Analysis of Historical Ambient Air Quality Data along with Emission from coal-based Thermal Power Plants for Developing a Decision Support System

Supported by

NITI Aayog

National Environmental Engineering Research Institute
(CSIR-NEERI), Nehru Marg, Nagpur – 440 020, India

December 2024

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Acknowledgement

The study was carried out with the financial support of NITI Aayog, Government of India and conducted by CSIR-NEERI, Nagpur
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Acknowledgement

We would also like to thank the following stakeholders who provided valuable inputs in shaping the report:

Shri Pankaj Agarwal, Secretary, Ministry of Power

Shri Ghanshyam Prasad, Chairperson, Central Electricity Authority

Shri B.C. Malick, PCE, Central Electricity Authority

Shri Piyush Singh, Joint Secretary, Ministry of Power

Shri Anandji Prasad, Adviser, Ministry of Coal

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Shri Bharat Kumar Sharma, Member Secretary, CPCB

Shri Nazimuddin, Scientist F, CPCB

Shri Ved Prakash Mishra, Director, MoEF&CC

Shri Sonu Singh, Addl. Director, MoEF&CC

Shri T. Venkateswarlu, CE, Central Electricity Authority

Shri P. Kumar, Director, Central Electricity Authority

Shri Sachin K. Bhise, Director, Central Electricity Authority

Shri K S Murthy, CMD, BHEL

Shri Jai Prakash Srivastava, Director (E, R&D), BHEL

Shri Tajinder Gupta, Director (Power), BHEL

Shri Sunil Kumar Gupta, GM-CTM/IS&E, BHEL

Ms. Alka Wadhwa, GM - CP-PSBG-I, BHEL

Mr. Sashi Kumar, Senior Manager, BHEL

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Shri M.K. Srivastava, ED, NTPC

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Shri Pankaj Kumar Gupta, GM, NTPC

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Report Available at:
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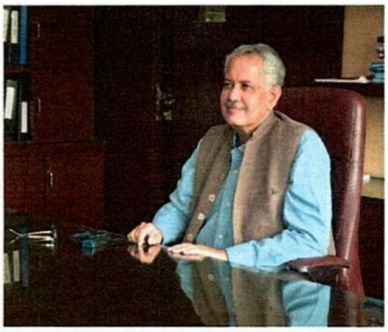
FOREWORD



NITI Aayog (National Institution for Transforming India) is the apex public policy think tank of Government of India having multiple verticals for addressing different needs of new India. Energy vertical, one among them deals with power, coal, petroleum, renewable energy and atomic power and examines projects for investment decisions. In its endeavour, NITI Aayog intended to review the latest notification (Dec. 7, 2025) of Ministry of Environment, Forest and Climate Change (MoEF & CC) that reframed the emission guideline for coal-based TPP. This notification introduced new flue gas emission norms for SO_2, NOx, and Mercury (Hg) based on generation capacity (MW) and commissioning year of TPP, compelling installation of flue gas desulphurization (FGD) technology to comply with SO_2 norms. In this context, NITI Aayog entrusted a study on the emission from coal based TPP and ambient air quality in the perspective of the new emission norms to CSIR-National Environmental Engineering Research Institute (NEERI) considering the expertise available.

The study included a detailed analysis of online continuous monitoring station (OCEMS) from TPP stacks and ambient air quality data from continuous ambient air quality monitoring station (CAAQMS) spread across India. Data from more than 343 OCEMS and 464 CAAQMS data were analysed. Emission data of particulate matter, NOx and SO_2 from TPP stacks provided by Central Pollution Control Board (CPCB), New Delhi, as well as National Thermal Power Corporation (NTPC) were analysed. CAAQMS data were gathered from CPCB web site.

It was observed that with the existing SO_2 emission load, the ground level concentration (GLC) of SO_2 rarely exceed the prescribed regulatory limit.

We would like to express our sincere gratitude to CPCB Delhi and NTPC for providing the data necessary for preparing the study report. We also gratefully acknowledge NITI Aayog for their invaluable suggestions throughout the course of data analysis and report preparation.

22/11/24

(Atul N. Vaidya)

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We extend our sincere gratitude to Dr. V. K. Saraswat, Hon’ble Member of NITI Aayog, for his advice to study the air quality data generated by CAAQMS near the TPP. This significantly enhanced the report's quality and relevance. Continuous tracking of project progress by Shri. Rajnath Ram, and Shri. Jawahar Lal, coupled with frequent discussions with the team of Energy vertical, NITI Aayog, for resolving the numerous queries that might have otherwise been overlooked initially, is hereby acknowledged.

We are also thankful to CPCB, NTPC and other stakeholders for providing the requisite data and permissions to visit their TPP, installed with FGD. This helped us a lot to understand the overall process and in-depth study of the system. We gratefully acknowledge the pivotal role played by Northern Coalfield Limited, Singrauli, in facilitating the sampling of particulate matter. We extend our heartfelt thanks to Bajaj Energy, Lalitpur, and Vedanta Aluminum Limited, Jharsuguda, for their invaluable assistance in studying air quality in their TPPs.

Dr. Atul Vaidya, Director, CSIR-NEERI gave the liberty of conducting field experiments, wherever necessary to understand the atmospheric fate of SO_2, to ensure scientific basis. At CSIR-NEERI, Rahul Vyawahare managed the project activity; Jay Singh Rajput, Pranav Nair, Arvind Somanathan, Pabitra Mandal, and Roshani Bang did the GIS mapping and data analysis under the guidance of Dr. Neel Kamal. Publications/literature available over the World Wide Web helped realize the difference between scientific analysis and opinion-based narratives.

The author is grateful for the contribution made by all during the course of the field, laboratory, and desk work.

Table of Contents

List of Tables

List of Figures

5. Discussion

Abbreviations

AI/ML	Artificial Intelligence/ Machine Learning
APC	Auxiliary Power Consumption
CAAQMS	Continuous Ambient Air Quality Monitoring System /Station
CEA	Central Electricity Authority
CO_2	Carbon Dioxide
CPCB	Central Pollution Control Board
CSIR-NEERI	Council of Scientific and Industrial Research - National Environmental Engineering Research Institute
CSTPS	Chandrapur Super Thermal Power Station
ED-XRF	Energy Dispersive X-Ray Fluorescence
EIA	Environmental Impact Assessment
ESP	Electrostatic Precipitator
FGD	Fuel Gas De-Sulphurisation
GCV	Gross Calorific Value
GHG	Greenhouse Gas
GIS	Geographic Information System
GLC	Ground Level Concentration
IC	Ion Chromatography
LPGCL	Lalitpur Power Generation Company Limited
MIDC	Maharashtra Industrial Development Corporation
MoEF&CC	Ministry of Environment, Forest and Climate Change
MT	Metric Tonnes
MW	Megawatts
NAAQM	National Ambient Air Quality Monitoring

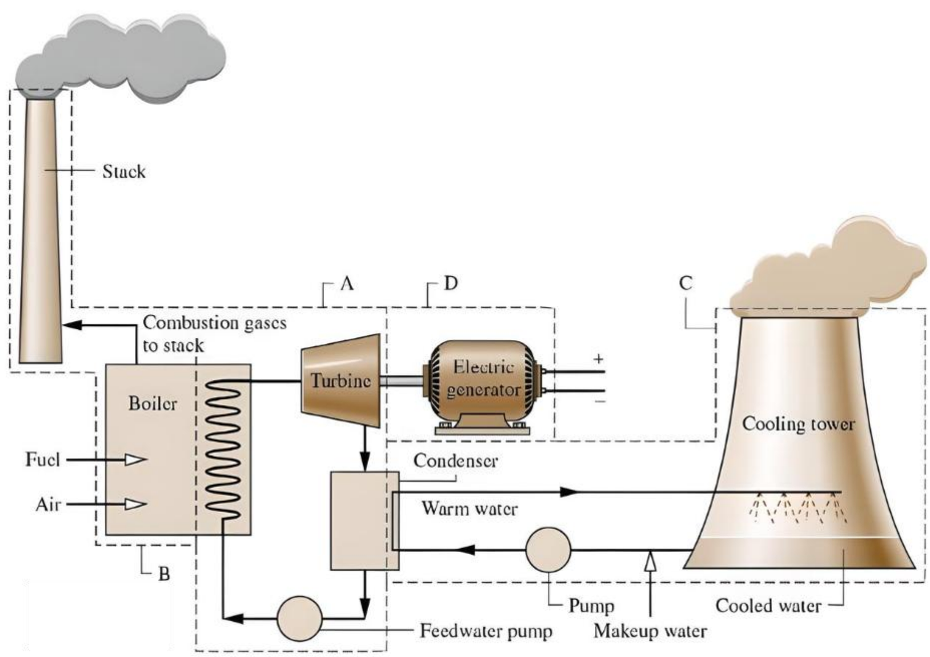
NAAQS	National Ambient Air Quality Standards
NAMP	National Air Quality Monitoring Programme
NCL	Northern Coalfield Limited
NTPC	National Thermal Power Corporation
OCEMS	Online Continuous Emission Monitoring System
PCB	Pollution Control Board
PM	Particulate Matter
PTFE	Poly-Tetra-Fluoro-Ethylene
R&D	Research and Development
RTI	Right to Information
SA	Source Apportionment
SCR	Selective Catalytic Reduction
SO_2	Sulphur Dioxide
SOP	Standard Operating Procedure
SPCB	State Pollution Control Board
SSI	Small-Scale Industries
STPS	Super Thermal Power Station
TPD	Tons Per Day
TPPs	Thermal Power Plants
TPS	Thermal Power Station
ULB	Urban Local Body
UNEP	United Nations Environment Program
VEO	Visual Emission Observation
WRF	Weather Research and Forecasting (Model)

Chapter 1
Introduction

1.1 Preamble

Coal is the primary source of power generation in India. However Indian coal is characterized by low calorific value, high ash, and low sulfur content. The increase in thermal power generation led to concerns about emissions of pollutants in the atmosphere. The high ash content led to a change in the design of the electrostatic precipitator (ESP) and bag house filter. Due to the large amount of ash, several electric fields must be added in series in the ESP for effective reduction of fly ash emission. As per an estimate, a 210 MW unit requires 6.5 times more collecting plate area for unit power generation for Indian coal-based TPS than European coal. The addition of a large size power plant at one station (660 MW x 3) led to the release of a relatively larger amount of SO_2 from a point (tri-flue stack). It was believed that a large amount of SO_2 from three units may lead to adverse impacts on the environment through acid formation, deposition and damage to property and human health. The fear of the likely adverse impact on the environment by SO_2 led to regulatory intervention by way of notification for reducing the emission load of SO_2 from 600 mg/Nm^3 to 100 mg/Nm^3 in the new power plants installed after Jan 1, 2017. Accordingly, the Ministry of Environment, Forest & Climate Change (MoEF&CC), vide its Notification dated December 7, 2015, has amended the Environment (Protection) Rules.

To comply with the amended Rules, the coal-based thermal power stations are required to install a Flue Gas Desulphurization (FGD) system at the end of the flue gas treatment system after ESP and before its release through tall stacks in the atmosphere.



Source: Google image search with the keyword “Thermal Power Plant”.

Fig. 1.1: Schematic diagram of thermal power plant (TPP)

1.2 Background of the Study

Niti Aayog received representation from stakeholders, both Govt. and Private players regarding the need for the installation of an FGD system in coal-based TPPs to reduce SO_2 concentration in the ambient air. It was contended that due to the low sulphur content of domestic Indian coal, the ambient air SO_2 levels are also relatively very low, and therefore, FGD installations may not necessarily be required.

It was brought forward that FGD installations would lead to increased auxiliary power consumption, a corresponding rise in coal consumption, and thus the proportionate increase of CO_2 emission, an increase in water consumption, pressure on mining and transportation of limestone, and disposal of Gypsum. In addition, FGD installation would certainly invite foreign players to supply and install, leading to FOREX outflows. We do not seem to have any studies in India that correlate the measured levels of SO_2 from power stations and ground-level concentrations of SO_2. Only in environmental impact assessment (EIA) studies is the impact of SO_2 assessed using source dispersion models, and the stack height is adjusted to comply with the ground level concentration (GLC) of ambient air SO_2.

With this background, NITI Aayog was awarded a study for being conducted by CSIR-NEERI, Nagpur, titled "Analysis of historical ambient air quality data across India for developing a decision support system." using available emission and ambient air quality data of SO_2 from CAAQMS and other pollutants from coal-based TPPs. The broad TOR of the study is presented in section 1.3.

1.3 Objective and Scope of Work

- Analysis of Online Continuous Emission Monitoring System (OCEMS) Data generated by coal-based thermal power plants (TPP). Emission data is to be collected from CPCB / MoEF&CC.

- Analysis of ambient air quality monitoring station (CAAQMS) and online continuous emission monitoring system (OCEMS) data across India available with CPCB and possibly all industrial operators, which can be made available through CPCB.

- A literature review will be carried out for studies related to SO_2 emissions, FGD implementation, etc.

- Examining the stipulations of the Ministry of Environment, Forest & Climate Change (MoEF&CC) Notification dated December 7, 2015, that has amended the Environment (Protection) Rules and related succeeding orders.

1.4 Structure of the Report

The report begins with the history of air pollution, the need for coal, its large-scale mining, and power generation. The increasing population and power demand lead to large amounts of coal combustion, causing higher levels of air pollutant emission, particularly SO_2, forcing regulatory authorities to consider its control using FGD, which is covered in Chapter 1.

Chapter 2 provides statistics on electrical power generation by different agencies, coal consumption, TPS categories (A, B, C), boiler types, and the FGD status of TPS in India. The emission of SO_2 is monitored using an online continuous emission monitoring station (OCEMS) installed in each stack as per the instruction of CPCB, Delhi. The data generated in OCEMS is transmitted and stored in the CPCB server. The OCEMS data for 343 power station stacks is analyzed and presented in Chapter 3. The data analysis shows the emission rates of PM, SO_2, and NO_2 from TPP in terms of different capacities and installation dates.

The ambient air quality is measured in different cities and industrial areas using a continuous ambient air quality monitoring station (CAAQMS), and the data is conveyed to the CPCB central server. The data from 464 CAAQMS is downloaded, analysed and discussed. Besides this, NTPC also gathered ambient air quality data at 486 stations near TPS and analysed it. Chapter 4 summarizes CAAQMS data for particulate matter (PM_{10}, $PM_{2.5}$) and gaseous pollutants (SO_2 and NO_2) in these stations.

Chapter 5 presents a discussion on data obtained in other studies, source apportionment studies, and studies in isolated TPP coal mining areas. Review of reports by international agencies, wherein the need for FGD in Indian TPP is emphasized without any field data analysis. Lime requirement, its transportation, gypsum transportation and corresponding CO_2 emission are also presented.

Chapter 6 provides observations and recommendations based on the entire study. Whether the decision to reduce SO_2 emission is based on achieving emission targets or meeting ambient air quality standards is discussed. The need for Indian TPP is to control particulate matter and not SO_2 emission due to typical coal characteristics, which is discussed. Finally, the recommendations on the need for FGD for new plants and already installed FGD.

Chapter 2

Power Generation in India

2.1 Introduction

This chapter presents the power generation capacity of different agencies, such as state, central, and Private Operators (Independent Power Producers). Regional or sector-wise distribution of power generation capacity, category of TPS (A, B, C) based on its location in the National Capital Region (NCR), millennium cities having population above 10 Lakhs, etc. is presented.

2.2 Resource-wise power generation

India's total installed electrical power generation capacity is 434195.20 MW as of March 21, 2024, comprising coal, renewal energy, hydroelectric, nuclear, diesel and gas. **Fig. 2.1** shows the share of each resource.

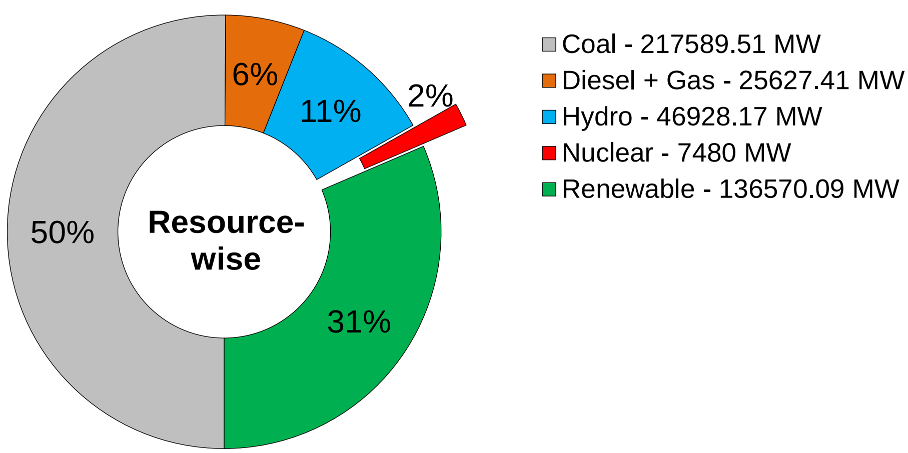


Fig.2.1: Resource-wise total installed power generation capacity (MW) in India.

2.3 Region-wise power generation

Due to the large geographical spread, power generation is divided into five regions: the north-eastern, eastern, northern, southern and western regions. **Fig. 2.2** shows the region-wise distribution of power generation in India.

2.4 Sector-wise power generation

Central, State Government and Private sector agencies own the power generation company. The share of each sector for power generation from different resources is given in Fig. 2.3. The Private sector generates more power compared to the Government sector. This power generation capacity includes all types of resources like solar, coal, wind, etc.

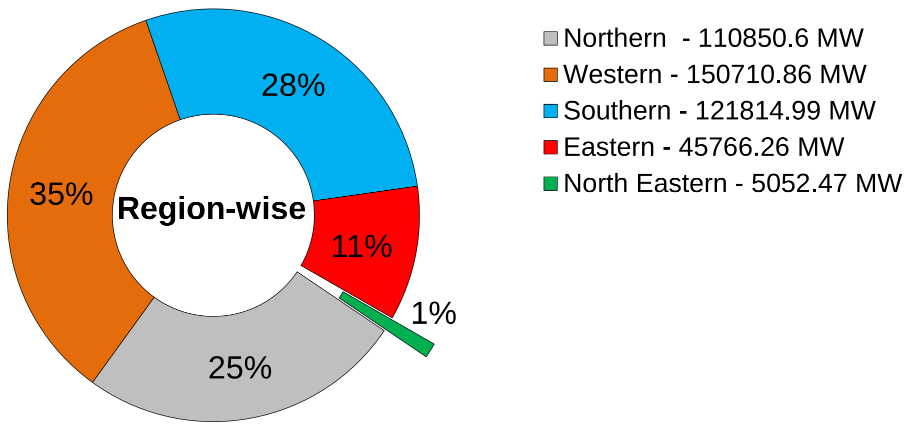


Fig.2.2: Region-wise total installed power generation capacity (MW) in India.

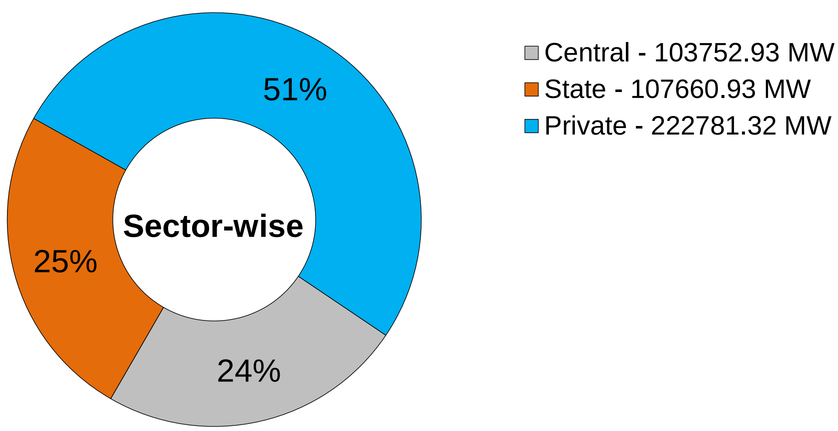


Fig.2.3: Sector-wise total installed power generation capacity (MW) in India.

2.5 State-wise power generation

State-wise overall power generation capacity is shown in **Fig. 2.4**.

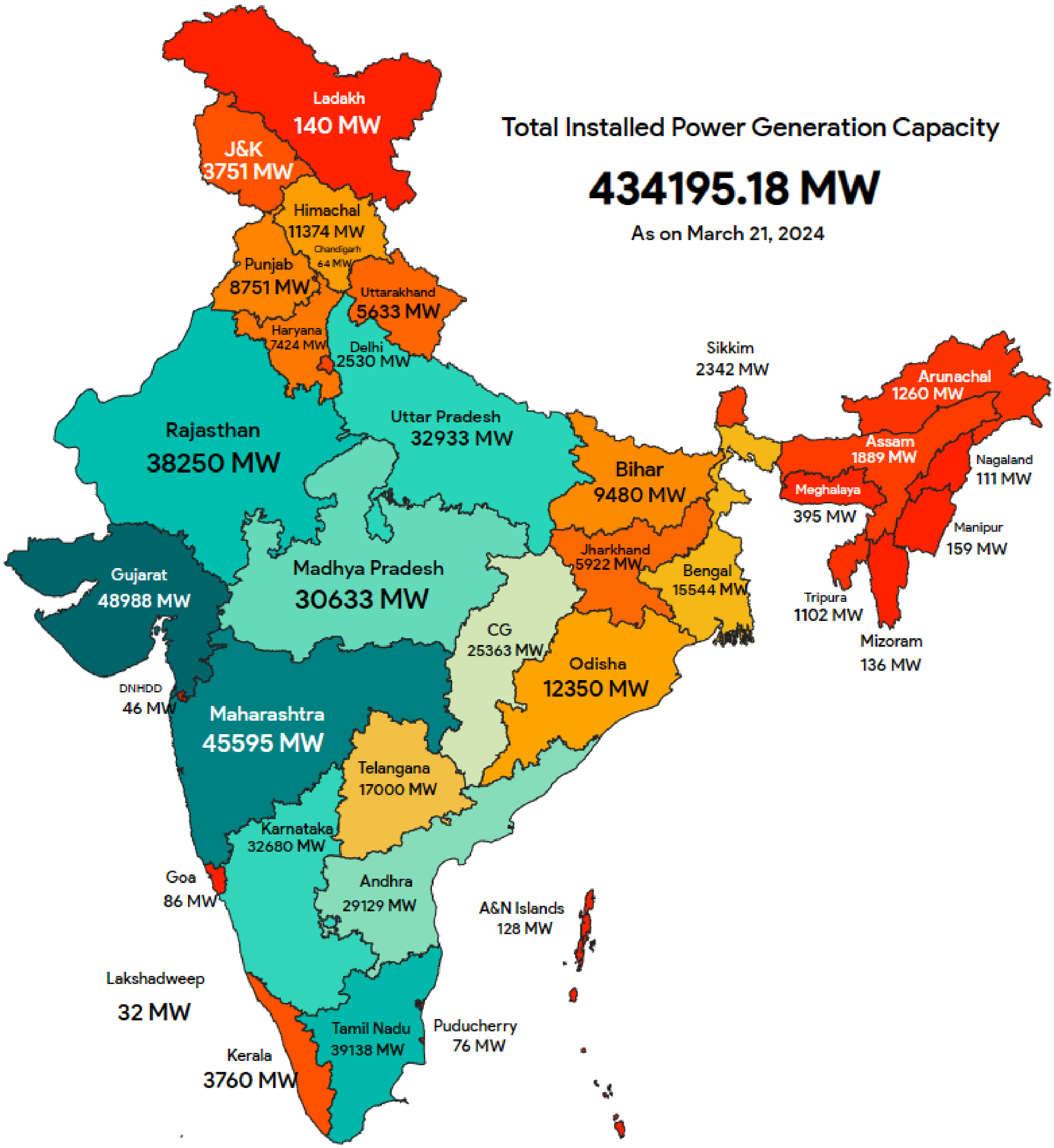


Fig 2.4: State-wise overall power generation capacity.

The percentage share of thermal power generation capacity of each state is shown in **Fig. 2.5** along with generation capacity in MW is depicted in **Fig. 2.6**. More than 50% of power capacity obtained by coal-based TPP is installed in Uttar Pradesh, Maharashtra, Chhattisgarh, Madhya Pradesh, and Gujarat.

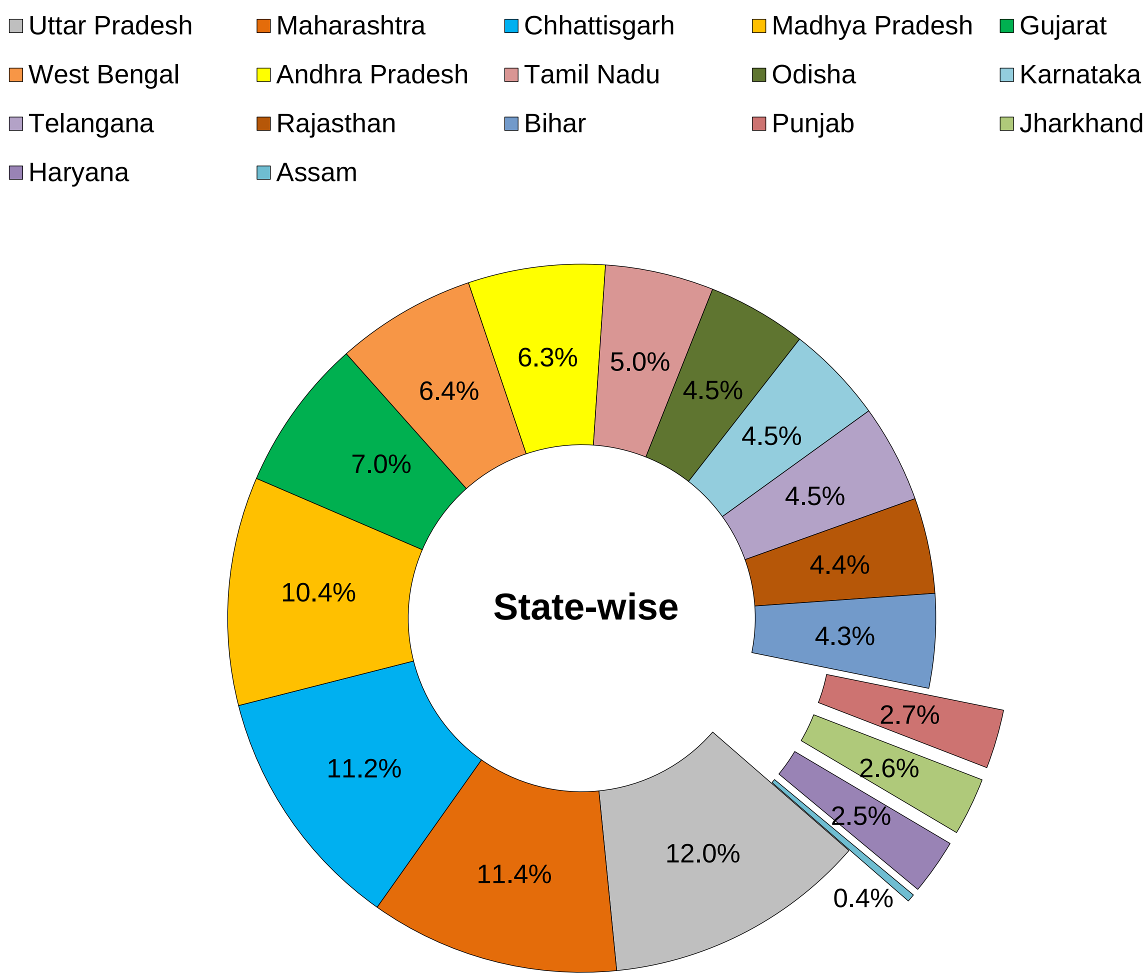


Fig.2.5: State-wise installed coal-based thermal power generation capacity (%) in India.

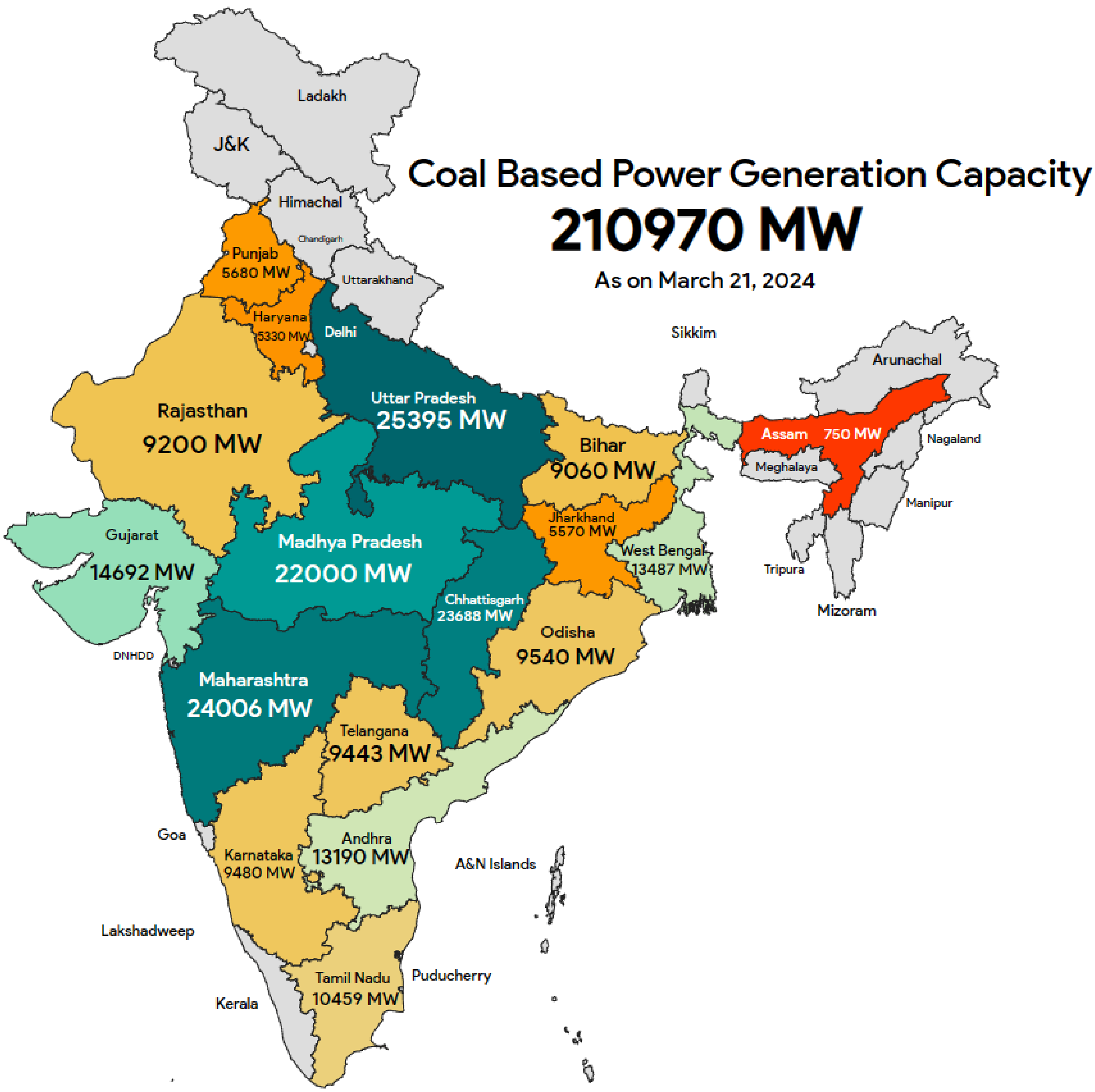


Fig 2.6: State-wise distribution of coal-based TPS.

2.6 Classification of Thermal Power Station

2.6.1 Based on Location

The Government of India (GoI) categorized coal-based TPS into three categories, 'A', 'B', and 'C', depending on its proximity to the National Capital Region and critically polluted area (MoEF&CC, 2022). The criteria for categorization are given in **Table 2.1**.

Table 2.1: Categorization of the TPS based on their location

S.No.	Category	Location /Area
1.	Category - A	Within a 10 km radius of the National Capital Region or cities having a million plus population.
2.	Category - B	Within a 10 km radius of Critically Polluted Areas or Non-attainment Cities.
3.	Category - C	Other than those included in category A and B.

The share of TPS in different categories is presented in **Fig. 2.7**. If stringent rules are to be imposed, it can be started from category 'A'. However, due reasoning by way of identifying the impact on SO_2 concentration observed in nearby monitoring stations (CAAQMS) and emission load from nearby TPS needs to be established.

The largest number of coal-based TPPs are in Category C (78.2%), followed by Category B (12.8%) and Category A (9.04%). Further, there is sector-wise distribution of a number of coal-based TPPs under each category (Pl see Fig. 1.5 (B)). The State authorities have the majority stack holding in Category 'A' TPPs, whereas Private authorities hold the highest share in Category 'C' and Category 'B'. However, Central authorities handle a minimum number of TPPs of each category.

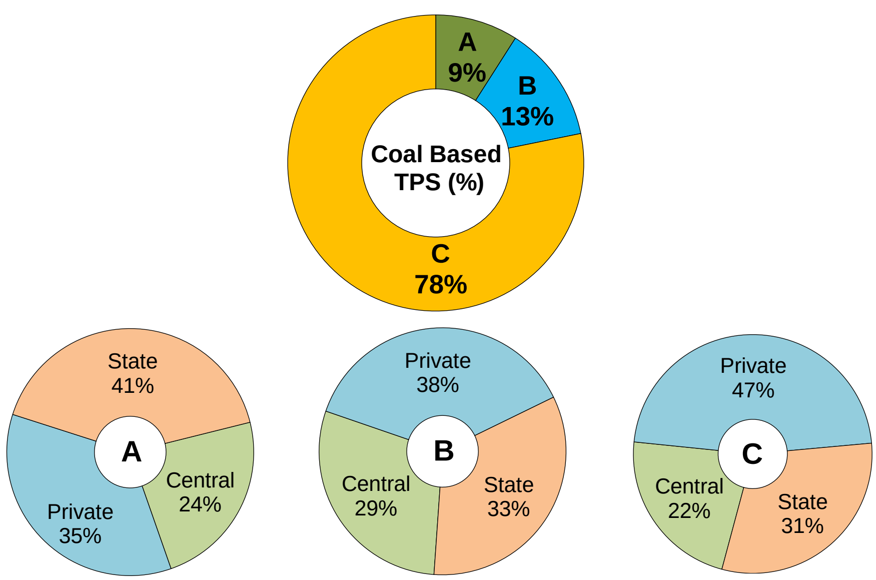


Fig 2.7: Share of category wise TPS with different sectors.

One of the concerns while deciding the category of TPS is the nearby city population that can be affected due to exposure to air pollutants. In view of this, the millennium cities are identified and located on a map to realize their relative position with respect to TPS (Fig. 2.8). A Digital copy of such a map is prepared, wherein the location of TPS and millennium cities can be identified for any decision making.

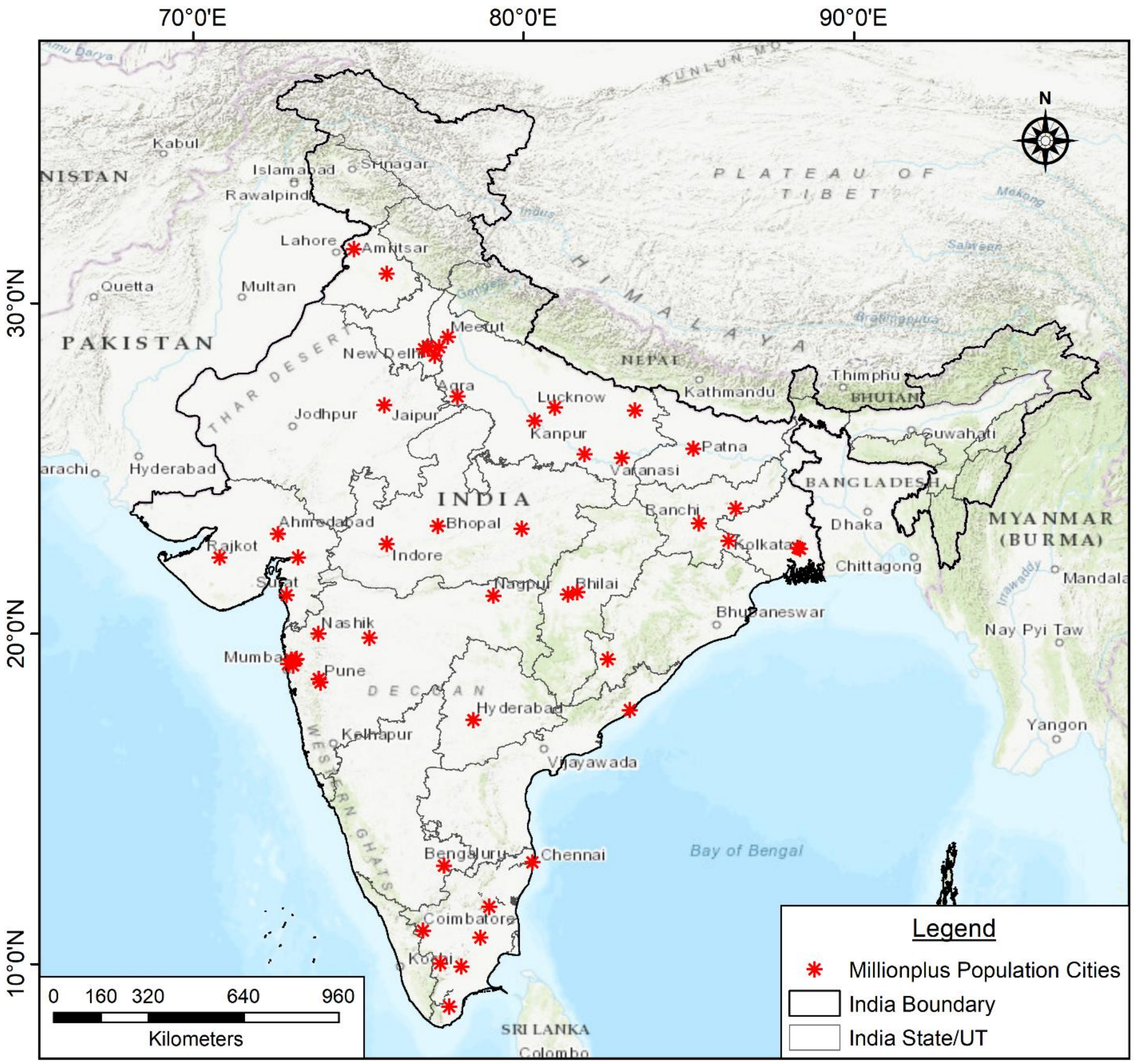


Fig. 2.8: Millennium cities of India.

TPS of the ‘A’, ‘B’ and ‘C’ categories is shown in **Fig. 2.9, 2.10,** and **2.11**. The list of TPS of the different categories is given in Annexure – A1.

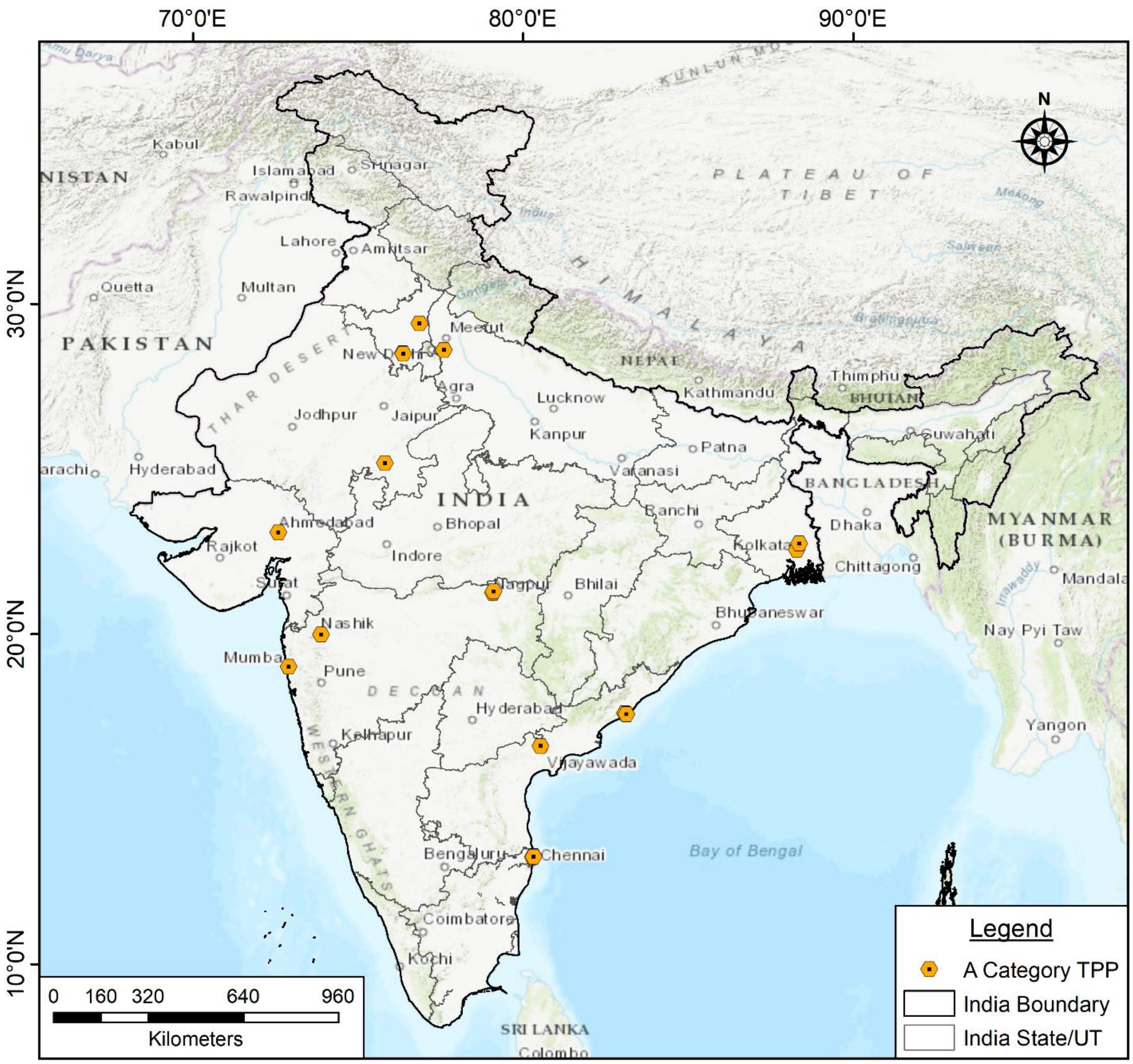


Fig. 2.9: TPS of Category ‘A’ (9%).

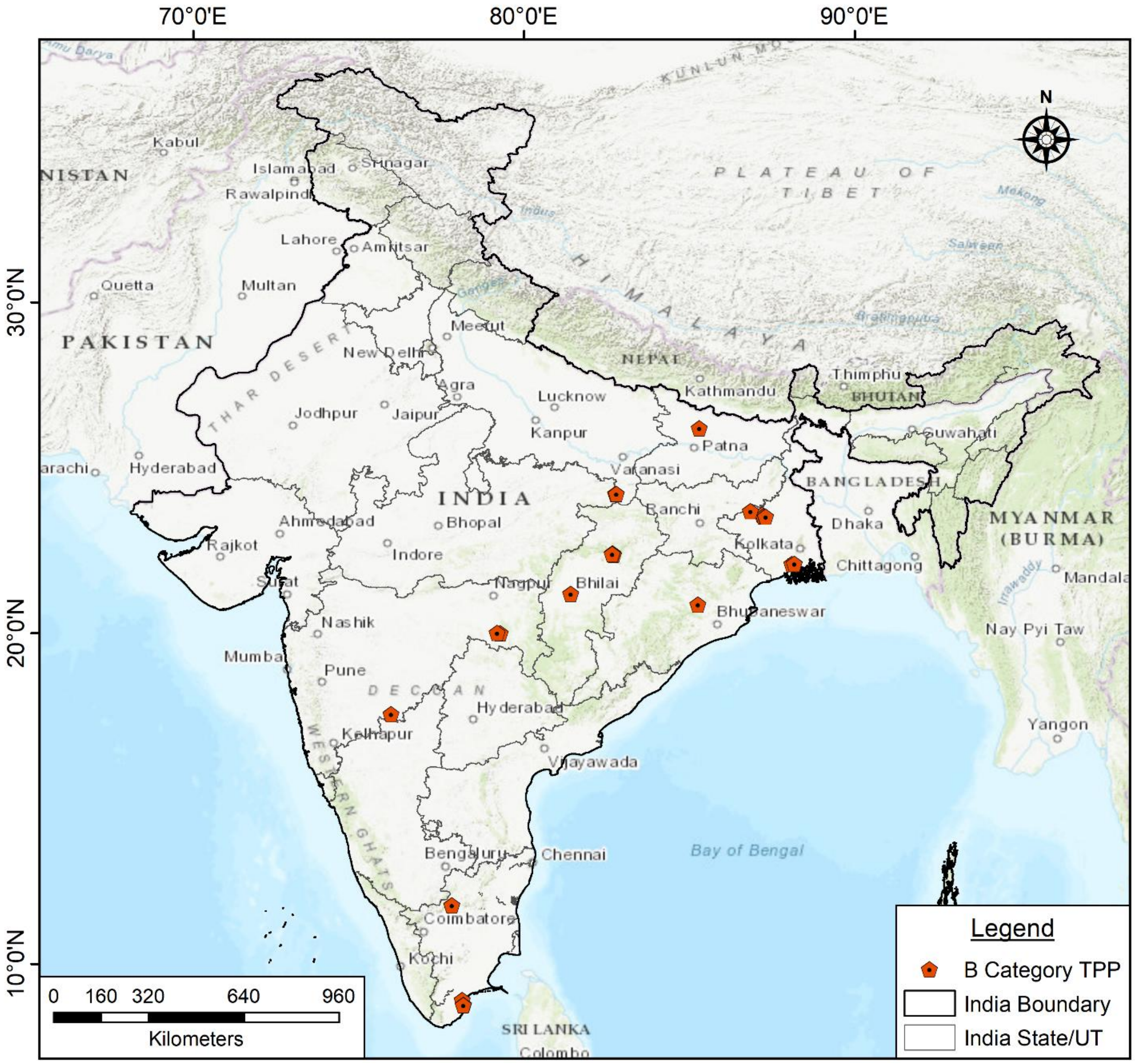


Fig. 2.10: TPS of Category 'B' (13%).

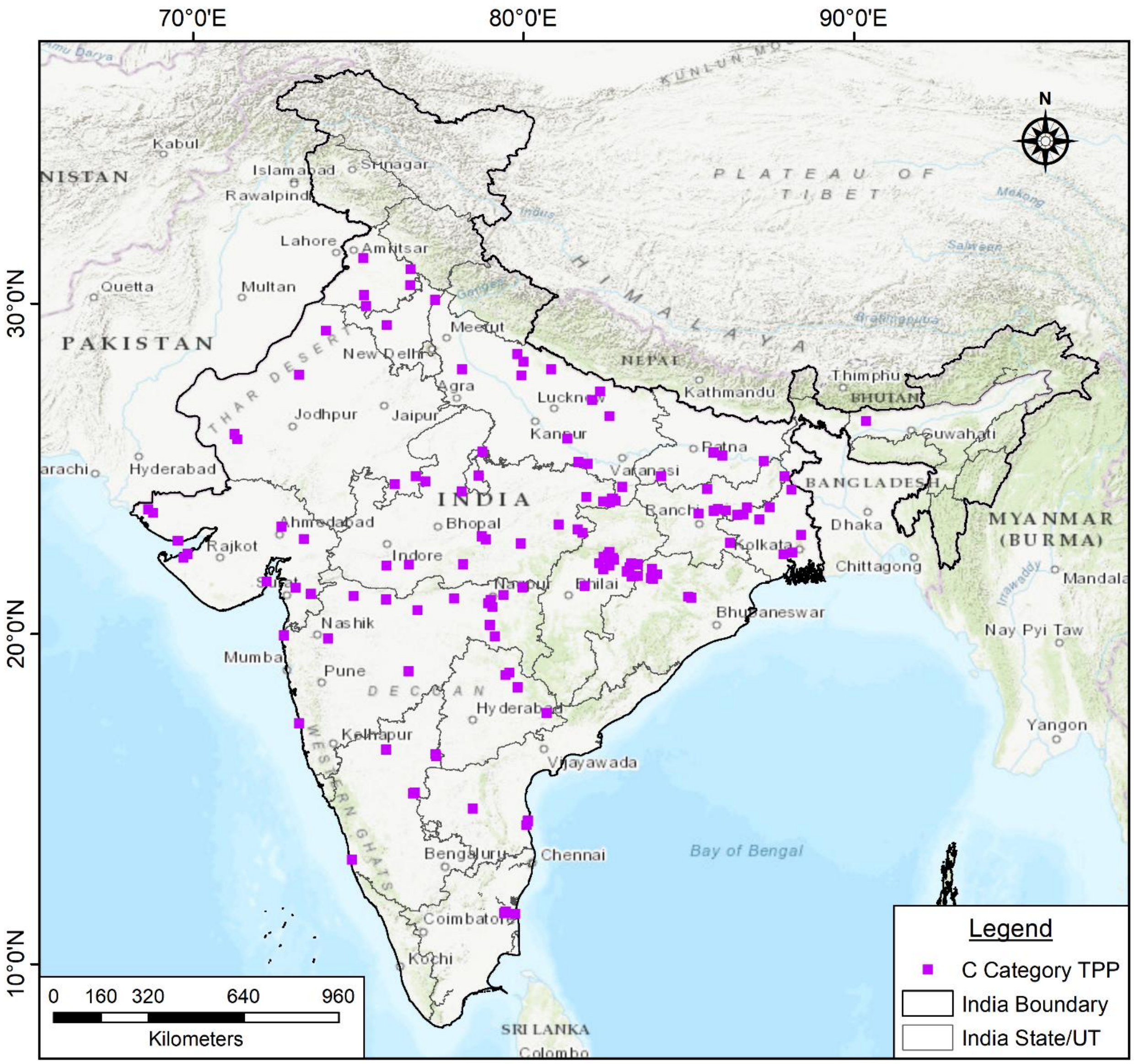


Fig. 2.11: TPS of Category ‘C’ (78%).

2.6.2 Based on Power Generation and Commissioning Year

Coal-based TPS are also classified based on their power generation capacity and year of commissioning, which is given in **Fig. 2.12**. Guidelines are for TPS before 2003, between 2003 and 2016, and beyond 2016. Besides this, TPS below 500 MW and those equal to or above 500 MW also have to follow different regulatory requirements.

2.6.3 Based on Combustion Technology

TPS are also grouped based on boiler technology, such as sub-critical, super-critical, and ultra-super-critical. The difference of these boilers is due to steam temperature and pressure. **Table 2.2** gives the details of boiler classification.

Table 2.2: Boiler classification based on pressure and temperature

Boiler Type	Main steam pressure (MPa)	Main steam temperature (˚C)
Sub-Critical	<22.1	Up to 565
Super-Critical	22.1–25	540–580
Ultra-Super-Critical	>25	>580

Source: Nalbandian, 2008: pp. 8

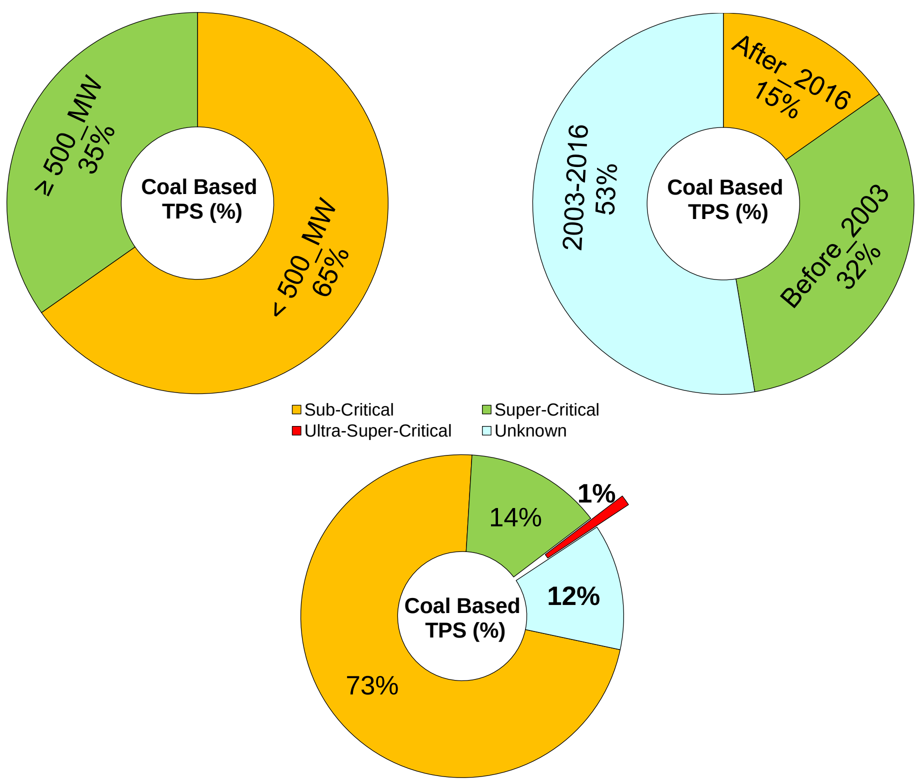


Fig. 2.12: TPS share based on its capacity, year of commissioning and boiler technology.

2.7 Status of FGD installation in TPP

As per the notification of 2015, the current status of FGD implementation is shown in Fig. 2.13.

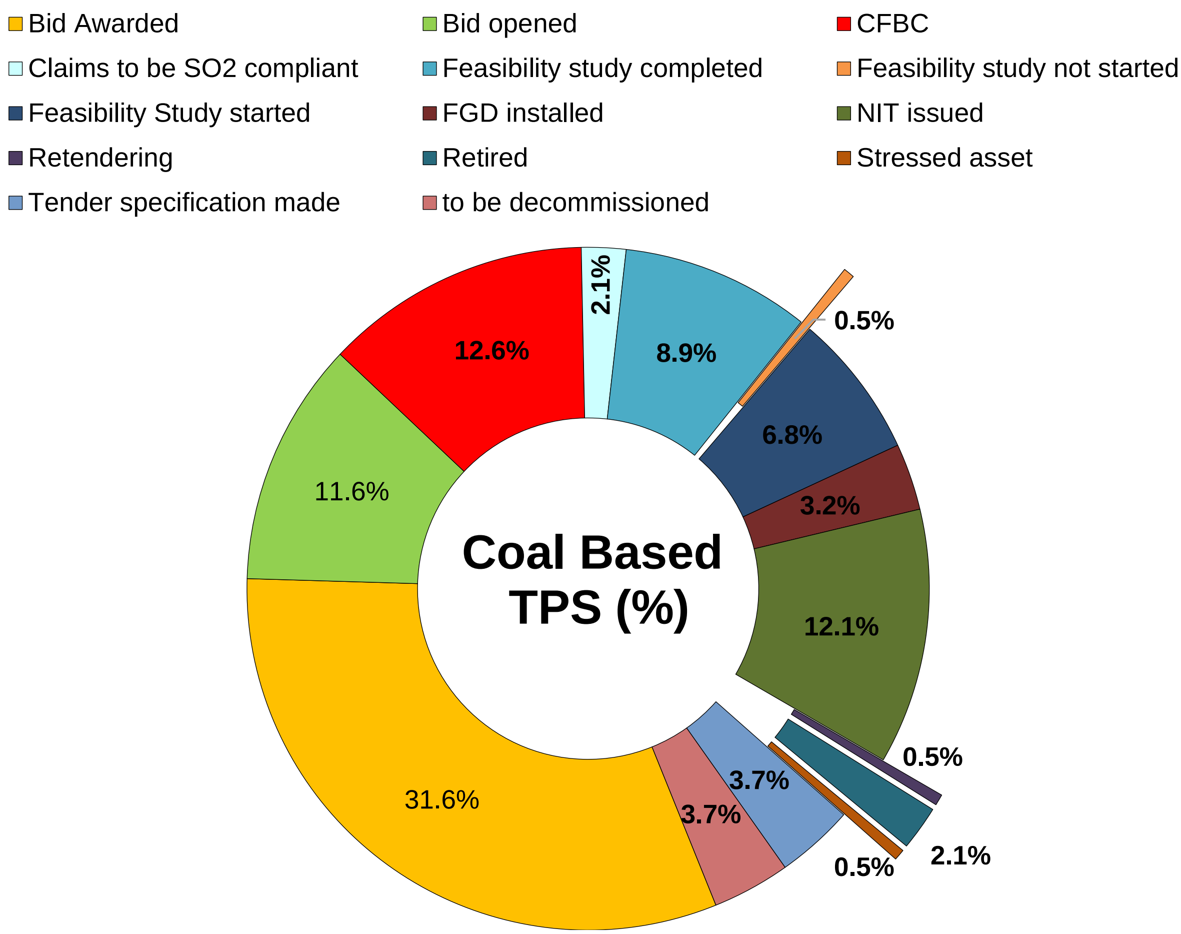


Fig. 2.13: Status of FGD in different TPS.

References:

1. MoEF&CC New Delhi (2022): Notification Dt. 5th September, 2022, No. G.S.R. 682(E). Categorization of TPS in A, B, C.
2. CPCB: B-33014/7/2021/IPC-II/TPP Dt. (23/6/2022): Amended category of TPS in A, B, and C.

Chapter 3

Online Continuous Emission Monitoring System

3.1 Introduction

To monitor the amount of air pollutants released and effluent discharge from industries (with high pollution potential), CPCB (vide its letter No. B-29016/04/06PCI-1/5401 dated 05.02.2014 issued directions under section 18(1)b of the Water and Air Acts to the SPCB and Pollution Control Committees for directing the 17 categories of highly polluting industries for installation of online effluent quality and emission monitoring systems. The directions envisage the installation of an online continuous emission monitoring system (OCEMS) in 17 categories of highly polluting industries and Common Hazardous waste and Biomedical waste incinerators. This intends to measure Particulate Matter, NH_3 (Ammonia), SO_2 (Sulphur Dioxide), NOx (Oxides of Nitrogen) and other sector-specific parameters, not later than by March 31, 2015, and transmission of online data so generated simultaneously to SPCB/ PCC and CPCB as well. The deadline was later extended to June 31, 2015. PM, SO_2 and NOx need to be monitored using OCEMS.

3.2 Data Analysis of OCEMS Data

In order to comply with the above order, all TPS were required to install OCEMS. Data from 343 stacks of TPS using Indian coal were gathered from CPCB, Delhi. The summary of data is presented in **Table 3.1**. For each state:

- The number of TPS,
- Total number of stacks,
- Plant belonging to State, Central or Private sector,
- Commissioned before 2003, between 2003 to 2016 or beyond 2016,
- Capacity of the unit
- The category of TPS (A, B, C) is presented due to its location.

3.2.1 Data Pre-processing and Analysis

Annexure A1 provides a list of TPS, which is analysed for visualization of PM, SO_2, and NOx emission The list of TPS can be accessed through CPCB. The information provided in the annexure can be understood by following nomenclature as follows:

State	:	Andhra Pradesh
City	:	Simhadri
Organization	:	NTPC
TPS ID	:	3672
TPS Name	:	C_A_500_Simhadri_2002
Combustion Technology	:	Sub-Critical, Critical, Supercritical
Commissioning Year	:	2002
FGD Status	:	Bid awarded or opened, Feasibility study, NIT issued

- TPS ID is the identification number derived from CPCB's list of TPS.
- TPS Name contains several information. The following example explains the meaning of each term in the TPS Name:

C_A_500_Simhadri_2002	**:**	C: Central Govt.; A: Category; 500: Capacity (MW); Simhadri: Name; 2002: Year of commissioning.
S_A_210_Tata Rao_1989	**:**	S: State Govt.; A: Category; 210: Capacity (MW); Tata Rao: Name; 1989: Year of commissioning.
P_B_685_Raikheda_2016	**:**	P: Private; B: Category; 685: Capacity (MW); Raikheda: Name; 2016: Year of commissioning.

OCEMS data gathered is analysed in terms of its share in each state; central, state and private operator (Fig. 3.1); year of commissioning (Fig. 3.2); capacity (Fig. 3.3); and category 'A', 'B', 'C' (Fig. 3.4).

3.2.2 Data Visualization

Annexure A2 provides a graphical visualization of OCEMS data. **Fig. 3.5** shows a box plot of the emission rate for (a) PM, (b) SO_2, and **(c)** NO_2 for all the 343 stacks together. It can be seen that the stringent PM emission limit from 2003, 2016 to 2017 is reflected in reducing emission load as the box plot is gradually moving down towards a lower emission rate. To meet the regulatory requirement of reduced emissions, the number of electric fields and collecting plate areas were increased.

Contrary to this, the emission limit of SO_2 is reduced from 600 mg/Nm^3 to 100 mg/Nm^3. However, the emission load continues to increase with the increase in power generation capacity. On the same line of SO_2, the regulatory limit value of NO_2 is also reduced over years (2003 - 2016 - 2017), however, the emission load continues to exceed the limit. The rationale behind reducing the regulatory limit value of gaseous pollutants is not known.

Table No. 3.1: Summary of OCEMS data analysed.

No.	State	Number of TPS	Total No. of Stack	Number of Stacks										
				Authority			Year of Commissioning			Capacity (MW)		Category		
				Central	State	Private	Before 2003	2003-2016	After Jan 2017	≥ 500	< 500	A	B	C
1	Andhra Pradesh	5	14	3	7	4	5	6	3	8	6	9		5
2	Assam	1	2	2				1	1		2			2
3	Bihar	4	8	8			3	3	2	3	5		3	5
4	Chhattisgarh	16	41	16	4	21	9	23	9	18	23		15	26
5	Gujarat	11	33		20	13	18	14	1	7	26	3		30
6	Haryana	5	11	3	7	1	2	9		6	5	8		3
7	Jharkhand	6	12	4	2	6	6	5	1	2	10			12
8	Karnataka	4	9	3	4	2	4	2	3	4	5			9
9	Madhya Pradesh	11	28	11	5	12	9	16	3	17	11			28
10	Maharashtra	14	33	6	16	11	10	17	6	17	16	4	9	20
11	Odisha	5	13	5	1	7	3	10		10	3		2	11
12	Punjab	5	15		10	5	8	5	2	4	11			15
13	Rajasthan	7	24	2	18	4	8	14	2	5	19	6		18
14	Tamil Nadu	9	27	14	8	5	14	9	4	9	18	3	5	19
15	Telangana	5	11	6	5		7	3	1	6	5			11
16	Uttar Pradesh	15	41	16	11	14	14	21	6	13	28			41
17	West Bengal	8	21	6	12	3	14	7		3	18		2	19
Total		**131**	**343**	**105**	**130**	**108**	**134**	**165**	**44**	**132**	**211**	**33**	**36**	**274**

Annexure A3 provides emission standard thermal power station of India and other countries.

Ref: CPCB (August 2018): Guidelines for Continuous Emission Monitoring Systems.

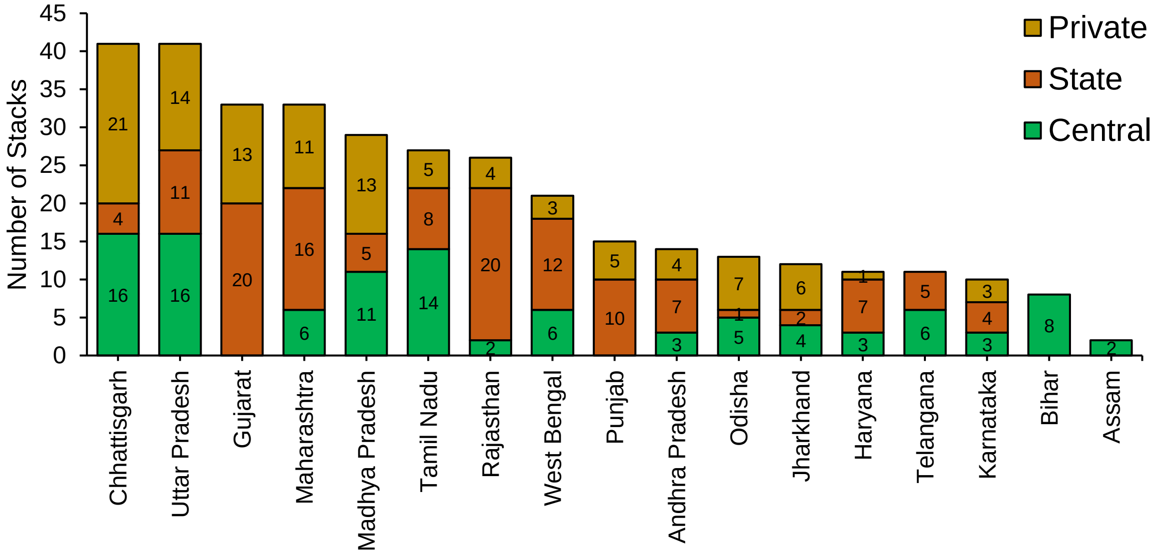


Fig. 3.1: Authority-wise distribution of collected OCEMS data for each state

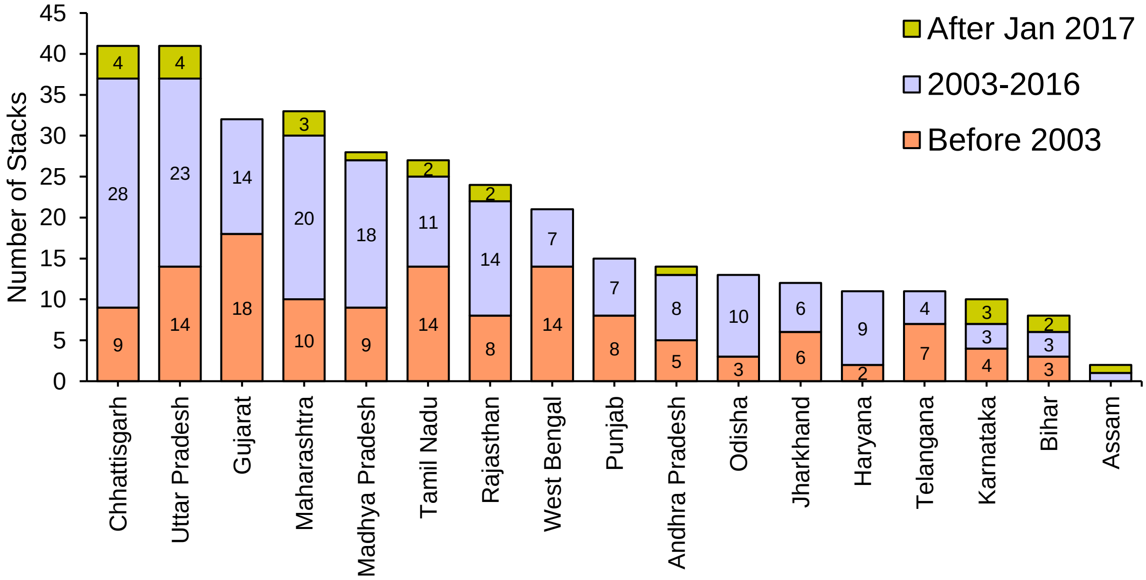


Fig. 3.2: Commissioning year wise distribution of collected OCEMS data for each state

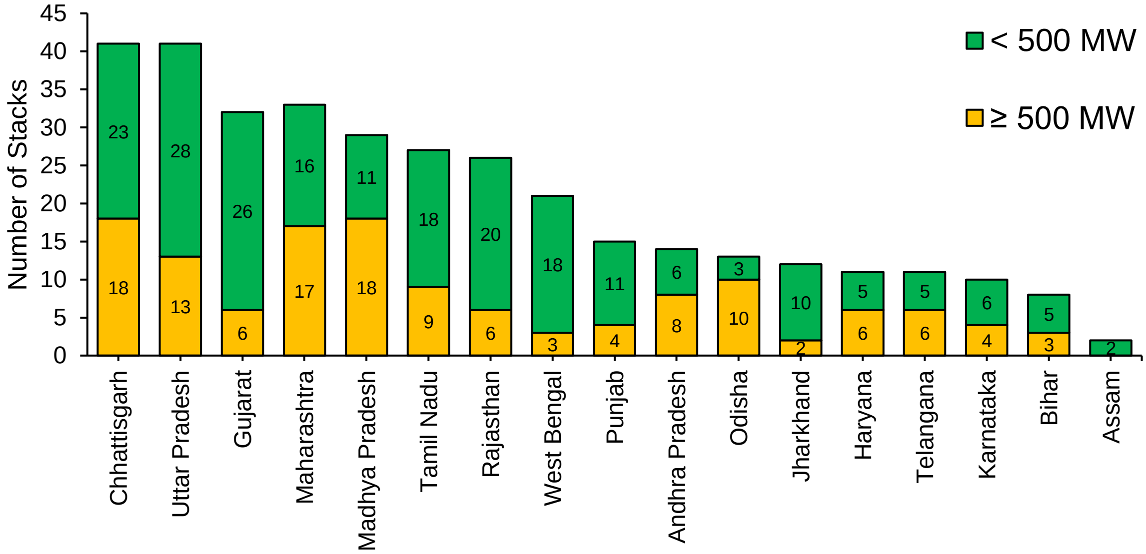


Fig. 3.3: Capacity wise distribution of collected OCEMS data for each state

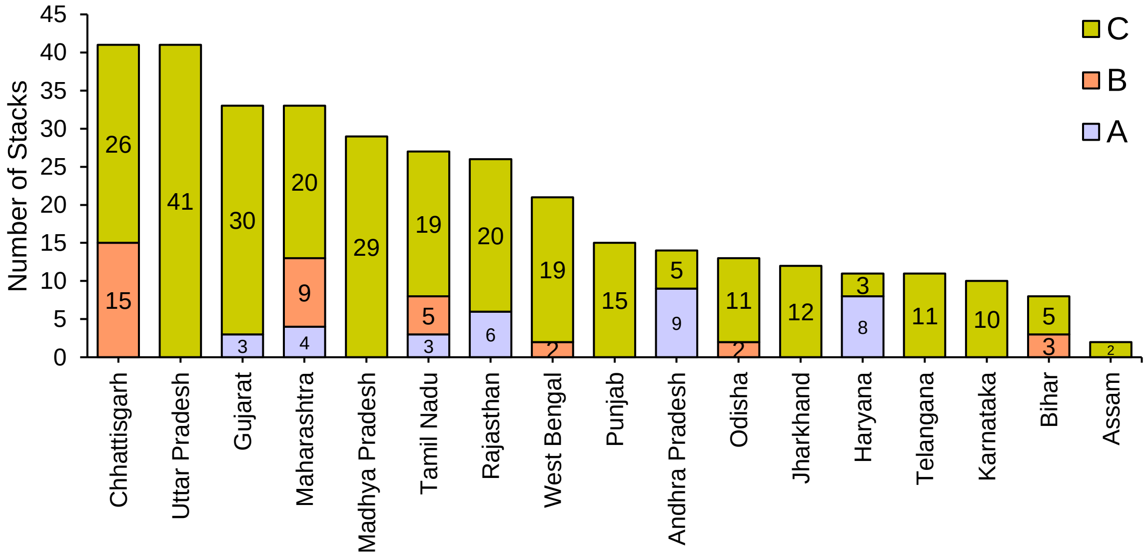


Fig. 3.4: Category wise distribution of collected OCEMS data for each state

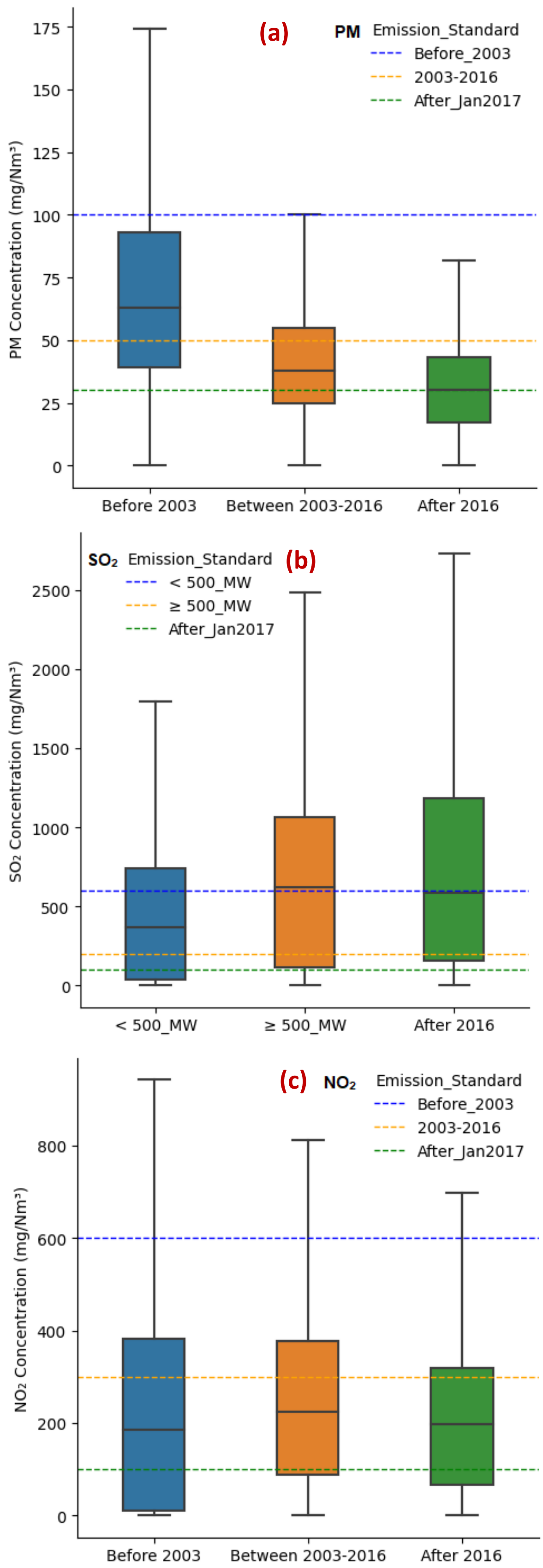


Fig. 3.5: Emission rate of different pollutants from TPS commissioned in three different times (2003, 2016, after 2017).

CHAPTER 4

Continuous Ambient Air Quality Monitoring

4.1 Introduction

Under the Air (Prevention & Control of Pollution) Act of 1981, the CPCB notified the fourth version of the National Ambient Air Quality Standards (NAAQS) in 2009. There are 12 identified health-based parameters, which are to be measured at the national level and with a view to having data comparison. The methods prescribed in the notification for respective parameters are a combination of both manual methods and continuous online methods. The manual method has some parameters measured by physical properties, while the remaining is by the wet chemical method. The manual methods have the disadvantage of random error due to manual intervention, whereas real-time monitoring may have systematic errors. **Fig. 4.1** shows the air quality parameters monitored under different methods.

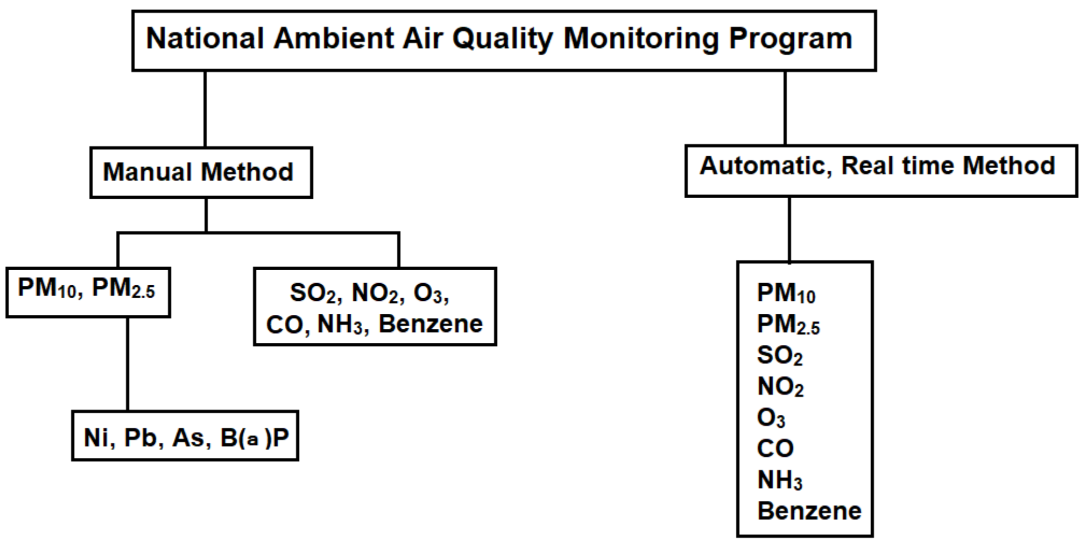


Fig. 4.1: Air quality parameters of Manual and automatic method of monitoring.

Due to the relatively lesser uncertainty of the real-time monitoring system and data availability in a structured format, CAAQMS data is analyzed and presented.

4.2 Data Analysis of CAAQMS Data

4.2.1 Data Collection

Data from the CPCB server were downloaded for varying periods. For major metropolitan cities, data is available from 2016 onwards, whereas for small cities, data from 2018 is available. For north-east states, data from 2021 is available. All available PM10, PM2.5, SO_2 and NO_2 data were downloaded and analyzed. CAAQMS data of 464 stations are shown in **Fig. 4.2**.

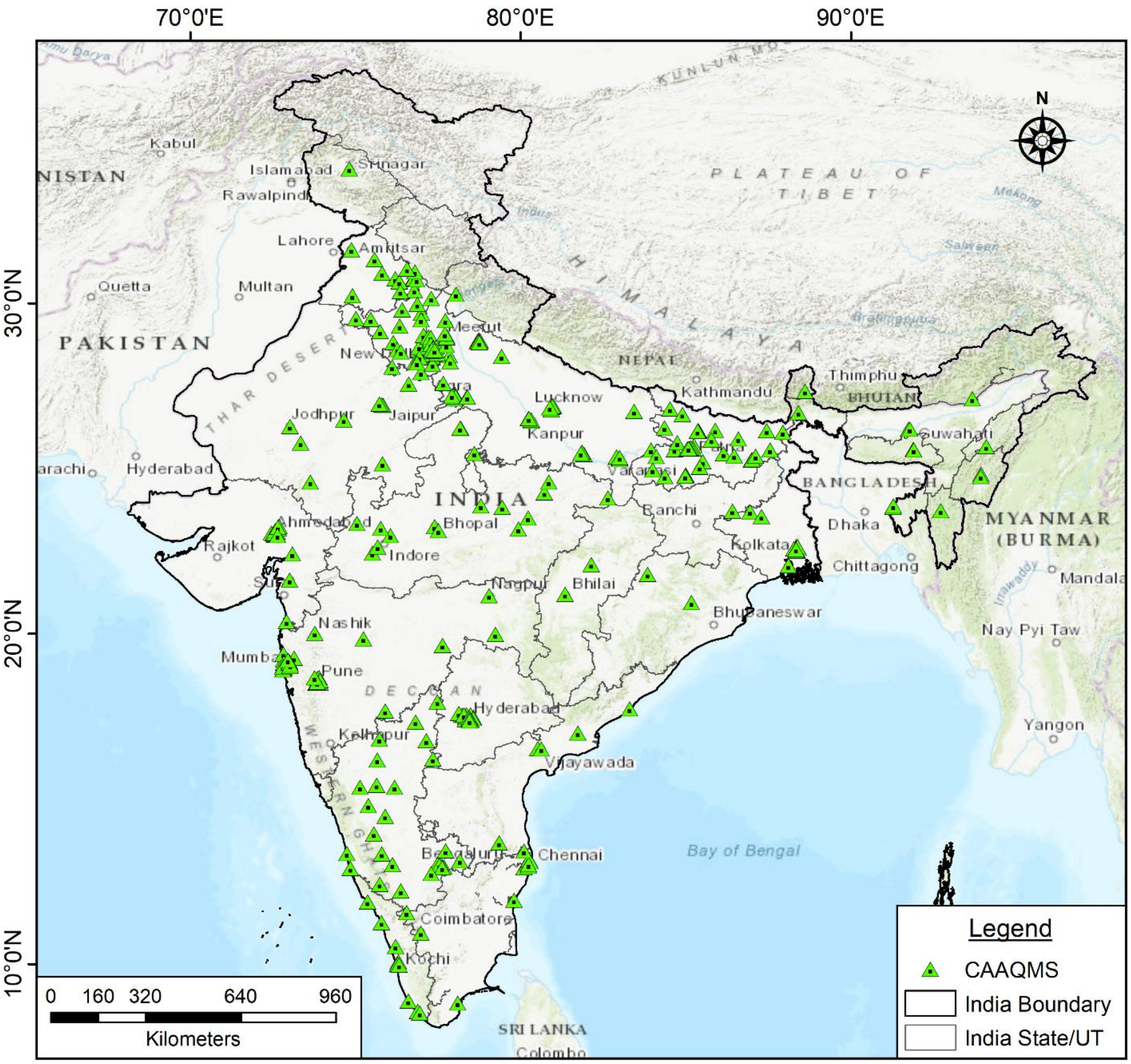


Fig. 4.2: Location of 464 CAAQMS in India.

Based on the data gathered under the NAAQM program, both by manual and automatic real-time methods, the cities that are non-compliant with respect to air quality parameters are identified. These cities are named non-attainment cities and are 132 as of today. **Fig. 4.3** shows the location of all such non-attainment cities.

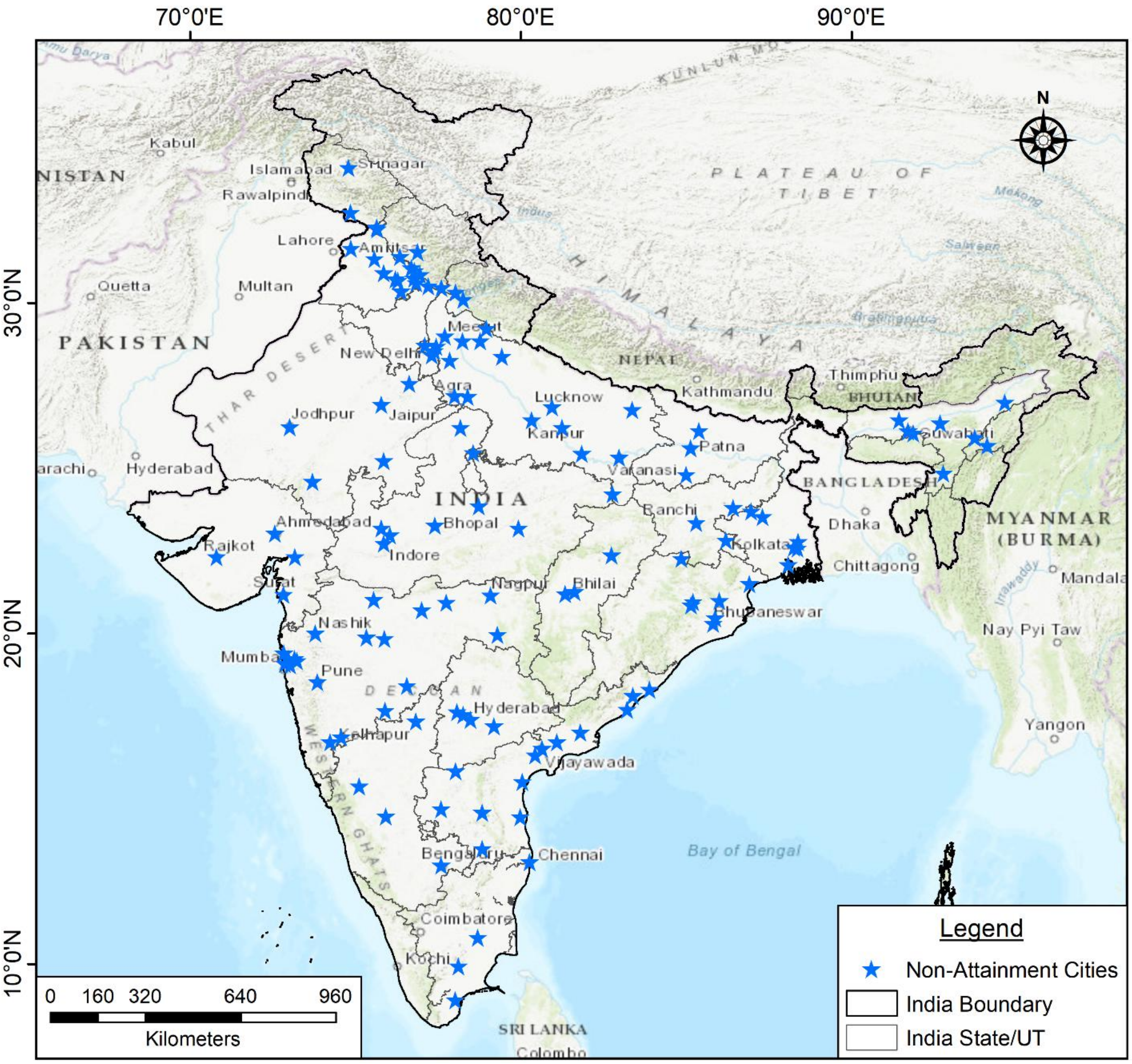


Fig. 4.3: Location of 132 non-attainment cities in India.

4.2.2 Data Summary

Table 4.1 presents the number of cities with CAAQMS and the number of CAAQMS in each state. In 238 cities in India, a total of 464 CAAQMS are installed. The list of CAAQMS is given in **Annexure B1**, and the pictorial presentation is in **Annexure B2**.

Table 4.1: Number of CAAQMS in different States.

No.	State / UT	Number of Cities having CAAQMS	Number of CAAQMS in the State / UT
	States		
1	Andhra Pradesh	8	10
2	Arunachal Pradesh	1	1
3	Assam	6	9
4	Bihar	25	35
5	Chhattisgarh	8	13
6	Gujarat	7	17
7	Haryana	23	30
8	Himachal Pradesh	1	1
9	Jharkhand	1	1
10	Karnataka	26	39
11	Kerala	8	9
12	Madhya Pradesh	14	42
13	Maharashtra	10	41
14	Manipur	1	2
15	Meghalaya	1	2
16	Mizoram	1	1
17	Nagaland	1	1
18	Odisha	9	12
19	Punjab	8	8
20	Rajasthan	27	31
21	Sikkim	1	1
22	Tamil Nadu	16	26
23	Telangana	1	14
24	Tripura	1	2
25	Uttar Pradesh	19	56
26	Uttarakhand	3	3
27	West Bengal	6	13
	Total	**233**	**420**
	Union Territories		
1	Chandigarh (UT)	1	3
2	Delhi (UT)	1	39
3	Jammu and Kashmir (UT)	1	1
4	Puducherry (UT)	1	1
	Total	**4**	**44**
	Overall Total	**238**	**464**

4.3 Data Evaluation

Annexure B2 (68 pages) visually represents large-size data gathered by CAAQMS. Air quality data is visualized by box-whisker plots for each parameter namely PM_{10}, $PM_{2.5}$, SO_2 and NO_2 in the ambient air.

Each box plot has an X-axis of the concentration of pollutant and a Y-axis as the name of the CAAQMS site. The box-whisker shows the minimum, first, second, third quartile and maximum values of air quality parameters. Outliers are excluded from the plot. A red vertical hard line shows the regulatory limit value for each parameter. A notable point in the box plot is that PM values exceed the regulatory limit value at each site. However, SO_2 remain within the regulatory limit value of 80 $\mu g/m^3$ at most of the sites.

Gaseous samples are collected through a tube and analyzed in respective SO_2 and NO_2 analyzers. Measurement of PM_{10} and $PM_{2.5}$ is carried out independently by two separate sampling inlets, as shown in **Fig. 4.4**.

Fig. 4.4: Two independent and separate $PM_{2.5}$ and PM_{10} samplers.

A total of 464 CAAQMS data were analyzed, and the summary of state-wise data in respect of violation of regulatory norms for PM_{10}, $PM_{2.5}$, SO_2 and NO_2 is presented in Table 4.2(a), 4.2(b) 4.2(c), and 4.2(d) respectively. With reference to ambient air SO_2, please refer to **Table 4.2(c)**. It can be seen that three CAAQMS each in Bihar, Gujarat, M.P. and one station each in Maharashtra, Rajasthan, and Tamil Nadu each exceed the regulatory limit of 80 $\mu g/m^3$ of SO_2 that too only one-quarter of the four years data. One station in Maharashtra exceeds SO_2 levels for less than 50% data.

The same state-wise data in tabular format is presented at the National level by combining each state and Union Territories data in Table 4.3(a), 4.3(b), 4.3(c) and 4.3(d) along with its pictorial representation in Fig. 4.5(a), 4.5(b), 4.5(c), and 4.5(d) for PM_{10}, $PM_{2.5}$, SO_2 and NO_2 respectively. It can be seen in **Table 4.3(c)** that for ambient air SO_2, out of 464 stations only 12 CAAQMS station exceed the regulatory limit of 80 $\mu g/m^3$ that too only one quarter of the four years data. SO_2 values at one station exceed for more than 25% and less than 50% data. Number of stations that exceeds regulatory limit value is 3% of the total number of stations.

For the sake of clarity of terms like a “quarter of several years’ data”, the regulatory guideline violation is graphically explained in **Fig. 4.6**. It can be seen that PM_{10} level does not exceed at 9% CAAQMS stations (top row), whereas at 2% stations (bottom row) exceed the regulatory limit entirely. Similarly for SO_2, 97% of CAAQMS does not violate the regulatory limit value. Only 3% of the CAAQMS exceed the regulatory limit for less than 25% of its data. Stations that violates SO_2 level is given below:

State	**CAAQMS Station Name**	**Violation**	**Page**
Bihar	Collectorate_Gaya, IGSC_Complex_Patna, Muzaffarpur_Collectorate	< 25% Data	B2-8
Gujarat	GIDC_Ankaleshwar, IIPHG_Gandhinagar, Maninagar_Ahmedabad	< 25% Data	B2-20
M.P.	Betul_Collectorate, Mandideep Sector New Industrial Area, Singrauli_Surya Kiran Bhawan Dudhichua	< 25% Data	B2-36
Maharashtra	Karve_Road_Pune_MPCB	< 25% Data	B2-40
Rajasthan	RIICO_Bhiwadi	< 25% Data	B2-49
Tamil Nadu	Sona_College_Salem	< 25% Data	B2-53
Maharashtra	RC_Shivajinagar_Pune_IITM	< 50% Data	B2-40

Since the current ambient air SO_2 level is very low, installation of FGD will not yield any additional advantage of air quality improvement, instead PM reduction should be the target for ambient air quality improvement.

4.4 Compliance Status of CAAQMS

Table 4.2 (a): Compliance status of PM_{10} Monitoring.

State	Number of CAAQMS	No Data	No Violation	Violation of < 25% Data	Violation of >25% & < 50% Data	Violation of >50% & < 75% Data	Violation >75% Data	100% Data Violation
Andhra Pradesh	10	2	1	6	0	1	0	0
Arunachal Pradesh	1	0	0	1	0	0	0	0
Assam	9	2	1	0	3	0	1	2
Bihar	35	0	3	2	2	18	10	0
Chandigarh	3	0	0	0	1	2	0	0
Chhattisgarh	13	4	2	1	0	1	2	3
Delhi	39	1	0	0	0	17	21	0
Gujarat	17	0	0	2	7	7	1	0
Haryana	30	4	0	0	1	20	5	0
Himachal Pradesh	1	0	0	0	0	0	1	0
J & K	1	0	0	0	1	0	0	0
Jharkhand	1	0	0	0	1	0	0	0
Karnataka	39	1	9	18	8	2	1	0
Kerala	9	0	1	8	0	0	0	0
Madhya Pradesh	42	0	3	13	9	15	2	0
Maharashtra	41	1	0	6	20	14	0	0
Manipur	2	0	1	1	0	0	0	0
Meghalaya	2	0	2	0	0	0	0	0
Mizoram	1	0	0	1	0	0	0	0
Nagaland	1	0	0	1	0	0	0	0
Odisha	12	2	0	0	2	1	4	3
Puducherry	1	0	1	0	0	0	0	0
Punjab	8	0	0	0	5	3	0	0
Rajasthan	31	21	0	0	4	4	2	0
Sikkim	1	0	1	0	0	0	0	0
Tamil Nadu	26	3	6	15	1	1	0	0
Telangana	14	1	6	2	4	1	0	0
Tripura	2	0	0	1	1	0	0	0
Uttar Pradesh	56	2	0	1	18	23	12	0
Uttarakhand	3	2	0	0	1	0	0	0
West Bengal	13	0	0	0	10	3	0	0
Total	**464**	**46**	**37**	**79**	**99**	**133**	**62**	**8**

Table 4.2 (b): Compliance status of $PM_{2.5}$ Monitoring.

State	Number of CAAQMS	No Data	No Violation	Violation of < 25% Data	Violation of >25% & < 50% Data	Violation of >50% & < 75% Data	Violation >75% Data	100% Data Violation
Andhra Pradesh	10	2	3	5	0	0	0	0
Arunachal Pradesh	1	0	1	0	0	0	0	0
Assam	9	2	1	0	3	0	1	2
Bihar	35	0	0	3	12	19	1	0
Chandigarh	3	0	0	1	1	1	0	0
Chhattisgarh	13	5	4	0	0	2	2	0
Delhi	39	1	0	0	2	35	1	0
Gujarat	17	0	0	5	10	1	1	0
Haryana	30	0	0	0	13	17	0	0
Himachal Pradesh	1	0	0	0	1	0	0	0
J & K	1	0	0	1	0	0	0	0
Jharkhand	1	0	0	0	0	1	0	0
Karnataka	39	4	9	23	1	2	0	0
Kerala	9	0	4	5	0	0	0	0
Madhya Pradesh	42	1	9	14	16	2	0	0
Maharashtra	41	2	0	14	22	3	0	0
Manipur	2	0	1	1	0	0	0	0
Meghalaya	2	0	2	0	0	0	0	0
Mizoram	1	0	1	0	0	0	0	0
Nagaland	1	0	0	1	0	0	0	0
Odisha	12	2	0	1	1	2	4	2
Puducherry	1	0	1	0	0	0	0	0
Punjab	8	0	2	6	0	0	0	0
Rajasthan	31	21	0	3	5	2	0	0
Sikkim	1	0	1	0	0	0	0	0
Tamil Nadu	26	4	7	15	0	0	0	0
Telangana	14	0	6	5	3	0	0	0
Tripura	2	0	0	0	2	0	0	0
Uttar Pradesh	56	0	0	6	27	23	0	0
Uttarakhand	3	2	0	1	0	0	0	0
West Bengal	13	0	0	1	11	1	0	0
Total	**464**	46	52	111	130	111	10	4

Table 4.2 (c): Compliance status of SO_2 Monitoring.

State	Number of CAAQMS	No Data	No Violation	Violation of < 25% Data	Violation of >25% & < 50% Data	Violation of >50% & < 75% Data	Violation >75% Data	100% Data Violation
Andhra Pradesh	10	2	8	0	0	0	0	0
Arunachal Pradesh	1	0	1	0	0	0	0	0
Assam	9	2	7	0	0	0	0	0
Bihar	35	0	32	3	0	0	0	0
Chandigarh	3	0	3	0	0	0	0	0
Chhattisgarh	13	4	9	0	0	0	0	0
Delhi	39	8	31	0	0	0	0	0
Gujarat	17	0	14	3	0	0	0	0
Haryana	30	1	29	0	0	0	0	0
Himachal Pradesh	1	0	1	0	0	0	0	0
J & K	1	0	1	0	0	0	0	0
Jharkhand	1	0	1	0	0	0	0	0
Karnataka	39	1	38	0	0	0	0	0
Kerala	9	0	9	0	0	0	0	0
M.P.	42	0	39	3	0	0	0	0
Maharashtra	41	9	30	1	1	0	0	0
Manipur	2	0	2	0	0	0	0	0
Meghalaya	2	0	2	0	0	0	0	0
Mizoram	1	0	1	0	0	0	0	0
Nagaland	1	0	1	0	0	0	0	0
Odisha	12	2	10	0	0	0	0	0
Puducherry	1	0	1	0	0	0	0	0
Punjab	8	0	8	0	0	0	0	0
Rajasthan	31	21	9	1	0	0	0	0
Sikkim	1	0	1	0	0	0	0	0
Tamil Nadu	26	3	22	1	0	0	0	0
Telangana	14	0	14	0	0	0	0	0
Tripura	2	0	2	0	0	0	0	0
Uttar Pradesh	56	2	54	0	0	0	0	0
Uttarakhand	3	2	1	0	0	0	0	0
West Bengal	13	0	13	0	0	0	0	0
Total	**464**	57	394	**12**	1	0	0	0

Table 4.2 (d): Compliance status of NO_2 Monitoring.

State	Number of CAAQMS	No Data	No Violation	Violation of < 25% Data	Violation of >25% & < 50% Data	Violation of >50% & < 75% Data	Violation >75% Data	100% Data Violation
Andhra Pradesh	10	2	8	0	0	0	0	0
Arunachal Pradesh	1	0	1	0	0	0	0	0
Assam	9	2	7	0	0	0	0	0
Bihar	35	0	17	14	4	0	0	0
Chandigarh	3	0	1	2	0	0	0	0
Chhattisgarh	13	4	8	0	0	0	0	1
Delhi	39	0	12	26	1	0	0	0
Gujarat	17	0	14	2	1	0	0	0
Haryana	30	0	22	7	1	0	0	0
Himachal Pradesh	1	0	1	0	0	0	0	0
J & K	1	0	1	0	0	0	0	0
Jharkhand	1	0	1	0	0	0	0	0
Karnataka	39	1	37	1	0	0	0	0
Kerala	9	0	9	0	0	0	0	0
Madhya Pradesh	42	3	34	5	0	0	0	0
Maharashtra	41	2	27	12	0	0	0	0
Manipur	2	0	2	0	0	0	0	0
Meghalaya	2	0	2	0	0	0	0	0
Mizoram	1	0	1	0	0	0	0	0
Nagaland	1	0	1	0	0	0	0	0
Odisha	12	2	9	1	0	0	0	0
Puducherry	1	0	1	0	0	0	0	0
Punjab	8	0	8	0	0	0	0	0
Rajasthan	31	21	7	3	0	0	0	0
Sikkim	1	0	1	0	0	0	0	0
Tamil Nadu	26	3	23	0	0	0	0	0
Telangana	14	0	12	2	0	0	0	0
Tripura	2	0	2	0	0	0	0	0
Uttar Pradesh	56	1	32	21	2	0	0	0
Uttarakhand	3	2	1	0	0	0	0	0
West Bengal	13	0	9	4	0	0	0	0
Total	**464**	43	311	100	9	0	0	1

Table 4.3 (a): Compliance status of PM_{10} Monitoring.

Compliance Status of PM_{10}	No. of CAAQMS
No Data	46
No Violation	37
Violation of < 25% Data	79
Violation of >25% & < 50% Data	99
Violation of >50% & < 75% Data	133
Violation >75% Data	62
100% Data Violation	8
Total CAAQMS Data	**464**

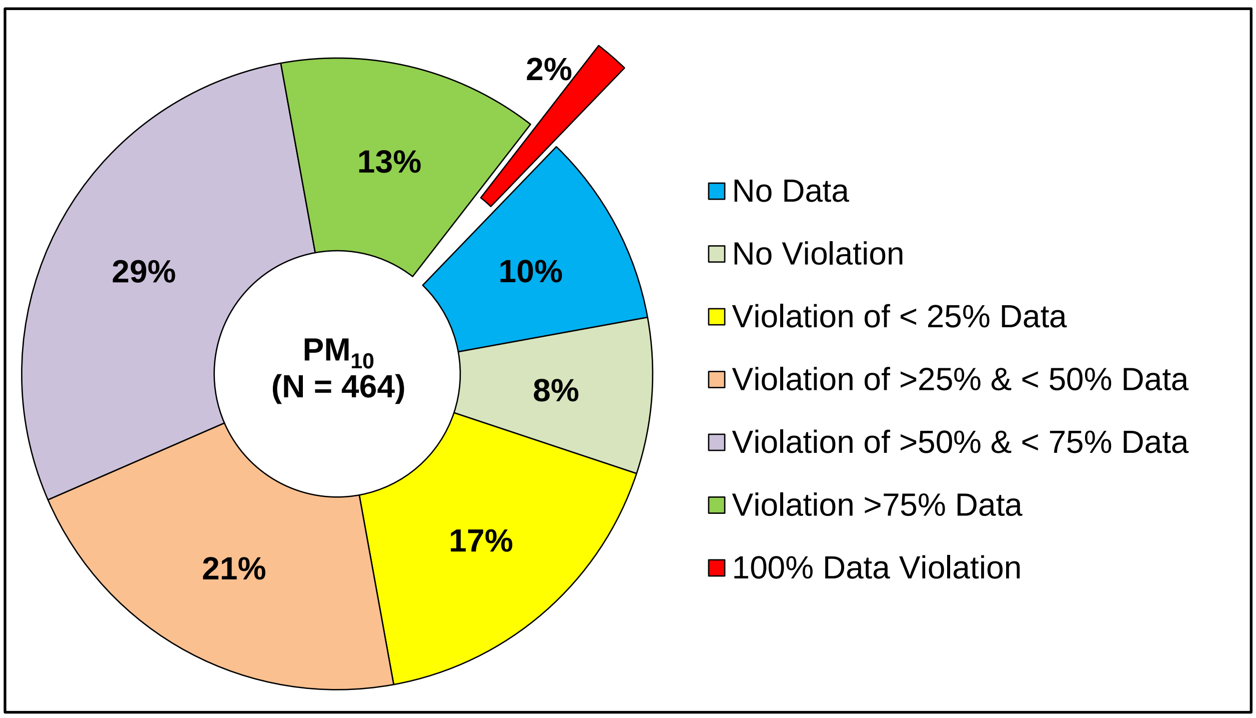


Fig. 4.5(a): Compliance status (%) of ambient air PM_{10} measured by CAQMS.

Table 4.3 (b): Compliance status of $PM_{2.5}$ Monitoring.

Compliance Status of $PM_{2.5}$	No. of CAAQMS
No Data	46
No Violation	52
Violation of < 25% Data	111
Violation of >25% & < 50% Data	130
Violation of >50% & < 75% Data	111
Violation >75% Data	10
100% Data Violation	4
Total CAAQMS Data	**464**

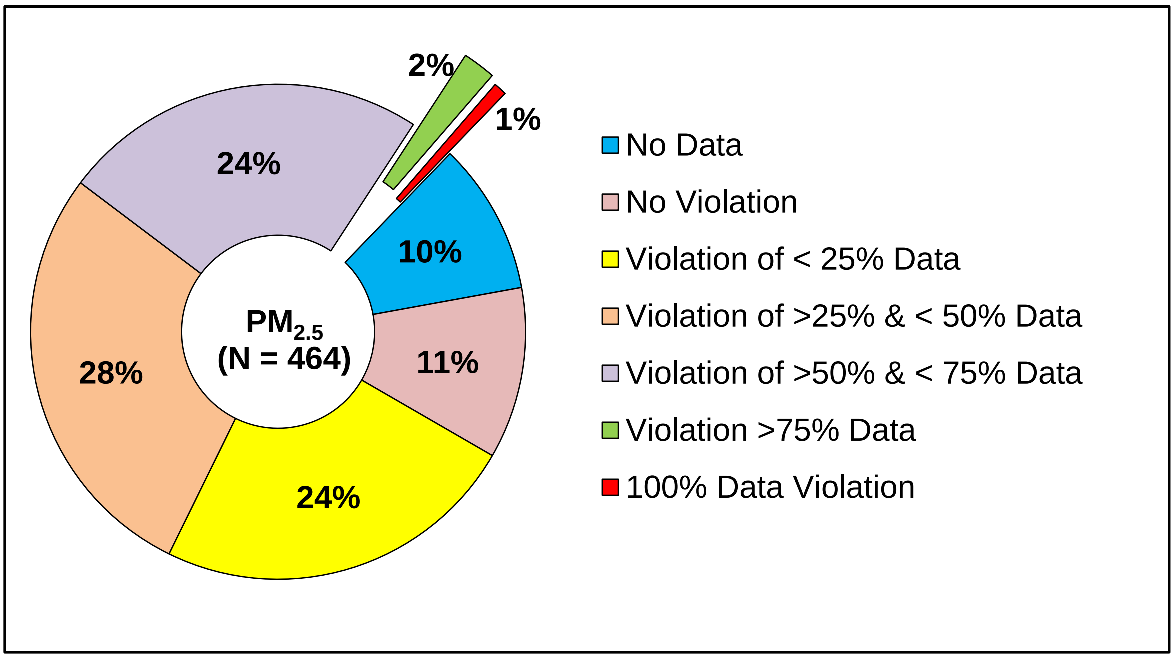


Fig. 4.5(b): Compliance status (%) of ambient air $PM_{2.5}$ measured by CAQMS.

Table 4.3 (c): Compliance status of SO_2 Monitoring.

