

Course Project – CE 666 (*Air Pollution and its Control*)

Trend Analysis of the 6 pollutants for 4 years from 2021-2024(6th September) for KANPUR CITY

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Presented By: Group 1

Representatives – Vagisha, Ritwik Yadav, Aadya Umrao

Project Objective:

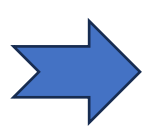
- To analyze the Trend, the Exceedance and the Variability of the criteria pollutants over the past 4 years in the Kanpur City.
- Three regions NSI Kalyanpur, Kidwai Nagar and Nehru Nagar are considered. Values for IIT Kanpur region ignored due to very less info available.
- The pollutants considered are PM 2.5, PM 10, CO, Sulphur Dioxide, Ozone and Benzene.
- To Compare the seasonal, monthly, diurnal and hourly variations of the pollutants over the three regions of the Kanpur City.
- To find out an overview - which region represents the Kanpur City the best.

6 pollutants considered:

- PM 2.5
- PM 10
- CO
- Sulphur Dioxide
- Ozone
- Benzene

15 mins. data are being analysed for each pollutant taken from CPCB, from which we have observations for seasonal variations, diurnal variations and the monthly variations over the three regions of Kanpur City – Kidwai Nagar, Nehru Nagar and NSI Kalyanpur.

Data's are collected from CPCB website.



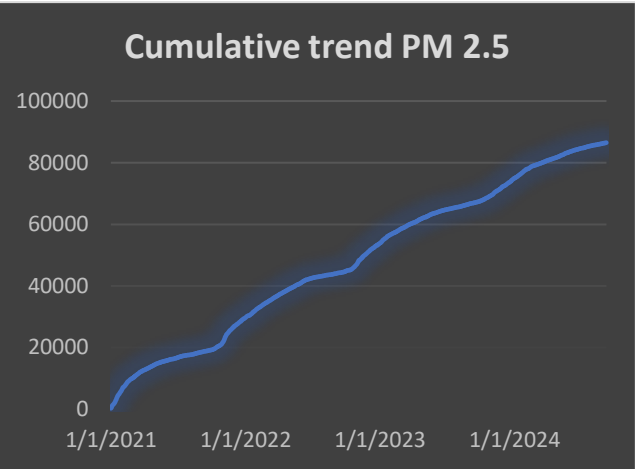
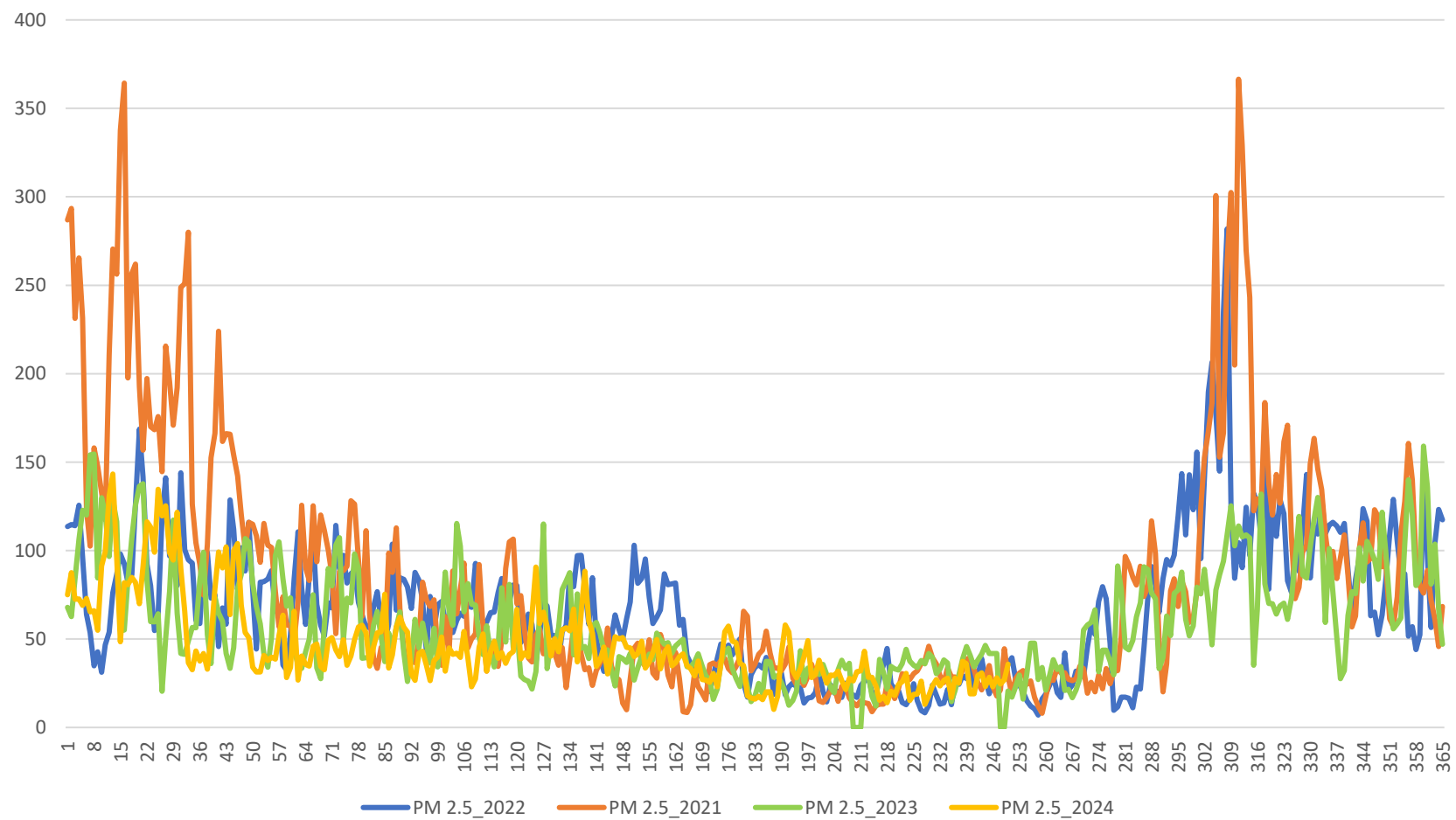
PM – PARTICULATE MATTER (PM 2.5 & PM 10)

- Particulate matter, both PM 2.5 and PM 10 remains a major and a criteria air pollutant which needs to be analyzed and monitored regularly for better air quality management.
- Characterizing the seasonal and diurnal variations of any pollutant is critical to understand the cause and the drivers of the air pollution and for finding out the best strategies.
- Our group work presents the trend, variability and the exceedance analysis of PM 2.5 and PM 10 in the Kanpur city from 2021 to 2024 (6th September).
- The maximum permissible limit for PM 2.5 should be 40 and 60 microgram/cubic meter and PM 10 should be 60 and 100 microgram/cubic meter given by NAAQS considered annually and for 24 hours respectively.

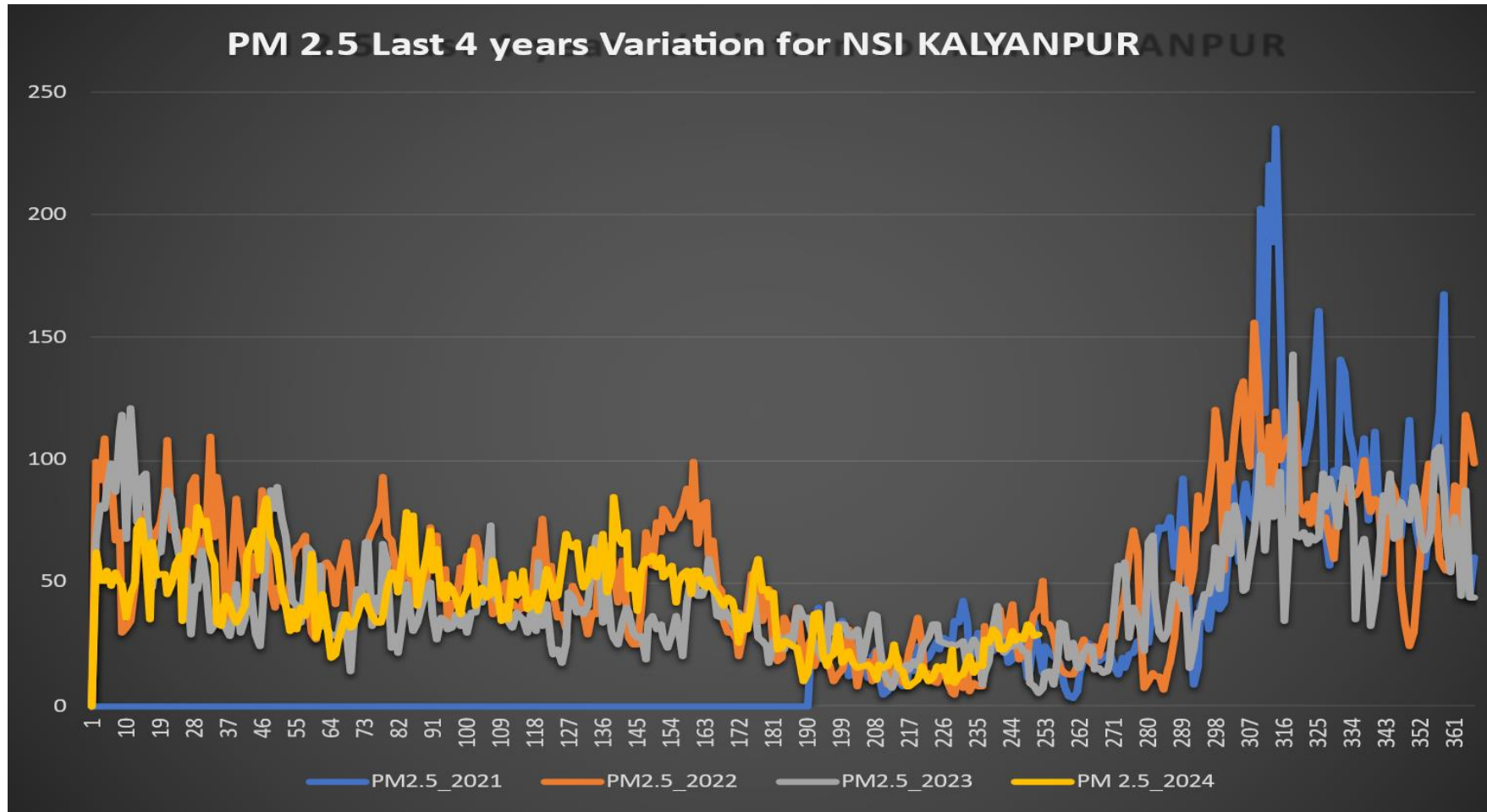
PM 2.5

PM 2.5: Diurnal trend for PM 2.5 for Nehru Nagar over past 4 years

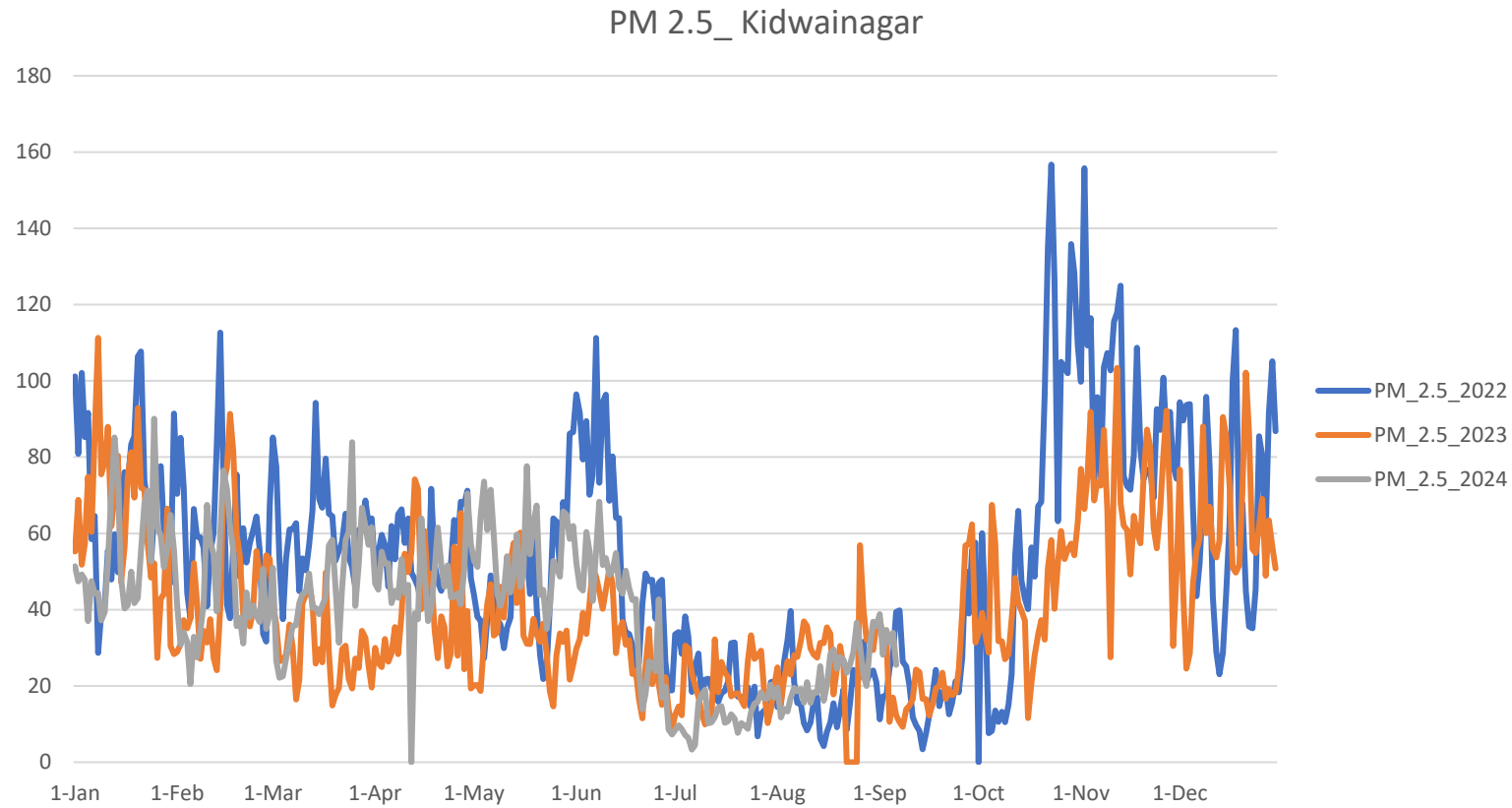
PM 2.5 Last 4 years Variation for nehru nagar



PM 2.5: Diurnal trend for PM 2.5 for NSI Kalyanpur over past 4 years



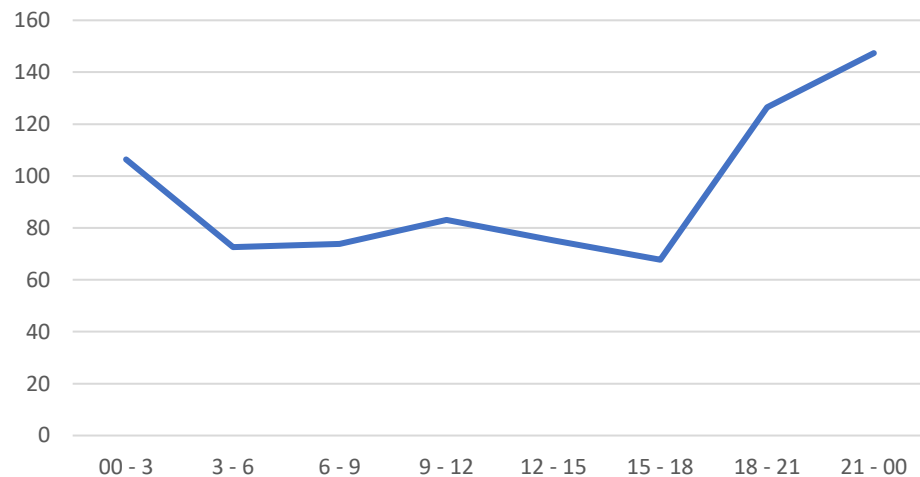
PM 2.5: Diurnal trend for PM 2.5 for Kidwai Nagar over past 4 years



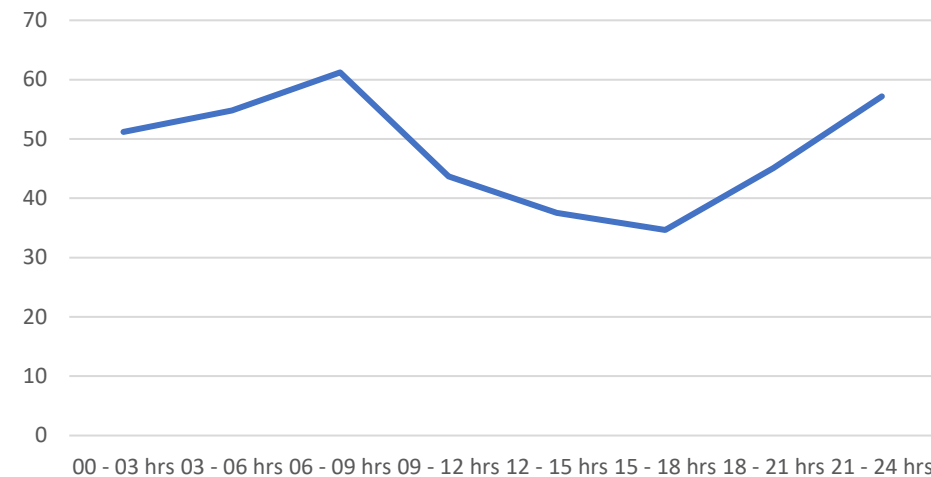
Nehru Nagar PM 2.5:

3 hourly data analysis for Winter, Summer and Monsoon season (2021 - 2023)

