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Air Quality Monitoring at Heavy Traffic Zone in Hyderabad

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Abstract: *Recently the intensity and magnitude of air pollutant concentration has grown up rapidly in the troposphere. The air pollution is primarily associated with automobiles and industrial sources Hyderabad, capital of Telangana, is a center of southern part of India for both industrial and commercial activity. It is one of the most populous urban areas with approximately 6.8 million inhabitants and over 73,000 small, medium and major industrial establishments sharing the greater city.Air pollution in India is monitored by the Central Pollution Control Board (CPCB) together with the State Pollution Control Boards (SPCBs) and the National Environmental Engineering Research Institute (NEERI) in Nagpur. The National Air Quality Monitoring Programme (NAMP) was started in 1984 with 7 sensor stations, 248 towns and cities have the air quality network of 591 Air Quality Monitoring Stations upto 2015, it is reported that in India 2022 added 180 manual air quality monitoring stations, increasing their number to 883 to achieve the target of 1,500 by 2024. For our study due to practical difficulties to collect, analysis the air quality, pollutants data has been collected from CPCB.The dataset contains City, Date, PM2.5, PM10, NO, NO2, NOx, NH3, CO, SO2, O3, Benzene, Toulene, Xylene, Air Quality Index (AQI). Hyderabad was divided into 6 zones, air quality monitoring sensors is located at 14 places in and around six zones. For our study we selected 2 stations Newmalakpet and Sanathnagar based on heavy traffic area to analyse the maximum concentration of pollutants such as $PM_{2.5}$, PM_{10}, NO_2, NO_3, SO_2, CO, for the period of three months (Dec 2022,Jan, Feb 2023).It was observed at site 1 to site 52$PM_{2.5}$,range 120 to 249 µg/m3 is very poor as per AQI, PM_{10} range 101.2 to 171 µg/m3 is moderately polluted as per AQI, NO_2 range 7.46 to 32.9 µg/m3 is good as per AQI, NH_3 range3.06 to 5.44 is good as per AQI, SO_2 is 12.97 to 8.53 µg/m3 is good ,CO 61.83 to 71.9 is severe as per AQI, continuous air quality monitoring is necessary to protect environment and human health.*

Keywords: Air Pollutant

I. INTRODUCTION

Levels of ambient air pollution in many of the world's largest cities are alarming. Accordingto the World Health Organization (WHO), 90% of the population living in cities in 2014 wasexposed to concentrations of _ne particulate matter (PM2:5) exceeding WHO air quality guide-lines.1 Most Indian cities have noxious urban air quality for much of the year.Hyderabad has also generated its own evidences on this insidious link especially in high traffic areas of the city. Very high respiratory symptoms have been noted in the locations close to traffic areas. This study throws a light on air pollutant level around 3 heavy traffic zones in Hyderabad because it is reported that in Hyderabad 1,700 to 3,000 people per year die prematurely as a result of inhaling PM". These figures reflect only the effects of acute exposure to air pollution. If the long-term effects of chronic exposure are taken into account, 10,000–15,000 people a year could die.

II. OBJECTIVE OF THE STUDY

To identify the source of heavy traffic zones in Hyderabad

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- To collect datas about sensor station around 6 zones
- For the present study we have select 5 sensor stations based on heavy traffic flow
- To collect air pollutant concentration level from CPCB
- To Assess the air pollutant variations level of daily,weekly and monthly from Dec 2022 to Feb 2023 around the 5 sensor station
- Compare the air quality with NAAQS [National Ambient Air Quality standard]
- Impact assessment of air on environment and human around study area
- To suggest sustainable measures to reduce the impact of air pollution on environment.

