JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

AIR QUALITY INDEX OF NARNAUL, MAHENDRAGARH DISTRICT, HARYANA, INDIA

Smita[1], Subroto Dutta[2]

[1,2] Department of Environment Science, Maharishi Dayanand Saraswati University, Ajmer, Rajasthan, India.

Abstract

In presents study, the ambient air quality along with variation in the concentration of gaseous and particulate matter such as PM_{10}, $PM_{2.5}$, SO_2 and NO_2 at Shastri Nagar, Narnaul city, Mahendragarh observed during the year 2023-2024 and compared with NAAQS. The data shows the concentration of SO_2 and NO_2 were always below the permissible limits of CPCB; and the mass concentration for PM_{10} and $PM_{2.5}$ crosses the permissible limit with particulate matter concentration maximum in post monsoon i.e. Nov & minimum during monsoon season.

As the AQI increases, large percentage of the population is likely to experience increasingly severe adverse health effects. In the study, Air Quality Index clearly depicts the changes in different meteorological season in 2023 and 2024. The study shows the air quality was very poor during winter month and satisfactory during monsoon season due to washout and rain out of pollutants.

Keywords: Air pollution, AQI, CPCB, WHO, particulate matter, PM_{10}, $PM_{2.5}$, SO_2 and NO_2

1. INTRODUCTION:

One can deny to drink polluted water but cannot deny the polluted air to breath. Air is the most essential determinant of survival along with the quality of life. Air pollution has emerged as a major problem, both regionally and globally. The problem becomes more complex due to multiple sources of air polluting factors (e.g., industries, automobiles/vehicular emissions, generator sets, domestic fuel burning, road side dusts, construction activities, etc.). About 70% of pollution in the environment comes from the transportation related activity.

The air pollution is the most prominent among all the environmental concern in Asia and all over the world. As per World Health Organization (WHO report 2024), more than 90% of the population is living in an area where air quality exceeds the safe limit. As per the State of Global Air 2020-Special Report on Global Exposure to Air Pollution and its Health Impacts, "Air pollution was the 4th leading risk factor for early death worldwide in 2019, surpassed only by high blood pressure, tobacco use, and poor diet".

In India, National Clean Air Programme (NCAP) aims to reduce particulate matter concentration by 20-30% by 2024 taking 2027 as the base year. ("NCAP report year 2019-2024"; www.ccacoaliton.org).

Air Quality Index (AQI) in general terms depicts the quality of air we breathe; that's why air quality is the most serious topic among developing and developed countries. It is a relatively simple instrument which enables the communication with the general public on air quality. It is a numeric representation used by government agencies to tell the people that how polluted the air they are breathing or how polluted it is forecast to become. The present study deals with the air quality index (AQI) of the Narnaul city during the year 2023 and 2024. Poor air quality

problem has been aggravated by extensive urbanization of the city and increase in the number of vehicles. In the current study, pollutant mass concentrations were evaluated to assess the air quality index (AQI) throughout the year 2023-2024 in Narnaul city of Mahendragarh district, Haryana.

2. MATERIAL & METHODS:

2.1 Study Area:

The State of Haryana is in North India, located between 27°39' to 30°35' N latitude and between 74°28' and 77°36' E longitude covering an area of 44,212 sq. km. Mahendragarh district is one of 22 districts of Haryana. It occupies an area of 1,899 km² and has a population of 922,088 (2011census). Mahendragarh has five blocks named Ateli, Kanina, Mahendragarh, Nangal Chaudhary, and Narnaul and three sub tehsils i.e. Ateli, Kanina and Nangal Chaudhary.

2.2 Site Description:

Shastri Nagar, Narnaul City was selected as the monitoring site in the study area and it falls under the category of residential area according to Central Pollution Control Board (CPCB). The site lies in and around the heart of city with distance 1.20 km from bus stand, 0.70 km District Education Office, 0.50 km from Mini-secretariate office, 0.90 km from S.P. office, 2.50 km away from railway station, 1.40 km away from Municipal council Narnaul and 1.0 Km from Income tax office making it a highly busy area prone to vehicular emission and other pollutants.

