 9.04 | 2.55 | 0.69 | 4.49 | 3.46 | - | - | - | - |
| 23/11/2014 | - | - | 5.43 | 6.84 | 2.54 | 0.56 | 4.03 | 2.95 | - | - | - | - |
| 24/11/2014 | 688.44 | 0.05 | 8 | 10.4 | 3.55 | 0.49 | 5.13 | 3.21 | 1.91 | 0.58 | 36.78 | 11.28 |
| 25/11/2014 | 1,586.98 | 0.06 | 8.3 | 12.37 | 2.57 | 0.66 | 9.26 | 3.34 | 0.49 | 0.35 | 20.53 | 2.3 |
| 26/11/2014 | 961.82 | 0.07 | 9.14 | 12.43 | 2.04 | 0.54 | 12.16 | 3.12 | 2.63 | 0.57 | 47.8 | 5.82 |
| 27/11/2014 | 1,487.59 | 0.07 | 9.48 | 13.1 | 40.98 | 0.58 | 15.73 | 3.19 | 1.13 | 0.4 | 22.04 | 2.35 |
| 28/11/2014 | 80.27 | 0.15 | 14.84 | 29.14 | 740.6 | 0.1 | 25.88 | 33.64 | - | - | - | - |
| 29/11/2014 | 2.87 | 0.22 | 17.85 | 9.46 | 503.03 | 0.04 | 10.35 | 16.53 | 0.16 | 0.66 | 22.07 | 2.74 |
| 30/11/2014 | 2.83 | 0.35 | 16.31 | 5.96 | 374.86 | 0.05 | 7.66 | 10.64 | - | - | - | - |
| 1/12/2014 | 3.43 | 0.79 | 41.55 | 20.75 | 586.79 | 0.06 | 9.91 | 15.63 | 3.63 | 0.48 | 39.3 | 8.94 |
| **AVERAGE** | **426.5931944** | **0.9189** | **23.47649** | **16.977** | **330.179** | **0.2697** | **26.5642** | **32.5277** | **321.55** | **0.20259** | **29.1375** | **24.4596** |

**Table: III (a) Comparison of BTM($SO_2$,CO,$NO_2$,NO),Peenya($SO_2$,CO,$NO_2$,NO),BWSSB($SO_2$,CO,$NO_2$, NO)**

***Averages for three different stations are presented as below:***

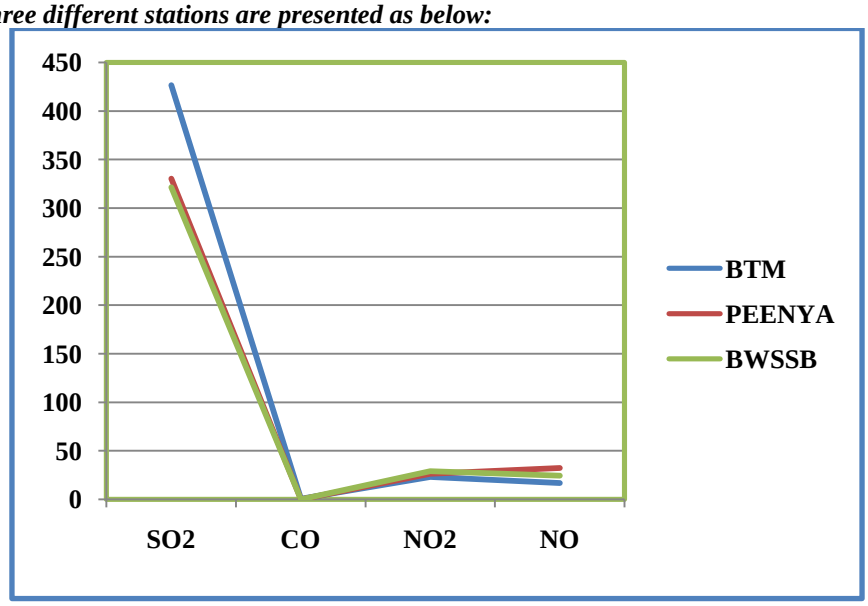


**Fig: III (a) Average values of pollutants from three stations**

The above analysis shows that BTM station is noted for very high release of $SO_2$ pollutant and whereas PEENYA noted high levels of Nitrogen oxide.BWSSB seen to be consistent in all the four parameters when compared with other two monitoring stations.

