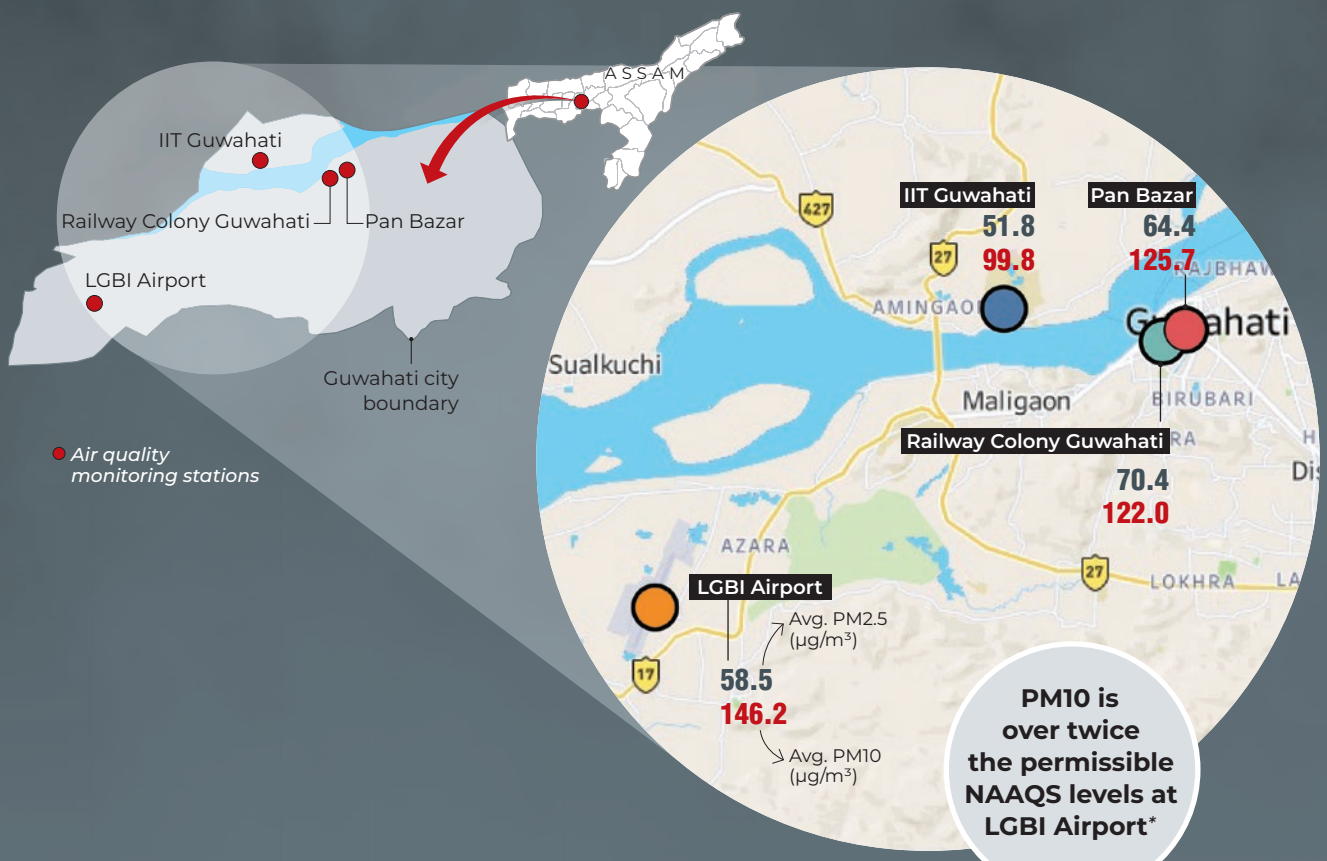
KNOW YOUR CITY AND WHAT YOU BREATHE

GUWAHATI AIR POLLUTION FACT SHEET

Guwahati city has an area of 216.79km² but it has only 4 Continuous Ambient Air Quality Monitoring Stations (CAAQMS).

