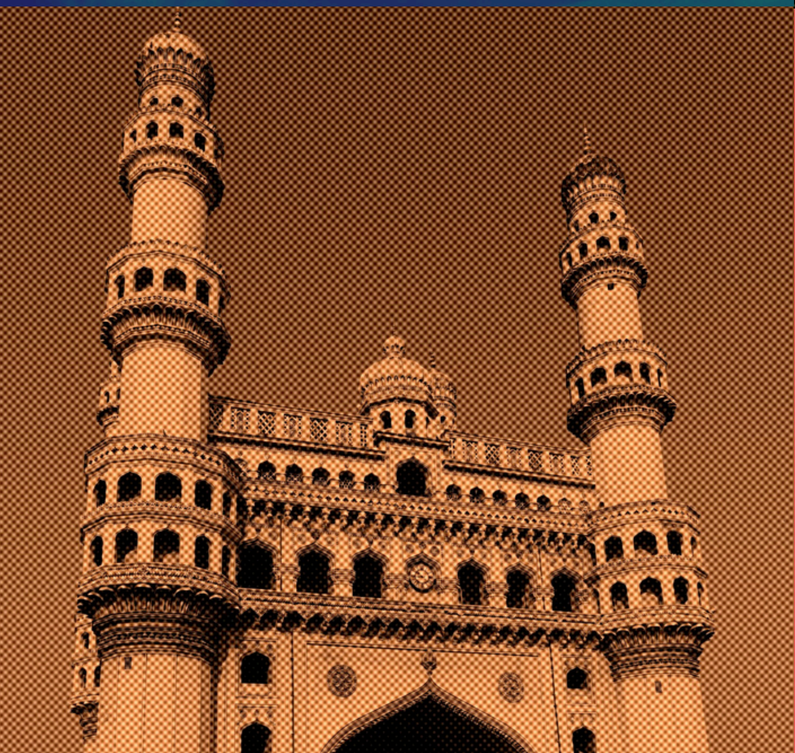
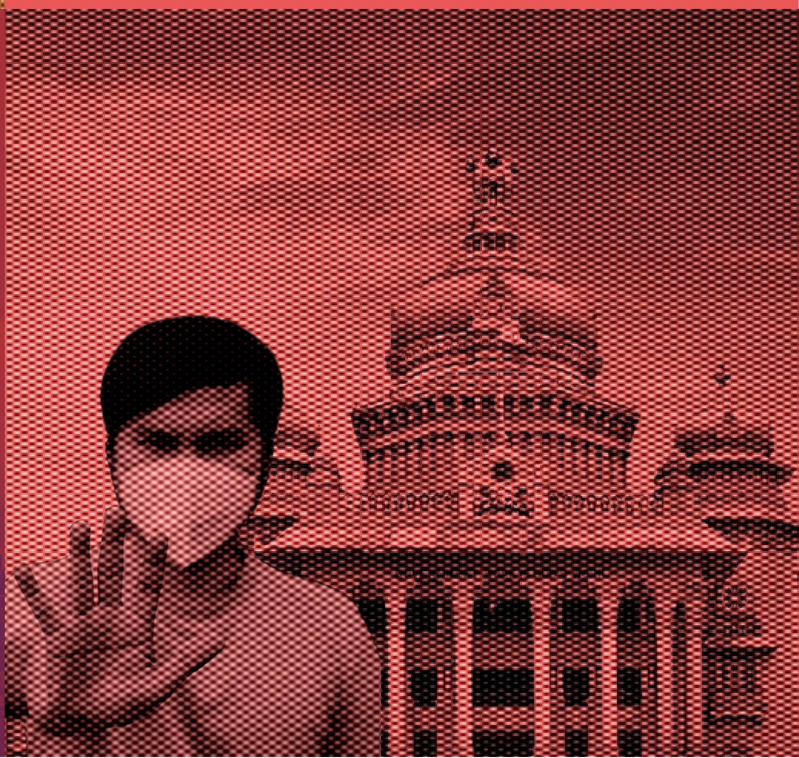


SPARE THE AIR 2

An Air Quality Analysis of 10 Cities from Southern India

Edition 2



SPARE THE AIR 2

An Air Quality Analysis of 10 Cities from Southern India
Edition-2

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CONTENT

INTRODUCTION

In recent years, air pollution has emerged as one of the foremost environmental concerns, significantly impacting public health and well-being in India. The complex interplay of industrial activities, vehicular emissions, and other anthropogenic activities has led to deteriorating air quality in numerous regions. As urban areas continue to expand, the challenge of managing air quality has grown more intricate. In this context, the question arises: are current strategies and standards sufficient to address the escalating air pollution crisis? Notably, India's National Ambient Air Quality Standards (NAAQS) have not been revised since 2009, raising concerns about their adequacy in light of evolving scientific evidence and updated international guidelines.

On 22 September 2021, the World Health Organization (WHO) unveiled updated air quality guidelines for the first time in 15 years, emphasising the urgent need for action. These revised guidelines are grounded in robust scientific research highlighting the grave consequences of air pollution on human health. Consequently, the WHO advocates for new air quality thresholds aimed at reducing the concentrations of key pollutants. However, the grim reality remains that nearly every urban centre in India surpasses the WHO's recommended air quality benchmarks. In India, the existing National Ambient Air Quality Standards (NAAQS) for pivotal pollutants are considerably less stringent than the WHO's guidelines. Accumulating evidence indicates that even minimal exposure to air pollution can pose risks to human health, with the danger escalating with prolonged exposure. A recent Lancet report highlights that short-term exposure to PM2.5 (particulate matter of diameter 2.5 micrometres or less) is associated with a heightened risk of mortality in India, even at levels well below the current Indian PM2.5 standards. This underscores the troubling reality that there may be no safe threshold for air pollution exposure.

The Government of India has initiated the National Clean Air Programme (NCAP), a comprehensive nationwide initiative to address air pollution. The program aims to achieve a 20–30% reduction in PM2.5 and PM10 concentration by 2024 compared to the recorded levels 2017. Within South India, various cities have been recognised as non-attainment cities, indicating their consistent failure to meet the National Ambient Air Quality Standards (NAAQS) established by the CPCB. The persistent exceedance of NAAQS levels calls for a detailed analysis of the specific sources and pollution patterns in South Indian cities, alongside a critical evaluation of the NCAP's implementation and impact. In September 2022, the central government revised NCAP targets, aiming for a 40% reduction in PM concentrations by 2026. However, the progress has been underwhelming; only 44 of the 131 non-attainment cities have conducted source apportionment studies to identify pollution sources. Additionally, a review of NCAP expenditures reveals that 64% of the total funds have been utilised primarily for dust control measures. In contrast, significantly less funding has been allocated to address primary emission sources such as industrial processes and vehicle emissions.

The Greenpeace report, titled 'SPARE THE AIR' 2nd Edition, analyses air pollution trends in 2023 across 10 cities in the South Indian states of India, building on the previous findings from the 2021-2022 assessment. The analysis reveals that PM2.5 and PM10 levels significantly exceeded the WHO guidelines and pose a significant threat to public health in south Indian cities. We propose recommendations to tackle air pollution levels in the state by focusing on phasing out fossil fuels through a just transition, building sustainable transportation systems and creating equitable cities. We also insist on urgently revising India's NAAQS following the WHO's latest and scientifically established air quality guidelines.

