MEERUT CITY CLEAN AIR ACTION PLAN

SEPTEMBER, 2020

UTTAR PRADESH POLLUTION CONTROL BOARD
TC-12V, VIBHUTI KHAND, GOMTI NAGAR, LUCKNOW,
UTTAR PRADESH 226010

CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ANNEXURES

I. INTRODUCTION

A vast country and an emerging economy like India, faces enormous challenges with its burgeoning population and widespread poverty, in meeting its various other significant commitments associated with poverty, and eradication of hunger under the SDGs. India has been going through a phase of accelerated industrial activities for the past three decades. The associated growth in terms of industrialization and urbanization has led to manifold increase in pollution issues, more specifically air pollution issues. In recent years, medium and small towns and cities have also witnessed an increase in pollution, thus getting fast reflected in the non-attainment cities of India. Air pollution has increasingly become a serious concern, predominantly because of its health impacts. The reported perplexing statistics in various international reports, correlating air pollution with health impacts without the use of indigenous dose response functions, further complicates the issue by possibly creating an ambiguous public perception.

With the recent focus on pollution in tier II cities, the MoEF&CC and CPCB has identified the non-attainment cities mostly in Indo-Gangetic Plains based on ambient air quality data for the period 2011 – 2015 and WHO report 2014/2018. However, many of tier II cities in India, including state capital, have similar problems of outdoor air pollution. Meerut is one of the largest urban agglomerations in the National Capital Region, has been identified as a NAC in the month of July, 2020 with the objective of evolving an action plan having action points with specific timelines based upon scientific inputs time bound actions and its effective implementation in order to bring down the pollution levels.

II. GOAL

The goal of the Action Plan is to meet the prescribed annual average ambient air quality standards at all locations in Meerut City within a stipulated timeframe (long-term).

III. TARGET

The global experiences clearly highlight the fact that internationally, the actions had been city specific rather than country oriented and, accordingly, the statistics indicates 35%–40% $PM_{2.5}$ reduction in five years for cities, such as Beijing and Seoul, whereas cities, such as Santiago and Mexico City have shown 73% and 61% reduction in 22 to 25 years with regard to $PM_{2.5}$ and PM_{10} concentrations, respectively. Recently, a new Lancet study by Peking University School of Public Health on the impact of China's 'Air Pollution Prevention and Control Action Plan' (2013–2017) has found that an annual average concentration of $PM_{2.5}$ decreased by 33.3% and PM_{10} levels reduced by 27.8% in the 74 key cities in China where the plan was implemented in the last five years. Sulphur dioxide reduced by 54.1% and CO by 28.2% in five years, but no significant improvements were seen in NO_2 or O_3 concentrations. TERI and ARAI report

dated August, 2018, analyzed various interventions and estimated their possible impacts over $PM_{2.5}$ and PM_{10} concentrations in Delhi and NCR. An alternative scenario has been developed considering the interventions which can provide maximum air quality benefits. The alternative scenario results in a reduction of 58% and 61% in $PM_{2.5}$ and PM_{10} concentrations in 2030, in Delhi and NCR with respect to the business-as-usual scenario, and achieves the daily ambient air quality standards for PM_{10} and $PM_{2.5}$. It is to be noted that in Delhi and NCR, the initiatives started in 1992 with the creation of the EPCA, and thus has a definite edge over other non-attainment cities. Taking into account the available international experiences and national studies, the tentative national level target of 20%–30% reduction of $PM_{2.5}$ and PM_{10} concentration by 2024 is proposed under the NCAP. This is keeping 2017 as the base year for the comparison of concentration. The targets for Meerut City are kept similar to the targets envisaged under NCAP as described above with a modified timeline by 2025 as interventions will be starting in 2020. The yearly targets will be decided so that the emphasis in first two years will be largely upon taking up the actions for the institutional strengthening and development of infrastructure in consultation with CPCB & MoEF&CC.

IV. PERIOD

This action plan is prepared for a term of five years (mid-term action plan) to begin with keeping 2020-21 as base year which is further extendable to 20-25 years in long-term after mid-term review of the outcomes.

V. OBJECTIVES

1. To ensure stringent implementation of mitigation measures for prevention, control and abatement of air pollution
2. To carry out scientific studies for apportionment of sources of air pollution, identification of gaps, identification of the hot spots and prioritization of actions for increasing the effectiveness of mitigations
3. To augment and evolve effective and proficient ambient air quality monitoring network across the city for ensuring a comprehensive and reliable database.
4. To augment public awareness and capacity-building measures encompassing data dissemination and public outreach programmes for inclusive public participation and for ensuring trained manpower and infrastructure on air pollution.
5. To evaluate the impact of mitigation measures periodically in order to ensure the effectiveness and realignment of the mitigation strategies

VI. OVERVIEW OF MEERUT CITY

Meerut city is the administrative headquarters of Meerut district of Uttar Pradesh. It is an ancient city with settlements dating back to the Indus Valley civilization having been found in and around the area. The city has the one of the largest army cantonments in the country. The city is one of the largest producers of sports goods, and the largest producer of musical instruments in India. It is also the largest producers of bicycle rickshaw in world.

The city is also an education hub in western Uttar Pradesh. The city is the second largest city under National Capital Region (NCR). Meerut district is the part of upper Ganga-Yamuna doab, which lies between 28° 47' and 29° 18' North latitudes and between 77° 7' and 78° 7' East longitudes. The city is situated at a distance of only 70 Kms from the National Capital of India, New Delhi.

VII. STATUS OF AIR QUALITY &ITS TREND IN MEERUT

Non-attainment status of a city is implicative of consistent high level of air pollutants above the national ambient air quality standards. Regional air quality problem characterized by the inhalable particulate matter (PM_{10}) and fine particles ($PM_{2.5}$), has become increasingly prominent, which harms people's health and affects social harmony and stability. As the deepening of the industrialization and urbanization, energy resource consumption keeps growing, and the pressure of air pollution prevention and control continues to increase. This action plan is developed in order to improve air quality in Meerut.

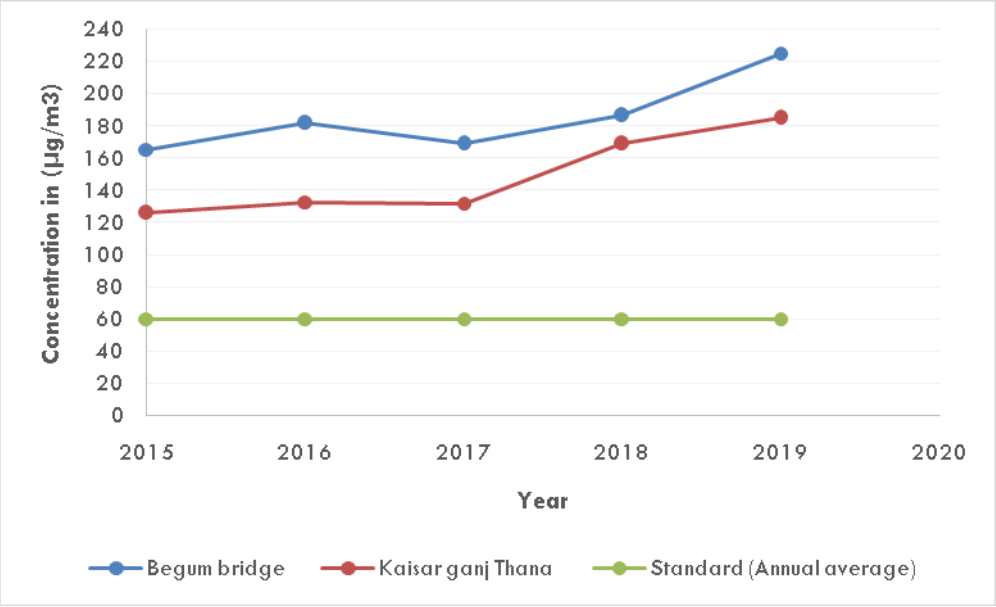


Figure 1: Yearly trend of PM10 concentration (µg/m3) in Meerut city

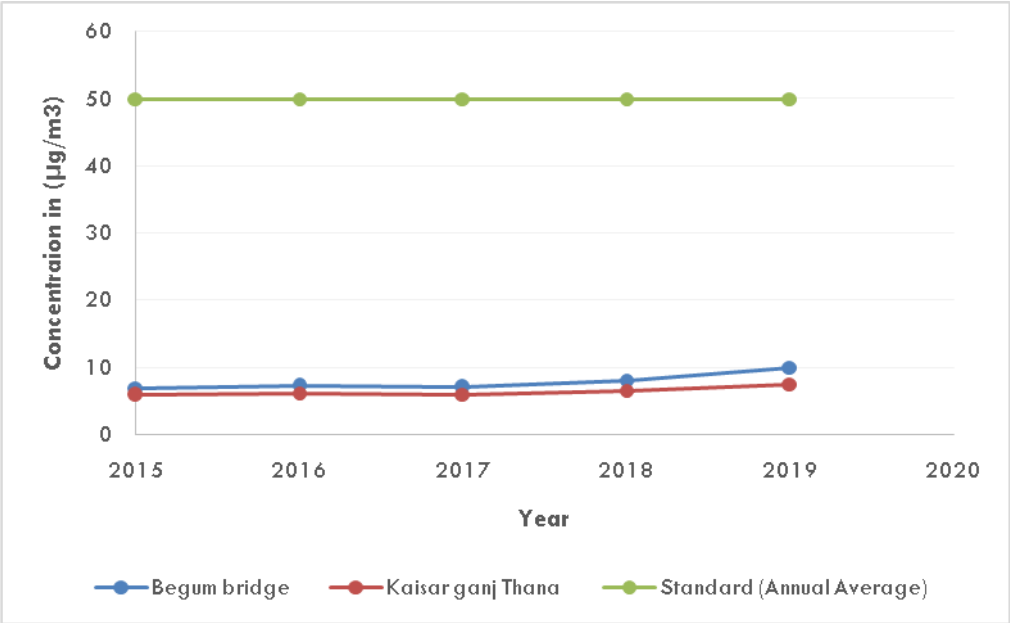


Figure 2 :Yearly trend of SO_2 concentration (µg/m3) in Meerut city

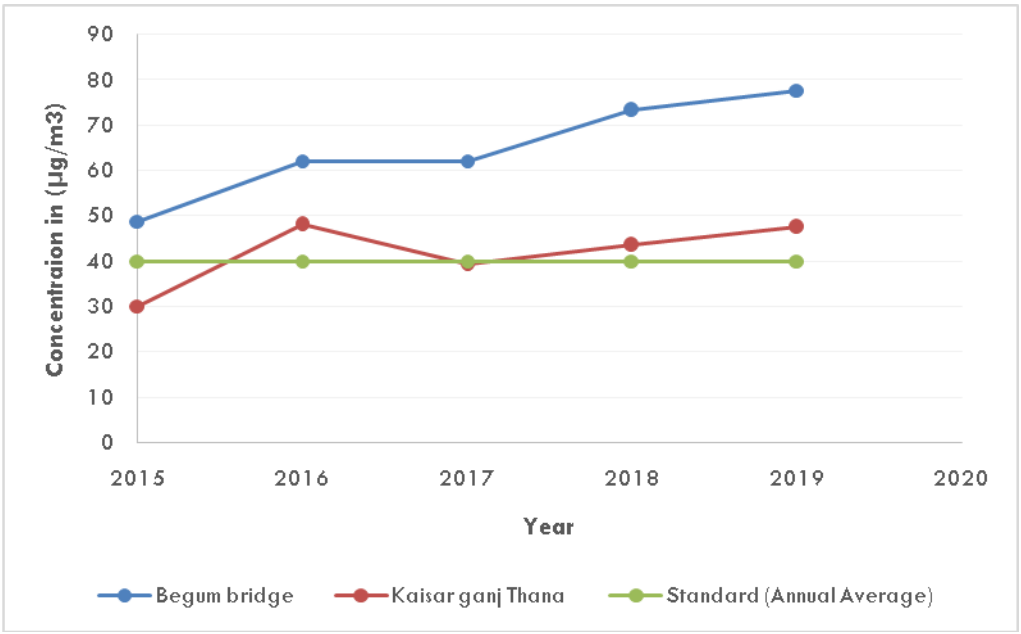


Figure 3: Yearly trend of NOx concentration (µg/m3) in Meerut city

While a predominant pollutant (i.e. PM_{10}& $PM_{2.5}$) is taken as a reason for non-attainment, it is important to note that air is spiked with numerous pollutants of which 12 are regulated under NAAQS and a good action plan shall be able to tackle all kinds of pollutants.

Air Quality Index is a tool for effective communication of air quality status to people in terms, which are easy to understand. It transforms complex air quality data of various pollutants into a single number (index value), nomenclature and colour as shown below.

Table 1 : Categories of Air Quality Index along with the expected impact

Good (0 – 50)	Minimal Impact
Satisfactory (51–100)	Minor breathing discomfort to sensitive people
Moderate (101–200)	Breathing discomfort to the people with lung, heart disease, children and older adults
Poor (201–300)	Breathing discomfort to people on prolonged exposure
Very Poor (301–400)	Respiratory illness to the people on prolonged exposure
Severe (>401)	Respiratory effects even on healthy people

Air Quality Index for the last 5 years has been calculated for the two monitoring stations on the basis of above three monitored parameters (PM_{10}, SO_2 and NO_2). While it is imperative to note that the AQI of the Meerut city has remained in the moderate risk category for last 5 years, which causes breathing comfort to the people with lung, heart disease and children and older adults, the AQI has followed an incremental trend which got hampered due to COVID-19 pandemic and the subsequent lockdown. Without effective measures the AQI is set to move into the poor category and hence an effective clean air action plan addressing all the major air pollution related issues is essential.

Table 2 : Air Quality Index trend at Begum Bridge monitoring station (Residential)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2015	140	138	137	142	149	145	144	144	141	141	151	152
2016	154	154	148	154	158	160	159	150	152	160	154	149
2017	141	139	141	149	150	148	144	141	139	148	165	154
2018	154	153	152	153	154	156	153	150	149	154	184	183
2019	181	178	180	181	185	188	185	184	179	186	187	191
2020	188	186	148			108						

Table 3 :Air Quality Index trend at Kaiser Ganj monitoring station (Commercial)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2015	120	118	115	116	119	119	117	116	115	114	121	119
2016	121	124	120	122	125	128	124	117	120	123	121	117
2017	116	115	118	117	119	117	115	114	112	114	158	141
2018	143	142	141	142	143	146	143	142	141	148	162	161
2019	161	160	161	162	169	65	168	166	164	173	174	175
2020	172	171	135			97						

VIII. GAPS IN DATABASE AUGMENTATION

A. Air Quality Monitoring Network

In view of the Hon'ble NGT order regarding the air quality monitoring stations the proposed action plan has recommended a plan for further strengthening of the monitoring grid. The NGT has directed that the scope of monitoring should be expanded to include all twelve notified parameters as per Notification NoB-29016/20/90/PCI-L dated 18 November 2009 of CPCB. It is further said that continuous Ambient Air Quality Monitoring Stations (AAQMS) should be preferred to manual monitoring stations. And, all such ambient air quality monitoring stations shall be connected to central server of CPCB for reporting analysis of results in a form of Air Quality Bulletin for general public at regular intervals at least on weekly basis and ambient air quality on continuous basison e-portal. MoEF&CC will provide requisite funds for the purpose.

UPPCB has been monitoring air quality at 5 monitoring locations which include 2 manual monitoring stations and 3 real time monitoring stations (CAAQMS).

Table 4 : Details of existing air quality monitoring stations

S. No.	Name of the Station	Geographical coordinates		Category of station	Type of station	Parameters monitored
		Latitude	Longitude			
1	Begum Bridge	28.995150	77.705310	Commercial	Manual	PM_{10}, SO_2, and NO_2
2	Kaiserganj Thana, Railway Road	28.981733	77.694431	Residential	Manual	PM_{10}, SO_2, and NO_2
3	CAAQMS IIMT Meerut **Address:** IIMT College, IIMT NAGAR, 'O' Pocket, Ganga Nagar Colony, Mawana Road, Meerut (U.P.)-250001	28.999264	77.7590354	Commercial	CAAQMS	PM_{10}, $PM_{2.5}$, SO_2, NO_2, NH_3, Benzene, Toluene, Xylene, Wind speed, Wind direction, Average temperature, Relative Humidity, Barometric Pressure, Solar radiation, and Total Rainfall
4	CAAQMS RG College Meerut **Address:** Anuyogipuram, Near Medical College, Meerut Garh Road, Meerut, Uttar Pradesh-250004	28.9535882	77.7622941	Residential	CAAQMS	
5	CAAQMS Pallavpuram Meerut **Address:** Regional Office, Pocket-T, C-3/2, Pallavpuram, Phase-II, Modi Puram, Meerut,U.P.-250110	29.0632752	77.707539		CAAQMS	

Figure 4: Regional Office, Meerut, UPPCB

Figure 5: Manual Air Quality Monitoring Station in Meerut city

The state further plans to expand the monitoring network as per the CPCB guidelines on the basis of city's population so that it may contribute to develop robust nationwide ambient air quality monitoring programme.

Status of existing air quality monitoring stations along with the gaps and proposed expansion in monitoring network is provided in the table below.

Table 5 : Status of existing air quality monitoring network

Category of station	Manual monitoring station			CAAQMS		
	Minimum no. of stations required	Existing no. of stations	Gap	Minimum no. of stations required	Existing no. of station	Gap
Background	1	0	1	0	0	0
Residential	1	1	0	2	2	0
Commercial	1	1	0	1	1	0
Traffic dominant	0	0	0	1	0	1
Industrial	0	0	0	1	0	1
Total	**3**	**2**	**1**	**5**	**3**	**2**

Figure 6: CAAQMS at R.G. College Meerut

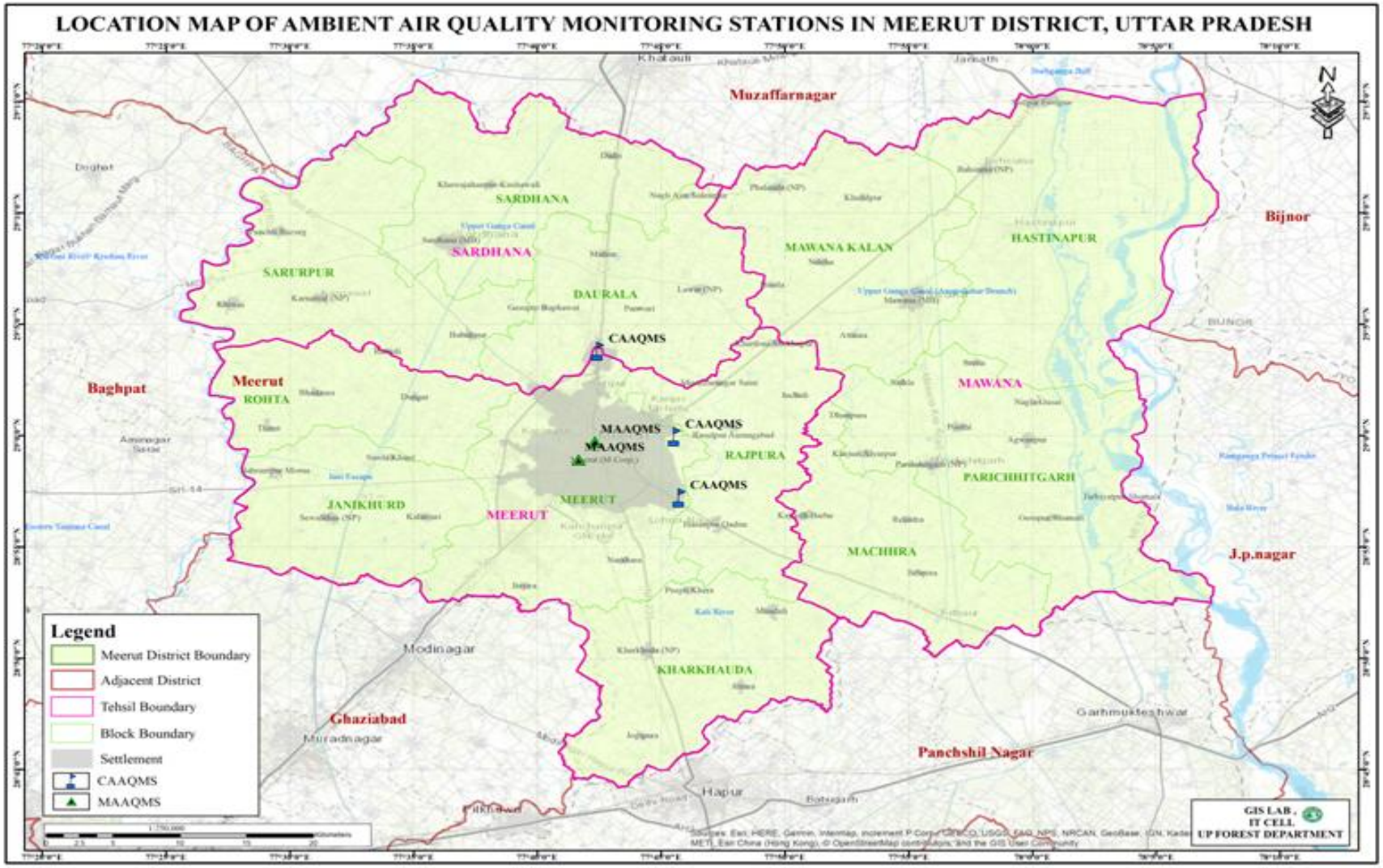


Figure 7: Location Map of AAQMS

B. Source Apportionment & Carrying Capacity Studies

It is necessary to understand the contribution of different sources of pollution to the ambient air quality for planning of source specific focused interventions for meeting the targets of improvement in the air quality in time bound manner. The Comprehensive Source Apportionment Study (CSAS) for Meerut City is not available which is identified a gap in the database augmentation.

The comprehensive source apportionment & carrying capacity studies will be conducted in due course of time through organizations of repute having ample experience in carrying out such studies and the action points will be prioritized and reviewed on the apportionment of various sources in the City.

However, to start with, UPPCB has made emission estimation from various sources with an objective of initiation of the implementation of the Action Plan based on the secondary data available.

C. Gaps in data related to Monitoring of Air Pollution Sources

Governments, multi-lateral organizations and the private sector are increasingly motivated to take action as a result of a growing understanding of the negative health and environmental effects associated with high levels of air pollution. Unfortunately, there is a critical lack of air quality data in most Non-Attainment Cities (NACs). The implementing agencies can take action without making substantial investments in air measurements systems. However, any robust air quality management system should include a measurement component to address city-specific air pollution reduction objectives and document trends over time. A quality data of the monitoring of various pollution sources with well-defined periodicity is a must for preparation of an Action Plan and also to monitor the impact of various actions for improvement of air quality in the city. This is also very important for decision makers at various stages in the air quality management process.

A successful, sustainable monitoring strategy requires equipment and critical human and institutional systems to sustain equipment and ensure that data quality remains high, and that any data collected can be analyzed and communicated to decision makers in support of desired objectives.

Although ambient air quality monitoring is being done by UPPCB through CAAQMSs and manual monitoring through outsourced Technical Institutions but presently, the regional office of Meerut is not having state of art air quality analysis lab and also the equipment which are needed for air quality monitoring of point and line sources are not available. The human resource and their capacity for data collection, analysis and data interpretation is also not available. The stack monitoring of the industries is limited to the analysis reports of accredited labs made available by the industries which has issues of reliability of sample and their analysis also. This plan envisages establishment of Air

Quality Monitoring Lab along with the staff & researchers for analysis and data interpretation to ensure periodic monitoring of point and line sources of air pollution in the city.

IX. STATUS OF KNOWLEDGE & ADOPTION OF INTERNATIONAL BEST PRACTICES ON AIR POLLUTION

The issue of management of air pollution in developing countries and countries with economy in transition is impacted by lack of expertise, technology and adequate related information. With reference to developing countries and countries with economy in transition as India, technological and expertise limitations are considered as major hindrance in achieving our obligations under various international conventions and in meeting the national commitments with reference to prevention, control and abatement of pollution; and protection of environment. Accordingly, technology transfer and information sharing is the way forward for any collaboration on environment. Technology transfer does not just relate to equipment or 'hardware', but also to total systems and their component parts, including know-how, goods and services, equipment, and organizational and managerial procedures. Accordingly, multilateral and bilateral cooperation on air pollution, including in related demonstration/pilot projects, including a prototype development for the best-available technologies and best environmental practices for pollution prevention, minimization, and mitigation strategies and for the control and abatement of pollution, specifically air pollution, are needed. The experience from around the world demonstrates that abatement of air pollution can only be done through a multipronged strategy involving interventions on various aspects at various levels including Institutional, Policy and Technical.

Broadly the best practices can be divided into two categories: Those of overall air quality management and the others that target some specific source sectors. UPPCB has also adopted some of these best practices for the betterment of air quality.

One of such practice that is being implemented across the state by UPPCB is the self-disclosure audit sheet by the infrastructure projects which are one of the main sources of dust generation.

In addition to this, the state has adopted a unique technique called Miyawaki's method for urban afforestation and increasing the overall green cover by planting native plant species in a very short span of time and thus mitigating the air pollution in long run.

UPPCB has already entered into a tripartite agreement with Ministry of Environment Forests & Climate Change (MoEF&CC) and Indian Institute of Technology Kanpur for getting technical assistance on various aspects related to air quality management in 15 non-attainment cities identified under National Clean Air Programme. The same agreement may be extended for the city of Meerut as well. In addition to this, UPPCB intends to take a decentralized approach through which local research and educational

institutions, which are well accustomed with the local conditions may be engaged as knowledge partners.

This plan envisages International scientific and technical cooperation in the area of air pollution will be established in accordance with national priorities and socio-economic development strategies and goals. Modalities of such cooperation may include joint research and technology development, field studies, pilot scale plants and field demonstration projects with active involvement of local academia, local research institutions and industries on either side.

X. INSTITUTIONAL STRENGTHENING

In order to execute the city action plan in the best possible manner, it is necessary that the institutional strengthening is done at the local level.

A. Public Awareness and Education

Awareness and education initiatives towards prevention, control, and mitigation of air pollution combined with specific information sharing on health advisories and dealing with air pollution exigency is an essential component, which provides communities with the knowledge and tools to take action and help improve their local air quality. Problem areas can easily be identified and monitored using citizen science methods, empowering communities, and reducing the risks of exposure to air pollution. Studies shows that simple measures such as walking just a few yards away from the curbsides of a busy road could reduce exposure by 30%. Idling your car engine uses more fuel and is worse for your engine than restarting. The all important first step is awareness. Engaging children at an early age is the best way to ensure we build a foundation in order to ensure clean air for the future generations. With air quality now engrained in public health frameworks and local authority jurisdiction, an ever-increasing number of industries are required to take action and all institutions have a responsibility to reduce their air quality footprint. The public can become more involved in reducing local air pollution impacts in their communities. Extensive awareness and outreach programme for various stakeholder groups need to be taken up for the non-attainment cities. Building public awareness will be vital in supporting implementation of the City Action Plan. This will be achieved through national portals, media engagement, civil society involvement, curricula reform and recognition/ awards etc.

City-specific awareness programme targeting key stakeholders to be formulated and taken up for implementation. This could include awareness generation in general public for prevention of adverse effects of air pollution. 2. Sensitization of the media for right interpretation of international reports and data as well as for disseminating information on measures being taken by the government for the abatement of air pollution to be undertaken.

Information Education & Communication activities shall be undertaken for dissemination of air pollution related information for the awareness of general public through various social media platform of departments engaged in city action plan (e.g. UPPCB, Meerut Nagar Nigam, Meerut Development Authority etc.). It is also planned to engage educational institutions (schools, colleges etc.) through workshops, seminars, competitions etc.

UPPCB intends to introduce "**Paryavaran Prahari**" programme under the principles of green skill development in which individuals will be trained for disseminating the role of a common citizen for control of pollution and for implementation of the action plan. The individuals may also be trained for augmenting their participation/services for monitoring of pollution sources where they may act as skilled personnel. The various aspects on which training shall be provided include sampling and analysis, operation of machinery and equipment related to air quality management and monitoring etc. All such trained individuals will form a panel through which the trained personnel may be engaged by the concerned department on pro-rata basis from time to time as per requirement and type of skills.

B. Training and Capacity Building

One of the major issues, which is a hurdle in an effective implementation of air pollution management plans have been observed to be a lack of capacity on air quality issues due to limited manpower and infrastructure in the UPPCB and ULBs, lack of formal training for various associated stakeholders, a limited number of trained individuals in air quality management, limited publications designed to provide information on local air quality issues, limited collaboration between government, universities, and other research institutions, lack of a forum for sharing of published local research work on air quality, etc. One of the key issues in implementation of action plan is the lack of capacity of in-house capability and adequately trained manpower. If this is not set right, all other improvements in infrastructure and processes etc. would not yield expected results. Key areas to focus on are:

a) **ULB –** waste management, plantation schemes, maintenance of roads, dust suppression measure, development of green infrastructure etc.

b) **UPPCB –** Internal training on handling of machinery and equipment for sampling and analysis

c) **Industries –** best practices for boiler and furnace operation, retrofitting of DG sets, up-gradation of machinery with cleaner technologies, usage of clean fuel

d) **Construction projects**- control measure for fugitive dust, segregation, handling and disposal of C&D waste.

An orientation workshop was carried out by UPPCB in collaboration of its knowledge network partner, IIT Kanpur, with an objective of mutual sharing of the best practices

and relevant knowledge with the other states in the country and also with the International Organizations namely UNEP, World Bank and Global NGOs under National Clean Air Programme on 14-15 Oct 2019. Besides this, UPPCB has also organized the training and capacity building workshops of the officers of the implementation departments/agencies for implementation of GRAP and various measures for control of air pollution.

Through this action plan, it is envisaged that extensive capacity-building programmes for both the UPPCB & other line departments/agencies with reference to both manpower and infrastructure augmentation will be formulated and intensive training, comprising national and international best practices and technological options, of all the associated stakeholders will be organized in the plan period. It is also envisaged that online training modules on the subjects of Solid Waste Management, Plastic Waste Management, C & D Waste Management and Operation and maintenance of Air Pollution Control Systems installed in industries and other sources shall be carried out to improve the overall capacity of the human resource for enhancement of Clean Air Actions in the City.

C. Setting Up Air Information/Monitoring Centre

An Air quality monitoring set up will be established in the regional office of UPPCB which will be part of Environment Pollution Control Centre. The scope of this center will be a more inclusive and it will also act as knowledge Centre. The Air information/monitoring Centre shall comprise of members from UPPCB regional office, Meerut Nagar Nigam and other local technical institutions. The local institutions like IIMT Engineering College, Chaudhary Charan Singh University etc. shall be considered and their capacities shall also be utilized for handholding the technical studies related to various pre and post project impact assessment in terms of air quality for assessment of efficacy of actions.

D. Monitoring Mechanism

The State has formulated a comprehensive monitoring mechanism with well-defined monitoring protocol. The Monitoring mechanism developed by the State is a three-tier mechanism in which regular monitoring shall be done at District level and at State level. The monitoring at State is being undertaken at the level of dedicated Air Quality Monitoring Committee (AQMC) under the Chairmanship of Principal Secretary, Environment, Forest & Climate Change and subsequently by the Chief Secretary, Government of Uttar Pradesh. The structure of Monitoring is as detailed below: -

a) *At State Level:*

The State has developed monitoring mechanism taking into consideration the requirement of statutes and Action Plans. The detail of AQMC constituted by State of Uttar Pradesh is as follows:

Table 6: Air Quality Monitoring Committee

S.No.	Name of Committee	Chairperson	Work area
1.	Air Quality Monitoring Committee	Additional Chief Secretary/ Principal Secretary Environment, Forest & Climate Change	Effective Air Pollution Control in the State and maintenance of Ambient Air Quality

b) *District and Commissioner Level-*

A District Level Committee under the Chairmanship of respective District Magistrates has been constituted by O.M. No. 13/2019/NGT-257/55-Parya-2-2019-44(Writ)/2016 dated 14-06-2019 for monthly monitoring of all the Environmental issues and compliance of Environmental Laws including implementation of GRAP and City Action Plan. The District Level Committee has 28 Officers of all the concerned District Level Departments. District Forest Officer is the convener of the Committee.

c) *The monitoring protocol shall be as below-*

The State has developed dedicated UP Environment Compliance Portal www.upecp.in for monitoring of various issues related to environmental compliances. The purpose of portal is to have mechanisms for a focused dialogue and to facilitate a smooth coordination on issues pertaining to air pollution. The access of portal is given to Chief Secretary, State Level Monitoring Committees and the District Level Committee. Portal has been provided with dedicated Template for Online Filing of the Compliance Status to be reviewed at State Level by the State Level Committees. The issues requiring State Level intervention shall be flagged before the Chief Secretary, Uttar Pradesh.

d) *Schedule of Monitoring:*

The monitoring is to be done as per following schedule-

Table 7: Schedule of Monitoring

Level of Monitoring	Schedule of Monitoring
District Level Committee under District Magistrates	1st week of every month
District Level Committee under Commissioner	2nd week of every month
State Level Committees	3rd week of every month
Chief Secretary Level	4th week of every month

In addition to above, District Environment Committee of Meerut shall be monitoring all the updates regarding city action plan as a part of State 3-tier monitoring system.

