Assessment of Ambient Air Quality of Lucknow City

Pre-Monsoon 2025

Vishvigyan Bhawan Campus

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सीएसआईआर-भारतीय विषविज्ञान अनुसंधान संस्थान
CSIR-INDIAN INSTITUTE OF TOXICOLOGY RESEARCH
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Salient Features of the Study Area: Lucknow City

- **Geographical Position** : 26° 52' N Latitude
  80° 56' E Longitude
  128 m above Sea Level
- **Area** : 631 sq. km.
- **Population** : 2815033 as per 2011 Census
- **Projected Population** : 65 lakhs as per Master Plan 2031
- **Climatic condition** : Subtropical climate, cool dry winter (Dec-Feb) & summer (Mar-Jun). Temperature about 45°C in summer to 3°C in winter. The average annual rainfall is about 100 cm.
- **Total Vehicular number as on 31/03/2025** : 3049540
- **Growth of Vehicles over 2024-2025** : 2.3%
- **Total No. of Fuel Filling Stations (Petrol/Diesel/CNG/LPG)** : 209
- **Consumption of Fuel**
  - **Petrol** : 301751 kL
  - **Diesel** : 212314 kL
  - **CNG** : 91481904 kg
  - **LPG** : 407000 kg
- **Major Sources of Pollution** : Automobiles, D.G. Sets
  Biomass bur ning
  Construction activities
  Dry sweeping and resuspension of road dust, residential emission
- **Parameters Monitored** : PM_{10}, $PM_{2.5}$, SO_2, NO_2, Pb, Ni, and Noise Level
- **Study Conducted by** : Environmental Monitoring Laboratory
  CSIR-IITR, Lucknow

ASSESSMENT OF AMBIENT AIR QUALITY OF LUCKNOW CITY DURING PRE-MONSOON, 2025

Summary

The air quality survey has been conducted by the institute for parameters of PM_{10}, $PM_{2.5}$, SO_2, NO_2, Lead (Pb), Nickel (Ni), and Noise levels of day-time and night-tome at 9 monitoring sites covering representative residential, commercial, and industrial areas of Lucknow city during April and May, 2025 (i.e., pre-monsoon 2025) to assess the extent of air pollution in different zones of the city.

Ambient particulate matter concentrations have exceeded their NAAQS limits (i.e., 100 $\mu g/m^3$ for PM_{10} and 60 $\mu g/m^3$ for $PM_{2.5}$). Overall, the city average exceedance factor (EF) was found to be 1.6 for both PM_{10} and $PM_{2.5}$, indicating critical pollution as per CPCB classification. However, gaseous pollutants (i.e., SO_2 and NO_2) were within their national limits of 80 $\mu g/m^3$. Further, the associated toxic metals with PM_{10} (i.e., Pb and Ni) were also found within their ambient standards. Whereas, the record of Noise levels during day-time and night-time were identified exceeded the national noise limits. Overall city has observed better ambient air quality compared to the previous 2024 year's premonsoon study.

During the survey period, April and May are typical dry summer season in Lucknow city. Thus, a rise in surface temperature and air turbulence results in loose soil and road dust resuspension into the atmosphere. The ongoing road widening, pavements, flyover, and building construction activities in the city also contributed the entrainment of dust into the ambient air environment. Growth in registered vehicles in city contributed to more jams and increased fuel consumption and relative traffic pollution along the city roads. However, the particulate levels have shown some declining trend from the previous year's pre-monsoon surveys.

Natural and anthropogenic activities are the contributors to higher air pollution levels in the city. Over the years multiple action plans have also been implemented in the city to mitigate the ambient air pollution concentration. During last one year (i.e. 2024-25) more number of EV buses (by 07 number) and CNG buses (by 47 number) have been added to the public transport of the city. The gradual increase in personal EV cars and EV two-wheelers has also been observed on city roads during the last one year indicating a shift to cleaner fuel vehicle use in the city. Besides, the number of passengers using the Lucknow city metro has increased. Several new flyovers, connecting roads, and outer roads have also shared the load of the city traffic. The outer ring-roads around the city have provided uninterrupted routes for long-distanced vehicles to avoid entry into the city. Furthermore, the deployment of almost 100 E-sweeping machines (slow moving vehicle) in city by the Lucknow Municipal Corporation (LMC) for road cleaning and dust suppression may also have contributed to the reduction in ambient particulate matter levels.

Air pollution is always changing phenomenon with respect to location and time depends on fluctuating natural and man-made activities. Continuous awareness on the status of city's air quality, and regular efforts by the individual and government communities are essential for the safe-guard of public health.

1.0 Introduction

Air pollution has become a major concern in India. Central Pollution Control Board (CPCB) has declared 131 non-attainment cities across 28 states and union territories, which have not met the annual average national ambient air quality standard for ambient particulate matter in the past few years with the base year 2017. Recent research also addressed the potential impact of ambient air pollution on public health, urban atmosphere, crop productivity, etc. Adverse atmospheric air leads a significant damage to the country's economy, wealth, and development. Along with the influence of meteorological and terrain conditions, there are numerous emission sources responsible for deteriorating the quality of air in the city such as dense traffic movement, entrainment of paved and/or unpaved road dust, dust emissions from construction and demolition activities, waste burning, DG sets emissions and road-side cooking, etc. Other than the local sources that are present within the cities, there are multiple elevated sources that also considerably contribute to atmospheric air pollution from outside of that city and influence the surface air quality within the cities. Not only the fine ambient particulate emissions, but other criteria pollutants like oxides of sulphur, oxides of nitrogen, ammonia, and volatile organic compounds (VOCs) cause adverse health of the public and further lead to the formation of secondary pollutants, which have a longer lifetime in the atmosphere.

In order to control and mitigate the ambient air pollution levels, the central and state administrators have taken several steps such as setting up of national ambient air quality standards, improved air quality monitoring systems, penetration of gaseous fuels in the residential and transport sector, emission norms for highly polluting industries, advanced vehicular emissions and fuel quality norms, etc. Despite these initiatives, the pollutant levels in some cities have reduced little and have increased in many cities with growth patterns. Evidently, more intensive efforts are still required at urban and national scales to combat the issues.

As a first step in this direction, MoEF&CC, GoI, has launched the national clean air framework i.e. National Clean Air Program (NCAP) with a goal to meet the prescribed

annual average ambient air quality standards at all locations in the country and with an interim national level target of 20-30% reduction in $PM_{2.5}$ and PM_{10} concentration by 2024-25 compared to the baseline year of 2017-18. The target has been revised to achieve a 40% reduction in $PM_{2.5}$ and PM_{10} concentration or meet national standards (60 µg/m³ and 100 µg/m³ respectively) by 2025-26. In this connection, different stockholders in India collectively focused on implementing improved methods in monitoring and developing technologies for treating air pollution in industrial and ambient environments.

In parallel and in view of the above rationale, CSIR-Indian Institute of Toxicology Research (IITR), one of the Institute of Reputes (IoRs) under NCAP of MoEF&CC, has been conducting air pollution monitoring and assessment in Lucknow city on a regular basis to address the influence of seasonal variations and land use changes on the city's air quality. CSIR-IITR has been conducting the air quality survey every year at 9 different locations in Lucknow city since 1997 for the pre-monsoon (April-May) and post-monsoon (September-October) seasons to determine the city's ambient particulate (PM_{10} and $PM_{2.5}$) and PM_{10} associated toxic metals (Pb & Ni), and gaseous (SO_2 and NO_x), and ambient Noise pollution levels. This report presents the assessment of the ambient air quality of Lucknow city during pre-monsoon 2025.

1.1 Layout of Lucknow City

Lucknow is the capital and the largest city in the Indian state of Uttar Pradesh and the city's area and urban population are growing rapidly. The present population of Lucknow city is almost 41 lakhs. Lucknow is the eleventh-most and the twelfth-most populous urban agglomeration of India. Bounded on the east by Barabanki, on the west by Unnao, on the south by Raebareli , and on the north by Sitapur and Hardoi, Lucknow sits on the northwestern shore of the Gomati. Gomati river flows across the city and divides it into 2 parts viz Cis and Trans Gomati. The city stands at an elevation of 124 meters (404 ft) above sea level. Lucknow city had an area of 402 km^2 till December 2019, when 88 villages were added to the municipal limits and the area increased to 631 km^2. Lucknow has always been a multicultural city that flourished as a North Indian

cultural and artistic hub and the seat of power of Nawabs in the 18th and 19th centuries. It is an important center of governance, administration, education, commerce, aerospace, finance, pharmaceuticals, technology, design, culture, tourism, music and poetry.

1.2 Vehicular Inventory and Fuel Consumption in the City

Registered vehicles and fuel consumption inventory of Lucknow city and other primary information were collected from RTO (Regional Transport Office) as of March 31, 2025 (Table 1). Based on vehicular and fuel consumption inventory, the vehicular population increased registered vehicle numbers by 2.1% in the city from 2023-24. The total number of CNG & electric buses of UPSRTC operational in Lucknow city is 52 & 115, respectively in 2025 (Table 2 & 3). Different oil and gas companies have provided the total number of fuel outlets (i.e. petrol, diesel & CNG) in Lucknow are 209 (Table 4). Consumption of fuel between the years 2024-2025 is presented in Table 5, and it is found that the consumption of petrol, diesel, and CNG increased by 15.1%, 22.4% and 74.0 %, respectively to the previous year (i.e., 2024), while LPG consumption decreased by 21.3% respectively by 2024-25. The number of vehicles with CNG and EV vehicle usage is reported in Table 6 (a & b).

1.3 Study rationale

Studies reported a significant increase in ambient air pollution concentration in Lucknow city. Dominant sources for the poor air quality of the city are vehicular emissions, construction/demolition activities, waste burning, cooking fuel combustion, road dust entrainment, etc. Despite implementing air pollution control measures in the city such as enforcement of BS-VI compliant vehicles, promotion of CNG, and e-vehicles on national wide, air pollution reduction in the city continue to exceed national standards and has become a great challenge for policymakers. Authorities have also initiated the installation of traffic signals to manage vehicle movements, however, the idle mode of vehicles, as well as traffic jams at multiple signals, has affected the air quality. Further, the increasing urban population and associated economic activities have resulted in demands for open cooking and street food stall activities, increasing the

cooking combustion-related emission load to ambient air. The problem is often compounded by the predominance of widely distributed area (fugitive) sources in the city and the lack of understanding of the sources of secondary aerosol, their formation, and transport.

Currently, dry seasonal natural wind-blown, new construction of major flyovers, roads, and road pavement activities, malls, and office complexes in the city are the major sources of atmospheric pollution. The unpaved and damaged roads are also sources of soil and road dust that are entrained to the atmosphere air. Although the Govt. has taken many initiatives like cleaning programs under the Swachha Bharat Programmes, many off-side localities/areas of the city have huge garbage and waste dumps, which are also a source of air pollution. The fugitive and house-cooking combustion sources along the roadsides also significantly contribute to air pollution.