***Mapping with recently proposed IND: AQI (CPCB) for different parameters:***

| *ategory* | *Breakpoint conc. for $S0_2(ug/m^3)$-24 Hrs* | *Break point conc. for $NO_2(ug/m^3)$-24 Hrs* | *Breakpoint conc. for $CO(mg/m^3)$-8Hrs* |
|---|---|---|---|
| **AQI** | | | |
| **Good** | **40** | **40** | **1** |
| **Satisfactory** | **80** | **80** | **2** |
| **Moderately polluted** | **380** | **180** | **10** |
| **Poor** | **800** | **280** | **17** |
| **Very poor** | **1600** | **400** | **34** |

| | | | |
|---|---|---|---|
| **Severe** | **1600+** | **400+** | **34+** |

**Table: III (b) Breakpoints values of IND: AQI**

| ***POLLUTNATS*** | ***BTM*** | ***CATEGORY*** | ***PEENYA*** | ***CATEGORY*** | ***BWSSB*** | ***CATEGORY*** |
|---|---|---|---|---|---|---|
| **$SO_2$** | 426.59 | Moderately polluted | 330.179 | Satisfactory | 321.55 | Satisfactory |
| **$NO_2$** | 23.47 | Good | 26.5642 | Good | 29.1375 | Good |
| **CO** | 0.0033 | Good | 8.66 | Satisfactory | 6.66 | Satisfactory |

**Table: III (c) Mapping of values with Proposed IND: AQI**

| ***S no*** | ***Pollutants*** | ***Effects on Economy and plants*** |
|---|---|---|
| **1** | $SO_2$ | In the presence of moisture and oxygen,SO2 gets converted to $H_2SO_4$ which causes corrosion when it falls on buildings, railway tracks,arts,architecture and buildings material due to chemical reaction with metals and limestone |
| **2** | $SO_2$ | Damage to paints and protective coatings of articles |
| **3** | $SO_X$ and $NO_X$ | Causes fading and deterioration of textile dyes and fibers |
| **4** | $SO_2$ | SO2 causes leather to loose much of its strength |
| **5** | $SO_2$ | Bleaching of leaves, cell membrane damage, necrosis |
| **6** | $NO_2$ | Suppressed growth and acute leaf injury |

**Table: III (d) Effects of pollutants**

## IV. CONCLUSIONS:

From the observations it is clear that sulphur dioxide ($SO_2$) levels are very high and it may lead to different health problems and also contribute to acid rains. Whereas Carbon monoxide levels are in Good range only at one station (BTM), and for $NO_2$ all the stations are observed in good range when compared with breakpoint concentration of $NO_2$ prescribes in IND: AQI-2014.Automatic Air quality monitoring stations are established in some cities and in some other cities the data is not updated at regular intervals therefore there is a need in establishing equipments. Real time monitoring reduces manpower and takes less time to analyze the pollutants. Public awareness is mandatory in industrial areas as many are not aware of Impacts. Industries should reduce the release of pollutants by establishing proper control equipments and follow industry standards.

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## REFERENCES

[1] Kaushik, C.P., Ravindra, K., Yadav, K., Mehta, S. and Haritash, A.K. Assessment of ambient air quality in urban centers of Haryana (India) in relation of different anthropogenic activities and health risks. *Environmental Monitoring and Assessment.* 2006, 122: 27-40.

[2] CPCB (Central Pollution Control Board). 2009. Indian National Ambient Air Quality Standards, New Delhi. Available on http://www.cpcb.gov.in

[3] CPCB: NAAQS Monitoring & Analysis Guidelines Volume-II

[4] CPCB-Control of urban pollution series (CUPS/82/2014-2015).

[5] Gupta, A. K., Patil, R. S. and Gupta, S. K. A long-term study of oxides of nitrogen, *Environmental Science and Health,* 2003, 38: 2877-2894.

[6] Lam, G. C. K., Leung, D. Y. C., Niewiadomski, M., Pang,S. W., Lee, A. W. F. and Louie, P. K. K. Street level concentrations of nitrogen dioxide and suspended particulate matter in Hong Kong. *Atmospheric Environment*, 1999, 33: 1–11.

[7] Aher S. B., Dobhal B. S., Awasthi R. S. Spatial and Temporal Variations of SO2, NOx, PM10 and TSPM Concentration in Ambient Air of Jalna City, India. *IJAEB: 7(3):* 2014, 571-579.

[8] Shukl a, A., A. Nasim an d S . Gangophadhyay Mass and Number concentration of respirable partic ulate matter in the ambient environment of Delhi.*Ind. J. Air Pollut. Cont., 6,* 2006, 44 -45

[9] Badhwar, N., R.C. Trivedi and B. Sengupta Air Quality status and trends in India. *Ind. J. Air Pollut. Cont.6,* 2006,71-79

[10] Tiwari, T.N. and M. Ali. Air Quality Index for Calcutta and its monthly variation for various localities.*Ind. J. Environ. Protect, 7,* 1987, 172-176.