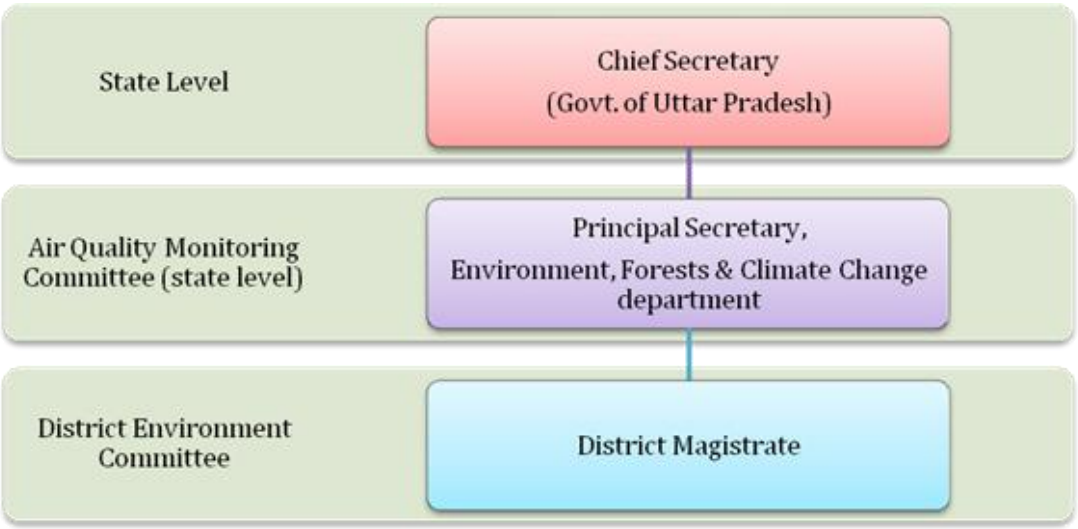


Figure 8: 3-tier monitoring system

XI. STATUS GAPS AND STRATEGIES OF AIR POLLUTION MITIGATION MEASURES FOR VARIOUS SOURCES

A. Meerut City Emission Inventory

Emission inventory (EI) is a comprehensive listing of pollutants from all sources in a geographical area during a period of time. The development of EI data base is very crucial to air quality management and helps in listing out the major sources of pollution, which in turn helps in planning the best solution for clean air action. Besides, the result from EIs can be used to study in other sectors related to human health, economic loss from air pollution, etc.

Emission Estimation and Factors

An emissions factor is a representative value that attempts to relate the quantity of a pollutant released to the atmosphere with an activity associated with the release of that pollutant. These factors are usually expressed as the mass of pollutant per unit mass of raw material, volume, distance travelled, or duration of the activity (e.g., grams of particulate emitted per kilogram of coal burnt). Such factors facilitate the estimation of emissions from various sources of air pollution. In most cases, these factors are simply averaging of all available data of acceptable quality and are generally assumed to be representative of long-term averages for all facilities in the source category.

The general equation for emissions estimation is:

E = A*EF*(1-ER/100) (1)

Where:

E = Emissions rate;

A = Activity rate;

EF = Emission factor, and

ER = Overall emission reduction efficiency, %

As there is a gap regarding the Comprehensive Source Apportionment Study for Meerut, the emission inventory for Meerut has been prepared following the bottom-up approach on the basis of secondary information available in view of starting planned efforts for control of air pollution. The emission inventory is subjected to further refinement during the comprehensive study for source apportionment and carrying capacity of the Meerut. The figure below depicts the various sources identified for calculating the emission load, which are primarily classified into point, area and line sources.

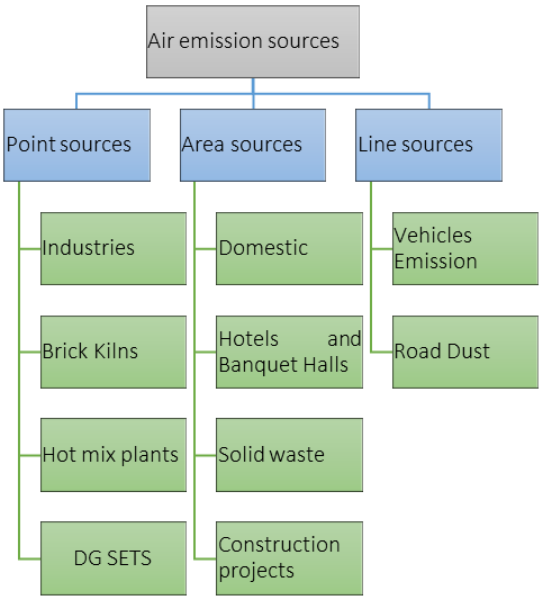


Figure 9-Emission Sources in Meerut

Emission load of the based on the secondary data available and information available with UPPCB. The detail of emission load for all the sources has been cumulated and is discussed as follows: -

B. Cumulative *Emission Inventory*

The overall baseline emission inventory for the all the sources is presented in **Table-8**and Figure-9. The pollutant wise contribution is shown in **Figures-10, 11, 12, 13 and 14.**

Table 8 :Cumulative Inventory (kg/day)

Source	Emission PM10 (Kg/day)	Emission PM2.5 (Kg/day)	Emission SO2 (Kg/day)	Emission NOx (Kg/day)	Emission CO (Kg/day)
Brick Kilns	9704.202	1069.202	9006.948	10434.136	835.662
Industry	20290.332	12197.946	17193.476	20997.840	425125.470
Construction	601.087	240.435	0.000	0.000	0.000
DG Sets	259.88	233.90	245.63	3724.02	804.23
Domestic	1692.36	1277.25	216.79	688.99	8442.02
Hotels (Cooking)	91.36	47.73	59.77	28.64	155.05
Banquet Hall (Cooking)	8.01	4.29	5.12	2.65	13.19
Hot-Mix palnts	6720.00	6048.00	61.60	84.00	280.00
MSW	128.00	51.20	8.00	480.00	672.00
Vehicular Exhaust	1372.40	1235.16	2.97	15161.96	26626.51
Road Dust	12089.54	2980.21	0.000	0.000	0.000
Total Emission (Kg/day)	**52957.17**	**25385.32**	**26800.30**	**51602.25**	**462954.13**
Total Emission (tonne/day)	**52.96**	**25.39**	**26.80**	**51.60**	**462.95**

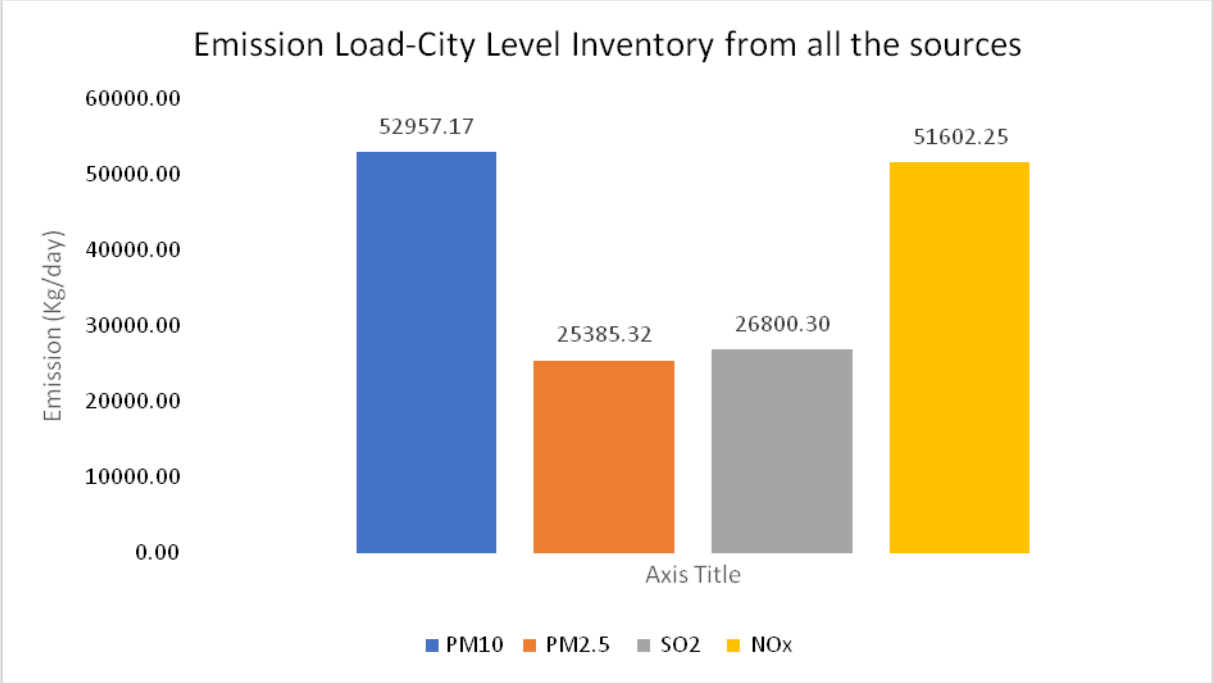


Figure 10: Estimated emission load for Meerut

The total emission load for $PM_{10}$is estimated to be 52957.17 Kg/day. The top contributors to PM_{10} emissions are Industries (38%), Road Dust (23%), Brick Kiln (18%) and Hot-Mix Plant (13%); these are based on annual emissions. Seasonal and daily emissions could be highly variable. The estimated emission suggests that there are many important sources and a composite emission abatement including most of the sources will be required to obtain the desired air quality. $PM_{2.5}$ emission load in the city is estimated to be 25385.32 Kg/day. The top contributors to $PM_{2.5}$ emissions are Industries (48%), Hot Mix plants (24%), Road Dust (12%), domestic fuel burning (5%)and Brick Kiln (4%); these are based on annual emissions. Seasonal and daily emissions could be highly variable. NOx emissions load is estimated to be 51602.25 Kg/day. Nearly 41 % of emissions are attributed to Industries followed by Vehicular Emissions (30 %) and Brick Kilns (20%). Vehicular emissions that occur at ground level, are the most important emission. NOx apart from being a pollutant itself, it is important component in the formation of secondary particles (nitrates) and ozone. NOx from vehicles and from industry are potential sources for controlling of NOx emissions. SO2 emission load is estimated to be 26800.30 Kg/day. Industry accounts for 64 percent of total emission. Brick Kilns contributes to 34% followed by DG sets (1%). Estimated Carbon Monoxide (CO) emission is about 462954.13 Kg/day. Nearly 92% emission of CO is from Industrial sector, followed by Vehicular exhaust (6%) and domestic (1.8%). The high emission load of CO is due to the large percent (70 %) of fuel used to run the combustion equipment is derived from bio-sources, such as Bagasse, Rice husk and wood etc. Such large amount of biomass assimilation as fuel led to the increased amount of CO load.

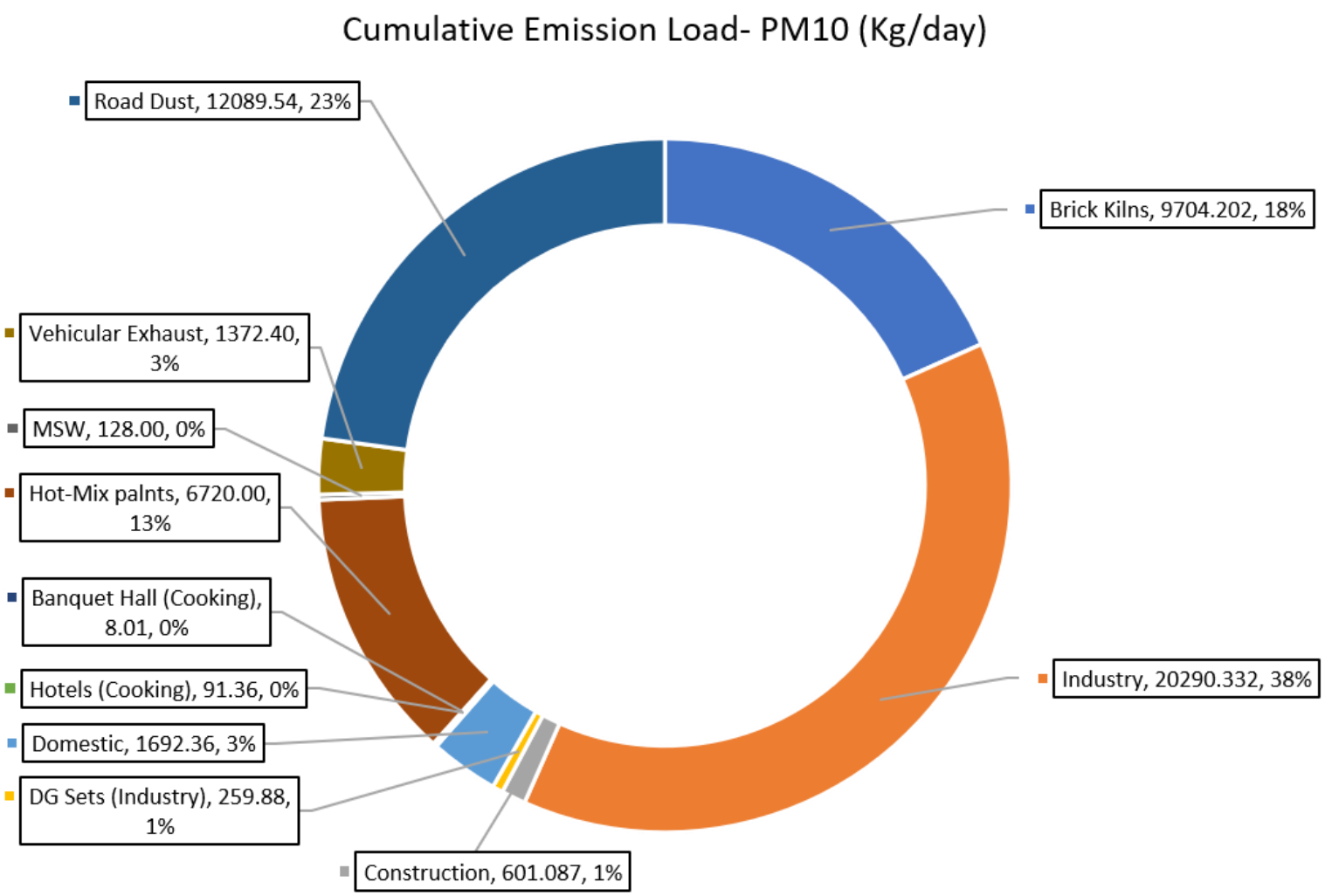


Figure 11: PM_{10} Emission Load of Different Sources in Meerut

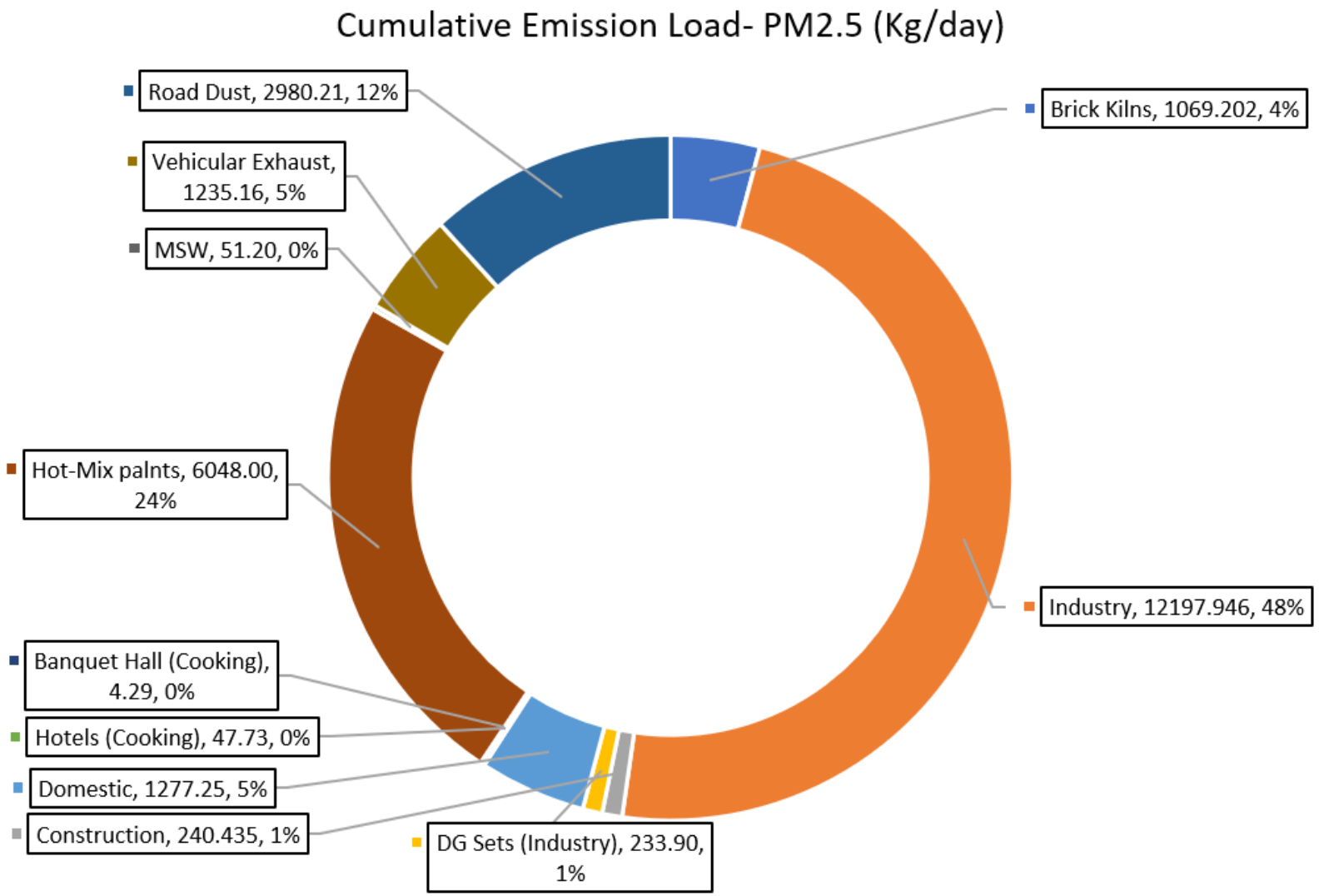


Figure 12: $PM_{2.5}$ Emission Load of Different Sources in Meerut

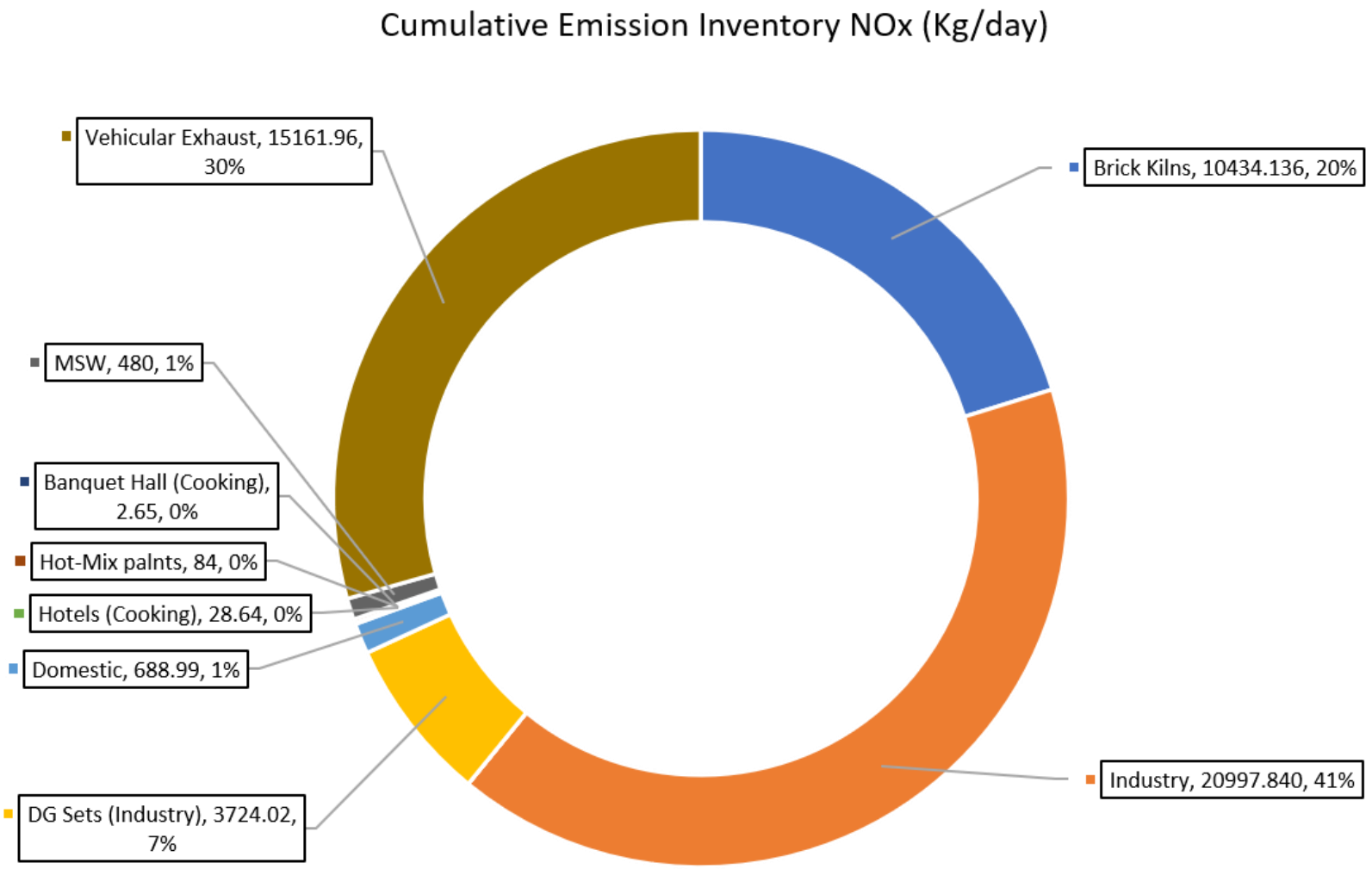


Figure 13: NOx Emission Load of Different Sources in Meerut

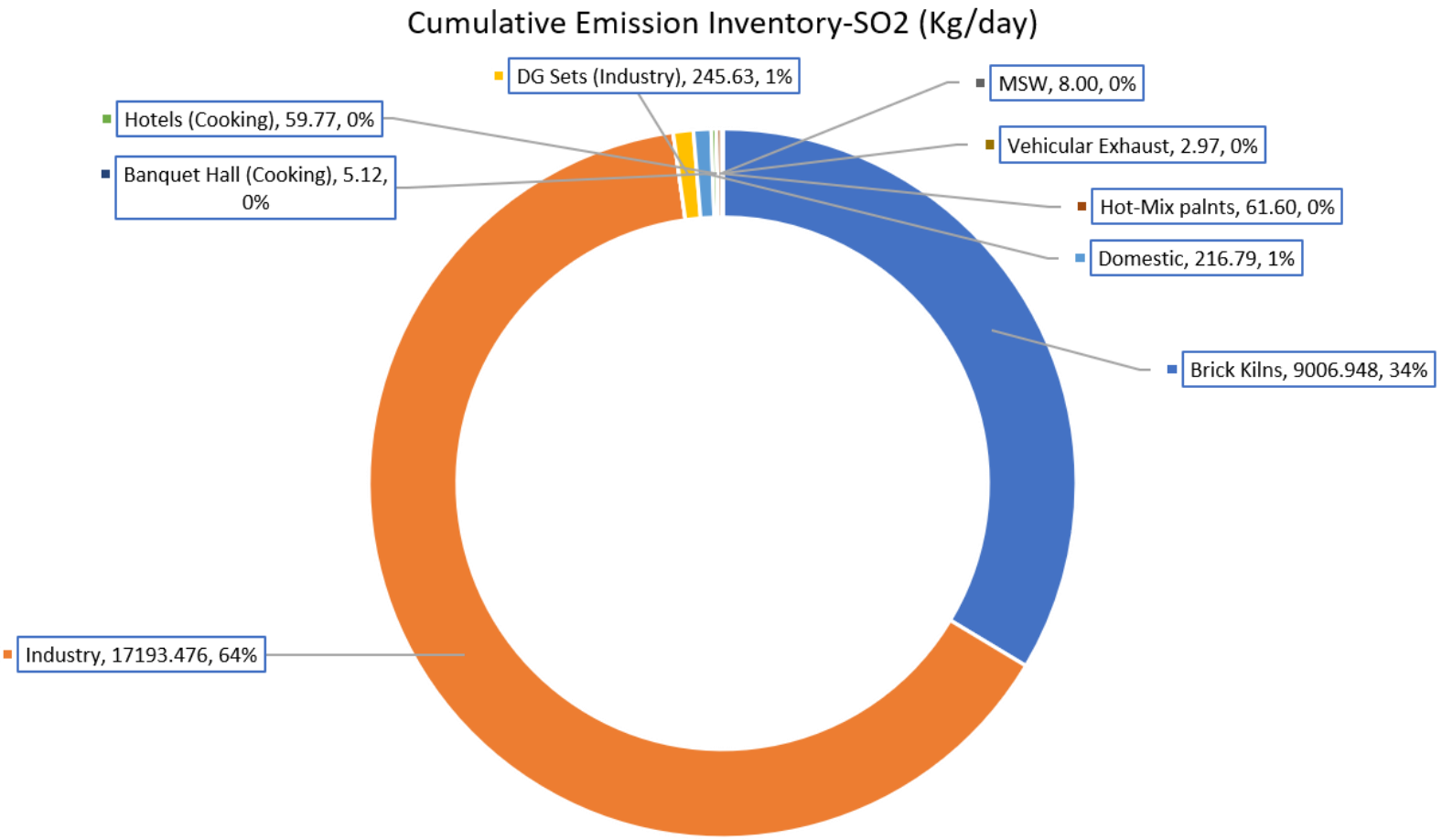


Figure 14: SO2 Emission Load of Different Sources inMeerut

C. Industrial Pollution

Industries are a major stationary source of air pollution emitting PM_{10}.

I. *Industrial profile of Meerut*

Meerut is famous as an industrial hub. It is also famous for Handloom work and Scissors Industry from older age. Being in the proximity of Delhi, it is ideal for industries like textile, transformers, sugar, distillery, chemicals, engineering, paper, sports goods and jewelry. Meerut is the largest suppliers of Sports Goods being the largest Indian Cricket Goods manufacturer and exporter. Uttar Pradesh State Industrial Development Corporation (UPSIDC) has already designated two industrial estates in Meerut namely Partapur and Uddyogpuram. Mohakampur Industrial Area is a private initiative. Bhurbaral Industrial Area is under development. Another Industrial Area has been identified by UPSIDC at Gagol Road adjacent to Delhi Road for which 1200 hectares of land is available for industrial development. Identified industrial areas are at Shatabdi Nagar, Delhi Road, Bagpat Road, Roorki Road, Mawana Road, Parikshit Garh Road, Garh Road and Hapur Road. The map below depicts various industries located within the Meerut.