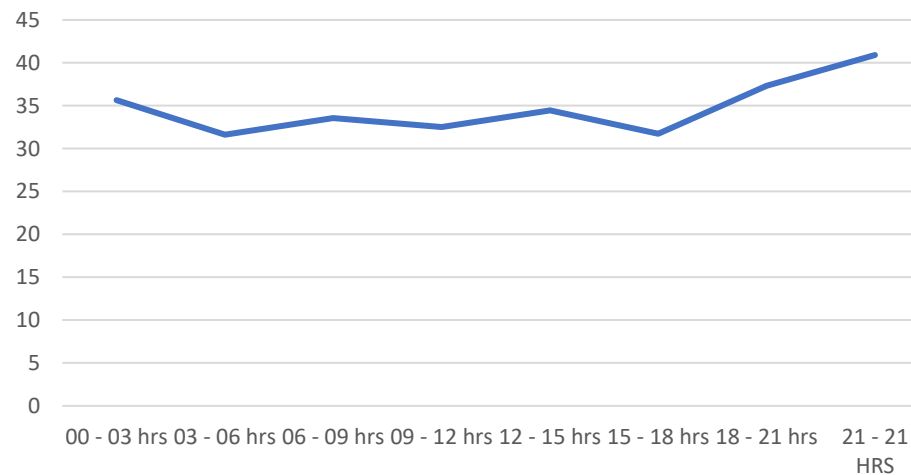
PM 2.5 of January month 2023



PM 2.5 Of May 2023 3hrs duration

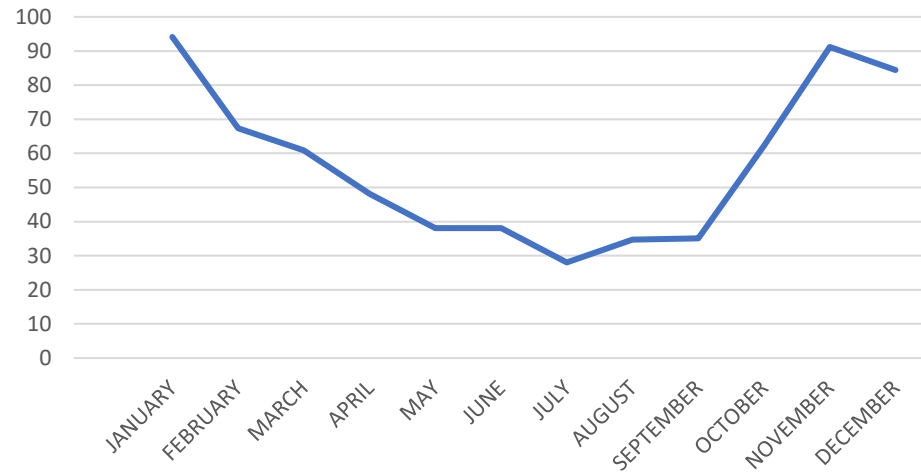


PM 2.5 of August 2023 3 hrs variation

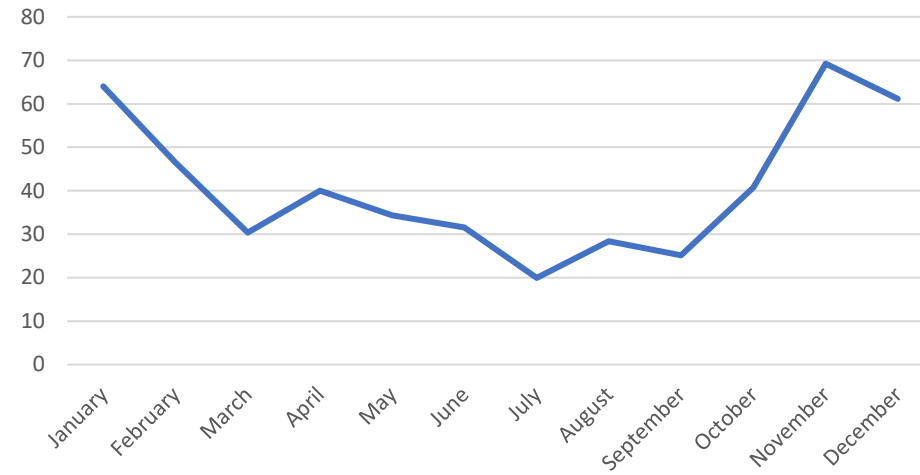


Monthly Variations of PM 2.5 for all the three regions

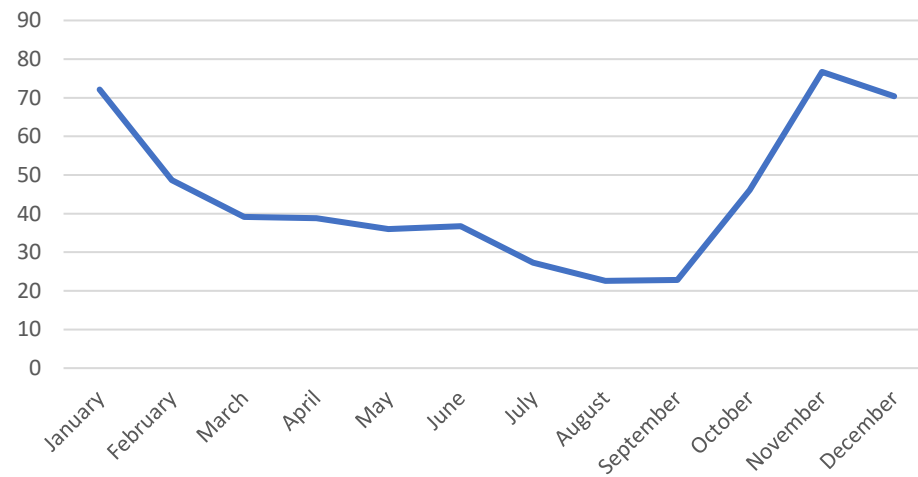
PM 2.5 Monthly variation of Nehru Nagar



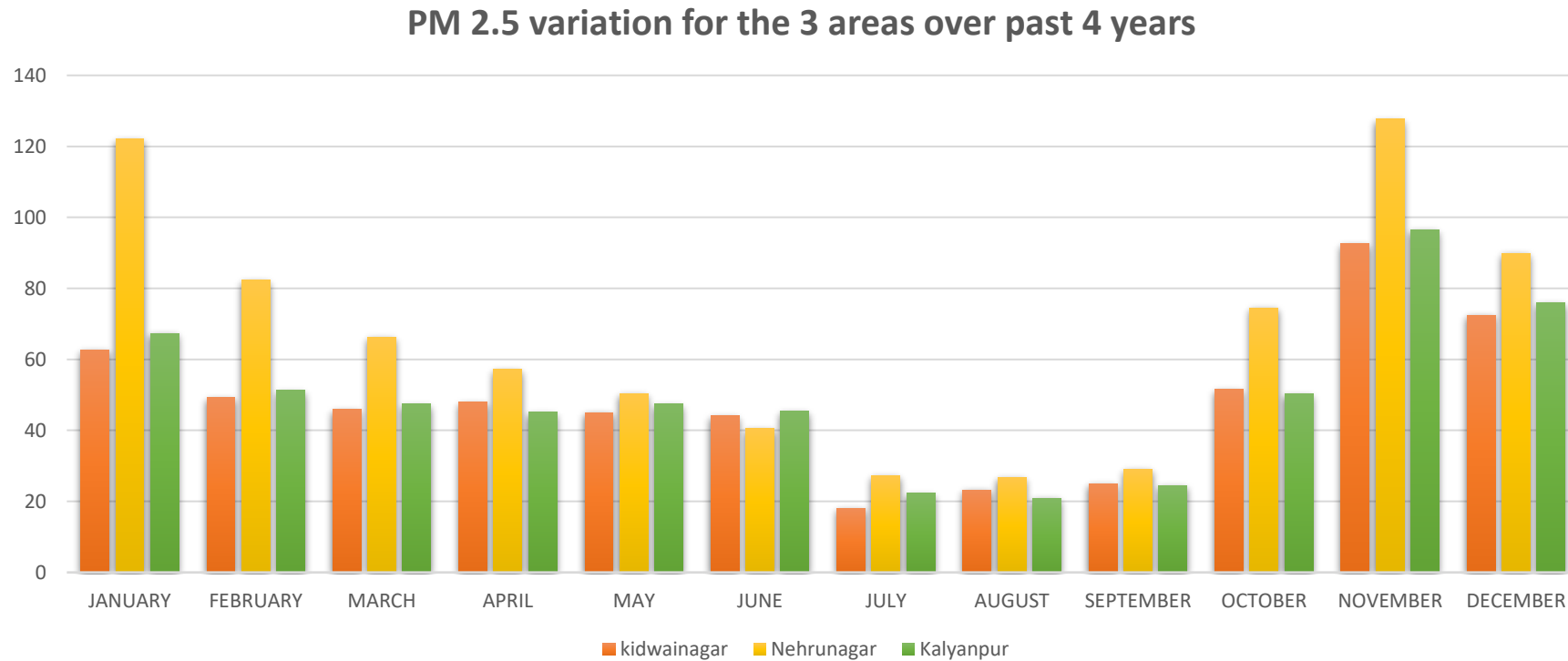
Monthly Average of PM 2.5 for kidwainagar



Monthly Average of PM 2.5 for kalyanpur

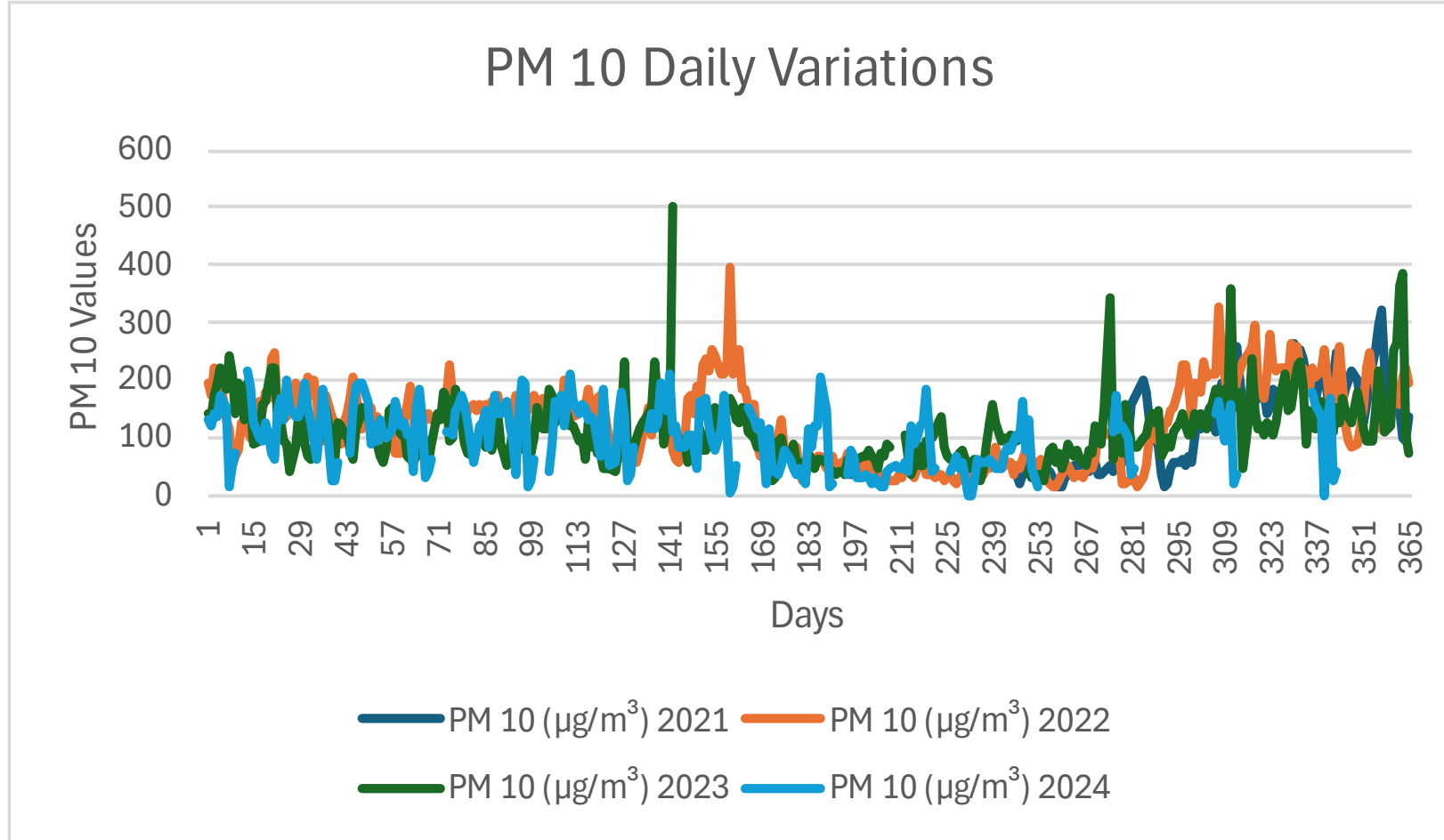


PM 2.5 variation of the THREE areas taken for past 4 years

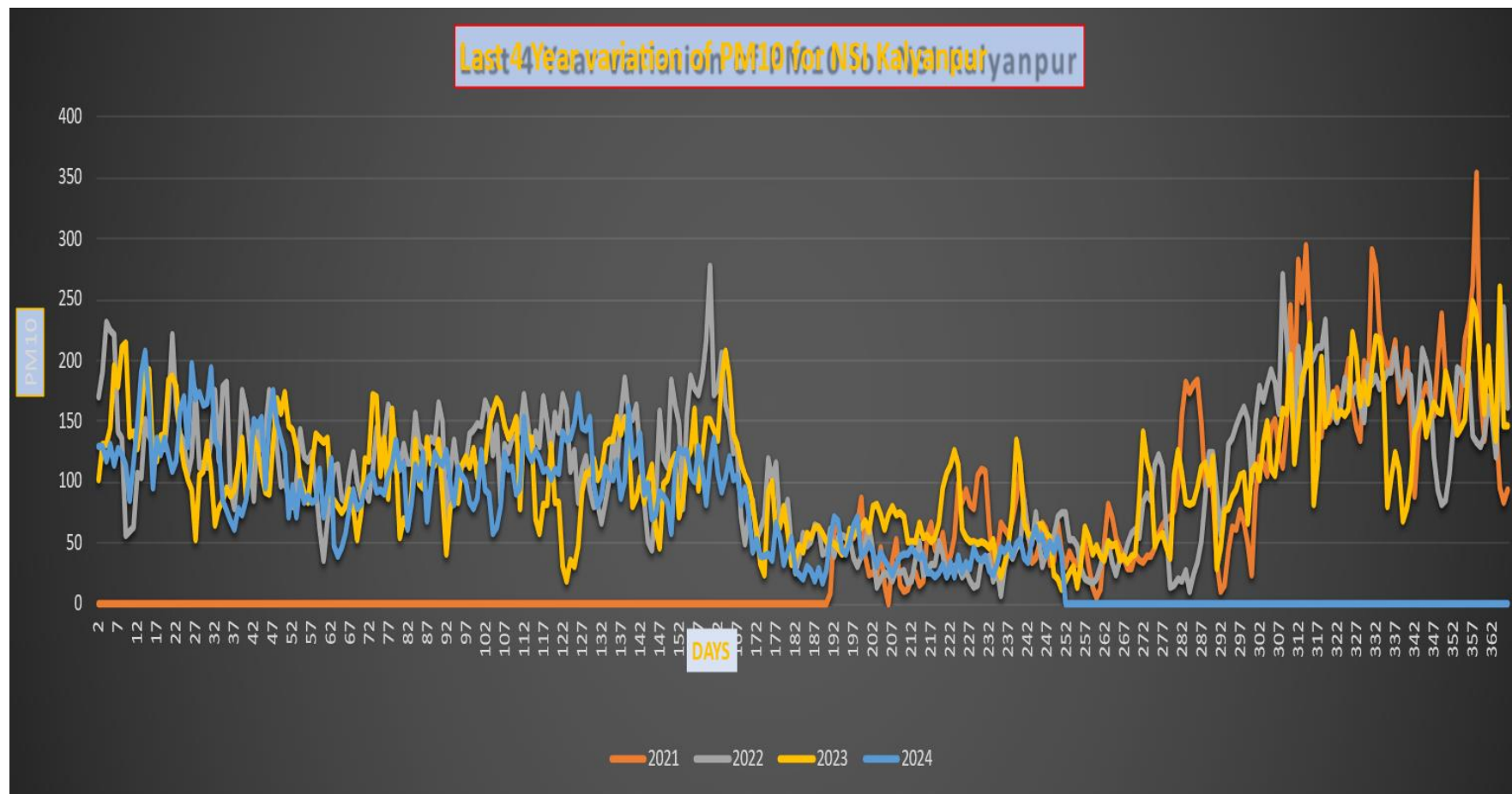


PM 10

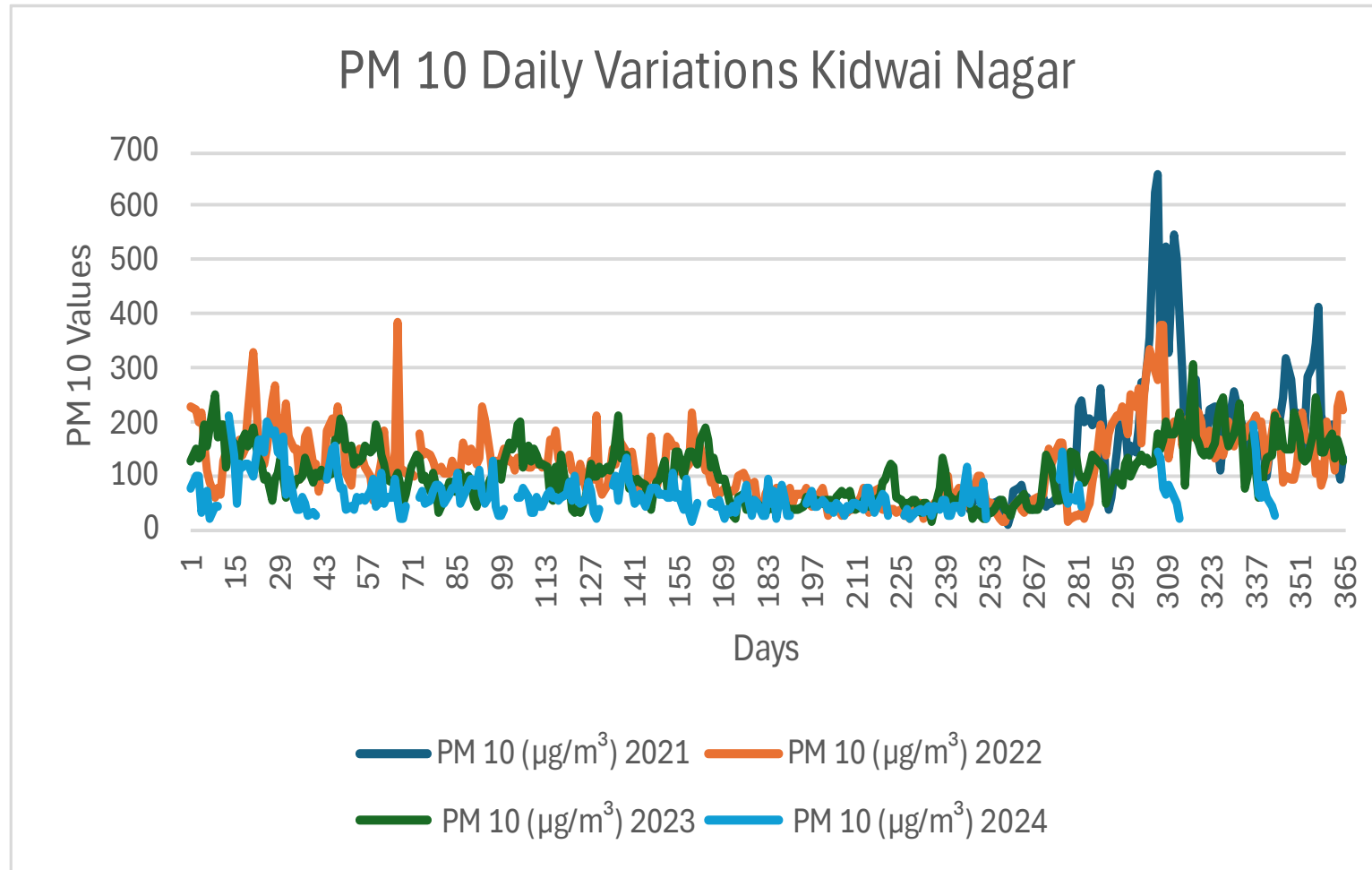
PM 10: Diurnal trend for PM 10 for Nehru Nagar over past 4 years



