NATIONAL AMBIENT AIR QUALITY MONITORING
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NATIONAL AMBIENT AIR QUALITY STATUS 2007

CENTRAL POLLUTION CONTROL BOARD
MINISTRY OF ENVIRONMENT & FORESTS
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FOREWORD

The Central Pollution Control Board (CPCB) in collaboration with the State Pollution Control Boards (SPCBs) has established the National Ambient Air Quality Monitoring (NAMP) Network, covering various cities/towns of the country. The Network has been established under the Air (Prevention and Control of Pollution) Act, 1981 to collect, compile and disseminate information on air quality.

The ambient air quality is monitored by CPCB, SPCBs, Pollution Control Committees (PCCs), and National Environmental Engineering Research Institute (NEERI). The data, thus generated, is transmitted to CPCB for scrutiny, analysis, compilation and publication as a consolidated Report.

This Report contains ambient air quality data for the calendar year 2007. Air pollution status of various pollutants has been defined in terms of Low, Moderate, High and Critical, vis-a -vis the notified ambient air standards. The status has also been depicted in form of both tables and figures. The air quality trends in sixteen polluted cities identified by Honourable Supreme Court, have been included together with the data on additional pollutants, such as ammonia, carbon monoxide etc.

The co-operation of all the monitoring agencies is gratefully acknowledged in successfully achieving this major task.

(J.M. Mauskar)

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1.0 INTRODUCTION

The quality of the air that we breathe can have important effects on our health and quality of life. It can also have major impacts on the ecosystems. Measuring and understanding air pollution provides a sound scientific basis for its management and control. Historically, air pollution problem has typically been high levels of smoke and sulphur dioxide arising from the combustion of sulphur-containing fossil fuels such as coal for domestic and industrial purpose. However, now the major threat to clean air is posed by traffic emissions. Vide variety of air pollutants are emitted by petrol and diesel-engined motor vehicles. These include carbon monoxide (CO), oxides of nitrogen (NOx), volatile organic compounds (VOCs) and particulates (PM_{10} and $PM_{2.5}$), which have an increasing impact on urban air quality. Also, photochemical reactions resulting from the action of sunlight on nitrogen dioxide (NO_2) and VOCs from vehicles leads to the formation of ozone. Ozone is a secondary long-range pollutant, which impacts in rural areas often far from the original emission site. Fine particles contains microscopic solids or liquid droplets that are very small and they can penetrate deep into the lungs and cause serious health problems. Numerous scientific studies have linked particle pollution exposure to a variety of health problems. Generally, coarse particles are directly emitted and fine particles can be formed in the atmosphere. The sources of particulate matter levels are vehicles, engine gensets, small scale industries, biomass incineration, boilers and emission from power plants, resuspension of traffic dust, commercial and domestic use of fuels, etc.

In order to arrest the deterioration in air quality, Government of India has enacted Air (Prevention and Control of Pollution) Act in 1981. The responsibility has been further emphasized under Environment (Protection) Act, 1986. It is necessary to assess the present and anticipated air pollution through continuous air quality survey/monitoring programs. Therefore, Central Pollution Control Board is executing a nation-wide network of ambient air quality monitoring known as National Air Quality Monitoring Programme (NAMP). The programme was started 1984 - 85 and gradually the number of stations have increased over the years.

The report presents results of ambient air quality monitoring carried out during the year 2007 at various monitoring stations under NAMP. Four pollutants namely sulphur dioxide, nitrogen dioxide, respirable suspended particulate matter and suspended particulate matter are monitored regularly at various monitoring locations. The air quality is described in terms of low, moderate, high and critical levels based on an exceedence factor. The pollutants that are exceeding the standards in many cities are suspended particulate matter and respirable suspended particulate matter. Results of additional pollutants such as benzene and carbon monoxide monitored in Delhi and ammonia measure in six cities are also presented. The next few chapters presents details of the National Air Quality Monitoring Programme and major findings during the year 2007. Also detailed are the initiatives taken for air pollution control.

1.1 Air Pollutants

a) Sulphur dioxide

SO_2, is formed when fuel containing sulfur is burned. Sulfur is prevalent in raw materials such as crude oil, coal, and ore that contains common metals like aluminum, copper, zinc, lead etc. SO_2 reacts with other gases in the atmosphere to form sulphates that can cause harm to human health. Effects of SO_2 include respiratory illness, visibility impairment, acid rain and aesthetic damage. Sulfur oxides are emitted in significant quantities from thermal power plants, smelting process of sulfide ores to produce copper, lead and zinc and also from petroleum refining processes. The diesel driven vehicles are specific source of sulfur dioxide generated during combustion process. Sulfate particles, can be transported over long distances and deposited far from the sources. SO_2 can result in respiratory illness, particularly in children and the elderly, and it can also aggravate existing heart and lung diseases.

b) Oxides of Nitrogen

Oxides of nitrogen is a generic term for a group of highly reactive gases that contain nitrogen and oxygen in varying amounts. Nitrogen dioxide (NO_2) alongwith particulates is seen as a reddish brown layer over urban areas. Nitrogen oxides are formed when fuel is burned at high temperature. Sources of nitrogen oxides includes vehicles, industrial processes that burn fuel. Oxides of nitrogen react with Volatile Organic Compounds (VOCs) to form ground level ozone. They also react to form nitrates, acid aerosols. They also contribute to nutrient overload that deteriorates water quality. Nitrogen dioxide Irritates the nose and throat, and it appears to increase susceptibility to respiratory infections.

c) Particulate Matter

Particulate matter is a mixture of many subclasses of pollutants that contain many different chemical species. The particle size is often described by aerodynamic diameter. Aerodynamic diameter depends on particle density and is defined as the diameter of a particle with the same settling velocity as spherical particle with unit density i.e. 1 g/cm^3 (USEPA, 1996). PM_{10} are the particles with upper size limited by a 50% cut at 10 μm aerodynamic diameter (USEPA, 1996). PM_{10} can be formed by physical processes of crushing, grinding and abrasion of surfaces. Mining and agricultural activities are some of the sources of large size particles.$PM_{2.5}$ are the particles with upper size limited by a 50% cut at 2.5 μm aerodynamic diameter (USEPA, 1996). Particulate matter is called primary if it is in the same form chemical form in which it is emitted into the atmosphere. The primary particulate matter include wind blown dust such as road dust, fly ash, soot etc. Particulate matter is called secondary it is formed by chemical reactions in the atmosphere. Secondary particulate matter include sulphates, nitrates etc.

The size of particles is directly linked to their potential for causing health problems. Small particles less than 2.5 micrometers in diameter pose the greatest problems, because they can get deep into your lungs, and some may even get into your bloodstream. Numerous scientific studies have linked particle pollution exposure to a variety of problems, including increased respiratory symptoms, such as irritation of the airways, coughing, or difficulty breathing, decreased lung function; aggravated asthma; development of chronic bronchitis; irregular heartbeat; nonfatal heart attacks; and premature death in people with heart or lung disease. (USEPA, 2008). People with heart or lung diseases, children and older adults are the most likely to be affected by particle pollution exposure (USEPA, 2008). Environmental effects of particulate matter include visibility reduction, aesthetic damage etc.

(1) Composition of Particulate Matter

Atmospheric particles include combustion-generated particles, such as diesel soot or fly ash; photochemically produced particles, such as those found in urban haze; and soil-like particles from resuspended dust. The major constituents of RSPM are organic and elemental carbon, metals/elements like silicon, magnesium, iron, ions like sulphates, nitrates, ammonium etc. Understanding composition of particulate matter is most important to gain insight into the health effects caused and sources to be controlled. Composition of particulate matter varies from place to place and season depending upon sources present.

(i) Elemental Carbon

Elemental carbon (EC), also called ‘‘black carbon’’ or ‘‘graphitic carbon’’, has a chemical structure similar to impure graphite. Atmospheric elemental carbon is from primary anthropogenic sources and is not formed by reactions involving gaseous hydrocarbon precursors in the atmosphere. EC plays an important role in atmospheric chemistry because of its adsorptive and catalytic properties, which can capture other pollutants to react on its surface.

(ii) Organic Carbon

Organic carbon (OC), a mixture of hydrocarbons and oxygenates, is formed by a variety of processes, including combustion and secondary organic aerosol (SOA) formation. Organic carbon may be emitted as primary particles directly from sources, but secondary organics can also be formed in the atmosphere from the low vapor pressure products of atmospheric chemical reactions. OC is a complex mixture of thousands of different organic compounds, containing polycyclic aromatic hydrocarbons and other components.

(iii) Elements/Metals

Calcium, aluminum, silicon, magnesium, and iron are some of the crustal material found predominately in the coarse particles. Most of the elements are emitted from coal, oil

combustion, vehicles, industrial processes. Other sources include crustral material from road dust, tyre wear, construction activities etc.

(iv) Ions

The common ions found in particulate matter are sodium, sulphates, nitrates, calcium, chloride, potassium. Potassium and nitrate may be found in both the small size and coarse particles. Potassium comes from soil in coarse particles and in small size particles it comes from wood burning. Nitrate in formed by reaction of gas phase nitric acid with gas-phase ammonia forming particulate ammonium nitrate.

d) Carbon Monoxide (CO)

Carbon monoxide is a colorless, odorless and poisonous gas. It is formed by incomplete combustion of carbon containing fuels. Major source of CO are vehicles. Incomplete combustion is most likely to occur at low air-to-fuel ratios in the engine. These conditions are common during vehicle starting when air supply is restricted, when cars are not tuned properly, and at altitude, where thin air effectively reduces the amount of oxygen available for combustion. CO enters the bloodstream through lungs and forms carboxyhemoglobin which inhibits blood's oxygen carrying capacity to organs and tissues. Persons with heart disease are especially sensitive to carbon monoxide poisoning and may experience chest pain if they breathe the gas while exercising. Infants, elderly persons, and individuals with respiratory diseases are also particularly sensitive.

e) Ozone

Ozone is a secondary pollutants formed in the atmosphere by reaction between oxides of nitrogen and volatile organic compounds (VOCs) in the presence of sunlight. Vehicles, industrial emissions, gasoline vapours, chemical solvents emit oxides of nitrogen and VOCs that form ozone. Peak O_3 levels occur typically during the warmer times of the year.

f) Ammonia

Ammonia is found in small quantities in the atmosphere, and is produced from the putrefaction of nitrogenous animal and vegetable matter. Ammonia occurs naturally and is produced by human activity. Ammonia and ammonium salts are also found in small quantities in rainwater. It is an important source of nitrogen which is needed by plants and animals. Ammonia gas can be dissolved in water and is called liquid ammonia or aqueous ammonia. Once exposed to open air, liquid ammonia quickly turns into a gas. Exposure to ammonia may occur by breathing or consuming food or water containing ammonia. No health effects have been found in humans exposed to typical environmental concentrations of ammonia. Exposure to high levels of ammonia in air may be irritating to skin, eyes, throat, and lungs and cause coughing and burns. Lung damage and death may occur after exposure to very high concentrations of ammonia.

g) Hazardous Air Pollutants

Hazardous air pollutants are also known as toxic air pollutants which may cause cancer or other serious health effects such as reproductive effects etc. Toxic air pollutants include benzene, perchlorethlyene, methylene chloride, dioxin, asbestos, toluene, and metals such as cadmium, mercury, chromium, and lead compounds. Sources of benzene are gasoline and perchlorethlyene, is emitted from some dry cleaning facilities. Methylene chloride is used as a solvent and paint stripper by a number of industries. As per USEPA, 2007 (Source:http://www.epa.gov/ttn/atw/allabout.html) people exposed to toxic air pollutants at sufficient concentrations and durations may have an increased chance of getting cancer or experiencing other serious health effects and these health effects can include damage to the immune system, as well as neurological, reproductive (e.g., reduced fertility), developmental, respiratory and other health problems. Also as per USEPA, 2007, in addition to exposure from breathing air toxics, some toxic air pollutants such as mercury can deposit onto soils or surface waters, where they are taken up by plants and ingested by animals and are eventually magnified up through the food chain.

1.2 Air (Prevention and Control of Pollution) Act 1981

Government of India enacted the Air (Prevention and Control of Pollution) Act 1981 to arrest the deterioration in the air quality. The act prescribes various functions for the Central Pollution Control Board (CPCB) at the apex level and State Pollution Control Boards at the state level. The main functions of the Central Pollution Control Board are as follows:

- To advise the Central Government on any matter concerning the improvement of the quality of the air and the prevention, control and abatement of air pollution.
- To plan and cause to be executed a nation-wide programme for the prevention, control and abatement of air pollution.
- To provide technical assistance and guidance to the State Pollution Control Board.
- To carry out and sponsor investigations and research related to prevention, control and abatement of air pollution.
- To collect, compile and publish technical and statistical data related to air pollution; and
- To lay down standards for the quality of air.

The main functions of the State Pollution Control Boards are as follows:

- To plan a comprehensive programme for prevention, control and abatement of air pollution and to secure the execution thereof.
- To advise the State Government on any matter concerning prevention, control and abatement of air pollution.
- To collect and disseminate information related to air pollution.

- To collaborate with Central Pollution Control Board in programme related to prevention, control and abatement of air pollution; and
- To inspect air pollution control areas, assess quality of air and to take steps for prevention, control and abatement of air pollution in such areas.

1.3 National Ambient Air Quality Standards (NAAQS)

The ambient air quality objectives/standards are pre-requisite for developing programme for effective management of ambient air quality and to reduce the damaging effects of air pollution. The objectives of air quality standards are: -

- To indicate the levels of air quality necessary with an adequate margin of safety to protect the public health, vegetation and property;
- To assist in establishing priorities for abatement and control of pollutant level;
- To provide uniform yardstick for assessing air quality at national level; and
- To indicate the need and extent of monitoring programme.

The Central Pollution Control Board had adopted first ambient air quality standards on November 11, 1982 as per section 16 (2) (h) of the Air (Prevention and Control of Pollution) Act, 1981. The air quality standards have been revised by the Central Pollution Control Board on April 11, 1994 and were notified in Gazette of India, Extra-ordinary Part-II Section 3, sub section (ii), dated May 20, 1994. The revised National Ambient Air Quality Standards are depicted in Annexure – I (Table A1.1).

These standards are based on the land use and other factors of the area. The guidelines for declaring sensitive areas as recommended by peer/core group of CPCB are as follows:

Sensitive areas – sensitive area may include the following:

1) 10 kms all around the periphery of health resorts that are notified by State Pollution Control Boards in consultation with department of public health of the concerned state.

2) 10 kms all around the periphery of biosphere reserves, sanctuaries and national parks, that are notified by Ministry of Environment and Forest or concerned states.

3) 5 kms all around the periphery of an archeological monument declared to be of national importance or otherwise that are notified by Archeological Survey of India (A.S.I.) in consultation with State Pollution Control Boards.

4) Areas which are delicate or sensitive to air pollution in terms of important agricultural/horticultural crops grown in that area and accordingly notified by State Pollution Control Boards in consultation with department of agriculture/horticulture of concerned state.

5) 5 kms around the periphery of centers of tourism and/or pilgrim due to their religious, historical, scenic or other attractions, that are notified by department of tourism of the concerned state in consultation with State Pollution Control Boards.

1.4 National Air Quality Monitoring Programme (N.A.M.P.)

Central Pollution Control Board initiated National Ambient Air Quality Monitoring (NAAQM) programme in the year 1984 with 7 stations at Agra and Anpara. Subsequently the programme was renamed as National Air Quality Monitoring Programme (N.A.M.P.). The report contains data of 321 operating stations during 2007 in the country.

1.4.1 Objectives

The objectives of the N.A.M.P. are as follows:

- To determine status and trends of ambient air quality;
- To ascertain whether the prescribed ambient air quality standards are violated,
- To Identify Non-attainment Cities
- To obtain the knowledge and understanding necessary for developing preventive and corrective measures;
- To understand the natural cleansing process undergoing in the environment through pollution dilution, dispersion, wind based movement, dry deposition, precipitation and chemical transformation of pollutants generated.

1.4.2 Monitoring Locations and Parameters

Under N.A.M.P., four air pollutants *viz*., Sulphur Dioxide (SO_2), Oxides of Nitrogen as NO_2 and Suspended Particulate Matter (SPM) and Respirable Suspended Particulate Matter (RSPM/PM_{10}), have been identified for regular monitoring at all the locations. Besides this, additional parameters such as Respirable Lead and other toxic trace metals, Hydrogen Sulphide (H_2S), Ammonia (NH_3) and Polycyclic Aromatic Hydrocarbons (PAHs) are also being monitored at selected locations.

The monitoring of meteorological parameters such as wind speed and direction, relative humidity and temperature was also integrated with the monitoring of air quality. The monitoring of pollutants is carried out for 24 hours (4-hourly sampling for gaseous pollutants and 8-hourly sampling for particulate matter) with a frequency of twice a week, to have 104 observations in a year.

The monitoring is being carried out by Central Pollution Control Board: in Delhi; State Pollution Control Boards: in the respective States; Pollution Control Committees: in the

respective Union Territories; National Environmental Engineering Research Institute (NEERI), Nagpur: in 6 metro cities of the country. CPCB co-ordinates with these agencies to ensure the uniformity, consistency of air quality data and provides technical and financial support to them for operating the monitoring station.

1.5 Data Analysis and Limitations

The air quality data generated at the monitoring stations are transmitted to CPCB where these are checked, scrutinized, compiled, processed and analyzed statistically to get the information on the annual mean, standard deviation etc. of the pollutants. In the present report, results of SO_2, NO_2 , RSPM and SPM, for the year 2007 are presented.

While presenting the air quality data in this report following conventions are followed:

i. Since the sampling for 24 hours in a day could not be fulfilled at all the locations due to reasons like power failure, rainfall etc, the values monitored for 16 hours and more are considered as the representative values for assessing the ambient air quality for that day;

ii. In case, no data is available in a particular month with respect to all the three parameters, the month has been excluded;

iii. In case, no data is reported for a particular station with respect to all the three parameters, during entire year, that station has been excluded; and

iv. The frequency of monitoring twice a week, 104 days in a year could not be met in some of the locations. In such cases, 50 days of monitoring in a year is considered adequate for the purpose of data analysis.

As NAMP is being operated through various monitoring agencies, a large number of personnel and equipments are involved in the sampling, chemical analyses, data reporting etc.. This increases the probability of personal biases reflecting in the data. Hence it is pertinent to mention that this document be referred keeping in view the above facts and the data be considered more as indicative rather than absolute. The data presented in this report is average over the entire year as available. In case, monthly average data is required then the same may be obtained by contacting CPCB.

1.6 Quality Assurance and Quality Control of Data

Quality assurance and Quality control (QA/QC) is an essential part of any monitoring system. QA/QC is a programme of activities that ensures that measurements meet defined standards of quality, with a stated level of confidence. In order to ensure the quality of data the CPCB is carrying out various exercises as follows:

1) Calibration, Servicing and Repair of Instruments and Evaluation of Ambient Air Quality Monitoring Stations

CPCB is carrying out a project on calibration, servicing and repair of instruments/equipments and evaluation of ambient air quality monitoring stations under NAMP. Servicing and repair of respirable dust sampler and high volume sampler is carried out and they are also calibrated using top loading calibrator. The location of monitoring stations are evaluated as per CPCB guidelines so as to ensure quality of data.

2) Training Program on Ambient Air Quality Monitoring

CPCB carries out training program on ambient air quality monitoring with an objective to improve quality of data generated under National Air Quality Monitoring Programme (NAMP). Training is provided to field and laboratory staff involved in NAMP. The training is provided on measurement methods of air pollutants i.e. sulphur dioxide (SO_2), nitrogen dioxide (NO_2), respirable suspended particulate matter (RSPM) and suspended particulate matter (SPM) etc.

3) Guidelines for Ambient Air Quality Monitoring

CPCB has developed guidelines for carrying out ambient air quality monitoring. The Guidelines for Ambient Air Quality Monitoring include site selection criteria, quality assurance and quality control in air quality monitoring, type of pollutants to be monitored in a city, frequency and duration of monitoring, data reporting and compilation procedures and measurement methods of various air pollutants etc.

4) Monitoring stations and monitoring laboratories are regularly inspected by CPCB officials to ensure proper and uniform methodology for sampling and analysis.

5) Review meetings are regularly conducted with monitoring agencies to discuss various problems related to monitoring activities and sort out the remedial measures.

6) Analytical quality control exercises using Ring Test Facility are regularly conducted to evaluate the performance of different laboratories.

Data of some State Air Quality Monitoring Stations have also been included in this report. These stations are in Amravati (Apurva Oil and Ind. Govt. College of Engineering, Rajkamal Square) , Bhubaneshwar (IRC Village, Capital Police Station), Cuttack (R.O. Cuttack Office), Balasore (Sahadevkhunta), Amritsar (Nagina Soap Factory and A-1 Platters), Bhatinda (M/s Bhatinda Dts. Coop. Milk Producers Union Ltd.) Derrabasi (M/s Punjab Chemicals and Crop Protection Ltd and M/s Winsome Yarns Ltd.), Jodhpur (DIC Office, Shastri Nagar Police Thana and Office of Housing Board) and Allahabad (Bharat Yantra Nigam Ltd., Square crossing).

2.0 SULPHUR DIOXIDE

The summary of SO_2 levels in the country is detailed in this chapter. Summary is given in terms of number of monitoring stations in various ranges of annual average concentration and percentage violation. The air quality of different cities/towns has been compared with the respective NAAQS. The air quality has been categorized into four broad categories based on an Exceedence Factor (the ratio of annual mean concentration of a pollutant with that of a respective standard. Air quality is described in terms of low, moderate, high and critical levels.

2.1 Annual Average Concentration

Number of monitoring stations in residential and industrial areas in various ranges of annual average concentration is depicted in Figure 2.1. National Ambient Air Quality Standard (NAAQS) (annual average) was not exceeded at any monitoring station in residential and industrial areas. SO_2 levels at 79% of the monitoring stations in industrial areas and 93% of the monitoring stations in residential areas were less than 20 $\mu g/m^3$. Table 2.1 shows top ten locations in terms of annual average concentration of sulphur dioxide in residential and industrial areas. The highest concentration in residential area was observed at monitoring station located at Nashik Municipal Corporation Building, Nashik and highest concentration in industrial area was observed at monitoring station located at CGCRI, Khurja, Uttar Pradesh during 2007, although SO_2 levels at none of the monitoring stations exceeded the NAAQS (Annual average).

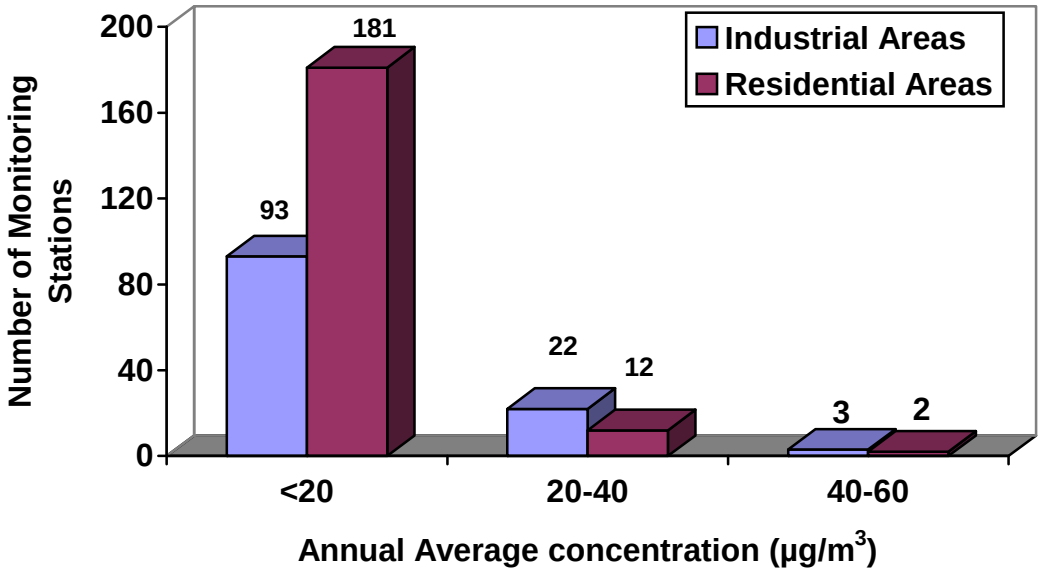


Fig 2.1: Number of Monitoring Stations in various ranges of Annual Average Concentration of SO_2.

Table 2.1 Top ten locations wrt Sulphur Dioxide during 2007 in residential areas.

S. No	Residential Areas		
	Location	**State**	**Annual Average conc. (µg/m^3)**
1	Nasik Municipal Council Building, Nashik	Maharashtra	49
2.	Ahirpara, Khurja	Uttar Pradesh	43
3.	Gram Panchayat Ghugus, Chandrapur	Maharashtra	39
4.	RTO Colony Tank, Nashik	Maharsahtra	36
5.	Nagar Parishad, Chandrapur	Maharashtra	34
6	Fisheries College, Tuticorin	Tamil Nadu	29
7.	AVM Jewellery Building, Tuticorin	Tamil Nadu	28
8.	Clock Tower, Dehradun	Uttaranchal	27
9.	Albert Ekka Chowk, Ranchi	Jharkhand	22
10.	Vishak Hostel, Bhilai	Chattisgarh	21

Table 2.2 Top ten locations wrt Sulphur Dioxide during 2007 in industrial areas.

S. No	Industrial Areas		
	Location	**State**	**Annual Average conc. (µg/m^3)**
1	CGCRI, Khurja	Uttar Pradesh	47
2.	VIP Industrial Area, Nashik	Maharashtra	44
3.	MIDC, Chandrapur	Maharashtra	41
4.	Bistupur Vehicle Testing Center, Jamshedpur	Jharkhand	39
5.	Golmuri Vehicle Testing Center, Jamshedpur	Jharkhand	37
6	Dombivali MIDC Phase-II	Maharashtra	32
7.	Ambernath Muncipal Council Office	Maharashtra	29
8.	Chemical Div. Labour Club, Nagda	Madhya Pradesh	28
9.	Raunaq Auto Limited, Gajraula	Uttar Pradesh	28
10.	Raja Agencies, Tuticorin	Tamil Nadu	28

2.2 Percentage Violation of NAAQS (24 Hourly Average)

Number of monitoring stations in various ranges of percentage violation of NAAQS (24 hourly average) of SO_2 is depicted in Figure 2.2. At all the monitoring stations in industrial areas and residential areas, the percentage violation of NAAQS (24 hourly average) was less than 2%.

2.3 Air Quality wrt SO_2

Number of monitoring stations with low and moderate levels of SO_2 is depicted in Figure 2.3. SO_2 levels at all the monitoring stations in residential and industrial areas were low except at five monitoring stations in residential areas and three monitoring stations in industrial areas where moderate levels were observed. The NAAQS (Annual average) of SO_2 was not exceeded at any of the monitoring stations in residential and industrial areas during 2007.

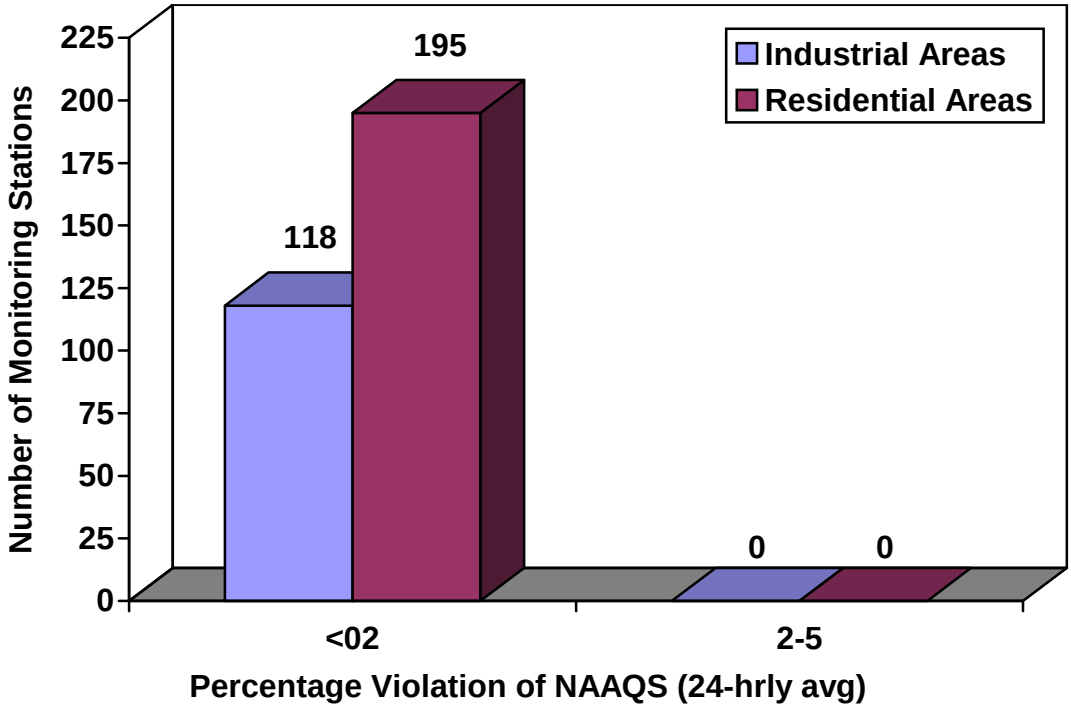


Figure 2.2 Number of Monitoring Stations in various ranges of Percentage Violation of NAAQS (24-hrly avg.) of SO_2.

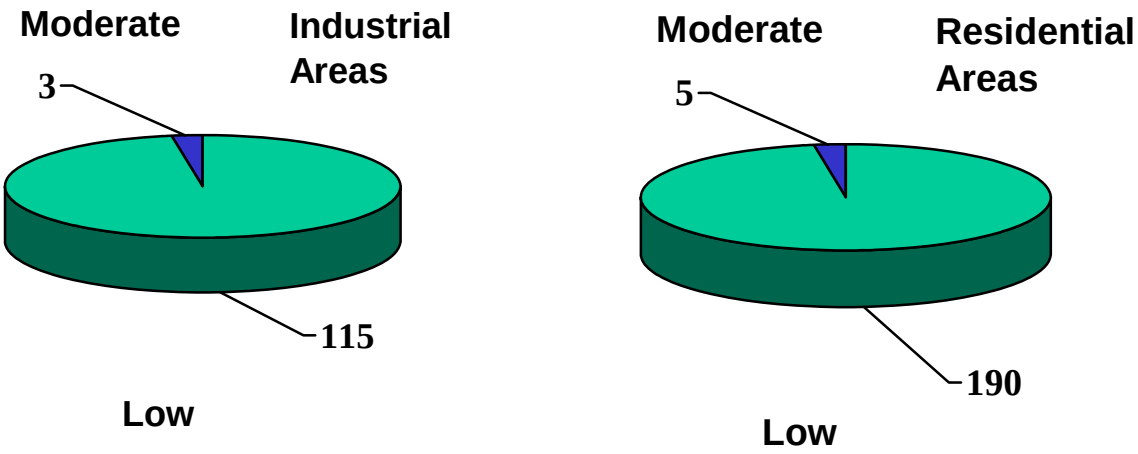


Figure 2.3: Number of Monitoring Stations with Low and Moderate Levels of SO_2.

2.4 Levels of SO_2

The annual average concentration of SO_2 at various monitoring stations is given in Table 2.3. The data given is annual average concentration, standard deviation and number of observations with 16 and more hours of monitoring a day. Also, described in the table is air quality in terms of low, moderate, high and critical. SO_2 levels at all the monitoring stations are within the prescribed NAAQS. Also, at almost all the stations low levels are observed.

Table 2.3: Summary of SO_2 levels (Annual Average Concentration in $\mu g/m^3$) during 2007.