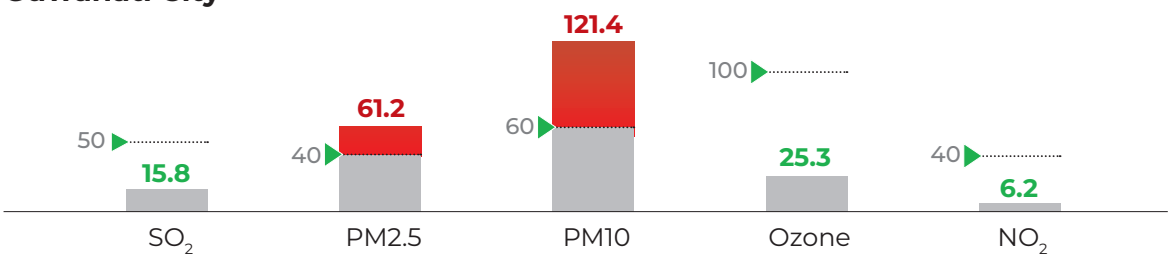


PM10 is over twice the permissible NAAQS levels at LGBI Airport*

**Based on 2023 average annual concentration data*

Pollutant Concentration

Guwahati City



Source: iFOREST Analysis

The average PM2.5 concentration in 2023 was 61.2 µg/m³ or 53% higher than the prescribed National Ambient Air Quality Standards (NAAQs).

The same for PM10 was 121.4 µg/m³, which is 100% higher than permissible standards.

Only Railway Colony Guwahati CAAQMS has 'Good' availability of data for all years 2019-2023.

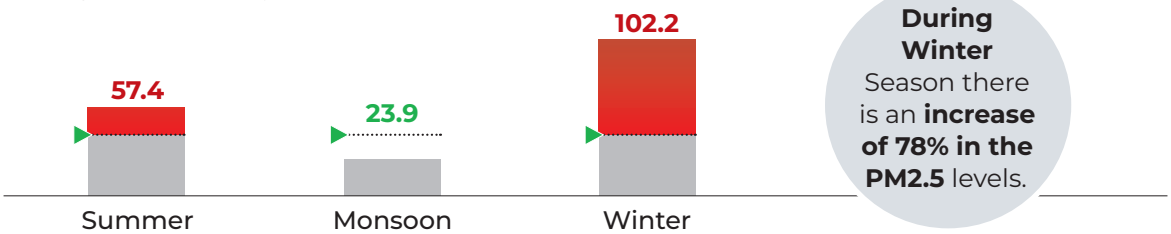
The peak time interval for pollutants PM10 PM2.5 and NO_2 is in evening around 6-11 PM.

SO_2 concentration is relatively stable during the day except for a marginal peak between 7 to 9 PM.

In 2021 and 2022 the data availability is "moderate" and 2023's data availability is "Good".

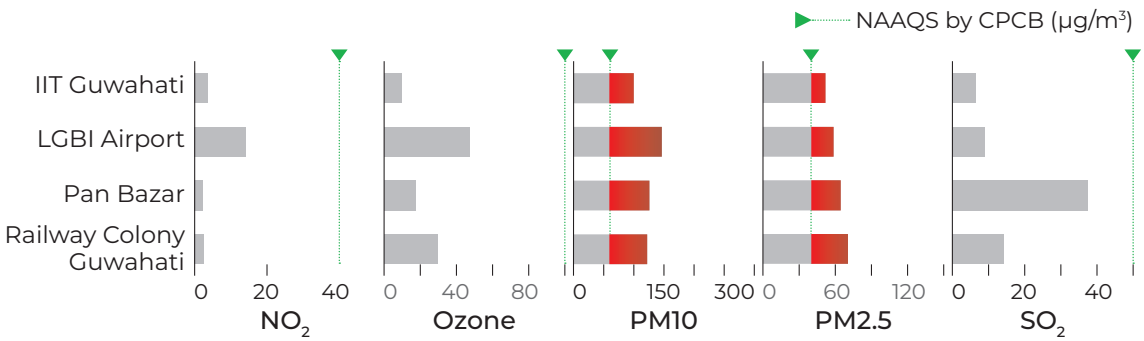
Seasonal concentration for PM2.5 in 2023

Average of PM2.5 (µg/m³)



During Winter Season there is an **increase of 78% in the PM2.5** levels.

Concentration of major pollutants: 2023



PM10 concentration in **all locations is around twice** the permissible NAAQS value.