KEY HIGHLIGHTS

1. This analysis focuses on the 10 south Indian cities, five of which (Bengaluru, Hyderabad, Chennai, Vijayawada, and Visakhapatnam) are non-attainment cities under NCAP.

2. The yearly and monthly levels of PM2.5 and PM10 exceeded the revised WHO standards in all studied south Indian cities.

3. In Visakhapatnam, PM2.5 levels are ten times and PM10 levels are 9 times higher than the revised WHO standards. Similarly, PM2.5 is 1.5 times, and PM10 is 2.5 times higher than NAAQS standards.

4. The annual average level of PM2.5 is 6 to 7 times higher than WHO standards in Hyderabad, Vijayawada, Kochi, Mangaluru, Amaravati and Chennai.

5. The annual average of PM10 level is slightly to 1.5 times higher than NAAQS standards in Mangaluru, Hyderabad, Kochi, Amravati, Chennai and Vijayawada.

6. The monthly average trend in Bengaluru city shows that PM2.5 levels are 5 to 6 times higher, and PM10 levels are 3 to 4.5 times higher than WHO annual guidelines in all months. Meanwhile, PM10 exceeds NAAQS annual limits in February, March, April, October, November, and December.

7 The monthly average trend in Hyderabad city shows that PM2.5 levels are 7 to 8 times higher and PM10 levels are 4 to 5 times higher than WHO annual guidelines. PM2.5 exceeds NAAQS annual limits from January to April, November, and December. PM10 exceeds NAAQS limits in January to June, August, October, November, and December.

8 The monthly average Trend in Chennai city shows that PM2.5 are 4 to 7 times higher and PM10 levels are 3 to 6 times higher than WHO annual guidelines. PM2.5 exceeds NAAQS annual limits in January, while PM10 exceeds limits in January, February, October, and December.

9 This report finds that air pollution is a matter of concern for south Indian cities as well as those in the north. These cities are selected based on the availability of data, population, and monitoring station networks.

10 The report shows that there is an urgent need to add other cities in south India to the non-attainment list under NCAP.

11 The Clean Air Action Plan reports have shown that the emissions from vehicle exhaust, road dust, construction and demolition activities, industrial processes, and burning biomass are the main sources of rising particulate matter (PM) levels.

STUDY APPROACH

According to the data published by CPCB's official dashboard, Central Control Room for Air Quality Management, annual average values of PM2.5 and PM10 analysis are performed for selected cities from southern India. The data is obtained from 1st January 2023 to 31st December 2023. The annual average mean values of both parameters have been calculated in all the cities. Further, the monthly average trends of Bengaluru, Hyderabad, and Chennai are analysed. However, WHO or NAAQS does not specify monthly averages, but We used the annual guideline as a reference to highlight that air quality issues persist year-round, not just seasonally. The qualitative and quantitative analyses are carried out using prescribed air quality guidelines and standards as referred to by WHO and National Ambient Air Quality (NAAQS), respectively.

Why are PM2.5 and PM10 considered?

Several types of air pollutants are monitored in real-time, with fine particulate matter such as PM2.5 and PM10 that differ in size and health impact. PM10 refers to particles with a diameter of 10 micrometres or less, which are large enough to settle in the lungs and cause respiratory issues. PM2.5 are finer particles, with a diameter of 2.5 micrometres or less, that can penetrate deeper into the lungs and even enter the bloodstream, posing more severe health risks.

These pollutants are commonly found in the surrounding air. Primary sources of these pollutants include power plants, vehicles powered by fossil fuels, and agricultural practices like stubble burning. These micro-sized particles can be absorbed easily in the bloodstream upon inhalation and potentially cause long-term health consequences such as asthma, preterm birth, low birth weight, depression, schizophrenia, diabetes, stroke, and lung cancer.

Presentation of Data

In this report, we assess annual average concentrations of PM2.5 and PM10. This report refers to two air quality guidelines sourced from the World Health Organization (WHO) and the National Ambient Air Quality Standards (NAAQS). The two guidelines are used to correlate PM2.5 and PM10 concentration values to a more relatable reference for potential harm to human health. The annual average level is assessed to determine the yearly air quality trend. 24-hour average levels and standards are typically used to evaluate short-term air quality exposure.

Pollutant	Average Period	NAAQS	WHO Guidelines 2021
PM10 (Coarse particulate matter)	Annual avg.	60 µg/m3	15 µg/m3
	24 hours	100µg/m3	45 µg/m3
PM2.5 (Fine particulate matter)	Annual avg.	40 µg/m3	5 µg/m3
	24 hours	60 µg/m3	15 µg/m3
O3 (Ozone)	Peak season	--	60 µg/m3
	8 hours	100 µg/m3	100 µg/m3
NO2 (Nitrogen dioxide	Annual avg.	40 µg/m3	10 µg/m3
	24 hours	80 µg/m3	25 µg/m3
SO2 (Sulfur dioxide)	24 hours	50 µg/m3	40 µg/m3

About the Cities

- We have analysed annual air quality for 10 south Indian cities. All the cities are the major cities of their respective states.

- Hyderabad, Chennai, Bengaluru and Amaravati are the capital cities of Telangana, Tamil Nadu, Karnataka and Andhra Pradesh. These cities are witnessing huge infrastructure development.

- Visakhapatnam and Puducherry are eastern, while Kochi and Mangaluru are western coastal regions. Their ports handle the cargo traffic. The port leads to the industrial settlement in the city.

- Vijayawada is considered an NCAP non-attainment city, and Mysuru has experienced rapid expansion of the transportation sector.

Cities	No. of NAAQMS
Visakhapatnam	1
Hyderabad	14
Vijayawada	5
Kochi	1
Mangaluru	1
Amaravati	1
Chennai	9
Bengaluru	14
Puducherry	1
Mysuru	1

Overall Findings

- The annual average of PM2.5 and PM10 in Visakhapatnam exceeded the highest level of both NAAQS and WHO standards.

- The levels of PM2.5 and PM10 are higher than the revised standards set by WHO in all 9 cities.

- A noticeable rise in air particulate concentrations is evident from the comparative graphs for both pollutants.

- The comparison with both standards is explained below :

Comparison with WHO revised standards:

- Data shows that the level of PM2.5 is 10 times higher and PM10 is 9 times higher than revised WHO standards in Visakhapatnam.

- The graphs indicate that the annual average level of PM2.5 is 6 to 7 times higher in 6 cities – Hyderabad, Vijayawada, Kochi, Mangaluru, Amaravati and Chennai.

- Additionally, the annual average of PM10 levels exceeded 4 to 5 times higher in 3 cities – Bengaluru, Puducherry and Mysuru.