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
1.	Andhra Pradesh	Hyderabad	Nacharam	I	4	2	87	L	0
			CITD Balanagar	I	5	1	107	L	0
			Uppal	I	5	1	108	L	0
			Jublee Hills	R	4	0.2	108	L	0
			Charminar	R	5	0.2	108	L	0
			Paradise	R	5	0.2	108	L	0
			Tarnaka	R	5	2	92	L	0
			ABIDS Circle	R	7	2	87	L	0
			Zoo Park	S	5	0.2	109	L	0
		Visakhapatnam	Industrial Estate	I	8	1	120	L	0
			Mindi	R	9	1	120	L	0
			Police Barracks	R	9	1	120	L	0
			Seethammadhara	R	9	1	118	L	0
			Ganapuram	R	9	2	119	L	0
			Naval Area	S	8	1	120	M	0
		Tirupati	Regional Science Centre	S	4	0	103	L	0
		Vijaywada	Auto Nagar	I	9	6	106	L	0
			Benz Circle	R	6	1	101	L	0
		Patancheru	Police Station	R	17	5	30	-	0
		Kurnool	Mourya Inn	R	4	1	111	L	0
		Ramagundam	RTC Bus Depot	R	4	2	66	L	0

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
2.	Assam	Guwahati	Bamunimaidam Head Office	R	10	3	297	L	0
			Fire Brigade Station	R	8	2	267	L	0
			ITI Building Goipnath Nagar	R	10	3	278	L	0
			Near Pragiyotish College	R	7	2	253	L	0
		Bongaigaon	Borpara Boards Regional Office	R	4	1	98	L	0
			Campus of Oil India Ltd.	R	4	1	94	L	0
		Dibrugarh	Dibrugarh Office Building	R	5	2	94	L	0
		Golaghat	Golaghat Office Buliding	R	5	2	100	L	0
		Sivasagar	Sivasagar Office Building	R	5	2	58	L	0
		Tezpur	Tezpur Office Building	R	4	1	98	L	0
		Hailakandi	CISF Campus	R	5	2	96	L	0
3.	Bihar	Patna	Beltron Bhavan	R	9	1	130	L	0
			Gandhi Maidan	R	11	3	49	-	0
4.	Chandigarh	Chandigarh	Industrial Area	I	BDL	0	151	L	0
			Sector –17C	R	BDL	0	151	L	0
			Punjab Engg. College	R	BDL	0	149	L	0
			IMTECH, Sector 39	R	BDL	0.3	132	L	0
			Kaimbwala Village	R	BDL	0	147	L	0

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
5.	Chattisgarh	Korba	Pragati Nagar	R	13	1	99	L	0
			HIG 21, 22, MP Nagar (Extn)	R	13	1	94	L	0
			ITI Rampur	R	13	1	93	L	0
		Bhilai	Laghu Udyog Nigam I.A.	I	25	1	94	L	0
			Vishak Hostel	R	21	3	91	L	0
			Regional Office Bunglow Office Building	R	5	2	100	L	0
		Raipur	M/s Wool Worth (I) Limited	I	14	2	80	L	0
			New HIG – 9, Hirapur	R	15	2	76	L	0
			Yatayat Thane	R	14	2	70	L	0
6.	Delhi	Delhi	Mayapuri Industrial Area	I	14	8	96	L	0
			Shahzada Bagh	I	4	1	78	L	0
			Shahdara	I	5	1	78	L	0
			Sarojini Nagar	R	7	5	79	L	0
			Town hall	R	12	8	95	L	0
			Nizamuddin	R	4	0	72	L	0
			Ashok Vihar	R	4	0	74	L	0
			Siri Fort	R	4	0	76	L	0
			Janakpuri	R	4	1	76	L	0
7.	Goa	Vasco	On the roof of Fuse Call Office, Elec. Dept.	I	BDL	1	102	L	0
			Mormugao Port Trust	I	BDL	1	99	L	0
		Panjim	Patto, Panaji	R	BDL	1	93	L	0

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
8.	Gujarat	Ahmedabad	Naroda GIDC	I	17	2	104	L	0
			Shardaben Hospital	I	12	4	101	L	0
			Cadilla Bridge, Narol	R	15	2	104	L	0
			L. D. Engineering College	R	9	2	94	L	0
			R.C.High school	R	12	2	96	L	0
			Behrampura	R	11	2	104	L	0
		Vadodara	CETP Nandesari	I	24	3	104	L	0
			GPCB Office, Geri Vasahat	R	9	2	104	L	0
			City Dandia Bazaar	R	17	3	104	L	0
			Shubhanpura	R	4	4	188	L	0
		Surat	Udhna	I	24	9	104	L	0
			SVR Engg. College	R	15	5	105	L	0
			Near Air India Office	R	19	5	105	L	0
		Rajkot	Sardhara Ind. Corporation	I	13	3	102	L	0
			Regional Office	R	12	3	93	L	0
		Ankaleshwar	Rallis India Ltd	I	26	4	104	L	0
			Durga Traders	R	18	4	104	L	0
		Vapi	GEB GIDC	I	26	4	104	L	0
			Vapi Nagar Palika	R	19	5	107	L	0
		Jamnagar	Fisheries Office	R	12	3	102	L	0
9.	Haryana	Faridabad	Shivalic Global Industries	I	12	2	97	L	0
			Regional Office	R	12	3	142	L	0
		Yamuna Nagar	Ballarpur Industries	I	12	4	34	-	0
		Hissar	Urban Estate II	R	8	2	73	L	0
			Guru Jambehswar Univ.	R	6	2	74	L	0

S.no.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
10.	Himachal Pradesh	Shimla	Tekka Bench, The Ridge	S	BDL	2	140	L	0
			Bus Stand	R	4	2	131	L	0
		Parwanoo	AC Office Building,	I	BDL	1	114	L	0
			Regional Office	R	BDL	1	137	L	0
		Damtal	Regional Office	R	BDL	0	109	L	0
			Old Road	R	BDL	0	111	L	0
		Paonta Sahib	Industrial Area, Gondpur	I	BDL	1	125	L	0
			Paonta Sahib	R	BDL	0	136	L	0
		Baddi	Industry Dept. Office Building	I	BDL	1	269	L	0
		Kala Amb	Industrial Area	I	BDL	0	150	L	0
			Trilokpur	R	BDL	0	157	L	0
11.	Jharkhand	Dhanbad	Regional Office	R	20	4	93	L	0
		Jharia	MADA	I	20	6	100	L	0
		Sindri	PDIL	I	18	4	90	L	0
		Ranchi	Albert Ekka Chowk	R	22	5	96	L	0
		Jamshedpur	Bistupur Vehicle Testing Center	I	39	4	96	L	0
			Golmuri Vehicle Testing Center	I	37	3	98	L	0
12.	Karnataka	Bangalore	Graphite India Limited	I	17	2	97	L	0
			KHB Industrial Area	I	16	2	97	L	0
			Peenya Industrial Area	I	17	2	111	L	0
			Amco Batteries	R	17	2	120	L	0
			Yeshwantpura	R	17	2	112	L	0
			Victoria Hospital	S	17	2	126	L	0

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
12.	Karnataka	Mysore	Hebbal Industrial Area	I	13	2	110	L	0
			K.R. Circle	R	13	2	104	L	0
		Hubli- Dharwad	Lakkamanahalli Industrial Area	I	BDL	1	78	L	0
			Rani Chennamma Circle	R	BDL	2	104	L	0
		Mangalore	Baikampady Indl. Area	I	7	1	106	L	0
		Gulbarga	Govt. Hospital	S	BDL	1	105	L	0
		Belgam	KSPCB Building	I	BDL	1	58	L	0
		Hassan	KSRTC Bus Stand Building	R	4	2	107	L	0
13.	Kerala	Kochi	Eloor	I	15	16	107	L	1
			Irumpanam	I	BDL	2	107	L	0
			Kalamassery	I	BDL	1	107	L	0
			Eloor II	I	8	7	107	L	0
			Ernakulum south	R	BDL	3	108	L	0
			M. G. Road	R	4	3	107	L	0
		Tiruvanantha-puram	Hitech Chackai	I	16	5	106	L	0
			SMV School	R	7	4	101	L	0
			Pettah	R	6	1	101	L	0
			PRS Hospital	S	7	3	103	L	1
		Kozhikode	Nallalam	I	BDL	0	108	L	0
			KSRTC Kozhikode	R	BDL	0.3	107	L	0
		Kottayam	Vadavathoor	I	5	1	96	L	0
			Kottayam	R	6	1	99	L	0
		Palakkad	SEPR Refractories India Ltd. Kanjikode	I	BDL	1	119	L	0

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
14.	Madhya Pradesh	Bhopal	CEPT Govindpura	I	9	4	52	L	0
			Hamidia Road	R	11	4	53	L	0
			TT Nagar	R	5	1	41	-	0
			Arera Colony	R	BDL	0	164	L	**0**
		Jabalpur	Vijay Nagar	R	BDL	0	90	L	0
		Nagda	Chemical Div. Labour Club	I	28	4	68	L	0
			Grasim Guest House No-2	R	16	3	70	L	0
			Grasim Kalyan Kendra	R	18	4	73	L	0
		Satna	Sub-divisional Office	I	4	1	76	L	0
			Regional Office	R	BDL	1	76	L	0
		Indore	Pologround	I	10	3	78	L	0
			Kothari Market	R	11	4	92	L	0
			Scheme No-78	R	5	2	90	L	0
		Dewas	EID Perry(I) Ltd	I	18	5	60	L	0
			Sub R.O. MPCB	R	15	4	86	L	0
		Sagar	Pt.Deendayal Nagar	R	5	2	91	L	0
		Gwalior	Dindayal Nagar	R	9	1	81	L	0
			Maharaj Beda	R	9	1	85	L	0
		Ujjain	District Office	I	15	4	85	L	0
			Regional Office	R	8	3	101	L	0
			Mahakal Temple	S	14	4	86	L	44

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
15.	Maharashtra	Mumbai	Parel	I	10	7	96	L	0
			Worli	R	10	8	94	L	0
			Kalbadevi	R	11	10	96	L	0
		Solapur	WIT Campus	I	16	2	108	L	0
			Voronoko Primary School Rang Bhawan	R	17	3	104	L	0
		Thane	Balkum/Kolshet	I	14	2	65	L	0
			Kopri	R	11	2	81	L	0
			Naupada	R	11	2	73	L	0
		Nagpur	MIDC Office	I	10	2	82	L	0
			Hingna Road	I	8	10	95	L	0
			Institution of Engineers	R	9	2	82	L	0
			Govt.Polytechnic College	R	9	2	85	L	0
			Nagpur Corporation Building, Maskasath	R	5	4	93	L	0
			NEERI Lab., Nehru Marg	R	5	6	91	L	0
		Pune	Bhosari	I	21	4	99	L	0
			Swargate	R	20	4	103	L	0
			Nalstop	R	20	4	104	L	0
		Nasik	VIP Industrial Area	I	44	6	104	M	0
			RTO Colony Tank	R	36	5	104	M	0
			Nasik Municipal Council Building	R	49	6	103	M	0
		Chandarpur	MIDC, Chandrapur	I	41	15	106	M	0
			Gram Panchayat Ghugus	R	39	11	96	M	0
			Nagar Parishad	R	34	13	104	M	1

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
15.	Maharashtra	Aurangabad	S.B.E.S. College	R	5	1	96	L	0
			C.A.D.A. Office	R	5	2	98	L	0
			Bibi Ka Maqbara	S	5	1	86	L	0
		Kolhapur	University Campus, Shivaji University	R	5	1	101	L	0
			Ruikar Trust, Dabholkar Corner	R	9	3	104	L	0
			Mahadwar Road , Near Mahalaxmi temple	R	7	2	88	L	0
		Dombivali	Dombivali MIDC Phase-II	I	32	14	97	L	0
			Ambernath Muncipal Council Office	I	29	16	98	L	0
		Navi Mumbai	MIDC Taloja	I	24	18	101	L	0
			MPCB Central Lab	I	18	17	99	L	0
			Airoli	R	13	10	81	L	0
			MESB Power Station	R	12	10	86	L	0
			Nerul	R	16	16	100	L	1
			Panvel	R	11	4	116	L	0
		Lote	MIDC WTP	I	19	11	104	L	0
			Chalke Wadi	R	18	10	85	L	0
		Tarapur	MIDC Compound	I	26	15	68	L	0
			Police Chowki	I	22	13	62	L	0
			Sport Stadium	I	27	12	64	L	0

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
15.	Maharashtra	Amravati	Apurva Oil and Ind.	I	10	2	96	L	0
			Govt. College of Engineering	R	9	2	94	L	0
			Rajkamal Square	R	11	3	96	L	0
16.	Manipur	Imphal	Secretariat Building	R	BDL	1	45	-	0
17.	Meghalaya	Shillong	Boards Office Premises	R	BDL	0.2	77	L	0
			MUDA Complex Police Bazar	R	4	2	58	L	0
18.	Mizoram	Aizawal	Bawongkawn	R	BDL	0	98	L	0
			Khatla	R	BDL	0.3	98	L	0
			Laipuitlang	R	BDL	0.3	98	L	0
19.	Nagaland	Dimapur	Bank colony	R	BDL	0.4	104	L	0
			Dhobinala	R	BDL	1	104	L	0
20.	Orrisa	Talcher	T.T.P.S. Colony	I	8	2	108	L	0
			Coal Field	I	10	2	97	L	0
		Angul	Industrial Estate	I	6	1	107	L	0
			NALCO Nagar Township	R	5	1	107	L	0
		Rourkela	IDL Police Outpost	R	6	0.4	100	L	0
			Regional Office	R	5	0.4	103	L	0
		Rayagada	Jaykaypur	I	BDL	1	94	L	0
			Regional Office	R	BDL	1	97	L	0
		Bhubaneshwar	SPCB Building	R	BDL	1	105	L	0
			IRC Village	R	BDL	2	105	L	0
			Capital Police Station	R	BDL	2	101	L	0
		Cuttack	R.O. Cuttack Office	R	BDL	1	104	L	0
			Roof of Traffic Tower	R	BDL	1	106	L	0

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
20.	Orrisa	Sambalpur	Roof of Filter Plant PHD Off.	R	BDL	3	111	L	0
		Behrampur	Regional Office	R	BDL	0.4	107	L	0
		Balasore	Sahadevkhunta	R	BDL	0.1	100	L	0
21.	Pondicherry	Pondicherry	PIPDIC Ind Estate	I	5	2	87	L	0
			DSTE Office	R	4	2	93	L	0
			Chamber of Commerce	R	4	1	97	L	0
22.	Punjab	Ludhiana	Milk Plant	I	9	1	136	L	0
			Rita Sewing Machine	I	12	4	125	L	0
			Vishwakarma Chowk	R	9	1	137	L	0
			PPCB Office Building	R	10	2	124	L	0
		Jalandhar	Focal Point	I	14	2	90	L	0
			M/s Gee Kay International	I	13	1	115	L	0
			Regional Office	R	11	1	111	L	0
			MC Tubewell	R	12	1	85	L	0
		Gobindgarh	M/s Raj Steel Rolling Mills	I	11	3	67	L	0
			M/s Modi Oil & General Mills	R	13	3	132	L	0
			United Rolling Machine	R	12	2	42	-	0
		Naya Nangal	M/s Punjab Alkalis & Chemicals Ltd.	R	9	3	112	L	0
			M/s NFL Guest House	R	10	3	120	L	0
		Amritsar	Nagina Soap Factory	I	13	1	77	L	0
			A-1 Platters	R	14	1	86	L	0
		Bathinda	M/s Bhantinda Dist, Coop Milk Procedures Union Ltd.	I	14	5	124	L	0
		Khanna	Markfed Vanaspati	I	10	2	127	L	0
			A S School	R	9	1	122	L	0

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
22.	Punjab	Derabessi	M/s Punjab Chemicals and Crop Protection Ltd.	I	12	3	129	L	0
			M/s Winsome Yarns Ltd.	I	11	3	143	L	0
23.	Rajasthan	Alwar	RIICO Pump House	I	7	3	94	L	0
			Vitage Distillers Ltd.	I	9	3	89	L	0
			Regional Office	R	8	2	85	L	0
		Jaipur	VKIA	I	9	8	102	L	0
			RIICO Office, M.I.A.	I	4	1	105	L	0
			Office of District Education Officer, Chandpole	R	5	1	105	L	0
			Ajmeri Gate	R	5	2	102	L	0
			Rajasthan SPCB Office	R	4	1	108	L	0
			Regional Office(North), RSPCB, Vidaya Nagar	R	5	1	102	L	0
		Jodhpur	R.O. Office	I	7	1	95	L	0
			DIC Office	I	7	1	97	L	0
			Sojati Gate	R	7	1	97	L	0
			Maha Mandir Police Thana	R	5	1	96	L	0
			Shastri Nagar Police Thane	R	7	1	99	L	0
			Office of Housing Board	R	5	1	99	L	0
		Kota	Regional Office	I	8	2	103	L	0
			KVK Bhorkhara	R	8	2	103	L	0
			Municipal Corporation Bldg	R	8	2	104	L	0
		Udaipur	Regional Office	I	13	3	93	L	0
			Town Hall	R	8	3	99	L	0
			Amabmata	R	7	2	96	L	0

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
24.	Tamil Nadu	Chennai	Thiruvottiyur Municipal Office	I	11	11	91	L	0
			Kathhivakkam	I	13	4	97	L	0
			Manali	I	13	5	101	L	0
			Thiruvottiyur	I	13	4	98	L	0
			Madras Medical College	R	9	8	43	-	0
			NEERI CSIR Campus	R	9	9	95	L	0
		Coimbatore	SIDCO Office	I	7	3	88	L	0
			Dist. Collectors Office	R	6	2	86	L	0
			Poniarajapuram	R	7	3	92	L	0
		Madurai	Fenner (I) Ltd.	I	11	2	97	L	0
			Highway	R	8	1	101	L	0
			Kunnathur Chatram	R	9	1	96	L	0
		Tuticorin	Raja Agencies	I	28	18	90	L	1
			Fisheries College	R	29	16	94	L	1
			AVM Jewellery Building	R	28	15	85	L	0
		Salem	Sowdeswari College Building	R	8	2	146	L	0
25.	Uttar Pradesh	Lucknow	Talkatora	I	9	1	107	L	0
			Kapoor Hotel	R	8	1	106	L	0
			Mahanagar	R	8	1	107	L	0
			Aminabad	R	9	1	109	L	0
			Aliganj	R	9	1	104	L	0
		Kanpur	Fazalganj	I	7	1	83	L	0
			Jajmau	I	7	1	86	L	0
			Deputy ka Padao	R	7	1	83	L	0
			Kidwai Nagar	R	7	1	95	L	0
			Sharda Nagar	R	7	1	78	L	0

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
25.	Uttar Pradesh	Varanasi	Regional Office	R	16	1	91	L	0
			Shivpur/Sira	R	16	1	71	L	0
		Anpara	Anapara Colony	I	20	1	104	L	0
			Renusagar Colony	I	20	1	103	L	0
		Gajraula	Raunaq Auto Limited	I	28	5	70	L	0
		Ghaziabad	Shahibabad Industrial Area	I	21	6	75	L	0
			Bulandshahar Road Industrial Area	I	19	5	62	L	0
		Agra	TajMahal	S	6	2	257	L	0
			Itmad ud daulah	S	5	2	115	L	0
			Rambagh	S	5	1	109	L	0
			DIC Nunhai	S	5	1	109	L	0
		Noida	M/s GEE PEE Electroplating and Engineering Works	I	13	3	96	L	0
			Regional Office	R	13	2	97	L	0
		Firozabad	Center for Development of Glass Industry	I	23	6	93	L	0
			Tilak Nagar	R	18	5	92	L	0
			Raza ka Tal	R	20	5	90	L	0
		Khurja	CGCRI	I	47	12	84	M	0
			Ahirpara	R	43	12	71	M	0
		Jhansi	Jail Chauraha	R	9	1	112	L	0
			Veerangna Nagar	R	8	1	111	L	0

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
25.	Uttar Pradesh	Allahabad	Bharat Yantra Nigam Ltd.	R	15	5	34	-	0
			Square crossing	R	25	10	35	-	0
		Meerut	Begum Bridge	R	11	1	55	L	0
			Thana Railway road	R	10	1	57	L	0
26.	Uttaranchal	Dehradun	Raipur Road	I	20	1	14	-	0
			Clock Tower	R	27	2	67	L	0
27.	West Bengal	Kolkata	Cossipore	I	16	14	95	L	0
			Behala Chowrasta	I	7	2	104	L	0
			Dunlop Bridge	I	6	2	104	L	0
			Lal Bazaar	R	14	13	96	L	0
			Kasba	R	12	12	96	L	0
			Baishabghate	R	5	1	104	L	0
			Salt Lake	R	6	2	104	L	0
			Minto Park	R	5	2	105	L	0
			Maulali	R	6	2	104	L	0
		Haldia	WBIIDC	I	10	2	96	L	0
			Super Market	I	9	2	105	L	0
		Durgapur	Dew India Ltd	I	10	3	105	L	0
			Kwality Hotel	I	7	2	95	L	0
			PCBL Club	R	5	1	105	L	0
		Asansol	Asansol Municipal Corporation	I	7	2	105	L	0
		Howrah	Howrah Municipal Corporation	I	6	2	105	L	0
			Bandhaghat	I	11	6	103	L	0
			Ghuseri Naskarpara	R	8	4	105	L	0
			Bator	R	5	2	105	L	0

Note:- R – Residential and other areas, I – Industrial area, S – Sensitive Areas, Std dev. – Standard deviation, n – number of days monitored for 16 and more hours a day L- Low, M- Moderate, H – High and C – Critical levels of pollution based on exceedence factor (calculated for n $\geq$ 50 days), % vio – percentage violation of NAAQS (24 hourly average)
BDL = Below Detection Limit (Concentration less than 4 $\mu g/m^3$ for SO_2).

3.0 NITROGEN DIOXIDE

The summary of NO_2 levels in the country is detailed in this chapter. Summary is given in terms of number of monitoring stations in various ranges of annual average concentration and percentage violation. The air quality of different cities/towns has been compared with the respective NAAQS. The air quality has been categorized into four broad categories based on an Exceedence Factor (the ratio of annual mean concentration of a pollutant with that of a respective standard. Air quality is described in terms of low, moderate, high and critical levels.

3.1 Annual Average Concentration

Number of monitoring stations in residential and industrial areas in various ranges of annual average concentration is depicted in Figure 3.1. NO_2 levels at seven monitoring stations exceeded the National Ambient Air Quality Standard (NAAQS) (annual average) in residential areas and NO_2 level at one monitoring stations in industrial areas exceeded NAAQS (Annual average). The seven monitoring stations in residential areas are located at Town Hall, Sarojini Nagar, Delhi, Moulali, Minto Park, Kolkata, Gandhi Maidan, Patna and Ghuseri, Howrah. One monitoring stations in industrial areas where NAAQS (Annual average) was exceeded is located at Bandhaghat, Howrah. NO_2 levels at remaining monitoring stations was less than the NAAQS (Annual Average) during 2007. NO_2 levels at 82% of the monitoring stations in industrial areas and 87% of the monitoring stations in residential areas were less than 40 $\mu g/m^3$. Table 3.1 and Table 3.2 shows top ten locations in terms of annual average concentration of nitrogen dioxide in residential and industrial areas respectively. The highest concentration in residential area was observed at monitoring station located at Town Hall, Delhi and highest concentration in industrial area was observed at monitoring station located at Bandhaghat, Howrah during 2007.

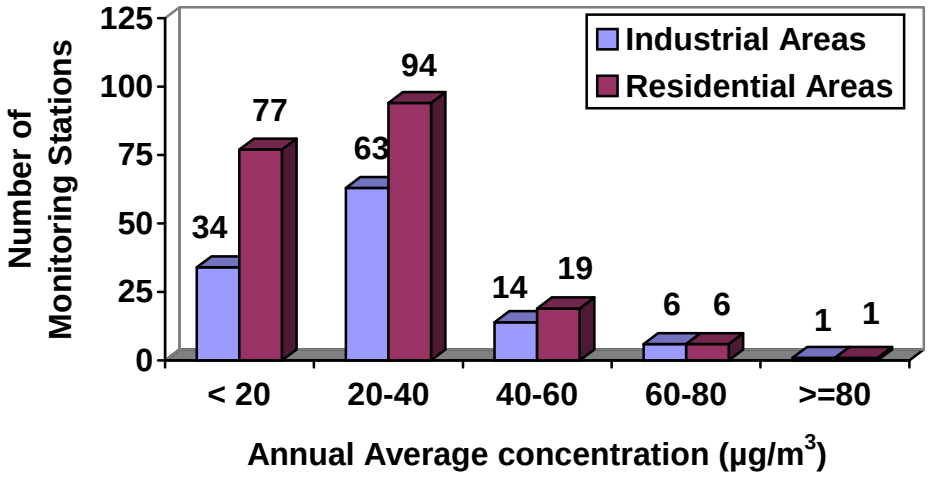


Fig 3.1: Number of Monitoring Stations in various ranges of Annual Average Concentration of NO_2.

Table 3.1 Top ten locations wrt Nitrogen Dioxide during 2007 in residential areas.

S.No	Residential Areas		
	Location	State	Annual Average conc. (µg/m^3)
1.	Town hall, Delhi	Delhi	82*
2.	Maulali, Kolkata	West Bengal	76*
3.	Ghuseri Naskarpara, Howrah	West Bengal	68*
4.	Gandhi Maidan, Patna	Bihar	67*
5.	Salt Lake, Kolkata	West Bengal	66*
6.	Sarojini Nagar, Delhi	Delhi	65*
7.	Minto Park, Kolkata	West Bengal	65*
8.	Bator, Howrah	West Bengal	57
9.	Lal Bazaar, Kolkata	West Bengal	54
10	Regional Office, Dhanbad	Jharkhand	52

* - Locations where annual mean concentration of NO_2 exceeded the NAAQS of 60 µg/m^3 for Residential areas.

Table 3.2 Top ten locations wrt Nitrogen Dioxide during 2007 in industrial areas.

S.No	Industrial Areas		
	Location	State	Annual Average conc. (µg/m^3)
1.	Bandhaghat, Howrah	West Bengal	91*
2.	Behala Chowrasta, Kolkata	West Bengal	73
3.	Howrah Municipal Corporation, Howrah	West Bengal	73
4.	Mayapuri Industrial Area, Delhi	Delhi	70
5.	Dew India Ltd, Durgapur	West Bengal	65
6.	Dunlop Bridge, Kolkata	West Bengal	62
7.	Cossipore, Kolkata	West Bengal	60
8.	Kwality Hotel, Durgapur	West Bengal	59
9.	Asansol Municipal Corporation, Asansol	West Bengal	57
10	Bistupur Vehicle Testing Center, Jamshedpur	Jharkhand	53

* - Locations where annual mean concentration of NO_2 exceeded the NAAQS of 80 µg/m^3 for Industrial areas.

3.2 Percentage Violation of NAAQS (24 Hourly Average)

Number of monitoring stations in various ranges of percentage violation of NAAQS (24 hourly average) of NO_2 is depicted in Figure 3.2. In industrial areas, the percentage violation of NAAQS (24 hourly Avg.) was equal to or more than 2% at six monitoring stations. In residential areas, the percentage violation of NAAQS (24 hourly Avg.) was equal to more than more than 2% at nineteen monitoring stations.

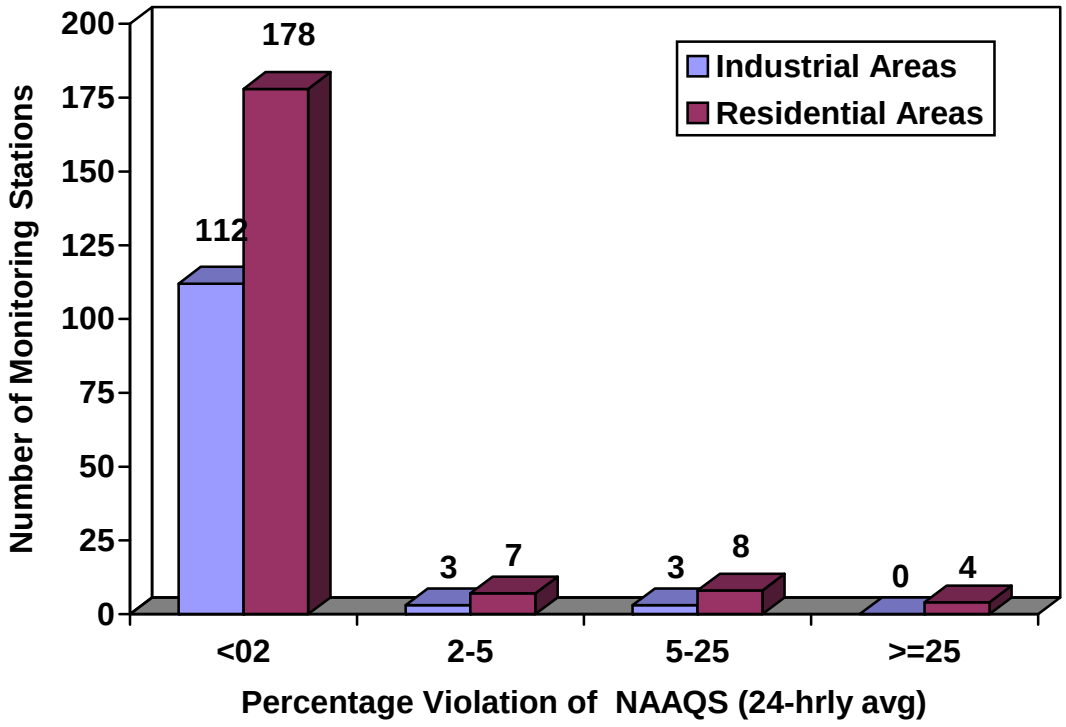


Figure 3.2 Number of Monitoring Stations in various ranges of Percentage Violation (various ranges) of NAAQS (24-hrly avg.) of NO_2

3.3 Air Quality wrt NO_2

Number of monitoring stations with low, moderate and high levels of NO_2 is depicted in Figure 3.3. NO_2 levels at 81 % of the monitoring stations in industrial areas and 70% of the monitoring stations in residential areas were low. High levels of NO_2 were observed at Town Hall, Sarojini Nagar, Delhi, Moulali, Minto Park, Kolkata, Gandhi Maidan, Patna and Ghuseri, Howrah. High levels of NO_2 were also observed at one monitoring station in industrial areas located at Bandhaghat, Howrah.

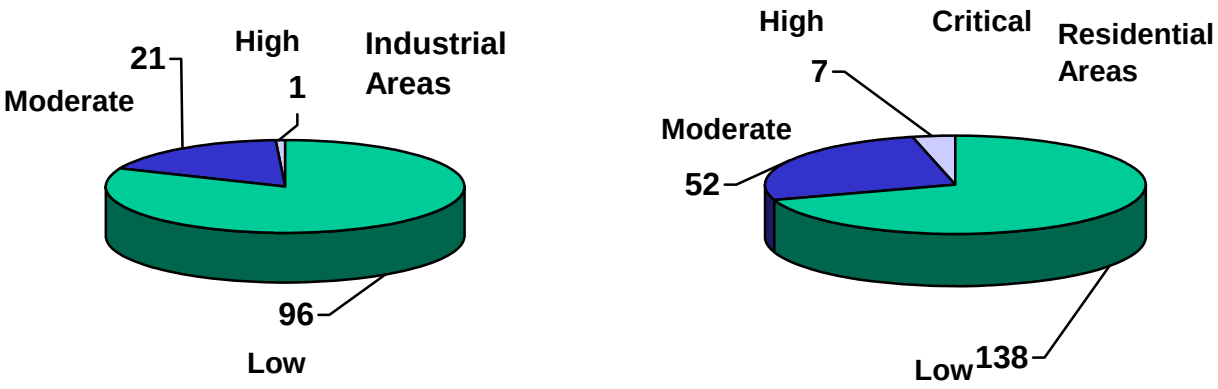


Figure 3.3: Number of Monitoring Stations with Low, Moderate, High and Critical levels of Nitrogen Dioxide.

3.4 Levels of NO_2

The annual average concentration of NO_2 at various monitoring stations is given in Table 3.3. The data given is annual average concentration, standard deviation and number of observations with 16 and more hours of monitoring a day. Also, described in the table is air quality in terms of low, moderate, high and critical. NO_2 levels at most of the monitoring stations were within the prescribed NAAQS. Also, at most of the monitoring stations low levels were observed.

Table 2.3: Summary of NO_2 levels (Annual Average Concentration in $\mu g/m^3$) during 2007.

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
1.	Andhra Pradesh	Hyderabad	Nacharam	I	11	6	88	L	0
			CITD Balanagar	I	35	8	107	L	0
			Uppal	I	34	8	108	L	0
			Jublee Hills	R	16	2	108	L	0
			Charminar	R	33	5	108	M	0
			Paradise	R	36	7	108	M	1
			Tarnaka	R	14	6	92	L	0
			ABIDS Circle	R	22	8	87	L	0
			Zoo Park	S	17	4	109	H	1
		Visakhapatnam	Industrial Estate	I	30	5	120	L	0
			Mindi	R	31	2	120	M	0
			Police Barracks	R	31	2	120	M	0
			Seethammadhara	R	30	2	118	M	0
			Ganapuram	R	30	2	119	M	0
			Naval Area	S	30	2	120	C	75
		Tirupati	Regional Science Centre	S	9	0	103	M	0
		Vijaywada	Auto Nagar	I	37	9	106	L	0
			Benz Circle	R	36	11	108	M	0
		Patancheru	Police Station	R	29	7	30	-	0
		Kurnool	Mourya Inn	R	17	5	110	L	0
		Ramagundam	RTC Bus Depot	R	12	4	66	L	0

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
2.	Assam	Guwahati	Bamunimaidam Head Office	R	18	5	298	L	0
			Fire Brigade Station	R	15	3	267	L	0
			ITI Building Goipnath Nagar	R	17	4	278	L	0
			Near Pragiyotish College	R	14	4	253	L	0
		Bongaigaon	Borpara Boards Regional Office	R	9	2	98	L	0
			Campus of Oil India Ltd.	R	10	3	94	L	0
		Dibrugarh	Dibrugarh Office Building	R	11	2	94	L	0
		Golaghat	Golaghat Office Buliding	R	12	3	100	L	0
		Sivasagar	Sivasagar Office Building	R	11	3	58	L	0
		Tezpur	Tezpur Office Building	R	10	3	98	L	0
		Hailakandi	CISF Campus	R	12	2	96	L	0
3.	Bihar	Patna	Beltron Bhavan	R	32	9	135	M	1
			Gandhi Maidan	R	67	38	50	H	24
4.	Chandigarh	Chandigarh	Industrial Area	I	21	8	151	L	0
			Sector –17C	R	16	7	151	L	0
			Punjab Engg. College	R	13	6	149	L	0
			IMTECH, Sector 39	R	13	6	132	L	0
			Kaimbwala Village	R	11	6	147	L	0

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
5.	Chattisgarh	Korba	Pragati Nagar	R	21	1	99	L	0
			HIG 21, 22, MP Nagar (Extn)	R	21	1	94	L	0
			ITI Rampur	R	21	1	93	L	0
		Bhilai	Laghu Udyog Nigam I.A.	I	31	1	94	L	0
			Vishak Hostel	R	26	2	91	L	0
			Regional Office Bunglow Office Building	R	16	2	100	L	0
		Raipur	M/s Wool Worth (I) Limited	I	35	2	80	L	0
			New HIG – 9, Hirapur	R	36	4	76	M	0
			Yatayat Thane	R	35	2	70	M	0
6.	Delhi	Delhi	Mayapuri Industrial Area	I	70	29	96	M	5
			Shahzada Bagh	I	36	8	78	L	0
			Shahdara	I	48	12	78	M	0
			Sarojini Nagar	R	65	25	79	H	23
			Town hall	R	82	32	95	H	42
			Nizamuddin	R	32	10	72	M	0
			Ashok Vihar	R	31	9	74	M	0
			Siri Fort	R	39	11	76	M	0
			Janakpuri	R	44	10	76	M	0
7.	Goa	Vasco	On the roof of Fuse Call Office, Elec. Dept.	I	15	8	102	L	0
			Mormugao Port Trust	I	10	6	99	L	0
		Panjim	Patto, Panaji	R	11	5	93	L	0

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
8.	Gujarat	Ahmedabad	Naroda GIDC	I	31	6	104	L	0
			Shardaben Hospital	I	21	4	101	L	0
			Cadilla Bridge, Narol	R	26	6	104	L	0
			L. D. Engineering College	R	15	4	94	L	0
			R.C.High school	R	20	4	96	L	0
			Berhampura	R	20	4	104	L	0
		Vadodara	CETP Nandesari	I	42	5	104	M	0
			GPCB Office, Geri Vasahat	R	17	5	104	L	0
			City Dandia Bazaar	R	27	4	104	L	0
			Shubhanpura	R	13	6	188	L	0
		Surat	Udhna	I	31	9	104	L	0
			SVR Engg. College	R	23	5	105	L	0
			Near Air India Office	R	29	4	105	L	0
		Rajkot	Sardhara Ind. Corporation	I	19	3	102	L	0
			Regional Office	R	17	4	93	L	0
		Ankaleshwar	Rallis India Ltd	I	32	4	104	L	0
			Durga Traders	R	26	5	104	L	0
		Vapi	GEB GIDC	I	32	4	104	L	0
			Vapi Nagar Palika	R	27	4	107	L	0
		Jamnagar	Fisheries Office	R	27	4	102	L	0
9.	Haryana	Faridabad	Shivalic Global Industries	I	24	3	97	L	0
			Regional Office	R	25	4	142	L	0
		Yamuna Nagar	Ballarpur Industries	I	30	4	34	-	0
		Hissar	Urban Estate II	R	BDL	1	73	L	0
			Guru Jambehswar Univ.	R	BDL	3	74	L	0