Compliance Status of SO_2	No. of CAAQMS
No Data	57
No Violation	394
Violation of < 25% Data	**12**
Violation of >25% & < 50% Data	**1**
Violation of >50% & < 75% Data	0
Violation >75% Data	0
100% Data Violation	0
Total CAAQMS Data	**464**

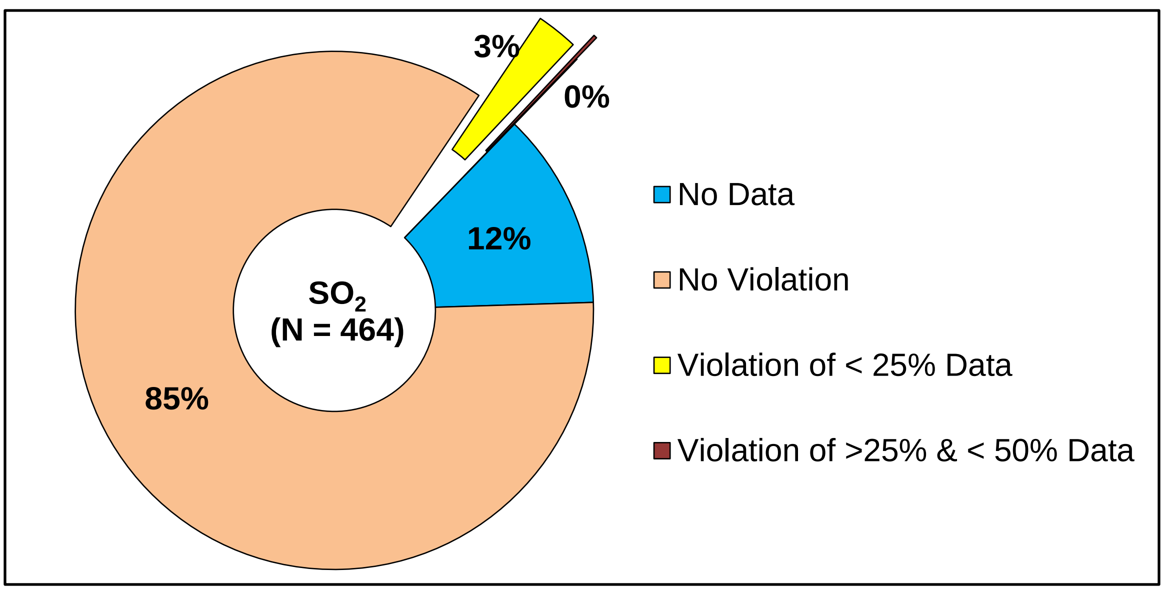


Fig. 4.5(c): Compliance status (%) of ambient air SO_2 as measured by CAQMS.

Table 4.3 (d): Compliance status of NO_2 Monitoring.

Compliance Status of NO_2	No. of CAAQMS
No Data	43
No Violation	311
Violation of < 25% Data	100
Violation of >25% & < 50% Data	9
Violation of >50% & < 75% Data	0
Violation >75% Data	0
100% Data Violation	1
Total CAAQMS Data	**464**

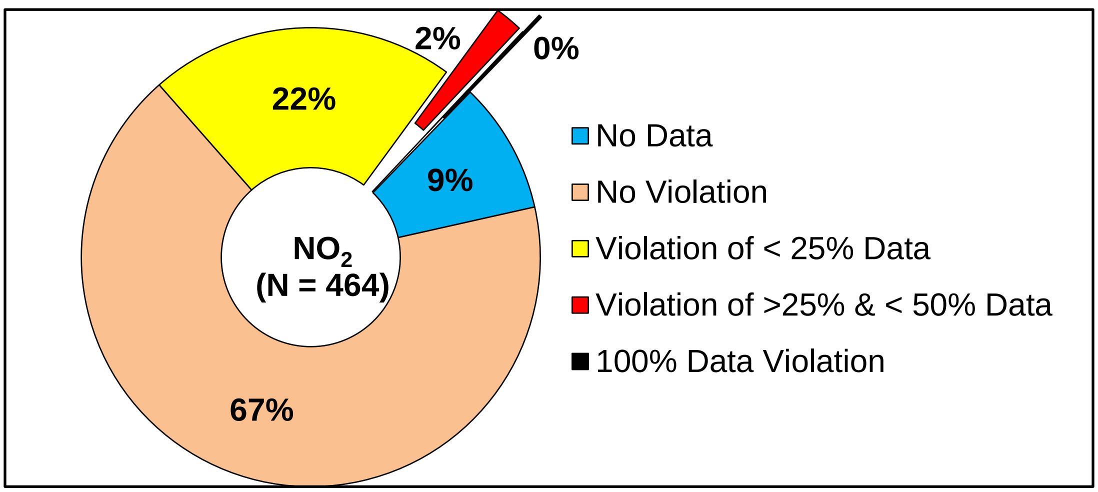
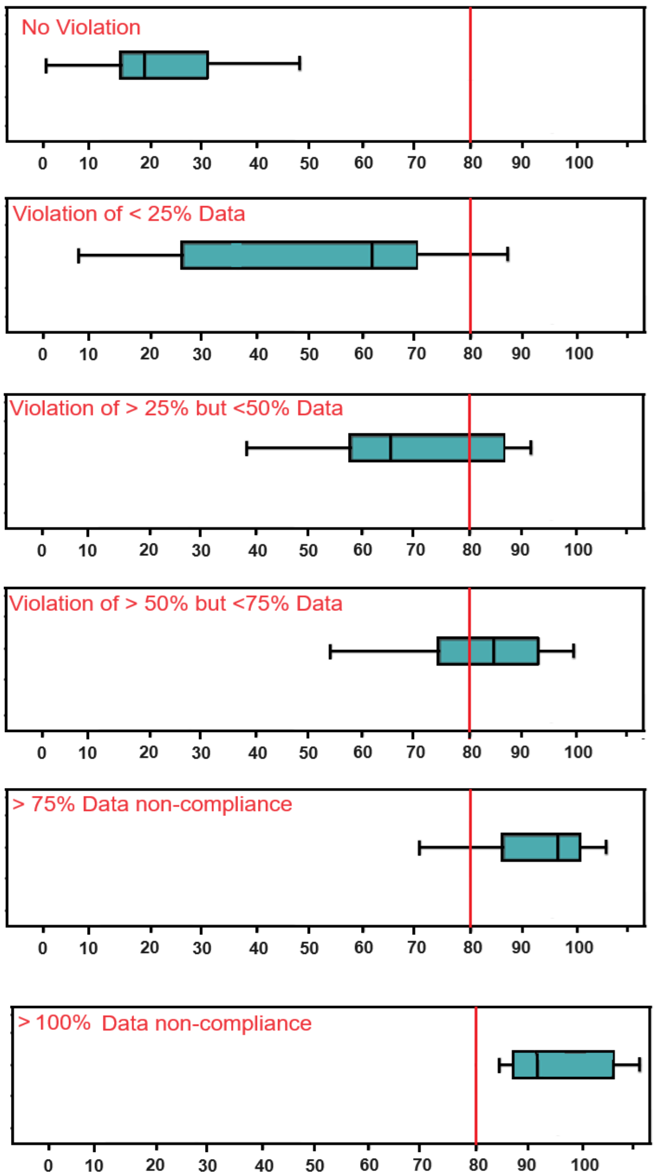


Fig. 4.5(d): Compliance status (%) of ambient air NO_2 measured by CAQMS.



PM_{10}	$PM_{2.5}$	SO_2	NO_2
9	12	97	74
19	27	3	24
24	31	----	2
32	27	----	----
15	2	----	----
2	1	----	----

Note: *Regulatory compliance limit of 80 $\mu g/m^3$ for SO_2 is shown for the pictorial explanation of data. For other parameters, the respective regulatory limits should apply. All values given on the right side column are in % of the total CAAQMS station. Since the values are rounded off to the nearest whole number, some station violations may not be shown.*

Fig. 4.6: Graphical presentation of compliance (**%**) status of air pollutants (CAAQMS data).

4.5 Ambient air quality near TPP having FGD installed

Till the time of CAAQMS data collection, FGD was installed in 24 units of TPP having a total generation capacity of 10600 MW. The ambient air quality gathered by CAAQMS surrounding these TPP was also analysed, and it was found that the ambient air average SO_2 level was 19.39 $\mu g/m^3$. CAAQMS operated by NTPC near TPP without FGD were also analysed, and it was found that the average SO_2 level is 14.82 $\mu g/m^3$. This clearly indicates that SO_2 at ground level is not affected by the release from nearby TPP. At the same time, the CAAQMS data of nearby urban areas operated by CPCB / SPCB also does not reach the regulatory limit values (80 μg/m3); instead, it is very low. In effect, it can be concluded that installation of FGD does not lead to improved air quality in terms of SO_2 due to very low emission load.

References

- CPCB: Guidelines for measuring Ambient Air Pollutants, Volume-I; National Ambient Air Quality Series: NAAQMS/36/2012-13.
- CPCB: Guidelines for Real-Time Sampling & Analyses; Volume II.

Chapter 5
Discussion

5.1 Introduction

The emission standards of the new coal-based TPP are regulated via Notification No. S.O. 3305(E) dated 7th December 2015 of MoEF&CC, according to which the emission standard for SO_2 is 100 to 600 mg/Nm^3 based on its year of installation and capacity. The literature search /review does not confirm the availability of any scientific study to arrive at the newly proposed emission standard. Without any background study, the very low emission limit of 100 mg/Nm^3 for Indian coal-based TPP appears to be arbitrary and an attempt to come close to or better than the emission standard of other developed countries (Pl. refer Annexure A3, page A3 - 4). The sulphur content of coals of other countries is much higher compared to Indian coal (<0.5%); therefore, prima facie, there does not seem to be a justified reason for reducing the SO_2 emission limit in Indian coal-based TPP, too, with a short implementation time.

It is worth noting that countries having high sulphur coal are necessarily required to install FGD for sulphur emission reduction. Once FGD is installed, the emission limit can be reduced to 100 mg/Nm^3 as FGD would serve the purpose. However, for low sulphur Indian coal, since the existing SO_2 emission limit does not affect the ground level, as evident from CAAQMS data analysis, lowering the SO_2 emission limit to 100 mg/Nm^3 is like competing with other countries' regulations. For meeting such a lower limit of SO_2 emission, the necessity of FGD arises, which is an extra investment and appears to be only towards competing with other countries.

If the emitted SO_2 after atmospheric dilution gets deposited on water bodies, plants, or land surfaces, it can impact them due to its inherent acidity. It was observed in the past (1960s) that the TPP of the United Kingdom using high sulphur coal led to acid deposition on the water bodies, loss of fish life and forest cover in Scandinavian countries. This led to a historic International meeting on June 5, 1972, at Rio-de-Janeiro, resulting in the birth of the United Nations Environment Program (UNEP) and the declaration of Environment Day (June 5). Reducing the SO_2 emission load of low sulphur coal to such a low level, as proposed in India, in an arbitrary manner, may be due to the fear born out of this incident in the past. This needs to be evaluated in the Indian context, where coal has very low sulphur content.

In the Indian environment eco-system, TPS uses low sulphur coal, leading to lower emissions of SO_2, but any negative environmental impact due to its deposition on plants, soil, and water bodies has not been noticed. All ground-level measurements show a very low level of SO_2. A question that arises is, do these environmental components (land plant, water body) have sufficient buffering capacity to neutralize the deposited acidic Sulphur to the extent that any scientific study or visible environmental impairment does not notice the impact of SO_2 release?

Comparing the coal characteristics of different countries, it can be seen that coal with GCV (≥5000 Kcal/kg), low ash (6 - 10 %) and high sulphur content (≥1.0 %), the priority goes towards limiting the emission of SO_2. In the same context, Indian coal has lower GCV (3400 Kcal/kg), high ash (>42%) and low sulphur (<0.5%), so the priority should be to primarily reduce PM emission instead of SO_2. The existing ESP having a large collecting plate area (9 field ESP) controls PM, which can be further polished by using a wet scrubber. Wet scrubbers would also reduce SO_2 to some extent, beyond what is emitted today, besides reducing PM emissions. An argument put forth is wet scrubber would increase the acidity of wastewater, which may corrode the leading metallic components. At this point neutralizing potential of fly ash should also be considered.

TPPs have fly ash ponds where bottom ash slurry is disposed. The wastewater generated in the wet scrubber is also likely to be disposed of in the same ash pond. The increase in acidity of ash pond water to the extent that it damages the environment needs to be studied. If such a need arises, offline treatment for neutralizing wet scrubber wastewater is also an option. Without these field-level studies, directly employing FGD to reduce SO2 is a costlier option. The option of using a wet scrubber as a polishing unit for PM emission control should be with caution of the availability of water and its sustainable operation. There were instances in the past when TPPs (CSTPS, Chandrapur) were shut down during summer due to a shortage of water.

In the earlier Chapters (3 & 4), an analysis of measurements done by OCEMS and CAAQMS is presented. This includes visualization of large-size data, and comparison of regulatory limit values with second and third-quartile values for assessment of compliance. In this chapter, results and outcomes of past studies, including data gathered under other projects by CSIR-NEERI, reports of International agencies, other reputed Indian Institutes, etc., are discussed.

5.2 Monitoring of SO_2 in India

Chapter 4 provides a detailed analysis of SO_2 measured by CAAQMS for 464 sites. The measurement is carried out by auto-samplers and analysers without much manual intervention like sample handling, sample processing and analysis. Therefore, it can be believed that the SO_2 data generated by CAAQMS is relatively less biased. Most of the data shows the SO_2 values below the regulatory limit value of 80 $\mu g/m^3$. The obvious question is, “Is there any study site apart from the CAAQMS location where the SO_2 level was observed to be relatively high”? CSIR-NEERI is engaged in SO_2 measurement under different industrial and urban area projects. Major among them is air quality monitoring under source apportionment city at Delhi (2007-08); air quality monitoring around Lalitpur Power Generation Company Limited, (LPGCL) Lalitpur, U.P.; air quality monitoring near pit head thermal power station of Singrauli Coal mine are of Northern coalfields limited, Singrauli (M.P.). National Ambient Air Quality Monitoring (NAAQM) Program is in six cities, namely Delhi, Mumbai, Kolkata, Chennai, Hyderabad, and Nagpur. Some short-term studies were also carried out using sulphur-bearing copper ore processing and imported coal. The outcome of some of the studies is as follows.

5.2.1 SO_2 monitoring at Delhi under source apportionment study (2007 – 08).

CPCB sponsored a source apportionment study for Delhi (SA Delhi by NEERI, Nagpur) consisting of manual monitoring of SO_2 at ten sites within the Delhi metropolitan city. Different air quality parameters were measured manually at ten sites in three different seasons. **Fig. 5.1** shows the box plot of SO_2 levels at ten sites in

Delhi in three seasons. One of the location's small-scale industries (SSI) showed relatively high levels of SO_2 during two seasons. During summer, the SO_2 levels were very low, which may be attributed to either wind direction reversal or relatively higher summer mixing height and wind velocity, leading to higher ventilation and thus dilution. However, during post-monsoon and winter, the SO_2 levels in the SSI area were very high. The emission inventory study revealed that small-scale industries in the region use unspecified fuels, high calorific value coal of high sulphur content and the emissions was released at a very low elevation of 30 m. Subsequent to the SA-Delhi study, the industries were shifted out of the SSI area in view of the pollution problem. In the present scenario, analysis of CAAQMS observed SO_2 levels at 39 stations at Delhi are below 30 $\mu g/m^3$ (pl. refer to Annexure B2, page B2-17).

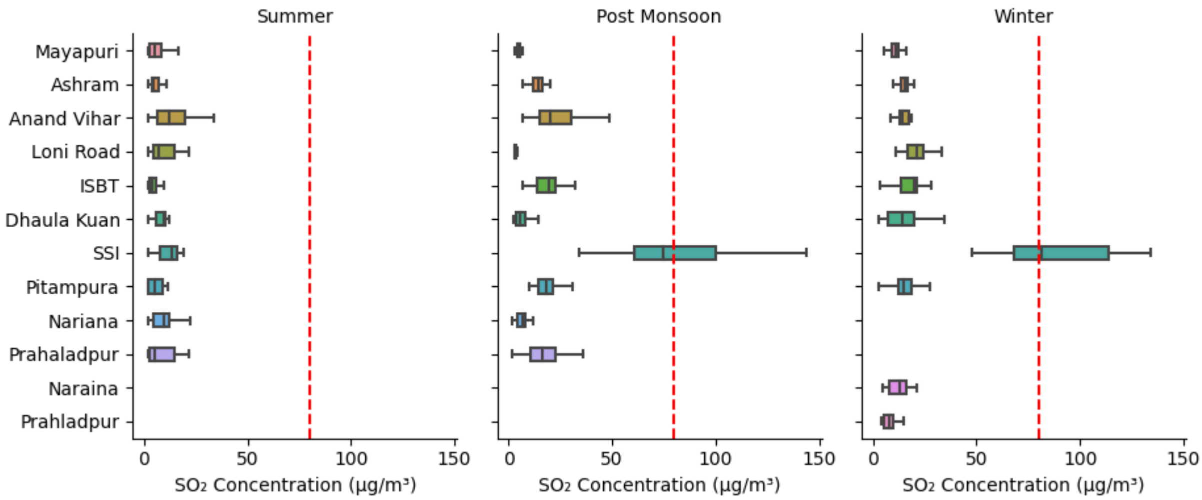


Fig. 5.1: Box plot of manual monitoring of SO_2 at Delhi (2007- 08).

5.2.2 Ambient air SO_2 levels at remotely located TPP

In order to understand the ambient air quality at a site not affected by any other source except a coal-based thermal power plant, the data of a coal-based thermal power plant at Lalitpur, U.P., was chosen. The TPP at Lalitpur Power Generation Company Limited (LPGCL), Tehsil Mahroni, Lalitpur, Uttar Pradesh, is surrounded by green cover within 25 km. This study site has a peculiarity that within a radius of 25 km, there is no activity other than coal-based TPP of 1800 MW (3 x 600 MW). Therefore, SO_2 observed at this site can be attributed only to TPP emission and not to any other activity. The plant has three boilers installed with super-critical technology. The total indigenous coal consumption is 8.51 MMTPA. An electrostatic precipitator of more than 99.9% efficiency is provided to control particulate matter to below 50 mg/Nm^3. The emission is vented through a single tri-flue stack of 275 m in height. Ambient air particulate matter (PM_{10} and $PM_{2.5}$) and SO_2 were measured throughout the year at four sites: Chiglaua, Mirchwara, R & D Yard and Vishnu Mandir.

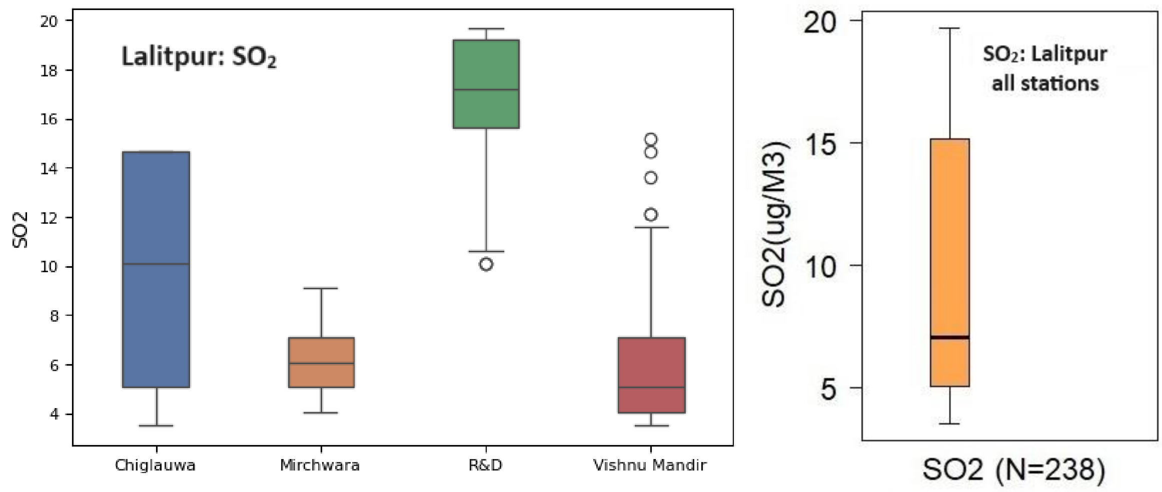


Fig. 5.2: SO_2 at Lalitpur, U.P. during year-long monitoring (2022 - 23).

Fig. 5.2 shows the measured SO_2 at four stations. There are 238 sample data to exhibit the ambient air SO_2 levels. It can be seen that most of the time the measured SO_2 levels are very low and is below 20 $\mu g/m^3$ as seen in the box plot shown on the right side. This gives two points to ponder:

i) The released SO_2 undergoes a chemical transformation in the atmosphere and is, therefore, not found at ground level. This goes against the assumption of the conservative nature of SO_2, which is assumed in the source dispersion modelling. Gaussian-based model assumes that particulate matter, SO_2 and NOx are conservative in nature. These are expected to be found as per the conservative dispersion model following Pasquill-Gifford-Turner-derived dispersion coefficient-based models.

The Prairie Grass experiment is a classic example of an experiment conducted during July-August 1956. For that experiment, a known amount of tracer SO_2 was released from a height of 46 cm above ground level and the concentration of SO_2 was measured on arcs at distances of 50 m, 100 m, 200 m, 400 m and 800 m. This experiment formed the basis of the subsequently developed source dispersion model with a very important assumption that the chemical species are conservative and do not undergo a chemical transformation in the atmosphere in a short distance and time.

In the case of the release of pollutants from a height of 275 m in TPP, even if particulate matter is assumed to be conservative, the gaseous species can undergo chemical transformation under the influence of strong solar insolation at elevated levels, by reacting with other chemical species of flue gas or of atmosphere, moisture etc. These reaction products are not included in the mathematical models that we are using for regulatory compliance, such as environmental impact assessment (EIA) studies.

ii) If the released SO_2 undergoes a chemical transformation in the atmosphere, it can be found as a secondary sulphate ion in the particulate matter. As on today, we do not have air monitoring network at National level to measure particulate matter bound sulphate ion. The National Ambient Air Quality Monitoring (NAQM) program does not include sulphate as a parameter for analysis.

5.3 Conversion of SO_2 to Sulphate (Eatough et al., 1994)

Gaseous emissions initially get diluted, followed by their deposition in water bodies, plants, land or chemical transformation in the atmosphere. One of the chemical transformations is to form salt, for example, ammonium sulphate, which may appear in particulate form. The formation of particulate sulphate is suggested to occur by three types of reactions:

- gas-phase homogeneous reactions,
- aqueous-phase reactions, and
- heterogeneous reactions on the surface of solids.

5.3.1 Gas-phase Homogeneous Reaction

The gas phase reaction requires hydroxyl radical, which is formed in the atmosphere from several sources like NO_2, HONO and H_2O_2. Photolysis reaction as follows:

$$NO_2 + h\nu \rightarrow NO + O$$
$$O + O_2 \rightarrow O_3$$
$$O_3 + h\nu \rightarrow O_2 + O$$
$$O + H_2O \rightarrow 2OH$$

$$HONO + h\nu \rightarrow OH + NO$$

$$H_2O_2 + h\nu \rightarrow 2OH$$

Under high solar insolation, formation of hydroxyl ion is also increased, leading to the above reaction.

$$OH + SO_2 \rightarrow HOSO_2$$
$$HOSO_2 + O_2 \rightarrow SO_3 + HO_2$$
$$SO_3 + H_2O \rightarrow H_2SO_4$$

Since the above reaction is a function of solar radiation, the transformation rate from SO_2 to Sulphate will be higher as we move from a higher latitude to the equator. Besides this, studies also report that during daytime, the reaction rate is high compared to nighttime due to relatively higher solar radiation. On the same line, the conversion rate in arid western United States and humid eastern United States is modelled, which shows the impact of solar radiation and humidity. India being closer to the equator, with relatively high solar radiation, the conversion of SO_2 to sulphate is expected at a higher rate.

5.3.2 Aqueous-Phase reaction

If water droplets are present in the atmosphere, particulate sulphate formation is faster than that of the gas phase reaction. Gaseous SO_2 can be adsorbed into water droplets as per:

SO_2 (g) <=> SO_2 (aq),
SO_2 (aq) <=> HSO_3^- + H^+
HSO_3^- <=> $SO_3^=$ + H^+

Ozone and SO_2 are both moderately soluble in water, while hydrogen peroxide is very soluble. The high conversion rate of SO_2 to sulphate sometimes encountered in fog and clouds can be attributed to the high solubility of H_2O_2 in water.

5.3.3 Heterogenous reactions on solid surfaces

Gaseous SO_2 conversion also occurs by adsorption on the surfaces of solid graphite, soot particles, fly ash, dust, MgO, Fe_2O_3 and MnO_2 and subsequent reaction with oxidants in the particle. The presence of co-pollutants and relative humidity also affects the rate of reaction. When an aqueous film covers the particles, oxidation is enhanced.

The relative contribution of heterogeneous reactions on surfaces is generally considered to be minor compared to hydroxyl radical and aqueous H_2O_2 oxidation. However, under certain circumstances, i.e., plumes with high particle density (>100 $\mu g/m^3$), heterogeneous reactions could be important. In Indian TPS, the emission of SO_2 is accompanied by a large amount of PM, and therefore, most of the sulphate ion should be found in PM.

5.4 Chemical sulphur of PM in different studies

Analysis of ambient air SO_2 data all over Indian cities and area close to TPP does not suggest that emitted SO_2 is impacting at ground level. An alternate hypothesis is that the gaseous SO_2 is converted to particulate sulphate ($SO_4^=$). If gaseous SO_2 undergoes atmospheric transformation to secondary particulate matter, it should be found as sulphur and sulphate ion. In order to have an assessment of chemical sulphur in PM, the data generated under other studies is presented here. These studies are for remote area TPP, which is not affected by any other source (Lalitpur TPP) and source apportionment study at pit-head TPP (Northern Coalfields Limited, Singrauli).

Elemental sulphur is measured using the energy-dispersive X-ray fluorescence (ED-XRF) technique. CSIR-NEERI, Nagpur is using this technique to measure sulphur in particulate matter collected on poly tetra fluoro ethylene (PTFE) filters under different studies in Indian urban centres. After the measurement of sulphur by non-destructive technique, the same PM collected on the PTFE filter is extracted in demineralized water using a sonicator, followed by its analysis using an Ion Chromatograph (IC).

5.4.1 PM study at remote area TPP

CSIR-NEERI collected samples at Lalitpur Power Generation Company Limited (LPGCL), Lalitpur, U.P., in which ambient air particulate matter and its sulphur and sulphate content were measured to understand the presence due to atmospheric chemical transformation.

Fig. 5.3 shows the elemental sulphur and sulphate content of ambient air $PM_{2.5}$ and PM_{10} sampled on a PTFE filter over a year. The molecular weight relation of sulphur and sulphate ions is shown below. If PM contains 32 mass units of elemental sulphur, the sulphate content should be 96 mass units. In other words, one unit of elemental sulphur would show three units of sulphate ion.

$$\underset{32}{S} \rightarrow \underset{96}{SO_4^{=}}$$

A somewhat similar relationship is found between the two in the box plot (Fig. 5.3). However, there is a gap in correlating gaseous SO_2 with elemental sulphur and sulphate of PM. This is further explained in another study carried out in the pit head thermal power station area.

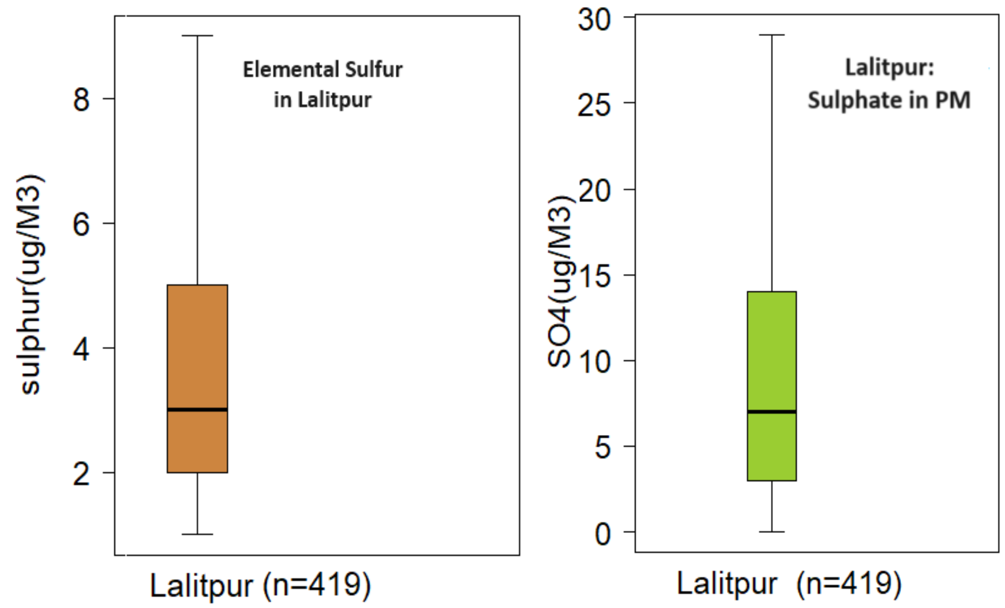


Fig. 5.3: Sulphate and Elemental Sulphur in PM at Lalitpur during year-long monitoring (2022 - 23).

5.4.2 Source apportionment study at Pit Head Thermal Power Plant area

A source apportionment study was carried in the pit head thermal power station area of the Singrauli coal mine area (**Fig. 5.4**). There are ten coal mines of Northern Coalfield Limited in operation. A large number of thermal power stations are in operation due to their shorter transport distance from coal mines.

All the TPS together have some 42 stacks bellowing out smoke. **Fig. 5.5** shows the stacks in the pit head. It can be seen from the opacity of emission smoke that most of them emit air pollutants at a higher rate than the permissible regulatory limit. **Fig. 5.6** shows the location of the TPS stack close to the coal mine in the street map.

The study involves the sampling of particulate matter (PM10, PM2.5) in the ambient air at the top of the mine and also from the ground level. It may be noted that the top surface of the coal mine overburden is at the level of the stack top. Schematically, this is shown in **Fig. 5.7**. The objective of sampling at the mine top and ground level is to differentiate the impact of emission at different elevations. Collected PM_{10} and $PM_{2.5}$ were analysed for Elements using ED-XRF, Ions using an Ion chromatograph, and Carbon using a DRI Carbon analyser.

Fig. 5.4: Ten open cast coal mines in Singrauli area.

Fig. 5.5: A large number of coal-based TPS in the Singrauli area

Chemical speciation data analysis shows that PM sampled at coal mine tops contains a relatively larger fraction of elements and soluble ions. Elemental content shows the source of PM as over-burden dust and ions, which convert gaseous pollutants (SO_2) to PM in the atmosphere. The carbon fraction in the PM at the top of the coal mine is relatively low, indicating that vehicular emission and coal dust particles are not lifted to higher elevations in the atmosphere.

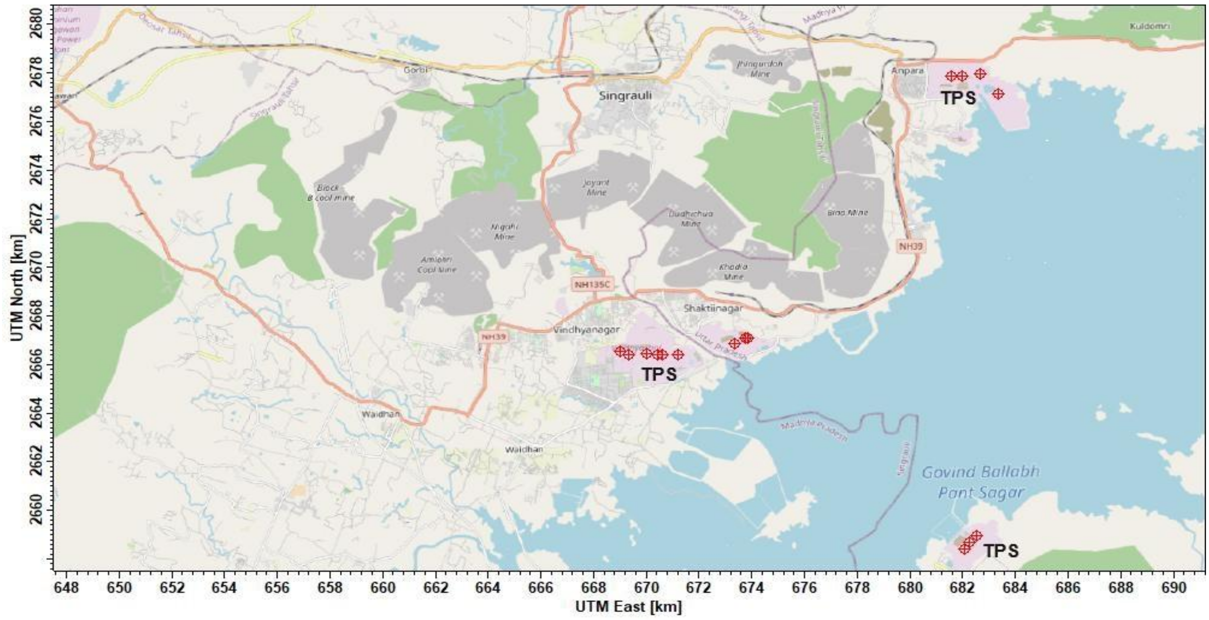


Fig. 5.6: Street map of coal mine and TPS in Singrauli area.

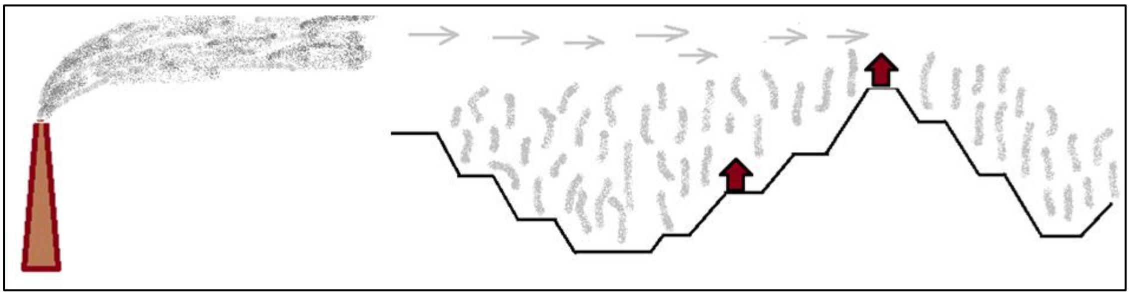


Fig. 5.7: Schematic diagram of TPS emission over coal mine top in Singrauli area.

PM sampled at ground level were also analysed for its chemical species, and it was found that ions were relatively low at ground level PM compared to that at the top of mine. Signatures of coal particles and diesel vehicle emissions were found at ground-level PM samples. The comparison of ground level and mine top PM chemical speciation indicates that a part of SO_2 is converted to particulate sulphate in the atmosphere at higher elevations along the plume path and gets dispersed. The impact can be observed at ground level but in very low concentrations due to dilution.

5.4.3 Sulphur in ambient air particulate matter – Data at National level

Ambient air particulate matter collected over PTFE under different projects in the last three years analysed in ED-XRF is discussed in this section. **Fig. 5.8** shows the box plot of elemental sulphur in the PTFE filter for a three-year study period. The data includes PM collected in Indian cities (5792 PTFE samples) and the Middle East (611 PTFE samples) to provide an unbiased view. For Indian samples, the outlier value of elemental sulphur was below 20 $\mu g/m^3$. After removing the outliers, the highest level is 8 $\mu g/m^3$. The sulphur content of about 611 PM samples collected in the Middle-east countries shows the highest (excluding outlier) value of 16 μg/m^3. The study site in the Middle-Eastern country has a large number of gas-based refineries fitted with flue gas desulphurization (FGD).

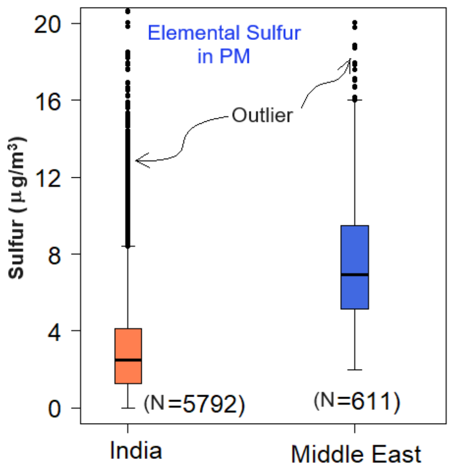
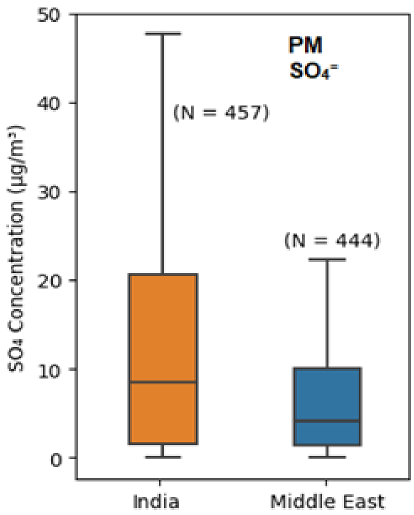


Fig. 5.8: Elemental sulphur in PM collected over PTFE filter during 2021-23.

5.4.4 Sulphate content of PM in Indian studies

In order to extend the scientific discussion on forms of atmospheric sulphur, the obvious question is, "Is there any study which has documented the presence of sulphate ion in particulate matter surrounding coal-based thermal power stations"? If so, "what is the extent of sulphate content in ambient air PM"? Analysis of sulphate in PM collected from different field samples in India and Middle East countries is shown in **Fig. 5.9**.



S ----> $SO4^{=}$
32 96

Fig. 5.9: Sulphate content in PM collected over PTFE filters under different studies.

This data consists of ambient air PM collected on PTFE over different cities, urban centres, mining areas, thermal power plants, etc., in the last three years. It can be seen that up to third quartile sulphate ($SO_4^{=}$) in ambient air PM samples is below 20 μg/m^3. Based on this information, if a flue gas desulfurization technique is installed to reduce sulphur emission from the thermal power stations, it will reduce a part of it, and the overall reduction in ambient air PM will be at the most 20 μg/m^3.

Referring to **Fig. 5.8**, the maximum sulphur content in Indian atmospheric PM is 8 $\mu g/m^3$ for a sample size of 5792. Considering the mass balance, the sulphate content should be three times the sulphur content, i.e. about 24 $\mu g/m^3$.

5.5 Review of Reports on FGD

There are several published reports on the air quality of Indian cities and industrial areas having large size TPS. These reports provide opinions on the need for FGD in those power plants but lacks scientific justification or data analysis on ambient air SO_2 levels. A few of those available reports are discussed in this section.

5.5.1 Air quality around Chandrapur Super Thermal Power Station

An independent research organisation, the Centre for Research on Energy and Clean Air (CREA), established in December 2019 in Helsinki, published a report on the health impacts of Chandrapur Super Thermal Power Station (CSTPS), Maharashtra. One of the key suggestion / opinion / finding of the report is that installation of Flue Gas Desulphurisation (FGD) will reduce SO_2 by 63-92%. Installation of FGD will also be able to reduce Mercury (Hg) emissions by 33%. A similar report is prepared for the states of West Bengal and Tamil Nadu and recommends the same suggestion of installation of FGD for SO_2 emission control.

These recommendations in the report do not appear to be driven by any factual field data analysis. Ambient air SO_2 levels of Chandrapur city is not discussed in such report to warrant installation of FGD. Such reports presents simulation of SO_2 emission with and without FGD using CalPuff Model. The simulation result shows that without FGD, the ground-level concentration of SO_2 will be relatively low. It needs to be worth mentioning that any mathematical simulation of ambient air quality with varying emission rates under similar meteorological condition would always show higher GLC for higher emission rate and vice-versa. Considering the non-conservative nature of gaseous SO_2 that too at very low emission rate, the impact can better be assessed by actual field measurement of ambient SO_2.

For the sake of probing into the Chandrapur city air quality, CAAQMS data for the Chandrapur Khutala area, MIDC is analysed and is presented in Annexure 'B2 - 40'. It can be seen that even the daily maximum value of SO_2 in four years' time (2019 - 22) did not exceed 40 $\mu g/m^3$. The mean of four years daily average value remains below 15 $\mu g/m^3$, which is much below the stipulated regulatory limit for SO_2 (80 $\mu g/m^3$). This clearly indicates that SO_2 emission from the stack top of Chandrapur STPS does not impact ground-level SO_2.

Such report on Chandrapur STPS gives monthly moving average $PM_{2.5}$ and PM_{10} from 2017 to 2021. The variation of ambient air quality is attributed to seasonal variation of micro-meteorology. Variation in meteorology can be better explained by variation of atmospheric mixing height and atmospheric ventilation of the region. For Chandrapur city, hourly mixing height and wind speed for one year is determined using weather research forecast (WRF) model. Atmospheric ventilation is determined by multiplying mixing height (m) with corresponding wind speed (m/s) of that hour. The monthly variation of ventilation is sufficient to correlate with air quality. **Fig. 5.10** shows the monthly variation of mixing height and ventilation of Chandrapur city.

The variation of ventilation and mixing height should corresponds to the variation of air quality parameters if meteorological conditions are the influencing factor. **Fig. 5.11** and **5.12** shows the monthly variation of PM_{10}, $PM_{2.5}$, SO_2 and NO_2. It can be seen for all the pollutants, monthly variation corresponds to the mixing height and ventilation. During May to September (summer and rain), the air pollution levels lowers due to higher dilution and washout by rain.

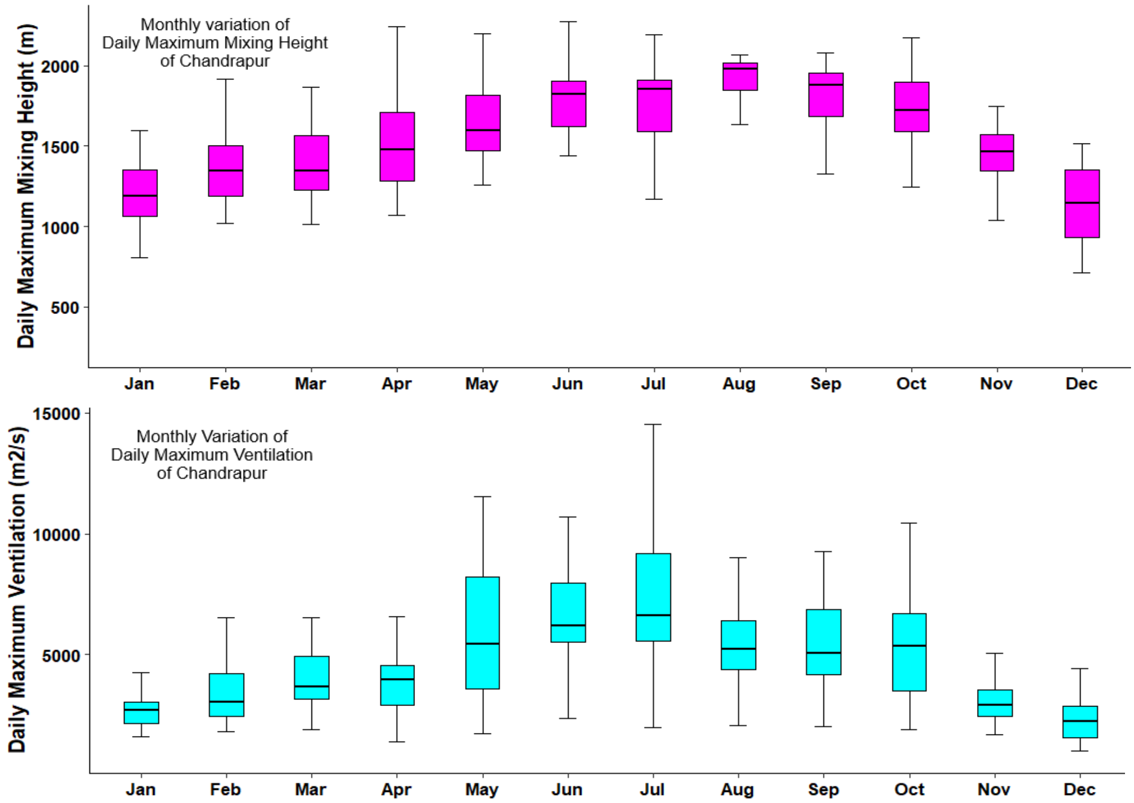


Fig. 5.10: Monthly variation of daily maximum mixing height & ventilation at Chandrapur.

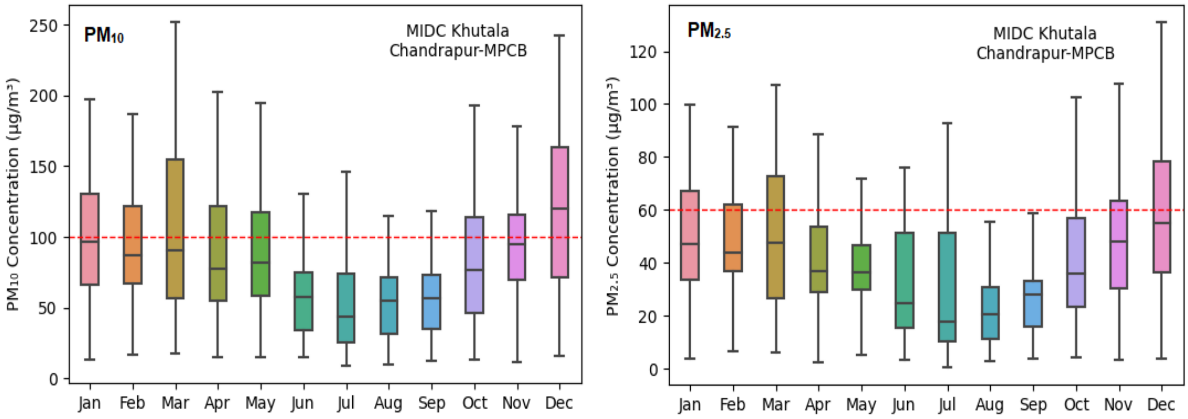


Fig. 5.11: Box plot of monthly variation of daily average PM_{10} and $PM_{2.5}$ at Chandrapur (2019 – 2022).

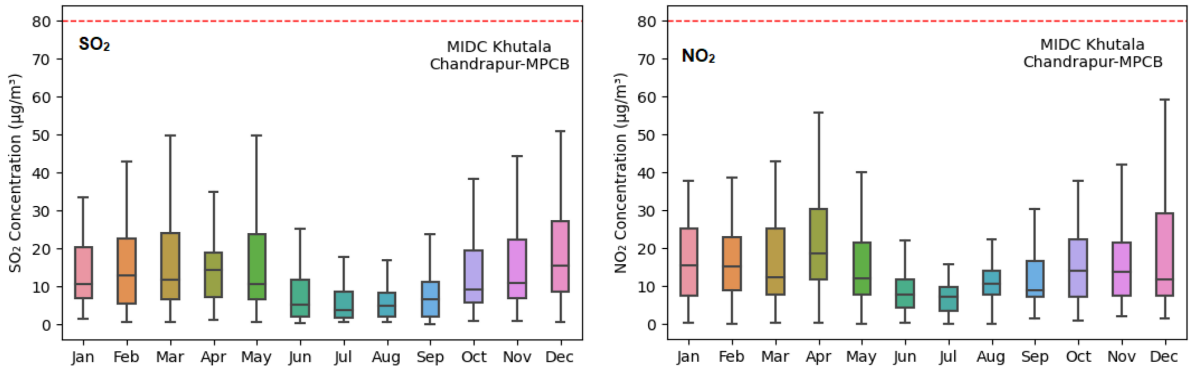


Fig. 5.12: Box plot of monthly variation of daily average SO_2 and NO_2 at Chandrapur (2019 – 2022).

Such report "on Chandrapur STPS" also suggests the need for mercury control in thermal power stations. Analysis of 5794 PTFE filters of ambient air particulate matter and 612 of the Middle East shows that in India, only a few samples show the presence of mercury, which are outliers for the given number of data. The box plot of mercury in the particulate form is presented in **Fig. 5.13**. It can be seen that, barring some outliers, mercury is absent in the atmosphere. Presently, TPS have installed analysers in the chimney of TPS for mercury monitoring. The relevant question is whether the recommendation for the installation of a mercury monitor came after some scientific study showing the presence of Mercury in the atmosphere or is it an arbitrary decision similar to the reduction of SO_2 emission.

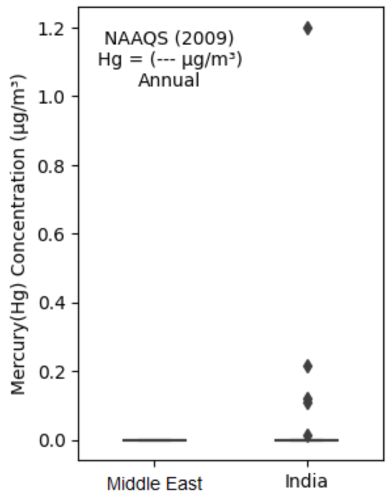


Fig. 5.13: Box plot of Mercury content in particulate matter collected over PTFE.

5.5.2 Report on air quality of Tamil Nadu

According to the **Emission Watch - Tamil Nadu 2021** report on the air quality of Tamil Nadu concludes that due to the high emission rate of SO_2 leading to poor air quality, it is necessary to install FGD and mercury monitoring and control systems. Following are some excerpts of the report:

a) A report describes the power stations of Neyveli, Chennai, Tuticorin and Mettur. Among these four major coal-burning clusters in Tamil Nadu, Neyveli and Chennai rank among the top 50 SO_2 hotspots globally in 2019.
b) There are discrepancies in the power plant emissions data (OCEMS) collected through RTI and the data provided on the PCB website (the RTI information was obtained for three months - April, May and June 2021). The data procured through RTI shows unusually low values for SO_2 emissions in absence of any control methods for few units.
c) The reactive gases such as SO_2 and NOx react with other gases and materials, and turn into secondary particles to form a major portion of particulate matter ($PM_{2.5}$), which is a globally known health hazard.

Analysis of CAAQMS data of Tamil Nadu- It is observed that Sona College Salem (Pl. refer Annexure B2 - 53), is the only station in Tamil Nadu, where ambient air SO_2 levels exceeds the regulatory limit value of 80 $\mu g/m^3$ for a very short duration. Remaining all stations show very low values of SO_2, thereby contradicting the conclusions given in such report.

Annexure A2 - 36 of this report provides the OCEMS data of SO_2 from different power stations in Tamil Nadu. It can be seen that TPS of less than 500 MW have relatively lower SO_2 emission rates. However, only two TPS of 500 MW commissioned in 2019 and 2021 show very high levels of SO_2 emission, around 2000 mg/Nm^3. There is no correlation between the SO_2 level of Sona College, Salem, and emission from New Neyveli Lignite TPS, which thereby contradicts the findings (b) of such reports.

5.6 Lime consumption and Gypsum disposal in FGD

Operation of FGD requires limestone as raw material, water for making slurry preparation, auxiliary power for pump operation etc. After the completion of the chemical reaction of lime water with SO_2, the product is gypsum, which needs to be disposed of by its supply to the cement plant. Most of the reports are restricted to the need of FGD to reduce SO_2 emission and do not discuss the cost involved in the disposal of gypsum generated in FGD. The overall FGD cost should also include the quantification of solid gypsum generated and its disposal mechanism. The carbon footprint left by the mining of limestone, its transportation, and associated water consumption should also be considered in decision-making.

As per the notification of MoEF&CC, fly ash needs to be procured by the cement plant and used as admixture up to 35%. If there is no cement plant in the vicinity of TPS, the cost of transportation of fly ash to distant cement is to be borne by the TPS and sometimes, the cost to accept the fly ash in the cement plant.

Cement manufacturing uses 2.5% gypsum, 61.5% clinker and 35% fly ash for producing finished cement. Gypsum generated in TPS can be used in cement plants. While FGD installation is promoted for the reduction of SO_2 emission and reduction of ambient air SO_2 levels, the commercial benefit of selling gypsum generated from FGD to cement plants is also promoted. A point that needs to be noted is that cement plants are private entities which aim for profit maximization. In this process, cement plants may buy fly ash and gypsum from TPS at the lowest rate. If the cement plant is far away, the TPS may have to pay for the transportation and assimilation of gypsum in the cement plant.

Most of the major cement plants use gypsum from two major sources. Mineral gypsum is obtained from mining activity, and industrial gypsum is obtained from different industries. Gypsum generated in FGD falls under industrial gypsum, which has a purity above 50%. The gypsum generated from TPS needs to be analysed for its purity and needs to be documented for record and future reference. In India, Bikaner mines are the source of Gypsum and have a purity of 50%. Mineral gypsum is imported from Oman and Iran and has a purity of 90%. Gypsum of any purity can be used by adjusting it with imported gypsum to meet the requirements of the cement industry.

Currently, imported gypsum from Oman costs Rs. 2500/- per ton at Mumbai port. After the addition of transportation charges, the cost at the cement plant gate reaches Rs. 3600/- per metric ton. Cost-benefit analysis of overall FGD should include the comparison of imported gypsum and industrial gypsum, including its transportation. The final electricity tariff should be determined by considering all such costs for a remote TPP, for which the source of Lime and disposal at the Cement plant is far away.

pH of Limewater

During the file study of TPP having FGD in operation, the data on the pH of limewater was discussed. It was learnt that the pH of limewater is around 8.5 when fresh, and it reaches 5.4 after one cycle of SO_2 removal. Is there any record of the pH of fresh and exhausted limewater for FGD operation? This data needs to be generated and analysed for each batch of limewater so that the effectiveness of the reaction and a standard operating procedure (SOP) can be developed and applied for all TPP in India. Currently, we are relying on the SOP developed by technologists of other countries. An ardent need is to apply the same in a few TPPs and maintain a record or future reference.

5.7 Rationale behind reduced stack height for TPS with FGD?

While going through different TPS having FGD, it is observed that new stacks of relatively shorter height are constructed with acid resistant cladding. A few issues are raised in this:

(i) How the new stack height was determined? Was there any source dispersion modelling exercise with the use of WRF generated gridded meteorology data carried out to arrive at a new stack height with revised emission load due to the implementation of FGD? The newly proposed stack is of lower height (150 m) than the previously designed 275 m stack for 500 MW and above. The temperature of flue gas emission with FGD will be relatively lower, thereby reducing the effective stack height ($H = h + \Delta h$) owing to lesser thermal buoyancy. There do not seem to be any margin of safety in case the ESP and / or FGD fails.

In case of failure of FGD / ESP, the entire dust load will be emitted at a relatively much lower elevation and may cause havoc in the vicinity of TPS. The time required for a thermal power plant to shut down is relatively longer compared to hydro-electrical power plants.

To understand the impact of SO_2 on ambient air if the FGD fails for some time, a simulation exercise is carried out. State-of-the-art CalPuff model is used in a meteorological domain of 48 km x 48 km, with sub-grid resolution of 4 km x 4 km. Two scenario is considered, one with stack height of 275 m and other with 150 m for a 600 MW TPP. GLC of SO_2 due to two scenarios is shown in **Fig. 5.14**. It can be seen that if the stack height is small (150 m), a large area will be under a non-compliance zone with a higher GLC of SO_2. Thus, the decision to reduce the stack height due to the installation of FGD needs reconsideration.

(ii) A new shorter stack (150 m) is constructed with acid-resistant cladding in the flue gas line along with FGD. In the absence of FGD, about 1250 mg/Nm3 of SO_2 passes through the stack, and there is no apprehension of corrosion of the metallic flue line. After the installation of FGD, the emission of SO_2 reduces to 200 mg/Nm^3, which is apparently wet due to FGD. Does such a relatively small amount of SO_2 (200 mg/Nm^3), cause corrosion of metallic flue-gas line? If so, what is the time (years) for the flue line to get corroded?

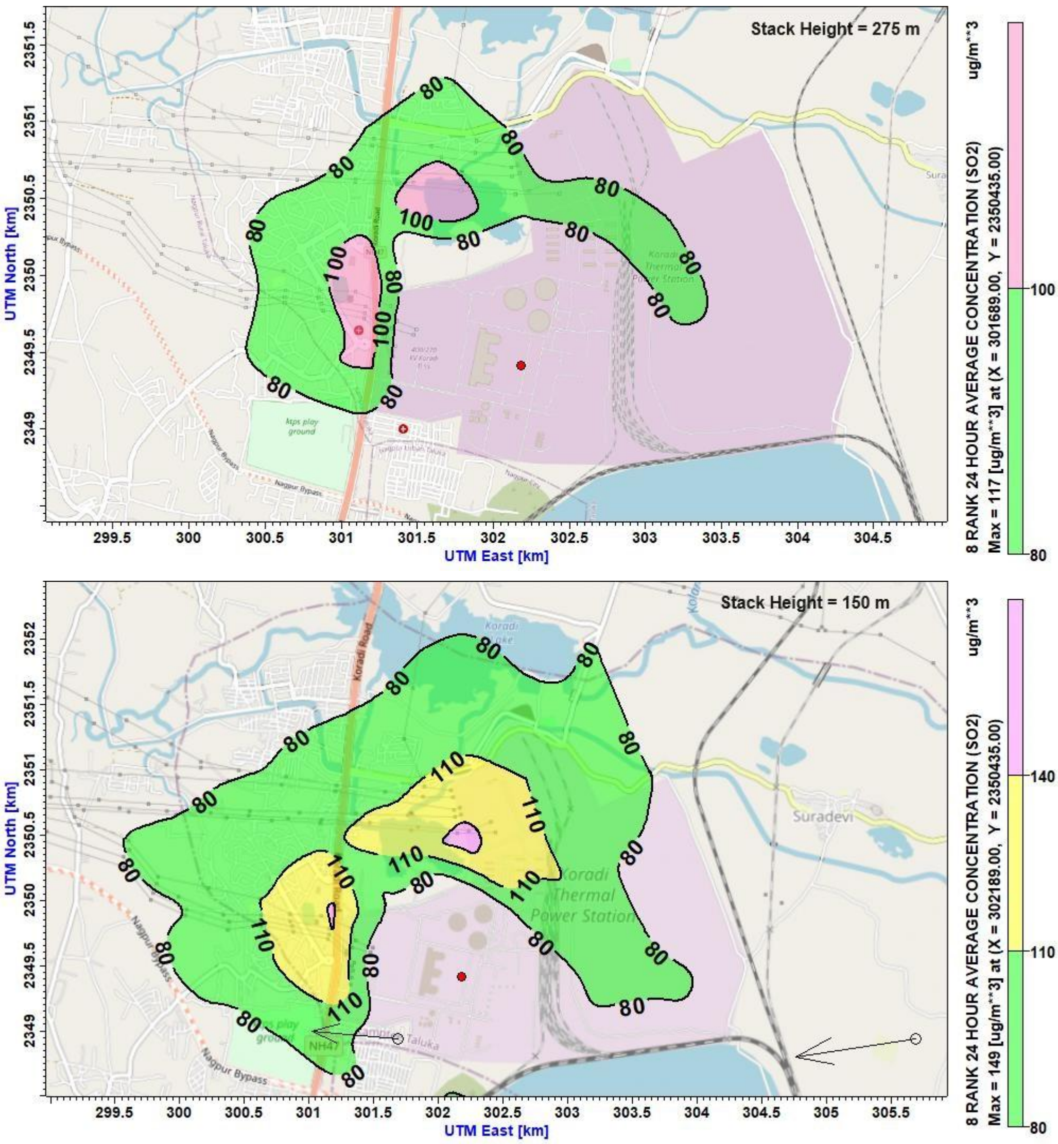


Fig. 5.14: Isopleth of GLC of SO_2 for stack height of 275 m and 150 m.

5.8 CO_2 Emission due to FGD operation

Since the chemical reaction between SO_2 and lime water leads to the emission of CO_2, a study is required to understand the extent of CO_2 emission. The CO_2 emission needs to be estimated under scope 1, 2 and 3. This includes the distance between the source of Limestone, TPS, & cement plant and the mode of transport of limestone and gypsum, i.e. by road or rail. Since these distances are variable for different TPS locations in India, a case study of one plant at Jharsuguda is considered for analysis.

The feasibility of FGD in thermal power stations can be analysed using the assessment of CO_2 emission during the life cycle of the raw material of FGD. CO_2 is emitted during limestone mining, its transportation by road, operation of FGD, chemical reaction of lime with SO_2 and gypsum formation, followed by transportation of wet gypsum to cement plant. All these CO_2 emissions are covered under Scope 1, 2 and 3 emissions for estimating GHG release.

1.	**Limestone requirement in Vedanta Ltd., Jharsuguda.**	
1.1	Limestone requirement/hour for unit MW of 135 MW capacity (MT)	2
1.2	Limestone requirement/hour for unit MW of 600 MW capacity (MT)	5
1.3	Limestone requirement for CPP of 135 MW x 9 per day (MT)	432
1.4	Limestone requirement for TPP of 600 MW x 4 per day (MT)	480
Total Limestone requirement per day at Vedanta Ltd. Jharsuguda. (MT)		**912**

2.	**CO_2 Emission due to limestone mining**	
2.1	CO_2 emission per ton of limestone mining (kg CO_2 / T $CaCO_3$)	3.0
Total CO_2 Emission per day for Vedanta Ltd. in limestone mining (MT)		**3**

3.	**Estimate of CO_2 emission in limestone transportation by Road**	
3.1	Average Distance for Limestone transportation (km)	1200
3.2	Average load carried by vehicle (MT)	30
3.3	Number of truck trips per day	30
3.4	Total distance covered by all trucks per day (km)	36480
3.5	Distance covered per Liter of Diesel (km)	3.29
3.6	Total Diesel Consumption per day (L)	11088.15
3.7	Emission factor (kg CO_2 / Litre)	2.64
Total CO_2 Emission in transporting Limestone by Road per day (MT)		**29**
4.	**Estimate of CO_2 emission in limestone transportation by Rail.**	
4.1	CO_2 emission if transported by Rail (kg CO_2/t-km)	0.00996
Total CO_2 emission per day for transporting lime by rail (MT)		**11**

Theoretically, SO_2 emission can be reduced by installing the FGD as per the following chemical reaction:

$$Limestone: CaCO_3\,(s) + SO_2\,(g) \rightarrow CaSO_3\,(s) + CO_2\,(g)$$
$$Lime: \quad Ca(OH)_2\,(s) + SO_2\,(g) \rightarrow CaSO_3\,(s) + H_2O(l)$$
$$CaSO_3\,(s) + \tfrac{1}{2}O_2\,(g) + 2H_2O(l) \rightarrow CaSO_4 \cdot 2H_2O(s)$$

- One mole CO_2 is being generated by absorption of one mole of SO_2 in all desulphurization process.

An additional 0.5% CO_2 will be produced to neutralize SO_2. The coal consumption is also expected to increase up to 1 % (due to APC) depending on the FGD.

- technology and Green House Gas (CO_2) will be released additionally due to increased coal consumption.
- 64 grams of SO_2 will generate 44 grams of CO_2.
- 1 MT $CaCO_3$ will generate 0.44 MT of CO_2.
- 1 MT $CaCO_3$ will generate 1.36 MT of Gypsum.
- Wet Gypsum at TPP with surface moisture would be approximately 1.5 T per Ton of Limestone.

CO_2 generated in converting **346320 MT** of limestone to Limewater per day at Vedanta Ltd. Jharsuguda (MT)	401

Estimate of CO_2 emission in Gypsum transportation by Road to Cement Plant	
Gypsum Generated per day at Vedanta Ltd. Jharsuguda (MT)	1240
Average Distance for Gypsum transportation (km)	200
Average load carried by vehicle (MT)	30
Number of truck trips per day	41
Total distance covered by all trucks per day (km)	8268.8
Distance covered per Litre of Diesel (km)	3.29
Total Diesel Consumption per day (L)	2513
Emission factor (kg CO_2 /litre)	2.64
CO_2 Emission in transporting Limestone by Road per day (MT) for Vedanta Ltd. Jharsuguda.	**7**

Overall CO_2 emitted per day (in MT) at Vedanta Ltd. Jharsuguda per day due to addition of FGD would be sum of:	
Mining of limestone	3
Transportation of limestone by Rail	11
Chemical reaction in gypsum formation	401
Transportation of Gypsum to Cement Plant	7
Total CO_2 emission due to addition of FGD (MT) per day.	**422**

5.8.1 CO_2 emission due to mining and transportation

In the CO_2 emission estimate, limestone is considered to be available in mines near central Madhya Pradesh, Katni, which is the closest mine.

Scenario 1: Limestone transport by Road.

Table 5.1: CO_2 emission if Limestone is transported by Road.

No.	CO_2 Emission (TPD)	TPD	%
1	Mining of limestone	3	0.004
2	Transportation of limestone 100% by Road	29	0.048
3	CO_2 emission due to Limewater making from Limestone	401	0.656
4	Transportation of Gypsum to Cement Plant	7	0.011
6	CO_2 emission due to Coal combustion (T/d)	60740	99.28
7	**Overall CO_2 emission due to Coal combustion and FGD (TPD)**	**61180**	**100**

Scenario 2: Limestone transport by Rail.

Table 5.2: CO_2 emission if Limestone is transported by Rail.

No.	CO_2 Emission (TPD)	TPD	%
1	Mining of limestone	3	0.004
2	Transportation of limestone 100% by Rail	11	0.018
3	CO_2 emission due to Limewater making from Limestone	401	0.648
4	Transportation of Gypsum to Cement Plant	13	0.022
5	CO_2 emission due to auxiliary power consumption for FGD operation (MT/day)	797	1.286
6	CO_2 emission due to Coal combustion (TPD)	60740	98.02
7	**Overall CO_2 emission due to Coal combustion and FGD (TPD)**	**61965**	**100**

5.8.2 CO_2 Emission due to coal combustion in power plant operation

		Unit	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23	Dec-23
CPP 135 x 9 MW	Coal Consumption	MT	549556	579921	598731	745018	737142	661292	694110	610803	653938
	Coal GCV	kcal/kg	3024	2947	2880	2727	2790	2862	2865	3004	3043
	Coal Consumption	GJ	6953101	7151056	7214628	8501247	8604426	7919249	8319884	7676469	8324591
	CO_2 Emission - from Coal Consumption	MT	634783	652856	658659	776121	785541	722988	759564	700823	759994
	LDO Consumption	MT	143	135	115	42	102	24	125	30	48
	LDO GCV	kcal/kg	10773	10865	10865	10832	10815	10796	10863	10698	10784
	LDO Consumption	GJ	6449	6128	5232	1912	4613	1082	5670	1349	2157
	CO_2 Emission from LDO Consumption	MT	454	431	368	135	325	76	399	95	152
	Total CO_2 from CPP	**MT**	635237	653287	659028	776256	785866	723064	759963	700918	760145
TPP 600 x 4 MW	Coal Consumption	MT	930776	1011937	988347	1025605	952207	1008397	1020165	988285	903475
	Coal GCV	kcal/kg	3143	3047	3086	2816	2882	2890	3020	3171	3312
	Coal Consumption	GJ	12238346	12899913	12763117	12083487	11480354	12191215	12891971	13113113	12519156
	CO_2 Emission - from Coal Consumption	MT	1117300	1177698	1165209	1103162	1048099	1112997	1176973	1197162	1142936
	LDO Consumption	MT	311	202	243	240	320	220	238	164	373
	LDO GCV	kcal/kg	10780	10732	10656	10776	10738	10782	10831	10831	10829
	LDO Consumption	GJ	14036	9056	10845	10821	14398	9944	10766	7454	16917
	CO_2 Emission from LDO Consumption	MT	988	638	763	762	1014	700	758	525	1191
	Total CO_2 from TPP	**MT**	1118288	1178335	1165972	1103924	1049113	1113697	1177730	1197686	1144127
	Overall CO_2 Emission per Month	MT	1753525	1831622	1825000	1880180	1834978	1836761	1937693	1898605	1904273
	Overall CO_2 Emission per day	**MT**	**58451**	**59085**	**60833**	**60651**	**59193**	**61225**	**62506**	**63287**	**61428**

The average CO_2 emission from Vedanata Ltd., Jharsuguda, is **60740 MT per day**.

5.8.3 Overall CO_2 Emission due to FGD and TPP

Considering rail transport as an economic transport system, the overall CO_2 emission for FGD operation and coal combustion in power plant will be as follows:

Table 5.3: CO_2 emission due to FGD and Power plant operation.

	CO_2 Emission (TPD)	**TPD**	**%**
1	CO_2 emission due to overall FGD operation (T/d)	1225	2
2	CO_2 emission due to Coal combustion (T/d)	60740	98
3	Overall CO_2 emission due to Coal combustion and FGD (TPD)	**61965**	100

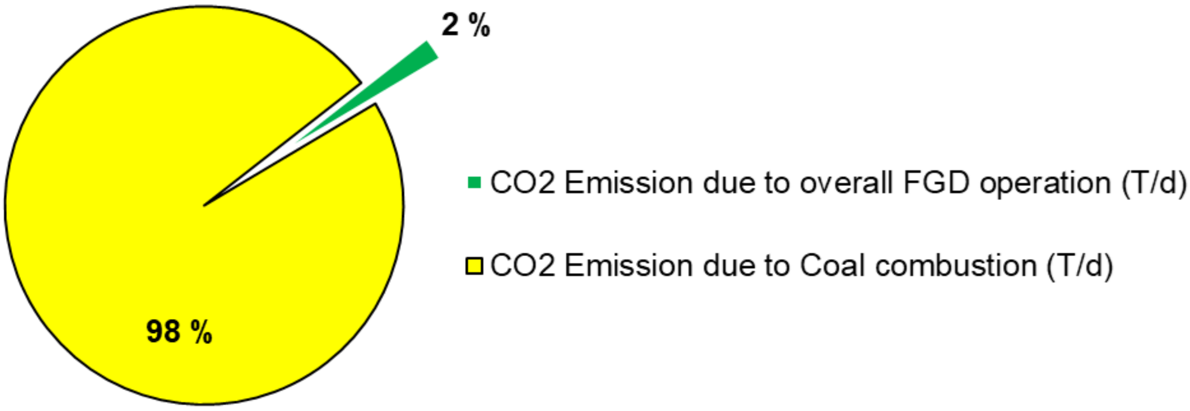


Fig. 5.15: CO_2 emission due to FGD and Power plant operation.

As shown in **Fig. 5.15**, the CO_2 emission data shows that the operation of FGD increases the CO_2 emission by an additional 1225 tons per day or 2% of the overall CO_2 emission. The relative merit of releasing SO_2 and CO_2 having different atmospheric life spans needs to be considered while considering the option of reducing SO_2 emissions arbitrarily, leading to the need for FGD. SO_2 is expected to have life span of 14 days, where-as CO_2 have life span in years leading to global warming. This can affect the net zero carbon objective by the year 2050.

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Chapter 6

Conclusion and Recommendations

6.1 Conclusion from data analysis

Under the study, online continuous emission monitoring systems and continuous ambient air quality monitoring station data were analysed. Besides this, some TPPs were also visited where FGDs are in operation. Literature related to SO_2 and FGD were also studied to arrive at any conclusion with a scientific background. The subsequent sections present the observations on particulate matter, SO_2 emission, ambient air quality, and FGD system in TPS.

6.1.1 PM Emission and concentration

The data on ambient air quality measured by continuous ambient air quality monitoring station (CAAQMS) was downloaded from the CPCB / SPCB website for 464 sites across India. Increasing ambient air PM levels are certainly a matter of concern with the increasing capacity of TPS. Therefore, there is an immediate need to control PM emissions from all sources, including TPS.

Emission data from 131 coal-based thermal power stations with 343 stacks have been analysed. As per the latest emission norms of 2015, MoEF&CC, the norms for PM is limited to 30 mg/Nm^3. For achieving this PM emission level, the ESP size needs to be increased up to 9 electric field in series. Visual observation of stack tops in different power plants over a long time shows instances when the opacity due to flue gas emission is very high, indicating that the emission norms are not always met. These instances of very high PM emission appear during the rapping of the collecting plate, though for a short duration. This appears to be a violation of PM emission load norms and how it is accommodated in the regulatory framework is not clear. While deciding the regulatory limit value of emission, the unscheduled emission during the rapping of the collecting plate and the use of furnace oil need to be given due consideration. This would require a review of emission load viz. a. viz. ESP performance.

The discussion on PM emission control is very important with reference to SO_2 emission reduction. Since the impact of SO_2 at ground level is not found to be significant enough to warrant the need for FGD, another argument proposed is the conversion of gaseous SO_2 to particulate sulphate. If the PM equivalent to transformed particulate sulphate is captured at the source itself by improved control technology, the demand for FGD will not arise.

6.1.2 SO_2 Emission

SO_2 measured from 464 CAAQMS spread across India were analysed, and it was found that out of 464 sites, only 13 sites have the highest SO_2 levels beyond the prescribed limit of 80 μg/m^3, which is 3% of the CAAQMS data. The data of these 3% stations exceed the regulatory limit of 80 μg/m^3 only in the 4th quartile. Thus, the CAAQMS data analysis does not suggest that SO_2 emission from Indian coal-based TPS is impacting the ambient air quality.

Analysis of SO_2 emission from the TPP stack (OCEMS data) indicates that most of the time, SO_2 emission exceeds the currently prevailing arbitrary emission norm of 200 - 600 mg/Nm^3. The installation of FGD will certainly reduce the load of SO_2 into the atmosphere. However, the existing ambient air data analysis does not indicate the impact of SO_2 on the surrounding air environment. However, the motivation behind setting new emission norms can be due to two reasons:

1) **Meeting the emission target:** In order to achieve the National or regional target of any pollutant emission, control at the source is required. For example, greenhouse gas emission reduction is aimed at attaining net zero by 2070. This can be achieved by reducing the emission of CO_2 from major sources like thermal power stations. However, in the case of SO_2, no such National or regional target is to be met; therefore, reducing the emission at source needs scientific reasoning.

2) **Meeting the ambient air quality norms:** Regulatory guidelines on ambient air quality require pollution levels to be below the prescribed health-based standards. In this endeavour, emission control at source is exercised to the extent that released pollutants after dispersion in the atmosphere attains ambient concentration values which are below the regulatory norm, and it does not adversely impact the environment. In the case of SO_2, the emission rate should be permitted to the level so as to restrict ambient air SO_2 below 80 μg/m^3.

Since gaseous SO_2 is not found as expected in the atmosphere, its chemical transformation to sulphate particle is another likely possibility. Therefore, the presence of elemental sulphur in ambient air PM is analysed. For this, the sulphur content of ambient air PM over the last three years is analysed. The sulphur of PM collected on the PTFE filter was analysed using ED-XRF. A total of 5792 PM samples in India spread in urban centres, coal mining areas and Thermal Power Stations (TPS) were analysed. It was found that the maximum sulphur content was 20 μg/m^3 in all these PM samples, which includes outliers. A statistical analysis consisting of the removal of outliers reveals the highest elemental sulphur content of 8 μg/m^3 in particulate matter. Even if all sulphur is considered as particulate sulphate, the increase in PM load would be 24 μg/m^3 (32 S : 96 $SO_4^{=}$).

Since no study focused on measuring ambient air PM's sulphate content, the sulphate (SO4=) data measured from different sites were also compiled and found that third quartile of sulphate represents about 20 μg/m^3 for sample size of 457. Fourth quartile data ranges from 20 to 47 μg/m^3.

Since there is no air quality monitoring network in India aimed to measure the impact of the emission of TPP, there is a need to set up an additional network or add some additional parameters to the existing National Air Quality Monitoring Programme (NAMP). The additional parameters that should be included are elemental sulphur, particulate sulphate, and nitrate, which are indicators of coal burning. The PM sampler used under this new air monitoring network should collect PM on PTFE (Poly-tetra-fluoro-ethylene) Membrane Filters to measure ions and elements with higher precision.

Appropriate institutional mechanisms and infrastructural development for capacity building in regulatory agencies, TPS and ULB is the need of the hour.

6.1.4 FGD System in TPP

In TPP, where FGDs are already installed, some experiments can be carried out to understand the extent of PM and SO_2 control if only water is used for wet scrubbing. Data on the use of additional water and limestone, the varying pH of limewater, power consumption, and related CO_2 emissions are required. OCEMS data from such operations need to be stored and analysed to create the emission inventory of TPS with FGD that can be used in subsequent dispersion modelling exercises under EIA protocols. The generated data can also be used to design industrial pollution control systems in other sectors.

In TPS, having FGD installed, ideally, PM control using nine electric fields should not be required. Less number of electric field with hybrid bag filter and / or wet scrubber may be sufficient. This also requires a study of the complete pressure profile of Induced Draft and Forced Draft fan capacity so that furnace operation heat exchange can be better performed. Further, the stack height needed to meet the regulatory requirement of ground-level concentrations (GLCs) of pollutants is also to be studied using gridded meteorological data. If TPP has an older 275 m stack, it should be maintained for emergency use.

The duration of flue gas flow or the volume of gas that can evaporate a unit volume of water needs to be studied. The present FGD system uses a very thick slurry of limewater to create an umbrella of limewater above the flue gas path. Pumps are used, which consume energy if the slurry is viscous. The power consumption using water and lime slurry needs to be studied for the same or necessary amount of emission control.

From the gathered data of FGD installation, itis not yet fully established except the reduced SO_2 emission rate. In future, we may be forced to come up with proposals to reduce other pollutants like mercury (Hg) and NOx emissions, the impact of which is not yet established. Even the presence of mercury in coal is not established by any large-size coal sample analysis.

- **Impact of FGD**

Globally, carbon markets aim to incentivise those generators that are reducing their carbon footprint and penalize those who are emitting carbon. With the installation of FGD, the country may be increasing its carbon footprint with a reduction in SO_2 emission, which is not advisable as per the present ambient air quality levels. Further, it is also important to note that Sulphur dioxide (SO_2) and carbon dioxide (CO_2) have different atmospheric lifetimes. SO_2 has a short atmospheric lifetime of several hours to about 15 days, while CO_2 persists for over 100 years.

- **Increase of tariff due to FGD installation**

The current cost of FGD systems is approximately Rs. 1.40 Crore per MW. As per recent CEA data estimate, around Rs. 1,47,000 Crores capital investment will be required for the installation of the remaining 105 GW coal-based power plants. Now, it becomes imperative that the country make timely decisions so that consumers can be prevented from additional financial burdens.

- **Impact due to reduced stack height**

A study on the new shorter stack height (150 m), constructed with acid-resistant cladding in the flue gas line along with FGD. In the absence of FGD, about 1250 mg/Nm^3 of SO_2 passes through the stack, and there is no apprehension of corrosion of the metallic flue line. After the installation of FGD, the emission of SO_2 reduces to 200 mg/Nm^3, which is apparently wet due to FGD. Does such a relatively small amount of SO_2 (200 mg/Nm^3), cause corrosion of metallic flue-gas line? If so, what is the time (years) for the flue line to get corroded?

6.2 Recommendations

The analysis suggests that the ambient SO_2 concentration in all the monitoring stations (CAAQMS) is well below the prescribed norms of 80 μg/m^3. This is despite the fact that most of the TPPs have not installed FGDs. Installation of FGDs in TPPs leads to higher capital investment, increased power consumption, increased consumer tariff, and higher water and carbon footprint without environmental benefits. Thus, the above suggests the following

1. An appropriate decision may be taken by the concerned authority regarding the installation of FGDs in TPPs considering that the ambient SO_2 concentration is well below the prescribed limit.

2. A study on the use of bag filters after ESP (with maintenance management) to ensure continuous PM control needs to be explored. The PM emission should be limited up to the level that covers the PM generated by conversion from gaseous SO_2 in ambient air to secondary particulate matter. If this is achieved, there will be no need for SO_2 control at the source.

3. The observation of the opacity of flue gas at the stack top does not suggest controlled emission of PM, and therefore, there is a need for the development of artificial intelligence / machine learning (AI/ML) tools on the visual image (observation) of the opacity of flue gas at the stack top and its correlation with OCEMS data. This will help develop the emission measurement system based on the opacity of flue gas. Visual Emission Observation (VEO) was already practised in developed countries (USA), where opacity inspectors regularly record and report the emission at a particular time of the day. With current progress in AI/ML technology, India can use it for emission regulation.

4. There is a need to revisit the stack emission norms for SO_2 as per the circular of MoEF&CC, 2015, with consideration of India's latitudinal position, close to the equator compared to European countries, the USA, the UK, developed countries who have given guidelines for SO_2 emission control. India has higher and stronger solar insolation, leading to high ground-level heating, vertical convection, high mixing height, high ventilation, etc.

ANNEXURE(S)

Annexure - A1

State	City	Organization	TPS ID	TPS Name	Combustion Technology	Commissioning Year	FGD Status
Andhra Pradesh	Simhadri	NTPC	3672	C_A_500_Simhadri_2002	Sub-Critical	2002	Bid Awarded
Andhra Pradesh	Simhadri	NTPC	3672	C_A_500_Simhadri_2011	Sub-Critical	2011	Bid Awarded
Andhra Pradesh	Simhadri	NTPC	3672	C_A_500_Simhadri_2012	Sub-Critical	2012	Bid Awarded
Andhra Pradesh	Vijayawada	APGENCO	4317	S_A_210_Tata Rao_1994	Sub-Critical	1994	Feasibility Study Started
Andhra Pradesh	Vijayawada	APGENCO	4317	S_A_210_Tata Rao_1989	Sub-Critical	1989	Feasibility Study Started
Andhra Pradesh	Vijayawada	APGENCO	4317	S_A_210_Tata Rao_1979	Sub-Critical	1979	Feasibility Study Started
Andhra Pradesh	Vijayawada	APGENCO	4317	S_A_500_Tata Rao_2009	Sub-Critical	2009	Feasibility Study Started
Andhra Pradesh	Visakhapatnam	HNPC	5874	P_A_520_Vizag_2015	Sub-Critical	2015	Feasibility Study Completed
Andhra Pradesh	Visakhapatnam	HNPC	5874	P_A_520_Vizag_2016	Sub-Critical	2016	Feasibility Study Completed
Andhra Pradesh	Kadapa	APGENCO	4084	S_C_210_Rayalaseema_1994	Sub-Critical	1994	Feasibility Study Completed
Andhra Pradesh	Kadapa	APGENCO	4084	S_C_210_Rayalaseema_2010	Sub-Critical	2010	Feasibility Study Completed
Andhra Pradesh	Kadapa	APGENCO	4084	S_C_210_Rayalaseema_2007	Sub-Critical	2007	Feasibility Study Completed
Andhra Pradesh	Nellore	SEIL	5509	P_C_660_SGPL_2016	Super-Critical	2016	Bid Opened
Andhra Pradesh	Nellore	SEIL	5509	P_C_660_SGPL_2017	Super-Critical	2017	Bid Opened
Assam	Kumguri	NTPC	5875	C_C_250_Bongaigaon_2015	Sub-Critical	2015	Bid Awarded
Assam	Kumguri	NTPC	5875	C_C_250_Bongaigaon_2017	Sub-Critical	2017	Bid Awarded
Bihar	Barh	NTPC	3194	C_C_660_Barh_2014	Super-Critical	2014	Bid Awarded
Bihar	Barh	NTPC	3194	C_C_660_Barh_2015	Super-Critical	2015	Bid Awarded
Bihar	Nabi Nagar	NTPC	7825	C_C_660_Nabi Nagar_2019	Super-Critical	2019	Bid Awarded
Bihar	Barauni	NTPC	5980	C_C_110_Barauni_1983	Sub-Critical	1983	To Be Decommissioned
Bihar	Barauni	NTPC	5980	C_C_110_Barauni_1985	Sub-Critical	1985	To Be Decommissioned
Bihar	Kanti	NTPC	5903	C_B_110_Muzaffarpur Kanti_1985	Sub-Critical	1985	NIT Issued
Bihar	Kanti	NTPC	5903	C_B_195_Muzaffarpur Kanti_2015	Sub-Critical	2015	NIT Issued
Bihar	Kanti	NTPC	5903	C_B_195_Muzaffarpur Kanti_2017	Sub-Critical	2017	NIT Issued
Chhattisgarh	Korba	NTPC	3269	C_B_500_Korba_1987	Sub-Critical	1987	NIT Issued
Chhattisgarh	Korba	NTPC	3269	C_B_500_Korba_1988	Sub-Critical	1988	NIT Issued
Chhattisgarh	Korba	NTPC	3269	C_B_200_Korba_1983	Sub-Critical	1983	Bid Awarded
Chhattisgarh	Korba	NTPC	3269	C_B_200_Korba_1984	Sub-Critical	1984	Bid Awarded
Chhattisgarh	Korba	NTPC	3269	C_B_500_Korba_1989	Sub-Critical	1989	NIT Issued
Chhattisgarh	Korba	NTPC	3269	C_B_500_Korba_2010	Sub-Critical	2010	NIT Issued
Chhattisgarh	Bhilai	NSPCL	3951	C_B_14_Bhilai_1982	Sub-Critical	1982	Bid Awarded
Chhattisgarh	Bhilai	NSPCL	3951	C_B_250_Bhilai_2009	Sub-Critical	2009	Bid Awarded
Chhattisgarh	Bhilai	NSPCL	3951	C_B_30_Bhilai_1982	Sub-Critical	1982	Bid Awarded
Chhattisgarh	Bhilai	NSPCL	3951	C_B_30_Bhilai_1983	Sub-Critical	1983	Bid Awarded
Chhattisgarh	Bhilai	NSPCL	3951	C_B_250_Bhilai_1982	Sub-Critical	1982	Bid Awarded
Chhattisgarh	Raikheda	APL	4691	P_B_685_Raikheda_2016	Super-Critical	2016	Feasibility Study Not Started
Chhattisgarh	Raikheda	APL	4691	P_B_685_Raikheda_2015	Super-Critical	2015	Feasibility Study Not Started
Chhattisgarh	Korba	CSPGCL	5589	S_B_250_Dr Shyama_2008	Sub-Critical	2008	NIT Issued
Chhattisgarh	Korba	CSPGCL	5589	S_B_250_Dr Shyama_2007	Sub-Critical	2007	NIT Issued
Chhattisgarh	Pathadi	LANCO	441	P_C_300_Pathadi_2010	Sub-Critical	2010	Tender Specification Made
Chhattisgarh	Pathadi	LANCO	441	P_C_300_Pathadi_2009	Sub-Critical	2009	Tender Specification Made
Chhattisgarh	Akaltara	WPCL	1706	P_C_600_Akaltara_2013	Super-Critical	2013	Feasibility Study Not Started

Chhattisgarh	Tamnar	JPL	1734	P_C_250_Tamnar_2007	Sub-Critical	2007	Bid Opened
Chhattisgarh	Tamnar	JPL	1734	P_C_600_Tamnar_2014	Sub-Critical	2014	Bid Opened
Chhattisgarh	Tamnar	JPL	1734	P_C_600_Tamnar_2015	Sub-Critical	2015	Bid Opened
Chhattisgarh	Baradarha	DBPCL	2088	P_C_600_Baradarha_2014	Sub-Critical	2014	Bid Awarded
Chhattisgarh	Baradarha	DBPCL	2088	P_C_600_Baradarha_2015	Sub-Critical	2015	Bid Awarded
Chhattisgarh	Sipat	NTPC	3673	C_C_500_Sipat_2007	Sub-Critical	2007	Bid Awarded
Chhattisgarh	Sipat	NTPC	3673	C_C_500_Sipat_2008	Sub-Critical	2008	Bid Awarded
Chhattisgarh	Sipat	NTPC	3673	C_C_660_Sipat_2011	Super-Critical	2011	Bid Awarded
Chhattisgarh	Sipat	NTPC	3673	C_C_660_Sipat_2012	Super-Critical	2012	Bid Awarded
Chhattisgarh	BANDAKHAR	MCCPL	4307	P_C_300_Bhandhakhar _2015	Sub-Critical	2015	Claims to be SO2 compliant
Chhattisgarh	Ratija	SCPL	4313	P_C_50_Ratija_2013	Sub-Critical	2013	CFBC
Chhattisgarh	Ratija	SCPL	4313	P_C_50_Ratija_2016	Sub-Critical	2016	CFBC
Chhattisgarh	Chakabura	ACB	4664	P_C_30_Chakabura_2007	Sub-Critical	2007	CFBC
Chhattisgarh	Chakabura	ACB	4664	P_C_30_Chakabura_2014	Sub-Critical	2014	CFBC
Chhattisgarh	Marwa	CSPGCL	4716	S_C_500_Marwa_2016	Sub-Critical	2016	NIT Issued
Chhattisgarh	Marwa	CSPGCL	4716	S_C_500_Marwa_2014	Sub-Critical	2014	NIT Issued
Chhattisgarh	Nawapara	TRNE	5342	P_C_300_Nawapara_2016	Sub-Critical	2016	Claims to be SO2 compliant
Chhattisgarh	Nawapara	TRNE	5342	P_C_300_Nawapara_2017	Sub-Critical	2017	Claims to be SO2 compliant
Chhattisgarh	Uchpinda	RKMPPL	6317	P_C_360_Uchpinda_2017	Sub-Critical	2017	Feasibility Study Not Started
Chhattisgarh	Uchpinda	RKMPPL	6317	P_C_360_Uchpinda_2019	Sub-Critical	2019	Feasibility Study Not Started
Chhattisgarh	Uchpinda	RKMPPL	6317	P_C_360_Uchpinda_2016	Sub-Critical	2016	Feasibility Study Not Started
Chhattisgarh	Uchpinda	RKMPPL	6317	P_C_360_Uchpinda_2015	Sub-Critical	2015	Feasibility Study Not Started
Chhattisgarh	Lara	NTPC	7790	C_C_800_Lara_2018	Super-Critical	2018	Bid Awarded
Gujarat	Sabarmati	TOR. POW.	5526	P_A_110_Sabarmati_1985	Sub-Critical	1985	Bid Opened
Gujarat	Sabarmati	TOR. POW.	5526	P_A_110_Sabarmati_1988	Sub-Critical	1988	Bid Opened
Gujarat	Sabarmati	TOR. POW.	5526	P_A_125_Sabarmati_2003	Sub-Critical	2003	Bid Opened
Gujarat	Wanakbori	GSECL	241	S_C_210_Wankabori_1983	Sub-Critical	1983	NIT Issued
Gujarat	Wanakbori	GSECL	241	S_C_210_Wankabori_1986	Sub-Critical	1986	NIT Issued
Gujarat	Wanakbori	GSECL	241	S_C_210_Wankabori_1982	Sub-Critical	1982	NIT Issued
Gujarat	Wanakbori	GSECL	241	S_C_210_Wankabori_1998	Sub-Critical	1998	NIT Issued
Gujarat	Wanakbori	GSECL	241	S_C_210_Wankabori_1984	Sub-Critical	1984	NIT Issued
Gujarat	Wanakbori	GSECL	241	S_C_210_Wankabori_1987	Sub-Critical	1987	NIT Issued
Gujarat	Nani Chher	GMDCL	859	S_C_125_Akrimota_2007	Sub-Critical	2007	CFBC
Gujarat	Nani Chher	GMDCL	859	S_C_125_Akrimota_2006	Sub-Critical	2006	CFBC
Gujarat	Dahej SEZ Area		2145	S_C__Gandhi Nagar (I)_	Sub-Critical		Cancelled
Gujarat	Khanot	GSECL	4205	S_C_75_Kutch LIG_2009	Sub-Critical	2009	
Gujarat	Khanot	GSECL	4205	S_C_75_Kutch LIG_1997	Sub-Critical	1997	
Gujarat	Khanot	GSECL	4205	S_C_70_Kutch LIG_1991	Sub-Critical	1991	Retired
Gujarat	Khanot	GSECL	4205	S_C_70_Kutch LIG_1990	Sub-Critical	1990	Retired
Gujarat	Ukai	GSECL	4206	S_C_500_Ukai_2013	Sub-Critical	2013	NIT issued
Gujarat	Ukai	GSECL	4206	S_C_210_Ukai_1985	Sub-Critical	1985	NIT issued
Gujarat	Ukai	GSECL	4206	S_C_120_Ukai_1976	Sub-Critical	1976	NIT issued
Gujarat	Sikka	GSECL	4209	S_C_250_Sikka_2015	Sub-Critical	2015	Bid opened
Gujarat	Sector 30	GSECL	4213	S_C_210_Gandhi Nagar (II)_1998	Sub-Critical	1998	NIT issued
Gujarat	Sector 30	GSECL	4213	S_C_200_Gandhi Nagar (II)_1991	Sub-Critical	1991	NIT issued
Gujarat	Sector 30	GSECL	4213	S_C_200_Gandhi Nagar (II)_1990	Sub-Critical	1990	NIT issued
Gujarat	Tunda	CGPL	5616	P_C_660_Mundra_2012	Super-Critical	2012	Bid Awarded

Gujarat	Tunda	CGPL	5616	P_C_330_Mundra_2009	Sub-Critical	2009	Bid Awarded
Gujarat	Tunda	CGPL	5616	P_C_660_Mundra_2011	Super-Critical	2011	Bid Awarded
Gujarat	Tunda	CGPL	5616	P_C_330_Mundra_2010	Sub-Critical	2010	Bid Awarded
Gujarat	Tunda	CGPL	5616	P_C_660_Mundra_2010	Super-Critical	2010	Bid Awarded
Gujarat	Salaya	EPGL	5790	P_C_600_Salaya_2012	Sub-Critical	2012	Tender Specification Made
Gujarat	Salaya	EPGL	5790	P_C_600_Salaya_2013	Sub-Critical	2013	Tender Specification Made
Gujarat	Nani Naroli	GIPCL	5901	P_C_125_Surat LIG_1999	Sub-Critical	1999	CFBC
Gujarat	Nani Naroli	GIPCL	5901	P_C_125_Surat LIG_2010	Sub-Critical	2010	CFBC
Gujarat	Nani Naroli	GIPCL	5901	P_C_125_Surat LIG_2000	Sub-Critical	2000	CFBC
Haryana	Jhajjar	JhPL(HR)	141	P_A_660_Mahatma Gandhi_2012	Super-Critical	2012	FGD Installed
Haryana	Jhajjar	NTPC	545	C_A_500_Indira Gandhi_2012	Sub-Critical	2012	Bid Awarded
Haryana	Jhajjar	NTPC	545	C_A_500_Indira Gandhi_2010	Sub-Critical	2010	Bid Awarded
Haryana	Jhajjar	NTPC	545	C_A_500_Indira Gandhi_2011	Sub-Critical	2011	Bid Awarded
Haryana	Assan	HPGCL	3456	S_A_250_Panipat_2004	Sub-Critical	2004	Bid Awarded
Haryana	Assan	HPGCL	3456	S_A_250_Panipat_2005	Sub-Critical	2005	Bid Awarded
Haryana	Assan	HPGCL	3456	S_A_210_Panipat_2001	Sub-Critical	2001	Bid Awarded
Haryana	Assan	HPGCL	3456	S_A_210_Panipat_1989	Sub-Critical	1989	Retired
Haryana	Hisar	HPGCL	399	S_C_600_Rajiv Gandhi_2011	Sub-Critical	2011	NIT Issued
Haryana	Hisar	HPGCL	399	S_C_600_Rajiv Gandhi_2010	Sub-Critical	2010	NIT Issued
Haryana	YamunaNagar		562	S_C_300_Yamuna Nagar_2008	Sub-Critical	2008	NIT Issued
Jharkhand	Chandrapura	DVC	420	C_C_250_Chandrapura_2011	Sub-Critical	2011	Bid Opened
Jharkhand	Chandrapura	DVC	420	C_C_130_Chandrapura_1968	Sub-Critical	1968	Retired
Jharkhand	Adityapur	ADHUNIK	1236	P_C_270_Mahadev Prasad_2012	Sub-Critical	2012	Feasibility Study Completed
Jharkhand	Dombhui	MPL	1817	P_C_525_Maithon RB_2011	Sub-Critical	2011	Bid Awarded
Jharkhand	Mauza-Govindpur	DVC	5273	C_C_200_Bokaro_1993	Sub-Critical	1993	Retired
Jharkhand	Mauza-Govindpur	DVC	5273	C_C_500_Bokaro_2016	Sub-Critical	2016	Bid opened
Jharkhand	Jamshedpur	TATA PCL	5533	P_C_120_Jojobera_2000	Sub-Critical	2000	Bid Awarded
Jharkhand	Jamshedpur	TATA PCL	5533	P_C_120_Jojobera_2001	Sub-Critical	2001	Bid Awarded
Jharkhand	Jamshedpur	TATA PCL	5533	P_C_120_Jojobera_2005	Sub-Critical	2005	Bid Awarded
Jharkhand	Jamshedpur	TATA PCL	5533	P_C_120_Jojobera_2011	Sub-Critical	2011	Bid Awarded
Jharkhand	Lalpania Bokaro	TVNL	5741	S_C_210_Tenughat_1996	Sub-Critical	1996	Feasibility Study Completed
Jharkhand	Lalpania Bokaro	TVNL	5741	S_C_210_Tenughat_1997	Sub-Critical	1997	Feasibility Study Completed
Karnataka	Torangallu	JSWEL	2258	P_C_300_Torangallu_2009	Sub-Critical	2009	
Karnataka	Torangallu	JSWEL	2258	P_C_130_Torangallu_2000	Sub-Critical	2000	
Karnataka	Torangallu	JSWEL	2258	P_C_300_Torangallu_2009	Sub-Critical	2009	
Karnataka	Bellary	KPCL	4333	S_C_500_Bellary_2007	Sub-Critical	2007	Bid opened
Karnataka	Kudgi	NTPC	5714	C_C_800_Kudgi_2016	Super-Critical	2016	Bid Awarded
Karnataka	Kudgi	NTPC	5714	C_C_800_Kudgi_2017	Super-Critical	2017	Bid Awarded
Karnataka	Kudgi	NTPC	5714	C_C_800_Kudgi_2018	Super-Critical	2018	Bid Awarded
Karnataka	Raichur	KPCL	5870	S_C_210_Raichur_1999	Sub-Critical	1999	Bid Awarded
Karnataka	Raichur	KPCL	5870	S_C_210_Raichur_1985	Sub-Critical	1985	Bid Awarded
Karnataka	Raichur	KPCL	5870	S_C_210_Raichur_1994	Sub-Critical	1994	Bid Awarded
Madhya Pradesh	Siddhikhurd	SPL	1571	P_C_660_Sasan_2014	Super-Critical	2014	Bid Awarded
Madhya Pradesh	Siddhikhurd	SPL	1571	P_C_660_Sasan_2013	Super-Critical	2013	Bid Awarded
Madhya Pradesh	Siddhikhurd	SPL	1571	P_C_660_Sasan_2015	Super-Critical	2015	Bid Awarded
Madhya Pradesh	Chachai		2050	P_C_210_Anuppur (I)_2009	Sub-Critical	2009	Bid Awarded
Madhya Pradesh	Gangai	NTPC	7482	C_C_800_Gadarwara_2018	Super-Critical	2018	Bid Awarded

Madhya Pradesh	Nigari	JPPVL	2238	P_C_660_Nigri_2015	Super-Critical	2015	NIT Issued
Madhya Pradesh	Nigari	JPPVL	2238	P_C_660_Nigri_2014	Super-Critical	2014	NIT Issued
Madhya Pradesh	Vindhyanagar	NTPC	3666	C_C_500_Vindhyachal_2006	Sub-Critical	2006	Bid awarded
Madhya Pradesh	Vindhyanagar	NTPC	3666	C_C_210_Vindhyachal_1990	Sub-Critical	1990	Bid Awarded
Madhya Pradesh	Vindhyanagar	NTPC	3666	C_C_210_Vindhyachal_1991	Sub-Critical	1991	Bid Awarded
Madhya Pradesh	Vindhyanagar	NTPC	3666	C_C_500_Vindhyachal_1999	Sub-Critical	1999	Bid awarded
Madhya Pradesh	Vindhyanagar	NTPC	3666	C_C_500_Vindhyachal_2000	Sub-Critical	2000	Bid awarded
Madhya Pradesh	Vindhyanagar	NTPC	3666	C_C_210_Vindhyachal_1987	Sub-Critical	1987	Bid Awarded
Madhya Pradesh	Vindhyanagar	NTPC	3666	C_C_210_Vindhyachal_1988	Sub-Critical	1988	Bid Awarded
Madhya Pradesh	Vindhyanagar	NTPC	3666	C_C_500_Vindhyachal_2013	Sub-Critical	2013	Bid awarded
Madhya Pradesh	Vindhyanagar	NTPC	3666	C_C_500_Vindhyachal_2007	Sub-Critical	2007	Bid awarded
Madhya Pradesh	Vindhyanagar	NTPC	3666	C_C_500_Vindhyachal_2012	Sub-Critical	2012	Bid awarded
Madhya Pradesh	Bandhaura	APL	4924	P_C_600_Mahan_2012	Sub-Critical	2012	Feasibility Study Started
Madhya Pradesh	Sarni	MPPGCL	5204	S_C_250_Satpura_2013	Sub-Critical	2013	Feasibility Study Started
Madhya Pradesh	Sarni	MPPGCL	5204	S_C_210_Satpura_1983	Sub-Critical	1983	Feasibility Study Started
Madhya Pradesh	Sarni	MPPGCL	5204	S_C_210_Satpura_1984	Sub-Critical	1984	Feasibility Study Started
Madhya Pradesh	Sarni	MPPGCL	5204	S_C_200_Satpura_1979	Sub-Critical	1979	Feasibility Study Started
Madhya Pradesh	Sirchopi	JPPVL	5477	P_C_250_Bina_2013	Sub-Critical	2013	Feasibility Study Started
Madhya Pradesh	Sirchopi	JPPVL	5477	P_C_250_Bina_2012	Sub-Critical	2012	Feasibility Study Started
Madhya Pradesh	Mundi	MPPGCL	5899	S_C_600_Shri Singhaji_2014	Sub-Critical	2014	NIT Issued
Madhya Pradesh	Barela	JHAPL	5983	P_C_600_Seioni_2016	Super-Critical	2016	Feasibility Study Completed
Madhya Pradesh	Laharpur	MBPMPL	6136	P_C_600_Anuppur (II)_2016	Sub-Critical	2016	Bid awarded
Madhya Pradesh	Laharpur	MBPMPL	6136	P_C_600_Anuppur (II)_2015	Sub-Critical	2015	Bid awarded
Madhya Pradesh	Laharpur	MBPMPL	6136	P_C_600_Anuppur (II)_	Sub-Critical		Bid awarded
Maharashtra	Nagpur	MAHAGENCO	5485	S_A_210_Khaperkheda_1989	Sub-Critical	1989	Feasibility Study Completed
Maharashtra	Mumbai	TROMBAY TPS	5961	P_A_500_Trombay_1984	Sub-Critical	1984	FGD Installed
Maharashtra	Mumbai	TROMBAY TPS	5961	P_A_250_Trombay_2009	Sub-Critical	2009	FGD Installed
Maharashtra	Mumbai	TROMBAY TPS	5961	P_A_180_Trombay_1984	Sub-Critical	1984	FGD Installed
Maharashtra	Chandrapur	MAHAGENCO	2806	S_B_500_Chandrapur_2016	Sub-Critical	2016	Feasibility Study Completed
Maharashtra	Chandrapur	MAHAGENCO	2806	S_B_500_Chandrapur_2015	Sub-Critical	2015	Feasibility Study Completed
Maharashtra	Chandrapur	MAHAGENCO	2806	S_B_210_Chandrapur_1985	Sub-Critical	1985	Feasibility Study Completed
Maharashtra	Chandrapur	MAHAGENCO	2806	S_B_500_Chandrapur_1992	Sub-Critical	1992	
Maharashtra	Chandrapur	MAHAGENCO	2806	S_B_500_Chandrapur_1991	Sub-Critical	1991	
Maharashtra	Chandrapur	MAHAGENCO	2806	S_B_210_Chandrapur_1986	Sub-Critical	1986	Feasibility study completed
Maharashtra	Chandrapur	MAHAGENCO	2806	S_B_500_Chandrapur_1997	Sub-Critical	1997	
Maharashtra	Fatatewadi	NTPC	5716	C_B_660_Solapur_2017	Super-Critical	2017	Bid Awarded
Maharashtra	Fatatewadi	NTPC	5716	C_B_660_Solapur_2019	Super-Critical	2019	Bid Awarded
Maharashtra	Tirora	APL	943	P_C_660_Tirora Gondia_2013	Super-Critical	2013	Bid Awarded
Maharashtra	Tirora	APL	943	P_C_660_Tirora Gondia_2014	Super-Critical	2014	Bid Awarded
Maharashtra	Tirora	APL	943	P_C_660_Tirora Gondia_2012	Super-Critical	2012	Bid Awarded
Maharashtra	Agwan	APL	1387	P_C_250_Dahanu_1995	Sub-Critical	1995	FGD installed
Maharashtra	Mohabala	GMR ENERG	2124	P_C_300_GMR Warora_2013	Sub-Critical	2013	Bid Opened
Maharashtra	Jalgoan		3449	S_C_210_Bhusawal (I)_1982	Sub-Critical	1982	To Be Decommissioned
Maharashtra	Jalgaon	MAHAGENCO	3450	S_C_500_Bhusawal (II)_2012	Sub-Critical	2012	Bid Opened
Maharashtra	Jalgaon	MAHAGENCO	3450	S_C_500_Bhusawal (II)_2013	Sub-Critical	2013	Bid Opened
Maharashtra	Mouda	NTPC	3671	C_C_500_Mauda_2012	Sub-Critical	2012	Bid Awarded
Maharashtra	Mouda	NTPC	3671	C_C_500_Mauda_2013	Sub-Critical	2013	Bid Awarded