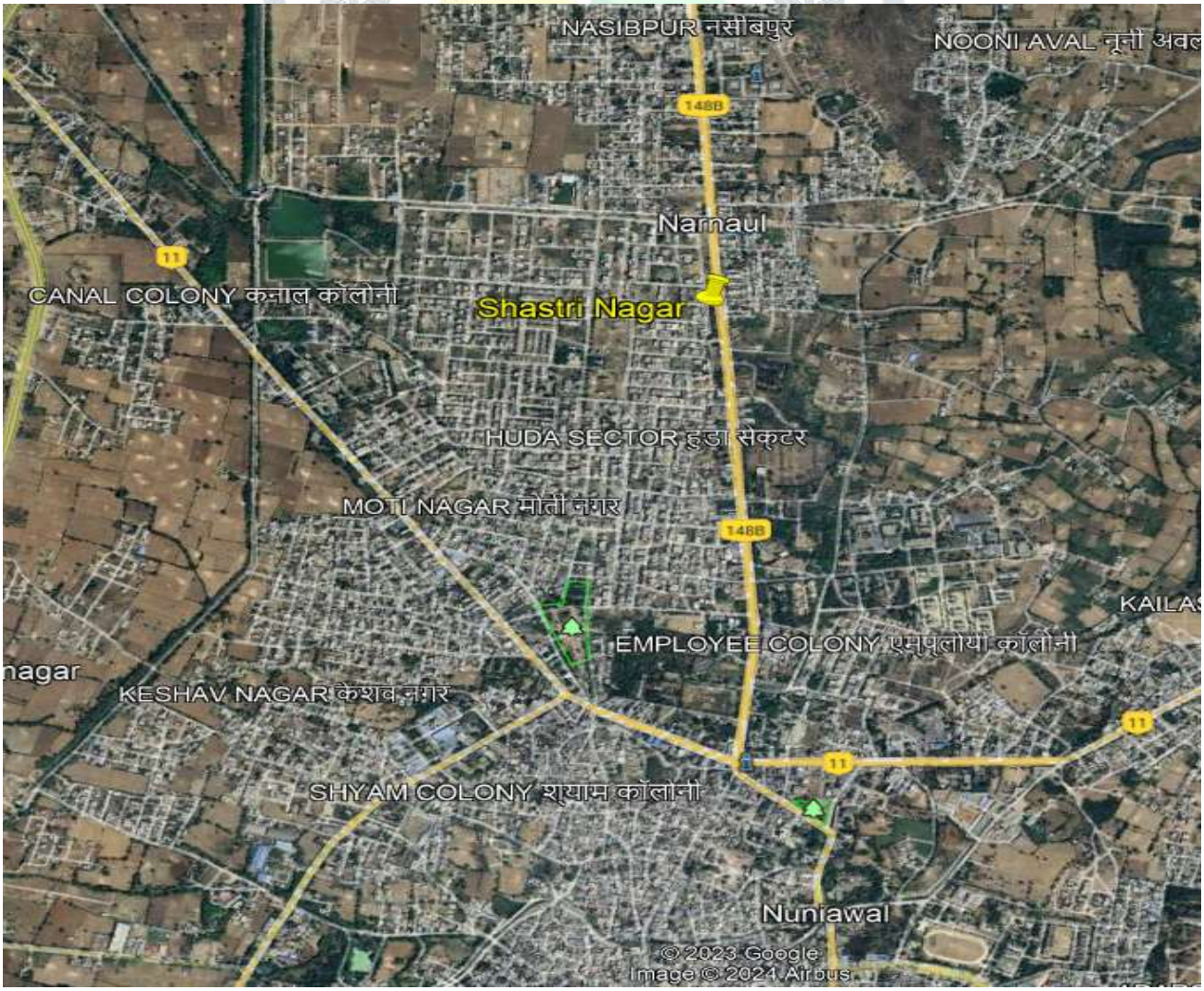

Fig 1: Showing Google image of Shastri Nagar station, Narnaul city

2.3 Data set:

The data used in study was collected from CPCB website (https://airquality.cpcb.gov.in/ccr/#/caaqm-dashboard-all/caaqm-landing/caaqm-data-repository) for Shastri Nagar, Narnaul, Mahendragarh during the year 2023-2024 for single monitoring station which is Shastri Nagar, Narnaul City for ambient air quality data.