S.no.	STATE	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
10.	Himachal Pradesh	Shimla	Tekka Bench, The Ridge	S	BDL	5	140	L	1
			Bus Stand	R	12	7	130	L	0
		Parwanoo	AC Office Building,	I	11	3	114	L	0
			Regional Office	R	BDL	3	137	L	0
		Damtal	Regional Office	R	17	3	119	L	0
			Old Road	R	20	2	119	L	0
		Paonta Sahib	Industrial Area, Gondpur	I	14	1	125	L	0
			Paonta Sahib	R	12	2	136	L	0
		Baddi	Industry Dept. Office Building	I	13	3	269	L	0
		Kala Amb	Industrial Area	I	14	2	150	L	0
			Trilokpur	R	12	2	156	L	0
11.	Jharkhand	Dhanbad	Regional Office	R	52	10	93	M	2
		Jharia	MADA	I	52	12	100	M	3
		Sindri	PDIL	I	47	9	90	M	0
		Ranchi	Albert Ekka Chowk	R	44	7	96	M	2
		Jamshedpur	Bistupur Vehicle Testing Center	I	53	4	96	M	0
			Golmuri Vehicle Testing Center	I	51	3	98	M	0
12.	Karnataka	Bangalore	Graphite India Limited	I	41	4	97	M	0
			KHB Industrial Area	I	39	3	97	L	0
			Peenya Industrial Area	I	39	3	111	L	0
			Amco Batteries	R	38	4	120	M	0
			Yeshwantpura	R	39	4	112	M	0
			Victoria Hospital	S	39	3	126	C	100

S.No.	STATE	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
12.	Karnataka	Mysore	Hebbal Industrial Area	I	18	3	110	L	0
			K.R. Circle	R	18	3	104	L	0
		Hubli- Dharwad	Lakkamanahalli Industrial Area	I	BDL	2	78	L	0
			Rani Chennamma Circle	R	BDL	2	104	L	0
		Mangalore	Baikampady Indl. Area	I	BDL	1	106	L	0
		Gulbarga	Govt. Hospital	S	14	4	105	M	32
		Belgam	KSPCB Building	I	16	9	58	L	0
		Hassan	KSRTC Bus Stand Building	R	19	3	107	L	0
13.	Kerala	Kochi	Eloor	I	9	4	107	L	0
			Irumpanam	I	BDL	3	107	L	0
			Kalamassery	I	BDL	3	107	L	0
			Eloor II	I	BDL	5	107	L	0
			Ernakulum south	R	15	7	108	L	0
			M. G. Road	R	16	6	107	L	0
		Tiruvanantha-puram	Hitech Chackai	I	21	4	106	L	0
			SMV School	R	31	4	101	M	0
			Pettah	R	24	7	101	L	1
			PRS Hospital	S	27	4	103	C	11
		Kozhikode	Nallalam	I	BDL	2	108	L	0
			KSRTC, Kozikode	R	10	3	107	L	0
		Kottayam	Vadavathoor	I	13	1	96	L	0
			Kottayam	R	22	2	98	L	0
		Palakkad	SEPR Refractories India Ltd. Kanjikode	I	BDL	1	119	L	0

S.No.	STATE	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
14.	Madhya Pradesh	Bhopal	CEPT Govindpura	I	14	4	52	L	0
			Hamidia Road	R	19	4	53	L	0
			TT Nagar	R	10	2	41	-	0
			Arera Colony	R	21	7	164	L	0
		Jabalpur	Vijay Nagar	R	24	2	90	L	0
		Nagda	Chemical Div. Labour Club	I	17	3	69	L	0
			Grasim Guest House No-2	R	24	8	70	L	0
			Grasim Kalyan Kendra	R	30	6	73	M	0
		Satna	Sub-divisional Office	I	9	3	76	L	0
			Regional Office	R	BDL	2	75	L	0
		Indore	Pologround	I	20	7	78	L	0
			Kothari Market	R	20	6	92	L	0
			Scheme No-78	R	11	3	90	L	0
		Dewas	EID Perry(I) Ltd	I	25	6	60	L	0
			Sub R.O. MPCB	R	20	6	86	L	0
		Sagar	Pt.Deendayal Nagar	R	13	3	84	L	0
		Gwalior	Dindayal Nagar	R	16	3	81	L	0
			Maharaj Beda	R	17	3	85	L	0
		Ujjain	District Office	I	16	4	85	L	0
			Regional Office	R	10	3	100	L	0
			Mahakal Temple	S	15	4	86	H	0

S.No.	STATE	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
15.	Maharashtra	Mumbai	Parel	I	37	22	96	L	0
			Worli	R	37	23	94	M	3
			Kalbadevi	R	43	28	96	M	11
		Solapur	WIT Campus	I	34	3	108	L	0
			Voronoko Primary School Rang Bhawan	R	34	4	104	M	0
		Thane	Balkum/Kolshet	I	13	3	64	L	0
			Kopri	R	10	2	81	L	0
			Naupada	R	10	2	73	L	0
		Nagpur	MIDC Office	I	26	9	82	L	0
			Hingna Road	I	29	23	95	L	1
			Institution of Engineers	R	25	8	82	L	0
			Govt.Polytechnic College	R	24	8	85	L	0
			Nagpur Corporation Building, Maskasath	R	27	16	93	L	2
			NEERI Lab., Nehru Marg	R	25	18	91	L	3
		Pune	Bhosari	I	45	7	99	M	0
			Swargate	R	45	7	103	M	0
			Nalstop	R	44	6	104	M	0
		Nasik	VIP Industrial Area	I	37	6	104	L	0
			RTO Colony Tank	R	28	3	104	L	0
			Nasik Municipal Council Building	R	41	6	103	M	0
		Chandarpur	MIDC, Chandrapur	I	46	7	106	M	0
			Gram Panchayat Ghugus	R	52	9	96	M	24
			Nagar Parishad	R	47	10	104	M	0

S.No.	STATE	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
15.	Maharashtra	Aurangabad	S.B.E.S. College	R	21	6	96	L	0
			C.A.D.A. Office	R	22	6	98	L	0
			Bibi Ka Maqbara	S	15	3	84	H	0
		Kolhapur	University Campus, Shivaji University	R	BDL	2	101	L	0
			Ruikar Trust, Dabholkar Corner	R	28	14	104	L	0
			Mahadwar Road , Near Mahalaxmi temple	R	15	8	88	L	0
		Dombivali	Dombivali MIDC Phase-II	I	34	12	97	L	0
			Ambernath Muncipal Council Office	I	35	16	98	L	0
		Navi Mumbai	MIDC Taloja	I	37	20	101	L	0
			MPCB Central Lab	I	25	14	100	L	0
			Airoli	R	25	13	88	L	2
			MESB Power Station	R	28	17	86	L	1
			Nerul	R	28	18	100	L	1
			Panvel	R	30	16	116	M	2
		Lote	MIDC WTP	I	20	7	104	L	0
			Chalke Wadi	R	22	11	85	L	0
		Tarapur	MIDC Compound	I	30	9	68	L	0
			Police Chowki	I	33	13	62	L	0
			Sport Stadium	I	31	9	62	L	0

S.No.	STATE	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
15.	Maharashtra	Amravati	Apurva Oil and Ind.	I	12	3	96	L	0
			Govt. College of Engineering	R	10	2	94	L	0
			Rajkamal Square	R	16	4	96	L	0
16.	Manipur	Imphal	Secretariat Building	R	19	3	46	-	0
17.	Meghalaya	Shillong	Boards Office Premises	R	BDL	1	77	L	0
			MUDA Complex Police Bazar	R	14	5	58	L	0
18.	Mizoram	Aizawal	Bawongkawn	R	BDL	3	98	L	0
			Khatla	R	BDL	2	98	L	0
			Laipuitlang	R	BDL	1	97	L	0
19.	Nagaland	Dimapur	Bank colony	R	14	3	104	L	0
			Dhobinala	R	14	4	104	L	0
20.	Orrisa	Talcher	T.T.P.S. Colony	I	18	3	108	L	0
			Coal Field	I	15	4	97	L	0
		Angul	Industrial Estate	I	17	2	107	L	0
			NALCO Nagar Township	R	19	4	107	L	0
		Rourkela	IDL Police Outpost	R	10	1	100	L	0
			Regional Office	R	10	1	103	L	0
		Rayagada	Jaykaypur	I	10	2	94	L	0
			Regional Office	R	13	5	97	L	0
		Bhubaneshwar	SPCB Building	R	14	6	105	L	0
			IRC Village	R	13	4	105	L	0
			Capital Police Station	R	16	8	102	L	0
		Cuttack	R.O. Cuttack Office	R	16	2	104	L	0
			Roof of Traffic Tower	R	43	6	106	M	0

S.No.	STATE	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
20.	Orrisa	Sambalpur	Roof of Filter Plant PHD Off.	R	11	2	111	L	0
		Behrampur	Regional Office	R	15	4	106	L	0
		Balasore	Sahadevkhunta	R	11	1	100	L	0
21.	Pondicherry	Pondicherry	PIPDIC Ind Estate	I	BDL	3	87	L	0
			DSTE Office	R	BDL	2	93	L	0
			Chamber of Commerce	R	BDL	2	97	L	0
22.	Punjab	Ludhiana	Milk Plant	I	34	5	136	L	0
			Rita Sewing Machine	I	42	4	126	M	0
			Vishwakarma Chowk	R	33	7	137	M	0
			PPCB Office Building	R	39	4	124	M	0
		Jalandhar	Focal Point	I	34	3	90	L	0
			M/s Gee Kay International	I	32	2	115	L	0
			Regional Office	R	27	2	111	L	0
			MC Tubewell	R	31	2	85	M	0
		Gobindgarh	M/s Raj Steel Rolling Mills	I	26	3	67	L	0
			M/s Modi Oil & General Mills	R	31	3	132	M	0
			United Rolling Machine	R	30	7	42	-	0
		Naya Nangal	M/s Punjab Alkalis & Chemicals Ltd.	R	27	5	112	L	0
			M/s NFL Guest House	R	28	5	120	L	0
		Amritsar	Nagina Soap Factory	I	33	3	77	L	0
			A-1 Platters	R	33	3	86	M	0
		Bathinda	M/s Bhantinda Dist, Coop Milk Procedures Union Ltd.	I	30	6	124	L	0
		Khanna	Markfed Vanaspati	I	38	4	127	L	0
			A S School	R	35	5	122	M	0

S.No.	STATE	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
22.	Punjab	Derabessi	M/s Punjab Chemicals and Crop Protection Ltd	I	30	4	129	L	0
			M/s Winsome Yarns Ltd.	I	29	4	143	L	0
23.	Rajasthan	Alwar	RIICO Pump House	I	21	11	94	L	0
			Vitage Distillers Ltd.	I	23	13	89	L	0
			Regional Office	R	25	16	85	L	0
		Jaipur	VKIA	I	30	8	102	L	0
			RIICO Office, M.I.A.	I	20	5	105	L	0
			Office of District Education Officer, Chandpole	R	39	7	105	M	0
			Ajmeri Gate	R	39	8	102	M	0
			Rajasthan SPCB Office	R	17	5	108	L	0
			Regional Office(North), RSPCB, Vidaya Nagar	R	21	5	102	L	0
		Jodhpur	R.O. Office	I	23	1	95	L	0
			DIC Office	I	24	2	97	L	0
			Sojati Gate	R	25	4	97	L	1
			Maha Mandir Police Thana	R	20	3	96	L	0
			Shastri Nagar Police Thane	R	25	1	99	L	0
			Office of Housing Board	R	20	4	98	L	0
		Kota	Regional Office	I	21	10	103	L	0
			KVK Bhorkhara	R	21	9	103	L	0
			Municipal Corporation Bldg	R	21	9	104	L	0
		Udaipur	Regional Office	I	34	10	93	L	0
			Town Hall	R	28	9	99	L	0
			Amabmata	R	23	8	96	L	0

S.No.	STATE	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
24.	Tamil Nadu	Chennai	Thiruvottiyur Municipal Office	I	12	14	92	L	0
			Kathhivakkam	I	20	6	97	L	0
			Manali	I	20	7	101	L	0
			Thiruvottiyur	I	24	8	98	L	0
			Madras Medical College	R	15	23	43	-	5
			NEERI CSIR Campus	R	9	8	95	L	0
		Coimbatore	SIDCO Office	I	32	10	88	L	0
			Dist. Collectors Office	R	28	10	86	L	0
			Poniarajapuram	R	26	9	92	L	0
		Madurai	Fenner (I) Ltd.	I	24	5	97	L	0
			Highway	R	21	7	101	L	1
			Kunnathur Chatram	R	20	3	96	L	0
		Tuticorin	Raja Agencies	I	20	15	89	L	0
			Fisheries College	R	15	7	94	L	0
			AVM Jewellery Building	R	17	15	85	L	1
		Salem	Sowdeswari College Building	R	25	7	146	L	0
25.	Uttar Pradesh	Lucknow	Talkatora	I	33	3	107	L	0
			Kapoor Hotel	R	32	3	106	M	0
			Mahanagar	R	32	3	107	M	0
			Aminabad	R	33	3	109	M	0
			Aliganj	R	32	2	104	M	0
		Kanpur	Fazalganj	I	25	4	83	L	0
			Jajmau	I	23	4	86	L	0
			Deputy ka Padao	R	24	4	83	L	0
			Kidwai Nagar	R	24	5	95	L	0
			Sharda Nagar	R	23	4	78	L	0
			Vikas Nagar	R	21	11	250	L	0

S.No.	STATE	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
25.	Uttar Pradesh	Varanasi	Regional Office	R	18	1	91	L	0
			Shivpur/ Sigra	R	19	1	71	L	0
		Anpara	Anapara Colony	I	30	3	104	L	0
			Renusagar Colony	I	30	3	103	L	0
		Gajraula	Raunaq Auto Limited	I	18	2	69	L	0
		Ghaziabad	Shahibabad Industrial Area	I	15	4	75	L	0
			Bulandshahar Road Industrial Area	I	15	5	62	L	0
		Agra	TajMahal	S	23	10	261	C	25
			Itmad ud daulah	S	27	9	113	C	36
			Rambagh	S	25	6	109	C	30
			DIC Nunhai	S	37	11	109	C	61
		Noida	M/s GEE PEE Electroplating and Engineering Works	I	50	5	96	M	0
			Regional Office	R	49	5	97	M	0
		Firozabad	Center for Development of Glass Industry	I	36	11	93	L	0
			Tilak Nagar	R	28	7	92	L	0
			Raza ka Tal	R	30	8	90	M	0
		Khurja	CGCRI	I	32	13	84	L	0
			Ahirpara	R	30	12	71	M	0
		Jhansi	Jail Chauraha	R	28	1	112	L	0
			Veerangna Nagar	R	28	1	111	L	0

S.No.	STATE	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
25.	Uttar Pradesh	Allahabad	Bharat Yantra Nigam	R	32	12	34	-	0
			Square crossing	R	48	12	35	-	0
		Meerut	Begum Bridge	R	45	4	55	M	0
			Thana Railway road	R	43	4	57	M	0
26.	Uttaranchal	Dehradun	Raipur Road	I	22	1	14	-	0
			Clock Tower	R	29	2	67	L	0
27.	West Bengal	Kolkata	Cossipore	I	60	26	95	M	2
			Behala Chowrasta	I	73	23	104	M	4
			Dunlop Bridge	I	62	19	104	M	0
			Lal Bazaar	R	54	28	96	M	23
			Kasba	R	42	31	95	M	17
			Baishabghate	R	43	15	104	M	1
			Salt Lake	R	66	25	104	H	27
			Minto Park	R	65	19	105	H	24
			Maulali	R	76	27	104	H	35
		Haldia	WBIIDC	I	45	8	96	M	0
			Super Market	I	41	8	105	M	0
		Durgapur	Dew India Ltd	I	65	16	105	M	0
			Kwality Hotel	I	59	15	95	M	0
			PCBL Club	R	43	8	105	M	0
		Asansol	Asansol Municipal Corporation	I	57	14	105	M	0
		Howrah	Howrah Municipal Corporation	I	73	26	105	M	5
			Bandhaghat	I	91	26	103	H	20
			Ghuseri Naskarpara	R	68	20	105	H	30
			Bator	R	57	19	105	M	13

Note:- R – Residential and other areas, I – Industrial area, S – Sensitive Areas, Std dev. – Standard deviation, n – number of days monitored for 16 and more hours a day L- Low, M- Moderate, H – High and C – Critical levels of pollution based on exceedence factor (calculated for n $\geq$ 50 days), % vio – percentage violation of NAAQS (24 hourly average)
BDL = Below Detection Limit (Concentration less than 9 $\mu g/m^3$ for NO_2).

4.0 RESPIRABLE SUSPENDED PARTICULATE MATTER

The summary of Respirable Suspended Particulate Matter (PM_{10}/RSPM) levels in the country are detailed in this chapter. Summary is given in terms of number of monitoring stations in various ranges of annual average concentration and percentage violation. The air quality of different cities/towns has been compared with the respective NAAQS. The air quality has been categorized into four broad categories based on an Exceedence Factor (the ratio of annual mean concentration of a pollutant with that of a respective standard. The four categories are low, moderate, high and critical levels.

4.1 Annual Average Concentration

Number of monitoring stations in industrial and residential areas in various ranges of annual average concentration is depicted in Figure 4.1 and Figure 4.2 respectively. RSPM levels were equal to or exceeded National Ambient Air Quality Standard (NAAQS) (annual average) at 44 monitoring stations in industrial areas and 157 monitoring stations in residential areas. Table 4.1 and Table 4.2 shows top ten locations in terms of annual average concentration of RSPM in residential and industrial areas respectively. The highest concentration in residential area was observed at monitoring station located at M/s Modi Oil & General Mills, Gobindgarh and highest concentration in industrial area was observed at monitoring station located at Sub-divisional Office, Satna.

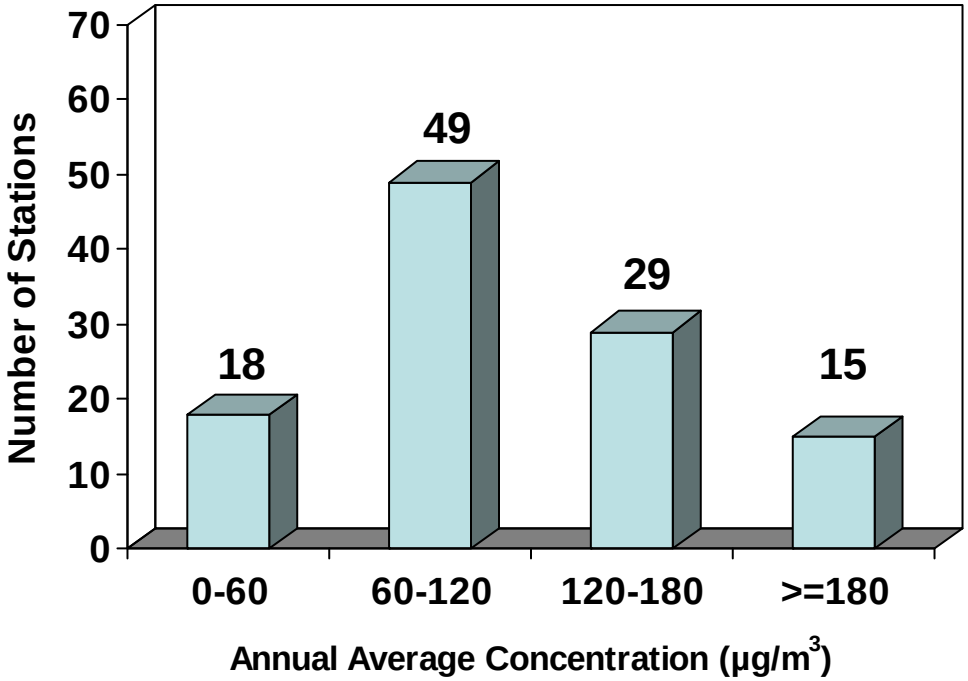


Fig 4.1: Number of Monitoring Stations (Industrial Area) in various Ranges of Annual Average Concentration of RSPM.

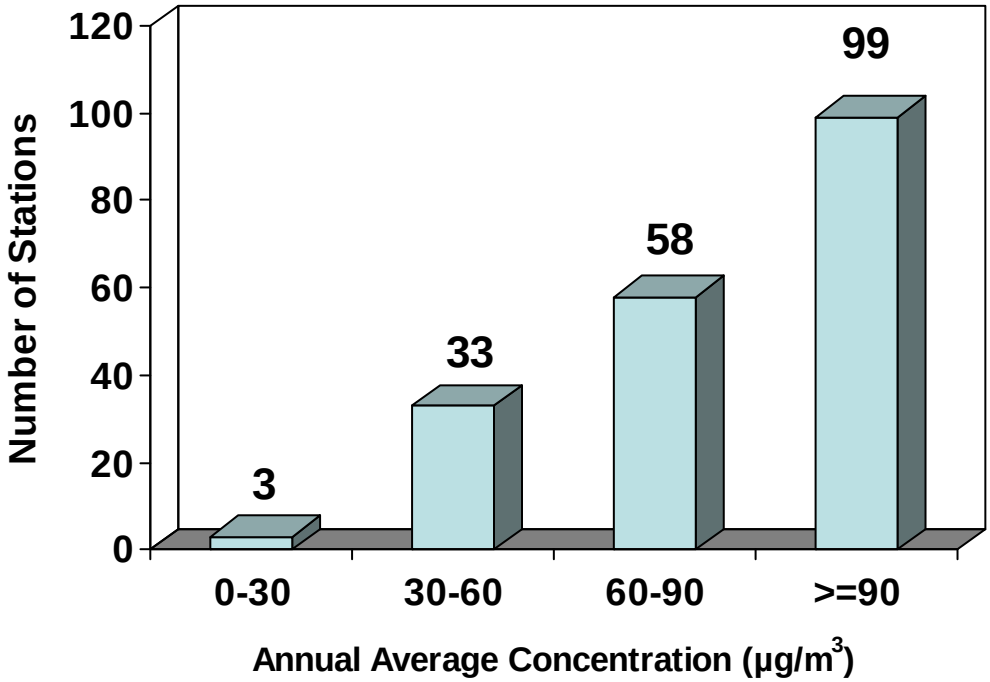


Fig 4.2: Number of Monitoring Stations (Residential Area) in various Ranges of Annual Average Concentration of RSPM.

Table 4.1 Top ten locations wrt RSPM during 2007 in residential areas.

S.No	Residential Areas		
	Location	State	Annual Average conc. (µg/m^3)
1.	M/s Modi Oil & General Mills, Gobindgarh	Punjab	252*
2.	PPCB Office Building, Ludhiana	Punjab	231*
3.	Ahirpara, Khurja	Uttar Pradesh	201*
4.	Deputy ka Padao, Kanpur	Uttar Pradesh	198*
5.	Town hall, Delhi	Delhi	198*
6.	Kidwai Nagar, Kanpur	Uttar Pradesh	197*
7.	A S School, Khanna	Punjab	196*
8.	Aminabad, Lucknow	Uttar Pradesh	193*
9.	Aliganj, Lucknow	Uttar Pradesh	190*
10	Sharda Nagar, Kanpur	Uttar Pradesh	185*

* - Locations where annual mean concentration of RSPM exceeded the NAAQS of 60 µg/m^3 for Residential areas.

Table 4.2 Top ten locations wrt RSPM during 2007 in industrial areas.

S.No	Industrial Areas		
	Location	State	Annual Average conc. (µg/m^3)
1.	Sub-divisional Office, Satna	Madhya Pradesh	288*
2.	Rita Sewing Machine, Ludhiana	Punjab	261*
3.	Shahibabad Industrial Area, Ghaziabad	Uttar Pradesh	250*
4.	Mayapuri Industrial Area, Delhi	Delhi	233*
5.	Markfed Vanaspati, Khanna	Punjab	233*
6.	M/s Raj Steel Rolling Mills, Gonindgarh	Punjab	228*
7.	Bulandshahar Road Industrial Area, Ghaziabad	Uttar Pradesh	210*
8.	CGCRI, Khurja	Uttar Pradesh	209*
9.	Center for Development of Glass Industry, Firozabad	Uttar Pradesh	205*
10	VKIA, Jaipur	Rajasthan	202*

* - Locations where annual mean concentration of RSPM exceeded the NAAQS of 120 µg/m^3 for Industrial areas.

4.2 Percentage Violation of NAAQS (24 Hourly Average)

Number of monitoring stations in various ranges of percentage violation of NAAQS (24 hourly average) of RSPM is depicted in Figure 4.3. The percentage violation of NAAQS (24 hourly Avg.) was less than 2% at 33 monitoring stations in industrial areas and 27 monitoring stations in residential areas. At all the remaining stations, the percentage violation of NAAQS (24 hourly avg.) was 2% or more.

4.3 Air Quality wrt RSPM

Number of monitoring stations with low, moderate, high and critical levels of RSPM is depicted in Figure 4.4. RSPM levels at 51 % of the monitoring stations in residential areas and 14% of the monitoring stations in industrial areas were critical.

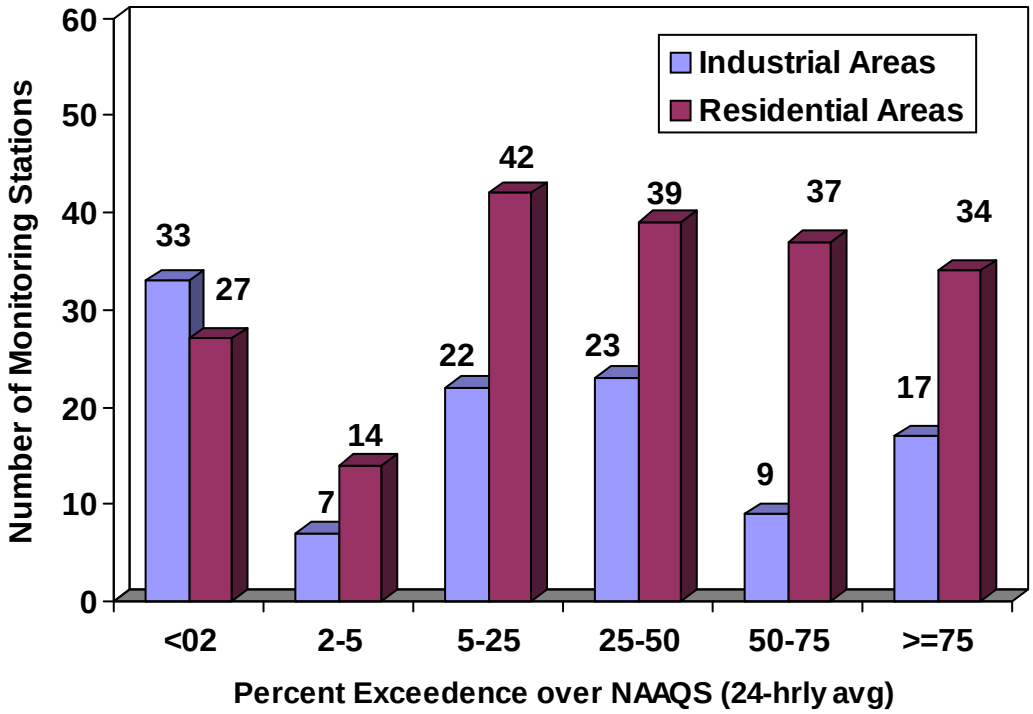


Figure 4.3 Number of Monitoring Stations in various ranges of Percentage Violation of NAAQS (24-hrly avg.) of RSPM.

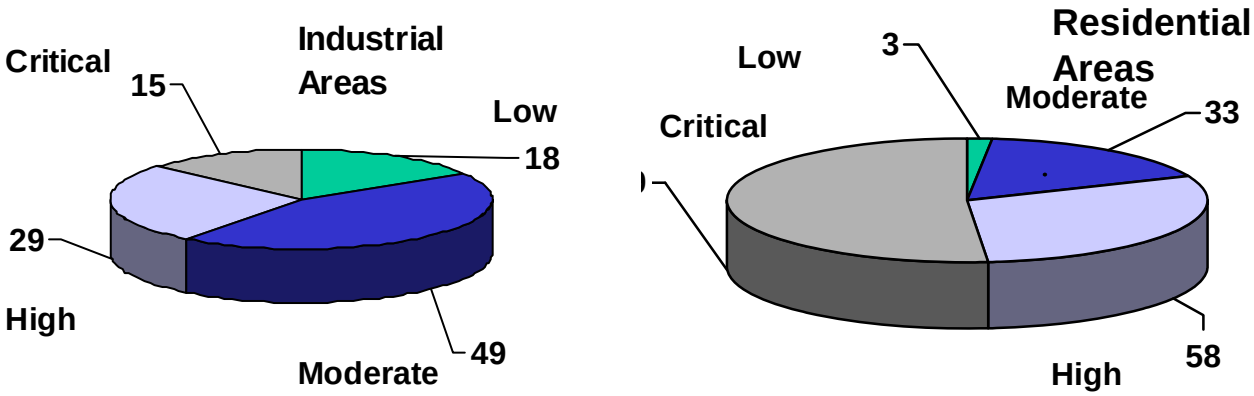


Figure 4.4: Number of Monitoring Stations with Low, Moderate, High and Critical levels of RSPM.

4.4 Levels of RSPM

The annual average concentration of RSPM at various monitoring stations is given in Table 4.3. The data given is annual average concentration, standard deviation and number of observations with 16 and more hours of monitoring a day. Also, described in the table is air quality in terms of low, moderate, high and critical. RSPM levels at many monitoring stations violated the prescribed NAAQS.

Table 2.3: Summary of RSPM levels (Annual Average Concentration in μg/m^3) during 2007.

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average (μg/m^3)	Std. Dev.	n	Air Quality	% vio
1.	Andhra Pradesh	Hyderabad	Nacharam	I	50	17	91	L	0
			CITD Balanagar	I	95	33	107	M	7
			Uppal	I	99	33	108	M	7
			Jublee Hills	R	49	17	108	M	0
			Charminar	R	101	28	107	C	50
			Paradise	R	103	21	108	C	60
			Tarnaka	R	63	24	95	H	6
			ABIDS Circle	R	67	27	89	H	15
			Zoo Park	S	51	20	110	H	10
		Visakhapatnam	Industrial Estate	I	91	10	120	M	0
			Mindi	R	97	13	120	C	39
			Police Barracks	R	103	18	120	C	58
			Seethammadhara	R	89	12	118	H	15
			Ganapuram	R	90	12	119	C	12
			Naval Area	S	77	8	119	C	66
		Tirupati	Regional Science Centre	S	26	4	103	M	0
		Vijaywada	Auto Nagar	I	92	16	107	M	0
			Benz Circle	R	85	13	109	H	9
		Patancheru	Police Station	R	107	88	30	-	37
		Kurnool	Mourya Inn	R	80	13	109	H	1
		Ramagundam	RTC Bus Depot	R	65	39	65	H	20

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
2.	Assam	Guwahati	Bamunimaidam Head Office	R	114	79	298	C	45
			Fire Brigade Station	R	96	56	268	C	40
			ITI Building Goipnath Nagar	R	96	58	278	C	38
			Near Pragiyotish College	R	90	52	253	C	38
		Bongaigaon	Borpara Boards Regional Office	R	48	27	98	M	6
			Campus of Oil India Ltd.	R	48	33	94	M	8
		Dibrugarh	Dibrugarh Office Building	R	59	33	94	M	11
		Golaghat	Golaghat Office Buliding	R	67	46	100	H	22
		Sivasagar	Sivasagar Office Building	R	90	41	58	C	45
		Tezpur	Tezpur Office Building	R	66	43	98	H	18
		Hailakandi	CISF Campus	R	47	31	96	M	6
3.	Bihar	Patna	Beltron Bhavan	R	109	19	138	C	69
			Gandhi Maidan	R	137	21	52	C	100
4.	Chandigarh	Chandigarh	Industrial Area	I	133	57	151	H	36
			Sector –17C	R	86	36	151	H	29
			Punjab Engg. College	R	94	45	149	C	41
			IMTECH, Sector 39	R	90	38	132	C	49
			Kaimbwala Village	R	100	47	148	C	41
5.	Chattisgarh	Korba	Pragati Nagar	R	94	9	90	C	21
			HIG 21, 22, MP Nagar (Extn)	R	103	11	85	C	64
			ITI Rampur	R	103	8	93	C	70

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
5.	Chattisgarh	Bhilai	Laghu Udyog Nigam I.A.	I	164	15	95	H	87
			Vishak Hostel	R	97	10	92	C	40
			Regional Office Bunglow Office Building	R	79	11	101	H	1
		Raipur	M/s Wool Worth (I) Ltd	I	177	27	92	H	82
			New HIG – 9, Hirapur	R	134	24	84	C	89
			Yatayat Thane	R	115	15	62	C	81
6.	Delhi	Delhi	Mayapuri Industrial Area	I	233	157	96	C	58
			Shahzada Bagh	I	154	95	73	H	38
			Shahdara	I	177	91	57	H	56
			Sarojini Nagar	R	131	83	79	C	53
			Town hall	R	198	141	95	C	67
			Nizamuddin	R	113	69	60	C	57
			Ashok Vihar	R	180	129	61	C	69
			Siri Fort	R	183	98	68	C	72
			Janakpuri	R	160	95	70	C	71
7.	Goa	Vasco	On the roof of Fuse Call Office, Elec. Dept.	I	57	30	104	L	1
			Mormugao Port Trust	I	44	28	100	L	0
		Panjim	Patto, Panaji	R	45	22	93	M	1
8.	Gujarat	Ahmedabad	Naroda GIDC	I	149	24	105	H	47
			Shardaben Hospital	I	88	17	101	M	0
			Cadilla Bridge, Narol	R	105	25	104	C	53
			L. D. Engineering College	R	62	18	95	H	4
			R.C.High school	R	89	24	97	H	18
			Behrampura	R	88	24	104	H	21

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
8.	Gujarat	Vadodara	CETP Nandesari	I	153	23	104	H	51
			GPCB Office, Geri Vasahat	R	59	18	105	M	4
			City Dandia Bazaar	R	115	17	104	C	80
			Shubhanpura	R	76	54	188	H	28
		Surat	Udhna	I	104	14	104	M	0
			SVR Engg. College	R	80	15	105	H	11
			Near Air India Office	R	93	13	105	C	31
		Rajkot	Sardhara Ind. Corporation	I	123	23	103	H	8
			Regional Office	R	76	19	93	H	11
		Ankaleshwar	Rallis India Ltd	I	109	16	104	M	0
			Durga Traders	R	90	13	104	C	24
		Vapi	GEB GIDC	I	81	6	104	M	0
			Vapi Nagar Palika	R	63	6	107	H	0
		Jamnagar	Fisheries Office	R	103	17	104	C	59
9.	Haryana	Faridabad	Shivalic Global Industries	I	171	12	97	H	93
			Regional Office	R	146	13	142	C	100
		Yamuna Nagar	Ballarpur Industries	I	99	39	34	-	29
		Hissar	Urban Estate II	R	148	67	71	C	96
			Guru Jambehswar Univ.	R	80	21	74	H	82
10.	Himachal Pradesh	Shimla	Tekka Bench, The Ridge	S	44	21	141	M	8
			Bus Stand	R	58	20	101	M	4
		Parwanoo	AC Office Building,	I	84	37	122	M	3
			Regional Office	R	62	30	141	H	11
		Damtal	Regional Office	R	56	24	135	M	7
			Old Road	R	79	38	124	H	17