Therefore, the current status of air pollution in the city is important to know for regulating the sources and receptor linkages and implementing cost-effective abatement measures to reduce air pollution load in the city. To address the air pollution status of Lucknow city, CSIR-IITR has been conducting air quality surveys at 9 locations across Lucknow city since 1997 for the pre-monsoon (May-June) and post-monsoon (October-November) seasons every year. The regular air quality survey identifies the new sources, vehicular number and fuel consumption inventory in the city. It generates air pollution data for different functional zones and seasons of the city for public awareness and to support government agencies in enforcing control measures. On account of these understandings, this report complies with the study results of the pre-monsoon 2025 (April to May) air quality survey at 9 different locations in Lucknow covering industrial, residential, and commercial areas concerning PM_{10}, $PM_{2.5}$ SO_2, NO_2, trace metals (Pb and Ni), and Noise pollution. Further, this report illustrates the scientific discussion, interpretations, and recommendations for reducing air pollution load in the city.

1.4 Objectives

The following objectives are delineated for the Pre-monsoon 2025 study:

- *To study the air quality status of pre-monsoon season of 2025 at different functional areas of the city*
- *To ascertain the concentration of PM_{10}, $PM_{2.5}$, SO_2, NO_2, and trace metals (Pb and Ni) associated with PM_{10}.*
- *To study the trend of air pollution in Lucknow city over the years.*
- *To find out the day and night-time Noise levels of the current season at different functional areas of the city*
- *To provide awareness of the current air pollution status of the city*
- *To develop the scientific database and recommendations to assist regulatory agencies with remedial measures in the city*

Table 1: Comparison of Vehicle Numbers in Lucknow

S. No.	Type of Vehicles	Number of Registered Vehicles as on March 31 of each year		Increment in %
		2023-24	2024-25	
1	Multi Articulated	8233	8369	1.6
2	Light, Medium & Heavy Weight Vehicles (Four Wheelers)	63060	63603	0.9
3	Light Commercial Vehicles (Three-Wheeler)	4685	5140	9.7
4	Buses	5362	5721	6.7
5	Omni Buses	553	0	-
6	Taxi	64569	64976	0.6
7	Light Motor Vehicles (Passenger)	22426	23100	3.0
8	Two Wheelers	2098522	2143390	2.1
9	Car	599023	613843	2.4
10	Tractors	32783	39941	21.8
11	Trailers	2437	2572	5.5
12	Others	78211	78885	0.9
Increase in total number of vehicles		**2979864**	**3049540**	**2.3**

Source: *RTO Lucknow, 2025*

Table 2: Details of CNG City Bus Service (Dubagaa Depot, 2025) in Lucknow

S. No.	Route No.	To and From	No. of Buses	Frequency (Km/Bus)
1	101	BBD to Charbagh-Matiyari-Husdiya-Patrakarpuram-Manoj Pandey Chauraha-Fun Mall-Dainik Jagaran-Sikandarbagh GPO	08	237
2	202	Industrial area Scooter India to Shaheedpath via Lulu Mall-Ekana-Kamta Bus Station	31	300
3	402	Integral university to Rajnikhand Nishatganj via GPO - Charbagh-Alambagh Nahar	10	293
4	801D	PM Awas Basant Kunj Yojana to Kamta Chauraha via Gaughat-saharaganj-Buttler Place-Lohia Hospital-Indragandhi Pratishthan	1	229
5	801D N	PM Awas Basant Kunj Yojana to Kamta Chauraha via Gaughat-saharaganj-Buttler Place-Nishatganj-HAL-Polytechnic Chauraha	2	232
		Total	**52**	

Table 3: Details of Electric City Bus Service (Dubagga Depot, 2025) in Lucknow

S.No.	Route No.	To and From	No. of Buses
1	801-E	Balaganj to Dubagga via Engineering Collage-Kamta Chauraha-Virajkhand	20
2	1201-E	Dubagga Bus Station to Buddeshwar Chauraha vis Telibagh - SGPGI-Mohanlalganj	20
3	PMI-02	Dubagga to Gangaganj via Charbagh and Gosainganj	06
4	PMI-05	Ghantaghar to Sandila via Chowk and Dubagga	14
5	PMI-06	Balaganj Chauraha to Gudwa Chauraha via Maal	07
6	PMI-06K	Balaganj Chauraha to Gudwa Chauraha via Kasmandi	02
7	PMI-07	Rajajipuram bus terminus to Dewa via Charbagh and Polytechnic	08
8	PMI-07A	Rajajipuram bus terminus to Dewa via Nishatganj	06
9	PMI-08	Scooter India to Engineering college via Charbagh and Kapoorthala	14
10	PMI-10	Ghanta Ghar to Bauniganj via Balaganj and Dubagga	02
11	PMI-10A	Ghanta Ghar to Bauniganj via Gudwa	02
12	PMI-12	Scooter India to Kamta via Utrathia and Ekana Stadium	14
Total			**115**

Table 4: Fuel Outlets in Lucknow City

S.No.	Agency	Number of outlets as of March 31, 2025
1	Indian Oil Corporation Limited (IOCL)	63
2	Bharat Petroleum Corporation Limited (BPCL)	38
3	Hindustan Petroleum Corporation Limited (HPCL)	44
4	Compressed Natural Gas Stations (CNGS)	13
5	Liquefied Petroleum Gas Stations (LPGS)	3
6	Green Gas Limited (GGL)	48
Total		**209**

Table 5: Fuel Consumption in Lucknow City, 2025

S. No.	Agency	Petrol in kL			High-Speed Diesel in kL			CNG in kg		
		April 23 to March 24	April 24 to March 25	% Change	April 23 to March 24	April 24 to March 25	% Change	April 23 to March 24	April 24 to March 25	% Change
1.	IOCL	135307	144471	6.8	86133	85806	-0.4	21089517.3	29612281	40.4
2.	BPCL	78017	93822	20.3	47680	79583	66.9	1667959.36	2425294	45.4
3.	HPCL	48798	63458	30	39629	46925	18.4	4018924	4395000	9.4
4.	GGL	-	-	-	-	-	-	25790379.23	55049329	113.4
Total		**262122**	**301751**	**15.1**	**173442**	**212314**	**22.4**	**52566780.13**	**91481904**	**74.0**
		LPG in Ton								
5.	**IOCL**	**April 23 to March 24**	**April 24 to March 25**	**% Change**	**-**	**-**	**-**	**-**	**-**	**-**
Total		**517**	**407**	**-21.3**	**-**	**-**	**-**	**-**	**-**	**-**

Source: *M/s Indian Oil Corporation Limited (IOCL), Lucknow; M/s Bharat Petroleum Corporation Limited (BPCL); M/s Hindustan Petroleum Corporation Limited (HPCL); M/s Green Gas Limited (GGL), Lucknow, 2025*

Table 6 (a): Comparison of Registered CNG Vehicle Number in Lucknow

S. No.	Vehicles	Total Number		% of Change
		2023-24	2024-25	
1	Auto Rickshaws	8167	8681	6.3
2	Tempo Taxi	4424	4693	6.1
3	Buses	354	401	13.3
4	School Buses	5544	5586	0.8
5	Private Cars	41302	51250	24.1
	Total	**59791**	**70611**	**18.1**

Source: *RTO Lucknow*

Table 6(b): Comparison of Registered EV-Vehicle Number in Lucknow

S. No.	Vehicles	Number		% of Change
		2023-24	2024-25	
1	Buses	0	7	-
2	e-Rickshaw with Cart(G)	953	2139	124.4
3	e-Rickshaw (P)	11809	19155	62.2
4	Goods Carrier	524	6068	1058.0
5	M-Cycle/Scooter	8601	11154	29.7
6	Moped	4	9	125.0
7	Motor Cab	7	11	57.1
8	Motar Car	1072	1848	72.4
9	Three Wheeler (Goods)	451	952	111.1
10	Three Wheeler (Passenger)	4441	14631	229.5
	Total	**27862**	**55974**	**100.9**

Source: *RTO Lucknow*

2.0 Monitoring locations and methodology

A total of nine air quality monitoring locations were selected to present various functional areas within the city i.e., representative of 4 residential, 4 commercial cum traffic and 1 industrial area were selected for the Pre-monsoon 2025 study as summarized in Table 7 and Figure 1. The methodologies employed for monitoring and analysis are given in Table 8. A total of 8-week samplings were carried out during April-May 2025.

Table 7: Monitoring Locations

S .No.	Locations	Activities
1	Aliganj	Residential
2	Vikas Nagar	Residential
3	Indira Nagar	Residential
4	Gomati Nagar	Residential
5	Charbagh	Commercial cum traffic
6	Alambagh	Commercial cum traffic
7	Aminabad	Commercial cum traffic
8	Chowk	Commercial cum traffic
9	Amausi	Industrial

Table 8: Parameters and Methodology for Air Quality Monitoring

Sl. No.	Parameters	Time Weighted Average	Methods of Measurement
1	Particulate Matter (PM_{10})	24 hours	Gravimetric
2	Fine Particles ($PM_{2.5}$)	24 hours	Gravimetric
3	Sulphur dioxide (SO_2)	24 hours	Improved West Gaeke
4	Nitrogen dioxide (NO_2)	24 hours	Modified Jacob & Hochhesier (Na-Arsenite)
5	Trace metals (i.e., Pb and Ni)	24 hours	Associated with PM_{10} sample and analyzed through AAS facility of IITR
6.	Noise Level	1 hour	The measurement of noise level was carried out during the day (6 AM to 10 PM) and night time (10 PM to 6 AM) by Noise Level Meter