PM 10: Diurnal trend for PM 10 for NSI Kalyanpur over past 4 years

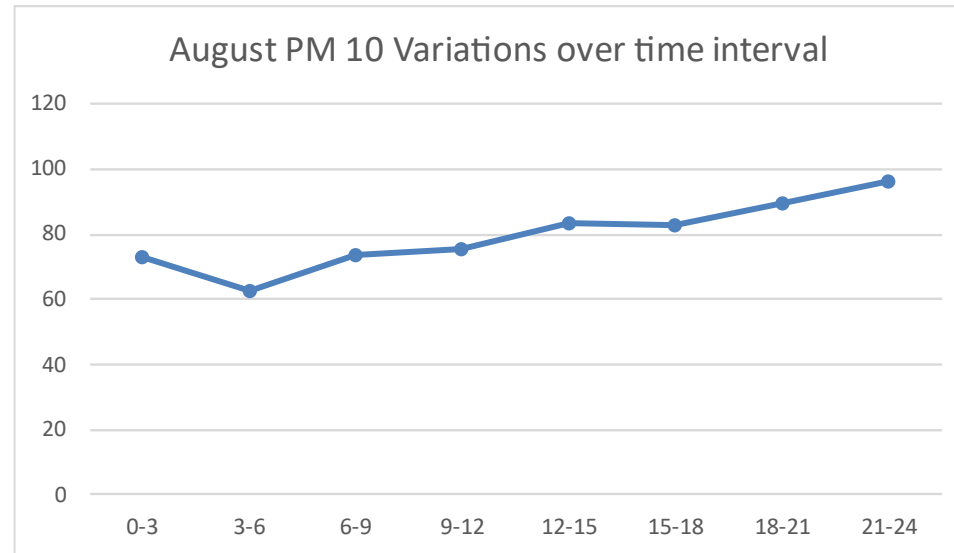
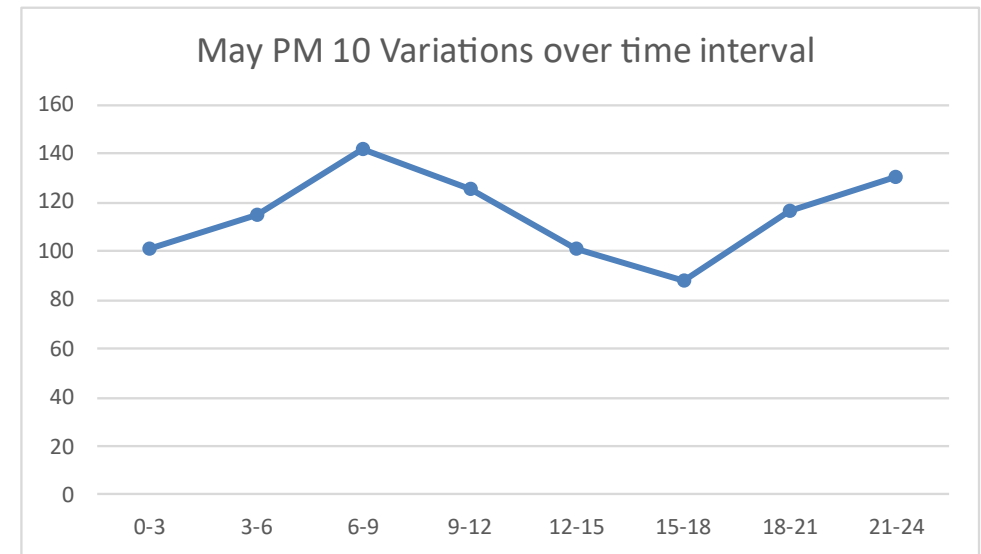
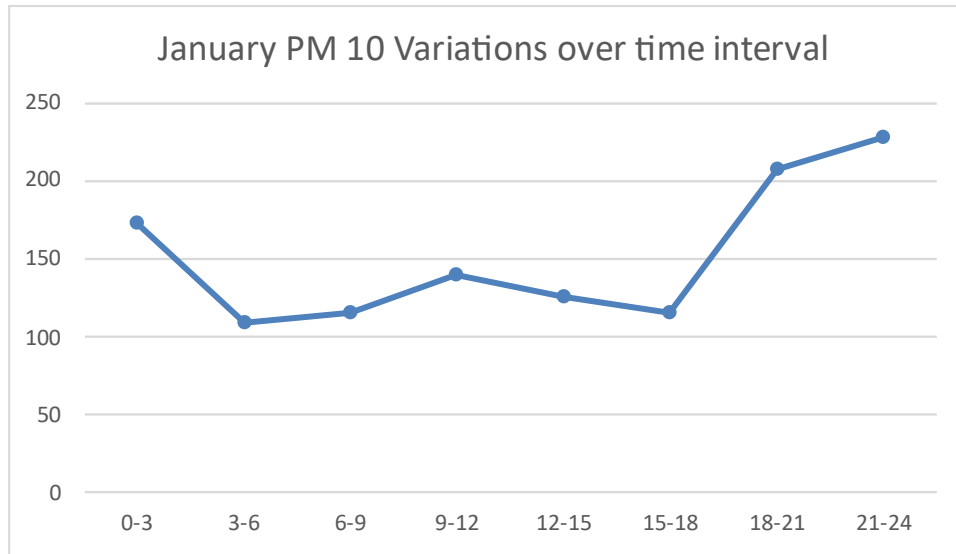


PM 10: Diurnal trend for PM 10 for Kidwai Nagar over past 4 years



Nehru Nagar PM 10:

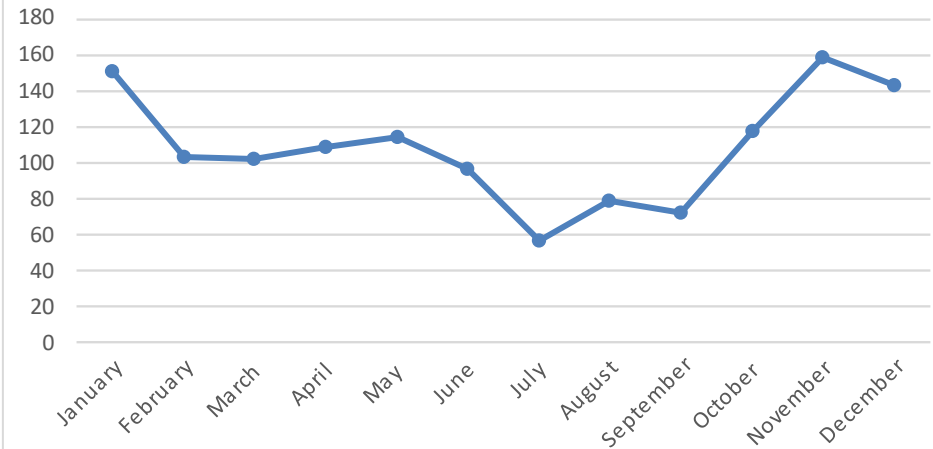
3 hourly data analysis for Winter, Summer and Monsoon season (2021 - 2023)