S.no.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
10.	Himachal Pradesh	Paonta Sahib	Industrial Area, Gondpur	I	177	66	127	H	64
			Paonta Sahib	R	81	36	139	H	28
		Baddi	Industry Dept. Office Building	I	204	65	21	-	81
		Kala Amb	Industrial Area	I	244	116	31	-	84
			Trilokpur	R	100	45	30	-	40
11.	Jharkhand	Dhanbad	Regional Office	R	107	54	96	C	49
		Jharia	MADA	I	180	74	100	C	58
		Sindri	PDIL	I	128	46	93	H	36
		Ranchi	Albert Ekka Chowk	R	136	31	91	C	93
		Jamshedpur	Bistupur Vehicle Testing Center	I	166	14	96	H	93
			Golmuri Vehicle Testing Center	I	166	12	98	H	92
12.	Jammu& Kashmir	Jammu	M.A Stadium Jewel Chawk	R	68	29	43	-	21
13.	Karnataka	Bangalore	Graphite India Limited	I	124	72	98	H	32
			KHB Industrial Area	I	77	30	97	M	2
			Peenya Industrial Area	I	86	35	111	M	5
			Amco Batteries	R	62	36	119	H	15
			Yeshwantpura	R	64	23	112	H	8
			Victoria Hospital	S	67	38	126	H	31
		Mysore	Hebbal Industrial Area	I	38	14	110	L	0
			K.R. Circle	R	45	18	105	M	2
		Hubli-Dharwad	Lakkamanahalli Industrial Area	I	90	43	78	M	13

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
13.	Karnataka	Hubli- Dharwad	Rani Chennamma Circle	R	145	43	104	C	62
		Mangalore	Baikampady Ind. Area	I	62	24	106	M	0
		Gulbarga	Govt. Hospital	S	80	35	105	C	51
		Belgam	KSPCB Building	I	39	14	58	L	0
		Hassan	KSRTC Bus Stand Building	R	62	14	107	H	0
14.	Kerala	Kochi	Eloor	I	48	23	107	L	0
			Irumpanam	I	42	19	107	L	0
			Kalamassery	I	46	25	107	L	4
			Eloor II	I	46	24	107	L	2
			Ernakulum south	R	48	22	108	M	4
			M. G. Road	R	43	30	107	M	4
		Tiruvanantha-puram	Hitech Chackai	I	91	15	105	M	0
			SMV School	R	77	25	101	H	2
			Pettah	R	52	10	101	M	1
			PRS Hospital	S	67	28	103	H	22
		Kozhikode	Nallalam	I	23	4	108	L	0
			Kozhikode City	R	28	9	107	L	0
		Kottayam	Vadavathoor	I	36	5	96	L	0
			Kottayam	R	59	9	98	M	0
		Palakkad	SEPR Refractories India Ltd. Kanjikode	I	68	62	119	M	12
15.	Madhya Pradesh	Bhopal	CEPT Govindpura	I	67	10	54	M	0
			Hamidia Road	R	84	11	55	H	9
			TT Nagar	R	41	7	41	-	0
			Arera Colony	R	125	75	164	C	61

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
15.	Madhya Pradesh	Jabalpur	Vijay Nagar	R	107	21	90	C	68
		Nagda	Chemical Div. Labour Club	I	90	15	72	M	0
			Grasim Guest House No-2	R	82	12	72	H	1
			Grasim Kalyan Kendra	R	85	12	78	H	3
		Satna	Sub-divisional Office	I	288	47	77	C	99
			Regional Office	R	122	32	76	C	75
		Indore	Pologround	I	145	56	80	H	40
			Kothari Market	R	124	46	96	C	67
			Scheme No-78	R	92	31	95	C	50
		Dewas	EID Perry(I) Ltd	I	28	13	65	L	0
			Sub R.O. MPCB	R	26	9	88	L	0
		Singrauli	Jayant Township	R	78	9	43	-	2
			NTPC Vidhyanagar	R	63	7	66	H	0
			Waidhan	R	50	5	45	-	0
		Sagar	Pt.Deendayal Nagar	R	66	33	31	-	16
		Gwalior	Dindayal Nagar	R	183	85	82	C	78
			Maharaj Beda	R	149	83	84	C	62
		Ujjain	District Office	I	121	34	85	H	26
			Regional Office	R	96	31	99	C	50
			Mahakal Temple	S	111	33	86	C	84
16.	Maharashtra	Mumbai	Parel	I	93	56	96	M	17
			Worli	R	92	44	94	C	37
			Kalbadevi	R	92	78	96	C	34

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
16.	Maharashtra	Solapur	WIT Campus	I	84	15	108	M	0
			Voronoko Primary School Rang Bhawan	R	95	23	104	C	41
		Thane	Balkum/Kolshet	I	53	2	83	L	0
			Kopri	R	50	2	96	M	0
			Naupada	R	50	3	95	M	0
		Nagpur	MIDC Office	I	164	107	86	H	51
			Hingna Road	I	108	62	95	M	22
			Institution of Engineers	R	124	90	88	C	55
			Govt.Polytechnic College	R	121	82	88	C	52
			Nagpur Corporation Building, Maskasath	R	88	42	91	H	32
			NEERI Lab., Nehru Marg	R	63	35	93	H	15
		Pune	Bhosari	I	109	44	99	M	15
			Swargate	R	108	55	103	C	47
			Nalstop	R	109	58	104	C	51
		Nasik	VIP Industrial Area	I	46	7	104	L	0
			RTO Colony Tank	R	39	6	104	M	0
			Nasik Municipal Council Building	R	51	7	103	M	0
		Chandarpur	MIDC, Chandrapur	I	146	80	106	H	41
			Gram Panchayat Ghugus	R	174	94	99	C	81
			Nagar Parishad	R	172	103	104	C	71
		Aurangabad	S.B.E.S. College	R	79	43	96	H	26
			C.A.D.A. Office	R	75	47	97	H	27
			Bibi Ka Maqbara	S	57	37	86	H	31

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
16.	Maharashtra	Kolhapur	University Campus, Shivaji University	R	43	10	89	M	0
			Ruikar Trust, Dabholkar Corner	R	87	21	90	H	44
			Mahadwar Road , Near Mahalaxmi temple	R	67	17	74	H	3
		Dombivali	Dombivali MIDC Phase-II	I	101	56	98	M	21
			Ambernath Muncipal Council Office	I	108	59	98	M	20
		Navi Mumbai	MIDC Taloja	I	97	48	101	M	13
			MPCB Central Lab	I	88	53	92	M	13
			Airoli	R	80	46	101	H	37
			MESB Power Station	R	90	56	78	C	40
			Nerul	R	86	60	100	H	37
			Panvel	R	112	55	115	C	57
		Lote	MIDC WTP	I	72	39	105	M	0
			Chalke Wadi	R	82	36	85	H	35
		Tarapur	MIDC Compound	I	73	26	68	M	0
			Police Chowki	I	103	62	57	M	11
			Sport Stadium	I	78	30	62	M	3
		Amravati	Apurva Oil and Ind.	I	61	19	89	M	0
			Govt. College of Engineering	R	47	13	86	M	0
			Rajkamal Square	R	78	25	88	H	19

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
17.	Manipur	Imphal	Secretariat Building	R	56	17	46	-	7
18.	Meghalaya	Shillong	Boards Office Premises	R	55	10	77	M	0
			MUDA Complex Police Bazar	R	78	17	58	H	5
19.	Mizoram	Aizawal	Bawongkawn	R	51	18	98	M	2
			Khatla	R	42	14	98	M	1
			Laipuitlang	R	25	11	97	L	0
20.	Nagaland	Dimapur	Bank colony	R	66	26	104	H	8
			Dhobinala	R	69	28	104	H	14
21.	Orrisa	Talcher	T.T.P.S. Colony	I	74	31	108	M	0
			Coal Field	I	89	40	97	M	9
		Angul	Industrial Estate	I	128	43	107	H	26
			NALCO Nagar Township	R	71	30	107	H	14
		Rourkela	IDL Police Outpost	R	95	13	100	C	37
			Regional Office	R	107	17	103	C	69
		Rayagada	Jaykaypur	I	54	16	94	L	0
			Regional Office	R	57	16	97	M	0
		Bhubaneshwar	SPCB Building	R	68	29	105	H	12
			IRC Village	R	65	32	105	H	18
			Capital Police Station	R	81	45	102	H	37
		Cuttack	R.O. Cuttack Office	R	75	32	104	H	23
			Roof of Traffic Tower	R	88	31	106	H	24
		Sambalpur	Roof of Filter Plant PHD Off.	R	49	12	111	M	0
		Behrampur	Regional Office	R	62	35	107	H	16
		Balasore	Sahadevkhunta	R	62	19	100	H	1

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
22.	Pondicherry	Pondicherry	PIPDIC Ind Estate	I	52	14	89	L	0
			DSTE Office	R	53	16	87	M	4
			Chamber of Commerce	R	45	11	99	M	0
23.	Punjab	Ludhiana	Milk Plant	I	186	33	138	C	99
			Rita Sewing Machine	I	261	50	127	C	98
			Vishwakarma Chowk	R	171	26	137	C	100
			PPCB Office Building	R	231	37	125	C	100
		Jalandhar	Focal Point	I	192	20	89	C	99
			M/s Gee Kay International	I	175	18	117	H	95
			Regional Office	R	146	18	111	C	100
			MC Tubewell	R	168	16	84	C	100
		Gobindgarh	M/s Raj Steel Rolling Mills	I	228	66	67	C	100
			M/s Modi Oil & General Mills	R	252	66	131	C	100
			United Rolling Machine	R	250	70	42	-	100
		Naya Nangal	M/s Punjab Alkalis & Chemicals Ltd.	R	94	13	108	C	11
		Khanna	Markfed Vanaspati	I	233	33	127	C	98
			A S School	R	196	28	122	C	100
24	Rajasthan	Alwar	RIICO Pump House	I	109	53	94	M	20
			Vitage Distillers Ltd.	I	115	61	91	M	25
			Regional Office	R	130	77	88	C	58

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
	Rajasthan	Jaipur	VKIA	I	202	101	104	C	64
			RIICO Office, M.I.A.	I	75	34	106	M	3
			Office of District Education Officer, Chandpole	R	125	57	105	C	56
			Ajmeri Gate	R	100	45	102	C	48
			Rajasthan SPCB Office	R	70	31	109	H	13
			Regional Office(North), RSPCB, Vidaya Nagar	R	95	59	105	C	37
		Jodhpur	R.O. Office	I	134	61	96	H	31
			DIC Office	I	110	49	97	M	25
			Sojati Gate	R	143	55	97	C	78
			Maha Mandir Police Thana	R	141	61	97	C	75
			Shastri Nagar Police Thane	R	129	49	99	C	71
			Office of Housing Board	R	115	53	99	C	65
		Kota	Regional Office	I	113	65	103	M	29
			KVK Bhorkhara	R	124	80	103	C	53
			Municipal Corporation Building	R	118	63	104	C	58
		Udaipur	Regional Office	I	143	123	90	H	41
			Town Hall	R	65	32	99	H	13
			Amabmata	R	78	51	96	H	21

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
25.	Tamil Nadu	Chennai	Thiruvottiyur Municipal Office	I	48	20	93	L	0
			Kathhivakkam	I	71	25	97	M	0
			Manali	I	77	30	101	M	3
			Thiruvottiyur	I	76	32	99	M	7
			Madras Medical College	R	68	38	42	-	21
			NEERI CSIR Campus	R	37	20	94	M	2
		Coimbatore	SIDCO Office	I	100	36	90	M	7
			Dist. Collectors Office	R	46	22	86	M	2
			Poniarajapuram	R	43	23	92	M	2
		Madurai	Fenner (I) Ltd.	I	40	16	92	L	0
			Highway	R	41	12	100	M	0
			Kunnathur Chatram	R	44	16	95	M	1
		Tuticorin	Raja Agencies	I	113	70	90	M	26
			Fisheries College	R	63	34	94	H	12
			AVM Jewellery Building	R	93	61	86	C	27
		Salem	Sowdeswari College Building	R	59	23	144	M	8
26	Uttar Pradesh	Lucknow	Talkatora	I	199	26	107	C	97
			Kapoor Hotel	R	181	27	106	C	100
			Mahanagar	R	183	26	107	C	100
			Aminabad	R	193	26	109	C	100
			Aliganj	R	190	25	104	C	100
		Kanpur	Fazalganj	I	205	41	46	-	89
			Jajmau	I	196	38	89	C	90
			Deputy ka Padao	R	198	43	87	C	100
			Kidwai Nagar	R	197	39	99	C	100
			Sharda Nagar	R	185	42	78	C	97
			Vikas nagar	R	160	118	250	C	59

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
	Uttar Pradesh	Varanasi	Regional Office	R	106	14	92	C	61
			Shivpur/ Sigra	R	121	8	71	C	100
		Anpara	Anapara Colony	I	126	33	104	H	31
			Renusagar Colony	I	129	36	102	H	34
		Gajraula	Raunaq Auto Limited	I	64	15	70	M	0
			Indra Chowk	R	48	15	27	-	0
		Ghaziabad	Shahibabad Industrial Area	I	250	41	74	C	97
			Bulandshahar Road Industrial Area	I	210	18	62	C	98
		Agra	TajMahal	S	167	117	262	C	65
			Itmad ud daulah	S	203	118	111	C	81
			Rambagh	S	203	126	105	C	80
			DIC Nunhai	S	274	134	106	C	86
		Noida	M/s GEE PEE Electroplating and Engineering Works	I	168	40	96	H	63
			Regional Office	R	162	38	97	C	100
		Firozabad	Center for Development of Glass Industry	I	205	93	80	C	71
			Tilak Nagar	R	176	76	79	C	79
			Raza ka Tal	R	174	78	77	C	77
		Khurja	CGCRI	I	209	79	84	C	76
			Ahirpara	R	201	76	71	C	92
		Jhansi	Jail Chauraha	R	185	52	112	C	100
			Veerangna Nagar	R	144	43	111	C	81

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
	Uttar Pradesh	Allahabad	Bharat Yantra Nigam	R	111	66	34	-	32
			Square crossing	R	206	82	35	-	100
		Meerut	Begum Bridge	R	120	9	55	C	100
			Thana Railway road	R	113	8	32	-	97
27.	Uttaranchal	Dehradun	Raipur Road	I	78	9	14	-	0
			Clock Tower	R	105	24	70	C	54
28.	West Bengal	Kolkata	Cossipore	I	163	103	95	H	45
			Behala Chowrasta	I	104	78	104	M	22
			Dunlop Bridge	I	93	72	104	M	19
			Lal Bazaar	R	134	97	96	C	52
			Kasba	R	133	129	94	C	42
			Baishabghate	R	74	63	104	H	28
			Salt Lake	R	81	68	104	H	33
			Minto Park	R	70	55	105	H	21
			Maulali	R	99	78	104	C	39
		Haldia	WBIIDC	I	60	50	96	M	12
			Super Market	I	60	52	105	M	11
		Durgapur	Dew India Ltd	I	163	108	105	H	44
			Kwality Hotel	I	126	86	95	H	33
			PCBL Club	R	74	47	105	H	27
		Asansol	Asansol Municipal Corporation	I	112	76	105	M	26
		Howrah	Howrah Municipal Corporation	I	132	108	105	H	32
			Bandhaghat	I	110	78	103	M	25
			Ghuseri Naskarpara	R	105	90	105	C	36
			Bator	R	101	92	105	C	37

Note:- R – Residential and other areas, I – Industrial area, S – Sensitive Areas, Std dev. – Standard deviation, n – number of days monitored for 16 and more hours a day L- Low, M- Moderate, H – High and C – Critical levels of pollution based on exceedence factor (calculated for n $\geq$ 50 days), % vio – percentage violation of NAAQS (24 hourly average)

5.0 SUSPENDED PARTICULATE MATTER

The summary of Suspended Particulate Matter (SPM) levels in the country are detailed in this chapter. Summary is given in terms of number of monitoring stations in various ranges of annual average concentration and percentage violation. The air quality of different cities/towns has been compared with the respective NAAQS. The air quality has been categorized into four broad categories based on an Exceedence Factor (the ratio of annual mean concentration of a pollutant with that of a respective standard. The four categories are low, moderate, high and critical levels.

5.1 Annual Average Concentration

Number of monitoring stations in industrial and residential areas in various ranges of annual average concentration of SPM is depicted in Figure 5.1 and Figure 5.2 respectively. National Ambient Air Quality Standard (NAAQS) (annual average) was equal to or exceeded at 18 monitoring stations in industrial areas and 133 monitoring stations in residential areas.

Table 5.1 and Table 5.2 shows top ten locations in terms of annual average concentration of SPM in residential and industrial areas respectively. The highest concentration in residential area was observed at monitoring station located at Town Hall, Delhi and highest concentration in industrial area was observed at monitoring station located at Regional Office, Udaipur.

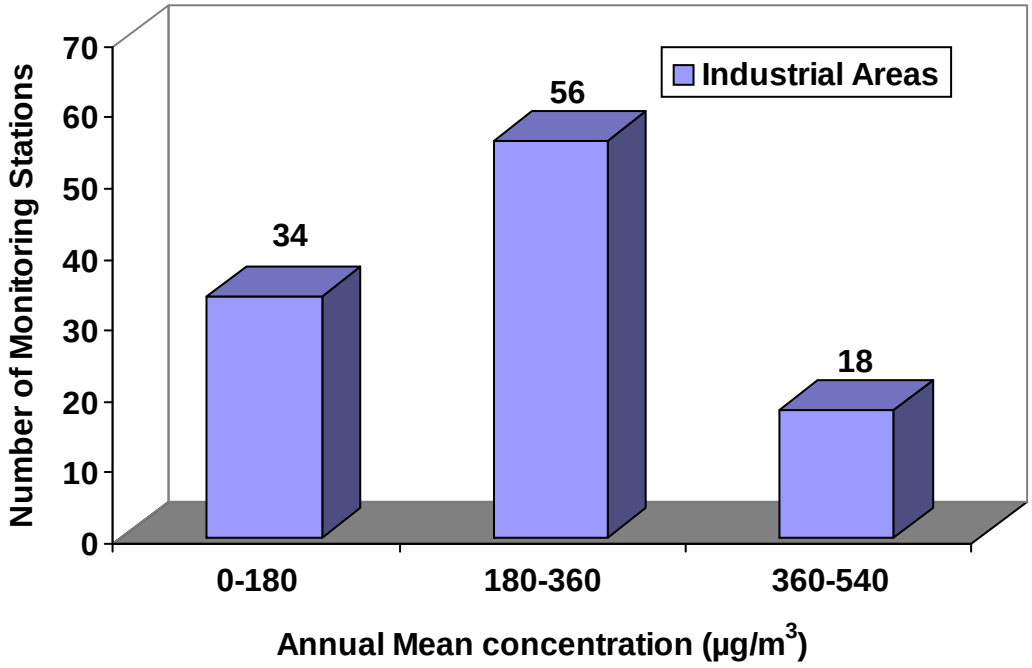


Fig 5.1: Number of Monitoring Stations (Industrial Areas) in Various Ranges of Annual Average Concentration of SPM.

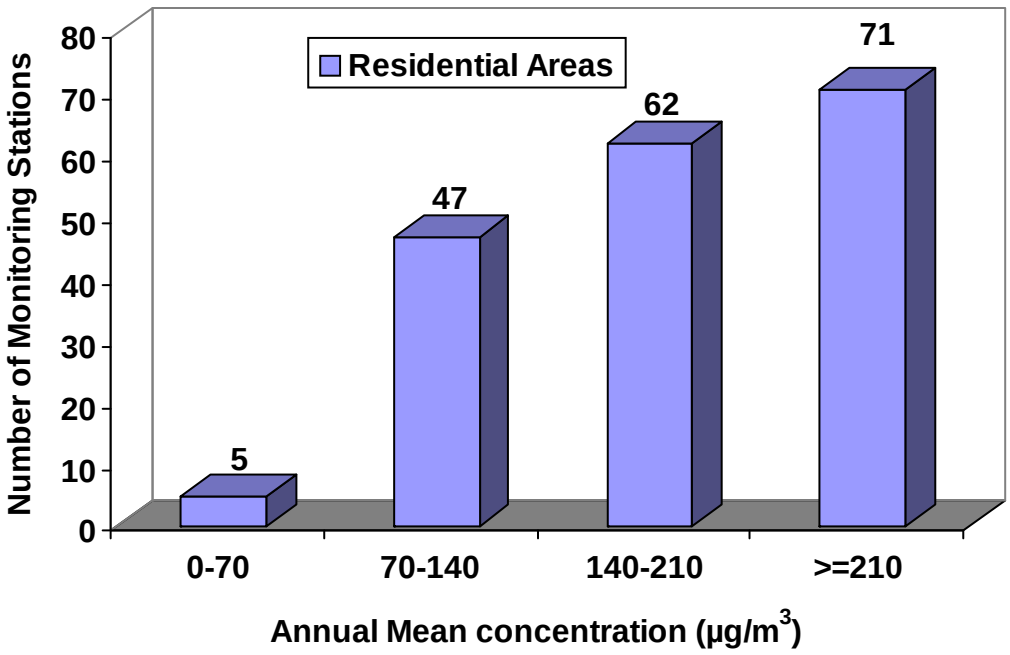


Fig 5.2: Number of Monitoring Stations (Residential Areas) in Various Ranges of Annual Average Concentration of SPM.

Table 5.1 Top ten locations wrt SPM during 2007 in residential areas.

S.No	Residential Areas		
	Location	State	Annual Average conc. (µg/m^3)
1.	Town hall, Delhi	Delhi	476*
2.	Regional Office, Noida	Uttar Pradesh	447*
3.	Kidwai Nagar, Kanpur	Uttar Pradesh	442*
4.	Deputy ka Padao, Kanpur	Uttar Pradesh	440*
5.	Ahirpara,Khurja	Uttar Pradesh	432*
6.	Shivpur/Sigra, Varanasi	Uttar Pradesh	422*
7.	Sharda Nagar, Kanpur	Uttar Pradesh	421*
8.	A-1 Platters, Amritsar	Punjab	411*
9.	Aminabad, Lucknow	Uttar Pradesh	402*
10.	Jail Chauraha, Jhansi	Uttar Pradesh	402*

* - Locations where annual mean concentration of SPM exceeded the NAAQS of 140 µg/m^3 for Residential areas.

Table 5.2 Top ten locations wrt SPM during 2007 in industrial areas.

S.No	Industrial Areas		
	Location	State	Annual Average conc. (µg/m^3)
1.	Regional Office, Udaipur	Rajasthan	520*
2.	Center for Development of Glass Industry, Firozabad	Uttar Pradesh	486*
3.	CGCRI, Khurja	Uttar Pradesh	485*
4.	Fazalganj, Kanpur	Uttar Pradesh	484*
5.	Shahibabad Industrial Area, Ghaziabad	Uttar Pradesh	475*
6.	Mayapuri Industrial Area, Delhi	Delhi	461*
7.	Jajmau, Kanpur	Uttar Pradesh	444*
8.	Shahdara, Delhi	Delhi	440*
9	M/s GEE PEE Electroplating and Engineering Works, Noida	Uttar Pradesh	437*
10	Sub-divisional Office, Satna	Madhya Pradesh	433*

* - Locations where annual mean concentration of SPM exceeded the NAAQS of 360 µg/m^3 for Industrial areas.

5.2 Percentage Violation of NAAQS (24 Hourly Average)

Number of monitoring stations in various ranges of percentage violation of NAAQS (24 hourly average) of SPM is depicted in Figure 5.3. The percentage violation of NAAQS (24 hourly Avg.) was less than 2% at 68 monitoring stations in industrial areas and 30 monitoring stations in residential areas. At all the remaining stations, the percentage violation of NAAQS (24 hourly avg.) was 2% or more.

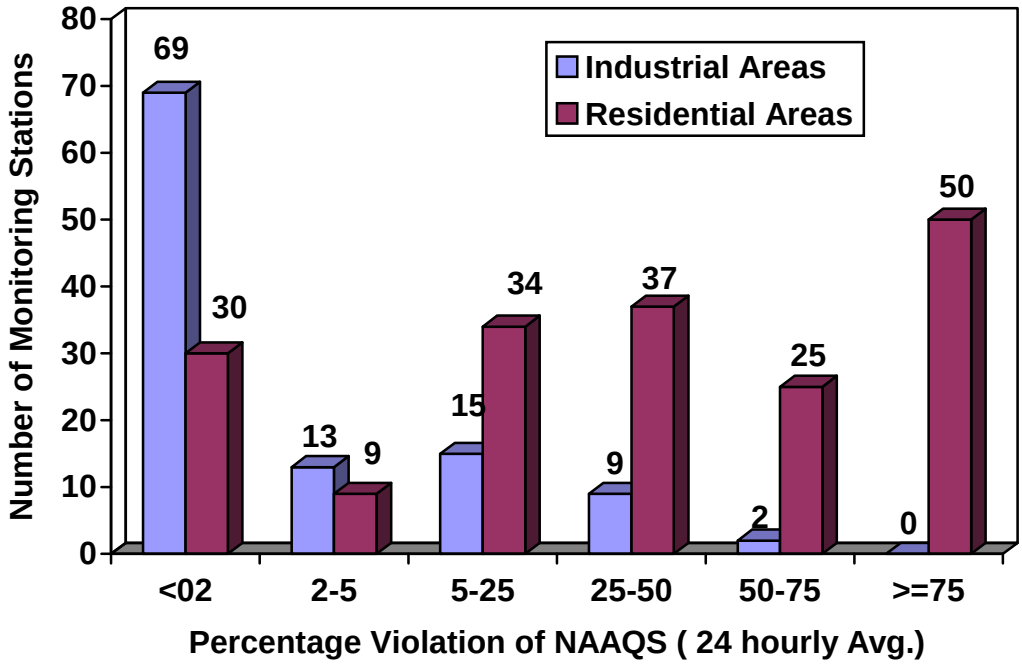


Figure 5.3 Number of Monitoring Stations in various ranges of Percentage Violation of NAAQS (24-hrly avg.) of SPM.

5.3 Air Quality wrt SPM

Number of monitoring stations with low, moderate, high and critical levels of RSPM is depicted in Figure 5.4. SPM levels at 39 % of the monitoring stations in residential areas were critical

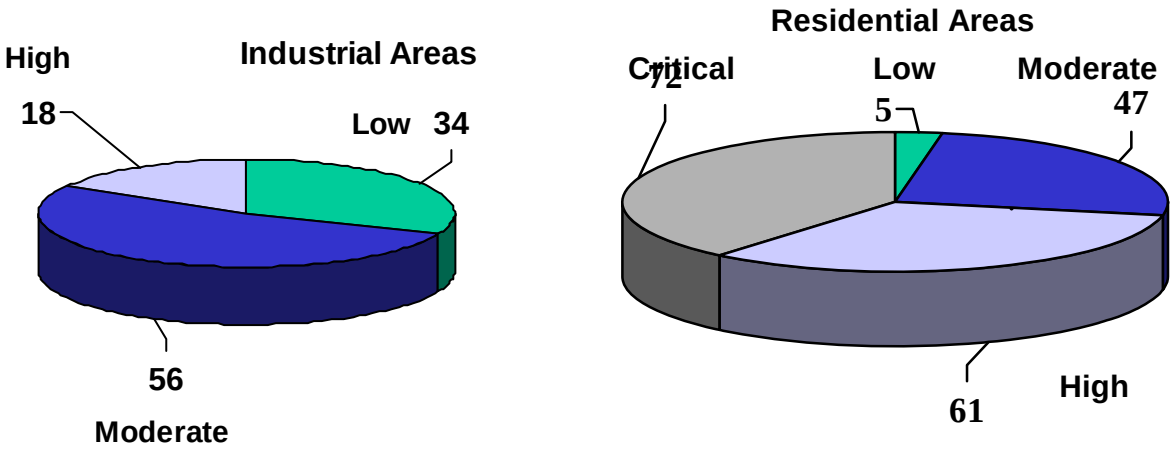


Figure 5.4: Number of Monitoring Stations with Low, Moderate, High and Critical levels of SPM.

5.4 Levels of SPM

The annual average concentration of SPM at various monitoring stations is given in Table 5.3. The data given is annual average concentration, standard deviation and number of observations with 16 and more hours of monitoring a day. Also, described in the table is air quality in terms of low, moderate, high and critical. SPM levels at many monitoring stations violated the prescribed NAAQS.

Table 2.3: Summary of SPM levels (Annual Average Concentration in μg/m^3) during 2007.

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average (μg/m^3)	Std. Dev.	n	Air Quality	% vio
1.	Andhra Pradesh	Hyderabad	Nacharam	I	117	32	91	L	0
			CITD Balanagar	I	301	70	107	M	0
			Uppal	I	268	73	108	M	0
			Jublee Hills	R	128	39	108	M	4
			Charminar	R	299	58	107	C	94
			Paradise	R	299	44	108	C	97
			Tarnaka	R	176	55	95	H	33
			ABIDS Circle	R	185	54	89	H	35
			Zoo Park	S	134	48	110	C	75
		Visakhapatnam	Industrial Estate	I	183	20	120	M	0
			Mindi	R	196	26	120	H	39
			Police Barracks	R	207	32	120	H	58
			Seethammadhara	R	181	22	118	H	14
			Ganapuram	R	184	26	119	H	13
			Naval Area	S	158	16	119	C	100
		Tirupati	Regional Science Centre	S	86	8	103	H	2
		Vijaywada	Auto Nagar	I	242	40	107	M	0
			Benz Circle	R	180	26	109	H	21
		Patancheru	Police Station	R	339	329	30	-	37
		Kurnool	Mourya Inn	R	167	37	109	H	10
		Ramagundam	RTC Bus Depot	R	213	98	65	C	52

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
2.	Assam	Guwahati	Bamunimaidam Head Office	R	189	138	298	H	34
			Fire Brigade Station	R	146	76	268	H	24
			ITI Building Goipnath Nagar	R	143	74	278	H	21
			Near Pragiyotish College	R	137	69	253	M	21
		Bongaigaon	Borpara Boards Regional Office	R	84	39	98	M	1
			Campus of Oil India Ltd.	R	92	68	94	M	11
		Dibrugarh	Dibrugarh Office Building	R	107	47	94	M	9
		Golaghat	Golaghat Office Buliding	R	102	54	100	M	5
		Sivasagar	Sivasagar Office Building	R	140	60	58	H	17
		Tezpur	Tezpur Office Building	R	128	83	98	M	16
		Hailakandi	CISF Campus	R	85	51	96	M	5
3.	Bihar	Patna	Beltron Bhavan	R	275	41	138	C	99
			Gandhi Maidan	R	348	53	51	C	98
4.	Chandigarh	Chandigarh	Industrial Area	I	291	109	151	M	3
			Sector –17C	R	184	72	151	H	37
			Punjab Engg. College	R	197	87	149	H	44
			IMTECH, Sector 39	R	197	77	132	H	55
			Kaimbwala Village	R	217	92	148	C	52

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
5.	Chattisgarh	Korba	Pragati Nagar	R	193	19	99	H	36
			HIG 21, 22, MP Nagar (Extn)	R	212	19	94	C	77
			ITI Rampur	R	215	16	93	C	85
		Bhilai	Laghu Udyog Nigam I.A.	I	259	22	95	M	0
			Vishak Hostel	R	182	12	92	H	4
			Regional Office Bunglow Office Building	R	160	16	101	H	1
		Raipur	M/s Wool Worth (I) Limited	I	304	37	92	M	0
			New HIG – 9, Hirapur	R	241	37	84	C	83
			Yatayat Thane	R	205	24	80	C	58
6.	Delhi	Delhi	Mayapuri Industrial Area	I	461	240	96	H	40
			Shahzada Bagh	I	378	183	78	H	26
			Shahdara	I	440	173	78	H	35
			Sarojini Nagar	R	305	164	79	C	66
			Town hall	R	476	224	95	C	92
			Nizamuddin	R	347	181	72	C	81
			Ashok Vihar	R	322	166	63	C	80
			Siri Fort	R	353	183	76	C	80
			Janakpuri	R	348	152	70	C	79
7.	Goa	Vasco	On the roof of Fuse Call Office, Elec. Dept.	I	144	85	104	L	2
			Mormugao Port Trust	I	99	57	101	L	0
		Panjim	Patto, Panaji	R	98	55	93	M	4

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
8.	Gujarat	Ahmedabad	Naroda GIDC	I	349	61	105	M	0
			Shardaben Hospital	I	203	49	101	M	0
			Cadilla Bridge, Narol	R	244	67	104	C	78
			L. D. Engineering College	R	143	47	95	H	6
			R.C.High school	R	206	71	97	H	41
			Behrampura	R	205	70	104	H	49
		Vadodara	CETP Nandesari	I	340	32	104	M	0
			GPCB Office, Geri Vasahat	R	127	34	105	M	2
			City Dandia Bazaar	R	247	31	104	C	95
			Shubhanpura	R	192	38	188	H	56
		Surat	Udhna	I	209	35	104	M	0
			SVR Engg. College	R	156	25	105	H	4
			Near Air India Office	R	184	27	105	H	29
		Rajkot	Sardhara Ind. Corporation	I	219	43	103	M	0
			Regional Office	R	143	36	93	H	7
		Ankaleshwar	Rallis India Ltd	I	216	42	104	M	0
			Durga Traders	R	174	29	104	H	20
		Vapi	GEB GIDC	I	161	24	104	L	0
			Vapi Nagar Palika	R	126	20	107	M	0
		Jamnagar	Fisheries Office	R	189	35	104	H	31
9.	Haryana	Faridabad	Shivalic Global Industries	I	376	23	97	H	0
			Regional Office	R	313	46	142	C	99
		Yamuna Nagar	Ballarpur Industries	I	174	50	34	-	0
		Hissar	Urban Estate II	R	237	107	71	C	79
			Guru Jambehswar Univ.	R	134	28	74	M	38