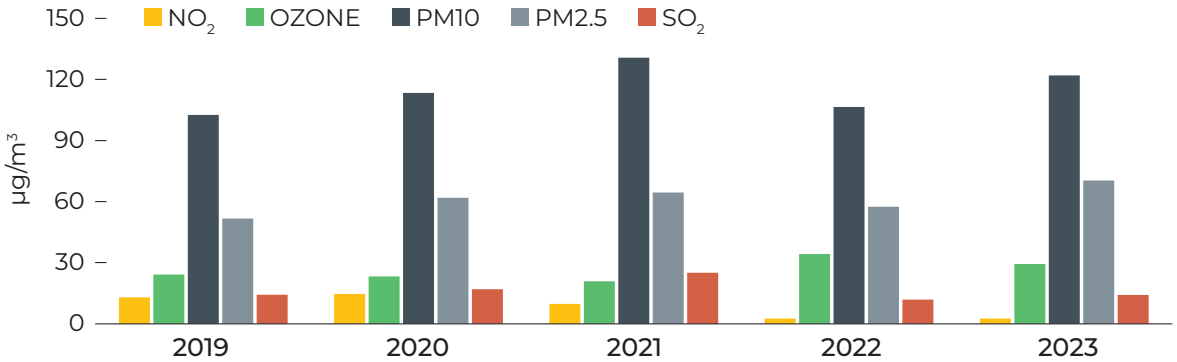
PM2.5 concentration in **all location is up to two times** the permissible NAAQS value.

Concentration of **NO_2, Ozone and SO_2 is well** within the NAAQS standards.

Concentration trends

ANNUAL

Average Concentration of key pollutants at Railway Colony CAAQMS Location in year 2019- 23



*Year wise trend analysis of only Railway Colony CAAQMS location is possible because of 'Good' Quality data in all years

A **15-18% Increase** in average **PM 10** concentration was observed till 2023 with an exception in 2022 (which saw a drop of 18%)

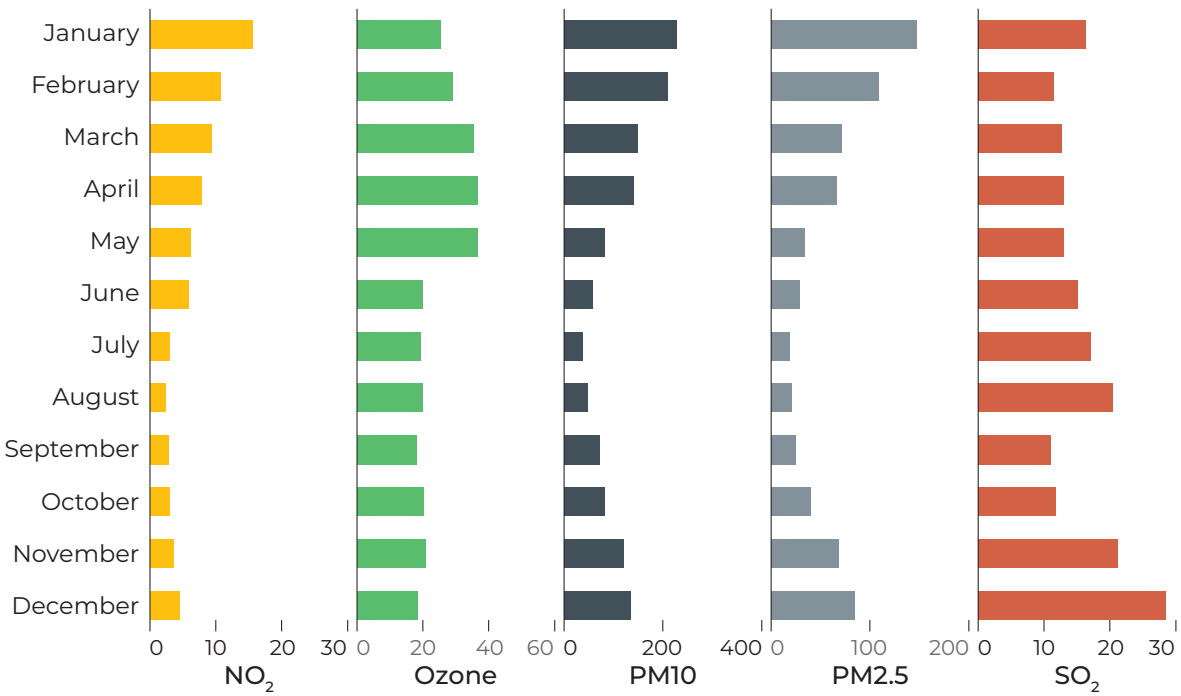
An **increase in the average PM2.5 concentration** was observed for 2020-2021, despite COVID-19 regulations.

NO_2 concentration has **decreased by 80%** since 2019.

However, **no significant variation** in SO_2 levels.