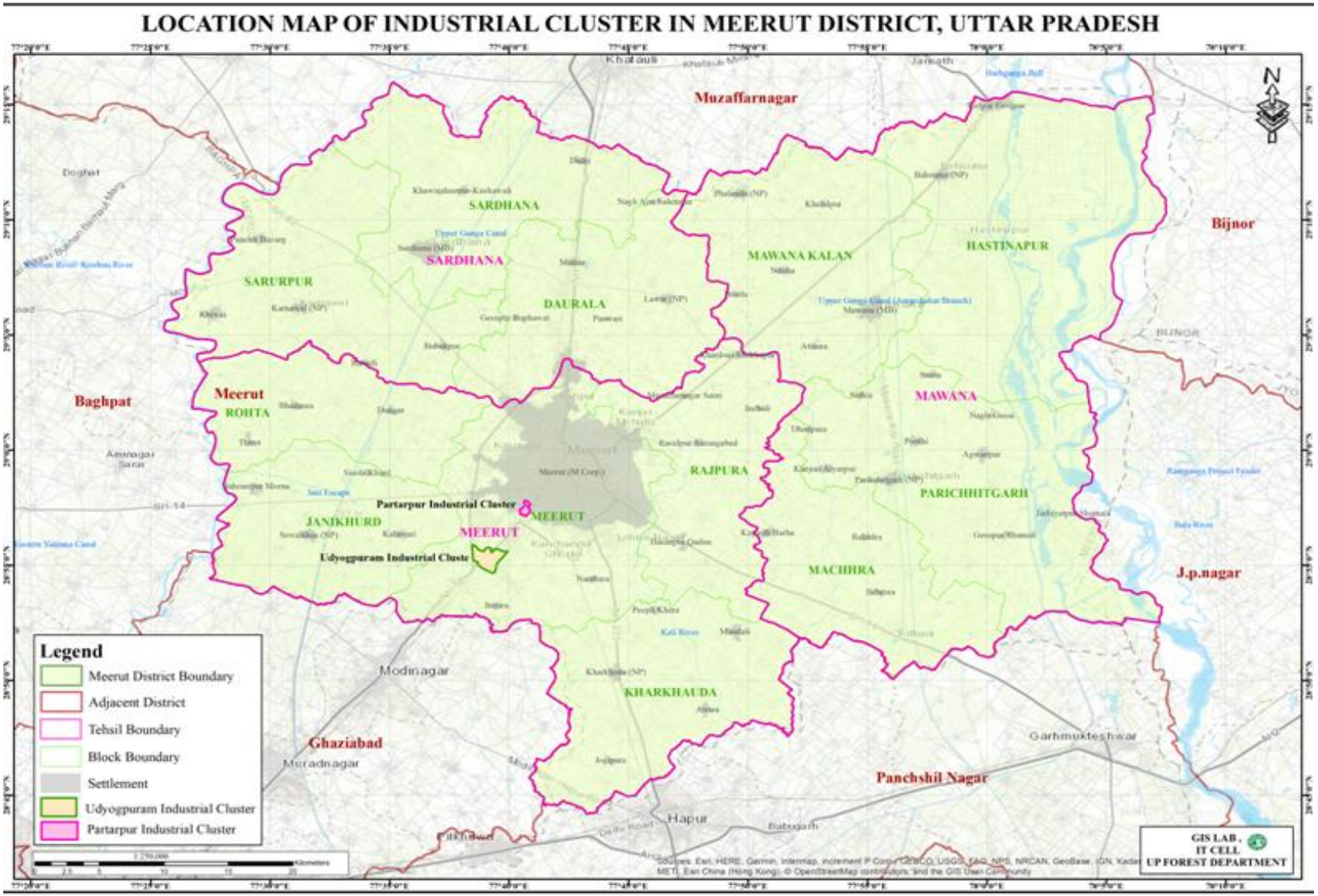


Figure 15: Industrial Cluster of Meerut

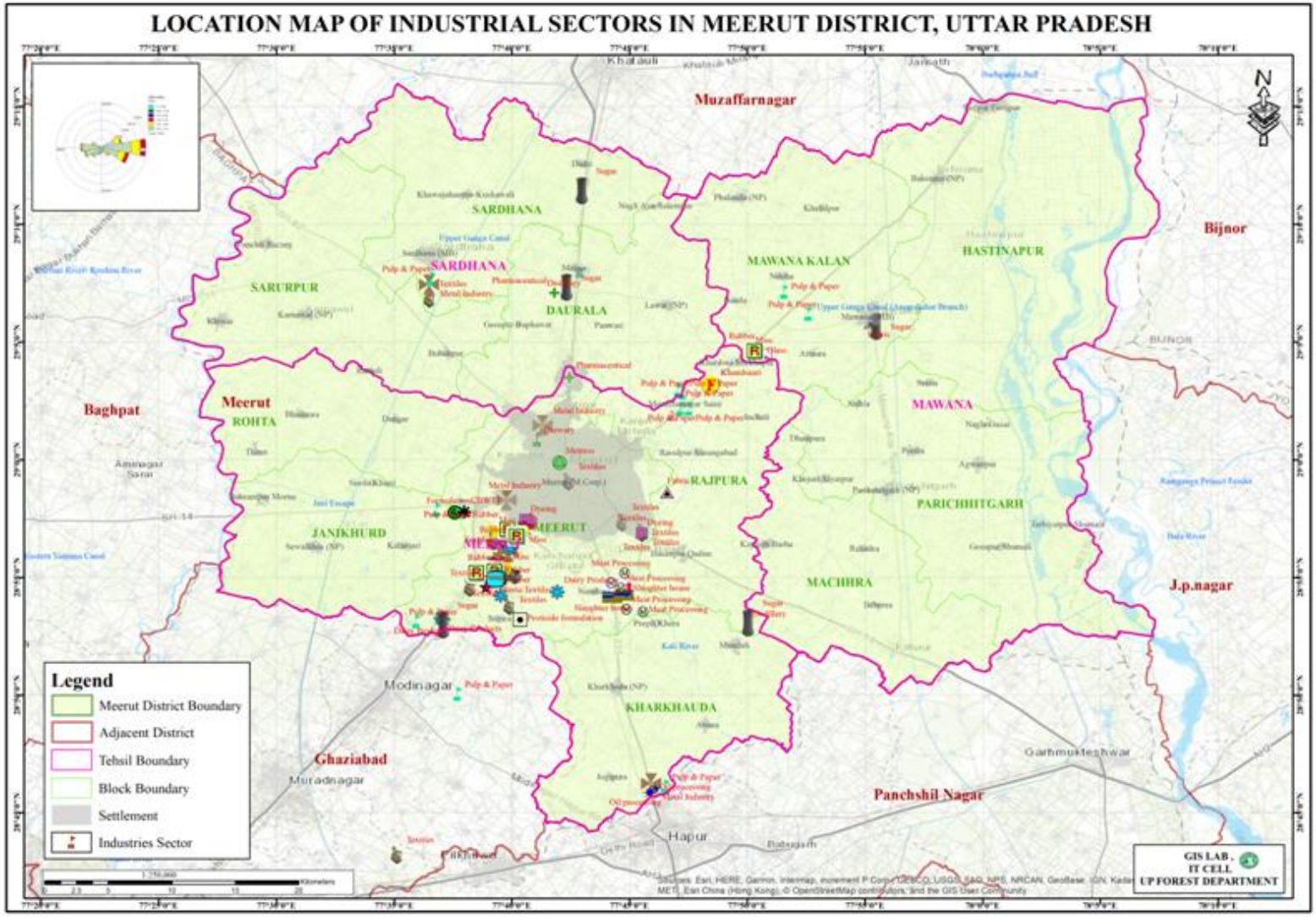


Figure 16: GIS Industrial profile of Meerut

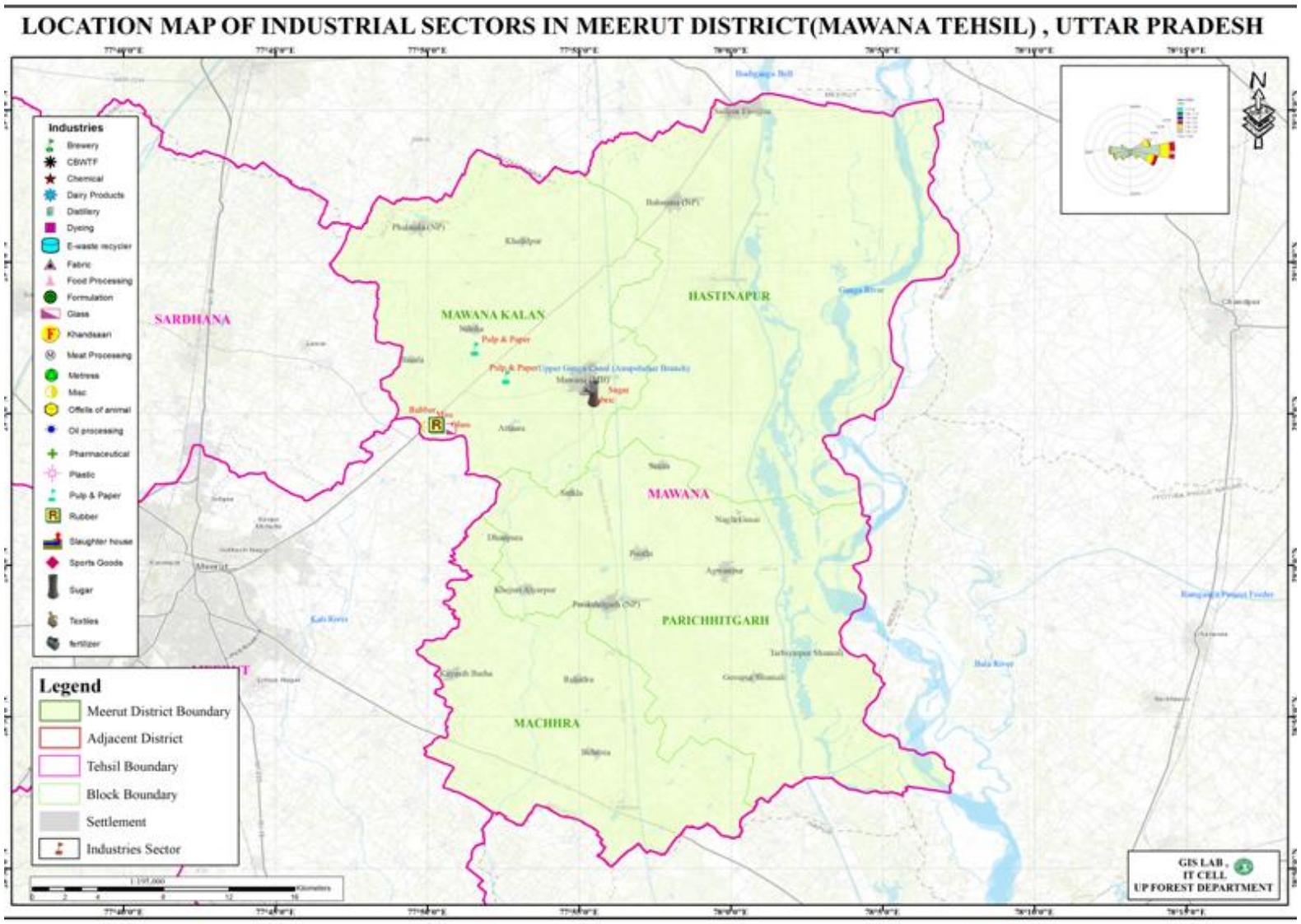


Figure 17: GIS Industrial profile of Mawana Tehsils in Meerut

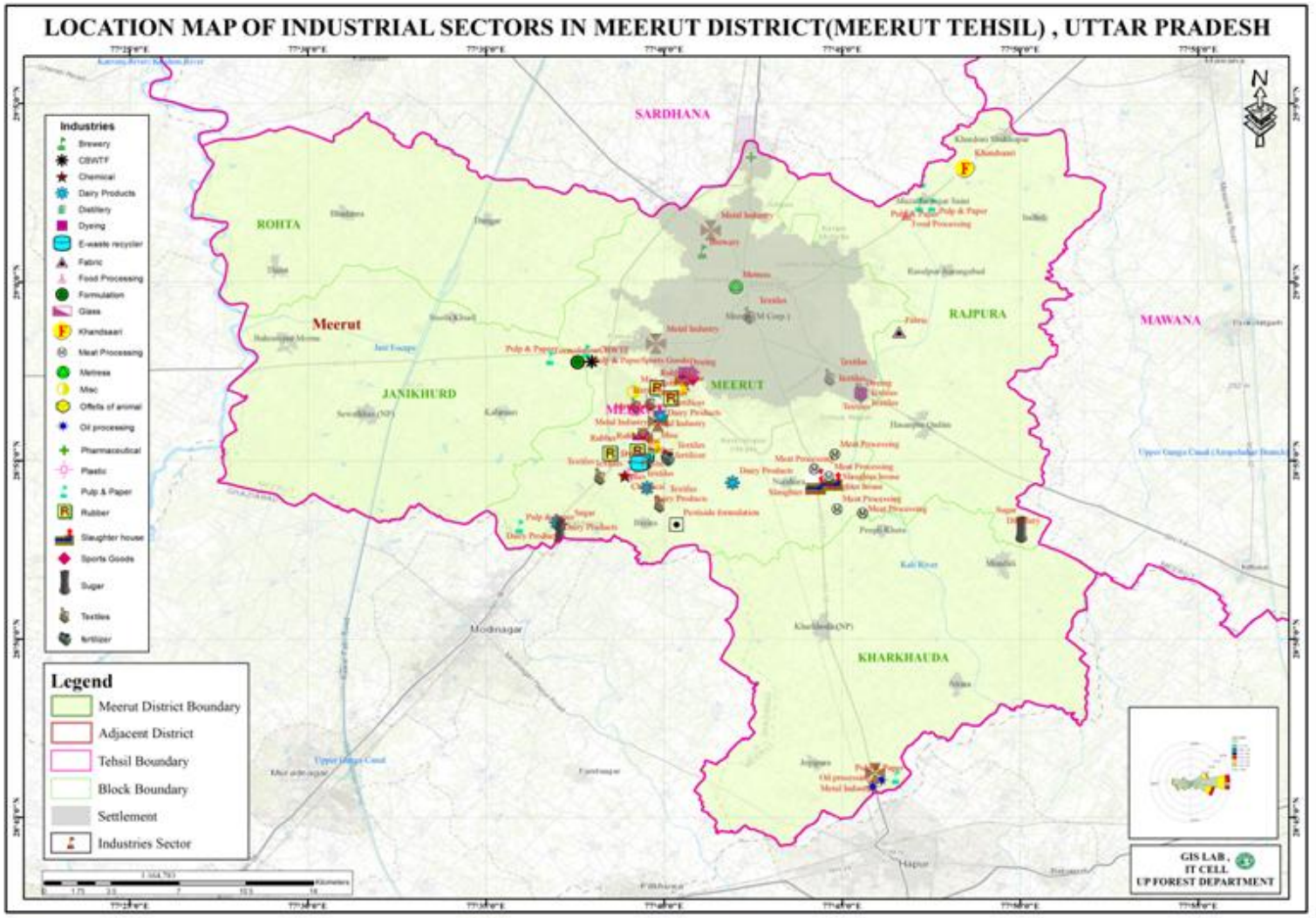


Figure 18: GIS Industrial profile of Meerut Tehsils in Meerut

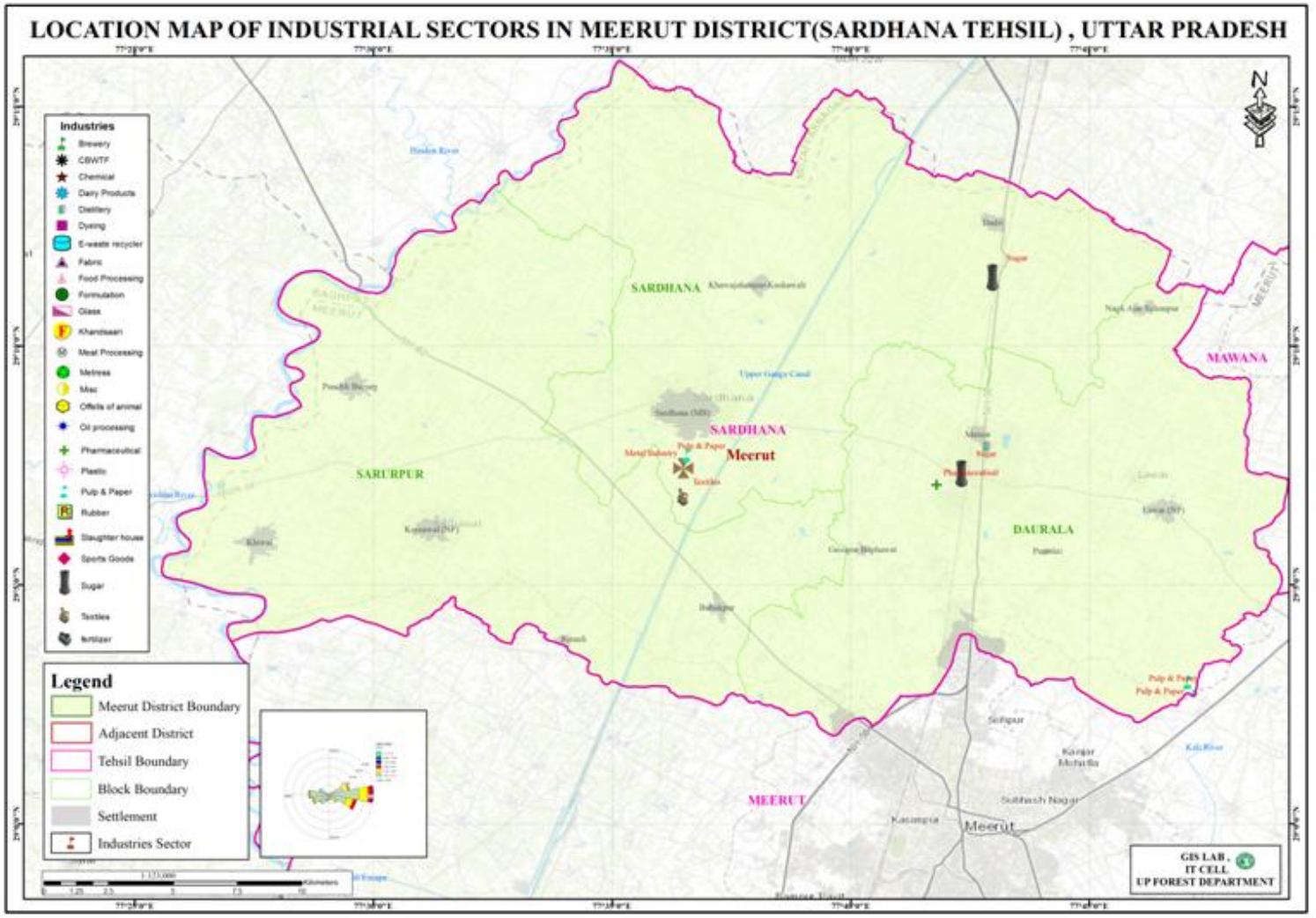


Figure 19: GIS Industrial profile of Sardhana Tehsils in Meerut

II. Industrial sectors in Meerut

Meerut is a hub for variety of industries. All these industries in the Meerut have been classified into sectors details of which are tabulated below and their percent contribution is depicted in the pie-chart:

Table 9: Categorization of industries

S.No	Industrial sector	Number of Industries
1.	Sugar	14
2.	Pulp & Paper	15
3.	Distillery	2
4.	Textile	19
5.	Slaughterhouse	3
6.	Chemical	3
7.	Food processing	4
8.	Metal	9
9.	Sports	7
10.	Others	48
	Total	**124**

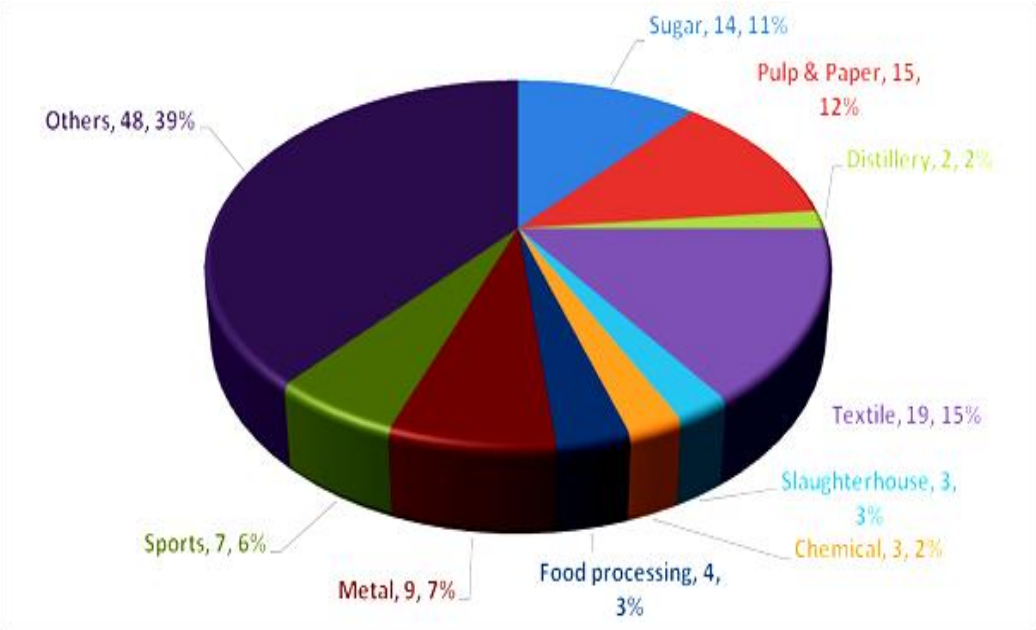


Figure 20: Sectoral classification of industries in Meerut

Figure 21: Anupam Processor Meerut city

Figure 22: Boiler of M/s Dayal Fertilizers (Capacity 1.5 TPH) in Meerut city

Figure 23: Air Pollution Control System in Shakun Handifab Pvt. Ltd. Partapur, Meerut city

III. Fuel usage in the sectors

a) Number and range of capacity of combustion equipment installed in the industries

Table 10: Number and range of capacity of combustion equipment installed

Capacity range	No.
Boiler	114
<1	5
1 to 3	49
4 to 6	14
7 to 25	20
>25	25
Thermopack	2
Up to 10 lakh kcl/hr	
11-12 lakh Kcal	
>20 Lakh Kcal/hr	2
Furnace (Oil furnace, Pit furnace, etc.)	**12**

b) Fuel usage in Meerut industries

Natural gas, wood, agricultural waste, and coal is the prominent fuel being used in the industrial processes. The type of fuel used by the various combustion equipments as per their capacity is given as follows:

Table 11: Percentage of type of fuel source used in Combustion equipment

S.No	Fuel Type	Consumption (Kg/day)	% Consumption
1.	Bagasse	3864000	63.77
2.	Biomass	188000	3.10
3.	Coal	1643800	27.13
4.	Diesel	22400	0.37
5.	Furnace Oil	44000	0.73
6.	HSD	8000	0.13
7.	LDO	4000	0.07
8.	PNG	8000	0.13
9.	Wood	276800	4.57

**Source- UPPCB – Regional Office, Meerut*

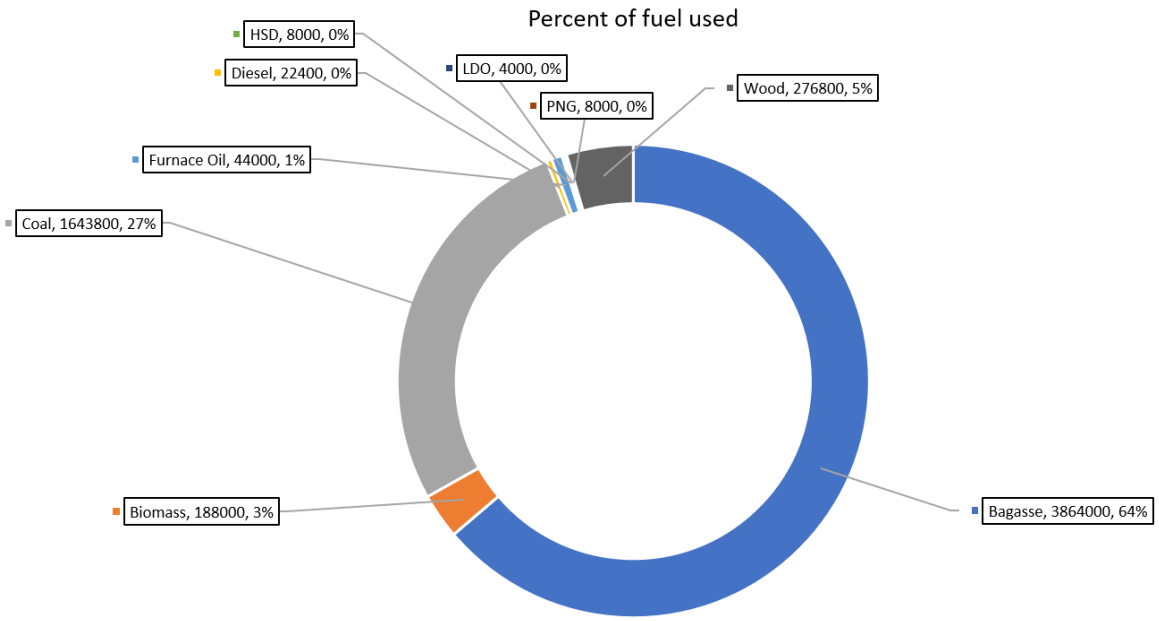


Figure 24 : Fuel Type Industry

c) Emission Estimation from industries in Meerut

The information on the number of industrial facilities and their activity data were collected from UPPCB- Regional office, Meerut. There are approximately 124 industries throughout the Meerut district that are air polluting in nature and require consent to operate from the state pollution control board to run the industry, have been considered for the study. The emissions of various pollutants such as SO_2, NOx, PM_{10}, $PM_{2.5}$, and CO were estimated from the activity data from each fuel type and then were

summed. The emission factors given by CPCB (2011) were used to calculate the emission load given as follows in **Table-12,** and is represented graphically in **Figure-25**:

Table 12: Percentage of type of fuel source used in Combustion equipment

Boiler/ Furnace Type	Fuel used in Boiler/ Furnace	No. of Furnaces / Boilers	Fuel Quantity (kg/day)	PM10 (kg/day)	PM2.5 (kg/day)	SO2 (kg/day)	NOx (Kg/day
Baby Boiler	Coal, Wood, Diesel, Rise Husk, LDO	39	155800	1035.56	622.57	791.42	897.92
Boiler	Coal, Wood, Diesel, Rise Husk, Steam Supply, Bagasse, Bio bricket	77	5675200	18229.90	10955.923	15621.096	19475.32
Furnaces	Coal, Wood, Diesel, Bagasse, HSD, PNG	12	228000	1024.8728	619.45024	780.96	624.6

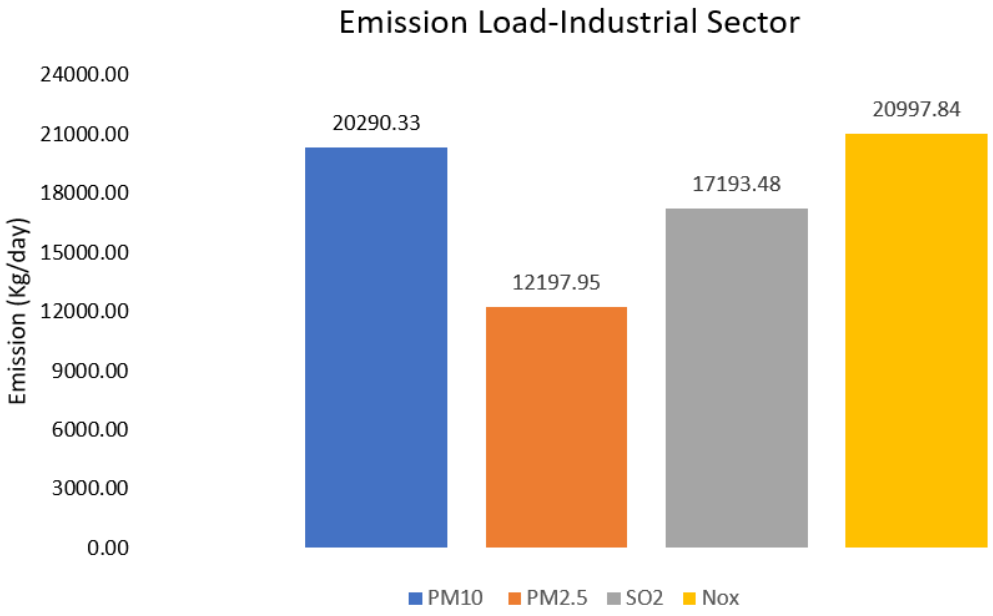


Figure 25: *Emission Load for Industries*

d) Observations

From the above estimation it is observed that Industries in Meerut are one of the major sources of PM_{10}, $PM_{2.5}$, SO_2 & NOx. The emission load for PM10 and NOx is observed to be highest. Emission loads from different sources for various pollutants is as follows: -

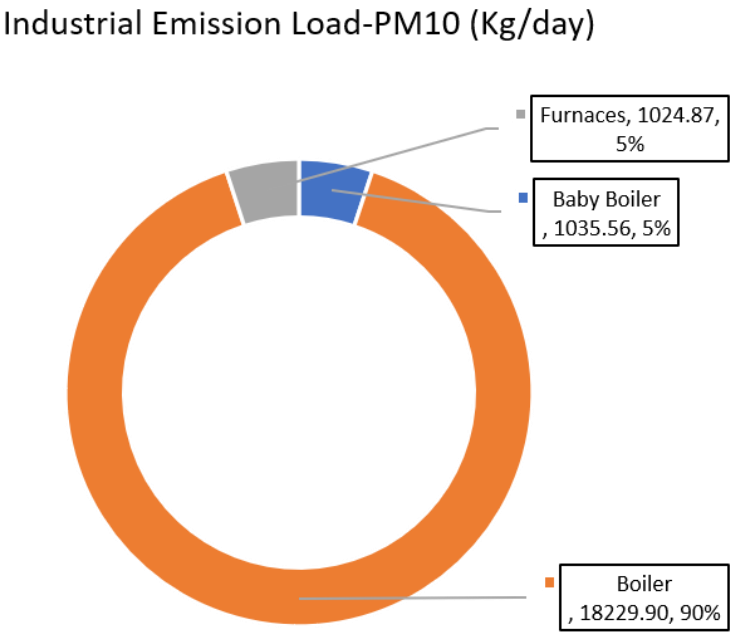


Figure 26: PM10 Emission from Industries (20290.33 Kg/day)

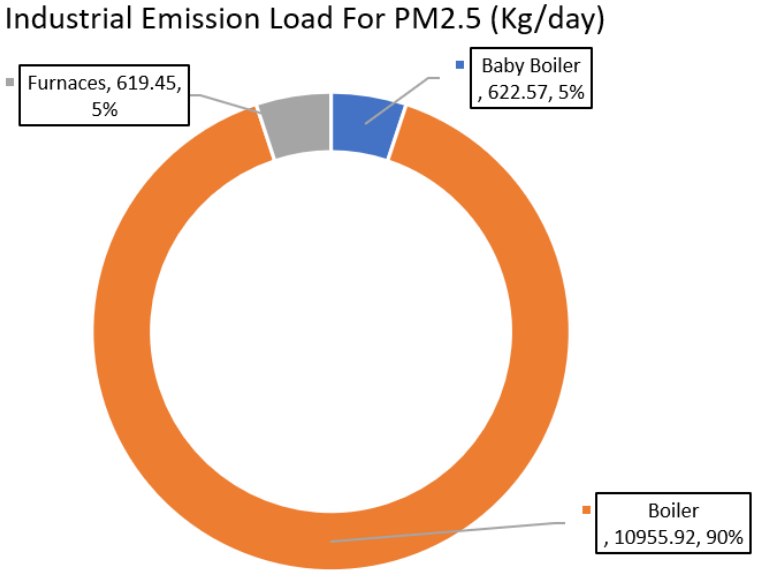


Figure 27: PM2.5 Emission from Industries (12197.95 Kg/day)

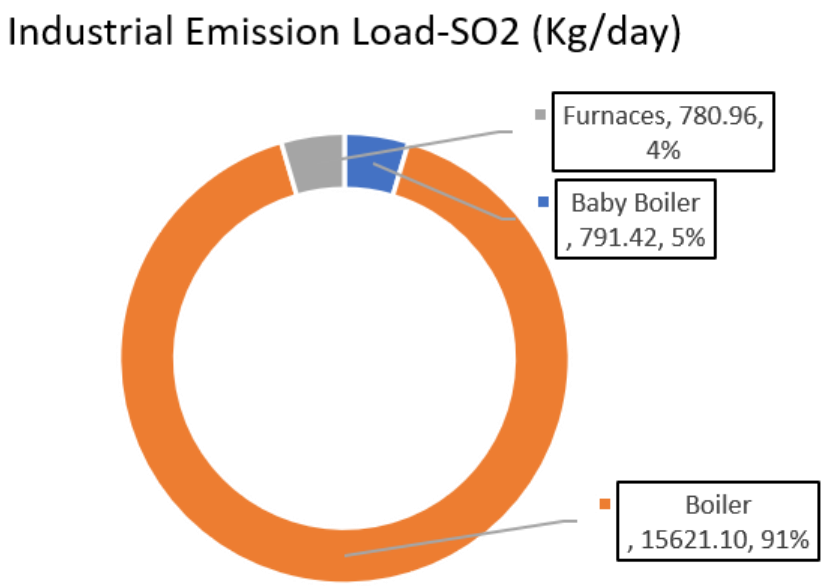


Figure 28: SO2 Emission from Industries (17193.48 Kg/day)

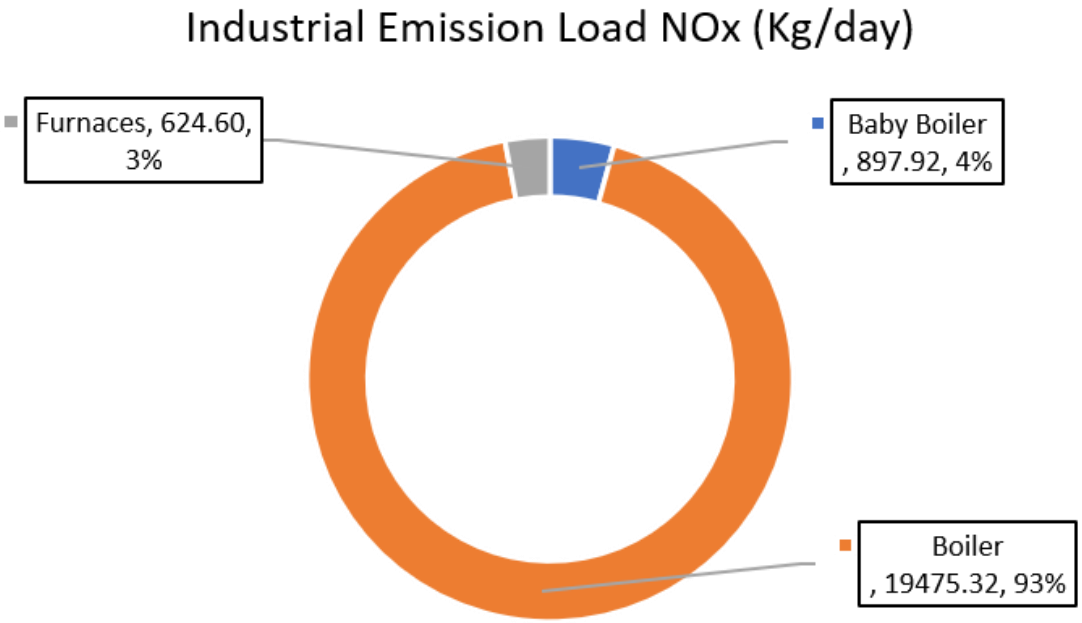


Figure 29: NOx Emission from Industries (20997.84 Kg/day)

The prime contributor to the concentration of pollutants is from the boilers installed. From **figures 26, 27, 28, 29,** it can be concluded that boilers are responsible for 90% of emissions. Secondly, the use of biomass as fuel is a prime factor responsible for high emissions. Although, Air pollution control Devices (APCDs) are installed but are not efficient to control such high emission rates of pollutants.

IV. Issues of Industrial pollution in Meerut

a) **Poor quality of inventory data** - Although UPPCB had attempted an inventory of industries, it was often incomplete and at times inaccurate. Many industries either did not have data on fuel consumption or a very accurate inventory of the pollution sources and their capacities, thus making the evaluation of pollution load a bit challenging. It is recommended for all the regulators to prepare a complete, updated and accurate inventory of the industries which will further assist in identifying the areas or sectors of concern from the perspective of environmental pollution.

b) **Inadequate data on small scale sectors** - There is little to no data on small scale industries or other unorganized sectors in most of the areas. These sectors are significant contributors to the overall pollution loading in industrial areas. Meerut Regional Office did not have a detailed inventory and there was no database on illegal small-scale units operating in their areas.

c) **Requirement of strategy for baby boilers -** There are a number of baby boilers (with capacity < 2 TPH) installed in the industries. A large number of baby boilers were found being used in small scale textile industries. The emission norms for such boilers (1200 mg/Nm3) are quite relaxed as compared to the norms for big boilers installed in the organized sector thereby providing huge margin for such industries to pollute the environment. Moreover, installing a continuous emissions monitoring system (CEMS) on such small boilers is not economical for the industries and therefore it is necessary to explore other monitoring options which are economically feasible to the medium and small-scale industries where these boilers are installed. Proper guidelines should be available to monitor the emissions from these boilers.

d) **Lack of clear fuel policy -** A clear fuel policy is required which mentions which fuels are banned and which clean fuels are recommended for industries to use now and in the future. Fuels that can be used in the long run by industries need to be made clear. Especially with the cost dynamics between coal and PNG, a lot of industries are looking at agro waste as a potential fuel which they are willing to use but are unsure if this will be allowed in the future. The regulators should also mention proper timelines for the implementation of such a policy to fast-track the change in fuel use and subsequently reduce the pollution load.

e) **Lack of manpower and capacity in UPCB**- It was observed that the UPPCB lack manpower and the available manpower is highly over utilized. The periodic inspection and monitoring of the industries (specifically small-scale industries) by the regulatory bodies to check and ensure compliance could not be conducted since the concerned officer is involved in various administrative assignments. There is an urgent requirement for UPPCB to develop the capacity of its existing officials and increase the manpower. It is also important to shift to technologies and systems which need least monitoring and ensure maximum compliance to reduce the unrealistic work load on board officials.

f) **Restructuring of CTOs to include relevant information on fuel, equipment, etc.** – Reliable industrial equipment and fuel consumption data is not available in many of industries, the required data is extracted from the CTO of industries. The basic requirement to estimate and analyze the pollution load is the detail of combustion equipment/pollution source of the industries and the type of fuel used in the industry. It is observed that there is no standard pro forma for CTO and the information is either not mentioned or partially available in the document. Regulators should standardize the CTO format so as to include all the important information (related to industries' production capacity, fuels consumed, combustion equipment installed and its capacity, and air pollution control devices installed) in a structured manner.

g) **Economic costs for switch over to natural gas** – It is observed that many industrial areas have access to natural gas as proper infrastructure is available, but the cost of shifting from conventional fuel to piped natural gas doesn't go well with the industries resulting in their unwillingness to switch over to PNG. The non-coverage of PNG under Goods and Services Tax (GST) and the application of Value Added Tax (VAT) on it makes it even more expensive compared to other fuels. The cost dynamics of different fuels with respect to the generation of per kg of steam is shown in the table below. (rate of natural gas has been considered as Rs 35 per SCM).

Table 13: Cost of steam generation with various fuels

Fuel	Price of steam (Rs/kg)
Coal	1.6-1.7
Furnace Oil	1.8-1.9
Natural Gas	2.2-2.3
Light Diesel Oil (LDO)/High Speed Diesel (HSD)	3.9–4.1

*Source: Nestle Inc., 2019

h) **No data is available on the number of operational hours of industries and their DG sets** - Information related to operating hours of industries and the DG sets installed is not available with UPPCB. DG consumes significant quantity of diesel in the industrial areas and contributes to the loading pattern. Therefore, there is a need to make a complete inventory of DG sets along with the number of operating hours for each of them.

i) **Poor road infrastructure, which adds substantially to fugitive dust emissions** - In most of the industrial areas of Meerut, it is observed that the condition of the roads is very poor. The agencies responsible for the development of industrial areas should develop a robust system for the maintenance and development of infrastructure in industrial areas. Industrial areas have poor road conditions with

the movement of heavy vehicles on them which led to high amount of PM10 fugitive emissions in the area.

j) **Improper industrial waste management and open burning of industrial waste** One of the most important aspects of industrial area development is the management of industrial waste which is generated in that area. It has been observed in most of the industrial areas that waste disposal is not proper.

k) **Issues with land-use planning with regard to communities living in close vicinity of industrial areas** - It has been observed in the industrial areas that residential colonies/areas are in close vicinity of the industries, making people prone to different diseases due to air pollution. There seem to be an issue in urban planning in the area, since the industries came into existence first and people started to settle in these areas slowly and gradually. The labour force of industries is provided by such colonies at the cost of the health of their residents. It is recommending that all the industrial area development agencies and urban planning departments should properly coordinate to clearly demarcate industrial and residential areas; and come up with remedial measures or buffer zones to prevent the residential population from the effects of air pollution from industries. Proper land use planning should be done for upcoming industrial areas or the expansion of the existing ones. Meteorology of the area should necessarily be considered while planning.

l) **Good practices by industrial associations** - Many of the industrial areas, industrial associations are doing a good job in maintaining the infrastructure in the industrial area, following good environment management practices, and also working towards the development of the area in association with the administrative bodies. It is recommended that industrial associations should be identified and considered as major stakeholders in the air pollution action plans being prepared by the concerned departments including UPPCB. They can play a very significant role in improving air quality.

m) **Requirement of technology-based standard for small scale industries** - Norms for small scale industries should be technology based rather than concentration based, since existing concentration-based norms are impossible to monitor, especially given the current capacity of UPPCB.

n) **Centralized steam generation units for industrial sectors -** Most of the small-scale industries have installed individual low capacity boilers for the purpose of steam generation. The opportunity to install a centralized steam generation system should be explored. This will help in improving the efficiency of the system and indirectly reduce fuel consumption in the industrial areas. It would also make it much easier to monitor a few centralized steam generation units rather than a large number of baby boilers located in small industries.