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
10.	Himachal Pradesh	Shimla	Tekka Bench, The Ridge	S	87	42	142	H	34
			Bus Stand	R	120	45	135	M	6
		Parwanoo	AC Office Building	I	154	69	120	L	0
			Regional Office	R	121	56	141	M	9
		Damtal	Regional Office	R	109	40	135	M	3
			Old Road	R	159	67	124	H	21
		Paonta Sahib	Industrial Area, Gondpur	I	260	81	126	M	2
			Paonta Sahib	R	139	56	139	M	15
		Baddi	Industry Dept. Office Building	I	418	204	282	H	29
		Kala Amb	Industrial Area	I	431	207	153	H	26
			Trilokpur	R	122	77	157	M	14
11.	Jharkhand	Dhanbad	Regional Office	R	167	99	96	H	30
		Jharia	MADA	I	251	108	100	M	2
		Sindri	PDIL	I	179	59	93	L	0
		Ranchi	Albert Ekka Chowk	R	356	105	98	C	94
		Jamshedpur	Bistupur Vehicle Testing Center	I	273	26	88	M	0
			Golmuri Vehicle Testing Center	I	269	27	98	M	0
12.	Jammu& Kashmir	Jammu	M.A Stadium Jewel Chawk	R	186	65	43	-	49
			S.P.C.B Office Complex	R	165	41	31	-	19
			Bari Brahma Industrial Area	I	123	49	29	-	0
13.	Karnataka	Bangalore	Graphite India Limited	I	348	171	98	M	19
			KHB Industrial Area	I	227	75	97	M	0
			Peenya Industrial Area	I	229	80	111	M	0
			Yeshwantpura	R	189	58	112	H	30
			Amco Batteries	R	181	77	119	H	37

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
13.	Karnataka	Bangalore	Victoria Hospital	S	199	72	126	C	100
		Mysore	Hebbal Industrial Area	I	75	27	110	L	0
			K.R. Circle	R	87	32	105	M	1
		Hubli-Dharwad	Lakkamanahalli Industrial Area	I	173	72	78	L	1
			Rani Chennamma Circle	R	263	133	104	C	57
		Mangalore	Baikampady Industrial Area	I	125	46	106	L	0
		Gulbarga	Govt. Hospital	S	218	85	105	C	92
		Belgam	KSPCB Building	I	90	38	58	L	0
		Hassan	KSRTC Bus Stand Building	R	129	27	107	M	0
14.	Kerala	Kochi	Eloor	I	81	29	107	L	0
			Irumpanam	I	76	25	107	L	0
			Kalamassery	I	79	31	107	L	1
			Eloor II	I	77	29	107	L	0
			Ernakulum south	R	88	31	108	M	0
			M. G. Road	R	78	35	107	M	1
		Tiruvanantha-puram	Hitech Chackai	I	100	16	105	L	0
			SMV School	R	86	32	101	M	1
			Pettah	R	61	9	101	L	0
			PRS Hospital	S	77	31	103	H	8
		Kozhikode	Nallalam	I	64	15	108	L	0
			Kozhikode City	R	70	19	107	M	0
		Kottayam	Vadavathoor	I	38	5	96	L	0
			Kottayam	R	63	10	98	L	0
		Palakkad	SEPR Refractories India Ltd. Kanjikode	I	149	96	119	L	1

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
15.	Madhya Pradesh	Bhopal	CEPT Govindpura	I	232	57	54	M	0
			Hamidia Road	R	306	67	55	C	95
			TT Nagar	R	89	16	41	-	0
			Arera Colony	R	309	140	164	C	75
		Jabalpur	Vijay Nagar	R	232	44	90	C	82
		Nagda	Chemical Division Labour Club	I	103	24	72	L	0
			Grasim Guest House No-2	R	95	20	72	M	0
			Grasim Kalyan Kendra	R	97	18	78	M	0
		Satna	Sub-divisional Office	I	433	70	77	H	13
			Regional Office	R	180	43	76	H	25
		Indore	Pologround	I	241	87	80	M	0
			Kothari Market	R	206	72	96	H	57
			Scheme No-78	R	156	55	95	H	21
		Dewas	EID Perry(I) Ltd	I	65	26	65	L	0
			Sub R.O. MPCB	R	59	19	88	L	0
		Singrauli	Jayant Township	R	391	50	43	-	100
			NTPC Vidhyanagar	R	309	50	66	C	99
			Waidhan	R	233	35	45	-	82
		Sagar	Pt.Deendayal Nagar	R	237	115	92	C	55
		Gwalior	Dindayal Nagar	R	347	160	82	C	77
			Maharaj Beda	R	250	117	84	C	60
		Ujjain	District Office	I	256	69	85	M	0
			Regional Office	R	205	63	100	H	54
			Mahakal Temple	S	236	67	86	C	95

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
16.	Maharashtra	Mumbai	Parel	I	251	121	96	M	1
			Worli	R	192	67	94	H	48
			Kalbadevi	R	246	126	96	C	57
		Solapur	WIT Campus	I	294	29	108	M	0
			Voronoko Primary School Rang Bhawan	R	301	46	104	C	97
		Thane	Balkum/Kolshet	I	116	29	31	-	0
		Nagpur	MIDC Office	I	240	115	86	M	4
			Hingna Road	I	198	86	95	M	0
			Institution of Engineers	R	194	95	88	H	39
			Govt.Polytechnic College	R	190	89	88	H	35
			Nagpur Corporation Building, Maskasath	R	230	94	91	C	59
			NEERI Lab., Nehru Marg	R	153	67	93	H	25
		Pune	Bhosari	I	194	82	99	M	0
			Swargate	R	197	99	103	H	45
			Nalstop	R	198	101	104	H	45
		Nasik	VIP Industrial Area	I	100	21	104	L	0
			RTO Colony Tank	R	85	13	104	M	0
			Nasik Municipal Council Building	R	109	13	103	M	0
		Chandarpur	MIDC, Chandrapur	I	208	89	106	M	0
			Gram Panchayat Ghugus	R	264	114	99	C	71
			Nagar Parishad	R	247	106	104	C	60

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
16.	Maharashtra	Aurangabad	S.B.E.S. College	R	292	123	96	C	75
			C.A.D.A. Office	R	222	114	94	C	61
			Bibi Ka Maqbara	S	125	73	87	C	56
		Kolhapur	University Campus, Shivaji University	R	99	23	89	M	0
			Ruikar Trust, Dabholkar Corner	R	238	106	90	C	60
			Mahadwar Road , Near Mahalaxmi temple	R	163	52	74	H	22
		Navi Mumbai	MIDC Taloja	I	255	153	101	M	7
			MPCB Central Lab	I	205	126	92	M	1
			Airoli	R	168	90	101	H	36
			MESB Power Station	R	221	139	77	C	56
			Nerul	R	176	109	100	H	37
			Panvel	R	346	198	115	C	70
		Lote	MIDC WTP	I	133	66	105	L	0
			Chalke Wadi	R	150	65	85	H	21
		Tarapur	MIDC Compound	I	116	59	68	L	2
			Police Chowki	I	151	80	56	L	2
			Sport Stadium	I	115	38	62	L	0

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
17.	Manipur	Imphal	Secretariat Building	R	115	34	46	-	9
18.	Meghalaya	Shillong	Boards Office Premises	R	63	11	77	L	0
			MUDA Complex Police Bazar	R	101	27	58	M	0
19.	Mizoram	Aizawal	Bawongkawn	R	114	37	98	M	4
			Khatla	R	88	26	98	M	1
			Laipuitlang	R	56	25	97	L	0
20.	Nagaland	Dimapur	Bank colony	R	120	48	104	M	3
			Dhobinala	R	129	47	104	M	5
21.	Orrisa	Talcher	T.T.P.S. Colony	I	163	70	108	L	0
			Coal Field	I	201	92	97	M	0
		Angul	Industrial Estate	I	260	91	107	M	2
			NALCO Nagar Township	R	142	56	107	H	18
		Rourkela	IDL Police Outpost	R	192	21	100	H	35
			Regional Office	R	186	22	103	H	30
		Rayagada	Jaykaypur	I	102	36	94	L	0
			Regional Office	R	105	30	97	M	9
		Bhubaneshwar	SPCB Building	R	130	73	105	M	9
			IRC Village	R	117	57	104	M	13
			Capital Police Station	R	156	84	102	H	37
		Cuttack	R.O. Cuttack Office	R	169	54	104	H	26
			Roof of Traffic Tower	R	324	87	106	C	97
		Sambalpur	Roof of Filter Plant PHD Off.	R	125	21	111	M	0
		Behrampur	Regional Office	R	157	87	107	H	24
		Balasore	Sahadevkhunta	R	138	33	100	M	1

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
22.	Pondicherry	Pondicherry	PIPDIC Ind Estate	I	84	21	89	L	0
			DSTE Office	R	84	23	95	M	0
			Chamber of Commerce	R	71	18	99	M	0
23	Punjab	Naya Nangal	M/s NFL Guest House	R	220	37	120	C	68
		Amritsar	Nagina Soap Factory	I	388	47	75	H	3
			A-1 Platters	R	411	54	84	C	100
		Bathinda	M/s Bhantinda Dist, Coop Milk Procedures Union Ltd.	I	243	76	102	M	1
		Derabessi	M/s Punjab Chemicals and Crop Protection Ltd	I	234	52	128	M	0
			M/s Winsome Yarns Ltd.	I	229	45	143	M	0
24.	Rajasthan	Alwar	RIICO Pump House	I	202	86	94	M	0
			Vitage Distillers Ltd.	I	206	88	91	M	0
			Regional Office	R	273	127	88	C	81
		Jaipur	VKIA	I	408	162	104	H	26
			RIICO Office, M.I.A.	I	198	84	106	M	0
			Office of District Education Officer, Chandpole	R	343	111	105	C	90
			Ajmeri Gate	R	272	120	102	C	76
			Rajasthan SPCB Office	R	183	106	109	H	31
			Regional Office(North), RSPCB, Vidaya Nagar	R	197	85	103	H	46
		Jodhpur	R.O. Office	I	357	97	96	M	6
			DIC Office	I	350	112	97	M	6
			Sojati Gate	R	359	91	97	C	97
			Maha Mandir Police Thana	R	366	84	97	C	100

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
	Rajasthan	Jodhpur	Shastri Nagar Police Thane	R	401	144	99	C	96
			Office of Housing Board	R	366	125	99	C	97
		Kota	Regional Office	I	283	143	103	M	5
			KVK Bhorkhara	R	235	126	103	C	57
			Municipal Corporation Building	R	246	113	104	C	68
		Udaipur	Regional Office	I	520	247	88	H	56
			Town Hall	R	197	110	99	H	43
			Amabmata	R	220	122	95	C	48
25.	Tamil Nadu	Chennai	Thiruvottiyur Municipal Office	I	154	67	93	L	0
			Kathhivakkam	I	183	91	97	M	0
			Manali	I	170	63	101	L	0
			Thiruvottiyur	I	152	71	99	L	0
			Madras Medical College	R	143	53	43	-	16
			NEERI CSIR Campus	R	86	37	94	M	0
		Coimbatore	SIDCO Office	I	210	81	90	M	0
			Dist. Collectors Office	R	83	38	86	M	0
			Poniarajapuram	R	84	51	92	M	4
		Madurai	Fenner (I) Ltd.	I	95	26	92	L	0
			Highway	R	93	21	100	M	0
			Kunnathur Chatram	R	102	29	95	M	1
		Tuticorin	Raja Agencies	I	198	119	90	M	2
			Fisheries College	R	111	54	94	M	6
			AVM Jewellery Building	R	160	92	86	H	22
		Salem	Sowdeswari Coll Building	R	100	35	144	M	1

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
26.	Uttar Pradesh	Lucknow	Talkatora	I	414	55	107	H	3
			Kapoor Hotel	R	386	56	106	C	100
			Mahanagar	R	385	57	107	C	100
			Aminabad	R	402	56	109	C	100
			Aliganj	R	395	51	104	C	100
		Kanpur	Fazalganj	I	484	93	84	H	42
			Jajmau	I	444	77	89	H	23
			Deputy ka Padao	R	440	89	87	C	100
			Kidwai Nagar	R	442	83	99	C	100
			Sharda Nagar	R	421	90	78	C	97
			Vikas Nagar	R	357	223	250	C	72
		Varanasi	Regional Office	R	365	50	92	C	99
			Shivpur/Sigra	R	422	33	71	C	100
		Anpara	Anapara Colony	I	265	76	104	M	0
			Renusagar Colony	I	257	84	102	M	0
		Gajraula	Raunaq Auto Limited	I	307	71	69	M	2
			Indra Chowk	R	186	32	27	-	19
		Ghaziabad	Shahibabad Industrial Area	I	475	72	73	H	36
			Bulandshahar Road Industrial Area	I	391	26	62	H	0
		Agra	TajMahal	S	296	148	259	C	83
			Itmad ud daulah	S	377	178	111	C	95
			Rambagh	S	439	153	110	C	93
			DIC Nunhai	S	584	210	105	C	100
		Noida	M/s GEE PEE Electroplating and Engineering Works	I	437	56	96	H	14

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
26.	Uttar Pradesh	Noida	Regional Office	R	447	73	97	C	100
		Firozabad	Center for Development of Glass Industry	I	486	187	93	H	58
			Tilak Nagar	R	387	151	92	C	85
			Raza ka Tal	R	394	157	90	C	82
		Khurja	CGCRI	I	485	133	84	H	49
			Ahirpara	R	432	114	71	C	97
		Jhansi	Jail Chauraha	R	402	103	112	C	100
			Veerangna Nagar	R	333	88	110	C	88
		Allahabad	Bharat Yantra Nigam	R	211	75	34	-	0
			Square crossing	R	469	193	35	-	100
27.	Uttaranchal	Dehradun	Raipur Road	I	187	19	14	-	0
			Clock Tower	R	259	55	70	C	84
28.	West Bengal	Kolkata	Cossipore	I	356	156	95	M	21
			Behala Chowrasta	I	220	131	104	M	4
			Dunlop Bridge	I	207	130	104	M	5
			Lal Bazaar	R	322	164	96	C	75
			Kasba	R	296	191	94	C	56
			Baishabghate	R	156	105	104	H	29
			Salt Lake	R	173	117	104	H	33
			Minto Park	R	155	93	104	H	21
			Maulali	R	200	122	104	H	38
		Haldia	WBIIDC	I	133	75	96	L	0
			Super Market	I	121	75	105	L	0
		Durgapur	Dew India Ltd	I	341	218	105	M	23

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average ($\mu g/m^3$)	Std. Dev.	n	Air Quality	% vio
	West Bengal	Durgapur	Kwality Hotel	I	253	148	95	M	11
			PCBL Club	R	151	81	105	H	21
		Asansol	Asansol Municipal Corporation	I	229	141	105	M	7
		Howarh	Howrah Municipal Corporation	I	278	188	105	M	17
			Bandhaghat	I	237	137	103	M	8
			Ghuseri Naskarpara	R	211	144	105	C	36
			Bator	R	206	144	105	H	40

Note:- R – Residential and other areas, I – Industrial area, S – Sensitive Areas, Std dev. – Standard deviation, n – number of days monitored for 16 and more hours a day L- Low, M- Moderate, H – High and C – Critical levels of pollution based on exceedence factor (calculated for n $\geq$ 50 days), % vio – percentage violation of NAAQS (24 hourly average).

6.0 ADDITIONAL POLLUTANTS

This chapter provides data of additional pollutants monitored in the country. Additional pollutants monitored are ammonia in six major cities, carbon monoxide and fine particulate matter with size less than 2.5 micrometer ($PM_{2.5}$).

6.1 Ammonia Levels

Ammonia levels measured in six major cities namely Jaipur, Mumbai, Chennai, Kolkata, Nagpur and Hyderabad by National Environmental Engineering Research Institute (NEERI) under National Air Quality Monitoring Programme (NAMP) of CPCB are detailed below.

Annual average concentration of ammonia has been compared with the NAAQS. The air quality has been categorized into four broad categories based on an Exceedence Factor (the ratio of annual mean concentration of a pollutant with that of a respective standard). The four categories are low, moderate, high and critical as explained in earlier chapters. Low levels were observed in Nagpur, Chennai and Kolkata. Moderate levels were observed in Delhi and residential areas of Hyderabad. There was no violation of NAAQS (annual average and 24 hourly average) at all the monitored locations. The air quality is given in Table 6.1. Annual average concentration of ammonia at 18 monitoring stations in 6 cities are given in Table 6.2

Table 6.1 : Ambient Air Quality wrt Ammonia in India during 2007.

Pollution level	**Annual Mean Concentration Range (µg/m^3)**	
Low (L)	0-50	
Moderate (M)	50-100	
High (H)	100-150	
Critical (C)	> 150	
STATE, UT / CITY	**Ammonia**	
AREA CLASS	**Industrial Areas**	**Residential Areas**
Andhra Pradesh		
Hyderabad	M	M
Delhi		
Delhi	M	M
Maharashtra		
Mumbai	M	M
Nagpur	L	L
Tamil Nadu		
Chennai	L	L
West Bengal		
Kolkata	L	L

Table 6.2: Summary of Ammonia Levels (Annual Average Concentration in μg/m^3) during 2007.

S.No.	STATE/UT	CITY	LOCATION	Type of Area	Average (μg/m^3)	Std. Dev.	n	% Vio. wrt NAAQS (24 hrly avg.)	Air Quality
1	Andhra Pradesh	Hyderabad	Nacharam	I	52	19	92	0	M
			Tarnaka	R	55	18	96	0	M
			ABIDS Circle	R	80	30	91	0	M
2	Delhi	Delhi	Mayapuri Ind. Area	I	67	29	96	0	M
			Sarojini Nagar	R	56	20	79	0	M
			Town Hall	R	76	29	95	0	M
3	Maharashtra	Mumbai	Parel	I	61	60	93	0	M
			Worli	R	46	36	94	0	L
			Kalbadevi	R	58	52	91	0	M
		Nagpur	Hingna Road	I	30	23	92	0	L
			Maskasath	R	39	26	86	0	L
			NEERI Lab., Nehru Marg	R	27	22	91	0	L
4	Tamil Nadu	Chennai	Thiruvottiyur Municipal Office	I	28	43	94	0	L
			Madras Medical College	R	21	17	44	0	-
			NEERI CSIR Campus	R	21	25	94	0	L
5	West Bengal	Kolkata	Cossipore	I	13	24	95	0	L
			Lal Bazaar	R	16	29	96	0	L
			Kasba	R	14	25	95	0	L

Note:- R – Residential and other areas, I – Industrial area, Std dev. – Standard deviation, n – number of days monitored for 16 and more hours a day L- Low, M- Moderate, H – High and C – Critical levels of pollution based on exceedence factor (calculated for n $\geq$ 50 days), % vio. Wrt NAAQS (24 hrly avg.) – Percentage violation wrt NAAQS (24 hourly average).

6.2 Carbon Monoxide

a) CO levels at BSZ Marg (ITO)

Carbon monoxide is monitored at Bahadur Shah Zafar (BSZ) Marg, New Delhi using Non-Dispersive Infrared Spectrometry (NDIR) method. Monthly average and annual average concentration of CO is given in Table 6.3. The annual average concentration of CO was 2469 µg/m^3 during 2007 and monthly average concentration varied from 1688 µg/m^3 to 4531 µg/m^3. High levels of CO might be attributed to increase in vehicular population especially passenger cars in Delhi.

Table 6.3: Concentration of Carbon Monoxide (CO) at BSZ Marg, New Delhi during 2007.

Months of 2007	CO Concentration (µg/m^3)
January	3285
February	2729
March	1907
April	2310
May	2330
June	1688
July	1834
August	1773
September	1750
October	2719
November	4531
December	2767
Annual Average	2469

NA – Data not adequate

b) CO levels at Siri Fort

Carbon monoxide is monitored at Siri Fort, New Delhi using Non-Dispersive Infrared Spectrometry (NDIR) method. Monthly average and annual average concentration of CO is given in Table 6.4. The annual average concentration of CO was 1475 µg/m^3 during 2007 and the monthly average concentration varied from 946 µg/m^3 to 2555 µg/m^3. High levels of CO might be attributed to increase in vehicular population especially passenger cars in Delhi.

Table 6.4: Concentration of Carbon Monoxide (CO) at Siri Fort, New Delhi during 2007.

Months of 2007	CO Concentration (µg/m^3)
January	1776
February	1879
March	1000
April	1581
May	1265
June	1045
July	956
August	946
September	995
October	1934
November	2555
December	1770
Average	1475

NA – Data not available

c) CO levels at Delhi College of Engineering (DCE), Bhawana

Carbon monoxide is monitored at Delhi College of Engineering (DCE), Bhawana, Delhi using Non-Dispersive Infrared Spectrometry (NDIR) method. Monthly average and annual average concentration of CO is given in Table 6.5. The annual average concentration of CO was 1250 µg/m^3 during 2007. The monthly average concentration varied from 669 µg/m^3 to 1590 µg/m^3.

Table 6.5: Concentration of Carbon Monoxide (CO) at DCE, Bhawana, Delhi during 2007.

Months of 2007	CO Concentration (µg/m^3)
January	1590
February	1386
March	1267
April	1285
May	1443
June	1347
July	1200
August	1344
September	669
October	912
November	1548
December	1013
Average	1250

NA – Data not available/not adequate

6.3 Ozone

Ozone was measured at Siri Fort using continuous analysers. Monthly average and annual average concentration of Ozone are given in Table 6.6. The annual average concentration of Ozone was 46 µg/m^3 during 2007. The monthly average concentration of ozone varied from 24 µg/m^3 to 79 µg/m^3.

Table 6.6: Concentration of Ozone at Siri Fort, Delhi during 2007.

Months of 2007	Ozone Concentration (µg/m^3)
January	26
February	79
March	49
April	53
May	57
June	54
July	39
August	47
September	44
October	36
November	24
December	45
Average	46

NA – Data not available/not adequate

Higher ozone concentrations are observed, in general, in Summer months as it is formed by photochemical reactions of NOx and VOCs. Ozone concentrations tend to peak in early to mid afternoon in areas where there is strong photochemical activity.

6.4 Particulate matter with size less than 2.5 µm ($PM_{2.5}$)

Particulate matter with size less than 2.5 micrometer ($PM_{2.5}$) was measured at BSZ Marg (ITO), New Delhi using continuous analysers. Monthly average and annual average concentration of $PM_{2.5}$ are given in Table 6.7. The annual average concentration of $PM_{2.5}$ was 102 µg/m^3 during 2007. The monthly average concentration of $PM_{2.5}$ varied from 34 µg/m^3 to 198 µg/m^3. Higher $PM_{2.5}$ levels were observed in winter months as mixing height is lower in winter months resulting is less volume of troposphere for mixing and hence higher concentrations. Lower concentrations were observed in monsoon months as particulate matter are washed out due to wet deposition.

Table 6.7: Concentration of $PM_{2.5}$ at BSZ Marg (ITO), Delhi during 2007.

Months of 2007	$PM_{2.5}$ Concentration ($\mu g/m^3$)
January	198
February	138
March	80
April	102
May	73
June	63
July	45
August	34
September	47
October	158
November	NA
December	189
Average	102

NA – Data not available/not adequate

7.0 AIR QUALITY TRENDS

Air quality trends are depicted in this chapter. Trends are plotted for annual average concentrations. Trends are depicted for sulphur dioxide, nitrogen dioxide, respirable suspended particulate matter and carbon monoxide.

7.1 Trend in Annual Average Concentrations

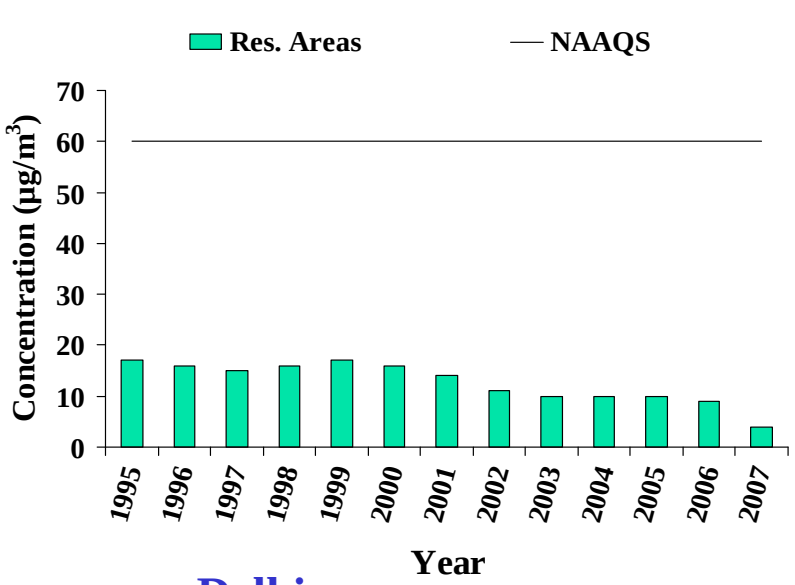
Trend in annual average concentrations of SO_2, NO_2, and RSPM in seventeen cities are described below.

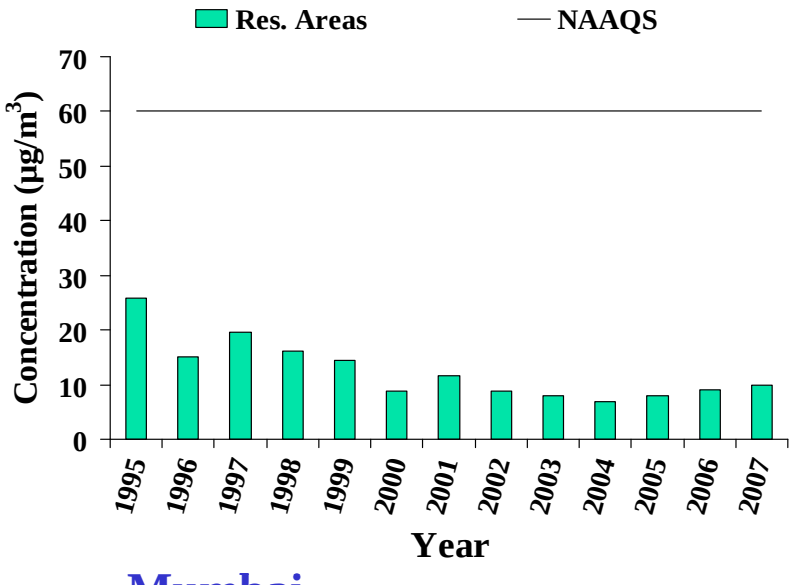
(a) SO_2

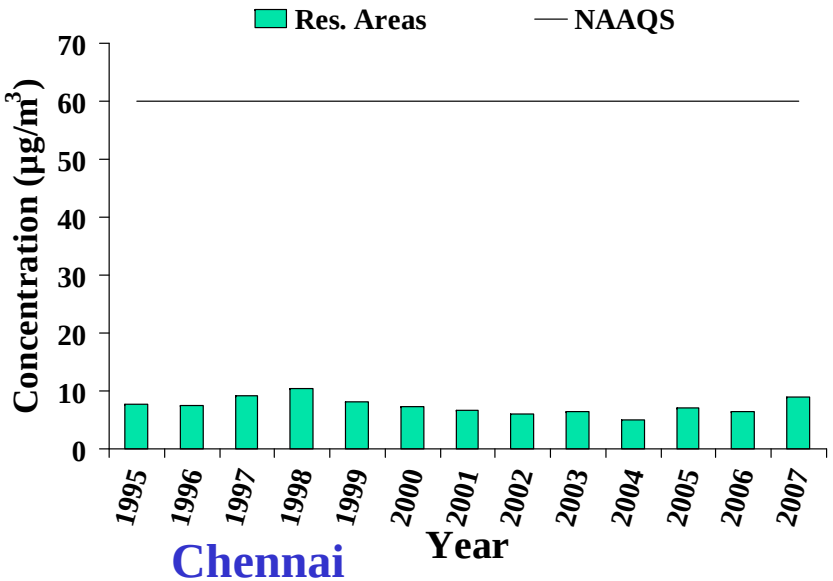
Trend in annual average concentration of SO_2 in residential areas of Delhi, Mumbai, Chennai and Kolkata is depicted in Figure 7.1. Trend in annual average concentration of SO_2 in residential areas of Hyderabad, Bangalore, Ahmedabad and Lucknow is depicted in Figure 7.2. Trend in annual average concentration of SO_2 in Jodhpur, Agra, Faridabad and Solapur is depicted in Figure 7.3. Trend in annual average concentration of SO_2 in Kanpur, Pune, Jharia, Patna and Varanasi is depicted in Figure 7.4. So2 levels are within the prescribed National Ambient Air Quality Standards in residential areas. A decreasing trend was observed in residential areas of Delhi, Lucknow and Pune. Decreasing trend may be due to various interventions that have taken place in recent years such as reduction of sulphur in diesel, use of cleaner fuel such as CNG in Delhi etc. Other measures include implementation of Bharat Stage-III emission norms for new vehicles and commensurate fuel quality. Also there has been a change in domestic fuel used from coal to LPG which may have contributed to reduction in ambient levels of SO_2.

(b) NO_2

Trend in annual average concentration of NO_2 in residential areas of Delhi, Mumbai, Chennai and Kolkata is depicted in Figure 7.5. Trend in annual average concentration of NO_2 in residential areas of Hyderabad, Bangalore, Ahmedabad and Lucknow is depicted in Figure 7.6. Trend in annual average concentration of NO_2 in Jodhpur, Agra, Faridabad and Solapur is depicted in Figure 7.7. Trend in annual average concentration of NO_2 in Kanpur, Pune, Jharia, Patna and Varanasi is depicted in Figure 7.8. NO_2 levels were within the prescribed NAAQS in residential areas. No definite trend has been observed in ambient nitrogen dioxide levels. In some cities ambient NO_2 levels are decreasing whereas in some cities the trend is fluctuating. Although various interventions have taken place to mitigate ambient NO_2 levels but at the same time number of vehicles have increased exponentially. The vehicles are one of the major sources of NO_2. Measures taken to mitigate ambient NO_2 levels are introduction of improved vehicular technology in the form of Bharat Stage –III vehicles, banning of old vehicles in some cities, improved traffic management etc.







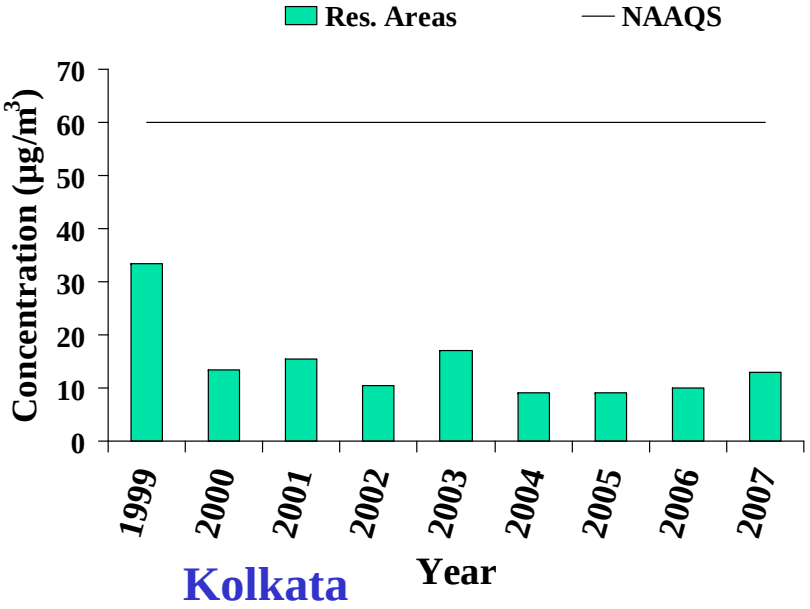


Fig: 7.1 Trends in Annual Average Concentration of SO_2 in residential areas of Delhi, Mumbai, Chennai and Kolkata.