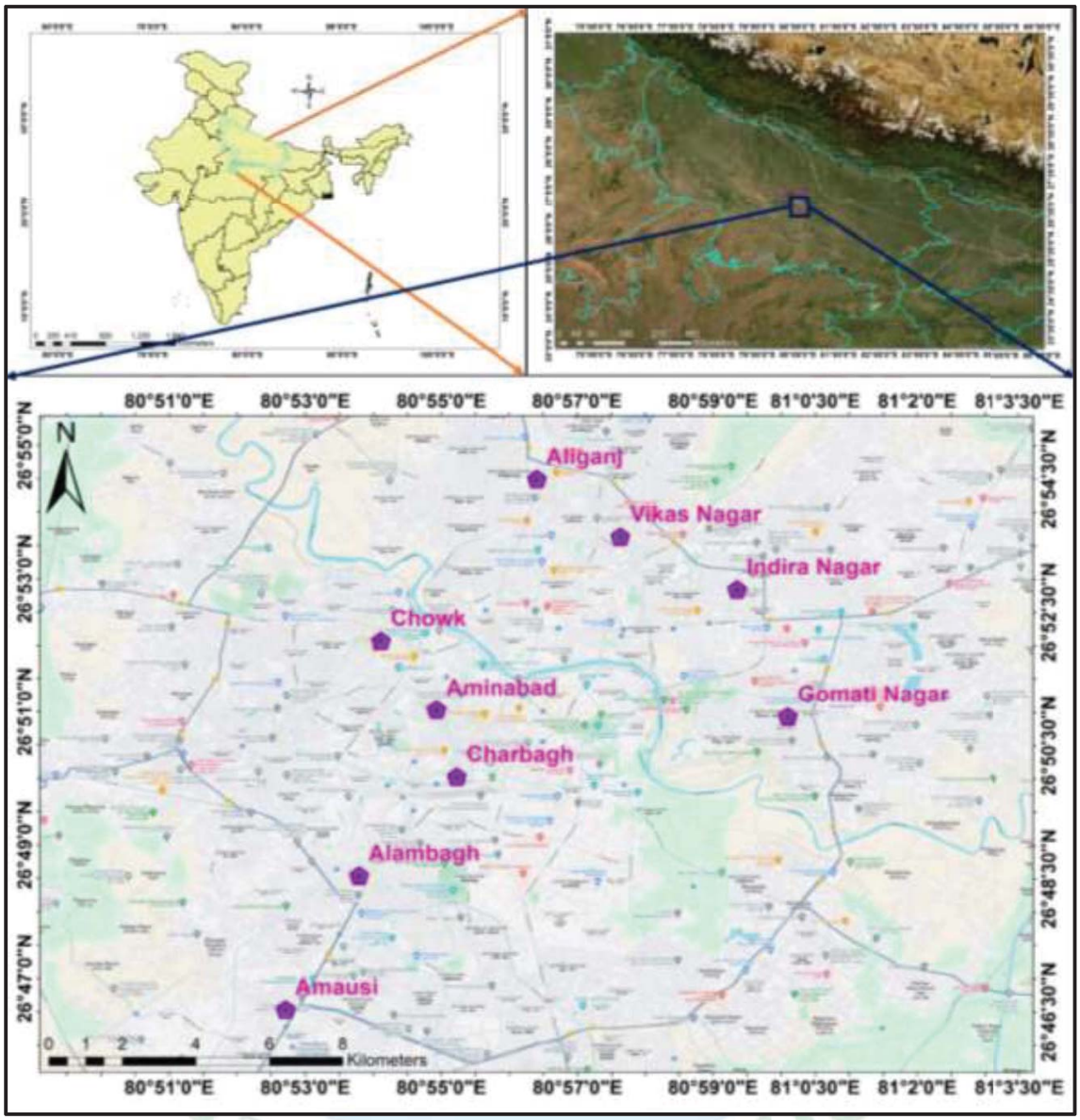

Figure 1: Shows ambient air pollution monitoring/sampling locations in Lucknow city.

3.0 Results

The detailed results of air quality monitoring during the pre-monsoon 2025 period are presented in Table 9 and Figure 2 to Figure 3.

3.1 Respirable Suspended Particulate Matter (RSPM or PM_{10})

In residential areas (Aliganj, Vikas Nagar, Indira Nagar and Gomati Nagar), the 24 hours concentrations of PM_{10} were in the range of 81.1 to 223.2 µg/m^3 with an average of 123.7 µg/m^3. The average PM_{10} concentration (131.3 µg/m^3) was highest at Gomati Nagar among the residential areas.

In commercial areas (Charbagh, Alambagh, Aminabad, and Chowk), the concentrations of PM_{10} were in the range of 92.2 to 344.3 µg/m^3 with an average of 169.1 µg/m^3, respectively. The average PM_{10} concentration (187.6 µg/m^3) was highest at Charbagh among the commercial areas.

In industrial areas (Amausi), the average concentration of PM_{10} was 186.1 µg/m^3. However, in all locations, PM_{10} levels exceeded the prescribed National Ambient Air Quality Standard (NAAQS) of 100 µg/m^3.

3.2 Fine Particulate Matter ($PM_{2.5}$)

In residential areas (Aliganj, Vikas Nagar, Indira Nagar and Gomati Nagar), the 24 hours concentrations of $PM_{2.5}$ were in the range of 49.3 to 108.4 µg/m^3 with an average of 74.2 µg/m^3. The average $PM_{2.5}$ concentration (82.5 µg/m^3) was highest at Gomati Nagar among the residential areas.

In commercial areas (Charbagh, Alambagh, Aminabad and Chowk), the concentration of $PM_{2,5}$ was in the range of 57.3 to 156.3 µg/m^3 with an average of 98.4 µg/m^3 respectively. The average $PM_{2.5}$ concentration (107.3 µg/m^3) was highest at Chowk among the commercial areas.

In the industrial area (Amausi), the average concentration of $PM_{2.5}$ was 114.5 µg/m^3. However, in all locations, $PM_{2.5}$ levels exceeded the prescribed National Ambient Air Quality Standard (NAAQS) of 60 µg/m^3.

3.3 Sulphur dioxide (SO_2)

In residential area (Aliganj, Vikas Nagar, Indira Nagar and Gomati Nagar), the levels of SO_2 ranged from 6.8 to 25.1 µg/m^3 with an average of 14.95 µg/m^3. In commercial areas (Charbagh, Alambagh, Aminabad and Chowk), the concentrations of SO_2 ranged from 10.5 to 34.9 µg/m^3 with an average of 19.0 µg/m^3. In the industrial area (Amausi), the average level of SO_2 was 26.4 µg/m^3. However, all the values of SO_2 were well below the prescribed NAAQS of 80 µg/m^3 for all the locations.

3.4 Nitrogen dioxide (NO_2)

In residential areas (Aliganj, Vikas Nagar, Indira Nagar and Gomati Nagar) the 24 hours concentration of NO_2 was in the range of 16.0 to 52.1 µg/m^3 with an average of 35.0 µg/m^3. In commercial areas (Charbagh, Alambagh, Aminabad and Chowk) the concentration of NO_2 was 20.4 to 108.3 µg/m^3 with an average of 41.3 µg/m^3. The average concentration in industrial areas (Amausi) was 39.3 µg/m^3. However, all the values of NO_2 were within the prescribed NAAQS of 80 µg/m^3 for all the monitoring locations.

Table 9: Concentration (µg/m^3) of PM_{10}, $PM_{2.5}$, SO_2 and NO_2 during Pre-monsoon 2025

Location	PM_{10} (RSPM)			$PM_{2.5}$			SO_2			NO_2		
Residential												
	Min	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**	**Min**	**Max**	**Avg**
Aliganj	81.1	184.8	126.8 ± 25.7	49.3	92.5	71.6±10.8	9.2	19.7	15.0±3.2	16.0	46.1	36.1±7.5
Vikas Nagar	91.7	166.6	117.2+18.1	55.3	87.7	68.3±10.2	6.8	19.4	13.7±4.0	23.0	36.0	28.5±3.9
Indira Nagar	83.2	223.2	119.8+38.6	60.6	91.8	74.5±8.7	9.0	25.1	15.1±4.4	18.4	46.9	32.7±8.9
Gomati Nagar	102.9	200.6	131.3+28.7	56.6	108.4	82.5±19.4	10.4	23.3	16.0±4.3	19.5	52.1	42.8±9.5
Average	**89.72**	**193.80**	**123.77**	**55.45**	**95.10**	**74.22**	**8.85**	**21.87**	**14.95**	**19.22**	**45.27**	**35.02**
Commercial												
Charbagh	132.1	344.3	187.6±66.4	85.3	156.3	107.0±25.2	14.2	28.2	19.5±5.2	29.4	57.3	38.3±11.0
Alambagh	99.3	293.6	151.7±68.2	57.3	127.9	86.5±26.9	10.5	24.6	18.7±5.4	29.2	62.6	39.3±15.6
Aminabad	92.2	265.7	162.6±42.5	59.7	139.2	92.9±22.6	12.2	30.5	18.7±4.8	20.4	104.1	41.8±25.4
Chowk	126.8	278.8	174.6±42.8	77.7	142.8	107.3±21.8	12.9	34.9	19.1±5.7	26.9	108.3	46.1±22.0
Average	**112.60**	**295.60**	**169.12**	**70.0**	**141.55**	**98.42**	**12.45**	**29.55**	**19.0**	**26.47**	**83.07**	**41.37**
Industrial												
Amausi	**119.5**	**364.5**	**186.1±77.1**	**78.1**	**164.6**	**114.5±30.8**	**16.8**	**37.6**	**26.4±8.8**	**18.6**	**117.3**	**39.3±43.7**
NAAQS	100			60			80			80		
WHO Guidelines	50			25			20			40*		

*=Annual Average, NAAQS=National Ambient Air Quality Standard

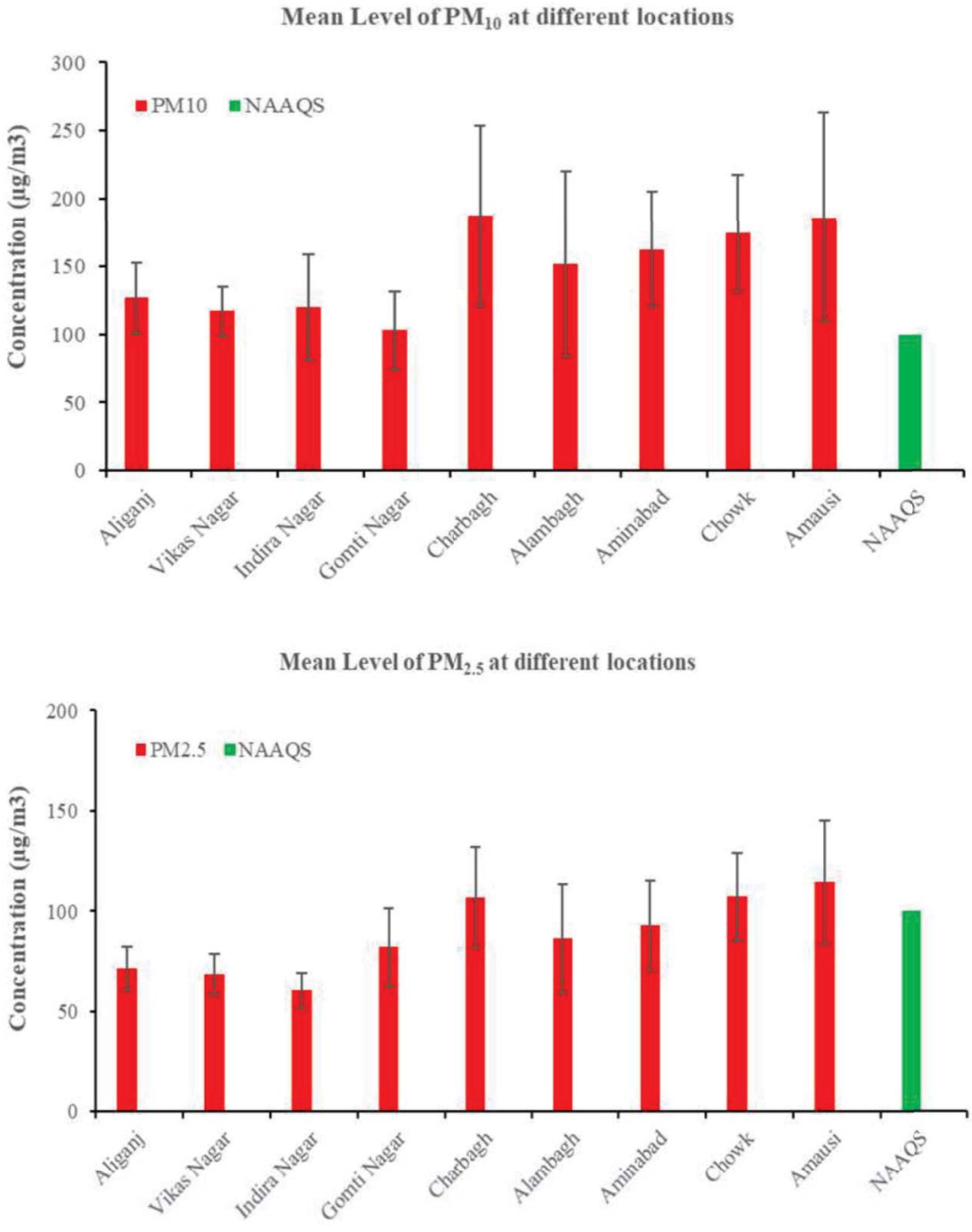

Figure 2: Concentration (µg/m^3) of PM_{10} and $PM_{2.5}$ in different functional areas of Lucknow city during Pre-monsoon 2025 and comparison with prescribed National Ambient Air Quality Standard (NAAQS)