Monthly Variations of PM 10 for all the three regions

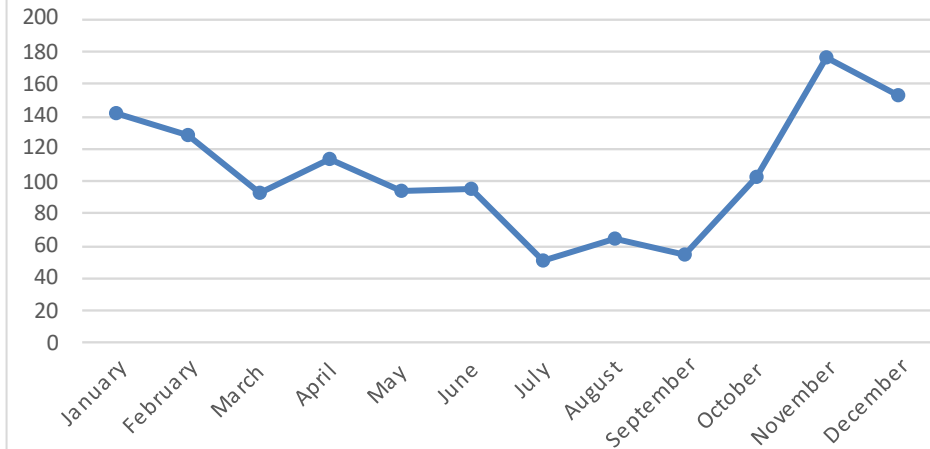
NEHRU NAGAR

2023 Month-wise PM 10 Distribution



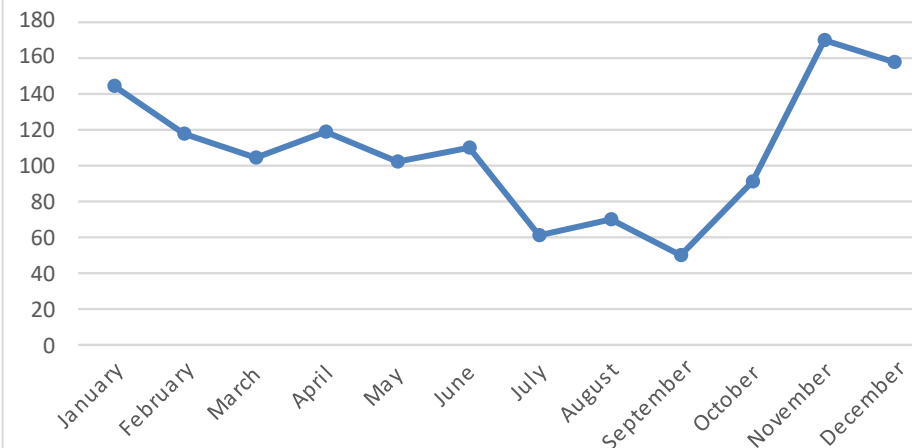
KIDWAI NAGAR

2023 Month-wise PM 10 Distribution

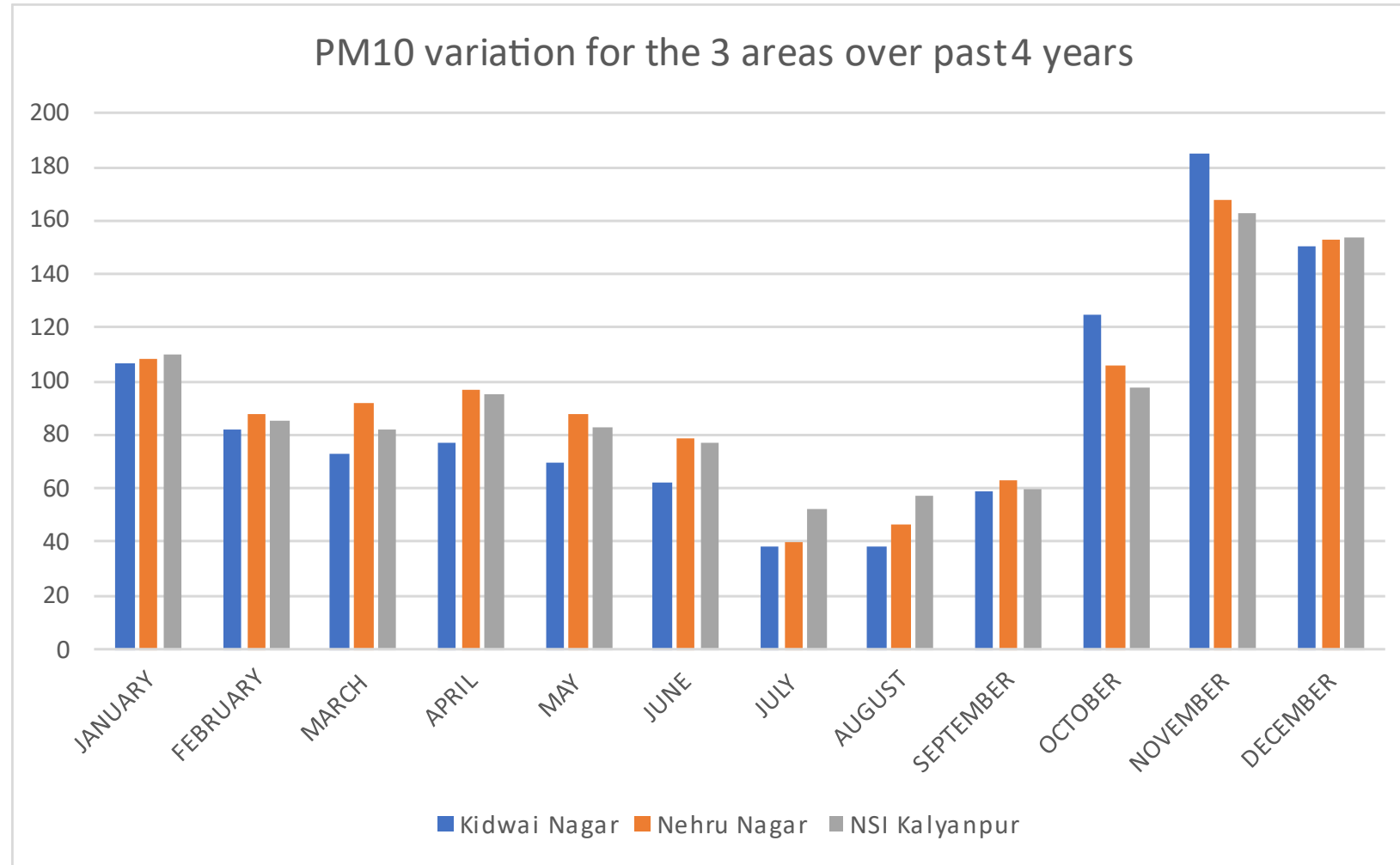


NSI KALYANPUR

2023 Month-wise PM 10 Distribution



PM 10 variation of the THREE areas taken for past 4 years

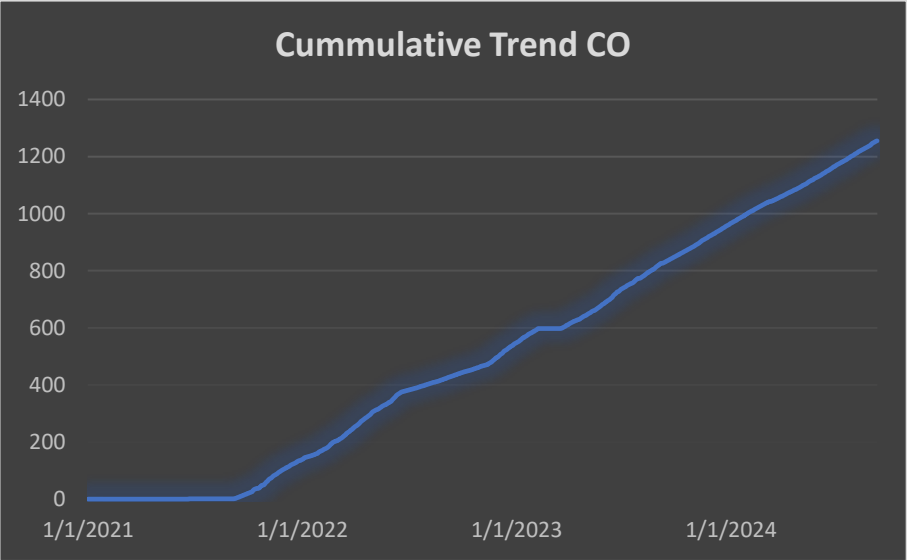
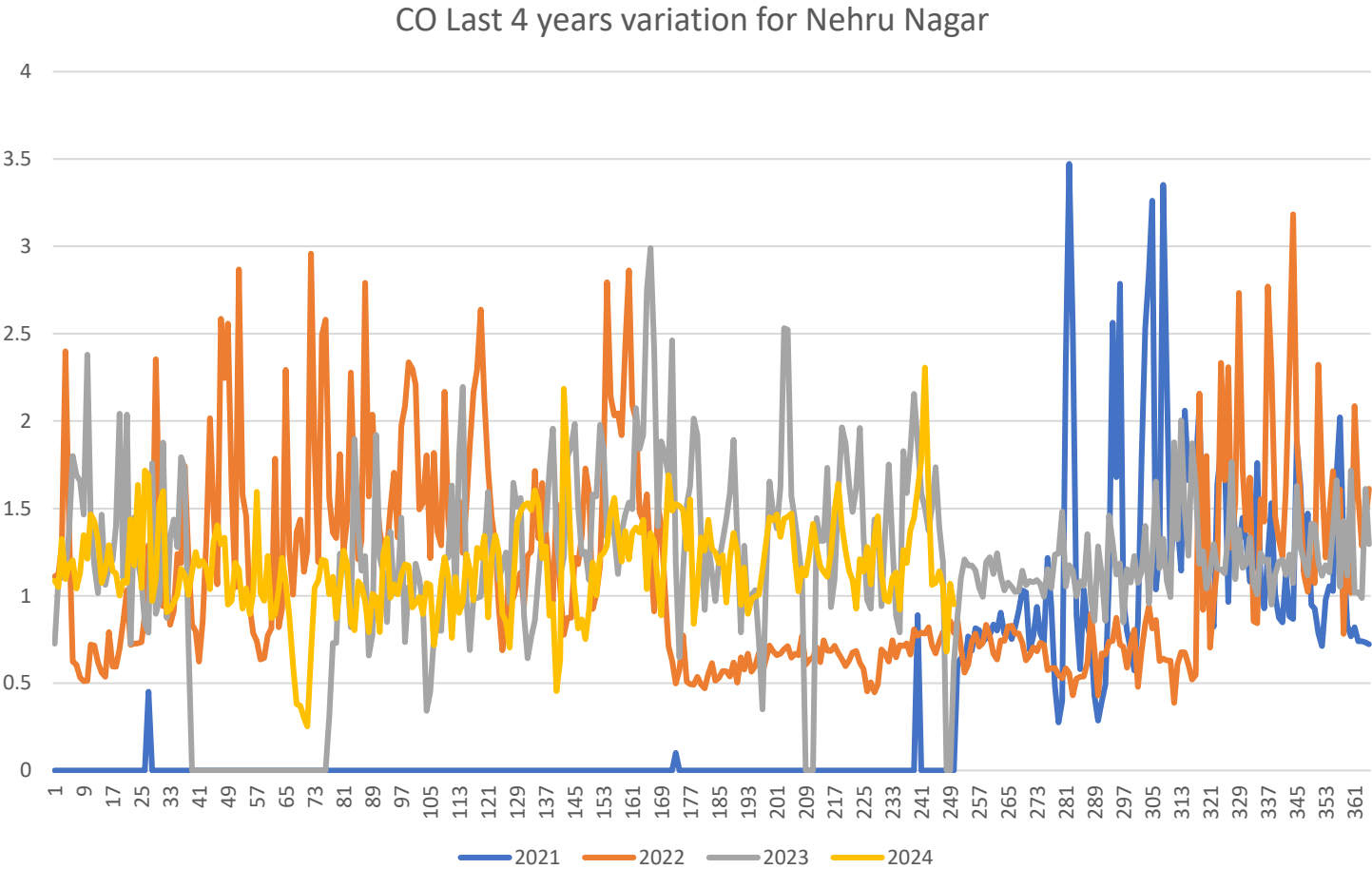


Carbon Monoxide (CO)

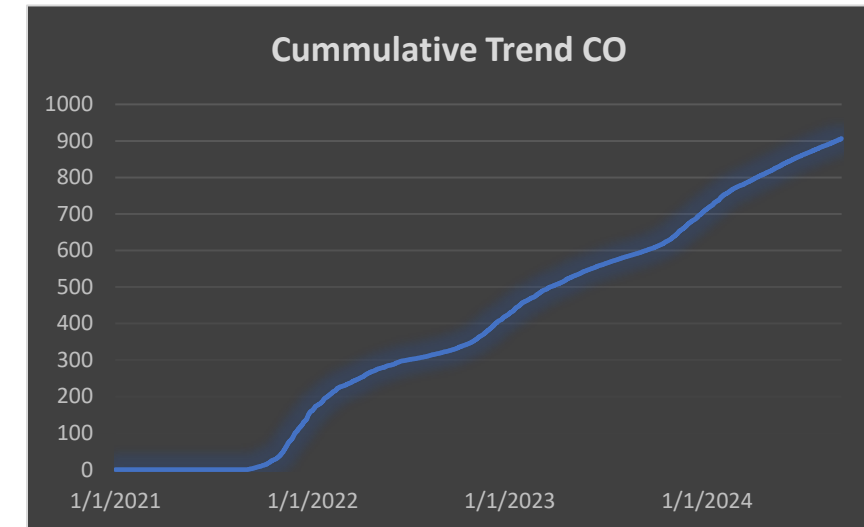
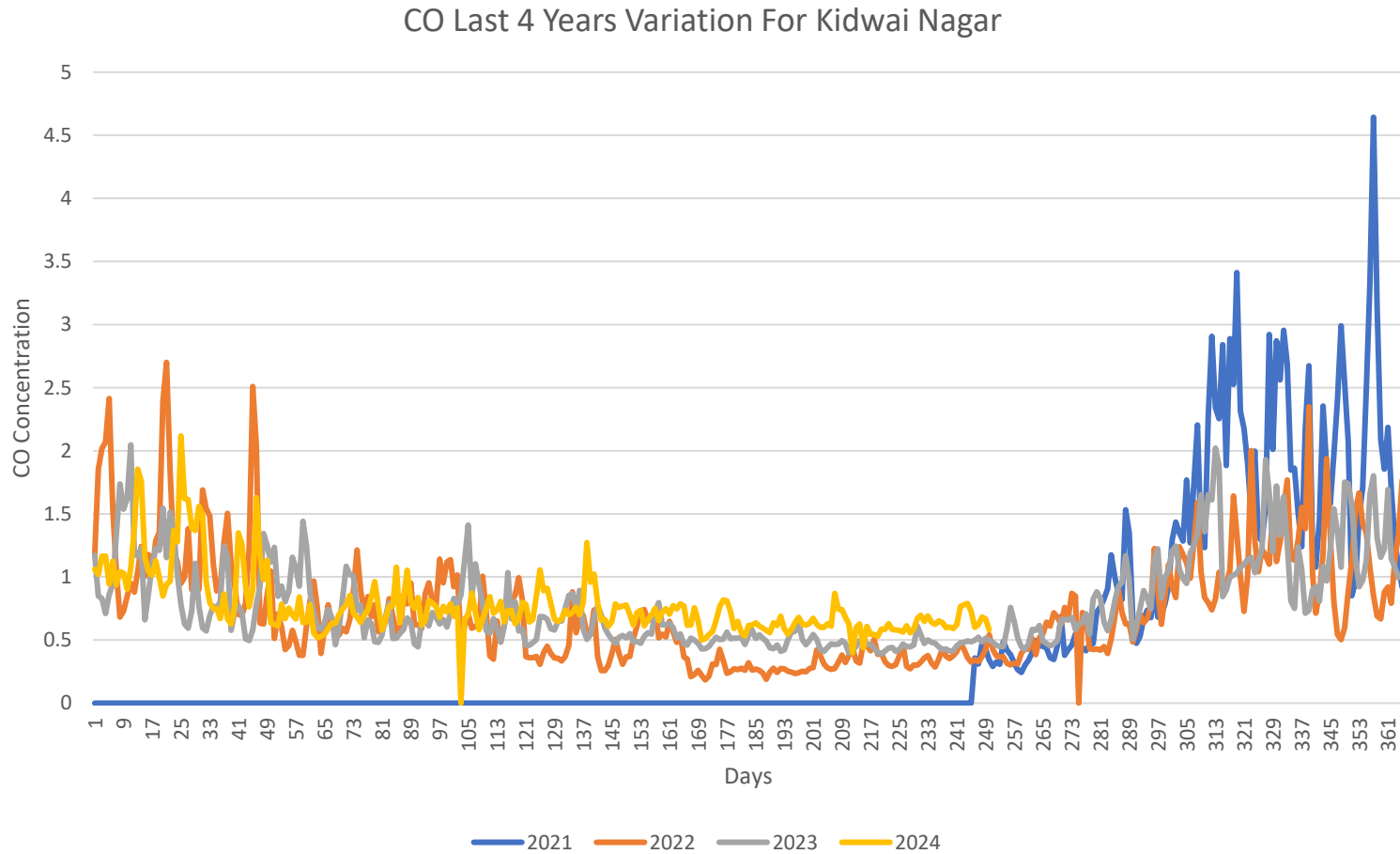
- CO is another harmful pollutant which affects environment in a number of ways.
- Biomass and fuel burning, as well as vehicular emissions are the major reasons for the increment in CO.
- CO NAAQS limit for 8 hours is 2 mg/cubic meter.
- CO reacts with other gases and can form harmful ground level ozone during the summer months.
- Also long term exposure to CO can lead to heart disease and problem in nervous system and when it enters the blood, it can react with hemoglobin and form carboxyhemoglobin. Therefore, analysing the trend and reducing it is a must step in air pollution control.

CO

CO: Diurnal trend for CO for Nehru Nagar over past 4 years

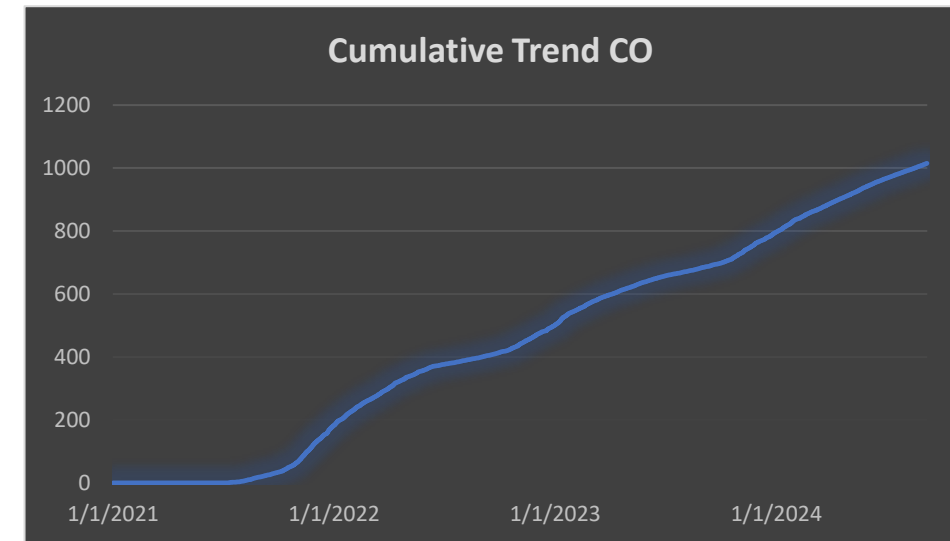
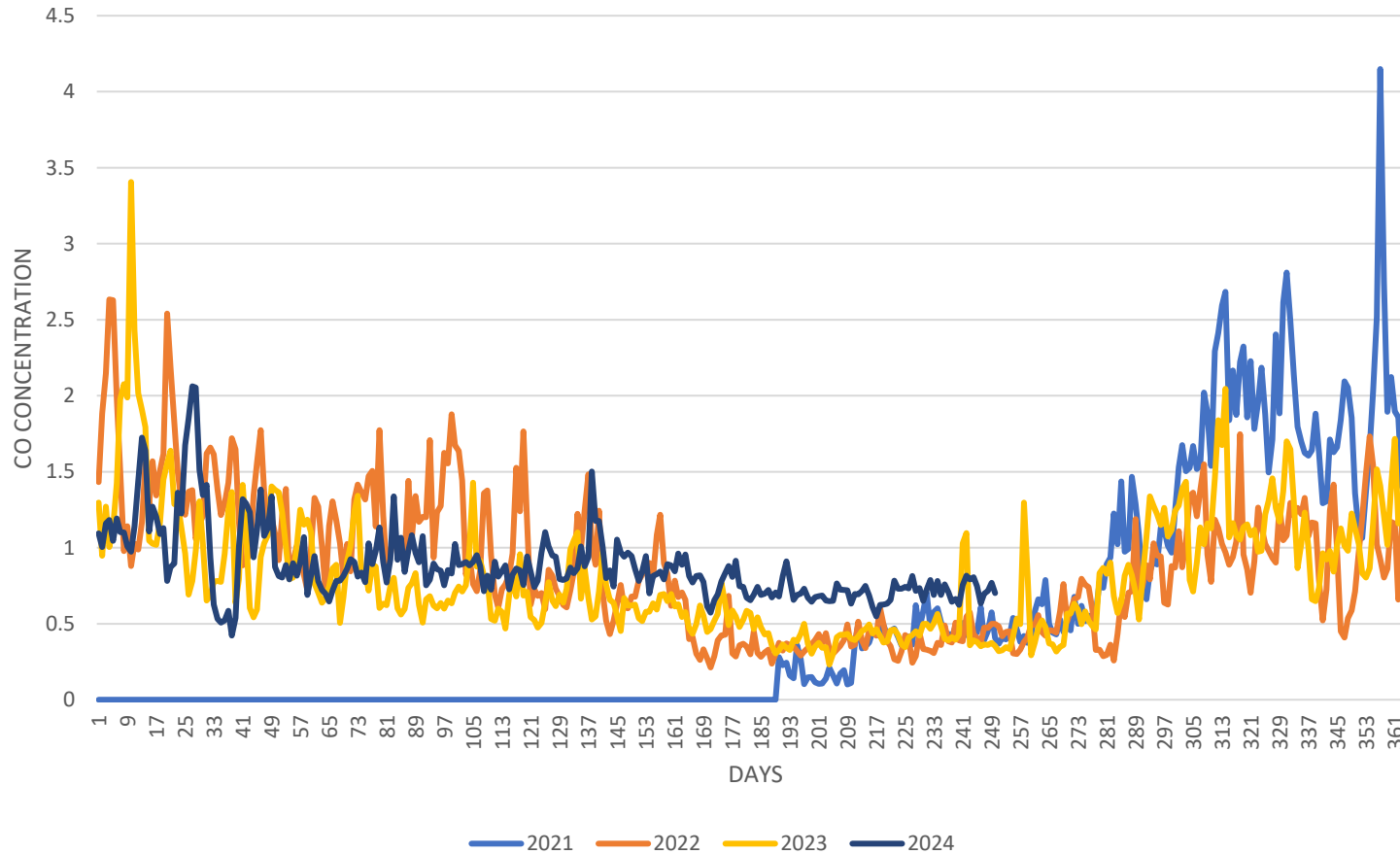


CO: Diurnal trend for CO for Kidwai Nagar over past 4 years



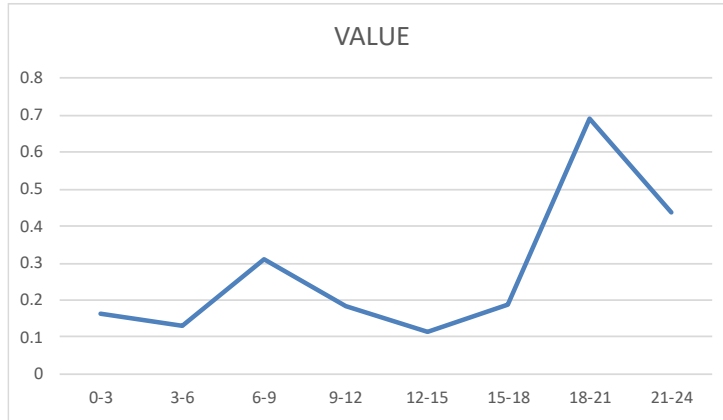
CO: Diurnal trend for CO for NSI Kalyanpur over past 4 years

CO LAST 4 YEARS VARIATION FOR KALYANPUR



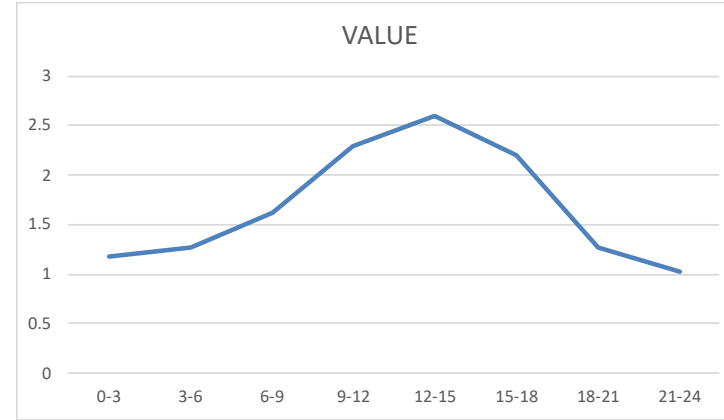
CO:

3 hourly data analysis for Winter and Summer season (2021 - 2023)