V. Non-recycling industrial plastic waste generation and its disposal issue of Meerut

a) Background

As we are all aware that Meerut is known for paper recycling in western U.P. In and around Meerut, there are as good as 17 Small and large scale of Paper & Paper board Manufacturers. All Companies are based on100% waste paper recycling process and they are not using any wood, bamboo or any other conventional raw-material for making the paper. The waste paper is the paper which is collected from different sources. Most commonly recycled paper items include Office Paper, Cardboard, Fiber Cores, Coated book stock, Kraft Bags, Mixed papers, Printer mix, Paper rolls Tissue, Ledger, Books, Magazines, newsprint and magazines, manuals and booklets, and assorted office papers. The procurement of waste paper (Raw-materials for Paper recycling) may be from within India or it may be imported. Waste paper contains plastic in the form of film on the paper or in laminated form. Generation of plastic waste from paper recycling process depends upon the quality and type of waste paper recycled. It may vary from 2% to 5% of the waste Paper.

b) Environmental issues due to plastic waste

Followings are the major environmental issues related to plastic waste:

I. Littering of plastic waste is one of the major environmental issues, it makes land infertile, choke drains, on ingestion by cattle cause death and give ugly look to a city or a town.

II. Open burning of plastic waste is a major health and environmental issue, as it emits toxic gases like CO, CO2 and unburnt carbon Polycyclic Aromatic Hydrocarbons (PAH) Total Polychlorinated Biphenyls (PCB) and particulate matter which leads to deteriorate the ambient air quality index and human health.

III. Leaching impact on soil, underground water etc. due to improper dumping of plastic waste.

c) Present Scenario of Plastic Waste in Meerut

The generation of plastic waste of paper mills of Meerut is around 90 MT/day i.e. around 2600 – 3000 MT/month as shown In Table below. Because of the non-biodegradable and impervious nature of plastic, if collected and deposited in the soil, they could arrest the recharging of ground water aquifers and also contribute the increase quantity of solid waste and associated problem with these plastic wastes. The generation of plastic waste of paper mills of Meerut region is as shown in the **Table-14**

Table 14: Present Scenario of Plastic Waste

S.No.	Name of Units	Plastic Waste Generation (tons/ month)
1.	Dev Priya Product Pvt ltd	1200
2.	Paswara papers limited	350
3.	Anand Duplex PVT Ltd	200
4.	Anand Triplex PVT Ltd	200
5.	Star Kraft PVT Ltd	150
6.	Kanav Papers (P) Ltd	150
7.	Janki News Print	200
8.	New bonanza India limited	50
9.	RPG	50
10.	Sangal papers PVT Ltd	65
11.	Chamunda Paper	30
12.	Gangeswar Papers pvt Ltd	Not estimated
13.	Sardhana Papers pvt Ltd	Not estimated
14.	Shri Venktesh Papers Mills	Not estimated
	Total	**2650 tons/month**

d) Gaps

i. **Current practices of plastic waste disposal in Meerut -** It is being observed as of now that non-recyclable plastic waste generated by the paper recycler in the Meerut region stored in their premises and send to the boiler, brick making industries and for uncontrolled burning which may contaminate ambient air quality resulting into diseases to human being.

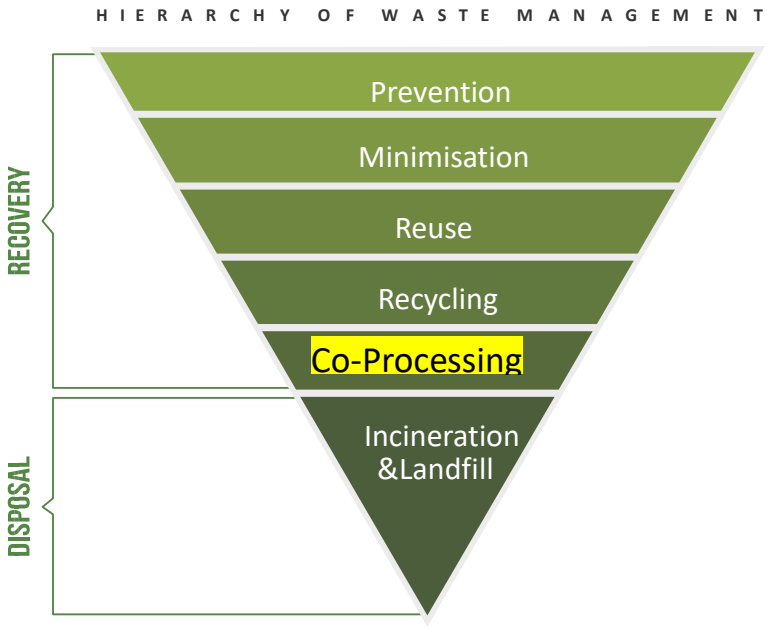
ii. **Management of non-recyclable plastic waste -** The extensive generation of non-recyclable of plastic waste has caused serious plastic waste management problems. The handling of increased amount of plastic waste has become a serious issue in the Meerut region and also caused adverse environmental impact.

iii. **Collection, Segregation& Transportation -** Every paper recycler shall be responsible for development and setting up of infrastructure for segregation, collection, storage, transportation, processing and disposal of the plastic waste on its own. The paper recycler shall be responsible for setting up, operationalization and for performing the associated functions, namely: -

- Ensuring segregation, collection, storage, transportation, processing and disposal of plastic waste at their cost and responsibility;
- Ensuring that no damage is caused to the environment during this process;
- Ensuring processing and disposal on non-recyclable fraction of plastic waste in accordance with the guidelines issued by the Central Pollution Control Board;
- Creating awareness among all stakeholders about their responsibilities;
- Ensuring that open burning of plastic waste does not take place.

e) Future Strategies: Disposal of non-recyclable plastic waste through Co-processing

Based on the various options practiced globally for disposal of non-recyclable plastic waste, the most preferred options are collection & disposal. The collected non-recyclable plastic must be used in Co-processing in cement kilns with emphasis on minimizing the waste generation at source.



Co-processing refers to the use of waste materials in industrial processes as alternative fuels and raw material (AFR) to recover energy and material from them. Due to the high temperature and long residence time in cement kiln, all types of wastes can be effectively disposed without any harmful emissions. As per the Basal Convention, variety of wastes including hazardous wastes, get disposed in an environmentally safe and sound manner through the technology of co-processing in cement kiln. In cement plants, plastic waste is used as Alternate Fuel and Raw-material (AFR), subjected to higher temperature around 1400ºC-1500ºC. During the process, energy is recovered while burning of plastic waste and its inorganic content get fixed with clinker. It requires an automatic feeding mechanism for feeding plastic waste to cement kilns.

Following should be considered as a prerequisite for permitting Co-processing of non-recyclable plastic wastes in cement plants.

- The producers of non-recyclable plastic shall arrange to collect the non-recyclable plastic waste and handover to cement plants. They shall maintain a record of quantity generated and handed over to cement plants.
- The cement plants shall maintain a record of quantity received and Co-processed by them.

The co-processing of the non-recyclable plastic waste in cement kilns shall follow the emission standards as notified by Ministry of Environment, Forest and Climate Change.

f) Recommendations & Conclusion:

- The most preferred option is minimization of use of non-recyclable plastic products& promoting use of alternate material, which could be easily recyclable/reusable and or compostable.
- The preferred option for disposal of non-recyclable plastic waste is therefore co-processing in cement plants due to its high temperature (up to 1500 °C). The producers of non-recyclable plastic shall work out modalities for co-processing of such waste in cement kilns.

VI. Issue of air polluting industries in nonconforming areas

Meerut has been hub for various kinds of MSME industries especially the scissors, sports goods, casting furnaces, dying & washing, power loom, embroidery, pressurized paraffin lamps (Petromax),plastic goods etc. operating in residential areas which also contribute the pollution load in the ambient air. The mapping of such industries operating in non-conforming areas has never being attempted and is a bit difficult exercise also as coordination of ULB, Electricity Department along with Administration and Police is required for this exercise. Such units operating in nonconforming areas do not comply with the requirement for industrial setup as per standards set by CPCB and UPPCB. Such units shall have to be mapped & as a long-term intervention may be shifted as per the norms to the conforming areas with the handholding by the Government. However, shifting of industries is a complicated affair, therefore it is better to first do the mapping and finding out the ways that how the air pollution issues due to these units may be quantified and addressed as an immediate measure.

D. Brick kilns

There are around 2,062 kilns in the NCR districts of Uttar Pradesh. The district of Baghpat has the greatest number of kilns followed by Bulandshahr, Muzaffarnagar, Ghaziabad, Meerut, Hapur and Gautambudh Nagar, respectively. One of the predominant industries in the Meerut district is brick kilns. It is pertinent to note that there are no Brick Kilns within the city boundary of Meerut, however, the effect of Brick Kilns on the air quality cannot be negated as most of them are situated on the outskirts of city and are expected to have a major impact to the city's air quality. The map below shows the brick kiln situated within the district boundary of Meerut.

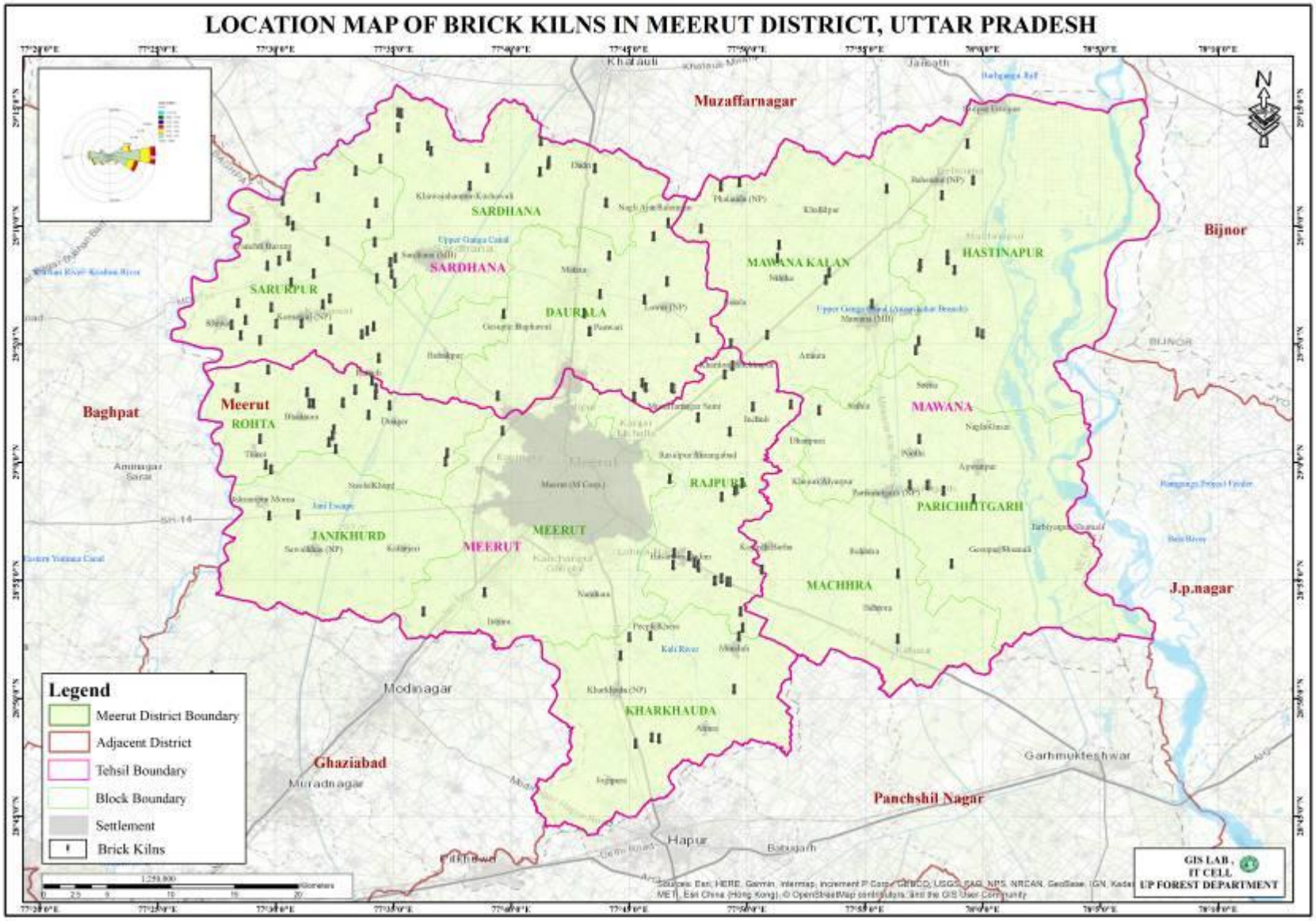


Figure 30: GIS Map showing Brick kilns in the Meerut district

Table 15: Status of brick kilns in Meerut

1	**No. Of brick kilns**	**237**
2	Capacity	47.4 Lakhs Bricks/day (for 237 kilns)
3	Fuel used	Coal
4	Quantity of fuel used	711 MT/day (for 237 bricks)
5	Converted to zig-zag	82
6	Consent status	Granted-82, Not Applied-155
7	EC imposed	Total Rs. 128.1 Lakhs (55 Brick kilns)

a) Emission Estimation for Brick Kilns

As per the data available by UPPCB the emission load for brick Kilns was calculated, the results are represented as follows:

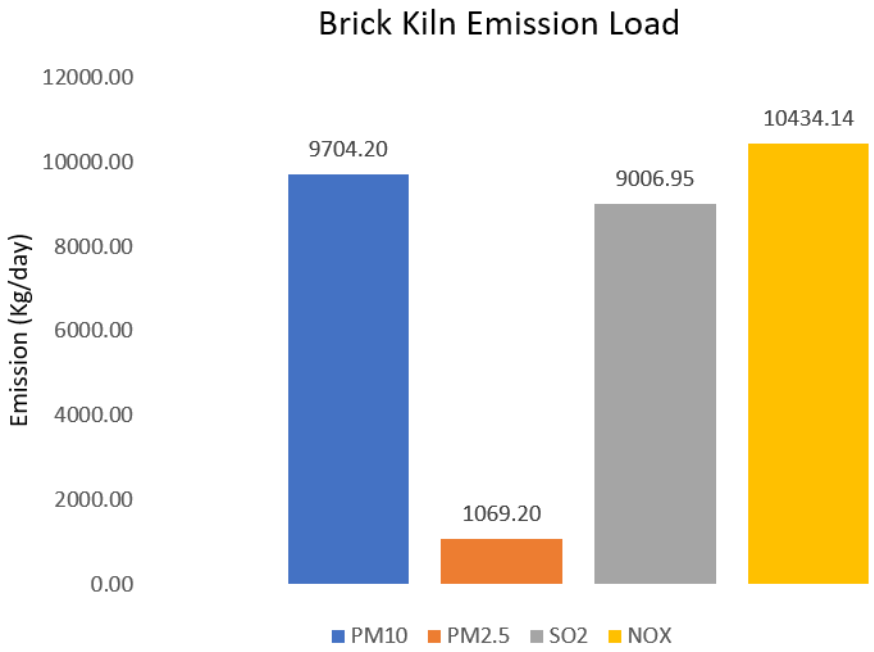


Figure 31: Emission Load from Brick Kilns

b) Observations

The high emission of pollutants such PM_{10}, NOx and SO_2 clearly shows that Brick Kilns are potential contributor of pollutants in the Meerut city "Airshed" system.

The major issues of brick kilns in Meerut include: -

i. **Conversion in to Zig-Zag -** Out of 237 brick kilns in Meerut districts 82Brick kilns have been converted in to zig-zag technology.

ii. **The primary fuel used for firing is coal but agricultural waste has been adopted at many places as an alternate-**The simple reason behind the use of

agricultural waste is its easy availability and lower price. About Twenty-two per cent of the total surveyed kilns were found to be using agricultural waste. Apart from this, many other hazardous wastes such as carbon from tyre pyrolysis plant, rubber waste, shredded plastics, etc., were seen being used at different kiln sites. More than 30 per cent of the kilns were seen using hazardous fuel.

iii. **Fugitive emission is common at all kiln sites -** The sources of emission are Coal Crushing Unit, openly stored fuel, dust on the road within the premises of the kiln, rubbish stored at the kiln and area where green bricks are prepared.

iv. **In a hope to comply with the CPCB order, most of kilns in NCR have chosen a shortcut approach -** The kiln owners have used the shortcuts, where they have converted only the oval section of the kilns into rectangular ones and have not even changed their miyan. The performance of such kilns would hamper the ultimate goal of reducing emissions.

c) Strategy

Based upon the survey findings and analysis, the following strategy is proposed in order to ensure that the kilns are constructed with proper design in order to improve the operational practices and get the desired result.

i. **Seminar and training** - District level seminars and exposure visits to Zig- Zag kilns for brick entrepreneurs in order to acquaint them to the new technology. In addition, regular training programmes for kiln entrepreneurs as well as workers and technicians such as course on Zig- Zag technology at institutes such as ITI, etc will be designed and organized.

ii. **Capacity building of regulators** - Setting up of an expert committee at the state/district level to monitor the conversion of the kilns. SPCBs to work jointly with other government departments and local NGOs to stop the usage of hazardous fuels. Enforcing construction of platform and approach ladder to reach porthole at chimney, to facilitate stack emission monitoring. Ensuring covered fuel storage, water sprinkling facility, concretized haul road, and use of PPEs.

iii. **Improving operational practice** - Adoption of single man fuel feeding process, double wall wicket gate closing mechanism & use of insulated apparatuses.

E. Diesel Generator Sets (DG Sets)

The DG sets are used as a backup, approximately 400 DG sets are installed in sectors such as Industries, Hotels, Banquet halls, Hospitals and Residential apartments. The majority of the electricity generator sets runs on natural gas, few runs on diesel. It is assumed that DG sets operate for four hour per day (primary survey finding). The minimum capacity corresponding to the production of the industry and stack height has been worked out and assumed as the capacity of the DG while estimating emissions. The

unit of the activity data is KWh power generation. The calculation is based on Eq (1), where ER, overall efficiency reduction was taken as zero. The CPCB (2011) emission factors were used for emission estimation. The total emissions from DG sets are shown in **Figure 32,** as follows:

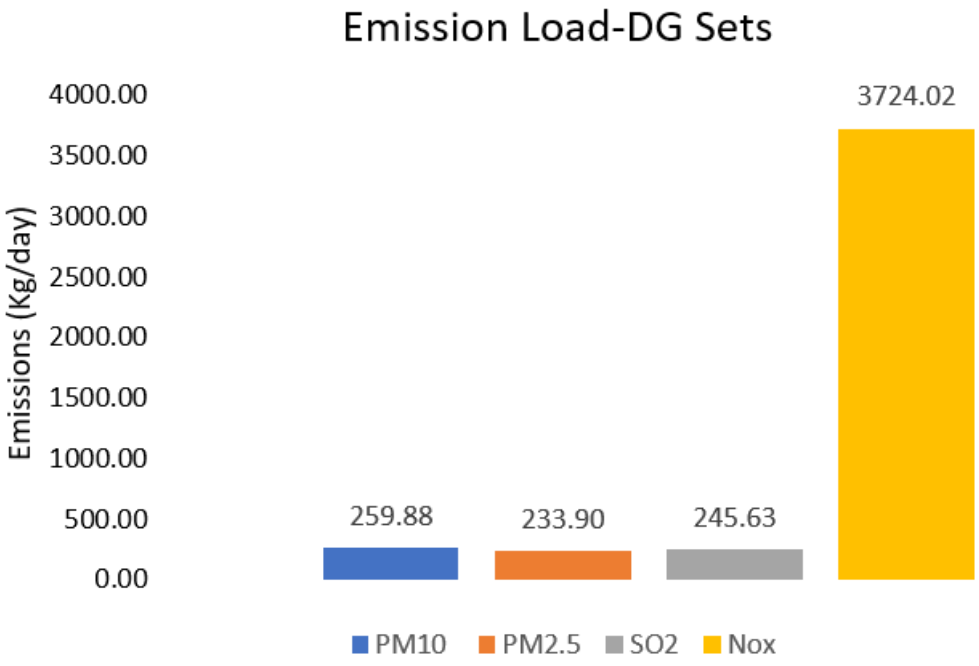


Figure 32: Emission Load Estimation for DG sets

I. Observations

The emission for NOx was observed to be highest from DG set sources. It is due to the use of Diesel as the only source of fuel, contribution to the NOx emission from DG sets. The percentage emission from various pollutants for various sectors i.e. Industrial DG sets, Hospital DGs, DG sets in hotels/banquet hall and residential apartments, is given in **figures 33, 34, 35, and 36.**

**Assumptions (DG set Load)*

- *Hospital (beds>500)-125KVA*
- *Hospitals (beds >50 &<500)-62.5 KVA*
- *Hospitals (Beds<50)-15 KVA*
- *Hotels & banquet Halls- 62.5 KVA*
- *Apartments- 125 KVA*

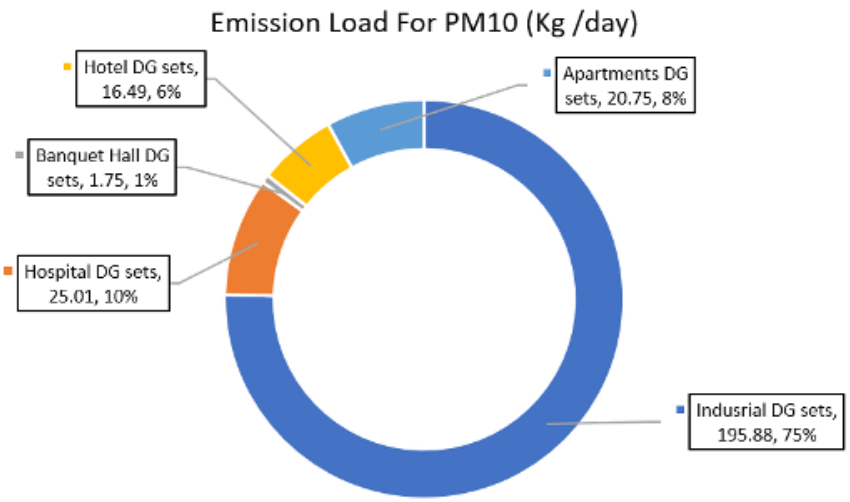


Figure 33: PM10 Emission from DG sets (259.88 Kg/day)

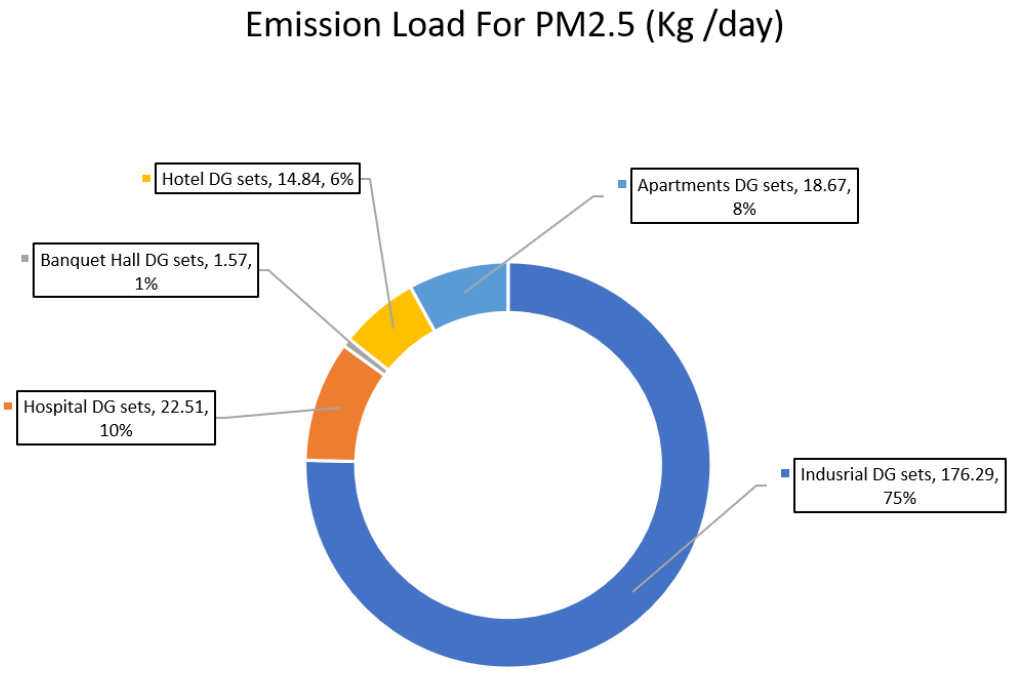


Figure 34: PM2.5 Emission from DG sets (233.90 Kg/day)

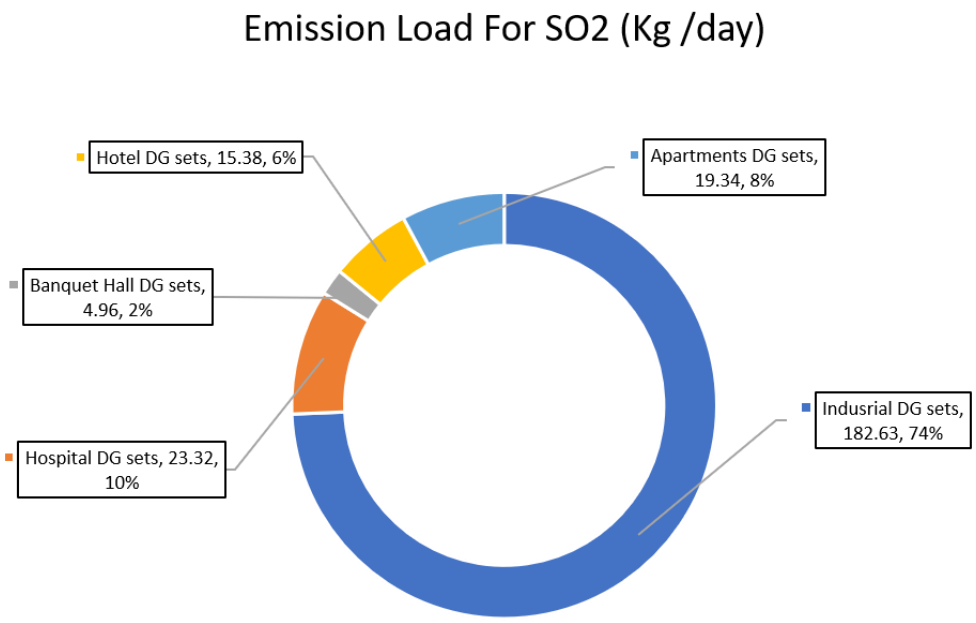


Figure 35: Emission from DG sets (245.63 Kg/day)

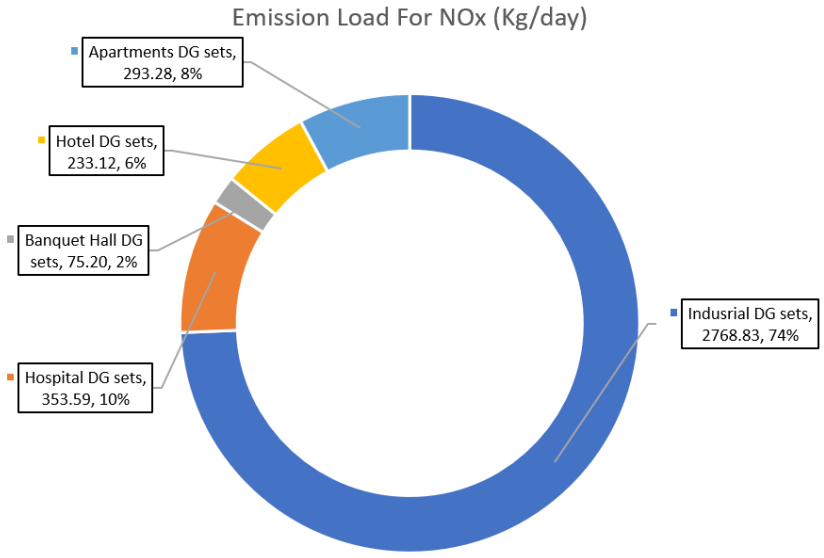


Figure 36: NOx Emission from DG sets (3724.02 Kg/day)

From the above pie- graphs it can be concluded that large number of DG sets are installed at industries which further increases the contribution of Industries also as major point source pollutants.

F. Hot-Mix Plant Emission Estimation

In a hot-mixture plant, handling of aggregates and raw material, conveyance of raw material/loading processes, drier and bitumen heating are some of the major processes contributing to air pollution. The major sources of air pollution in the hot-mix asphalt are (i) drier, and (ii) bitumen heating tanks. To get a proper heating effect to the aggregate in the drier, a draft is created by providing an inducted draft (ID) fan. This causes in carrying out much of the fine dust introduced with the aggregate. In order to minimize plant's impact on ambient air quality it is essential that air pollution control equipment and practices are in place for point as well as non-point sources of air pollution.

The total Hot- Mix Plant unit present in the Meerut boundary is 14 throughout the district, given in the **Table-16**,out of which only 7 are operational, these units are located outside the city boundary. Data for Activity rate calculation has been collected from UPPCB and emission factors has been obtained from CPCB (2011) have been used to estimate the emissions from Hot- Mix Plant.