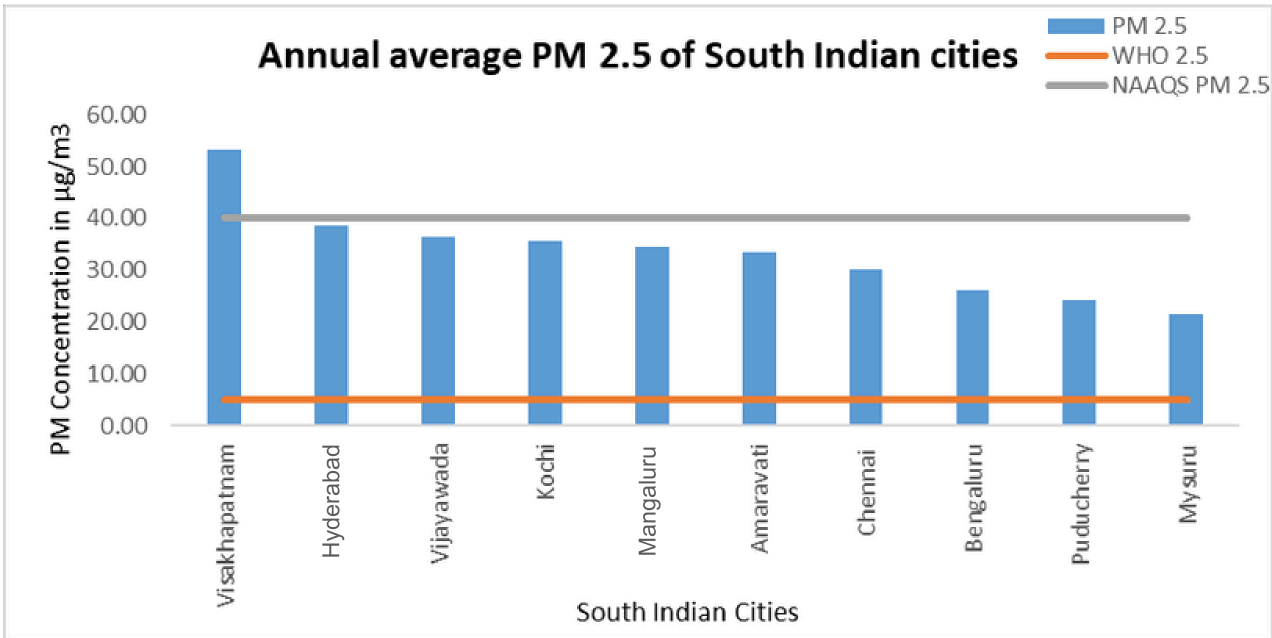
Comparison with National Ambient Air Quality Standards (NAAQS) standards:

- The annual average of PM2.5 is 1.5 times higher, and PM10 is 2.5 times higher than NAAQS standards in Visakhapatnam.

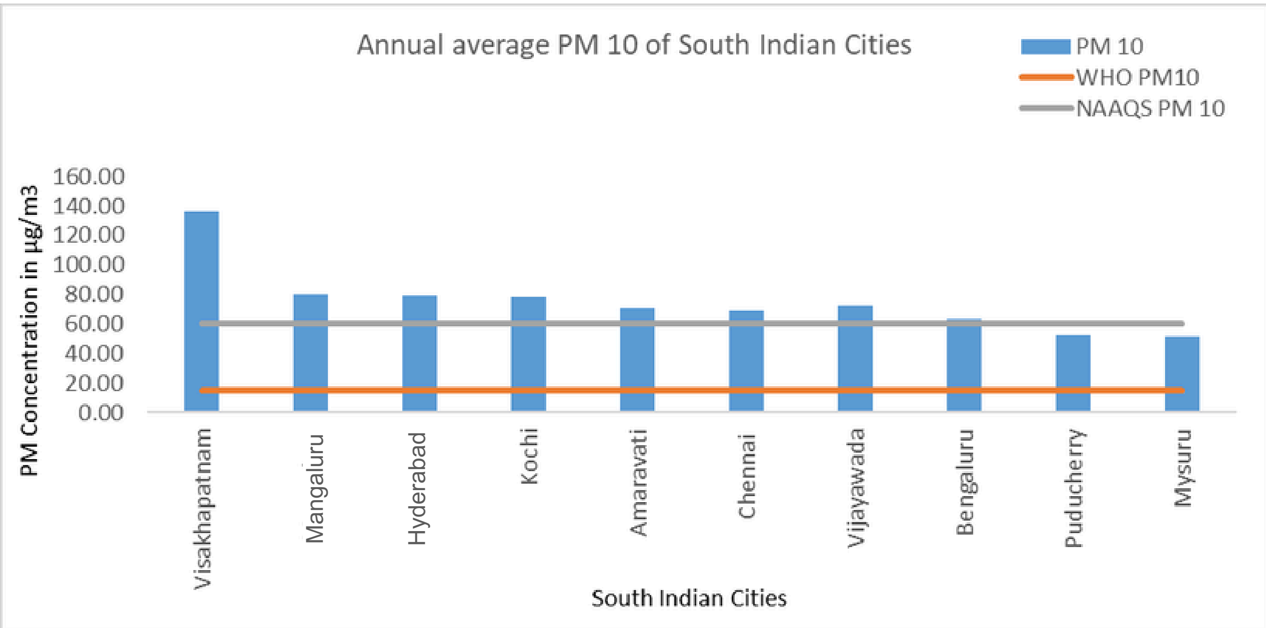
- The graph indicates that the level of PM2.5 is well within the standards in all 9 cities.

- Additionally, the level of PM10 is 1.5 times higher in Mangaluru, Hyderabad, Kochi, Amravati, Chennai and Vijayawada.

- The PM10 level is well within the standards in Bengaluru, Puducherry and Mysuru cities.



Annual average PM2.5 concentration of South Indian cities with respect to NAAQS and WHO revised standards.



Annual average PM10 concentration of South Indian cities with respect to NAAQS and WHO revised standard.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#BENGALURU

STUDY OF TOP THREE METRO CITIES OF SOUTH INDIA

BENGALURU

Bengaluru is the capital of Karnataka, a silicon city and a huge hub of the IT sector. The city's population grew by 47% Between 2001 and 2011. (Verma et al., 2017). According to the World Population Review (2021), the estimated population of Bengaluru increased by 12.7 million, almost growing by 48%, from 2011 to 2021. To accommodate this rapid increase, the city began replacing open spaces with concrete infrastructure. This growth led to higher emissions from various sources, including construction, demolition, cooking with wood and kerosene, coal use in restaurants, burning garbage, and using diesel generators in tall buildings and IT parks (Guttikunda et al., 2019). Additionally, unchecked growth in vehicle number and size caused more pollution from exhaust emissions and dust as well as traffic congestion (Guttikunda et al., 2019).

A 2010 study by TERI found that in 2007, the main sources of pollution in Bengaluru were transport, road and construction dust, domestic and commercial fuels, industries and diesel generator (DG) sets. At the city level, the largest contributor to PM10 emissions was transport (42%), followed by road dust (20%), construction dust (14%), industry (14%), DG sets (7%), and domestic fuel (3%).

A later study in 2019 by (Guttikunda, et al., 2019) revealed that by 2015, the major sources of PM10 emissions had shifted. Transport contributed 19.7%, while road and construction dust accounted for 61.4%, industries for 8.3%, waste burning for 5.5%, domestic fuel for 3%, and DG sets for 2%. This study noted that the share of emissions from industries decreased by nearly 5% from 2007 to 2015, but road and construction dust emissions nearly doubled during that time.

The city is considered among the 131 non-attainment cities, so the Karnataka State Pollution Control Board has prepared the Clean Air Action Plan with all necessary action points after recognising all the major pollution contributors in the city.