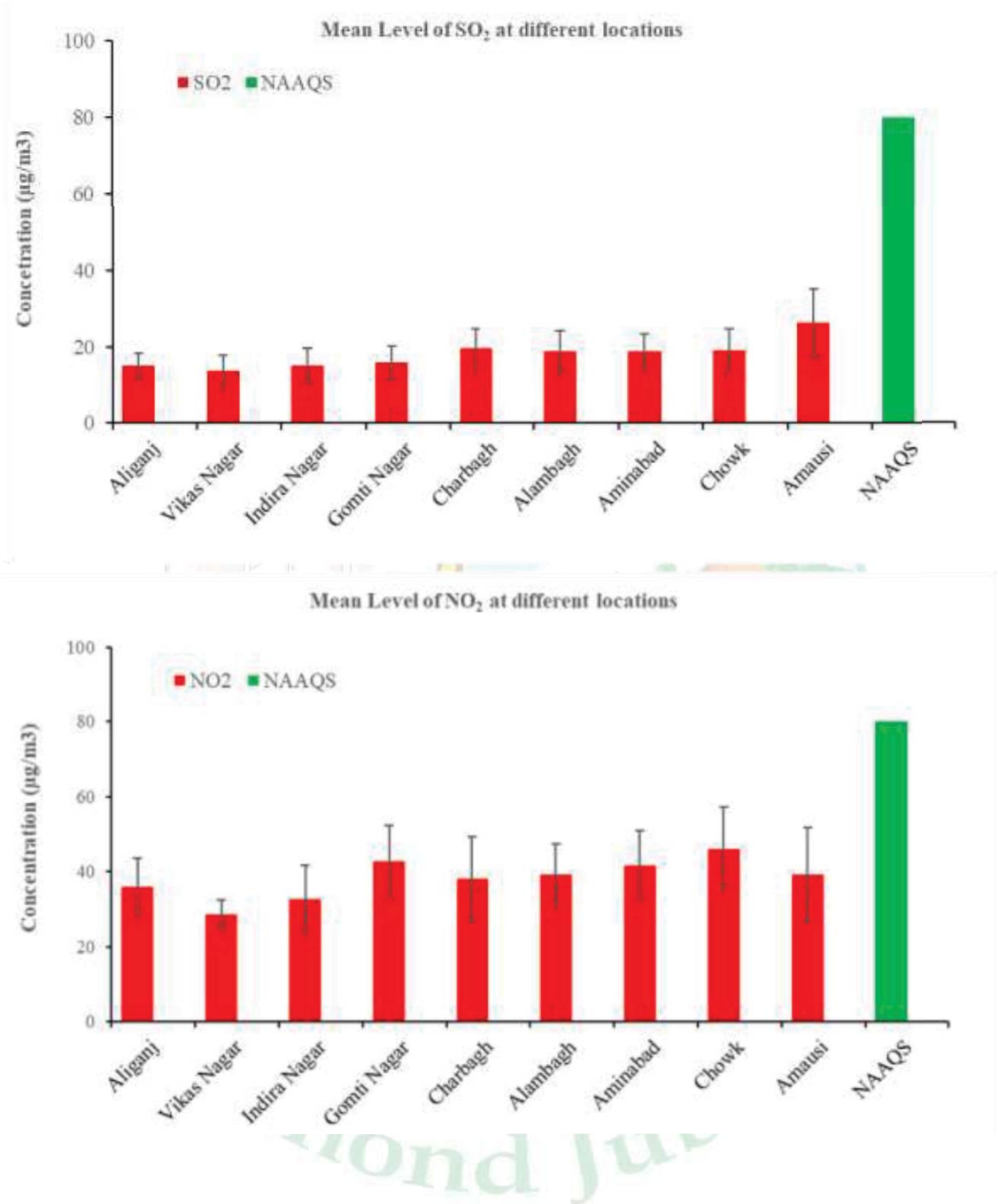

Figure 3: Concentration (µg/m^3) of SO_2 and NO_2 in different areas of Lucknow city during Pre-monsoon 2025 and comparison with prescribed National Ambient Air Quality Standard (NAAQS)

3.5 Trace elements

Metal concentrations in ng/m^3 associated with PM_{10} are presented in Table 10. The concentration of Pb among the residential areas ranged between 0.10 (Indira Nagar) to 0.14 (Gomati Nagar) µg /m^3 with an average of 0.12 µg /m^3. In commercial areas, the values ranged between 0.12 (Aminabad) to 0.18 (Charbagh) µg /m^3 with an average of 0.15 µg /m^3. In the industrial area Amausi, the value of Pb was 0.14 µg /m^3.

The concentration of Ni among the residential areas ranged between 8.2 (Vikas Nagar) to 9.5 (Aliganj) ng/m^3 with an average of 8.88 ng/m^3. In commercial areas, the values ranged between 9.5 (Chowk) to 12.5 (Charbagh) ng/m^3 with an average of 10.63 ng/m^3.In the industrial area Amausi, the value of Ni was 10.5 ng/m^3.

Table 10: Metal concentration (ng/m^3) associated with PM_{10}

S. No.	Location	Pb, µg/m^3	Ni, ng/m^3
1	Aliganj	0.13	9.5
2	Vikas Nagar	0.11	8.2
3	Indira Nagar	0.10	8.6
4	Gomati Nagar	0.14	9.2
Average		**0.12**	**8.88**
5	Charbagh	0.18	12.5
6	Alambagh	0.15	10.3
7	Aminabad	0.12	10.2
8	Chowk	0.15	9.5
Average		**0.15**	**10.63**
9	Amausi	0.14	10.5
NAAQS		**1$^{\#}$**	**20***

= 24-hour Average and *= Annual Average

3.6 Noise Level

The noise monitoring data recorded during the pre-monsoon period (April-May 2025) is presented in Table 11. In residential areas, the average day and night time noise levels

were recorded in the range of 51.2 to 99.2 and 52.2 to 87.6 dB(A), respectively. All the average values were significantly higher than the prescribed national limits of 55 and 45 dB (A) for day and night, respectively. In commercial and traffic areas, the day and night noise levels were recorded in the range of 64.6 to 111.7 and 58.7 to 101.1 dB(A), respectively. Noise levels at all commercial sites were significantly higher than the prescribed national limits of 65 dB (A) and 55 dB (A) for day and night, respectively. In the industrial area Amausi, the day and night noise levels ranged between 65.2 to 106.8 during the day and 62.4 to 96.6 dB(A) at night, respectively. Noise levels in industrial areas were recorded higher than the NAAQS of 75.0 and 70.0 dB(A), respectively.

Table 11: Noise level dB(A) during day and night time

Location	Range	Day	Night
Aliganj	Min	61.5	57.7
	Max	87.4	81.2
	Avg. (Leq)	**74.4**	69.5
Vikas Nagar	Min	53.1	57.8
	Max	87.1	82.4
	Avg. (Leq)	**70.1**	62.7
Indira Nagar	Min	54.8	52.2
	Max	94.2	87.6
	Avg. (Leq)	**71.3**	**63.5**
Gomati Nagar	Min	51.2	54.5
	Max	99.2	70.0
	Avg. (Leq)	75.2	62.3
NAAQS for Residential Area		**55**	**45**
Charbagh	Min	71.9	68.1
	Max	111.7	101.1
	Avg. (Leq)	**91.8**	**84.6**
Alambagh	Min	73.5	60.9
	Max	103.0	99.8
	Avg. (Leq)	**88.3**	**75.3**
Aminabad	Min	64.6	58.7
	Max	96.3	94.3
	Avg. (Leq)	**80.5**	**76.5**
Chowk	Min	72.6	58.7
	Max	108.2	94.3
	Avg. (Leq)	**90.4**	**80.5**
NAAQS for Commercial Area		**65**	**55**
Amausi	Min	65.2	62.4
	Max	106.8	96.6
	Avg. (Leq)	**86.0**	**72.5**
NAAQS for Industrial Area		**75**	**70**

4.0 Trends of ambient air quality in Lucknow city

The observed PM_{10}, $PM_{2.5}$, SO_2, and NO_2 for the past 5 years of pre-monsoon seasonal data (i.e., from 2021 to 2025) have been compared to find out the prevailing trend of air pollution in Lucknow city (Figures 4-7). Overall, a slight change was observed in the air quality trend, which is attributed to some local environmental, urban development, and climatic factors.

4.1 Trend of PM_{10} and $PM_{2.5}$

Figure 4 indicates that PM_{10} levels consistently exceeded the NAAQS limit (100 µg/m³) across all years. The PM_{10} levels remained relatively stable at Aliganj and Vikas Nagar, while Indira Nagar showed an increase in 2024, followed by a decline in 2025. A similar trend was observed in Gomti Nagar. In commercial areas such as Charbagh, PM_{10} levels fluctuated over the five years but declined in 2025 compared to 2024. Overall, commercial areas exhibited a sharp increase in PM_{10} levels from 2021 to 2024, with a slight decrease in 2025, though values remained above the NAAQS limit. In the industrial area (Amausi), PM_{10} levels showed a variable trend, increasing from 2023 to a peak in 2024, followed by a slight decline in 2025. **Figure 5** indicates that $PM_{2.5}$ concentrations exceeded the NAAQS limit (60 µg/m³) throughout the study period. An overall upward trend was observed across all zones, peaking in 2024, followed by a slight decline in 2025. Despite this reduction, $PM_{2.5}$ levels remained consistently above the permissible limit in all locations. Commercial and industrial areas consistently recorded higher pollution levels compared to residential areas.

4.2 Trend of SO_2 and NO_2

The trend of SO_2 and NO_2 for the pre-monsoon seasons from 2020 to 2025 is presented in Figure 6 and Figure 7 for all the locations in the city. The overall concentration shows an increase from 2021 to 2025, whereas it shows an increase and a decrease trend from last year. However, all the values of the present study were found to be lower than the NAAQS.