Maharashtra	Mouda	NTPC	3671	C_C_660_Mauda_2016	Super-Critical	2016	Bid Awarded
Maharashtra	Mouda	NTPC	3671	C_C_660_Mauda_2017	Super-Critical	2017	Bid Awarded
Maharashtra	Amravati	RATTANINDIA	5428	P_C_270_Amaravati_2015	Sub-Critical	2015	Tender Specification Made
Maharashtra	Amravati	RATTANINDIA	5428	P_C_270_Amaravati_2014	Sub-Critical	2014	Tender Specification Made
Maharashtra	Amravati	RATTANINDIA	5428	P_C_270_Amaravati_2013	Sub-Critical	2013	Tender Specification Made
Maharashtra	Paras	MAHAGENCO	5489	S_C_250_Paras_2010	Sub-Critical	2010	Bid Awarded
Maharashtra	Paras	MAHAGENCO	5489	S_C_250_Paras_2007	Sub-Critical	2007	Bid Awarded
Maharashtra	Parli	MAHAGENCO	5737	S_C_250_Parli (I)_2007	Sub-Critical	2007	Bid Opened
Maharashtra	Parli	MAHAGENCO	5737	S_C_250_Parli (I)_2010	Sub-Critical	2010	Bid Opened
Maharashtra	Parli		5743	S_C_250_Parli (II)_2016	Sub-Critical	2016	Bid Opened
Odisha	Kamlanga	GMR ENERG	3945	P_B_350_Kamalanga_2013	Sub-Critical	2013	Bid Opened
Odisha	Kamlanga	GMR ENERG	3945	P_B_350_Kamalanga_2014	Sub-Critical	2014	Bid Opened
Odisha	Banharpalli	IBPIL	889	S_C_210_Ind Barath_1995	Sub-Critical	1995	Feasibility Study Started
Odisha	Talcher	NTPC	3670	C_C_500_Talcher_2006	Sub-Critical	2006	Bid Awarded
Odisha	Talcher	NTPC	3670	C_C_500_Talcher_2005	Sub-Critical	2005	Bid Awarded
Odisha	Talcher	NTPC	3670	C_C_500_Talcher_1996	Sub-Critical	1996	Bid Awarded
Odisha	Talcher	NTPC	3670	C_C_500_Talcher_1995	Sub-Critical	1995	Bid Awarded
Odisha	Talcher	NTPC	3670	C_C_500_Talcher_2003	Sub-Critical	2003	Bid Awarded
Odisha	Derang	JITPL	5018	P_C_600_Derang_2015	Sub-Critical	2015	Bid Opened
Odisha	Derang	JITPL	5018	P_C_600_Derang_2014	Sub-Critical	2014	Bid Opened
Odisha	Banjari	SEL	5500	P_C_600_Sterlite_2010	Sub-Critical	2010	Feasibility Study Started
Odisha	Banjari	SEL	5500	P_C_600_Sterlite_2012	Sub-Critical	2012	Feasibility Study Started
Odisha	Banjari	SEL	5500	P_C_600_Sterlite_2011	Sub-Critical	2011	Feasibility Study Started
Punjab	Rajpura	NPL	124	P_C_700_ Nabha_2014	Super-Critical	2014	Bid Awarded
Punjab	Talwandi	TSPL	1719	P_C_660_Talwandi Sabo_2016	Super-Critical	2016	Tender Specification Made
Punjab	Talwandi	TSPL	1719	P_C_660_Talwandi Sabo_2015	Super-Critical	2015	Tender Specification Made
Punjab	Talwandi	TSPL	1719	P_C_660_Talwandi Sabo_2014	Super-Critical	2014	Tender Specification Made
Punjab	Lehra Mohabbat	PSPCL	2127	S_C_210_Guru Hargobind_1997	Sub-Critical	1997	Feasibility Study Completed
Punjab	Lehra Mohabbat	PSPCL	2127	S_C_210_Guru Hargobind_1998	Sub-Critical	1998	Feasibility Study Completed
Punjab	Lehra Mohabbat	PSPCL	2127	S_C_250_Guru Hargobind_2008	Sub-Critical	2008	Feasibility Study Completed
Punjab	Lehra Mohabbat	PSPCL	2127	S_C_250_Guru Hargobind_2010	Sub-Critical	2010	Feasibility Study Completed
Punjab	Ropar	PSPCL	4362	S_C_210_Ropar_1992	Sub-Critical	1992	NIT Issued
Punjab	Ropar	PSPCL	4362	S_C_210_Ropar_1988	Sub-Critical	1988	NIT Issued
Punjab	Ropar	PSPCL	4362	S_C_210_Ropar_1989	Sub-Critical	1989	NIT Issued
Punjab	Ropar	PSPCL	4362	S_C_210_Ropar_1993	Sub-Critical	1993	NIT Issued
Punjab	Ropar	PSPCL	4362	S_C_210_Ropar_1985	Sub-Critical	1985	Retired
Punjab	Ropar	PSPCL	4362	S_C_210_Ropar_1984	Sub-Critical	1984	Retired
Punjab	Goindwal Sahib	GPGSL (GVK)	5317	P_C_270_Goindwal Sahib_2016	Sub-Critical	2016	Bid Opened
Rajasthan	KOTA	RRVUNL	4548	S_A_210_Kota_1988	Sub-Critical	1988	To Be Decommissioned
Rajasthan	KOTA	RRVUNL	4548	S_A_210_Kota_1989	Sub-Critical	1989	To Be Decommissioned
Rajasthan	KOTA	RRVUNL	4548	S_A_210_Kota_1997	Sub-Critical	1997	To Be Decommissioned
Rajasthan	KOTA	RRVUNL	4548	S_A_110_Kota_1983	Sub-Critical	1983	To Be Decommissioned
Rajasthan	KOTA	RRVUNL	4548	S_A_195_Kota_2004	Sub-Critical	2004	To Be Decommissioned
Rajasthan	KOTA	RRVUNL	4548	S_A_195_Kota_2009	Sub-Critical	2009	To Be Decommissioned
Rajasthan	Suratgarh	RRVUNL	1567	S_C_250_Suratgarh_1998	Sub-Critical	1998	
Rajasthan	Suratgarh	RRVUNL	1567	S_C_250_Suratgarh_2001	Sub-Critical	2001	
Rajasthan	Suratgarh	RRVUNL	1567	S_C_250_Suratgarh_2002	Sub-Critical	2002	

Rajasthan	Suratgarh	RRVUNL	1567	S_C_250_Suratgarh_2003	Sub-Critical	2003	
Rajasthan	Suratgarh	RRVUNL	1567	S_C_250_Suratgarh_2009	Sub-Critical	2009	
Rajasthan	Suratgarh	RRVUNL	1567	S_C_250_Suratgarh_2000	Sub-Critical	2000	
Rajasthan	Suratgarh	RRVUNL	1567	S_C_250_Suratgarh_	Sub-Critical		
Rajasthan	Suratgarh	RRVUNL	1567	S_C_660_Suratgarh_2021	Super-Critical	2021	
Rajasthan	Suratgarh	RRVUNL	1567	S_C_660_Suratgarh_2019	Super-Critical	2019	
Rajasthan	Suratgarh	RRVUNL	1567	S_C_660_Suratgarh_	Sub-Critical		
Rajasthan	Bhadresh	RWPL (JSW)	1693	P_C_135_Jalipa Kapurdi_2013	Sub-Critical	2013	CFBC
Rajasthan	Bhadresh	RWPL (JSW)	1693	P_C_135_Jalipa Kapurdi_2011	Sub-Critical	2011	CFBC
Rajasthan	Bhadresh	RWPL (JSW)	1693	P_C_135_Jalipa Kapurdi_2010	Sub-Critical	2010	CFBC
Rajasthan	Chowki Motipura	RRVUNL	2086	S_C_125_Giral_2008	Sub-Critical	2008	CFBC
Rajasthan	Chowki Motipura	RRVUNL	2086	S_C_125_Giral_2007	Sub-Critical	2007	CFBC
Rajasthan	Jhalawar	RRVUNL	2678	S_C_600_Kalisindh_2015	Super-Critical	2015	Bid Awarded
Rajasthan	Jhalawar	RRVUNL	2678	S_C_600_Kalisindh_2014	Super-Critical	2014	Bid Awarded
Rajasthan	Kawai	APL	4596	P_C_660_Kawai_2014	Super-Critical	2014	Bid Awarded
Rajasthan	Bikaner	NLC	5676	C_C_125_Barsingsar_2011	Sub-Critical	2011	CFBC
Rajasthan	Bikaner	NLC	5676	C_C_125_Barsingsar_2010	Sub-Critical	2010	CFBC
Tamil Nadu	TIRUVALLUR	NTECL	4784	C_A_500_Vallur_2014	Sub-Critical	2014	Bid Awarded
Tamil Nadu	TIRUVALLUR	NTECL	4784	C_A_500_Vallur_2013	Sub-Critical	2013	Bid Awarded
Tamil Nadu	TIRUVALLUR	NTECL	4784	C_A_500_Vallur_2012	Sub-Critical	2012	Bid Awarded
Tamil Nadu	METTUR	TANGEDCO	1684	S_B_210_Mettur_1987	Sub-Critical	1987	NIT Issued
Tamil Nadu	METTUR	TANGEDCO	1684	S_B_210_Mettur_1989	Sub-Critical	1989	NIT Issued
Tamil Nadu	METTUR	TANGEDCO	1684	S_B_210_Mettur_1990	Sub-Critical	1990	NIT Issued
Tamil Nadu	MELAMARUTHURA	CEPL	3942	P_B_600_Muthiara_2014	Sub-Critical	2014	Feasibility Study Completed
Tamil Nadu	MELAMARUTHURA	CEPL	3942	P_B_600_Muthiara_2016	Sub-Critical	2016	Feasibility Study Completed
Tamil Nadu	Neyveli	Neyveli Lignite	1382	C_C_210_Neyveli (II)_1986	Sub-Critical	1986	Bid Opened
Tamil Nadu	Neyveli	Neyveli Lignite	1382	C_C_210_Neyveli (II)_1991	Sub-Critical	1991	Bid Opened
Tamil Nadu	Neyveli	Neyveli Lignite	1382	C_C_210_Neyveli (II)_1992	Sub-Critical	1992	Bid Opened
Tamil Nadu	Neyveli	Neyveli Lignite	1382	C_C_210_Neyveli (II)_1987	Sub-Critical	1987	Bid Opened
Tamil Nadu	Neyveli	Neyveli Lignite	1382	C_C_210_Neyveli (II)_1993	Sub-Critical	1993	Bid Opened
Tamil Nadu	Tuticorin	TANGEDCO	1724	S_C_210_Tuticorin_1982	Sub-Critical	1982	NIT Issued
Tamil Nadu	Tuticorin	TANGEDCO	1724	S_C_210_Tuticorin_1992	Sub-Critical	1992	NIT Issued
Tamil Nadu	Tuticorin	TANGEDCO	1724	S_C_210_Tuticorin_1990	Sub-Critical	1990	NIT Issued
Tamil Nadu	Tuticorin	TANGEDCO	1724	S_C_210_Tuticorin_1979	Sub-Critical	1979	NIT Issued
Tamil Nadu	Tuticorin	TANGEDCO	1724	S_C_210_Tuticorin_1980	Sub-Critical	1980	NIT Issued
Tamil Nadu	Neyveli	TAQA	2640	P_C_250_Neyveli Zero_2015	Sub-Critical	2015	Bid Awarded
Tamil Nadu	Cuddalore	IL&FS	4607	P_C_600_Cuddalore IL&FS_2016	Super-Critical	2016	FGD Installed
Tamil Nadu	Cuddalore	IL&FS	4607	P_C_600_Cuddalore IL&FS_2015	Super-Critical	2015	FGD Installed
Tamil Nadu	Neyveli	Neyveli Lignite	3839	C_C_500_New Neyveli_2021	Sub-Critical	2021	Bid Opened
Tamil Nadu	Neyveli	Neyveli Lignite	3839	C_C_500_New Neyveli_2019	Sub-Critical	2019	Bid Opened
Tamil Nadu	Neyveli	Neyveli Lignite	5725	C_C_210_Neyveli (I)_2002	Sub-Critical	2002	
Tamil Nadu	Neyveli	Neyveli Lignite	5725	C_C_250_Neyveli (I)_2015	Sub-Critical	2015	
Tamil Nadu	Neyveli	Neyveli Lignite	5725	C_C_210_Neyveli (I)_2003	Sub-Critical	2003	
Tamil Nadu	Neyveli	Neyveli Lignite	5725	C_C_250_Neyveli (I)_2011	Sub-Critical	2011	
Telangana	New Paloncha	TSGENCO	2352	S_C_250_Kothagudem_1998	Sub-Critical	1998	Feasibility Study Completed
Telangana	New Paloncha	TSGENCO	2352	S_C_250_Kothagudem_1997	Sub-Critical	1997	Feasibility Study Completed
Telangana	Chelpur	TSGENCO	2609	S_C_600_Kakatiya_2015	Sub-Critical	2015	Feasibility Study Completed

Telangana	Chelpur	TSGENCO	2609	S_C_500_Kakatiya_2010	Sub-Critical	2010	Feasibility Study Completed
Telangana	Singareni	SCCL	6159	S_C_600_Pegadapalli_2016	Sub-Critical	2016	Bid Awarded
Telangana	Ramagundem	NTPC	3665	C_C_500_Ramagundem (I)_1989	Sub-Critical	1989	Bid Awarded
Telangana	Ramagundem	NTPC	3665	C_C_500_Ramagundem (I)_2005	Sub-Critical	2005	Bid Awarded
Telangana	Ramagundem	NTPC	3665	C_C_200_Ramagundem (I)_1984	Sub-Critical	1984	Bid Awarded
Telangana	Ramagundem	NTPC	3665	C_C_200_Ramagundem (I)_1983	Sub-Critical	1983	Bid Awarded
Telangana	Ramagundem	NTPC	3665	C_C_500_Ramagundem (I)_1988	Sub-Critical	1988	Bid Awarded
Telangana	Ramagundem	TSGENCO	4082	C_C_62.5_Ramagundem (II)_1971	Sub-Critical	1971	To Be Decommissioned
Uttar Pradesh	Barkhera	BEPL	1662	P_C_45_Barkhera_2011	Sub-Critical	2011	CFBC
Uttar Pradesh	Kastuwa-Kundarki	BEPL	1663	P_C_45_Kundarki_2012	Sub-Critical	2012	CFBC
Uttar Pradesh	Khambarkhera	BEPL	1664	P_C_45_Khambarkhera_2011	Sub-Critical	2011	CFBC
Uttar Pradesh	Utraula	BEPL	1666	P_C_45_Utraula_2012	Sub-Critical	2012	CFBC
Uttar Pradesh	Maqsoodpur	BEPL	1667	P_C_45_Maqsoodpur_2011	Sub-Critical	2011	CFBC
Uttar Pradesh	Rausar Kothi	RPSCL	1705	P_C_300_Rosa_2009	Sub-Critical	2009	Bid Awarded
Uttar Pradesh	Rausar Kothi	RPSCL	1705	P_C_300_Rosa_2011	Sub-Critical	2011	Bid Awarded
Uttar Pradesh	Rausar Kothi	RPSCL	1705	P_C_300_Rosa_2010	Sub-Critical	2010	Bid Awarded
Uttar Pradesh	Rausar Kothi	RPSCL	1705	P_C_300_Rosa_2012	Sub-Critical	2012	Bid Awarded
Uttar Pradesh	Vidyut Nagar	UPRVUNL	2148	S_C_110_Harduaganj_1978	Sub-Critical	1978	Feasibility Study Started
Uttar Pradesh	Vidyut Nagar	UPRVUNL	2148	S_C_250_Harduaganj_2011	Sub-Critical	2011	Feasibility Study Started
Uttar Pradesh	Vidyut Nagar	UPRVUNL	2148	S_C_250_Harduaganj_2012	Sub-Critical	2012	Feasibility Study Started
Uttar Pradesh	Ambedkar Nagar	NTPC	3196	C_C_110_Tanda_1988	Sub-Critical	1988	Bid Awarded
Uttar Pradesh	Ambedkar Nagar	NTPC	3196	C_C_110_Tanda_1998	Sub-Critical	1998	Bid Awarded
Uttar Pradesh	Ambedkar Nagar	NTPC	3196	C_C_110_Tanda_1990	Sub-Critical	1990	Bid Awarded
Uttar Pradesh	Ambedkar Nagar	NTPC	3196	C_C_660_Tanda_2021	Super-Critical	2021	Bid Awarded
Uttar Pradesh	Ambedkar Nagar	NTPC	3196	C_C_660_Tanda_2019	Super-Critical	2019	Bid Awarded
Uttar Pradesh	Ambedkar Nagar	NTPC	3196	C_C_110_Tanda_1989	Sub-Critical	1989	Bid Awarded
Uttar Pradesh	Rihand Nagar	NTPC	3197	C_C_500_Rihand_1988	Sub-Critical	1988	Bid Awarded
Uttar Pradesh	Rihand Nagar	NTPC	3197	C_C_500_Rihand_2005	Sub-Critical	2005	Bid Awarded
Uttar Pradesh	Rihand Nagar	NTPC	3197	C_C_500_Rihand_2013	Sub-Critical	2013	Bid Awarded
Uttar Pradesh	Rihand Nagar	NTPC	3197	C_C_500_Rihand_2012	Sub-Critical	2012	Bid Awarded
Uttar Pradesh	Rihand Nagar	NTPC	3197	C_C_500_Rihand_1989	Sub-Critical	1989	Bid Awarded
Uttar Pradesh	Unchahar	NTPC	3677	C_C_210_Firoz Gandhi_2006	Sub-Critical	2006	
Uttar Pradesh	Unchahar	NTPC	3677	C_C_210_Firoz Gandhi_1989	Sub-Critical	1989	Bid Awarded
Uttar Pradesh	Unchahar	NTPC	3677	C_C_210_Firoz Gandhi_1999	Sub-Critical	1999	Bid Awarded
Uttar Pradesh	Unchahar	NTPC	3677	C_C_210_Firoz Gandhi_1988	Sub-Critical	1988	Bid Awarded
Uttar Pradesh	Parichha	UPRVUNL	5041	S_C_250_Parichha_2012	Sub-Critical	2012	Feasibility Study started
Uttar Pradesh	Parichha	UPRVUNL	5041	S_C_110_Parichha_1984	Sub-Critical	1984	Feasibility Study started
Uttar Pradesh	Parichha	UPRVUNL	5041	S_C_250_Parichha_2013	Sub-Critical	2013	Feasibility Study started
Uttar Pradesh	Parichha	UPRVUNL	5041	S_C_210_Parichha_2006	Sub-Critical	2006	Feasibility Study started
Uttar Pradesh	Parichha	UPRVUNL	5041	S_C_210_Parichha_2007	Sub-Critical	2007	Feasibility Study started
Uttar Pradesh	Burogaon	LPGCL	5402	P_C_660_Lalitpur_2015	Super-Critical	2015	Retendering
Uttar Pradesh	Burogaon	LPGCL	5402	P_C_660_Lalitpur_2016	Super-Critical	2016	Retendering
Uttar Pradesh	Obra	UPRVUNL	5695	S_C_200_OBRA_1979	Sub-Critical	1979	Retired
Uttar Pradesh	Obra	UPRVUNL	5695	S_C_200_OBRA_1982	Sub-Critical	1982	Retired
Uttar Pradesh	Obra	UPRVUNL	5695	S_C_200_OBRA_1977	Sub-Critical	1977	Retired
Uttar Pradesh	Prayagraj	PPGCL (Tata)	5955	P_C_660_Bara _2015	Super-Critical	2015	Bid awarded
Uttar Pradesh	Prayagraj	PPGCL (Tata)	5955	P_C_660_Bara _2016	Super-Critical	2016	Bid awarded

Uttar Pradesh	Prayagraj	PPGCL (Tata)	5955	P_C_660_Bara _2017	Super-Critical	2017	Bid awarded
Uttar Pradesh	Meja	NTPC	6671	C_C_660_Meja_2018	Super-Critical	2018	Bid awarded
West Bengal	Durgapur	DPL	3372	S_B_300_D.P.L_2008	Sub-Critical	2008	Bid Opened
West Bengal	Durgapur	DPL	3372	S_B_250_D.P.L_2014	Sub-Critical	2014	Bid Opened
West Bengal	Pujali	CESC	1468	P_C_250_Budge_1997	Sub-Critical	1997	Bid Opened
West Bengal	Pujali	CESC	1468	P_C_250_Budge_1999	Sub-Critical	1999	Bid Opened
West Bengal	Pujali	CESC	1468	P_C_250_Budge_2010	Sub-Critical	2010	Bid Opened
West Bengal	Durgapur	DVC	2695	C_C_210_Durgapur_1982	Sub-Critical	1982	Retired
West Bengal	Farakka	NTPC	3206	C_C_500_Farakka_2011	Sub-Critical	2011	Bid Awarded
West Bengal	Farakka	NTPC	3206	C_C_500_Farakka_1994	Sub-Critical	1994	Bid Awarded
West Bengal	Farakka	NTPC	3206	C_C_200_Farakka_1986	Sub-Critical	1986	Bid Awarded
West Bengal	Farakka	NTPC	3206	C_C_200_Farakka_1987	Sub-Critical	1987	Bid Awarded
West Bengal	Bandel	WBPDC	4316	S_C_60_Bandel_1965	Sub-Critical	1965	Retired
West Bengal	Bandel	WBPDC	4316	S_C_210_Bandel_1982	Sub-Critical	1982	Retired
West Bengal	East Midnapore	WBPDC	5486	S_C_210_Kolaghat_1994	Sub-Critical	1994	
West Bengal	East Midnapore	WBPDC	5486	S_C_210_Kolaghat_1986	Sub-Critical	1986	Retired
West Bengal	East Midnapore	WBPDC	5486	S_C_210_Kolaghat_1995	Sub-Critical	1995	
West Bengal	East Midnapore	WBPDC	5486	S_C_210_Kolaghat_1991	Sub-Critical	1991	
West Bengal	East Midnapore	WBPDC	5486	S_C_210_Kolaghat_1990	Sub-Critical	1990	Retired
West Bengal	East Midnapore	WBPDC	5486	S_C_210_Kolaghat_1984	Sub-Critical	1984	
West Bengal	Santaldihi	WBPDC	5752	S_C_250_Santaldih_2007	Sub-Critical	2007	Bid Opened
West Bengal	Santaldihi	WBPDC	5752	S_C_250_Santaldih_2011	Sub-Critical	2011	Bid Opened
West Bengal	Raghunathpur	DVC	5915	C_C_600_Raghunathpur_2014	Super-Critical	2014	Bid Awarded

TPS Name: Authority_Category_Capacity(MW)_TPSName_Commissioning_Year
Authority: C-Central, S-State, P-Private, Category: A, B, C
For Example: P_C_660_Bara _2017 (Authority: Private, Category: C, Capacity (MW): 660, TPS Name: Bara, Commissioning Year: 2017

Abbreviation: NTPC: National Thermal Power Corporation, APGENCO: Andhra Pradesh Power Generation Corporation Limited, HNPC: Hinduja National Power Corporation Ltd., SEIL: Sembcorp Energy India Limited, NSPCL: National Thermal Power Corporation and Steel Authority of India Limited., APL: Adani Power Limited, CSPGCL: Chhattisgarh State Power Generation Company Limited, LANCO: Lanco Amarkantak Power Limited, WPCL: Wardha Power Company Ltd, JPL: Jindal Power Ltd., DBPCL: Dainik Bhaskar Power Ltd, MCCPL: Maruti Clean Coal and Power Limited, SCPL: Spectrum Coal and Power Limited, ACB: ACB (INDIA) LTD., TRNE: TRN Energy Pvt. Ltd., RKMPPL: RKM Powergen Pvt. Limited, TOR. POW.: Torrent Power Ltd, GSECL: Gujarat State Electricity Corporation Limited, GMDCL: Gujarat Mineral Development Corparation Limited, CGPL: Coastal Gujarat Power Ltd., EPGL: Essar Power Limited, GIPCL: Gujarat Industries Power Company Limited, JhPL(HR): Jhajjar Power Ltd., HPGCL: Haryana Power Generation Corporation Limited, DVC: Damodar Valley Corporation, ADHUNIK: Adhunik Power And Natural Resources Limited, MPL: Maithon Power Limited, TATA PCL: Tata Power Company Ltd., TVNL: Tenughat Vidyut Nigam Limited, JSWEL: JSW Energy Ltd., KPCL: Karnataka Power Corporation Limited, SPL: Sasan Power Limited, JPPVL: Jai Prakash Power Ventures Limited, MPPGCL: M. P. Power Generating Corporation Limited, JHAPL: Jai Prakash Power Ventures Limited, MBPMPL: MB Power Madhya Pradesh Ltd, MAHAGENCO: Maharashtra State Power Generation Company Limited, TROMBAY TPS: Tata Power Company Ltd., GMR ENERG: Gmr Energy Limited, RATTANINDIA: Rattan India Power Limited, IBPIL: Ind Bharath Power Infra Limited, JITPL: Jindal India Thermal Power Ltd., SEL: Sterlite Energy Ltd., NPL: Nabha Power Ltd., TSPL: Talwandi Sabo Power Limited, PSPCL: Punjab State Power Corp. Ltd., GPGSL (GVK):, GVK Power (Goindwal Sahib) Limited, RRVUNL: Rajasthan Rajya Vidyut Utpadan Nigam Limited, RWPL (JSW): Raj West Power Limited, NLC: Neyveli Lignite Corporation, NTECL: NTPC Tamilnadu Energy Company Limited, TANGEDCO: Tamil Nadu Generation & Distribution Corp. Ltd., CEPL: Coastal Energen Pvt. Ltd., NEYVELI LIGNITE: Neyveli Lignite Corporation Limited, TAQA: TAQA Neyveli Power Company Pvt. Ltd, IL&FS: IL & FS Tamil Nadu Power Company Limited, TSGENCO: Telangana State Genco, SCCL: Singareni Collieries Co Ltd, BEPL: Bajaj Energy Pvt. Ltd., RPSCL: Rosa Power Supply Co. Ltd., UPRVUNL: Uttar Pradesh Rajya Vidyut Utpadan Nigam Limited, LPGCL: Lalitpur Power Generation Co Ltd, PPGCL (Tata): Prayagraj Power Generation Company Ltd., DPL: Durgapur Projects Limited, CESC: Calcutta Electric Supply Co. Ltd., WBPDC: West Bengal Power Development Corp. Limited

Annexure - A2

Graphical visualization of OCEMS data generated by TPP.

Explanation of plot is as follows:

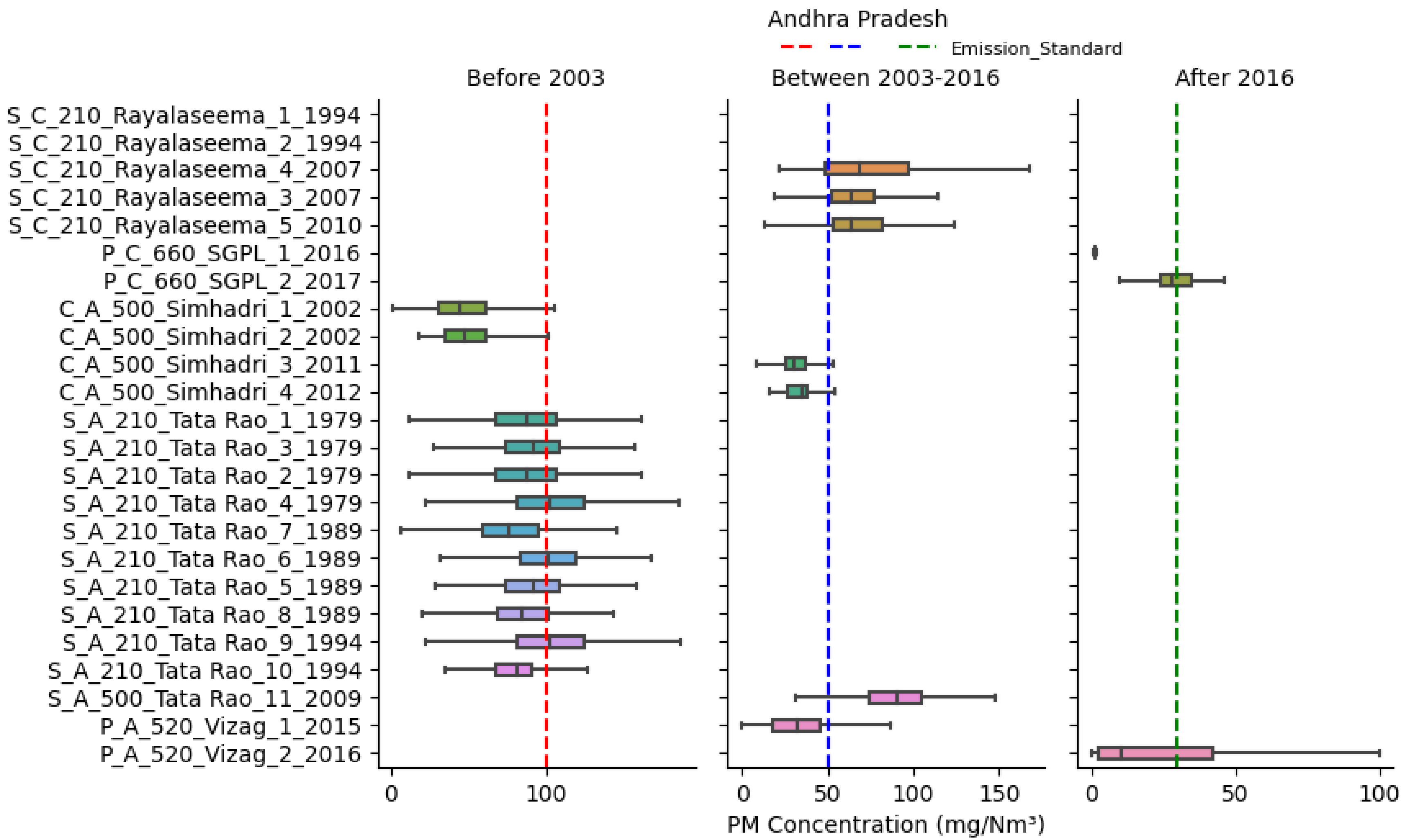
There are three box plots each for TPS:
- installed before 2003,
- between 2003 to 2016 and those
- beyond 2016.

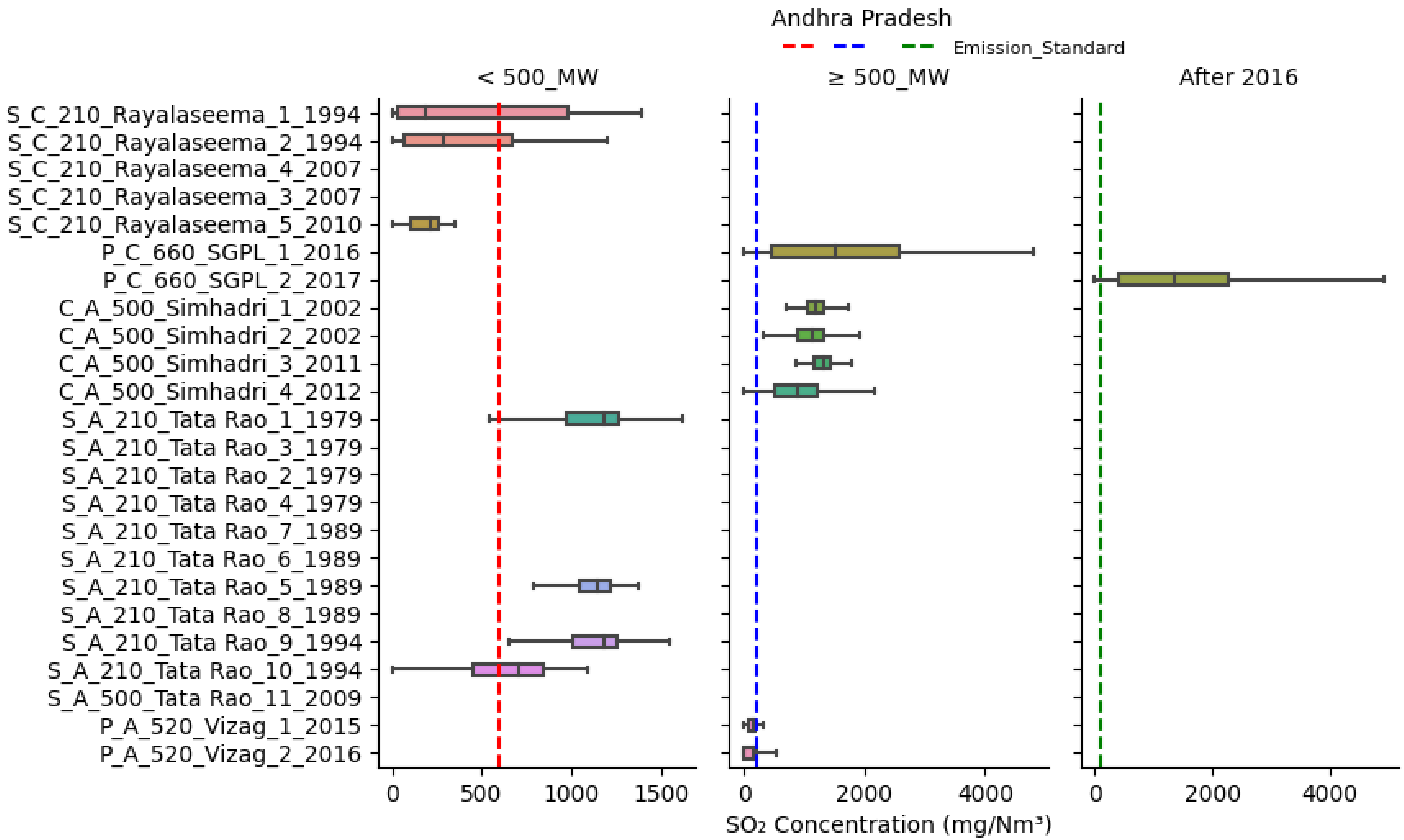
On Y-axis, the name of power plant stack is given. It can be seen that in each plot, a vertical dashed coloured line is given, which is the regulatory limit of emission in mg/Nm^3. For the case of Particulate Matter (PM) the limit of emission rate is:

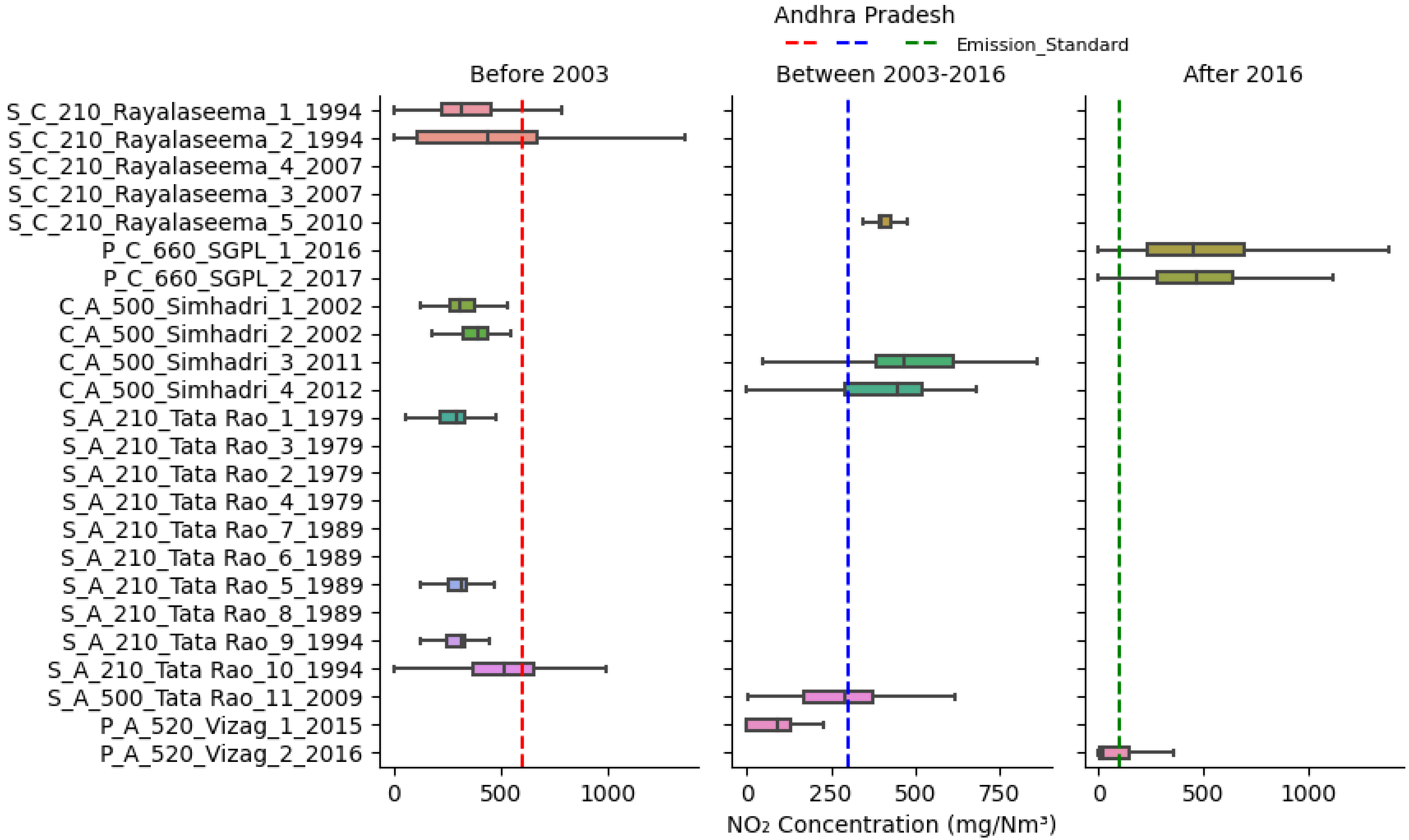
- 100 mg/Nm^3, for TPP commissioned before 2003;
- 50 mg/Nm^3, for TPP commissioned between 2003 and 2016;
- 30 mg/Nm^3, for new TPS after 2016 have a regulatory limit of 30 mg/Nm^3.

The plots are made for PM, SO_2 and NO_2 emission rates in three different pages / plots.

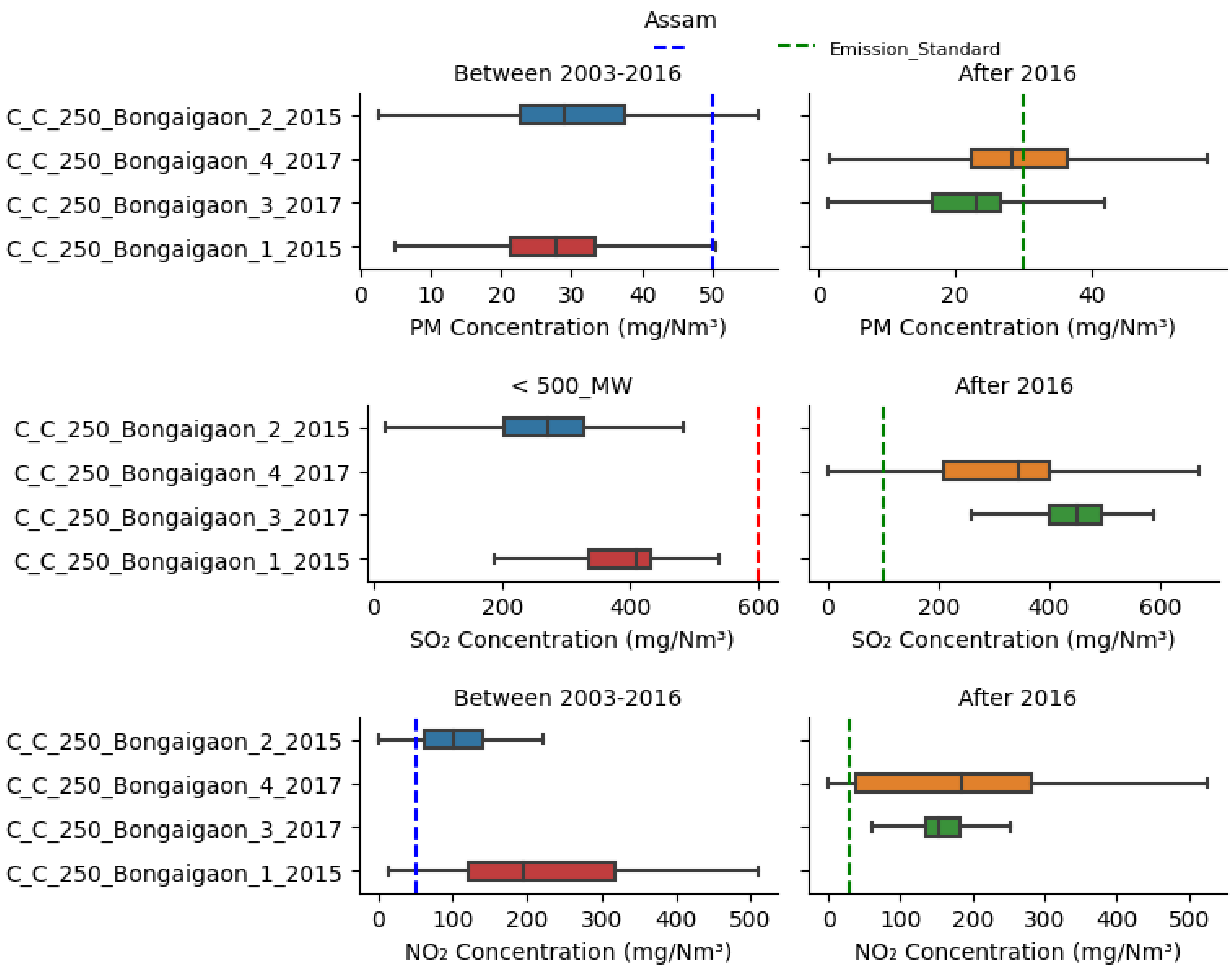
Andhra Pradesh



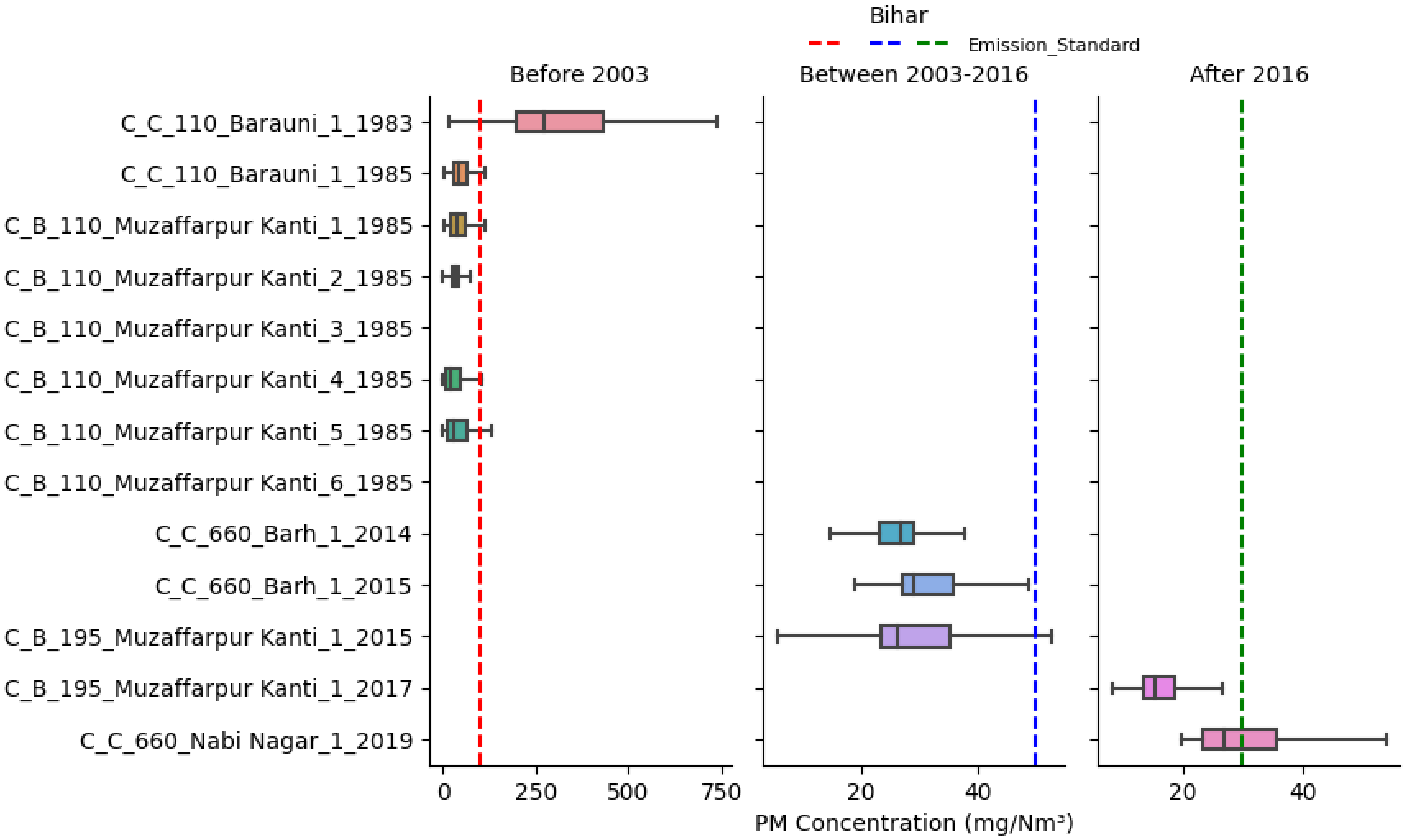

Andhra Pradesh
Emission_Standard
< 500_MW
≥ 500_MW
After 2016
S_C_210_Rayalaseema_1_1994
S_C_210_Rayalaseema_2_1994
S_C_210_Rayalaseema_4_2007
S_C_210_Rayalaseema_3_2007
S_C_210_Rayalaseema_5_2010
P_C_660_SGPL_1_2016
P_C_660_SGPL_2_2017
C_A_500_Simhadri_1_2002
C_A_500_Simhadri_2_2002
C_A_500_Simhadri_3_2011
C_A_500_Simhadri_4_2012
S_A_210_Tata Rao_1_1979
S_A_210_Tata Rao_3_1979
S_A_210_Tata Rao_2_1979
S_A_210_Tata Rao_4_1979
S_A_210_Tata Rao_7_1989
S_A_210_Tata Rao_6_1989
S_A_210_Tata Rao_5_1989
S_A_210_Tata Rao_8_1989
S_A_210_Tata Rao_9_1994
S_A_210_Tata Rao_10_1994
S_A_500_Tata Rao_11_2009
P_A_520_Vizag_1_2015
P_A_520_Vizag_2_2016
0
500
1000
1500
0
2000
4000
0
2000
4000
SO₂ Concentration (mg/Nm³)

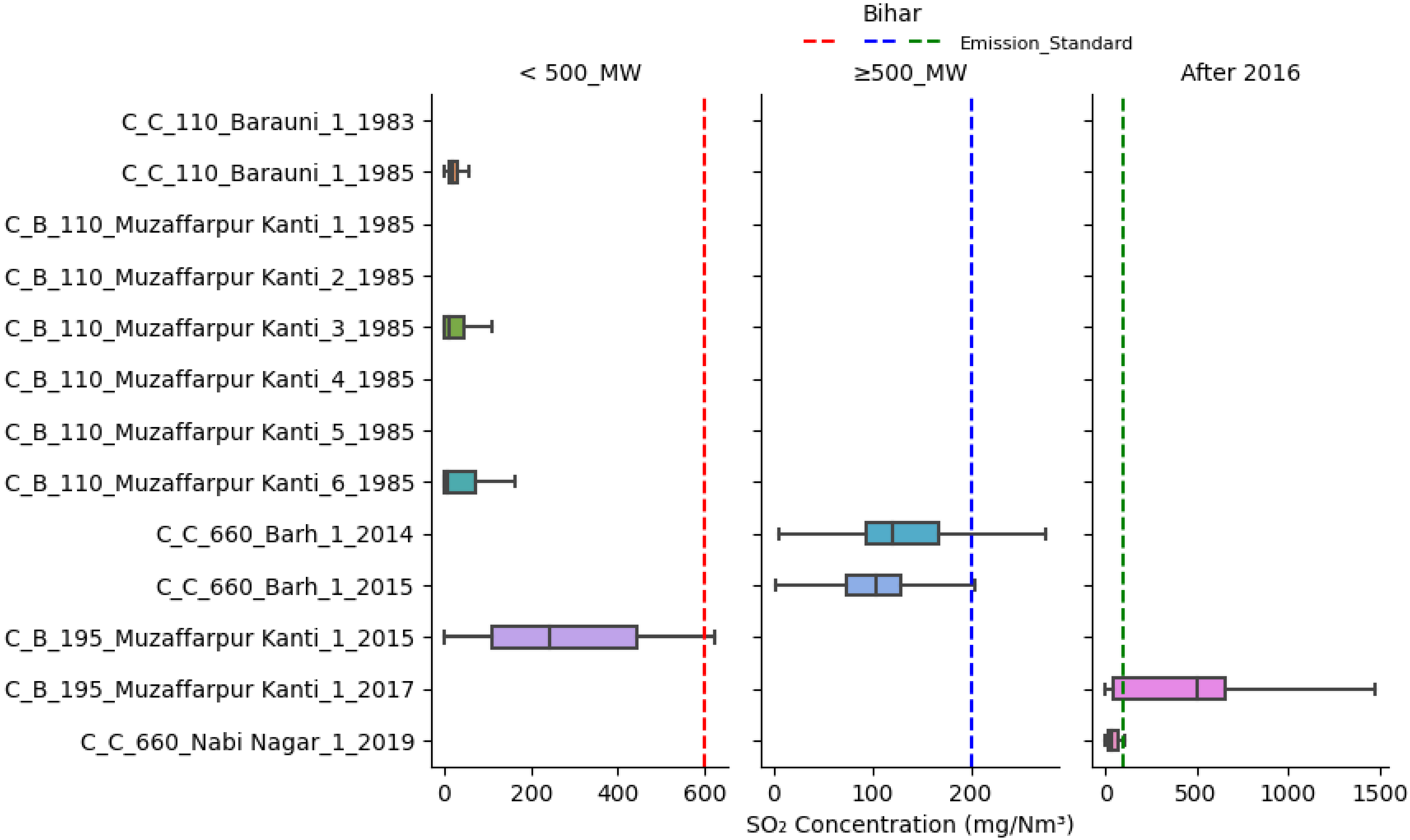

Andhra Pradesh
Emission_Standard
Before 2003
Between 2003-2016
After 2016
S_C_210_Rayalaseema_1_1994
S_C_210_Rayalaseema_2_1994
S_C_210_Rayalaseema_4_2007
S_C_210_Rayalaseema_3_2007
S_C_210_Rayalaseema_5_2010
P_C_660_SGPL_1_2016
P_C_660_SGPL_2_2017
C_A_500_Simhadri_1_2002
C_A_500_Simhadri_2_2002
C_A_500_Simhadri_3_2011
C_A_500_Simhadri_4_2012
S_A_210_Tata Rao_1_1979
S_A_210_Tata Rao_3_1979
S_A_210_Tata Rao_2_1979
S_A_210_Tata Rao_4_1979
S_A_210_Tata Rao_7_1989
S_A_210_Tata Rao_6_1989
S_A_210_Tata Rao_5_1989
S_A_210_Tata Rao_8_1989
S_A_210_Tata Rao_9_1994
S_A_210_Tata Rao_10_1994
S_A_500_Tata Rao_11_2009
P_A_520_Vizag_1_2015
P_A_520_Vizag_2_2016
0
500
1000
0
250
500
750
0
500
1000
NO₂ Concentration (mg/Nm³)

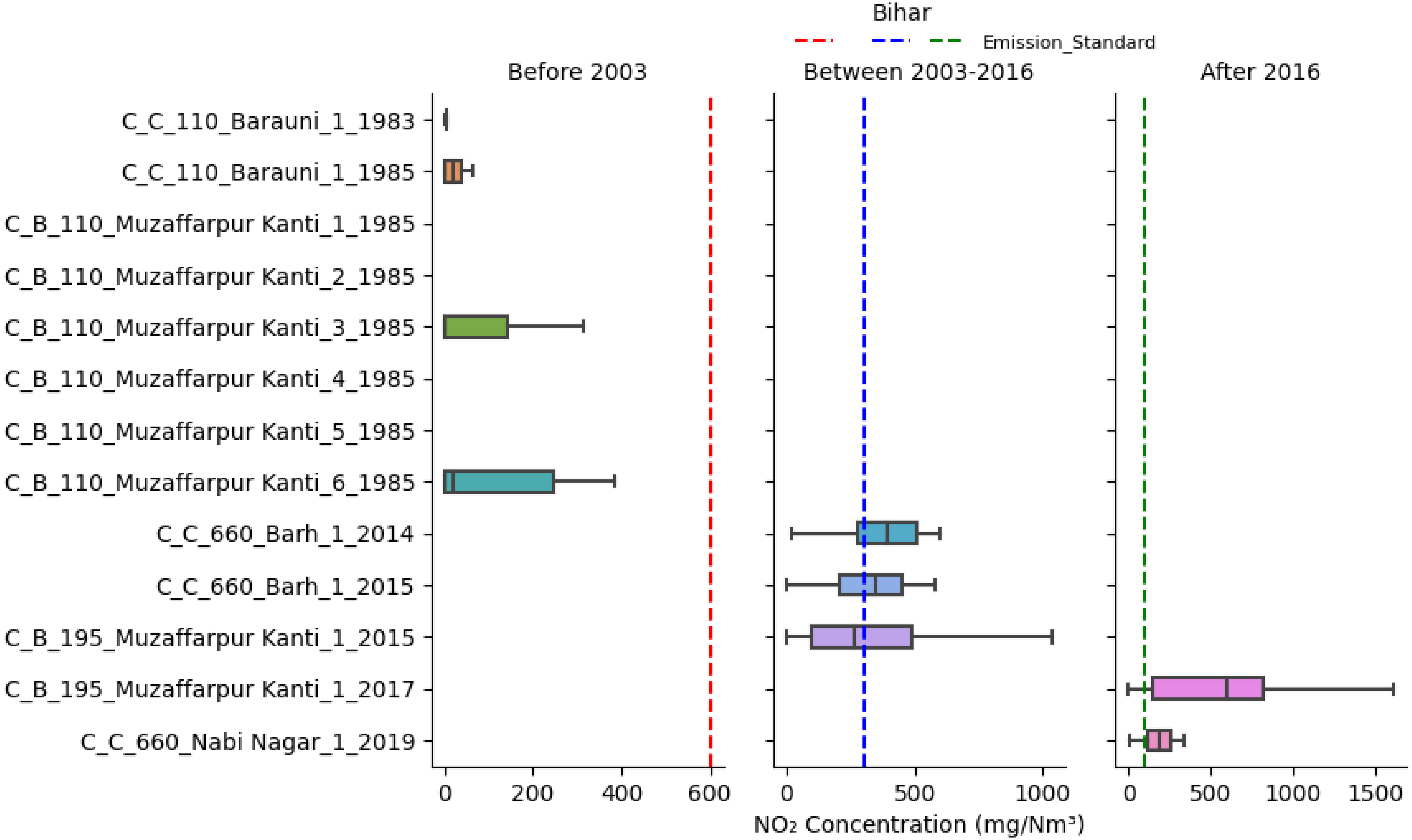
Assam


Assam
Emission_Standard
Between 2003-2016
After 2016
C_C_250_Bongaigaon_2_2015
C_C_250_Bongaigaon_4_2017
C_C_250_Bongaigaon_3_2017
C_C_250_Bongaigaon_1_2015
PM Concentration (mg/Nm³)
PM Concentration (mg/Nm³)
< 500_MW
After 2016
SO₂ Concentration (mg/Nm³)
SO₂ Concentration (mg/Nm³)
Between 2003-2016
After 2016
NO₂ Concentration (mg/Nm³)
NO₂ Concentration (mg/Nm³)

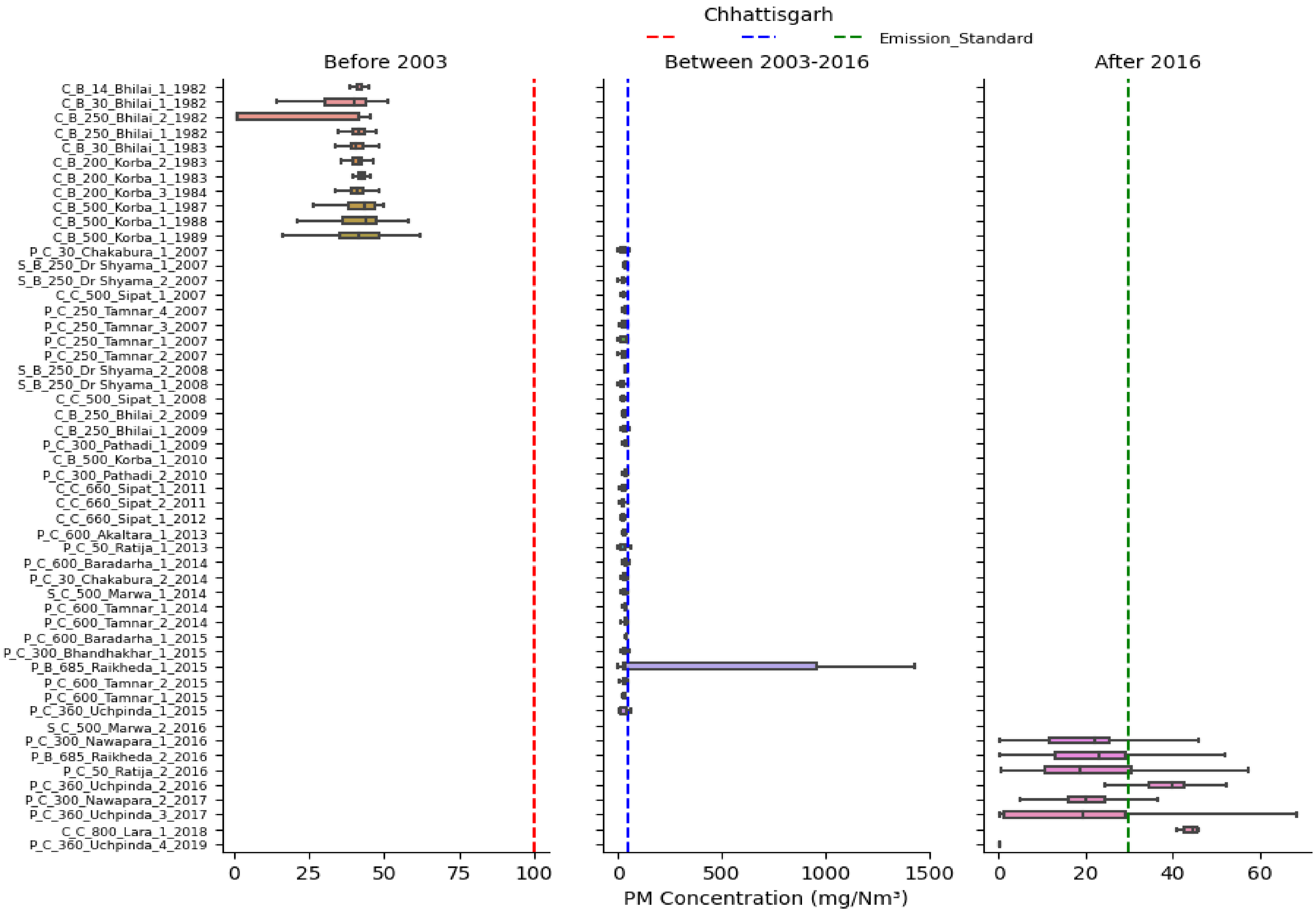
Bihar

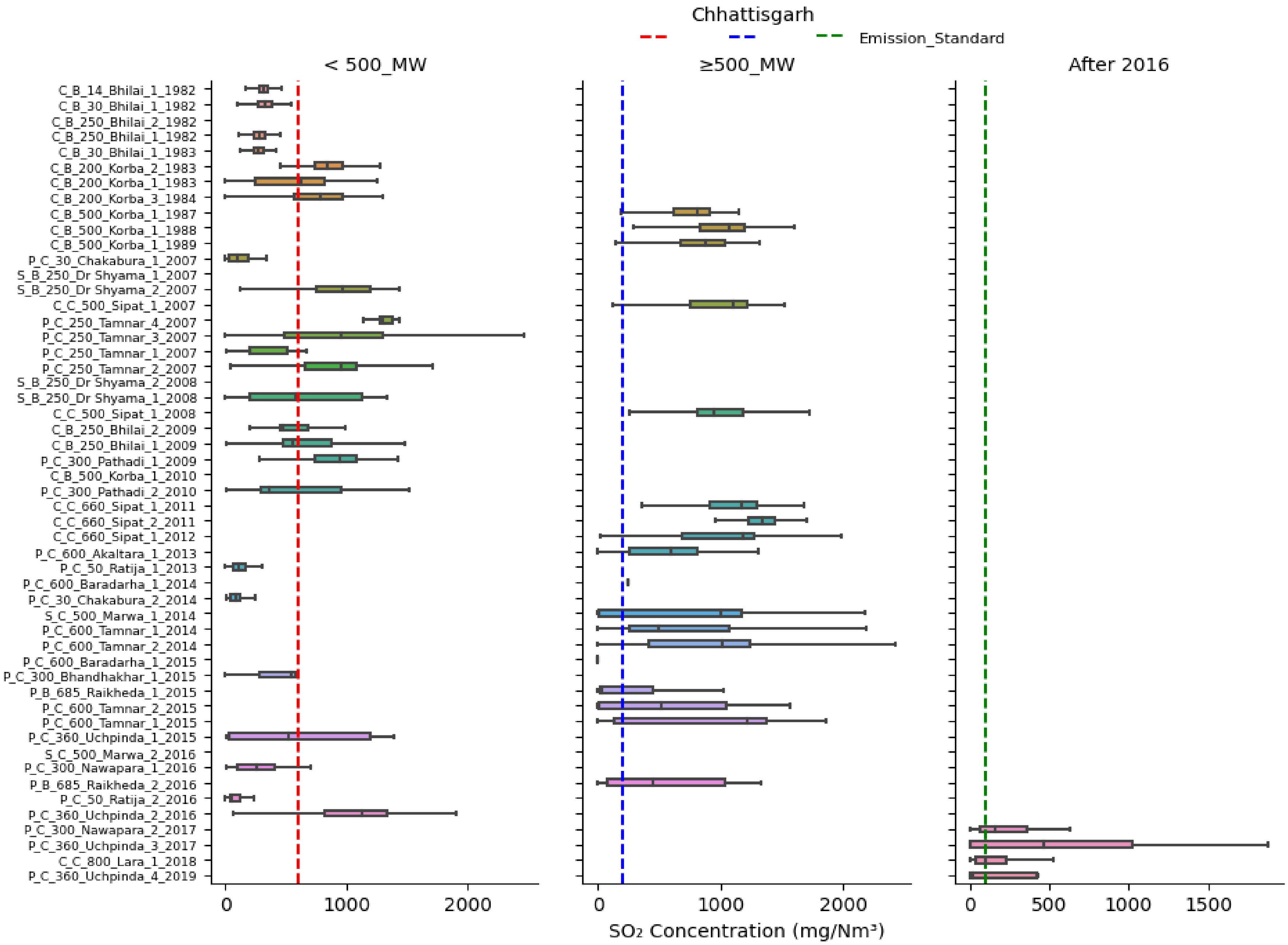

Bihar
Emission_Standard
Before 2003
Between 2003-2016
After 2016
C_C_110_Barauni_1_1983
C_C_110_Barauni_1_1985
C_B_110_Muzaffarpur Kanti_1_1985
C_B_110_Muzaffarpur Kanti_2_1985
C_B_110_Muzaffarpur Kanti_3_1985
C_B_110_Muzaffarpur Kanti_4_1985
C_B_110_Muzaffarpur Kanti_5_1985
C_B_110_Muzaffarpur Kanti_6_1985
C_C_660_Barh_1_2014
C_C_660_Barh_1_2015
C_B_195_Muzaffarpur Kanti_1_2015
C_B_195_Muzaffarpur Kanti_1_2017
C_C_660_Nabi Nagar_1_2019
0
250
500
750
20
40
20
40
PM Concentration (mg/Nm³)

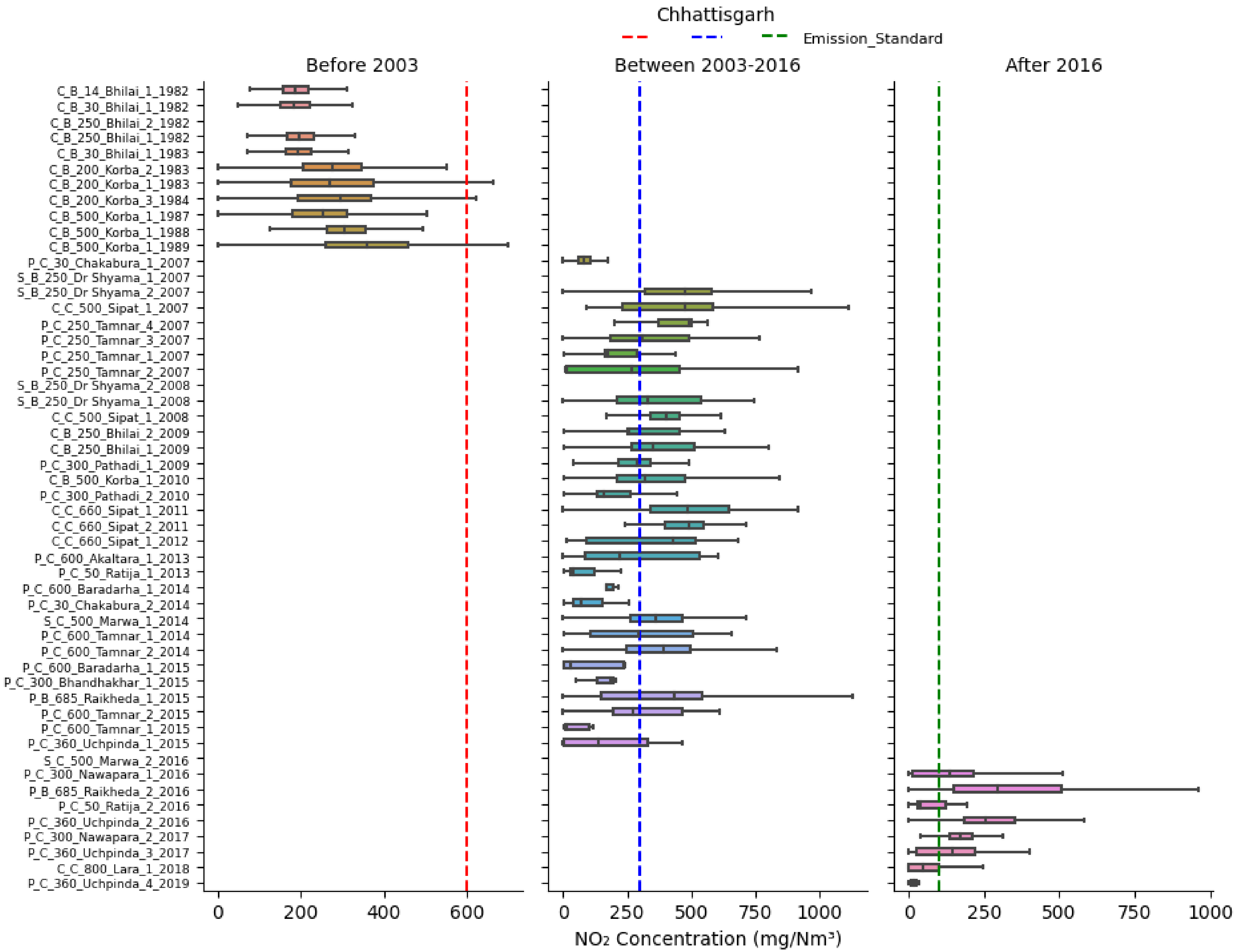

Bihar
Emission_Standard
< 500_MW
≥500_MW
After 2016
C_C_110_Barauni_1_1983
C_C_110_Barauni_1_1985
C_B_110_Muzaffarpur Kanti_1_1985
C_B_110_Muzaffarpur Kanti_2_1985
C_B_110_Muzaffarpur Kanti_3_1985
C_B_110_Muzaffarpur Kanti_4_1985
C_B_110_Muzaffarpur Kanti_5_1985
C_B_110_Muzaffarpur Kanti_6_1985
C_C_660_Barh_1_2014
C_C_660_Barh_1_2015
C_B_195_Muzaffarpur Kanti_1_2015
C_B_195_Muzaffarpur Kanti_1_2017
C_C_660_Nabi Nagar_1_2019
0
200
400
600
0
100
200
0
500
1000
1500
SO₂ Concentration (mg/Nm³)


Bihar
Emission_Standard
Before 2003
Between 2003-2016
After 2016
C_C_110_Barauni_1_1983
C_C_110_Barauni_1_1985
C_B_110_Muzaffarpur Kanti_1_1985
C_B_110_Muzaffarpur Kanti_2_1985
C_B_110_Muzaffarpur Kanti_3_1985
C_B_110_Muzaffarpur Kanti_4_1985
C_B_110_Muzaffarpur Kanti_5_1985
C_B_110_Muzaffarpur Kanti_6_1985
C_C_660_Barh_1_2014
C_C_660_Barh_1_2015
C_B_195_Muzaffarpur Kanti_1_2015
C_B_195_Muzaffarpur Kanti_1_2017
C_C_660_Nabi Nagar_1_2019
0
200
400
600
0
500
1000
0
500
1000
1500
NO_2 Concentration (mg/Nm³)

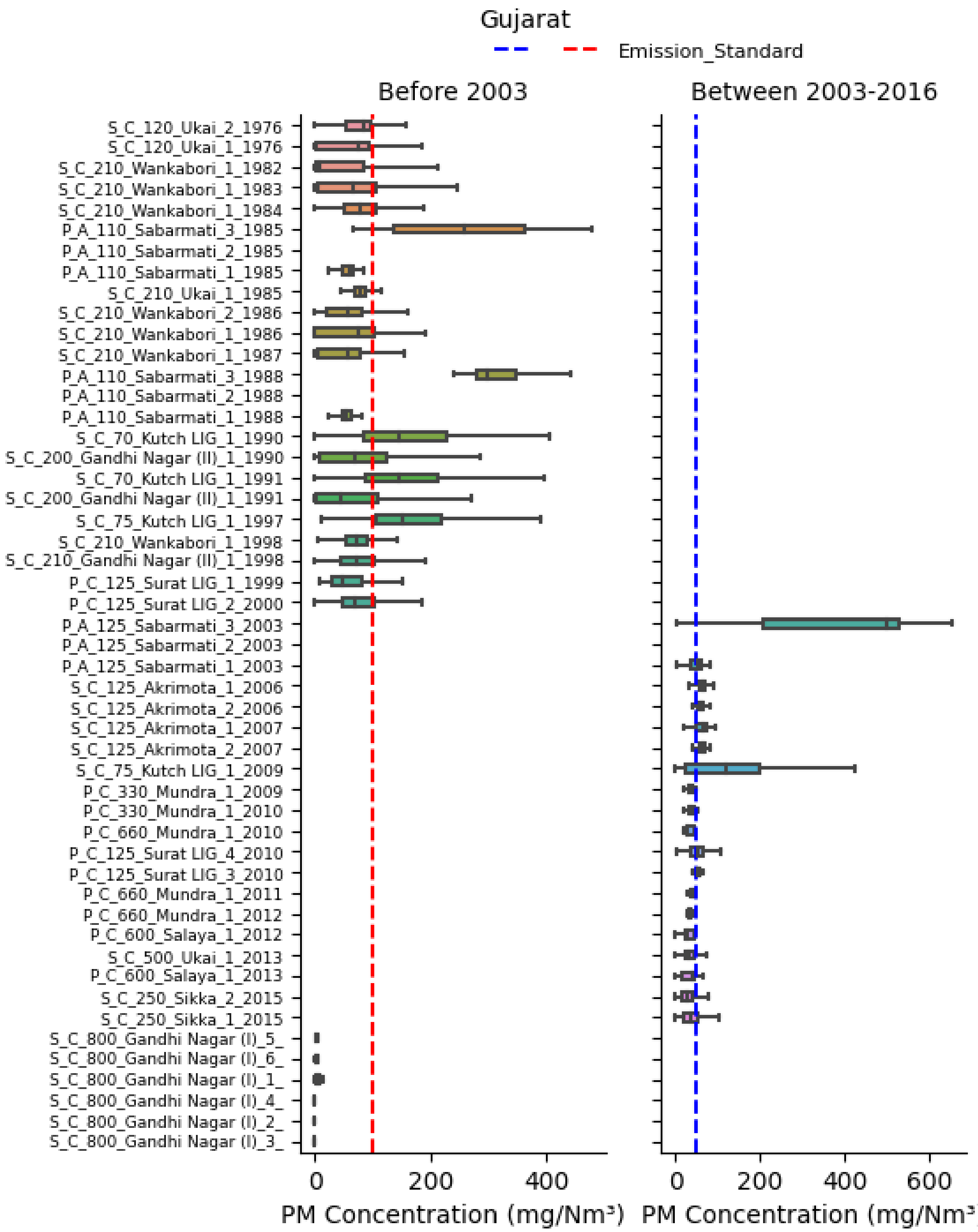
Chhattisgarh

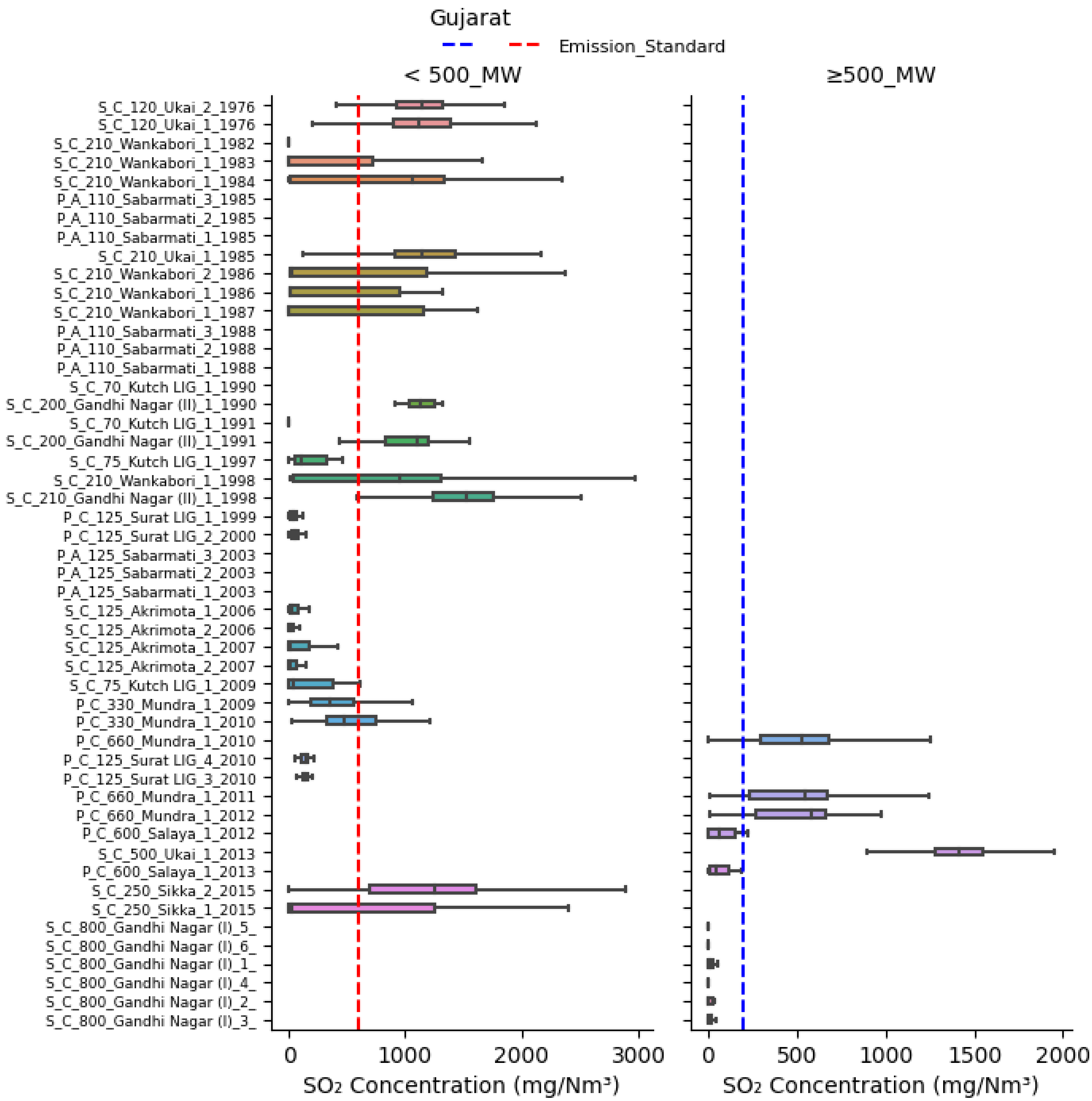


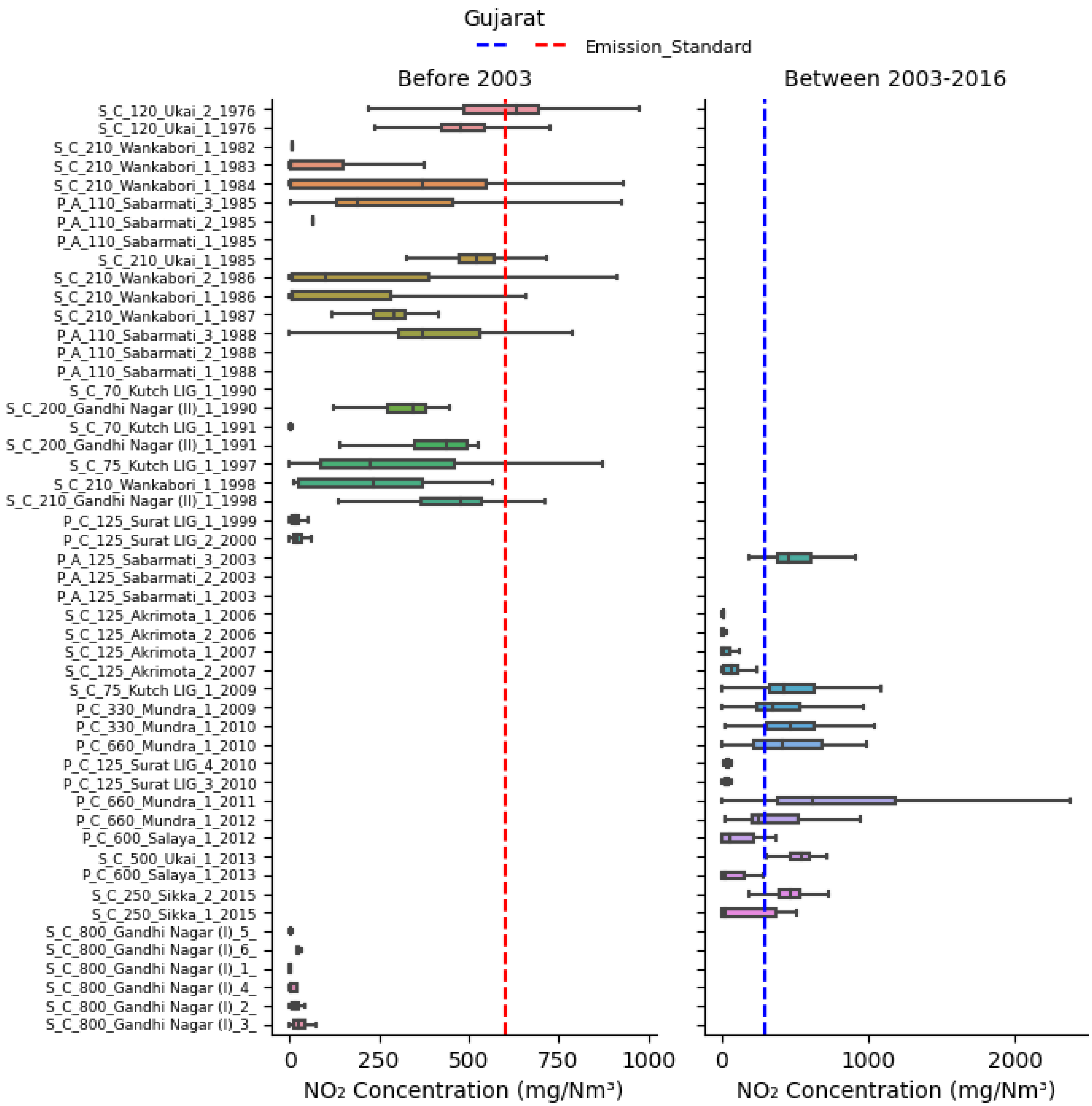

Chhattisgarh
Emission_Standard
< 500_MW
≥500_MW
After 2016
C_B_14_Bhilai_1_1982
C_B_30_Bhilai_1_1982
C_B_250_Bhilai_2_1982
C_B_250_Bhilai_1_1982
C_B_30_Bhilai_1_1983
C_B_200_Korba_2_1983
C_B_200_Korba_1_1983
C_B_200_Korba_3_1984
C_B_500_Korba_1_1987
C_B_500_Korba_1_1988
C_B_500_Korba_1_1989
P_C_30_Chakabura_1_2007
S_B_250_Dr Shyama_1_2007
S_B_250_Dr Shyama_2_2007
C_C_500_Sipat_1_2007
P_C_250_Tamnar_4_2007
P_C_250_Tamnar_3_2007
P_C_250_Tamnar_1_2007
P_C_250_Tamnar_2_2007
S_B_250_Dr Shyama_2_2008
S_B_250_Dr Shyama_1_2008
C_C_500_Sipat_1_2008
C_B_250_Bhilai_2_2009
C_B_250_Bhilai_1_2009
P_C_300_Pathadi_1_2009
C_B_500_Korba_1_2010
P_C_300_Pathadi_2_2010
C_C_660_Sipat_1_2011
C_C_660_Sipat_2_2011
C_C_660_Sipat_1_2012
P_C_600_Akaltara_1_2013
P_C_50_Ratija_1_2013
P_C_600_Baradarha_1_2014
P_C_30_Chakabura_2_2014
S_C_500_Marwa_1_2014
P_C_600_Tamnar_1_2014
P_C_600_Tamnar_2_2014
P_C_600_Baradarha_1_2015
P_C_300_Bhandhakhar_1_2015
P_B_685_Raikheda_1_2015
P_C_600_Tamnar_2_2015
P_C_600_Tamnar_1_2015
P_C_360_Uchpinda_1_2015
S_C_500_Marwa_2_2016
P_C_300_Nawapara_1_2016
P_B_685_Raikheda_2_2016
P_C_50_Ratija_2_2016
P_C_360_Uchpinda_2_2016
P_C_300_Nawapara_2_2017
P_C_360_Uchpinda_3_2017
C_C_800_Lara_1_2018
P_C_360_Uchpinda_4_2019
0
1000
2000
0
1000
2000
0
500
1000
1500
SO₂ Concentration (mg/Nm³)


Chhattisgarh
Emission_Standard
Before 2003
Between 2003-2016
After 2016
C_B_14_Bhilai_1_1982
C_B_30_Bhilai_1_1982
C_B_250_Bhilai_2_1982
C_B_250_Bhilai_1_1982
C_B_30_Bhilai_1_1983
C_B_200_Korba_2_1983
C_B_200_Korba_1_1983
C_B_200_Korba_3_1984
C_B_500_Korba_1_1987
C_B_500_Korba_1_1988
C_B_500_Korba_1_1989
P_C_30_Chakabura_1_2007
S_B_250_Dr Shyama_1_2007
S_B_250_Dr Shyama_2_2007
C_C_500_Sipat_1_2007
P_C_250_Tamnar_4_2007
P_C_250_Tamnar_3_2007
P_C_250_Tamnar_1_2007
P_C_250_Tamnar_2_2007
S_B_250_Dr Shyama_2_2008
S_B_250_Dr Shyama_1_2008
C_C_500_Sipat_1_2008
C_B_250_Bhilai_2_2009
C_B_250_Bhilai_1_2009
P_C_300_Pathadi_1_2009
C_B_500_Korba_1_2010
P_C_300_Pathadi_2_2010
C_C_660_Sipat_1_2011
C_C_660_Sipat_2_2011
C_C_660_Sipat_1_2012
P_C_600_Akaltara_1_2013
P_C_50_Ratija_1_2013
P_C_600_Baradarha_1_2014
P_C_30_Chakabura_2_2014
S_C_500_Marwa_1_2014
P_C_600_Tamnar_1_2014
P_C_600_Tamnar_2_2014
P_C_600_Baradarha_1_2015
P_C_300_Bhandhakhar_1_2015
P_B_685_Raikheda_1_2015
P_C_600_Tamnar_2_2015
P_C_600_Tamnar_1_2015
P_C_360_Uchpinda_1_2015
S_C_500_Marwa_2_2016
P_C_300_Nawapara_1_2016
P_B_685_Raikheda_2_2016
P_C_50_Ratija_2_2016
P_C_360_Uchpinda_2_2016
P_C_300_Nawapara_2_2017
P_C_360_Uchpinda_3_2017
C_C_800_Lara_1_2018
P_C_360_Uchpinda_4_2019
0
200
400
600
0
250
500
750
1000
0
250
500
750
1000
NO2 Concentration (mg/Nm³)

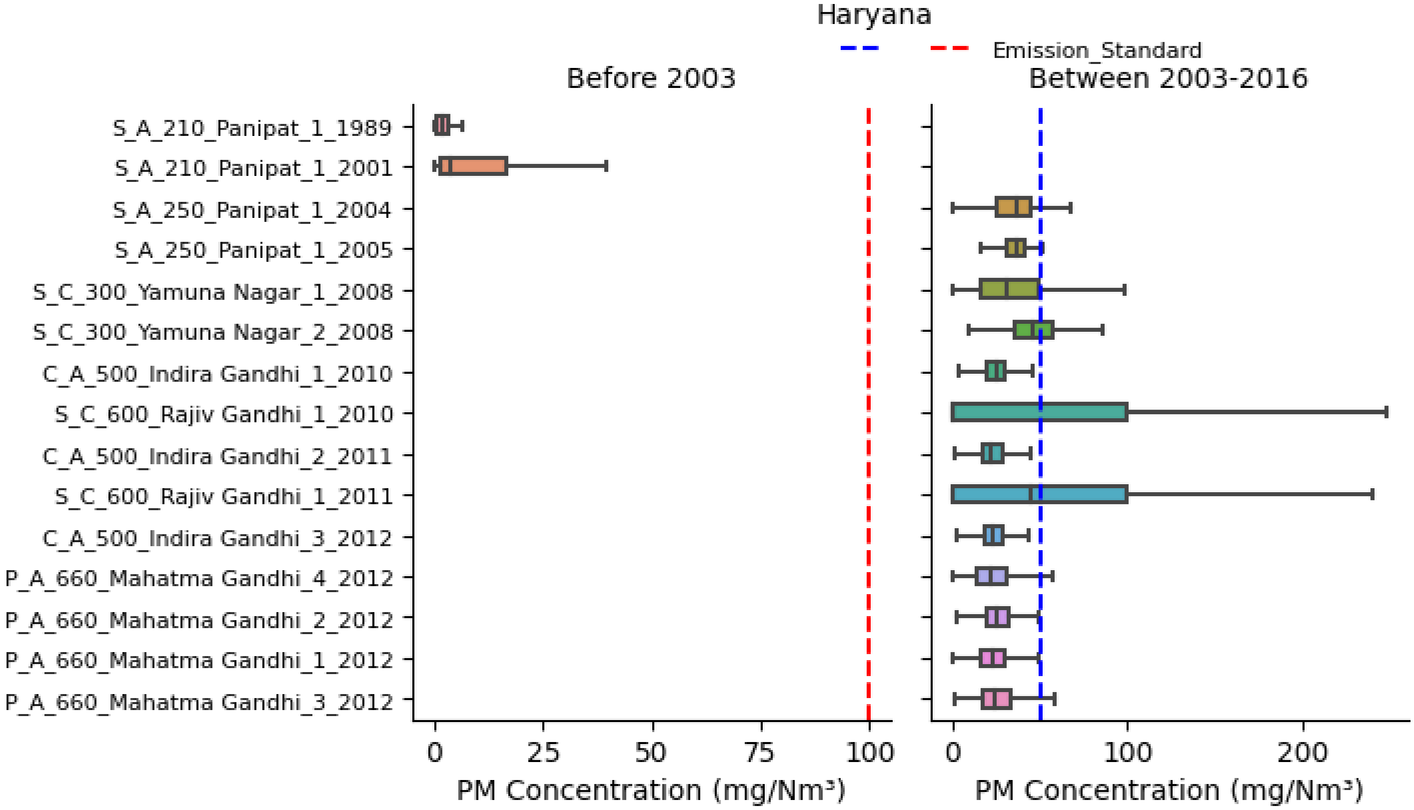
Gujarat

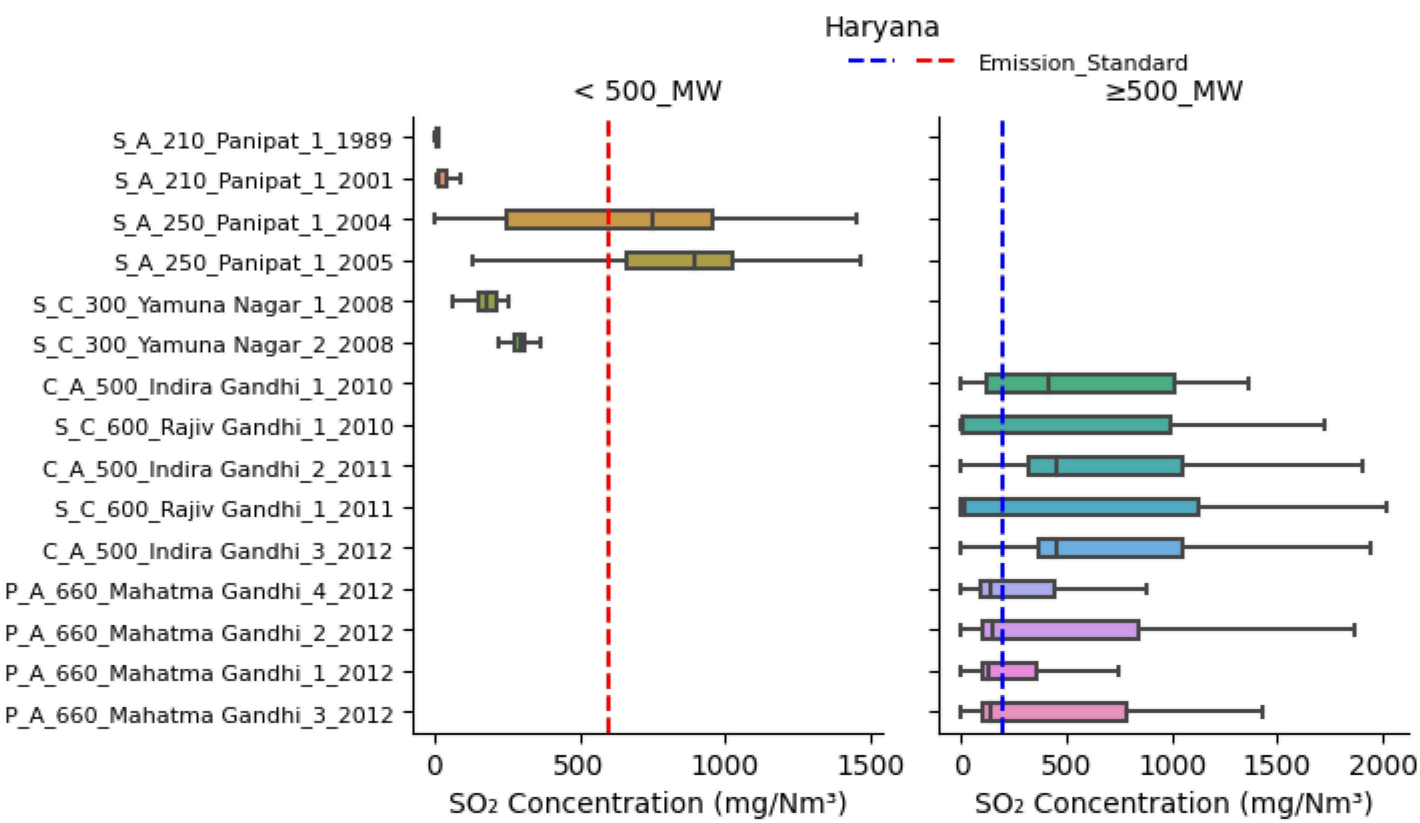

Gujarat
Emission_Standard
Before 2003
Between 2003-2016
S_C_120_Ukai_2_1976
S_C_120_Ukai_1_1976
S_C_210_Wankabori_1_1982
S_C_210_Wankabori_1_1983
S_C_210_Wankabori_1_1984
P_A_110_Sabarmati_3_1985
P_A_110_Sabarmati_2_1985
P_A_110_Sabarmati_1_1985
S_C_210_Ukai_1_1985
S_C_210_Wankabori_2_1986
S_C_210_Wankabori_1_1986
S_C_210_Wankabori_1_1987
P_A_110_Sabarmati_3_1988
P_A_110_Sabarmati_2_1988
P_A_110_Sabarmati_1_1988
S_C_70_Kutch LIG_1_1990
S_C_200_Gandhi Nagar (II)_1_1990
S_C_70_Kutch LIG_1_1991
S_C_200_Gandhi Nagar (II)_1_1991
S_C_75_Kutch LIG_1_1997
S_C_210_Wankabori_1_1998
S_C_210_Gandhi Nagar (II)_1_1998
P_C_125_Surat LIG_1_1999
P_C_125_Surat LIG_2_2000
P_A_125_Sabarmati_3_2003
P_A_125_Sabarmati_2_2003
P_A_125_Sabarmati_1_2003
S_C_125_Akrimota_1_2006
S_C_125_Akrimota_2_2006
S_C_125_Akrimota_1_2007
S_C_125_Akrimota_2_2007
S_C_75_Kutch LIG_1_2009
P_C_330_Mundra_1_2009
P_C_330_Mundra_1_2010
P_C_660_Mundra_1_2010
P_C_125_Surat LIG_4_2010
P_C_125_Surat LIG_3_2010
P_C_660_Mundra_1_2011
P_C_660_Mundra_1_2012
P_C_600_Salaya_1_2012
S_C_500_Ukai_1_2013
P_C_600_Salaya_1_2013
S_C_250_Sikka_2_2015
S_C_250_Sikka_1_2015
S_C_800_Gandhi Nagar (I)_5_
S_C_800_Gandhi Nagar (I)_6_
S_C_800_Gandhi Nagar (I)_1_
S_C_800_Gandhi Nagar (I)_4_
S_C_800_Gandhi Nagar (I)_2_
S_C_800_Gandhi Nagar (I)_3_
0
200
400
600
PM Concentration (mg/Nm³)
PM Concentration (mg/Nm³)

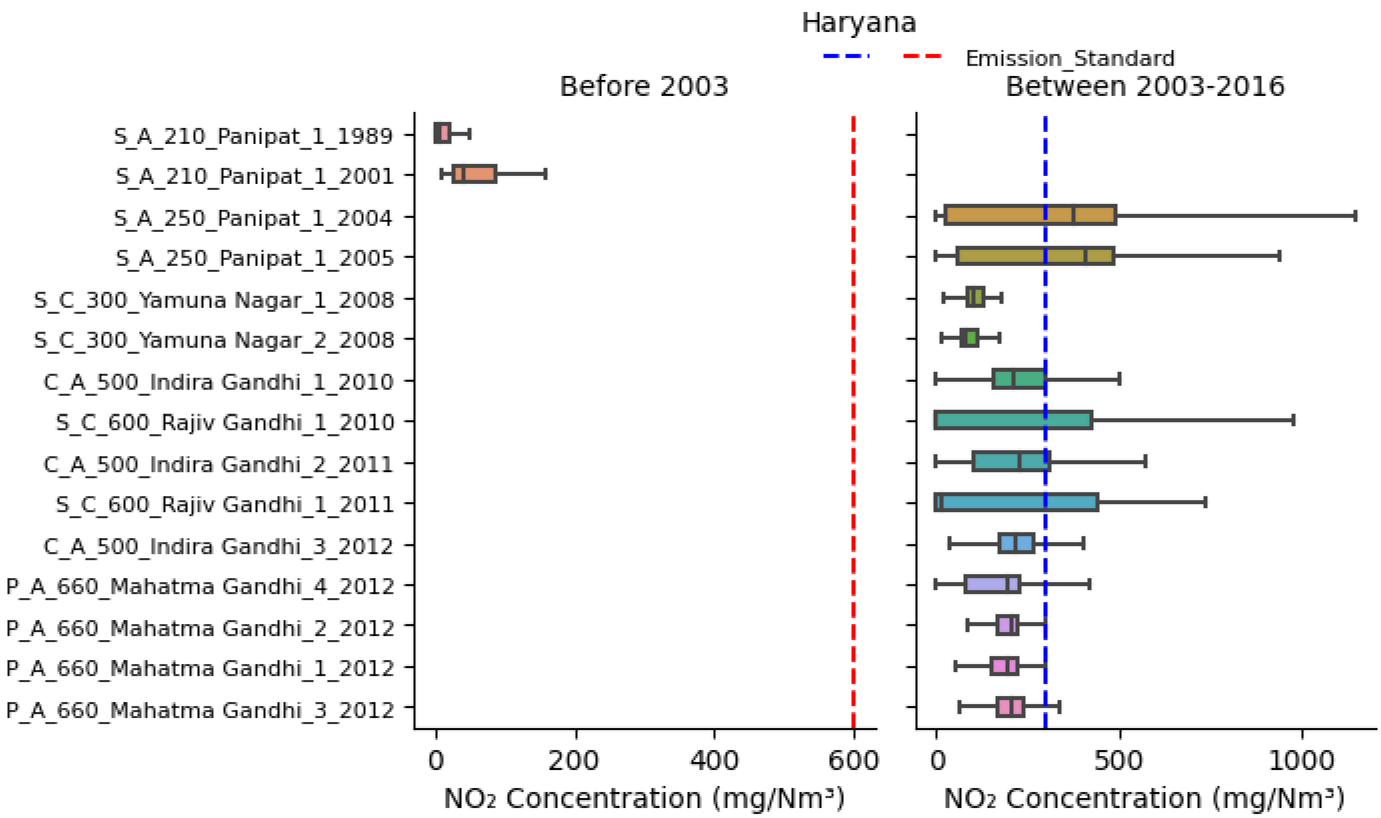

Gujarat
Emission_Standard
< 500_MW
≥500_MW
S_C_120_Ukai_2_1976
S_C_120_Ukai_1_1976
S_C_210_Wankabori_1_1982
S_C_210_Wankabori_1_1983
S_C_210_Wankabori_1_1984
P_A_110_Sabarmati_3_1985
P_A_110_Sabarmati_2_1985
P_A_110_Sabarmati_1_1985
S_C_210_Ukai_1_1985
S_C_210_Wankabori_2_1986
S_C_210_Wankabori_1_1986
S_C_210_Wankabori_1_1987
P_A_110_Sabarmati_3_1988
P_A_110_Sabarmati_2_1988
P_A_110_Sabarmati_1_1988
S_C_70_Kutch LIG_1_1990
S_C_200_Gandhi Nagar (II)_1_1990
S_C_70_Kutch LIG_1_1991
S_C_200_Gandhi Nagar (II)_1_1991
S_C_75_Kutch LIG_1_1997
S_C_210_Wankabori_1_1998
S_C_210_Gandhi Nagar (II)_1_1998
P_C_125_Surat LIG_1_1999
P_C_125_Surat LIG_2_2000
P_A_125_Sabarmati_3_2003
P_A_125_Sabarmati_2_2003
P_A_125_Sabarmati_1_2003
S_C_125_Akrimota_1_2006
S_C_125_Akrimota_2_2006
S_C_125_Akrimota_1_2007
S_C_125_Akrimota_2_2007
S_C_75_Kutch LIG_1_2009
P_C_330_Mundra_1_2009
P_C_330_Mundra_1_2010
P_C_660_Mundra_1_2010
P_C_125_Surat LIG_4_2010
P_C_125_Surat LIG_3_2010
P_C_660_Mundra_1_2011
P_C_660_Mundra_1_2012
P_C_600_Salaya_1_2012
S_C_500_Ukai_1_2013
P_C_600_Salaya_1_2013
S_C_250_Sikka_2_2015
S_C_250_Sikka_1_2015
S_C_800_Gandhi Nagar (I)_5_
S_C_800_Gandhi Nagar (I)_6_
S_C_800_Gandhi Nagar (I)_1_
S_C_800_Gandhi Nagar (I)_4_
S_C_800_Gandhi Nagar (I)_2_
S_C_800_Gandhi Nagar (I)_3_
0
1000
2000
3000
SO₂ Concentration (mg/Nm³)
0
500
1000
1500
2000
SO₂ Concentration (mg/Nm³)


Gujarat
Emission_Standard
Before 2003
Between 2003-2016
S_C_120_Ukai_2_1976
S_C_120_Ukai_1_1976
S_C_210_Wankabori_1_1982
S_C_210_Wankabori_1_1983
S_C_210_Wankabori_1_1984
P_A_110_Sabarmati_3_1985
P_A_110_Sabarmati_2_1985
P_A_110_Sabarmati_1_1985
S_C_210_Ukai_1_1985
S_C_210_Wankabori_2_1986
S_C_210_Wankabori_1_1986
S_C_210_Wankabori_1_1987
P_A_110_Sabarmati_3_1988
P_A_110_Sabarmati_2_1988
P_A_110_Sabarmati_1_1988
S_C_70_Kutch LIG_1_1990
S_C_200_Gandhi Nagar (II)_1_1990
S_C_70_Kutch LIG_1_1991
S_C_200_Gandhi Nagar (II)_1_1991
S_C_75_Kutch LIG_1_1997
S_C_210_Wankabori_1_1998
S_C_210_Gandhi Nagar (II)_1_1998
P_C_125_Surat LIG_1_1999
P_C_125_Surat LIG_2_2000
P_A_125_Sabarmati_3_2003
P_A_125_Sabarmati_2_2003
P_A_125_Sabarmati_1_2003
S_C_125_Akrimota_1_2006
S_C_125_Akrimota_2_2006
S_C_125_Akrimota_1_2007
S_C_125_Akrimota_2_2007
S_C_75_Kutch LIG_1_2009
P_C_330_Mundra_1_2009
P_C_330_Mundra_1_2010
P_C_660_Mundra_1_2010
P_C_125_Surat LIG_4_2010
P_C_125_Surat LIG_3_2010
P_C_660_Mundra_1_2011
P_C_660_Mundra_1_2012
P_C_600_Salaya_1_2012
S_C_500_Ukai_1_2013
P_C_600_Salaya_1_2013
S_C_250_Sikka_2_2015
S_C_250_Sikka_1_2015
S_C_800_Gandhi Nagar (I)_5_
S_C_800_Gandhi Nagar (I)_6_
S_C_800_Gandhi Nagar (I)_1_
S_C_800_Gandhi Nagar (I)_4_
S_C_800_Gandhi Nagar (I)_2_
S_C_800_Gandhi Nagar (I)_3_
0
250
500
750
1000
NO₂ Concentration (mg/Nm³)
0
1000
2000
NO₂ Concentration (mg/Nm³)