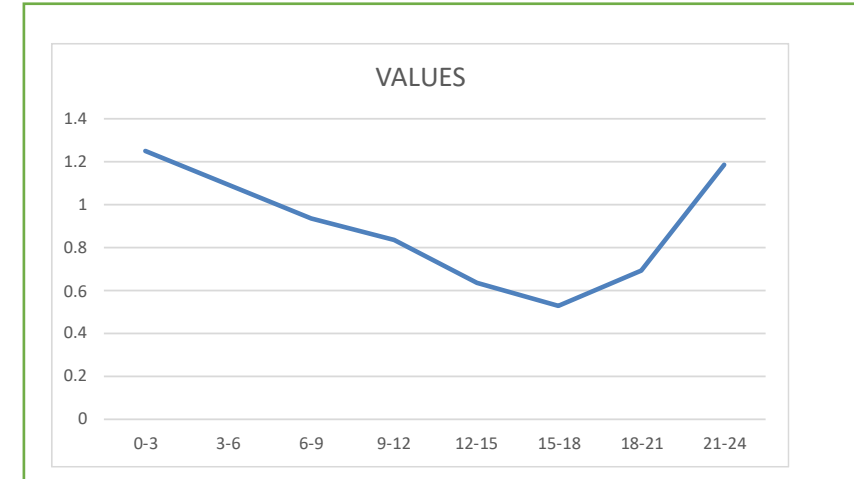


February

NEHRU NAGAR

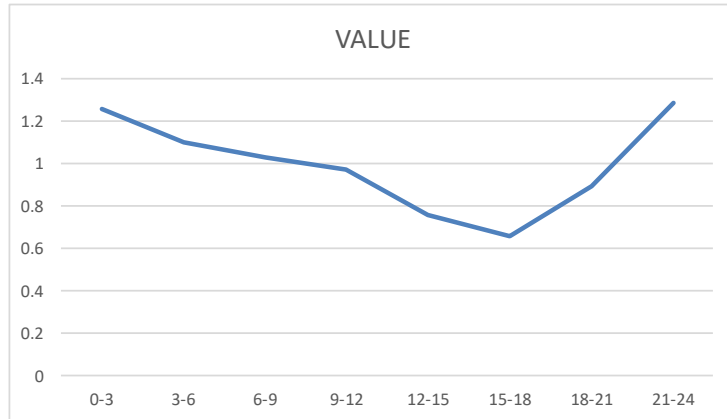


June



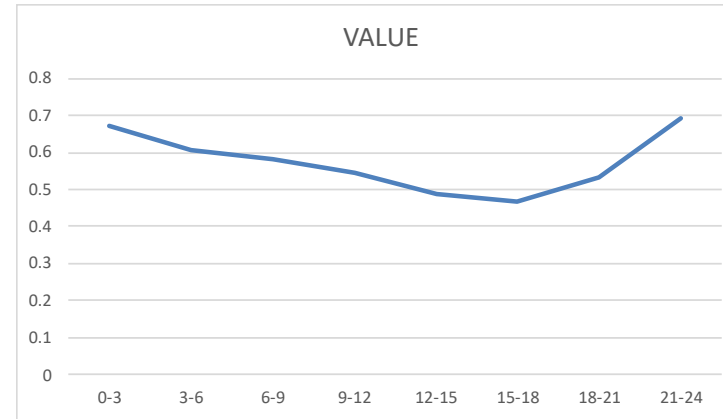
KIDWAI
NAGAR

February

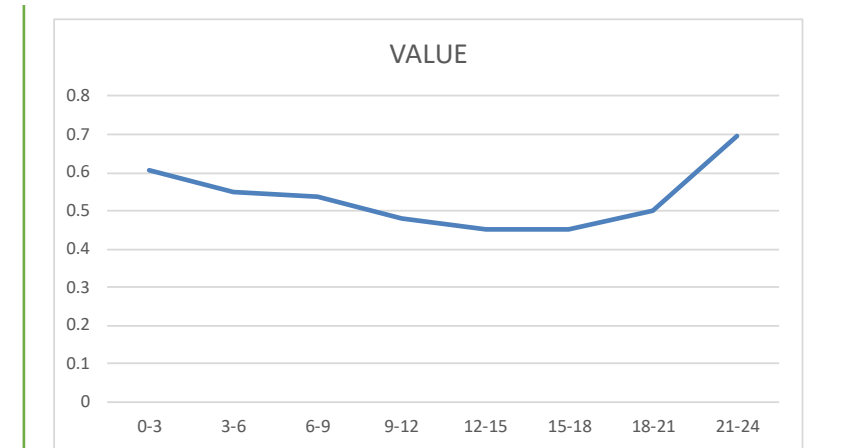


February

NSI KALYANPUR

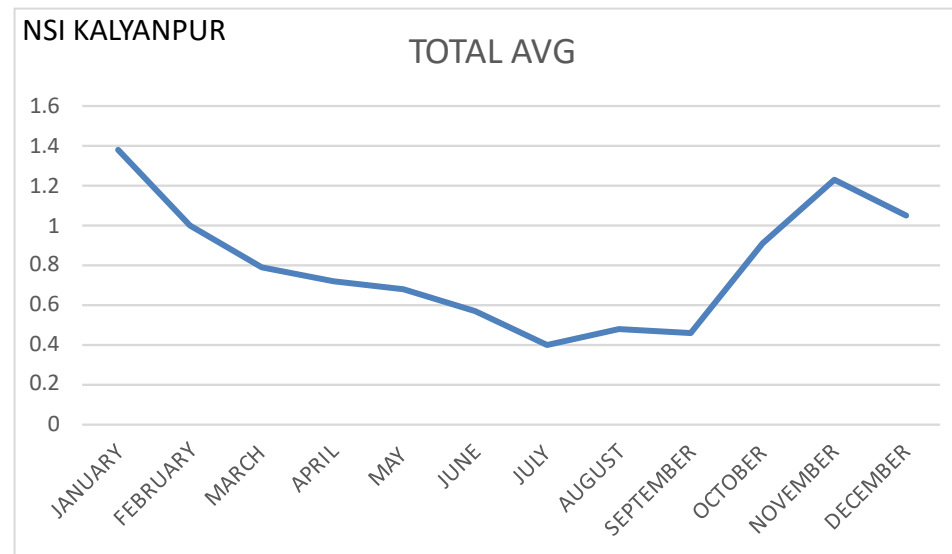
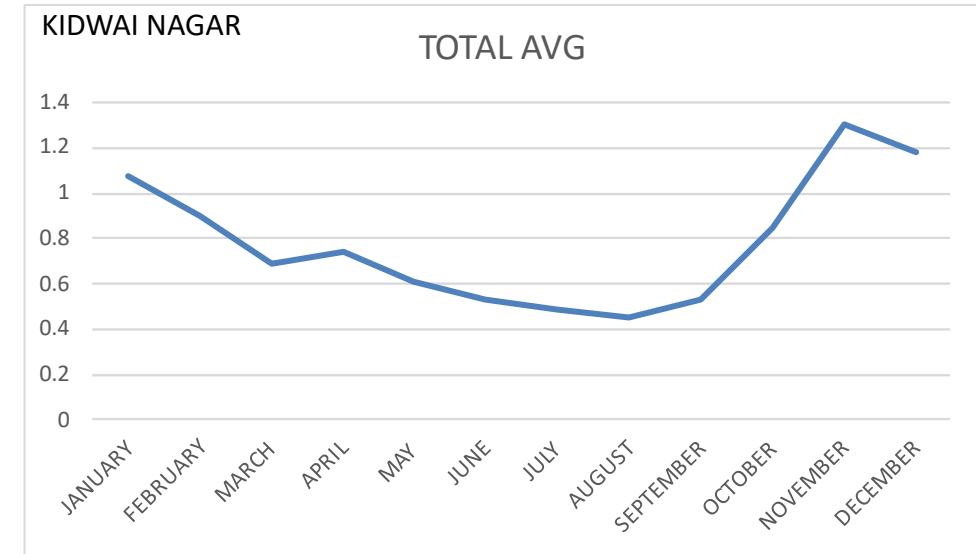
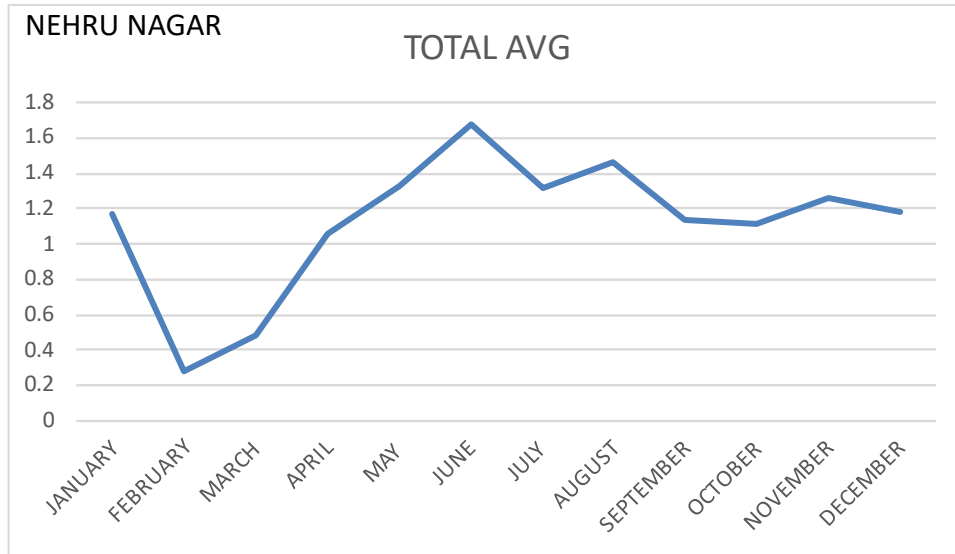


June

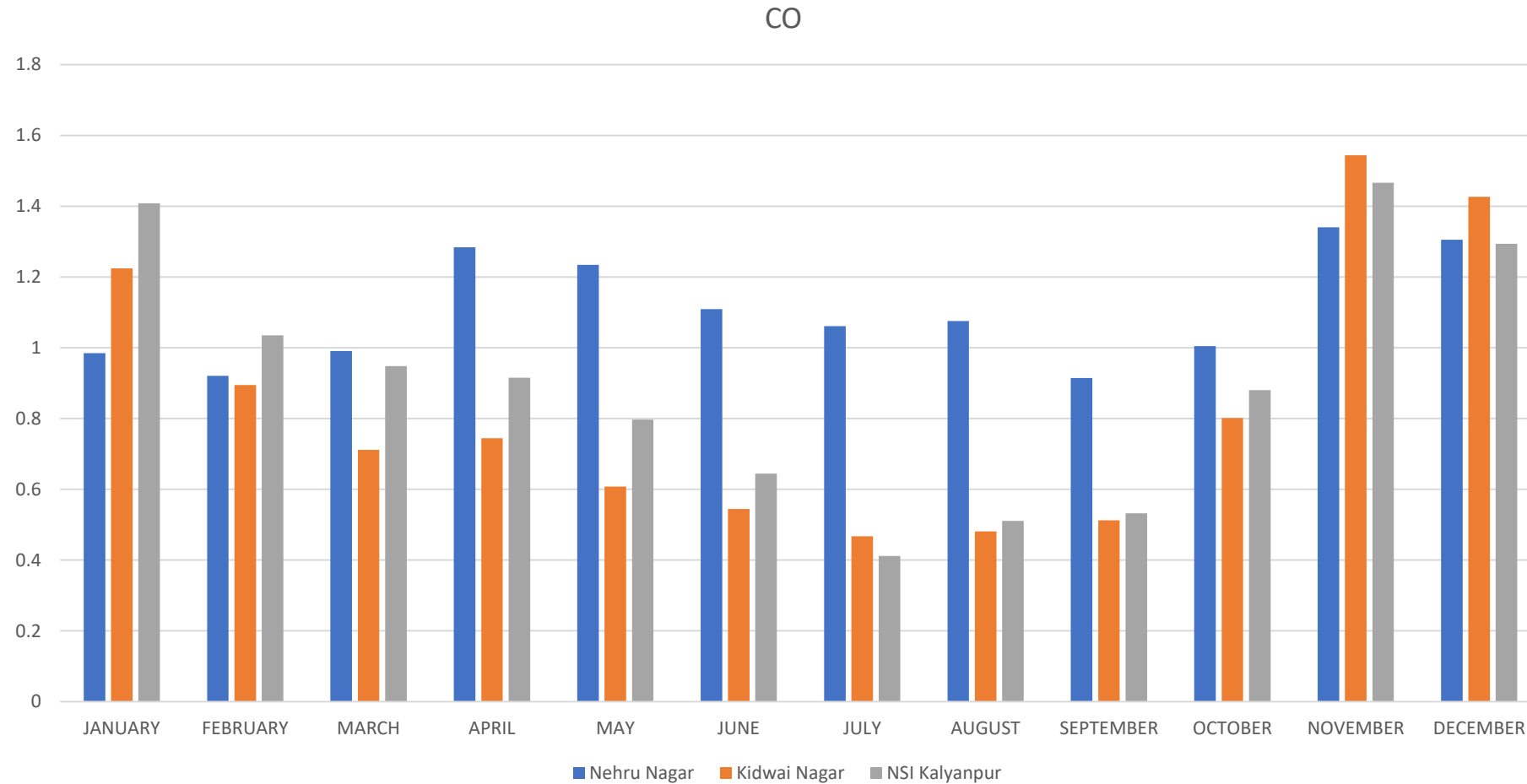


June

Monthly Variations of CO for all the three regions



CO variation of the THREE areas taken for past 4 years



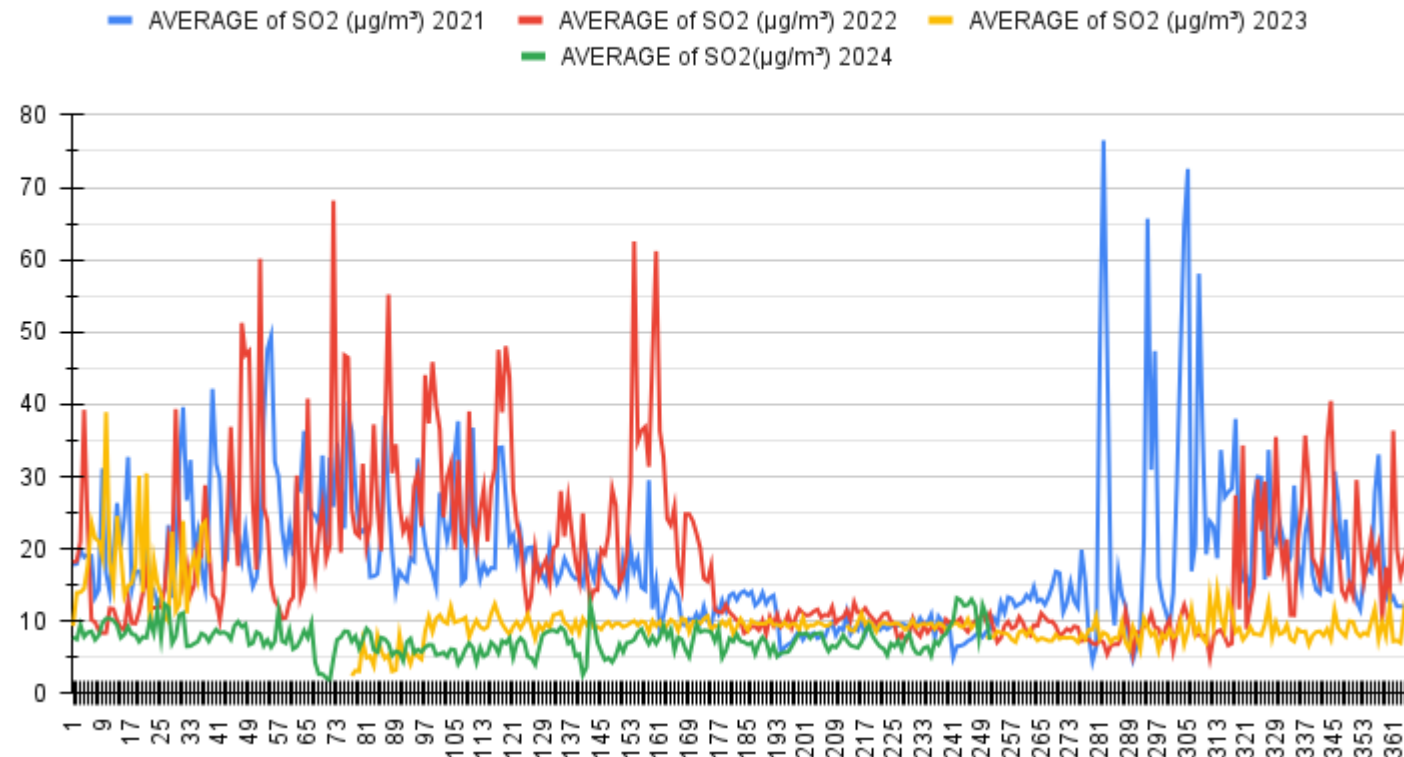
Sulphur dioxide (SO₂)

- Sulphur dioxide, limit by the NAAQS is 50 and 80 micrograms/meter cube for the annual and 24 hours variation.
- It's an acidic gas which acts as a precursor for acid rain.
- The largest source of SO₂ in the atmosphere is the burning of fossil fuel that contains sulfur, such as coal or oil, in power plants and other industrial facilities.
- It destroys the cleaning mechanism of the macrophages hence important to analyse and reduce it.