Data Findings

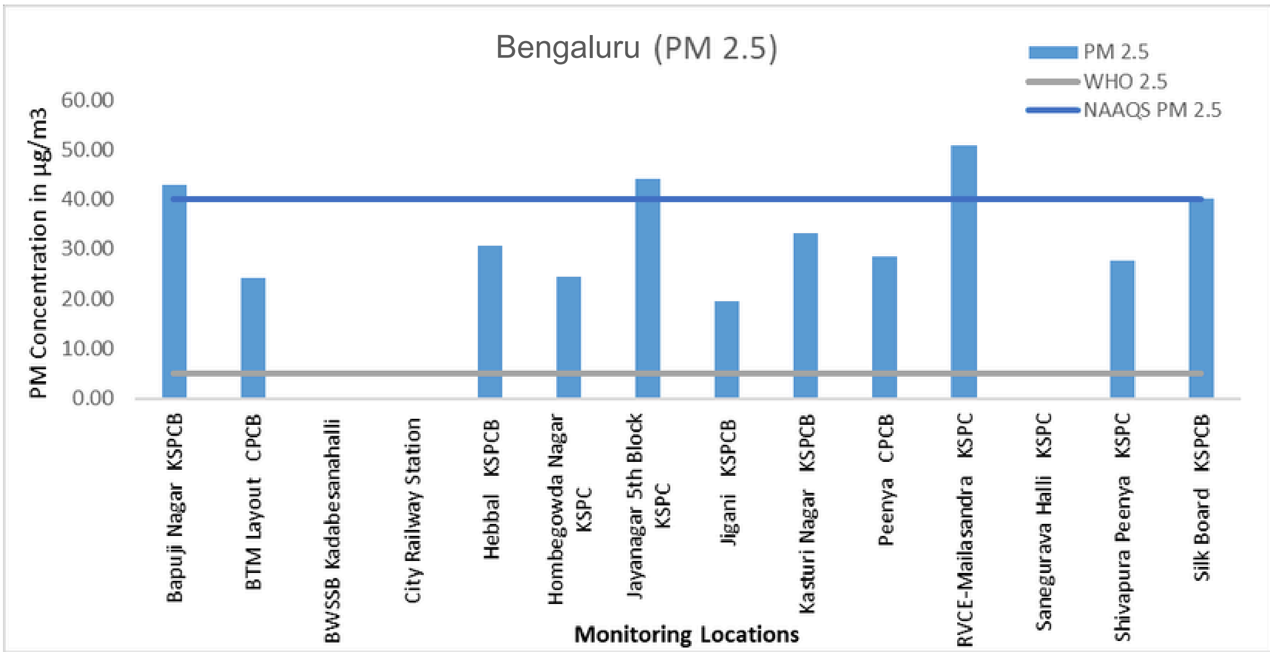
- The city has 14 monitoring stations set up by CPCB and KSPCB. However, data was not recorded at 3 stations: BWSSB Kadabesanahalli, City Railway Station, and Saneguravahalli KSPCB.

- The annual average levels of PM2.5 are 4 to 5 times higher at 7 locations and 8 to 9 times higher at 3 locations in the city than the revised WHO standards.

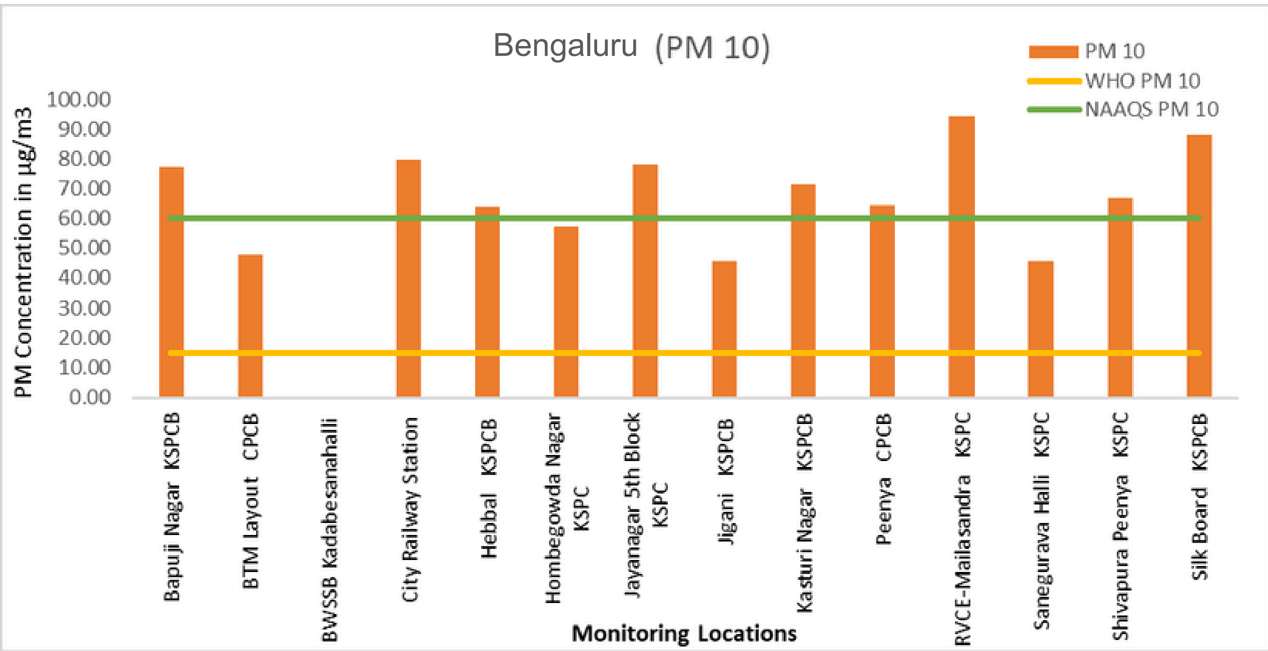
- Additionally, the annual average of PM10 is 3 to 4 times higher at 7 locations and 5 to 6 times higher at 5 locations in the city than the revised WHO standards.

- The city's annual average of PM2.5 levels is slightly higher at 3 locations, and the rest of the stations are well within the NAAQS standards.

- Similarly, the annual average of PM10 levels is slightly higher to 1.5 times higher at 9 stations, exceeding the city's NAAQS standards.



Annual average PM2.5 concentrations of Bengaluru city with respect to NAAQS and WHO revised standards.