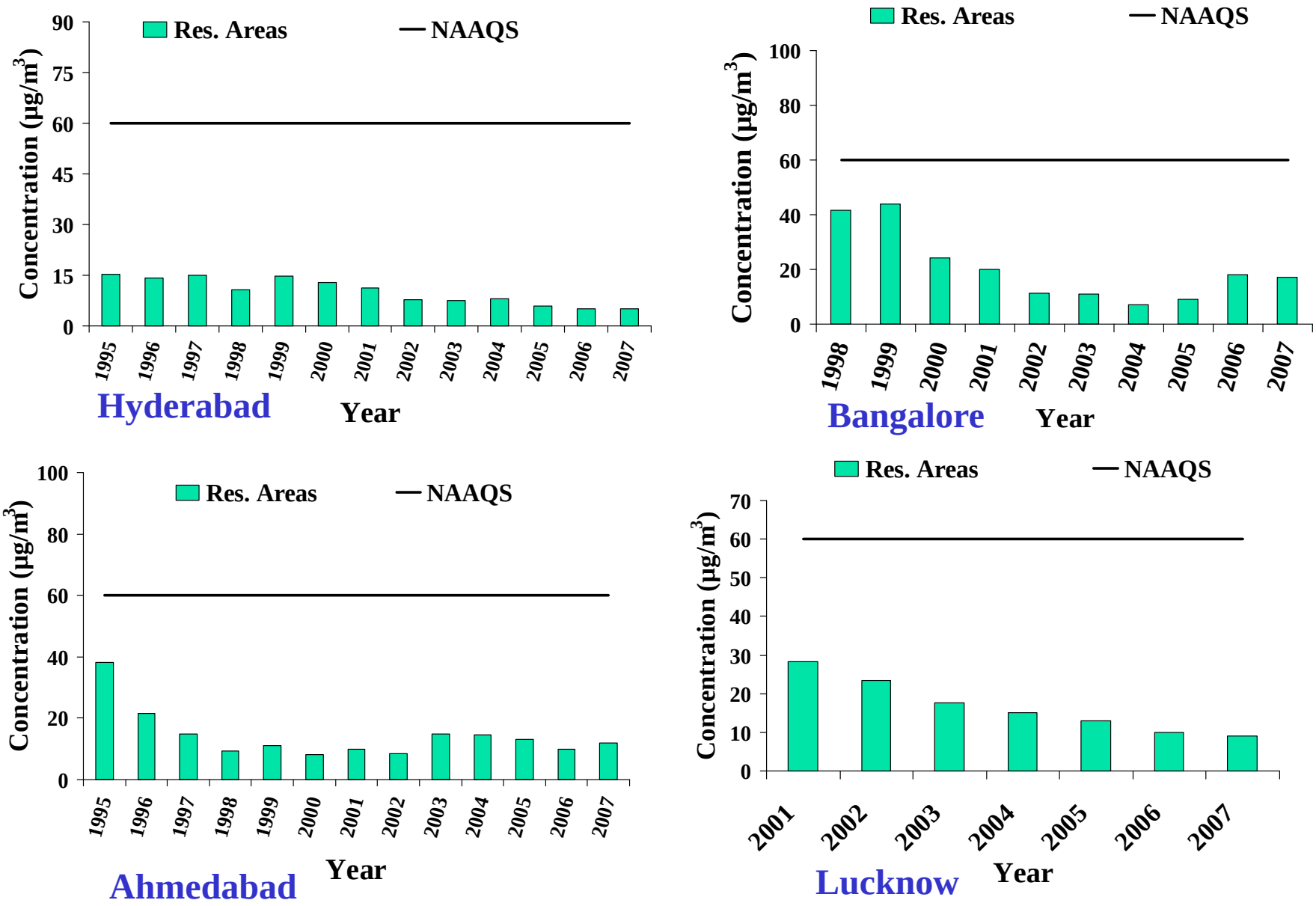
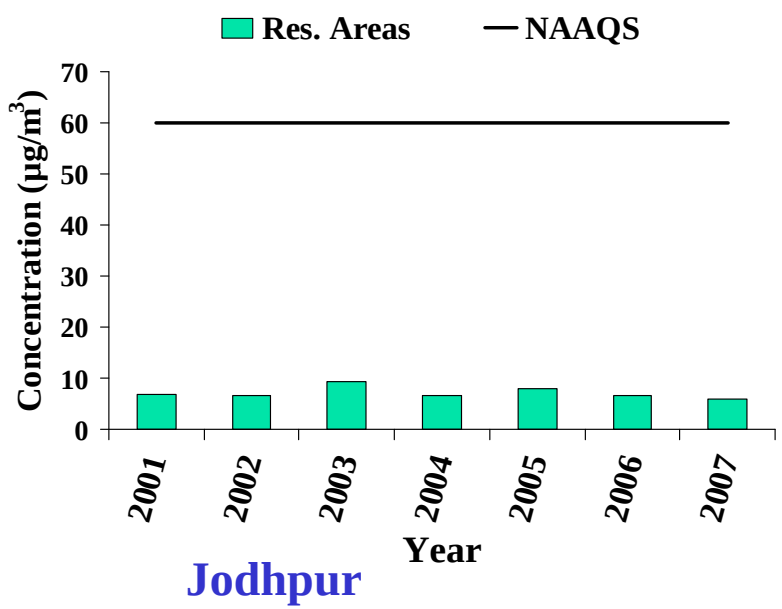
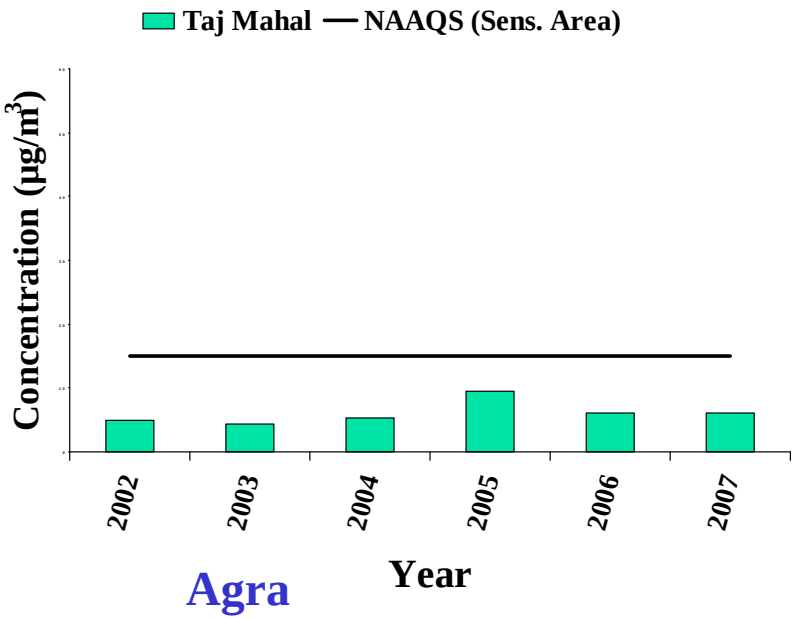
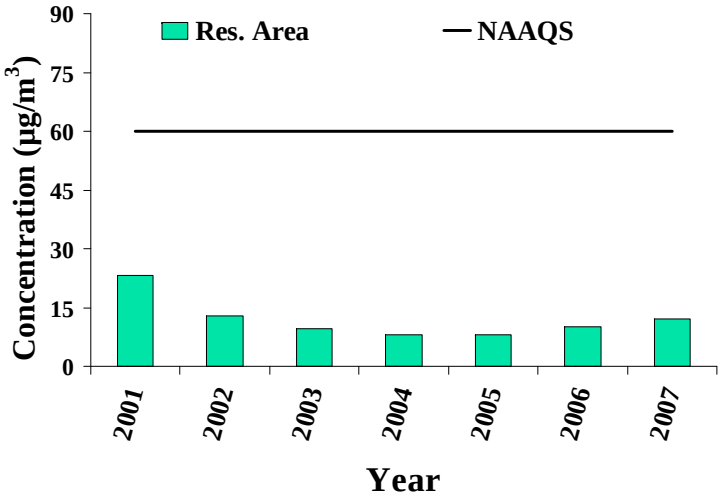


Fig 7.2: Trends in Annual Average Concentration of SO_2 in residential areas of Hyderabad, Bangalore, Ahmedabad and Lucknow.







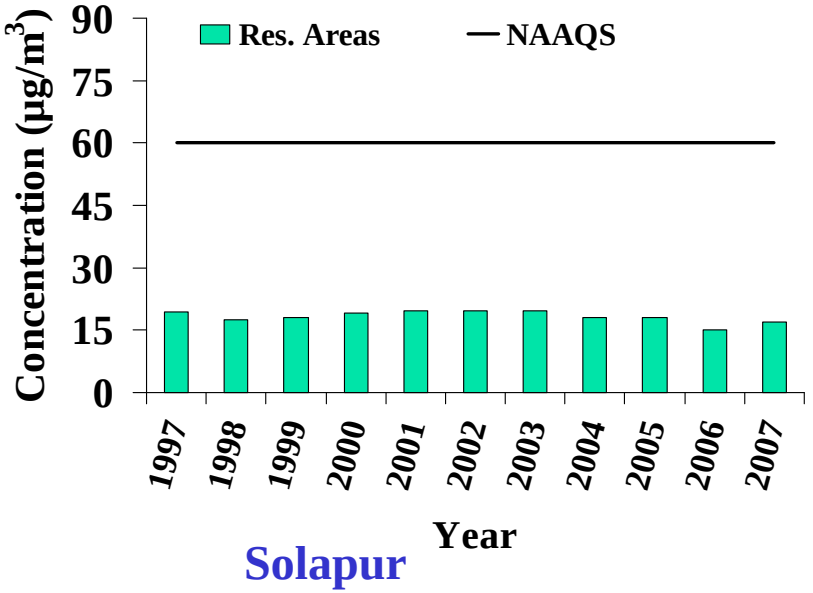


Fig 7.3: Trends in Annual Average Concentration of SO_2 in Jodhpur, Agra, Faridabad and Solapur.

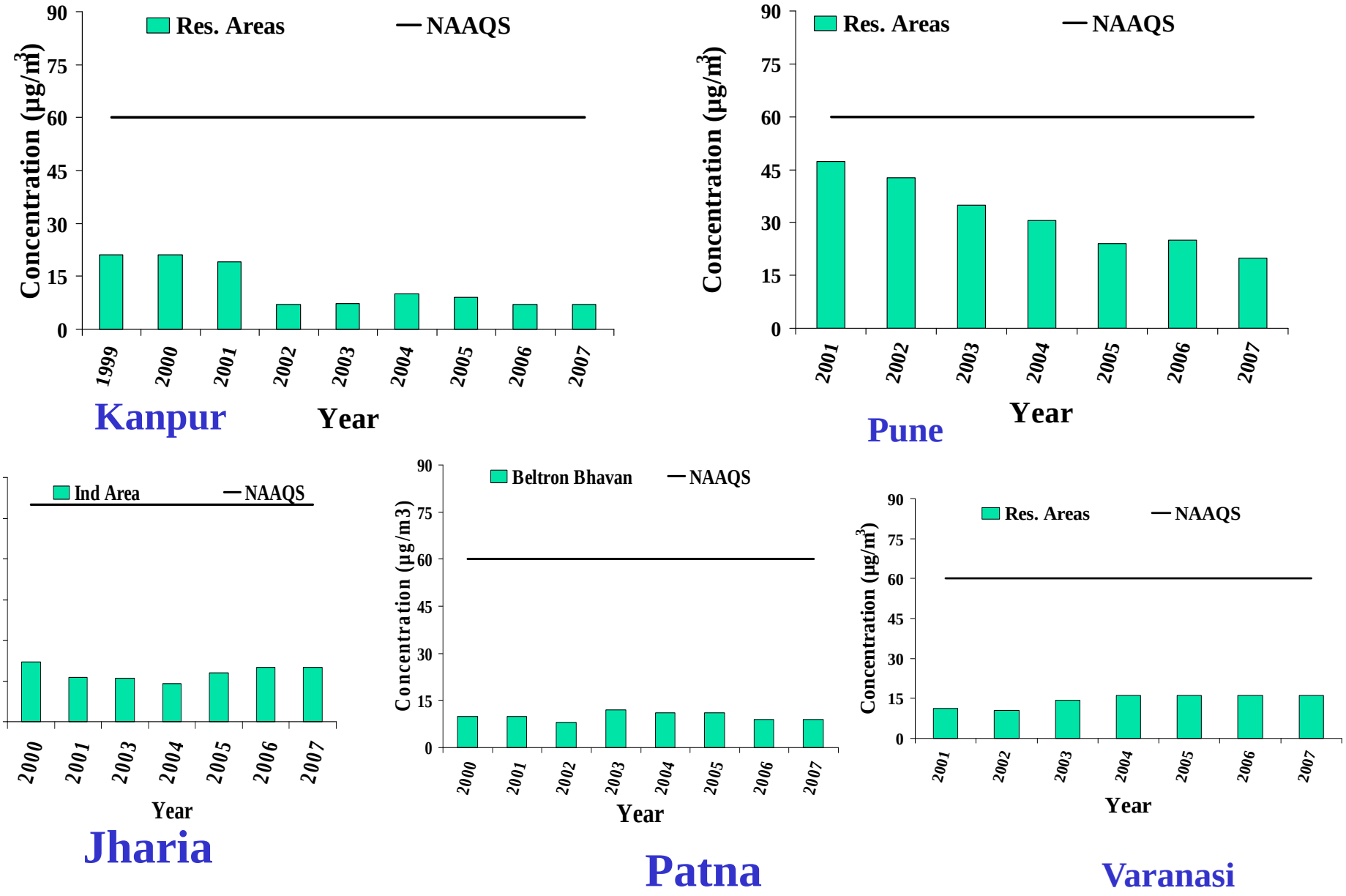
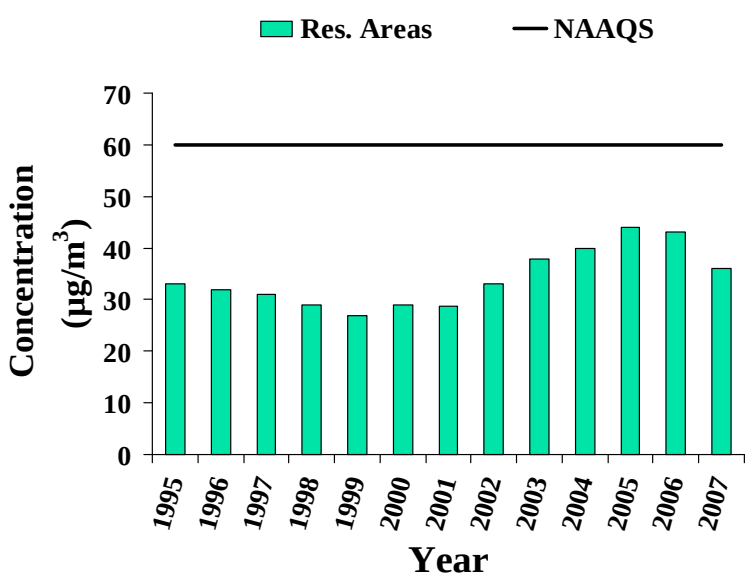
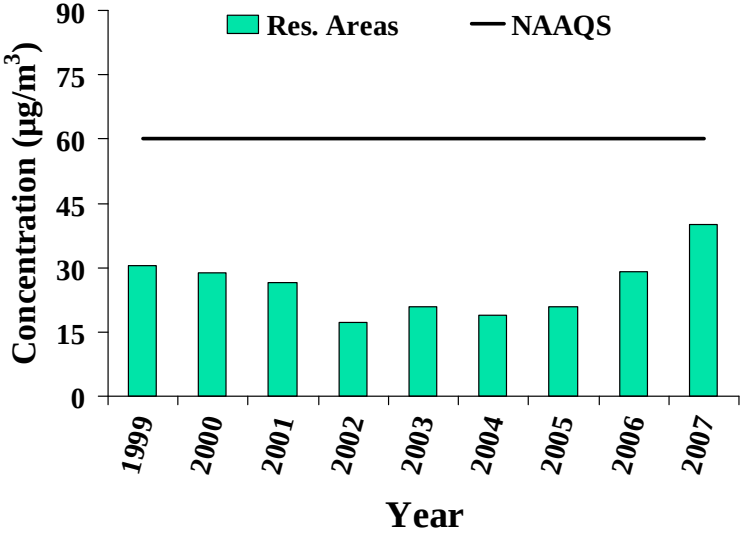


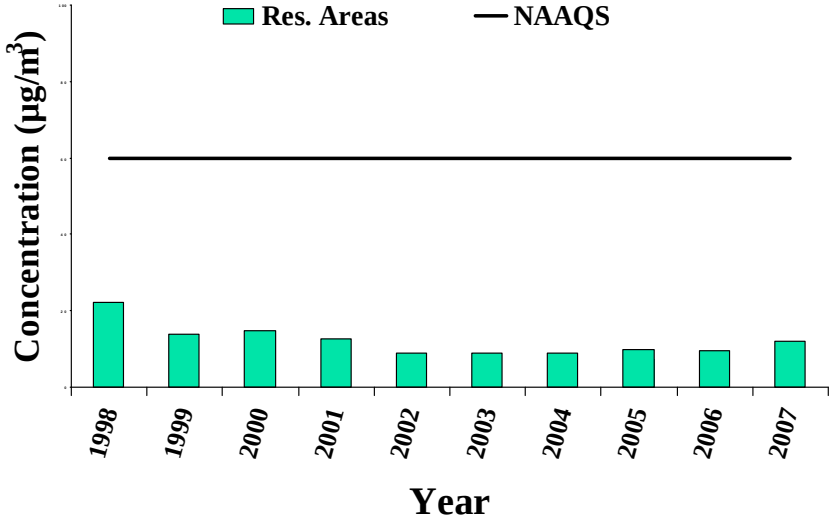
Fig 7.4: Trends in Annual Average Concentration of SO_2 in Kanpur, Pune, Jharia, Patna and Varanasi.



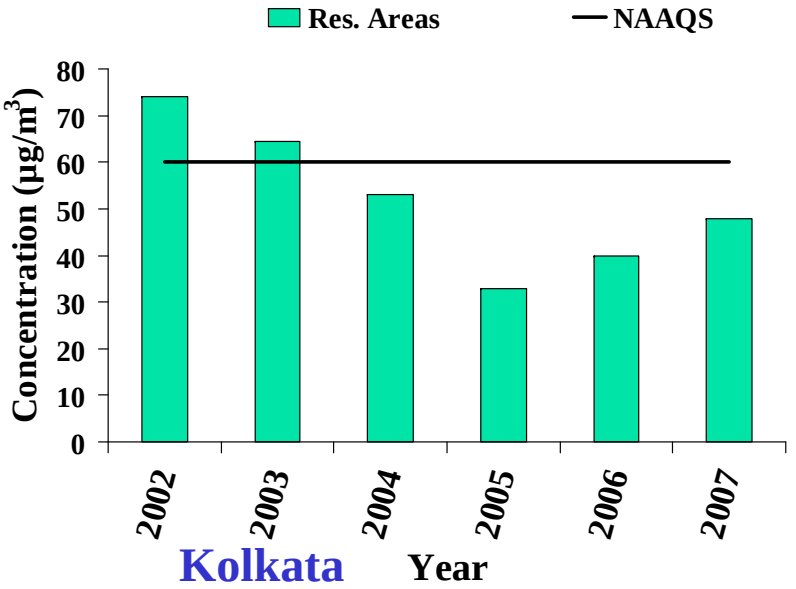
Delhi



Mumbai

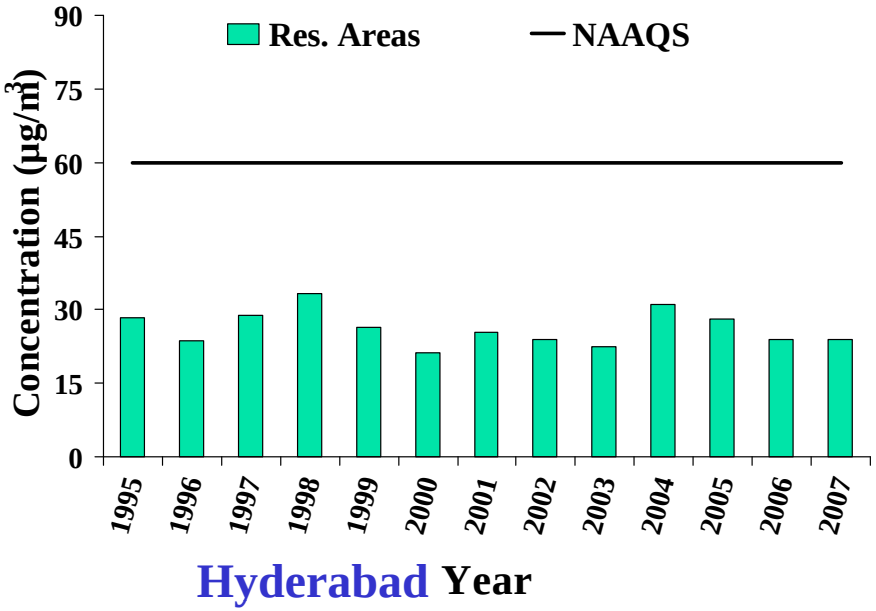


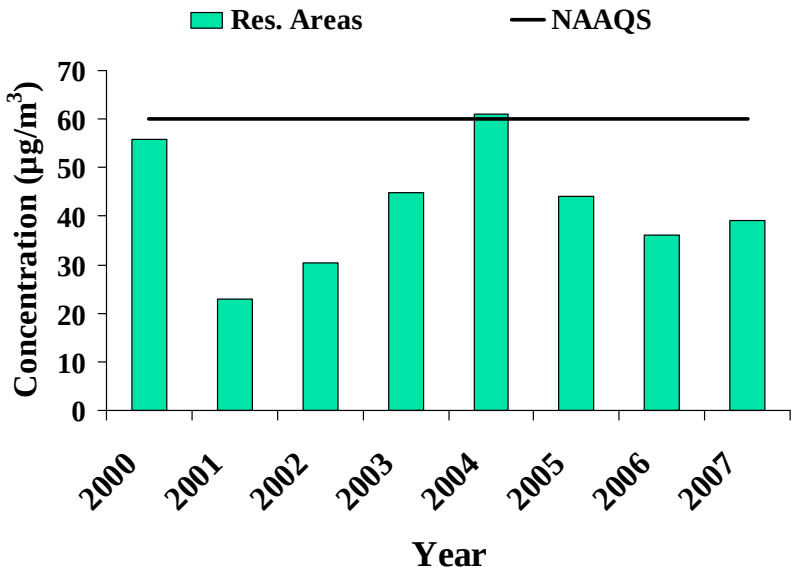
Chennai

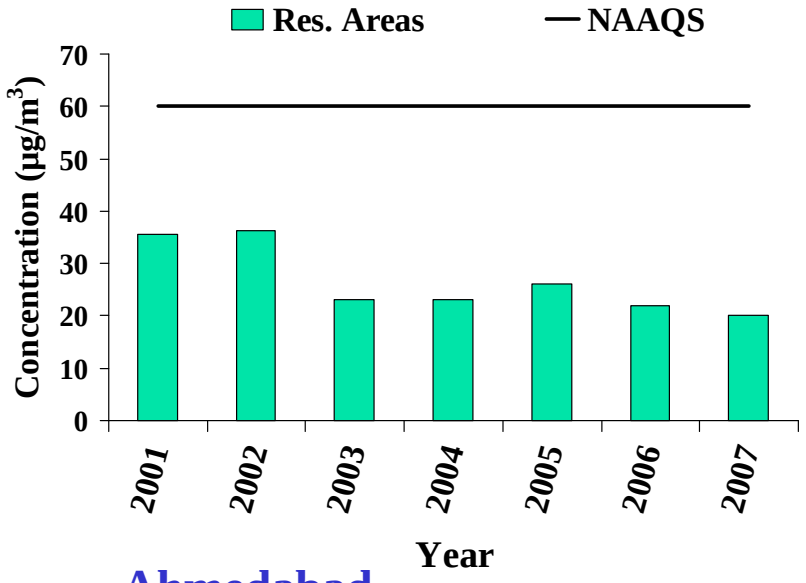


Kolkata

Fig 7.5: Trends in Annual Average Concentration of NO_2 in residential areas of Delhi, Mumbai, Chennai and Kolkata.







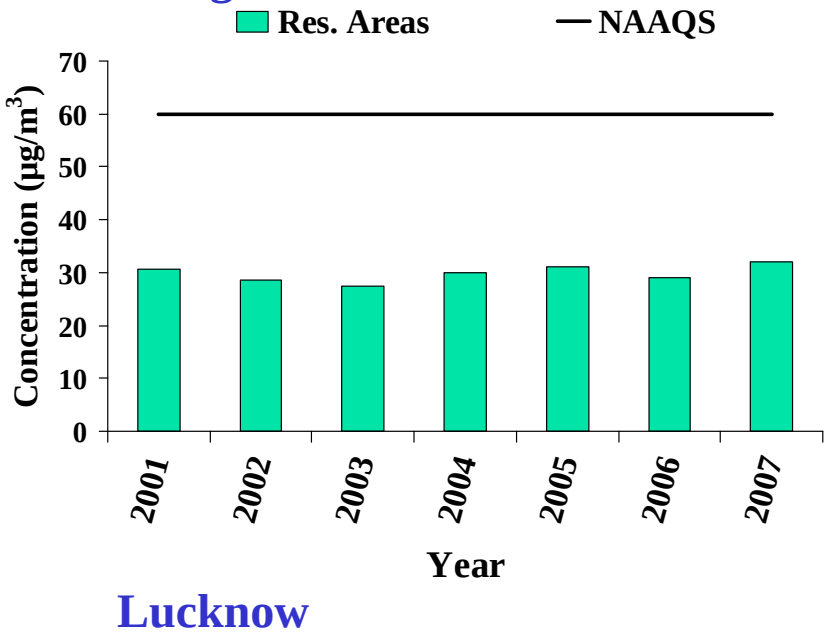
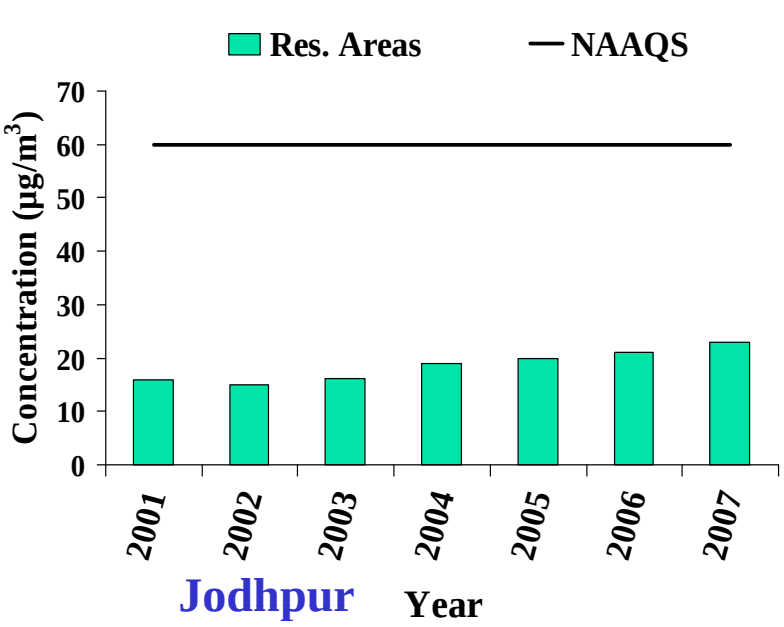
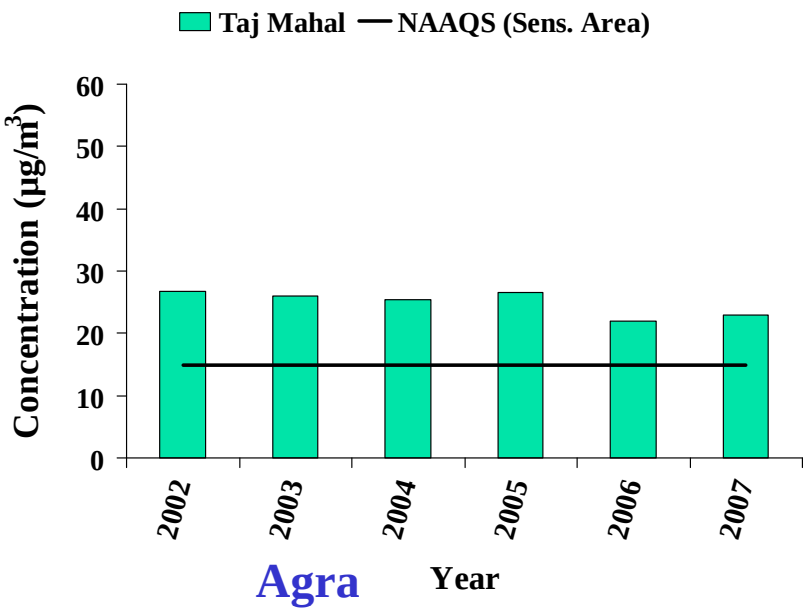
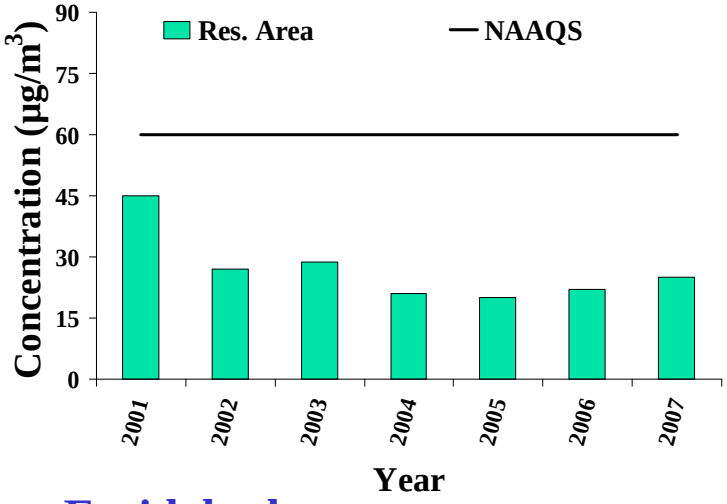


Fig 7.6: Trends in Annual Average Concentration of NO_2 in residential areas of Hyderabad, Bangalore, Ahmedabad and Lucknow.







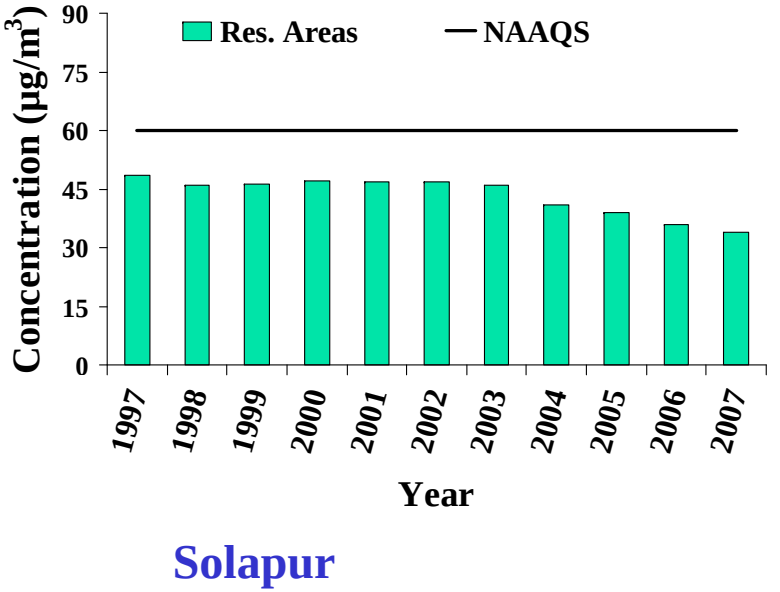


Fig 7.7: Trends in Annual Average Concentration of NO_2 in Jodhpur, Agra, Faridabad and Solapur.

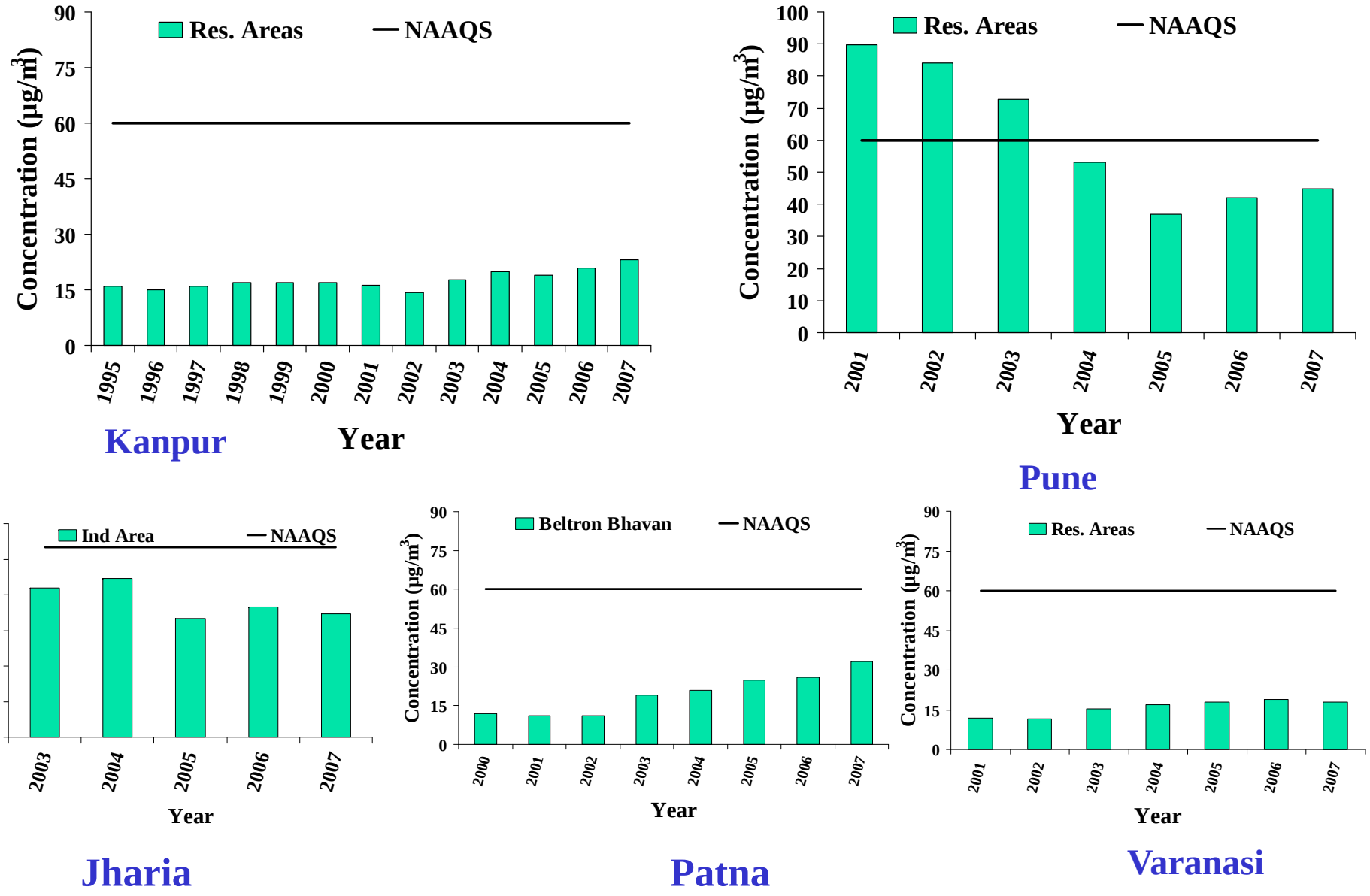


Fig 7.8: Trends in Annual Average Concentration of NO_2 in Kanpur, Pune, Jharia, Patna and Varanasi.

(c) Carbon monoxide (CO)

Trend in annual average concentration of Carbon monoxide (CO) in Delhi is depicted in Figure 7.9. High levels of CO might be attributed to increase in vehicular population especially passenger cars in Delhi. Despite an increase in number of vehicles, CO levels have reduced during last few years. The decrease may be attributed to measures such as conversion of three wheelers of CNG in Delhi.