III. METHODOLOGY

The Flow chart for the Study of Air Pollution is adopted in the Fig 1

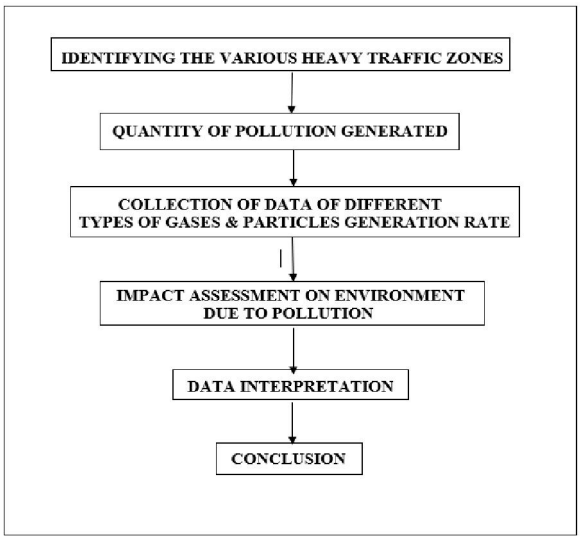

Fig 1: Flow chart of methodology

3.1 Description of Study Area

Hyderabad City, Telangana State, South Central India. It is the largest and most populous city in Telangana and the most important urban centre for all of South-Central India. Hyderabad was the capital of Andhra Pradesh from 1956 to 2014, but with the establishment of Telangana in Andhra Pradesh in 2014, Hyderabad became the capital of both states.Hyderabadis located on the Musi River in the heart of the Telangana Plateau, the major highland region of the Deccan (Indian peninsula). The urban area is about 500 meters above sea level and is relatively flat compared to the gentle undulations. The climate is mild to hot monsoon (that is, characterized by wet and dry seasons) with moderate annual rainfall. Most of the rain falls during the rainy monsoon season from June to October.Hyderabad has developed into a commercial hub and an international information technology (IT) hub. Pharmaceuticals, tobacco, textiles, etc. are manufactured here. Service activities, especially those related to IT, have expanded dramatically and now constitute a large part of the urban economy.

Hyderabad City is divided into 6 zones. Charminar, L.B. Nagar, Khairtabad, Secunderabad, Serilingampally, Kukatpally, Each zone is further divided into a total of 30 circles.In addition, the circle will be divided into 150 stations .In 2020, each district will have 40,000-50,000 people.

3.2 Description of the Sampling Stations

Sampling stations are located around six zones in Hyderabad for our study we selected newmalakpet and sanathnagar. Location of sensor stations which we are selected is presented in Table 2 :

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Table 2: Location of sensor stations which we are selected

S.NO	Zones	Sensor stations	Latitude	Longitude
1	Khiratabad	Sanathnagar	17.416º N	78.4652º E
2	Charminar	Newmalakpet	17.3616º N	78.4747º E

LAMINAR AQM21 is a smart air quality monitoring system, ideal for real time monitoring of criteria pollutants, particulate matter, noise level, weather parameters and other gaseous contaminants. AQM21 is equipped to monitor air pollution data for $PM_{2.5}$, PM_{10}, NO_2, NO_3, SO_2,CO,VOCs and environmentaldata for temperature, humidity. pressure, wind speed, wind direction along with the noise, UV, Light intensity and more.

3.3 Collection of Air Pollutant

Maximum pollutant levelof following parameters $PM_{2.5}$, PM_{10}, NO_3, NO_2, CO, SO_2at two sites **New Malakpet, Sanathnagar,** from dec to feb daily variations (morning to evening)observed and presented in Table 1 to 6.

Table 1: Maximum pollutant level at New Malakpet during Dec **.**

Morning							
S.no	**Weeks**	**$PM_{2.5}$**	**PM_{10}**	**NO_2**	**NH_3**	**SO_2**	**CO**
1	1ST	111	87.7	5.5	2.2	8	33.5
2	2ND	140.6	98.1	6.3	2.6	11.8	42.8
3	3RD	49.5	**112.5**	6.5	2.75	**12.5**	45.75
4	4TH	122	87.25	6	2.75	11.5	56.75
5	5TH	**147.8**	88.2	**6.8**	**2.8**	13	**76**
Afternoon							
S.no	**Weeks**	**$PM_{2.5}$**	**PM_{10}**	**NO_2**	**NH_3**	**SO_2**	**CO**
1	1ST	70	56.75	5.5	2.5	8	24
2	2ND	138.1	95.16	6.8	**6.33**	12.8	45.16
3	3RD	45	110	6.5	2.75	12.5	46.75
4	4TH	122	87.25	6.5	3	**14.5**	52.5
5	5TH	**147.8**	88.2	**7**	4.6	13.2	**76**
Evening							
S.no	**Weeks**	**$PM_{2.5}$**	**PM_{10}**	**NO_2**	**NH_3**	**SO_2**	**CO**
1	1ST	24	55.5	5.5	2.5	8	24
2	2ND	112	90.6	6.8	2.8	12.8	45.16
3	3RD	44	**108.5**	6.5	2.75	12.5	46.25
4	4TH	145	98.25	6.5	**3**	**14.25**	57.25
5	5TH	**147.2**	87	**7.2**	2.8	13.2	**86.8**