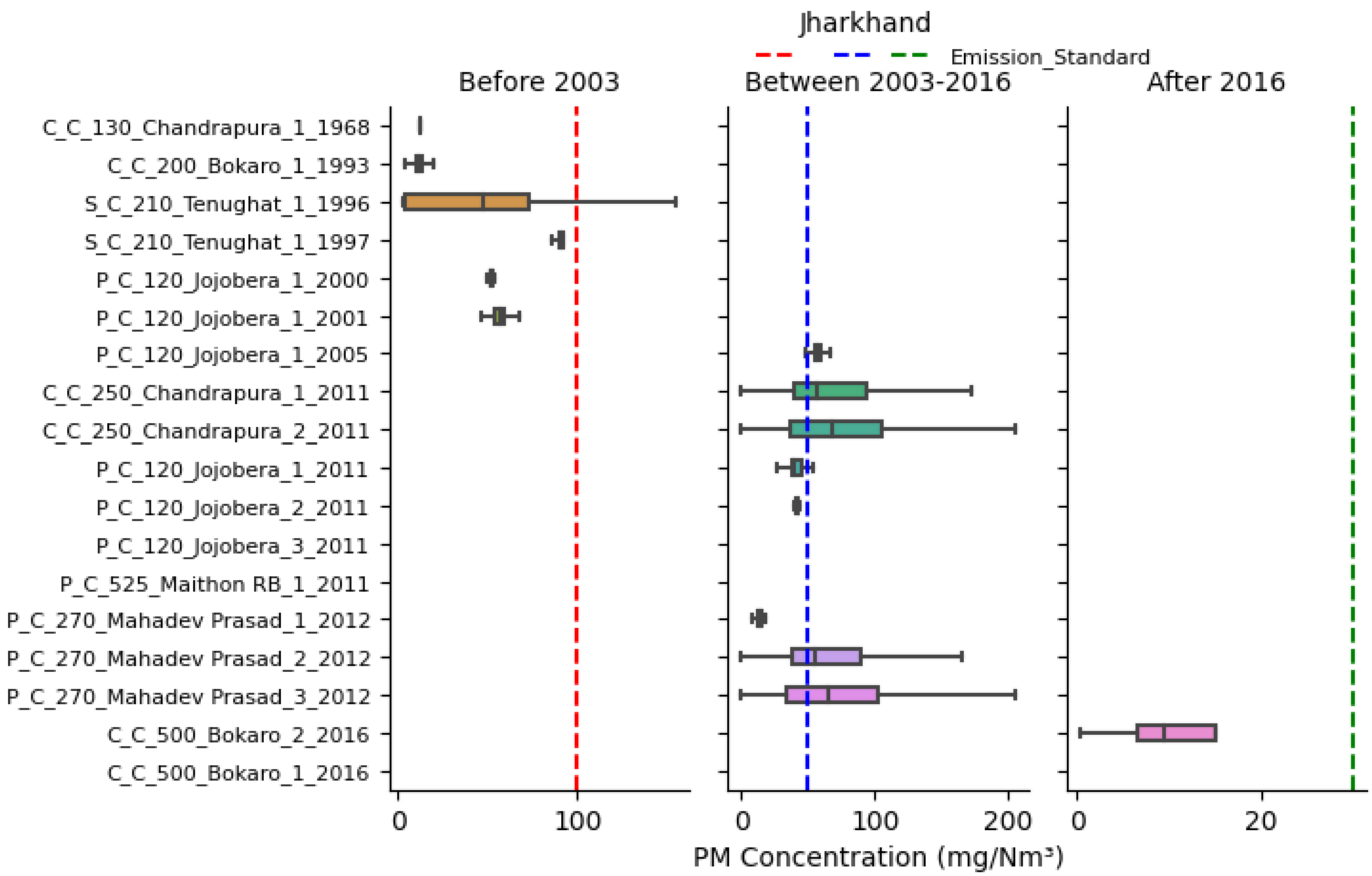
Haryana

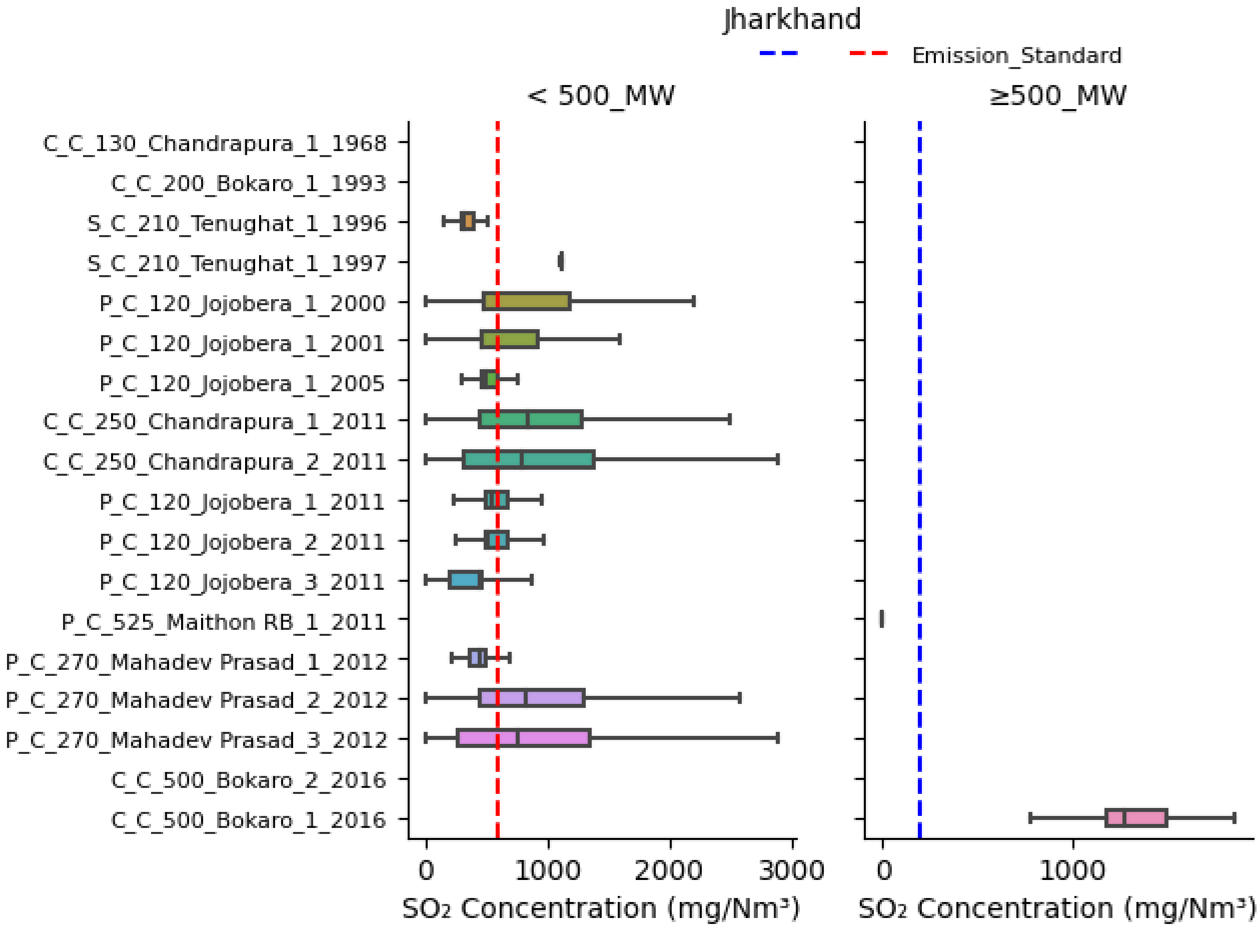

Haryana
Emission_Standard
Before 2003
Between 2003-2016
S_A_210_Panipat_1_1989
S_A_210_Panipat_1_2001
S_A_250_Panipat_1_2004
S_A_250_Panipat_1_2005
S_C_300_Yamuna Nagar_1_2008
S_C_300_Yamuna Nagar_2_2008
C_A_500_Indira Gandhi_1_2010
S_C_600_Rajiv Gandhi_1_2010
C_A_500_Indira Gandhi_2_2011
S_C_600_Rajiv Gandhi_1_2011
C_A_500_Indira Gandhi_3_2012
P_A_660_Mahatma Gandhi_4_2012
P_A_660_Mahatma Gandhi_2_2012
P_A_660_Mahatma Gandhi_1_2012
P_A_660_Mahatma Gandhi_3_2012
0
25
50
75
100
0
100
200
PM Concentration (mg/Nm³)
PM Concentration (mg/Nm³)

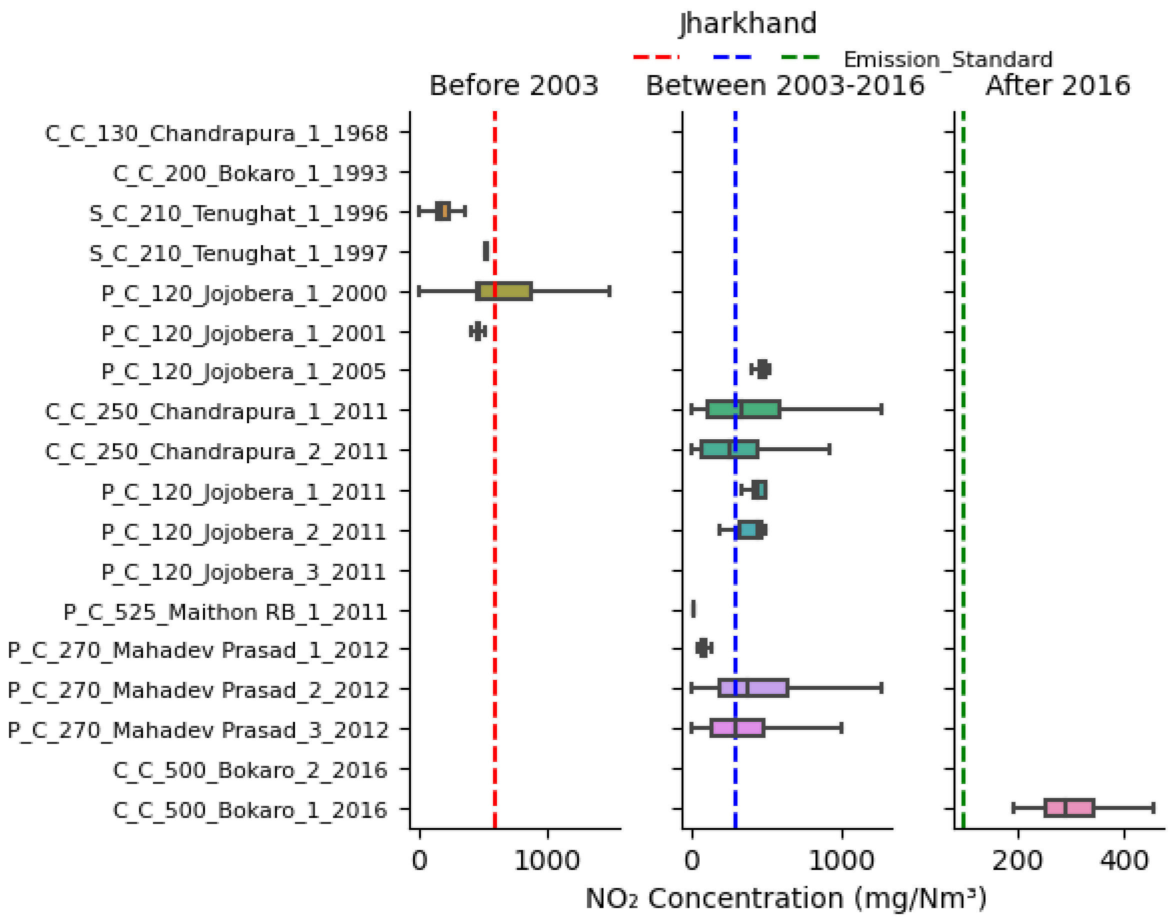

Haryana
Emission_Standard
< 500_MW
≥500_MW
S_A_210_Panipat_1_1989
S_A_210_Panipat_1_2001
S_A_250_Panipat_1_2004
S_A_250_Panipat_1_2005
S_C_300_Yamuna Nagar_1_2008
S_C_300_Yamuna Nagar_2_2008
C_A_500_Indira Gandhi_1_2010
S_C_600_Rajiv Gandhi_1_2010
C_A_500_Indira Gandhi_2_2011
S_C_600_Rajiv Gandhi_1_2011
C_A_500_Indira Gandhi_3_2012
P_A_660_Mahatma Gandhi_4_2012
P_A_660_Mahatma Gandhi_2_2012
P_A_660_Mahatma Gandhi_1_2012
P_A_660_Mahatma Gandhi_3_2012
0
500
1000
1500
0
500
1000
1500
2000
SO₂ Concentration (mg/Nm³)
SO₂ Concentration (mg/Nm³)


Haryana
Emission_Standard
Before 2003
Between 2003-2016
S_A_210_Panipat_1_1989
S_A_210_Panipat_1_2001
S_A_250_Panipat_1_2004
S_A_250_Panipat_1_2005
S_C_300_Yamuna Nagar_1_2008
S_C_300_Yamuna Nagar_2_2008
C_A_500_Indira Gandhi_1_2010
S_C_600_Rajiv Gandhi_1_2010
C_A_500_Indira Gandhi_2_2011
S_C_600_Rajiv Gandhi_1_2011
C_A_500_Indira Gandhi_3_2012
P_A_660_Mahatma Gandhi_4_2012
P_A_660_Mahatma Gandhi_2_2012
P_A_660_Mahatma Gandhi_1_2012
P_A_660_Mahatma Gandhi_3_2012
0
200
400
600
0
500
1000
NO2 Concentration (mg/Nm³)
NO2 Concentration (mg/Nm³)

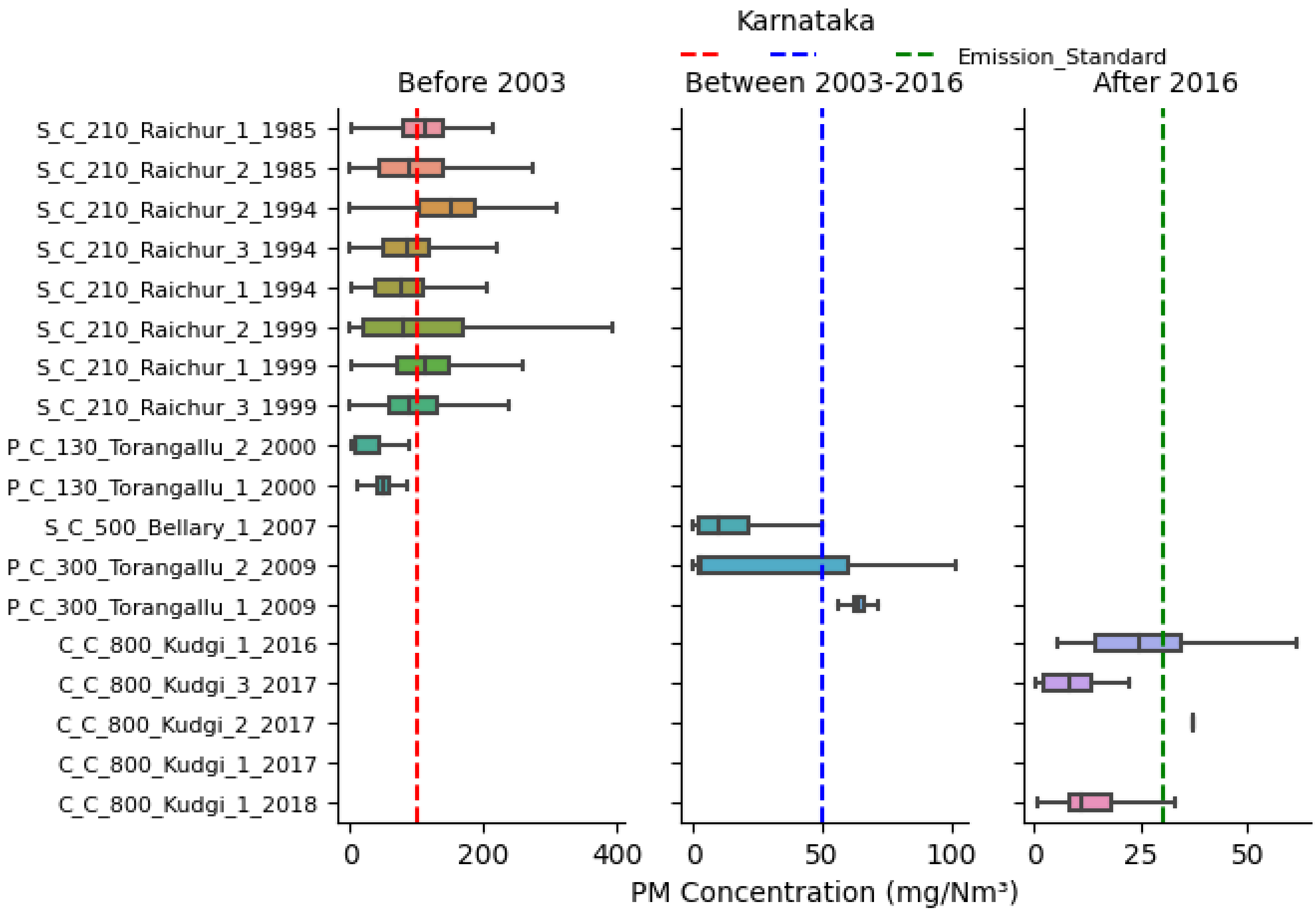
Jharkhand

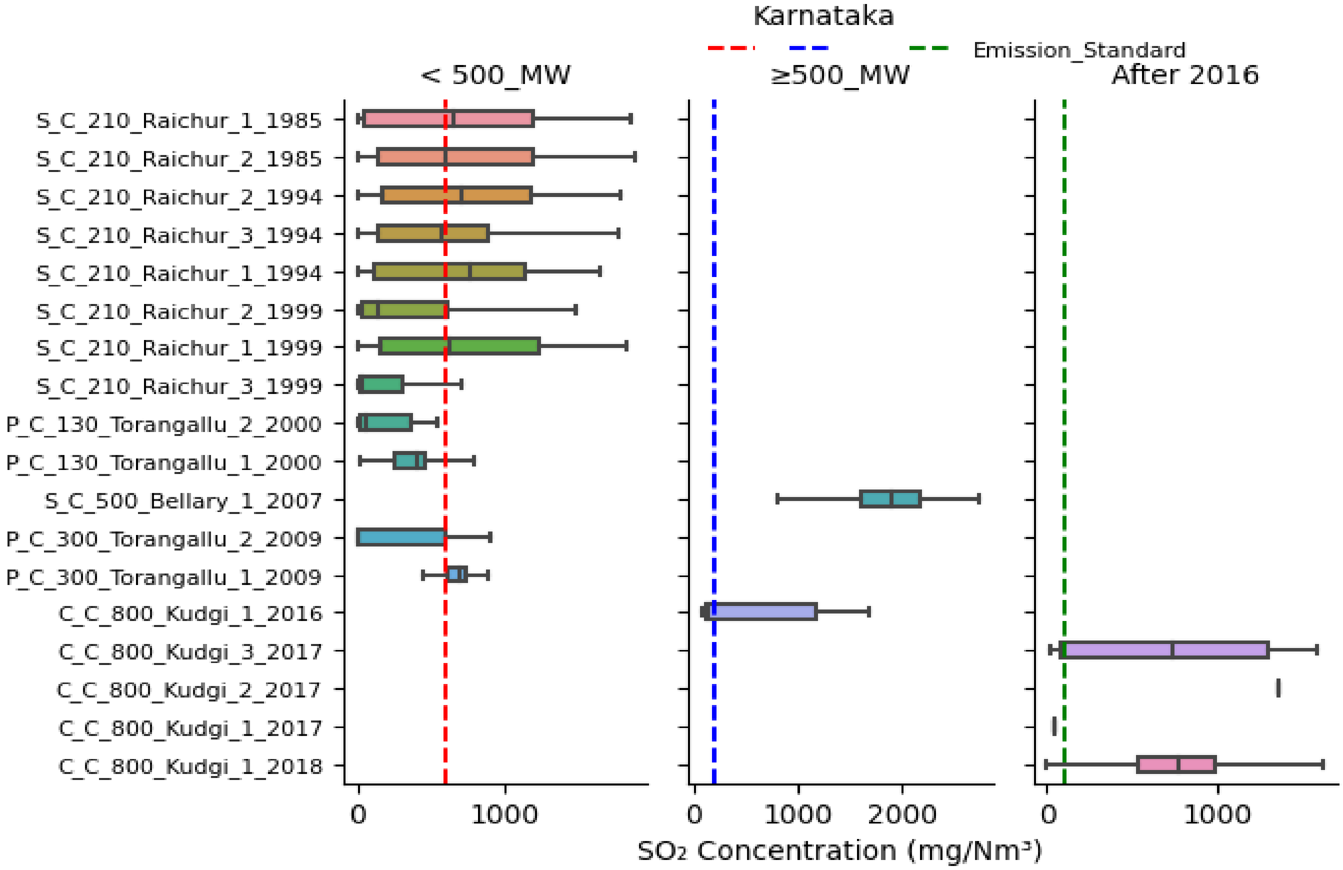

Jharkhand
Emission_Standard
Before 2003
Between 2003-2016
After 2016
C_C_130_Chandrapura_1_1968
C_C_200_Bokaro_1_1993
S_C_210_Tenughat_1_1996
S_C_210_Tenughat_1_1997
P_C_120_Jojobera_1_2000
P_C_120_Jojobera_1_2001
P_C_120_Jojobera_1_2005
C_C_250_Chandrapura_1_2011
C_C_250_Chandrapura_2_2011
P_C_120_Jojobera_1_2011
P_C_120_Jojobera_2_2011
P_C_120_Jojobera_3_2011
P_C_525_Maithon RB_1_2011
P_C_270_Mahadev Prasad_1_2012
P_C_270_Mahadev Prasad_2_2012
P_C_270_Mahadev Prasad_3_2012
C_C_500_Bokaro_2_2016
C_C_500_Bokaro_1_2016
0
100
0
100
200
0
20
PM Concentration (mg/Nm³)

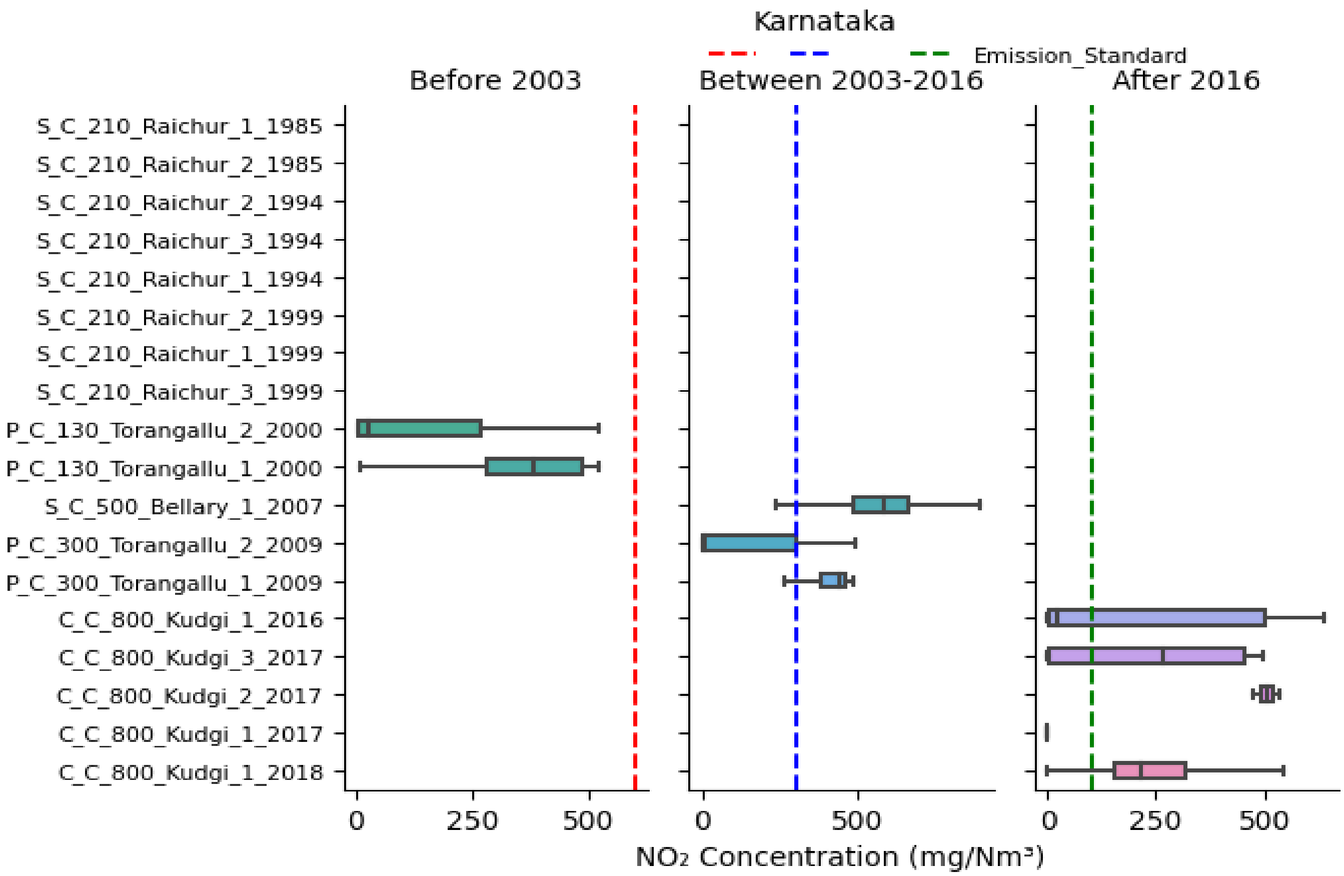

Jharkhand
Emission_Standard
< 500_MW
≥500_MW
C_C_130_Chandrapura_1_1968
C_C_200_Bokaro_1_1993
S_C_210_Tenughat_1_1996
S_C_210_Tenughat_1_1997
P_C_120_Jojobera_1_2000
P_C_120_Jojobera_1_2001
P_C_120_Jojobera_1_2005
C_C_250_Chandrapura_1_2011
C_C_250_Chandrapura_2_2011
P_C_120_Jojobera_1_2011
P_C_120_Jojobera_2_2011
P_C_120_Jojobera_3_2011
P_C_525_Maithon RB_1_2011
P_C_270_Mahadev Prasad_1_2012
P_C_270_Mahadev Prasad_2_2012
P_C_270_Mahadev Prasad_3_2012
C_C_500_Bokaro_2_2016
C_C_500_Bokaro_1_2016
0
1000
2000
3000
0
1000
SO₂ Concentration (mg/Nm³)
SO₂ Concentration (mg/Nm³)


Jharkhand
Emission_Standard
Before 2003
Between 2003-2016
After 2016
C_C_130_Chandrapura_1_1968
C_C_200_Bokaro_1_1993
S_C_210_Tenughat_1_1996
S_C_210_Tenughat_1_1997
P_C_120_Jojobera_1_2000
P_C_120_Jojobera_1_2001
P_C_120_Jojobera_1_2005
C_C_250_Chandrapura_1_2011
C_C_250_Chandrapura_2_2011
P_C_120_Jojobera_1_2011
P_C_120_Jojobera_2_2011
P_C_120_Jojobera_3_2011
P_C_525_Maithon RB_1_2011
P_C_270_Mahadev Prasad_1_2012
P_C_270_Mahadev Prasad_2_2012
P_C_270_Mahadev Prasad_3_2012
C_C_500_Bokaro_2_2016
C_C_500_Bokaro_1_2016
0
1000
0
1000
200
400
NO₂ Concentration (mg/Nm³)

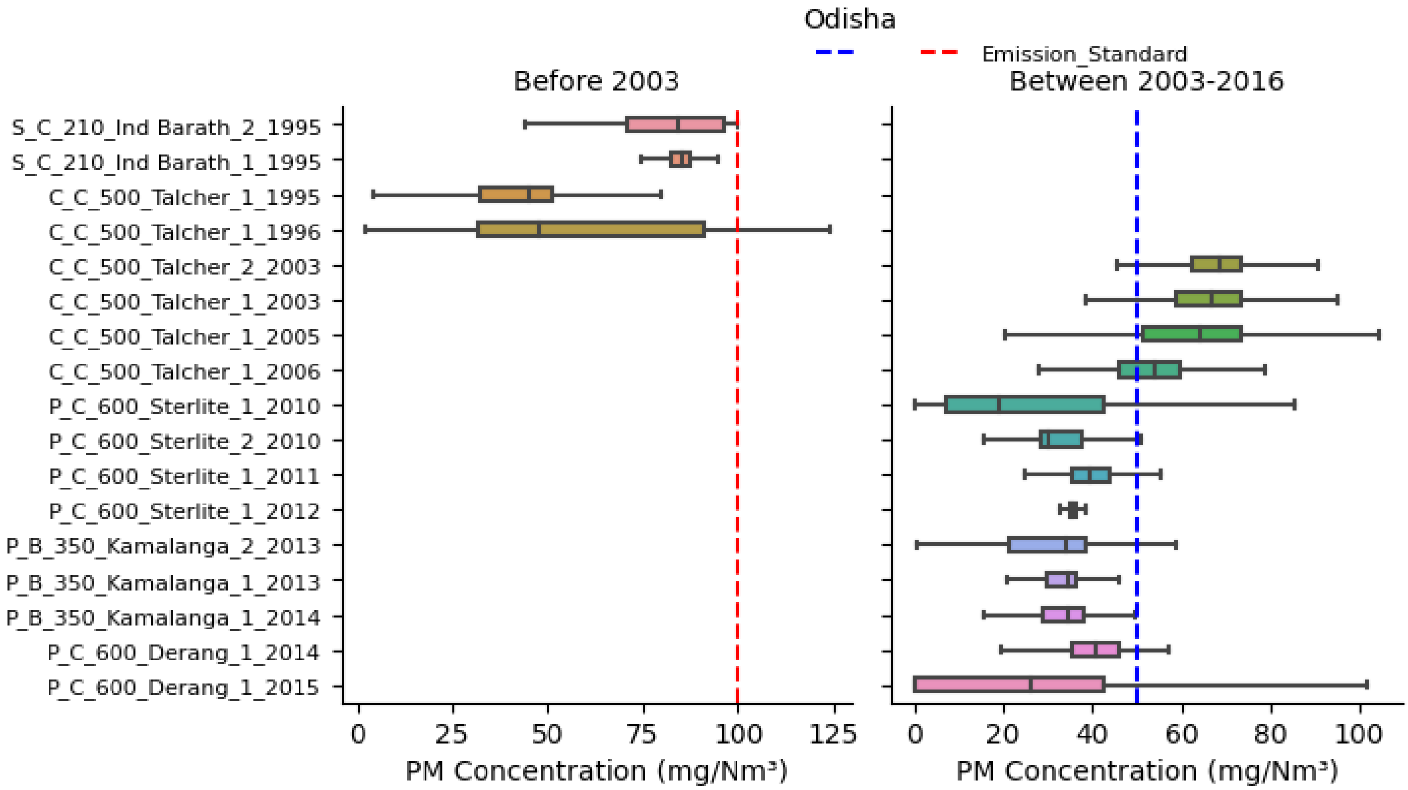
Karnataka

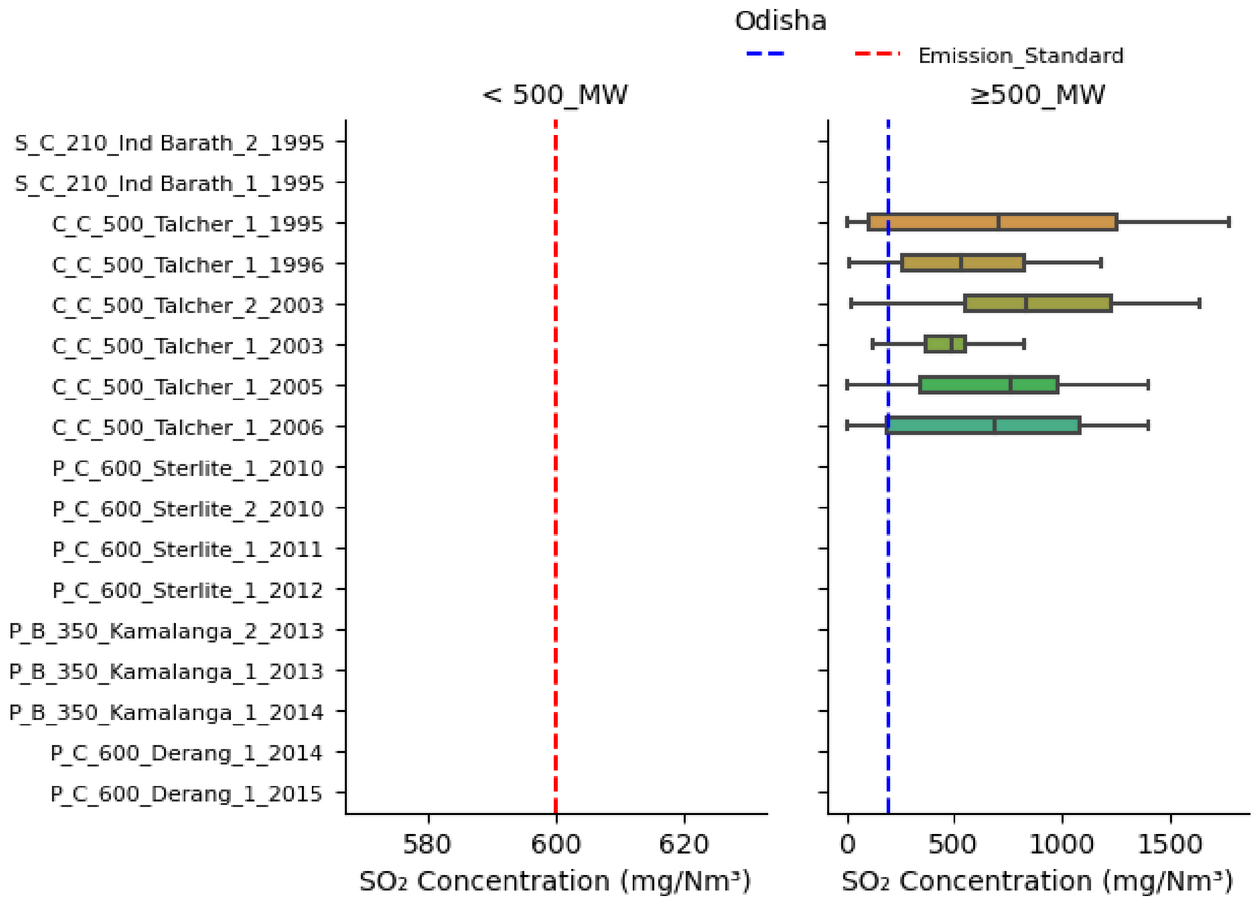

Karnataka
Emission_Standard
Before 2003
Between 2003-2016
After 2016
S_C_210_Raichur_1_1985
S_C_210_Raichur_2_1985
S_C_210_Raichur_2_1994
S_C_210_Raichur_3_1994
S_C_210_Raichur_1_1994
S_C_210_Raichur_2_1999
S_C_210_Raichur_1_1999
S_C_210_Raichur_3_1999
P_C_130_Torangallu_2_2000
P_C_130_Torangallu_1_2000
S_C_500_Bellary_1_2007
P_C_300_Torangallu_2_2009
P_C_300_Torangallu_1_2009
C_C_800_Kudgi_1_2016
C_C_800_Kudgi_3_2017
C_C_800_Kudgi_2_2017
C_C_800_Kudgi_1_2017
C_C_800_Kudgi_1_2018
0
200
400
0
50
100
0
25
50
PM Concentration (mg/Nm³)

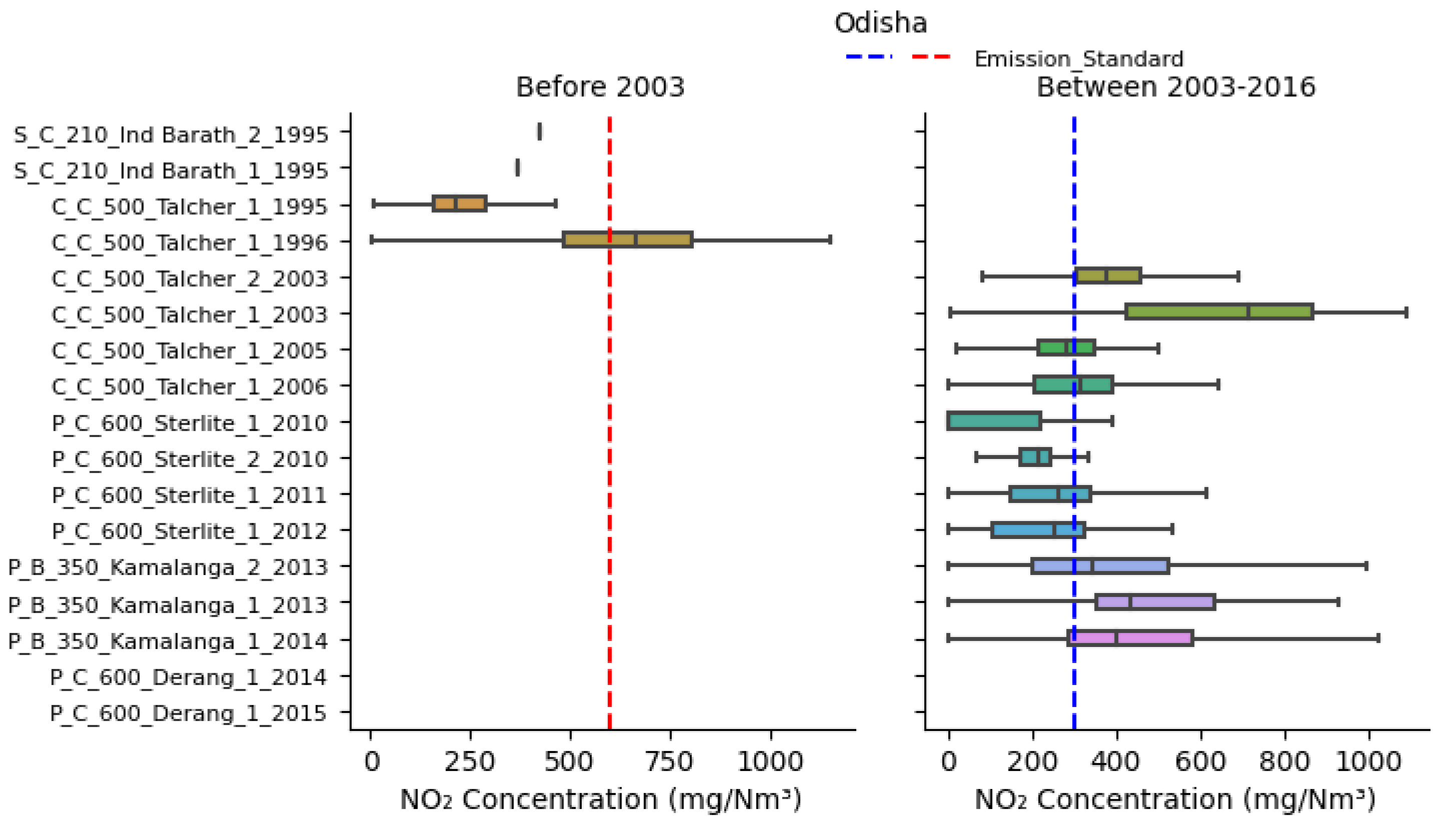

Karnataka
Emission_Standard
< 500_MW
≥500_MW
After 2016
S_C_210_Raichur_1_1985
S_C_210_Raichur_2_1985
S_C_210_Raichur_2_1994
S_C_210_Raichur_3_1994
S_C_210_Raichur_1_1994
S_C_210_Raichur_2_1999
S_C_210_Raichur_1_1999
S_C_210_Raichur_3_1999
P_C_130_Torangallu_2_2000
P_C_130_Torangallu_1_2000
S_C_500_Bellary_1_2007
P_C_300_Torangallu_2_2009
P_C_300_Torangallu_1_2009
C_C_800_Kudgi_1_2016
C_C_800_Kudgi_3_2017
C_C_800_Kudgi_2_2017
C_C_800_Kudgi_1_2017
C_C_800_Kudgi_1_2018
0
1000
0
1000
2000
0
1000
SO2 Concentration (mg/Nm³)


Karnataka
Emission_Standard
Before 2003
Between 2003-2016
After 2016
S_C_210_Raichur_1_1985
S_C_210_Raichur_2_1985
S_C_210_Raichur_2_1994
S_C_210_Raichur_3_1994
S_C_210_Raichur_1_1994
S_C_210_Raichur_2_1999
S_C_210_Raichur_1_1999
S_C_210_Raichur_3_1999
P_C_130_Torangallu_2_2000
P_C_130_Torangallu_1_2000
S_C_500_Bellary_1_2007
P_C_300_Torangallu_2_2009
P_C_300_Torangallu_1_2009
C_C_800_Kudgi_1_2016
C_C_800_Kudgi_3_2017
C_C_800_Kudgi_2_2017
C_C_800_Kudgi_1_2017
C_C_800_Kudgi_1_2018
0
250
500
0
500
0
250
500
NO2 Concentration (mg/Nm³)

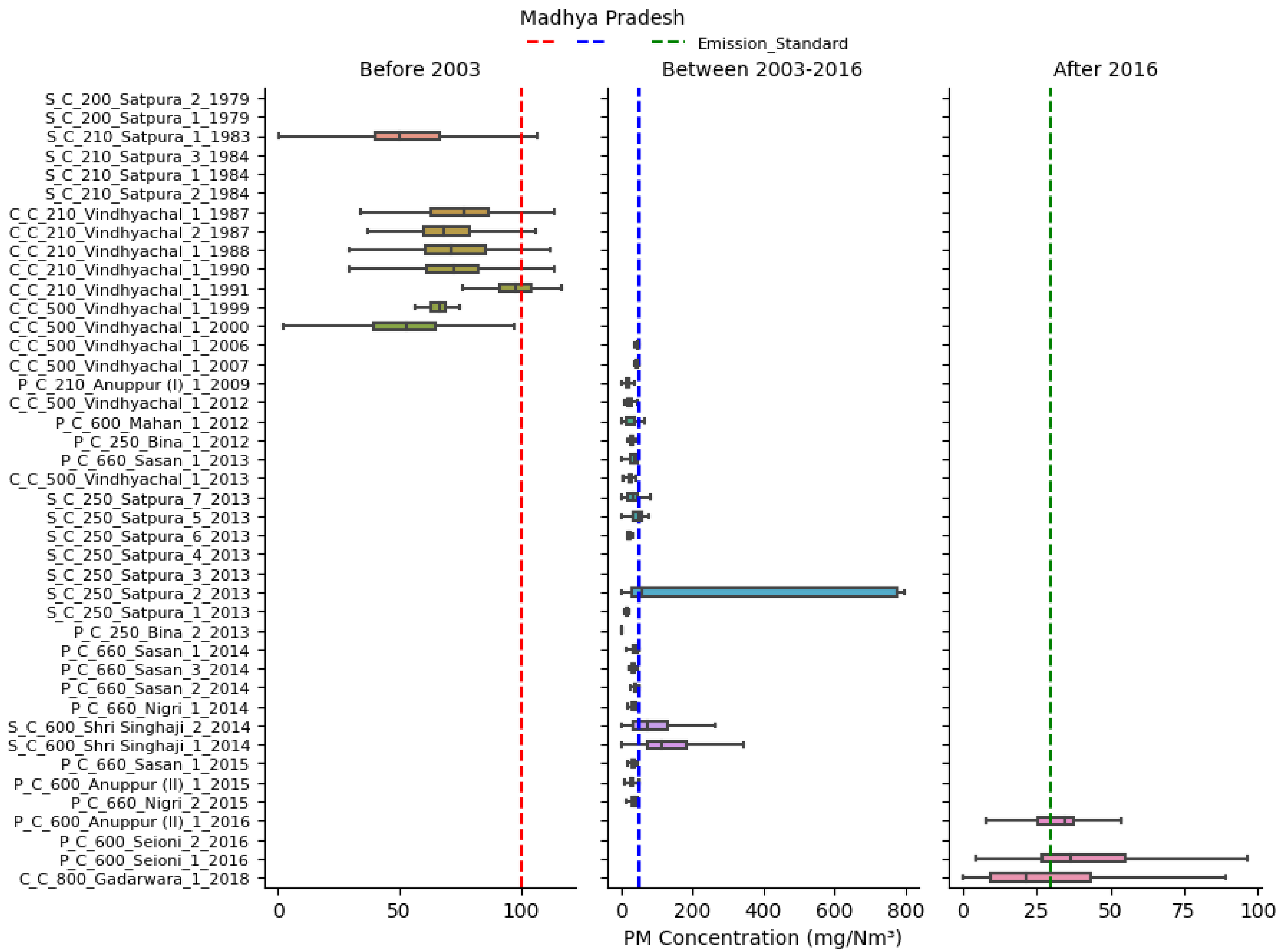
Odisha

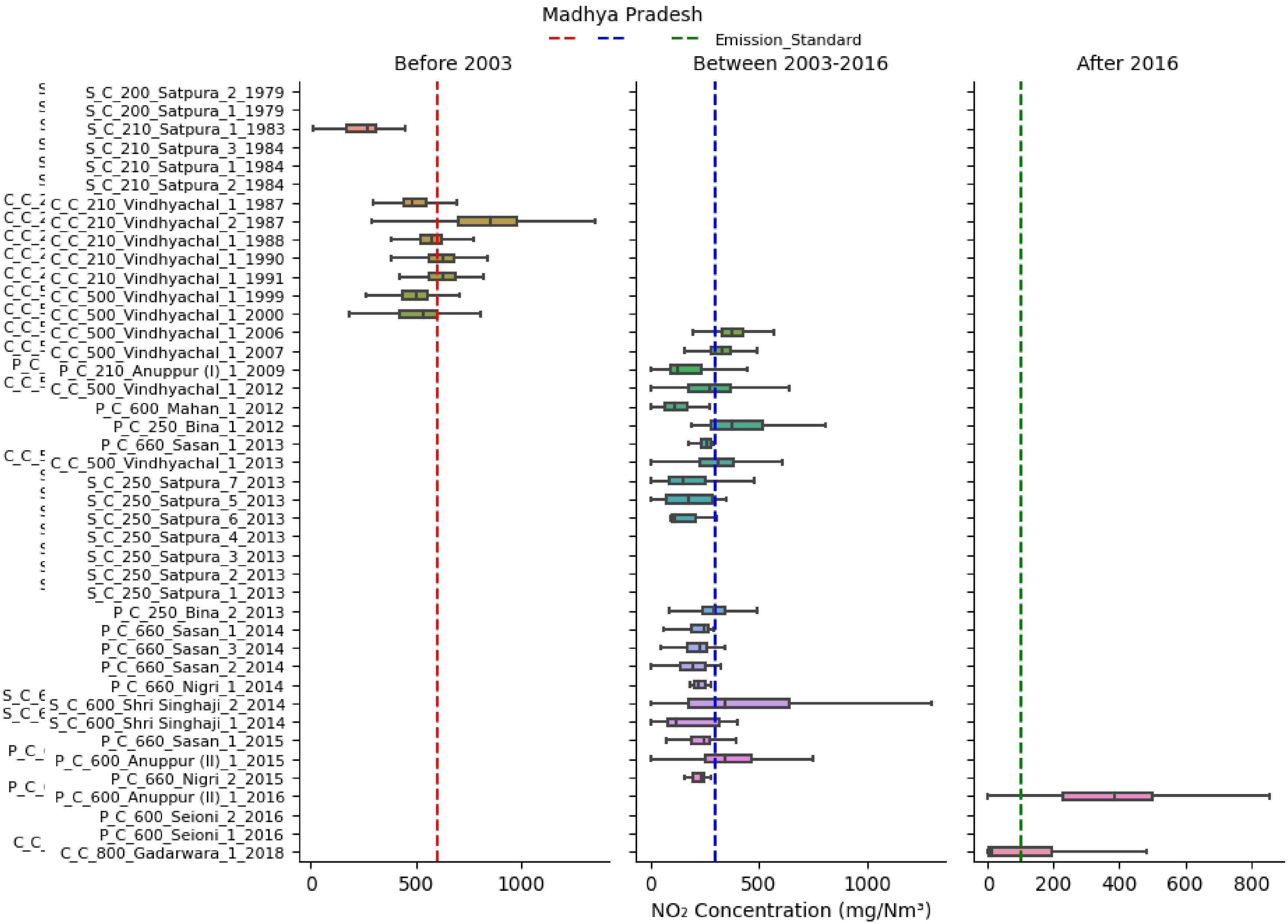

Odisha
Emission_Standard
Before 2003
Between 2003-2016
S_C_210_Ind Barath_2_1995
S_C_210_Ind Barath_1_1995
C_C_500_Talcher_1_1995
C_C_500_Talcher_1_1996
C_C_500_Talcher_2_2003
C_C_500_Talcher_1_2003
C_C_500_Talcher_1_2005
C_C_500_Talcher_1_2006
P_C_600_Sterlite_1_2010
P_C_600_Sterlite_2_2010
P_C_600_Sterlite_1_2011
P_C_600_Sterlite_1_2012
P_B_350_Kamalanga_2_2013
P_B_350_Kamalanga_1_2013
P_B_350_Kamalanga_1_2014
P_C_600_Derang_1_2014
P_C_600_Derang_1_2015
0
25
50
75
100
125
0
20
40
60
80
100
PM Concentration (mg/Nm³)
PM Concentration (mg/Nm³)


Odisha
Emission_Standard
< 500_MW
≥500_MW
S_C_210_Ind Barath_2_1995
S_C_210_Ind Barath_1_1995
C_C_500_Talcher_1_1995
C_C_500_Talcher_1_1996
C_C_500_Talcher_2_2003
C_C_500_Talcher_1_2003
C_C_500_Talcher_1_2005
C_C_500_Talcher_1_2006
P_C_600_Sterlite_1_2010
P_C_600_Sterlite_2_2010
P_C_600_Sterlite_1_2011
P_C_600_Sterlite_1_2012
P_B_350_Kamalanga_2_2013
P_B_350_Kamalanga_1_2013
P_B_350_Kamalanga_1_2014
P_C_600_Derang_1_2014
P_C_600_Derang_1_2015
580
600
620
0
500
1000
1500
SO₂ Concentration (mg/Nm³)
SO₂ Concentration (mg/Nm³)

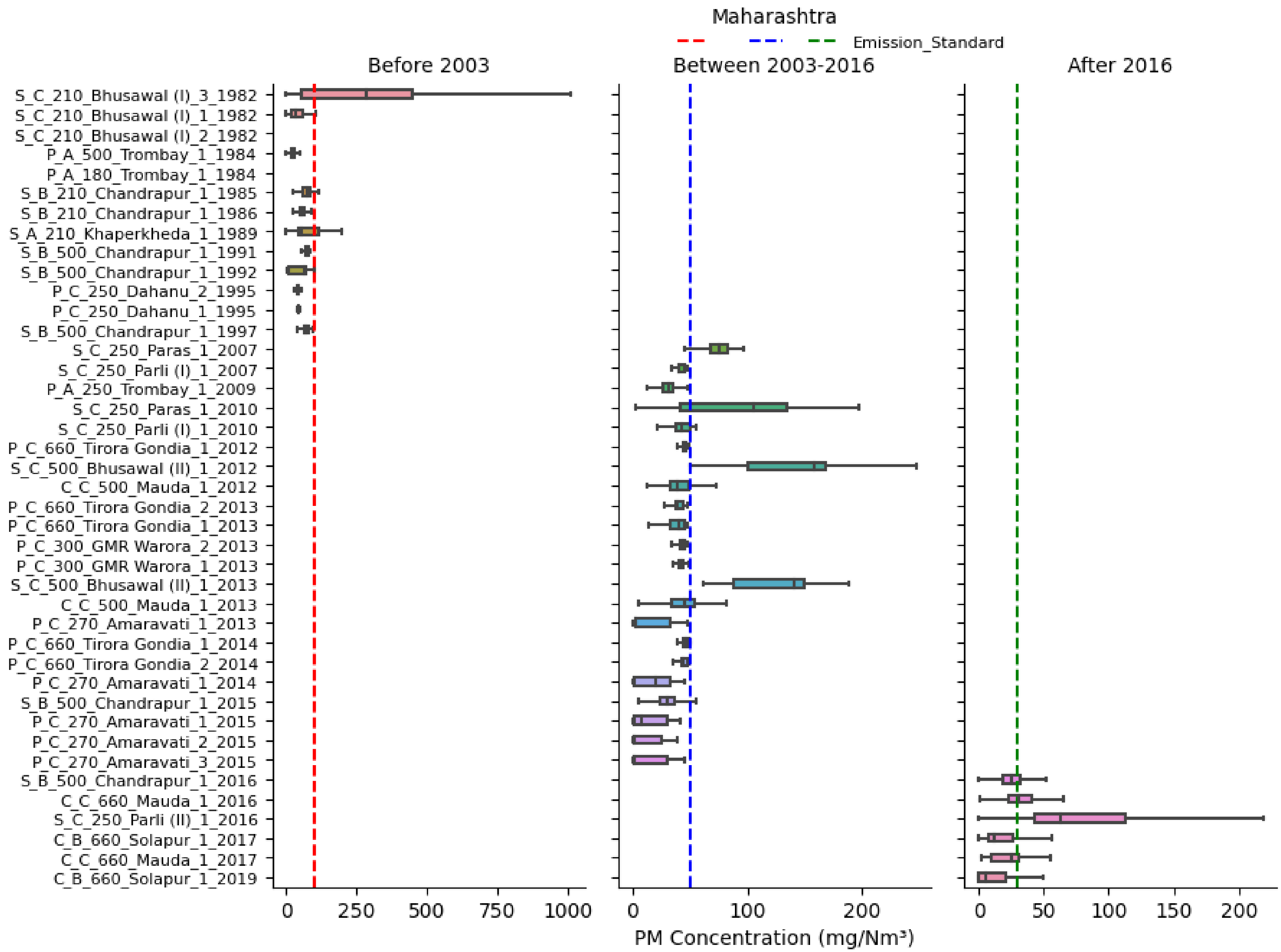

Odisha
Emission_Standard
Before 2003
Between 2003-2016
S_C_210_Ind Barath_2_1995
S_C_210_Ind Barath_1_1995
C_C_500_Talcher_1_1995
C_C_500_Talcher_1_1996
C_C_500_Talcher_2_2003
C_C_500_Talcher_1_2003
C_C_500_Talcher_1_2005
C_C_500_Talcher_1_2006
P_C_600_Sterlite_1_2010
P_C_600_Sterlite_2_2010
P_C_600_Sterlite_1_2011
P_C_600_Sterlite_1_2012
P_B_350_Kamalanga_2_2013
P_B_350_Kamalanga_1_2013
P_B_350_Kamalanga_1_2014
P_C_600_Derang_1_2014
P_C_600_Derang_1_2015
0
250
500
750
1000
NO₂ Concentration (mg/Nm³)
0
200
400
600
800
1000
NO₂ Concentration (mg/Nm³)

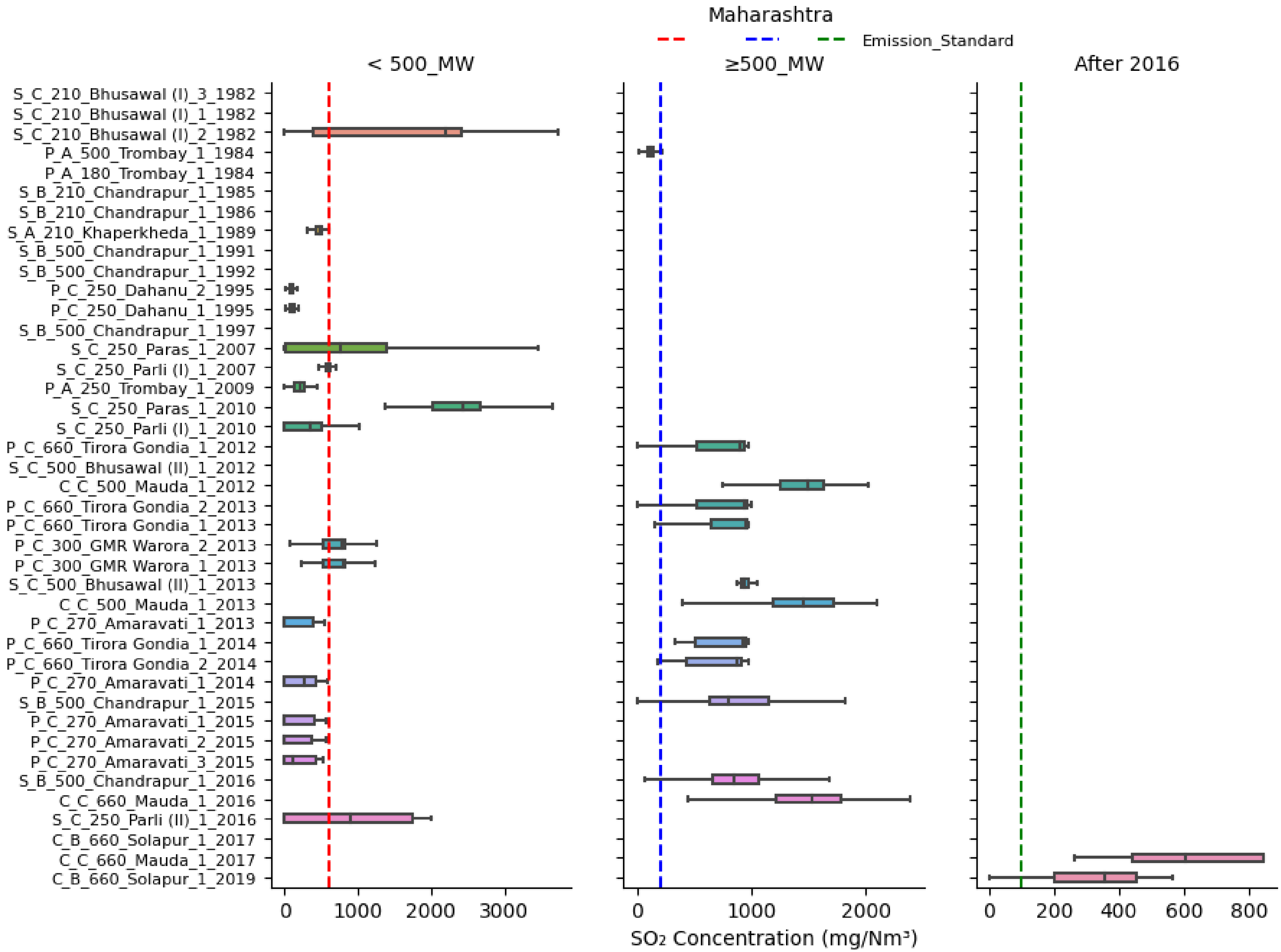
Madhya Pradesh

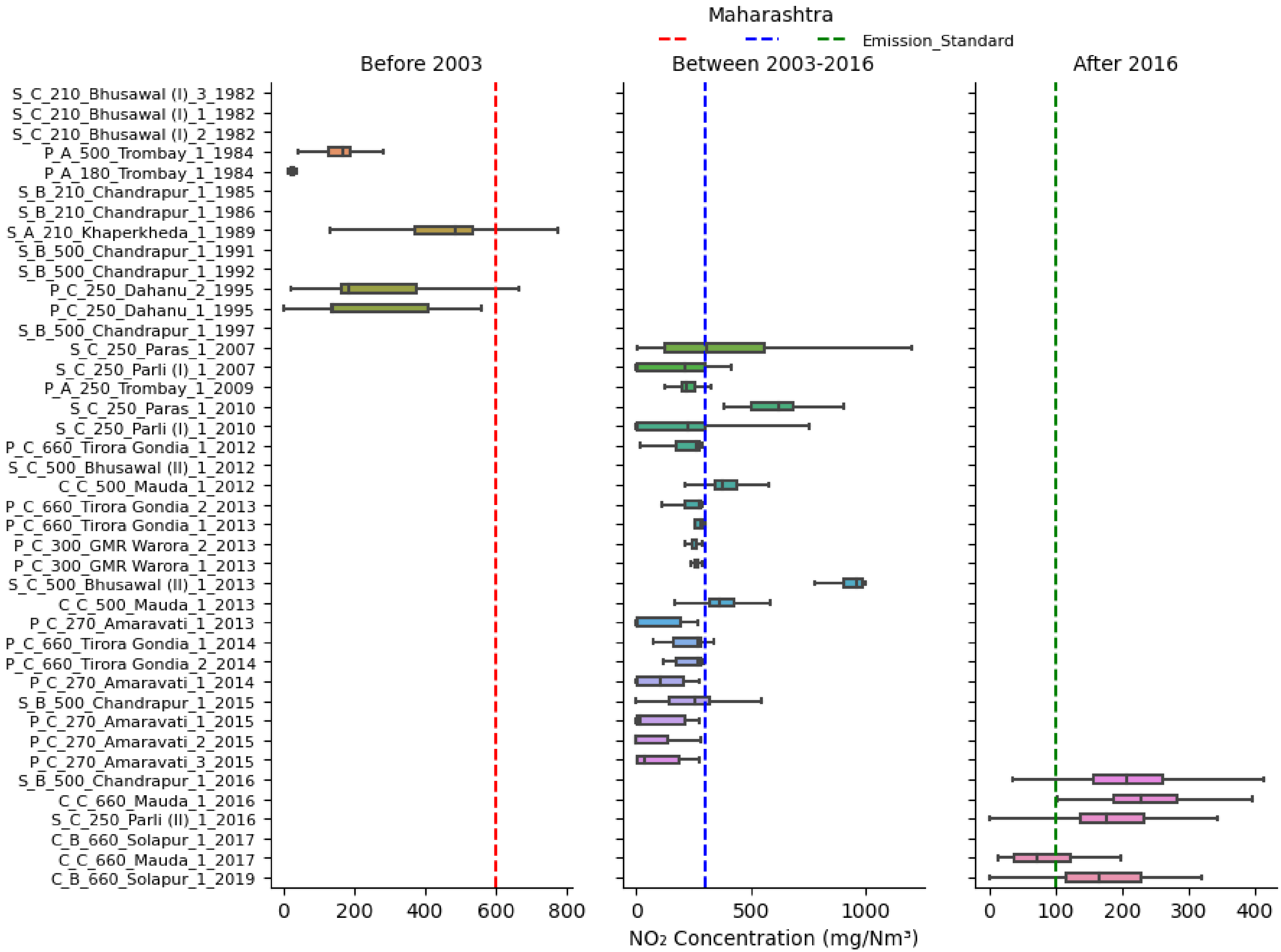


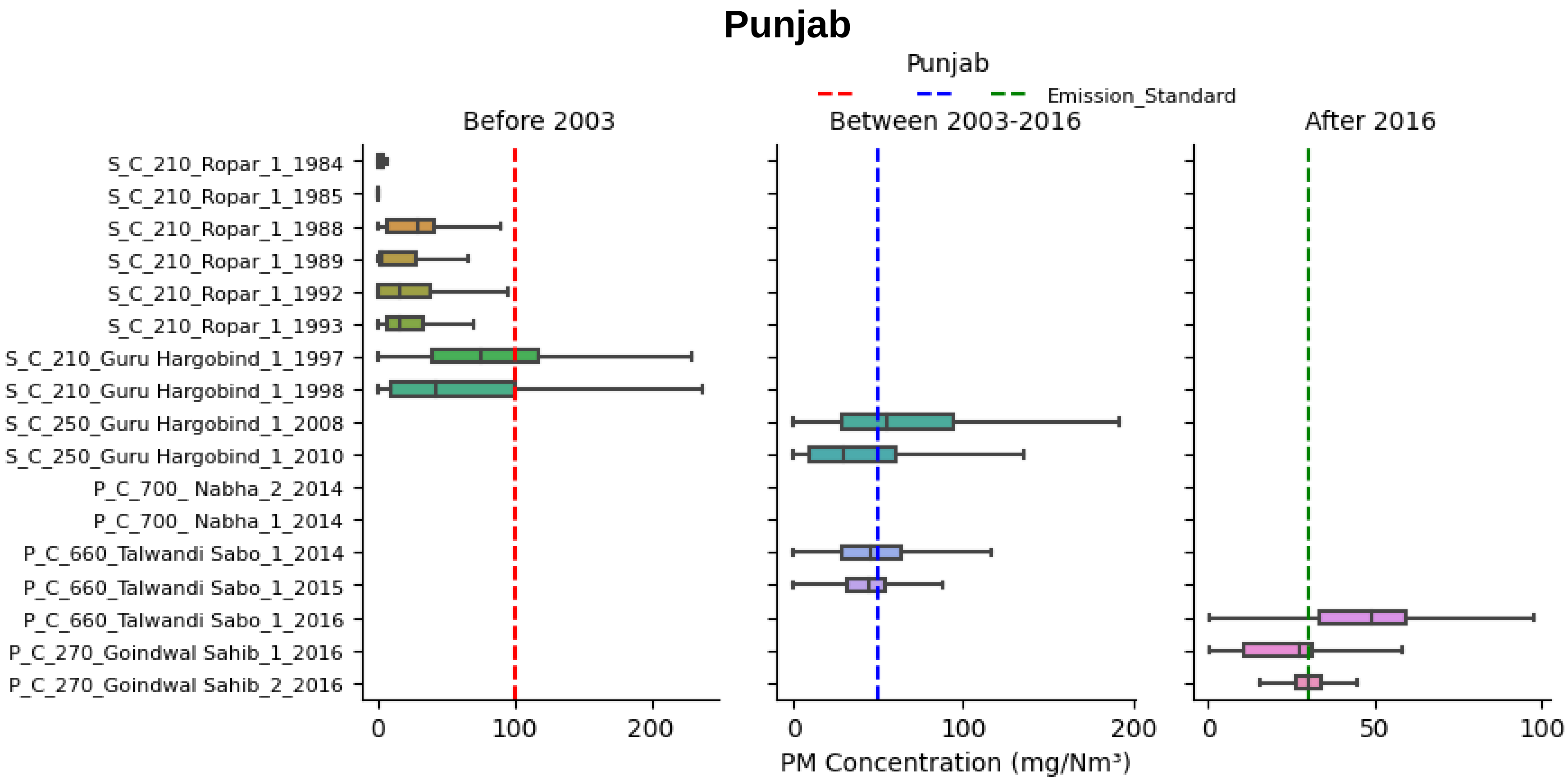

Madhya Pradesh
Emission_Standard
Before 2003
Between 2003-2016
After 2016
S_C_200_Satpura_2_1979
S_C_200_Satpura_1_1979
S_C_210_Satpura_1_1983
S_C_210_Satpura_3_1984
S_C_210_Satpura_1_1984
S_C_210_Satpura_2_1984
C_C_210_Vindhyachal_1_1987
C_C_210_Vindhyachal_2_1987
C_C_210_Vindhyachal_1_1988
C_C_210_Vindhyachal_1_1990
C_C_210_Vindhyachal_1_1991
C_C_500_Vindhyachal_1_1999
C_C_500_Vindhyachal_1_2000
C_C_500_Vindhyachal_1_2006
C_C_500_Vindhyachal_1_2007
P_C_210_Anuppur (I)_1_2009
C_C_500_Vindhyachal_1_2012
P_C_600_Mahan_1_2012
P_C_250_Bina_1_2012
P_C_660_Sasan_1_2013
C_C_500_Vindhyachal_1_2013
S_C_250_Satpura_7_2013
S_C_250_Satpura_5_2013
S_C_250_Satpura_6_2013
S_C_250_Satpura_4_2013
S_C_250_Satpura_3_2013
S_C_250_Satpura_2_2013
S_C_250_Satpura_1_2013
P_C_250_Bina_2_2013
P_C_660_Sasan_1_2014
P_C_660_Sasan_3_2014
P_C_660_Sasan_2_2014
P_C_660_Nigri_1_2014
S_C_600_Shri Singhaji_2_2014
S_C_600_Shri Singhaji_1_2014
P_C_660_Sasan_1_2015
P_C_600_Anuppur (II)_1_2015
P_C_660_Nigri_2_2015
P_C_600_Anuppur (II)_1_2016
P_C_600_Seioni_2_2016
P_C_600_Seioni_1_2016
C_C_800_Gadarwara_1_2018
0
500
1000
0
500
1000
0
200
400
600
800
NO₂ Concentration (mg/Nm³)

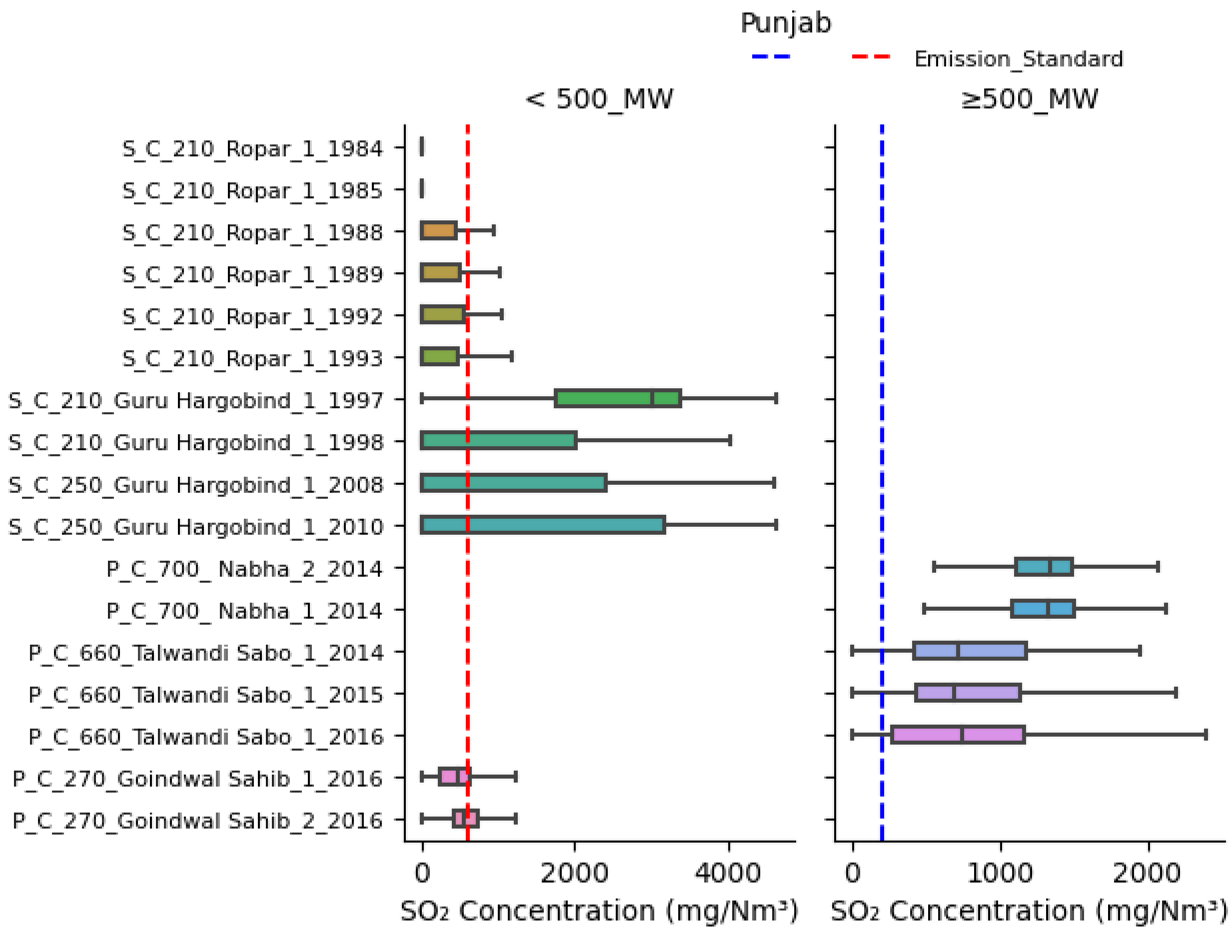
Maharashtra

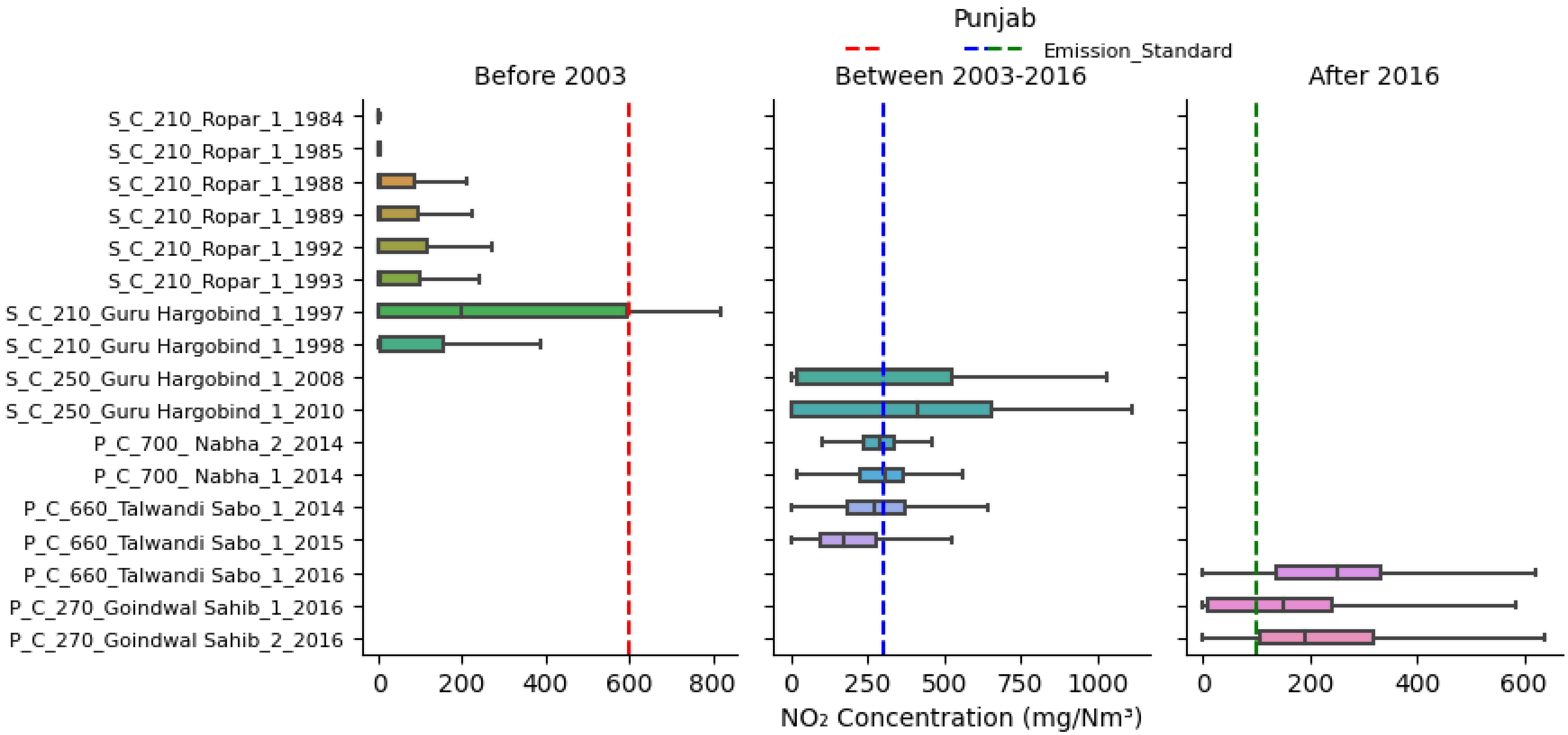



Maharashtra
Emission_Standard
< 500_MW
≥500_MW
After 2016
S_C_210_Bhusawal (I)_3_1982
S_C_210_Bhusawal (I)_1_1982
S_C_210_Bhusawal (I)_2_1982
P_A_500_Trombay_1_1984
P_A_180_Trombay_1_1984
S_B_210_Chandrapur_1_1985
S_B_210_Chandrapur_1_1986
S_A_210_Khaperkheda_1_1989
S_B_500_Chandrapur_1_1991
S_B_500_Chandrapur_1_1992
P_C_250_Dahanu_2_1995
P_C_250_Dahanu_1_1995
S_B_500_Chandrapur_1_1997
S_C_250_Paras_1_2007
S_C_250_Parli (I)_1_2007
P_A_250_Trombay_1_2009
S_C_250_Paras_1_2010
S_C_250_Parli (I)_1_2010
P_C_660_Tirora Gondia_1_2012
S_C_500_Bhusawal (II)_1_2012
C_C_500_Mauda_1_2012
P_C_660_Tirora Gondia_2_2013
P_C_660_Tirora Gondia_1_2013
P_C_300_GMR Warora_2_2013
P_C_300_GMR Warora_1_2013
S_C_500_Bhusawal (II)_1_2013
C_C_500_Mauda_1_2013
P_C_270_Amaravati_1_2013
P_C_660_Tirora Gondia_1_2014
P_C_660_Tirora Gondia_2_2014
P_C_270_Amaravati_1_2014
S_B_500_Chandrapur_1_2015
P_C_270_Amaravati_1_2015
P_C_270_Amaravati_2_2015
P_C_270_Amaravati_3_2015
S_B_500_Chandrapur_1_2016
C_C_660_Mauda_1_2016
S_C_250_Parli (II)_1_2016
C_B_660_Solapur_1_2017
C_C_660_Mauda_1_2017
C_B_660_Solapur_1_2019
0
1000
2000
3000
0
1000
2000
0
200
400
600
800
SO₂ Concentration (mg/Nm³)

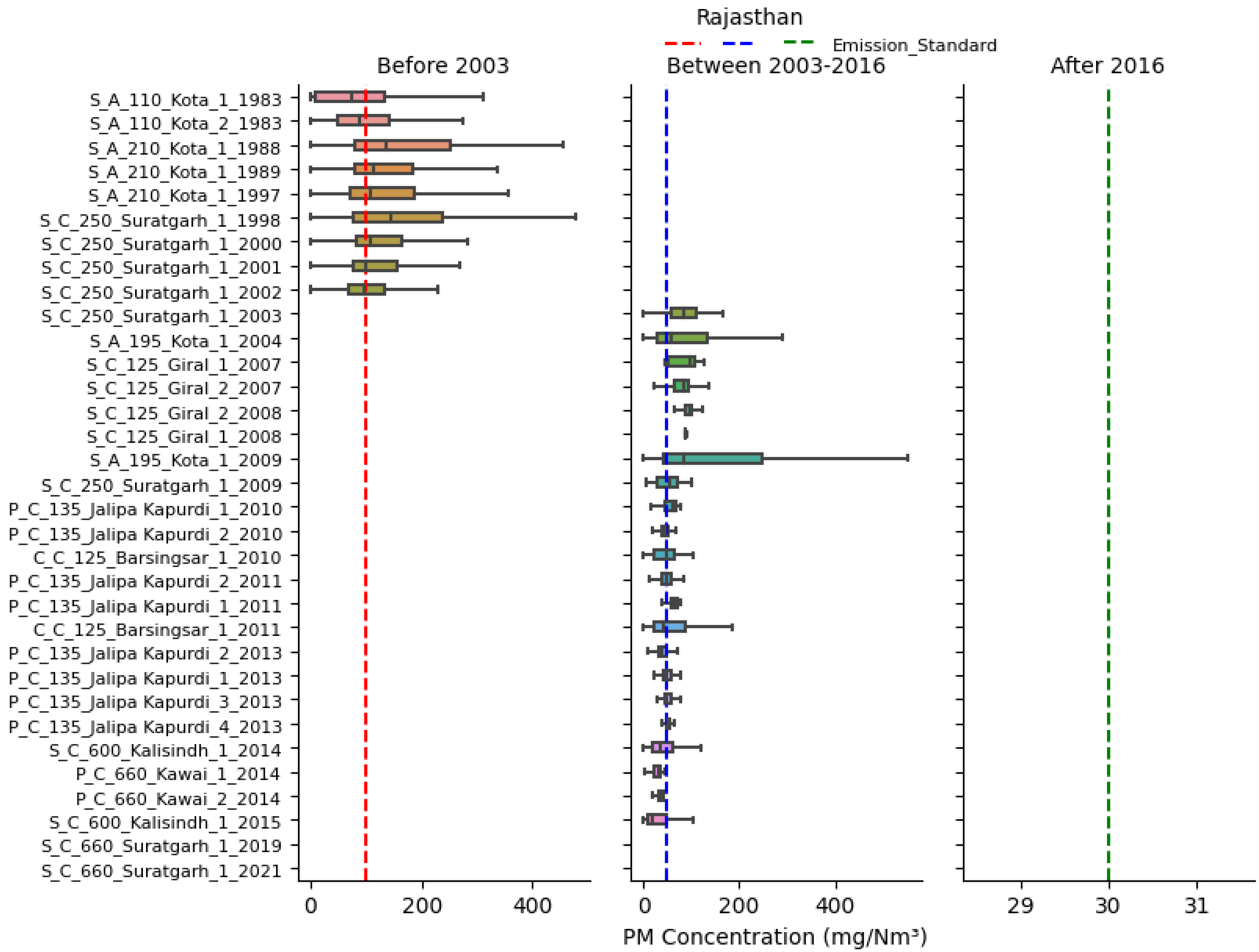

Maharashtra
Emission_Standard
Before 2003
Between 2003-2016
After 2016
S_C_210_Bhusawal (I)_3_1982
S_C_210_Bhusawal (I)_1_1982
S_C_210_Bhusawal (I)_2_1982
P_A_500_Trombay_1_1984
P_A_180_Trombay_1_1984
S_B_210_Chandrapur_1_1985
S_B_210_Chandrapur_1_1986
S_A_210_Khaperkheda_1_1989
S_B_500_Chandrapur_1_1991
S_B_500_Chandrapur_1_1992
P_C_250_Dahanu_2_1995
P_C_250_Dahanu_1_1995
S_B_500_Chandrapur_1_1997
S_C_250_Paras_1_2007
S_C_250_Parli (I)_1_2007
P_A_250_Trombay_1_2009
S_C_250_Paras_1_2010
S_C_250_Parli (I)_1_2010
P_C_660_Tirora Gondia_1_2012
S_C_500_Bhusawal (II)_1_2012
C_C_500_Mauda_1_2012
P_C_660_Tirora Gondia_2_2013
P_C_660_Tirora Gondia_1_2013
P_C_300_GMR Warora_2_2013
P_C_300_GMR Warora_1_2013
S_C_500_Bhusawal (II)_1_2013
C_C_500_Mauda_1_2013
P_C_270_Amaravati_1_2013
P_C_660_Tirora Gondia_1_2014
P_C_660_Tirora Gondia_2_2014
P_C_270_Amaravati_1_2014
S_B_500_Chandrapur_1_2015
P_C_270_Amaravati_1_2015
P_C_270_Amaravati_2_2015
P_C_270_Amaravati_3_2015
S_B_500_Chandrapur_1_2016
C_C_660_Mauda_1_2016
S_C_250_Parli (II)_1_2016
C_B_660_Solapur_1_2017
C_C_660_Mauda_1_2017
C_B_660_Solapur_1_2019
0
200
400
600
800
0
500
1000
0
100
200
300
400
NO₂ Concentration (mg/Nm³)

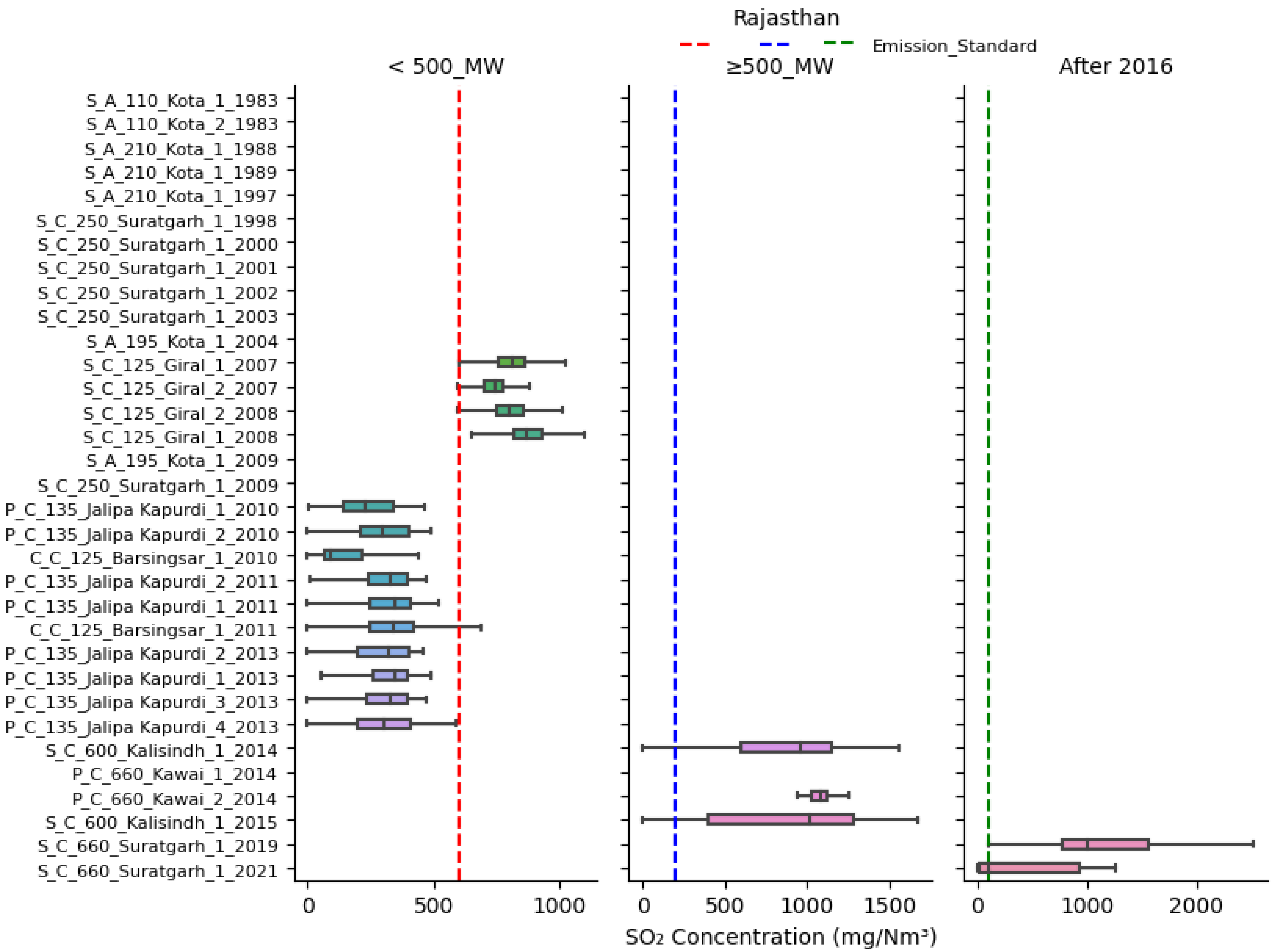

Punjab
Punjab
Emission_Standard
Before 2003
Between 2003-2016
After 2016
S_C_210_Ropar_1_1984
S_C_210_Ropar_1_1985
S_C_210_Ropar_1_1988
S_C_210_Ropar_1_1989
S_C_210_Ropar_1_1992
S_C_210_Ropar_1_1993
S_C_210_Guru Hargobind_1_1997
S_C_210_Guru Hargobind_1_1998
S_C_250_Guru Hargobind_1_2008
S_C_250_Guru Hargobind_1_2010
P_C_700_ Nabha_2_2014
P_C_700_ Nabha_1_2014
P_C_660_Talwandi Sabo_1_2014
P_C_660_Talwandi Sabo_1_2015
P_C_660_Talwandi Sabo_1_2016
P_C_270_Goindwal Sahib_1_2016
P_C_270_Goindwal Sahib_2_2016
0
100
200
0
100
200
0
50
100
PM Concentration (mg/Nm³)

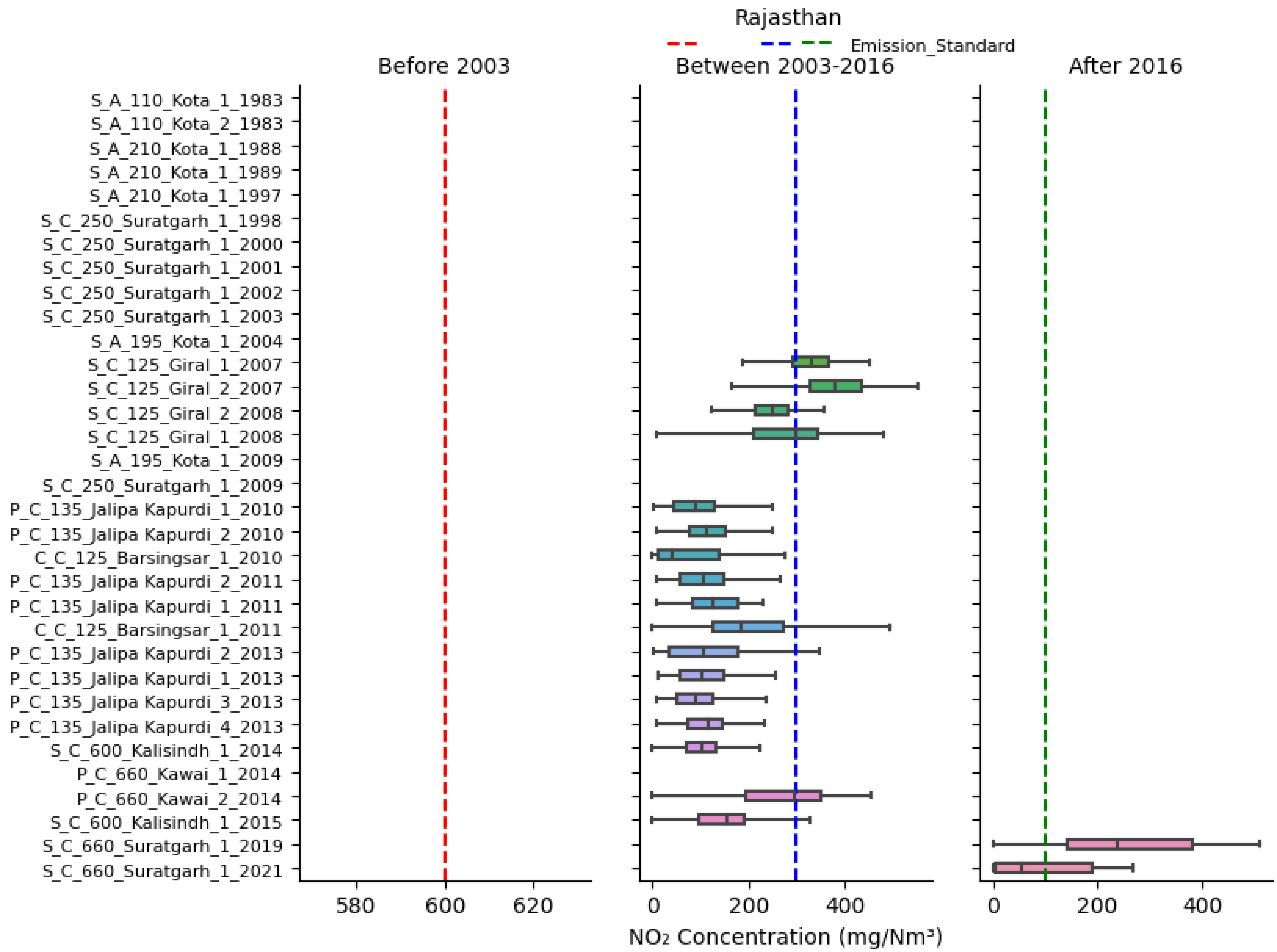

Punjab
Emission_Standard
< 500_MW
≥500_MW
S_C_210_Ropar_1_1984
S_C_210_Ropar_1_1985
S_C_210_Ropar_1_1988
S_C_210_Ropar_1_1989
S_C_210_Ropar_1_1992
S_C_210_Ropar_1_1993
S_C_210_Guru Hargobind_1_1997
S_C_210_Guru Hargobind_1_1998
S_C_250_Guru Hargobind_1_2008
S_C_250_Guru Hargobind_1_2010
P_C_700_ Nabha_2_2014
P_C_700_ Nabha_1_2014
P_C_660_Talwandi Sabo_1_2014
P_C_660_Talwandi Sabo_1_2015
P_C_660_Talwandi Sabo_1_2016
P_C_270_Goindwal Sahib_1_2016
P_C_270_Goindwal Sahib_2_2016
0
2000
4000
1000
SO₂ Concentration (mg/Nm³)
SO₂ Concentration (mg/Nm³)


Punjab
Emission_Standard
Before 2003
Between 2003-2016
After 2016
S_C_210_Ropar_1_1984
S_C_210_Ropar_1_1985
S_C_210_Ropar_1_1988
S_C_210_Ropar_1_1989
S_C_210_Ropar_1_1992
S_C_210_Ropar_1_1993
S_C_210_Guru Hargobind_1_1997
S_C_210_Guru Hargobind_1_1998
S_C_250_Guru Hargobind_1_2008
S_C_250_Guru Hargobind_1_2010
P_C_700_ Nabha_2_2014
P_C_700_ Nabha_1_2014
P_C_660_Talwandi Sabo_1_2014
P_C_660_Talwandi Sabo_1_2015
P_C_660_Talwandi Sabo_1_2016
P_C_270_Goindwal Sahib_1_2016
P_C_270_Goindwal Sahib_2_2016
0
200
400
600
800
0
250
500
750
1000
0
200
400
600
NO₂ Concentration (mg/Nm³)

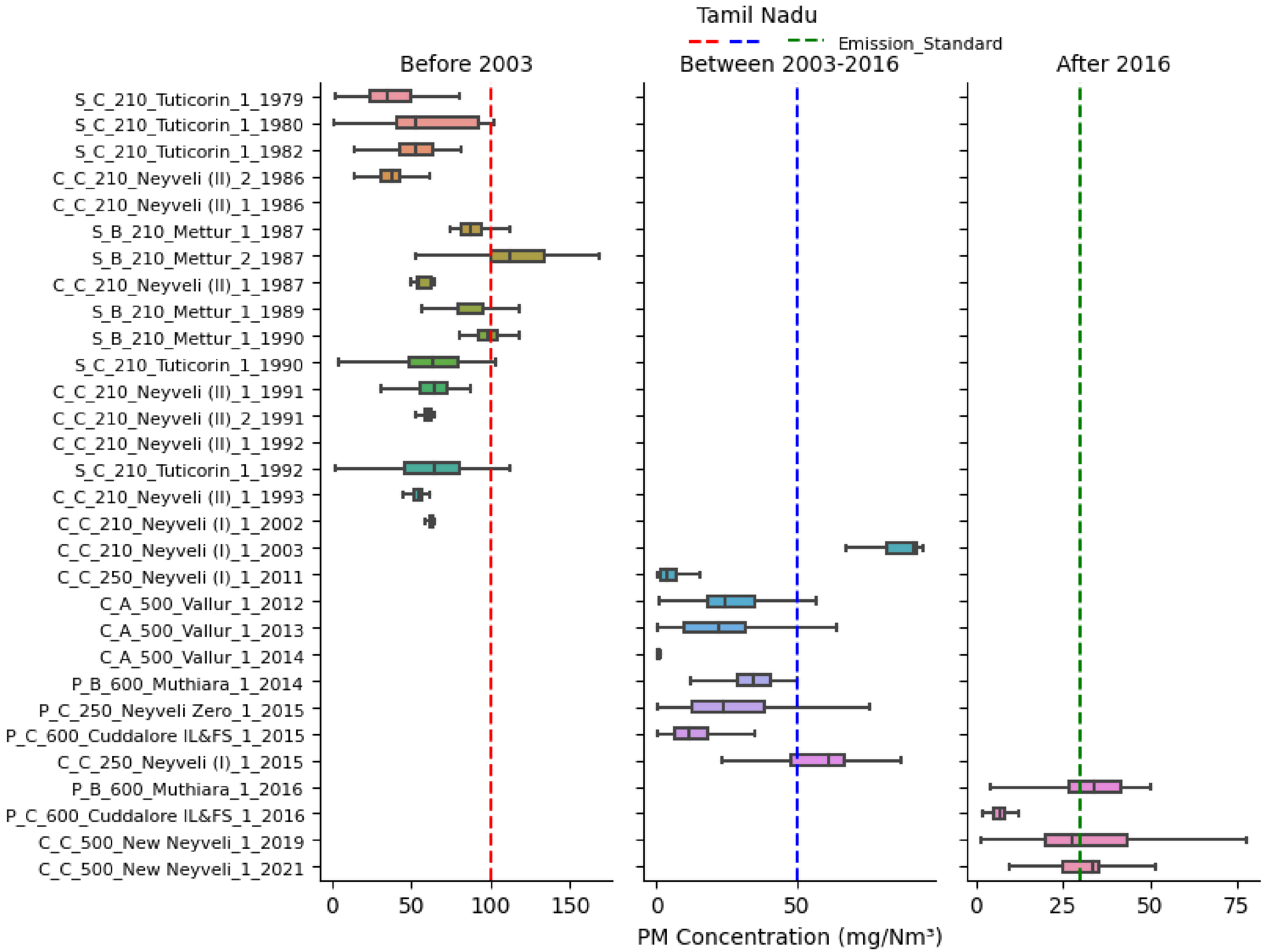
Rajasthan

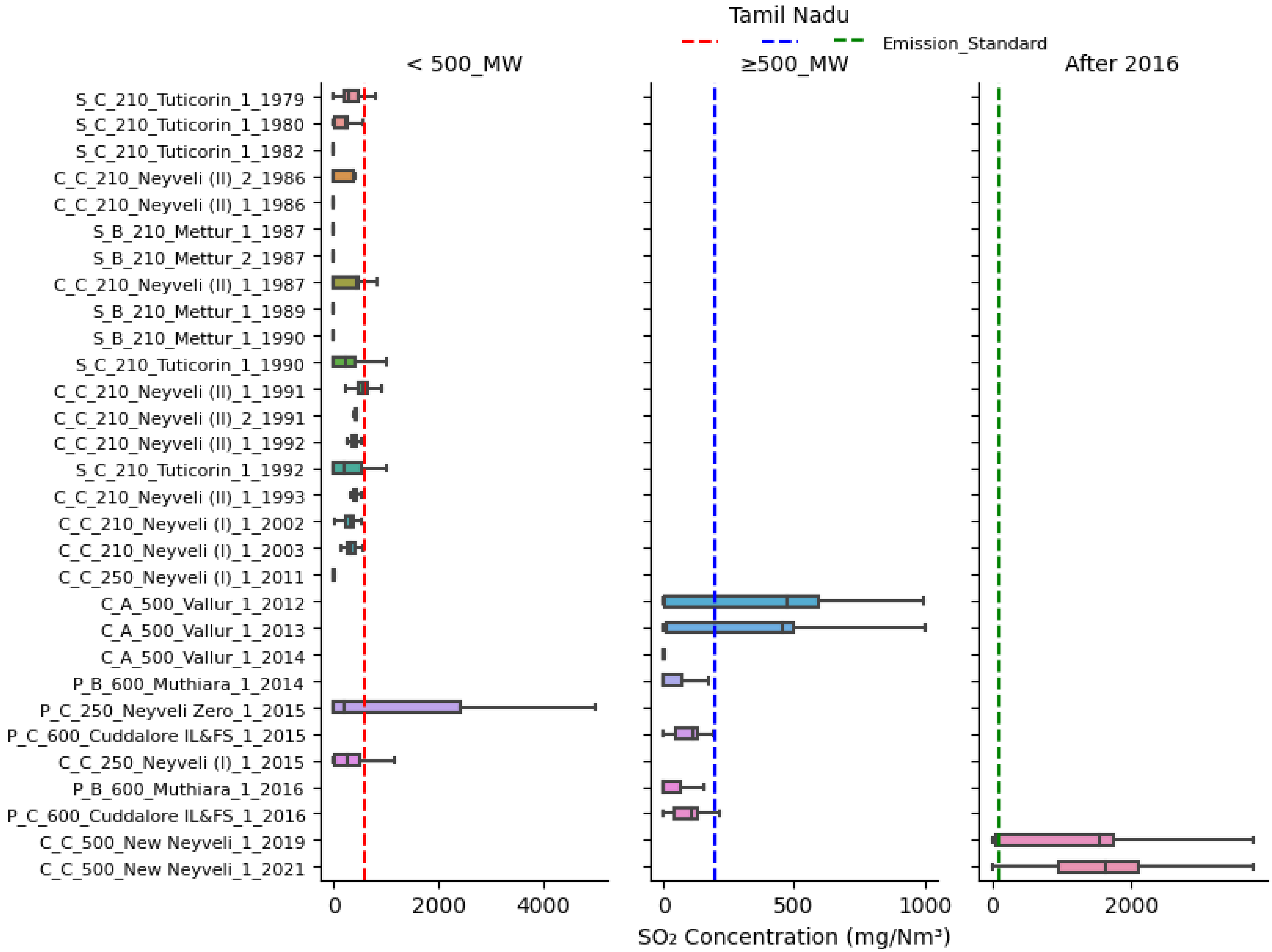

Rajasthan
Emission_Standard
Before 2003
Between 2003-2016
After 2016
S_A_110_Kota_1_1983
S_A_110_Kota_2_1983
S_A_210_Kota_1_1988
S_A_210_Kota_1_1989
S_A_210_Kota_1_1997
S_C_250_Suratgarh_1_1998
S_C_250_Suratgarh_1_2000
S_C_250_Suratgarh_1_2001
S_C_250_Suratgarh_1_2002
S_C_250_Suratgarh_1_2003
S_A_195_Kota_1_2004
S_C_125_Giral_1_2007
S_C_125_Giral_2_2007
S_C_125_Giral_2_2008
S_C_125_Giral_1_2008
S_A_195_Kota_1_2009
S_C_250_Suratgarh_1_2009
P_C_135_Jalipa Kapurdi_1_2010
P_C_135_Jalipa Kapurdi_2_2010
C_C_125_Barsingsar_1_2010
P_C_135_Jalipa Kapurdi_2_2011
P_C_135_Jalipa Kapurdi_1_2011
C_C_125_Barsingsar_1_2011
P_C_135_Jalipa Kapurdi_2_2013
P_C_135_Jalipa Kapurdi_1_2013
P_C_135_Jalipa Kapurdi_3_2013
P_C_135_Jalipa Kapurdi_4_2013
S_C_600_Kalisindh_1_2014
P_C_660_Kawai_1_2014
P_C_660_Kawai_2_2014
S_C_600_Kalisindh_1_2015
S_C_660_Suratgarh_1_2019
S_C_660_Suratgarh_1_2021
0
200
400
0
200
400
29
30
31
PM Concentration (mg/Nm³)

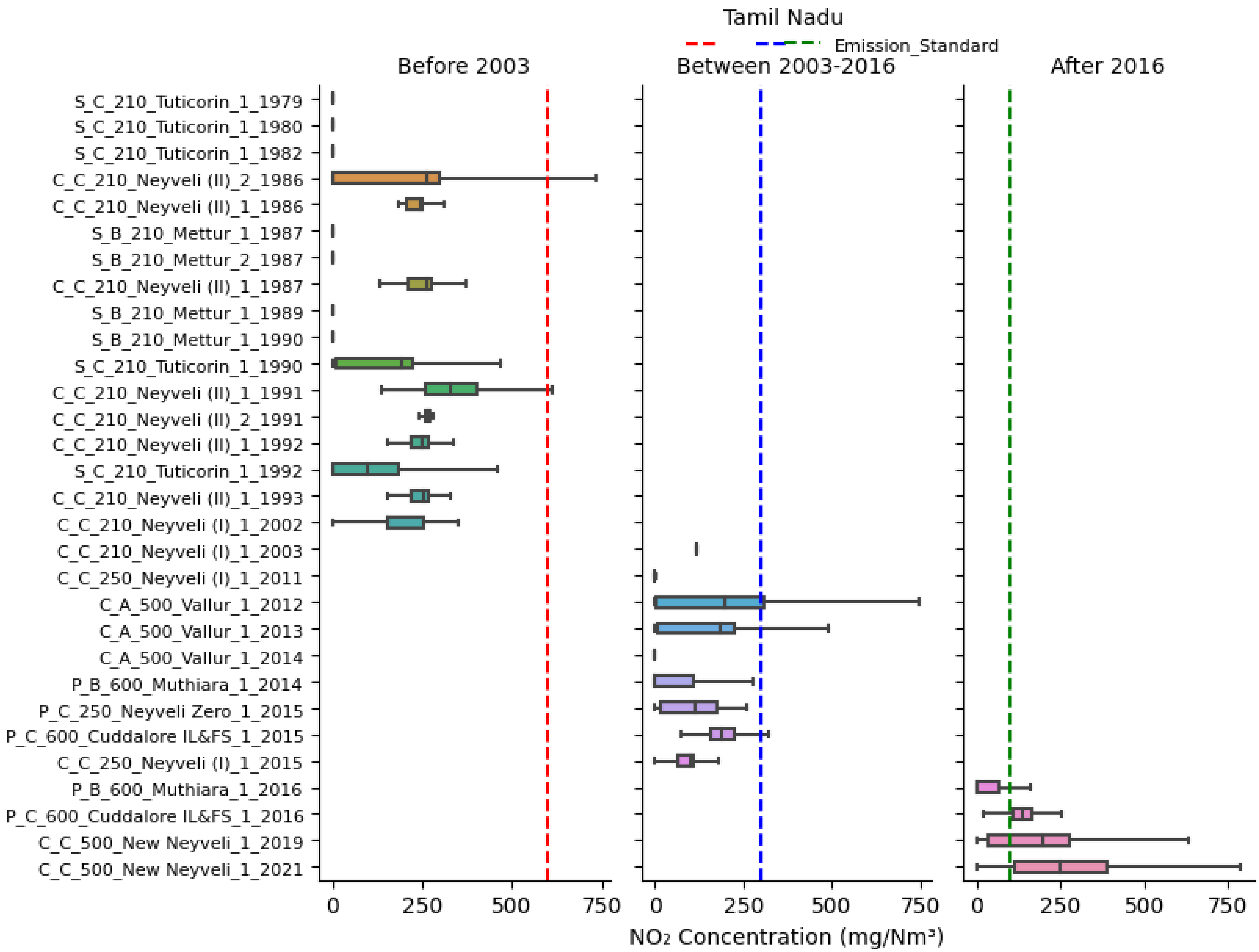

Rajasthan
Emission_Standard
< 500_MW
≥500_MW
After 2016
S_A_110_Kota_1_1983
S_A_110_Kota_2_1983
S_A_210_Kota_1_1988
S_A_210_Kota_1_1989
S_A_210_Kota_1_1997
S_C_250_Suratgarh_1_1998
S_C_250_Suratgarh_1_2000
S_C_250_Suratgarh_1_2001
S_C_250_Suratgarh_1_2002
S_C_250_Suratgarh_1_2003
S_A_195_Kota_1_2004
S_C_125_Giral_1_2007
S_C_125_Giral_2_2007
S_C_125_Giral_2_2008
S_C_125_Giral_1_2008
S_A_195_Kota_1_2009
S_C_250_Suratgarh_1_2009
P_C_135_Jalipa Kapurdi_1_2010
P_C_135_Jalipa Kapurdi_2_2010
C_C_125_Barsingsar_1_2010
P_C_135_Jalipa Kapurdi_2_2011
P_C_135_Jalipa Kapurdi_1_2011
C_C_125_Barsingsar_1_2011
P_C_135_Jalipa Kapurdi_2_2013
P_C_135_Jalipa Kapurdi_1_2013
P_C_135_Jalipa Kapurdi_3_2013
P_C_135_Jalipa Kapurdi_4_2013
S_C_600_Kalisindh_1_2014
P_C_660_Kawai_1_2014
P_C_660_Kawai_2_2014
S_C_600_Kalisindh_1_2015
S_C_660_Suratgarh_1_2019
S_C_660_Suratgarh_1_2021
0
500
1000
0
500
1000
1500
0
1000
2000
SO₂ Concentration (mg/Nm³)