Air Quality Index (AQI) is one such tool for effective dissemination of air quality information to people. In numbers, AQI is diagrammatic between a scale of "0 to 500", in which 0 representing fresh air and 500 representing hazardous air (Values can vary from country to country). The measurement scale is based on a prefixed colour system for a definite value on scale. In India the national AQI was launched in New Delhi on 17th September, 2014 under the Swachh Bharat Abhiyan. The proposed index has 6 categories with elegant colour scheme (Table 1).

Table 1: Showing AQI category

AQI	Associated Health Impacts
Good (0–50)	Minimal Impact
Satisfactory (51–100)	May cause minor breathing discomfort to sensitive people.
Moderately polluted (101–200)	May cause breathing discomfort to people with lung disease such as asthma, and discomfort to people with heart disease, children and older adults.
Poor (201–300)	May cause breathing discomfort to people on prolonged exposure, and discomfort to people with heart disease
Very Poor (301–400)	May cause respiratory illness to the people on prolonged exposure. Effect may be more pronounced in people with lung and heart diseases.
Severe (401-500)	May cause respiratory impact even on healthy people, and serious health impacts on people with lung/heart disease. The health impacts may be experienced even during light physical activity.

There are six AQI categories, namely Good, Satisfactory, Moderately polluted, Poor, Very Poor, and Severe. The proposed AQI will consider eight pollutants (PM_{10}, $PM_{2.5}$, NO_2, SO_2, CO, O_3, NH_3, and Pb) for which short-term (up to 24-hourly averaging period) National Ambient Air Quality Standards are prescribed.

3. RESULT AND DISCUSSION:

In present study, the monthly average concentration of different pollutants was collected from CPCB website and summarized for the year 2023 and 2024 respectively in table below:

Table 2: Average mass concentration of Pollutants (Year 2023)

Months	$PM_{2.5}$	PM_{10}	NO_2	SO_2
Jan	102.28	141.49	14.93	9.21
Feb	69.77	122.01	15.00	6.53

March	50.16	104.40	14.96	4.52
April	67.21	136.04	14.98	8.01
May	42.36	95.37	14.98	3.89
June	45.57	110.00	15.10	5.82
July	46.44	104.63	18.14	25.67
Aug	29.51	88.18	7.43	32.61
Sept	27.59	88.37	4.31	23.18
Oct	49.18	145.87	21.98	11.14
Nov	140.67	236.14	102.41	15.11
Dec	72.40	176.16	57.62	7.97
Minimum	27.59	88.18	4.31	3.89
Maximum	140.67	236.14	102.41	32.61

Table 3: Average mass concentration of Pollutants (Year 2024)

Months	**$PM_{2.5}$**	**PM_{10}**	**NO_2**	**SO_2**
Jan	53.58	118.76	26.34	14.79
Feb	38.26	76.52	27.55	13.17
March	31.10	61.68	27.63	12.13
April	43.50	78.04	31.90	13.01
May	67.08	132.25	37.67	13.50
June	37.22	60.25	35.57	25.04
July	24.36	61.54	20.18	23.86
Aug	29.23	44.22	21.61	43.94
Sept	32.84	49.44	22.16	25.14
Oct	45.93	71.42	22.60	34.36
Nov	92.75	137.49	23.96	18.77
Dec	111.58	164.77	21.39	22.89
Minimum	24.36	44.22	20.18	12.13
Maximum	111.58	164.77	37.67	43.94