SO₂

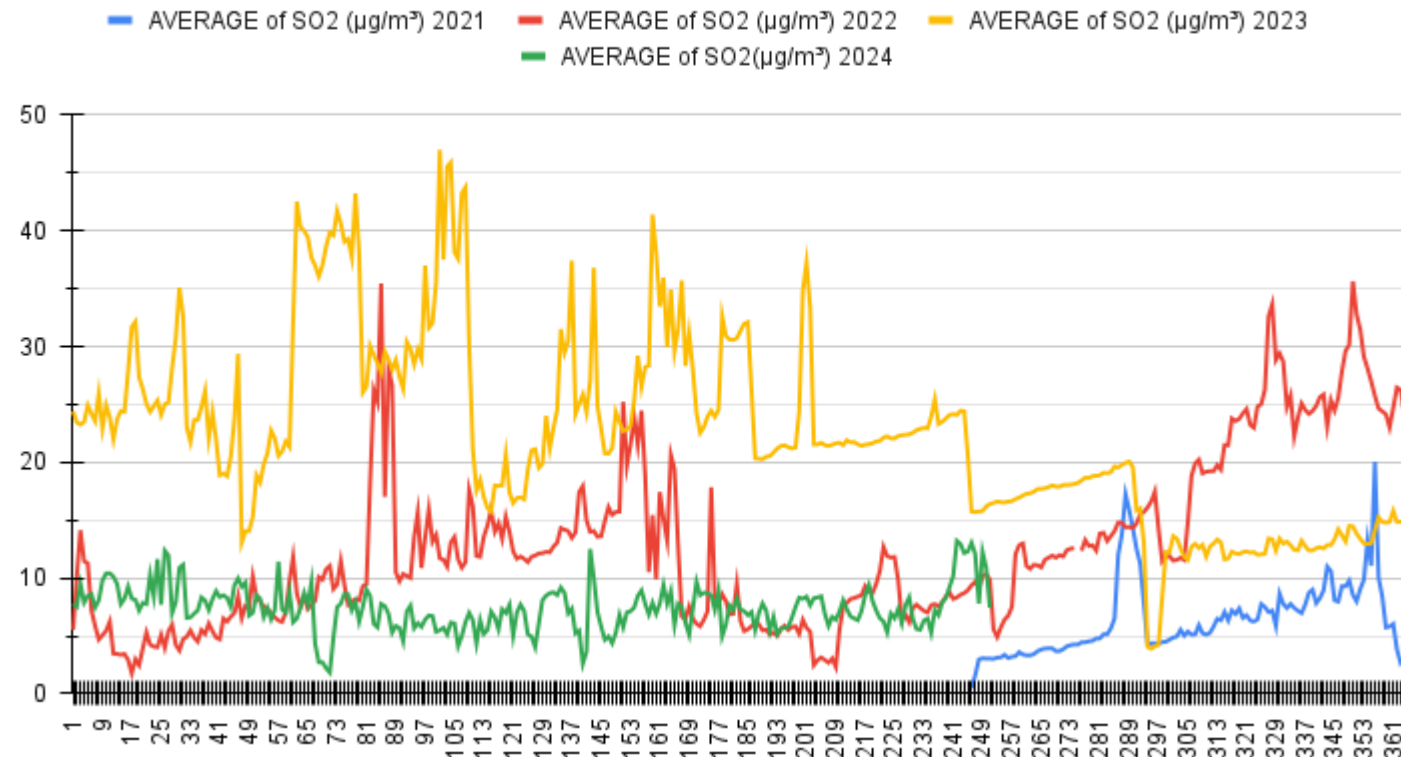
SO₂: Diurnal trend for Sulphur Dioxide for Nehru Nagar over past 4 years

SO₂ last 4 year variation for Nehru Nagar



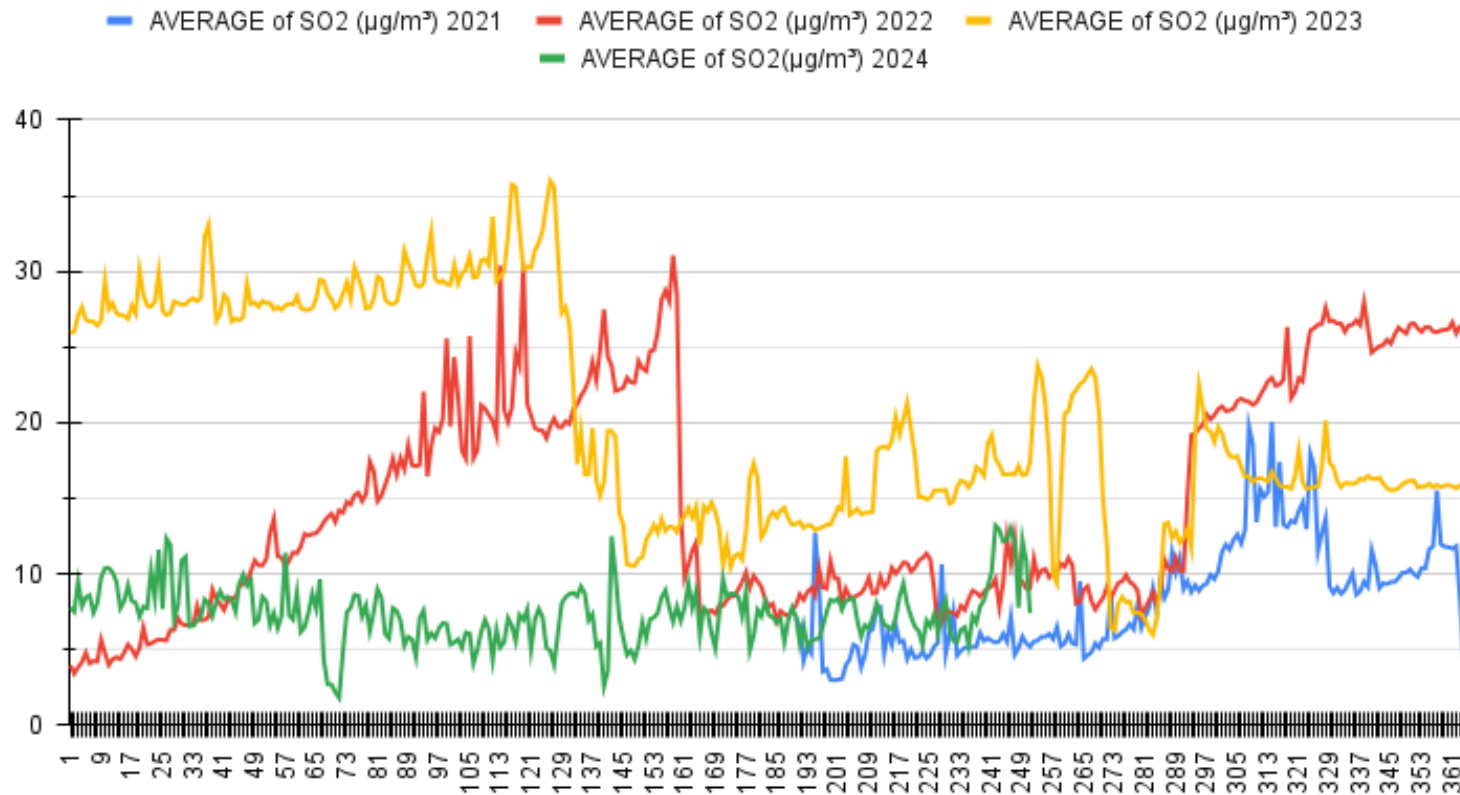
SO₂: *Diurnal trend for Sulphur Dioxide for Kidwai Nagar over past 4 years*

SO₂ last 4 year variation for Kidwai Nagar



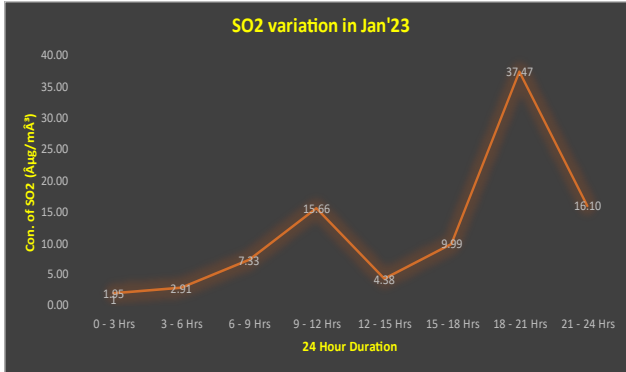
SO₂: *Diurnal trend for Sulphur Dioxide for NSI Kalyanpur over past 4 years*

SO₂ last 4 year variation for NSI Kalyanpur



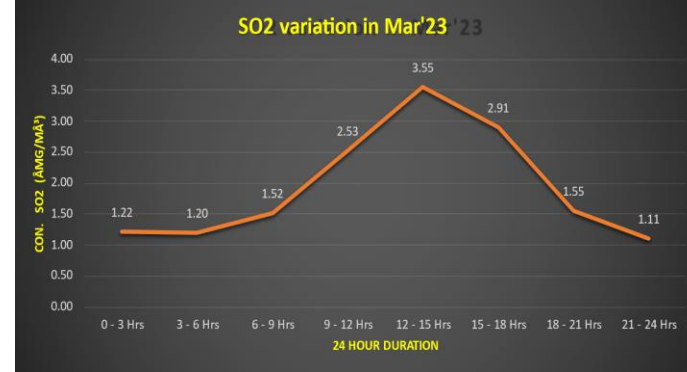
SO₂:

3 hourly data analysis for Winter season (2021 - 2023)



January

NEHRU NAGAR



March



KIDWAI
NAGAR

December

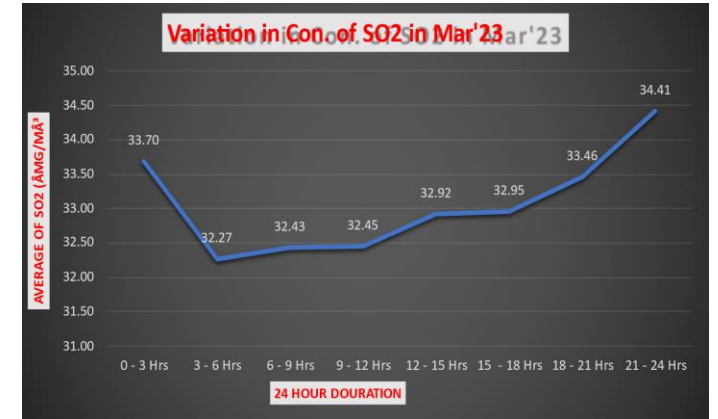


December

NSI KALYANPUR

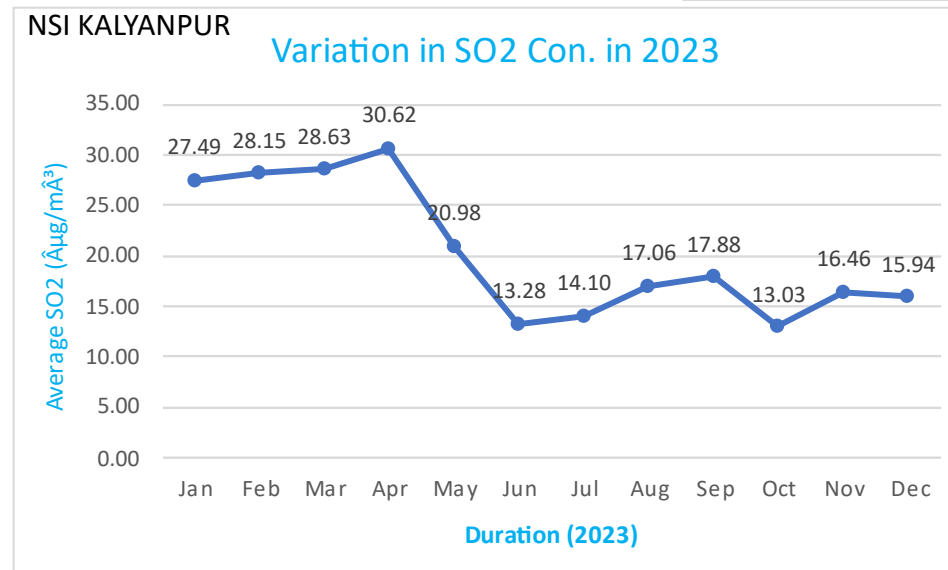
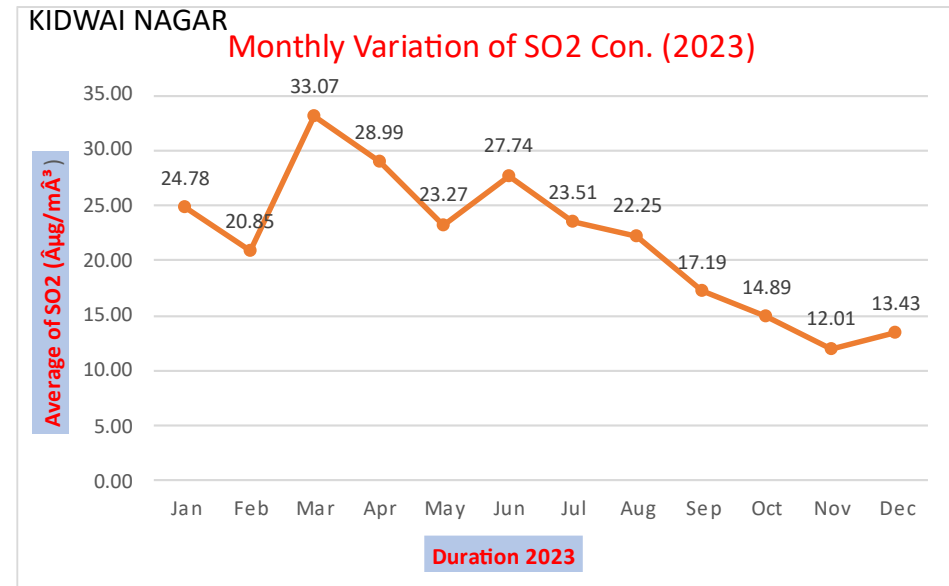
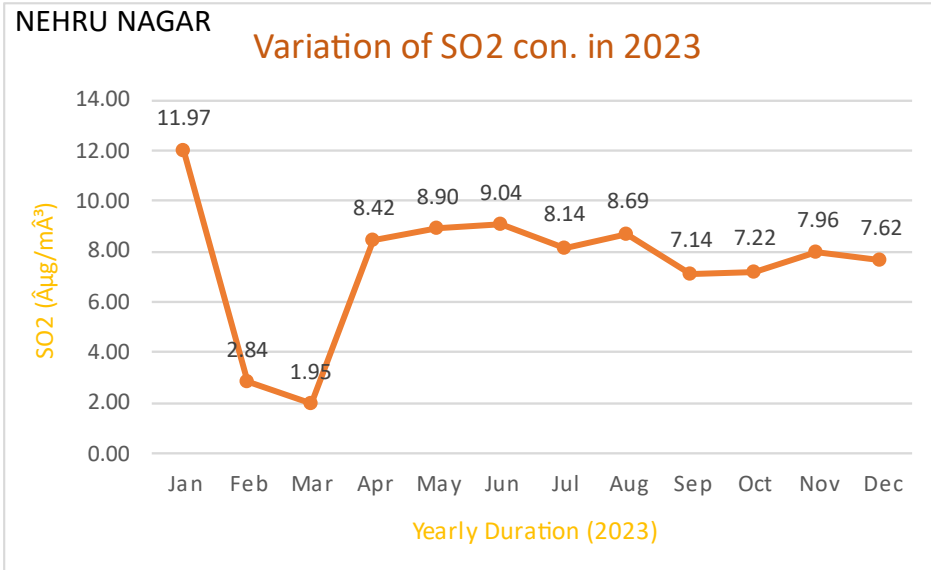