Table.2: Maximum pollutant level at New Malakpet during Jan

Morning							
S.no	**Weeks**	**$PM_{2.5}$**	**PM_{10}**	**NO_2**	**NH_3**	**SO_2**	**CO**
1	1ST	123.2	85	7	**2.71**	11.42	**73.8**
2	2ND	**172.3**	**108.8**	**7.16**	2.16	**13.66**	68.5
3	3RD	95	82	5.75	2.5	12	54.75
4	4TH	79.1	91	3.5	2.6	10.5	50.6
5	5TH	134	106.3	6.6	3	12.6	49.3
Afternoon							
S.no	**Weeks**	**$PM_{2.5}$**	**PM_{10}**	**NO_2**	**NH_3**	**SO_2**	**CO**
1	1ST	**146.28**	90.5	7.14	**2.71**	11.42	**74**
2	2ND	144.6	**109.33**	**7.33**	2.3	**13.8**	68.5

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3	3RD	95	82	6.5	2.5	12	55.8
4	4TH	79.1	91	4.3	2.6	10.8	50.1
5	5TH	106.3	106.3	7	3	12.6	50
Evening							
S.no	**Weeks**	**$PM_{2.5}$**	**PM_{10}**	**NO_2**	**NH_3**	**SO_2**	**CO**
1	1ST	**158.8**	95.1	7.14	**2.71**	11.42	**70.7**
2	2ND	144.6	95.66	**7.33**	2.3	**13.8**	69.83
3	3RD	89.75	78	6.5	2.5	11.75	56.25
4	4TH	74.8	94.1	4.5	2.3	10.8	54
5	5TH	116.6	**106**	7	3	12.6	49.6

Table 3: Maximum pollutant level at New Malakpet during Feb. .

Morning							
S.no	**Weeks**	**$PM_{2.5}$**	**PM_{10}**	**NO_2**	**NH_3**	**SO_2**	**CO**
1	1ST	109	**108.2**	8	3	13.6	53.6
2	2ND	117.8	102.3	7.5	**3.3**	**17.8**	56
3	3RD	**150.3**	106	10.8	3.1	15.1	**101.16**
4	4TH	113.8	105.8	**13.8**	2.66	13.3	76.8
5	5TH	75	88	13	2	13	60
Afternoon							
S.no	**Weeks**	**$PM_{2.5}$**	**PM_{10}**	**NO_2**	**NH_3**	**SO_2**	**CO**
1	1ST	106.4	108.2	8.2	3	13.8	55.6
2	2ND	117.5	104.1	7.6	**3.5**	**17.8**	57
3	3RD	**149.3**	107	12	3.3	15.3	**101.16**
4	4TH	100.8	106.6	**13.8**	2.83	13.83	80.16
5	5TH	182	**112**	13	2	13	60
Evening							
S.no	**Weeks**	**$PM_{2.5}$**	**PM_{10}**	**NO_2**	**NH_3**	**SO_2**	**CO**
1	1ST	110.2	110	8.2	3	13.8	56.4
2	2ND	127.6	103.6	7.6	**3.66**	**17.8**	61.3
3	3RD	128.5	106.3	12	3.3	15.1	**102.8**
4	4TH	86	99.8	**13.8**	2.66	13.5	80.16
5	5TH	182	**114**	12	2	13	67

Table 4: Maximum pollutant level at Sanathnagar during d New Malakpet ec

Morning							
S.no	**Weeks**	**$PM_{2.5}$**	**PM_{10}**	**NO_2**	**NH_3**	**SO_2**	**CO**
1	1ST	**333**	156	47	6.2	8	82
2	2ND	309	154.7	**81**	**8**	9	52
3	3RD	301	**199**	68	8	8	82
4	4TH	316	185	33	5	6	64
5	5TH	302	156	22	3	**10**	**86**
		312.2	170.14	50.2	6.04	8.2	73.2
Afternoon							
S.no	**Weeks**	**$PM_{2.5}$**	**PM_{10}**	**NO_2**	**NH_3**	**SO_2**	**CO**
1	1ST	**321**	170	49	3.5	8.5	83.5
2	2ND	312	186	**80**	**6**	**9.5**	55