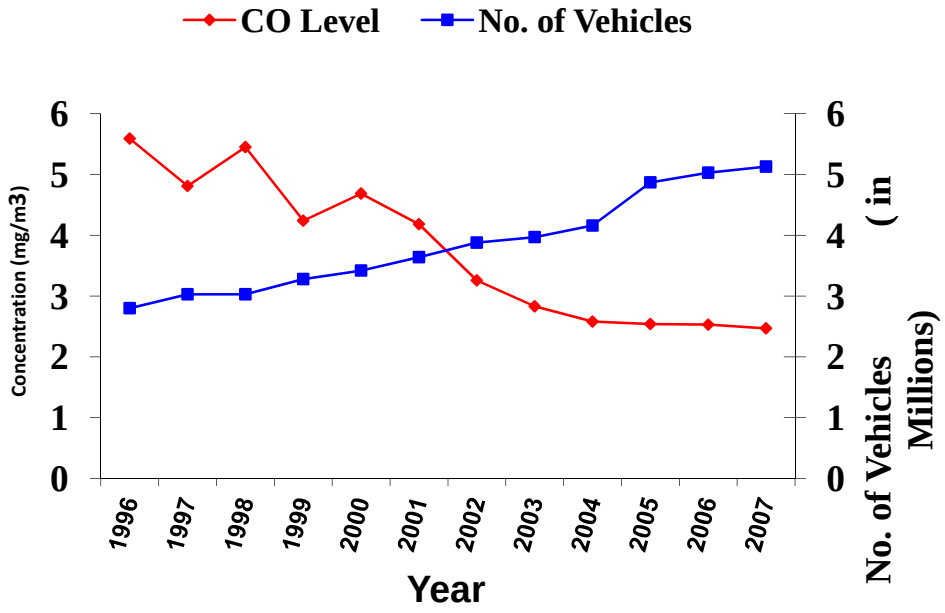
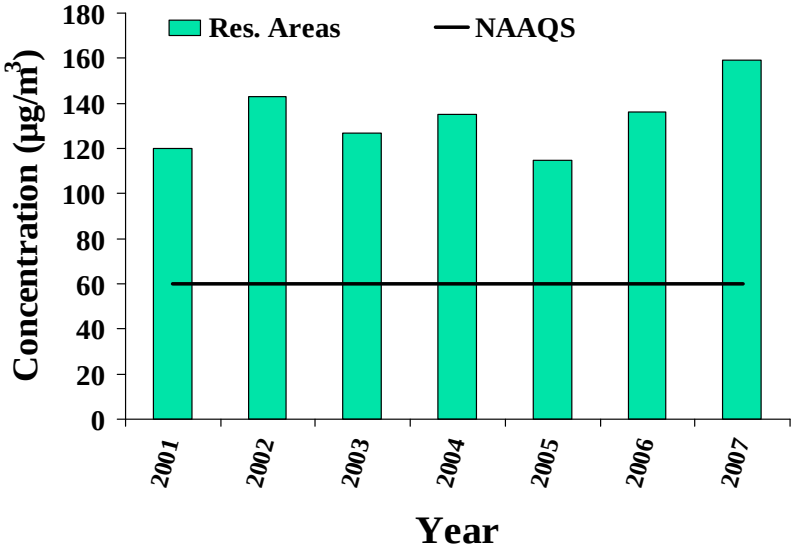


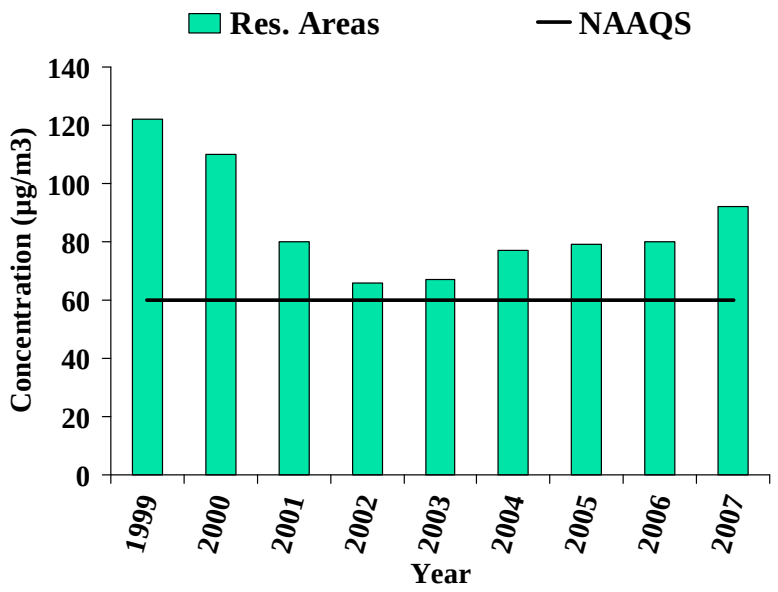
Figure 7.9: Trend in Carbon monoxide (CO) levels at BSZ Marg (ITO), New Delhi.

(d) RSPM

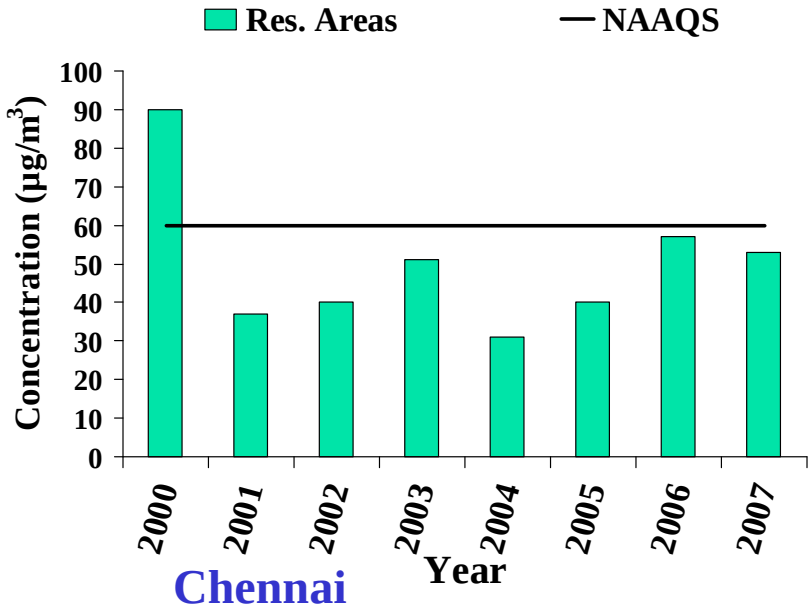
Trend in annual average concentration of RSPM in residential areas of Delhi, Mumbai, Chennai and Kolkata is depicted in Figure 7.10. Trend in annual average concentration of RSPM in residential areas of Hyderabad, Bangalore, Ahmedabad and Lucknow is depicted in Figure 7.11. Trend in annual average concentration of RSPM in Jodhpur, Agra, Faridabad and Solapur is depicted in Figure 7.12. Trend in annual average concentration of RSPM in Kanpur, Pune, Jharia, Patna and Varanasi is depicted in Figure 7.13. RSPM levels exceed the prescribed NAAQS in most of the cities. No definite trend has been observed in ambient Respirable Suspended Particulate Matter. In some cities ambient RSPM levels are decreasing whereas in some cities the trend is fluctuating. Although various interventions have taken place to mitigate ambient RSPM levels but at the same time number of vehicles have increased exponentially. The vehicles are one of the major sources of RSPM. Measures taken to mitigate ambient RSPM levels are implementation of stricter vehicle emission norms and commensurate fuel quality, use of cleaner fuels, banning of diesel driven vehicles in some cities etc. The reason for high particulate matter levels may be vehicles, engine gensets, small scale industries, biomass incineration, resuspension of traffic dust, commercial and domestic use of fuels, etc.



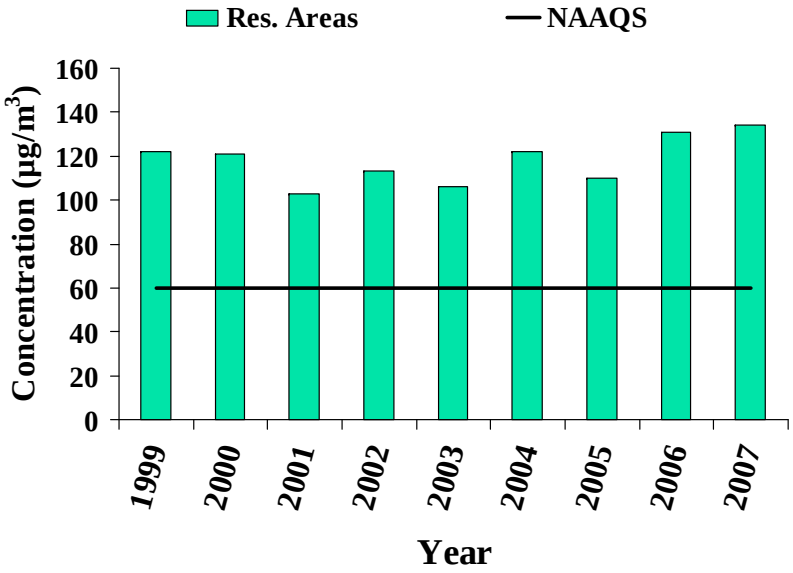
Delhi



Mumbai

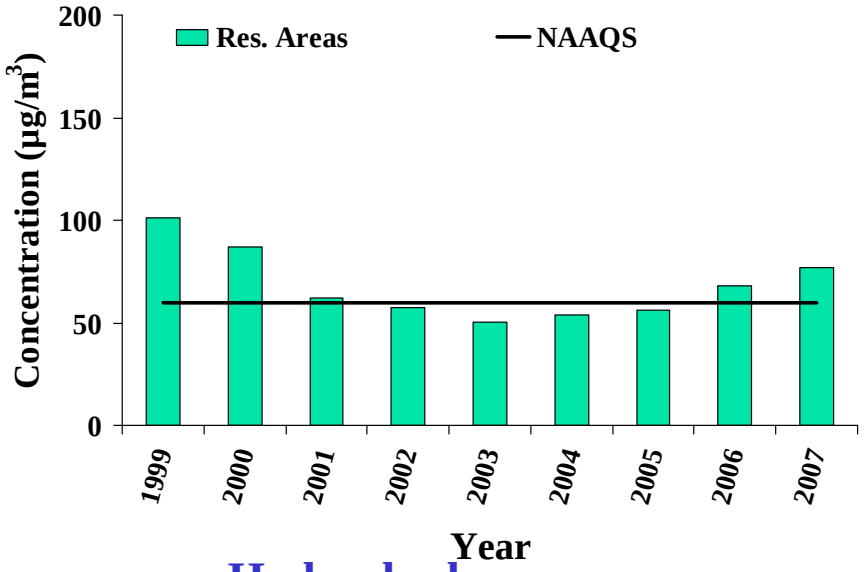


Chennai

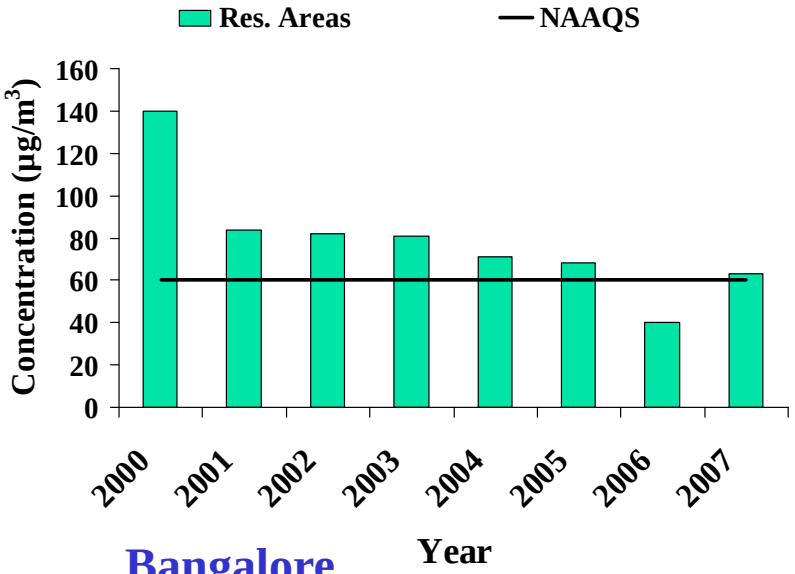


Kolkata

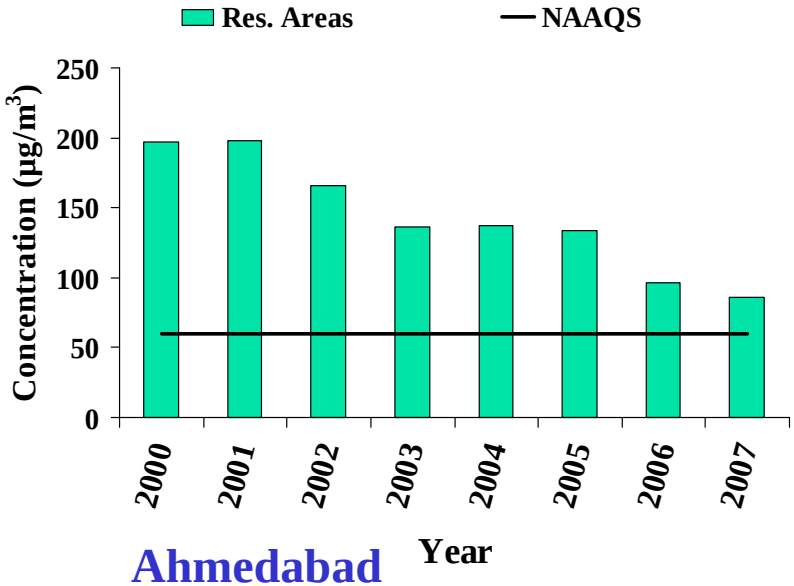
Fig 7.10: Trends in Annual Average Concentration of RSPM in residential areas of Delhi, Mumbai, Chennai and Kolkata.



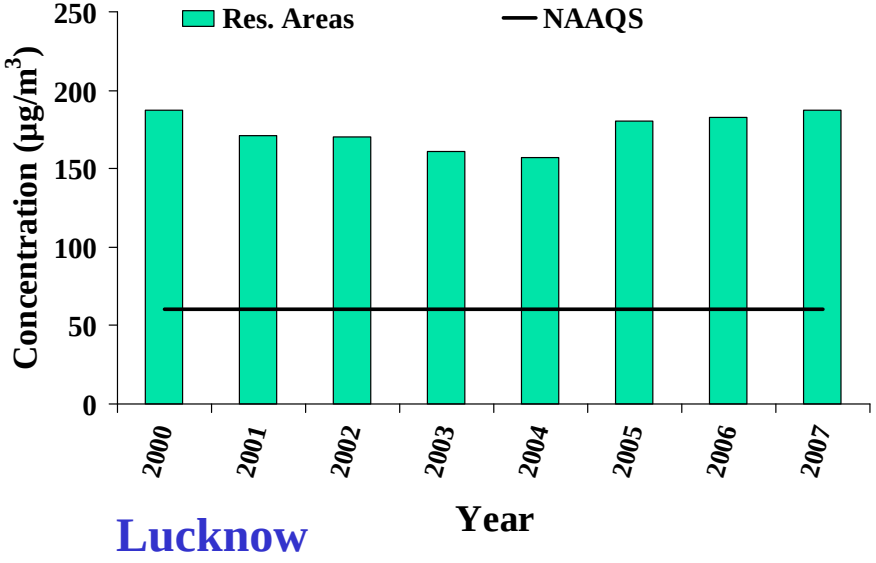
Hyderabad



Bangalore

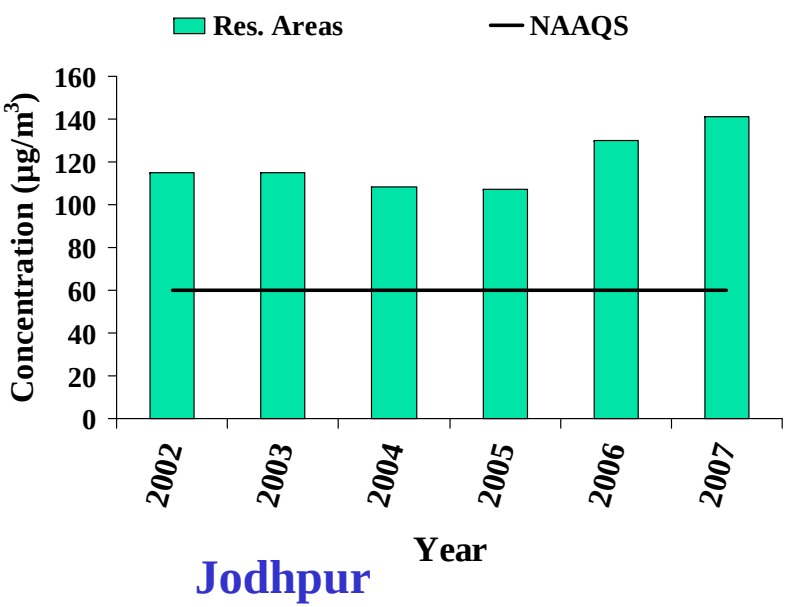


Ahmedabad

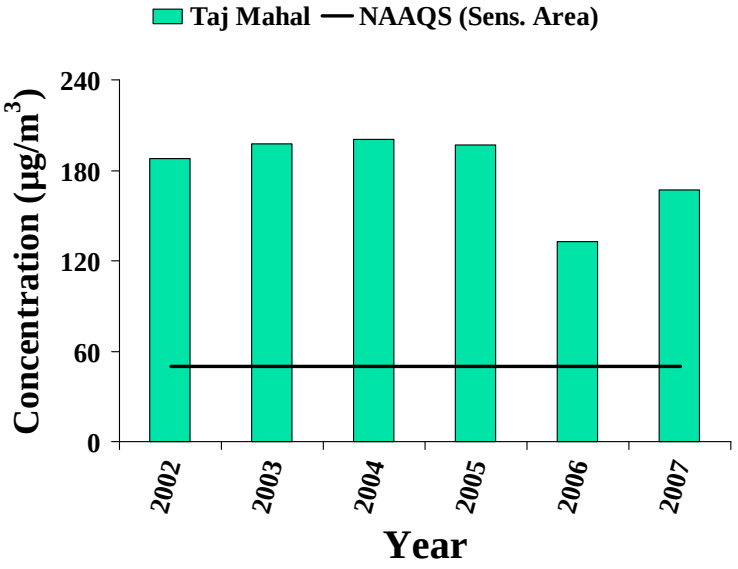


Lucknow

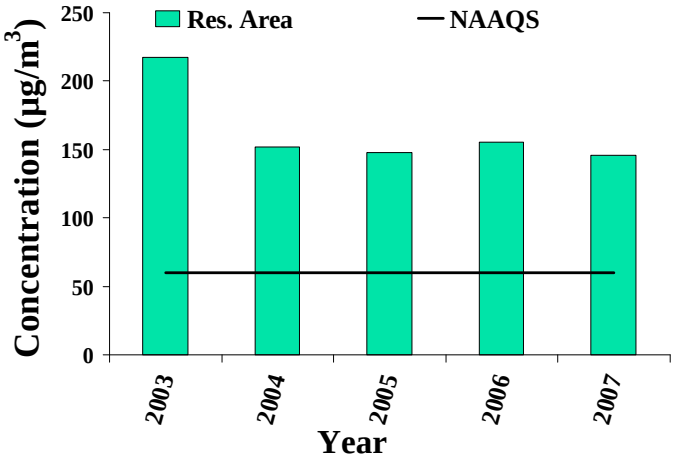
Fig 7.11: Trends in Annual Average Concentration of RSPM in residential areas of Hyderabad, Bangalore, Ahmedabad and Lucknow.



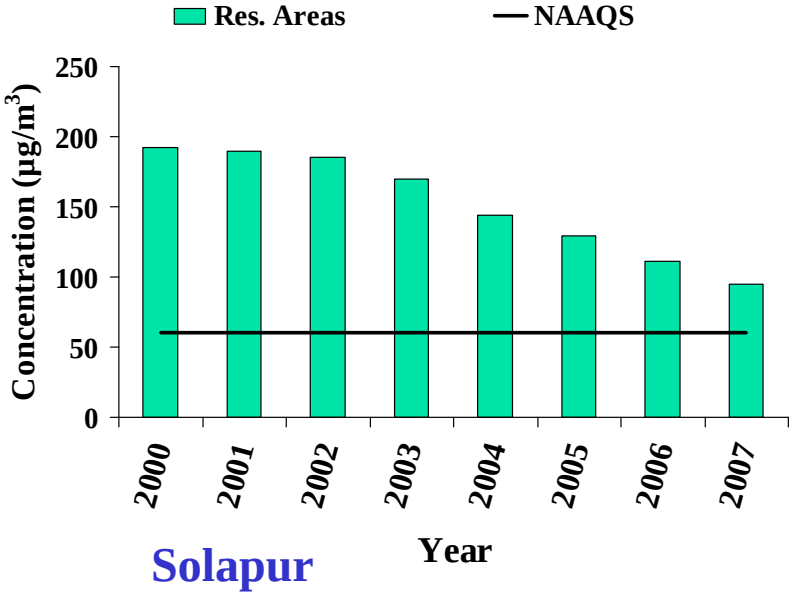
Jodhpur



Agra

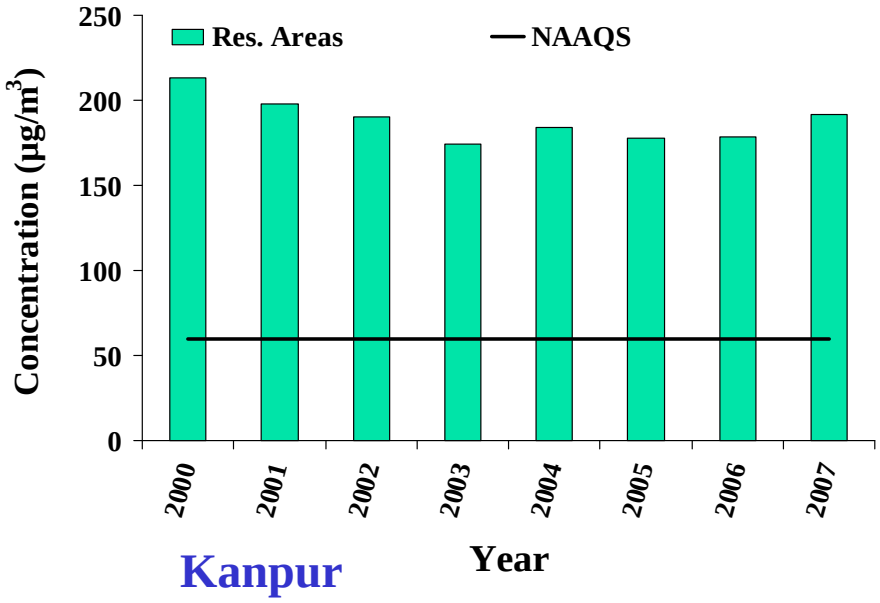


Faridabad

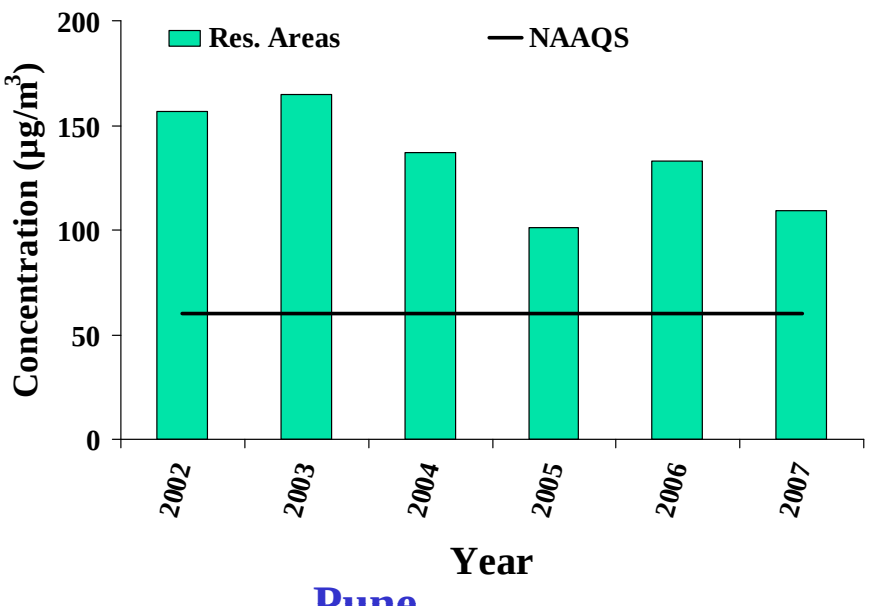


Solapur

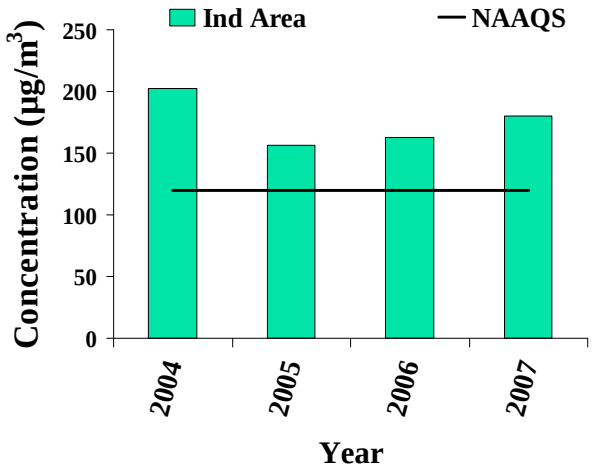
Fig 7.12: Trends in Annual Average Concentration of RSPM in residential areas of Jodhpur, Agra, Faridabad and Solapur.



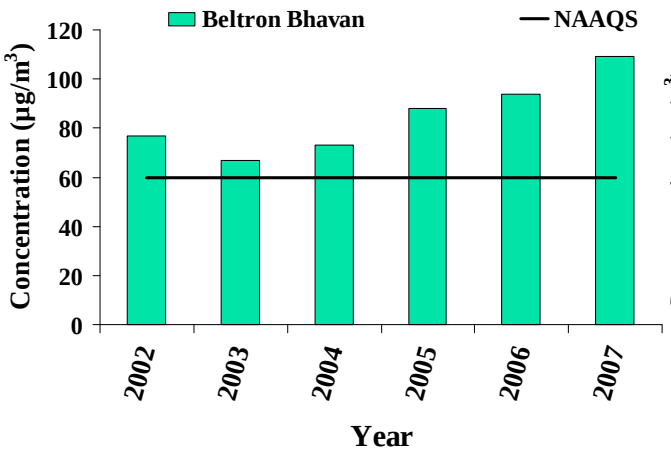
Kanpur



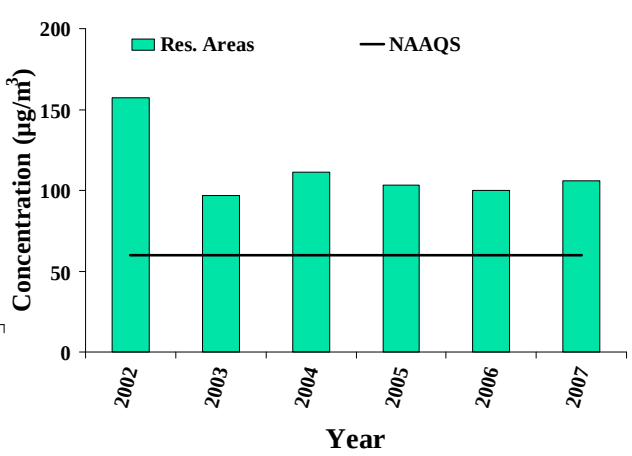
Pune



Jharia



Patna



Varanasi

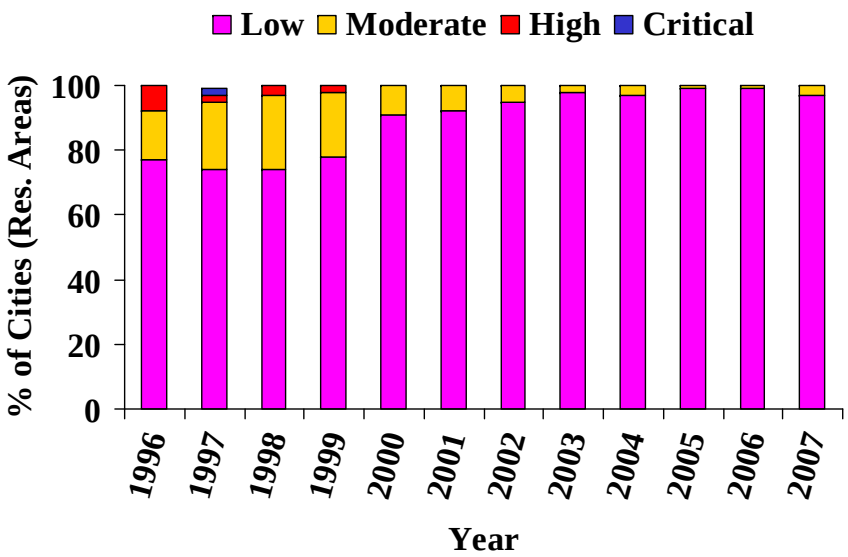
Fig 7.13: Trends in Annual Average Concentration of RSPM in Kanpur, Pune, Jharia, Patna and Varanasi.

7.2 Percentage of Cities with Low, Moderate, High and Critical Levels

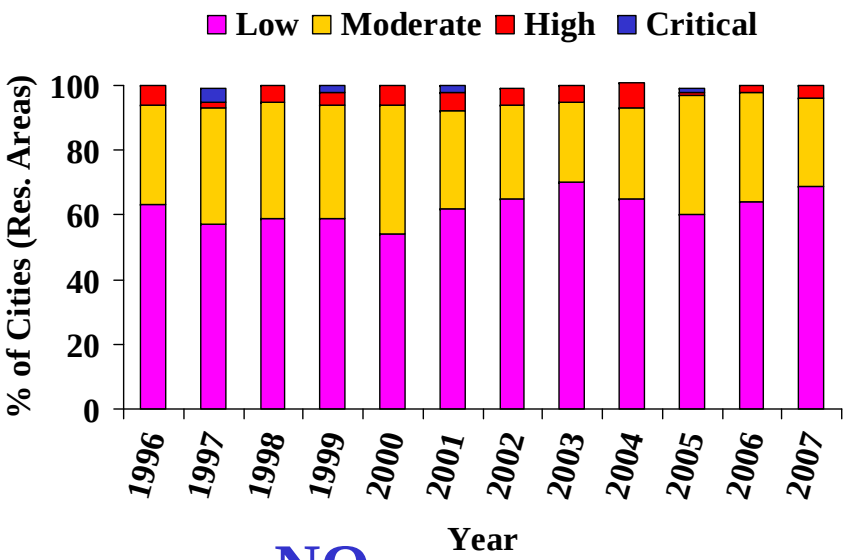
Trend in percentage of cities (Res. Areas) with low, moderate, high and critical levels of SO_2, NO_2, RSPM and SPM is depicted in Figure 7.14. Percentage of cities with low levels of SO_2 have decreased over the years thus indicating that SO_2 pollution have reduced over the years.

7.3 National Mean Concentration

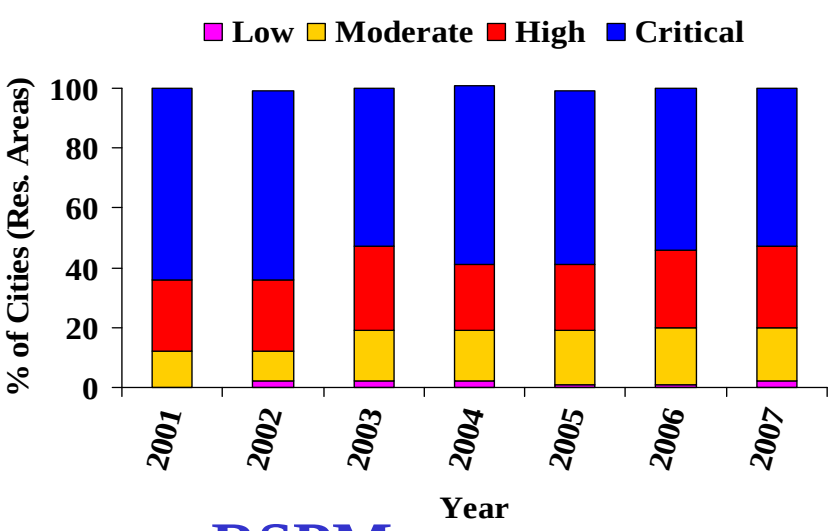
National mean concentration with 90^{th} percentile and 10^{th} percentile for SO_2, NO_2, RSPM and SPM is depicted in Figure 7.15. National mean SO_2 concentration has decreased over the years indicating that there has been a decline in SO_2 levels. National mean NO_2 and RSPM concentration has remained stable over the years despite increase in sources like vehicles. The reason for this may be various intervention measures that have taken place such as improvement in vehicle technology and other vehicular pollution control measures like alternate fuel etc. National mean SPM concentration has been fluctuating over the years.



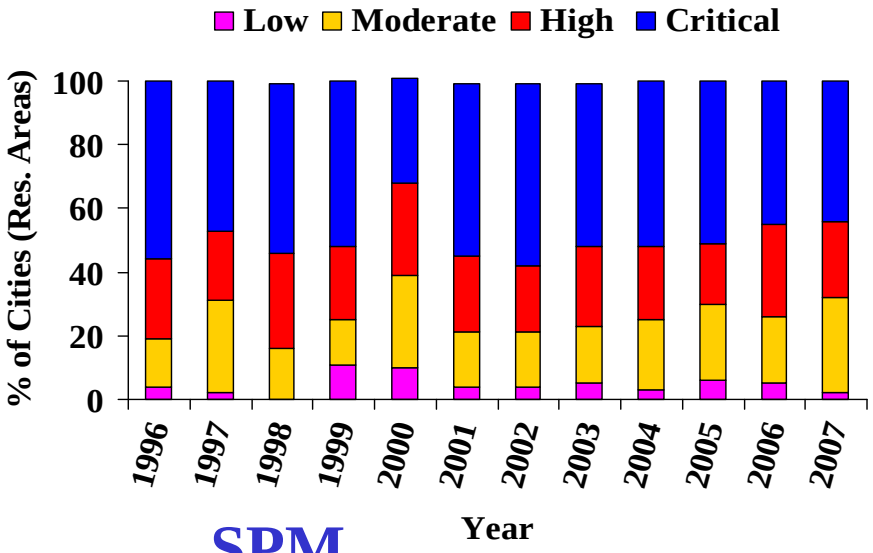
SO_2



NO_2



RSPM



SPM

Figure 7.14: Percentage of Cities (Res. Areas) with Low, Moderate, High and Critical levels of SO_2, NO_2, RSPM and SPM.

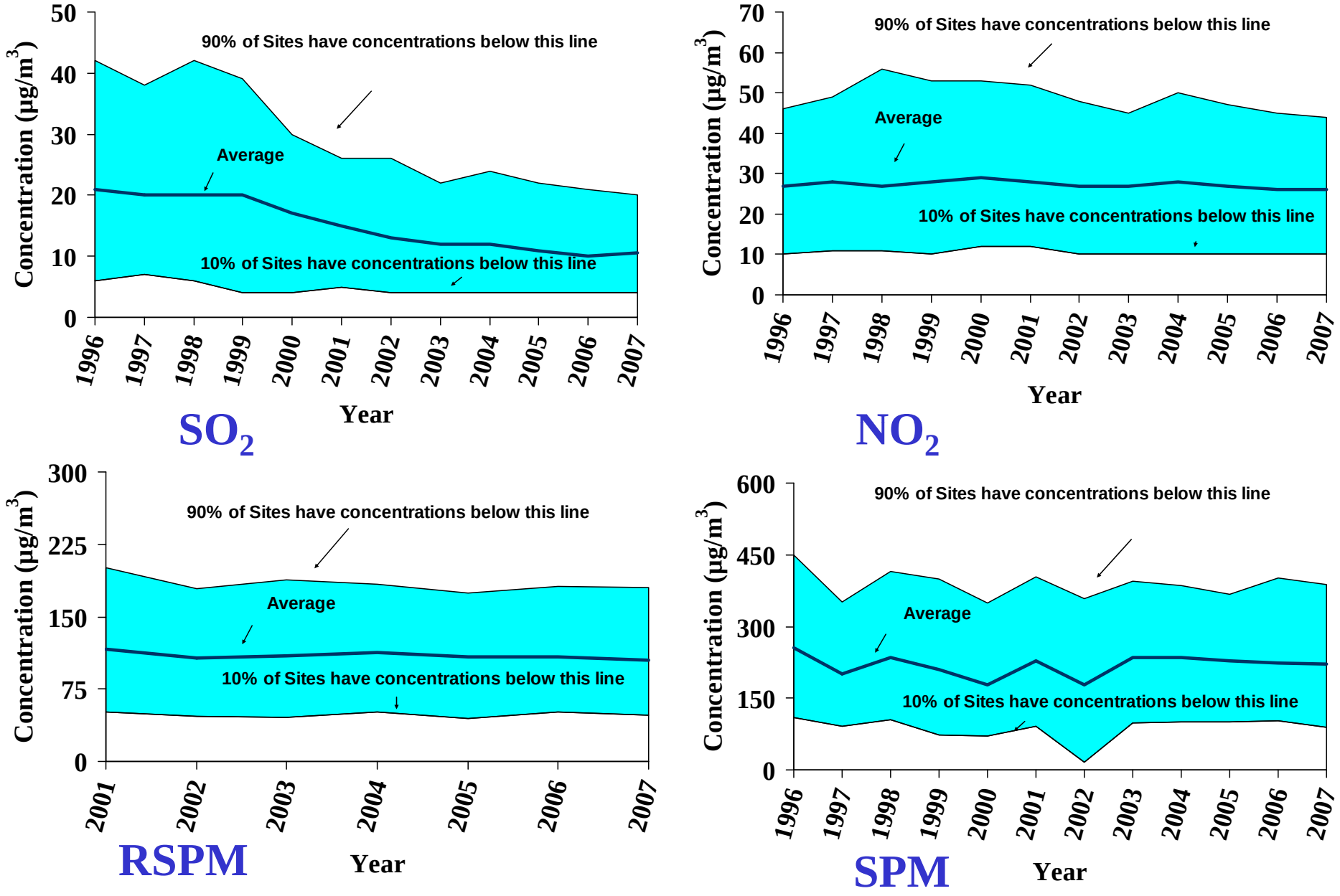


Figure 7.15: National Mean Concentration of SO_2, NO_2, RSPM and SPM

8.0 MAJOR FINDINGS

Major findings of the ambient air quality monitoring carried out during the year 2007 are presented in this chapter.