March



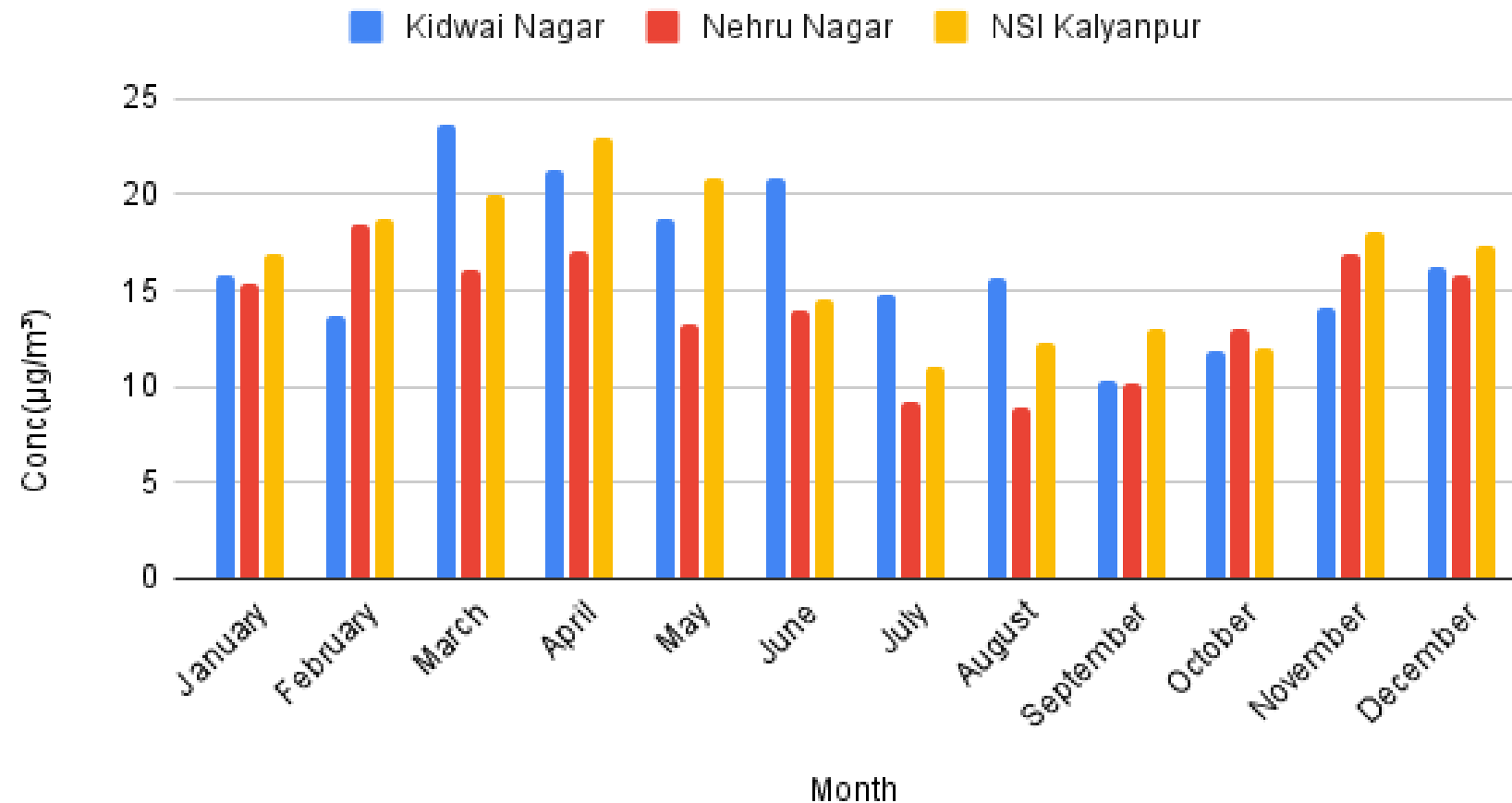
March

Monthly Variations of SO₂ for all the three regions



SO₂ variation of the THREE areas taken for past 4 years

SO₂ monthly variation state wise

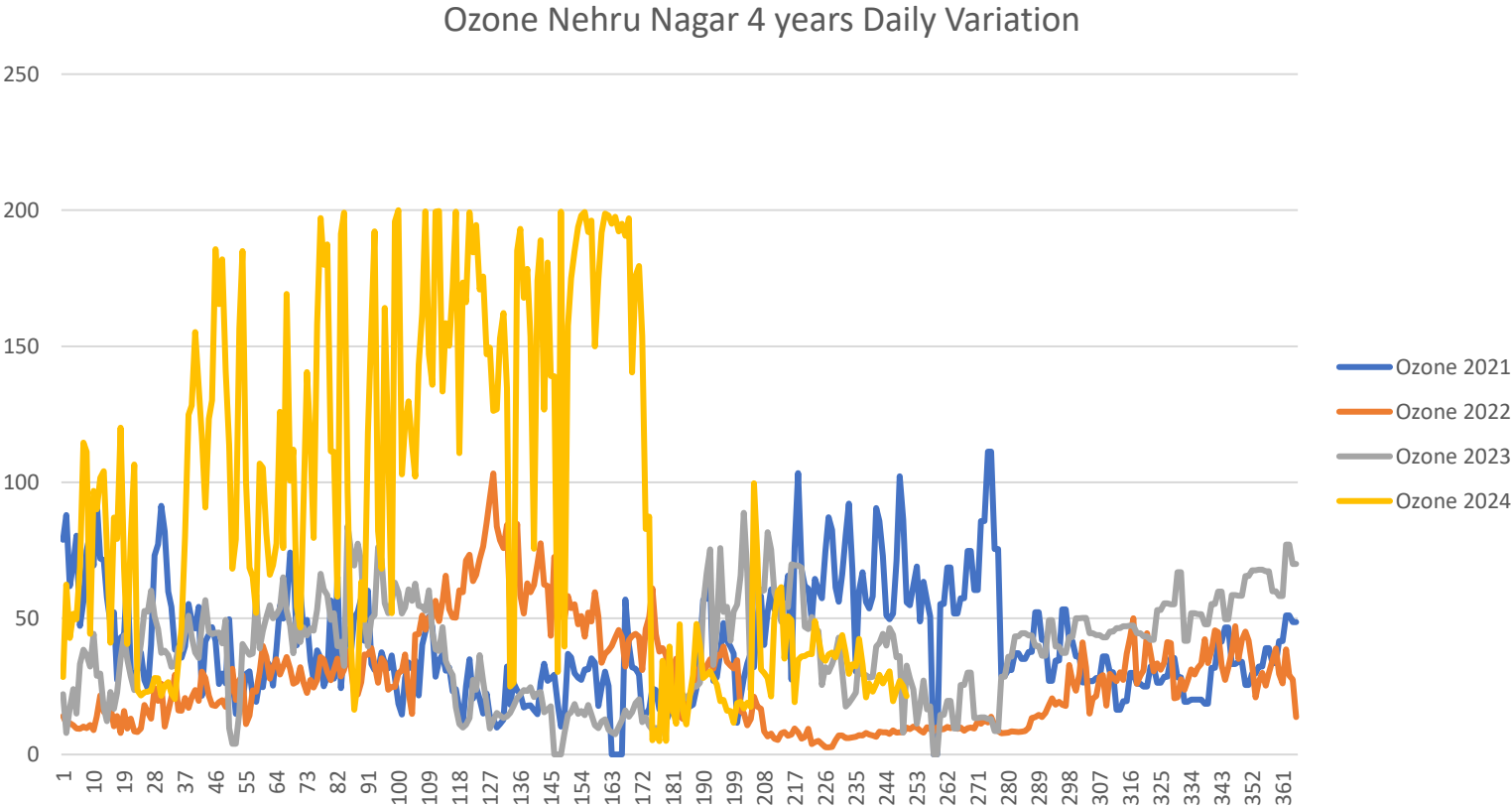


Ozone (O₃)

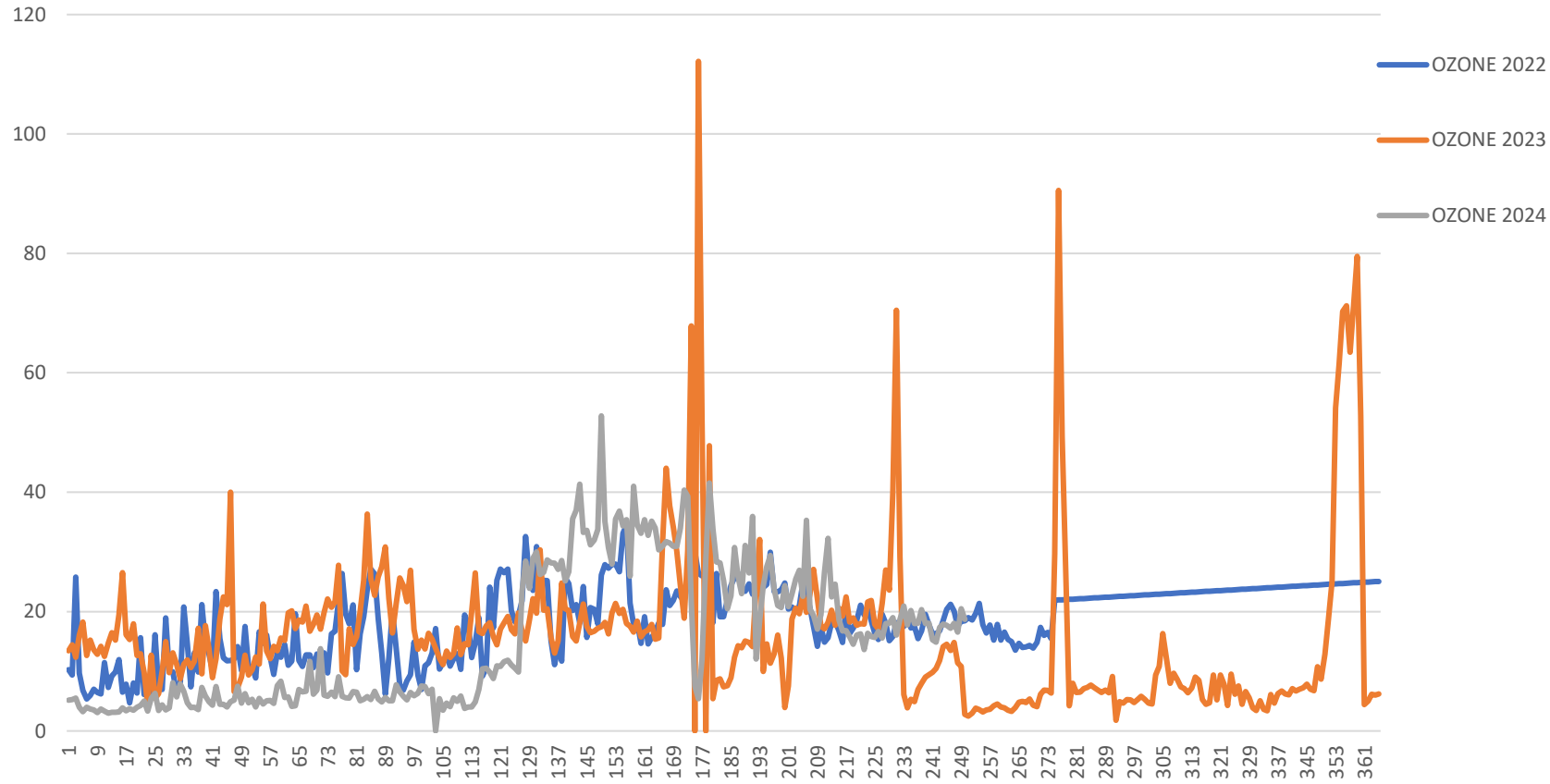
- NAAQS limit for Ozone is $100 \mu\text{g}/\text{m}^3$ for 8 hours.

O₃

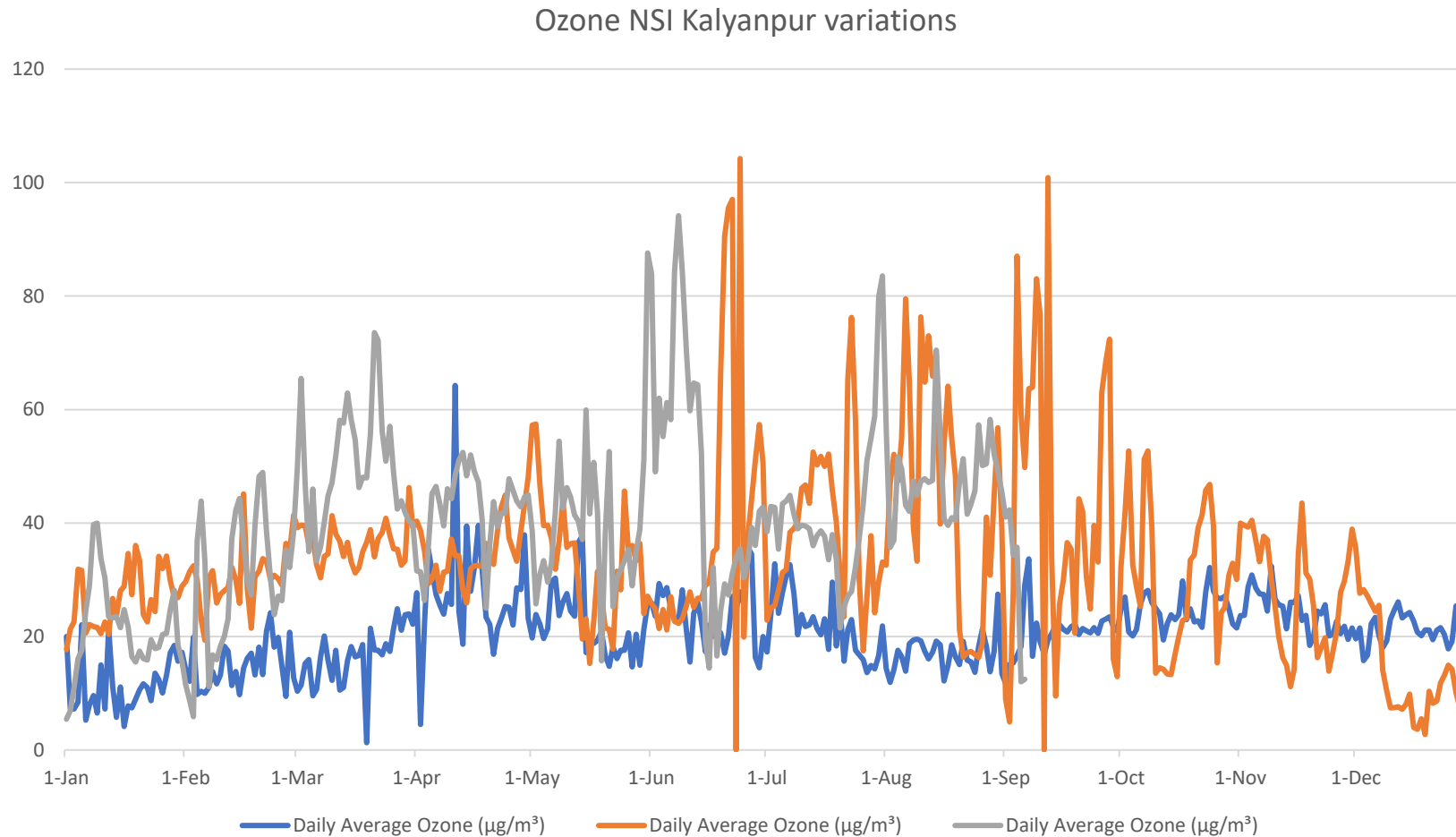
O₃: Diurnal trend for Ozone for Nehru Nagar over past 4 years



O₃: Diurnal trend for Ozone for Kidwai Nagar over past 4 years

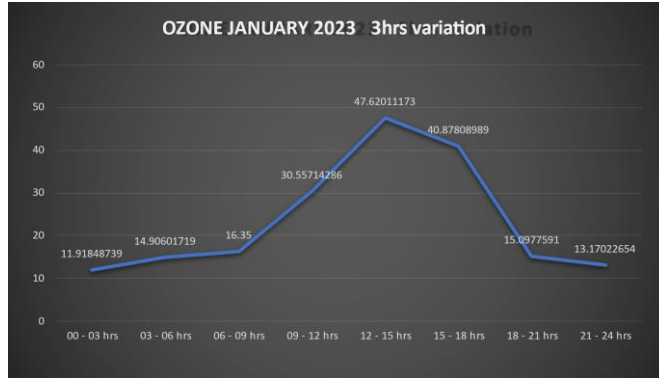


O₃: *Diurnal trend for Ozone for NSI Kalyanpur over past 4 years*

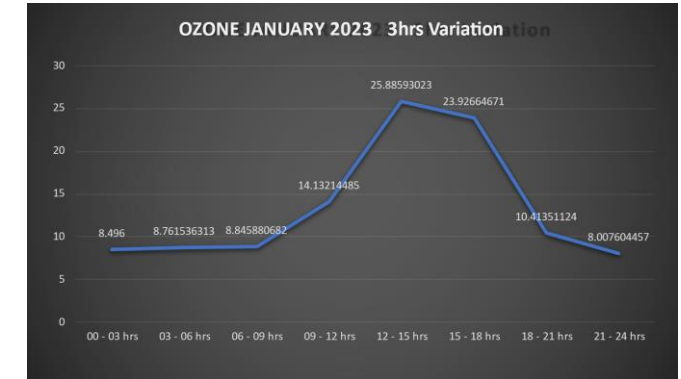
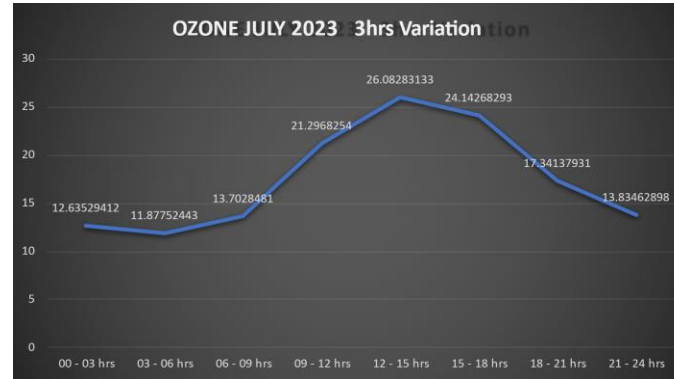


O₃:

3 hourly data analysis for Winter and Summer season (2021 - 2023)



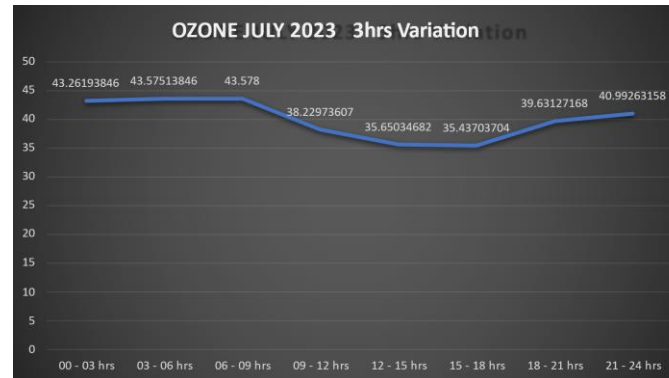
NEHRU NAGAR



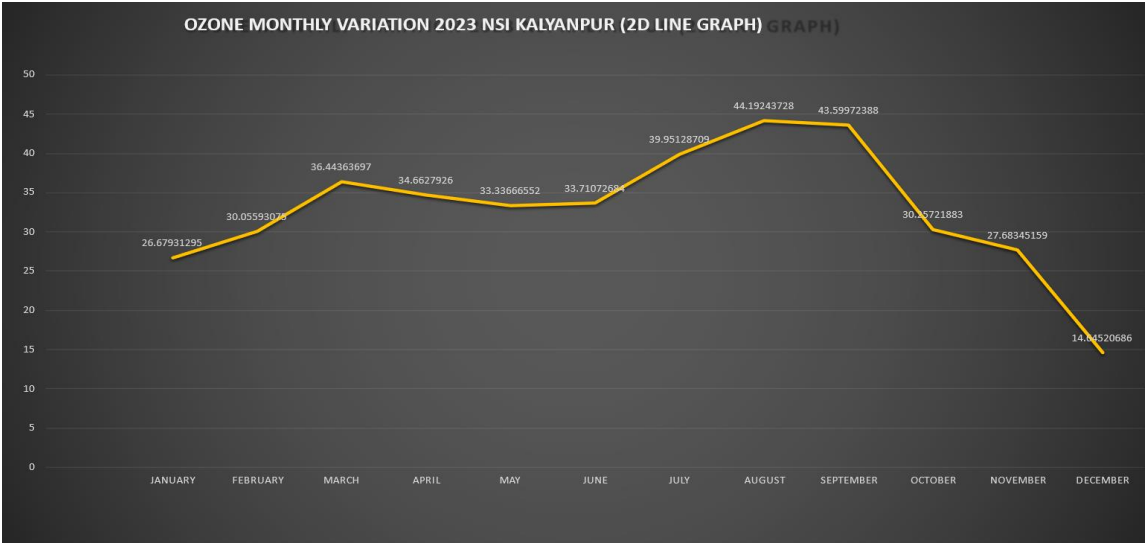
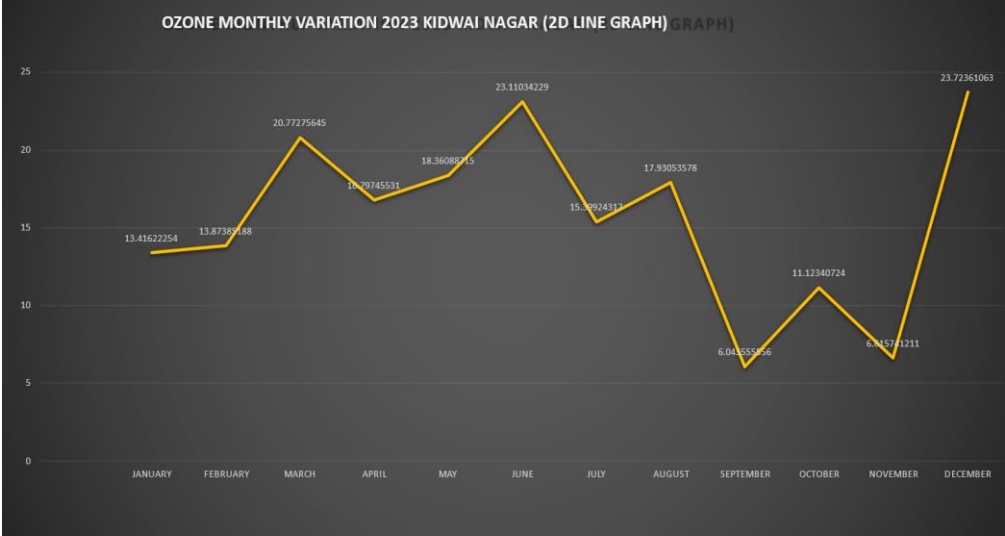
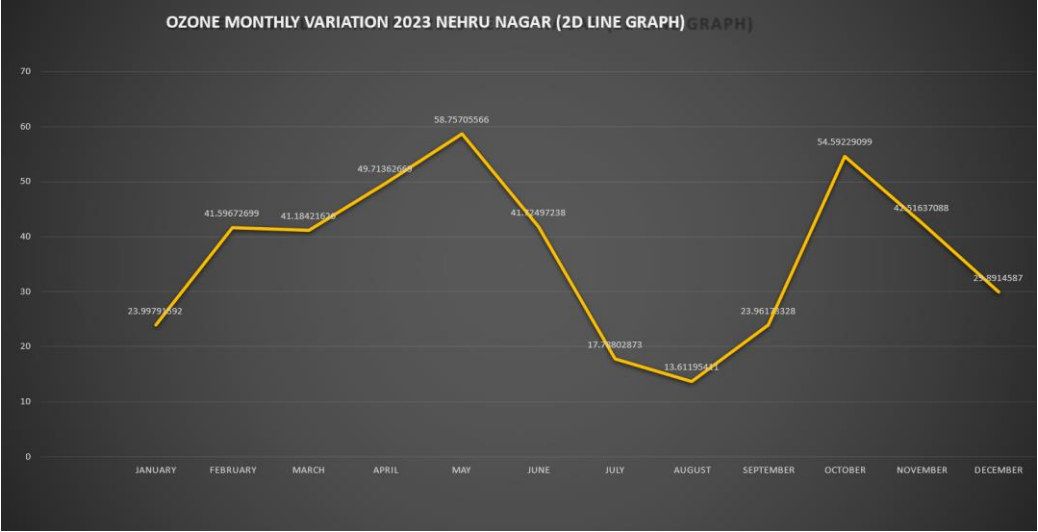
KIDWAI
NAGAR