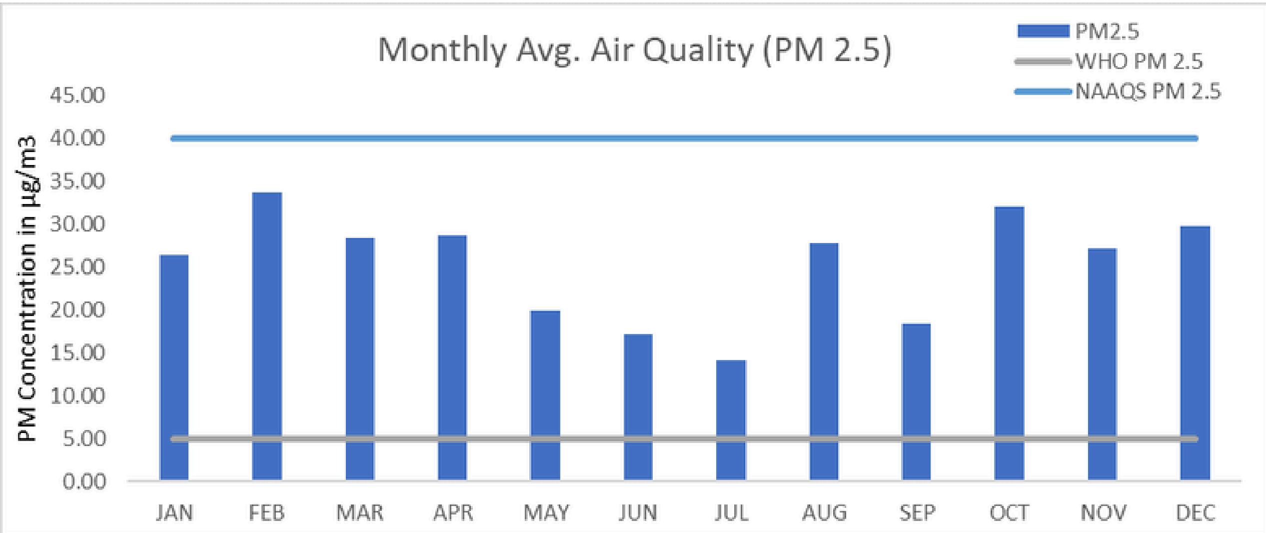
Annual average PM10 concentration of Bengaluru city with respect to NAAQS and WHO revised standards.

Monthly Air Quality Trend

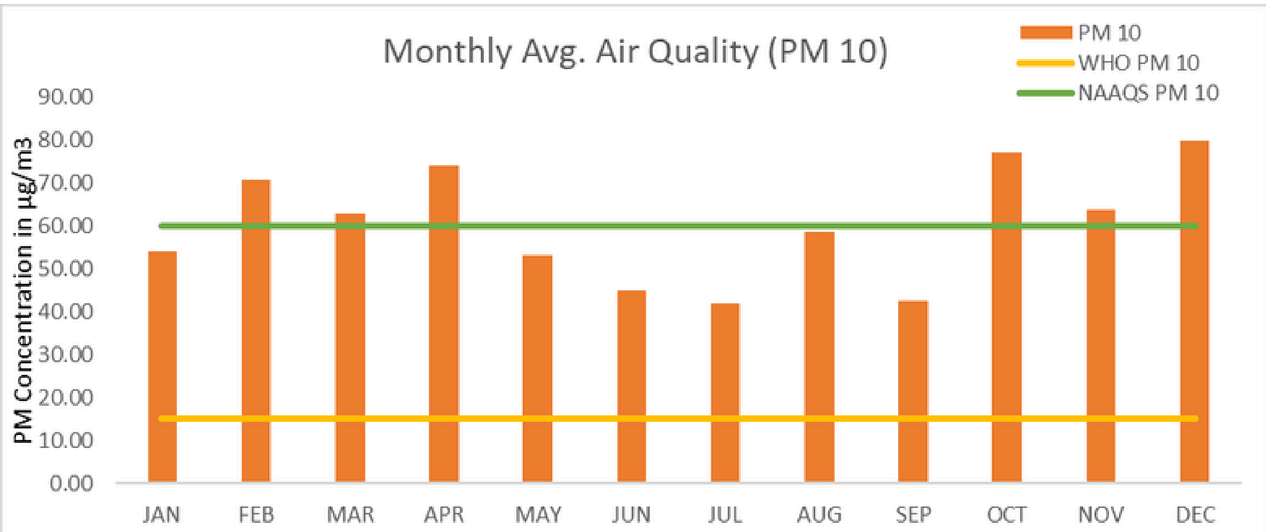
- The monthly air quality trend for Bengaluru shows that PM2.5 levels are 5 to 6 times higher and PM10 levels are 3 to 4.5 times higher than the revised WHO guidelines.

- At all the locations, the value of PM2.5 levels is within the NAAQS limits throughout the year.

- However, PM10 levels exceeded NAAQS limits in February, March, April, October, November, and December.



Monthly average trend for PM2.5 concentration of Bengaluru city with respect to NAAQS and WHO revised standards.



Monthly average trend for PM10 concentration of Bengaluru city with respect to NAAQS and WHO revised standards.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HYDERABAD

Hyderabad is the capital and the largest city of Telangana. In 2014, its population was estimated at 8.7 million, making it India's 4th most populous city. By 2018, this number grew to over 9 million. As of 2024, the population of Hyderabad is estimated at 11.07 million. In 2007, the Greater Hyderabad Municipal Corporation (GHMC) was established to manage the city's infrastructure, expanding the Hyderabad area from 175 to 650 square kilometres. This expansion led to an 87% increase in the city's population. Today, the GHMC has around 10 million people, making it India's 6th most populous urban area. Its population has grown significantly from 7.7 million in 2011.

In 2006, the Andhra Pradesh State Pollution Control Board conducted a study on particulate pollution in the Greater Hyderabad Municipal Corporation. The study found that vehicle exhaust and road dust were the biggest contributors, making up 30% and 30-45% of the pollution, respectively. Other sources, including coal burning in industries and open waste burning, were also responsible for pollution (Guttikunda et al. 2014).

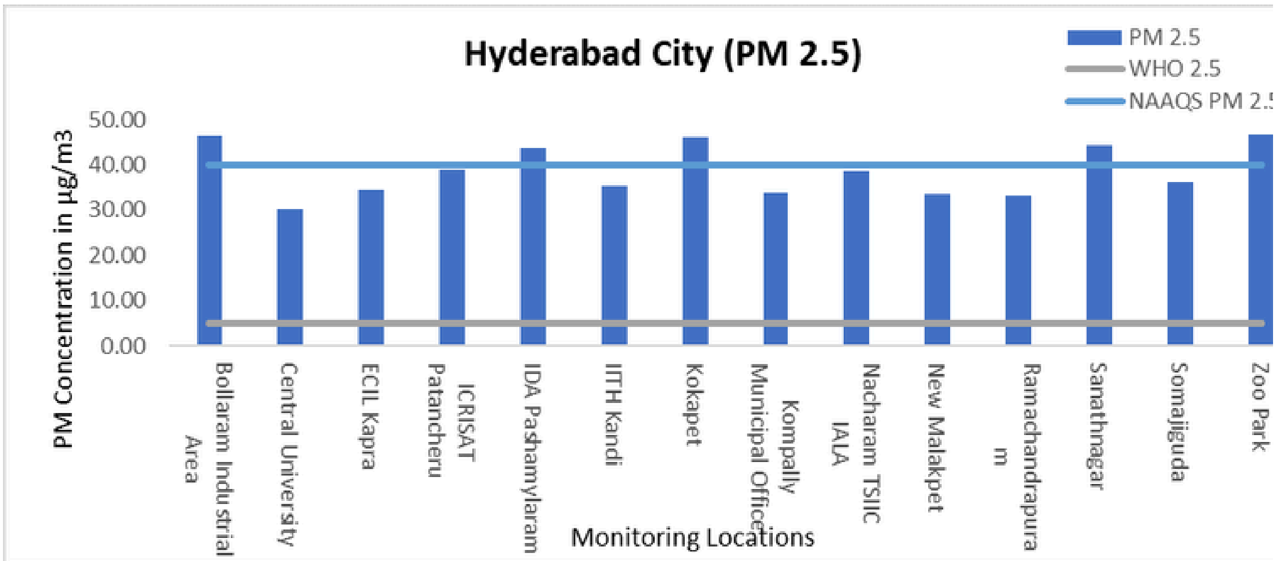
Data Findings

- In Hyderabad city, there are 14 monitoring stations located by CPCB and TSPCB. It is to be noted that data was not recorded at the Sanathnagar monitoring station.
- The annual average values of PM2.5 are 5 to 6 times higher at 7 locations and 7 to 8 times higher at another 7 locations than the WHO revised standards.