Rajasthan
Emission_Standard
Before 2003
Between 2003-2016
After 2016
S_A_110_Kota_1_1983
S_A_110_Kota_2_1983
S_A_210_Kota_1_1988
S_A_210_Kota_1_1989
S_A_210_Kota_1_1997
S_C_250_Suratgarh_1_1998
S_C_250_Suratgarh_1_2000
S_C_250_Suratgarh_1_2001
S_C_250_Suratgarh_1_2002
S_C_250_Suratgarh_1_2003
S_A_195_Kota_1_2004
S_C_125_Giral_1_2007
S_C_125_Giral_2_2007
S_C_125_Giral_2_2008
S_C_125_Giral_1_2008
S_A_195_Kota_1_2009
S_C_250_Suratgarh_1_2009
P_C_135_Jalipa Kapurdi_1_2010
P_C_135_Jalipa Kapurdi_2_2010
C_C_125_Barsingsar_1_2010
P_C_135_Jalipa Kapurdi_2_2011
P_C_135_Jalipa Kapurdi_1_2011
C_C_125_Barsingsar_1_2011
P_C_135_Jalipa Kapurdi_2_2013
P_C_135_Jalipa Kapurdi_1_2013
P_C_135_Jalipa Kapurdi_3_2013
P_C_135_Jalipa Kapurdi_4_2013
S_C_600_Kalisindh_1_2014
P_C_660_Kawai_1_2014
P_C_660_Kawai_2_2014
S_C_600_Kalisindh_1_2015
S_C_660_Suratgarh_1_2019
S_C_660_Suratgarh_1_2021
580
600
620
0
200
400
0
200
400
NO₂ Concentration (mg/Nm³)

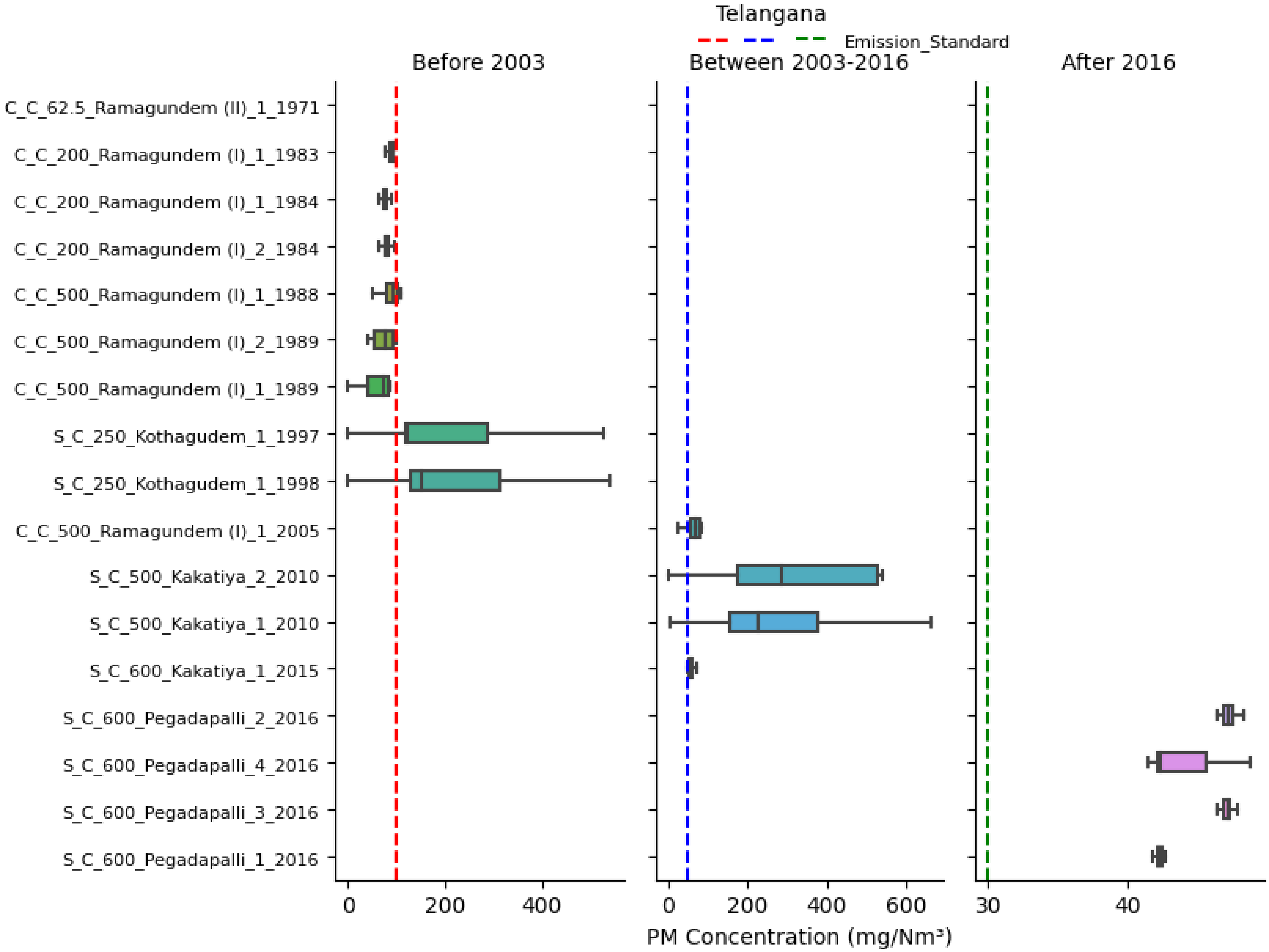
Tamil Nadu

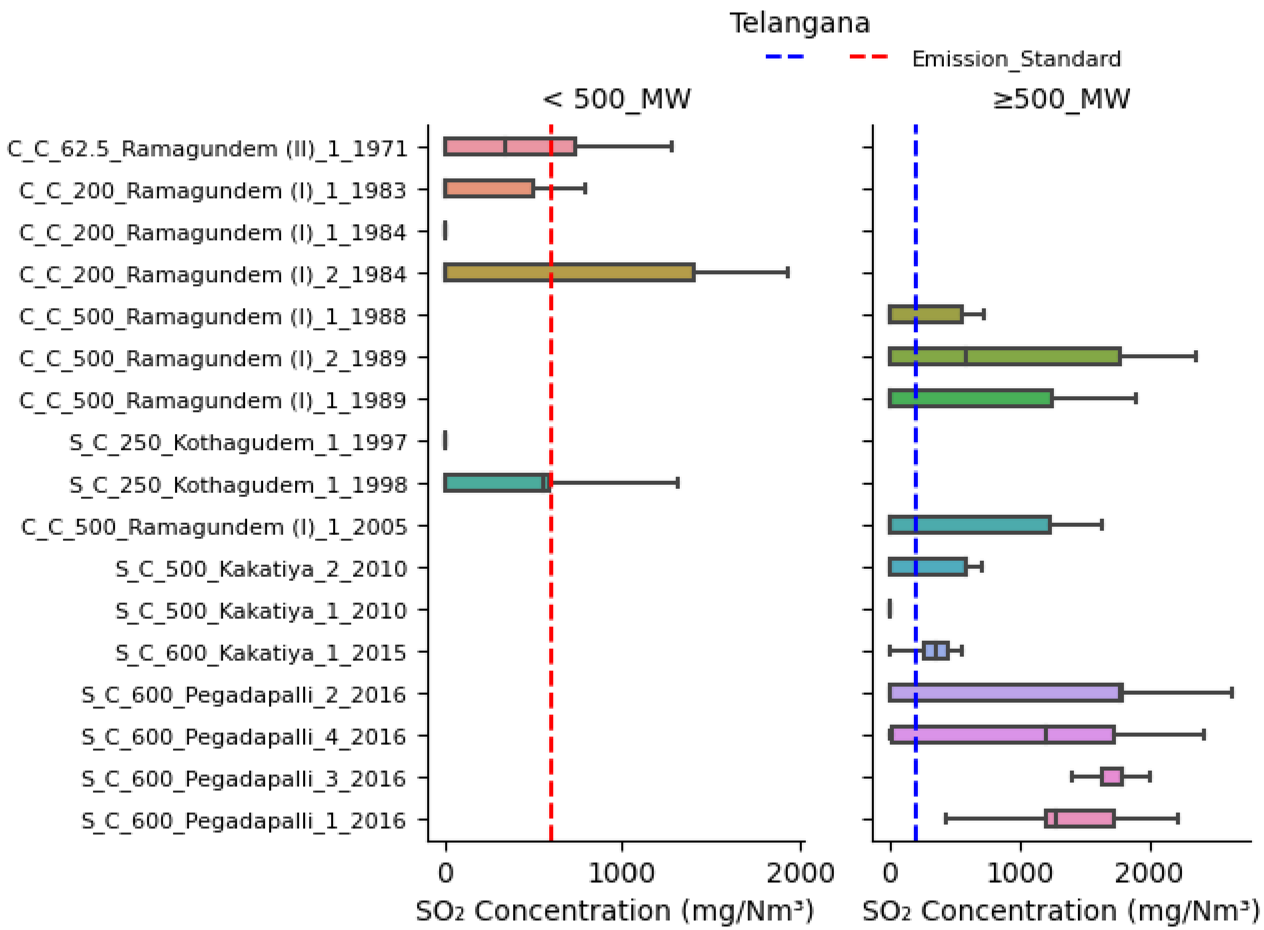

Tamil Nadu
Emission_Standard
Before 2003
Between 2003-2016
After 2016
S_C_210_Tuticorin_1_1979
S_C_210_Tuticorin_1_1980
S_C_210_Tuticorin_1_1982
C_C_210_Neyveli (II)_2_1986
C_C_210_Neyveli (II)_1_1986
S_B_210_Mettur_1_1987
S_B_210_Mettur_2_1987
C_C_210_Neyveli (II)_1_1987
S_B_210_Mettur_1_1989
S_B_210_Mettur_1_1990
S_C_210_Tuticorin_1_1990
C_C_210_Neyveli (II)_1_1991
C_C_210_Neyveli (II)_2_1991
C_C_210_Neyveli (II)_1_1992
S_C_210_Tuticorin_1_1992
C_C_210_Neyveli (II)_1_1993
C_C_210_Neyveli (I)_1_2002
C_C_210_Neyveli (I)_1_2003
C_C_250_Neyveli (I)_1_2011
C_A_500_Vallur_1_2012
C_A_500_Vallur_1_2013
C_A_500_Vallur_1_2014
P_B_600_Muthiara_1_2014
P_C_250_Neyveli Zero_1_2015
P_C_600_Cuddalore IL&FS_1_2015
C_C_250_Neyveli (I)_1_2015
P_B_600_Muthiara_1_2016
P_C_600_Cuddalore IL&FS_1_2016
C_C_500_New Neyveli_1_2019
C_C_500_New Neyveli_1_2021
0
50
100
150
0
50
0
25
50
75
PM Concentration (mg/Nm³)

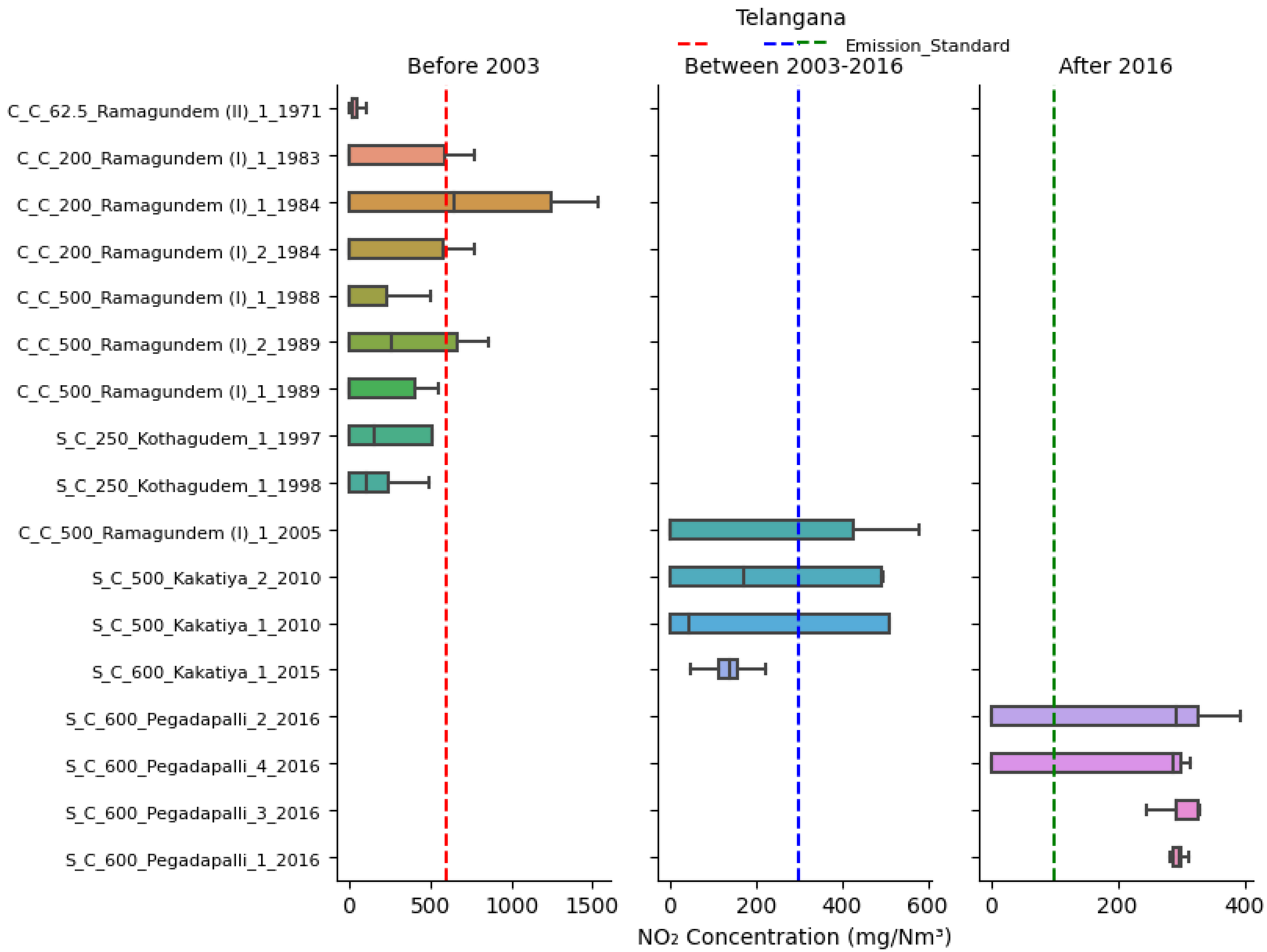

Tamil Nadu
Emission_Standard
< 500_MW
≥500_MW
After 2016
S_C_210_Tuticorin_1_1979
S_C_210_Tuticorin_1_1980
S_C_210_Tuticorin_1_1982
C_C_210_Neyveli (II)_2_1986
C_C_210_Neyveli (II)_1_1986
S_B_210_Mettur_1_1987
S_B_210_Mettur_2_1987
C_C_210_Neyveli (II)_1_1987
S_B_210_Mettur_1_1989
S_B_210_Mettur_1_1990
S_C_210_Tuticorin_1_1990
C_C_210_Neyveli (II)_1_1991
C_C_210_Neyveli (II)_2_1991
C_C_210_Neyveli (II)_1_1992
S_C_210_Tuticorin_1_1992
C_C_210_Neyveli (II)_1_1993
C_C_210_Neyveli (I)_1_2002
C_C_210_Neyveli (I)_1_2003
C_C_250_Neyveli (I)_1_2011
C_A_500_Vallur_1_2012
C_A_500_Vallur_1_2013
C_A_500_Vallur_1_2014
P_B_600_Muthiara_1_2014
P_C_250_Neyveli Zero_1_2015
P_C_600_Cuddalore IL&FS_1_2015
C_C_250_Neyveli (I)_1_2015
P_B_600_Muthiara_1_2016
P_C_600_Cuddalore IL&FS_1_2016
C_C_500_New Neyveli_1_2019
C_C_500_New Neyveli_1_2021
0
2000
4000
0
500
1000
0
2000
SO₂ Concentration (mg/Nm³)


Tamil Nadu
Emission_Standard
Before 2003
Between 2003-2016
After 2016
S_C_210_Tuticorin_1_1979
S_C_210_Tuticorin_1_1980
S_C_210_Tuticorin_1_1982
C_C_210_Neyveli (II)_2_1986
C_C_210_Neyveli (II)_1_1986
S_B_210_Mettur_1_1987
S_B_210_Mettur_2_1987
C_C_210_Neyveli (II)_1_1987
S_B_210_Mettur_1_1989
S_B_210_Mettur_1_1990
S_C_210_Tuticorin_1_1990
C_C_210_Neyveli (II)_1_1991
C_C_210_Neyveli (II)_2_1991
C_C_210_Neyveli (II)_1_1992
S_C_210_Tuticorin_1_1992
C_C_210_Neyveli (II)_1_1993
C_C_210_Neyveli (I)_1_2002
C_C_210_Neyveli (I)_1_2003
C_C_250_Neyveli (I)_1_2011
C_A_500_Vallur_1_2012
C_A_500_Vallur_1_2013
C_A_500_Vallur_1_2014
P_B_600_Muthiara_1_2014
P_C_250_Neyveli Zero_1_2015
P_C_600_Cuddalore IL&FS_1_2015
C_C_250_Neyveli (I)_1_2015
P_B_600_Muthiara_1_2016
P_C_600_Cuddalore IL&FS_1_2016
C_C_500_New Neyveli_1_2019
C_C_500_New Neyveli_1_2021
0
250
500
750
NO₂ Concentration (mg/Nm³)

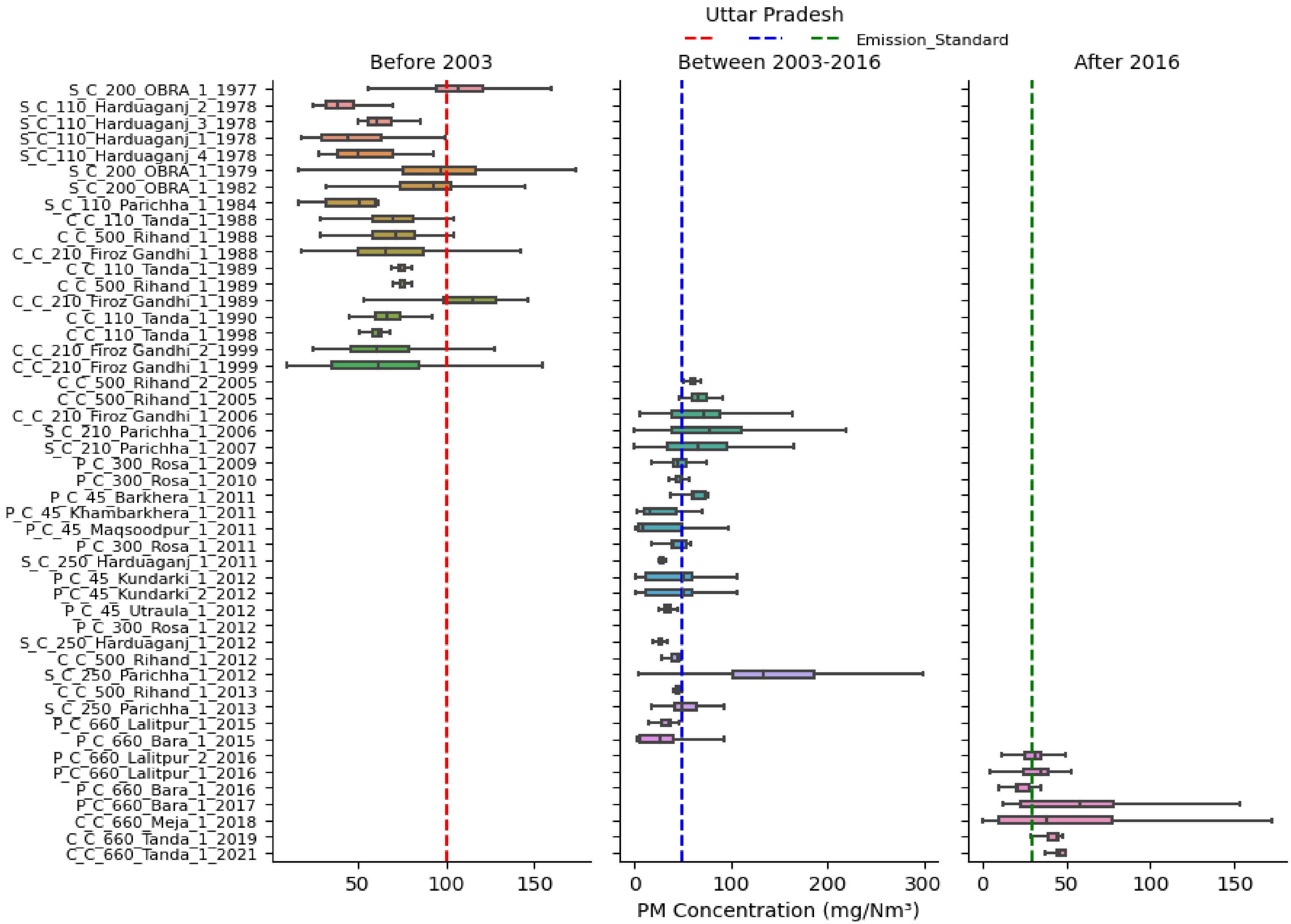
Telangana

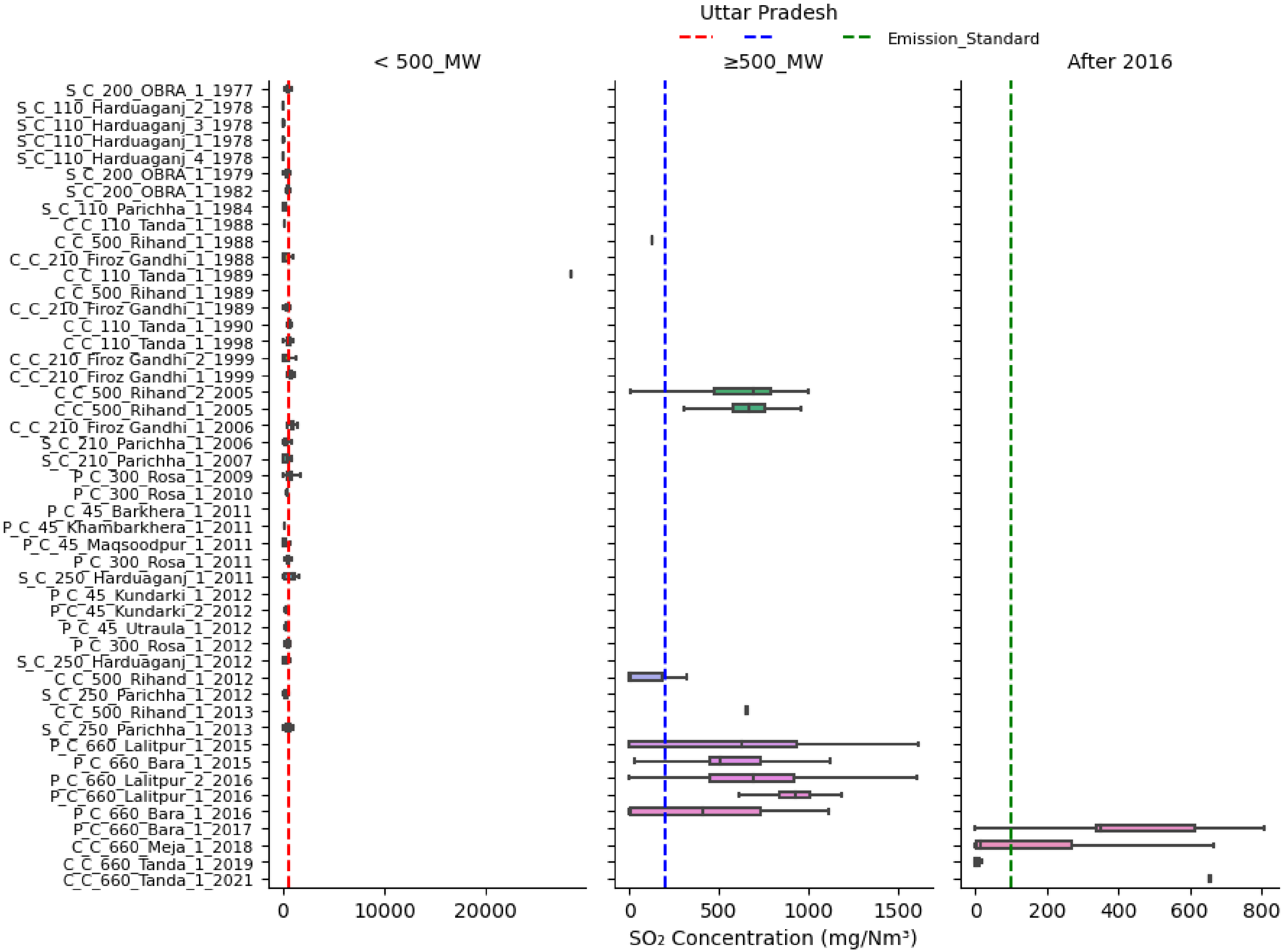

Telangana
Emission_Standard
Before 2003
Between 2003-2016
After 2016
C_C_62.5_Ramagundem (II)_1_1971
C_C_200_Ramagundem (I)_1_1983
C_C_200_Ramagundem (I)_1_1984
C_C_200_Ramagundem (I)_2_1984
C_C_500_Ramagundem (I)_1_1988
C_C_500_Ramagundem (I)_2_1989
C_C_500_Ramagundem (I)_1_1989
S_C_250_Kothagudem_1_1997
S_C_250_Kothagudem_1_1998
C_C_500_Ramagundem (I)_1_2005
S_C_500_Kakatiya_2_2010
S_C_500_Kakatiya_1_2010
S_C_600_Kakatiya_1_2015
S_C_600_Pegadapalli_2_2016
S_C_600_Pegadapalli_4_2016
S_C_600_Pegadapalli_3_2016
S_C_600_Pegadapalli_1_2016
0
200
400
0
200
400
600
30
40
PM Concentration (mg/Nm³)

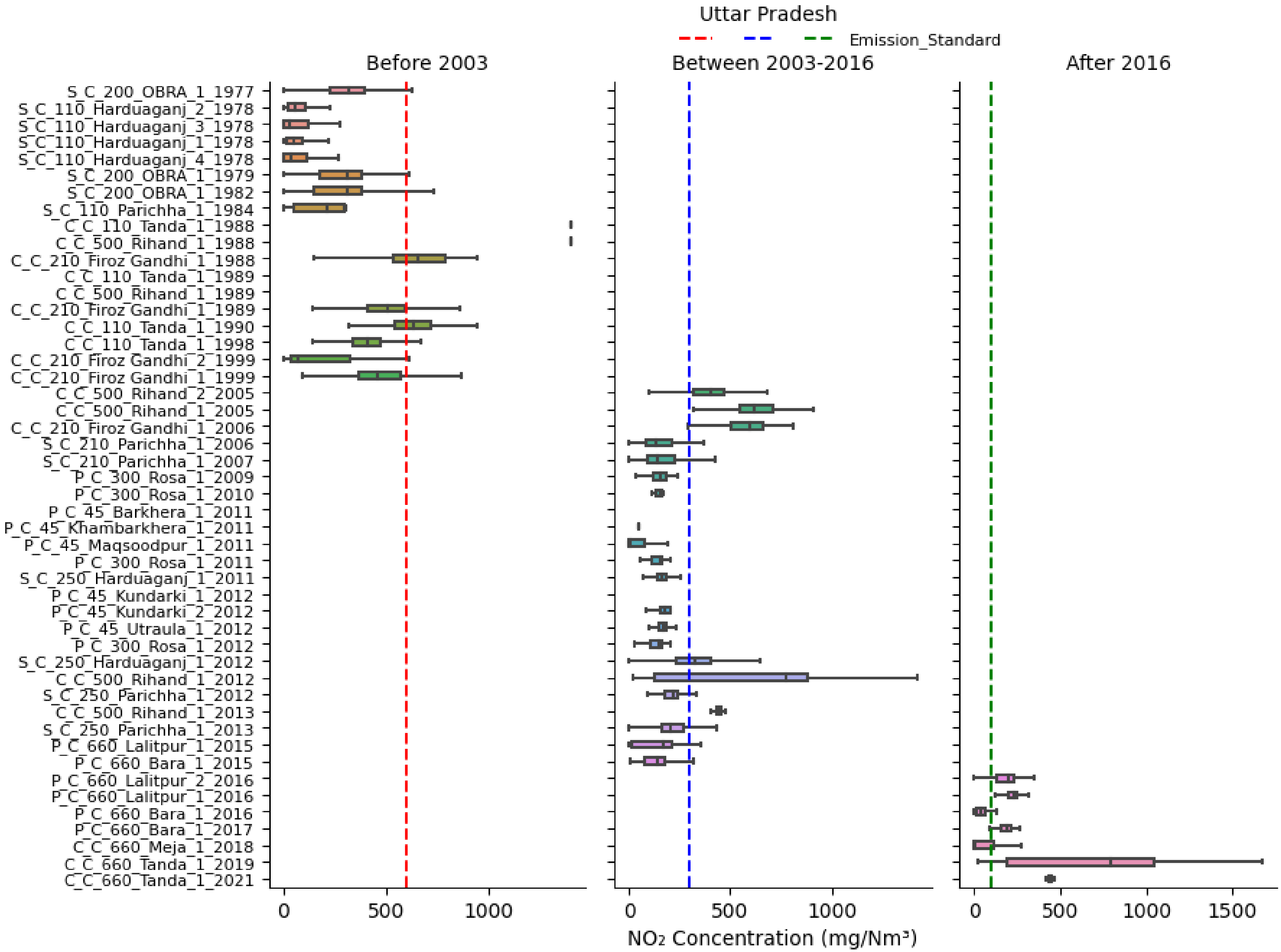

Telangana
Emission_Standard
< 500_MW
≥500_MW
C_C_62.5_Ramagundem (II)_1_1971
C_C_200_Ramagundem (I)_1_1983
C_C_200_Ramagundem (I)_1_1984
C_C_200_Ramagundem (I)_2_1984
C_C_500_Ramagundem (I)_1_1988
C_C_500_Ramagundem (I)_2_1989
C_C_500_Ramagundem (I)_1_1989
S_C_250_Kothagudem_1_1997
S_C_250_Kothagudem_1_1998
C_C_500_Ramagundem (I)_1_2005
S_C_500_Kakatiya_2_2010
S_C_500_Kakatiya_1_2010
S_C_600_Kakatiya_1_2015
S_C_600_Pegadapalli_2_2016
S_C_600_Pegadapalli_4_2016
S_C_600_Pegadapalli_3_2016
S_C_600_Pegadapalli_1_2016
0
1000
2000
SO₂ Concentration (mg/Nm³)
0
1000
2000
SO₂ Concentration (mg/Nm³)


Telangana
Emission_Standard
Before 2003
Between 2003-2016
After 2016
C_C_62.5_Ramagundem (II)_1_1971
C_C_200_Ramagundem (I)_1_1983
C_C_200_Ramagundem (I)_1_1984
C_C_200_Ramagundem (I)_2_1984
C_C_500_Ramagundem (I)_1_1988
C_C_500_Ramagundem (I)_2_1989
C_C_500_Ramagundem (I)_1_1989
S_C_250_Kothagudem_1_1997
S_C_250_Kothagudem_1_1998
C_C_500_Ramagundem (I)_1_2005
S_C_500_Kakatiya_2_2010
S_C_500_Kakatiya_1_2010
S_C_600_Kakatiya_1_2015
S_C_600_Pegadapalli_2_2016
S_C_600_Pegadapalli_4_2016
S_C_600_Pegadapalli_3_2016
S_C_600_Pegadapalli_1_2016
0
500
1000
1500
0
200
400
600
0
200
400
NO₂ Concentration (mg/Nm³)

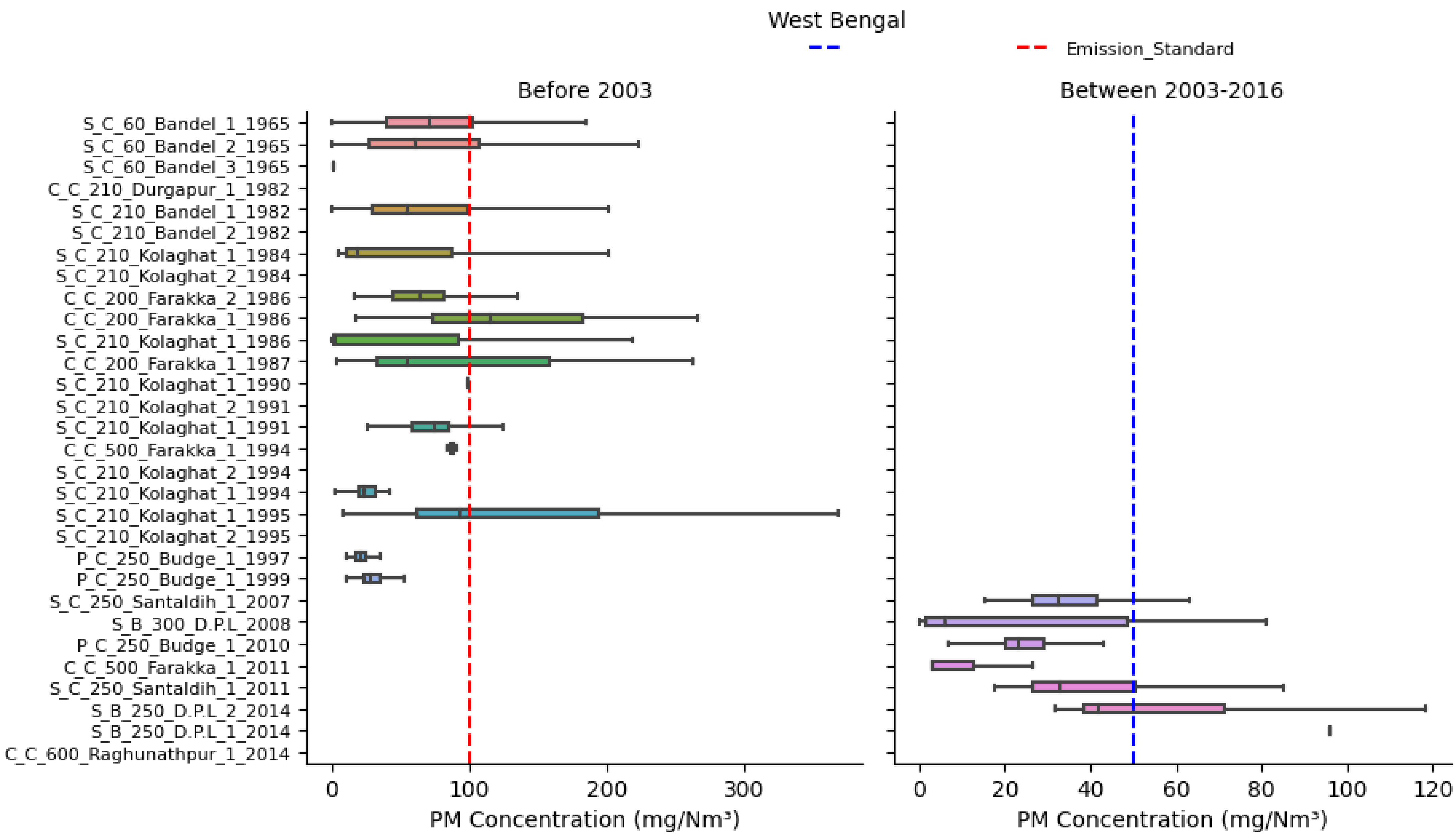
Uttar Pradesh

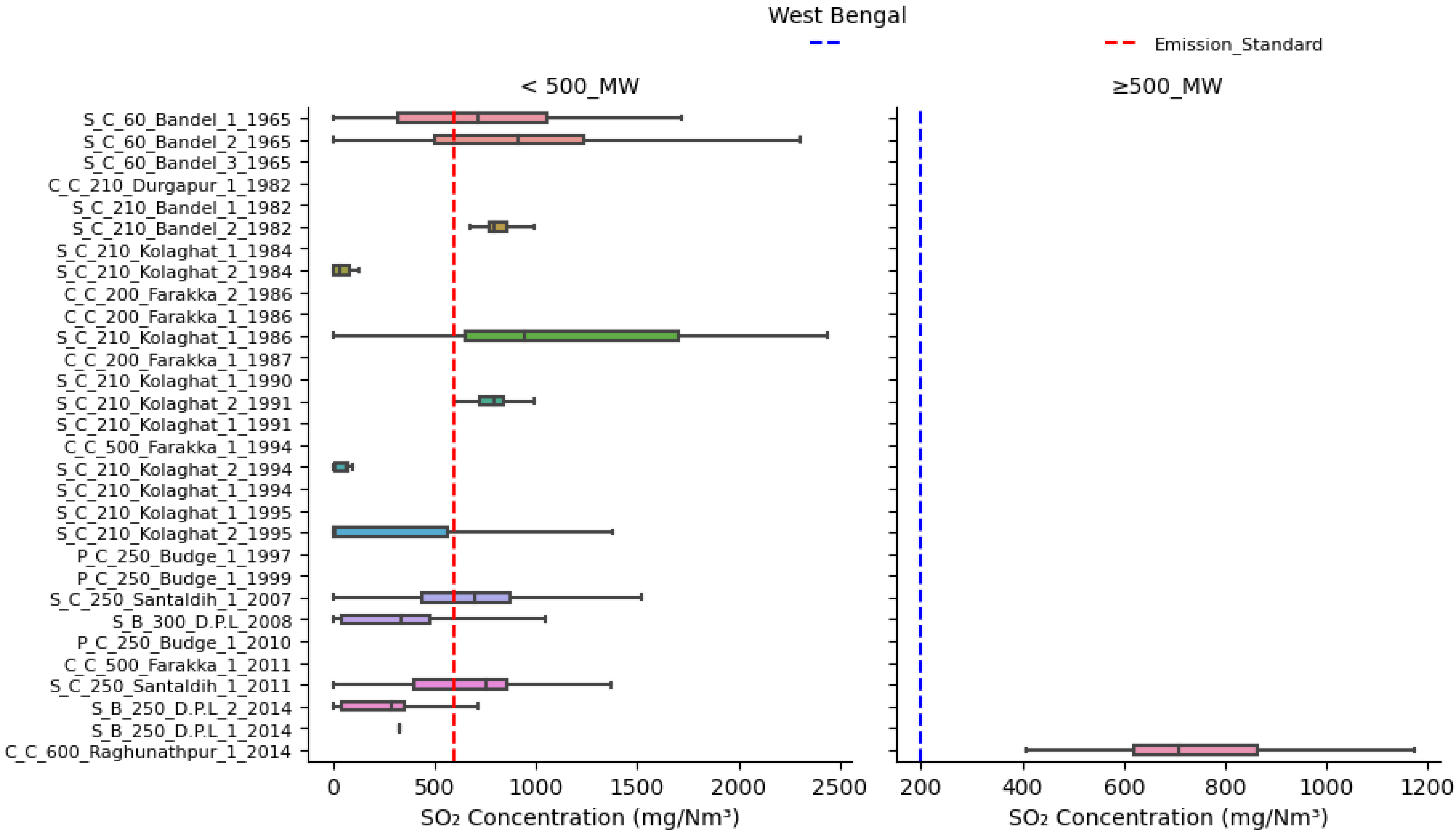


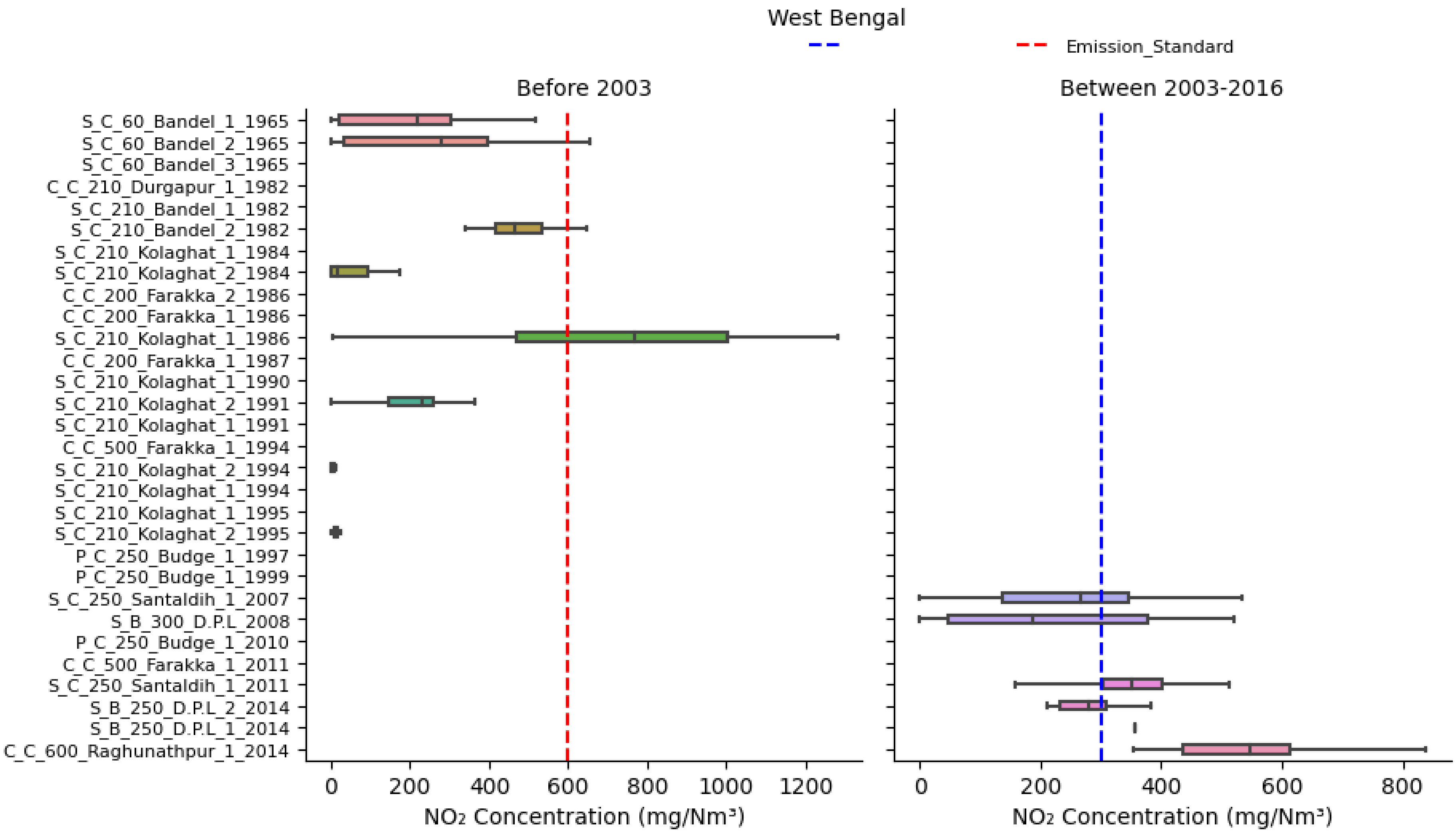

Uttar Pradesh
Emission_Standard
< 500_MW
≥500_MW
After 2016
S_C_200_OBRA_1_1977
S_C_110_Harduaganj_2_1978
S_C_110_Harduaganj_3_1978
S_C_110_Harduaganj_1_1978
S_C_110_Harduaganj_4_1978
S_C_200_OBRA_1_1979
S_C_200_OBRA_1_1982
S_C_110_Parichha_1_1984
C_C_110_Tanda_1_1988
C_C_500_Rihand_1_1988
C_C_210_Firoz Gandhi_1_1988
C_C_110_Tanda_1_1989
C_C_500_Rihand_1_1989
C_C_210_Firoz Gandhi_1_1989
C_C_110_Tanda_1_1990
C_C_110_Tanda_1_1998
C_C_210_Firoz Gandhi_2_1999
C_C_210_Firoz Gandhi_1_1999
C_C_500_Rihand_2_2005
C_C_500_Rihand_1_2005
C_C_210_Firoz Gandhi_1_2006
S_C_210_Parichha_1_2006
S_C_210_Parichha_1_2007
P_C_300_Rosa_1_2009
P_C_300_Rosa_1_2010
P_C_45_Barkhera_1_2011
P_C_45_Khambarkhera_1_2011
P_C_45_Maqsoodpur_1_2011
P_C_300_Rosa_1_2011
S_C_250_Harduaganj_1_2011
P_C_45_Kundarki_1_2012
P_C_45_Kundarki_2_2012
P_C_45_Utraula_1_2012
P_C_300_Rosa_1_2012
S_C_250_Harduaganj_1_2012
C_C_500_Rihand_1_2012
S_C_250_Parichha_1_2012
C_C_500_Rihand_1_2013
S_C_250_Parichha_1_2013
P_C_660_Lalitpur_1_2015
P_C_660_Bara_1_2015
P_C_660_Lalitpur_2_2016
P_C_660_Lalitpur_1_2016
P_C_660_Bara_1_2016
P_C_660_Bara_1_2017
C_C_660_Meja_1_2018
C_C_660_Tanda_1_2019
C_C_660_Tanda_1_2021
0
10000
20000
0
500
1000
1500
0
200
400
600
800
SO₂ Concentration (mg/Nm³)


Uttar Pradesh
Emission_Standard
Before 2003
Between 2003-2016
After 2016
S_C_200_OBRA_1_1977
S_C_110_Harduaganj_2_1978
S_C_110_Harduaganj_3_1978
S_C_110_Harduaganj_1_1978
S_C_110_Harduaganj_4_1978
S_C_200_OBRA_1_1979
S_C_200_OBRA_1_1982
S_C_110_Parichha_1_1984
C_C_110_Tanda_1_1988
C_C_500_Rihand_1_1988
C_C_210_Firoz Gandhi_1_1988
C_C_110_Tanda_1_1989
C_C_500_Rihand_1_1989
C_C_210_Firoz Gandhi_1_1989
C_C_110_Tanda_1_1990
C_C_110_Tanda_1_1998
C_C_210_Firoz Gandhi_2_1999
C_C_210_Firoz Gandhi_1_1999
C_C_500_Rihand_2_2005
C_C_500_Rihand_1_2005
C_C_210_Firoz Gandhi_1_2006
S_C_210_Parichha_1_2006
S_C_210_Parichha_1_2007
P_C_300_Rosa_1_2009
P_C_300_Rosa_1_2010
P_C_45_Barkhera_1_2011
P_C_45_Khambarkhera_1_2011
P_C_45_Maqsoodpur_1_2011
P_C_300_Rosa_1_2011
S_C_250_Harduaganj_1_2011
P_C_45_Kundarki_1_2012
P_C_45_Kundarki_2_2012
P_C_45_Utraula_1_2012
P_C_300_Rosa_1_2012
S_C_250_Harduaganj_1_2012
C_C_500_Rihand_1_2012
S_C_250_Parichha_1_2012
C_C_500_Rihand_1_2013
S_C_250_Parichha_1_2013
P_C_660_Lalitpur_1_2015
P_C_660_Bara_1_2015
P_C_660_Lalitpur_2_2016
P_C_660_Lalitpur_1_2016
P_C_660_Bara_1_2016
P_C_660_Bara_1_2017
C_C_660_Meja_1_2018
C_C_660_Tanda_1_2019
C_C_660_Tanda_1_2021
0
500
1000
0
500
1000
0
500
1000
1500
NO₂ Concentration (mg/Nm³)

West Bengal


West Bengal
Emission_Standard
Before 2003
Between 2003-2016
S_C_60_Bandel_1_1965
S_C_60_Bandel_2_1965
S_C_60_Bandel_3_1965
C_C_210_Durgapur_1_1982
S_C_210_Bandel_1_1982
S_C_210_Bandel_2_1982
S_C_210_Kolaghat_1_1984
S_C_210_Kolaghat_2_1984
C_C_200_Farakka_2_1986
C_C_200_Farakka_1_1986
S_C_210_Kolaghat_1_1986
C_C_200_Farakka_1_1987
S_C_210_Kolaghat_1_1990
S_C_210_Kolaghat_2_1991
S_C_210_Kolaghat_1_1991
C_C_500_Farakka_1_1994
S_C_210_Kolaghat_2_1994
S_C_210_Kolaghat_1_1994
S_C_210_Kolaghat_1_1995
S_C_210_Kolaghat_2_1995
P_C_250_Budge_1_1997
P_C_250_Budge_1_1999
S_C_250_Santaldih_1_2007
S_B_300_D.P.L_2008
P_C_250_Budge_1_2010
C_C_500_Farakka_1_2011
S_C_250_Santaldih_1_2011
S_B_250_D.P.L_2_2014
S_B_250_D.P.L_1_2014
C_C_600_Raghunathpur_1_2014
0
100
200
300
PM Concentration (mg/Nm³)
0
20
40
60
80
100
120
PM Concentration (mg/Nm³)


West Bengal
Emission_Standard
< 500_MW
≥500_MW
S_C_60_Bandel_1_1965
S_C_60_Bandel_2_1965
S_C_60_Bandel_3_1965
C_C_210_Durgapur_1_1982
S_C_210_Bandel_1_1982
S_C_210_Bandel_2_1982
S_C_210_Kolaghat_1_1984
S_C_210_Kolaghat_2_1984
C_C_200_Farakka_2_1986
C_C_200_Farakka_1_1986
S_C_210_Kolaghat_1_1986
C_C_200_Farakka_1_1987
S_C_210_Kolaghat_1_1990
S_C_210_Kolaghat_2_1991
S_C_210_Kolaghat_1_1991
C_C_500_Farakka_1_1994
S_C_210_Kolaghat_2_1994
S_C_210_Kolaghat_1_1994
S_C_210_Kolaghat_1_1995
S_C_210_Kolaghat_2_1995
P_C_250_Budge_1_1997
P_C_250_Budge_1_1999
S_C_250_Santaldih_1_2007
S_B_300_D.P.L_2008
P_C_250_Budge_1_2010
C_C_500_Farakka_1_2011
S_C_250_Santaldih_1_2011
S_B_250_D.P.L_2_2014
S_B_250_D.P.L_1_2014
C_C_600_Raghunathpur_1_2014
0
500
1000
1500
2000
2500
200
400
600
800
1000
1200
SO₂ Concentration (mg/Nm³)
SO₂ Concentration (mg/Nm³)


West Bengal
Emission_Standard
Before 2003
Between 2003-2016
S_C_60_Bandel_1_1965
S_C_60_Bandel_2_1965
S_C_60_Bandel_3_1965
C_C_210_Durgapur_1_1982
S_C_210_Bandel_1_1982
S_C_210_Bandel_2_1982
S_C_210_Kolaghat_1_1984
S_C_210_Kolaghat_2_1984
C_C_200_Farakka_2_1986
C_C_200_Farakka_1_1986
S_C_210_Kolaghat_1_1986
C_C_200_Farakka_1_1987
S_C_210_Kolaghat_1_1990
S_C_210_Kolaghat_2_1991
S_C_210_Kolaghat_1_1991
C_C_500_Farakka_1_1994
S_C_210_Kolaghat_2_1994
S_C_210_Kolaghat_1_1994
S_C_210_Kolaghat_1_1995
S_C_210_Kolaghat_2_1995
P_C_250_Budge_1_1997
P_C_250_Budge_1_1999
S_C_250_Santaldih_1_2007
S_B_300_D.P.L_2008
P_C_250_Budge_1_2010
C_C_500_Farakka_1_2011
S_C_250_Santaldih_1_2011
S_B_250_D.P.L_2_2014
S_B_250_D.P.L_1_2014
C_C_600_Raghunathpur_1_2014
0
200
400
600
800
1000
1200
NO₂ Concentration (mg/Nm³)
0
200
400
600
800
NO₂ Concentration (mg/Nm³)

Annexure – A3

Emission standards of Thermal Power Station

Power generation facilities all around the world are obliged to comply with emission standards[1] in order to reap environmental and social benefit along with maximum power generation. These emission standards are played a vital role for the country's sustainable development. However, the requirements for emission standards vary per country that is determined by the country's level of knowledge and environmental acceptability. The World Bank has recommended siting guideline for different capacity of thermal power plant based on good, moderate and poor airshed (See Table).

Table: World Bank guidelines for siting of power plants.

Power Plant Capacity	Airshed category	Environmental assessment and emission requirements
Less than 500 MW	Good air quality	Subject to the maximum emission levels specified in the guidelines including SO_2 emission of 0.2 tpd per MW of capacity (maximum of 100 tpd for 500 MW) and maximum concentration of 2000 mg/m^3.
Greater than equal to 500 MW	Good air quality	Subject to the maximum emission levels specified in the guidelines including SO_2 emission of 0.2 tpd per MW upto 500 MW and 0.1 tpd for each additional capacity over 500 MW.
Less than 500 MW	Moderate air quality	Subject to the maximum emission levels specified in the guidelines provided that the environmental assessment shows that the plant will not lead to either the airshed dropping into category having poor air quality or an increase of more than 5 μg/m^3 in the annual mean level for the entire airshed of the pollutant. If either of these conditions is not satisfied, then lower site-specific emission levels should be established. The limit of 5 μg/m^3 increase will apply to the cumulative total impact of all power plants built in the airshed within any 10 years, beginning and after the date of the guidelines comes into effect.
Greater than or equal to 500 MW	Moderate air quality and all plants in airshed with poor air quality	Subject to site specific requirements that includes offset provisions to ensure that no net increase in the total emissions within the airshed of the pollutants which are the reason for the airshed being classified as having moderate or poor air quality. The measures agreed under the offset provisions must be implemented before the power plant comes fully on stream.

Source: The World Bank and "*Review of environmental guidelines: India vs other countries*" TERI Report obtained from CEA archive.

[1] The emission standards are regulatory or legal requirements that quantify permissiable limits of air pollutant emitted from any specific source in to the atmosphere.

This study focuses on emission standard of coal based thermal power station and ambient air of different country with specific attention towards India. For each country, emission standards are formulated to reduce the level of a particular pollutant's concentration and to set a control over emissions up to a desired level.

Emission standards of TPS in India

India began enacting environmental regulations at the end of 1970 to combat with modern environmental issues. The major environmental legislation of India is *Wildlife Protection Act* in 1972, *Water Pollution Prevention Act* in 1974, *Forest Protection Act* in 1980, and *Air Pollution Prevention and Control Act* in 1981. The first comprehensive environmental law ("*Environmental Protection Act*") in India was passed by the Federal Parliament in May 1986. The Environmental Protection Act of India (EPA, India) went into effect on November 19, 1986. In this way, modern environmental legal system has been developed in India. The Environment (Protection) Act (No. 29 of 1986, 23 May 1986, last amended in 1991) state that the implementation of power plant projects requires clearance from the MoEF & CC via an environmental impact assessment. The old emission standards (1989) consider only particulate matter based on their power generation capacity (MW).

Emission standard guideline for thermal power station in India

Old Emission Standards (1989)				
Power generation capacity (MW)	**PM**	**SO_2**	**NO_X**	**Hg**
< 210 MW	350 mg/Nm^3	None	None	None
≥ 210 MW	150 mg/Nm^3	None	None	None

New Emission Standards (2015)	
Parameter	**Standards (in mg/Nm^3)**
TPPs(units) installed before 31st December 2003*	
Particulate Matter (PM)	100
Sulphur Dioxide (SO_2)	600 (For units having < 500 MW capacity) 200 (For units having ≥ 500 MW capacity)
Oxides of Nitrogen (NOx)	600
Mercury (Hg)	0.03 (For units having ≥ 500 MW capacity)
TPPs(units) installed after 1st January, 2003, up to 31st December 2016*	
Particulate Matter (PM)	50
Sulphur Dioxide (SO_2)	600 (For units having < 500 MW capacity) 200 (For units having ≥ 500 MW capacity)
Oxides of Nitrogen (NOx)	300
Mercury (Hg)	0.03
TPPs (units) to be installed from 1st January, 2017**	
Particulate Matter (PM)	30
Sulphur Dioxide (SO_2)	100
Oxides of Nitrogen (NOx)	100
Mercury (Hg)	0.03

* Units shall meet the limits within two years from date of publication of this notification.

** Includes all the units, which have been accorded environmental clearance and under construction.

Source: MOEF & CC Notification No: S.O.3305 (E) titled 'Environmental (Protection) Amendment rules, 2015 dated 7.12.2015.

The MoEF&CC has notified with Notification No: S.O.3305 (E) titled 'Environmental (Protection) Amendment rules, 2015 dated 7.12.2015 to revise the emission standards for coal-based Thermal Power Plants in the country, with the primary aim of minimizing pollution. For this purpose, Thermal power stations are categorized into 3 categories, namely those:- (i) Installed before 31st December, 2003 (ii) Installed after 2003 upto 31st December, 2016 and (iii) Installed after 31st December, 2016 (See Table:). These emission standards are stringent for recent plants compared to older plants and it is highly stringent for upcoming plants in future. As compared with other countries, India adopted highly stringent emission norms, especially for newly constructed TPP (See Table). The SO_2 permissible limit is 100 for new TPP that is more than the emission standard adopted by China and more than the other countries. Furthermore, NO_x permissible limits are equivalent to China and less than other countries. The particulate matter permissible limits are much lesser but it more than China, European Union, United States, and Korea.

The emission standards (2015) have not specified about the time period of monitoring of pollutant. However, the pollutant emissions are regularly monitored through online continuous monitoring system (OCEMS) in TPP, as mandated by MoEF&CC. The OCEMS data provide 24h averaged data for each day. Therefore, it become important to know about the time period of monitoring of permissible limits of pollutant to fulfill the compliances of the emission standards.

Emission limits for existing and new power plants in selected countries /regions (mg/Nm^3)

Region	Policy	SO_2		NO_x		PM	
		Existing	New	Existing	New	Existing	New
China[a]	Emission standard of air pollutants for thermal power plant, 2011	100-400	50	100-200	100	30	20
European Union	Industrial Emissions Directive, 2010	200-400	150-400	200-450	150-400	20-30	10-20
United States[b]	New Source Performance Standards, 2015	160-640	160	117-640	117	23	23
India	Environment (Protection) Amendment Rules, 2015	200-600	100	300-600	100	50-100	30
Indonesia	MOE decree no. 21 2008	750	750	850	750	150	100
Japan[c]	Air Pollution Control Law 1993	-	-	123-513	123-513	30-100	30-100
Mexico[d]	Mexican Official Standard NOM-085-ECOL-1994 (in PPMV for SO_2 and NO_x)	550-2200	30-2200	110-375	25-375	60-450	60-450
Philippines	National Emission Standards for Particulate Matter for Stationary Sources	1000-1500	200-700	1000-1500	500-1000	150-200	150-200
South Africa	The Minimum Emissions Standards are published by the government	3500	500	1100	750	100	50
Korea	Special Measures for Metropolitan Air Qality Improvement, 2002	286	229	308	164	40	20-30
Thailand	Royal Thai Government Gazette	700-1300	180-360	400	200	80-320	80
Vietnam	Industrial emission standards for dust and inorganic substances,2005	1500	500	1000	650-1000	400	200

"New" Special emission limits for air pollutants applicable to key areas adopted in China.
[b]US emission limits were converted from lb/MBtu to mg/m^3 assuming an F-factor of 1800 standard cu. Ft. of CO_2 and a CO_2 content of 12% in the flue gas.
[c]Japan Air Pollution Control Law (APCL) specifies emission limits for SO_X, NO_X, and PM that differ depending on the scale of facilities, technologies, and regions. Prior to the construction of new plants in Japan, local authorities and power generation companies usually arrive at bilateral pollution prevention agreements more stringent than those mandated in the APCL, 1993.
[d]For Mexico, SO2 and NOX are expressed in parts per million by volume (PPMV).

Notes: "Existing" refers to the emission limit for currently operating power plants. "New" refers to the limit for planned or proposed plants.

Source: *"Advances in ultra-low emission control technologies for coal-fired power plants" by* Tao Wang and published by Elsevier.

Emission limits for existing coal-fired power plants*				
Jurisdiction	**SO_2**	**NOx**	**PM**	**Hg**
EU: from 2023, hard coal	130	150	8	4
EU: from 2023, lignite	130	175	8	7
China: from 2020	35	50	10	30
EU: from 2015	200	200	20	–
U.S.	640	640	23	1.6
China: All plants	200	100	30	30
South Korea	286	308	36	–
Japan	200	376	46	–
India: units installed after 2003*	**200**	**600**	**50**	**30**
Turkey	400	200	50	–
Chile	400	500	50	–
South Africa*	680	1020	68	–
India: units installed before 2003*	200	300	100	30
Indonesia	589	589	107	–
Australia	–	856	109	–
Philippines	1607	1607	214	–
Vietnam	500	1000	400	–
***Unit: mg/Nm^3, except Hg as µg/Nm^3, dry STP 6% oxygen.**				

Emission limits for new coal-fired power plants*				
Jurisdiction	**SO_2**	**NOx**	**PM**	**Hg**
China	35	50	10	30
United States – MATS	60	99	13	0.5
EU, hard coal	75	85	5	2
EU, lignite	75	85	5	4
India	**100**	**100**	**30**	**30**
Turkey	150	150	10	30
South Korea	229	164	18	30
Vietnam	350	455	140	30
Philippines	594	1071	161	30
South Africa	680	1020	68	30
Indonesia	804	804	107	30
Australia	–	856	109	30
***Unit: mg/Nm^3, except Hg as µg/Nm^3, dry STP 6% oxygen.**				

Source: https://energyandcleanair.org/

Annexure - B1

List of continuous ambient air quality monitoring station (CAAQMS)

State / UT	City	No. of CAAQMS station
Andhra Pradesh	Rajamahendravaram	Anand Kala Kshetram, Rajamahendravaram - APPCB
Andhra Pradesh	Chittoor	Gangineni Cheruvu, Chittoor - APPCB
Andhra Pradesh	Anantapur	Gulzarpet, Anantapur - APPCB
Andhra Pradesh	Visakhapatnam	GVM Corporation, Visakhapatnam - APPCB
Andhra Pradesh	Vijayawada	Kanuru, Vijayawada - APPCB
Andhra Pradesh	Vijayawada	PWD Grounds, Vijayawada - APPCB
Andhra Pradesh	Amaravati	Secretariat, Amaravati - APPCB
Andhra Pradesh	Tirupati	Tirumala, Tirupati - APPCB
Andhra Pradesh	Tirupati	Vaikuntapuram, Tirupati - APPCB
Andhra Pradesh	Kadapa	Yerramukkapalli, Kadapa - APPCB
Arunachal Pradesh	Naharlagun	Naharlagun, Naharlagun - APSPCB
Assam	Nalbari	Bata Chowk, Nalbari - PCBA
Assam	Byrnihat	Central Academy for SFS, Byrnihat - PCBA
Assam	Nagaon	Christianpatty, Nagaon - PCBA
Assam	Sivasagar	Girls College, Sivasagar - PCBA
Assam	Guwahati	IITG, Guwahati - PCBA
Assam	Guwahati	LGBI Airport, Guwahati - PCBA
Assam	Guwahati	Pan Bazaar, Guwahati - PCBA
Assam	Guwahati	Railway Colony, Guwahati - PCBA
Assam	Silchar	Tarapur, Silchar - PCBA
Bihar	Muzaffarpur	Buddha Colony, Muzaffarpur - BSPCB
Bihar	Buxar	Central Jail, Buxar - BSPCB
Bihar	Siwan	Chitragupta Nagar, Siwan - BSPCB
Bihar	Gaya	Collectorate, Gaya - BSPCB
Bihar	Bihar Sharif	D M Colony, Bihar Sharif - BSPCB
Bihar	Sasaram	Dada Peer, Sasaram - BSPCB
Bihar	Rajgir	Dangi Tola, Rajgir - BSPCB
Bihar	Chhapra	Darshan Nagar, Chhapra - BSPCB
Bihar	Bhagalpur	DM Office_Kachari Chowk, Bhagalpur - BSPCB
Bihar	Samastipur	DM Office_Kasipur, Samastipur - BSPCB
Bihar	Begusarai	DRCC Anandpur, Begusarai - BSPCB
Bihar	Patna	DRM Office Danapur, Patna - BSPCB
Bihar	Manguraha	Forest Rest House, Manguraha - BSPCB
Bihar	Motihari	Gandak Colony, Motihari - BSPCB
Bihar	Patna	Govt. High School Shikarpur, Patna - BSPCB
Bihar	Aurangabad	Gurdeo Nagar, Aurangabad - BSPCB
Bihar	Patna	IGSC Planetarium Complex, Patna - BSPCB
Bihar	Hajipur	Industrial Area, Hajipur - BSPCB
Bihar	Bettiah	Kamalnath Nagar, Bettiah - BSPCB
Bihar	Gaya	Kareemganj, Gaya - BSPCB
Bihar	Araria	Kharahiya Basti, Araria - BSPCB
Bihar	Purnia	Mariam Nagar, Purnia - BSPCB
Bihar	Bhagalpur	Mayaganj, Bhagalpur - BSPCB
Bihar	Katihar	Mirchaibari, Katihar - BSPCB
Bihar	Muzaffarpur	MIT-Daudpur Kothi, Muzaffarpur - BSPCB
Bihar	Patna	Muradpur, Patna - BSPCB
Bihar	Muzaffarpur	Muzaffarpur Collectorate, Muzaffarpur - BSPCB
Bihar	Arrah	New DM Office, Arrah - BSPCB
Bihar	Saharsa	Police Line, Saharsa - BSPCB

Bihar	Patna	Rajbansi Nagar, Patna - BSPCB
Bihar	Patna	Samanpura, Patna - BSPCB
Bihar	Kishanganj	SDM Office_Khagra, Kishanganj - BSPCB
Bihar	Gaya	SFTI Kusdihra, Gaya - BSPCB
Bihar	Darbhanga	Town Hall - Lal Bagh, Darbhanga - BSPCB
Bihar	Munger	Town Hall, Munger - BSPCB
Chhattisgarh	Bhilai	32Bungalows, Bhilai - CECB
Chhattisgarh	Raipur	AIIMS, Raipur - CECB
Chhattisgarh	Raipur	Bhatagaon New ISBT, Raipur - CECB
Chhattisgarh	Bhilai	Civic Center, Bhilai - Bhilai Steel Plant
Chhattisgarh	Milupara	Govt. Higher Secondary School, Milupara - CECB
Chhattisgarh	Bhilai	Hathkhoj, Bhilai - CECB
Chhattisgarh	Raipur	Krishak Nagar, Raipur - CECB
Chhattisgarh	Bilaspur	Mangala, Bilaspur - NTPC
Chhattisgarh	Chhal	Nawapara SECL Colony, Chhal - CECB
Chhattisgarh	Tumidih	OP Jindal Industrial Park, Tumidih - CECB
Chhattisgarh	Kunjemura	OP Jindal School, Kunjemura - CECB
Chhattisgarh	Korba	Rampur, Korba - CECB
Chhattisgarh	Raipur	Siltara Phase-II, Raipur - CECB
Chhattisgarh	Korba	Urja Nagar, Korba - CECB
Gujarat	Ahmedabad	Chandkheda, Ahmedabad - IITM
Gujarat	Ankleshwar	GIDC, Ankleshwar - GPCB
Gujarat	Nandesari	GIDC, Nandesari - Nandesari Ind. Association
Gujarat	Gandhinagar	GIFT City, Gandhinagar - IITM
Gujarat	Ahmedabad	Gyaspur, Ahmedabad - IITM
Gujarat	Gandhinagar	IIPHG Lekawada, Gandhinagar - IITM
Gujarat	Ahmedabad	Maninagar, Ahmedabad - GPCB
Gujarat	Vapi	Phase-1 GIDC, Vapi - GPCB
Gujarat	Vatva	Phase-4 GIDC, Vatva - GPCB
Gujarat	Ahmedabad	Raikhad, Ahmedabad - IITM
Gujarat	Ahmedabad	Rakhial, Ahmedabad - IITM
Gujarat	Ahmedabad	SAC ISRO Bopal, Ahmedabad - IITM
Gujarat	Ahmedabad	SAC ISRO Satellite, Ahmedabad - IITM
Gujarat	Ahmedabad	Sardar Vallabhbhai Patel Stadium, Ahmedabad - IITM
Gujarat	Surat	Science Center, Surat - SMC
Gujarat	Gandhinagar	Sector-10, Gandhinagar - GPCB
Gujarat	Ahmedabad	SVPI Airport Hansol, Ahmedabad - IITM
Haryana	Bahadurgarh	Arya Nagar, Bahadurgarh - HSPCB
Haryana	Sirsa	F-Block, Sirsa - HSPCB
Haryana	Mandikhera	General Hospital, Mandikhera - HSPCB
Haryana	Yamuna Nagar	Gobind Pura, Yamuna Nagar - HSPCB
Haryana	Bhiwani	H.B. Colony, Bhiwani - HSPCB
Haryana	Fatehabad	Huda Sector, Fatehabad - HSPCB
Haryana	Rohtak	MD University, Rohtak - HSPCB
Haryana	Charkhi Dadri	Mini Secretariat, Charkhi Dadri - HSPCB
Haryana	Dharuhera	Municipal Corporation Office, Dharuhera - HSPCB
Haryana	Sonipat	Murthal, Sonipat - HSPCB
Haryana	Ballabgarh	Nathu Colony, Ballabgarh - HSPCB
Haryana	Faridabad	New Industrial Town, Faridabad - HSPCB
Haryana	Gurugram	NISE Gwal Pahari, Gurugram - IMD
Haryana	Ambala	Patti Mehar, Ambala - HSPCB
Haryana	Jind	Police Lines, Jind - HSPCB
Haryana	Kaithal	Rishi Nagar, Kaithal - HSPCB
Haryana	Faridabad	Sector 11, Faridabad - HSPCB
Haryana	Faridabad	Sector 30, Faridabad - HSPCB
Haryana	Faridabad	Sector- 16A, Faridabad - HSPCB

Haryana	Karnal	Sector-12, Karnal - HSPCB
Haryana	Panipat	Sector-18, Panipat - HSPCB
Haryana	Manesar	Sector-2 IMT, Manesar - HSPCB
Haryana	Gurugram	Sector-51, Gurugram - HSPCB
Haryana	Panchkula	Sector-6, Panchkula - HSPCB
Haryana	Kurukshetra	Sector-7, Kurukshetra - HSPCB
Haryana	Narnaul	Shastri Nagar, Narnaul - HSPCB
Haryana	Palwal	Shyam Nagar, Palwal - HSPCB
Haryana	Gurugram	Teri Gram, Gurugram - HSPCB
Haryana	Hisar	Urban Estate-II, Hisar - HSPCB
Haryana	Gurugram	Vikas Sadan, Gurugram - HSPCB
Himachal Pradesh	Baddi	HIMUDA Complex Phase-1, Baddi - HPPCB
Jharkhand	Dhanbad	Sardar Patel Nagar, Dhanbad - JSPCB
Jharkhand	Jorapokhar	Tata Stadium, Jorapokhar - JSPCB
Karnataka	Haveri	Ashwini Nagar, Haveri - KSPCB
Karnataka	Hassan	B.Katihalli, Hassan - KSPCB
Karnataka	Bengaluru	Bapuji Nagar, Bengaluru - KSPCB
Karnataka	Udupi	Brahmagiri, Udupi - KSPCB
Karnataka	Bengaluru	BTM Layout, Bengaluru - CPCB
Karnataka	Bengaluru	BWSSB Kadabesanahalli, Bengaluru - CPCB
Karnataka	Chikkaballapur	Chikkaballapur Rural, Chikkaballapur - KSPCB
Karnataka	Bengaluru	City Railway Station, Bengaluru - KSPCB
Karnataka	Yadgir	Collector Office, Yadgir - KSPCB
Karnataka	Hubballi	Deshpande Nagar, Hubballi - KSPCB
Karnataka	Davanagere	Devaraj Urs Badavane, Davanagere - KSPCB
Karnataka	Koppal	Diwator Nagar, Koppal - KSPCB
Karnataka	Raichur	Haji Colony, Raichur - KSPCB
Karnataka	Mysuru	Hebbal 1st Stage, Mysuru - KSPCB
Karnataka	Bengaluru	Hebbal, Bengaluru - KSPCB
Karnataka	Bengaluru	Hombegowda Nagar, Bengaluru - KSPCB
Karnataka	Vijayapura	Ibrahimpur, Vijayapura - KSPCB
Karnataka	Bengaluru	Jayanagar 5th Block, Bengaluru - KSPCB
Karnataka	Mangalore	Kadri, Mangalore - KSPCB
Karnataka	Dharwad	Kalabhavan, Dharwad - KSPCB
Karnataka	Chikkamagaluru	Kalyana Nagara, Chikkamagaluru - KSPCB
Karnataka	Kalaburagi	Lal Bahadur Shastri Nagar, Kalaburagi - KSPCB
Karnataka	Hubballi	Lingaraj Nagar, Hubballi - KSPCB
Karnataka	Kalaburagi	Mahatma Basaveswar Colony, Kalaburgi - KSPCB
Karnataka	Bidar	Naubad, Bidar - KSPCB
Karnataka	Gadag	Panchal Nagar, Gadag - KSPCB
Karnataka	Bengaluru	Peenya, Bengaluru - CPCB
Karnataka	Belgaum	Ramteerth Nagar, Belgaum - KSPCB
Karnataka	Bengaluru	RVCE-Mailasandra, Bengaluru - KSPCB
Karnataka	Bengaluru	Sanegurava Halli, Bengaluru - KSPCB
Karnataka	Bengaluru	Shivapura_Peenya, Bengaluru - KSPCB
Karnataka	Bengaluru	Silk Board, Bengaluru - KSPCB
Karnataka	Madikeri	Stuart Hill, Madikeri - KSPCB
Karnataka	Kolar	Tamaka Ind. Area, Kolar - KSPCB
Karnataka	Tumakuru	Thimmalapura, Tumakuru - KSPCB
Karnataka	Chamarajanagar	Urban, Chamarajanagar - KSPCB
Karnataka	Bagalkot	Vidayagiri, Bagalkot - KSPCB
Karnataka	Ramanagara	Vijay Nagar, Ramanagara - KSPCB
Karnataka	Shivamogga	Vinoba Nagara, Shivamogga - KSPCB
Kerala	Thrissur	Corporation Ground, Thrissur - Kerala PCB
Kerala	Ernakulam	Kacheripady, Ernakulam - Kerala PCB
Kerala	Thiruvananthapuram	Kariavattom, Thiruvananthapuram - Kerala PCB

Kerala	Kozhikode	Palayam, Kozhikode - Kerala PCB
Kerala	Thiruvananthapuram	Plammoodu, Thiruvananthapuram - Kerala PCB
Kerala	Kollam	Polayathode, Kollam - Kerala PCB
Kerala	Kannur	Thavakkara, Kannur - Kerala PCB
Kerala	Eloor	Udyogamandal, Eloor - Kerala PCB
Kerala	Kochi	Vyttila, Kochi - Kerala PCB
Madhya Pradesh	Anuppur	Collectorate
Madhya Pradesh	Betul	Collector
Madhya Pradesh	Bhopal	Collector
Madhya Pradesh	Bhopal	Paryavaran
Madhya Pradesh	Bhopal	TT Nagar
Madhya Pradesh	Damoh	Shrivastav Colony
Madhya Pradesh	Dewas	Bhopal Chauraha
Madhya Pradesh	Dewas	Govt MG Hospital
Madhya Pradesh	Gwalior	Maharaja Bada
Madhya Pradesh	Gwalior	PhoolBagh
Madhya Pradesh	Gwalior	City Center
Madhya Pradesh	Gwalior	DD Nagar
Madhya Pradesh	Indore	Airport Area
Madhya Pradesh	Indore	Chhoti Gwaltoli
Madhya Pradesh	Indore	Maguda Nagar
Madhya Pradesh	Indore	Playground
Madhya Pradesh	Indore	Redional Park
Madhya Pradesh	Indore	Regional Park
Madhya Pradesh	Indore	Residence Area
Madhya Pradesh	Indore	Vijay Nagar
Madhya Pradesh	Jabalpur	Govindh Bhavan Colony
Madhya Pradesh	Jabalpur	Gupteshwar
Madhya Pradesh	Jabalpur	Marhatal
Madhya Pradesh	Jabalpur	Suhagi
Madhya Pradesh	Katni	Gole Bazar
Madhya Pradesh	Katni	Regional Office
Madhya Pradesh	Khandwa	Lok Seva Kendra
Madhya Pradesh	Khargone	Nagar Palika
Madhya Pradesh	Maihar	Sharda Temple
Madhya Pradesh	Mandideep	Sector New Industrial Area
Madhya Pradesh	Narsinghpur	District Education Office
Madhya Pradesh	Panna	Collectorate
Madhya Pradesh	Pithampur	Sector-2 Industrial Area
Madhya Pradesh	Ratlam	Shathri Nagar
Madhya Pradesh	Rewa	Collector Office
Madhya Pradesh	Rewa	Regional Office
Madhya Pradesh	Sagar	Collectorate Office
Madhya Pradesh	Sagar	Deen Dayal Nagar
Madhya Pradesh	Satna	Bandhavgar Colony
Madhya Pradesh	Singrauli	Surya Kiran Bhawan Dudhichua
Madhya Pradesh	Singrauli	Trauma Centre Waidhan
Madhya Pradesh	Ujjain	Mahakaleshwar Temple
Maharashtra	Navi Mumbai	Airoli, Navi Mumbai - MPCB
Maharashtra	Pune	Alandi, Pune - IITM
Maharashtra	Mumbai	Bandra Kurla Complex, Mumbai - IITM
Maharashtra	Mumbai	Bandra, Mumbai - MPCB
Maharashtra	Pune	Bhosari, Pune - IITM
Maharashtra	Mumbai	Borivali East, Mumbai - IITM
Maharashtra	Mumbai	Borivali East, Mumbai - MPCB
Maharashtra	Mumbai	Chakala-Andheri East, Mumbai - IITM

Maharashtra	Chandrapur	Chauhan Colony, Chandrapur - MPCB
Maharashtra	Mumbai	Chhatrapati Shivaji Intl. Airport (T2), Mumbai - MPCB
Maharashtra	Mumbai	Colaba, Mumbai - MPCB
Maharashtra	Mumbai	Deonar, Mumbai - IITM
Maharashtra	Nashik	Gangapur Road, Nashik - MPCB
Maharashtra	Pune	Hadapsar, Pune - IITM
Maharashtra	Mumbai	Kandivali East, Mumbai - MPCB
Maharashtra	Pune	Karve Road, Pune - MPCB
Maharashtra	Kalyan	Khadakpada, Kalyan - MPCB
Maharashtra	Mumbai	Khindipada-Bhandup West, Mumbai - IITM
Maharashtra	Mumbai	Kurla, Mumbai - MPCB
Maharashtra	Navi Mumbai	Mahape, Navi Mumbai - MPCB
Maharashtra	Mumbai	Malad West, Mumbai - IITM
Maharashtra	Mumbai	Mazgaon, Mumbai - IITM
Maharashtra	Pune	Mhada Colony, Pune - IITM
Maharashtra	Chandrapur	MIDC Khutala, Chandrapur - MPCB
Maharashtra	Pune	MIT-Kothrud, Pune - IITM
Maharashtra	Aurangabad	More Chowk Waluj, Aurangabad - MPCB
Maharashtra	Mumbai	Mulund West, Mumbai - MPCB
Maharashtra	Mumbai	Navy Nagar-Colaba, Mumbai - IITM
Maharashtra	Navi Mumbai	Nerul, Navi Mumbai - MPCB
Maharashtra	Nagpur	Opp GPO Civil Lines, Nagpur - MPCB
Maharashtra	Thane	Pimpleshwar Mandir, Thane - MPCB
Maharashtra	Mumbai	Powai, Mumbai - MPCB
Maharashtra	Pune	Revenue Colony-Shivajinagar, Pune - IITM
Maharashtra	Navi Mumbai	Sector-19A Nerul, Navi Mumbai - IITM
Maharashtra	Mumbai	Siddharth Nagar-Worli, Mumbai - IITM
Maharashtra	Mumbai	Sion, Mumbai - MPCB
Maharashtra	Solapur	Solapur, Solapur - MPCB
Maharashtra	Pune	Transport Nagar-Nigdi, Pune - IITM
Maharashtra	Mumbai	Vasai West, Mumbai - MPCB
Maharashtra	Mumbai	Vile Parle West, Mumbai - MPCB
Maharashtra	Mumbai	Worli, Mumbai - MPCB
Manipur	Imphal	DM College of Science, Imphal - Manipur PCB
Manipur	Imphal	Manipur University, Imphal - Manipur PCB
Meghalaya	Shillong	JN Stadium, Shillong - Meghalaya PCB
Meghalaya	Shillong	Lumpyngngad, Shillong - Meghalaya PCB
Mizoram	Aizawl	Sikulpuikawn, Aizawl - Mizoram PCB
Nagaland	Kohima	PWD Juction, Kohima - NPCB
Odisha	Tensa	Barsua Iron Ore Mines, Tensa - OSPCB
Odisha	Nayagarh	Dabuna, Nayagarh - OSPCB
Odisha	Rairangpur	Divisional Forest Office, Rairangpur - OSPCB
Odisha	Rourkela	Fertilizer Township, Rourkela - OSPCB
Odisha	Brajrajnagar	GM Office, Brajrajnagar - OSPCB
Odisha	Keonjhar	Jagamohanpur, Keonjhar - OSPCB
Odisha	Baripada	Meher Colony, Baripada - OSPCB
Odisha	Suakati	OMC Colony, Suakati - OSPCB
Odisha	Rourkela	Raghunathpali, Rourkela - OSPCB
Odisha	Rourkela	Sector-2, Rourkela - OSPCB
Odisha	Talcher	Talcher Coalfields,Talcher - OSPCB
Odisha	Bileipada	Tata Township, Bileipada - OSPCB
Punjab	Jalandhar	Civil Line, Jalandhar - PPCB
Punjab	Amritsar	Golden Temple, Amritsar - PPCB
Punjab	Bathinda	Hardev Nagar, Bathinda - PPCB
Punjab	Khanna	Kalal Majra, Khanna - PPCB
Punjab	Patiala	Model Town, Patiala - PPCB

Punjab	Ludhiana	Punjab Agricultural University, Ludhiana - PPCB
Punjab	Rupnagar	Ratanpura, Rupnagar - Ambuja Cements
Punjab	Mandi Gobindgarh	RIMT University, Mandi Gobindgarh - PPCB
Rajasthan	Jaipur	Adarsh Nagar, Jaipur - RSPCB
Rajasthan	Udaipur	Ashok Nagar, Udaipur - RSPCB
Rajasthan	Ajmer	Civil Lines, Ajmer - RSPCB
Rajasthan	Jodhpur	Collectorate, Jodhpur - RSPCB
Rajasthan	Kota	Dhanmandi, Kota - RSPCB
Rajasthan	Rajsamand	Dhoinda, Rajsamand - RSPCB
Rajasthan	Hanumangarh	Housing Board, Hanumangarh - RSPCB
Rajasthan	Pali	Indira Colony Vistar, Pali - RSPCB
Rajasthan	Jhunjhunu	Indra Nagar, Jhunjhunu - RSPCB
Rajasthan	Jodhpur	Jhalamand, Jodhpur - RSPCB
Rajasthan	Dausa	Khatikan Mohalla, Dausa - RSPCB
Rajasthan	Bharatpur	Krishna Nagar, Bharatpur - RSPCB
Rajasthan	Jaipur	Mansarovar Sector-12, Jaipur - RSPCB
Rajasthan	Bikaner	MM Ground, Bikaner - RSPCB
Rajasthan	Alwar	Moti Doongri, Alwar - RSPCB
Rajasthan	Kota	Nayapura, Kota - RSPCB
Rajasthan	Sri Ganganagar	Old City, Sri Ganganagar - RSPCB
Rajasthan	Jaipur	Police Commissionerate, Jaipur - RSPCB
Rajasthan	Pratapgarh	Pragati Nagar, Pratapgarh - RSPCB
Rajasthan	Sikar	Radhakishan Pura, Sikar - RSPCB
Rajasthan	Barmer	Railway Colony, Barmer - RSPCB
Rajasthan	Dholpur	Raja Ganj, Dholpur - RSPCB
Rajasthan	Jhalawar	Rajlaxmi Nagar, Jhalawar - RSPCB
Rajasthan	Banswara	Rati Talai, Banswara - RSPCB
Rajasthan	Bhiwadi	RIICO Ind. Area III, Bhiwadi - RSPCB
Rajasthan	Sawai Madhopur	Sahu Nagar, Sawai Madhopur - RSPCB
Rajasthan	Jodhpur	Samrat Ashok Udhyan, Jodhpur - RSPCB
Rajasthan	Karauli	Satyawati Vihar, Karauli - RSPCB
Rajasthan	Jaipur	Sector-2 Murlipura, Jaipur - RSPCB
Rajasthan	Chittorgarh	Shastri Nagar, Chittorgarh - RSPCB
Rajasthan	Jaipur	Shastri Nagar, Jaipur - RSPCB
Rajasthan	Tonk	Shastri Nagar, Tonk - RSPCB
Rajasthan	Kota	Shrinath Puram, Kota - RSPCB
Rajasthan	Churu	Subash Chowk, Churu - RSPCB
Rajasthan	Sirohi	Vedhaynath Colony, Sirohi - RSPCB
Sikkim	Gangtok	Zero Point GICI, Gangtok - SSPCB
Tamil Nadu	Chennai	Alandur Bus Depot, Chennai - CPCB
Tamil Nadu	Gummidipoondi	Anthoni Pillai Nagar, Gummidipoondi - TNPCB
Tamil Nadu	Chennai	Arumbakkam, Chennai - TNPCB
Tamil Nadu	Palkalaiperur	Bharathidasan University, Palkalaiperur - TNPCB
Tamil Nadu	Ooty	Bombay Castel, Ooty - TNPCB
Tamil Nadu	Ramanathapuram	Chalai Bazaar, Ramanathapuram - TNPCB
Tamil Nadu	Chengalpattu	Crescent University, Chengalpattu - TNPCB
Tamil Nadu	Chennai	Gandhi Nagar_Ennore, Chennai - TNPCB
Tamil Nadu	Ariyalur	Keelapalur, Ariyalur - TNPCB
Tamil Nadu	Kanchipuram	Kilambi, Kanchipuram - TNPCB
Tamil Nadu	Chennai	Kodungaiyur, Chennai - TNPCB
Tamil Nadu	Cuddalore	Kudikadu, Cuddalore - TNPCB
Tamil Nadu	Tirupur	Kumaran College, Tirupur - TNPCB
Tamil Nadu	Chennai	Manali Village, Chennai - TNPCB
Tamil Nadu	Chennai	Manali, Chennai - CPCB
Tamil Nadu	Thoothukudi	Meelavittan, Thoothukudi - TNPCB
Tamil Nadu	Dindigul	Mendonsa Colony, Dindigul - TNPCB

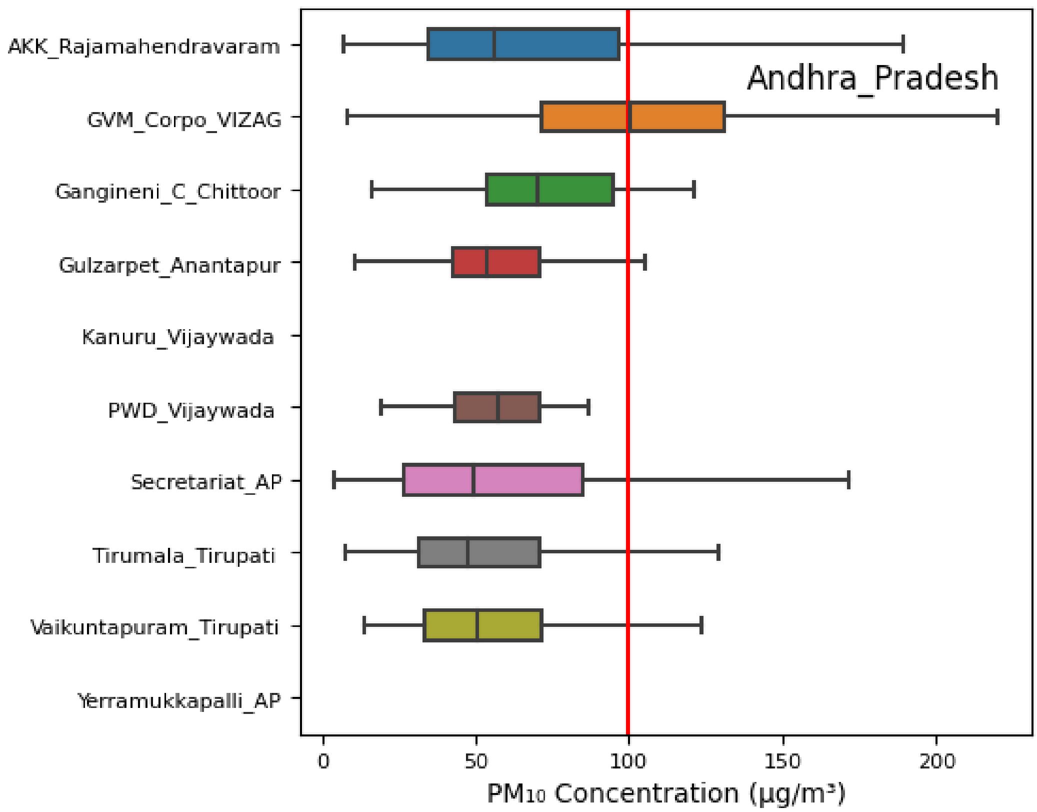
Tamil Nadu	Chennai	Perungudi, Chennai - TNPCB
Tamil Nadu	Coimbatore	PSG College of Arts and Science, Coimbatore
Tamil Nadu	Chennai	Royapuram, Chennai - TNPCB
Tamil Nadu	Cuddalore	Semmandalam, Cuddalore - TNPCB
Tamil Nadu	Coimbatore	SIDCO Kurichi, Coimbatore - TNPCB
Tamil Nadu	Hosur	SIPCOT Phase-1, Hosur - TNPCB
Tamil Nadu	Salem	Sona College of Technology, Salem - TNPCB
Tamil Nadu	Vellore	Vasanthapuram, Vellore - TNPCB
Tamil Nadu	Chennai	Velachery Res. Area, Chennai - CPCB
Telangana	Hyderabad	Bollaram Industrial Area, Hyderabad - TSPCB
Telangana	Hyderabad	Central University, Hyderabad - TSPCB
Telangana	Hyderabad	ECIL Kapra, Hyderabad - TSPCB
Telangana	Hyderabad	ICRISAT Patancheru, Hyderabad - TSPCB
Telangana	Hyderabad	IDA Pashamylaram, Hyderabad - TSPCB
Telangana	Hyderabad	IITH Kandi, Hyderabad - TSPCB
Telangana	Hyderabad	Kokapet, Hyderabad - TSPCB
Telangana	Hyderabad	Kompally Municipal Office, Hyderabad - TSPCB
Telangana	Hyderabad	Nacharam_TSIIC IALA, Hyderabad - TSPCB
Telangana	Hyderabad	New Malakpet, Hyderabad - TSPCB
Telangana	Hyderabad	Ramachandrapuram, Hyderabad - TSPCB
Telangana	Hyderabad	Sanathnagar, Hyderabad - TSPCB
Telangana	Hyderabad	Somajiguda, Hyderabad - TSPCB
Telangana	Hyderabad	Zoo Park, Hyderabad - TSPCB
Tripura	Agartala	Bardowali, Agartala - Tripura SPCB
Tripura	Agartala	Kunjaban, Agartala - Tripura SPCB
Uttar Pradesh	Hapur	Anand Vihar, Hapur - UPPCB
Uttar Pradesh	Varanasi	Ardhali Bazar, Varanasi - UPPCB
Uttar Pradesh	Lucknow	B R Ambedkar University, Lucknow - UPPCB
Uttar Pradesh	Varanasi	Bhelupur, Varanasi - UPPCB
Uttar Pradesh	Moradabad	Buddhi Vihar, Moradabad - UPPCB
Uttar Pradesh	Bareilly	Civil Lines, Bareilly - UPPCB
Uttar Pradesh	Moradabad	Eco Herbal Park, Moradabad - UPPCB
Uttar Pradesh	Moradabad	Employment Office, Moradabad - UPPCB
Uttar Pradesh	Kanpur	FTI Kidwai Nagar, Kanpur - UPPCB
Uttar Pradesh	Meerut	Ganga Nagar, Meerut - UPPCB
Uttar Pradesh	Lucknow	Gomti Nagar, Lucknow - UPPCB
Uttar Pradesh	Varanasi	IESD Banaras Hindu University, Varanasi - UPPCB
Uttar Pradesh	Kanpur	IITK, Kanpur - IITK
Uttar Pradesh	Ghaziabad	Indirapuram, Ghaziabad - UPPCB
Uttar Pradesh	Meerut	Jai Bhim Nagar, Meerut - UPPCB
Uttar Pradesh	Prayagraj	Jhunsi, Prayagraj - UPPCB
Uttar Pradesh	Moradabad	Jigar Colony, Moradabad - UPPCB
Uttar Pradesh	Khurja	Kalindi Kunj, Khurja - UPPCB
Uttar Pradesh	Moradabad	Kashiram Nagar, Moradabad - UPPCB
Uttar Pradesh	Lucknow	Kendriya Vidyalaya, Lucknow - CPCB
Uttar Pradesh	Greater Noida	Knowledge Park - III, Greater Noida - UPPCB
Uttar Pradesh	Greater Noida	Knowledge Park - V, Greater Noida - UPPCB
Uttar Pradesh	Lucknow	Kukrail Picnic Spot-1, Lucknow - UPPCB
Uttar Pradesh	Moradabad	Lajpat Nagar, Moradabad - UPPCB
Uttar Pradesh	Lucknow	Lalbagh, Lucknow - CPCB
Uttar Pradesh	Ghaziabad	Loni, Ghaziabad - UPPCB
Uttar Pradesh	Gorakhpur	Madan Mohan University of Technology, Gorakhpur
Uttar Pradesh	Varanasi	Maldahiya, Varanasi - UPPCB
Uttar Pradesh	Agra	Manoharpur, Agra - UPPCB
Uttar Pradesh	Prayagraj	Motilal Nehru NIT, Prayagraj - UPPCB
Uttar Pradesh	Prayagraj	Nagar Nigam, Prayagraj - UPPCB

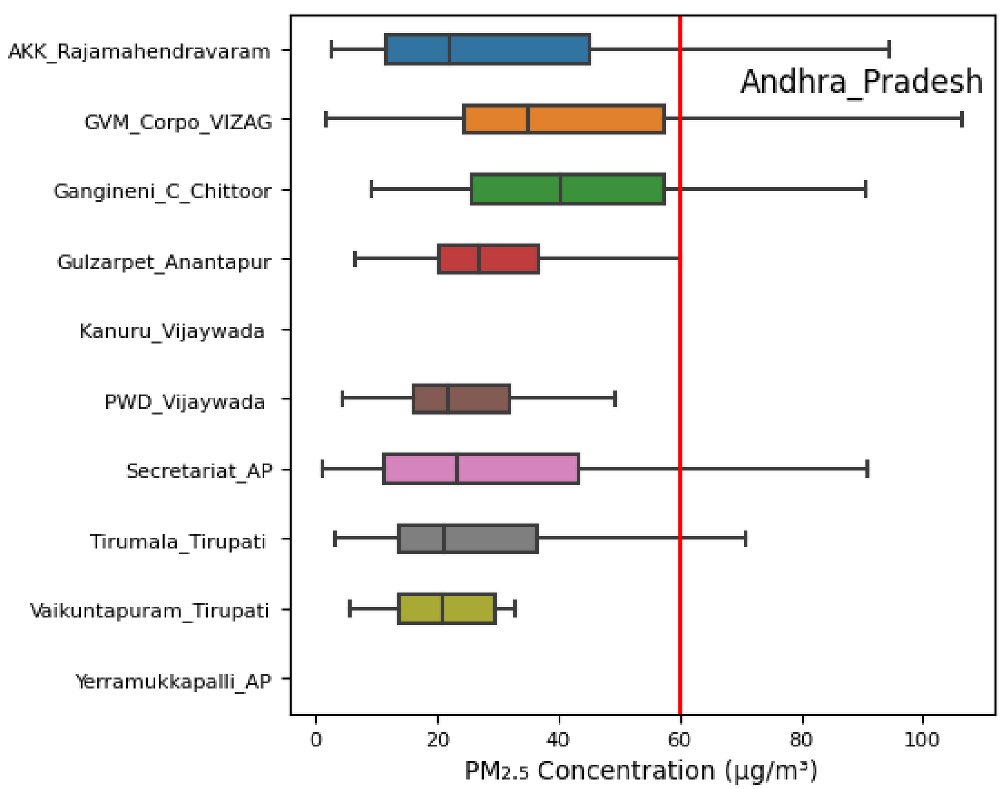
Uttar Pradesh	Firozabad	Nagla Bhau, Firozabad - UPPCB
Uttar Pradesh	Kanpur	Nehru Nagar, Kanpur - UPPCB
Uttar Pradesh	Baghpat	New Collectorate, Baghpat - UPPCB
Uttar Pradesh	Muzaffarnagar	New Mandi, Muzaffarnagar - UPPCB
Uttar Pradesh	Lucknow	Nishant Ganj, Lucknow - UPPCB
Uttar Pradesh	Kanpur	NSI Kalyanpur, Kanpur - UPPCB
Uttar Pradesh	Vrindavan	Omex Eternity, Vrindavan - UPPCB
Uttar Pradesh	Meerut	Pallavpuram Phase 2, Meerut - UPPCB
Uttar Pradesh	Bareilly	Rajendra Nagar, Bareilly - UPPCB
Uttar Pradesh	Agra	Rohta, Agra - UPPCB
Uttar Pradesh	Ghaziabad	Sanjay Nagar, Ghaziabad - UPPCB
Uttar Pradesh	Agra	Sanjay Palace, Agra - UPPCB
Uttar Pradesh	Baghpat	Sardar Patel Inter College, Baghpat - UPPCB
Uttar Pradesh	Noida	Sector - 125, Noida - UPPCB
Uttar Pradesh	Noida	Sector - 62, Noida - IMD
Uttar Pradesh	Noida	Sector-1, Noida - UPPCB
Uttar Pradesh	Noida	Sector-116, Noida - UPPCB
Uttar Pradesh	Agra	Sector-3B Avas Vikas Colony, Agra - UPPCB
Uttar Pradesh	Agra	Shahjahan Garden, Agra - UPPCB
Uttar Pradesh	Agra	Shastripuram, Agra - UPPCB
Uttar Pradesh	Jhansi	Shivaji Nagar, Jhansi - UPPCB
Uttar Pradesh	Lucknow	Talkatora District Industries Center, Lucknow - CPCB
Uttar Pradesh	Moradabad	Transport Nagar, Moradabad - UPPCB
Uttar Pradesh	Ghaziabad	Vasundhara, Ghaziabad - UPPCB
Uttar Pradesh	Firozabad	Vibhab Nagar, Firozabad - UPPCB
Uttar Pradesh	Bulandshahr	Yamunapuram, Bulandshahr - UPPCB
Uttarakhand	Dehradun	Doon University, Dehradun - UKPCB
Uttarakhand	Kashipur	Govt. Girls Inter College, Kashipur - UKPCB
Uttarakhand	Rishikesh	Shivaji Nagar, Rishikesh - UKPCB
West Bengal	Asansol	Asansol Court Area, Asansol - WBPCB
West Bengal	Kolkata	Ballygunge, Kolkata - WBPCB
West Bengal	Howrah	Belur Math, Howrah - WBPCB
West Bengal	Kolkata	Bidhannagar, Kolkata - WBPCB
West Bengal	Kolkata	Fort William, Kolkata - WBPCB
West Bengal	Howrah	Ghusuri, Howrah - WBPCB
West Bengal	Kolkata	Jadavpur, Kolkata - WBPCB
West Bengal	Howrah	Padmapukur, Howrah - WBPCB
West Bengal	Haldia	Priyambada Housing Estate, Haldia - WBPCB
West Bengal	Kolkata	Rabindra Bharati University, Kolkata - WBPCB
West Bengal	Kolkata	Rabindra Sarobar, Kolkata - WBPCB
West Bengal	Durgapur	Sidhu Kanhu Indoor Stadium, Durgapur - WBPCB
West Bengal	Kolkata	Victoria, Kolkata - WBPCB
West Bengal	Siliguri	Ward-32 Bapupara, Siliguri - WBPCB

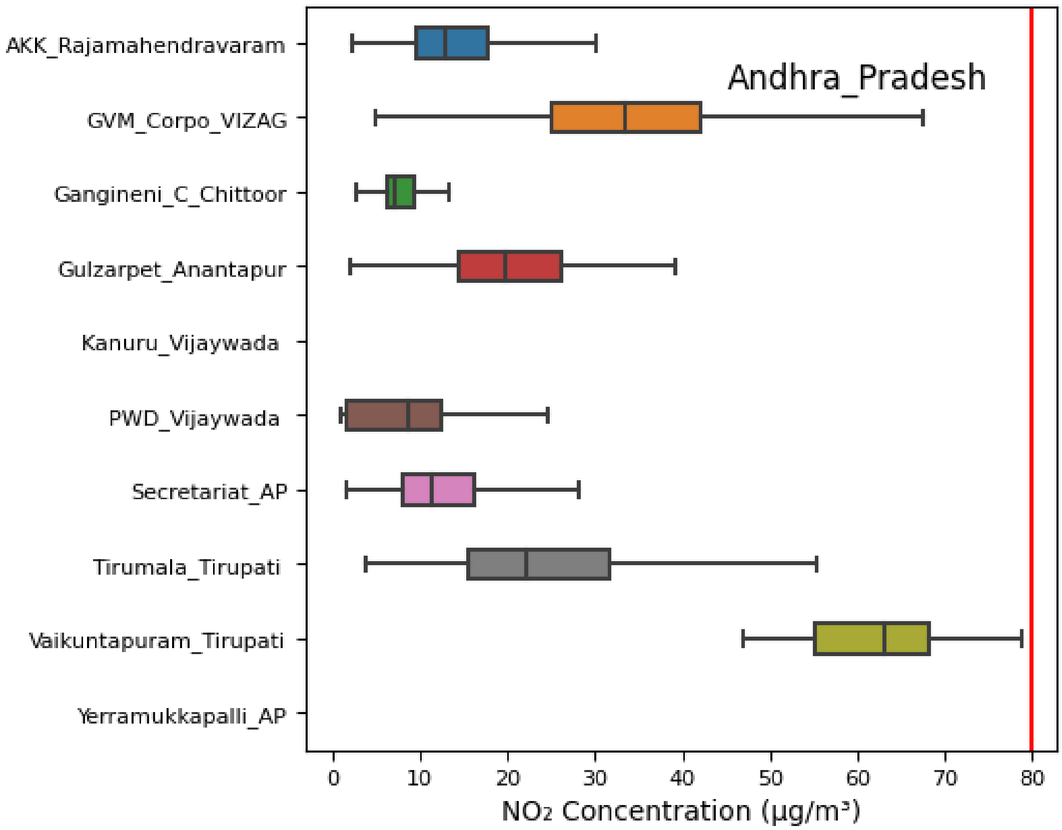
Union Territories		
Chandigarh	Chandigarh	Sector 22, Chandigarh - CPCC
Chandigarh	Chandigarh	Sector-25, Chandigarh - CPCC
Chandigarh	Chandigarh	Sector-53, Chandigarh - CPCC
Delhi	Delhi	Alipur, Delhi - DPCC
Delhi	Delhi	Anand Vihar, Delhi - DPCC
Delhi	Delhi	Ashok Vihar, Delhi - DPCC
Delhi	Delhi	Aya Nagar, Delhi - IMD
Delhi	Delhi	Bawana, Delhi - DPCC
Delhi	Delhi	Burari Crossing, Delhi - IMD
Delhi	Delhi	Chandni Chowk, Delhi - IITM
Delhi	Delhi	CRRI Mathura Road, Delhi - IMD
Delhi	Delhi	Dr. Karni Singh Shooting Range, Delhi - DPCC
Delhi	Delhi	DTU, Delhi - CPCB
Delhi	Delhi	Dwarka-Sector 8, Delhi - DPCC
Delhi	Delhi	East Arjun Nagar, Delhi - CPCB
Delhi	Delhi	IGI Airport (T3), Delhi - IMD
Delhi	Delhi	IHBAS, Dilshad Garden, Delhi - CPCB
Delhi	Delhi	ITO, Delhi - CPCB
Delhi	Delhi	Jahangirpuri, Delhi - DPCC
Delhi	Delhi	Jawaharlal Nehru Stadium, Delhi - DPCC
Delhi	Delhi	Lodhi Road, Delhi - IITM
Delhi	Delhi	Lodhi Road, Delhi - IMD
Delhi	Delhi	Major Dhyan Chand National Stadium, Delhi - DPCC
Delhi	Delhi	Mandir Marg, Delhi - DPCC
Delhi	Delhi	Mundka, Delhi - DPCC
Delhi	Delhi	Najafgarh, Delhi - DPCC
Delhi	Delhi	Narela, Delhi - DPCC
Delhi	Delhi	Nehru Nagar, Delhi - DPCC
Delhi	Delhi	North Campus, DU, Delhi - IMD
Delhi	Delhi	NSIT Dwarka, Delhi - CPCB
Delhi	Delhi	Okhla Phase-2, Delhi - DPCC
Delhi	Delhi	Patparganj, Delhi - DPCC
Delhi	Delhi	Punjabi Bagh, Delhi - DPCC
Delhi	Delhi	Pusa, Delhi - DPCC
Delhi	Delhi	Pusa, Delhi - IMD
Delhi	Delhi	R K Puram, Delhi - DPCC
Delhi	Delhi	Rohini, Delhi - DPCC
Delhi	Delhi	Shadipur, Delhi - CPCB
Delhi	Delhi	Sirifort, Delhi - CPCB
Delhi	Delhi	Sonia Vihar, Delhi - DPCC
Delhi	Delhi	Sri Aurobindo Marg, Delhi - DPCC
Delhi	Delhi	Vivek Vihar, Delhi - DPCC
Delhi	Delhi	Wazirpur, Delhi - DPCC
Jammu and Kashmir	Srinagar	Rajbagh, Srinagar - JKSPCB
Puducherry	Puducherry	Jawahar Nagar, Puducherry - PPCC