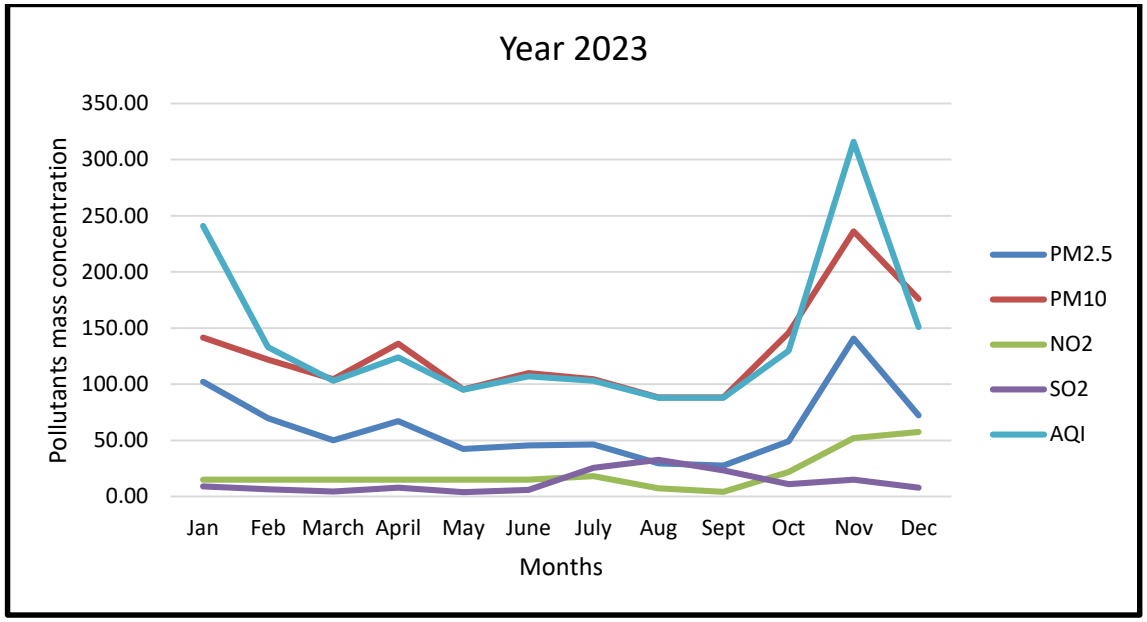

Figure 2: Month wise variation in concentration of pollutants during Year 2023

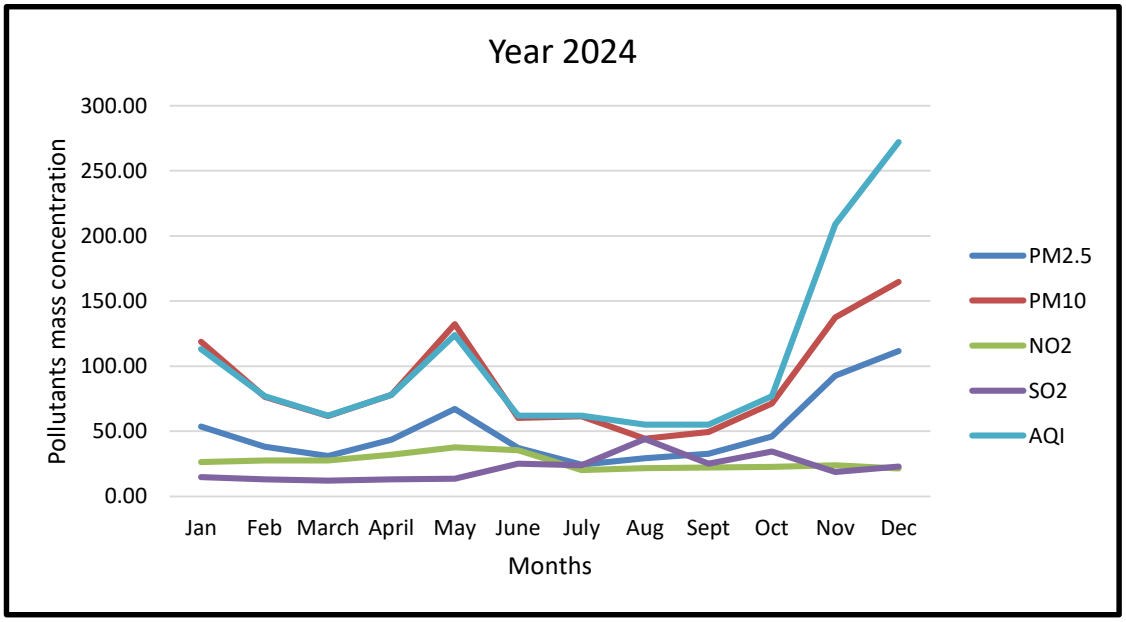

Figure 3: Month wise variation in concentration of pollutants during Year 2024

The observed $PM_{2.5}$ concentration shows maximum 140.67 µg/m^3 and minimum 27.59 µg/m^3 in year 2023; whereas, maximum 111.58 µg/m^3 and minimum 24.46 µg/m^3 in year 2024. The PM_{10} mass concentration shows 88.18 to 236.14 µg/m^3 and 44.22 to 164.77 µg/m^3 respectively in year 2023 and 2024. These values exceed the CPCB prescribed limits.