Table 16: List of Hot Mix Plants in Meerut District

S.No	Location & Adress of Hot Mix	Capacity	Unit	Production Capacity Kg/day	Operational/Non-Operational
1	R.C.C Devlopers, Vill- Lakhwaya, Jagethi Road, Meerut	50	ton/hr	200000	Non-Operational
2	Sunshine Builders, baghpat road, Meerut	50	ton/hr	200000	Operational
3	Juneja Construction Pvt Ltd, Jagethi Meerut	50	ton/hr	200000	Operational
4	Akansha Construction, Garh Road Meerut	60	ton/hr	240000	Non-Operational
5	Shanti Contruction, Vill- Raali Chauhan, killa road, Meerut	50	ton/hr	200000	Operational
6	S K Contruction, Kharkhoda, Hapur road Meerut	50	ton/hr	200000	Non-Operational
7	Ashok Kumar Thekedar (Hot mix plant), Meerut hapur bypass, bijli bamba, meerut	50	ton/hr	200000	Non-Operational

8	Jeet Construction, meerut hapur bypass, bijli bamba, Meerut	50	ton/hr	200000	Non-Operational
9	Arora R.C.C Devlopers, Mulipur fool, Garh Road, Meerut	50	ton/hr	200000	Non-Operational
10	Lohiya Developers, Kharkhoda, Hapur Road, Meerut	50	ton/hr	200000	Operational
11	Preeti Buildkaan, Shahpur Nagli, Meerut	50	ton/hr	200000	Operational
12	R S Builders Near Krishna Public School, NH 58, Jatoli Meerut	50	ton/hr	200000	Operational
13	Partapur Rainway Line, Aminagar, meerut	50	ton/hr	200000	Operational
14	Gangnaher, jaani Meerut	50	ton/hr	200000	Non-Operational

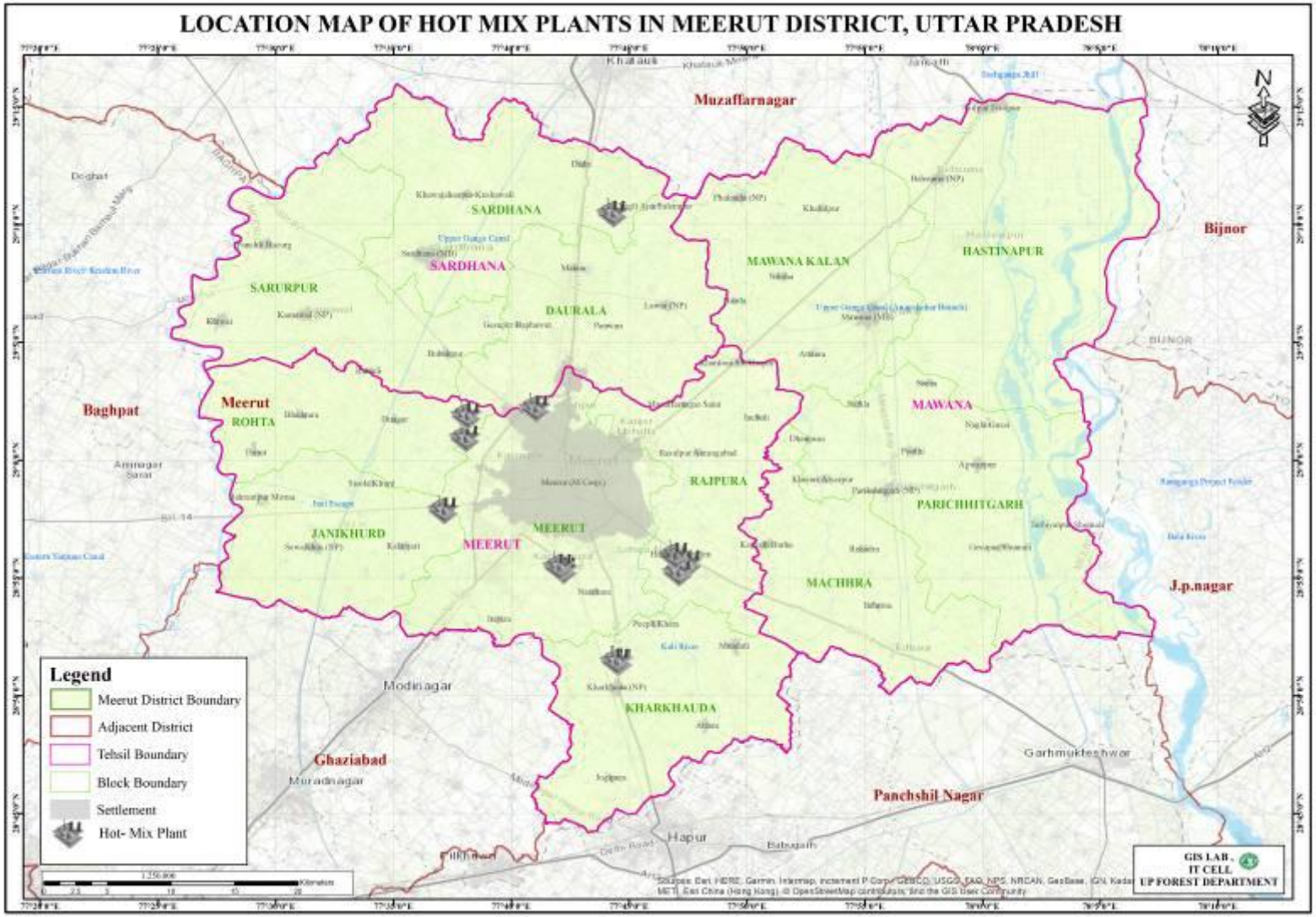


Figure 37: Hot-Mix Plant of Meerut District

The total emissions from Hot- mix Plant is shown in **Figure-38**, as follows:

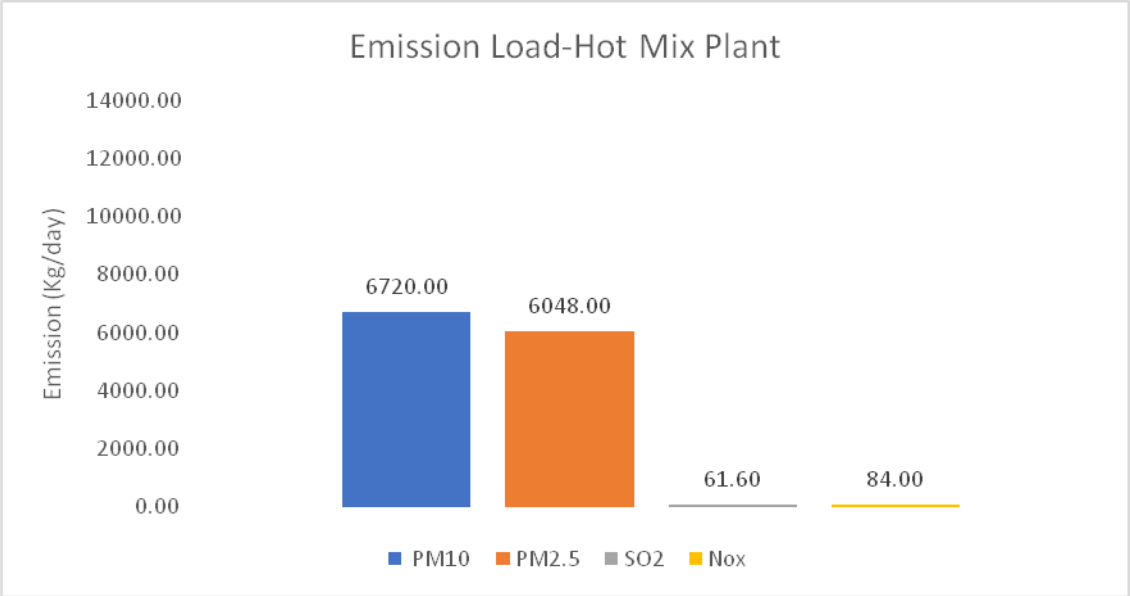


Figure 38: Emission Load estimation for Hot-Mix Plant

I. Observations

PM_{10} and $PM_{2.5}$ are the peak pollutant observed from Hot-mix Plant. This is due to the emission of Particulate matter during the handling, loading and unloading process along with emissions from the stack attached to the power sources.

II. Measures to be taken for control and abatement of air pollution

- MoEF & CC's notification dated 25.01.2018 has laid down dust abatement measures during construction and demolition activities, same should be applicable for transportation, handling and transfer of raw materials in a hot mix plant. SOP should also be adhered to with regards to construction of paved roads and sprinkling.
- The conveyance channel for feeding into the drier and bitumen tank should be closed to minimize fugitive emissions.
- A combination of dry scrubbing system/filters and wet scrubbing system should be installed for drier and flue gases from bitumen heating process respectively.
- Stack of at least 6 meters height should be installed. The stack should have port hole and monitoring platform as per Emission Regulatory Guidelines (Part III) of Central Pollution Control Board.
- Earlier, Furnace oil was a prominent fuel in Hot mix plants, however after being banned by Hon'ble Supreme Court most of the plants have switched to LDO. In order to minimize the impact, new plants should be permitted only on LPG kits, these are already being used in hot mix plants in UP-NCR cities.
- Preferably, a PTZ camera should be installed for purpose of remote monitoring of operations and visible emissions from the hot mix plant.
- Hot mix plants should install separate energy meter for pollution control systems.
- Adequate green buffer should be maintained around the hot mix plants.

G. Emission Estimation from Domestic Sector

The interior boundaries in the map (Figure 19) obtained from Meerut Development Authority, Meerut show the administrative boundaries of MDA limits. After obtaining the total population of the city (Meerut Municipal Corporation) as per the AMRUT report and Census 2011, the emission density for the area is calculated for different pollutants (PM_{10}, $PM_{2.5}$, SO2, NOx, and CO). The emission factors given by CPCB (2011) and AP-42 (USEPA, 2000) were used for each fuel type.

For emission calculation of different pollutants, emission per capita for total population was calculated, as activity data was available on the basis of per capita. The fuel usage pattern of the households for the study area (MDA) is presented in **Table-17.**

Table 17: Fuel Usage Pattern

Fuel Type	Percent used
Fire wood	4.80%
Crop Residue	0.70%
Coal/Charcoal	0.10%
Kerosene	0.80%
Cow Dung	7.60%
LPG	86%
Total	**100.00%**

The overall emission from domestic sources is presented in **Figure-39.**

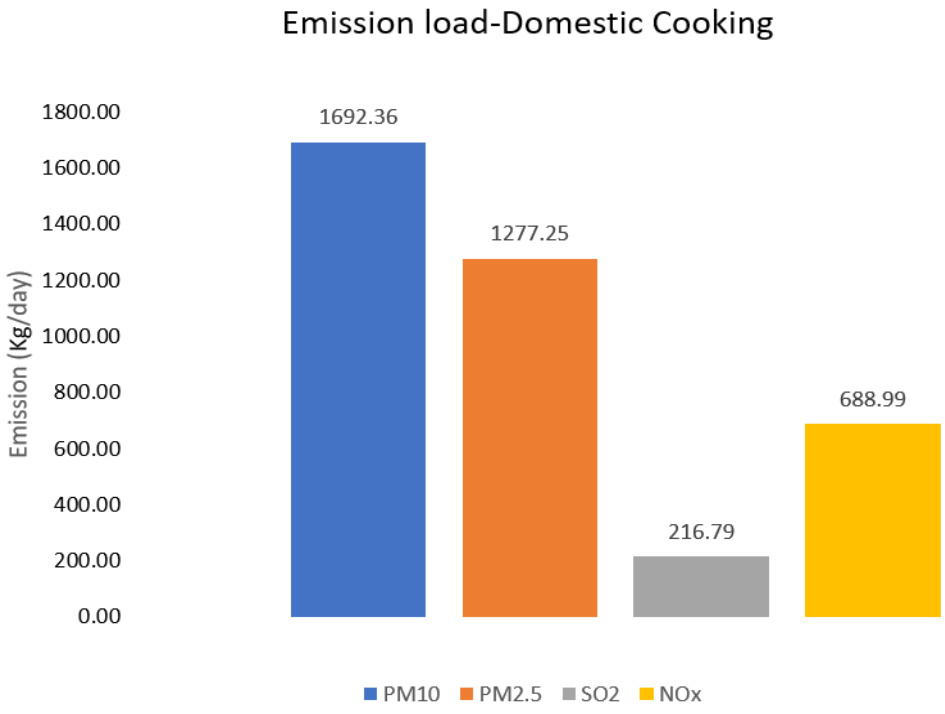


Figure 39: Emission Estimation for Domestic source

I. Observation

The LPG penetration in Meerut City is 86% (PPAC Primary survey on household cooking fuel usage and willingness to convert to LPG report, 2016). PM_{10} emission is observed to be highest. This is due to high activity rate and emission of fuel sources such as fire wood, Crop residue and Cow dung etc. This could be better understood through emission contribution from different fuel types to different pollutants as shown in **Figures 40, 41, 42 and 43.**

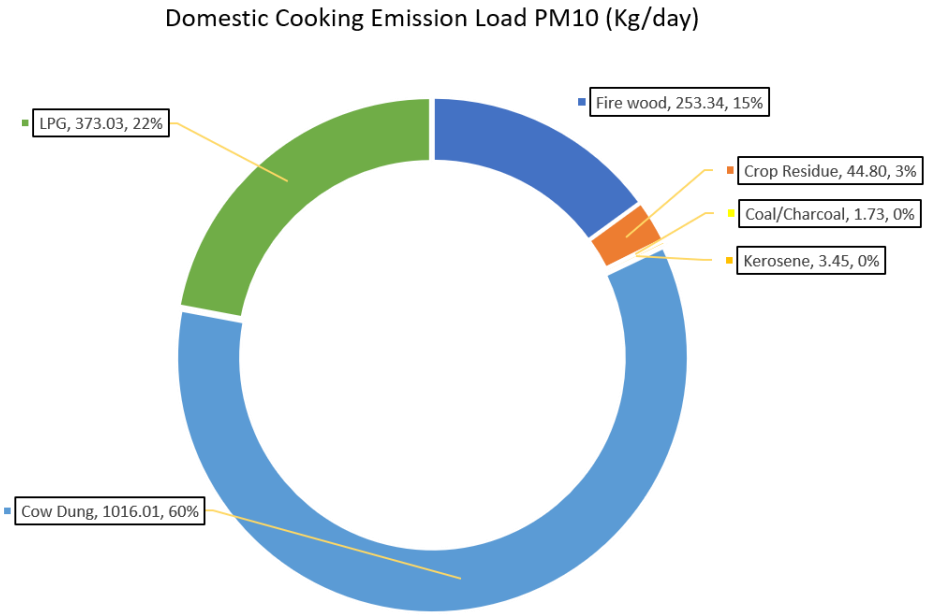


Figure 40: PM10 Emission Load from Domestic Cooking in MDA (kg/day, %)

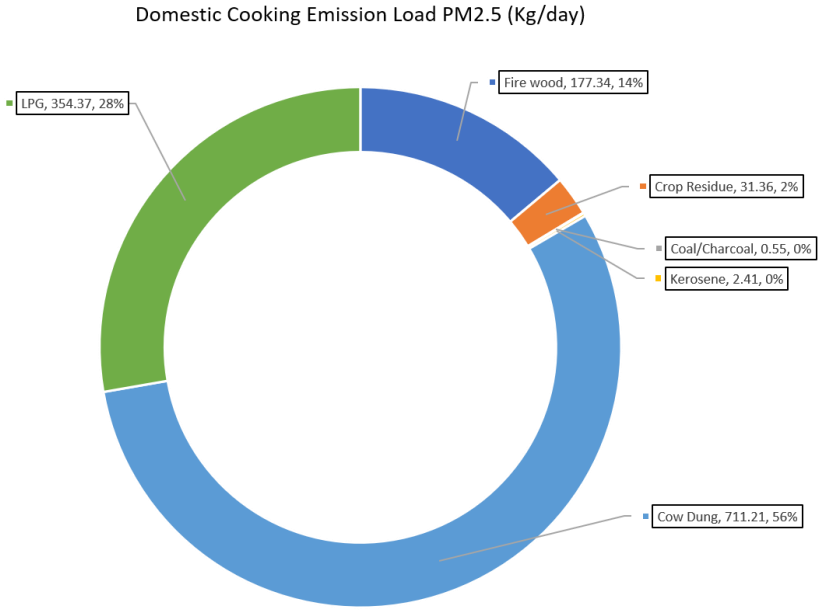


Figure 41: PM2.5 Emission Load from Domestic Cooking in MDA (kg/day, %)

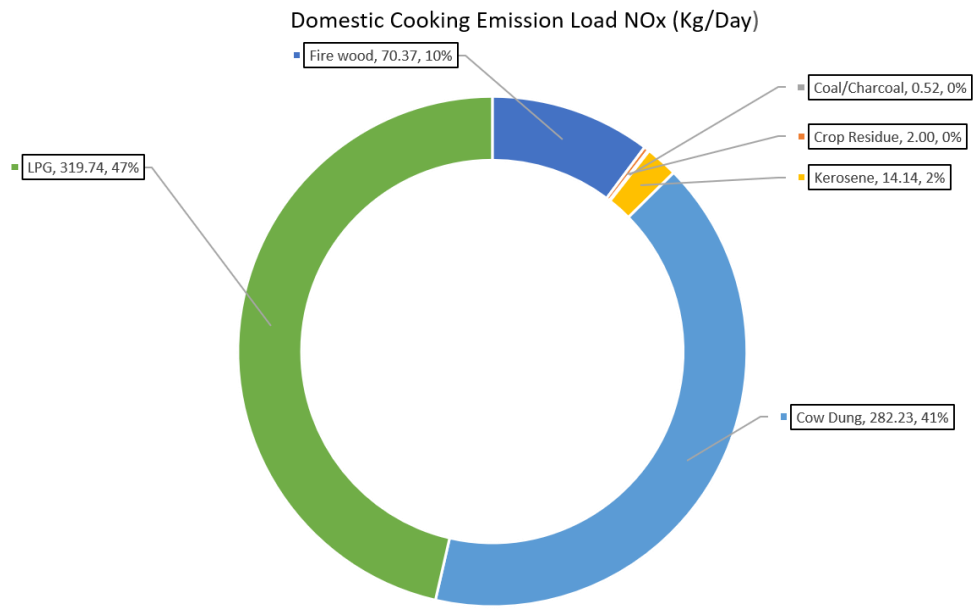


Figure 42: SO2 Emission Load from Domestic Cooking in MDA (kg/day, %)

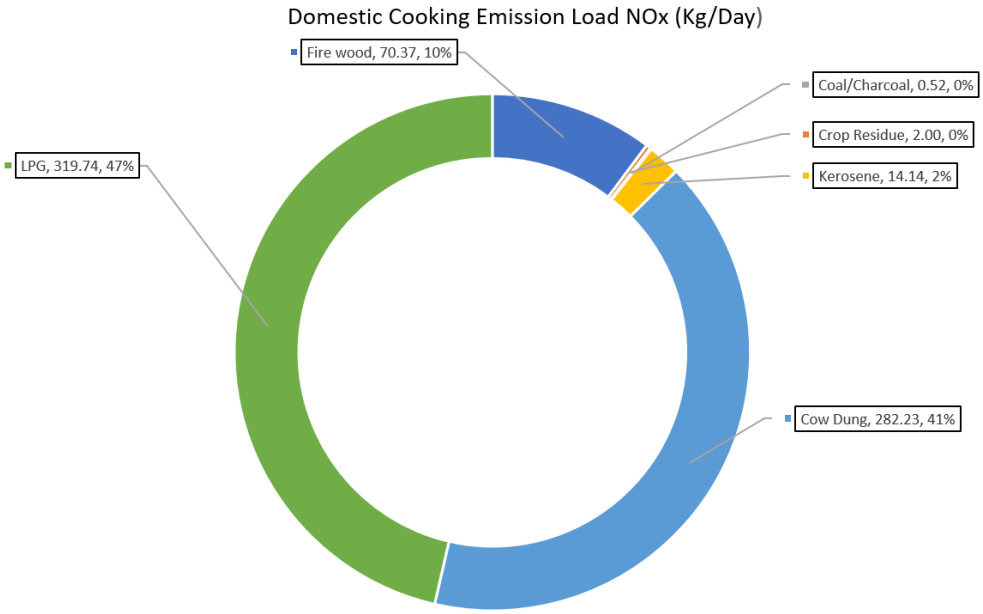


Figure 43: NOx Emission Load from Domestic Cooking in MDA (kg/day, %)

H. Hotels and Banquet halls emission estimation (Kitchen emissions)

The primary survey was conducted by UPPCB- Regional office, Meerut team to identify the hotels and banquet halls. During the field survey it was observed that hotels, banquet halls etc. use coal as fuel in tandoors. The average consumption of coal in tandoor based on survey was 80 kg/day. The total number of Hotel and Banquet halls enterprise was

approximately 82. The common fuel other than in tandoor is LPG. The fuel consumption for each fuel type was estimated. In most of the cases, it was found that there were no control devices installed at these activities. The emissions of various parameters such as SO_2, NOx, PM_{10}, $PM_{2.5}$, and CO were estimated from the activity data from each fuel type and then were summed up in each grid cell. The emission factors given by CPCB (2011) were used. The overall emission from these area sources (Hotels and Banquet halls) is shown in **Figure-44 and 45.**

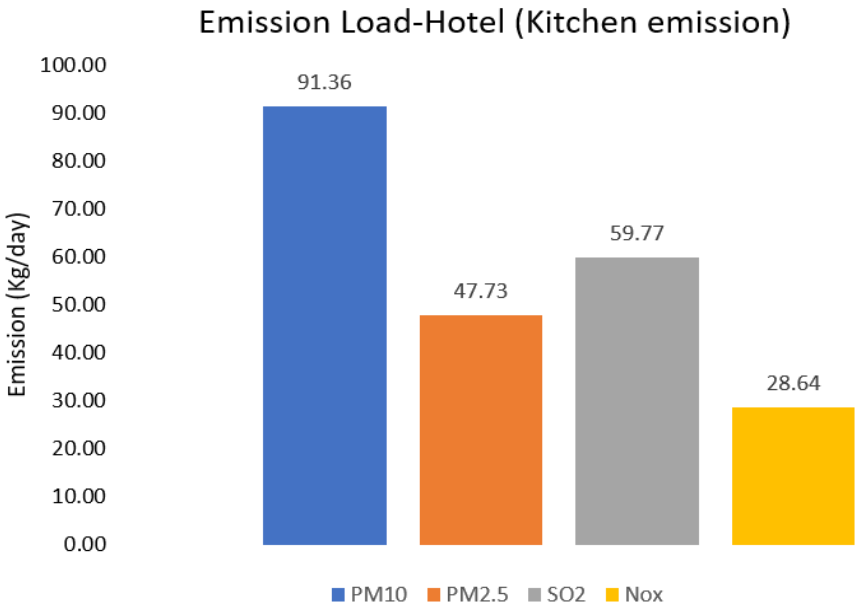


Figure 44: Emission Load from Hotels

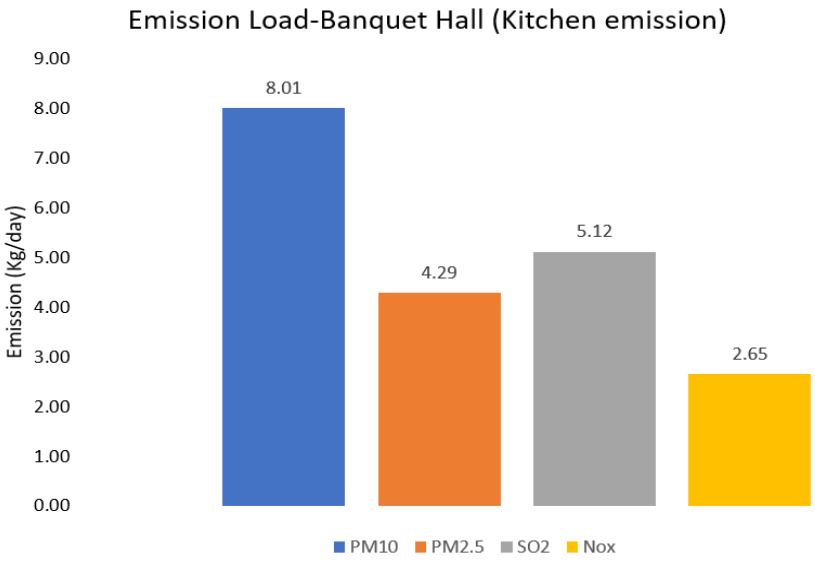


Figure 45: Emission Load from Banquet Halls

I. Observation

The High emission for PM_{10} (91.36 Kg/day-In Hotels, 8.01 Kg/day- In Banquet Halls) is very evident due to the high consumption of Coal i.e. 80 Kg/day. It can also be explained as no APCDs or other control devices are installed.

I. Vehicular Pollution and traffic congestions

Vehicular pollution is another major issue in the city of Meerut and being an old city, the road infrastructure of the city is not optimal for hassle free flow of traffic and needs strengthening. The Meerut town is developed in organic pattern, number of regional highways pass through this city, Delhi- Roorkee road, Meerut –Baghpat road, Meerut – Bijnor road, Meerut -Garh road meet at central hub point commonly known as ―Begum Bridge. All these major state /regional /national highways pass through the central built up area of city. So, the city has naturally grown concentric pattern of circulation network.

a) Traffic and Transportation problems in Meerut - The following problems have been observed and identified by people, residing in the city, daily commuters and people frequent to this city to pursue business and other affairs.

i. General Problems Related To Traffic and Transport facilities

- **Capacity Constraint**: Most of the roads have Capacity Constraint: the width or road especially in inner built up areas, inner cordon roads and even at some points the regional and outer cordon roads have lesser width/related infrastructure in context to the traffic volume they have to bear.
- **Inadequate Road hierarchy**: Road hierarchy is not as per the acceptable level, so the traffic movement is not smooth, the primary corridors, secondary corridors do not follow the norms.
- **Encroachments**: Most of the roads in the area encroached by permanent temporary encroachments, leading to reduction of width and capacity of roads: at most of the places the hoardings, shop displays, advertising panels are placed in ROW even on the Metalled areas. The roads have also been encroached chajja projections, ramps and other civil features constructed in the ROW.
- **Mixed Traffic**: The most of the roads in the city are subjected to mixed kind of traffic, the slow, very slow, fast moving traffic move on the same roads /traffic corridors, due to which the average speed of city is lowered down.
- **Traffic management**: The city has very weak traffic management; the traffic is regulated by traffic police, which is mostly untrained/not properly trained in traffic affairs, which fails in regulating traffic.
- **Absence of Traffic Management Plan**: No comprehensive Traffic Management Plan is prepared for the city; the only methodology adopted is the traffic plan by police which is done in non-technical way.

- **Poor road quality**: The quality of roads in inner cordon, middle cordon, and outer cordon as well as regional roads is of poor quality in terms of surfacing, gradients.
- **Weak Traffic infrastructure**: The entire infrastructure is weak to cater to the magnitude of traffic
- **Slow average traffic speed**: The average speed of traffic in the city is very low leading to deterioration of efficiency of city.
- **Inadequate Pedestrian facilities**: The Pedestrian facilities on all most all the roads of different levels are inadequate, promoting less of pedestrian movement and more of traffic
- **Limited provision for bicycles**: In the entire city provision required infrastructure to promote cycle movement in the city is very limited
- **Problem of informal marketing on road side**: Hawkers, road side vendors, informal squatting of vegetable /grocery item vendors are a serious problem in the city, affecting the road efficiency.

Figure 46: Traffic at Meerut City

ii. Problems Related to Parking Issues

- A large number of markets, commercial and other activity centers on various roads in Meerut are suffering from inadequate parking facilities. On most of these stretches, the root cause of the congestion on the street is caused due to on street parking.
- Problems of Parking, unorganized and unauthorized parking are located at following points in the city: The both sides of Begum bridge road up to Eves Chowraha, both

sides of Sadar bazza, Sarrfa Market, PL Sharma Road up to court complex, both sides of Shahstri Marg, in roads of area near Budhana Gate, Khair Nagar Market, Old Gantaghar Area, Eastern and Western Kachehri Road, Bhaghpat Road, the area around Kabari Bajaar, Sharda Road, Transport Nagar Garh Road, Hapur Road etc.

iii. Problems Related Intersections, Round About& Junctions - The detailed traffic and transportation surveys were got conducted by the authorities and concluded that some of the intersections and crossings had number of problems leading to huge clogging of traffic and slowing down of average speed

- **Begumpul**: This intersection having improper road Geometry, there are number of educational institutions leading to huge traffic at peak hours, temporary and permanent encroachments, problem of huge member of road side vendors, parking of rikshaw, and private vehicles leading to inefficient intersection
- **Bachcha Park**: This intersection having improper road Geometry, there are number of temporary and permanent encroachments, problem of huge member of road side vendors, parking of rickshaws, tempos, busses and private vehicles leading to inefficient intersection.
- **Hapur Adda**: This intersection is also used as Hapur bus stand so is having huge traffic beside this, it is having improper road Geometry, there are number of temporary and permanent encroachments, problem of huge member of road side vendors, parking of rickshaws, tempos, busses and private vehicles leading to inefficient intersection.
- **Eves Chaupala**: This intersection is surrounded by number of colleges and commercial establishments and so is having huge traffic beside this it is having improper road Geometry, there are number of temporary and permanent encroachments, problem of road side vendors, parking of rickshaws, tempos, busses and private vehicles leading to inefficient intersection
- **Kchahari chowk**: This intersection is having court complex and so is having huge traffic beside this it is having improper road Geometry, there are number of temporary and permanent encroachments, problem of road side vendors, parking of rickshaws, tempos, buses and private vehicles leading to inefficient intersection
- **Nauchandi:** This intersection is surrounded by number of commercial establishments, fair ground, thickly populated residential areas and so is having huge traffic beside this it is having improper road Geometry, there are number of temporary and permanent encroachments, problem of road side vendors, parking of rickshaws, tempos, busses and private vehicles leading to inefficient intersection.
- **Ghantaghar**: This intersection is surrounded by number of commercial establishments, educational institutions, thickly populated residential areas hugr commercial markets and so is having huge traffic beside this it is having improper road Geometry, there are number of temporary and permanent encroachments, problem of road side vendors, parking of rickshaws, Private vehicles leading to inefficient intersection, Huge number of Pedestrian.
- **Baghpath Chowraha**: This intersection is surrounded by number of commercial establishments, retail shopping, thickly populated residential areas commercial markets, vegetable market and so is having huge traffic beside this it is having

improper road Geometry, there are number of temporary and permanent encroachments, problem of road side vendors, parking of rickshaws, private vehicles leading to inefficient intersection, Huge number of Pedestrian.

- **Bhumiapul**: This intersection is surrounded by number of small commercial establishments, thickly populated residential areas so is having huge mixed kind of traffic, beside this it is having improper road hierarchy of roads Geometry, there are number of temporary and permanent encroachments, problem of road side vendors, parking of rickshaws, private vehicles leading to inefficient intersection, Huge number of Pedestrian.
- **Meerut Bus Stand**: The road/ Carriageway width is less with inefficient Geometry, number of small commercial establishments along the Delhi road , thickly populated residential areas in the vicinity, so is having huge mixed kind of traffic, beside this, this area is having improper road hierarchy of roads, there are number of temporary and permanent encroachments ,problem of road side vendors, parking of rickshaws, private vehicles leading to inefficient transport system, Huge number of Pedestrian with no facilities adds to the problem.
- **Thapar Nagar** : The road/ Carriageway width is less with inefficient Geometry, number of small commercial establishments/commercial strip development along the main roads, thickly populated residential areas in the vicinity, so is having huge mixed kind of traffic, beside this, this area is having improper road hierarchy of roads, there are number of temporary and permanent encroachments, problem of road side vendors, parking of rickshaws, private vehicles leading to inefficient transport system, Huge number of Pedestrian with no facilities adds to the problem.
- **Jail Road** : The road leads to Bijnour and its width is less, number of small commercial establishments/commercial strip development along the main roads near the existing settlements , residential areas in the vicinity, so is having huge mixed kind of traffic, beside this the area is having improper road hierarchy of roads, there are number of temporary and permanent encroachments ,problem of road side vendors, parking of rickshaws, private vehicles leading to inefficient transport system, Huge number of Pedestrian with no facilities adds to the problem, Hawking and Encroachment, On-street Parking
- **Commissionery Choaraha**: This is located at major intersection near Divisional Commissioner's office though the Geometry is comfortable but because of its vicinity to the Meerut College and other important offices, court offices the capacity of road and intersection is week.
- **Sardana Bus Adda**: This is located at Meerut –Roorkee Road, though the Geometry is comfortable but because of its vicinity to the central hub, markets begum pul,Abu lane and this place acts as local bus stand to Modipuram area and other important offices ,court offices the capacity of road and intersection is week. so is generally acute traffic problem because of hawkers, vendors, roadside Rickshaw parking, tempo, local busses and heavy pedestrian movement

b) Traffic Congestion points in Meerut city - The following table shows the major Traffic Congestion points in Meerut city:

Table 18: Major congestion points in the Meerut city

S. No.	Area	Latitude	Longitude
1	Garh Road	28.96195	77.745188
		28.956368	77.753642
2	Soharab Gate Bus Stand	28.970023	77.722565
3	Hapur Road	28.946039	77.723473
4	Hapur-Delhi Link Road	28.971017	77.723465
5	HRS Chowk	28.973823	77.691185
6	Hapur Cir, Gandhi Nagar	28.9738	77.713569
7	76, Boundary road, near Begum Pul	28.994975	77.705461
8	Jali Kothi Rd, Shohrab Gate	28.98071944	77.706055
9	Dharmashala	28.98071944	77.695969
10	Noornagar, Lisari	28.94675556	77.699408
11	SH 14, Mahmud Nagar	28.97064722	77.70575

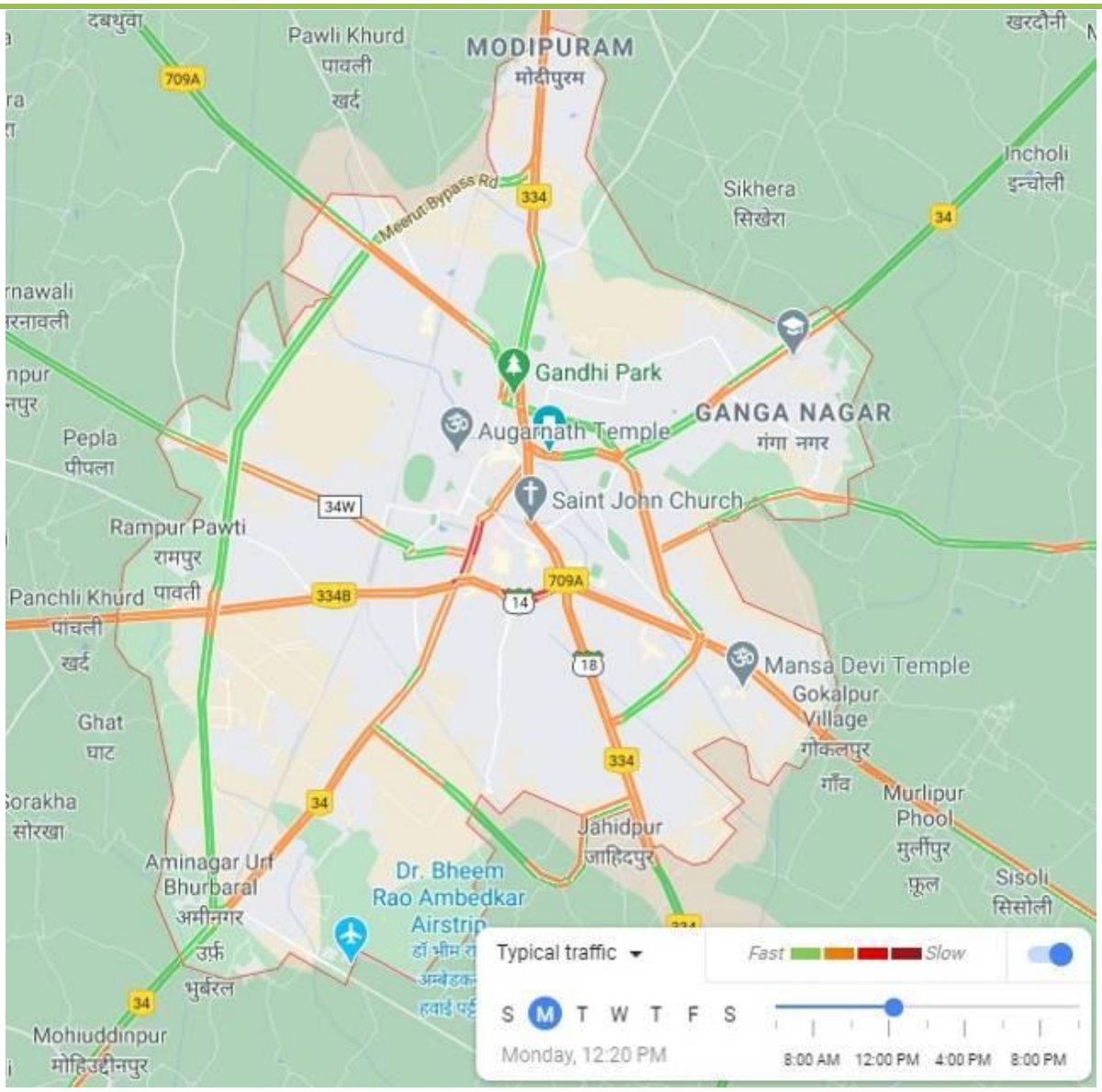


Figure 47: Map showing major congestion points in the Meerut city

Road lengths for major and minor roads were calculated. The information on traffic flow from traffic counts was translated into the vehicles on the roads. The number of registered vehicles from 2005to 2020 were taken in account for the study. The emissions from each vehicle category for each grid is estimated and summed up. The emissions from railway locomotives are not taken into considerations, as the emissions are negligible in comparison with the vehicles and other sources. ARAI (2011) and CPCB (2011) emission factors were used to calculate the emissions. The emission from vehicles is shown in **Figure-48** Emission contribution of each vehicle type in city of Meerut is presented in **Figures-49, 50, 51 and 52.**