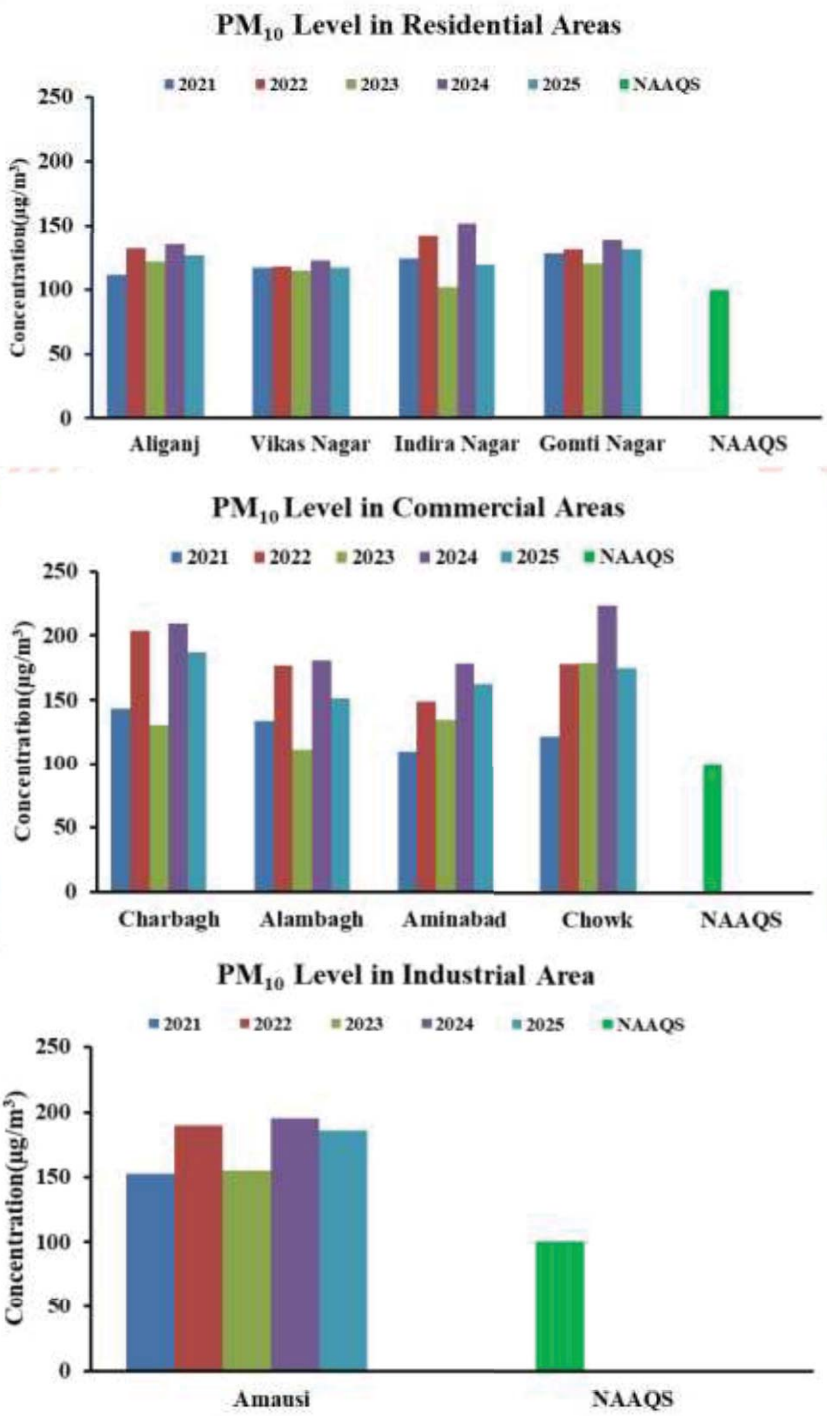

Figure 4: Concentration (µg/m^3) of PM_{10} **(**RSPM**)** in residential, commercial and industrial areas of Lucknow city during 2021 to 2025 (pre-monsoon) and compared with prescribed National Ambient Air Quality Standard (NAAQS)

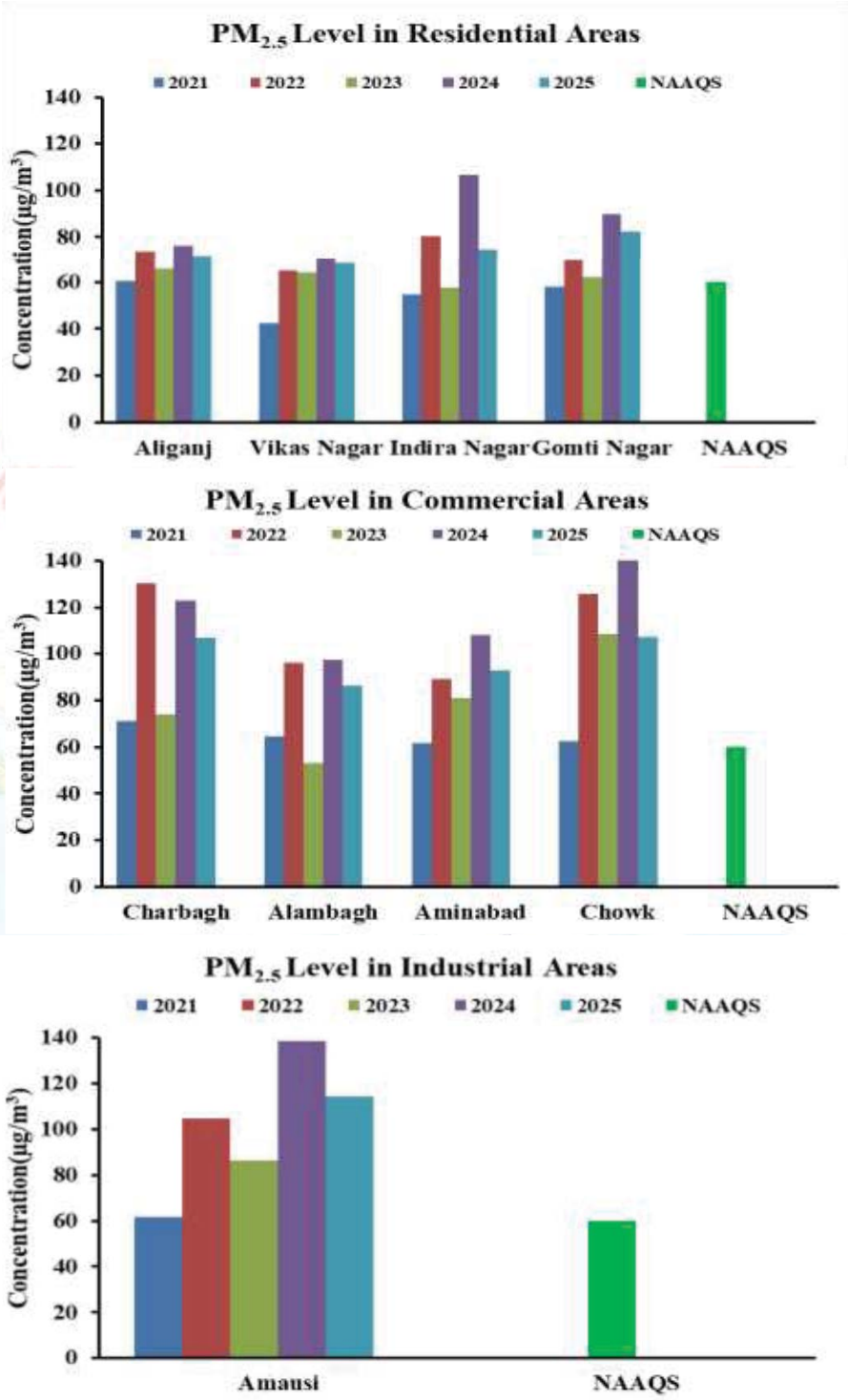

Figure 5: Concentration (µg/m^3) of $PM_{2.5}$ in residential, commercial and industrial areas of Lucknow city during 2021 to 2025 (pre-monsoon) and compared with prescribed National Ambient Air Quality Standard (NAAQS)

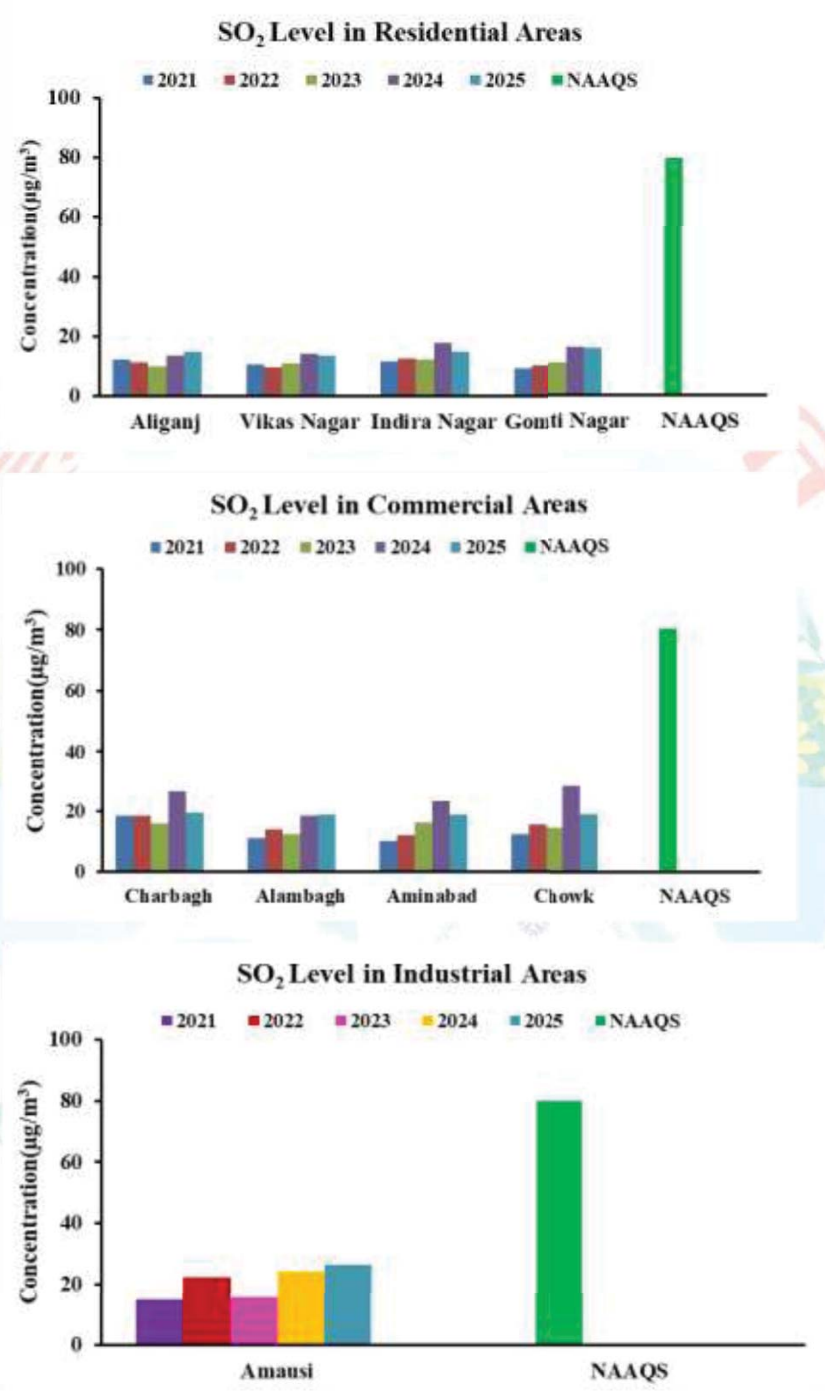

Figure 6: Concentration (µg/m^3) of SO_2 in residential, commercial and industrial areas of Lucknow city during 2021 to 2025 (pre-monsoon) and compared with prescribed National Ambient Air Quality Standard (NAAQS)