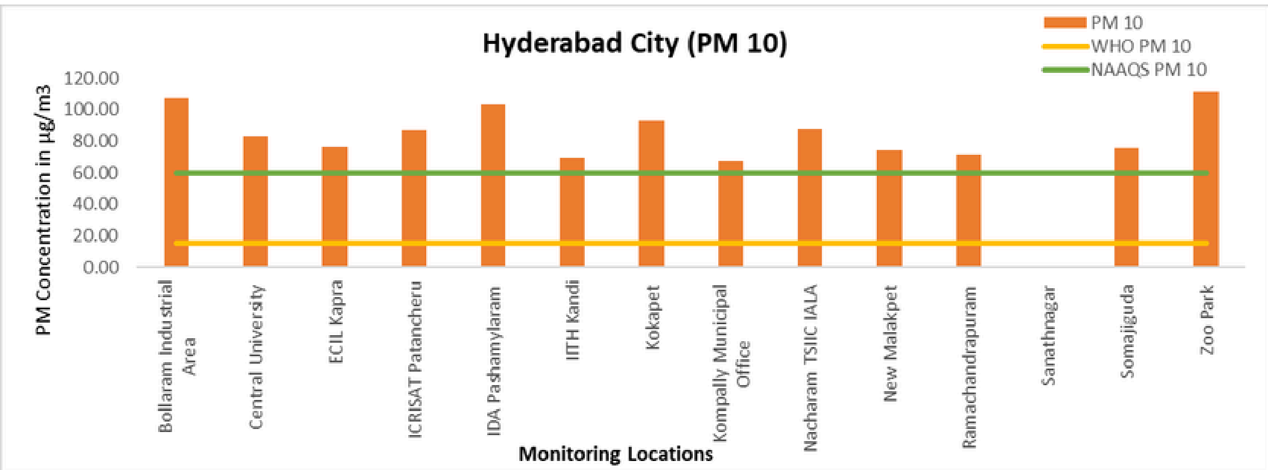
- Additionally, the PM10 value shows that the levels are 6-7 times higher at 8 locations and 4 to 5 times higher at 6 locations than the WHO revised standards.

- Apart from that, five stations have slightly higher PM2.5, and the rest are well within the NAAQS standards.

- PM10 values are slightly to 1.5 times higher than NAAQS standards at all the locations.



Annual average PM2.5 concentration of Hyderabad city with respect to NAAQS and WHO revised standards.



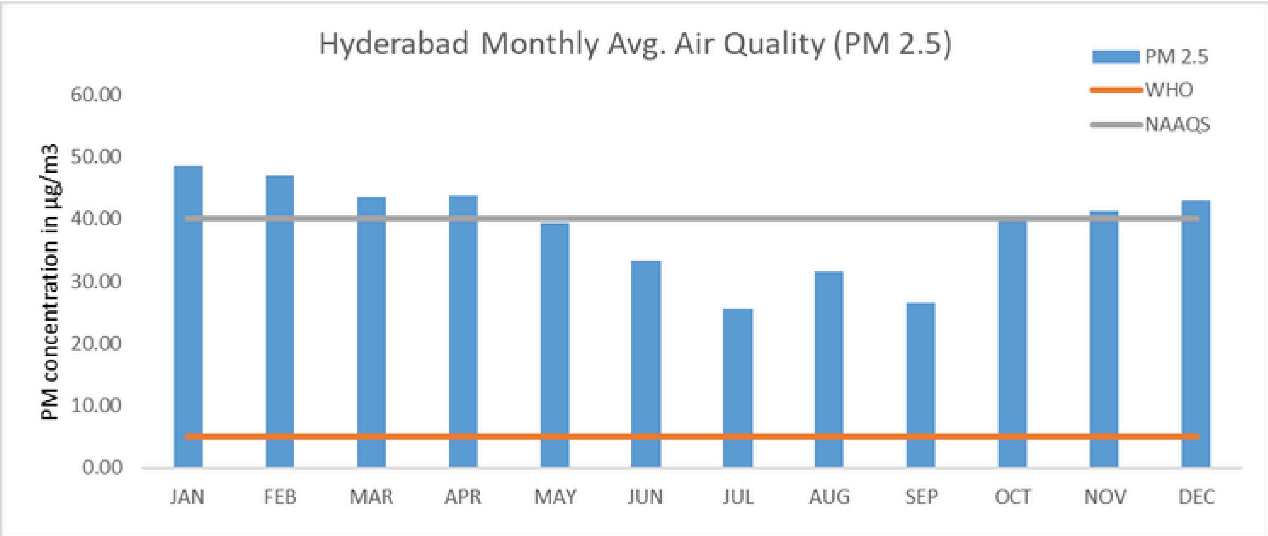
Annual average PM10 concentration of Hyderabad city with respect to NAAQS and WHO revised standards.

Monthly Air Quality Trend

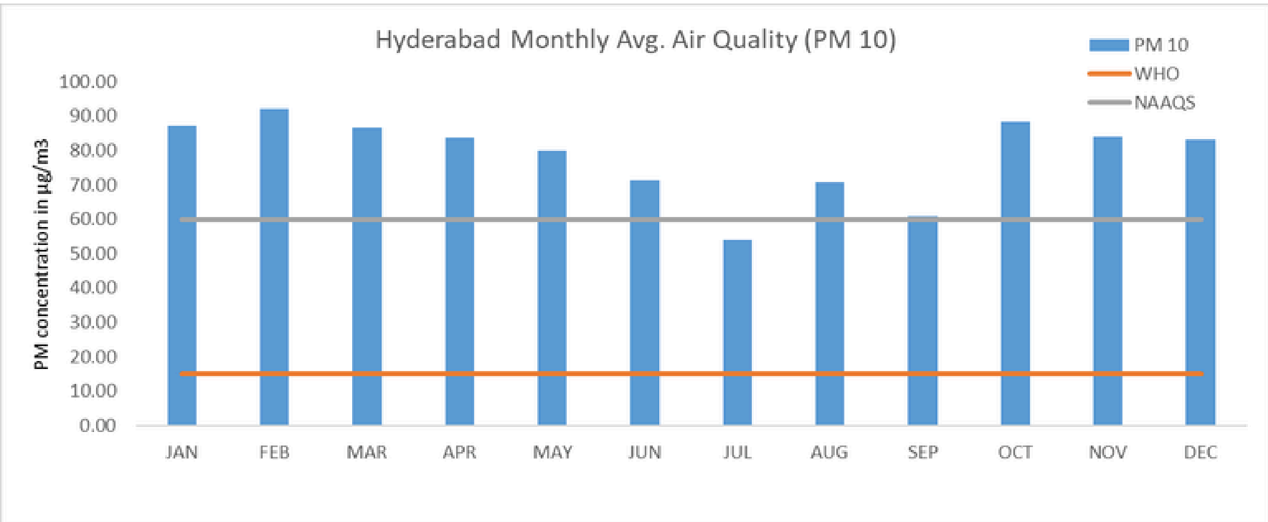
- The monthly air quality trend of Hyderabad for PM2.5 and PM10 values shows that all the monthly average values are more than 7 to 8 times higher than WHO revised guidelines.