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3	3RD	306	**195**	64	2	8	**86**
4	4TH	309	176	68	3	7.5	60
5	5TH	318	183	35	5	9	84
		313.2	182	59.2	3.9	8.5	73.7
Evening							
S.no	**Weeks**	**$PM_{2.5}$**	**PM_{10}**	**NO_2**	**NH_3**	**SO_2**	**CO**
1	1ST	**330**	160	45	3	7.5	**82**
2	2ND	320	**194**	53	3	6	63
3	3RD	325	132	62	2.5	8.2	55
4	4TH	328	190	73	**5**	7	69
5	5TH	309	185	**80**	3	**9.3**	58

Table 5: Maximum pollutant level at sanathnagar during jan .

Morning							
S.no	**Weeks**	**$PM_{2.5}$**	**PM_{10}**	**NO_2**	**NH_3**	**SO_2**	**CO**
1	1ST	264	186	**18**	2	**8**	64
2	2ND	**308**	**201**	16	2	7	**82**
3	3RD	278	198	15	5	7	60
4	4TH	115	165	14	**6**	6	47
5	5TH	117	199	14	4	7	60
Afternoon							
S.no	**Weeks**	**$PM_{2.5}$**	**PM_{10}**	**NO_2**	**NH_3**	**SO_2**	**CO**
1	1ST	230	158	12	**6**	7.2	62
2	2ND	**265**	164	**18**	6	**8.6**	54
3	3RD	228	**190**	16	5	6.4	**83**
4	4TH	120	176	15	3	6	76
5	5TH	115	182	13.5	2.5	5	74
Evening							
S.no	**Weeks**	**$PM_{2.5}$**	**PM_{10}**	**NO_2**	**NH_3**	**SO_2**	**CO**
1	1ST	235	160	14	5	8	64
2	2ND	**262**	**195**	12	4	8.6	50
3	3RD	220	187	16	4	**9**	70
4	4TH	125	173	**18**	3.5	6	**84**
5	5TH	118	186	12.5	**6**	5	60

Table 6: Maximum pollutant level at Sanathnagar during Feb. .

Morning							
S.no	**Weeks**	**$PM_{2.5}$**	**PM_{10}**	**NO_2**	**NH_3**	**SO_2**	**CO**
1	1ST	179	140	15	3.5	7	56
2	2ND	266	156	18	6	8	60
3	3RD	**323**	160	20	**8**	10	82
4	4TH	285	**182**	21	5.5	10	62
5	5TH	111	120	**30**	6.4	**14**	**104**
Afternoon							
S.no	**Weeks**	**$PM_{2.5}$**	**PM_{10}**	**NO_2**	**NH_3**	**SO_2**	**CO**
1	1ST	154	118	13	3	9	50
2	2ND	250	134	14	5	8	62

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3	3RD	**301**	**195**	19	6	**12**	80
4	4TH	260	180	18	4.2	6	57
5	5TH	109	101	**25**	**8**	10	**102**
Evening							
S.no	**Weeks**	**$PM_{2.5}$**	**PM_{10}**	**NO_2**	**NH_3**	**SO_2**	**CO**
1	1ST	158	140	21	5	10	52
2	2ND	260	180	16	6	**12**	60
3	3RD	**282**	**185**	**24**	5	8	98
4	4TH	206	164	15	4	7	54
5	5TH	114	132	21	**7**	9	**99**

IV. RESULTS AND DISCUSSIONS

The average concentration of 6 pollutant during three session of day from Dec to Feb of two sites is shown fig 2 to 7.