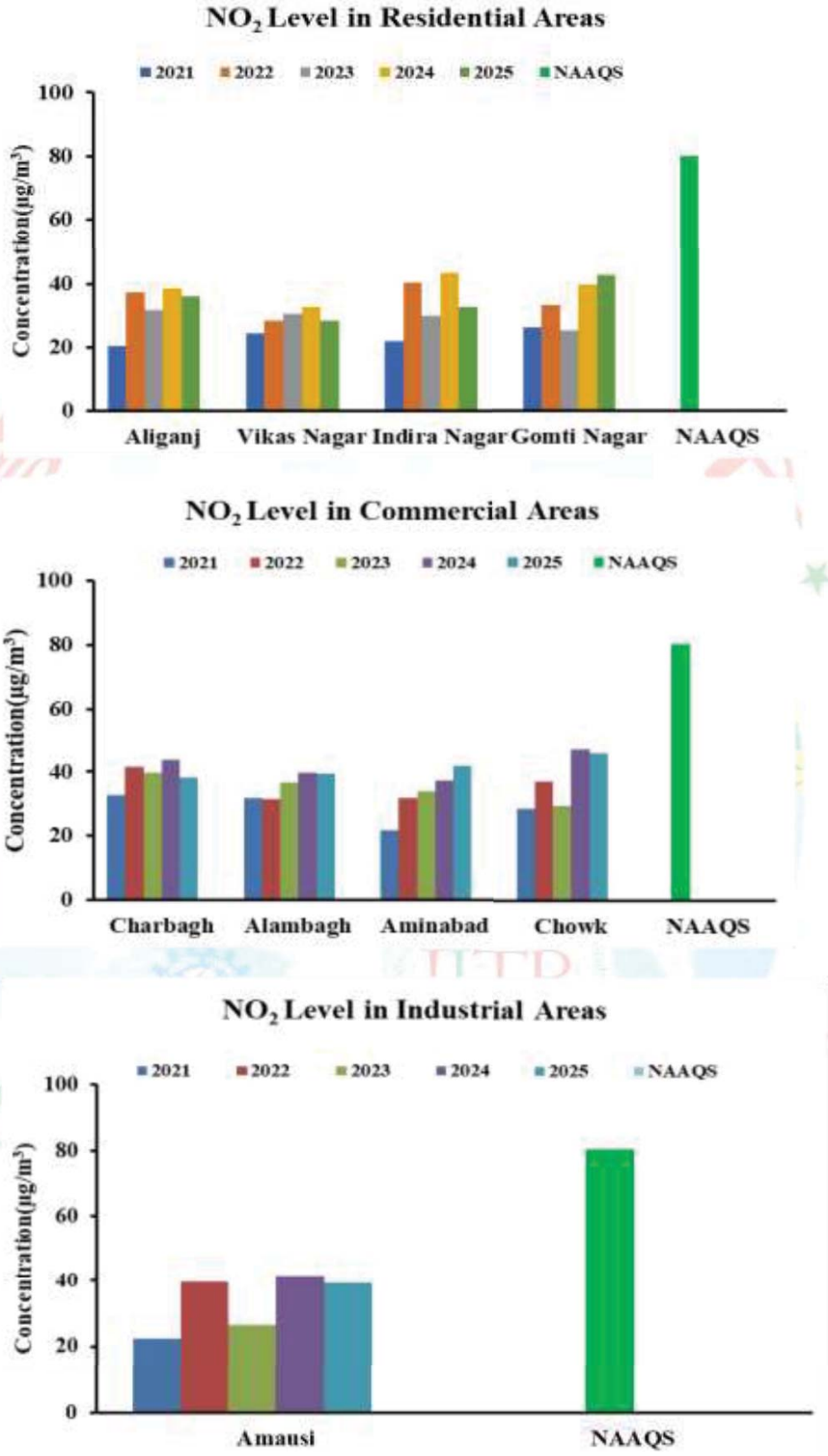

Figure 7: Concentration (µg/m^3) of NO_2 in residential, commercial and industrial areas of Lucknow city during 2021 to 2025 (pre-monsoon) and compared with prescribed National Ambient Air Quality Standard (NAAQS)

4.3 Trend of Noise Level

The current year's Pre-monsoon 2025 noise data was compared with the corresponding data of the previous four years (i.e. 2021 to 2024), and results are presented in Figures 8 and 9. The higher noise levels adversely affect the lives of millions of people in the city. Studies have shown that there are direct links between noise and health.

4.3.1 Day time noise level

All residential, commercial cum traffic and industrial areas showed a slight decrease trend over that of the previous year except the residential area (Aliganj) and industrial area (Amausi). The comparative data are presented in Figure 8.

4.3.2 Night time noise level

The night time noise level trend in residential areas decreased slightly over the years, except in Aliganj, where a marginal increase was observed. In commercial-cum-traffic areas, noise levels generally exhibited an increasing trend, except for Alambagh, which showed a decline. In industrial areas, night time noise levels slightly decreased compared to the previous year. The comparative data are presented in Figure 9.

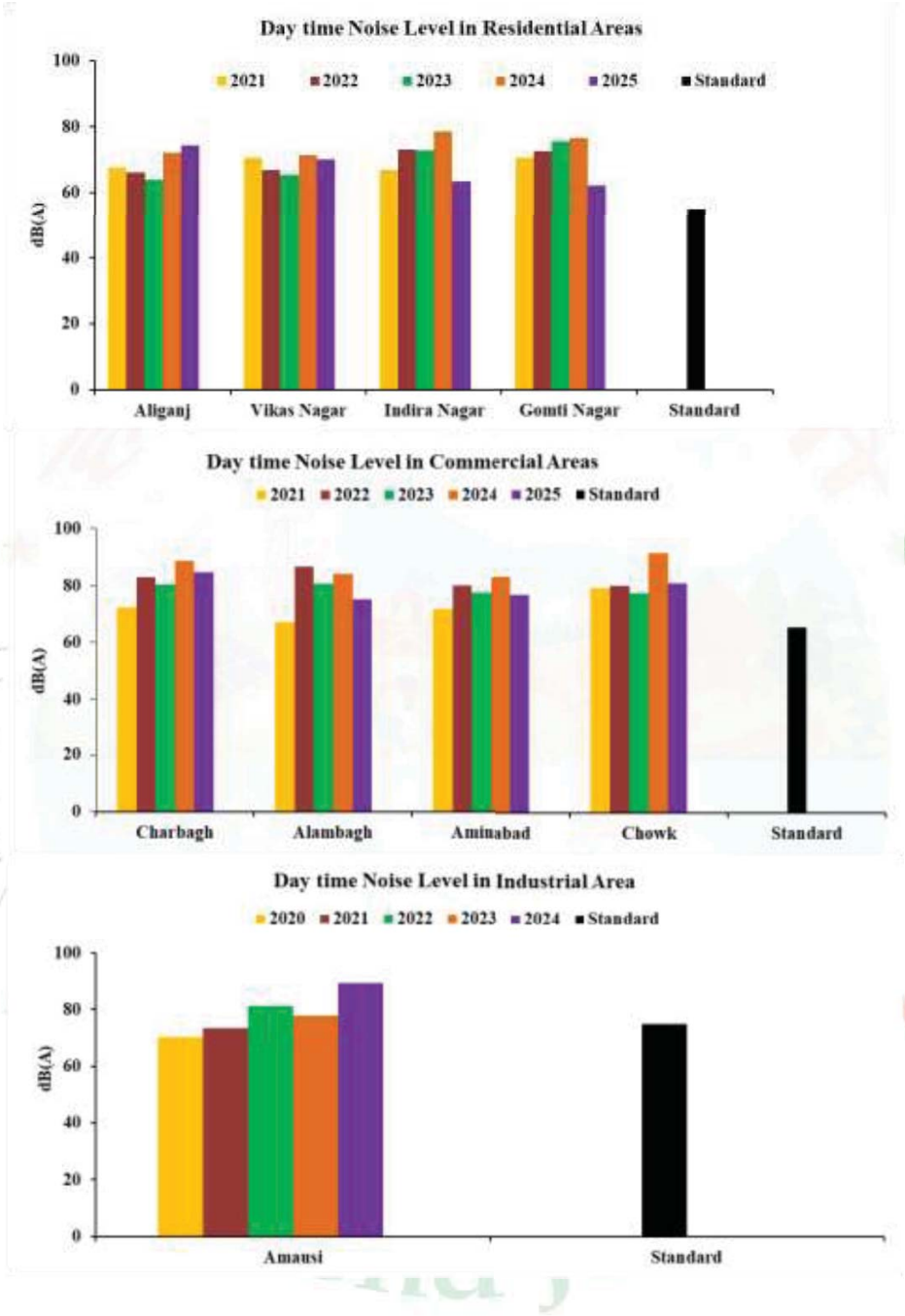

Figure 8: Comparison of day time Noise Level in dB(A) for different areas of Lucknow city (Pre-monsoon 2021-2025)