MONTHLY

Average Concentration (µg/m³) of key pollutants in year 2023



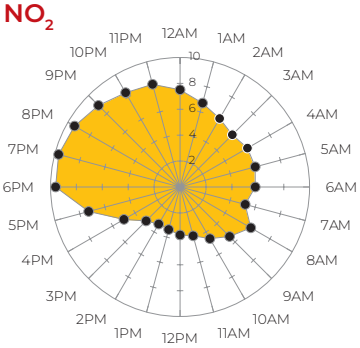
PM2.5 and PM10 concentrations were found to be **within the NAAQS permissible levels** during the monsoon and post-monsoon season (May to Oct).

NO_2, SO_2 and ozone are found **to be well below** the **NAAQS across all the months**.

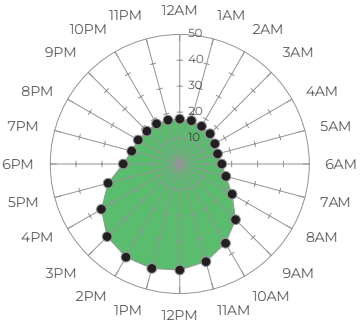
HOURLY

24-Hourly Average Concentration (µg/m³) of key pollutants in year 2023

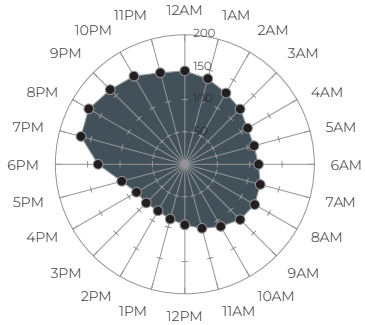
NO_2



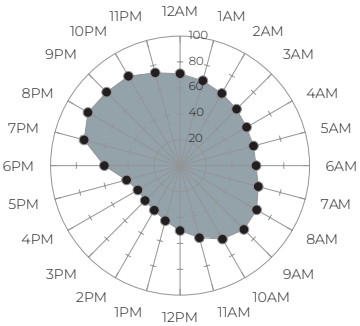
Ozone



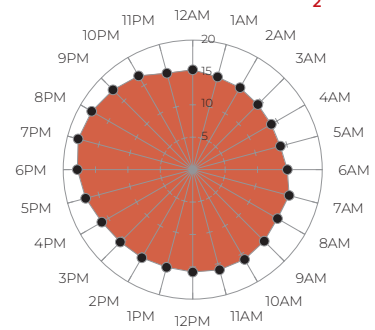
PM10



$PM_{2.5}$



SO_2



PM10 and PM2.5 hourly trend analysis shows that the **peak for both pollutants** is observed **in the evening between 7-11PM**.

Peak for NO_2 and **SO_2** is **observed between 6 - 8PM**.

The **minimum concentrations for NO_2, PM10** and **PM2.5** are **between 12 and 4PM**.

However, **Ozone peaks during the same interval**.

What PM2.5/PM10 Ratio Reveals?

The ratio is greater than 0.5 in all locations implying a higher presence in smaller particulate matter. This implies higher presence of smaller particulate matter.

Air pollution data availability in Guwahati

ANNUAL AVERAGE (2019 - 2023)

YEARS	PM10	PM2.5	NO_2	OZONE	SO_2
2019	26%	26%	27%	27%	27%
2020	32%	30%	32%	32%	32%
2021	58%	57%	58%	57%	61%
2022	50%	50%	48%	45%	53%
2023	74%	77%	80%	84%	86%

MONTHLY AVERAGE (2021-2023)

Months	PM10	PM2.5	NO_2	OZONE	SO_2
January	91%	89%	66%	83%	88%
February	86%	63%	93%	94%	96%
March	80%	83%	85%	87%	88%
April	84%	85%	93%	95%	95%
May	86%	90%	91%	94%	91%
June	57%	70%	75%	67%	84%
July	67%	88%	73%	95%	94%
August	59%	74%	78%	89%	91%
September	47%	55%	72%	68%	72%
October	55%	57%	72%	68%	72%
November	82%	83%	72%	83%	82%
December	90%	85%	85%	85%	74%

LOCATION WISE (2021-2023)

Locations	PM10	PM2.5	NO_2	OZONE	SO_2
IIT Guwahati	86%	78%	94%	93%	95%
LGBI AIRPORT	62%	83%	92%	76%	80%
Pan Bazar	66%	68%	38%	73%	73%
Railway Colony Guwahati	80%	79%	94%	93%	94%

The year **2023 saw 'Good' availability of air pollution data** from CAAQMS in Guwahati.