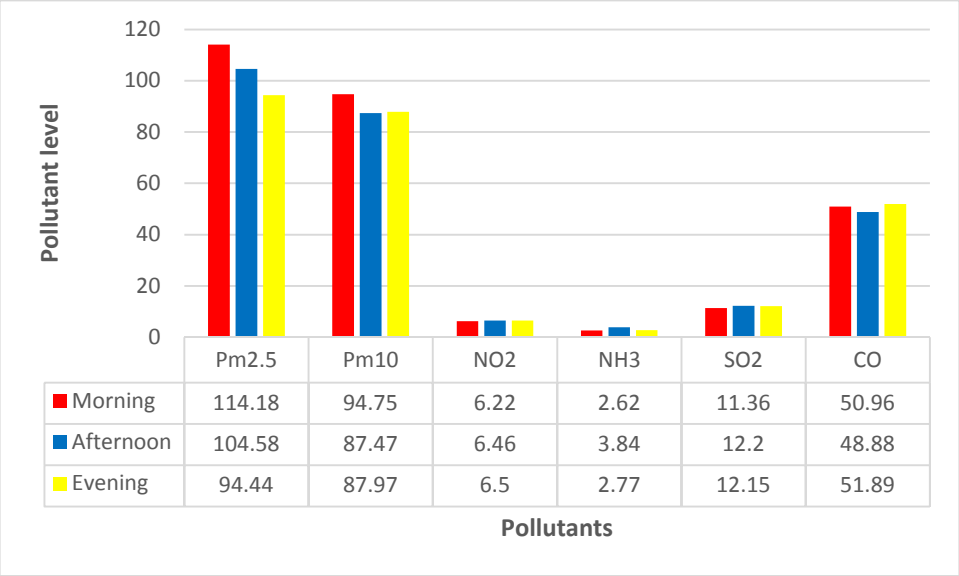

Fig 2 Pollution level during Dec at Site -1

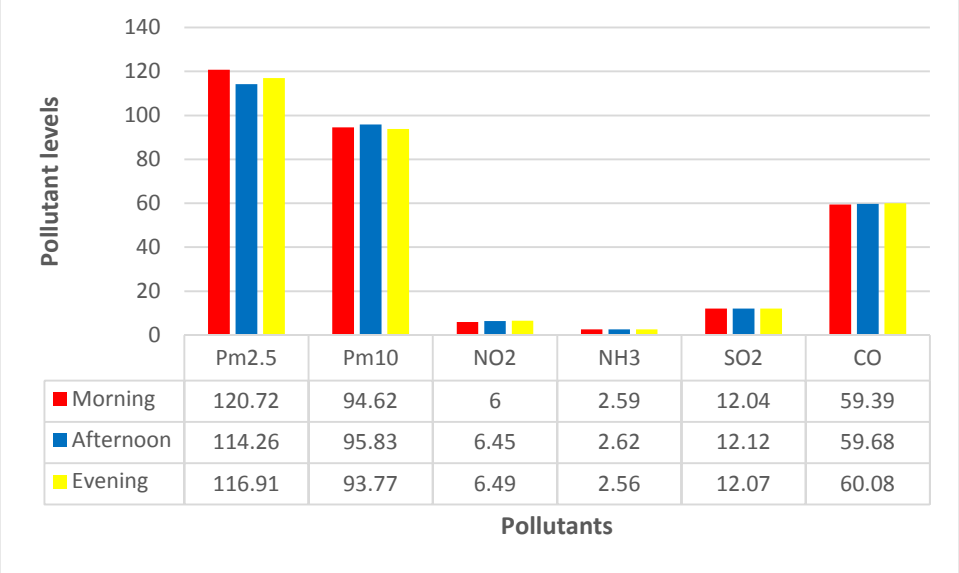

Fig 3 Pollution level during Jan at Site -1

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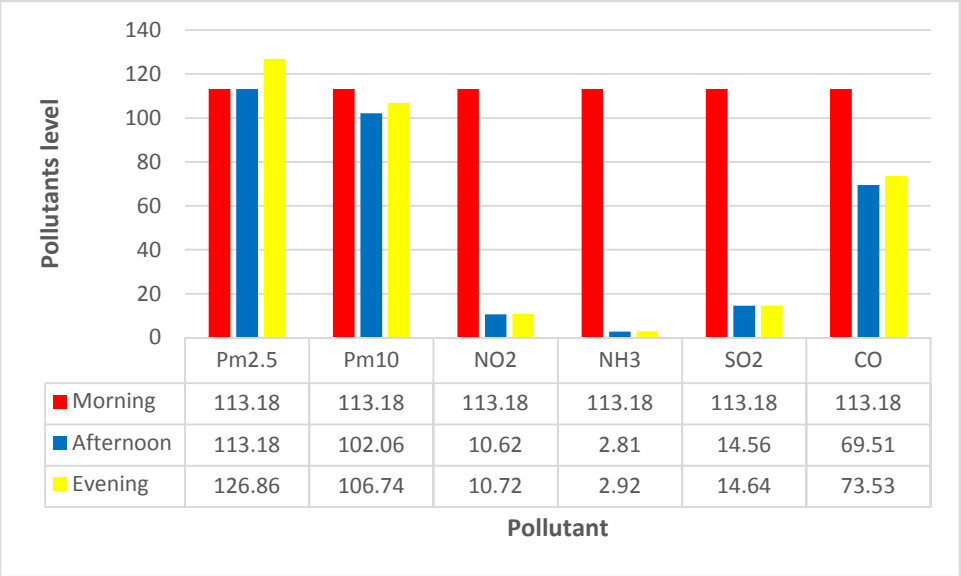