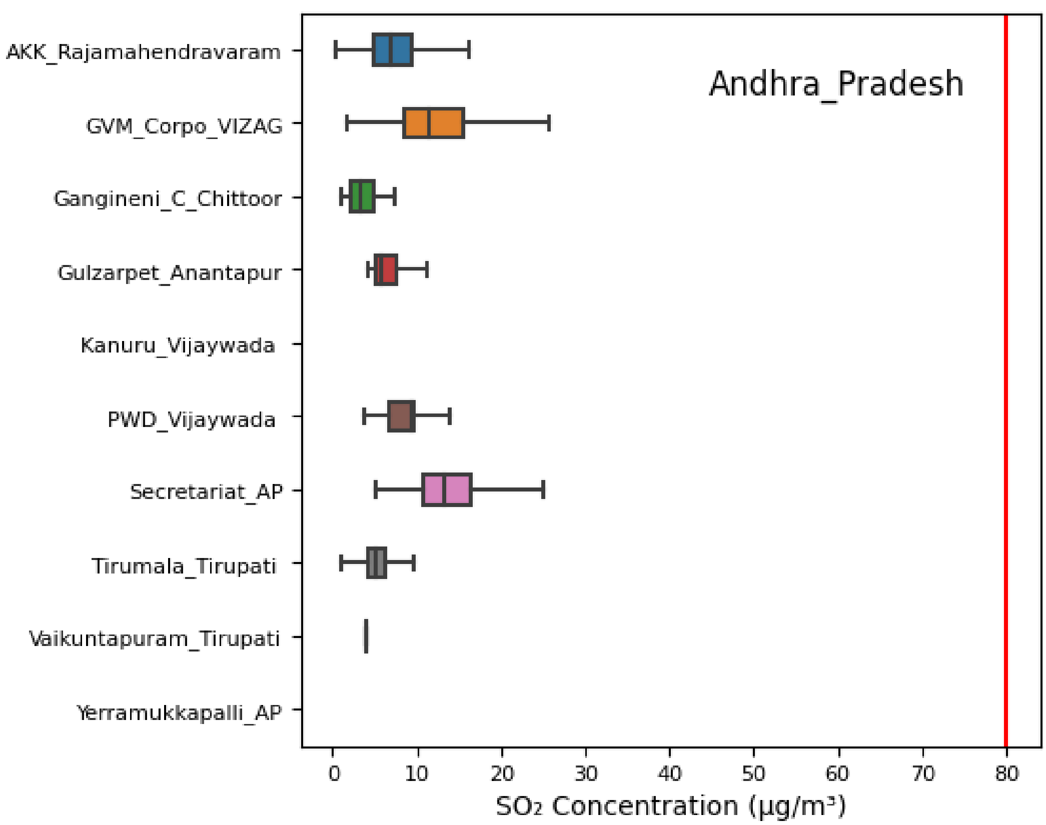
Annexure - B2

Andhra Pradesh

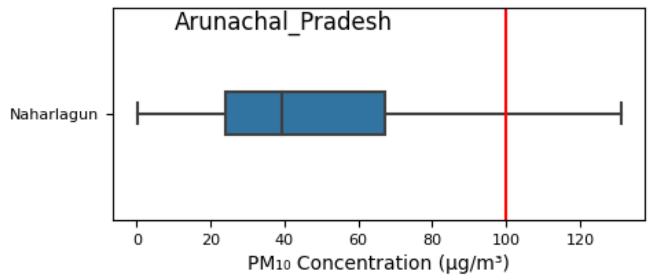


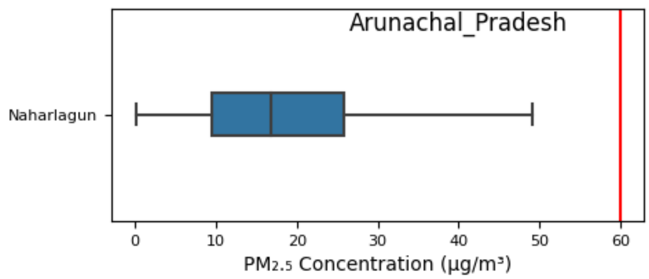


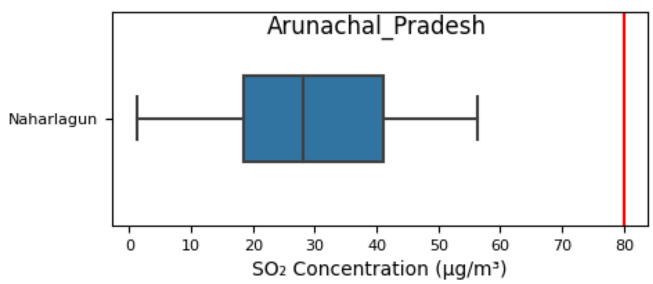

Andhra_Pradesh
AKK_Rajamahendravaram
GVM_Corpo_VIZAG
Gangineni_C_Chittoor
Gulzarpet_Anantapur
Kanuru_Vijaywada
PWD_Vijaywada
Secretariat_AP
Tirumala_Tirupati
Vaikuntapuram_Tirupati
Yerramukkapalli_AP
0
10
20
30
40
50
60
70
80
NO₂ Concentration (µg/m³)

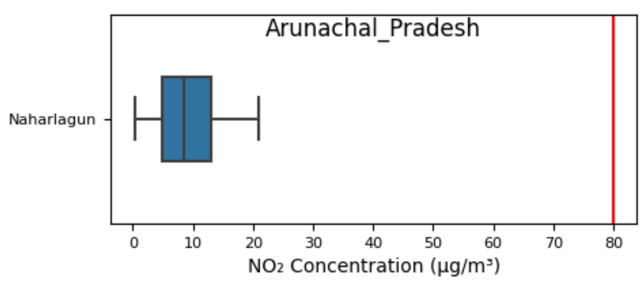

Andhra_Pradesh
AKK_Rajamahendravaram
GVM_Corpo_VIZAG
Gangineni_C_Chittoor
Gulzarpet_Anantapur
Kanuru_Vijaywada
PWD_Vijaywada
Secretariat_AP
Tirumala_Tirupati
Vaikuntapuram_Tirupati
Yerramukkapalli_AP
0
10
20
30
40
50
60
70
80
SO₂ Concentration (µg/m³)

Arunachal Pradesh

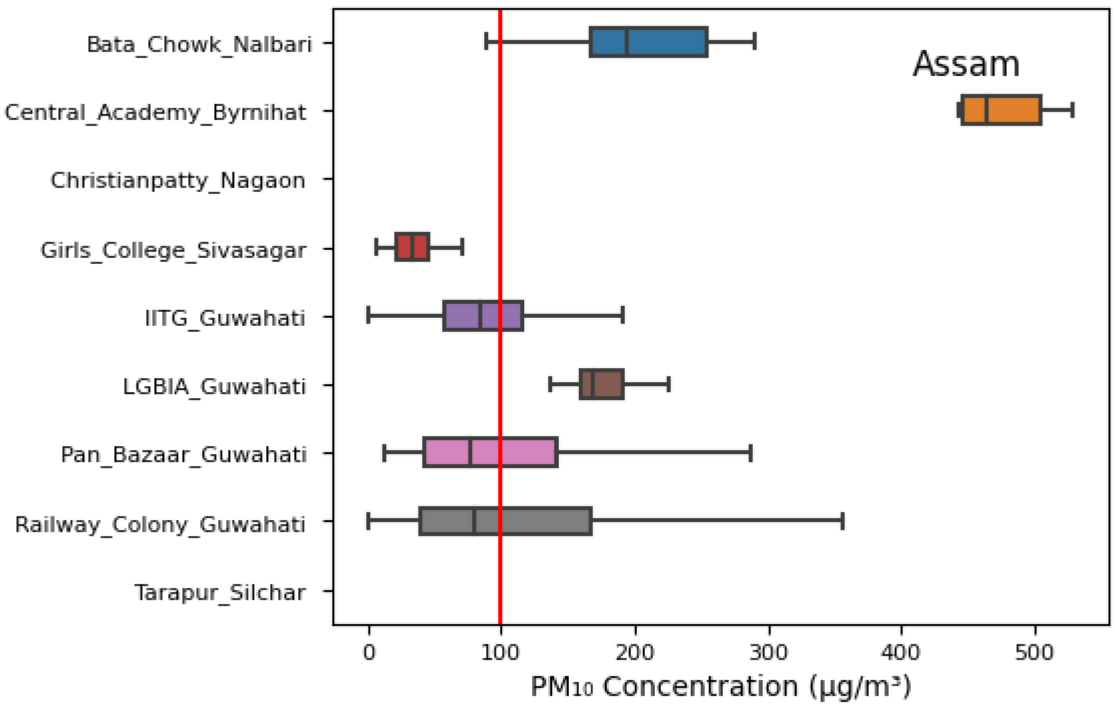


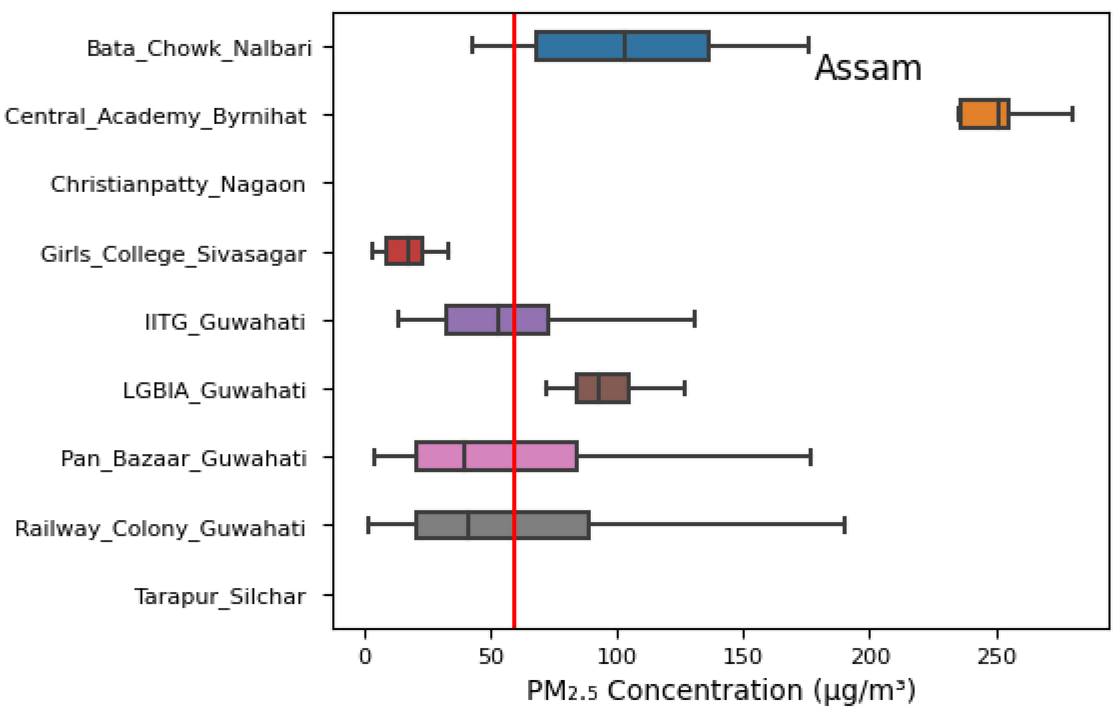


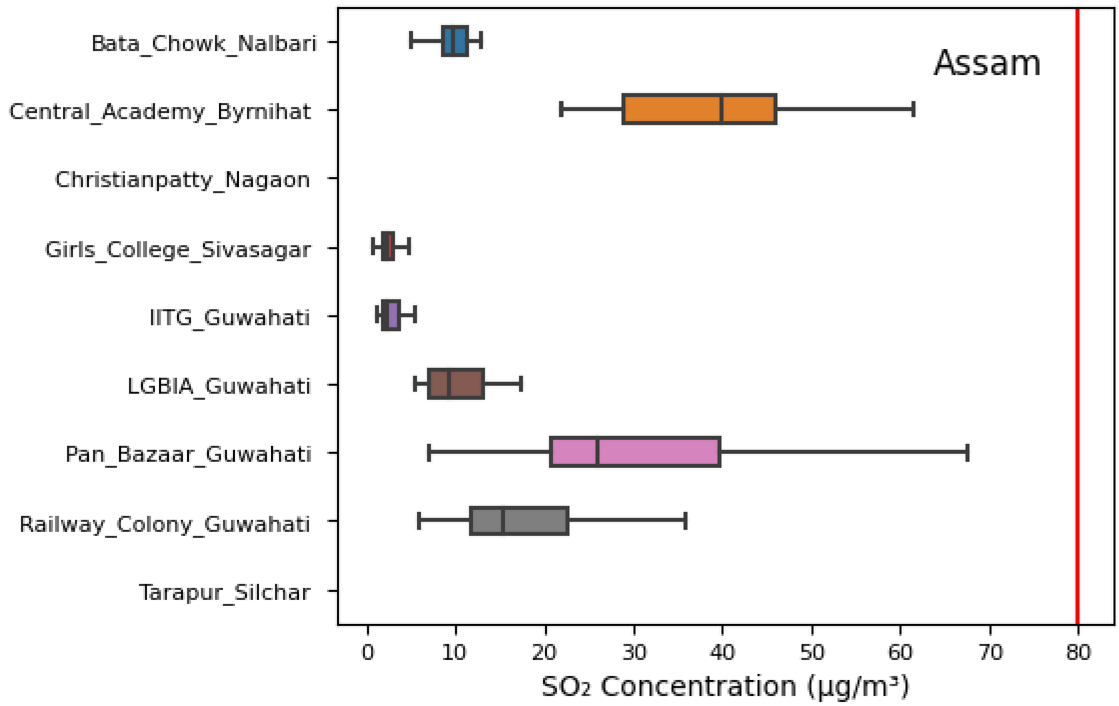


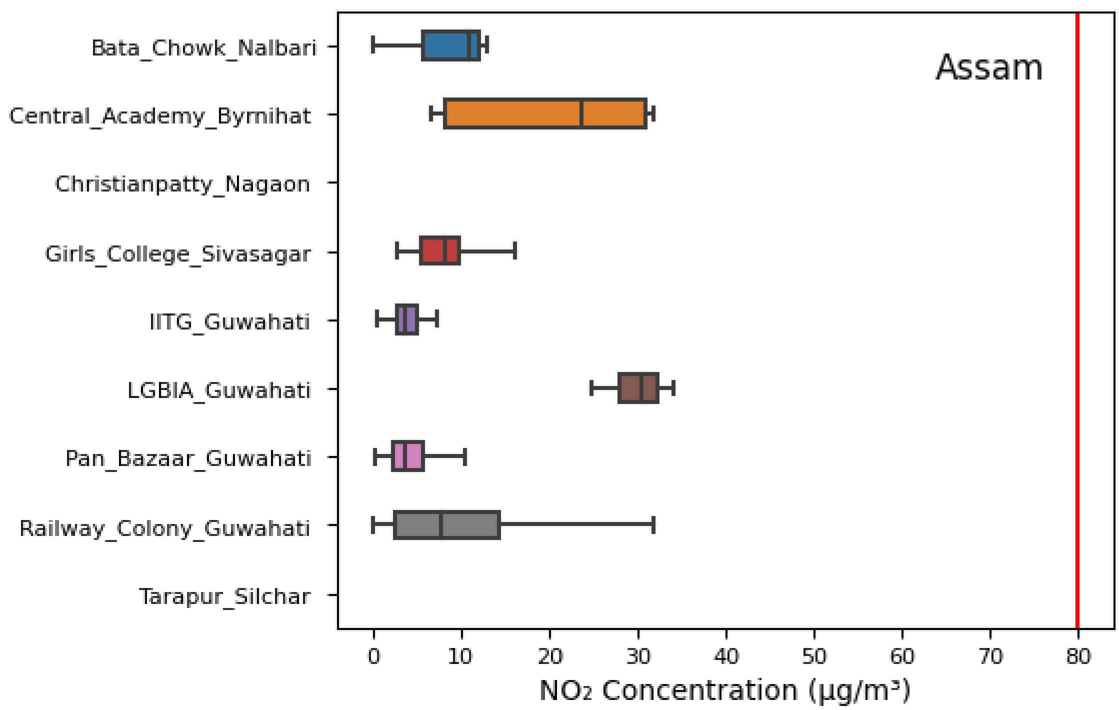


Assam

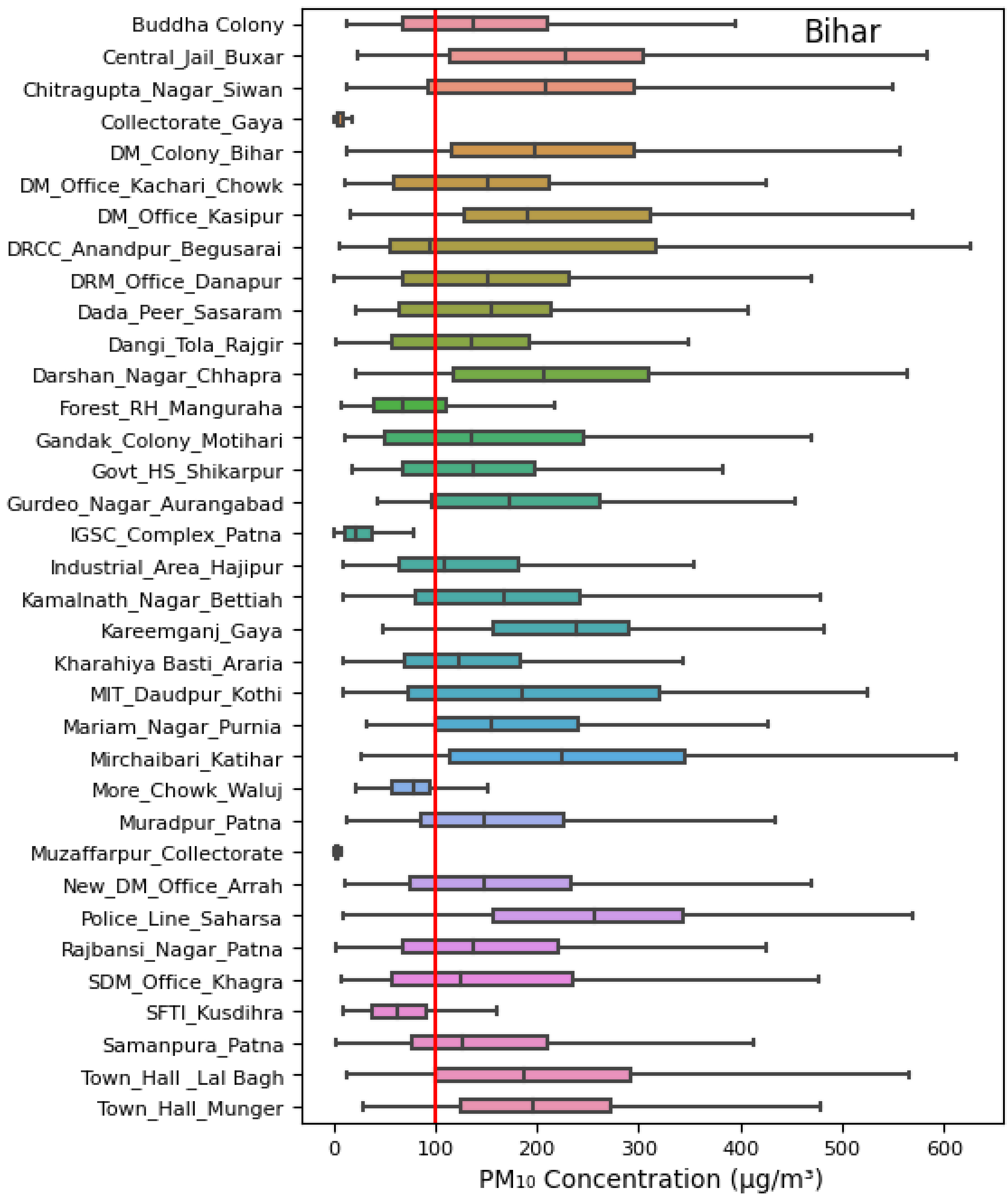

Assam
Bata_Chowk_Nalbari
Central_Academy_Byrnihat
Christianpatty_Nagaon
Girls_College_Sivasagar
IITG_Guwahati
LGBIA_Guwahati
Pan_Bazaar_Guwahati
Railway_Colony_Guwahati
Tarapur_Silchar
0
100
200
300
400
500
PM10 Concentration (µg/m³)

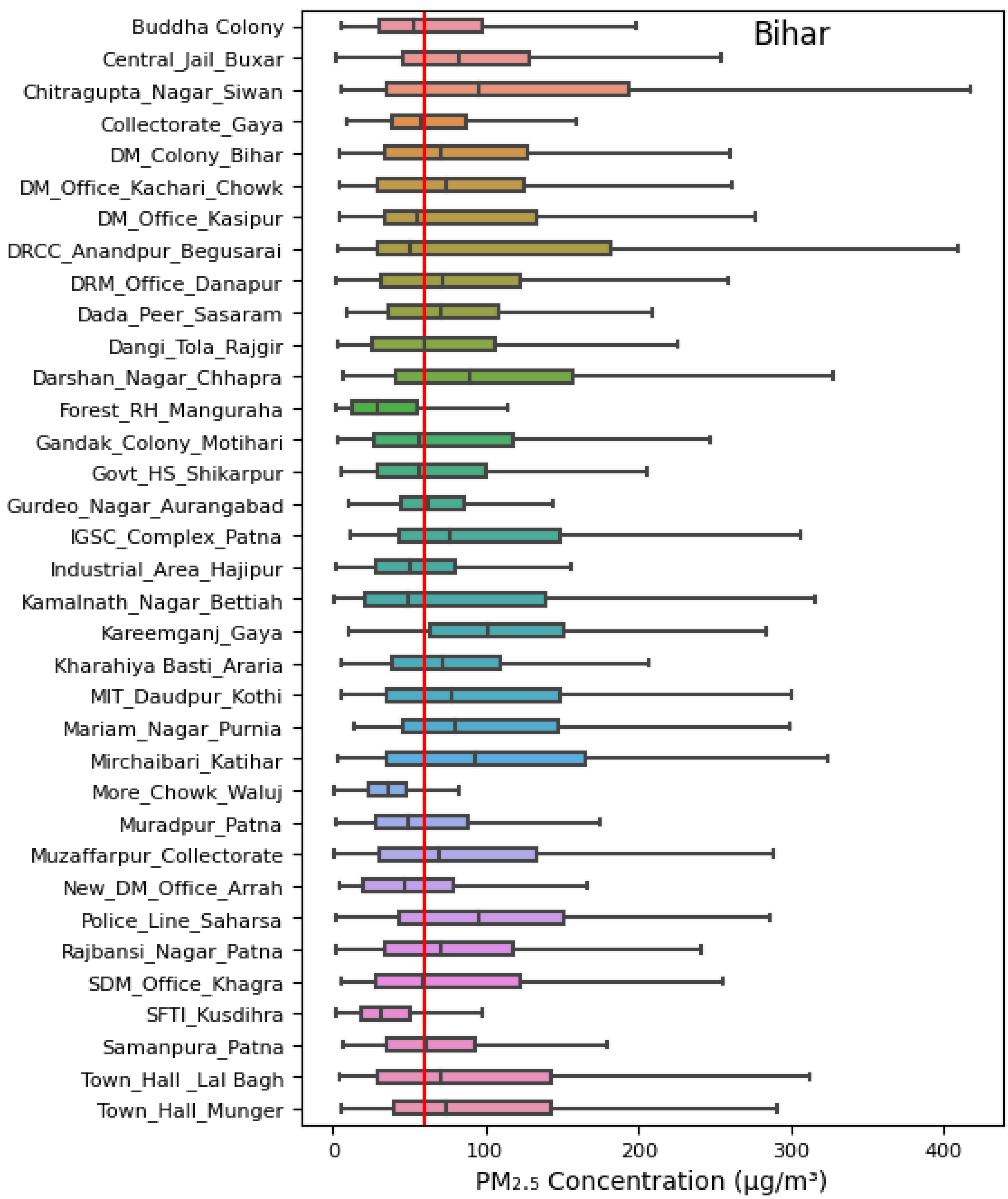

Assam
Bata_Chowk_Nalbari
Central_Academy_Byrnihat
Christianpatty_Nagaon
Girls_College_Sivasagar
IITG_Guwahati
LGBIA_Guwahati
Pan_Bazaar_Guwahati
Railway_Colony_Guwahati
Tarapur_Silchar
0
50
100
150
200
250
PM2.5 Concentration (µg/m³)

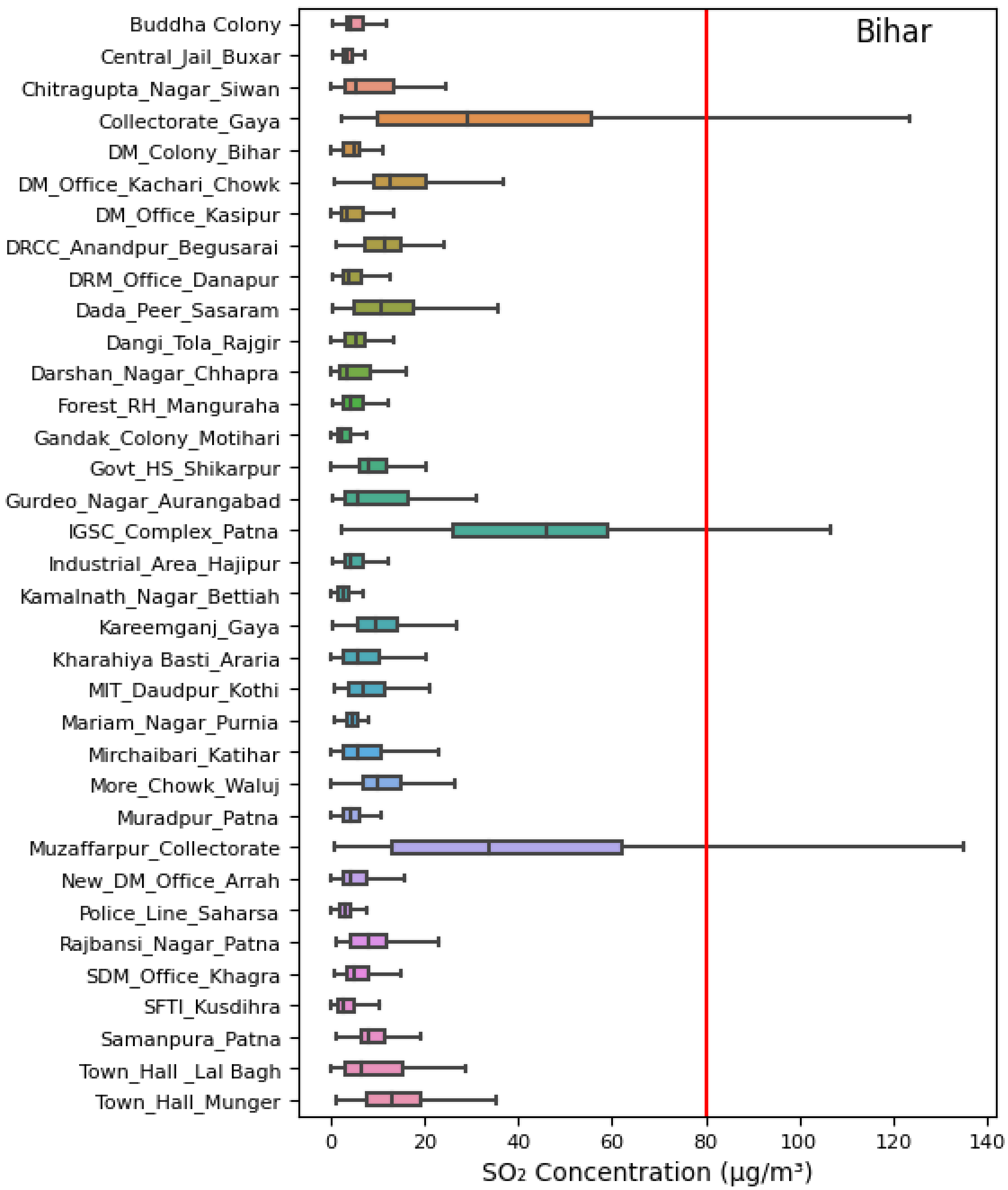

Assam
Bata_Chowk_Nalbari
Central_Academy_Byrnihat
Christianpatty_Nagaon
Girls_College_Sivasagar
IITG_Guwahati
LGBIA_Guwahati
Pan_Bazaar_Guwahati
Railway_Colony_Guwahati
Tarapur_Silchar
0 10 20 30 40 50 60 70 80
SO₂ Concentration (µg/m³)

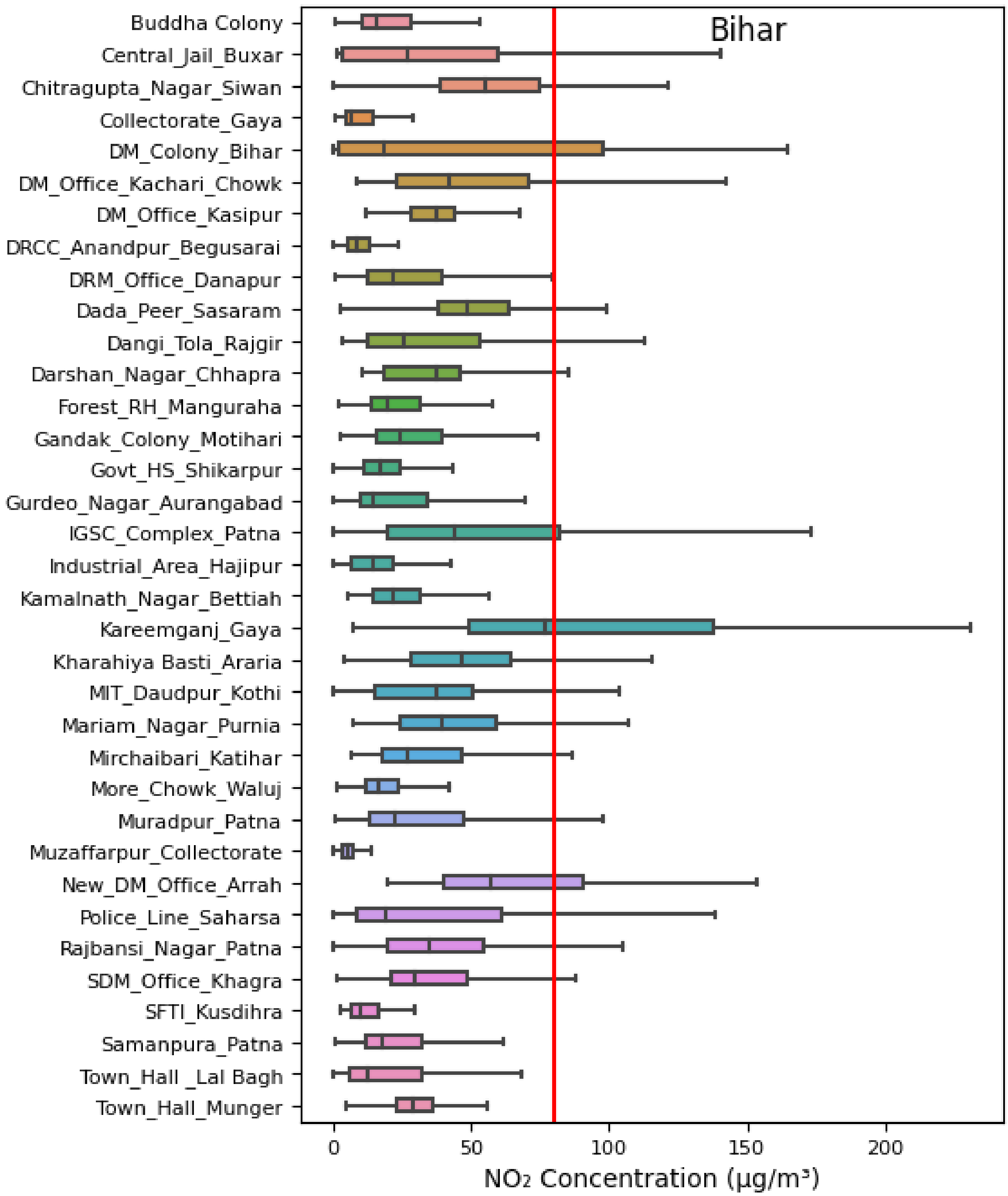

Assam
Bata_Chowk_Nalbari
Central_Academy_Byrnihat
Christianpatty_Nagaon
Girls_College_Sivasagar
IITG_Guwahati
LGBIA_Guwahati
Pan_Bazaar_Guwahati
Railway_Colony_Guwahati
Tarapur_Silchar
0 10 20 30 40 50 60 70 80
NO₂ Concentration (µg/m³)

Bihar

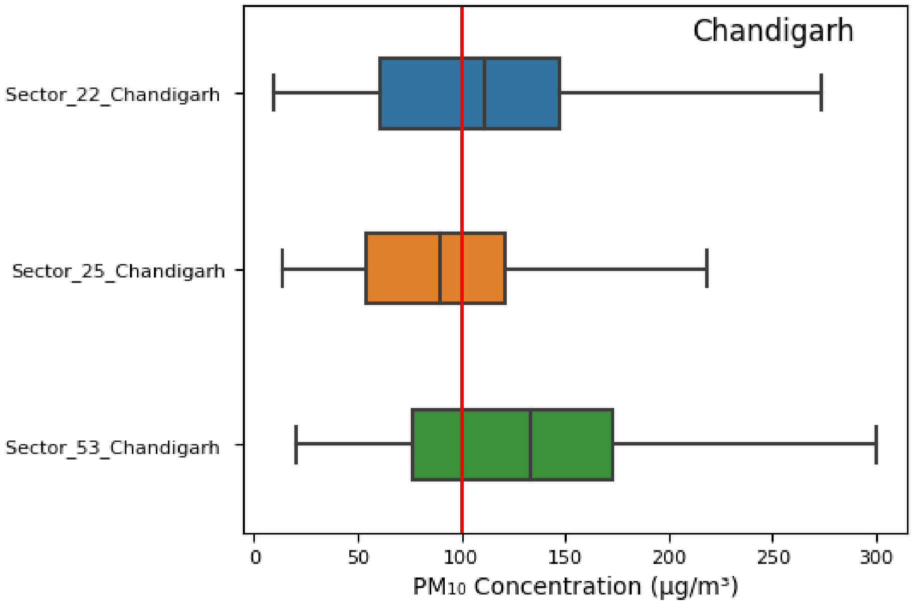

Bihar
Buddha Colony
Central_Jail_Buxar
Chitragupta_Nagar_Siwan
Collectorate_Gaya
DM_Colony_Bihar
DM_Office_Kachari_Chowk
DM_Office_Kasipur
DRCC_Anandpur_Begusarai
DRM_Office_Danapur
Dada_Peer_Sasaram
Dangi_Tola_Rajgir
Darshan_Nagar_Chhapra
Forest_RH_Manguraha
Gandak_Colony_Motihari
Govt_HS_Shikarpur
Gurdeo_Nagar_Aurangabad
IGSC_Complex_Patna
Industrial_Area_Hajipur
Kamalnath_Nagar_Bettiah
Kareemganj_Gaya
Kharahiya Basti_Araria
MIT_Daudpur_Kothi
Mariam_Nagar_Purnia
Mirchaibari_Katihar
More_Chowk_Waluj
Muradpur_Patna
Muzaffarpur_Collectorate
New_DM_Office_Arrah
Police_Line_Saharsa
Rajbansi_Nagar_Patna
SDM_Office_Khagra
SFTI_Kusdihra
Samanpura_Patna
Town_Hall _Lal Bagh
Town_Hall_Munger
0
100
200
300
400
500
600
PM10 Concentration (µg/m³)

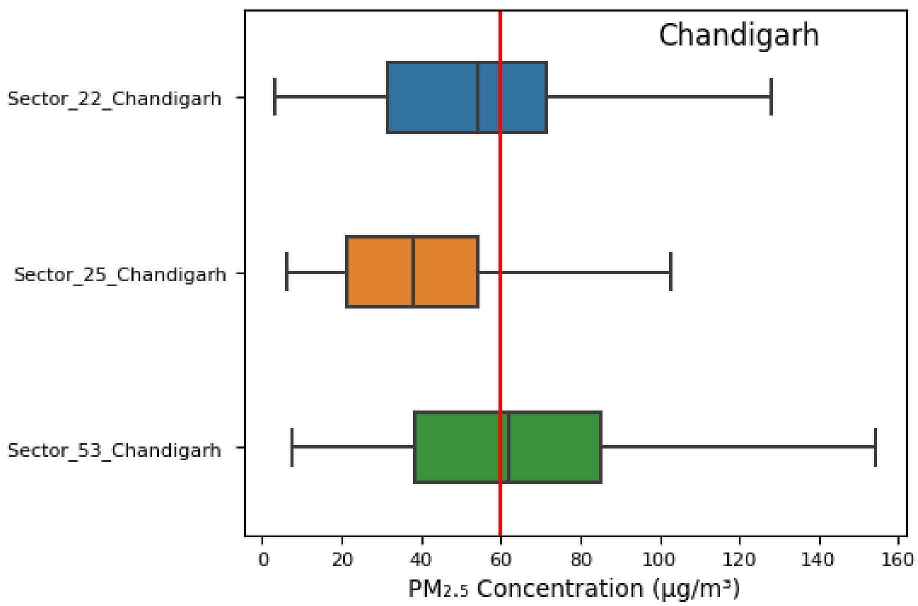

Bihar
Buddha Colony
Central_Jail_Buxar
Chitragupta_Nagar_Siwan
Collectorate_Gaya
DM_Colony_Bihar
DM_Office_Kachari_Chowk
DM_Office_Kasipur
DRCC_Anandpur_Begusarai
DRM_Office_Danapur
Dada_Peer_Sasaram
Dangi_Tola_Rajgir
Darshan_Nagar_Chhapra
Forest_RH_Manguraha
Gandak_Colony_Motihari
Govt_HS_Shikarpur
Gurdeo_Nagar_Aurangabad
IGSC_Complex_Patna
Industrial_Area_Hajipur
Kamalnath_Nagar_Bettiah
Kareemganj_Gaya
Kharahiya Basti_Araria
MIT_Daudpur_Kothi
Mariam_Nagar_Purnia
Mirchaibari_Katihar
More_Chowk_Waluj
Muradpur_Patna
Muzaffarpur_Collectorate
New_DM_Office_Arrah
Police_Line_Saharsa
Rajbansi_Nagar_Patna
SDM_Office_Khagra
SFTI_Kusdihra
Samanpura_Patna
Town_Hall _Lal Bagh
Town_Hall_Munger
0
100
200
300
400
PM2.5 Concentration (µg/m³)

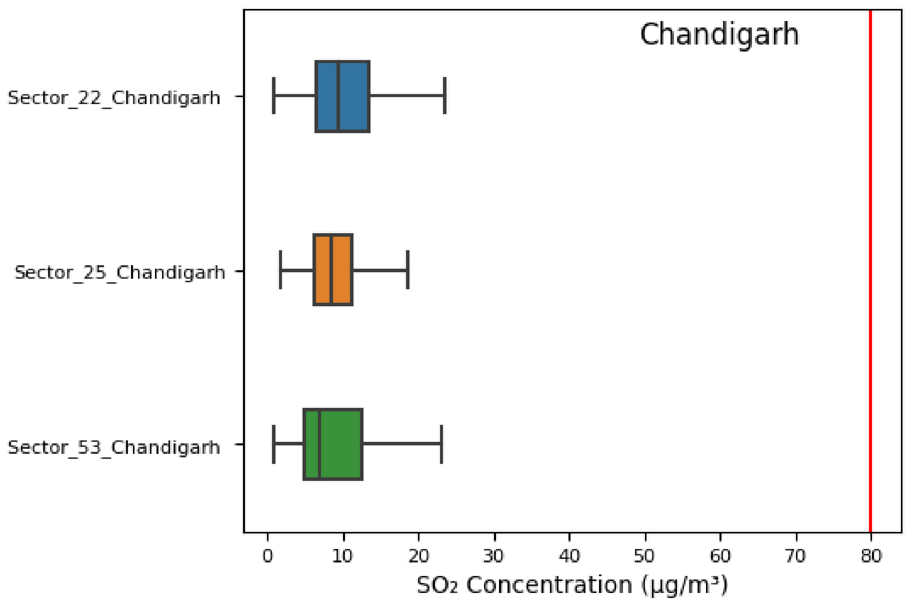

Bihar
Buddha Colony
Central_Jail_Buxar
Chitragupta_Nagar_Siwan
Collectorate_Gaya
DM_Colony_Bihar
DM_Office_Kachari_Chowk
DM_Office_Kasipur
DRCC_Anandpur_Begusarai
DRM_Office_Danapur
Dada_Peer_Sasaram
Dangi_Tola_Rajgir
Darshan_Nagar_Chhapra
Forest_RH_Manguraha
Gandak_Colony_Motihari
Govt_HS_Shikarpur
Gurdeo_Nagar_Aurangabad
IGSC_Complex_Patna
Industrial_Area_Hajipur
Kamalnath_Nagar_Bettiah
Kareemganj_Gaya
Kharahiya Basti_Araria
MIT_Daudpur_Kothi
Mariam_Nagar_Purnia
Mirchaibari_Katihar
More_Chowk_Waluj
Muradpur_Patna
Muzaffarpur_Collectorate
New_DM_Office_Arrah
Police_Line_Saharsa
Rajbansi_Nagar_Patna
SDM_Office_Khagra
SFTI_Kusdihra
Samanpura_Patna
Town_Hall _Lal Bagh
Town_Hall_Munger
0
20
40
60
80
100
120
140
SO₂ Concentration (µg/m³)

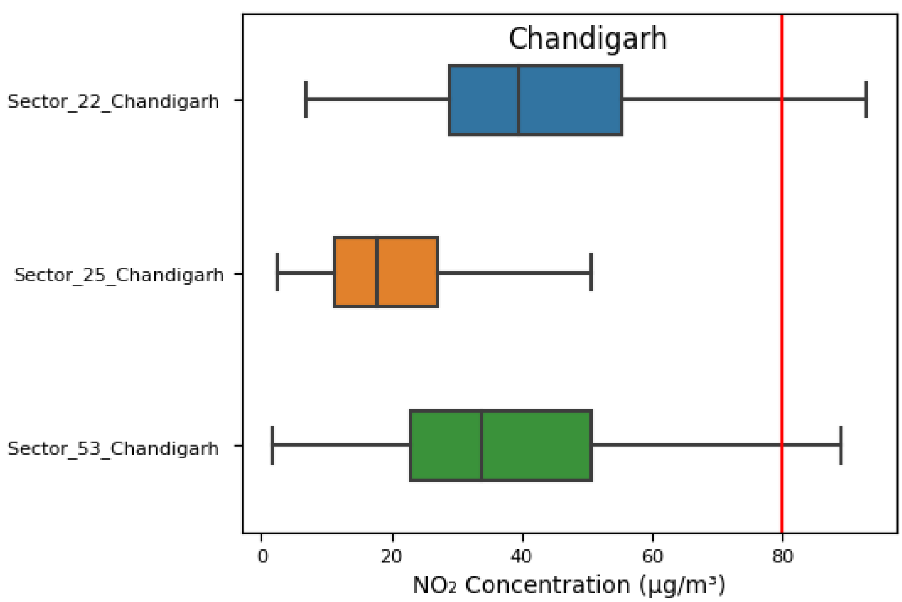

Bihar
Buddha Colony
Central_Jail_Buxar
Chitragupta_Nagar_Siwan
Collectorate_Gaya
DM_Colony_Bihar
DM_Office_Kachari_Chowk
DM_Office_Kasipur
DRCC_Anandpur_Begusarai
DRM_Office_Danapur
Dada_Peer_Sasaram
Dangi_Tola_Rajgir
Darshan_Nagar_Chhapra
Forest_RH_Manguraha
Gandak_Colony_Motihari
Govt_HS_Shikarpur
Gurdeo_Nagar_Aurangabad
IGSC_Complex_Patna
Industrial_Area_Hajipur
Kamalnath_Nagar_Bettiah
Kareemganj_Gaya
Kharahiya Basti_Araria
MIT_Daudpur_Kothi
Mariam_Nagar_Purnia
Mirchaibari_Katihar
More_Chowk_Waluj
Muradpur_Patna
Muzaffarpur_Collectorate
New_DM_Office_Arrah
Police_Line_Saharsa
Rajbansi_Nagar_Patna
SDM_Office_Khagra
SFTI_Kusdihra
Samanpura_Patna
Town_Hall _Lal Bagh
Town_Hall_Munger
0
50
100
150
200
NO₂ Concentration (µg/m³)

Chandigarh

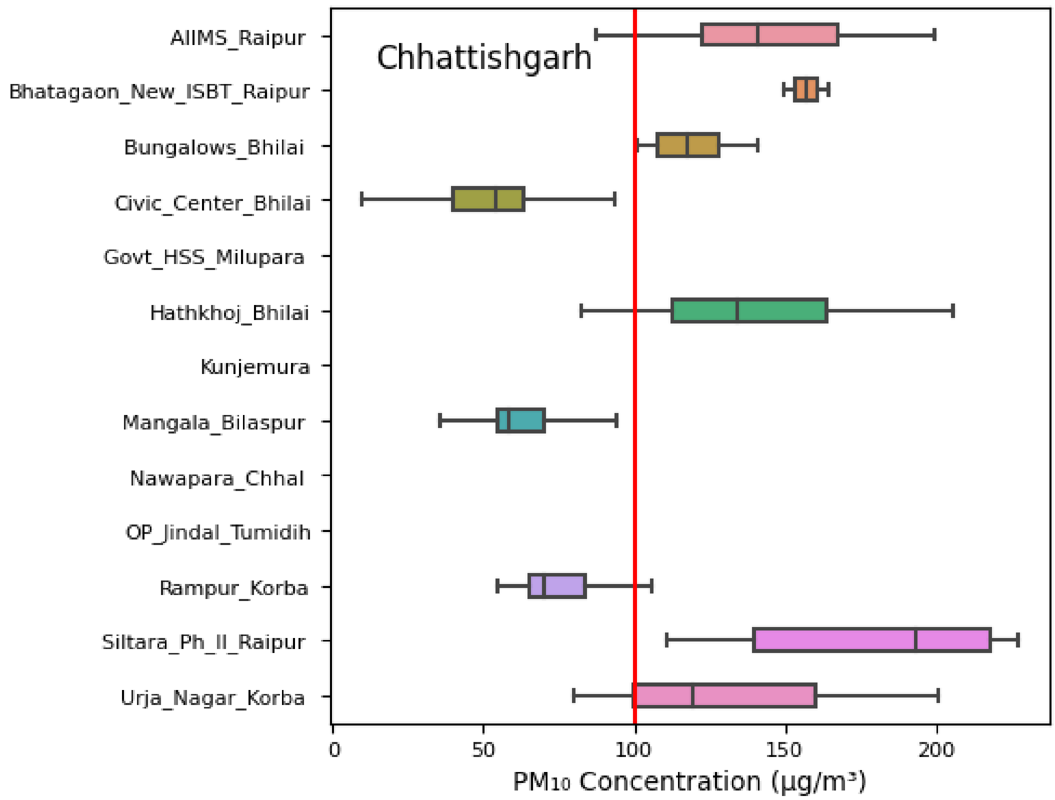

Chandigarh
Sector_22_Chandigarh
Sector_25_Chandigarh
Sector_53_Chandigarh
0
50
100
150
200
250
300
PM10 Concentration (µg/m³)

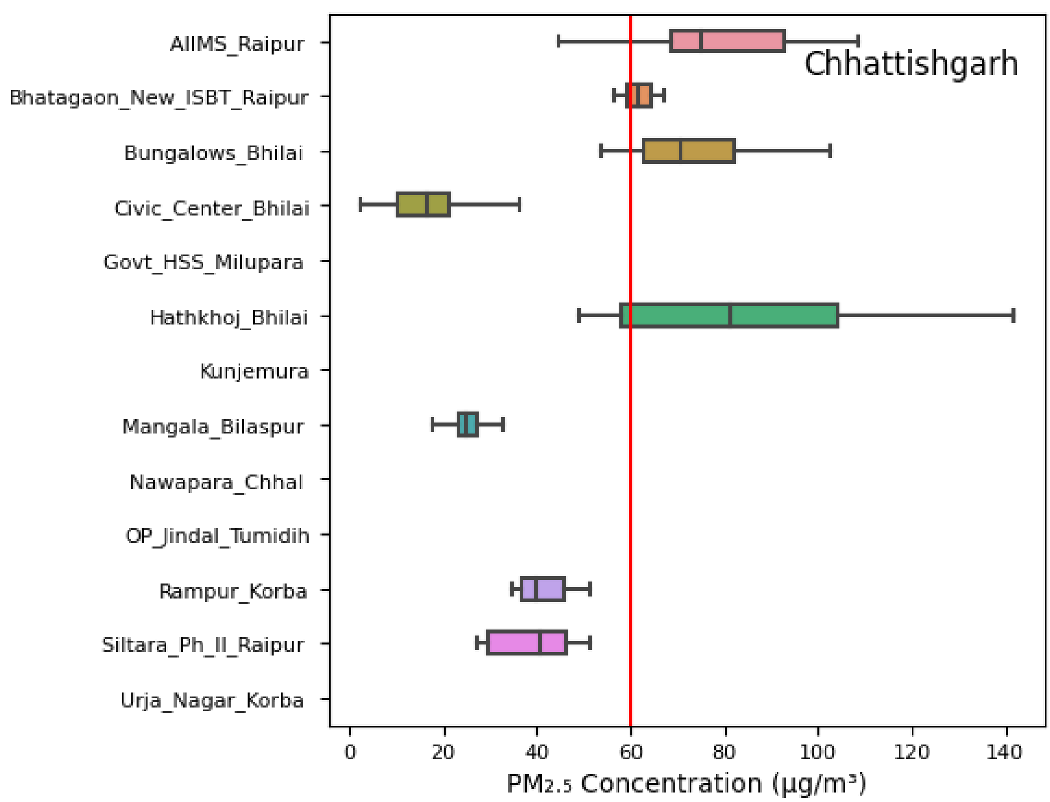

Chandigarh
Sector_22_Chandigarh
Sector_25_Chandigarh
Sector_53_Chandigarh
0
20
40
60
80
100
120
140
160
PM2.5 Concentration (µg/m³)

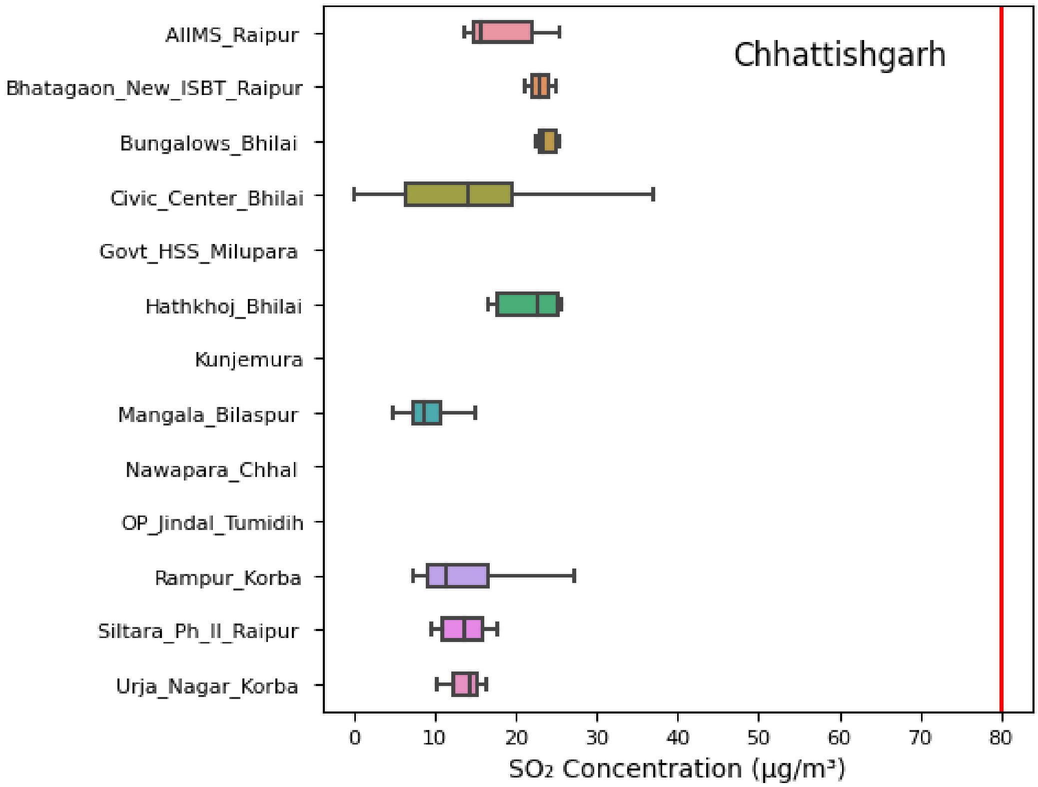

Chandigarh
Sector_22_Chandigarh
Sector_25_Chandigarh
Sector_53_Chandigarh
0
10
20
30
40
50
60
70
80
SO₂ Concentration (µg/m³)

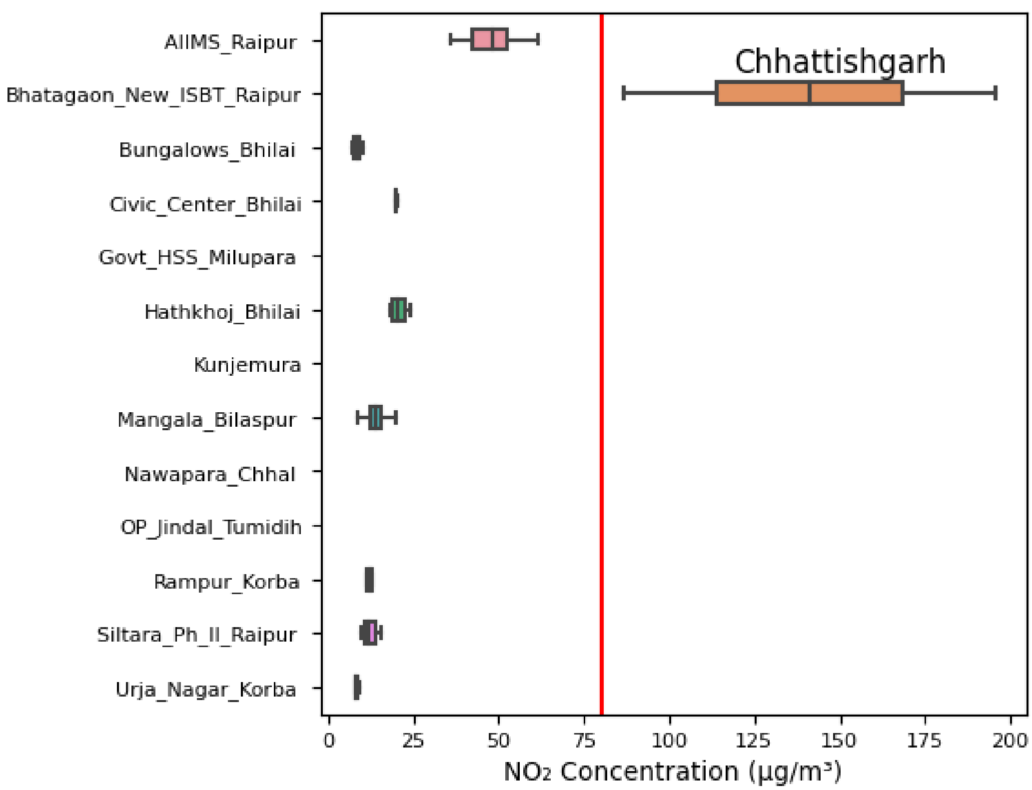

Chandigarh
Sector_22_Chandigarh
Sector_25_Chandigarh
Sector_53_Chandigarh
0
20
40
60
80
NO₂ Concentration (µg/m³)

Chhattisgarh

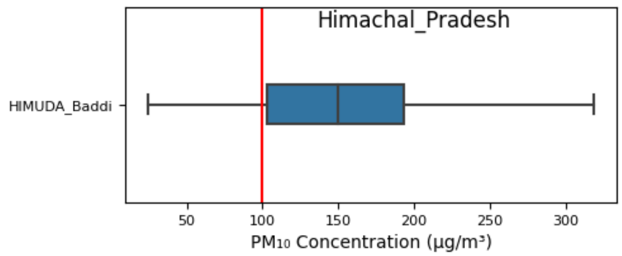


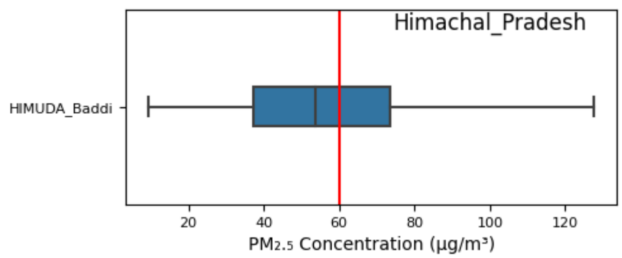


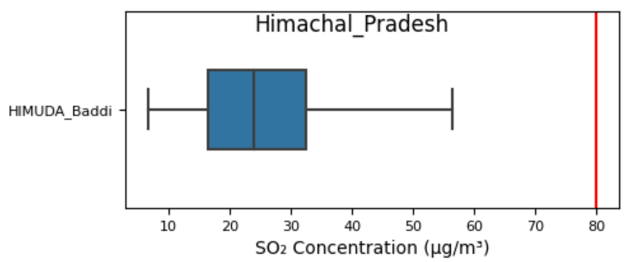

Chhattishgarh
AIIMS_Raipur
Bhatagaon_New_ISBT_Raipur
Bungalows_Bhilai
Civic_Center_Bhilai
Govt_HSS_Milupara
Hathkhoj_Bhilai
Kunjemura
Mangala_Bilaspur
Nawapara_Chhal
OP_Jindal_Tumidih
Rampur_Korba
Siltara_Ph_II_Raipur
Urja_Nagar_Korba
0 10 20 30 40 50 60 70 80
SO2 Concentration (µg/m³)

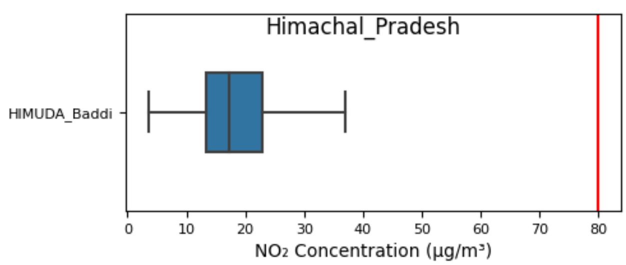

Chhattishgarh
AIIMS_Raipur
Bhatagaon_New_ISBT_Raipur
Bungalows_Bhilai
Civic_Center_Bhilai
Govt_HSS_Milupara
Hathkhoj_Bhilai
Kunjemura
Mangala_Bilaspur
Nawapara_Chhal
OP_Jindal_Tumidih
Rampur_Korba
Siltara_Ph_II_Raipur
Urja_Nagar_Korba
0 25 50 75 100 125 150 175 200
NO2 Concentration (µg/m³)

Himachal Pradesh

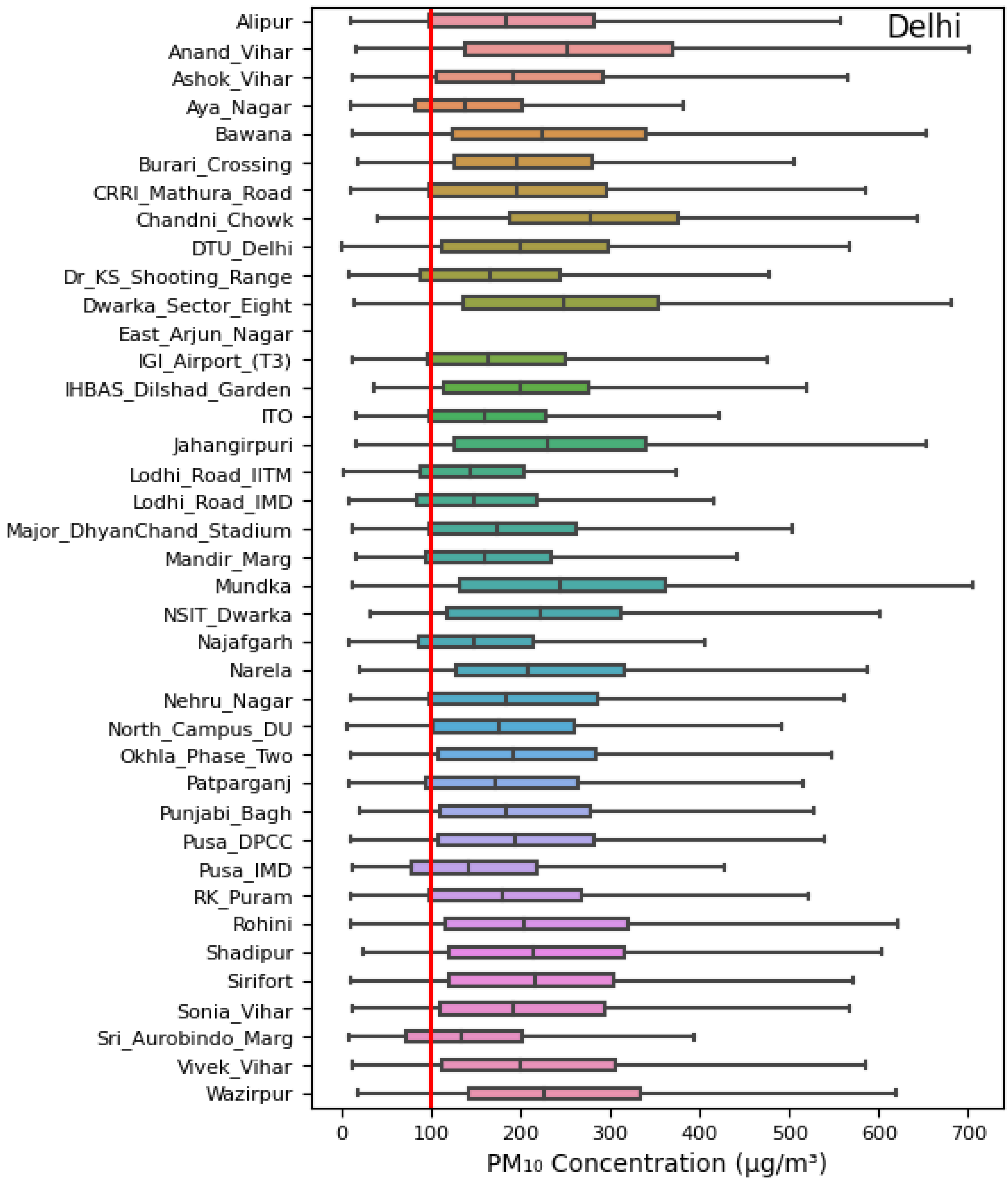


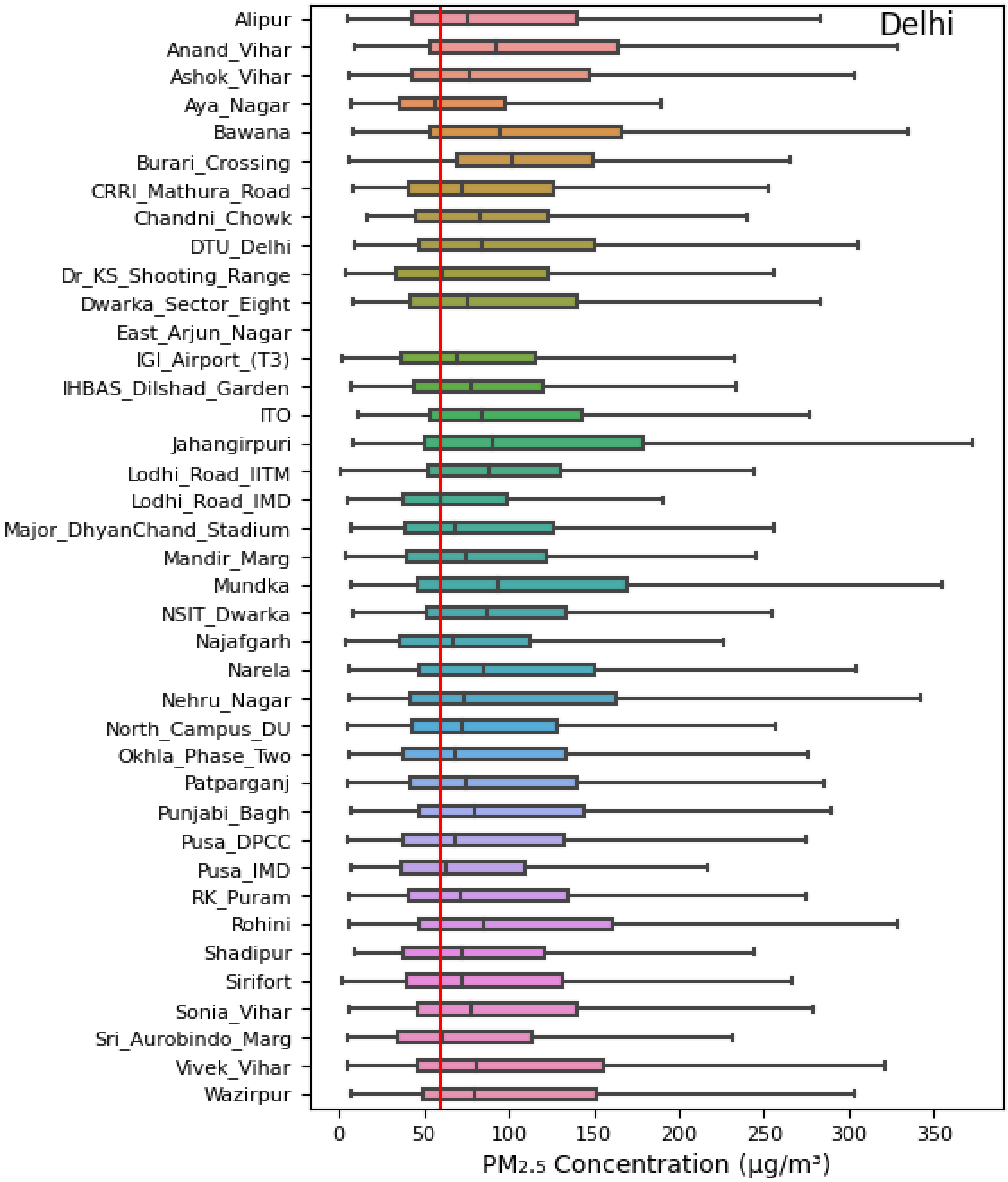


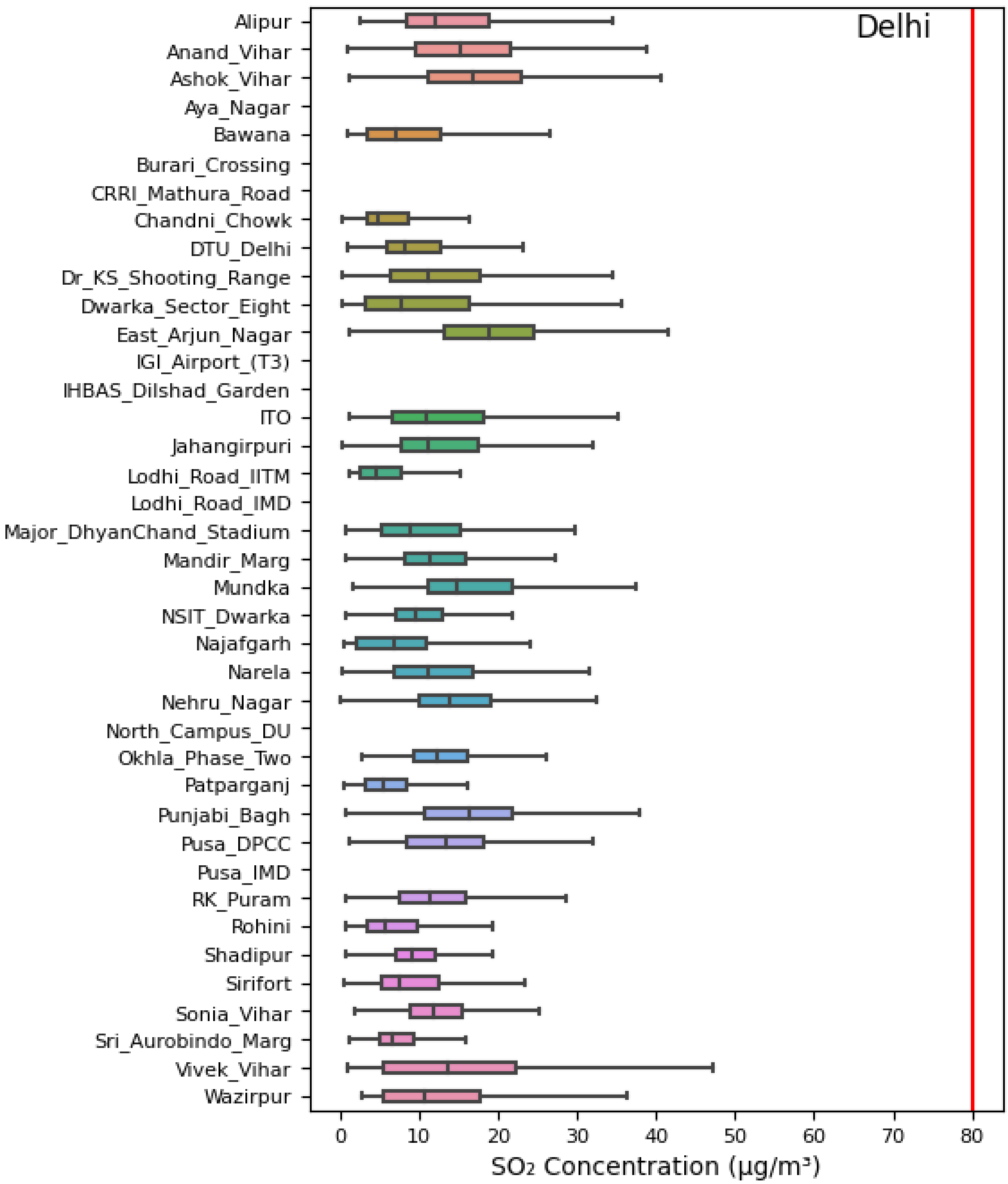


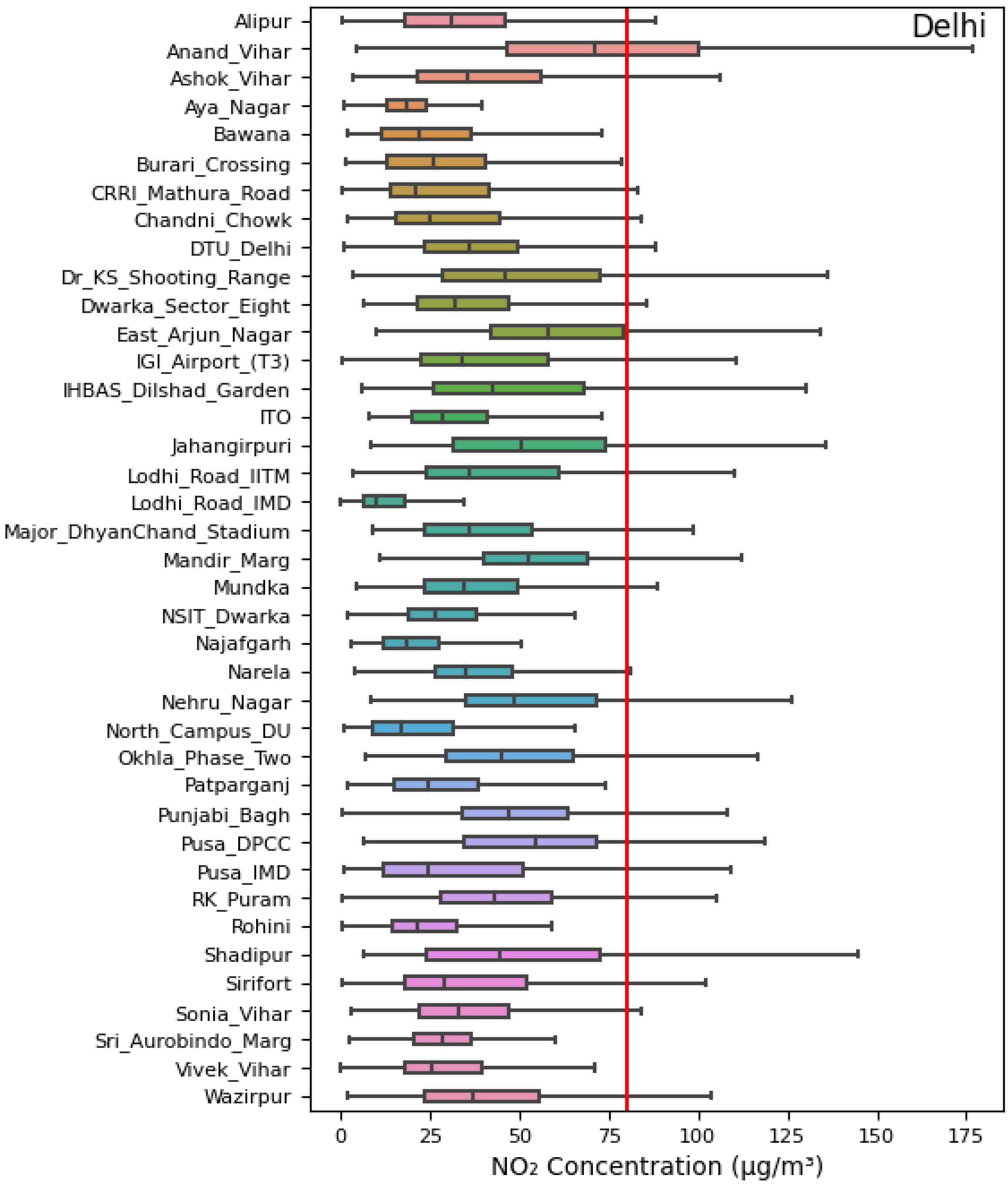


Delhi

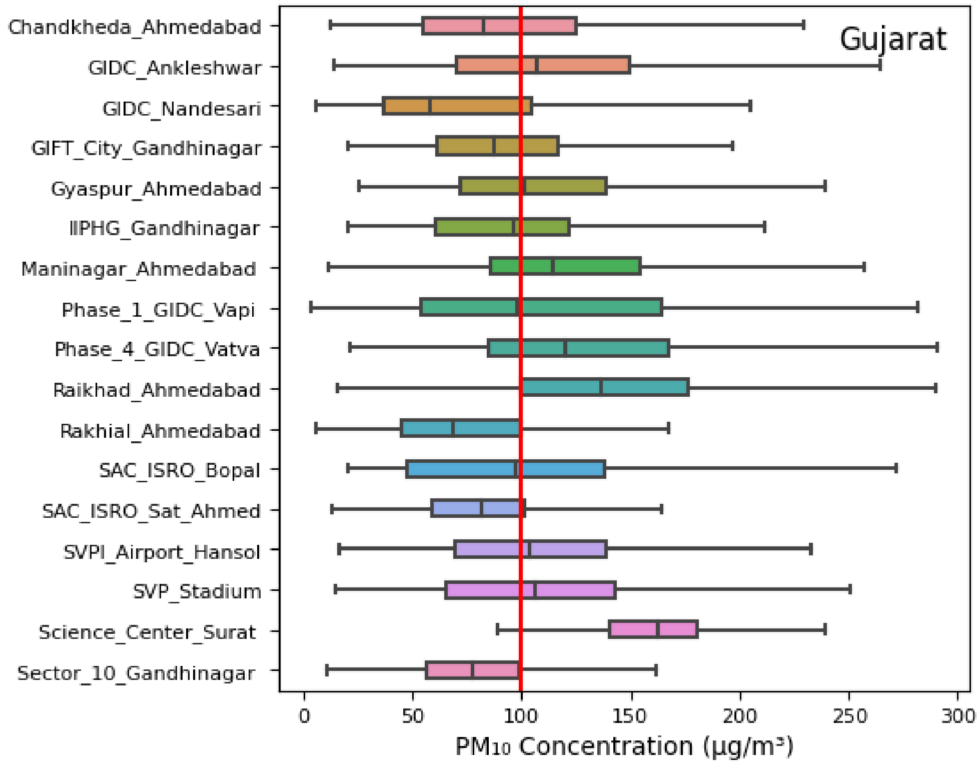

Delhi
Alipur
Anand_Vihar
Ashok_Vihar
Aya_Nagar
Bawana
Burari_Crossing
CRRI_Mathura_Road
Chandni_Chowk
DTU_Delhi
Dr_KS_Shooting_Range
Dwarka_Sector_Eight
East_Arjun_Nagar
IGI_Airport_(T3)
IHBAS_Dilshad_Garden
ITO
Jahangirpuri
Lodhi_Road_IITM
Lodhi_Road_IMD
Major_DhyanChand_Stadium
Mandir_Marg
Mundka
NSIT_Dwarka
Najafgarh
Narela
Nehru_Nagar
North_Campus_DU
Okhla_Phase_Two
Patparganj
Punjabi_Bagh
Pusa_DPCC
Pusa_IMD
RK_Puram
Rohini
Shadipur
Sirifort
Sonia_Vihar
Sri_Aurobindo_Marg
Vivek_Vihar
Wazirpur
0
100
200
300
400
500
600
700
PM_{10} Concentration (µg/m³)

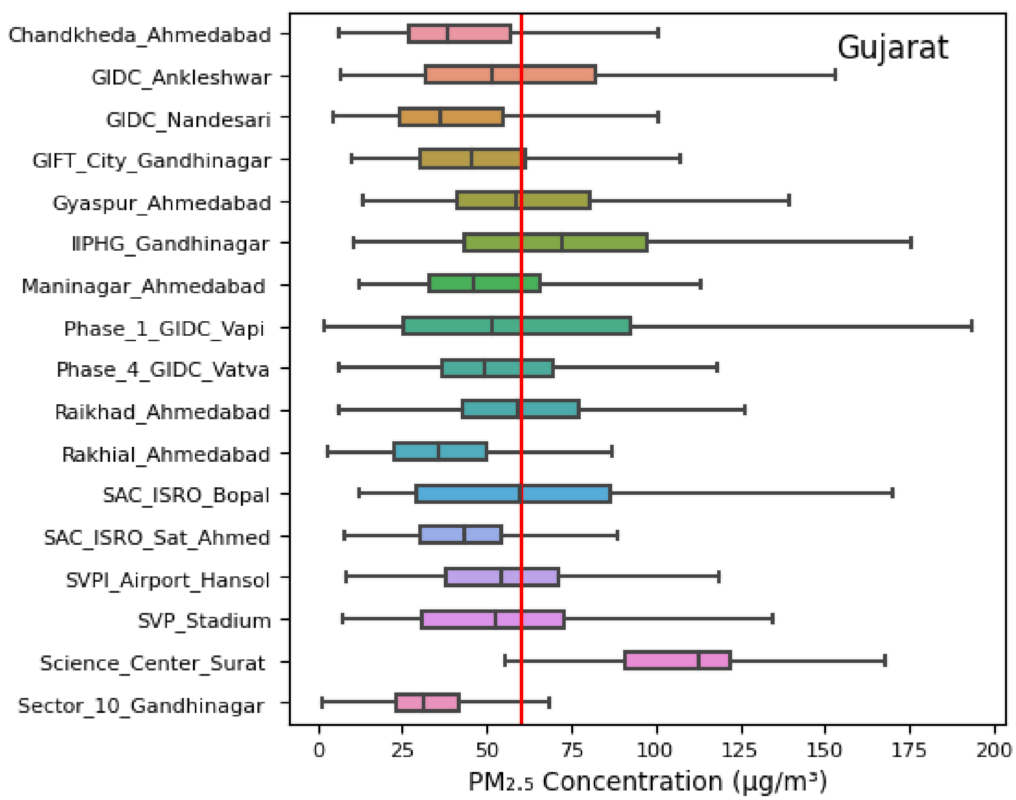

Delhi
Alipur
Anand_Vihar
Ashok_Vihar
Aya_Nagar
Bawana
Burari_Crossing
CRRI_Mathura_Road
Chandni_Chowk
DTU_Delhi
Dr_KS_Shooting_Range
Dwarka_Sector_Eight
East_Arjun_Nagar
IGI_Airport_(T3)
IHBAS_Dilshad_Garden
ITO
Jahangirpuri
Lodhi_Road_IITM
Lodhi_Road_IMD
Major_DhyanChand_Stadium
Mandir_Marg
Mundka
NSIT_Dwarka
Najafgarh
Narela
Nehru_Nagar
North_Campus_DU
Okhla_Phase_Two
Patparganj
Punjabi_Bagh
Pusa_DPCC
Pusa_IMD
RK_Puram
Rohini
Shadipur
Sirifort
Sonia_Vihar
Sri_Aurobindo_Marg
Vivek_Vihar
Wazirpur
0
50
100
150
200
250
300
350
PM2.5 Concentration (μg/m³)

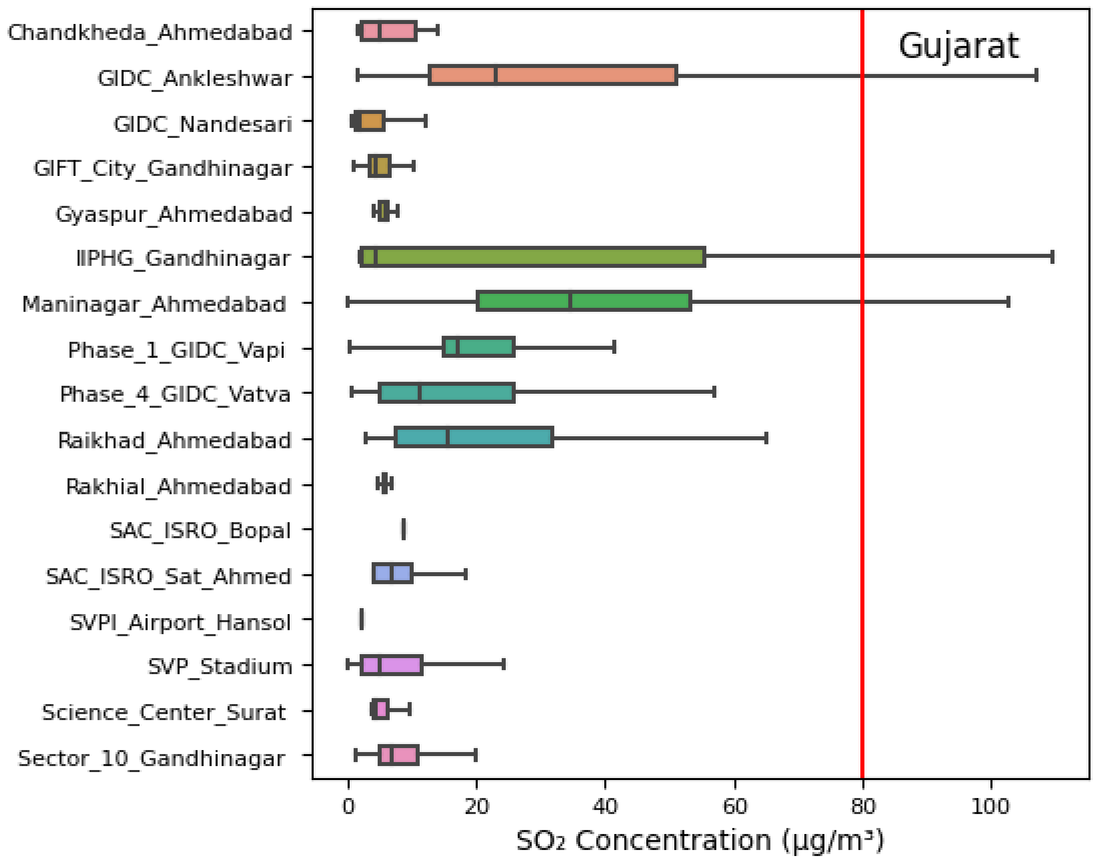

Delhi
Alipur
Anand_Vihar
Ashok_Vihar
Aya_Nagar
Bawana
Burari_Crossing
CRRI_Mathura_Road
Chandni_Chowk
DTU_Delhi
Dr_KS_Shooting_Range
Dwarka_Sector_Eight
East_Arjun_Nagar
IGI_Airport_(T3)
IHBAS_Dilshad_Garden
ITO
Jahangirpuri
Lodhi_Road_IITM
Lodhi_Road_IMD
Major_DhyanChand_Stadium
Mandir_Marg
Mundka
NSIT_Dwarka
Najafgarh
Narela
Nehru_Nagar
North_Campus_DU
Okhla_Phase_Two
Patparganj
Punjabi_Bagh
Pusa_DPCC
Pusa_IMD
RK_Puram
Rohini
Shadipur
Sirifort
Sonia_Vihar
Sri_Aurobindo_Marg
Vivek_Vihar
Wazirpur
0
10
20
30
40
50
60
70
80
SO₂ Concentration (µg/m³)

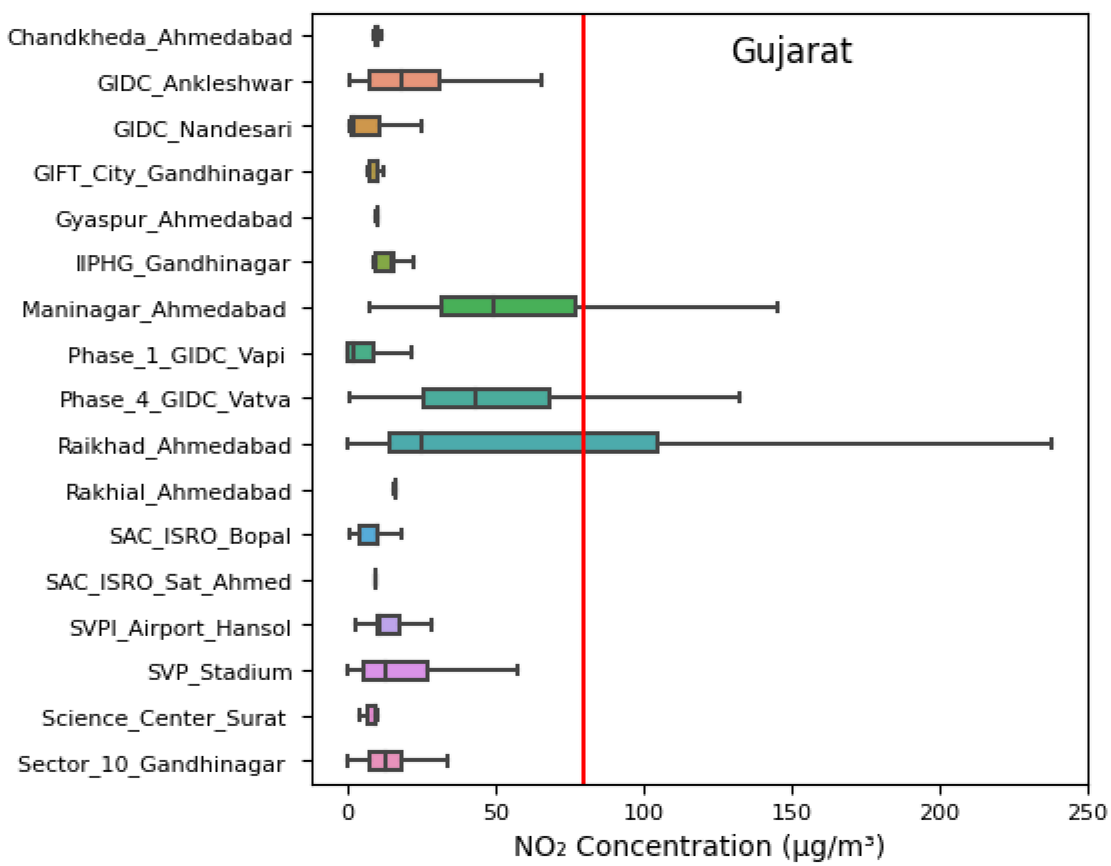

Delhi
Alipur
Anand_Vihar
Ashok_Vihar
Aya_Nagar
Bawana
Burari_Crossing
CRRI_Mathura_Road
Chandni_Chowk
DTU_Delhi
Dr_KS_Shooting_Range
Dwarka_Sector_Eight
East_Arjun_Nagar
IGI_Airport_(T3)
IHBAS_Dilshad_Garden
ITO
Jahangirpuri
Lodhi_Road_IITM
Lodhi_Road_IMD
Major_DhyanChand_Stadium
Mandir_Marg
Mundka
NSIT_Dwarka
Najafgarh
Narela
Nehru_Nagar
North_Campus_DU
Okhla_Phase_Two
Patparganj
Punjabi_Bagh
Pusa_DPCC
Pusa_IMD
RK_Puram
Rohini
Shadipur
Sirifort
Sonia_Vihar
Sri_Aurobindo_Marg
Vivek_Vihar
Wazirpur
0
25
50
75
100
125
150
175
NO2 Concentration (µg/m³)

Gujarat

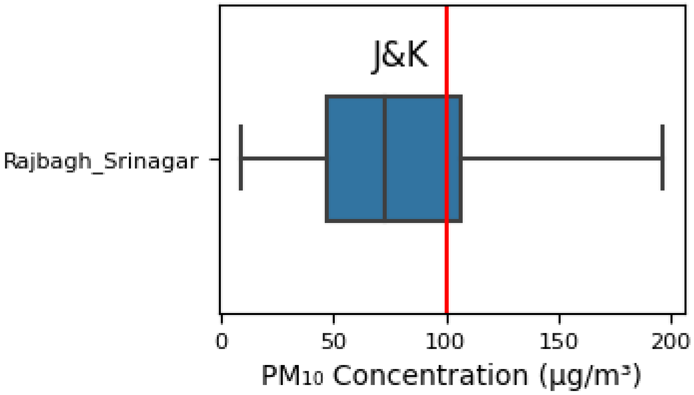

Gujarat
Chandkheda_Ahmedabad
GIDC_Ankleshwar
GIDC_Nandesari
GIFT_City_Gandhinagar
Gyaspur_Ahmedabad
IIPHG_Gandhinagar
Maninagar_Ahmedabad
Phase_1_GIDC_Vapi
Phase_4_GIDC_Vatva
Raikhad_Ahmedabad
Rakhial_Ahmedabad
SAC_ISRO_Bopal
SAC_ISRO_Sat_Ahmed
SVPI_Airport_Hansol
SVP_Stadium
Science_Center_Surat
Sector_10_Gandhinagar
0 50 100 150 200 250 300
PM10 Concentration (µg/m³)

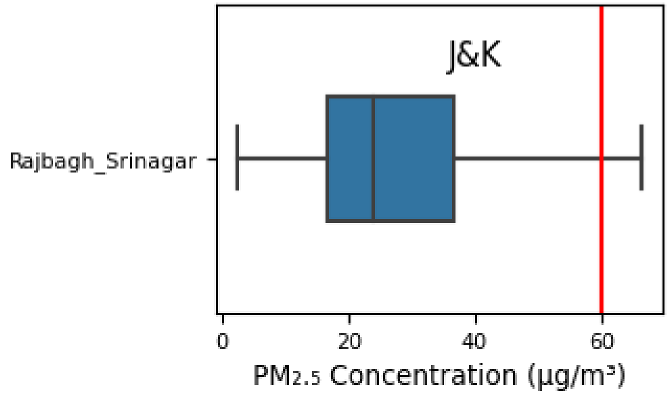

Gujarat
Chandkheda_Ahmedabad
GIDC_Ankleshwar
GIDC_Nandesari
GIFT_City_Gandhinagar
Gyaspur_Ahmedabad
IIPHG_Gandhinagar
Maninagar_Ahmedabad
Phase_1_GIDC_Vapi
Phase_4_GIDC_Vatva
Raikhad_Ahmedabad
Rakhial_Ahmedabad
SAC_ISRO_Bopal
SAC_ISRO_Sat_Ahmed
SVPI_Airport_Hansol
SVP_Stadium
Science_Center_Surat
Sector_10_Gandhinagar
0 25 50 75 100 125 150 175 200
PM2.5 Concentration (µg/m³)

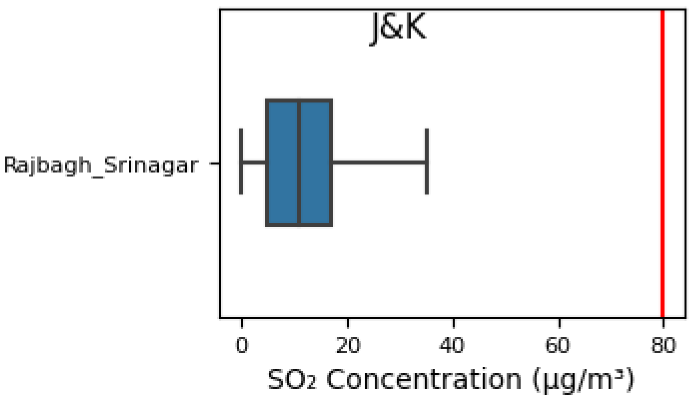

Gujarat
Chandkheda_Ahmedabad
GIDC_Ankleshwar
GIDC_Nandesari
GIFT_City_Gandhinagar
Gyaspur_Ahmedabad
IIPHG_Gandhinagar
Maninagar_Ahmedabad
Phase_1_GIDC_Vapi
Phase_4_GIDC_Vatva
Raikhad_Ahmedabad
Rakhial_Ahmedabad
SAC_ISRO_Bopal
SAC_ISRO_Sat_Ahmed
SVPI_Airport_Hansol
SVP_Stadium
Science_Center_Surat
Sector_10_Gandhinagar
0
20
40
60
80
100
SO₂ Concentration (µg/m³)

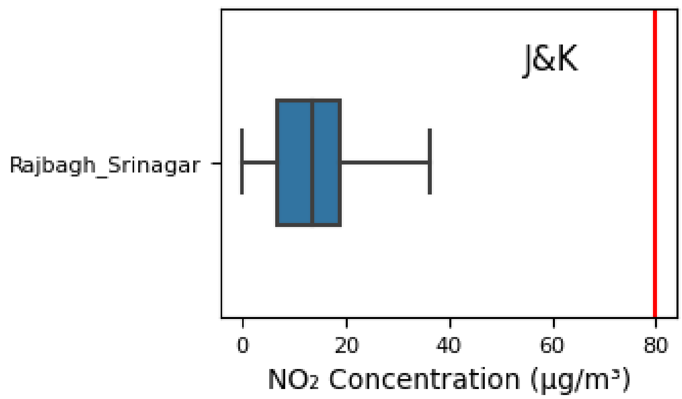

Gujarat
Chandkheda_Ahmedabad
GIDC_Ankleshwar
GIDC_Nandesari
GIFT_City_Gandhinagar
Gyaspur_Ahmedabad
IIPHG_Gandhinagar
Maninagar_Ahmedabad
Phase_1_GIDC_Vapi
Phase_4_GIDC_Vatva
Raikhad_Ahmedabad
Rakhial_Ahmedabad
SAC_ISRO_Bopal
SAC_ISRO_Sat_Ahmed
SVPI_Airport_Hansol
SVP_Stadium
Science_Center_Surat
Sector_10_Gandhinagar
0
50
100
150
200
250
NO₂ Concentration (µg/m³)