NSI KALYANPUR



Monthly Variations of O₃ for all the three regions



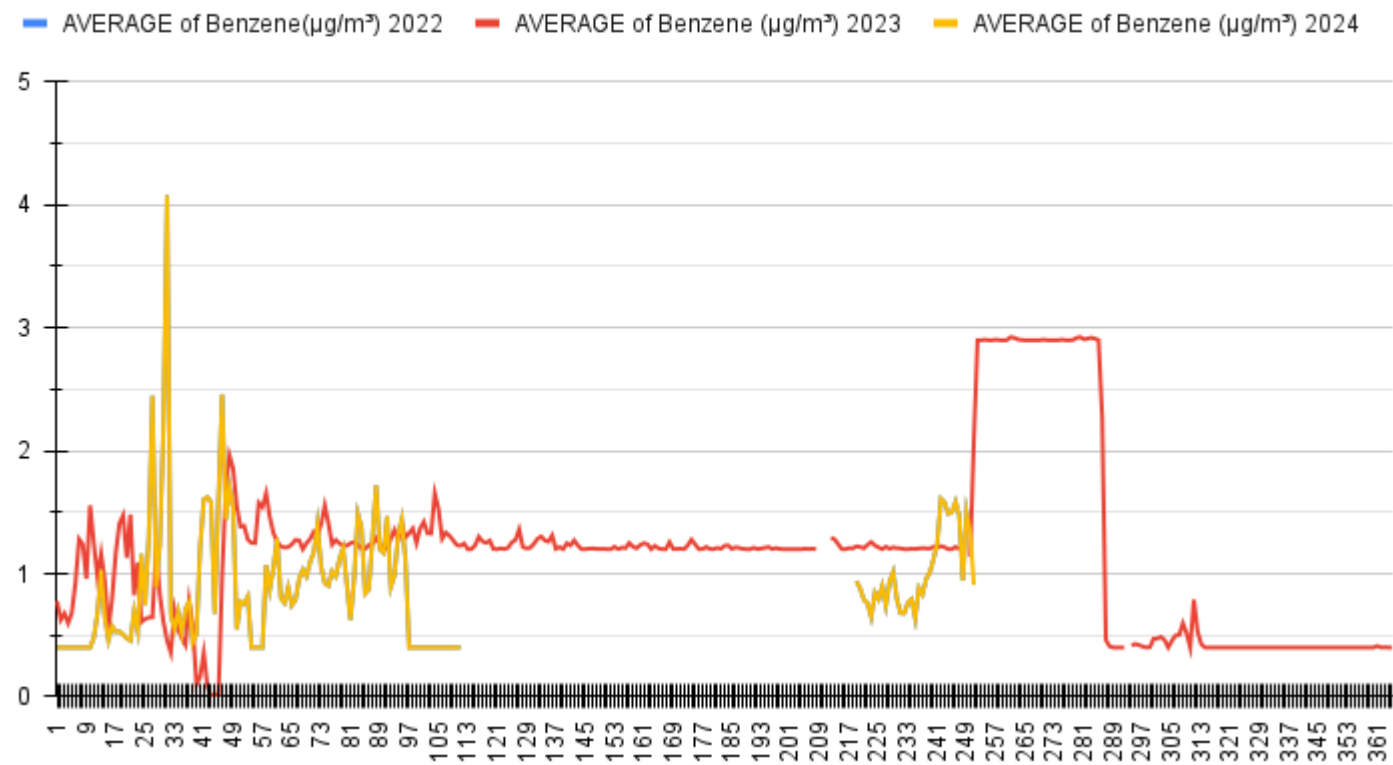
Benzene

- NAAQS limit for Ozone is $100 \mu\text{g}/\text{m}^3$ for 8 hours.

Benzene

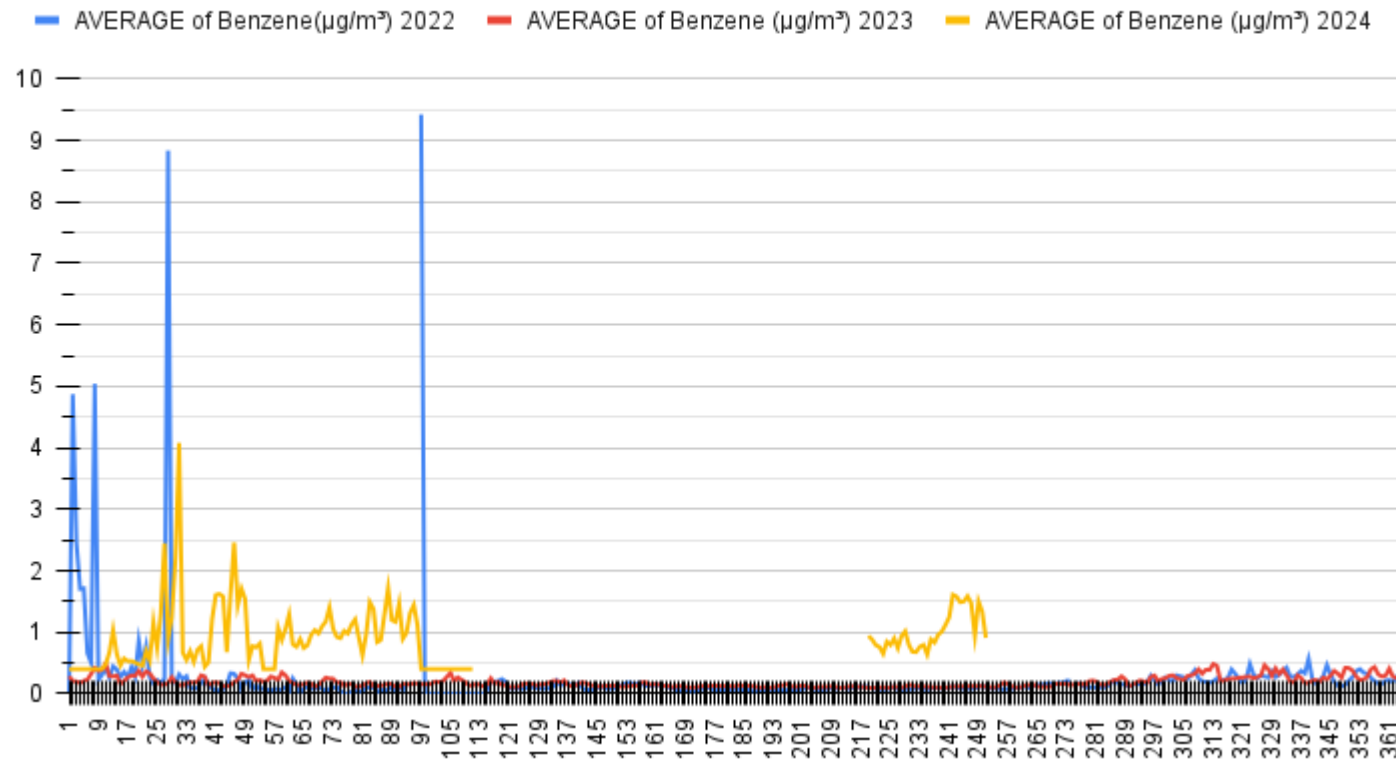
Benzene: *Diurnal trend for Benzene for Nehru Nagar over past 4 years*

Benzene last 4 year variation for Nehru Nagar



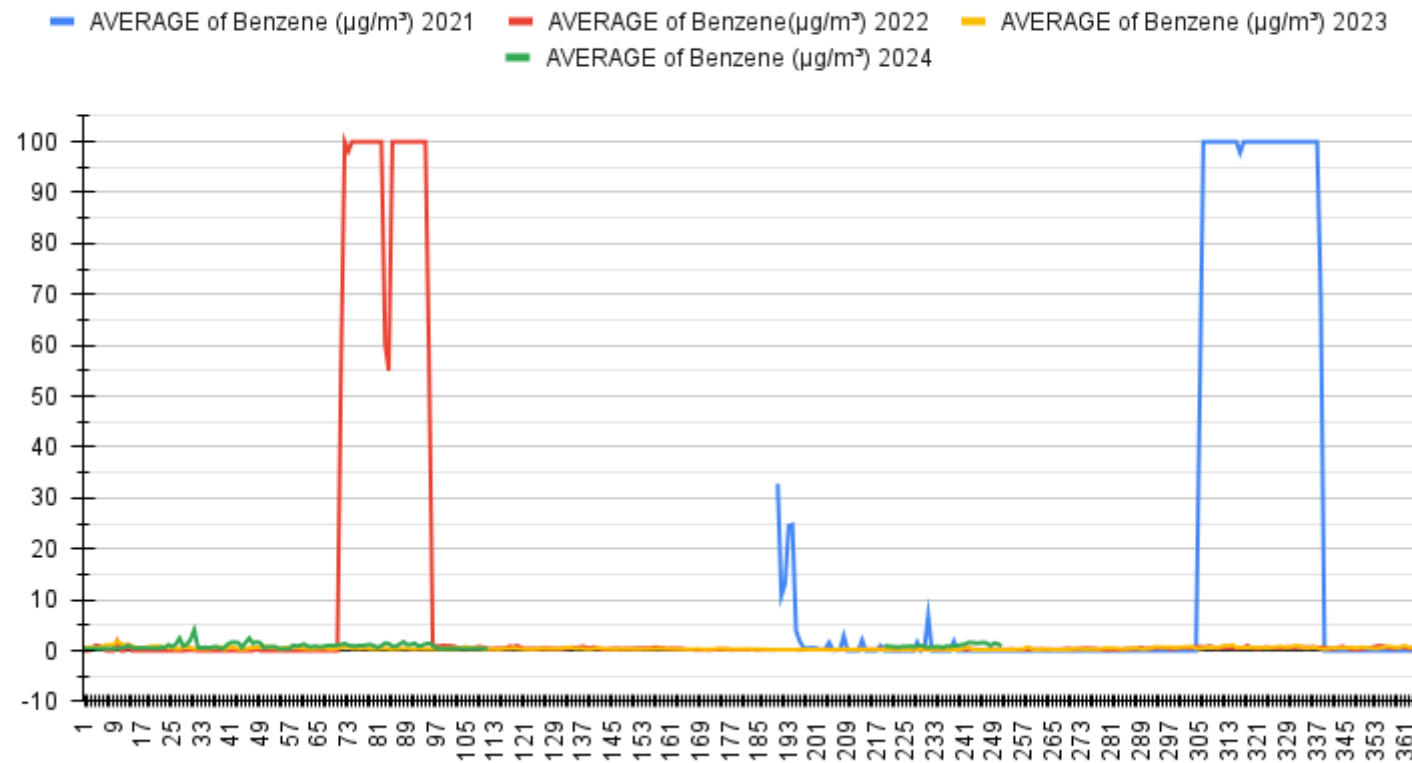
Benzene: *Diurnal trend for Benzene for Kidwai Nagar over past 4 years*

Benzene last 4 year variation for Kidwai Nagar

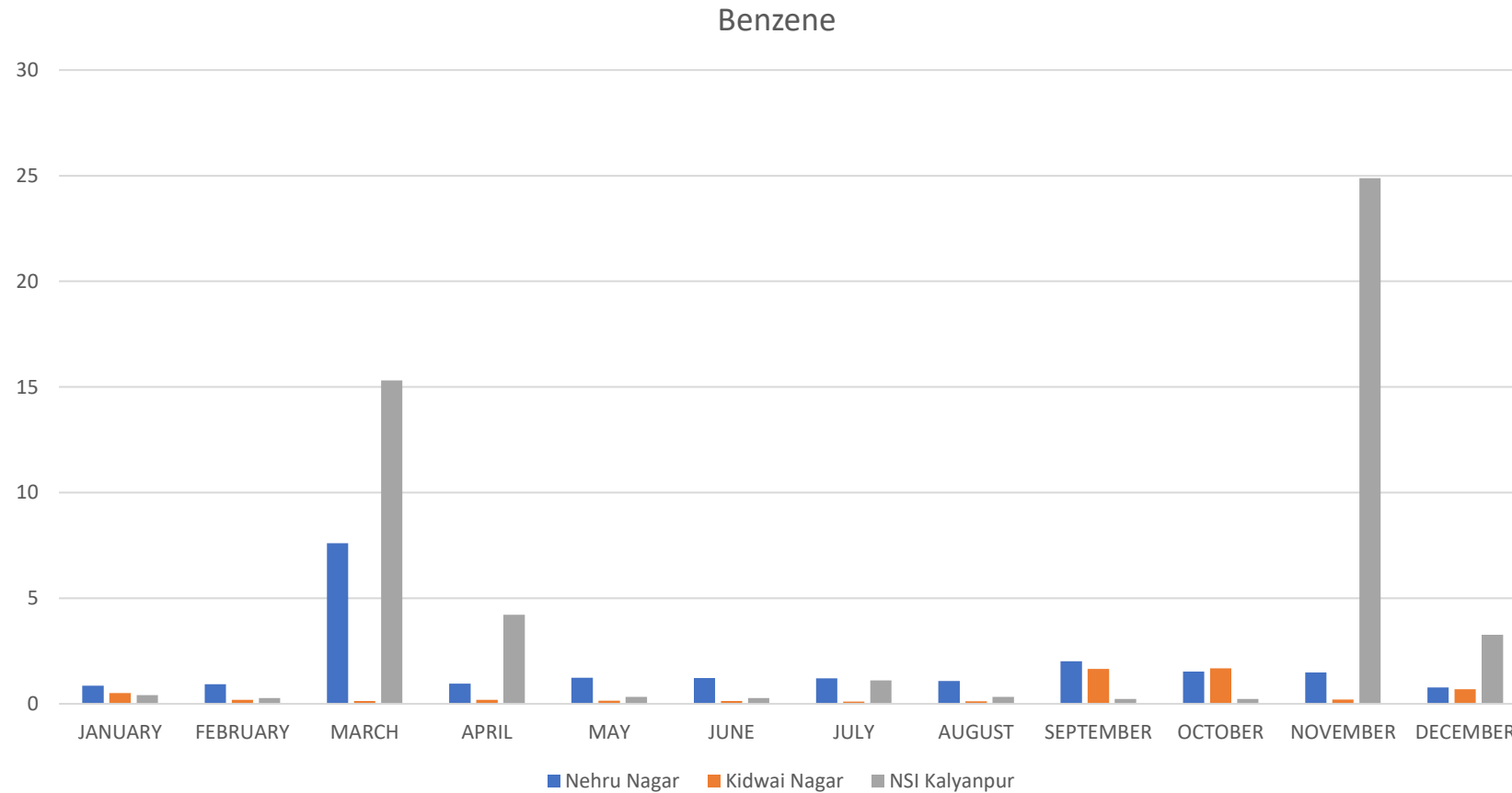


Benzene: *Diurnal trend for Benzene for NSI Kalyanpur over past 4 years*

Benzene last 4 year variation for NSI Kalyanpur



Benzene variation of the THREE areas taken for past 4 years



Conclusions:

- PM 2.5 and PM 10 exceeded and showed high levels the Indian NAQQS for Nehru Nagar, Kidwai Nagar and NSI Kalyanpur.
- CO exceeded the NAAQS limit for Nehru Nagar which is 02 mg/cubic meter most of the days, while it exceeded the limit for Kidwai Nagar and NSI Kalyanpur during the winter season.
- The SO_2 concentration did not exceed the NAAQS limit for the three regions.
- The Nehru Nagar region has the highest of Sulphur dioxide concentration.
- The maximum values are attained for the winter season and at the night time due to stable and sub-adiabatic atmospheric conditions and increased emissions.
- Earth cools and air adjacent to earth also cools and inversion prevails due to which mixing and dispersion of pollutants is decreased to a significant level, which happens until the day breaks.
- The monsoon season shows the least amount, even lesser than the NAAQS criteria due to the wet scavenging and the washout of the pollutant by the rain.
- In the day time and in the summer season, there is good amount of mixing of the pollutants due to the unstable and super-adiabatic conditions.

QnA?

Thank You