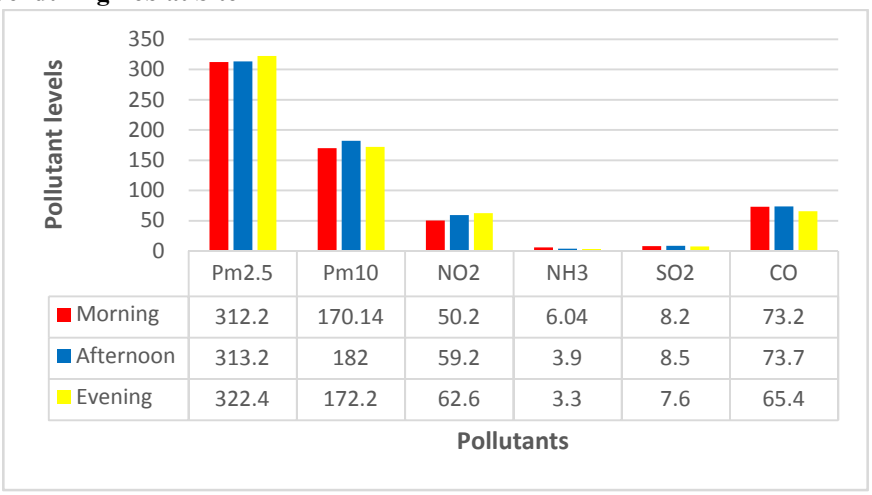


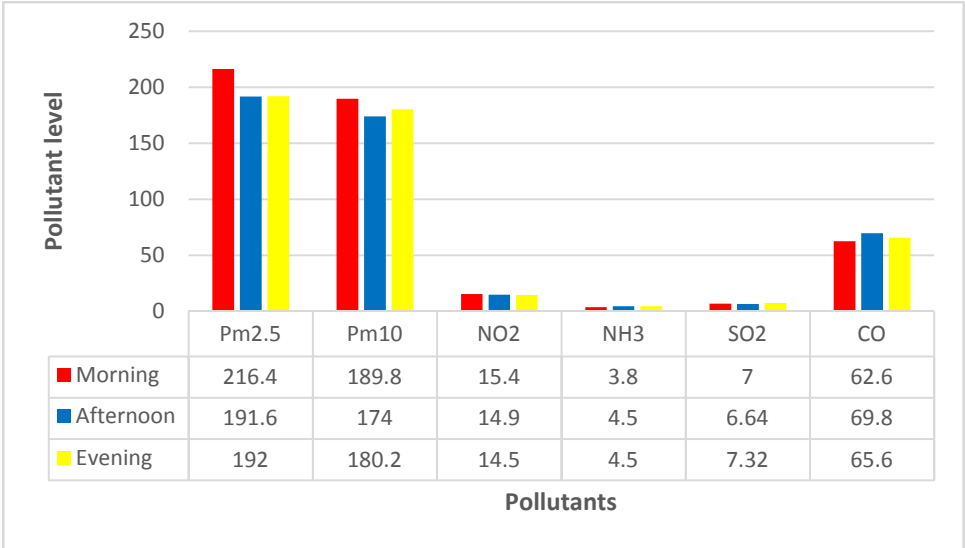
	Pm2.5	Pm10	NO2	NH3	SO2	CO
Morning	113.18	113.18	113.18	113.18	113.18	113.18
Afternoon	113.18	102.06	10.62	2.81	14.56	69.51
Evening	126.86	106.74	10.72	2.92	14.64	73.53