Jammu & Kashmir

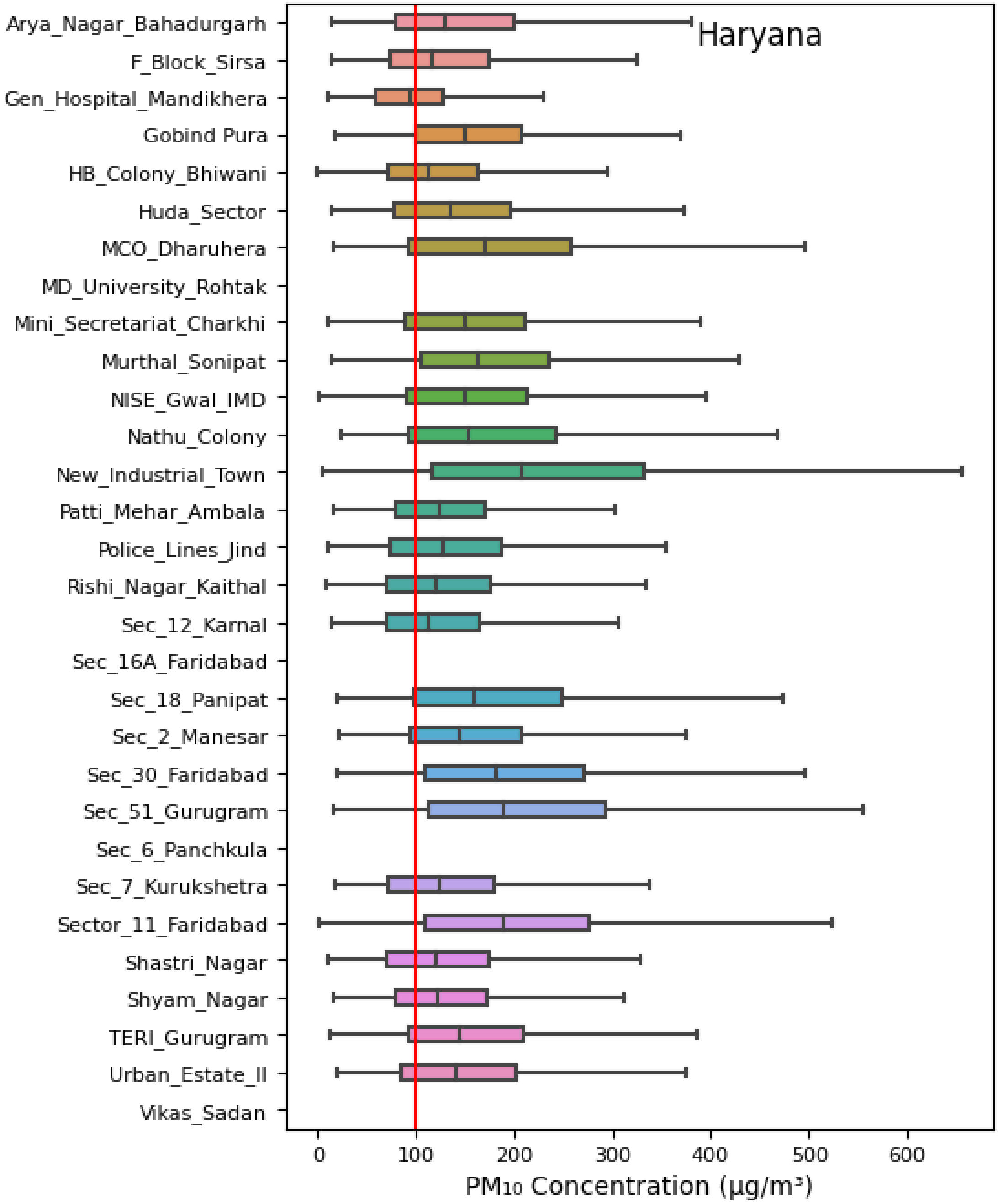


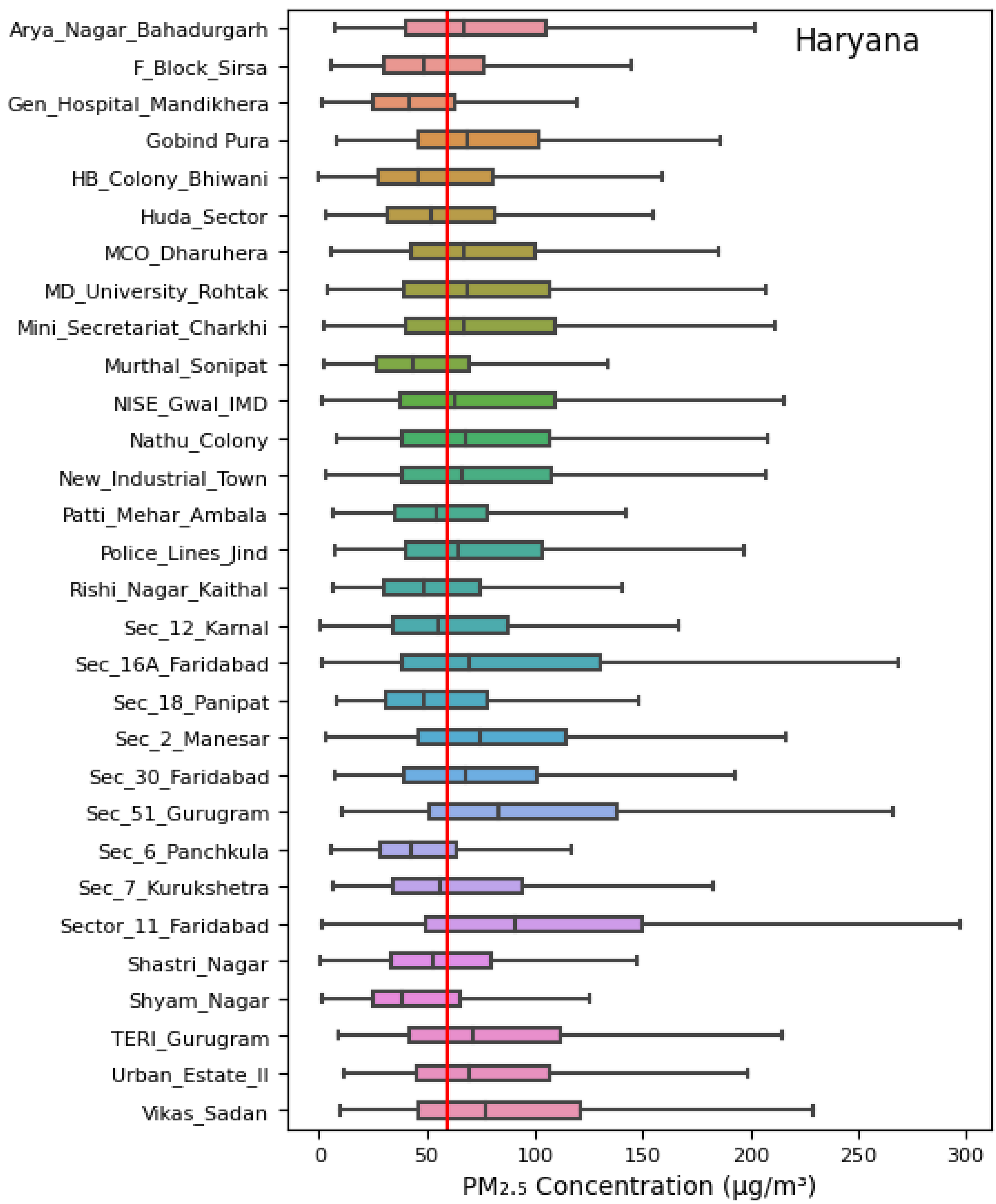


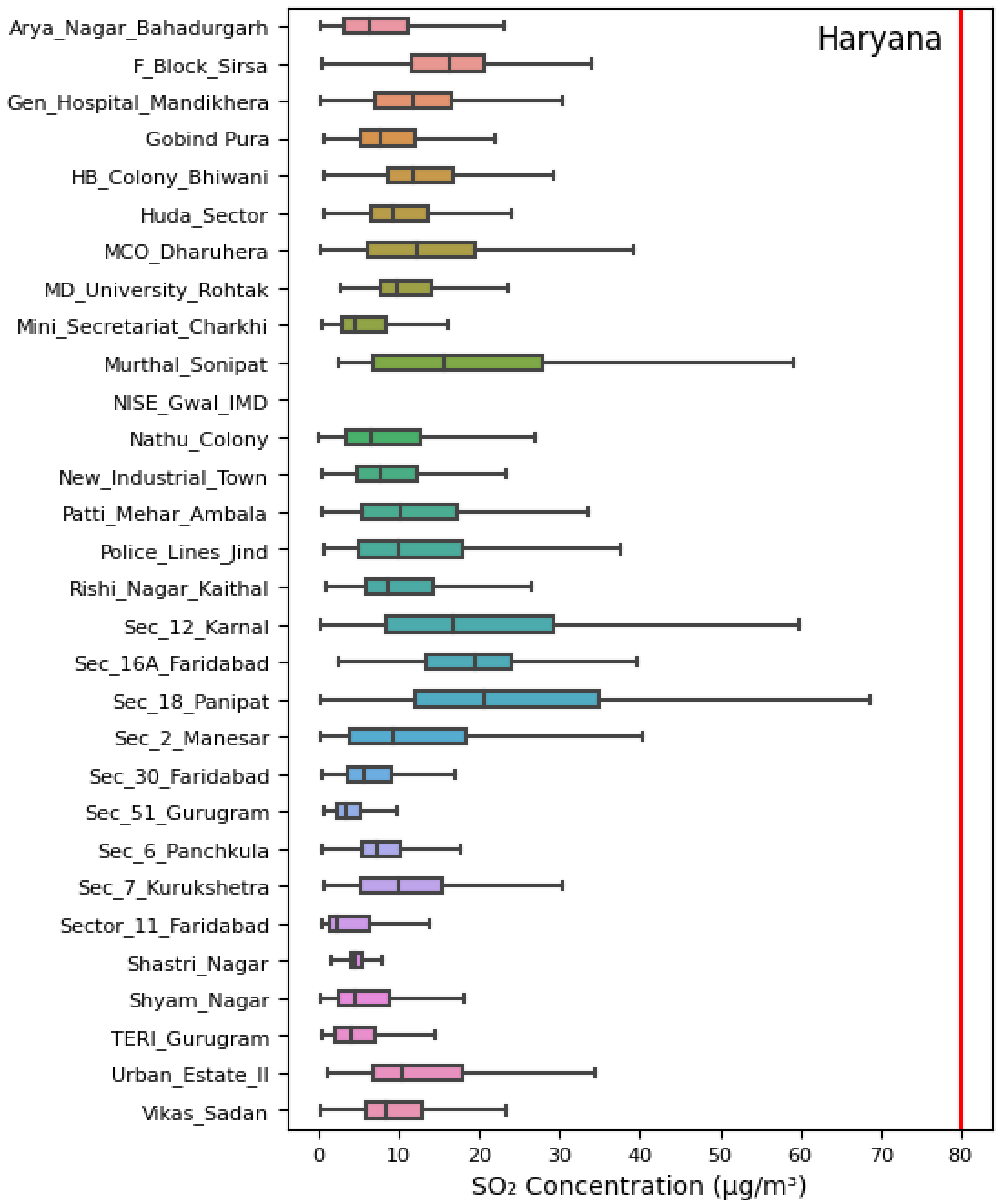


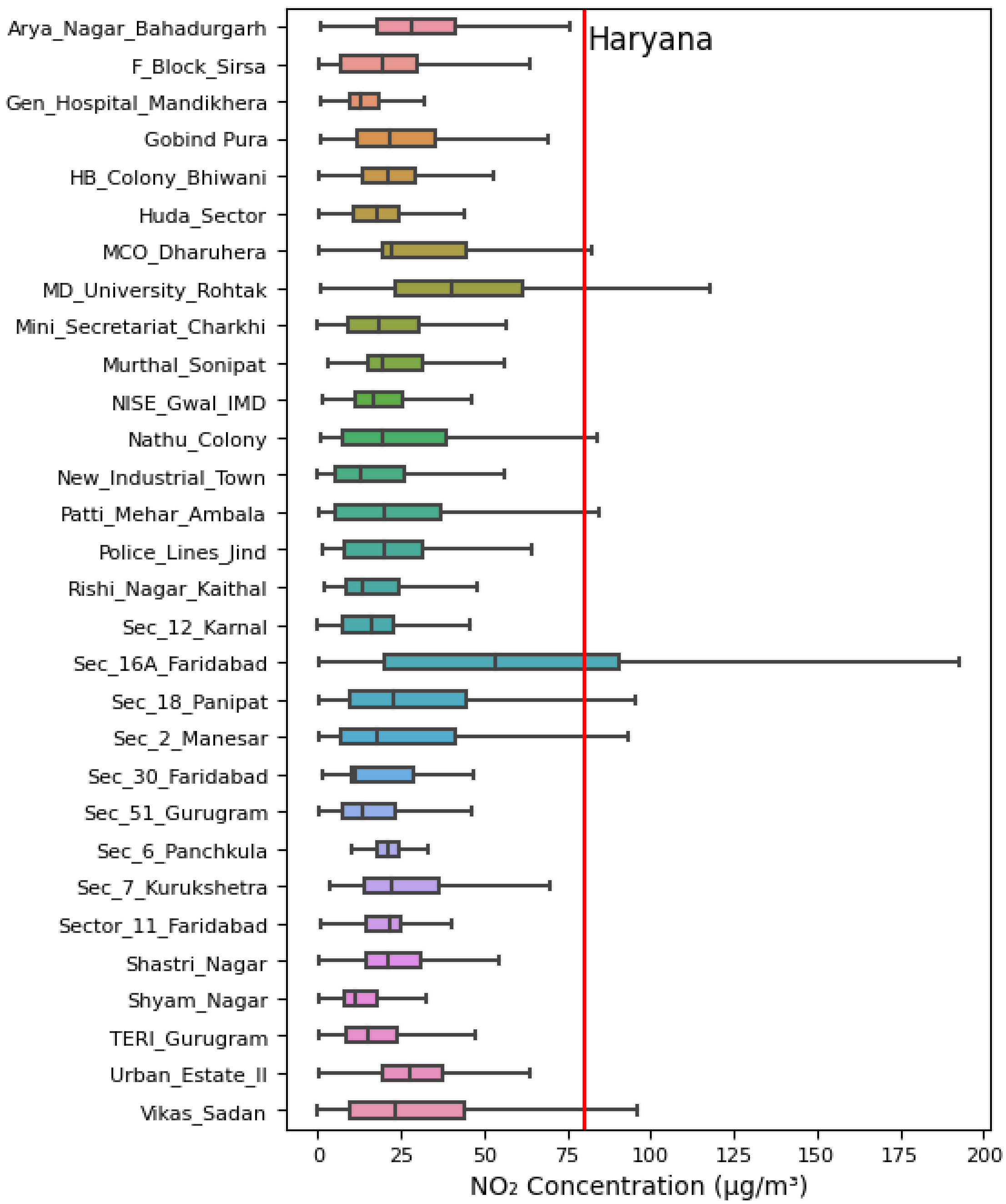


Haryana

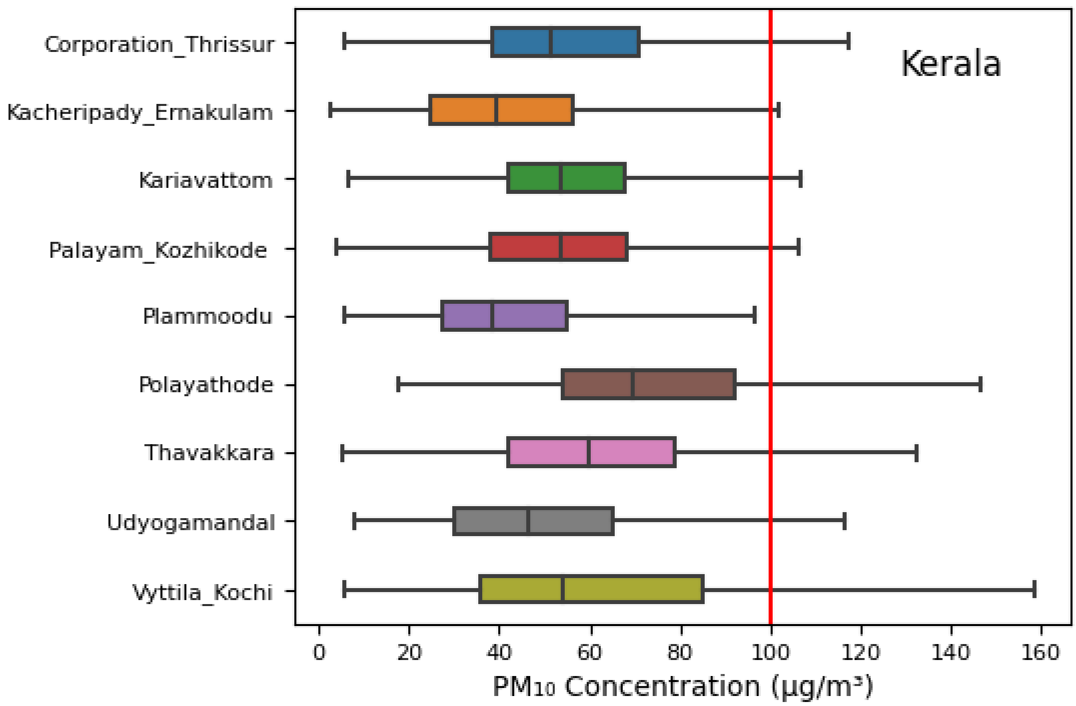

Haryana
Arya_Nagar_Bahadurgarh
F_Block_Sirsa
Gen_Hospital_Mandikhera
Gobind Pura
HB_Colony_Bhiwani
Huda_Sector
MCO_Dharuhera
MD_University_Rohtak
Mini_Secretariat_Charkhi
Murthal_Sonipat
NISE_Gwal_IMD
Nathu_Colony
New_Industrial_Town
Patti_Mehar_Ambala
Police_Lines_Jind
Rishi_Nagar_Kaithal
Sec_12_Karnal
Sec_16A_Faridabad
Sec_18_Panipat
Sec_2_Manesar
Sec_30_Faridabad
Sec_51_Gurugram
Sec_6_Panchkula
Sec_7_Kurukshetra
Sector_11_Faridabad
Shastri_Nagar
Shyam_Nagar
TERI_Gurugram
Urban_Estate_II
Vikas_Sadan
0
100
200
300
400
500
600
PM_{10} Concentration (µg/m³)

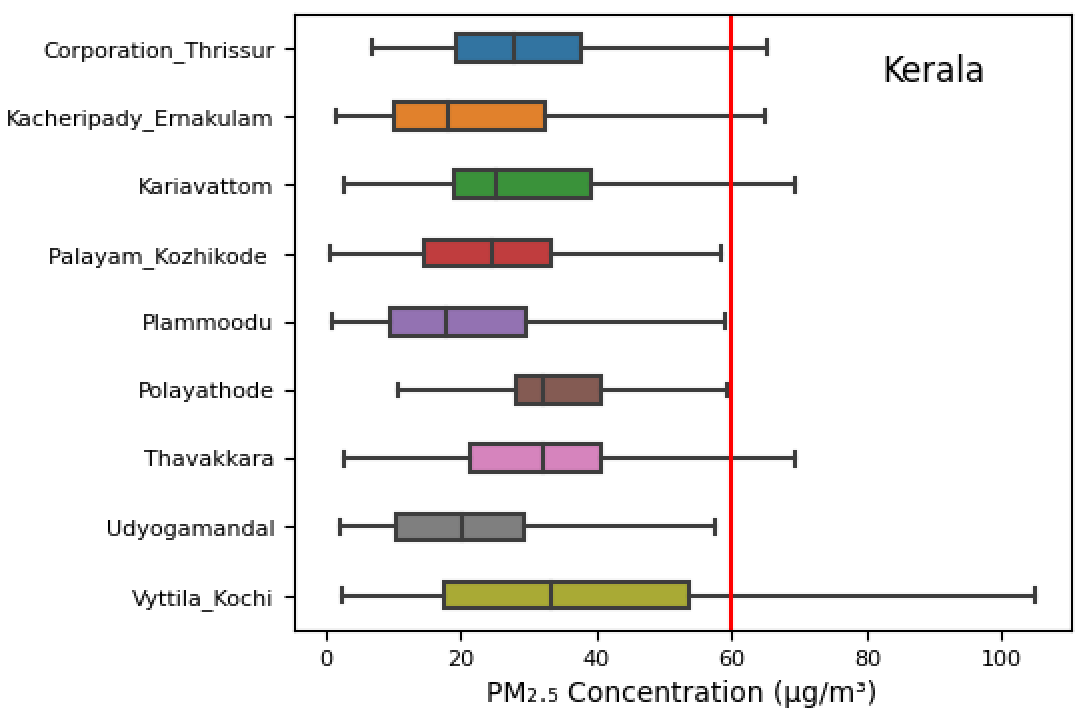

Haryana
Arya_Nagar_Bahadurgarh
F_Block_Sirsa
Gen_Hospital_Mandikhera
Gobind Pura
HB_Colony_Bhiwani
Huda_Sector
MCO_Dharuhera
MD_University_Rohtak
Mini_Secretariat_Charkhi
Murthal_Sonipat
NISE_Gwal_IMD
Nathu_Colony
New_Industrial_Town
Patti_Mehar_Ambala
Police_Lines_Jind
Rishi_Nagar_Kaithal
Sec_12_Karnal
Sec_16A_Faridabad
Sec_18_Panipat
Sec_2_Manesar
Sec_30_Faridabad
Sec_51_Gurugram
Sec_6_Panchkula
Sec_7_Kurukshetra
Sector_11_Faridabad
Shastri_Nagar
Shyam_Nagar
TERI_Gurugram
Urban_Estate_II
Vikas_Sadan
0
50
100
150
200
250
300
PM2.5 Concentration (µg/m³)

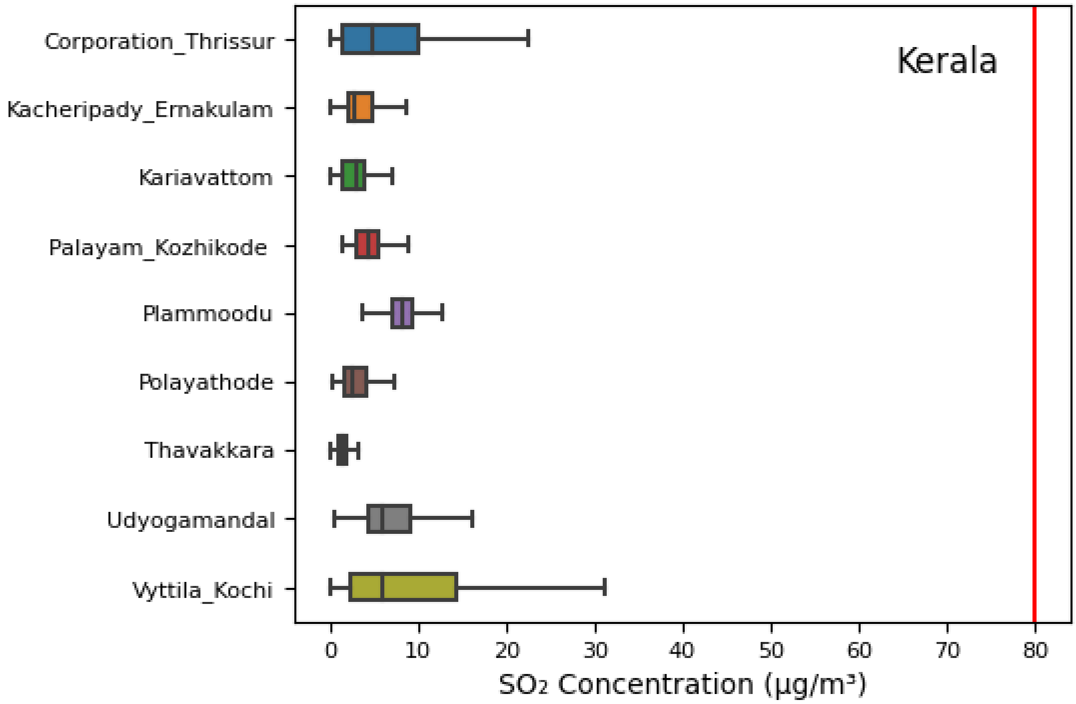

Haryana
Arya_Nagar_Bahadurgarh
F_Block_Sirsa
Gen_Hospital_Mandikhera
Gobind Pura
HB_Colony_Bhiwani
Huda_Sector
MCO_Dharuhera
MD_University_Rohtak
Mini_Secretariat_Charkhi
Murthal_Sonipat
NISE_Gwal_IMD
Nathu_Colony
New_Industrial_Town
Patti_Mehar_Ambala
Police_Lines_Jind
Rishi_Nagar_Kaithal
Sec_12_Karnal
Sec_16A_Faridabad
Sec_18_Panipat
Sec_2_Manesar
Sec_30_Faridabad
Sec_51_Gurugram
Sec_6_Panchkula
Sec_7_Kurukshetra
Sector_11_Faridabad
Shastri_Nagar
Shyam_Nagar
TERI_Gurugram
Urban_Estate_II
Vikas_Sadan
0
10
20
30
40
50
60
70
80
SO_2 Concentration (µg/m³)

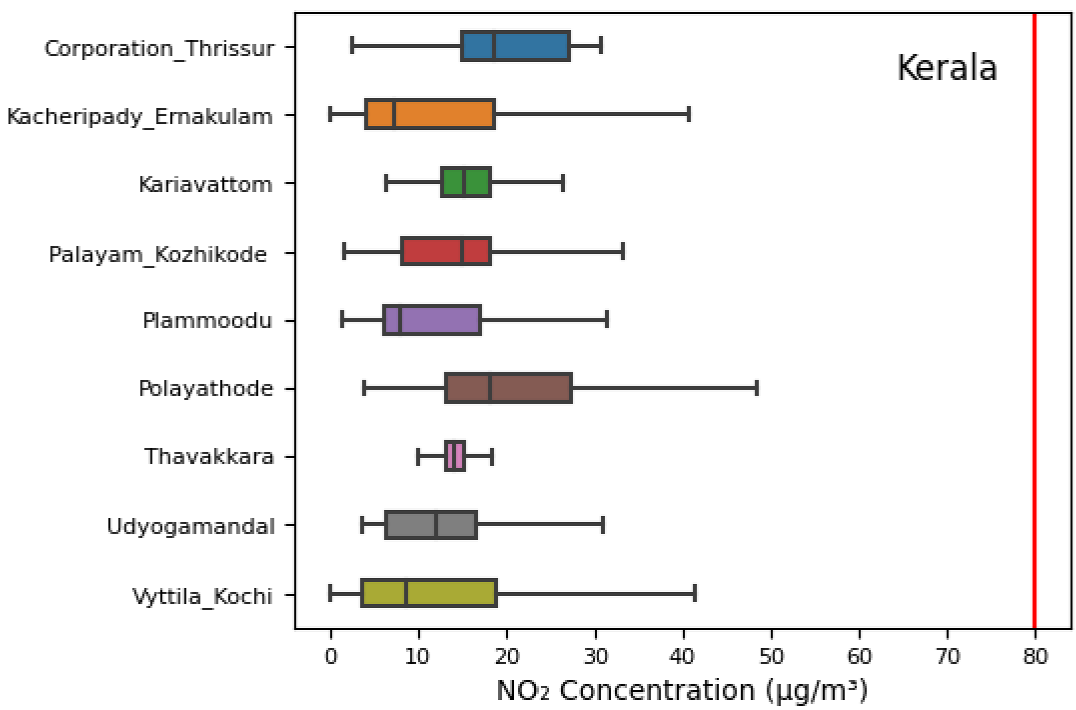

Haryana
Arya_Nagar_Bahadurgarh
F_Block_Sirsa
Gen_Hospital_Mandikhera
Gobind Pura
HB_Colony_Bhiwani
Huda_Sector
MCO_Dharuhera
MD_University_Rohtak
Mini_Secretariat_Charkhi
Murthal_Sonipat
NISE_Gwal_IMD
Nathu_Colony
New_Industrial_Town
Patti_Mehar_Ambala
Police_Lines_Jind
Rishi_Nagar_Kaithal
Sec_12_Karnal
Sec_16A_Faridabad
Sec_18_Panipat
Sec_2_Manesar
Sec_30_Faridabad
Sec_51_Gurugram
Sec_6_Panchkula
Sec_7_Kurukshetra
Sector_11_Faridabad
Shastri_Nagar
Shyam_Nagar
TERI_Gurugram
Urban_Estate_II
Vikas_Sadan
0
25
50
75
100
125
150
175
200
NO₂ Concentration (μg/m³)

Kerala

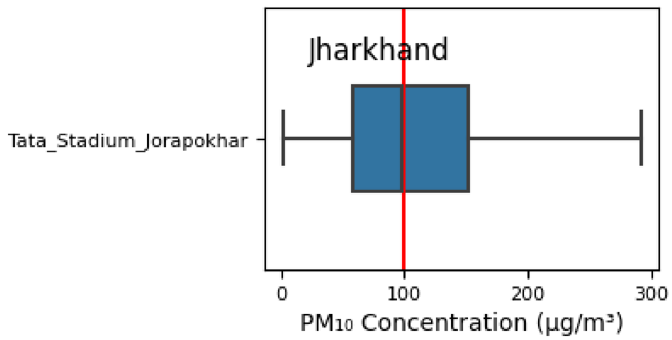

Kerala
Corporation_Thrissur
Kacheripady_Ernakulam
Kariavattom
Palayam_Kozhikode
Plammoodu
Polayathode
Thavakkara
Udyogamandal
Vyttila_Kochi
0
20
40
60
80
100
120
140
160
PM10 Concentration (µg/m³)

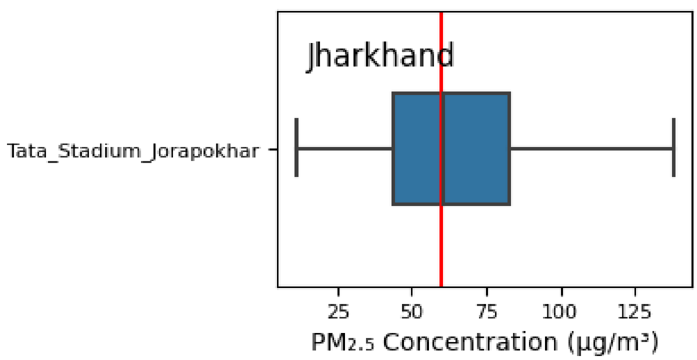

Kerala
Corporation_Thrissur
Kacheripady_Ernakulam
Kariavattom
Palayam_Kozhikode
Plammoodu
Polayathode
Thavakkara
Udyogamandal
Vyttila_Kochi
0
20
40
60
80
100
PM2.5 Concentration (µg/m³)

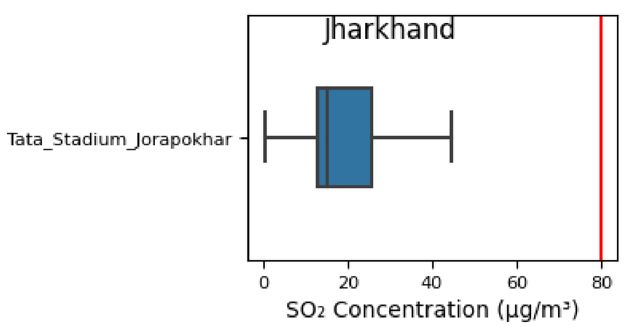

Kerala
Corporation_Thrissur
Kacheripady_Ernakulam
Kariavattom
Palayam_Kozhikode
Plammoodu
Polayathode
Thavakkara
Udyogamandal
Vyttila_Kochi
0
10
20
30
40
50
60
70
80
SO₂ Concentration (µg/m³)

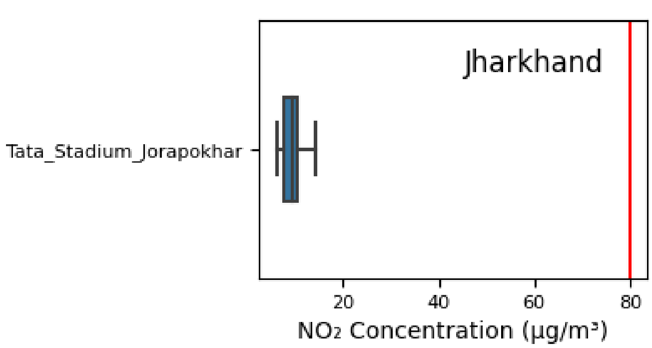

Kerala
Corporation_Thrissur
Kacheripady_Ernakulam
Kariavattom
Palayam_Kozhikode
Plammoodu
Polayathode
Thavakkara
Udyogamandal
Vyttila_Kochi
0
10
20
30
40
50
60
70
80
NO₂ Concentration (µg/m³)

Jharkhand

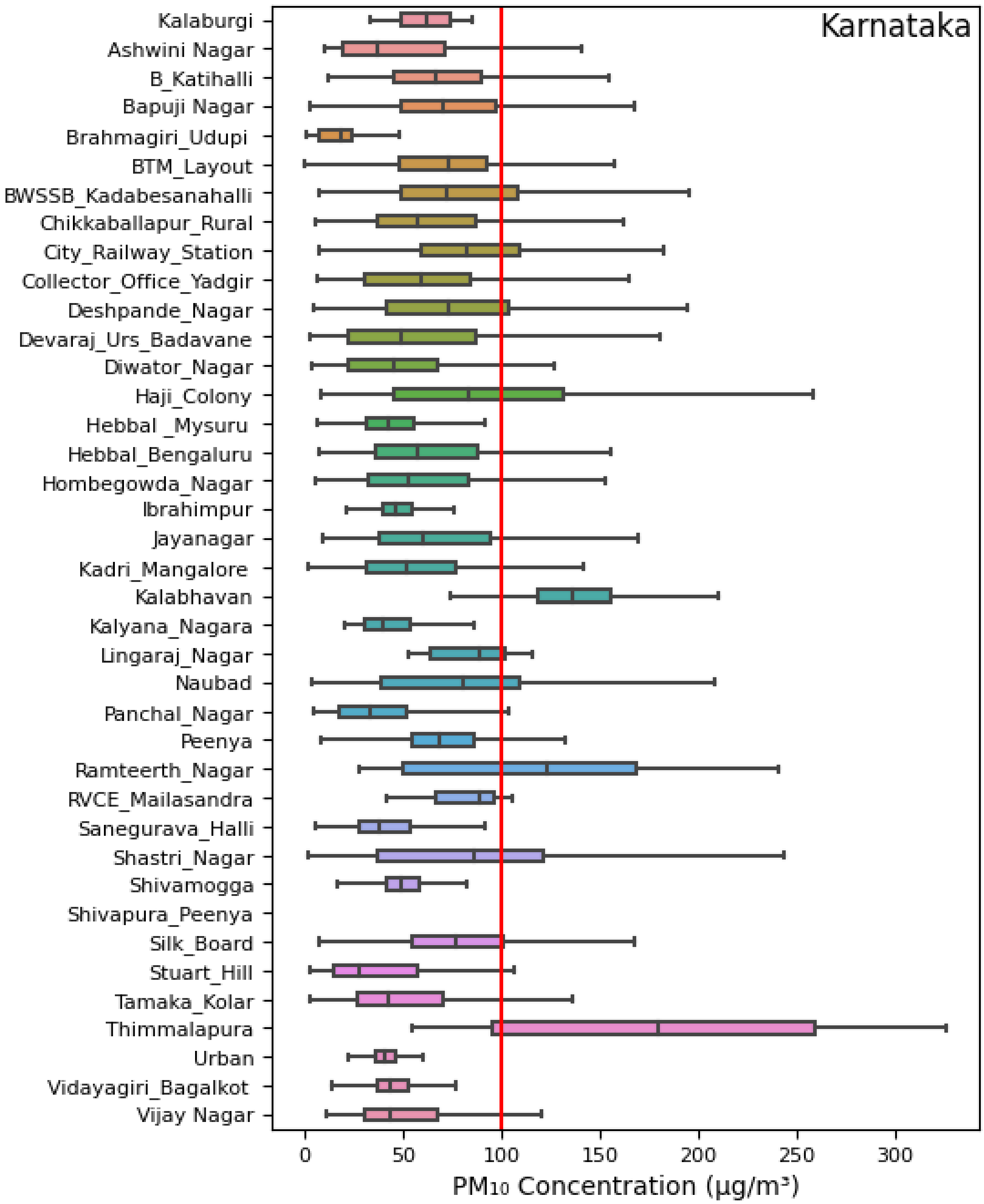

Jharkhand
Tata_Stadium_Jorapokhar
0
100
200
300
PM10 Concentration (µg/m³)

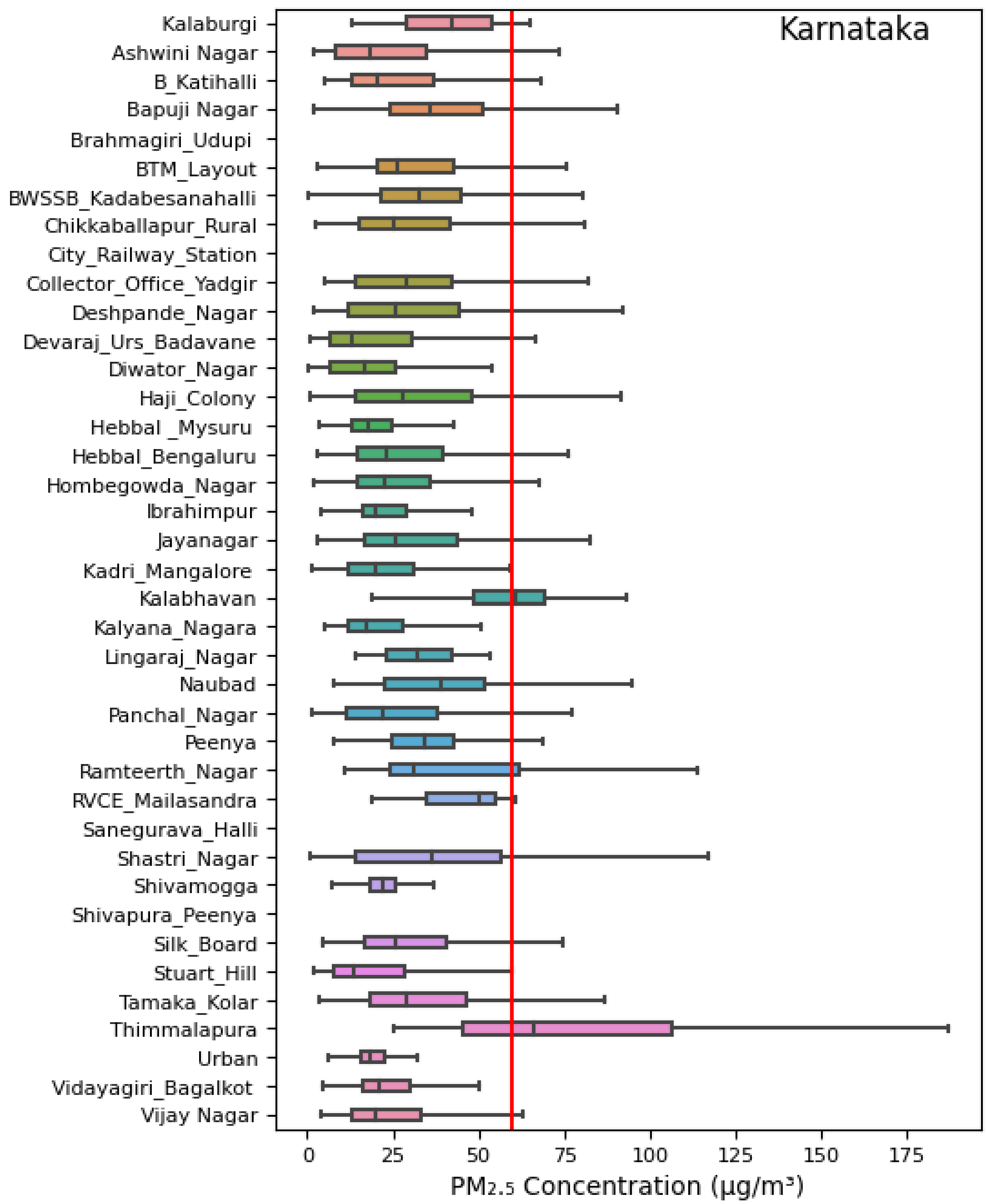

Jharkhand
Tata_Stadium_Jorapokhar
25
50
75
100
125
PM2.5 Concentration (µg/m³)

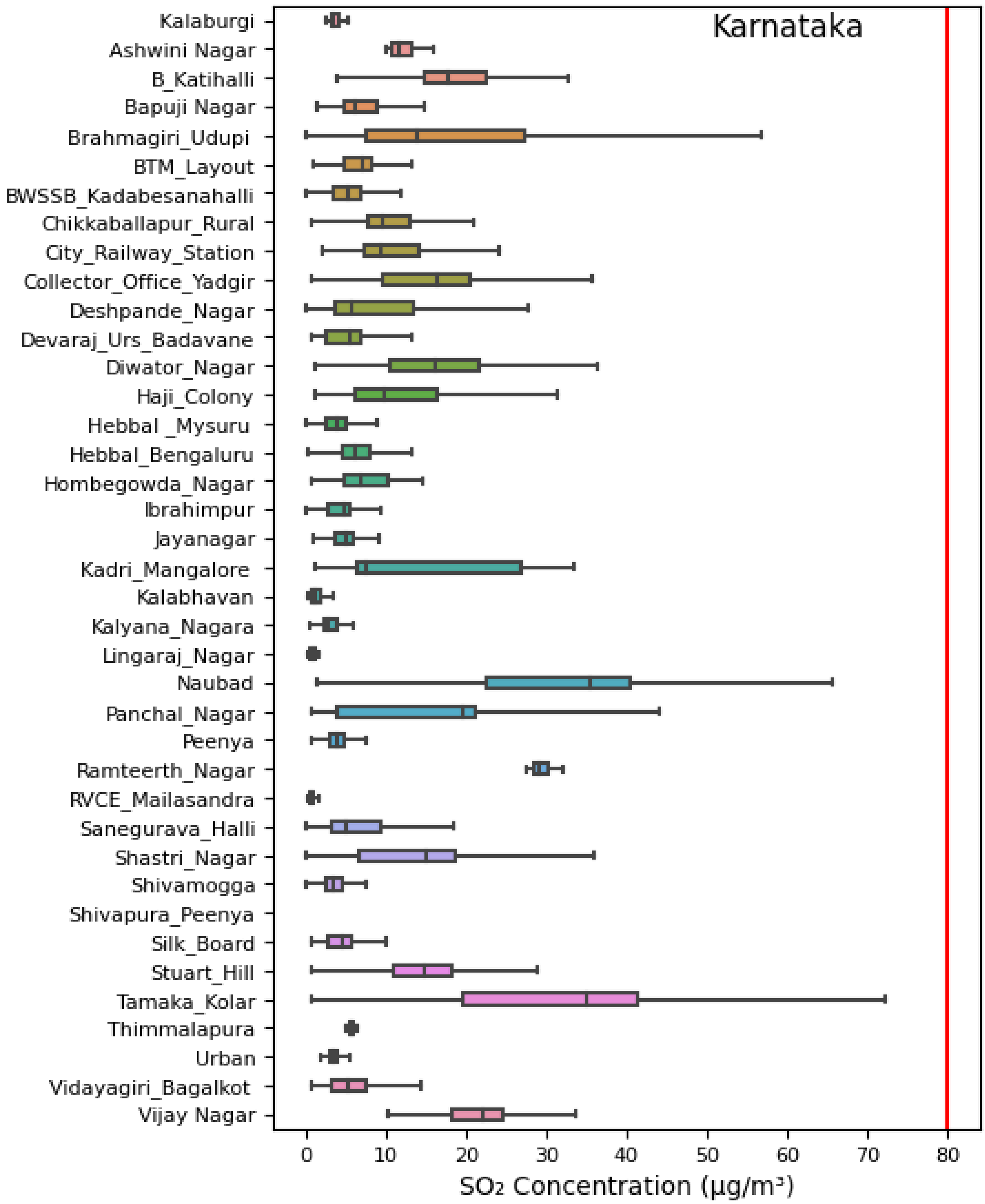

Jharkhand
Tata_Stadium_Jorapokhar
0
20
40
60
80
SO2 Concentration (µg/m³)

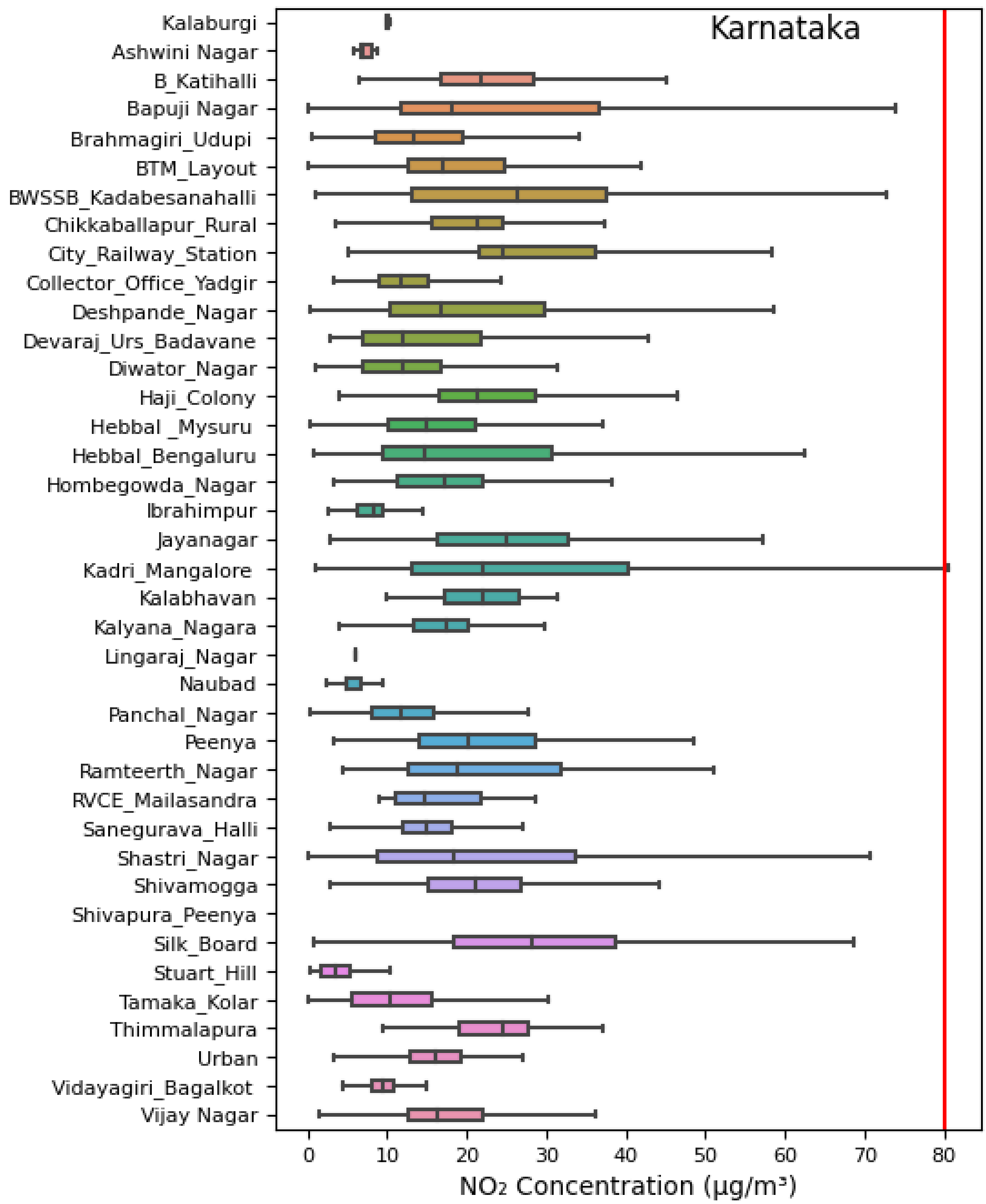

Jharkhand
Tata_Stadium_Jorapokhar
20
40
60
80
NO2 Concentration (µg/m³)

Karnataka

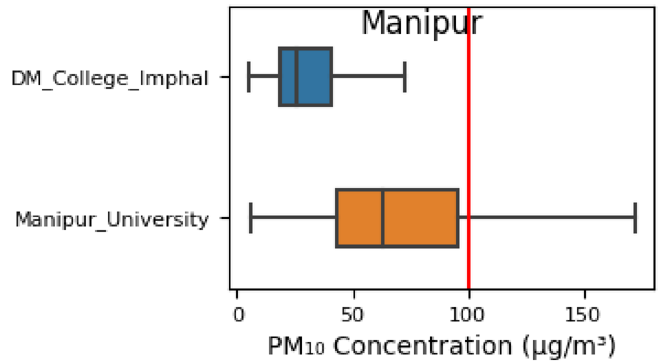

Karnataka
Kalaburgi
Ashwini Nagar
B_Katihalli
Bapuji Nagar
Brahmagiri_Udupi
BTM_Layout
BWSSB_Kadabesanahalli
Chikkaballapur_Rural
City_Railway_Station
Collector_Office_Yadgir
Deshpande_Nagar
Devaraj_Urs_Badavane
Diwator_Nagar
Haji_Colony
Hebbal _Mysuru
Hebbal_Bengaluru
Hombegowda_Nagar
Ibrahimpur
Jayanagar
Kadri_Mangalore
Kalabhavan
Kalyana_Nagara
Lingaraj_Nagar
Naubad
Panchal_Nagar
Peenya
Ramteerth_Nagar
RVCE_Mailasandra
Sanegurava_Halli
Shastri_Nagar
Shivamogga
Shivapura_Peenya
Silk_Board
Stuart_Hill
Tamaka_Kolar
Thimmalapura
Urban
Vidayagiri_Bagalkot
Vijay Nagar
0
50
100
150
200
250
300
PM10 Concentration (µg/m³)

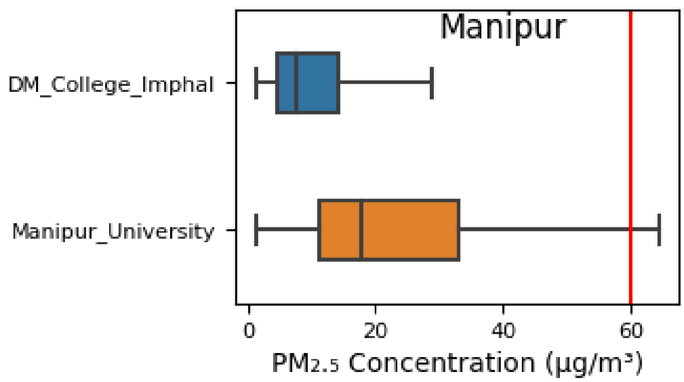

Karnataka
Kalaburgi
Ashwini Nagar
B_Katihalli
Bapuji Nagar
Brahmagiri_Udupi
BTM_Layout
BWSSB_Kadabesanahalli
Chikkaballapur_Rural
City_Railway_Station
Collector_Office_Yadgir
Deshpande_Nagar
Devaraj_Urs_Badavane
Diwator_Nagar
Haji_Colony
Hebbal _Mysuru
Hebbal_Bengaluru
Hombegowda_Nagar
Ibrahimpur
Jayanagar
Kadri_Mangalore
Kalabhavan
Kalyana_Nagara
Lingaraj_Nagar
Naubad
Panchal_Nagar
Peenya
Ramteerth_Nagar
RVCE_Mailasandra
Sanegurava_Halli
Shastri_Nagar
Shivamogga
Shivapura_Peenya
Silk_Board
Stuart_Hill
Tamaka_Kolar
Thimmalapura
Urban
Vidayagiri_Bagalkot
Vijay Nagar
0
25
50
75
100
125
150
175
PM2.5 Concentration (µg/m³)

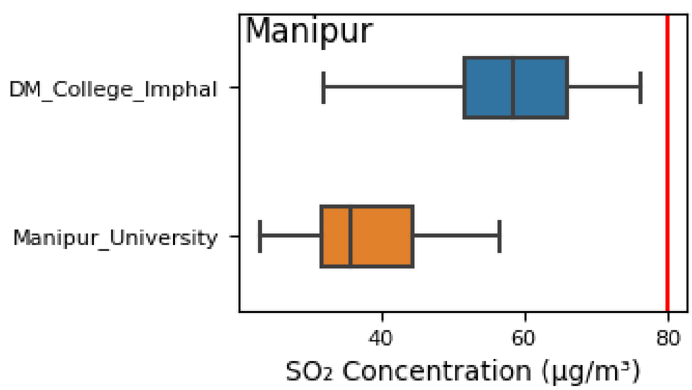

Karnataka
Kalaburgi
Ashwini Nagar
B_Katihalli
Bapuji Nagar
Brahmagiri_Udupi
BTM_Layout
BWSSB_Kadabesanahalli
Chikkaballapur_Rural
City_Railway_Station
Collector_Office_Yadgir
Deshpande_Nagar
Devaraj_Urs_Badavane
Diwator_Nagar
Haji_Colony
Hebbal _Mysuru
Hebbal_Bengaluru
Hombegowda_Nagar
Ibrahimpur
Jayanagar
Kadri_Mangalore
Kalabhavan
Kalyana_Nagara
Lingaraj_Nagar
Naubad
Panchal_Nagar
Peenya
Ramteerth_Nagar
RVCE_Mailasandra
Sanegurava_Halli
Shastri_Nagar
Shivamogga
Shivapura_Peenya
Silk_Board
Stuart_Hill
Tamaka_Kolar
Thimmalapura
Urban
Vidayagiri_Bagalkot
Vijay Nagar
0
10
20
30
40
50
60
70
80
SO_2 Concentration (µg/m³)

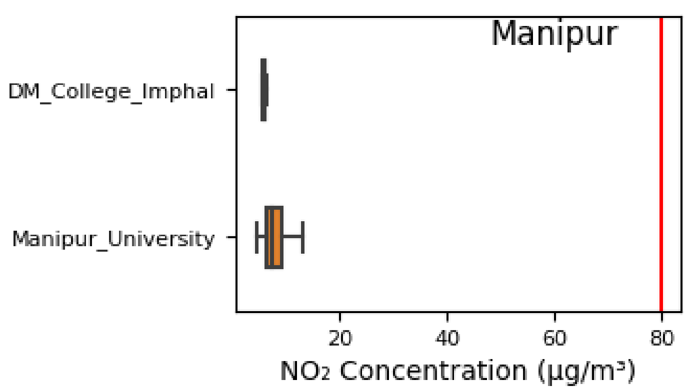

Karnataka
Kalaburgi
Ashwini Nagar
B_Katihalli
Bapuji Nagar
Brahmagiri_Udupi
BTM_Layout
BWSSB_Kadabesanahalli
Chikkaballapur_Rural
City_Railway_Station
Collector_Office_Yadgir
Deshpande_Nagar
Devaraj_Urs_Badavane
Diwator_Nagar
Haji_Colony
Hebbal _Mysuru
Hebbal_Bengaluru
Hombegowda_Nagar
Ibrahimpur
Jayanagar
Kadri_Mangalore
Kalabhavan
Kalyana_Nagara
Lingaraj_Nagar
Naubad
Panchal_Nagar
Peenya
Ramteerth_Nagar
RVCE_Mailasandra
Sanegurava_Halli
Shastri_Nagar
Shivamogga
Shivapura_Peenya
Silk_Board
Stuart_Hill
Tamaka_Kolar
Thimmalapura
Urban
Vidayagiri_Bagalkot
Vijay Nagar
0 10 20 30 40 50 60 70 80
NO₂ Concentration (µg/m³)

Manipur

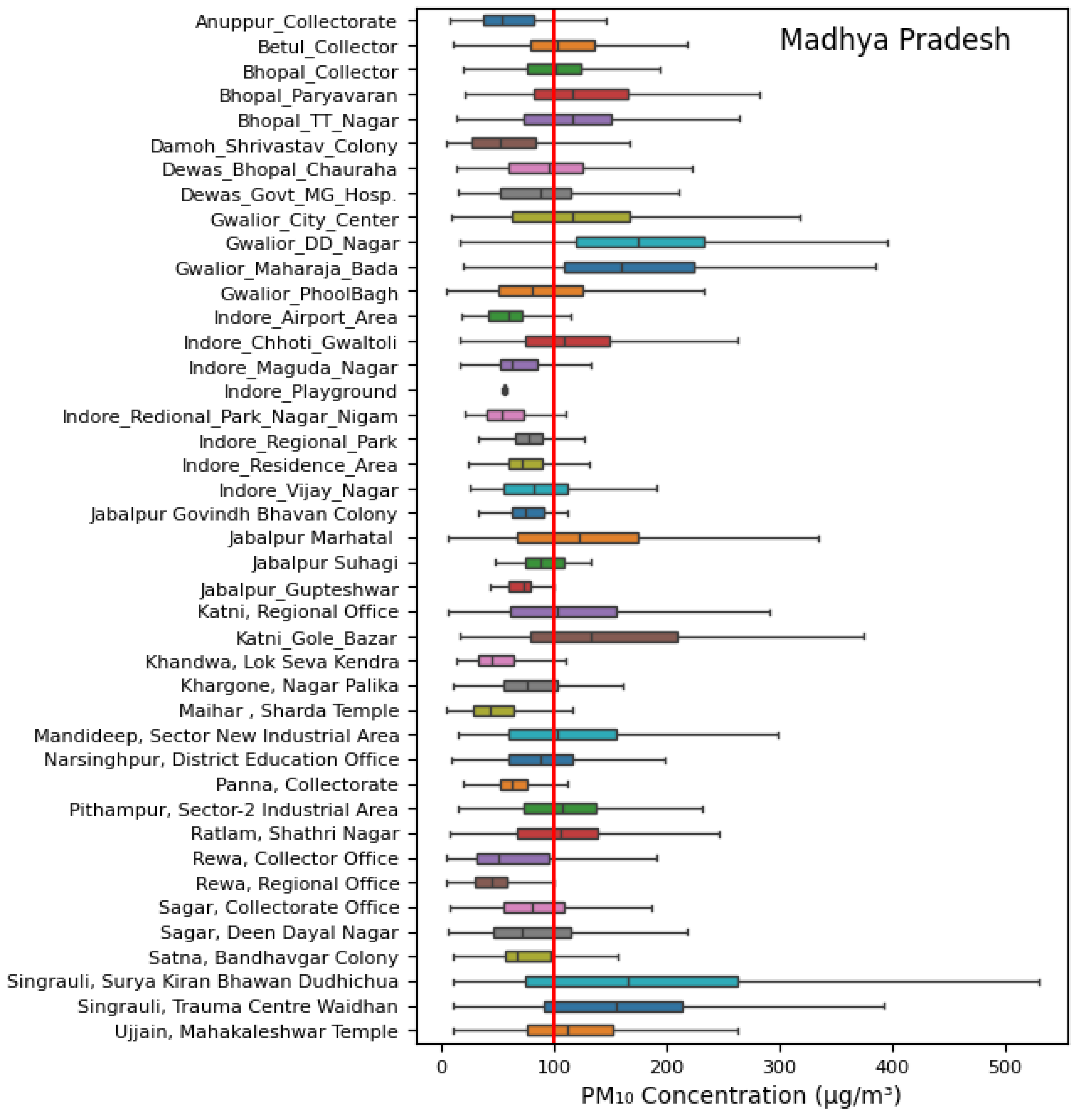

Manipur
DM_College_Imphal
Manipur_University
0
50
100
150
PM10 Concentration (µg/m³)

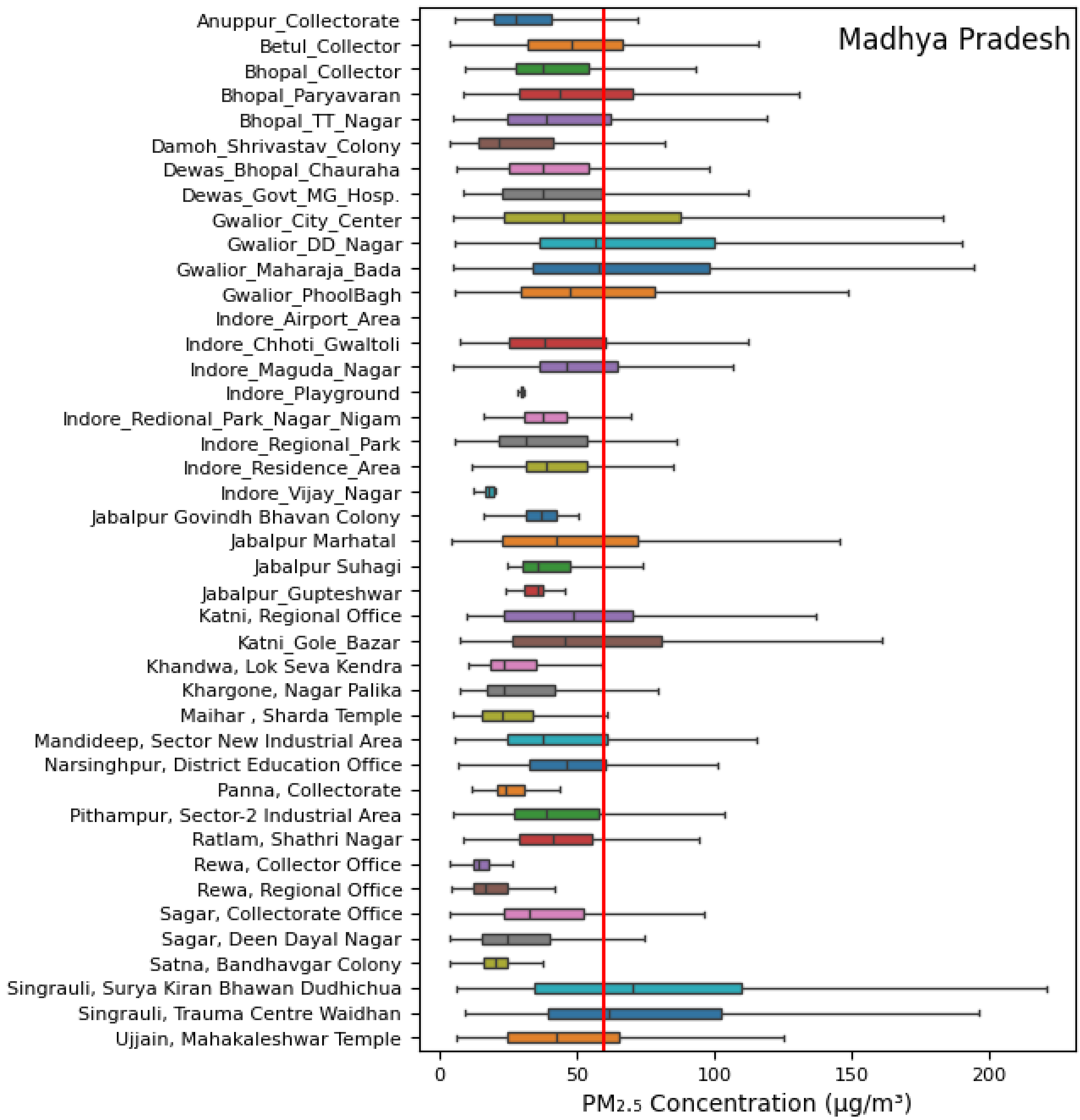

Manipur
DM_College_Imphal
Manipur_University
0
20
40
60
PM2.5 Concentration (µg/m³)

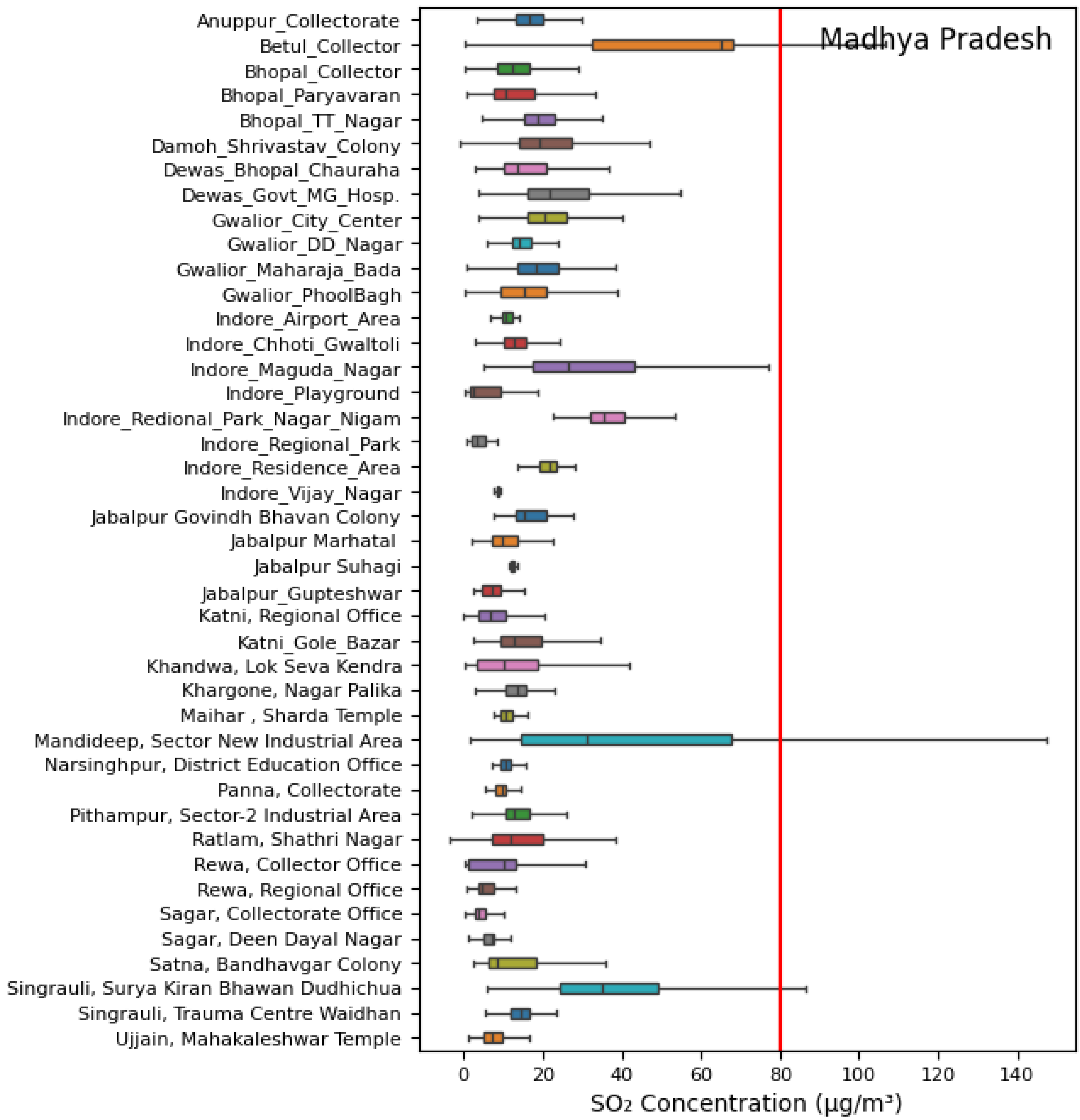

Manipur
DM_College_Imphal
Manipur_University
40
60
80
SO2 Concentration (µg/m³)

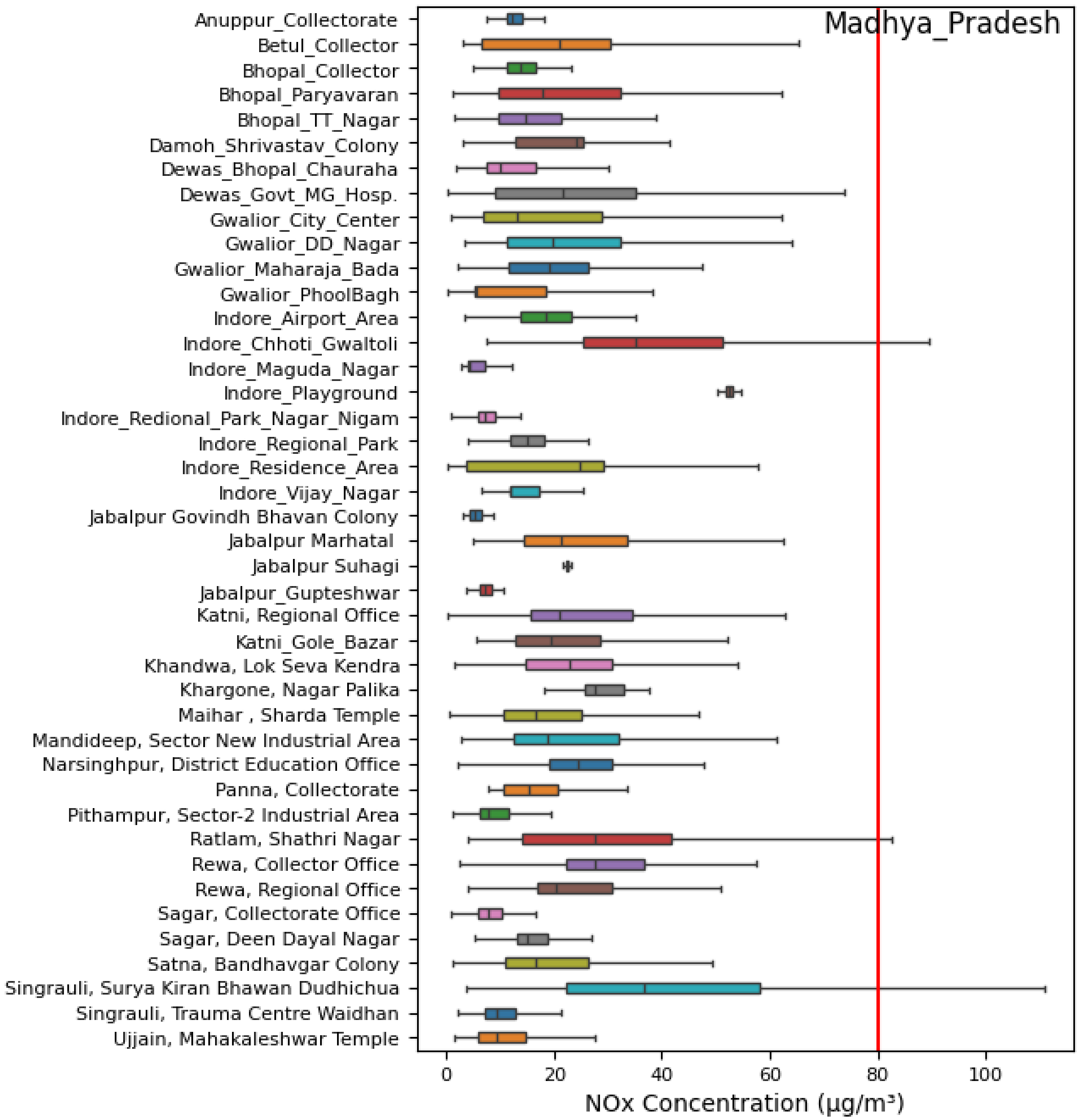

Manipur
DM_College_Imphal
Manipur_University
20
40
60
80
NO2 Concentration (µg/m³)

Madhya Pradesh

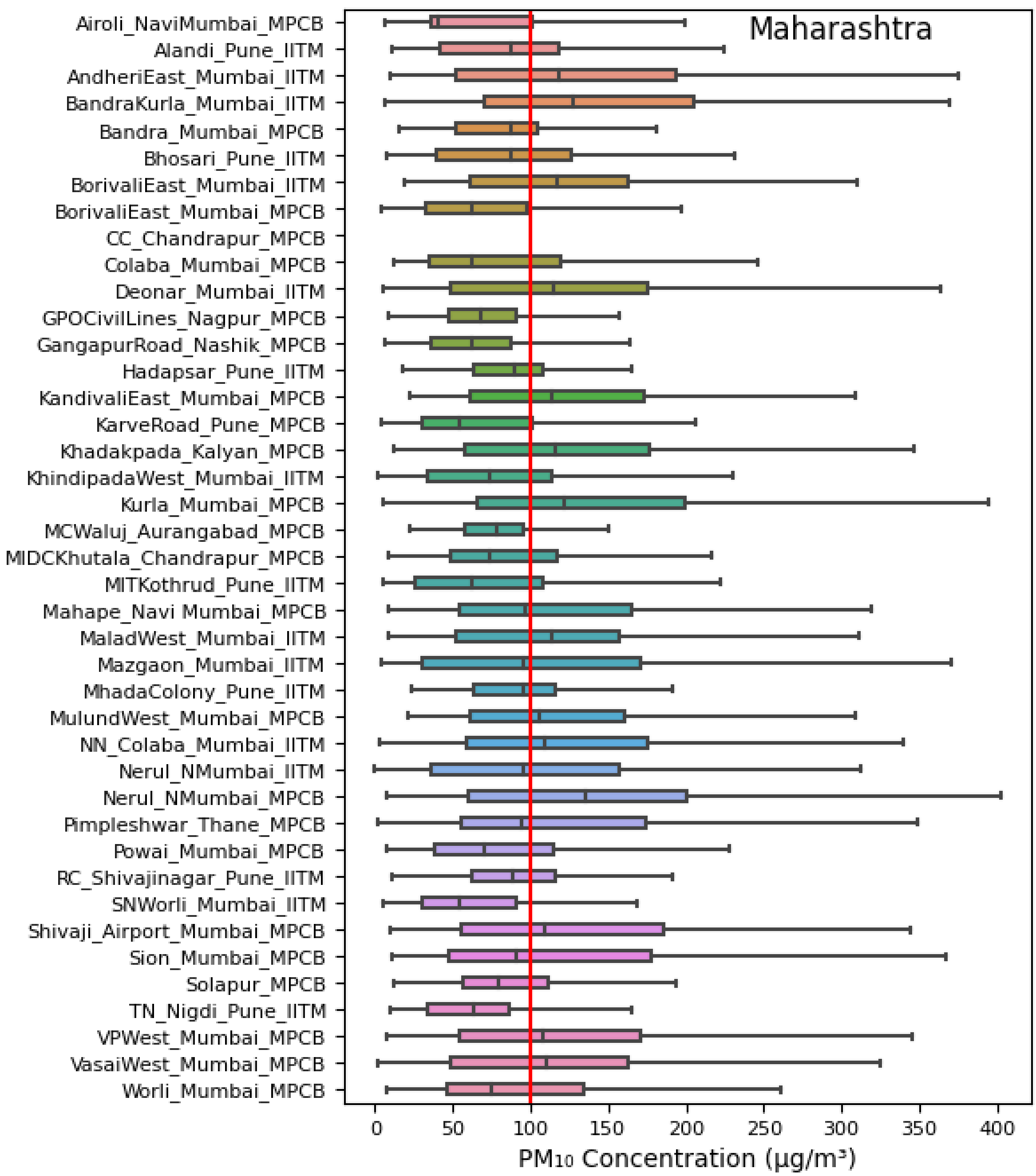


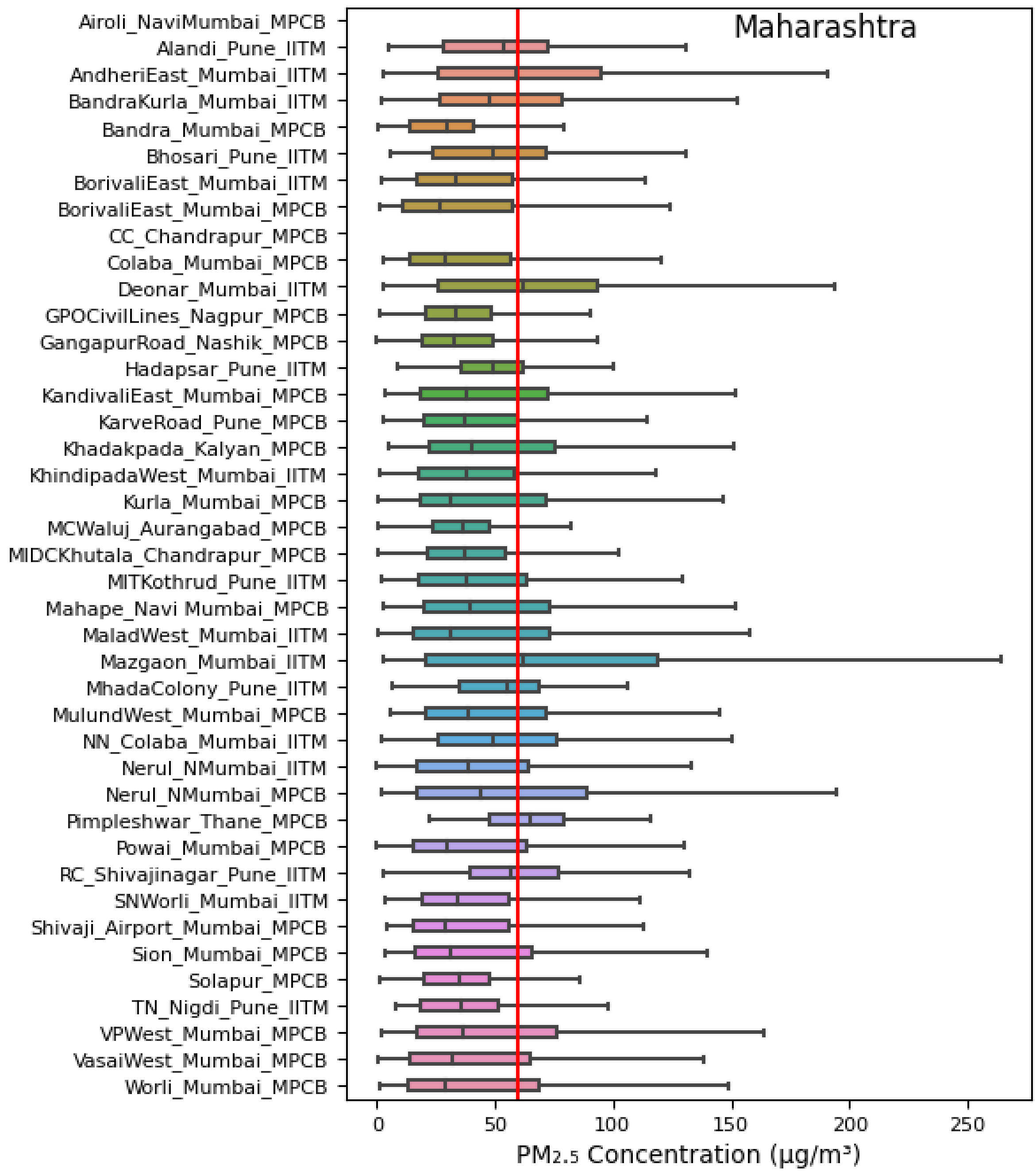

Madhya Pradesh
Anuppur_Collectorate
Betul_Collector
Bhopal_Collector
Bhopal_Paryavaran
Bhopal_TT_Nagar
Damoh_Shrivastav_Colony
Dewas_Bhopal_Chauraha
Dewas_Govt_MG_Hosp.
Gwalior_City_Center
Gwalior_DD_Nagar
Gwalior_Maharaja_Bada
Gwalior_PhoolBagh
Indore_Airport_Area
Indore_Chhoti_Gwaltoli
Indore_Maguda_Nagar
Indore_Playground
Indore_Redional_Park_Nagar_Nigam
Indore_Regional_Park
Indore_Residence_Area
Indore_Vijay_Nagar
Jabalpur Govindh Bhavan Colony
Jabalpur Marhatal
Jabalpur Suhagi
Jabalpur_Gupteshwar
Katni, Regional Office
Katni_Gole_Bazar
Khandwa, Lok Seva Kendra
Khargone, Nagar Palika
Maihar , Sharda Temple
Mandideep, Sector New Industrial Area
Narsinghpur, District Education Office
Panna, Collectorate
Pithampur, Sector-2 Industrial Area
Ratlam, Shathri Nagar
Rewa, Collector Office
Rewa, Regional Office
Sagar, Collectorate Office
Sagar, Deen Dayal Nagar
Satna, Bandhavgar Colony
Singrauli, Surya Kiran Bhawan Dudhichua
Singrauli, Trauma Centre Waidhan
Ujjain, Mahakaleshwar Temple
0
50
100
150
200
PM2.5 Concentration (µg/m³)

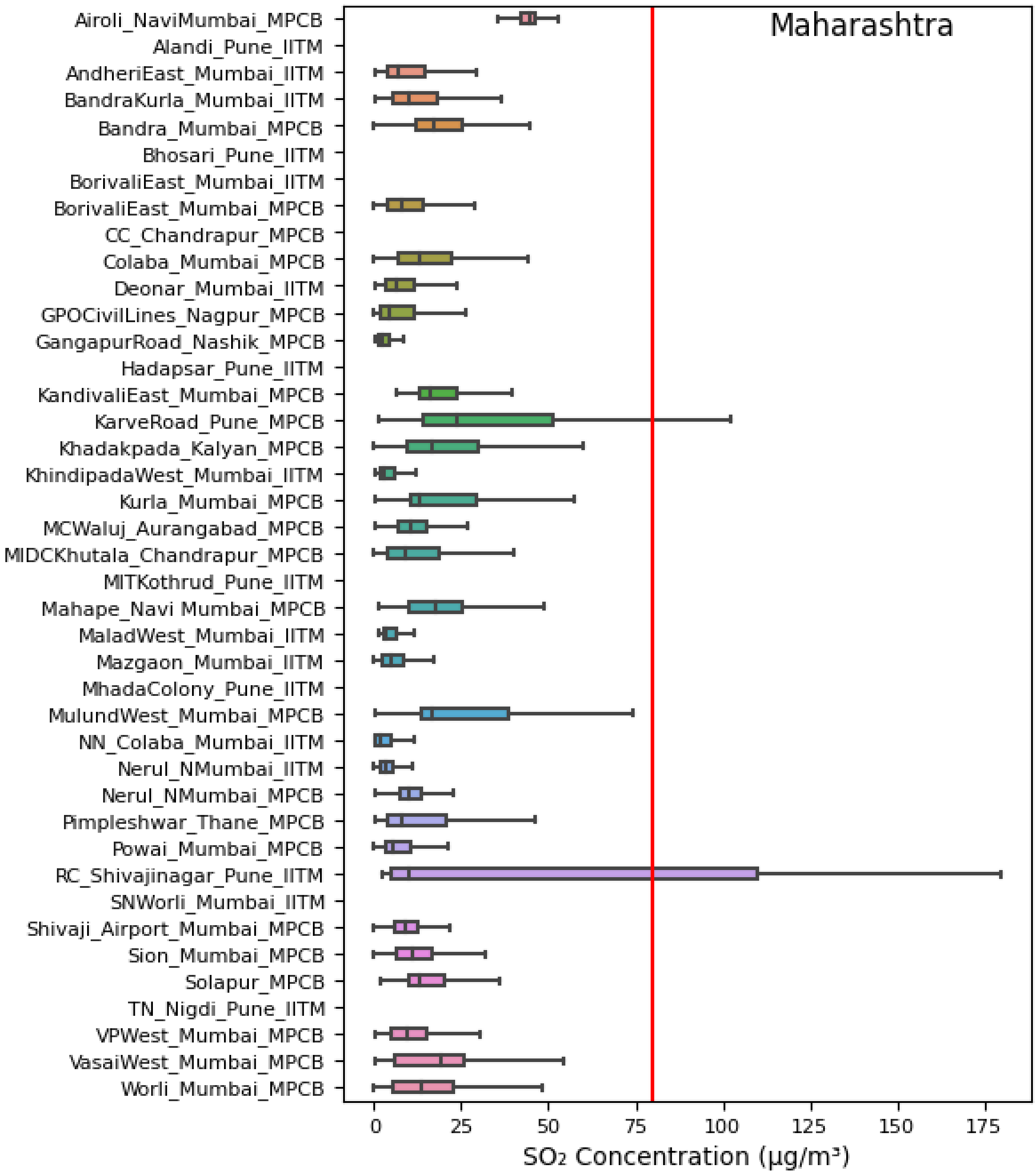

Madhya Pradesh
Anuppur_Collectorate
Betul_Collector
Bhopal_Collector
Bhopal_Paryavaran
Bhopal_TT_Nagar
Damoh_Shrivastav_Colony
Dewas_Bhopal_Chauraha
Dewas_Govt_MG_Hosp.
Gwalior_City_Center
Gwalior_DD_Nagar
Gwalior_Maharaja_Bada
Gwalior_PhoolBagh
Indore_Airport_Area
Indore_Chhoti_Gwaltoli
Indore_Maguda_Nagar
Indore_Playground
Indore_Redional_Park_Nagar_Nigam
Indore_Regional_Park
Indore_Residence_Area
Indore_Vijay_Nagar
Jabalpur Govindh Bhavan Colony
Jabalpur Marhatal
Jabalpur Suhagi
Jabalpur_Gupteshwar
Katni, Regional Office
Katni_Gole_Bazar
Khandwa, Lok Seva Kendra
Khargone, Nagar Palika
Maihar , Sharda Temple
Mandideep, Sector New Industrial Area
Narsinghpur, District Education Office
Panna, Collectorate
Pithampur, Sector-2 Industrial Area
Ratlam, Shathri Nagar
Rewa, Collector Office
Rewa, Regional Office
Sagar, Collectorate Office
Sagar, Deen Dayal Nagar
Satna, Bandhavgar Colony
Singrauli, Surya Kiran Bhawan Dudhichua
Singrauli, Trauma Centre Waidhan
Ujjain, Mahakaleshwar Temple
0
20
40
60
80
100
120
140
SO₂ Concentration (µg/m³)

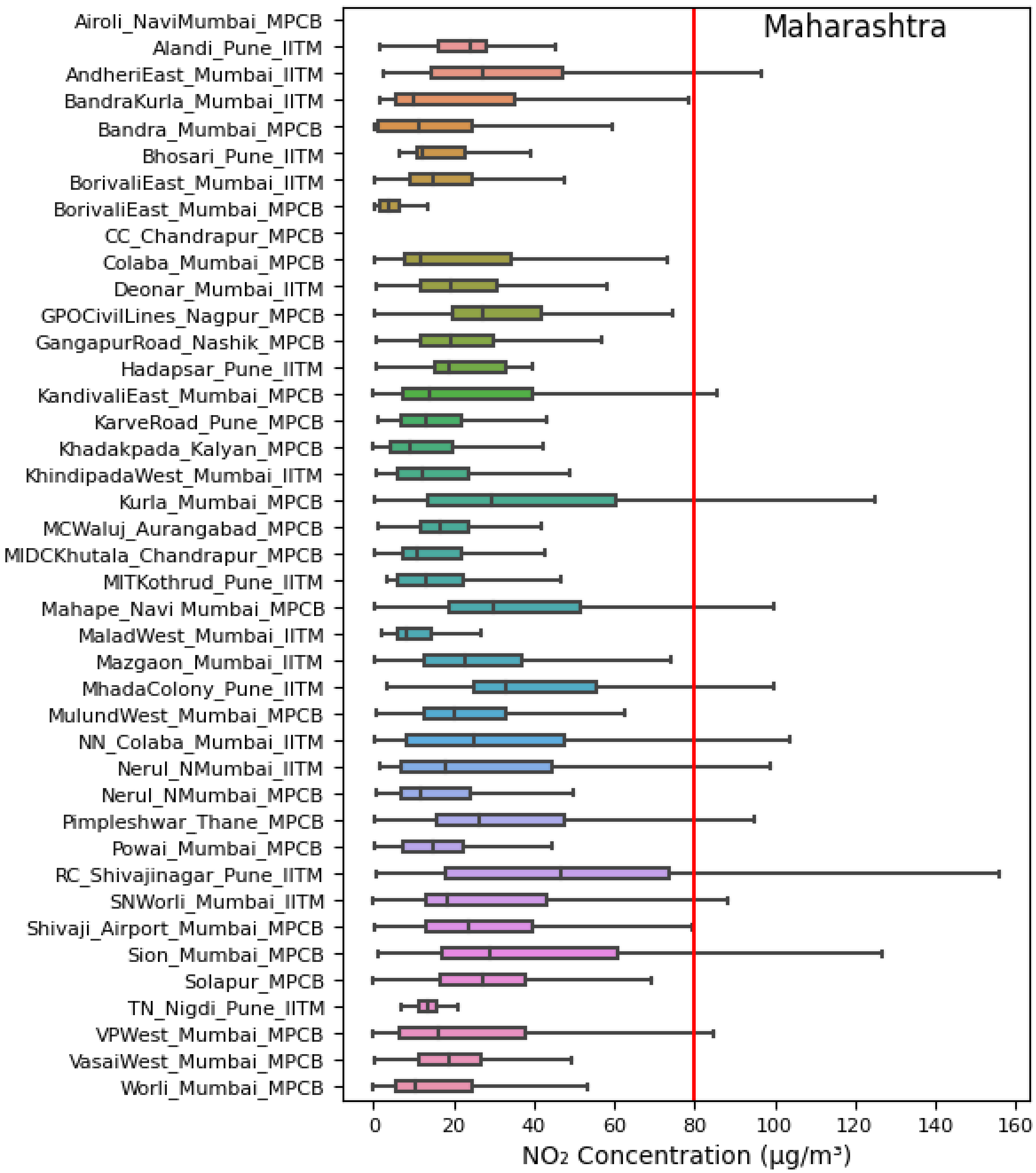

Madhya_Pradesh
Anuppur_Collectorate
Betul_Collector
Bhopal_Collector
Bhopal_Paryavaran
Bhopal_TT_Nagar
Damoh_Shrivastav_Colony
Dewas_Bhopal_Chauraha
Dewas_Govt_MG_Hosp.
Gwalior_City_Center
Gwalior_DD_Nagar
Gwalior_Maharaja_Bada
Gwalior_PhoolBagh
Indore_Airport_Area
Indore_Chhoti_Gwaltoli
Indore_Maguda_Nagar
Indore_Playground
Indore_Redional_Park_Nagar_Nigam
Indore_Regional_Park
Indore_Residence_Area
Indore_Vijay_Nagar
Jabalpur Govindh Bhavan Colony
Jabalpur Marhatal
Jabalpur Suhagi
Jabalpur_Gupteshwar
Katni, Regional Office
Katni_Gole_Bazar
Khandwa, Lok Seva Kendra
Khargone, Nagar Palika
Maihar , Sharda Temple
Mandideep, Sector New Industrial Area
Narsinghpur, District Education Office
Panna, Collectorate
Pithampur, Sector-2 Industrial Area
Ratlam, Shathri Nagar
Rewa, Collector Office
Rewa, Regional Office
Sagar, Collectorate Office
Sagar, Deen Dayal Nagar
Satna, Bandhavgar Colony
Singrauli, Surya Kiran Bhawan Dudhichua
Singrauli, Trauma Centre Waidhan
Ujjain, Mahakaleshwar Temple
0
20
40
60
80
100
NOx Concentration (µg/m³)

Maharashtra

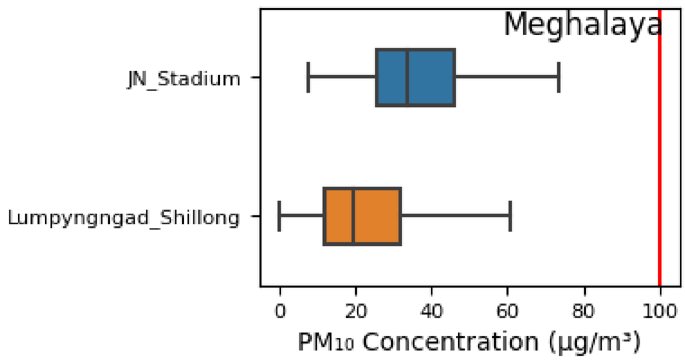


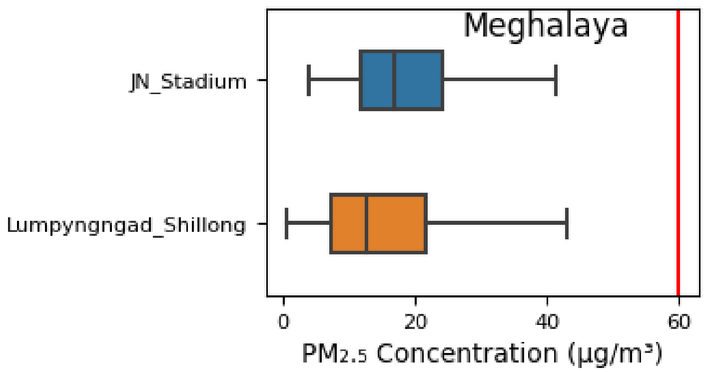

Maharashtra
Airoli_NaviMumbai_MPCB
Alandi_Pune_IITM
AndheriEast_Mumbai_IITM
BandraKurla_Mumbai_IITM
Bandra_Mumbai_MPCB
Bhosari_Pune_IITM
BorivaliEast_Mumbai_IITM
BorivaliEast_Mumbai_MPCB
CC_Chandrapur_MPCB
Colaba_Mumbai_MPCB
Deonar_Mumbai_IITM
GPOCivilLines_Nagpur_MPCB
GangapurRoad_Nashik_MPCB
Hadapsar_Pune_IITM
KandivaliEast_Mumbai_MPCB
KarveRoad_Pune_MPCB
Khadakpada_Kalyan_MPCB
KhindipadaWest_Mumbai_IITM
Kurla_Mumbai_MPCB
MCWaluj_Aurangabad_MPCB
MIDCKhutala_Chandrapur_MPCB
MITKothrud_Pune_IITM
Mahape_Navi Mumbai_MPCB
MaladWest_Mumbai_IITM
Mazgaon_Mumbai_IITM
MhadaColony_Pune_IITM
MulundWest_Mumbai_MPCB
NN_Colaba_Mumbai_IITM
Nerul_NMumbai_IITM
Nerul_NMumbai_MPCB
Pimpleshwar_Thane_MPCB
Powai_Mumbai_MPCB
RC_Shivajinagar_Pune_IITM
SNWorli_Mumbai_IITM
Shivaji_Airport_Mumbai_MPCB
Sion_Mumbai_MPCB
Solapur_MPCB
TN_Nigdi_Pune_IITM
VPWest_Mumbai_MPCB
VasaiWest_Mumbai_MPCB
Worli_Mumbai_MPCB
0
50
100
150
200
250
PM2.5 Concentration (µg/m³)

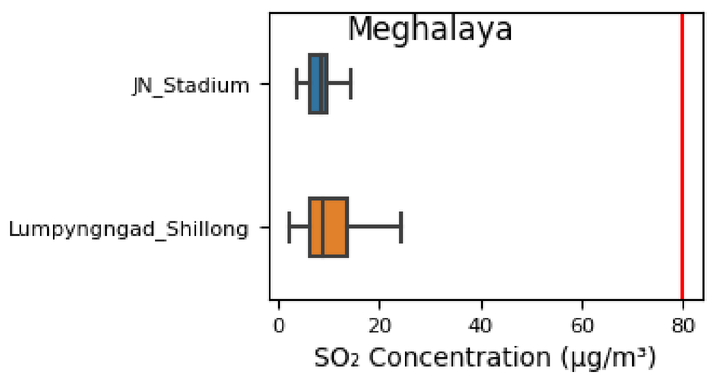

Maharashtra
Airoli_NaviMumbai_MPCB
Alandi_Pune_IITM
AndheriEast_Mumbai_IITM
BandraKurla_Mumbai_IITM
Bandra_Mumbai_MPCB
Bhosari_Pune_IITM
BorivaliEast_Mumbai_IITM
BorivaliEast_Mumbai_MPCB
CC_Chandrapur_MPCB
Colaba_Mumbai_MPCB
Deonar_Mumbai_IITM
GPOCivilLines_Nagpur_MPCB
GangapurRoad_Nashik_MPCB
Hadapsar_Pune_IITM
KandivaliEast_Mumbai_MPCB
KarveRoad_Pune_MPCB
Khadakpada_Kalyan_MPCB
KhindipadaWest_Mumbai_IITM
Kurla_Mumbai_MPCB
MCWaluj_Aurangabad_MPCB
MIDCKhutala_Chandrapur_MPCB
MITKothrud_Pune_IITM
Mahape_Navi Mumbai_MPCB
MaladWest_Mumbai_IITM
Mazgaon_Mumbai_IITM
MhadaColony_Pune_IITM
MulundWest_Mumbai_MPCB
NN_Colaba_Mumbai_IITM
Nerul_NMumbai_IITM
Nerul_NMumbai_MPCB
Pimpleshwar_Thane_MPCB
Powai_Mumbai_MPCB
RC_Shivajinagar_Pune_IITM
SNWorli_Mumbai_IITM
Shivaji_Airport_Mumbai_MPCB
Sion_Mumbai_MPCB
Solapur_MPCB
TN_Nigdi_Pune_IITM
VPWest_Mumbai_MPCB
VasaiWest_Mumbai_MPCB
Worli_Mumbai_MPCB
0
25
50
75
100
125
150
175
SO₂ Concentration (µg/m³)

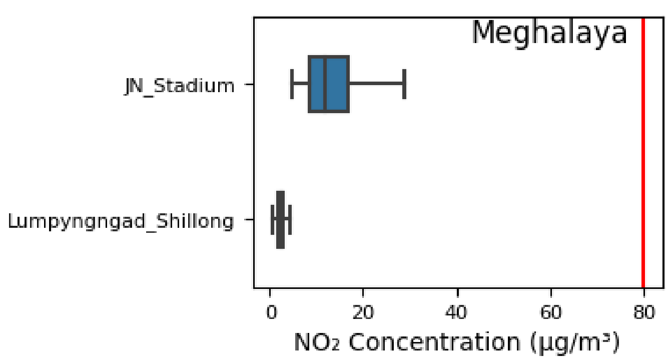

Maharashtra
Airoli_NaviMumbai_MPCB
Alandi_Pune_IITM
AndheriEast_Mumbai_IITM
BandraKurla_Mumbai_IITM
Bandra_Mumbai_MPCB
Bhosari_Pune_IITM
BorivaliEast_Mumbai_IITM
BorivaliEast_Mumbai_MPCB
CC_Chandrapur_MPCB
Colaba_Mumbai_MPCB
Deonar_Mumbai_IITM
GPOCivilLines_Nagpur_MPCB
GangapurRoad_Nashik_MPCB
Hadapsar_Pune_IITM
KandivaliEast_Mumbai_MPCB
KarveRoad_Pune_MPCB
Khadakpada_Kalyan_MPCB
KhindipadaWest_Mumbai_IITM
Kurla_Mumbai_MPCB
MCWaluj_Aurangabad_MPCB
MIDCKhutala_Chandrapur_MPCB
MITKothrud_Pune_IITM
Mahape_Navi Mumbai_MPCB
MaladWest_Mumbai_IITM
Mazgaon_Mumbai_IITM
MhadaColony_Pune_IITM
MulundWest_Mumbai_MPCB
NN_Colaba_Mumbai_IITM
Nerul_NMumbai_IITM
Nerul_NMumbai_MPCB
Pimpleshwar_Thane_MPCB
Powai_Mumbai_MPCB
RC_Shivajinagar_Pune_IITM
SNWorli_Mumbai_IITM
Shivaji_Airport_Mumbai_MPCB
Sion_Mumbai_MPCB
Solapur_MPCB
TN_Nigdi_Pune_IITM
VPWest_Mumbai_MPCB
VasaiWest_Mumbai_MPCB
Worli_Mumbai_MPCB
0
20
40
60
80
100
120
140
160
NO_2 Concentration (µg/m³)

Meghalaya

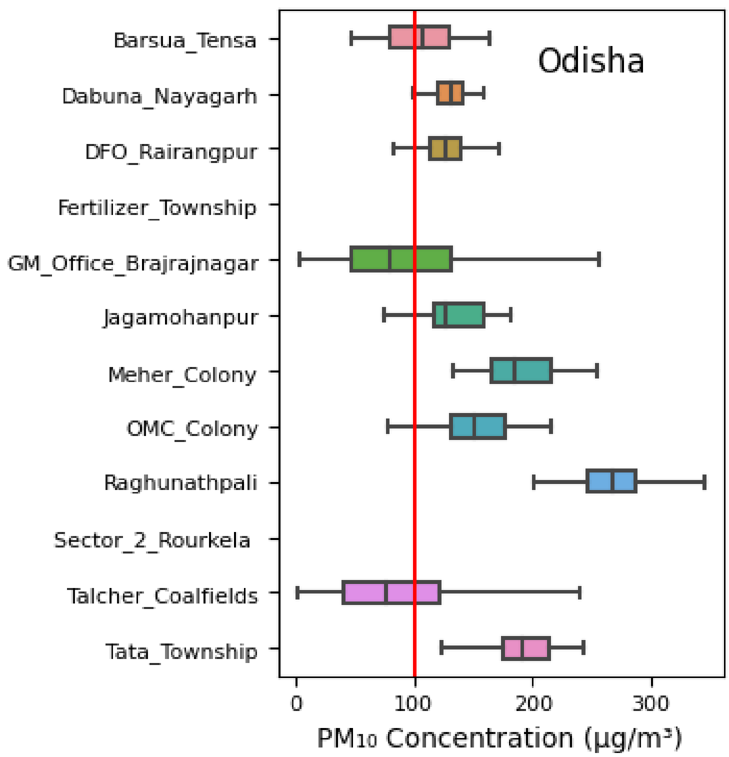

Meghalaya
JN_Stadium
Lumpyngngad_Shillong
0
20
40
60
80
100
PM10 Concentration (μg/m³)

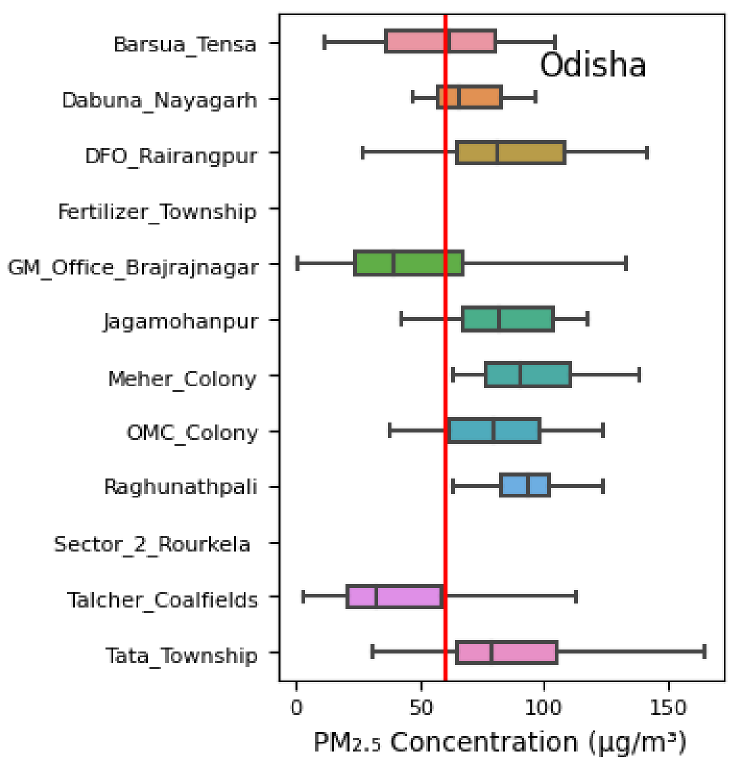

Meghalaya
JN_Stadium
Lumpyngngad_Shillong
0
20
40
60
PM2.5 Concentration (μg/m³)

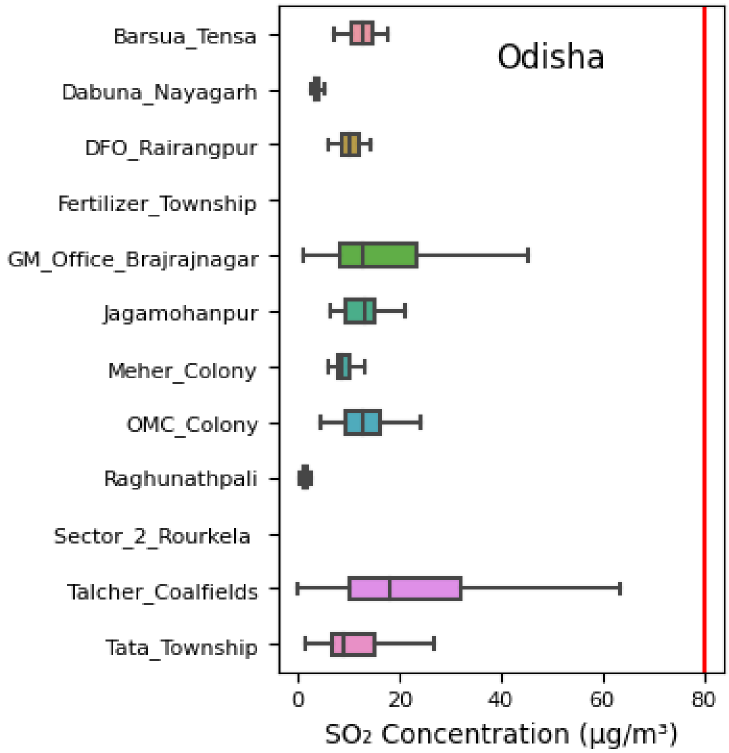

Meghalaya
JN_Stadium
Lumpyngngad_Shillong
0
20
40
60
80
SO2 Concentration (μg/m³)

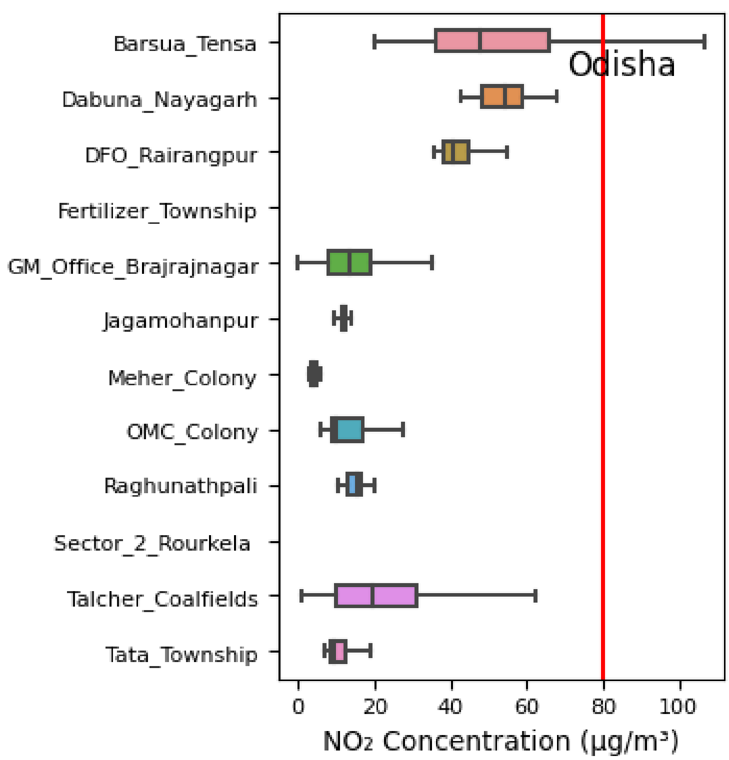

Meghalaya
JN_Stadium
Lumpyngngad_Shillong
0
20
40
60
80
NO2 Concentration (μg/m³)

Odisha

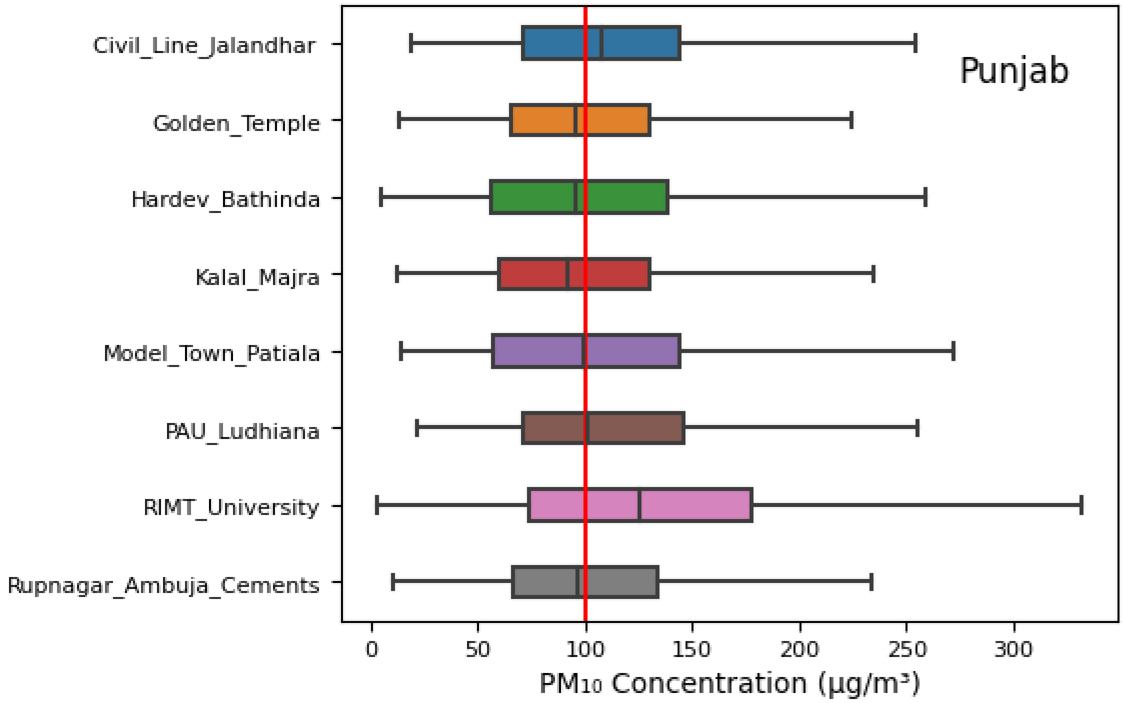

Odisha
Barsua_Tensa
Dabuna_Nayagarh
DFO_Rairangpur
Fertilizer_Township
GM_Office_Brajrajnagar
Jagamohanpur
Meher_Colony
OMC_Colony
Raghunathpali
Sector_2_Rourkela
Talcher_Coalfields
Tata_Township
0
100
200
300
PM10 Concentration (µg/m³)

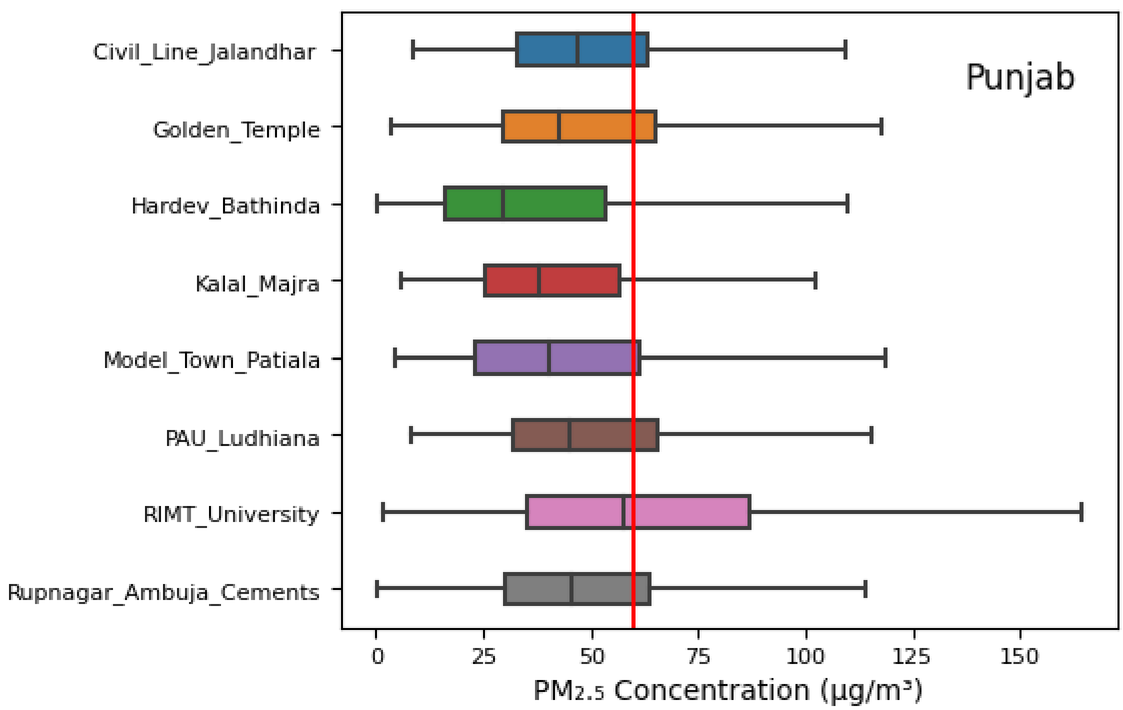

Odisha
Barsua_Tensa
Dabuna_Nayagarh
DFO_Rairangpur
Fertilizer_Township
GM_Office_Brajrajnagar
Jagamohanpur
Meher_Colony
OMC_Colony
Raghunathpali
Sector_2_Rourkela
Talcher_Coalfields
Tata_Township
0
50
100
150
PM2.5 Concentration (µg/m³)