8.1 Air Quality Assessment

The air quality of different cities/towns has been compared with the respective NAAQS. The air quality has been categorized into four broad categories based on an Exceedence Factor (the ratio of annual mean concentration of a pollutant with that of a respective standard). The Exceedence Factor (EF) is calculated as follows:

$$\text{Exceedence Factor} = \frac{\text{Observed annual mean concentration of criteria pollutant}}{\text{Annual standard for the respective pollutant and area class}}$$

The four air quality categories are:

- Critical pollution (C) : when EF is more than 1.5;
- High pollution (H) : when the EF is between 1.0 - 1.5;
- Moderate pollution (M) : when the EF between 0.5 - 1.0; and
- Low pollution (L): when the EF is less than 0.5.

It is obvious from the above categorization, that the locations in either of the first two categories are actually violating the standards, although, with varying magnitude. Those, falling in the third category are meeting the standards as of now but likely to violate the standards in future if pollution continues to increase and is not controlled. However, the locations in Low pollution category have a rather pristine air quality and such areas are to be maintained at low pollution level by way of adopting preventive and control measures of air pollution. Adequate data for annual average concentration (with 50 and more day of monitoring) for SO_2 was received for 326 stations and adequate data for NO_2 was received for 328 stations. Adequate data for RSPM was received for 317 stations and adequate data for SPM was received for 306 monitoring stations. The details of number of stations for which data was inadequate for annual average concentration is given in Table 8.1. Data of sixteen stations under State Ambient Air Quality Monitoring Programme (SAMP) were also included in analysis. The ambient air quality status of various cities/towns is given in Table 8.2.

Table 8.1 Details of Monitoring Stations where Ambient Air Quality Monitoring was carried out during 2007.

Area type	Number of monitoring stations							
	Adequate data				Inadequate data			
	SO_2	NO_2	RSPM	SPM	SO_2	NO_2	RSPM	SPM
Residential	195	197	193	185	8	7	15	12
Industrial	118	118	111	108	2	2	4	3
Sensitive	13	13	13	13	0	0	0	0
Total	**326**	**328**	**317**	**306**	**10**	**9**	**19**	**15**

Table 8.2 : Ambient Air Quality in India during 2007.

Pollution level	Annual Mean Concentration Range (µg/m^3)				
	Industrial (I)			Residential (R)	
	SO_2 & NO_2	RSPM	SPM	SO_2, NO_2, & RSPM	SPM
Low (L)	0-40	0-60	0-180	0-30	0-70
Moderate (M)	40-80	60-120	180-360	30-60	70-140
High (H)	80-120	120-180	360-540	60-90	140-210
Critical (C)	>120	>180	>540	>90	>210

STATE, UT / CITY	SO_2		NO_2		RSPM		SPM	
AREA CLASS	**I**	**R**	**I**	**R**	**I**	**R**	**I**	**R**
Andhra Pradesh								
Hyderabad	L	L	L	M	M	C	M	C
Visakhapatnam	L	L	L	M	M	C	M	H
Vijayawada	L	L	L	M	M	H	M	H
Ramagundum	-	L	-	L	-	H	-	C
Kurnool	-	L	-	L	-	H	-	H
Assam								
Guwahati	-	L	-	L	-	C	-	H
Bongaigaon	-	L	-	L	-	M	-	M
Tezpur	-	L	-	L	-	H	-	M
Dibrugarh	-	L	-	L	-	M	-	M
Golaghat	-	L	-	L	-	H	-	M
Sivasagar	-	L	-	L	-	C	-	H
Hailakandi	-	L	-	L	-	M	-	M
Bihar								
Patna	-	L	-	H	-	C	-	C
Chattisgarh								
Bhilai	L	L	L	L	H	C	M	H
Korba	-	L	-	L	-	C	-	C
Raipur	L	L	L	M	H	C	M	C
Chandigarh								
Chandigarh	L	L	L	L	H	C	M	C
Delhi								
Delhi	L	L	M	H	C	C	H	C
Gujarat								
Ahmedabad	L	L	L	L	H	C	M	C
Ankleshwar	L	L	L	L	M	C	M	H
Jamnagar	-	L	-	L	-	C	-	H
Rajkot	L	L	L	L	H	H	M	H

STATE, UT/ CITY	SO_2		NO_2		RSPM		SPM	
AREA CLASS	**I**	**R**	**I**	**R**	**I**	**R**	**I**	**R**
Surat	L	L	L	L	M	C	M	H
Vadodara	L	L	M	L	H	C	M	C
Vapi	L	L	L	L	M	H	L	M
Goa								
Panjim	-	L	-	L	-	M	-	M
Vasco	L	-	L	-	L	-	L	-
Himachal Pradesh								
Damtal	-	L	-	L	-	H	-	H
Parwanoo	L	L	L	L	M	H	L	M
Paonta Sahib	L	L	L	L	H	H	M	M
Shimla	-	L	-	L	-	M	-	M
Baddi	L	-	L	-	-	-	H	-
Kala Amb	L	L	L	L	-	-	H	M
Haryana								
Faridabad	L	L	L	L	H	C	H	C
Hissar	-	L	-	L	-	C	-	C
Jharkhand								
Dhanbad	-	L	-	M	-	C	-	H
Jharia	L	-	M	-	C	-	M	-
Sindri	L	-	M	-	H	-	L	-
Jamshedpur	L	-	M	-	H	-	M	-
Ranchi	-	L	-	M	-	C	-	C
Karnataka								
Bangalore	L	L	M	M	H	H	M	H
Mysore	L	L	L	L	L	M	L	M
Hubli-Dharwad	L	L	L	L	M	C	L	C
Belgaum	L	-	L	-	L	-	L	-
Hassan	-	L	-	L	-	H	-	M
Mangalore	L	-	L	-	M	-	L	-
Kerala								
Kochi	L	L	L	L	L	M	L	M
Kottayam	L	L	L	L	L	M	L	L
Kozhikode	L	L	L	L	L	L	L	M
Thiruvananthapuram	L	L	L	M	M	H	L	M
Palakad	L	-	L	-	M	-	L	-
Maharashtra								
Mumbai	L	L	L	M	M	C	M	C
Chandrapur	M	M	M	M	H	C	M	C
Dombivali	L	-	L	-	M	-	-	-
Kolhapur	-	L	-	L	-	H	-	C

STATE, UT/ CITY	SO_2		NO_2		RSPM		SPM	
AREA CLASS	**I**	**R**	**I**	**R**	**I**	**R**	**I**	**R**
Nagpur	L	L	L	L	H	C	M	C
Nashik	M	M	L	M	L	M	L	M
Pune	L	L	M	M	M	C	M	H
Solapur	L	L	L	M	M	C	M	C
Thane	L	L	L	L	L	M	-	-
Aurangabad	-	L	-	L	-	H	-	C
Navi Mumbai	L	L	L	M	M	C	M	C
Lote	L	L	L	L	M	H	L	H
Tarapur	L	-	L	-	M	-	L	-
Amravati	L	L	L	L	M	H	-	-
Madhya Pradesh								
Bhopal	L	L	L	L	M	C	M	C
Indore	L	L	L	L	H	C	M	H
Jabalpur	-	L	-	L	-	C	-	C
Nagda	L	L	L	M	M	H	L	M
Satna	L	L	L	L	C	C	H	H
Gwalior	-	L	-	L	-	C	-	C
Dewas	L	L	L	L	L	L	L	L
Sagar	-	L	-	L	-	-	-	C
Ujjain	L	L	L	L	H	C	M	H
Singrauli	-	-	-	-	-	H	-	C
Meghalaya								
Shillong	-	L	-	L	-	H	-	M
Mizoram								
Aizwal	-	L	-	L	-	M	-	M
Nagaland								
Dimapur	-	L	-	L	-	H	-	M
Orissa								
Angul	L	L	L	L	H	H	M	H
Bhubaneshwar	-	L	-	L	-	H	-	H
Cuttack	-	L	-	M	-	H	-	C
Rourkela	-	L	-	L	-	C	-	H
Talcher	L	-	L	-	M	-	M	-
Rayagada	L	L	L	L	L	M	L	M
Sambalpur	-	L	-	L	-	M	-	M
Berhampur	-	L	-	L	-	H	-	H
Balasore	-	L	-	L	-	H		M
Pondicherry								
Pondicherry	L	L	L	L	L	M	L	M

STATE, UT/ CITY	SO_2		NO_2		RSPM		SPM	
AREA CLASS	**I**	**R**	**I**	**R**	**I**	**R**	**I**	**R**
Punjab								
Gobindgarh	L	L	L	M	C	C	-	-
Jalandhar	L	L	L	M	C	C	-	-
Ludhiana	L	L	M	M	C	C	-	-
Naya Nangal	-	L	-	L	-	C	-	C
Amritsar	L	L	L	M	-	-	H	C
Khanna	L	L	L	M	C	C		
Derabassi	L	-	L	-	-	-	M	-
Bhatinda	L	-	L	-	-	-	M	-
Rajasthan								
Alwar	L	L	L	L	M	C	M	C
Jaipur	L	L	L	M	C	C	H	C
Kota	L	L	L	L	M	C	M	C
Udaipur	L	L	L	L	H	H	H	C
Jodhpur	L	L	L	L	H	C	H	C
Tamil Nadu								
Chennai	L	L	L	L	M	M	M	M
Coimbatore	L	L	L	L	M	M	M	M
Madurai	L	L	L	L	L	M	L	M
Salem	-	L	-	L	-	M	-	M
Tuticorin	L	L	L	L	M	C	M	H
Uttaranchal								
Dehradun	-	L	-	L	-	C	-	C
Uttar Pradesh								
Anpara	L	-	L	-	H	-	M	-
Gajraula	L	-	L	-	M	-	M	-
Kanpur	L	L	L	L	C	C	H	C
Firozabad	L	L	L	M	C	C	H	C
Lucknow	L	L	L	M	C	C	H	C
Noida	L	L	M	M	H	C	H	C
Varanasi	-	L	-	L	-	C	-	C
Ghaziabad	L	-	L	-	C	-	H	-
Jhansi	-	L	-	L	-	C	-	C
Khurja	M	M	L	M	C	C	H	C
Meerut	-	L	-	M	-	C	-	-
West Bengal								
Asansol	L	-	M	-	M	-	M	-
Durgapur	L	L	M	M	H	H	M	H
Haldia	L	-	M	-	M	-	L	-
Howrah	L	L	H	H	H	C	M	C
Kolkata	L	L	M	H	H	C	M	C

8.2 Summary and Conclusion

1. Table 8.3 shows the number of stations violating annual standards and 24-hourly NAAQS during the year 2007. It is quite evident NAAQS of RSPM and SPM are violated at most of the monitoring stations. NAAQS (Annual average) of SPM was violated at 71% of the monitoring stations in residential areas and 17 % of the monitoring stations in industrial areas. NAAQS (Annual average) of RSPM was violated at 81% of the monitoring stations in residential areas and 40% of the monitoring stations in industrial areas. There was no violation of NAAQS (Annual average) of SO_2 at any monitoring station in residential and industrial areas. NAAQS (Annual average) of NO_2 was violated at 18 monitoring stations and NAAQS (24 hourly average) of NO_2 was violated at 27 monitoring stations.

Table 8.3 Number of Monitoring stations violating NAAQS (Annual average and 24-hourly average).

Area Class	SO_2		NO_2		RSPM		SPM	
	24-Hourly	Annual	24-Hourly	Annual	24-Hourly	Annual	24-Hourly	Annual
Residential	-	-	14	7	160	157	154	132
Industrial	-	-	5	1	76	44	32	18
Sensitive	1	-	8	10	12	11	12	13
Total	**1**	**-**	**27**	**18**	**248**	**212**	**198**	**163**

2. Sulphur dioxide

- The annual average concentration of SO_2 varied from BDL at Industrial Area, Chandigarh and other locations to 47 $\mu g/m^3$ at CGCRI, Khurja in industrial areas. In residential areas, the annual average concentration varied from BDL at Arera Colony Bhopal and other locations to 49 $\mu g/m^3$ at Nashik Municipal Council Building, Nashik.

- A decreasing trend was observed in residential areas of Delhi, Lucknow etc. Decreasing trend may be due to various interventions that have taken place in recent years such as reduction of sulphur in diesel, use of cleaner fuel such as CNG in Delhi etc. Other measures include implementation of Bharat Stage-III emission norms for new vehicles and commensurate fuel quality. Also there has been a change in domestic fuel used from coal to LPG which may have contributed to reduction in ambient levels of SO_2.

3. Nitrogen dioxide

- The annual average concentration of NO_2 varied from BDL at Irumpanam, Kochi and other locations to 91 $\mu g/m^3$ at Bandhaghat, Howrah in industrial areas. In residential areas, the annual average concentration varied from BDL at Regional Office, Parwanoo and other locations to 82 $\mu g/m^3$ at Town Hall, Delhi.

- In Howrah and Kolkata, levels are high due to large number of diesel vehicles. Vehicles are one of the major sources of NO_2 in the country.

- No definite trends have been observed in ambient NO_2 levels. In some cities, NO_2 levels are deceasing whereas in some cities NO_2 levels are fluctuating. Vehicles are one of the major sources of NO_2 and their number is increasing exponentially. Measures that have been taken to mitigate ambient NO_2 levels are introduction of improved vehicular technology in the form of Bharat Stage –III vehicles, banning of old vehicles in some cities, improved traffic management etc.

4. Respirable Suspended Particulate Matter

- The annual average concentration of RSPM varied from 23 $\mu g/m^3$ at Nallalam, Kozhikode to 288 $\mu g/m^3$ at Sub-divisional Office, Satna in industrial areas. In residential areas, the annual average concentration varied from 25 $\mu g/m^3$ at Laipuitlang, Mizoram to 252 $\mu g/m^3$ at M/s Modi Oil & General Mills, Gobindgarh.

- RSPM levels exceed the prescribed NAAQS in most of the cities No definite trends have been observed in ambient RSPM levels. In some cities, RSPM levels are deceasing whereas in some cities RSPM levels are fluctuating. Vehicles are one of the major sources of RSPM and their number is increasing exponentially. The measures that have been taken to mitigate RSPM levels are implementation of stricter vehicle emission norms and commensurate fuel quality, use of cleaner fuels, banning of diesel driven vehicles in some cities etc. The reason for high particulate matter levels may be vehicles, engine gensets, small scale industries, biomass incineration, resuspension of traffic dust, commercial and domestic use of fuels, etc.

5. Suspended Particulate Matter

- The annual average concentration of SPM varied from 38 $\mu g/m^3$ at Vadavathoor, Kottayam to 520 $\mu g/m^3$ at Regional Office, Udaipur, Delhi in industrial areas. In residential areas, the annual average concentration varied from 56 $\mu g/m^3$ at Laipuitlang, Mizoram to 476 $\mu g/m^3$ at Town Hall, Delhi.

- SPM levels exceed the prescribed NAAQS in many cities especially in residential areas. Northern cities like Delhi, Jodhpur, Varanasi, Lucknow experience dust storms and hazy conditions during summer months. These dust storms build up particulate matter in ambient levels resulting in high SPM levels. Trend in SPM is fluctuating in many cities. The reason for high SPM levels may be natural dust, resuspension of dust, vehicles, commercial and domestic use of fuel etc.

6. The reason for high particulate matter levels may be vehicles, engine gensets, small scale industries, biomass incineration, boilers and emission from power plants, resuspension of traffic dust, commercial and domestic use of fuels, etc.

7. Lower levels of RSPM were observed during monsoon months possibly due to wet deposition. Higher levels of RSPM were observed during winter months possibly due to lower mixing heights and more calm conditions.

8. SO_2 levels have shown a declining trend and national mean SO_2 concentration has reduced over the years indicating that SO_2 pollution has reduced in the country. National mean NO_2 and RSPM concentration has remained stable over the years despite increase in number of sources like vehicles. This could be result of various interventions that have taken place such as vehicular pollution control measures.

8.3 Recommendations

Following measures would greatly enhance the quality and reliability of data and monitoring activities as such:

(i) Background stations may be included in the network to assess the anthropogenic impact

(ii) Calibration of air quality monitoring instruments may be carried out regularly.

(iii) Analytical quality control exercises may be carried out regularly to improve quality of data.

(iv) A comprehensive urban air quality management strategy should be formulated and action plan should be regularly reviewed keeping into view the results of implementation.

(v) Studies on inventory of air polluting sources and source apportionment studies may be undertaken to improve upon the action plan to control air pollution.

(vi) Epidemiological studies should be undertaken to develop dose-response relationships.

(vii) Monitoring of hazardous air pollutants may be undertaken as they are well known to have marked effect on human health and environment.

9.0 INITIATIVES FOR CONTROL OF AIR POLLUTION

Various measures have been taken to control air pollution from vehicles, industries and other sources. The steps taken to control air pollution from vehicles and industries are as follows:

9.1 Measures taken to Reduce Vehicular Pollution

1) Vehicular Emission Norms

a) During 1990-91 India for the first time notified mass emission norms for the vehicles at the manufacturing stage as well as for in-use vehicles. These norms were notified under EPA, motor vehicles rules & Air Act.

b) The emission norms introduced in 1996 have been important in controlling vehicular pollution because of stringency of emission norms along with fuel quality in 1996. For the first time crankcase emission norms and evaporative emission norms were introduced.

c) From April 1995 passenger cars were allowed to register only if they are fitted with a catalytic converter in four metros-Delhi, Mumbai, Kolkata & Chennai. Emission norms for such vehicles were notified under motor vehicles rules during January 1998. These norms were stricter by 50 percent compared to 1996 norms.

d) The testing method for passenger car norms were changed from hot start to cold start, which is also a stringent measure, compared to the earlier one.

e) More stringent norms were introduced for the year 2000. These norms were notified under Motor Vehicle Rules during 1997. Automobile manufacturers have to undergo major modification to meet these norms.

f) As per Hon'ble Supreme Court's directions only private vehicles conforming to at least EURO-I norms are being registered in NCR from June 1999 and from April 2000 only private vehicles conforming to Euro-II equivalent i.e. Bharat Stage-II norms were registered. In Mumbai Euro-II norms for private vehicles (4 wheelers) was applicable from 2001. In Kolkata, India-2000 norms (Euro-I) have been made applicable from November 1999.

g) From 1st October 1999, emission norms for agricultural tractors were introduced throughout the country. Bharat Stage-II and Bharat Stage-III emission norms for tractors have been scheduled to be implemented from 2003 and 2005 respectively.

h) The Bharat Stage-II norms for new 4-wheeler private non-commercial vehicle were introduced in Mumbai from January 2001, Kolkata and Chennai from July 2001 to 24th October, 2001.

i) Only those taxies are being registered in Delhi, which are meeting Bharat Stage-II norms.

j) Bharat Stage-II norms for Diesel 4 wheeler transport vehicles were introduced in NCT from 24th October, 2001, in Greater Mumbai, Kolkata & Chennai from 31.10.2001

k) The expert committee on Auto Oil, Policy was constituted during September 2001. The interim report of the committee was submitted to Govt. on 1.1.2000. Recommending Bharat Stage-III emission norms for all category of 4-wheelers in 7 mega cities from 2005 and rest of the country by 2010. Final report of the committee has been submitted in September 2002 which includes road map for control of vehicular pollution up to 2010.

l) Final report of the Inter-Ministerial Task Force constituted by MO & P&NG at the instance of the Committee of Secretaries to evolve a long term policy for vehicular emission and auto fuel policy has been submitted which recommended introduction of Bharat Stage-II norms for 4-wheelers and next stage emission norms for 2/3 wheelers throughout the country from 2005 and introduction of Bharat stage-III norms for four wheelers in 7-mega cities from 2005.

2) Fuel Quality Specifications

For the first time diesel and gasoline fuel quality with respect to environment related parameters has been notified under EPA during April 1996. Gasoline lead phase out programme is given in Table 9.1.

Table 9.1: Gasoline Lead Phase Out Programme

Phase	Date of Introduction	Lead Content	Areas Covered
Phase-I	June 1994	Low lead (0.15 g/l)	Delhi, Mumbai, Kolkata, Chennai
Phase-II	1.4.1995	Unleaded (0.013 g/l)+ low leaded	Delhi, Mumbai, Kolkata, Chennai
Phase-III	1.1.1997	Low leaded	Entire country
Phase-IV	1.9.1998	Only unleaded	NCT
Phase-V	31.12.1998	Unleaded+Low leaded	Capitals of states & Uts
Phase-VI	1.9.1998	Unleaded	NCR
Phase-VII	1.2.2000	Unleaded	Entire Country

Diesel sulphur reduction programme is given in Table 9.2. Gasoline benzene reduction programme is given in Table 9.3.

Table 9.2: Diesel Sulphur Reduction Programme.

Phase	Date of Introduction	Sulphur Content	Areas Covered
Phase-I	April 1996	0.50%	Four metros & Taj
Phase-II	August 1997	0.25%	Delhi & Taj
Phase-III	April 1998	0.25%	Metro Cities
Phase-IV	January 2000	0.25%	Entire Country
Phase-V	April 2000	0.05%	NCR-private vehicles
	January 2000	0.05%	Mumbai-all vehicles
	March 2001	0.05%	NCT-all vehicles
	June 2001	0.05%	NCR-all vehicles
	July 2001	0.05%	Chennai & Kolkata
Phase-VI	October 2001	0.05%	All retail outlets of four metros
Phase-VII	2003	0.05%	Ahemadabad, Surat, Agra, Pune & Kanpur
Phase-VIII	2005	0.05%	Entire country
Phase-IX	2005	0.035%	10 metro cities & Agra
Phase-X	2010	0.035%	Entire country
Phase-XI	2010	0.005%	10 metro cities

Table 9.3: Gasoline Benzene Reduction Programme.

Date of Introduction	Benzene Content	Areas Covered
Before 1996	No specification	Entire Country
April 1996	5% benzene	Entire Country
April 2000	3% benzene	Metro Cities
November 2000	1% benzene	NCT & Mumbai
2005	1% benzene	All Metro cities

3) Better traffic management in Delhi

- Restriction has been imposed on goods vehicles during day time from August 1999 in Delhi .
- Left lane has been made exclusive to buses and other HMV in Delhi .
- Time clocks have been installed in important red lights to enable the drivers to switch off their vehicles depending on the time left in the time clocks.
- Construction of more fly-overs and subways and closing of T-Junctions for better traffic flow.
- Regular information about traffic flow through radio FM bands for avoiding congested roads.

4) Improvement of the Public transport System in Delhi

- Various steps taken for the improvement of the public transport system in Delhi are as follows:
- Number of buses has been increased to discourage use of individual vehicles by allowing private sectors for operation.
- Metro Rail Project for Various stretches in Delhi has been completed Successfully and work is in progress to connect various zones of Delhi.

5) Reduction of emissions by the use of lubricants

- Specifications of 2T oil for two stroke engine with respect to smoke have been notified under EPA during September 1998 for implementation from 1.4.1999 throughout the country.
- Pre-mix 2T oil dispenser has been installed at all petrol filling stations in Delhi so that excessive oil is not being used by the vehicle owners. Sale of loose 2T oil has been banned from December 1998 in Delhi & Kolkata.

6) Mass awareness regarding vehicular pollution control

- Messages/articles related to vehicular emissions are disseminated through newsletters, pamphlets, newspapers, magazines, Television, Radio, Internet, Workshops and Summer Exhibitions.
- Display of ambient air quality data through display system near ITO, Newspapers, daily news& Internet.
- NGOs working on vehicular pollution control are being encouraged for mass awareness campaigns.

7) Alternate fuelled vehicles

- CNG vehicles introduced in Mumbai & Delhi. At present more than 80,000 CNG vehicles(19000 cars, 49810 Autos, 4935 RTVs & 8874 Buses) are plying in Delhi and about 23,000 in Mumbai. All city buses converted to CNG mode in Delhi .
- There are more than 111 CNG filling stations installed in Delhi with average consumption of674 tonnes per day of CNG.
- Emission norms for CNG & LPG driven vehicles has been notified.
- Petrol vehicles are running on ethanol blended (5%) petrol in states of Maharastra, AndhraPradesh, Goa, Gujarat, Haryana, Karnataka, Tamil Nadu Uttar Pradesh, Daman & Diu andUnion Territories of Dadar & Nagar Hawali, Chandigarh and Pondicherry .
- Work is in progress to run diesel vehicles on bio-diesel.

8) Control of pollution from in-use vehicles :

- Idling emission norms notified for in-use vehicles. Pollution Under Control (PUC) certificate areissued for adherence to idling emission norms every 6/3 months. Number of computerizedPUC centers in Delhi is around 353.
- More than15 year old commercial vehicles are phased out from Delhi since 1998.
- New in- use vehicles norms proposed

9) Recommendations of the final report of the Expert Committee on "Auto Fuel Policy"

- Bharat Stage-II norms for new vehicles except two & three wheelers, which are in place in thefour mega cities of Delhi, Mumbai, Kolkata & Chennai to be extended to Hyderabad, Bangalore, Ahemadabad, Kanpur, Pune, Surat & Agra by 2003 and entire country by 2005.
- Euro-III equivalent emission norms for all new vehicles except 2 & 3 wheelers to be applicable in 11 cities from 1 st April 2005 and extended throughout the country by 2010.
- Euro -IV equivalent emission norms for all new vehicles except 2 & 3 wheelers to be applicablein 11 cities by April 2010.
- Bharat Stage-II Emission norms for 2&3 wheelers to be applied through out the country byApril 2005 and Bharat Stage-III by 2008/2010.
- To meet Bharat Stage-II, Euro-III and Euro-IV equivalent emission norms, matching quality of petrol & diesel should be simultaneously made available.

9.2 Measures Taken for Controlling Air Pollution from Industries

The measures taken for controlling air pollution from industries are as follows:

(a) Emission standards have been notified under the Environment (Protection) Act, 1986 to check pollution.

(b) Industries have been directed to install necessary pollution control equipment in a time bound manner and legal action has been initiated against the defaulting units.

(c) 24 critically polluted areas have been identified. Action Plan have been formulated for restoration of environmental quality in these areas.

(d) Environmental guidelines have evolved for siting of industries.

(e) Environmental clearance is made compulsory for 29 categories of development projects involving public hearing/ NGO participation as an important component of Environmental Impact Assessment process.

(f) Environmental audit in the form of environmental statement has been made mandatory for all polluting industries.

(g) Preparation of zoning Atlas for siting of industries based on environmental considerations in various districts of the country has been taken up.

(h) Power plants (coal based) located beyond 1000 kms from the pit-head are required to use low ash content coal (not exceeding 34%) with effect from 1.6.2002. Power plants located in the sensitive areas are also required to use low ash coal irrespective of their distance from the pit head.

ANNEXURE – I

Table A1.1 NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS)

Pollutant	Time Weighted Average	Concentration in Ambient Air			Method of Measurement
		Industrial Area	Residential, Rural and other Areas	Sensitive Area	
Sulphur Dioxide (SO_2)	**Annual Average***	**80 µg/m^3**	**60 µg/m^3**	**15 µg/m^3**	**1. Improved West and Gaeke Method 2. Ultraviolet Fluorescence**
	24 Hours Average**	**120 µg/m^3**	**80 µg/m^3**	**30 µg/m^3**	
Oxides of Nitrogen as NO_2	**Annual Average***	**80 µg/m^3**	**60 µg/m^3**	**15 µg/m^3**	**1. Jacob & Hochheiser modified (NaOH-$NaAsO_2$) Method 2. Gas Phase Chemiluminescence**
	24 Hours Average**	**120 µg/m^3**	**80 µg/m^3**	**30 µg/m^3**	
Suspended Particulate Matter (SPM)	**Annual Average***	**360 µg/m^3**	**140 µg/m^3**	**70 µg/m^3**	**High Volume Sampling (Average flow rate not less than 1.1m^3/minute)**
	24 Hours Average**	**500 µg/m^3**	**200 µg/m^3**	**100 µg/m^3**	
Respirable Particulate Matter (Size less than 10µm) (RPM)	**Annual Average***	**120 µg/m^3**	**60 µg/m^3**	**50 µg/m^3**	**Respirable Particulate Matter Sampler**
	24 Hours Average**	**150 µg/m^3**	**100 µg/m^3**	**75 µg/m^3**	
Lead (Pb)	**Annual Average***	**1.0 µg/m^3**	**0.75 µg/m^3**	**0.50 µg/m^3**	**AAS Method after sampling using EPM 2000 or equivalent filter paper**
	24 Hour Average**	**1.5 µg/m^3**	**1.0 µg/m^3**	**0.75 µg/m^3**	
Carbon Monoxide (CO)	**8 Hours Average****	**5.0 mg/m^3**	**2.0 mg/m^3**	**1.0 mg/m^3**	**Non dispersive Infrared Spectroscopy**
	1 Hour Average	**10.0mg/m^3**	**4.0 mg/m^3**	**2.0 mg/m^3**	
Ammonia (NH_3)	**Annual Average***	**0.1 mg/m^3**			**-**
	24 Hour Average**	**0.4 mg/m^3**			

* Annual Arithmetic mean of minimum 104 measurements in a year twice a week 24 hourly at uniform interval.

** 24 hourly/8 hourly values should be met 98% of the time in a year. However, 2% of the time, it may exceed but not on two consecutive days.

NOTE

1. National Ambient Air Quality Standard : The levels of air quality necessary with an adequate margin of safety, to protect the public health, vegetation and property.
2. Whenever and wherever two consecutive values exceed the limit specified above for the respective category, it would be considered adequate reason to institute regular/continuous monitoring and further investigations.
3. The State Government / State Board shall notify the sensitive and other areas in the respective states within a period of six months from the date of notification of National Ambient Air Quality Standards

APPENDIX – I

Appendix- I

Method of Measurements

a) Sulphur Dioxide (SO_2)

Sulphur dioxide content in the ambient air is measured by the modified West and Gaeke method. Sulphur dioxide in ambient air is absorbed in a solution of 0.04M sodium tetrachloromercurate at an average flow rate of 1 liter per minute (LPM), resulting in the formation of dischlorosulphitomercurate complex. The main interference is due to the oxides of nitrogen, ozone and trace metals. Interference from oxides of nitrogen can be prevented by adding sulphamic acid, which acts as a reducing agent and converts some of the oxygenated nitrogen species to nitrogen gas. Interference from ozone can be eliminated by aging the sample prior to analysis. Interference from trace metals can be prevented by adding EDTA (disodium salt) to the unexposed absorbing solution. For analysis, the exposed sample is treated with sulphamic acid, formaldehyde and acid bleached pararosaniline containing hydrochloric acid. Pararosaniline, formaldehyde and bisulfite anion react to form violet red coloured pararosaniline methyl sulphonic acid. The intensity of the colour is measured on a spectrophotometrer at 560 nm wavelength. The detection range of the SO_2 concentration is 4 – 1050 $\mu g/m^3$.

b) Nitrogen dioxide (NO_2)

In the method the NO_2 from ambient air is absorbed in a solution of sodium hydroxide and sodium arsenite. Sulphur dioxide is the major interfering compound. The interference of sulphur dioxide is eliminated by converting it to sulphuric acid by addition of hydrogen peroxide. The absorbed nitrogen dioxide is then reacted with sulphanilamide in the presence of phosphoric acid at a pH of less than 2 and then coupling it with N-(1Nepthyl) ethylenediamine dihydrochloride. The absorbance of the highly coloured azo dye is measured on spectrophotometer at a wavelength of 540 nm. The detection range of the NO_2 concentration is 9 – 750 $\mu g/m^3$.

c) Suspended Particulate Matter (SPM)

SPM are particulate/aerosol having diameter less than 100μm that tend to remain suspended in the atmosphere for a long period of time. Sea salt, soil dust, volcanic particles and smoke from forest fires are the natural sources of total suspended particulates. Fossil fuel burning and industrial processes are the anthropogenic sources of suspended particulate matter. Monitoring of SPM is carried out for 24 hours with 8-hourly sampling. SPM is measured gravimetrically with GFA/EPM 2000 filter paper using high volume sampler.

For measurement of SPM, ambient air is drawn into a covered housing of HVS through a 20.3 x 25.4 cm (8 x 10") Whatman GF/A or EPM pre weighed glass fiber filter paper at a flow rate of 1.1 to 1.5 cubic meters per minute. The main housing should be rectangular (29 cm x 36 cm) and must be provided with a gable roof having 45^o to the

horizontal so that the filter is protected from precipitation and particles less than 100 µm size are only collected on the filter surface. Particles within the size range of 100 to 0.1 µm are ordinarily collected on glass fiber filter.

The mass concentration of SPM in the ambient air, expressed in micrograms per cubic meter is calculated by measuring the mass of collected particulate and the volume of air drawn.

d) Respirable Suspended Particulate Matter (RSPM/ PM_{10})

PM_{10} are the particulate matter having aerodynamic diameter less than 10 µm and it is fraction of the particulate matter suspended in air and it represents the fraction that is considered to enter the respiratory system. Sources of PM_{10} include road dust, emission from petrol and diesel exhaust, construction and fireplaces. PM_{10} may also be formed from other pollutants (acid rain, NO_x, SO_x, organics) and from incomplete combustion of any fuel. Monitoring of RSPM is carried out for 24 hours with 8-hourly sampling. RSPM is measured gravimetrically with GFA/EPM 2000 filter paper using respirable dust sampler.

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