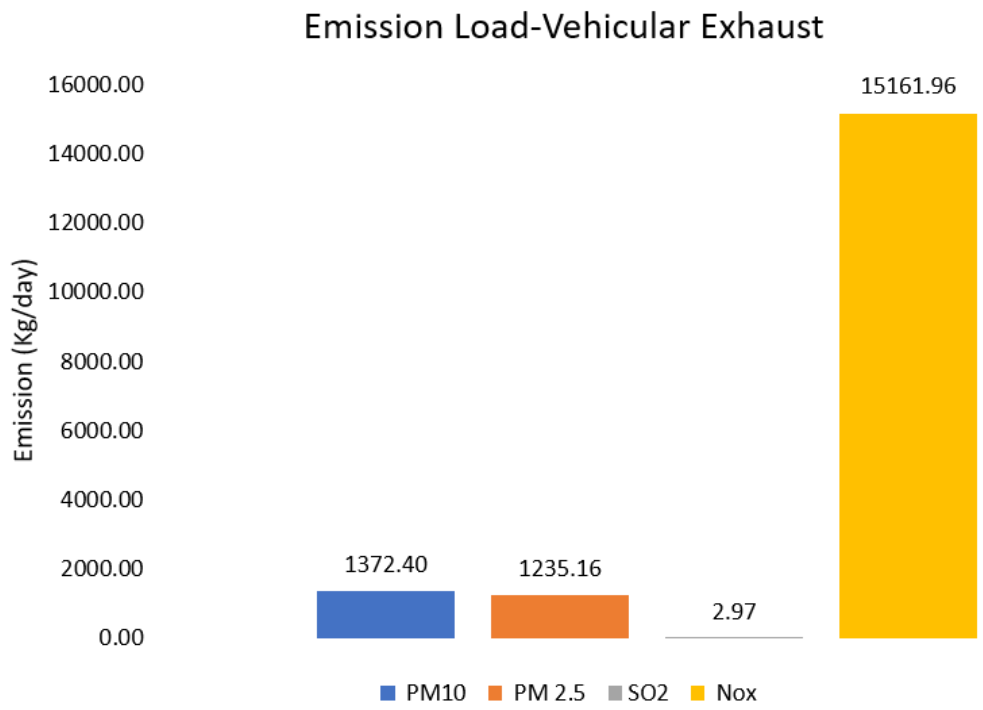


Figure 48: Emission estimated loads from Vehicular Exhausts (Kg/day)

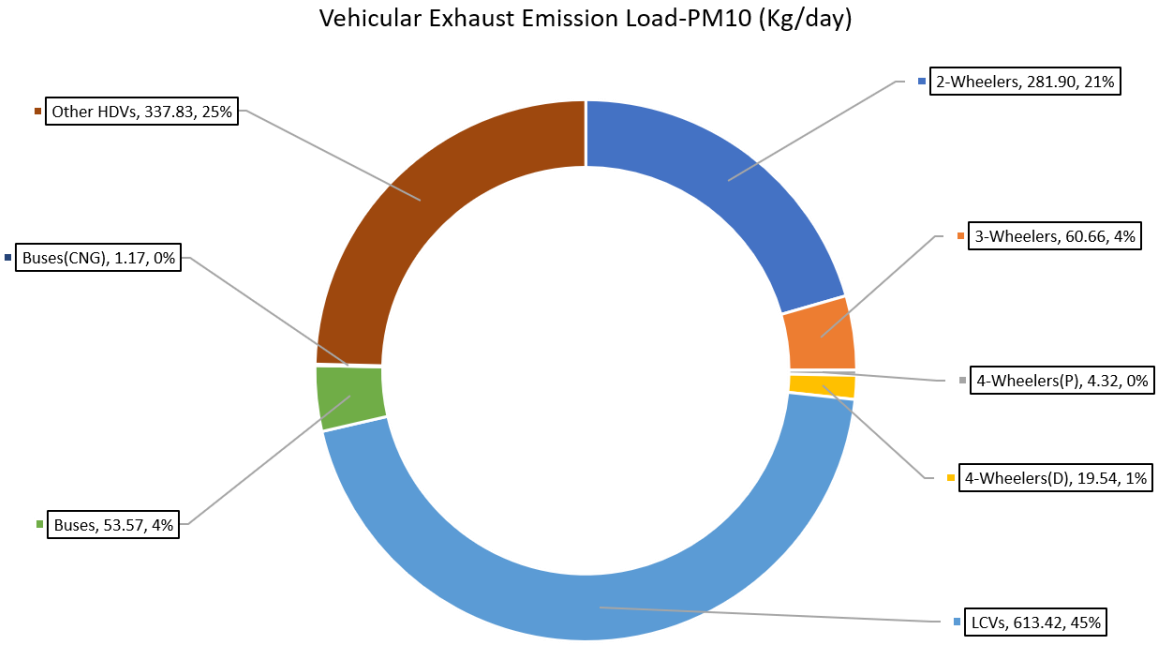


Figure 49: PM10 Emission Load contribution of each vehicle type in city of Meerut

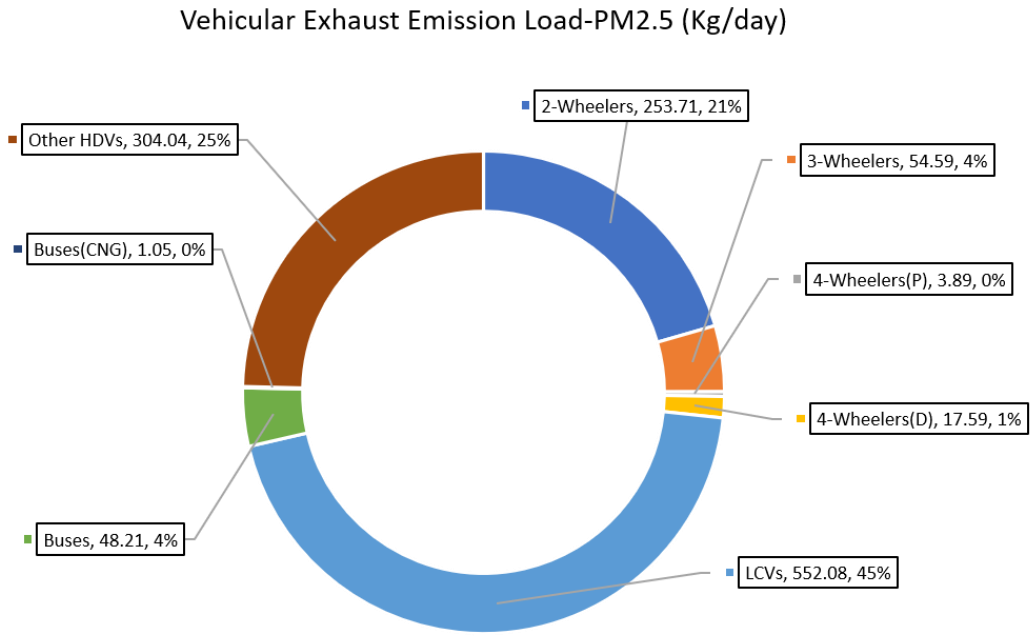


Figure 50: PM2.5 Emission Load contribution of each vehicle type in city of Meerut

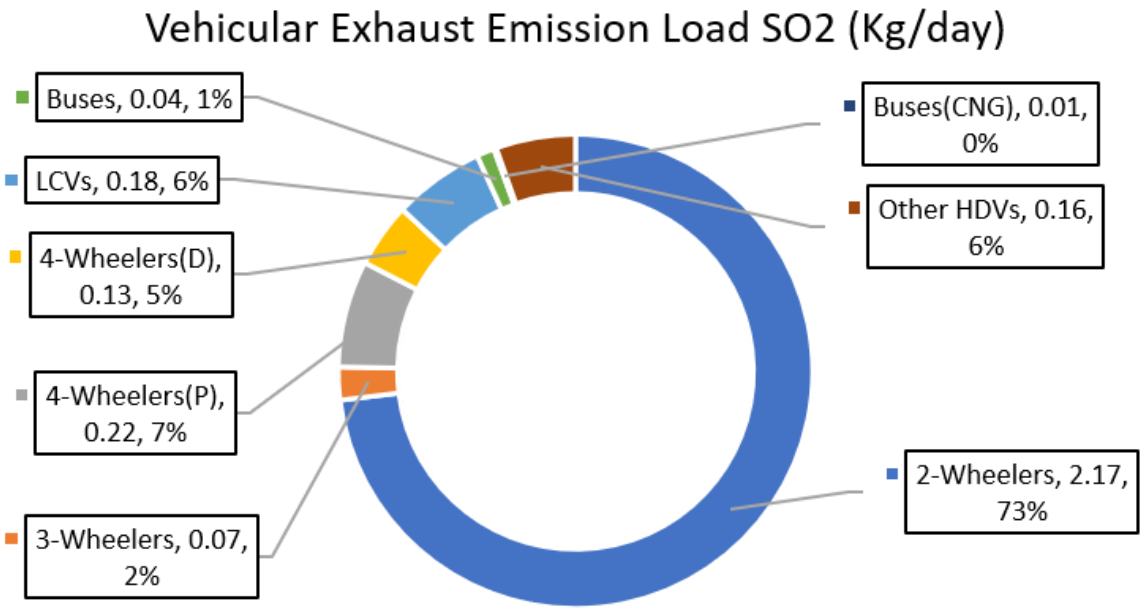


Figure 51: SO2 Emission Load contribution of each vehicle type in city of Meerut

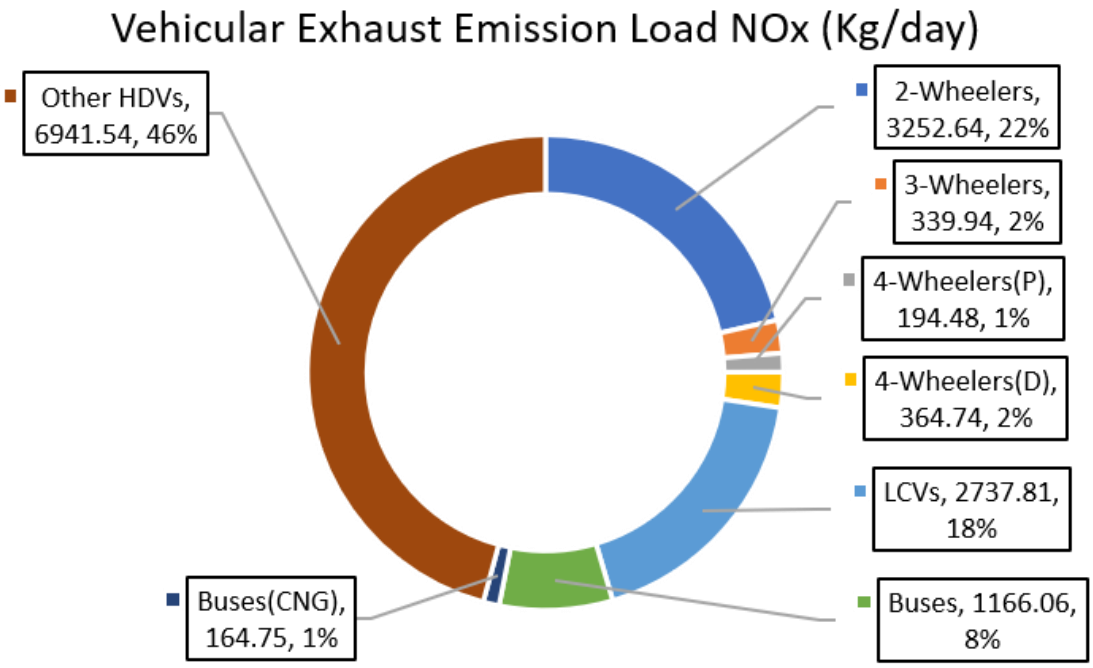


Figure 52: NOx Emission Load contribution of each vehicle type in city of Meerut

I. Observations

LCVs are major contributor to PM_{10} and $PM_{2.5}$ whereas HDVs are leading in NOx. SO_2 release is negligible mostly from 2-wheelers.

II. Proposals of Third Meerut Master Plan 2021 - Road Pattern and Typology in Meerut Master Plan 2021 a total of 10% of land ie 1550 hectare of land was earmarked for Transportation Land Use. The major recommendations of Meerut Master Plan 2021 regarding roads are-

- Development of Ghaziabad –Meerut Expressway
- Widening of all regional roads, and Fly Overs
- Development and enhancement of Main Intersections
- Improvement of Local Bus Service
- Development of Parking Spaces
- Development of Comprehensive Traffic Management Plan
- Improvement of Meerut-Baghpat- Sonipat State Highway
- Bus Stands and Truck Terminus
- Development of bus stands near Railway stations.
- Shifting of all bus stands located in inner parts of city to outer areas
- development of transport nagar near Baghpat and Garh Road
- The roads which caters to local and regional traffic can be developed in participation with private partners
- In the areas where there is probability of development, a proper Zonal Plan may be prepared and accordingly the road may be constructed by the betterment charges obtained from the plot owners of that area.

- Improvement of all intersections and construction of Railway over bridges
- Railway Infrastructure Improvement of Delhi-Sahranpur and Meerut –Hapur Rail Way Line including Electrification
- Development of Rapid Rail Network Between Delhi and Meerut
- Development of Cargo near Mohiddinpur, construction of Railway Over Bridges

III. **Future Strategy** – A good quality Comprehensive Mobility Plan needs to be updated and implemented with clearly defined timelines.

- Mobility Corridor Plan
  - Missing Links
  - Road capacity augmentation
- Public transport plan
  - Mass Transit
  - Fleet augmentation
  - Infrastructure
  - Relocation of Inter-city bus terminals
- Non-motorized transport plan
  - Footpath
  - Grade separated pedestrian crossing
  - Dedicated Cycle track
- Freight management plan
- Parking management plan
- Nallah corridor plan
- Short term traffic improvement measures

J. Construction and Road Dust

Road dust and dust arising from construction and demolition (C&D) are the major contributors to the pollution in Indian cities. The potential control options are sweeping and watering of roads, better construction and maintenance, growing plants, grass, etc., to prevent re-suspension of dust. City-specific plans need to evaluate the options of mechanical sweeping, greening, and landscaping of the major arterial roads, identification of major-impact roads, including national highways, etc. Spraying of water twice per day (before peak hours of traffic) is very effective in reducing air-borne dust load. Grassing of open spaces with native grasses also prevent dust pollution and clean air. The mechanical sweepers were introduced in NCR-UP as manual sweeping by brooms blow more dust particles in air than it cleans off the ground. NCR-UP has now more than 25 mechanical sweepers, which keeps the road free of dust. At present, the dust collected is mostly taken to the landfill sites and dumped. When the wind blows, these particles return to the city rendering the entire sweeping process ineffective. Even a light wind is able to raise a dust storm if the dumped dust is not dampened with water or have a green cover over it. There is no proper mechanism or standard operating procedure (SOP) on how to dump the dust

collected so that they do not return to the city after disposal. The government has notified Construction & Demolition (C&D) Waste Management Rules, 2016, which had been an initiative towards effectively tackling the issues of pollution and waste management. The basis of these rules is to recover, recycle, and reuse the waste generated through C&D. Segregating C&D and depositing it to the collection centres for processing is now be the responsibility of every waste generator. Local bodies are to utilize 10%–20% material from C&D waste in municipal and government contracts. It was noted that there was no regulation prescribing preventive measures to be taken for the management of dust, including road dust and C&D dust that arises during construction. Taking note of the increasing air pollution and to keep dust material under control in towns and cities, the MoEF&CC has issued a Dust Mitigation notification in January 2018 under EPA, 1986; making mandatory dust mitigation measures in infrastructural projects and demolition activities in the country. This would help to keep the dust under control to reduce air pollution in metros and cities. The notified rules inserted 11-point measures in the existing act, thereby empowering the ministry to issue notices against local authorities and state agencies for non-implementation of those actions.

a) Road Dust

The amounts of fugitive dust present in the air is usually classified in two main size fractions, namely PM10 and PM2,5 with aerodynamic diameters less than 10μm and 2.5 μm respectively. To give a comparative indication of size, the PM10 fraction (i.e. from 2.5μm to 10 μm) is about one seventh the diameter of a human hair and is referred to as the coarse fraction. The PM2.5 fraction is referred to as the fine fraction. Both the PM10 and PM2.5 fractions are invisible to the naked eye. The very coarse fractions larger than these are particularly evident in traffic-generated dust. The amount of this dust that is generated and then re-settles on the road surface depends on various factors including traffic speed, vehicle weight, local road conditions and rainfall. The strength and direction of the wind is a highly influential factor on its transportation. The coarser fraction has local road safety, agricultural and environmental impacts on travelers and on residents near unpaved roads. The finer fraction can be transported more widely with potentially highly damaging impacts to health. The visible very coarse fraction that re-settles on the road surface is then also subjected to grinding and re-grinding by traffic to produce the coarse and fine particles as defined above. Unpaved roads provide an almost inexhaustible supply of dust. The surface of unpaved roads is disturbed regularly so that dust particles are entrained into the air by every passing vehicle. The action of the vehicles wheels also pulverizes the road material into ever decreasing particle sizes so that dust of all sizes is continually being produced, including the potentially dangerous PM10 and PM2.5 fractions. Vehicle movement is one of the main dust-producing activities in the road sector. The shearing action by the tyres on the road surface creates loose material that is then transported into the air by the turbulence caused by the movement of the vehicle. This action is present on both paved and unpaved roads. On paved roads dust, which is often contaminated by fuel products and other

pollutants are continually disturbed and made airborne. On unpaved roads, high volumes of surfacing material are available to be transported into the air as dust clouds and these may also contain other air-borne pollutants. High vehicle speed is an important factor in generating dust due to the increased transfer of energy disturbing the dust from the surface of the road and the greater turbulence which transfers a greater amount of dust into the air.

Figure 53: Road Dust of Meerut city

In the absence of quantitative information, it is only possible to speculate what the impacts of traffic-generated dust on health might be in developing countries. Figures given by the WHO indicate the potentially damaging health effects of exposure to PM10 and PM2.5 particulates in the developing world, especially on women and children. Extrapolation of the results from studies undertaken in developed countries can, to some extent, provide information on some of the probable impacts. Given the number of variables involved, professional research expertise in the health sector will be needed to obtain the data required to enable the impact of traffic-generated dust on health to be quantified. However, from the available data and the statistics provided by the World Health Organization, it is possible to speculate on the impacts to some degree. It is highly likely that impacts of long-term exposure to dust experienced by children and adults living close to and travelling regularly along unpaved roads will be additive to the high concentration levels from exposure to other sources of particulates (biomass fuels) that cause the 1.5 – 2.0 million premature deaths amongst mostly women and children in developing countries.

b) Paved and Unpaved Road Dust

Dust emissions from paved and unpaved roads have been found that these vary with the 'silt loading' present on the road surface and average weight of vehicles traveling on the

road. The term silt loading (sL) refers to the mass of the silt-size material (equal to or less than 75 µm in physical diameter) per unit area of the travel surface. The quantity of dust emissions from the movement of vehicles on a paved or unpaved road can be estimated using the following empirical expression (USEPA, 2000):

$$\mathbf{E_{ext}=[k*(sL)^{0.65}*(W/3)^{1.5}]*[1-P/N*4]} \quad (2)$$

Where

E = particulate emission factor (having units matching the units of k),

sL = road surface silt loading (grams per square meter) (0.06 g/m2), and

W = average weight (tons) of the vehicles traveling the road (1.2 tons).

Eext = annual or other long-term average emission factor in the same units as k,

P = number of "wet" days with at least 0.254 mm (0.01 in) of precipitation during the averaging period (120 days), and

N = number of days in the averaging period (365).

k: constant (a function of particle size) in g VKT-1 (Vehicle Kilometer Travel)

*_Source AP-42 (Chapter 13)_

The mean weight of the vehicle fleet (W) was estimated by giving the weightage to the percentage of vehicles of all types with their weight. Then the emission rate (g VKT-1) was calculated based on Eq (2). VKT for each grid was calculated by considering the tonnage of each road. Then finally, the emission loads from paved and unpaved roads were found out by using Eq (2). The PM10 and PM2.5 emission from road dust is 12089.54 kg/day and 2980.21 kg/day, respectively. Silt load varies a lot. In winter and monsoon season, it is less due to moisture and dew atmospheric conditions. Emission are graphically represented in **Figure-54.**

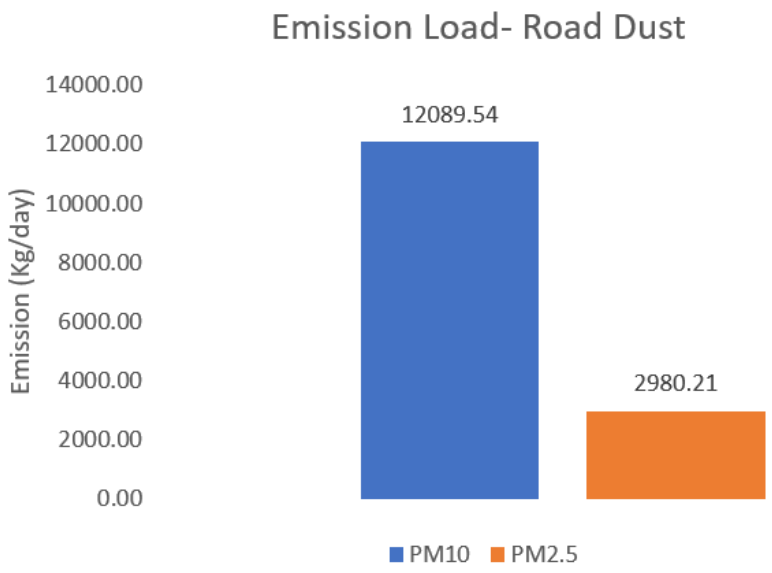


Figure 54: Emission Load for Road Dust(kg/day)

c) Construction and Demolition Dust

The emission factors given by AP-42 (USEPA, 2000) were used for estimating the construction and demolition emissions. The major construction activities include buildings (including residential housing and apartments) and flyover development. The areas under construction activities were calculated on the basis of data from UPPCB-regional office, Meerut and Google earth. Total emissions from construction and demolition activities are presented in **Table-19** and **Figure-55**.

Table 19: Classification of Construction Activities Emission Load (kg/day)

S.No	Particulars	PM10	PM2.5
1	Building Construction	180.92	72.37
2	Flyover/Road Construction	420.17	168.07
	Total	**601.09**	**240.43**

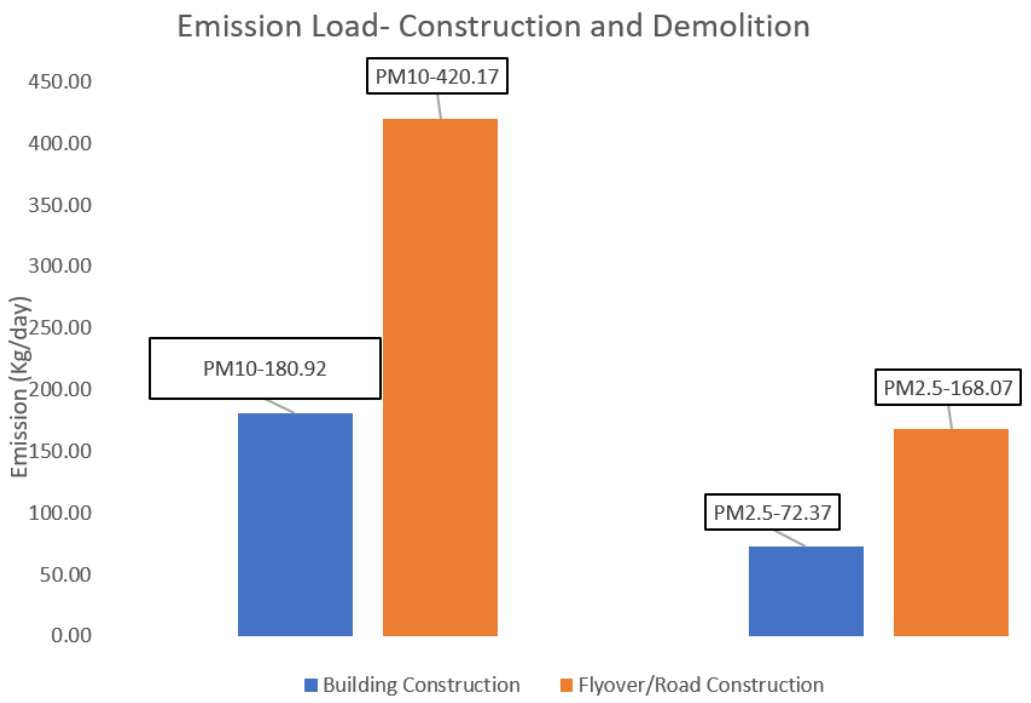


Figure 55: Emission Load from Construction and Demolition activities (kg/day)

The practices to be adopted in the construction projects for control of dust emissions are given in **Table-21**, below:

The strategy for control of road dust include-

i. Edge to edge paving/greening
ii. Water sprinkling on unpaved roads
iii. Making the roads pothole free
iv. Mechanical sweeping/vacuum cleaning of the paved roads
v. Night washing of the paved roads
vi. Regular monitoring of the dust load on the road and its effective removal
vii. Ensuring that the building material is fully covered while transporting
viii. Wheel washing
ix. Ensuring no C & D Waste stored on the road side
x. Evolve SOP for addressing the specific issue of disposal of collected dust from mechanical sweeping, taking into consideration all the above cited factors.
xi. Stringent implementation of C&D Rules, 2016, and Dust Mitigation notification, 2018, of Government of India.
xii. Sewage treatment plant-treated water sprinkling system along the roads and at intersecting road junctions and spraying of water twice a day before peak traffic hours.

d) Construction Dust

The details are listed in the table below and depicted in the map below:

Table 20: Details of ongoing construction projects

S.No.	Location of construction site	Latitude	Longitude	Type of construction
1	Partapur Railway Line, Meerut	28°53'35.2"N	77°37'34.8"E	Highway
2	NH34, Partapur, Aminagar Urf Bhurbaral, Meerut	28°54'36.1"N	77°38'20.6"E	Flyover
3	New Sainik Colony, Kankar kheda, Meerut,	29°02'12.0"N	77°40'41.5"E	Underpass
4	NH334, Modipuram, Meerut,	29°03'31.8"N	77°42'29.8"E	Flyover
5	"Sikka Krrish Greens" at Vill-Jatoli, Tehsil-Sardana, Distt-Meerut	29°02'24.8"N	77°40'32.7"E	Residential Project

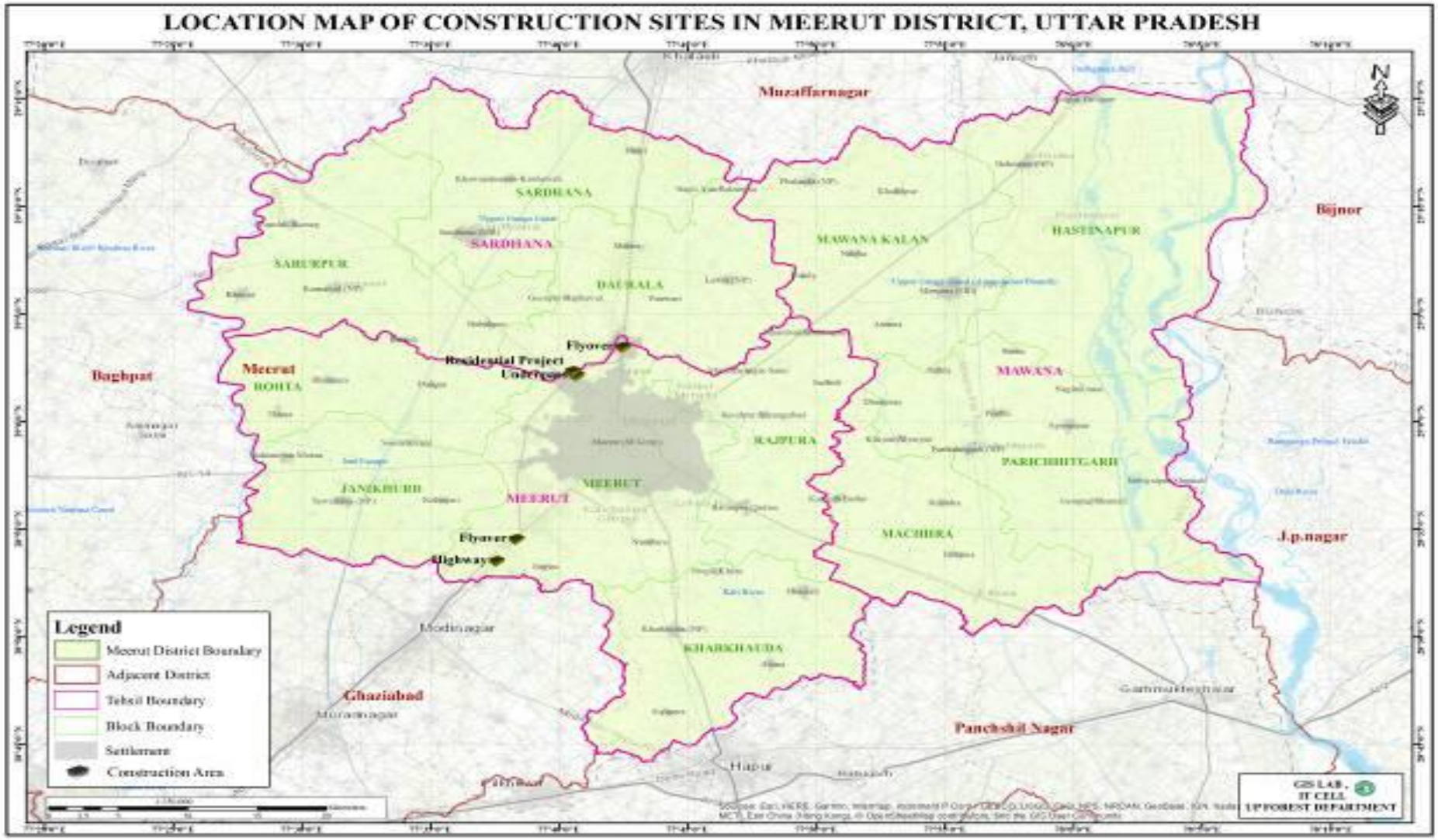


Figure 56: Construction Sites in Meerut

The practices to be adopted in the construction projects for control of dust emissions are given in the table below-

Table 21: Details of practices to be adopted for control of construction dust

Field	Practices to Reduce Emissions
Treated Water Application	Applying treated water to mitigate dust generation on construction site. (Water can be applied by a variety of methods, for instance **Anti-Smog Guns**, trucks, water pulls, water cannons, hoses, fire hydrants, sprinklers, etc.)
Dust Suppressants	Use of dust suppressants: (i) liquid polymer emulsions (ii) agglomerating chemicals (e.g., lignosulfonates, polyacrylamides); (iii) cementitious products (e.g., lime-based products, calcium sulphate); (iv) petroleum-based products (e.g., petroleum emulsions); and (v) chloride salts (e.g., calcium chloride and magnesium chloride).
Design	Designing layout of the construction site to minimize fugitive dust generation potential, including access roads, entrances and exits, storage piles, vehicle staging areas, and other potential sources of dust emissions.
	Use of pre-fabricated materials and modular construction units.
	Minimize distances travelled for delivery of materials
Site Preparation	Utilize wind fencing around the site
	Use of scaffolding sheets/nets for dust control
	Stabilize completed earthworks with stone/soil/geotextiles/Vegetation/compacting
	Reduce certain activities during windy conditions
Storage Piles	Utilize enclosures/coverings for storage piles e.g.. tarpaulins, plastic, agrished nets or other material
	Utilize wind fences/screens for storage piles
	Storage pile activity (Loading & unloading) should be conducted downwind
	Properly shape storage piles so that they do not have steep sides or faces. In addition, sharp changes of shape in the final storage pile should be avoided.
	Properly schedule the delivery of landscaping materials in order to minimize the storage time on site
Vehicles and Equipment	PUC Certificate for vehicles used for transport of materials
	Covering of building material during transportation

	Ensuring adequate stack height and acoustic enclosures for DG Sets
Material Handling & Transfer Systems	Remove material from truck underbodies and tires prior to leaving the site as well as implement techniques to periodically remove mud/dirt track out/carryout from paved streets at the access point(s).
	Prevent PM emissions from spills
	Capture fugitive dust emissions
	Ensuring proper collection, Segregation and disposal of C& D Waste and maintenance of log book for disposal
	Minimize material drop height at the transfer point and ensure enclosure around transfer point
Road Surfaces	Surface improvements to unpaved road surfaces
	Proper maintenance of unpaved roads
Fabrication	Applying water spray in conjunction with cutting, grinding & drilling
	Apply wet process for Sand and grit blasting and façade cleaning
	Ensure Mixing processes in enclosures
	Dust suppression/collection equipment should be attached when using sanding and cutting machinery. In addition, vacuum cleaning should be used whenever possible.
Monitoring	Installation of display board in Construction site mentioning the Details of statutory environmental clearance, Name, address, contact no. & email of Site In charge and owner
	Installation of PTZ Camera with open access to UPPCB
	Whether internal daily Monitoring Protocols Developed
	Daily Monitoring Spreadsheet and status of Monitoring

UPPCB has developed an online system of **Self Declaration of Dust Control Audit** dustapp.upecp.in for construction projects through which every construction project has to self-declare online status of dust mitigation measures in the project. The objective is to guide the project proponents and their site in charges, the relevant dust control measures to be taken up on one side and enthuse in them the system of self-auditing. This declaration will also be periodical so that the shortcomings in the dust mitigation measures may be addressed and declared by the projects. Besides this, UPPCB has also issued directions under the provisions of Air Act for installation of Pan Tilt Zoom Cameras in the construction projects and providing its open access to UPPCB so that 24x7 virtual monitoring may be done from the UPPCB end.