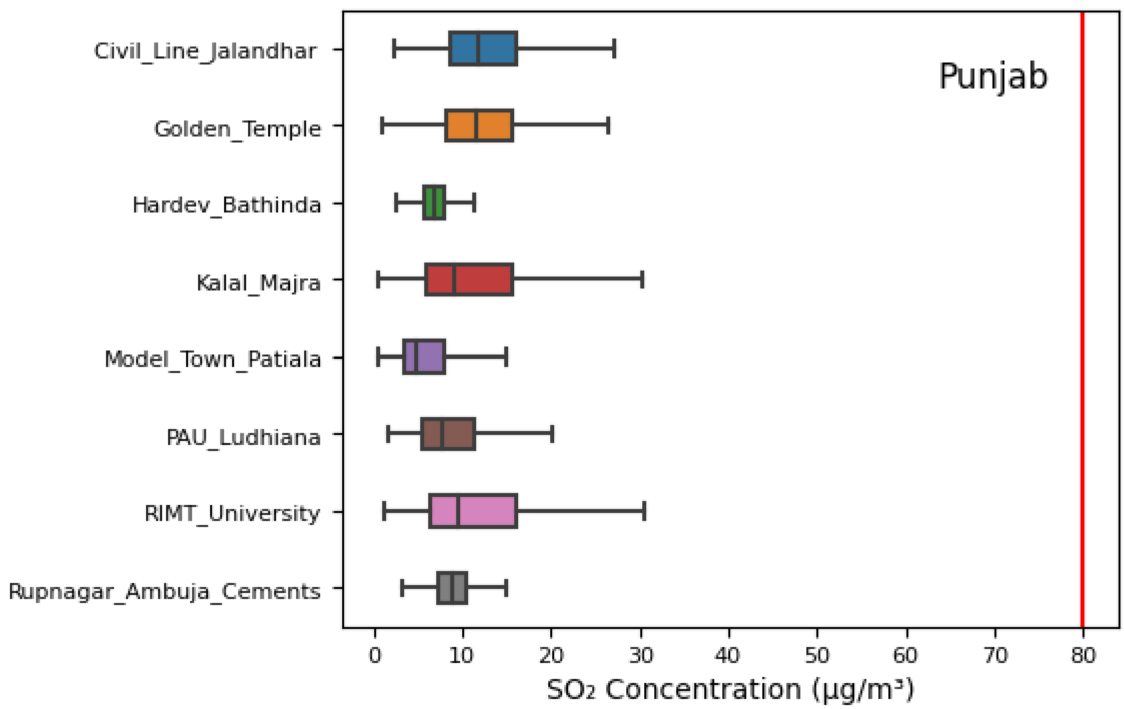

Odisha
Barsua_Tensa
Dabuna_Nayagarh
DFO_Rairangpur
Fertilizer_Township
GM_Office_Brajrajnagar
Jagamohanpur
Meher_Colony
OMC_Colony
Raghunathpali
Sector_2_Rourkela
Talcher_Coalfields
Tata_Township
0
20
40
60
80
SO₂ Concentration (µg/m³)

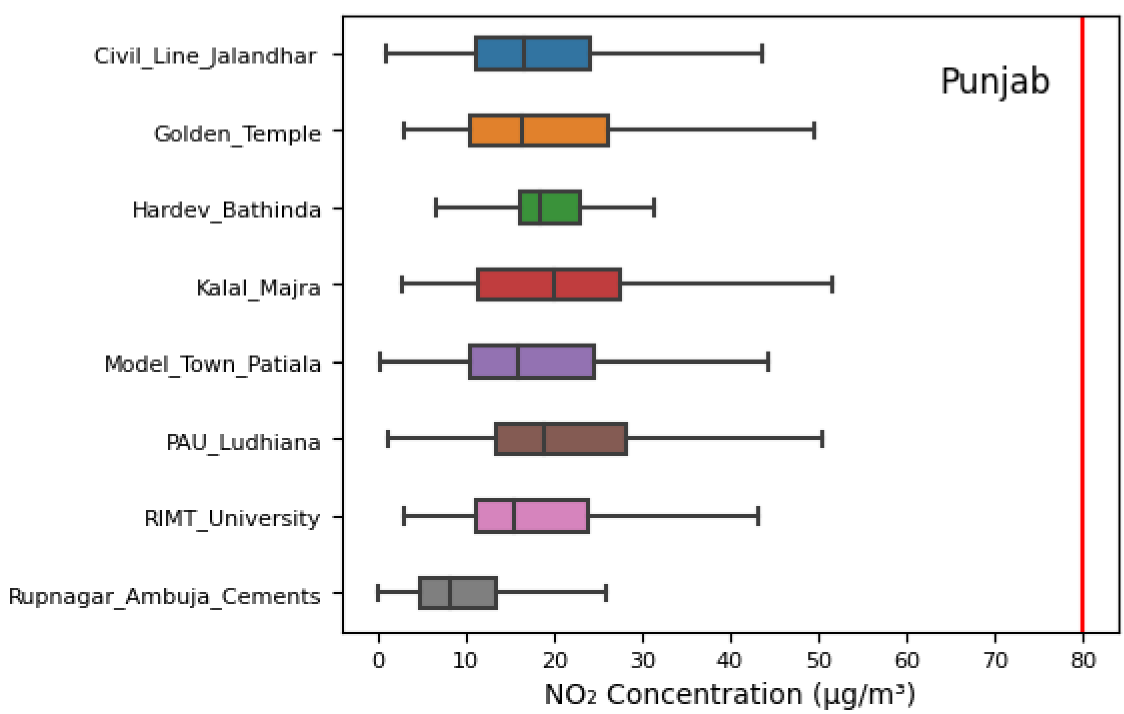

Odisha
Barsua_Tensa
Dabuna_Nayagarh
DFO_Rairangpur
Fertilizer_Township
GM_Office_Brajrajnagar
Jagamohanpur
Meher_Colony
OMC_Colony
Raghunathpali
Sector_2_Rourkela
Talcher_Coalfields
Tata_Township
0
20
40
60
80
100
NO₂ Concentration (µg/m³)

Punjab

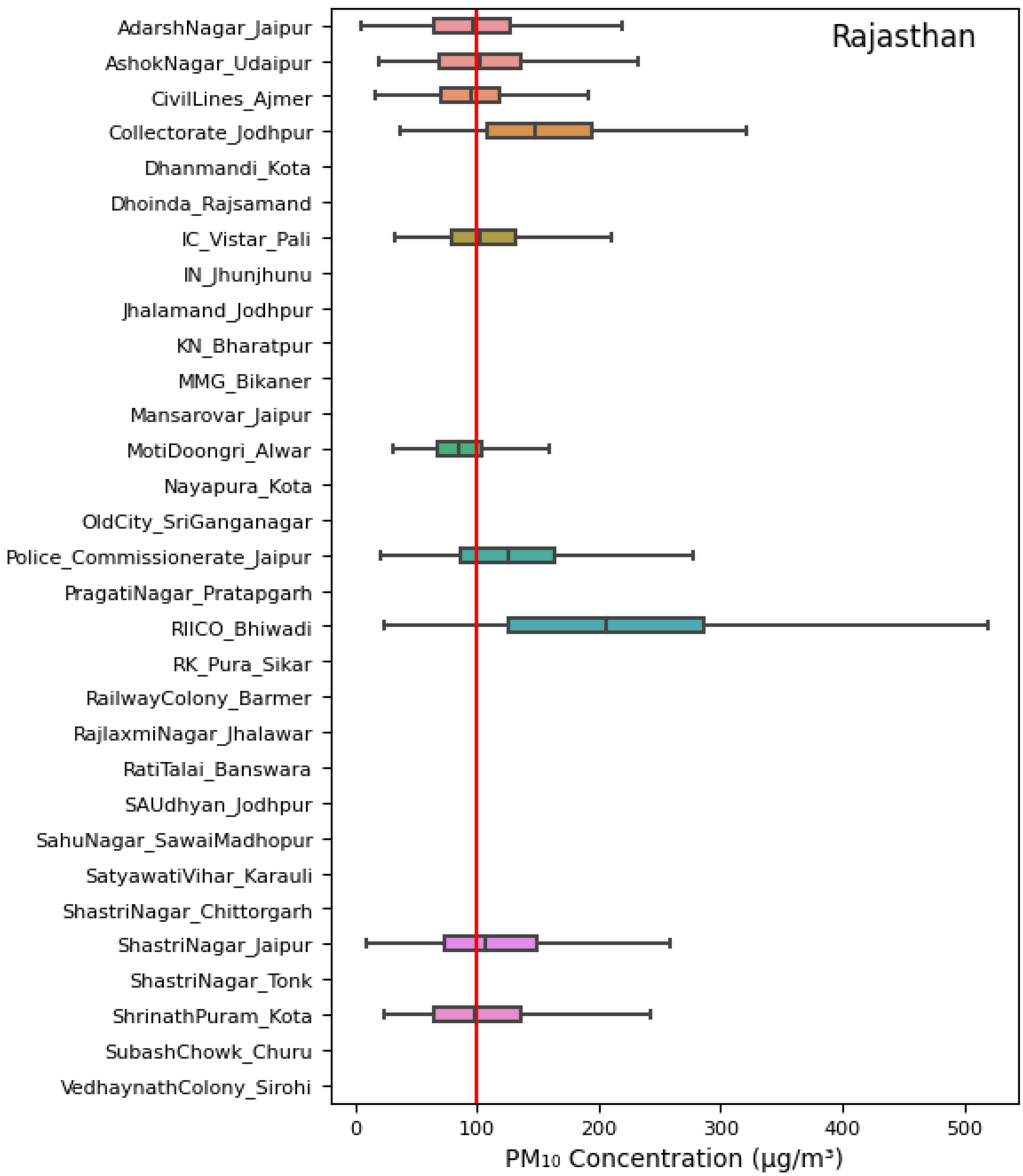

Civil_Line_Jalandhar
Golden_Temple
Hardev_Bathinda
Kalal_Majra
Model_Town_Patiala
PAU_Ludhiana
RIMT_University
Rupnagar_Ambuja_Cements
Punjab
0
50
100
150
200
250
300
PM10 Concentration (µg/m³)

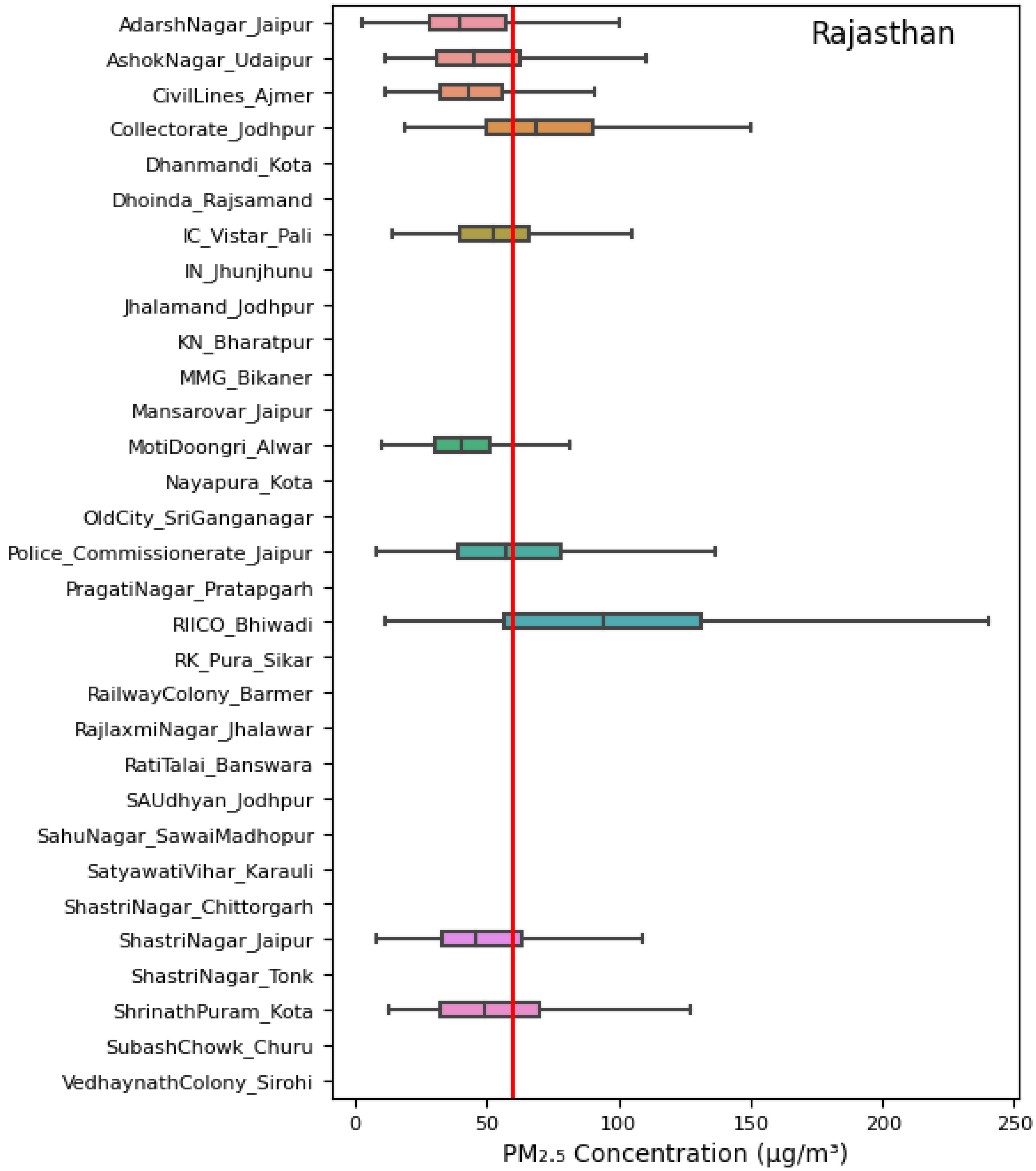

Civil_Line_Jalandhar
Golden_Temple
Hardev_Bathinda
Kalal_Majra
Model_Town_Patiala
PAU_Ludhiana
RIMT_University
Rupnagar_Ambuja_Cements
Punjab
0
25
50
75
100
125
150
PM2.5 Concentration (µg/m³)

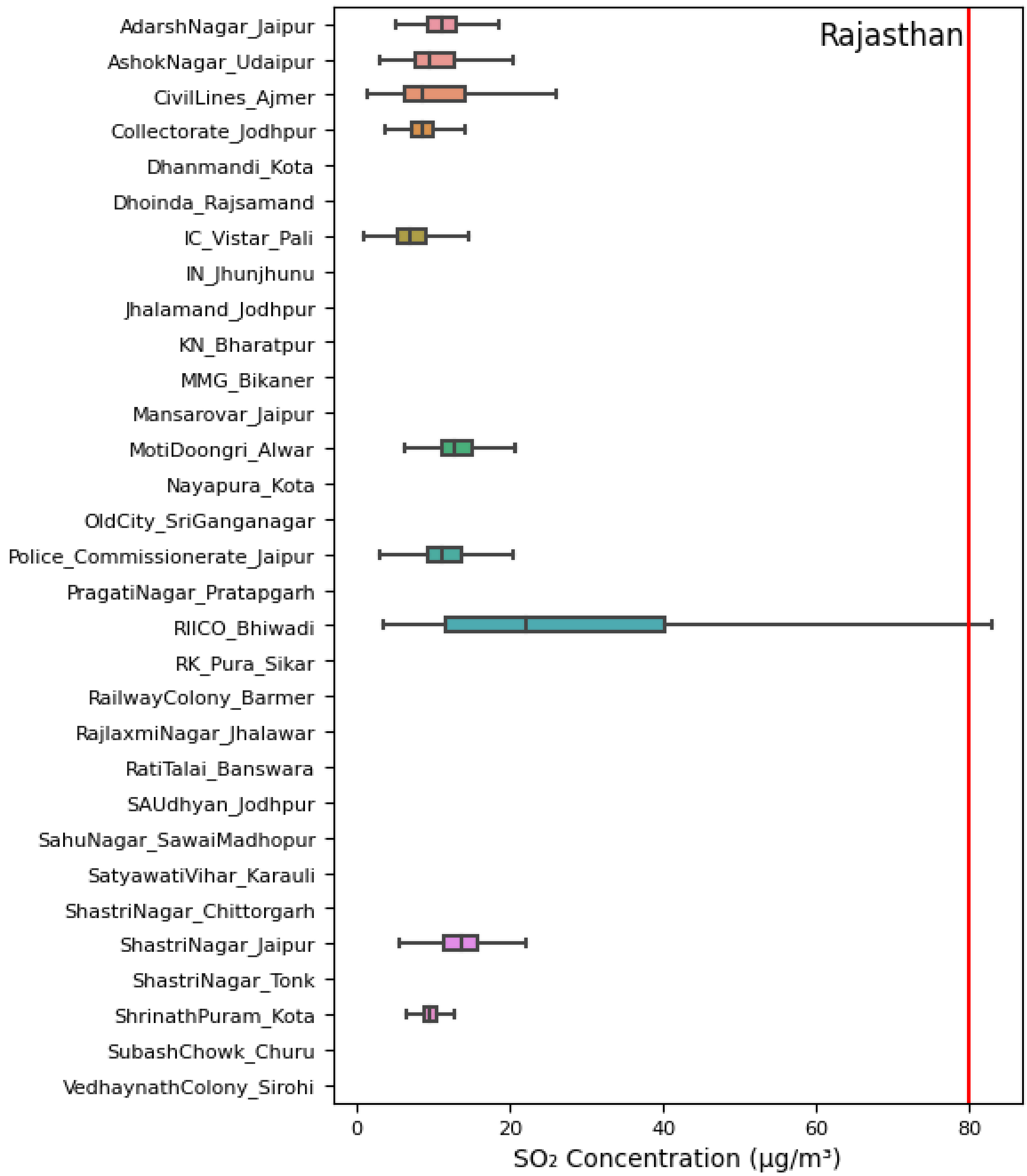

Punjab
Civil_Line_Jalandhar
Golden_Temple
Hardev_Bathinda
Kalal_Majra
Model_Town_Patiala
PAU_Ludhiana
RIMT_University
Rupnagar_Ambuja_Cements
0
10
20
30
40
50
60
70
80
SO₂ Concentration (µg/m³)

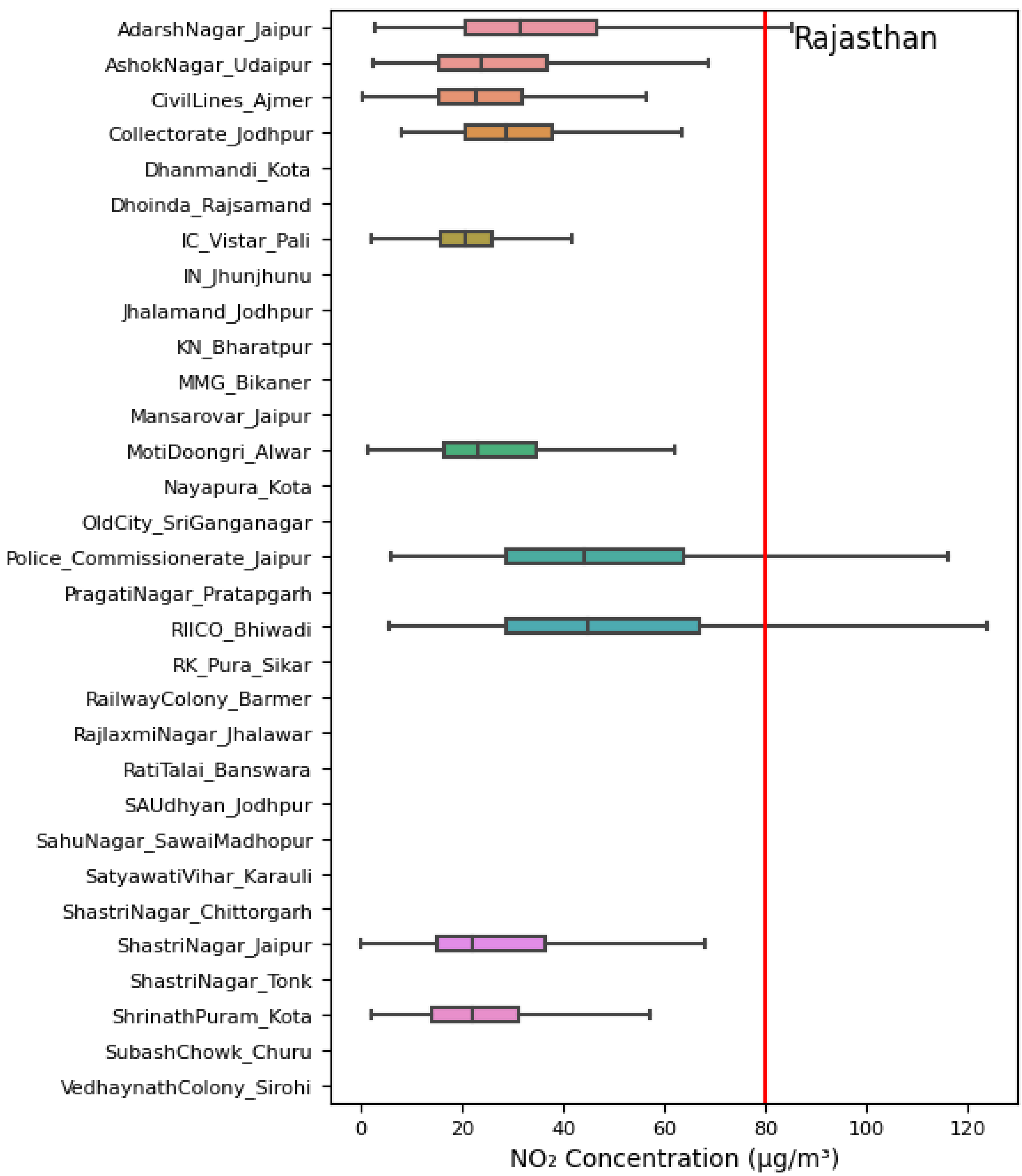

Punjab
Civil_Line_Jalandhar
Golden_Temple
Hardev_Bathinda
Kalal_Majra
Model_Town_Patiala
PAU_Ludhiana
RIMT_University
Rupnagar_Ambuja_Cements
0
10
20
30
40
50
60
70
80
NO₂ Concentration (µg/m³)

Rajasthan

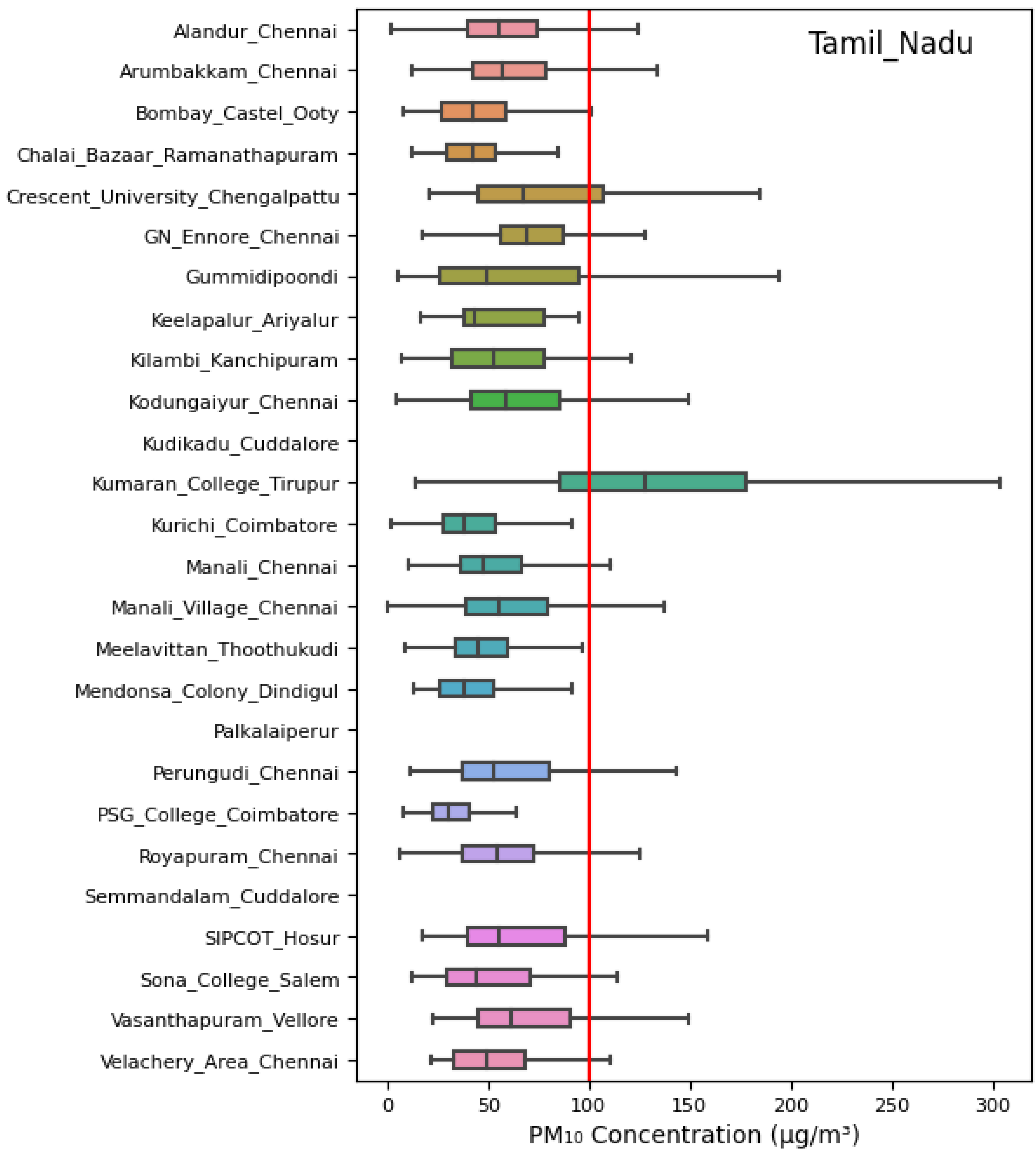

Rajasthan
AdarshNagar_Jaipur
AshokNagar_Udaipur
CivilLines_Ajmer
Collectorate_Jodhpur
Dhanmandi_Kota
Dhoinda_Rajsamand
IC_Vistar_Pali
IN_Jhunjhunu
Jhalamand_Jodhpur
KN_Bharatpur
MMG_Bikaner
Mansarovar_Jaipur
MotiDoongri_Alwar
Nayapura_Kota
OldCity_SriGanganagar
Police_Commissionerate_Jaipur
PragatiNagar_Pratapgarh
RIICO_Bhiwadi
RK_Pura_Sikar
RailwayColony_Barmer
RajlaxmiNagar_Jhalawar
RatiTalai_Banswara
SAUdhyan_Jodhpur
SahuNagar_SawaiMadhopur
SatyawatiVihar_Karauli
ShastriNagar_Chittorgarh
ShastriNagar_Jaipur
ShastriNagar_Tonk
ShrinathPuram_Kota
SubashChowk_Churu
VedhaynathColony_Sirohi
0
100
200
300
400
500
PM10 Concentration (µg/m³)

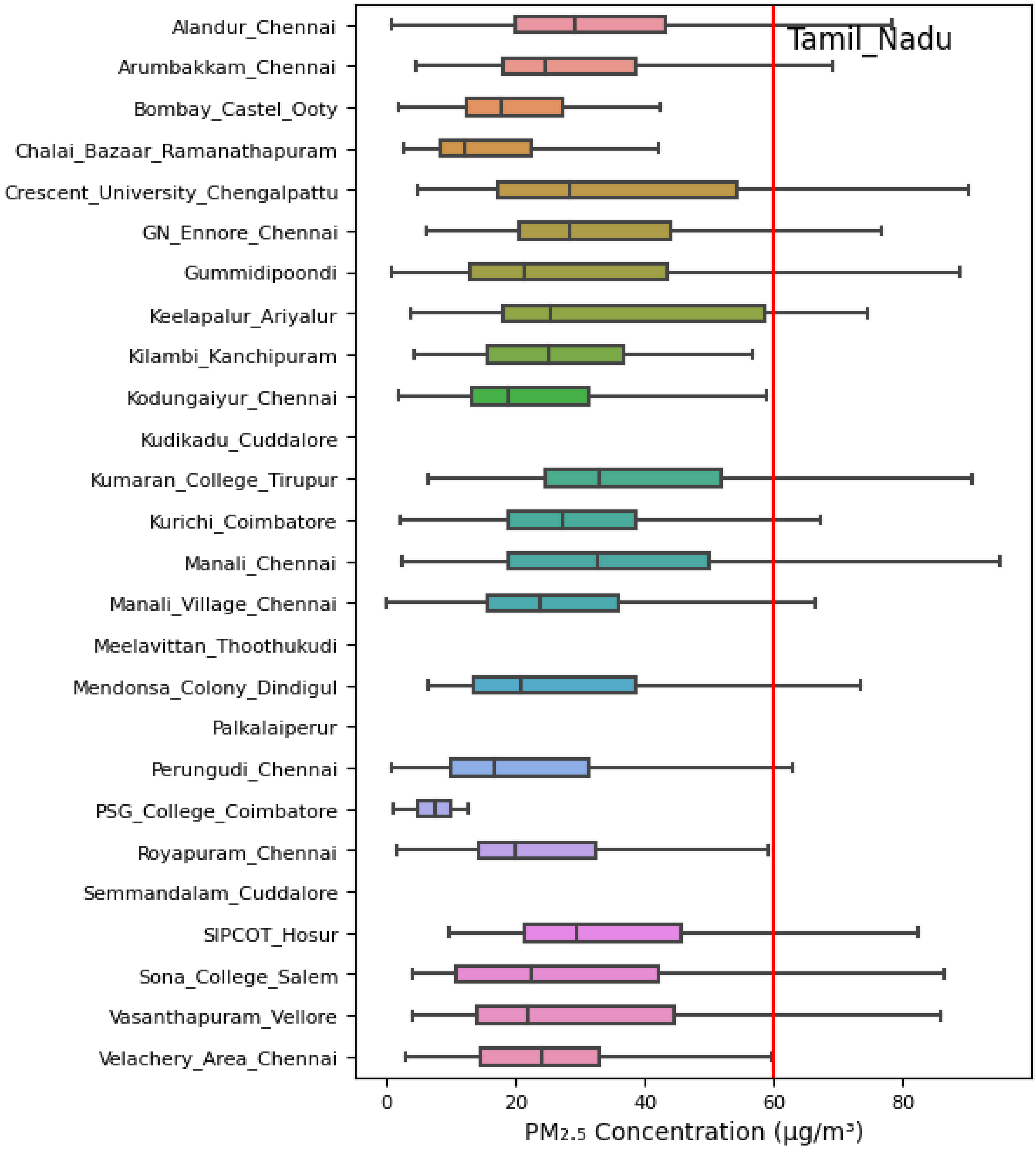

Rajasthan
AdarshNagar_Jaipur
AshokNagar_Udaipur
CivilLines_Ajmer
Collectorate_Jodhpur
Dhanmandi_Kota
Dhoinda_Rajsamand
IC_Vistar_Pali
IN_Jhunjhunu
Jhalamand_Jodhpur
KN_Bharatpur
MMG_Bikaner
Mansarovar_Jaipur
MotiDoongri_Alwar
Nayapura_Kota
OldCity_SriGanganagar
Police_Commissionerate_Jaipur
PragatiNagar_Pratapgarh
RIICO_Bhiwadi
RK_Pura_Sikar
RailwayColony_Barmer
RajlaxmiNagar_Jhalawar
RatiTalai_Banswara
SAUdhyan_Jodhpur
SahuNagar_SawaiMadhopur
SatyawatiVihar_Karauli
ShastriNagar_Chittorgarh
ShastriNagar_Jaipur
ShastriNagar_Tonk
ShrinathPuram_Kota
SubashChowk_Churu
VedhaynathColony_Sirohi
0
50
100
150
200
250
$PM_{2.5}$ Concentration (µg/m³)

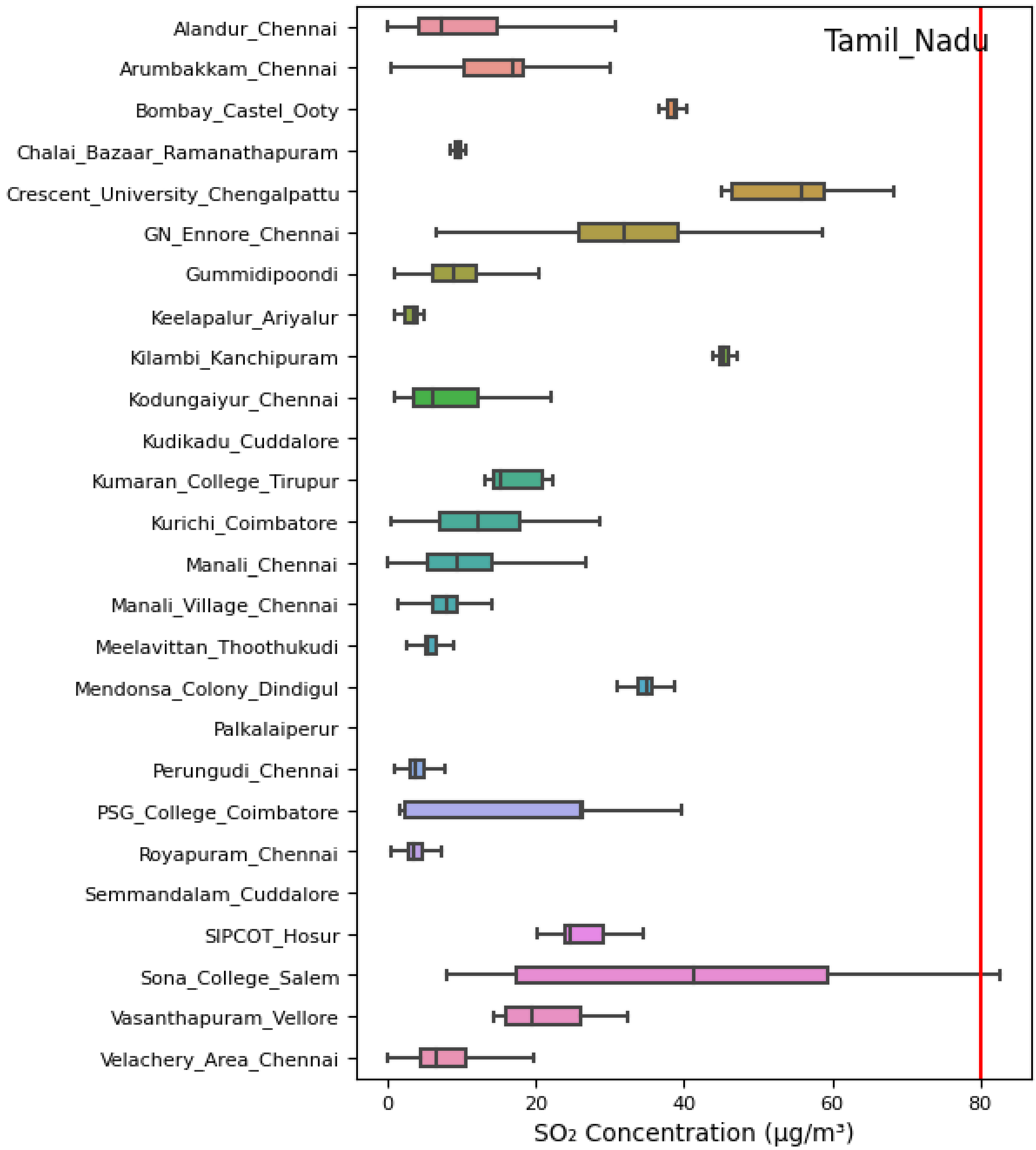

Rajasthan
AdarshNagar_Jaipur
AshokNagar_Udaipur
CivilLines_Ajmer
Collectorate_Jodhpur
Dhanmandi_Kota
Dhoinda_Rajsamand
IC_Vistar_Pali
IN_Jhunjhunu
Jhalamand_Jodhpur
KN_Bharatpur
MMG_Bikaner
Mansarovar_Jaipur
MotiDoongri_Alwar
Nayapura_Kota
OldCity_SriGanganagar
Police_Commissionerate_Jaipur
PragatiNagar_Pratapgarh
RIICO_Bhiwadi
RK_Pura_Sikar
RailwayColony_Barmer
RajlaxmiNagar_Jhalawar
RatiTalai_Banswara
SAUdhyan_Jodhpur
SahuNagar_SawaiMadhopur
SatyawatiVihar_Karauli
ShastriNagar_Chittorgarh
ShastriNagar_Jaipur
ShastriNagar_Tonk
ShrinathPuram_Kota
SubashChowk_Churu
VedhaynathColony_Sirohi
0
20
40
60
80
SO₂ Concentration (µg/m³)

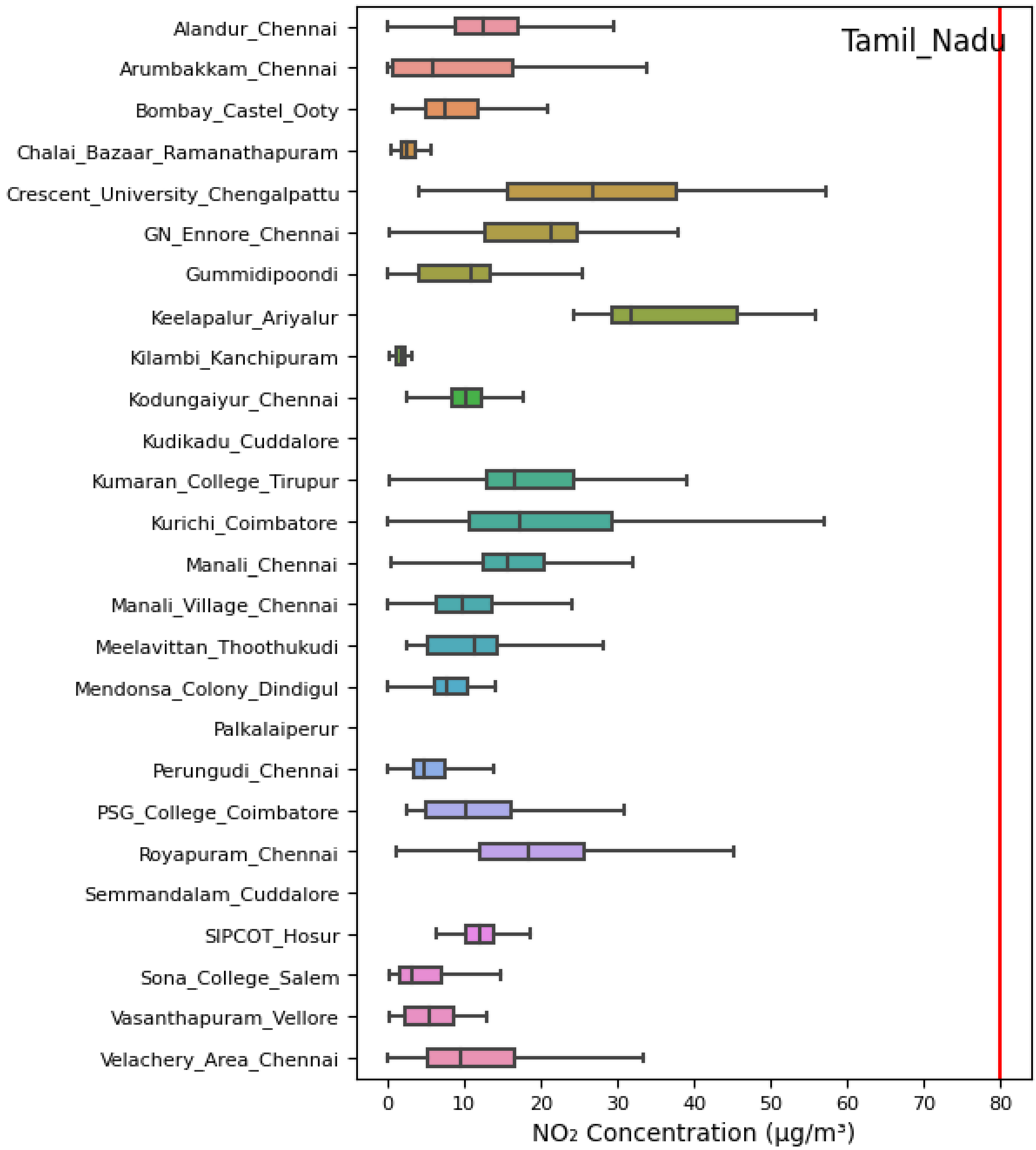

Rajasthan
AdarshNagar_Jaipur
AshokNagar_Udaipur
CivilLines_Ajmer
Collectorate_Jodhpur
Dhanmandi_Kota
Dhoinda_Rajsamand
IC_Vistar_Pali
IN_Jhunjhunu
Jhalamand_Jodhpur
KN_Bharatpur
MMG_Bikaner
Mansarovar_Jaipur
MotiDoongri_Alwar
Nayapura_Kota
OldCity_SriGanganagar
Police_Commissionerate_Jaipur
PragatiNagar_Pratapgarh
RIICO_Bhiwadi
RK_Pura_Sikar
RailwayColony_Barmer
RajlaxmiNagar_Jhalawar
RatiTalai_Banswara
SAUdhyan_Jodhpur
SahuNagar_SawaiMadhopur
SatyawatiVihar_Karauli
ShastriNagar_Chittorgarh
ShastriNagar_Jaipur
ShastriNagar_Tonk
ShrinathPuram_Kota
SubashChowk_Churu
VedhaynathColony_Sirohi
0
20
40
60
80
100
120
NO_2 Concentration (µg/m³)

Tamil Nadu

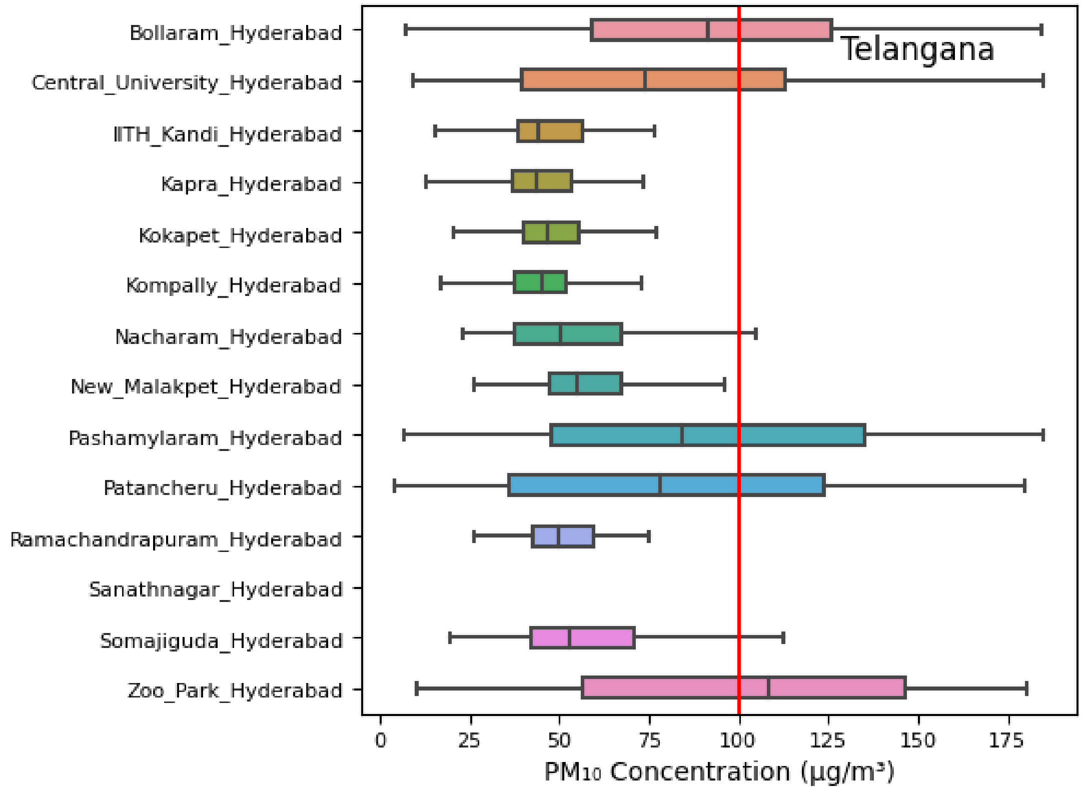

Tamil_Nadu
Alandur_Chennai
Arumbakkam_Chennai
Bombay_Castel_Ooty
Chalai_Bazaar_Ramanathapuram
Crescent_University_Chengalpattu
GN_Ennore_Chennai
Gummidipoondi
Keelapalur_Ariyalur
Kilambi_Kanchipuram
Kodungaiyur_Chennai
Kudikadu_Cuddalore
Kumaran_College_Tirupur
Kurichi_Coimbatore
Manali_Chennai
Manali_Village_Chennai
Meelavittan_Thoothukudi
Mendonsa_Colony_Dindigul
Palkalaiperur
Perungudi_Chennai
PSG_College_Coimbatore
Royapuram_Chennai
Semmandalam_Cuddalore
SIPCOT_Hosur
Sona_College_Salem
Vasanthapuram_Vellore
Velachery_Area_Chennai
0
50
100
150
200
250
300
PM10 Concentration (µg/m³)

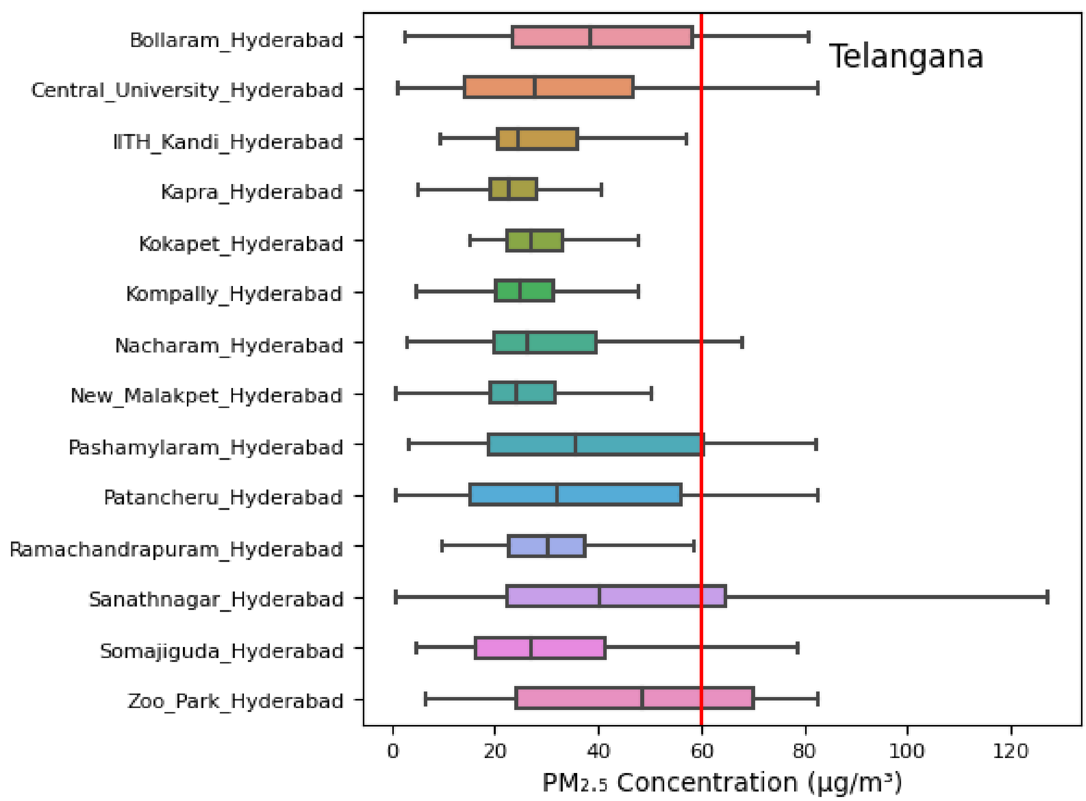

Tamil_Nadu
Alandur_Chennai
Arumbakkam_Chennai
Bombay_Castel_Ooty
Chalai_Bazaar_Ramanathapuram
Crescent_University_Chengalpattu
GN_Ennore_Chennai
Gummidipoondi
Keelapalur_Ariyalur
Kilambi_Kanchipuram
Kodungaiyur_Chennai
Kudikadu_Cuddalore
Kumaran_College_Tirupur
Kurichi_Coimbatore
Manali_Chennai
Manali_Village_Chennai
Meelavittan_Thoothukudi
Mendonsa_Colony_Dindigul
Palkalaiperur
Perungudi_Chennai
PSG_College_Coimbatore
Royapuram_Chennai
Semmandalam_Cuddalore
SIPCOT_Hosur
Sona_College_Salem
Vasanthapuram_Vellore
Velachery_Area_Chennai
0
20
40
60
80
PM2.5 Concentration (µg/m³)

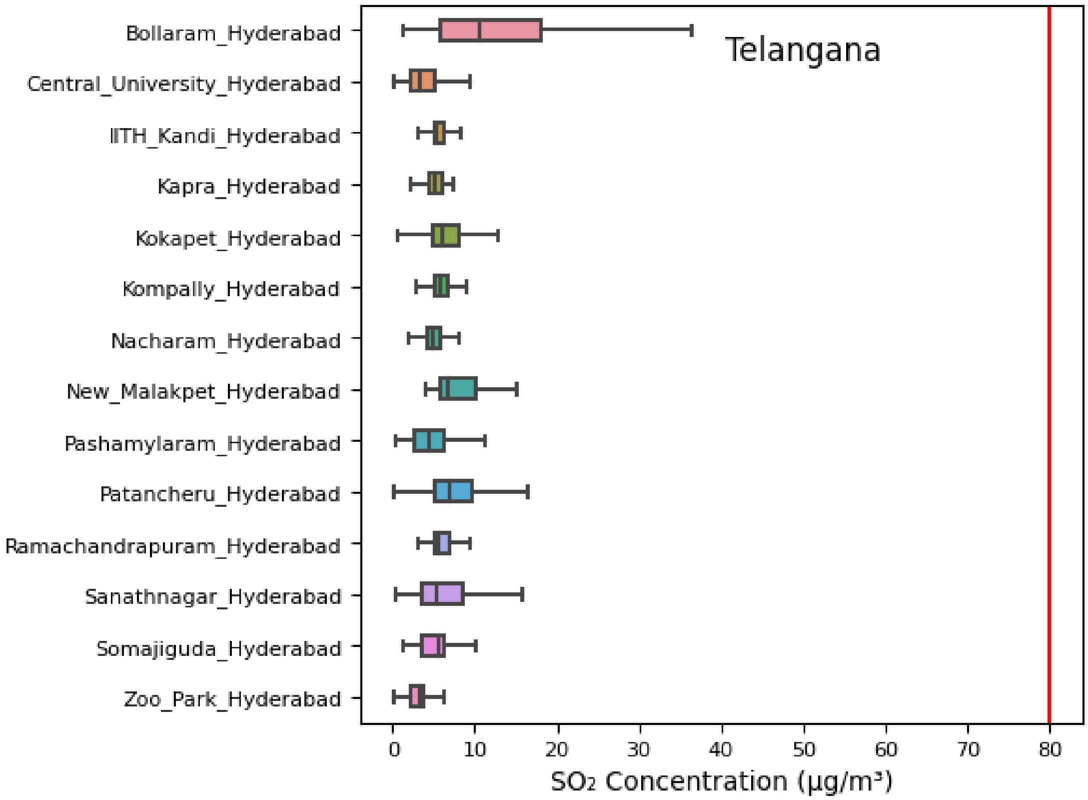

Tamil_Nadu
Alandur_Chennai
Arumbakkam_Chennai
Bombay_Castel_Ooty
Chalai_Bazaar_Ramanathapuram
Crescent_University_Chengalpattu
GN_Ennore_Chennai
Gummidipoondi
Keelapalur_Ariyalur
Kilambi_Kanchipuram
Kodungaiyur_Chennai
Kudikadu_Cuddalore
Kumaran_College_Tirupur
Kurichi_Coimbatore
Manali_Chennai
Manali_Village_Chennai
Meelavittan_Thoothukudi
Mendonsa_Colony_Dindigul
Palkalaiperur
Perungudi_Chennai
PSG_College_Coimbatore
Royapuram_Chennai
Semmandalam_Cuddalore
SIPCOT_Hosur
Sona_College_Salem
Vasanthapuram_Vellore
Velachery_Area_Chennai
0
20
40
60
80
SO₂ Concentration (µg/m³)

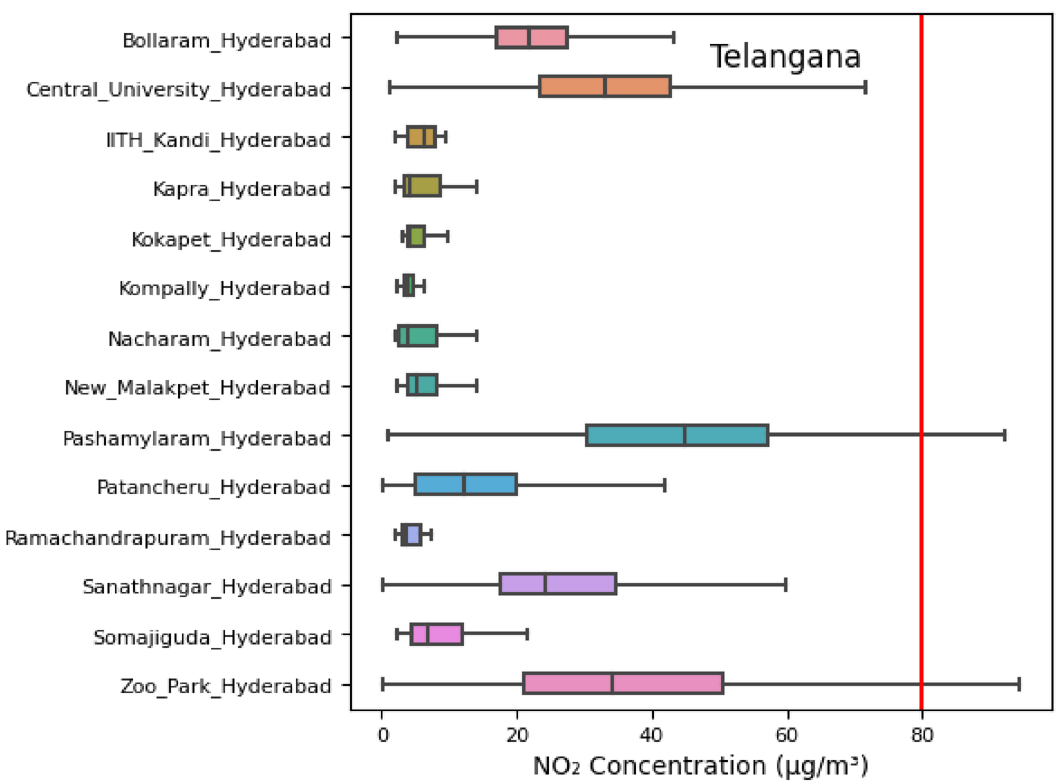

Tamil_Nadu
Alandur_Chennai
Arumbakkam_Chennai
Bombay_Castel_Ooty
Chalai_Bazaar_Ramanathapuram
Crescent_University_Chengalpattu
GN_Ennore_Chennai
Gummidipoondi
Keelapalur_Ariyalur
Kilambi_Kanchipuram
Kodungaiyur_Chennai
Kudikadu_Cuddalore
Kumaran_College_Tirupur
Kurichi_Coimbatore
Manali_Chennai
Manali_Village_Chennai
Meelavittan_Thoothukudi
Mendonsa_Colony_Dindigul
Palkalaiperur
Perungudi_Chennai
PSG_College_Coimbatore
Royapuram_Chennai
Semmandalam_Cuddalore
SIPCOT_Hosur
Sona_College_Salem
Vasanthapuram_Vellore
Velachery_Area_Chennai
0
10
20
30
40
50
60
70
80
NO₂ Concentration (µg/m³)

Telangana

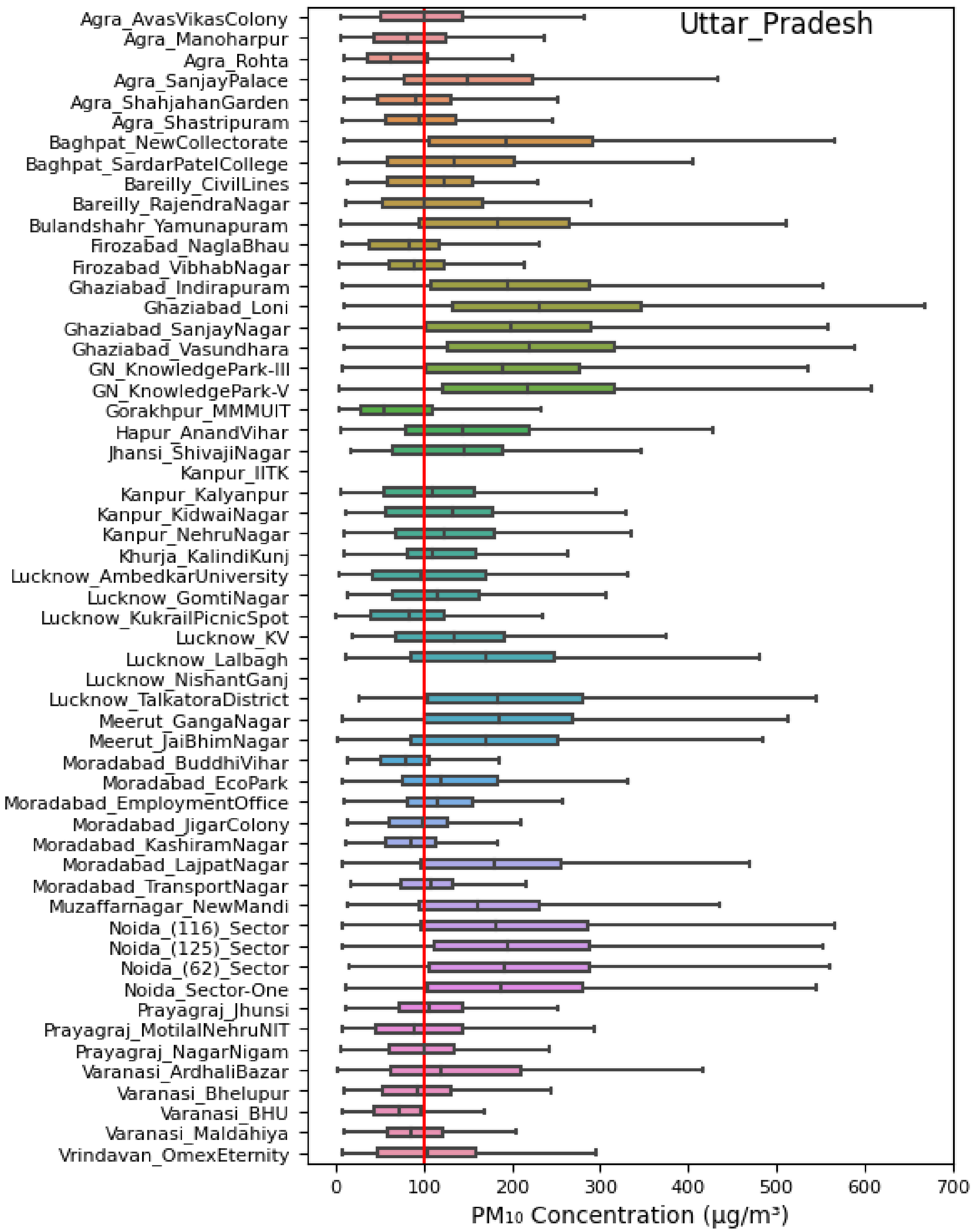

Telangana
Bollaram_Hyderabad
Central_University_Hyderabad
IITH_Kandi_Hyderabad
Kapra_Hyderabad
Kokapet_Hyderabad
Kompally_Hyderabad
Nacharam_Hyderabad
New_Malakpet_Hyderabad
Pashamylaram_Hyderabad
Patancheru_Hyderabad
Ramachandrapuram_Hyderabad
Sanathnagar_Hyderabad
Somajiguda_Hyderabad
Zoo_Park_Hyderabad
0 25 50 75 100 125 150 175
PM10 Concentration (µg/m³)

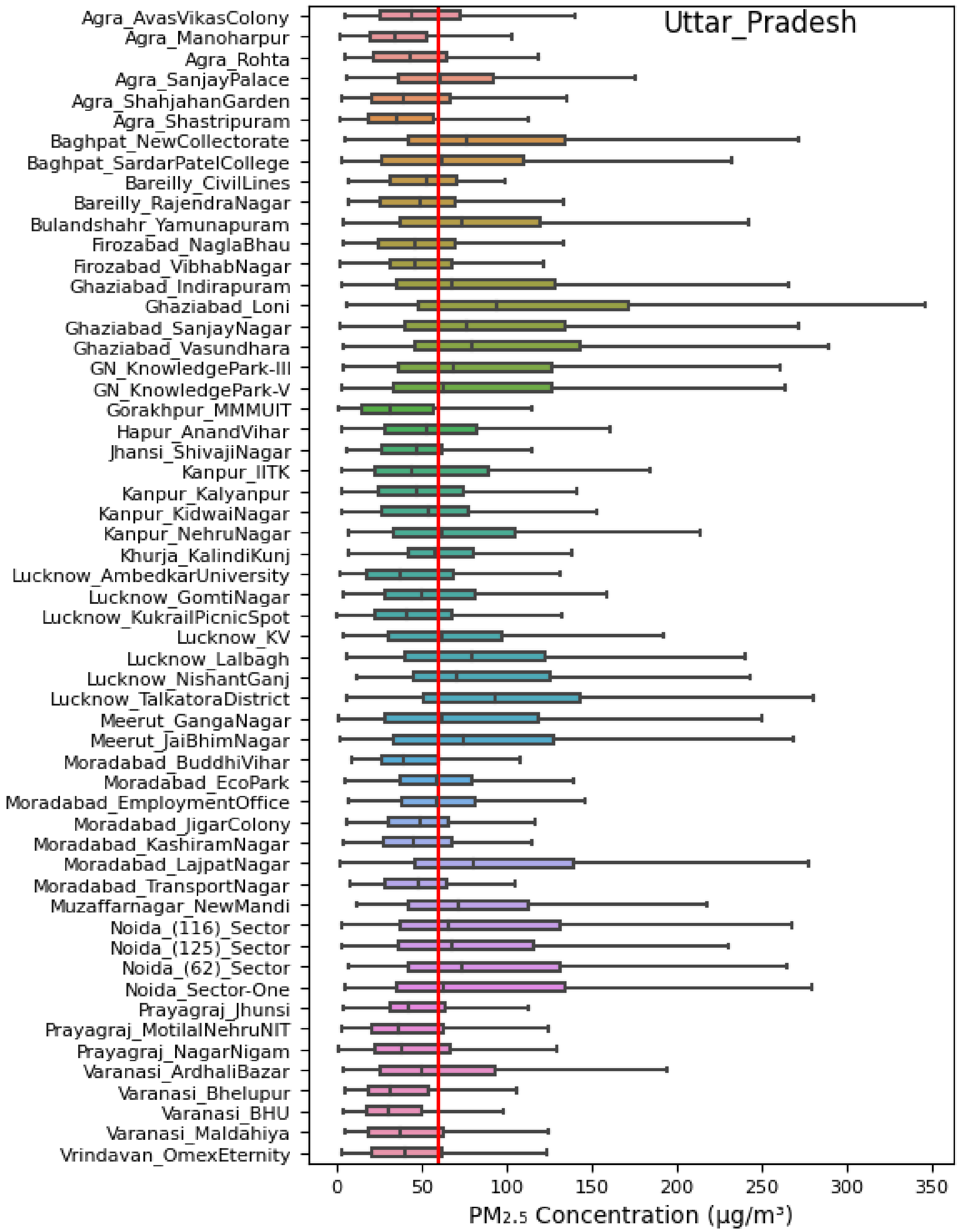

Telangana
Bollaram_Hyderabad
Central_University_Hyderabad
IITH_Kandi_Hyderabad
Kapra_Hyderabad
Kokapet_Hyderabad
Kompally_Hyderabad
Nacharam_Hyderabad
New_Malakpet_Hyderabad
Pashamylaram_Hyderabad
Patancheru_Hyderabad
Ramachandrapuram_Hyderabad
Sanathnagar_Hyderabad
Somajiguda_Hyderabad
Zoo_Park_Hyderabad
0 20 40 60 80 100 120
PM2.5 Concentration (µg/m³)

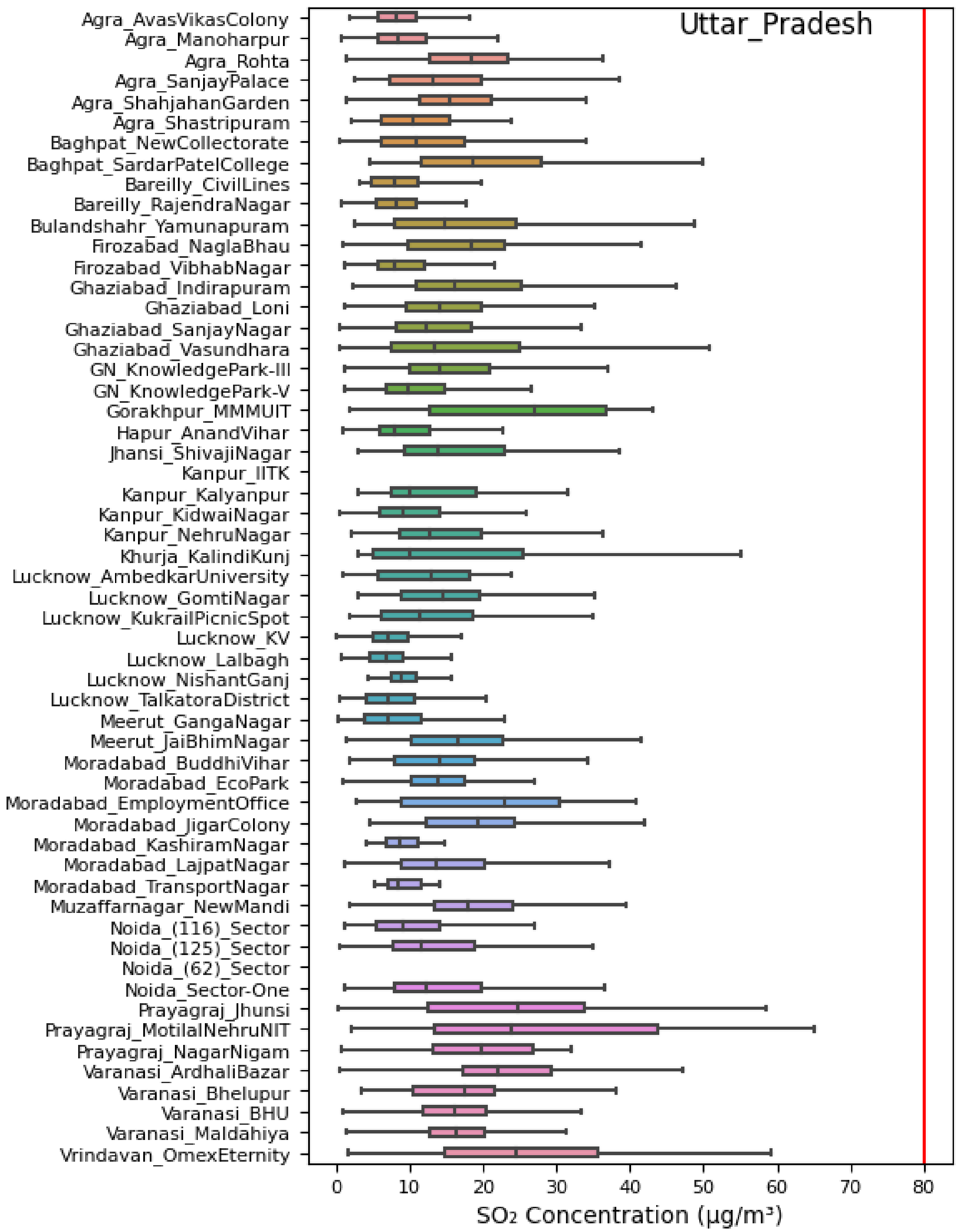

Telangana
Bollaram_Hyderabad
Central_University_Hyderabad
IITH_Kandi_Hyderabad
Kapra_Hyderabad
Kokapet_Hyderabad
Kompally_Hyderabad
Nacharam_Hyderabad
New_Malakpet_Hyderabad
Pashamylaram_Hyderabad
Patancheru_Hyderabad
Ramachandrapuram_Hyderabad
Sanathnagar_Hyderabad
Somajiguda_Hyderabad
Zoo_Park_Hyderabad
0 10 20 30 40 50 60 70 80
SO₂ Concentration (µg/m³)

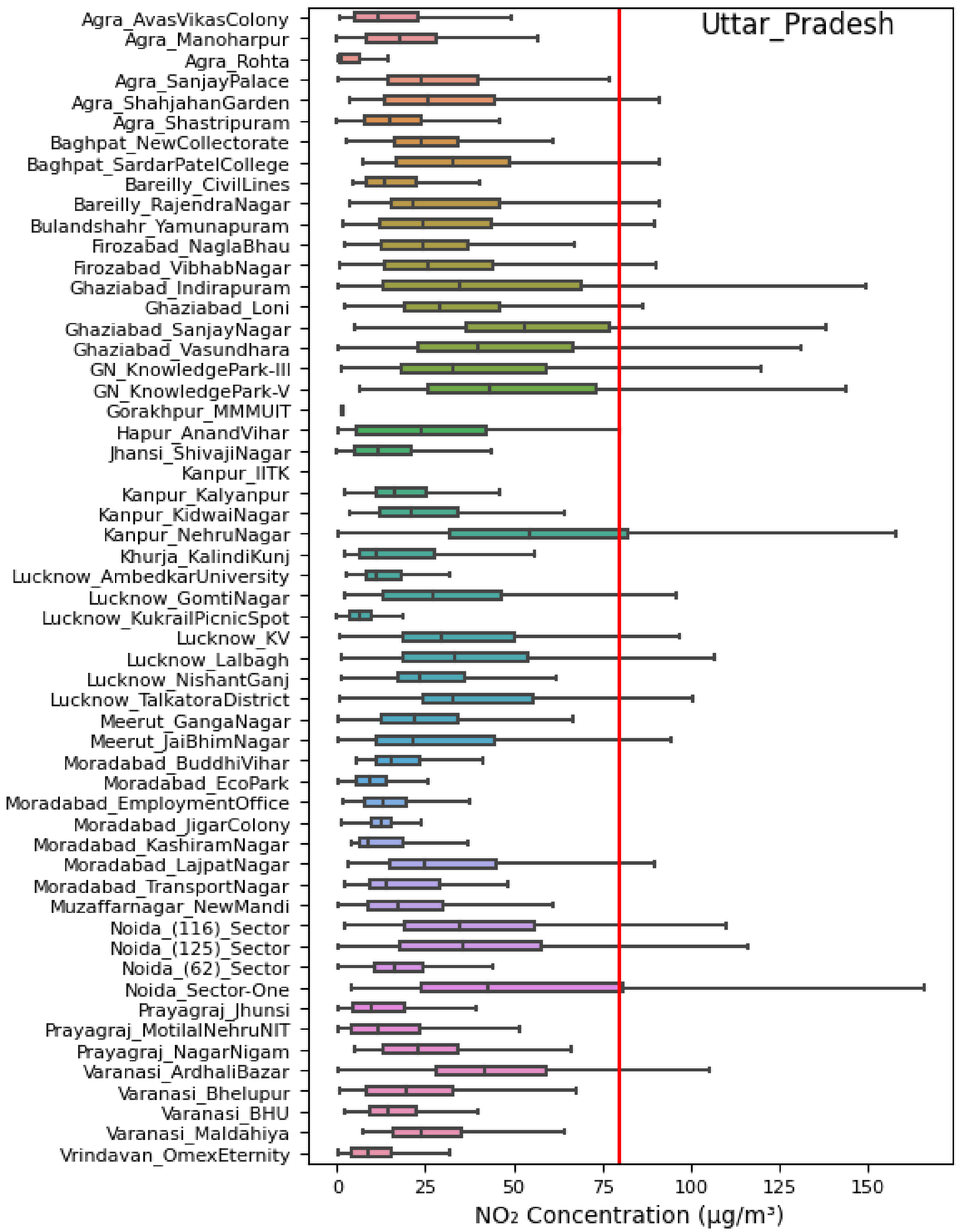

Telangana
Bollaram_Hyderabad
Central_University_Hyderabad
IITH_Kandi_Hyderabad
Kapra_Hyderabad
Kokapet_Hyderabad
Kompally_Hyderabad
Nacharam_Hyderabad
New_Malakpet_Hyderabad
Pashamylaram_Hyderabad
Patancheru_Hyderabad
Ramachandrapuram_Hyderabad
Sanathnagar_Hyderabad
Somajiguda_Hyderabad
Zoo_Park_Hyderabad
0 20 40 60 80
NO₂ Concentration (µg/m³)

Uttar Pradesh




Uttar_Pradesh
Agra_AvasVikasColony
Agra_Manoharpur
Agra_Rohta
Agra_SanjayPalace
Agra_ShahjahanGarden
Agra_Shastripuram
Baghpat_NewCollectorate
Baghpat_SardarPatelCollege
Bareilly_CivilLines
Bareilly_RajendraNagar
Bulandshahr_Yamunapuram
Firozabad_NaglaBhau
Firozabad_VibhabNagar
Ghaziabad_Indirapuram
Ghaziabad_Loni
Ghaziabad_SanjayNagar
Ghaziabad_Vasundhara
GN_KnowledgePark-III
GN_KnowledgePark-V
Gorakhpur_MMMUIT
Hapur_AnandVihar
Jhansi_ShivajiNagar
Kanpur_IITK
Kanpur_Kalyanpur
Kanpur_KidwaiNagar
Kanpur_NehruNagar
Khurja_KalindiKunj
Lucknow_AmbedkarUniversity
Lucknow_GomtiNagar
Lucknow_KukrailPicnicSpot
Lucknow_KV
Lucknow_Lalbagh
Lucknow_NishantGanj
Lucknow_TalkatoraDistrict
Meerut_GangaNagar
Meerut_JaiBhimNagar
Moradabad_BuddhiVihar
Moradabad_EcoPark
Moradabad_EmploymentOffice
Moradabad_JigarColony
Moradabad_KashiramNagar
Moradabad_LajpatNagar
Moradabad_TransportNagar
Muzaffarnagar_NewMandi
Noida_(116)_Sector
Noida_(125)_Sector
Noida_(62)_Sector
Noida_Sector-One
Prayagraj_Jhunsi
Prayagraj_MotilalNehruNIT
Prayagraj_NagarNigam
Varanasi_ArdhaliBazar
Varanasi_Bhelupur
Varanasi_BHU
Varanasi_Maldahiya
Vrindavan_OmexEternity
0
50
100
150
200
250
300
350
PM2.5 Concentration (µg/m³)


Uttar_Pradesh
Agra_AvasVikasColony
Agra_Manoharpur
Agra_Rohta
Agra_SanjayPalace
Agra_ShahjahanGarden
Agra_Shastripuram
Baghpat_NewCollectorate
Baghpat_SardarPatelCollege
Bareilly_CivilLines
Bareilly_RajendraNagar
Bulandshahr_Yamunapuram
Firozabad_NaglaBhau
Firozabad_VibhabNagar
Ghaziabad_Indirapuram
Ghaziabad_Loni
Ghaziabad_SanjayNagar
Ghaziabad_Vasundhara
GN_KnowledgePark-III
GN_KnowledgePark-V
Gorakhpur_MMMUIT
Hapur_AnandVihar
Jhansi_ShivajiNagar
Kanpur_IITK
Kanpur_Kalyanpur
Kanpur_KidwaiNagar
Kanpur_NehruNagar
Khurja_KalindiKunj
Lucknow_AmbedkarUniversity
Lucknow_GomtiNagar
Lucknow_KukrailPicnicSpot
Lucknow_KV
Lucknow_Lalbagh
Lucknow_NishantGanj
Lucknow_TalkatoraDistrict
Meerut_GangaNagar
Meerut_JaiBhimNagar
Moradabad_BuddhiVihar
Moradabad_EcoPark
Moradabad_EmploymentOffice
Moradabad_JigarColony
Moradabad_KashiramNagar
Moradabad_LajpatNagar
Moradabad_TransportNagar
Muzaffarnagar_NewMandi
Noida_(116)_Sector
Noida_(125)_Sector
Noida_(62)_Sector
Noida_Sector-One
Prayagraj_Jhunsi
Prayagraj_MotilalNehruNIT
Prayagraj_NagarNigam
Varanasi_ArdhaliBazar
Varanasi_Bhelupur
Varanasi_BHU
Varanasi_Maldahiya
Vrindavan_OmexEternity
0
10
20
30
40
50
60
70
80
SO₂ Concentration (μg/m³)


Uttar_Pradesh
Agra_AvasVikasColony
Agra_Manoharpur
Agra_Rohta
Agra_SanjayPalace
Agra_ShahjahanGarden
Agra_Shastripuram
Baghpat_NewCollectorate
Baghpat_SardarPatelCollege
Bareilly_CivilLines
Bareilly_RajendraNagar
Bulandshahr_Yamunapuram
Firozabad_NaglaBhau
Firozabad_VibhabNagar
Ghaziabad_Indirapuram
Ghaziabad_Loni
Ghaziabad_SanjayNagar
Ghaziabad_Vasundhara
GN_KnowledgePark-III
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Gorakhpur_MMMUIT
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Jhansi_ShivajiNagar
Kanpur_IITK
Kanpur_Kalyanpur
Kanpur_KidwaiNagar
Kanpur_NehruNagar
Khurja_KalindiKunj
Lucknow_AmbedkarUniversity
Lucknow_GomtiNagar
Lucknow_KukrailPicnicSpot
Lucknow_KV
Lucknow_Lalbagh
Lucknow_NishantGanj
Lucknow_TalkatoraDistrict
Meerut_GangaNagar
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Moradabad_BuddhiVihar
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Muzaffarnagar_NewMandi
Noida_(116)_Sector
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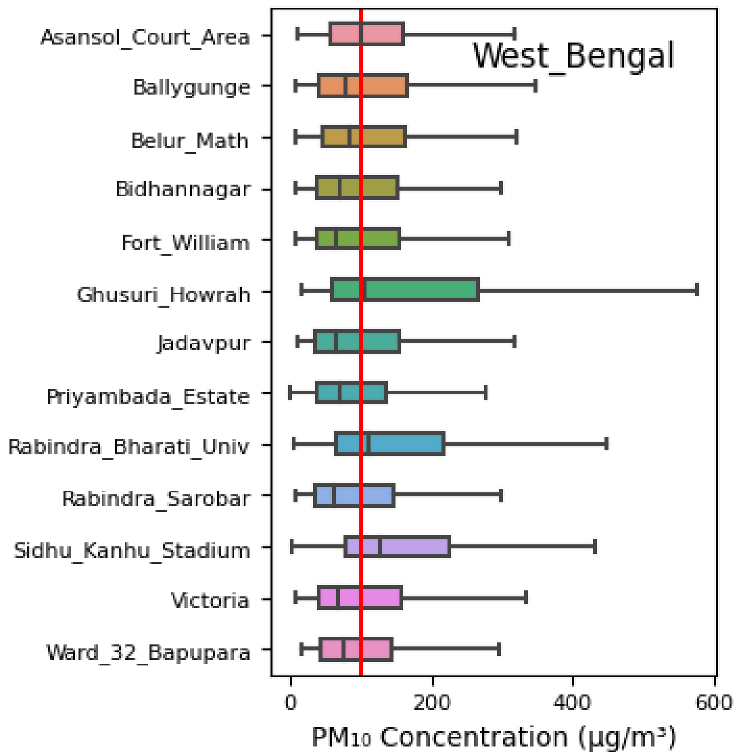
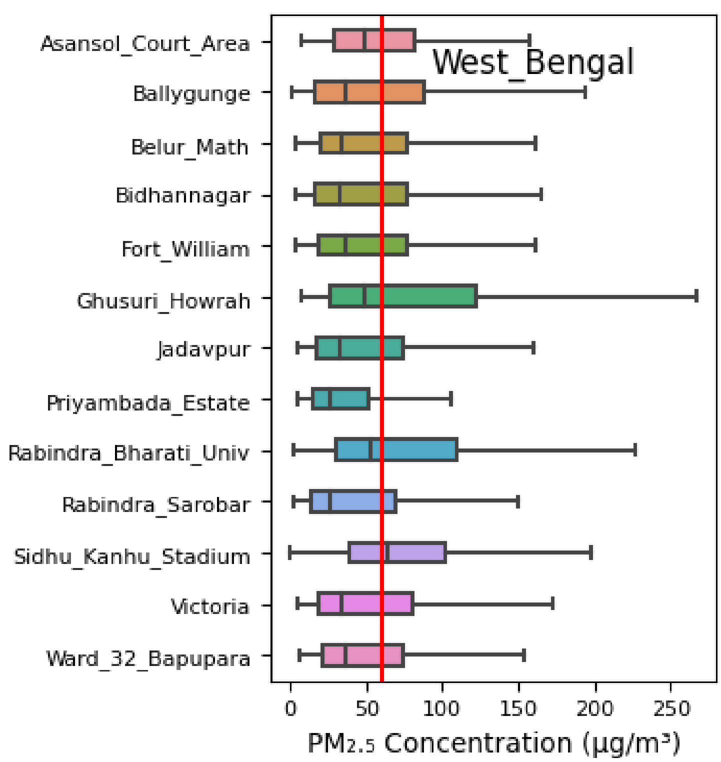
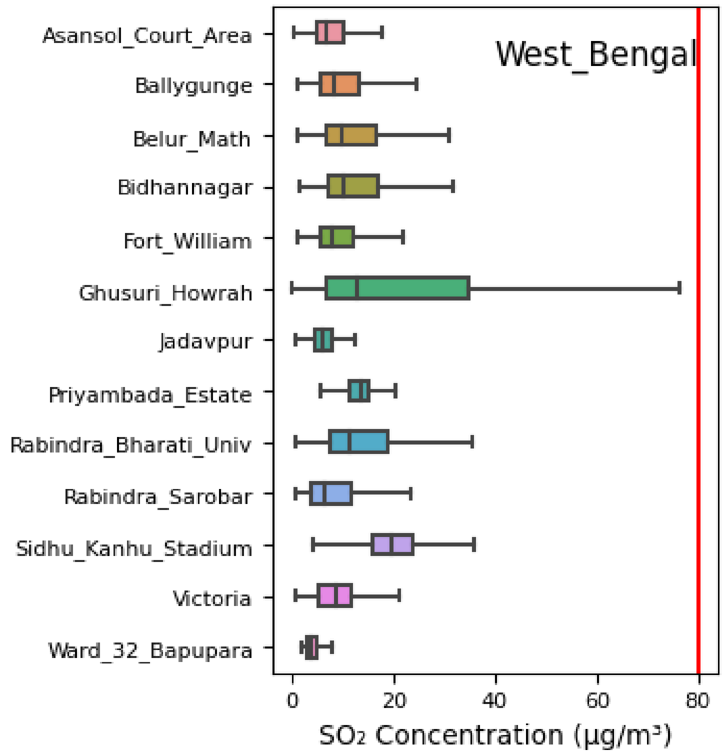
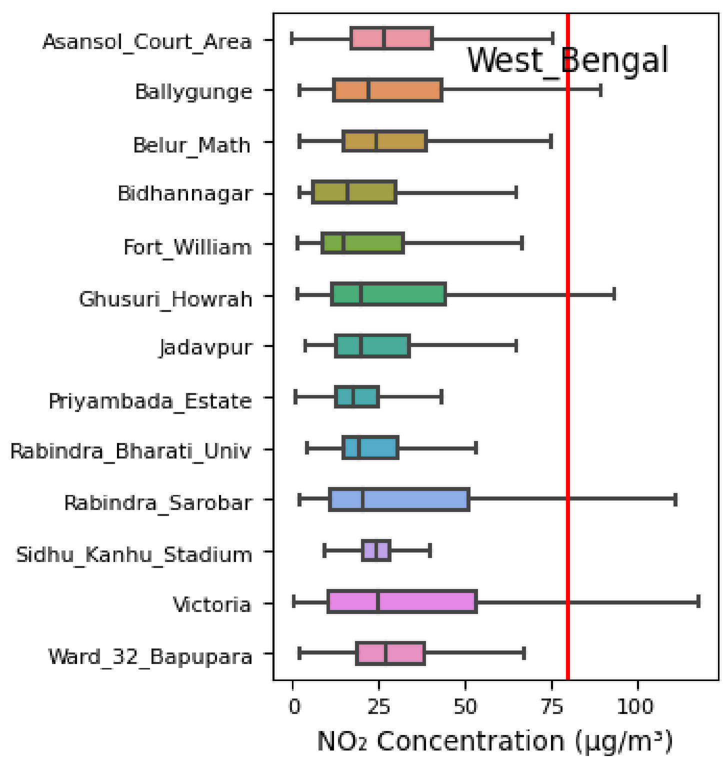
Prayagraj_NagarNigam
Varanasi_ArdhaliBazar
Varanasi_Bhelupur
Varanasi_BHU
Varanasi_Maldahiya
Vrindavan_OmexEternity
0
25
50
75
100
125
150
NO₂ Concentration (µg/m³)

West Bengal

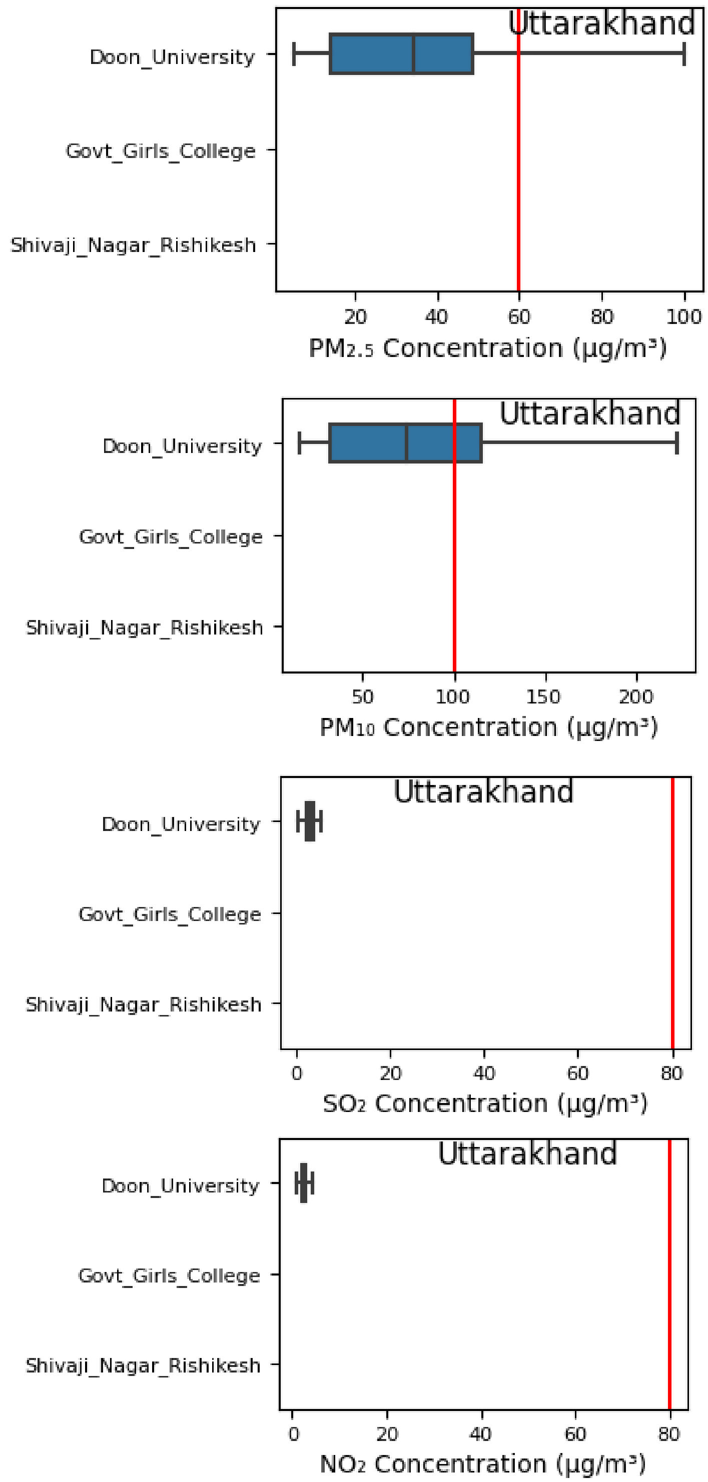

Asansol_Court_Area
Ballygunge
Belur_Math
Bidhannagar
Fort_William
Ghusuri_Howrah
Jadavpur
Priyambada_Estate
Rabindra_Bharati_Univ
Rabindra_Sarobar
Sidhu_Kanhu_Stadium
Victoria
Ward_32_Bapupara
West_Bengal
0
200
400
600
PM10 Concentration (μg/m³)


Asansol_Court_Area
Ballygunge
Belur_Math
Bidhannagar
Fort_William
Ghusuri_Howrah
Jadavpur
Priyambada_Estate
Rabindra_Bharati_Univ
Rabindra_Sarobar
Sidhu_Kanhu_Stadium
Victoria
Ward_32_Bapupara
West_Bengal
0
50
100
150
200
250
PM2.5 Concentration (μg/m³)

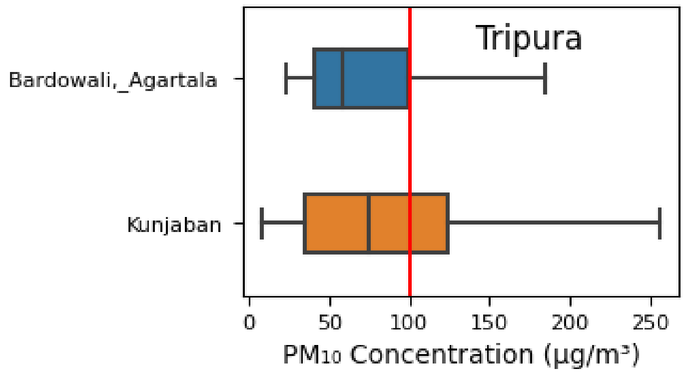

West_Bengal
Asansol_Court_Area
Ballygunge
Belur_Math
Bidhannagar
Fort_William
Ghusuri_Howrah
Jadavpur
Priyambada_Estate
Rabindra_Bharati_Univ
Rabindra_Sarobar
Sidhu_Kanhu_Stadium
Victoria
Ward_32_Bapupara
0
20
40
60
80
SO₂ Concentration (µg/m³)

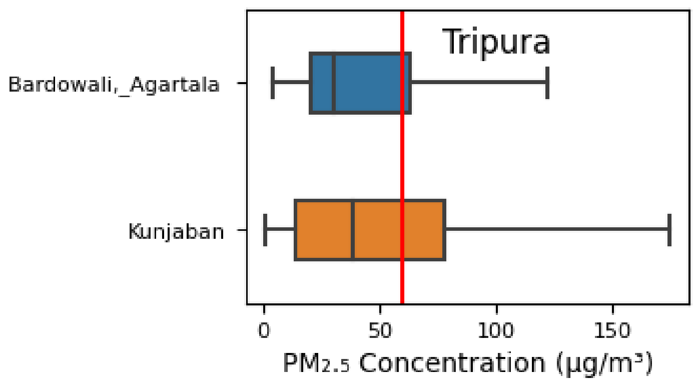

West_Bengal
Asansol_Court_Area
Ballygunge
Belur_Math
Bidhannagar
Fort_William
Ghusuri_Howrah
Jadavpur
Priyambada_Estate
Rabindra_Bharati_Univ
Rabindra_Sarobar
Sidhu_Kanhu_Stadium
Victoria
Ward_32_Bapupara
0
25
50
75
100
NO₂ Concentration (µg/m³)

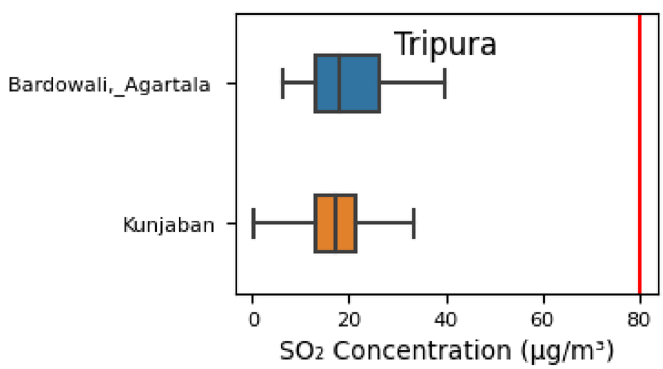
Uttarakhand

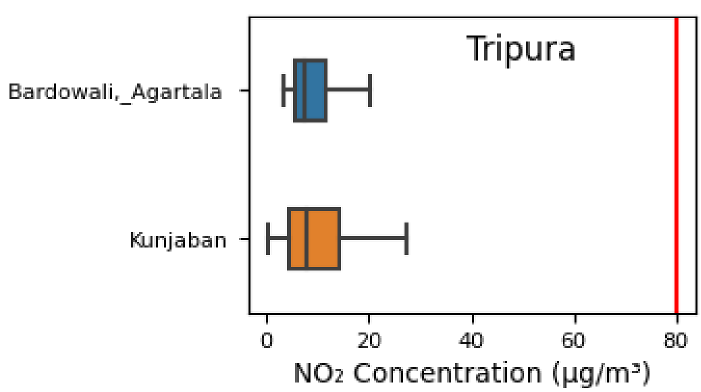


Tripura

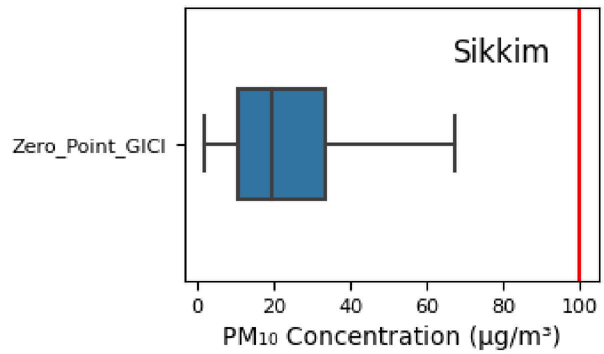

Tripura
Bardowali,_Agartala
Kunjaban
0
50
100
150
200
250
PM10 Concentration (µg/m³)

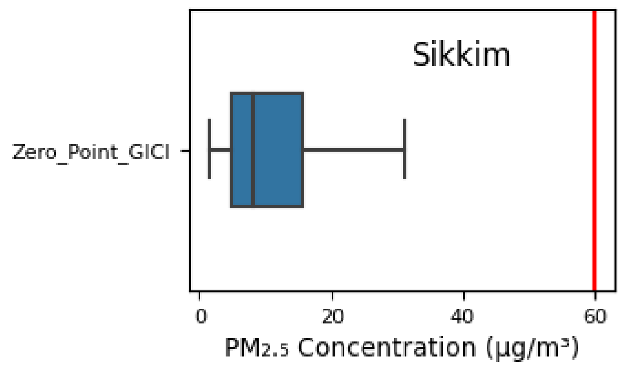

Tripura
Bardowali,_Agartala
Kunjaban
0
50
100
150
PM2.5 Concentration (µg/m³)

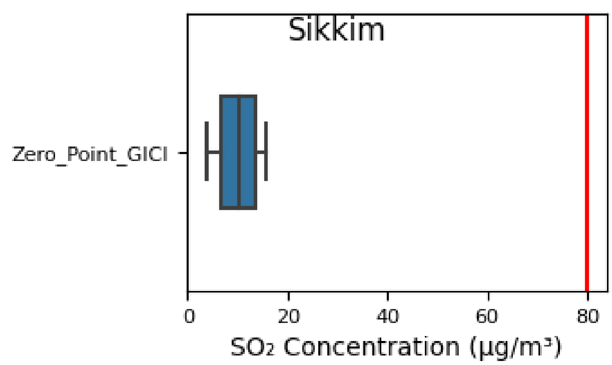

Tripura
Bardowali,_Agartala
Kunjaban
0
20
40
60
80
SO2 Concentration (µg/m³)

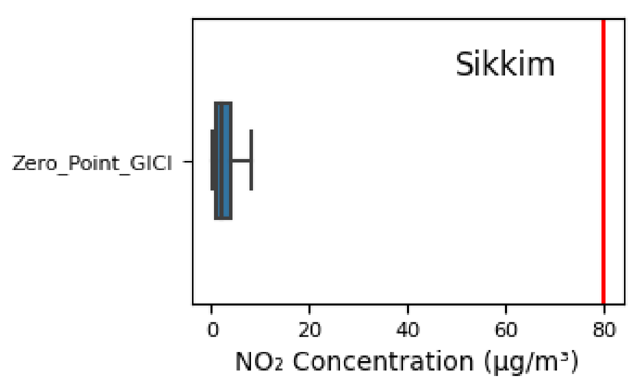

Tripura
Bardowali,_Agartala
Kunjaban
0
20
40
60
80
NO2 Concentration (µg/m³)

Sikkim

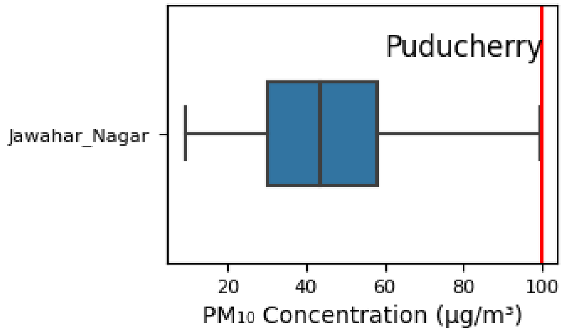

Sikkim
Zero_Point_GICI
0
20
40
60
80
100
PM10 Concentration (µg/m³)

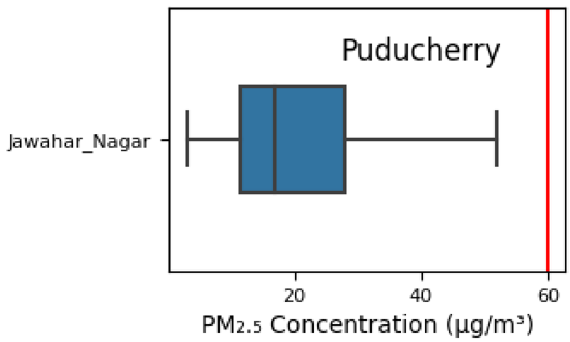

Sikkim
Zero_Point_GICI
0
20
40
60
PM2.5 Concentration (µg/m³)

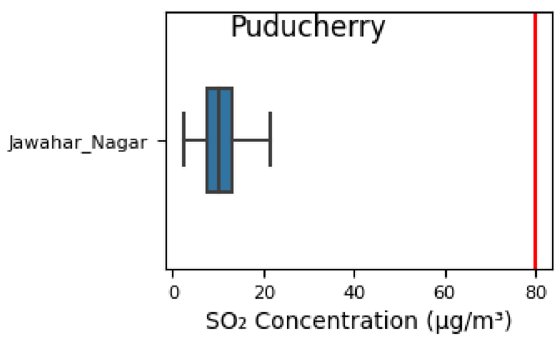

Sikkim
Zero_Point_GICI
0
20
40
60
80
SO2 Concentration (µg/m³)

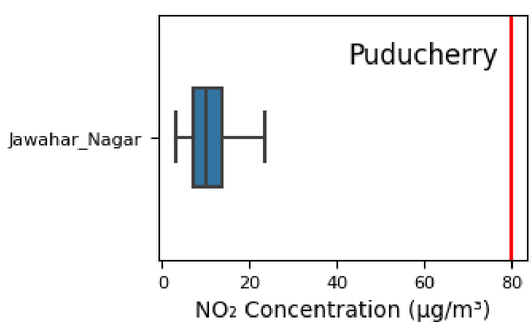

Sikkim
Zero_Point_GICI
0
20
40
60
80
NO2 Concentration (µg/m³)

Puducherry

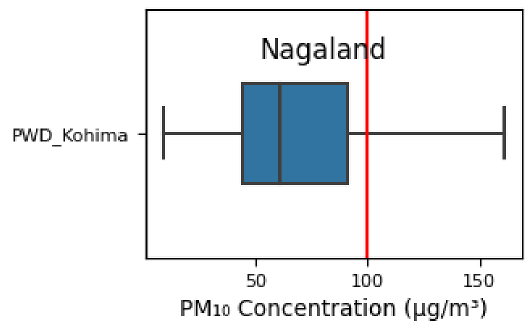

Puducherry
Jawahar_Nagar
20
40
60
80
100
PM10 Concentration (µg/m³)

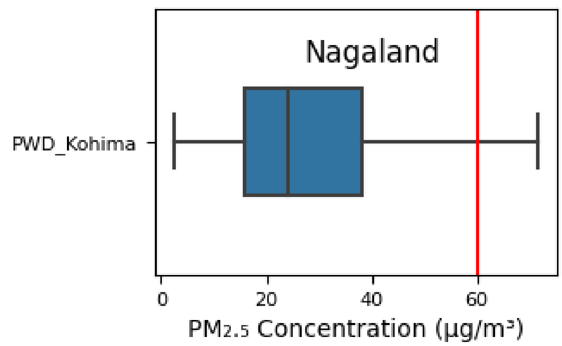

Puducherry
Jawahar_Nagar
20
40
60
PM2.5 Concentration (µg/m³)

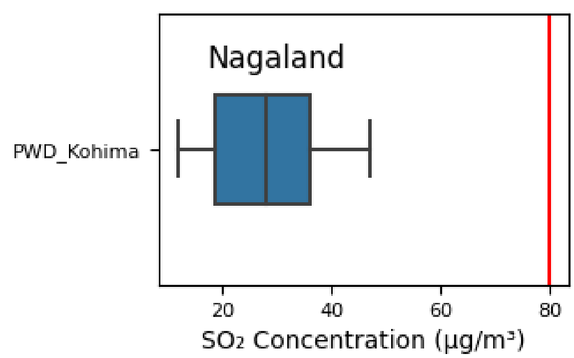

Puducherry
Jawahar_Nagar
0
20
40
60
80
SO2 Concentration (µg/m³)

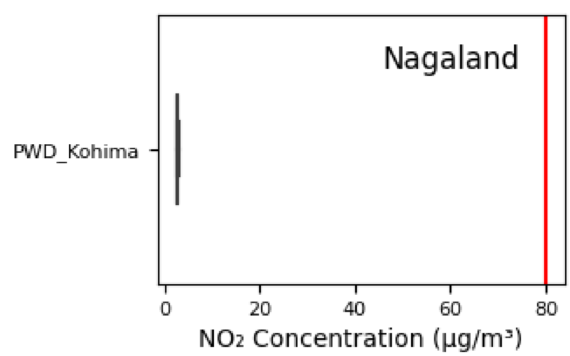

Puducherry
Jawahar_Nagar
0
20
40
60
80
NO2 Concentration (µg/m³)

Nagaland

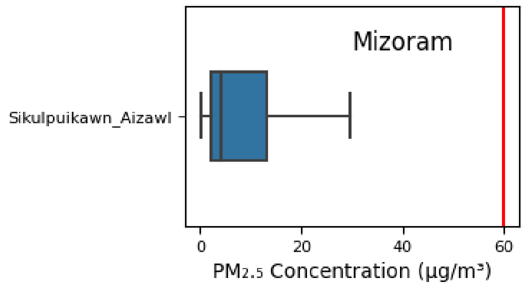

Nagaland
PWD_Kohima
50
100
150
PM10 Concentration (µg/m³)

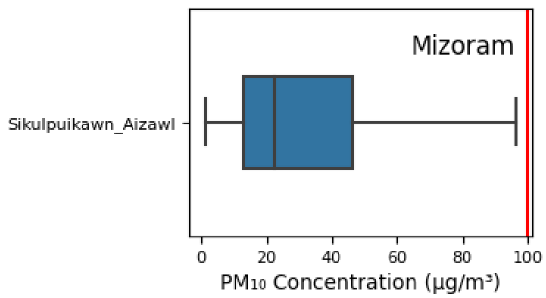

Nagaland
PWD_Kohima
0
20
40
60
PM2.5 Concentration (µg/m³)

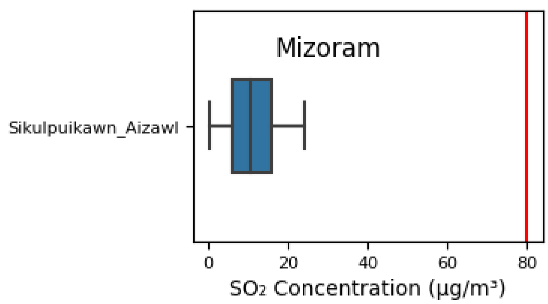

Nagaland
PWD_Kohima
20
40
60
80
SO2 Concentration (µg/m³)

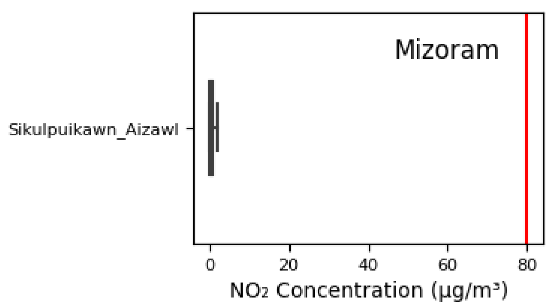

Nagaland
PWD_Kohima
0
20
40
60
80
NO2 Concentration (µg/m³)

Mizoram


Mizoram
Sikulpuikawn_Aizawl
0
20
40
60
PM2.5 Concentration (µg/m³)


Mizoram
Sikulpuikawn_Aizawl
0
20
40
60
80
100
PM10 Concentration (µg/m³)


Mizoram
Sikulpuikawn_Aizawl
0
20
40
60
80
SO2 Concentration (µg/m³)


Mizoram
Sikulpuikawn_Aizawl
0
20
40
60
80
NO2 Concentration (µg/m³)

Notes

LAST PAGE