Sulphur dioxide observed concentration ranges between 3.89 to 32.61 µg/m^3 and 12.13 to 43.94 µg/m^3 in year 2023 and 2024 respectively. Nitrogen dioxide concentration ranges between 4.31 to 57 and 20.18 to 37.67 µg/m^3 in year 2023 and 2024 respectively. These two values are within the CPCB prescribed limits.

The mass concentration of PM10, SO2 & NO2 showed seasonality with higher concentration during winter seasons and lowest during monsoon season.

The values of AQI for ambient air quality of selected site is represented in table 4 and graphically represented in figure 4.

Table 4: Month-wise Air Quality Index (for Year 2023 and 2024)

Months	Year 2023	Year 2024
Jan	241	113
Feb	133	77
March	103	62
April	124	78
May	95	124
June	107	62
July	103	62
Aug	88	55
Sept	88	55
Oct	130	77
Nov	316	209
Dec	151	272

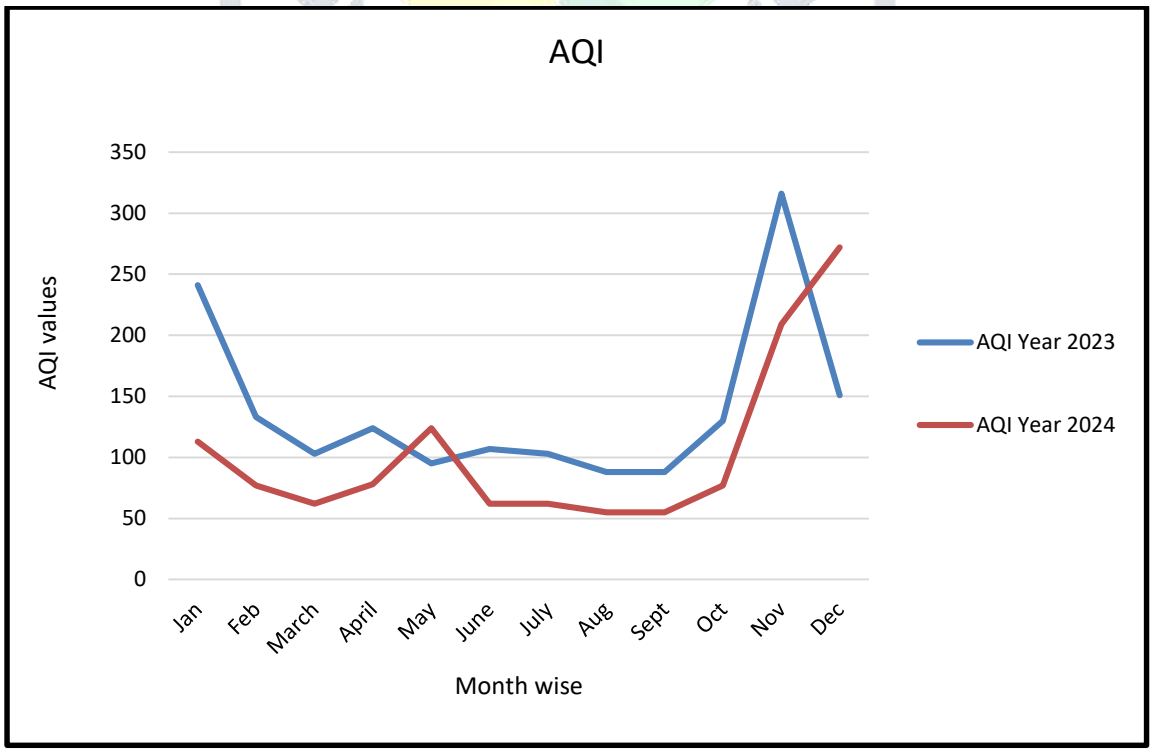

Figure 4: Air Quality Index of the selected area

The AQI values in the study area vary between 88 to 316 and 55 to 272 in year 2023 and 2024 respectively. AQI shows satisfactory to poor to very poor pollutant concentration during the selected period. Lowest AQI values observed during monsoon period (August and September month) as the mass concentration is wash out by the rain drops.