Figure 57: Construction Dust Site in Meerut City

K. Management of Solid Waste and garbage burning

a) Municipal Solid Waste (MSW) Burning emission estimation

Open burning activities are broadly classified into refuse and biomass burning. The refuse or municipal solid waste (MSW) burning depends on solid waste generation and extent of disposal and infrastructure for collection. The contribution of MSW burning may surprise many persons. It is a myth that MSW is not burned in Meerut. This emission is expected to be large in the regions of economically lower strata of the society which do not have proper infrastructure for collection and disposal of MSW. The emission factors given by CPCB (2011) and AP-42 (USEPA, 2000) were used for estimating the emission from MSW burning using the same procedure of emission density in city w.r.t. total population. The emissions from MSW burning are presented in **Figure-58.**

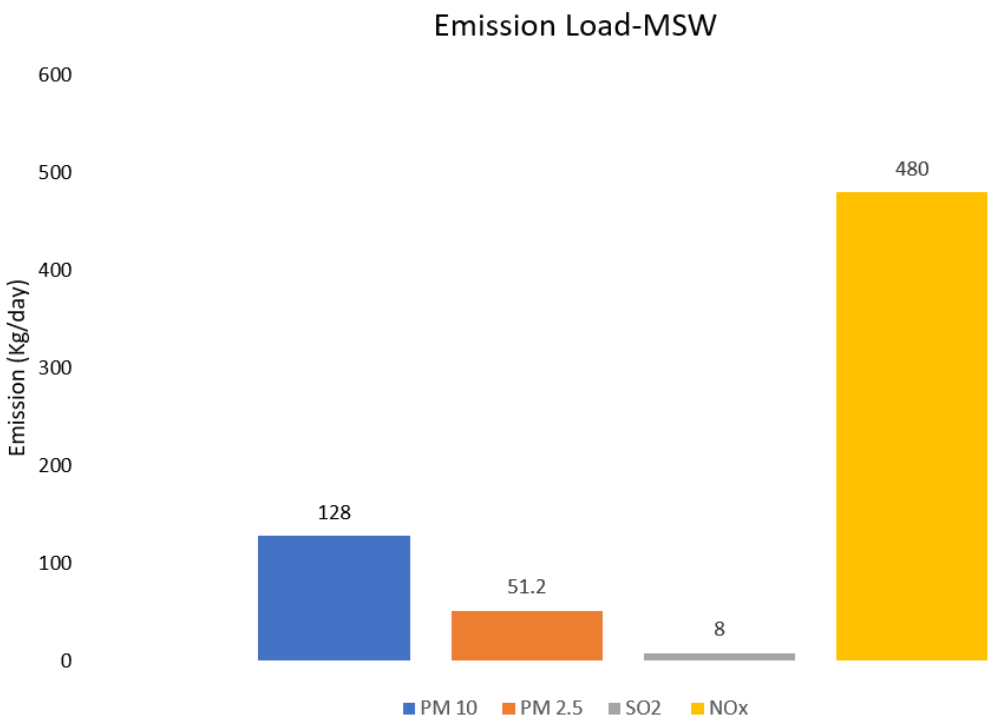


Figure 58: Emission Estimation for MSW Burning

b) Status and Gaps in MSW management

The city of Meerut has a 100% door to door collection of solid waste. The Solid Waste generation in Meerut city is estimated to be 800 Ton per day. Meerut city is divided into 90 wards. Door to door collection of Solid waste is being practiced in all the 90 Wards. Partial source segregation of Solid waste is done. The city has a Air Ballistic Separator of 150 TPD at Village Gawri wherein the Separation of waste into Plastic waste, Inert waste and Bio degradable waste is done. The Plastic waste, after separation, is sent to Waste to Energy plant of 1.0 MW capacity at Mohiddinpur, Delhi Road, Meerut. For disposal of the Inert waste component is land filling site is not available. The Bio degradable constituent is being dumped at scattered sites and subjected to composting through temporary measures like mixing of culture etc. Rest of solid waste of city, approximately 650 TPD, is being dumped at present at Lohia Nagar, Hapur Road and Mangatpuram, Delhi Road, Meerut. It is evident from the table that due to the shortage of treatment and processing facility, most the garbage collected is either burnt or dumped in the dumping sites. This further adds in to the deterioration of air quality of the city.

Figure 59: Solid Waste Dump Site

c) Proposed plan for Solid Waste Management:

Solid waste management facility of 240 TPD capacity is proposed to be installed and commissioned by December 2020. In addition, Material Recovery facility is also proposed by December 2020.

d) Details of legacy waste dumping site

Due to huge gap in the generation and treatment of MSW, the problem of legacy waste is very serious in Meerut City. However, the bio-remediation of the legacy waste has been started in Gawdi and about 1.00 lakh MT of legacy waste has been bio-remediated. This necessitates the strict vigil in on burning of MSW by the Nagar Nigam and UPPCB as a short-term measure. The Municipal Corporation must take up the establishment of MSW Treatment facility on war footings. As per future plan, the remediation of legacy waste shall be completed within 02 years.

Table 22: Details of legacy Waste dumping Sites in Meerut

S.No.	District	Name of Dumping site	Area (Ha)	Legacy Current	Estimated quantity of MSW (MT)	Name of ULB/ Panchayat	Disposal Plan (Yes / No)
1	Meerut	Village-Ganwadi	8	Legacy	50000	Nagar Nigam, Meerut	**No**
2	Meerut	Lohiya Nagar Village-Ghosipur, Hapur Road, Meerut	0.291	Legacy	10,00,000	Nagar Nigam, Meerut	**No**
3	**Meerut**	**Mangatpuram, delhi road, Meerut**	**3.6**	**Legacy**	**7,50,000**	**Nagar Nigam, Meerut**	**No**

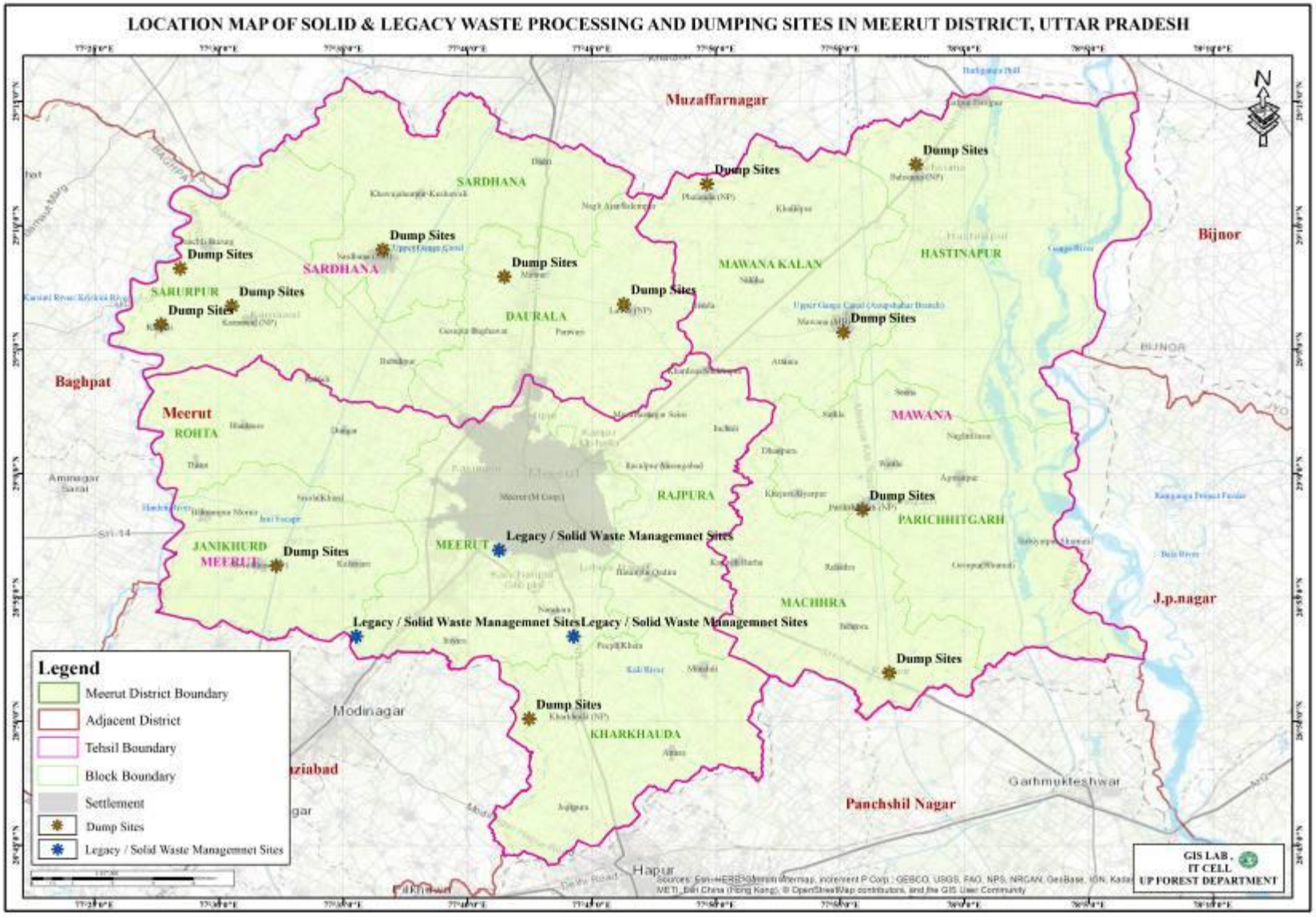


Figure 60: GIS map showing the Location of MSW treatment & dumpsites

Figure 61: Solid Waste Dump Site

L. Greening & Afforestation

Population growth, climate change, resource depletion, pollution and urbanization are all major global challenges facing humankind and nowhere more than in our cities. The quality of our urban environments is particularly at risk and vulnerable. As we move towards a more sustainable future it is critical that cities adapt to and address these contemporary challenges.

The role of green infrastructure in addressing the challenges of the 21st century cannot be underestimated. It is a natural, service providing infrastructure that is often more cost effective, more resilient and more capable of meeting social, environmental and economic objectives than 'grey' infrastructure.

The growth of future cities depends upon how well we are able to plan for the 'unplanned'. The generic theme evolving is that as cities expand, the 'informal' sector grows faster than the 'formal' sector. This means that our plans will need paradigmatic change to deal with the heterogeneous housing and mobility needs of growing city populations. We will have to plan spaces for activities that cannot always be well-defined and predicted. It is better to plan for what is inevitable than to turn a blind eye to the future.

In many cases a substantial transformation of city environments will be required to create effective Green Infrastructure and achieve a better balance between green and grey. However, by recognizing nature as an opportunity for an effective solution and by realizing that Green Infrastructure can be integrated and linked into existing and future built developments in an attractive way, the potential is there to create more livable cities with reducing impact of air population in particular on the people living in the Cities.

Urban particulate air pollution is a serious health issue. Green Infrastructure including trees within cities can remove fine particles from the atmosphere and consequently improve air quality and human health. Tree effects on PM2.5 concentrations and human health have been modeled and it has been found that the total amount of PM2.5 removed annually by trees varied from 4.7 tonnes to 64.5 tonnes, with annual values varying from $1.1 million in Syracuse to $60.1 million. Most of these values were from the effects of reducing human mortality.

a) **Green Infrastructures** - "Green infrastructure" is defined as open spaces, natural areas, urban woodland and parks; green streets, squares and public realm; sustainable drainage systems and healthy waterways, cycle ways and pedestrian routes within our city environments; and smaller scale green roofs, walls and facades. It has got following benefits-

Table 23: Benefits of Green Infrastructure

Environmental Benefits	Economic Benefits	Social Benefits
Improved Visual Amenity	Increased Property Prices	Encouraging Physical Activity
Enhanced Urban Microclimate	Increased Land Values	Improving Childhood Development
Improved Air Quality	Faster Property Sales	Improved Mental Health
Reduced Flood Risk	Encouraging Inward Investment	Faster Hospital Recovery Rates
Better Water Quality	Reduced Energy Costs via Microclimate Regulation	Improved Mental Health
Improved Biodiversity	Improved Chances of Gaining Planning Permission	Improved Workplace Productivity
Reduced Ambient Noise	Improved Tourist and Recreation Facilities	Increasing Social Cohesion
Reducing Atmospheric CO2	Lower Healthcare Costs	Reduction in Crime

b) Types of GIs

The following types of Green Infrastructures have been developed in the Cities across the world under different initiatives. However, this list is not exhaustive-

i. Miyawaki Forests
ii. Urban Forests
iii. Bio-diversity Parks & Wetlands
iv. Green Belts
v. Green Pavements
vi. Vertical Gardens & rooftop green houses
vii. Rooftop Greens
viii. Multilayered and integrated green infrastructure
ix. Green Walls
x. Sustainable drainage system to clean by nature the Road run off
xi. Water roofs to attenuate storm water flows — by storing water temporarily on a flat roof.
xii. A pocket park: green space is valuable at all scales in the urban environment.

c) Challenges

The challenges for development of green infrastructure in particular reference to the Non-Attainment Cities of Uttar Pradesh include-

i. Absence of baseline and mapping of spaces available for retrofitting the City with nature
ii. Limited availability of space
iii. Know-how for development of Green Infrastructure & their SOPs
iv. Suitability of type of GI for a particular City and space available
v. Suitability of GIs on the basis of maximising the impact on air pollution and particulate matter
vi. Interventions for future city planning without infringing the development of the City
vii. Low Cost approach for development of suitable high impact GIs in consonance with the 7R principle

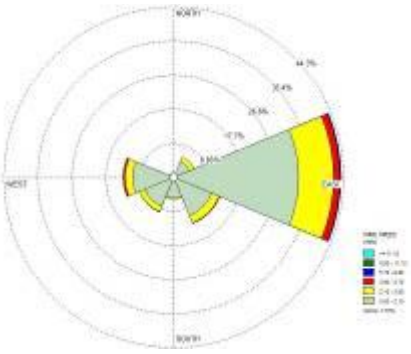
d) Future Strategy

i. **Planned retrofitting of the City and development of with green Infrastructures** - and The UPPCB intends to institute a study for developing a plan for development of Green Infrastructures in Non-Attainment Cities of Meerut along with the environmental & economic suitability and also providing with the Standard Operating Procedures for all types suitable GIs in a cost effective manner for overall improvement of City Environment with particular reference to the reduction in air pollution & particulate matter. The proposed study includes preparation of a plan for development of GIs in 16 NACs of Uttar Pradesh including Meerut under the following detailed scope-

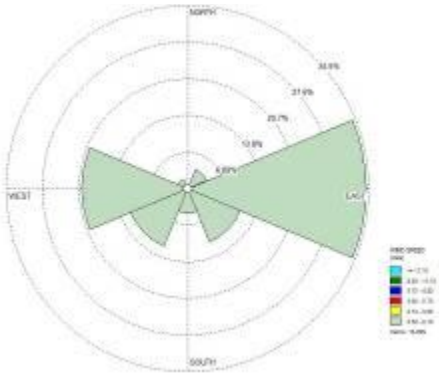
- Reconnaissance Survey of all 16 NACs (Lucknow, Kanpur, Agra, Prayagraj, Varanasi, Jhansi, Khurja, Gajraula, Ghaziabad, Noida, Anpara, Bareilly, Moradabad, Meerut, Raibareilly & Firozabad) of Uttar Pradesh for the initial assessment of the types of space available for retrofitting the City with green Infrastructure

- Identification of Types of workable GIs for 16 NACs of Uttar Pradesh
- Suitability analysis of GIs with reference to Cost and reduction in pollution and specifically the reduction of air pollution in NACs on the basis of wind-rose diagrams
- Identification of ways and means of using the wastes for development and maintenance of GIs in order to reduce cost on the lines of 7R principle
- Preparation of SOPs for development of suitable GIs
- Preparation of GIS map of NACs to identify the spaces available for development of suitable GIs
- Development of an action plan for retrofitting the NACs with the GIs and suggestions for future planning for development of GIs after stakeholders consultation
- Publication of a bilingual field guide for the use of the ground level functionaries of the Government Department/Agencies to facilitate them the work of development of suitable GIs in cost effective and time bound manner.

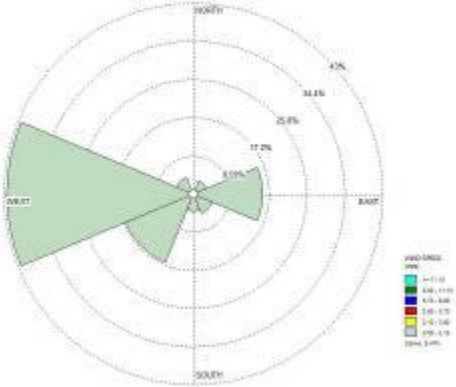
ii. **Taking up Afforestation on the basis of wind-rose study**– The wind rose for the four seasons have been plotted which indicate that the predominant wind direction is blowing from East, Northeast and Southeast direction. The wind pattern is very helpful in demarcating the locations preferable for plantation so that they may act as barriers to air pollution in the downwind direction. The detailed area identification for plantation/development of Miyawaki Forests on the basis of wind rose pattern is enclosed as **Annexure No.- II**



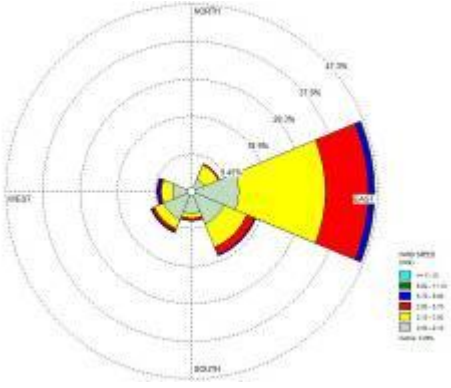
Winter season (Jan- Feb)



Summer season (March-May)



Monsoon season (June- September)



Post-monsoon (October – December)

M. Agriculture residue burning

Agricultural residue burning has been one of the key factors responsible for sudden deterioration of air quality during post-monsoon season. The table below lists out the number of burning incidents in Meerut city during the months of October and November.

Table 24: Details of agricultural residue burning incidents in Meerut

Sources	Time Duration	No. of Crop Burning Cases in Meerut
Paddy Crop Residue Burning	01-10-2016 TO 30-11-2016	123
	01-10-2017 TO 30-11-2017	128
	01-10-2018 TO 30-11-2018	40
	01-10-2019 TO 30-11-2019	38

Meerut district has been classified in the Orange Zone in the state on the basis of vulnerability survey which means that the vulnerability for stubble burning is not very high. Various measures have been taken at both state and district level to stop agricultural residue burning. These measures include:

a) A ban on burning of agriculture waste and crop residue has been imposed by the Environment Department under provisions of Air act on 28.10.2015.

b) Govt. order dated 10.02.2017 has been issued by the Department of Agriculture to ensure the use of combined harvesting machine and straw ripper with binder to restrict burning of agricultural residual waste.

c) A scheme of "Promotion of Agriculture Mechanization for In-Situ management of crop residue is being run since financial year 2018-19

d) An order dated 05.01.18 has been issued by UPPCB for using a minimum 20% of bio briquette as fuel in the boiler depending upon its availability

e) Fines and penalties are being charged if any burning case is reported

f) Under ex-situ management of crop residue, the paddy crop residue is being supplied to the cow shelters of the district.

g) Under ex-situ management of crop residue, 01 Bio CNG Plants of capacity 5.1 MT is proposed 01 in Meerut which is likely to be established by 2022.

All these efforts have resulted in decrease of burning incidents and strict implementation of all the measures will ensure complete stoppage of agricultural residue burning in the coming years.

XII. IDENTIFICATION AND POLLUTION MITIGATION IN THE HOTSPOTS

As preventive action for winter pollution draws attention in Delhi and the National Capital Region (NCR), the focus of Government's policy has shifted towards highly polluted locations and neighborhoods or the pollution hotspots. The Environment Protection (Prevention and Control) Authority [EPCA] while directing implementation of Graded Response Action Plan (GRAP) for daily emergency action from October 15, 2019 onwards, has also sought local action plans for targeted pollution hotspots — 16 in UP-NCR. This focus on hotspot action is consistent with the global trend in which governments not only aim to reduce ambient air pollution but also protect vulnerable communities from extremely harmful local exposure; and strengthen health protection for all. Following Hotspots have been identified in Meerut City-

Table 25: Details of hotspots in Meerut

Cause	Name of the Hotspot	Location	
		Latitude	Longitude
Road Dust/Unpaved Roads	Partapur to Modipuram (Bypass road) NH 58	28°54'53.0"N	77°38'30.5"E
		29°02'52.9"N	77°42'27.3"E
	Begumpul to Bijlibumbabypass, (Hapur road)	28°59'41.7"N	77°42'19.3"E
		28°55'50.7"N	77°41'50.8"E
	Begumpul to Partapur (Delhi road)	28°59'41.7"N	77°42'19.3"E
		28°54'53.0"N	77°38'30.5"E
Industrial	Partapur Industrial area	28°55'39.4"N	77°39'25.2"E
	Mohkampur Industrial area	28°56'58 N	77°40'27 E
	Hapur Road &Dheerkhera Industrial area	28°76'62.31"N	77°76'81.04"E
Vehicular/Traffic Congestion	Garh Road	28.961897 N	77.745348 E
		28.96195 N	77.745188 E
		28.956368 N	77.753642 E
	Shohrab Gate Bus Stand	28.970023 N	77.722565 E
	Hapur Road	28.946039 N	77.723473 E
		28.946049 N	77.723473 E
		28.946048 N	77.723465 E
	Hapur-Delhi Link Road	28.971017 N	77.701469 E
	HRS Chowk	28.973823 N	77.691185 E
		28.97384 N	77.691175 E
Garbage Dumping/Burning	Village- Ganwadi	28°53'25.3" N	77°35'31.3"E
	Lohiya Nagar Village- Ghosipur, Hapur Road, Meerut	28°53'25.3"N	77°44'16.1"E
	Mangatpuram, delhi road, Meerut	28°56'54"N	77°41'16"E

The hotspot action plans to be finalized by October 15, are expected to identify local pollution from non-compliant stack emissions, fugitive emissions, open burning of industrial waste and municipal solid waste and dust generators for stronger local action. This will include penalty and deterrence. The pollution hotspot action plans will also provide for night patrolling and responsive action based on complaints. These hotspots have been identified by the Central Pollution Control Board (CPCB) and the UPPCB. The assessment of hotspots is currently generic and does not have any legal definition.

XIII. PROPOSED ACTIONS

Short term &Long-term Action Plan along with the clearly defined timelines, cost estimates, Budget provisions and the responsible department/agencies is enclosed as **Annexure No-I**

XIV. COST ESTIMATES

All Figures in Rs. Lakhs

S.No.	Interventions	Total Fund required	Funds Allocated	Funds released	Funds Utilized	Additional Funds Required
1.	Capacity building, monitoring network and source apportionment	1288.31	635.96	635.96	503.96	405
2.	Public outreach	22.0	-	-	-	-
3.	Road dust activities	3072.67	2250.67	2157	635	-
4.	Construction activities	67.34	33.67	-	-	-
5.	Vehicles	100				50
6.	Industries	90	-	-	-	80
7.	Waste and biomass-dumping and burning	6.02	-	-	-	-
	Total	**4646.34**	**2920.3**	**2792.96**	**1138.96**	**535**

XV. MID TERM EVALUATION OF THE ACTION PLAN

The Action Plan shall be evaluated after the completion of comprehensive Source Apportionment Study and the Carrying Capacity Study is done in order to-

a) Review the impact of various actions based upon the monitoring of various pollution sources and their impact upon the ambient air quality

b) Prioritizing the action points on the basis of findings of the abovementioned studies

ANNEXURE NO.-I

Summary

Basic Information		
Name of Non-Attainment City		Meerut
Sate/ Union Territory		Uttar Pradesh
Name of Nodal Officer at PCB/ PCC		Rakesh Kumar Tyagi, Chief Environmental Officer
Email Id		ceolab@uppcb.com
Contact Number		7839891707
Action Point Code	Sector	Total Number of Actions
CB	CAPACITY BUILDING, MONITORING NETWORK AND SOURCE APPORTIONMENT	
PO	PUBLIC OUTREACH	
RD/ C&D	ROAD DUST AND CONTRUCTION & DEMOLITION	
VE	VEHICLES	
IP	INDUSTRIES	
BB/DF	WASTE AND BIOMASS- DUMPING AND BURNING	
AQ	AIR QUALITY DATA	

CAPACITY BUILDING, MONITORING NETWORK AND SOURCE APPORTIONMENT

Action Point Code	Action Point	Department/ Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs. Lakh)	Additional Funds Required (Rs. Lakh)	Source of Funding
CB1	**Insatllation& Commissioning of Monitoring Stations**													
CB1.1	CAAQMS	UPPCB	Number of CAAQMS	05 CAAQMS	Feb-21	03 CAAQMS	Yes	List of locations of CAAQMS	1000.0(With purchase, installation and 05 years of O & M)	600	600	480	400 (With purchase, installation and 05 years of O & M)	15 FC
CB1.2	Manual Stations	UPPCB	Number of Manual Stations	03 Manual Stations	Dec-20	01 Manual Station	Yes	List of locations of Manual Stations	10.56 (for O&M per year) for 03 stations *As per CPCB guidelines under NAMP*	8.96 (for O&M per year) for 02 stations	8.96	8.96	5.0	15 FC
CB3	**Assessment of sources**	UPPCB												
CB3.1	Emission Inventory	UPPCB	Yes	1	06 months after receiving the fund from MoEF&CC/15th FC	NA	NA	NA	8.0	0	0	0	0	15 FC
CB3.3	Source Apportionment Study	UPPCB	Yes	1	March, 2022	NA	NA	NA	70	0	0	0	0	15 FC
CB4	**Training & Capacity Building**							Steps taken						

Action Point Code	Action Point	Department/ Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs. Lakh)	Additional Funds Required (Rs. Lakh)	Source of Funding
CB4.1	Development of online training module with online test & certificate generation facility for training & skill development of public officals on Waste Management and ensure periodic trainings	UPPCB, Directorate of Environment & Concerned Departments	Number of modules developed & no of trainings organised	4 Modules	31.03.2020	NA	NA	NA	35 Lakh	27 Lakh	27 lakh	15 Lakh	NA	State/ UPPCB Consent Funds
CB4.2	Infrastructure development (Laboratory/ AQM Cell)	UPPCB	Yes	AQM Cell in Regional Office	March, 2021	NA	NA	NA	Capex 20.0 Opex 5.0/Year	0	0	0	NA	15 FC
CB4.3	Enforcement Units	UPPCB /Nagar Nigam/ Development Autority	Yes	3	Dec-20	_	NA	Details of Enforcement Units along with the facilities provided	24.75 lakh (@ 8.25 lakhs per unit including vehicles and 01 Staff)	0	0	0	NA	15 FC
CB4.4	Development of online training module with online test & certificate generation facility for skill development for improving operation of Air Pollution Control	UPPCB, Directorate of Environment & Concerned Departments	Number of modules developed & no of trainings organised	3	31.03.2021	_	NA	NA	30 Lakh	_	_	NA	NA	State/ UPPCB Consent Funds /CSR

Action Point Code	Action Point	Department/ Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs. Lakh)	Additional Funds Required (Rs. Lakh)	Source of Funding
	Systems installed at sources, operation of brick kilns, Cane Kohus etc. and ensure periodic trainings													
CB4.5	Conduct study on developemnt of Green Infrastructures in the City for Identification of suitable green infrastrucures for control of air pollution and earmarking the places on GIS platform along with a publication of a field guide of SOPs	UPPCB	Yes	1	31.06.2021	Award of Study by UPPCB	Yes	Details of ToR and progress	10 Lakhs	_	NA	NA	NA	State/ UPPCB Consent Funds /CSR
CB5	**Emergency Response System**	State Disaster Management Authority/UPPCB	Yes	GRAP (Graded Response Action Plan) implemented	NA	NA	NA	Copy of GRAP	NA	NA	NA	NA	NA	NA
CB6	**Carrying Capacity**													

Action Point Code	Action Point	Department/ Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs. Lakh)	Additional Funds Required (Rs. Lakh)	Source of Funding
CB6.1	Assessment of Carrying Capacity of NAC	UPPCB	Yes	1	Dec-22	NA	NA	NA	75.0	0	0	0	NA	15 FC
CB6.2	Revision of Master Plan on the basis of Carrying Capacity of NAC	Meerut Development Authority	Yes	NA	At the time of revision of Master Plan	NA	NA	NA	NA	NA	NA	NA	NA	Meerut Development Authority Funds
***In case timeline extends to more than one year the annual targets must be fixed.**														
****Mention specific numeric identity to the attachment. Example- Attachment-1**														

PUBLIC OUTREACH

Action Point Code	Action Point	Department / Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs. Lakh)	Additional Funds Required (Rs. Lakh)	Source of Funding
PO1	**Public Outreach**													
PO1.1	Daily Air Quality Public Information Dissemination System	UPPCB/ CPCB	Yes	SAMEER App of CPCB is functional	Achieved	NA	NA	NA	NA	NA	NA	NA	NA	NA
PO1.3	Issue public advisory for prevention and control of air polltuion by newspaper publication and radio jingles	UPPCB	Number	Continuous Activity as and when needed	NA	NA	Yes	Number and detail of public advisories issued	5.0/Year					NCAP/15th FC
PO1.4	Deeper public engagement and consultation (Hackathons/Workshops/ Programmes in schools/ colleges)	UPPCB/ DIOS/ University / Colleges	Number	Continuous Activity	NA	NA	Yes	Number & details of public awareness events held	10.0/Year					NCAP/15th FC
PO1.6	Develop & online awareness/orientation module with online test & certificate generation facility for Common Citizen in order to ensure their participation (**ParyavaranPrahari**) in control of air pollution and ensure regular online training	UPPCB/Directorate of Environment	Yes	1	31.03.2021	NA	No	Number of Citizens trained/oriented	7.00 Lakhs	Nil	Nil	NA	NA	UPPCB/CSR
PO2	**Public GreivanceRedressal System**													

Action Point Code	Action Point	Department / Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs. Lakh)	Additional Funds Required (Rs. Lakh)	Source of Funding
PO2. 1	App Based System	UPPCB	Yes	Swacchavayu app is functional	Achieved	NA	No	Number of complaints registered and number of complaints resolved per month	NA	NA	NA	NA	NA	NA
***In case timeline extends to more than one year the annual targets must be fixed.**														
****Mention specific numeric identity to the attachment. Example- Attachment 1**														

ROAD DUST AND CONTRUCTION & DEMOLITION

Action Point Code	Action Point	Department/ Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs. Lakh)	Additional Funds Required (Rs. Lakh)	Source of Funding
RD1	**Road dust**													
RD1.1	Immediate lifting of solid waste generated from disilting and cleaning of municipal drains for its disposal	Nagar Nigam/Development Authority	No.	14 large drains/2	30-06-2020/ 31.3.2021	14 drains / 2 drains	Yes	List Enclosed / Drains of Lohianagar&Shatabdinagar	42 Lacs	NA	NA	NA	NA	Development Authority Fund
RD1.2	Maintain potholes free roads	Nagar Nigam/ Development Authority	No.	35.8 Km/16km	Sep, 2020/ 31.3.2021	38.8K m/ 16km	Yes	List Enclosed / Strengthing of roads in shatabdinagar&LohiyanagarYojna	750 lacs	NA	NA	NA	NA	Development Authority Fund
RD1.3	Regular cleaning of street surfaces and spraying of water to suppress dust.	Nagar Nigam/Development Authority	No.	94 km/57 km	as required/ 31.3.2021	94km/ 57km	Yes	List Enclosed/ Regular cleaning of roads of the shatabdinagar&LohiyanagarYojna.	30 Lacs	NA	NA	NA	NA	Development Authority Fund
RD1.4	Black-topping of unpaved road	Nagar Nigam/Development Authority	km	NA	NA	NA	NA	NA		NA	NA	NA	NA	NA
RD1.6	To take appropriate action to remove road dust/silt regularly by using mechanical sweepers	Nagar Nigam/Development Authority	No.	2	31.12.2020	31-Dec	Yes	two mechanical sweeping machine are in process of purchasing/ Development authority is not having mechanical sweeping machine. There are manually sweeping of the roads of the scheme which are	NA	NA	NA	NA	NA	MNN Funding

Action Point Code	Action Point	Department/ Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs. Lakh)	Additional Funds Required (Rs. Lakh)	Source of Funding
								under the maintenance of development authority.						
RD1.7	End-to-end paving of the road	Nagar Nigam/Development Authority	Km	6 km	31.03.2021	As per availability of fund		Estimate Under Preparation/ End to end paving of the road is not recommended in scheme of development authority. Road side are left unpaved for percolation of water.	As per availability of fund/ NA	NA	NA	NA	NA	Development Authority Fund
RD1.9	Introduce water fountain at major traffic intersection	Nagar Nigam/Development Authority	No.	NA	NA	NA	NA	three water fountain are existing 1-Bachcha park Chowk 2-Commissionary chowk and 3-Ambedkar Chowk/ Development authority have no plan to introduce water fountain at major traffic junction for this year.	NA	NA	NA	NA	NA	NA
RD1.11	Improvement of infrastructure for decongestion of road.	Nagar Nigam/Development Authority	NA	NA	NA	NA	NA	No Fly-overs, ROBs, By Pass, Peripheral Roads are proposed for this financial year by the development authority	NA	NA	NA	NA	NA	NA