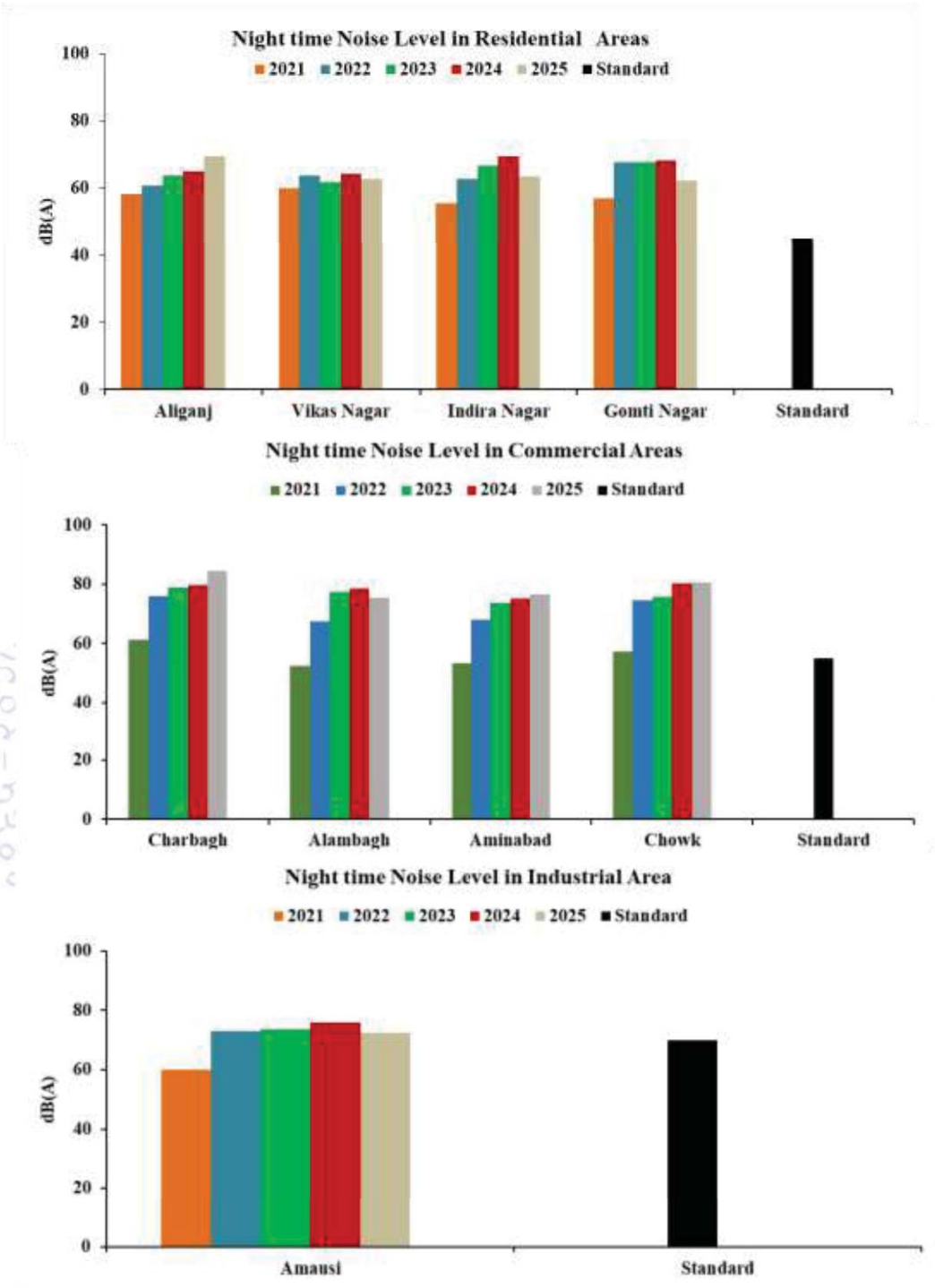

Figure 9: Comparison of night time Noise Level in dB(A) for different areas of Lucknow city (Pre-monsoon 2021-2025)

5.0 Conclusions/ main findings

CSIR-IITR conducted monitoring of air pollutants such as PM_{10}, $PM_{2.5}$, SO_2, NO_2 and toxic heavy metals i.e., Lead (Pb) and Nickel (Ni) associated with PM_{10} at 9 locations to assess ambient air quality during the month of April-May 2025 (i.e., pre-monsoon period). Day and night noise levels were also monitored at the exact locations across the city. The main findings from the study are summarized below:

The 24 hr concentrations of particular matter were determined, with PM_{10} ranging from 81.1 $\mu g/m^3$ to 364.5 $\mu g/m^3$ with an average of 159.6 $\mu g/m^3$ while in the case of $PM_{2.5}$, the 24 hr concentrations ranged from 49.33 $\mu g/m^3$ to 164.6 $\mu g/m^3$ with an average of 95.7 $\mu g/m^3$. Irrespective of location, these average values of PM_{10} and $PM_{2.5}$ were found to be above the permissible limits of 100 $\mu g/m^3$ for PM_{10} and 60 $\mu g/m^3$ for $PM_{2.5}$ as prescribed by the Central Pollution Control Board, New Delhi. The exceedance factor (EF) of PM_{10} was recorded as 1.24, 1.69, and 1.86, while that of $PM_{2.5}$ was 1.24, 1.64, and 1.91 in residential, commercial, and industrial areas, respectively. These values indicate that all three zones are experiencing critical levels of particulate pollution, with the industrial area being the most severely affected. However, both PM_{10} and $PM_{2.5}$ concentrations decreased by 9.77% and 16.4%, respectively, compared to levels of pre-monsoon 2024.

Trace metals analysis of particulate matter (i.e. Pb and Ni) in the city showed that Pb concentration ranged from 0.21-0.75 $\mu g/m^3$with an average of 0.43 $\mu g/m^3$. The Ni concentration is also in the range of 9.6-18.6 ng/m^3 with an average value of 14.1 ng/m^3. The 24 hr concentrations of SO_2 ranged from 6.8 to 37.6 $\mu g/m^3$ with an average of 20.1 $\mu g/m^3$ while NO_2 ranged from 16.0 to 117.3 $\mu g/m^3$ with an average of 38.5 $\mu g/m^3$. The concentration of SO_2 and NO_2 decreased by 0.9 % and 5.6 %, respectively. However, average values of SO_2 and NO_2 were well below the permissible limits of 80 $\mu g/m^3$ for SO_2 and NO_2 as prescribed by CPCB (NAAQS-2009).

The day time and night time noise levels ranged from 51.2 to 99.2 dB(A) and 52.2to 87.6 dB(A) in residential areas and from 64.6 to 111.7 dB(A) and 58.7 to 101.1 dB(A) in commercial areas respectively. These measured values were above their respective day-time standard of 55 dB(A) and night time standard of 45 dB(A) for residential areas

and 65 dB(A) and 55 dB(A) for commercial areas respectively as per NAAQS. In the Amausi Industrial area, the average day time and night time noise levels were 86.0 dB(A) and 72.5 dB(A) respectively. The values are above the national standard of 75 dB(A) for day time and 70 dB(A) for night time recommended for industrial areas.

Trend analysis of particulate matter (PM_{10} and $PM_{2.5}$) over five years (i.e., 2021-2025). was performed to assess the temporal dynamics of air quality in the region. A decline in particulate matter concentrations was observed from pre-monsoon 2024 to pre-monsoon 2025. Specifically, PM_{10} concentrations decreased by 9.8%, 14.6%, and 4.9% while $PM_{2.5}$ concentrations declined by 13.6%, 17.2%, and 17.4% in residential, commercial, and industrial areas, respectively. This downward trend suggests an overall improvement in air quality across all zones. The observed reduction in the concentration of particulate matter may be due to relatively moderate atmosphere dryness conditions during the 2025 sampling period, compared to the completely dry seasons in 2024. However, high surface level micro-meteorology may have contributed to the natural wind blowing entrain of the soil and road dust into the atmosphere.

Further, Gomati Nagar (residential area), Amausi (industrial area), and Charbagh (commercial area) sites in the city particularly recorded the highest particle pollution concentration. The reasons for the exceeded pollution levels at these sites are excess on-road vehicular flow and traffic jams, which are also affected by ongoing activities such as construction and pavements of the roads. Besides, the percentage of registered vehicular increment and fuel consumption in the city has increased from last year, which likely impacts increase in air pollution concentration than NAAQS throughout the city.

The trend analysis of Noise levels revealed that both residential and commercial sites experienced higher noise during day time compared to night time in residential areas, this elevation was due to the impact of near and surrounded on-road activities. In commercial areas increased day time noise levels were linked to near-market activities and excess regular vehicle movements. Notably, during the night time, the noise levels at commercial sites were significantly exceeded due to heavy carriers/truck movements through roads of commercial sites in the city.

6.0 Health impacts of air and noise pollution

Rapid urban development and modernization have resulted in an increase in air pollution. Researchers have recently begun to pay more attention to explore and establish the association between air pollution and respiratory system diseases. Studies in toxicology, epidemiology, and other related fields have demonstrated that respirable particles are closely associated with the incidence of human diseases and mortality rate.

Particulate Matter (PM_{10} & $PM_{2.5}$)

When inhaled, fine airborne particulate matter for the diameter ≤ 2.5 µm would penetrate beyond the larynx. $PM_{2.5}$ (particles less than 2.5 micrometers in diameter) can penetrate deeply into the lung, irritate and corrode the alveolar wall, and impair lung function, cause emphysema and bronchitis, and aggravate existing heart disease. Ultrafine particles ranging from 0.001 to 0.1 microns in diameter can penetrate deep into the lungs and alveolar sacs where gaseous exchange occurs. Particles increase the blood flow rates and vascular permeability to white blood cells, elevating clotting activity, constriction of the airways, and fever induction.

Sulfur Dioxide (SO_2)

Increased SO_2 may irritate the eyes, nose, and throat and cause choking and coughing. Reflex cough, irritation, and a feeling of chest tightness, which may lead to narrowing of the airways, is particularly likely to occur in people suffering from chronic lung disease, whose airways are often inflamed and easily irritated. Oral inhalation of larger volumes may reach the segmental bronchi and damage the organ and exposure of the eyes may result in loss of vision and severe burns. Repeated or prolonged exposure to moderate concentrations may cause respiratory tract inflammation, wheezing, and lung damage.

Oxides of Nitrogen (NO_x)

Various compounds and derivatives in the family of NO_2, including NO_2, HNO_3, NO, nitrates and nitric oxide, cause a variety of health impacts. Long-term exposure to NO_2 may affect lung function and lower the resistance to diseases such as pneumonia and influenza. Extremely high-dose exposure (as in a building fire) to NO_2 may result in

pulmonary edema, diffuse lung injury and development of bronchitis. Industrial exposure to nitric oxide can cause unconsciousness and vomiting. Exposure to low levels of nitrogen oxides in smog can irritate the eyes, nose, throat and lungs and can cause coughing, shortness of breath, fatigue, and nausea.

Trace element-Lead (Pb)

Lead is a neurotoxin causing impairment of neurodevelopment in children, and effects the development of the brain of the fetus. Mortality in workers exposed to high levels of lead is increased. In children, decreased nerve conduction velocity, cognitive development and instinctual performance, hearing loss, jaundice, anemia. Cognitive and neuro-behavioral deficits are seen in children at low levels of exposure.

Trace element-Nickel (Ni)

The harmful human health effects of nickel are an allergic reaction, chronic bronchitis, reduced lung function, lung cancer and nasal sinus cancer. Animal studies have found an increase in newborn deaths and a decrease in newborn weight after ingesting Nickel.

Noise

Noise pollution is the spread of unwanted sounds into the environment. Unwanted sounds have a range of mental health effects. The brain continuously monitors sounds for signs of danger, even during sleep. Continued exposure to noise pollution can trigger anxiety or stress. Problems related to noise include stress-related illnesses, high blood pressure, speech interference, hearing loss, sleep disruption, and lost productivity. People living with noise pollution may feel irritable, on edge, frustrated, or angry. If a person feels they cannot control the amount of noise in their environment, its impact on their mental health intensifies.