As this is not the case for **years 2019 - 2022**, this period has **not been considered for analysis**.

Location wise **all CAAQMS recorded 'Good'** quality data **in 2023**, except **Pan Bazar**, which recorded **'Good' quality data for just 38%** of the time in 2023.

ANNEXURE

Context and significance of big data analytics for air pollution

- Understanding air pollution phenomena using big data analysis techniques helps support critical decision making for improving air quality
- The real time and continuous pollutant concentration data recorded by the ground air pollution monitoring stations in the city, typically known as Continuous Ambient Air Quality Monitoring Stations (CAAQMS), can be aggregated to form the big data that can be analysed to understand pollution patterns.
- CAAQMS record concentration of various pollutants at an average frequency of 15 seconds. Data recording at such short intervals of 15 seconds provides rich data for correlation with economic activities for source mapping.
- Big data regarding concentration of pollutants can also help policy makers understand the trends- Yearly, Monthly and Hourly of different pollutants in different locations and identify hot spots for suitable action.
- However, data cleaning to remove biases and poor quality data, is a critical step while using big data analysis before calculating average pollutant concentrations at every location.
- Recommendations based on this assessment can help in formulation of hyper-local action plans for the city.

Guidelines available for Air Pollution measurements

PM10	PM2.5	NO_2	SO_2	Ozone

- The key pollutants, as per the CPCB guidelines, for calculation of Air Quality Index and consideration of a zone as non-attainment or polluted zone are PM10, PM2.5, NO_2, SO_2 and Ozone .
- According to CPCB, the region or location is considered as polluted or is considered as a non-attainment region, if the annual average, taken of 104 measurements, that is 2-day data for each week, 4-hour sample for gaseous and 8-hour sample for PM, exceeds the values mentioned in the National Ambient Air Quality Standards (NAAQS). The permissible level or standard for the key pollutants are:
  - PM 10 : 60 µg/m^3.
  - PM2.5 : 40 µg/m^3.
  - NO_2 : 40 µg/m^3.
  - SO_2 : 50 µg/m^3.
  - Ozone : 100 µg/m^3.
- According to World Health Organization (WHO), a region or a zone is considered as prone to health risks, if the Annual average concentration and 99th percentile of day's average, particularly in case of SO_2, exceeds the values mentioned in the guidelines. The WHO guidelines for the key pollutants are :
  - PM 10 : 15 µg/m^3.
  - PM2.5 : 5 µg/m^3.
  - NO_2 : 10 µg/m^3.
  - SO_2 : 40 µg/m^3.
- According to National Centre for Biotechnology Information PM2.5/ PM 10 ratio is an important factor in understanding the source of pollution in the region. A high PM2.5/PM10 ratio (>0.5) typically suggests that fine particles and secondary particulates such as NO^3-, SO^42- NH4+, and organics, are major contributors. Conversely, a lower PM2.5/ PM10 ratio indicates the dominance of coarse particles.

METHODOLOGY ADOPTED

For Continuous Ambient Air Quality Monitoring Station (CAAQMS) data to be reliable, especially in cases where pollutant concentrations and meteorological parameters like wind speed are being recorded, a robust methodology for data cleaning, aggregation, and analysis is crucial. This ensures accurate yearly, monthly, and hourly trend analysis as well as hot spot identification based on 'Good' quality data.

Methodology

Collection of time series data (15 minute frequency) of pollutants recorded at different CAAQMS in the city from Central Pollution Control Board website.

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Aggregating data to form big-data of the complete city.

↓

Clearing out the monthly data points of pollutant, if the data recorded in any month for any year is less than 60%.

↓

Clearing out daily data points of pollutant, if the data recorded on any day is less than 60%.

↓

Data Visualisation and Analysis.

Data Quality Based on clean data availability

Data Availability %	Data Quality
>80%	Excellent
60%-80%	Good
40%-59%	Moderate
<40%	Poor

- According to Department of Environment, Government of NCT of Delhi, the pollutant concentration analysis over the annual, monthly and hourly timestamps is essential to identify major pollutants in the 2 km radius of the CAAQMS location.
- Major pollutant hots pots have been identified in this factsheet on the basis of relative average annual concentration of the pollutants across locations and the guidelines specified by Central Pollution Control Board.

Cleaned data → Relative pollutant concentration analyzed by taking an average of the pollutant for available data points

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