Similar to Kumar et al (2011), observed Ambient Air Quality station of Jaipur city in 2009-1010. The result shows that particulate level exceeds the prescribed limits whereas SO_2 and NO_2 levels remain within prescribed limits of CPCB. Here, the AQI value represents the heavy air pollution in selected urban areas.

Similarly, Rai et. al (2017) represents a case study of Jodhpur City in which residential areas have been analysed for five criteria pollutants i.e., PM10, PM2.5, SO2, NO2 and CO at selected sites for the year 2016 at five different locations of residential areas in Jodhpur city and reveals that SO2 and NO2 concentrations were within prescribed limit of standard norms. Only particulate matters were crossing the standard limit and specially PM10. Overall AQI was falling under the category of Good to moderate category. Thus, it can be concluded from the study that major pollution in the residential areas of Jodhpur was due to particulate matter.

Dobhal et. al (2019) studied the Ambient Air Quality Assessment of Jalna City, India where pollutants such as SO_2, NO_2, RSPM and NRSPM were assessed at residential and industrial sites for one-year period. Results suggest better air quality at residential sits than industrial. Annual mean concentrations of SO2 and NOx found within the permissible limits of Indian National Ambient Air Quality standards (NAAQS), while RSPM and NRSPM concentrations violated at both sites. The annual AQI values 127.79 and 88.50 were recorded for residential and industrial site respectively due to higher RSPM.

4. CONCLUSION

The present study reveals that the concentration of particulate matter (PM_{10} and $PM_{2.5}$) exceeds the permissible standard except monsoon season. The presence of high concentration of particulate has a significant negative impact on emission as its concentration is highest in November and December month while lowest in August and September months during selected period.
From the studies, it is evident that development and planning of transport system and social awareness can play a major role in improving the quality of urban areas.

We understand the basic meaning of Air Quality Index and the general approach used in the calculation of AQI. It is an effective way to communicate the status of the polluted air to the general public in the simple color-coded form. It is an unitless index which indicates the air quality and its health effects.

REFERENCES:

1. World Health Organization (WHO), 1999, 2019; 2020, 2023 and 2024 reports.

2. Transport, Climate and Sustainability Global Status Report - 3rd edition- Asia Regional Overview-2023).

3. Air Quality Life Index, 2023.

4. NCAP (National Clean Air Programme) Report 2019-2020 – www.ccacoaliton.org.

5. *"International Air Quality". Archived from the original on 12 June 2018. Retrieved 20 August 2015.*

6. *CPCB, NAAQS-2009 norms*

7. *AQI report, India- 2024*

8. Nitish Kumar Rai, Tilkesh Sharma, Anil Vyas And Singh S.K (2017) Air Quality Index Determination Of Residential Areas Of Jodhpur City: A Case Study International Journal Of Current Advanced Researchvolume 6; Issue 10; October 2017; Page No. 7046-7048, www.journalijcar.org DOI: http://dx.doi.org/10.24327/ijcar.2017.7048.1070

9. Dobhal B.S., Jadhav S., Sangvikar M. and Farooqui M., 2016. Study of Ambient Air Quality of Jalna City (MS), India, Ultra Chem., 12(2): 29-34.

10. B.S. Dobhal, R.P. Shimpi And Mazahar Farooqui (2019) "Ambient Air Quality Assessment of Jalna City (Ms), India"; Indian J.Sci.Res. 10 (2): 45-53, 2020.

11. Anand kumar, Dr Asish Garg, Proj upendr Pandel (2011), A Study of AAQ States in Jaipur city (Rajasthan, India) Using AQI. Nature and Science 2011, 9(6) (38-45), http://www.sciencepub.net/nature .

12. Web-site: *cpcb.nic.in*

13. https://airquality.cpcb.gov.in/ccr/#/caaqm-dashboard-all/caaqm-landing/caaqm-data-repository