- PM2.5 values in January to April, November and December are higher than the NAAQS guidelines.

- In the case of PM10, the values of January to June, August and October to December exceed the NAAQS values.



Monthly average PM2.5 concentration of Hyderabad city with respect to NAAQS and WHO revised standards.



Monthly average PM10 concentration of Hyderabad city with respect to NAAQS and WHO revised standards.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CHENNAI

Chennai covers an area of about 426 km² and is divided into three regions: North, South, and Central. The northern part is designated as the industrial zone. The city has an estimated population of around 10.9 million. While the old areas of Chennai witnessed an 8% growth between 2001 and 2011, the newly added areas experienced a significant 54% growth during the same period. Chennai is also home to over one-third of India's automobile industries, making it the largest industrial and commercial hub in South India.

A recent study done by Mangaraj et al. (2024) revealed that the combustion of fossil fuels in industries and transport activities dominates the air quality of Chennai city. Road dust (27.9%), transport (23.2%), industry (20.2%), biomass burning (12.7%) and construction (4.4%) are majorly contributing to higher emissions of PM10.

Data Findings

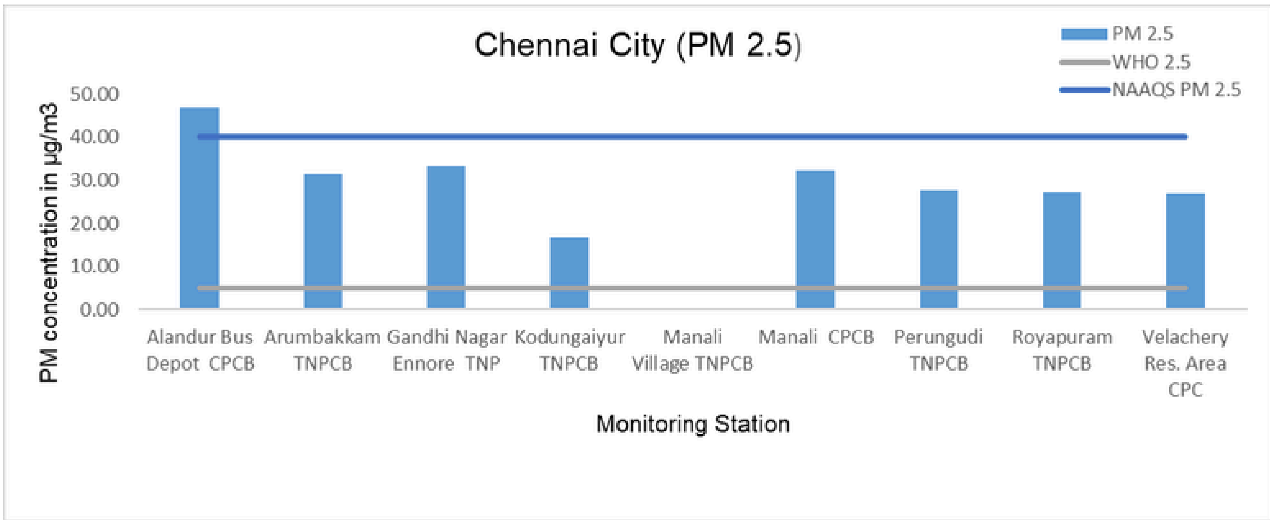
- In Chennai, there are 9 monitoring stations set up by CPCB and TNPCB. Data for both parameters was not recorded at Manali village TNPCB station.

- The annual average levels of PM2.5 at 7 locations are 5 to 6 times higher, and at 1 location, it is 8 times higher than the revised WHO standards.

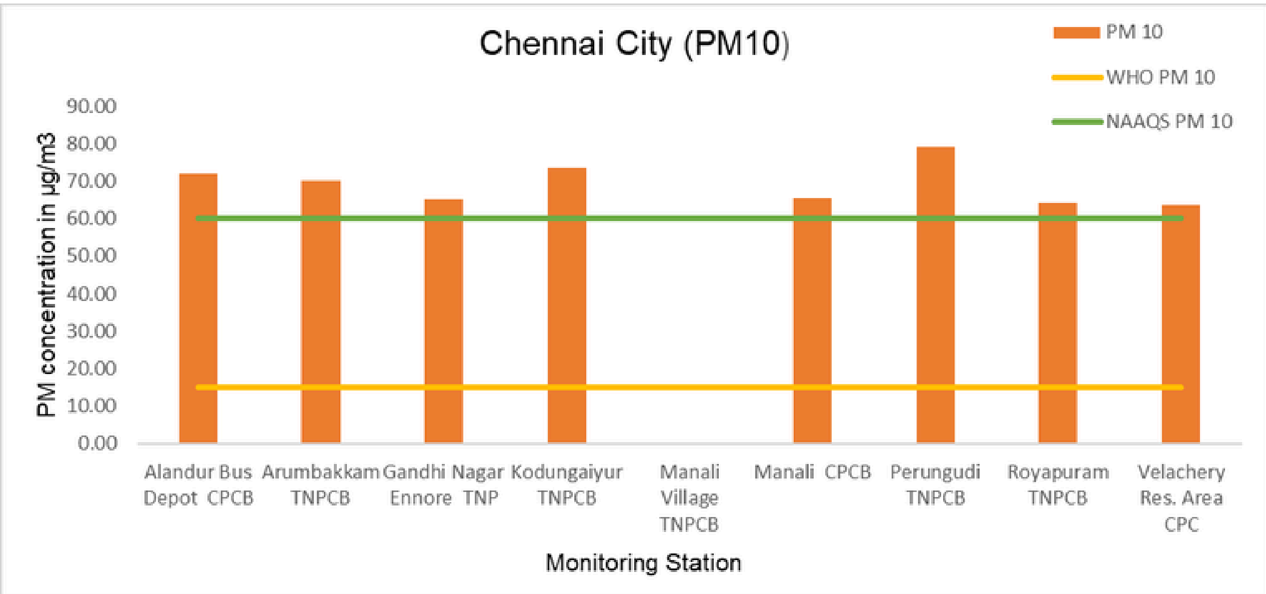
- Additionally, PM10 levels are 4 to 5 times higher at all locations than the revised WHO standards.

- The annual average of PM10 values is slightly higher than NAAQS standards at all 8 locations.

- While PM2.5 levels are slightly exceeded at 1 location, other locations remain well within the NAAQS standards.