Fig 4 Pollution level during Feb at Site -1



	Pm2.5	Pm10	NO2	NH3	SO2	CO
Morning	312.2	170.14	50.2	6.04	8.2	73.2
Afternoon	313.2	182	59.2	3.9	8.5	73.7
Evening	322.4	172.2	62.6	3.3	7.6	65.4

Fig 5 Pollution level during Dec at Site -2



	Pm2.5	Pm10	NO2	NH3	SO2	CO
Morning	216.4	189.8	15.4	3.8	7	62.6
Afternoon	191.6	174	14.9	4.5	6.64	69.8
Evening	192	180.2	14.5	4.5	7.32	65.6

Fig 6 Pollution level during Jan at Site -2

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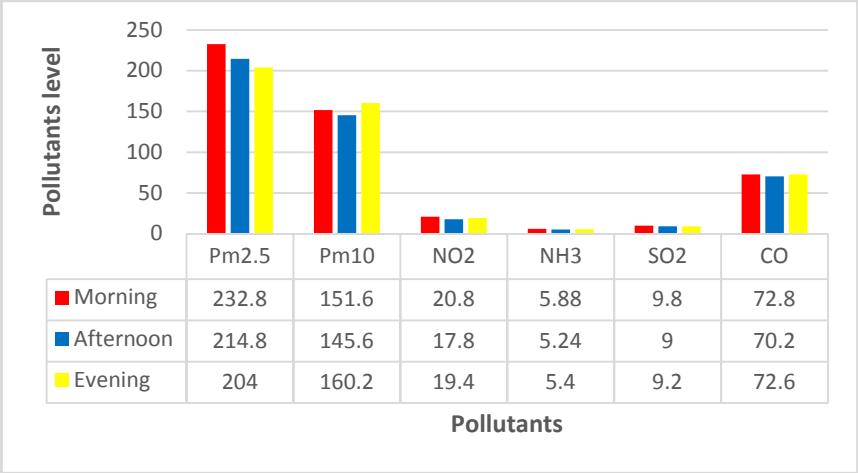

	Pm2.5	Pm10	NO2	NH3	SO2	CO
Morning	232.8	151.6	20.8	5.88	9.8	72.8
Afternoon	214.8	145.6	17.8	5.24	9	70.2
Evening	204	160.2	19.4	5.4	9.2	72.6

Fig 7 Pollution level during Feb at Site -2

From our Study it was observed that most of the pollutant exceeds the AQI. At site 1 average concentration Pollutant level in new malakpet area $PM_{2.5}$ is 120 µg/m3 is poor so the human faces breathing discomfort to most people on prolonged exposure, PM_{10} is 101.2 µg/m3 is moderated polluted the human faces problems like breathing discomfort ,lungs asthma and hard diseases. NO_2 value is 7.46 µg/m3 , $NH_3$3.06 µg/m3 , So_2 is 12.97 µg/m3 ,is good for this human faces minimal impact. Respectively CO is 61.83 µg/m3 shows severe this affects healthy people and seriously impacts those with existing diseases as per AQI concentration. In sanathnagararea $PM_{2.5}$ is249 is very poor so human faces respiratory illness on prolonged exposure, PM_{10} is 171 is moderate human faces breathing discomfort to sensitive people, NO_2 is 32.9 µg/m3. NH_3 is 5.44 µg/m, similarly So_2 is 8.53 µg/m3 good for this human faces minimum impact. CO is 71.9 µg/m3 range severe this affects healthy people and seriously impacts those with existing diseases as per AQI concentration

V. CONCLUSION

Air quality level was observed and compared with AQI, the results obtained and their impact on human is presented from selected site 4 to site 5 respectively $PM_{2.5}$,range 120-249 µg/m3 is very poor causes respiratory illness, PM_{10} range101.2-171 µg/m3 is moderately polluted causes breathing discomfort (Asthma, lungs), NO_2 range 7.46-32.9 µg/m3 is good causes minor effect, NH_3 range is goodcauses minor effect, SO_2 is 12.97-8.53µg/m3 is good causes minor effect ,CO 61.83-71.9 is severe effects on healthy people and serious impact for those with existing diseases, so continuous air quality monitoring is necessary to protect environment and human health.

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