7.0 Recommendations for mitigation of air pollution in Lucknow

Every year, government authority/district administration may organize short-duration programs like a summit/seminar by inviting relevant stakeholder agencies, such as State PCBs, CPCB, CPWD, R&D organizations, Universities/ engineering institutes, social workers, regulatory bodies, city planners, NGOs, general public for their valuable input/ ideas and recommendations through debate & discussion about the causes and effects of air pollution and preventive control measures which are to be adopted for the management of air pollution in the city. The experts in the meeting shall review the implantation and their influence on the improved air quality in the city. Besides, the following are some recommendations as they stand and are required for the city's improved air quality

1. Govt. action plans are also required to include and promote device-based technology solutions to control/treat the city's ambient air pollution directly.
2. Road works, flyover construction, and demolition activities in the city should be planned during non-peak hours to avoid traffic jams and the relative additional load of vehicular exhaust contribution to air pollution.
3. Construction and demolition activities in the city should be done with dust obstacles and follow the construction and demolition waste management rules.
4. Retrofitting of particulate matter filters should be encouraged in vehicles and the fasten the usage of BS VI vehicle models and avoid old-age vehicles.
5. Wrong-side parking or blocking roads should be prohibited to prevent traffic jams and unforeseen incidents.
6. CNG-based vehicles and electrical/battery-operated or hybrid vehicles are to be encouraged.
7. CNG filling stations across the city should be increased.
8. Avoid the random burning of waste, and prioritize waste reduction, reuse, and recycling. If burning is necessary, ensure proper permits and follow regulations to minimize pollution.
9. All active city roads should be maintained clean by frequent water sprinkling/ sweeping operations.
10. Subsidized public transport systems such as metro-rail & buses should be promoted and public awareness to utilize the subsidy and reduce private vehicle emissions in the city.
11. All transportation goods/HCV/LCV should be covered properly before entering highways.
12. Vehicular engines should be switched off when idling mode, particularly during jams at traffic signals.
13. Solid-waste dump yards should be shifted from the roadsides and solid waste must be disposed off in completely covered conditions.

14. Pressure horns are to be removed from vehicles, and minimal usage of horns should be promoted.
15. Public awareness programme to be organized about air pollution and its health effects, reduction of automobile emissions by proper maintenance of vehicles, and driving skills.
16. Subsidize EVs and expand charging infrastructure throughout the city.
17. Develop carpooling incentives, low-emission zones, and eco-friendly public transport.
18. Establish Vehicle Scrapping Centers for old/retired vehicles.
19. Green buildings and urban planning: Promote vertical gardens, green roofs, and air-purifying infrastructure in building codes.
20. Citizen reporting platforms: Create mobile apps or helplines for the public to report pollution violations.

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Contributors of the Study:

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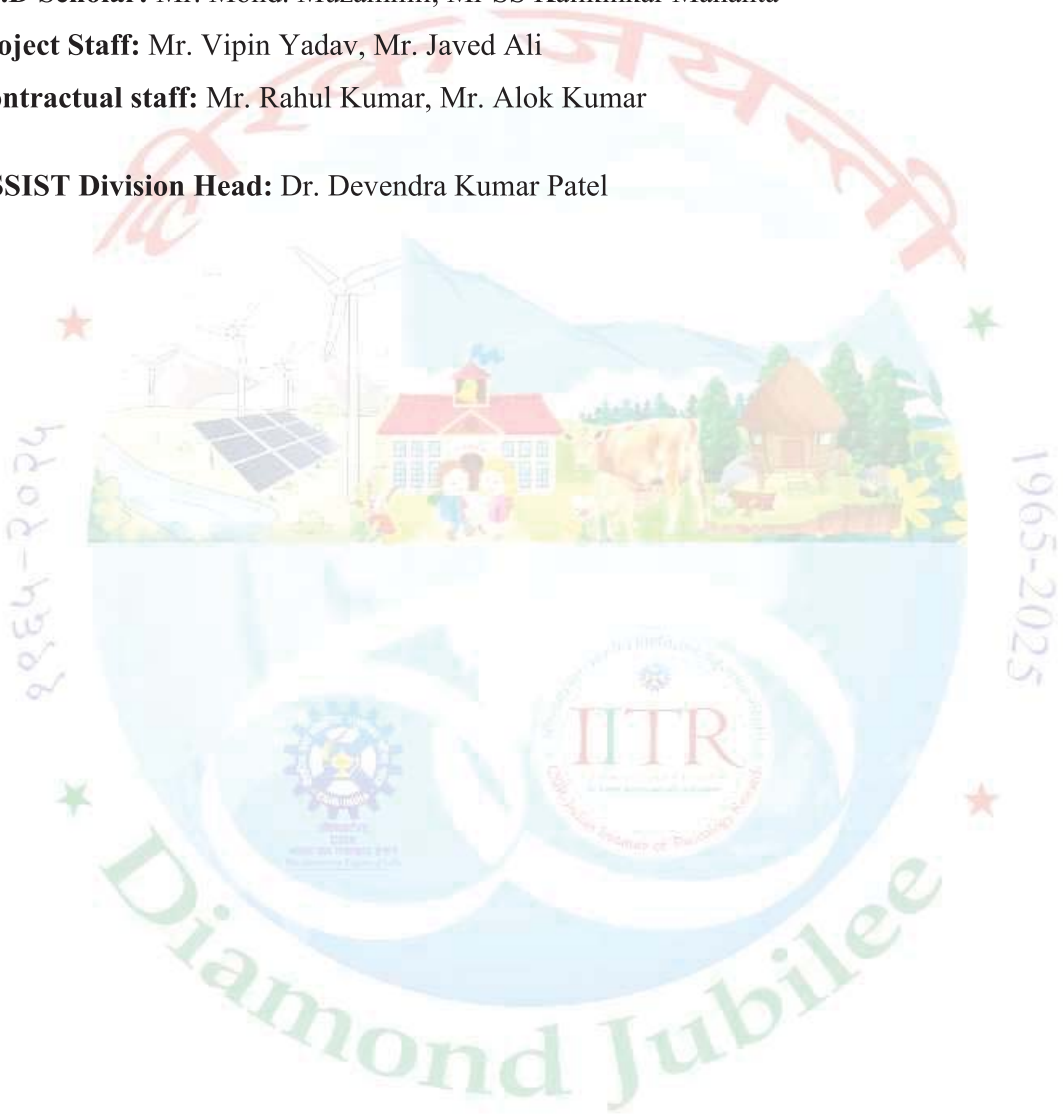

सीएसआईआर-भारतीय विषविज्ञान अनुसंधान संस्थान
CSIR-INDIAN INSTITUTE OF TOXICOLOGY RESEARCH

"सामूहिक सफलता में ही प्रत्येक व्यक्ति की सफलता निहित है।" "Until all of us have succeeded, none of us have"




अनुसंधान एवं विकास प्रभाग
- खाद्य, औषधि, पर्यावरण और प्रणाली विषविज्ञान (FEST)
- विश्लेषणात्मक विज्ञान, सेवाएं और तकनीकी समाधान के माध्यम से औद्योगिक सहायता (ASSIST)
- विनियामक और कम्प्यूटेशनल विषविज्ञान (ReaCT)

अनुसंधान क्षेत्र
- खाद्य, औषधि और रासायनिक विषविज्ञान
- पर्यावरण विषविज्ञान
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- टॉक्सिकोइंफॉर्मेटिक्स एवं औद्योगिक अनुसंधान
- प्रणाली विषविज्ञान एवं स्वास्थ्य आपदा मूल्यांकन

उद्योग और स्टार्टअप के लिए आर एंड डी साझेदारी
- सेंटर फॉर इनोवेशन एंड ट्रांसनैशनल रिसर्च (सितार–बाइरैक–बायोनेस्ट)
- डीएसआईआर–आईआईटीआर–सीआरटीडीएच पर्यावरण निगरानी और हस्तक्षेप हब

सेवाएं दी गईं
- जीएलपी प्रमाणित पूर्व–नैदानिक विषाक्तता अध्ययन
- एनएबीएल (आईएसओ/आईईसी 17025:2017) मान्यता प्राप्त एनसीई की सुरक्षा/विषाक्तता मूल्यांकन
- जल गुणवत्ता मूल्यांकन और निगरानी
- विश्लेषणात्मक सेवाएं
- पर्यावरण निगरानी और प्रभाव मूल्यांकन
- रसायनों/उत्पादों के बारे में जानकारी
- कम्प्यूटेशनल भविष्य कहनेवाला विषाक्तता मूल्यांकन

मान्यताएं
- वैज्ञानिक और औद्योगिक अनुसंधान संगठन (एसआईआरओ)
- यूपी प्रदूषण नियंत्रण बोर्ड (जल और वायु)
- भारतीय कारखाना अधिनियम (पीने का पानी)
- भारतीय मानक ब्यूरो (सिंथेटिक डिटर्जेंट)
- भारतीय खाद्य सुरक्षा और मानक प्राधिकरण (FSSAI)

विकसित/उपलब्ध प्रौद्योगिकियां
- ओनीर– सुरक्षित पेयजल के लिए एक नया समाधान
- पोर्टेबल जल विश्लेषण किट
- पर्यावरण और मानव स्वास्थ्य के लिए मोबाइल प्रयोगशाला
- सरसों के तेल में आर्जीमोन की त्वरित जांच के लिए एओ किट
- मक्खन पीले रंग का पता लगाने के लिए एमओ जांच, एक मिलावटी, खाद्य तेलों में

R & D Divisions
- Food, Drug, Environment & Systems Toxicology (FEST)
- Analytical Sciences & Services and Industrial Support through Technological Solutions (ASSIST)
- Regulatory and Computational Toxicology (ReaCT)

Research Areas
- Food, Drug & Chemical Toxicology
- Environmental Toxicology
- Regulatory Toxicology
- Toxicoinformatics & Industrial Research
- Systems Toxicology & Health Risk Assessment

R & D Partnership for Industries & Startup
- Centre for Innovation and Transnational Research (CITAR-BIRAC-BioNEST)
- DSIR-IITR-CRTDH Environmental Monitoring and Intervention Hub

Services Offered
- GLP certified pre-clinical toxicity studies
- NABL (ISO/IEC 17025:2017) accredited Safety/ toxicity evaluation of NCEs
- Water quality assessment and monitoring
- Analytical services
- Environmental monitoring and impact assessment
- Information on chemicals/ products
- Computational predictive toxicity assessment

Recognitions
- Scientific & Industrial Research Organizations (SIROs)
- UP Pollution Control Board (Water & Air)
- Indian Factories Act (Drinking water)
- Bureau of Indian Standards (Synthetic detergents)
- Food Safety & Standards Authority of India (FSSAI)

Technologies Developed/ Available
- Oneer- A novel solution for safe drinking water
- Portable Water Analysis Kit
- Mobile Laboratory for environment and human health
- AO Kit for rapid screening of Argemone in mustard oil
- MO Check for detection of Butter Yellow, an adulterant, in edible oils

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