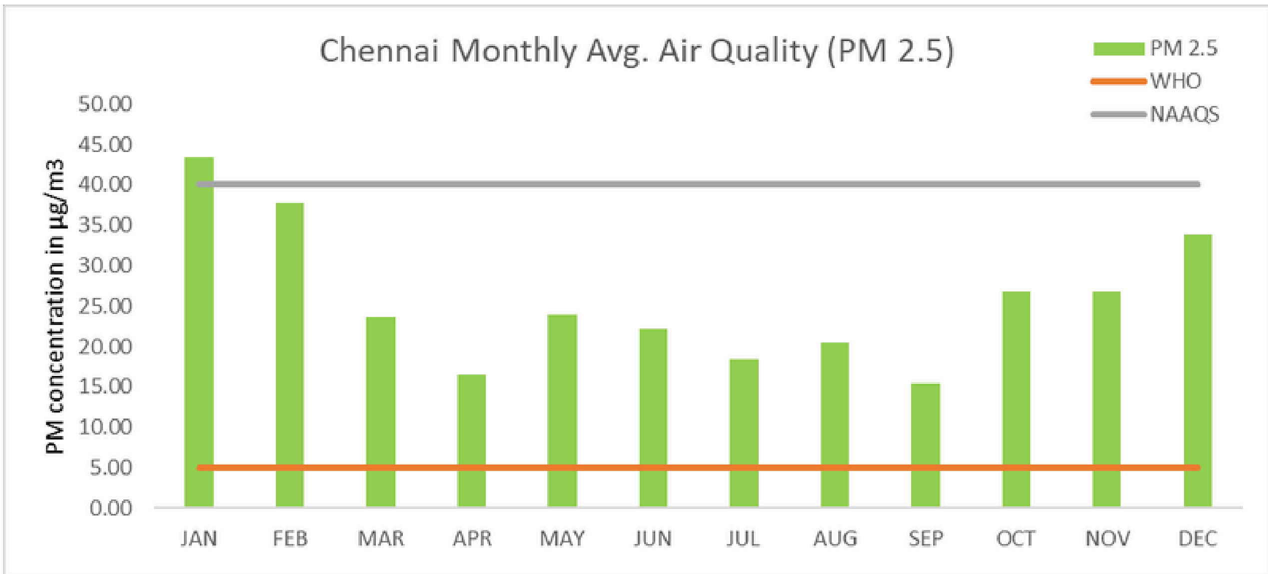
Annual average PM2.5 concentration of Chennai city with respect to NAAQS and WHO revised standards.



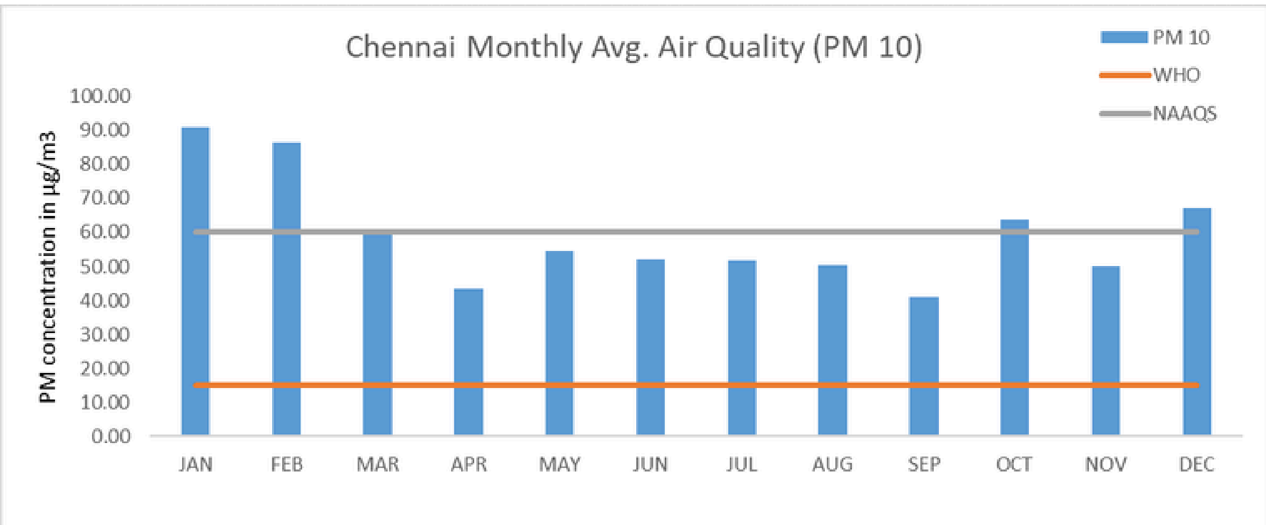
Annual average PM10 concentration of Chennai city with respect to NAAQS and WHO revised standards.

Monthly Air Quality Trend

- The monthly air quality trend of Chennai city shows that PM2.5 and PM10 levels are 7 to 8 times higher than the revised WHO guidelines.
- In January, PM2.5 levels also exceeded the NAAQS standards.
- The PM10 levels exceeded NAAQS standards in January, February, October and December.



Monthly average PM2.5 concentration of Chennai city with respect to NAAQS and WHO revised standards.



Monthly average PM10 concentration of Chennai city with respect to NAAQS and WHO revised standard.

WAY FORWARD

Air pollution remains a critical global challenge, adversely impacting both the environment and public health. The World Health Organization (WHO) estimates that air pollution causes 7 million premature deaths annually, with a significant burden on respiratory and cardiovascular health. Moreover, pollutants such as particulate matter (PM2.5), nitrogen oxides (NOx), and sulfur dioxide (SO_2) contribute to environmental degradation, including acid rain, eutrophication, and climate change.

Below are some recommendations and actions that need to be taken to address the air pollution crisis:

- India's Central Pollution Control Board (CPCB) must take a health-based approach to revising National Ambient Air Quality Standards (NAAQS) and have the ambition to move to WHO air quality guidelines, which are based on the latest scientific understanding. Additionally, considering the unique pollution profiles and climatic conditions of South Indian cities, it is recommended that these cities/regions should have their own regional ambient air quality standards aligning with regional airshed management approaches. The focus should be on setting achievable goals tailored to local contexts, aiming to protect public health effectively. Tailoring air quality standards to local conditions can encourage more relevant and effective measures for managing air pollution.

- Increased investment should be directed towards developing a "hybrid" air quality monitoring network that integrates low-cost sensors with existing systems and satellite data. By boosting resource allocation, more monitoring stations can be established, which will provide richer spatial and temporal data. This expanded network should enable detailed assessment of neighbourhood-level air quality variations, helping to identify the most vulnerable populations and areas with the highest pollution levels. Facilitating real-time public access to air quality information will improve trend analysis, validate models, pinpoint emission sources, and support more effective and targeted interventions.

Additionally, this approach can aid in developing equitable policies to address air quality disparities and reduce health inequities.

- Local governments should promote decentralised renewable energy solutions, such as rooftop solar while addressing other major pollution sources. Specifically, they need to reduce vehicular emissions by supporting enhancing public transit, improving waste management to prevent emissions from waste burning, enforcing green building standards in construction and urban planning, regulating industrial emissions with cleaner technologies, and encouraging cleaner alternatives to biomass burning. This integrated approach will effectively lower carbon footprints and enhance air quality.

- Adopt a regional air-shed management strategy to address air pollution on a broader, more integrated scale. This approach should involve coordinated efforts across multiple cities and states within the same air shed, focusing on shared sources of pollution, cross-boundary impacts, and collaborative solutions. By managing air quality collectively within defined regions, stakeholders can more effectively address the complex interplay of local and regional pollution sources, ensuring more comprehensive and impactful improvements in air quality.

- Map and analyse sectoral hotspot zones, traffic congestion, roads and high-emission areas to develop targeted action points for effective pollution control.

- Create awareness programmes to encourage people to adopt sustainable practices such as public transport, electric vehicles and solar energy to reduce fossil fuel dependency.

- Strengthen healthcare services to diagnose and treat air pollution-related conditions better. Establish a health advisory system to provide timely alerts to the public during high pollution periods and offer guidance on protective measures.

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