Action Point Code	Action Point	Department/ Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs. Lakh)	Additional Funds Required (Rs. Lakh)	Source of Funding
RD1.12	Designing and Construction of environment friendly roads	Forest Department/Horticulture/Nagar Nigam & Development Authorities	Km	2.1 lm	31.10.2022	2.1 km	yes	Enclosed list of main roads of other department / 45 meter wide connecting road in between mawana road to killa road. Total length of road 2.1km.	19.50 crore	19.50 crore	19.50 crore	5.5 crore	NA	External development fund of Meerut development authority Meerut.
RD1.13	Implement truck loading guidelines; use of appropriate enclosures for haul trucks; gravel paving for all haul routes.	Nagar Nigam, Development Authority, Construction Agencies	Yes	NA	NA	NA	NA	Details on the steps notification copy	NA	NA	NA	NA	NA	NA
RD1.14	Identify road stretches with high dust generation	Nagar Nigam/Development Authority	No.	1	NA	NA	yes	1-D.N. colloge to Ghantnaghar to Bhudana gate to Indrachowk	NA	NA	NA	NA	NA	MNN Funding
RD1.15	Create Proper Pedestrian & Cycling Infrastructure	Nagar Nigam/Development Authority	Km	1km	31.03.2021	1 km	yes	Footpath are proposed along the TejGarhi crossing, Jail Chungi crossing & HRS chowk of Meerut City.	60 Lacs	60 Lacs	_	_	_	Development Authority Fund

Action Point Code	Action Point	Department/ Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs. Lakh)	Additional Funds Required (Rs. Lakh)	Source of Funding
RD1.16	All the canals/nullah's side roads should be brick lined. Proper plantation also carried out.	Irrigation Department/ Forest department	ha	NA	NA	NA	Yes	Irrigation Dpt. has already constructed the roads of canals under the juridiction of blocks of irrigation dept. and planted 9200 plants in the financial year of 2020-21 and planted in future as per decided by the Government.	NA	NA	NA	NA	NA	Irrigation Funding
RD1.17	Development of infrastructure for use of treated water of STPs for dust suppression and irrigation	Nagar Nigam/Development Authority	No.	13 STP	Regular activity	13 STP		treated water is being used for suppression of Dust	NA	NA	NA	NA	NA	Development Authority funding Funding
RD1.18	Regular monitoring of dust load on major roads of the city	Jointly by UPPCB, Nagar Nigam & Development Authority	Yes	94 km/57 km	Regular activity	Regular Activity	Yes	Monitoring Reports	NA	NA	NA	NA	NA	NA
RD1.19	Prepation and implementation of Road dust hotspot action plan	Nagar Nigam/Development Authority	Yes	3	15.10.2020	NA	Yes	Progress of implementation	NA	NA	NA	NA	NA	NA
RD2	**Creation of green cover**													

Action Point Code	Action Point	Department/ Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs. Lakh)	Additional Funds Required (Rs. Lakh)	Source of Funding
RD2.2	Creation of green buffers along the traffic corridors and their maintenance	Forest Department/Horticulture/Nagar Nigam & Development Authorities	ha	NA/12.5km	-	NA/12.5km	Yes	the plantation work on all routes has been completed by FOREST Dpt. No further work left by the dpt. List enclosed /List Enclosed in wich green buffers is already existing (nagarnigam)	NA	NA	NA	NA	NA	Forest Dept. Fund
RD2.3	Necessary changes in byelaws-Greening of open areas, gardens,community places, schools and housing societies	Nagar Nigam & Development Authorities	Yes	NA	Achieved	Achieved	Yes	Necessary required changes has been made in latest revised building by laws attached.	NA	NA	NA	NA	NA	Nagar Nigam & Development Authorities
RD2.4	Urban Greening with green infrastructures (vertical garden, green pavements, pocket parks, City Forest, Miyawaki forest &grasscrete tiles etc.)	Nagar Nigam & Development Authorities	plantation no.	59000	31.03.2021	59000	NA	Vast Plantation of 35000 plants has been done as per target provided by the U.P. Govt. & Balance 24000 plants are to be planted in MIYAWAKI Park in Shatabadi Nagar Yojna.	202 Lacs	202 Lacs	202 Lacs	80 Lacs	NA	Development Authority Fund

Action Point Code	Action Point	Department/ Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs. Lakh)	Additional Funds Required (Rs. Lakh)	Source of Funding
RD2.5	Builders should leave 33% area for green belt in residential colonies to be made mandatory.	Nagar Nigam & Development Authorities	Yes	NA	NA	NA	Yes	Building byelaws abstraction concerned has been attached for 15% green, 33% green can be made mandatory only by state Govt.	NA	NA	NA	NA	NA	MNN Funding
RD2.7	Implementation of maintaining at least 33% forest cover area in the city in master plan.	Development Authority	yes	NA	2031	NA	Yes	In Meerut Master plan 2021 area for parks open spaces Green Belt & forest has been earmarked which is 18.59% of Total master plan area. For forest 3.5% of total length has been reserved.	NA	NA	NA	NA	NA	Devolopment Authority fund
C&D 1.1	Ensure transportation of construction materials in covered vehicles	Nagar Nigam/Development Authority/Construction Agencies/UPPCB	Yes	NA	Regular activity	NA	NA	order of NGT Shall be followed(Nagarnigam) /Construction material are transported in covered vehical. As per UPPCB/NGT guidelines. (MDA)	NA	NA	NA	NA	NA	NA

Action Point Code	Action Point	Department/ Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs. Lakh)	Additional Funds Required (Rs. Lakh)	Source of Funding
C&D 1.2	Strict enforcement of CPCB guidelines for construction (use of green screens, side covering of digging sites, etc.)	Nagar Nigam/Development Authority/Construction Agencies/UPPCB	Yes	NA	Regular activity	NA	Yes	order of NGT Shall be followed (Nagarnigam)/ Green screens are being used at site for covering the materials at on going construction site.(MDA)	NA	NA	NA	NA	NA	development Authority fund
C&D 1.3	Restriction on storage of construction materials along the road.	Nagar Nigam/Development Authority/Construction Agencies	No. of construction sites	6	Regular activity	NA	Yes	All material are stored on the construction site within barricading area to avoid traffic congestion (NHAI)/ In the Schemes Maintained by Development Authority. The const. Materials are not allowed to store on or along the road.(MDA)	NA	NA	NA	NA	NA	NHAI Funding/development Authority fund
C&D 1.4	Covering of construction site.	Nagar Nigam/Development Authority/Construction Agencies/UPPCB	No.of construction sites	6	Regular activity	NA	Yes	The Construction site has been barricaded and water stacking being done time to time on earth work to prepare (NHAI) /The construction site/ongoing projects under the development authority follow	NA	NA	NA	NA	NA	NHAI Funding/development Authority fund

Action Point Code	Action Point	Department/ Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs. Lakh)	Additional Funds Required (Rs. Lakh)	Source of Funding
								the Rules/Norms fixed by the NGT/UPPCB.(MDA)						
C&D 1.5	To create separate space/zone to handle solid waste, C&D waste and other waste in the city	Nagar Nigam	No.	1	Aug. 2021	_	Yes	C&D waste material recovery facility centre shall be established in village Naglatasi of cost 33.67 Lakh	33.67 Lacs	33.67 Lacs	NA	NA	NA	MNN Fund
C&D 1.6	To mandate facility of tar/brick/gravel lined road inside the construction site for movement of vehicles carrying construction material	Nagar Nigam/Development Authority/Construction Agencies/UPPCB	No.	Roads are already existing/6	NA	NA	Yes	The Vehicle movement on road only except in dumping area within construction site.(NHAI)/the const. sites of Development authority are in the schemes developed by the Development authority The roads are already in the schemes.(MDA)	NA	NA	NA	NA	NA	NHAI Funding/Development Authority fund
C&D 1.7	Promotion of the use of prefabricated blocks for building construction	Nagar Nigam/Development Authority/Construction Agencies/UPPCB	Yes	NA	NA	NA	NA	At present the prefabricated blocks are not used. In future it will be considered if it is required at construction site. (MDA)	NA	NA	NA	NA	NA	development Authority fund

Action Point Code	Action Point	Department/ Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs. Lakh)	Additional Funds Required (Rs. Lakh)	Source of Funding
C&D 1.8	Enforcement of Construction and Demolition Waste Rules	Nagar Nigam/Development Authority/Construction Agencies/UPPCB	Yes	yes/followed	Regular activity	NA	NA	Rules and regulation for C&D waste is being followed. (Nagarnigam)/The waste demolition material is stored in the camp office/batching plant area. For proper disposal and contractor has been directed to strictly comply the direction. (NHAI) /The Construction &Demolition waste Rules are Followed. (MDA)	NA	NA	NA	NA	NA	NHAI Funding/development Authority fund
C&D 1.9	Control measures for fugitive emissions from material handling-conveying and screening operations	Nagar Nigam/Development Authority/Construction Agencies/UPPCB	Yes	_	Regular activity	NA	NA	Contractor already directed to take all control measures for fugitive emissions from material handing at constructionzone. (NHAI) /NGT. Norms are followed for this purpose. (MDA)	NA	NA	NA	NA	NA	NHAI Funding/development Authority fund

Action Point Code	Action Point	Department/ Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs. Lakh)	Additional Funds Required (Rs. Lakh)	Source of Funding
C&D 1.10	Develop and implement dust control measures for all types of construction activities -- buildings and infrastructure.	Nagar Nigam/Development Authority/Construction Agencies/UPPCB	Yes	Followed/ 17.781km	Regular activity	Yes	NA	Dust control measures for the construction works carried out by the Development Authority and also by the Private Builders/Developers. (MDA)/Proper sprinkling on construction sites is being maintain with desired number of water tanker.(NHAI)	NA	NA	NA	NA	NA	NHAI Funding/development Authority fund
C&D 1.11	Enforce restrictions on construction activities within urban air shed zones during high pollution period	Nagar Nigam/Development Authority/Construction Agencies/UPPCB	Yes	Followed/ 17.781Km	NA	NA	NA	Its followed when such type of directions issued by the UPPCB or NGT. (MDA)/Enforce restriction on construction activities during high pollution period is strictly followed. (NHAI)	NA	NA	NA	NA	NA	NHAI Funding/Development Authority fund
C&D 1.12	Frame and implement policy for segregation of construction and demolition waste and provide a network of decentralized C&D waste segregation and collection sites	Nagar Nigam/Development Authority/Construction Agencies	No. of decentralised units	NA	NA	NA	NA	The construction & demolition waste are reused at the site. (MDA)/Nagar Nigam reuse of C& D waste of it self(Nagar Nigam)	NA	NA	NA	NA	NA	MNN Funding/Development Authority fund

Action Point Code	Action Point	Department/ Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs. Lakh)	Additional Funds Required (Rs. Lakh)	Source of Funding
	across the city.													
C&D 1.13	Promote recycling of construction and demolition waste.	Nagar Nigam/Development Authority/Construction Agencies	Yes	NA	_	NA	_	Recycling of dismantling waste is being recycled at plant for various construction activities. (NHAI)/Not required in the works carried out by the Development Authority.(MDA)	NA	NA	NA	NA	NA	NHAI Funding/Development Authority fund
C&D 1.14	Mandatory installation of PTZ Cameras in Construction Sites with open access to UPPCB	Nagar Nigam/Development Authority/Construction Agencies	No. of PTZ cameras	NA	15.10.2020	NA	NA	As per the latest UPPCB direction, all construction sites shall have PTZ cameras installed	NA	NA	NA	NA	NA	NA
C&D 1.15	Develop, ensure & monitor periodic online Self Declaration of Dust Control Audit by the Project Proponents/ Site In Charges on the portal http://dustapp.upecp.in/ developed by UPPCB	UPPCB	No of Self Declarations made	All Construction Projects	Regular activity	NA	Yes	Copy of the dashboard of the portal indicating the self-declarations and respective grades	5.00 Lakh	5.00 Lakh	5.00 Lakh	5.00 Lakh	NA	UPPCB Consent Funds

Action Point Code	Action Point	Department/ Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs. Lakh)	Additional Funds Required (Rs. Lakh)	Source of Funding
C&D 1.16	Appropriate combination of dry scrubber system/filters and wet scrubbing system should be installed for drier and flue gases to control fugitive and flue gas emission.	UPPCB/ Hot mix plant Agencies	Nos. of Hot Mix Plants	All Hot Mix Plants	Regular activity	NA	Yes	List of Hot Mix Plants and APCS installed	NA	NA	NA	NA	NA	NA
C&D 1.17	Mandatory installation of PTZ Cameras in Hot mix plants with open access to UPPCB for remote monitoring.	UPPCB /Hot mix plant Agencies	No. of PTZ cameras	NA	Oct. 2020	NA	NA	ID for PTZ camera access	NA	NA	NA	NA	NA	NA
C&D 1.18	New plants should be permitted only on LPG fuel. Promotion of fuel conversion to LPG in existing Plants	UPPCB /Hot mix plants Agencies	Nos. of Hot Mix Plants	NA	Regular activity	NA	NA	List of Hot Mix Plants using LPG	NA	NA	NA	NA	NA	NA

***In case timeline extends to more than one year the annual targets must be fixed.**

****Mention specific numeric identity to the attachment. Example- Attachment-1**

VEHICLES

Action Point Code	Action Point	Department/ Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs. Lakh)	Additional Funds Required (Rs. Lakh)	Source of Funding
VE1	**Improve and strengthen PUC programme**													
VE1.1	Number of PUC centers in the city	Transport Department	No. of PUC centers	74	31.03.2024	22	Yes	List of centres attached	NR	NA	NA	NA	NA	Transport Dept Funding
VE1.2	Regular checking of Vehicular emission and issue of Pollution under Control Certificate (PUC)	Transpot Department/ Traffic Police	No. of PUC issued	NA	NA	NA	NA	Regular Checking of PUC Certified is done by Enforcement Officers (RTO)/vehicles are being checked by traffic police officials on regular basis at important crossings all over the city. In total 43 points in the city traffic police is deployed and vehicles are being checked on regular basis. Whenever there is information of traffic congestion traffic is diverted and if there is necessity no. of checking points are increased. (Traffic Dept.)	NA	NA	NA	NA	NA	Transport Dept Funding/ Traffic Dept Funding

Action Point Code	Action Point	Department/ Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs. Lakh)	Additional Funds Required (Rs. Lakh)	Source of Funding
VE1.3	Auditing and reform of Pollution Under Control (PUC) certification	Transport Department	No.	NA	NA	NA	NA	All the PUC centres are regularly checked by technical officers & monitoring is being done regularly.	NA	NA	NA	NA	NA	Transport Dept Funding
VE1.4	linking of PUC centres with remote server and eliminate manual intervention in PUC testing.	Transport Department	Number	NA	Achieved	NA	NA	This exercise is already completed in the department as per directions of transport Commissioners UP	NA	NA	NA	NA	NA	Transport Dept Funding
VE1.6	Link PUC certificates with annual vehicle insurance	Transport Department	Yes		31.03.2023		Yes	Insurance Companies are being apprised of this action plan	NA	NA	NA	NA	NA	Transport Dept Funding
VE2	**Vehicle labelling or sticker programme**	Transport Department	No.	NA	31.03.2021	NA	Yes	Instruction have been given to PUC Centres for pasting stickers at the time of sale of vehicle. So that vehicle that are fulfilling pollution norms can be identified.	NA	NA	NA	NA	NA	Transport Dept Funding
VE3	**Freight transport**													
VE3.1	Use of off-peak passenger travel times to move freight and restrict the entry of heavy vehicles	Transport Department/ Traffic Police	Text	NA	Achieved	NA	NA	No entry of heavy vehicles areprohibited during 07:00 AM to 22:00 PM. During this period heavy	NA	NA	NA	NA	NA	Transport Dept Funding

Action Point Code	Action Point	Department/ Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs. Lakh)	Additional Funds Required (Rs. Lakh)	Source of Funding
	into cities during the day to continue							vehicle are restricted						
VE3.2	Provide truck rest areas/parks along national and state highways to prevent entry of trucks into cities during peak hours.	Transport Department/ Nagar Nigam & Development Authorities	Yes	NA	NA	NA	Yes	Concerned with nagarnigam/NHAI and other road construction agencies direction are given to all concerned department in district road safety committee meeting	NA	NA	NA	NA	NA	NA
VE3.3	Diversion of truck traffic	Traffic Police	Yes	NA	Achieved	NA	NA	Trucks and heavy vehicles are prohibited during 07:00 AM to 22:00 PM. They are diverted through bypass.	NA	NA	NA	NA	NA	Traffic Dept Funding

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VE3.4	Check overloading: Use weigh-in-motion bridges / machines (WIM) and Weigh bridges at entry points to the city to check the payload of commercial vehicles. As per the CMVR, a penalty of 10 times the applicable rate for overloaded vehicles is applicable.	Transport Department/ NHAI/ Road Construction Agencies	Yes	NA	Achieved	NA	NA	WIM is already installed in all lanes along with two SWB on both side toll plaza. Both WIM and SWB are functional and operational since last 2 years and penalty too is being levied to overloaded vehicles. Conclusively, this measure for air pollution control has already been implemented by NHAI	NA	NA	NA	NA	NA	Transport Dept Funding
VE3.5	Define routes, permits, fares, vehicle design and safety standards, and vehicle technology standards for para-transit vehicles.	Transport Department/ Traffic Police	Text	NA	Achieved	NA	NA	This direction is already been followed. All the taxis vehicle are already covered by different type of permits. Vehicle design and safety standards are regularly checked by technical officers	NA	NA	NA	NA	NA	Transport Dept Funding
VE4	**Clean fuel and fuel Quality**													

Action Point Code	Action Point	Department/ Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs. Lakh)	Additional Funds Required (Rs. Lakh)	Source of Funding
VE4.1	Check on fuel adulteration and random monitoring of fuel quality data	District Supply Officer/Oil companies	No.	170	31.03.2021 and then regular activity	170		Total petrol pumps in district Meerut is 170 and check on fuel adulteration and random monitoring of fuel quality data of all these petrol pumps regularly.	NA	NA	NA	NA	NA	Departmental Funding
VE4.4	Use of Bioethanol in the city/urban transport system/waste to energy.	Transport Department/Nagar Nigam	yes	NA	NA	NA	NA	This point has to be decided by government, not yet implemented. (RTO)/1 megawatt waste to energy plant is under process(Nagarnigam)	NA	NA	NA	NA	NA	MNN Funding
VE5	**Parking Management**													
VE5.1	Prevent parking of vehicles in the non-designated areas	Traffic Police/ Nagar Nigam	Number of areas	NA	NA	NA	NA	No parking areas are identified. Those vehicles found parked on roads area are toed by crane and challenged.	NA	NA	NA	NA	NA	Transport Dept Funding
VE5.2	Development of Multi-layer parking	Nagar Nigam/ Development Authorities	No. of places for parking	1	31.03.2022	NA	Yes	One multilevel parking is proposed in nagarnigam campus in smart city project of cost Rs. 4000 lakh.	NA	NA	NA	NA	NA	world bank funding

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VE5.3	Penalise parking of vehicles in non-designated areas	Traffic Police/ Nagar Nigam	No.of penalties	NA	Regular activity	NA	NA	Two type of penalties are effective in non-designated areas i.e. No Parking penalty is 500 rupees and crane charge rs 200 rupees	NA	NA	NA	NA	NA	Traffic Dept Funding
VE6	**Strengthening of Public Transportation**													
VE6.1	Regulate the taxi industry	Transport Department	Text	NA	NA	NA	Yes	Taxies are covered by a different type of permits, operating individually or attached with different travel agencies likes OLA, UBER	NA	NA	NA	NA	NA	Transport Dept Funding
VE6.2	Assess and introduce a city bus system of appropriate fleet size of small buses and desirable bus type replete with GPS tracking, ETVMs for fare collection and Passenger Information Systems.	Nagar Nigam/ Development Authorities	No.	10	31.03.2021		Yes	Meerut city transport bus service has 10 number of volvoinflete with GPS tracking, ETVMs for fare collection and passenger information system						MNN Funding

Action Point Code	Action Point	Department/ Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs. Lakh)	Additional Funds Required (Rs. Lakh)	Source of Funding
VE6.3	Develop route plan for bus operation; target trunk roads	Nagar Nigam/ Development Authorities	No.	5	NA	NA	Yes	5 Routes has already been defined and running. List Attached	NA	NA	NA	NA	NA	MNN Funding
VE6.4	Intermediate public transport (IPT) and bus system	Nagar Nigam/ Development Authorities	Number	NA	NA	NA	NA	After the completion of NCRTC Project, nagarnigam shall be planed for IPT	NA	NA	NA	NA	NA	MNN Funding
VE6.5	Introduction of new electric buses (with proper infrastructure facilities such as charging stations) and CNG buses for public transport which will reduce plying of private vehicles on road and help to curb tail-pipe emissions.	Nagar Nigam/ Development Authority/ Oil & Gas Companies	No.	50	31.03.2022	NA	NA	50 New Electric bus has been mentioned by UP Government and yet to come	NA	NA	NA	NA	NA	MNN Funding
VE6.6	CNG infrastructure for auto gas supply in the city and transition of public transport vehicles to CNG mode Introduction of	District Supply Officer/Nagar Nigam/Oil companies	No.	50	31.03.2021	NA	NA	50 New C.N.G. bus from Kanpur has been ordered by Government for Meerut city transport bus service	NA	NA	NA	NA	NA	MNN Funding

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	e-buses for Public transport in metro cities													
VE6.7	Steps for promoting battery operated vehicles like E-rickshaw/E-Cart	Transport Department/ Nagar Nigam & Development Authorities	No.	1000	31.03.2021	NA	Yes	Steps for promoting battery operated vehicles like E-rickshaw is lift up and 300 E-rickshaws are being already in operation in Meerut city and 700 E-rickshaws come up to 31.03.2021	NA	NA	NA	NA	NA	MNN Funding
VE7.	**Traffic Congestion**													
VE7.1	Conducting audit of traffic intersections and install functional traffic signals at all major intersections	Traffic Police	No.	NA	NA	NA	NA	Traffic signals are established at 13 places by municipal corporation and BOT (Heera Times)	NA	NA	NA	NA	NA	Traffic Dept Funding
VE7.2	Synchronize traffic movements/Introduce intelligent traffic system for lane-driving	Traffic Police	No. of Crossings	NA	NA	NA	NA	Work under ITMS is in Process and area traffic control system, traffic surveillance, traffic enforcement system and traffic command system is in	50 lakhs	NA	NA	NA	NA	nagarnigam through world bank funding

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								process under smart city project.						
VE7.3	Prepare plan for construction of diversion ways/ bypasses to avoid congestion due to nondestined vehicles.	N.H.A.I. /PWD	No.	6	–	Yes	–	At Construction site proper diversion has been made to avoid Traffic Congestion.	–	–	–	–	–	NHAI Funding
VE8	**Launch Public awareness campaign for air pollution control, vehicle maintenance, minimizing use of personal vehicle, lane discipline, etc.**	transport Department/ Traffic Police	No.	NA	31.03.2023	NA	Yes	Launch so many minimizing use of personal vehicle, lane disciplineetc public awareness campaign are regularly being conducted by transport dept. in deferentschools, busstands, taxi stands and other public places.	c	NA	NA	NA	NA	Transport Dept Funding
VE10	**To check the calibration of emission monitoring equipments, housed in Emission Testing Centers (ETCs) once in 6 months to know the status of equipments**	Transport Department	Yes	NA	31.3.2022	NA	Yes	Regular Checking of PUC Centres is done by Technical Officers. Mobile lab is required for Conducting these tests.	50 Lakh	NA	NA	NA	50 Lakh	NA

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VE11	**Phase out old vehicles and vehicle scrappage policy**	transport Department	No.	NA	NA	NA	NA	As per order of NGT no diesel vehicle older than 10 years and petrol vehicle older that 15 years is being allow for re-registration in the district only NOC is issued for districts allowed by transport commissioners or the number of such vehicles is cancelled	NA	NA	NA	NA	NA	Transport Dept Funding
VE11.1	Inspection /maintenance to all BSII & BS III	Transport Department	Number (2)	NA	NA	NA	NA	Inspection of commercial Vehicles is done by RI (Tech) in office as per norms for private vehicles. It is the responsibility of vehicle owner	NA	NA	NA	NA	NA	Transport Dept Funding

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VE11.2	Restriction on plying and phasing out of 15 years old commercial diesel driven vehicles.	Transport Department	Number (2)	NA	NA	NA	NA	As per order of NGT no diesel vehicle older than 10 years and petrol vehicle older that 15 years is being allow for re-registration in the district only NOC is issued for districts allowed by transport commissioners or the number of such vehicles is cancelled	NA	NA	NA	NA	NA	Transport Dept Funding
VE11.3	Enforcement of law against visibly polluting vehicles: remove them from road, impose penalty, and launch extensive awareness drive against polluting vehicles.	Transport Department	No.	NA	NA	NA	NA	For the year 2019-20, 891 challans against, No production of PUCC regular checking conducted by the enforcement officers. Regular awareness campaign is conducted and its intensity will be increased in future	NA	NA	NA	NA	NA	Transport Dept Funding
VE11.5	To increase fine on vehicle owners (not drivers) where the visible smoke is emitted and noticed.	Tranport Department	No.	NA	NA	NA	NA	Govt, has recently increased fine against non-production of PUCC of pollution vehicle from Rs 1000/- to Rs 2000/-	NA	NA	NA	NA	NA	Transport Dept Funding

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VE11.6	Examine existing framework for removing broken down buses or trucks from roads and create a system for speedy removal and ensuring minimal disruption to traffic from such buses or trucks.	Traffic Police	Text	NA	NA	NA	NA	Traffic police has three cranes to remove broken down buses or trucks from road. In order to make better the frame work private cranes are also taken in help of traffic police. Private hydra and big cranes are hired whenever needed.	NA	NA	NA	NA	NA	Traffic Dept Funding
VE11.7	The restriction on use of two stroke vehicles in phased manner (2-Stroke, 3-stroke)	Tranport Department	Number	NA	NA	NA	NA	As per NGT order, use of diesel vehicle older than 10 years and petrol vehicle more than 15 years old is restricted. Registration certificate of Non-Transport Vehicle falling in this category has been suspended. Currently there is not provision for restricting use of vehicle on the basis of engine stroke type	NA	NA	NA	NA	NA	Transport Dept Funding

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VE11.8	Prepare and implement Comprehensive Mobility Plan for Meerut City	Nagar Nigam	Number	1	31.03.2022	Award of Work	_	Details of Award RFP etc.	_	_	_	_	NA	State/Central Scheme
VE12	**NMT**			NA	NA	NA	NA		NA	NA	NA	NA	NA	NA
VE12.1	Introducing cycle tracks along with the roads	Nagar Nigam/ Development Authority	No.	NA	NA	NA	NA	Not proposed by MDA, Meerut.	NA	NA	NA	NA	NA	NA
VE12.2	Prepare and implement zonal plans to develop an NMT network	Nagar Nigam/ Development Authority	Plans	NA	NA	NA	NA	Not proposed by MDA, Meerut.	NA	NA	NA	NA	NA	NA

***In case timeline extends to more than one year the annual targets must be fixed.**

****Mention specific numeric identity to the attachment. Example- Attachment-1**

INDUSTRIES

Action Point Code	Action Point	Department/ Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs. Lakh)	Additional Funds Required (Rs. Lakh)		Source of Funding
IP1	**Industrial air pollution control**														
IP1.1	To intensify monitoring of industries to reduce of emission by the industries.	UPPCB	No.	60	30.09.2021	60	Yes	Total Air polluting industries in Meerut is 30 and their monitoring is being done time to time by this office.	NA	NA		NA	NA	NA	NA
IP1.2	Action against non-complying industrial units	UPPCB	No.	29	ongoing	ongoing	Yes	Inspections of industries are being done on regular basis and find the defaulter of the industries action is taken under section 31A of air pollution (Prevention and control) act 1981 as amended by UPPCB	NA	NA		NA	NA	NA	NA
IP1.3	Shifting/Closing of Polluting Industries from non-conforming to conforming area	Department of Infrastructure & Industrial Development/UPPCB/District Administration	No.	0	31.03.2024	0	Yes	A team shall be constituted by DM sir along with concerned depts and ensure the shifting of polluting industries from non-confirming to	NA	NA		NA	NA	NA	NA

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								confirming area up to 31.03.2024							
IP1.5	Auditing for Air pollution measures and Online reporting systems in the industrial sectors namely Slaughter houses, Sugar industries, Textile industries, Pulp & paper industries	UPPCB	No.	30		30	Yes	The total Air polluting industries in Meerut is 30 and installed air pollution control measures for controlling air pollution such as ESP, Wet scrubber, Multicyclone dust collector, bag filters etc and installed continuousEmission monitoring system which connect to CPCB or UPPCB server.	NA	NA		NA	NA	NA	NA
IP1.10	Ensuring installation/Up-gradation and operation of air pollution control devices in industries	UPPCB	No.	30	31.03.2021		Yes	The Air polluting industries situated inMeerut already installed/up-graded with air pollution control devices. All these air polluting industries are	NA	NA		NA	NA	NA	NA

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								monitored by UPPCB time to time and Linked to CPCB or UPPCB server through online monitoring continuous monitoring system							
IP1.11	Action/closure against defaulting/unauthorized industrial units.	UPPCB	No.	NA	Continuous process	NA		Defaulting 24 Kolhus have been sealed by the team constituted by DM Meerut and imposed environment compensation on defaulting four industries. This is continuous process to identify the defaulting units and action taken time to time by this office.	NA	NA		NA	NA	NA	NA
IP1.12	Ensuring emission standards in industries	UPPCB	No.	30	ongoing	30	Yes	All air polluting industries installed continuous emission monitoring system which connect to	NA	NA		NA	NA	NA	NA

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								CPCB or UPPCB server and ensure the emission standards in industries.							
IP1.14	Measures taken for location specific Emission reduction.	UPPCB	No.				Yes	Details of locations considered	NA	NA		NA	NA	N A	NA
IP1.26	Bank guarantee should be taken for the compliance of conditions imposed in CTO/CTE for control of Environmental Pollution from industries.	UPPCB	Yes	NA	31.03.2021	NA	NA	Bank guarantee shall be taken for the compliance of conditions imposed in CTO/CTE for control of Environmental pollution from industries	NA	NA		NA	NA	N A	NA
IP1.28	Implementation of SOx and NOx standards notified by MOEF&CC	UPPCB	Yes	NA	Achieved	NA	**Yes**	SOx and NOx standards for industries notified by MoEF& CC notification GSR 29(E) dated 29.01.2018 has been implemented.	NA	NA		NA	NA	N A	NA

Action Point Code	Action Point	Department/ Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs. Lakh)	Additional Funds Required (Rs. Lakh)		Source of Funding
IP1.29	Prepare and implement local area action plan for pollution hotspots and strict enforcement of air pollution control measures in all industries, including those located in unauthorized areas.	Nagar Nigam/UPPCB/MDA/NHAI/PWD	Yes	NA	NA	NA	Yes	Implementation for pollution hotspots, a inspection team had been constituted by DM Meerut to have a servilence on industries vide-letter no. 1688/NCR/2019 dated 16.10.2019 and a team along with concerned depts for those industries which located in unauthorized area shall be constituted as soon as possible.	NA	NA		NA	NA	NA	NA
IP1.30	Assess the number of industrial units that are non-compliant and prepare unit/plant wise action plan for time bound compliance or be shut down.	UPPCB	Yes/ No	NA	NA	NA	Yes	Details on the action undertaken							
IP1.32	Industrial units to install water spraying system of internal roads and washing of tyres of vehicles	UPPCB	**Yes**	**NA**	**NA**	**NA**	**Yes**	Details on the action undertaken	NIL	NIL		NIL	NIL	NIL	NIL

Action Point Code	Action Point	Department/ Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs. Lakh)	Additional Funds Required (Rs. Lakh)		Source of Funding
IP1.33	Monitoring of Cane Kolhus for compliance of CPCB guidelines.	UPPCB	Yes	NA	31.05.2022	NA	NA	Monitoring of cane kolhus for compliance of CPCB guidelines shall be done up to 31.05.2022	NA	NA		NA	NA	NA	NA
IP1.34	Support to Cane Kolhus for installation of appropriate Air Pollution Control System	UPPCB/ Cane Department	Yes	NA	NA	NA	NA	To support cane kolhus for installation of appropriate Air Pollution Control System as per CPCB guidelines, a workshop shall be organized with the help of cane dept and initiate the installation of APCS	NA	NA		NA	NA	NA	NA
IP1.35	To conduct feasibility study to phase out small boilers in Industrial Clusters in Partapur, Shatabdinagar, Gangol Road, Udyogpuram, Sports ComplexMohakampur Phase I & II by centralized steam supply system	UPSIDA, MDA, DIC	Yes		31.03.2021	NA	Yes	TOR of the proposed study	10 Lakhs	_		NA	NA	NA	Own Resources

Action Point Code	Action Point	Department/ Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs. Lakh)	Additional Funds Required (Rs. Lakh)		Source of Funding
IP1.36	Promote use of non-recyclable plastic waste generated from industries especially the Paper & Pulp Industries for co-processing in Cement Plants	UPPCB &Department of Industries	Yes	2650 MT/Month	31.03.2021	NA	Yes	Details of Plastc waste from industries disposed through co-processing	NA	NA		NA	NA	NA	NA
IP3	**OCEMS in Industries**														
IP3.1	There should be provision to use CEMS data as legal evidence and a policy be framed in consultation with Central Pollution Control Board.	CPCB/UPPCB	Yes	NA	NA	NA	Yes	Yes	NA	NA		NA	NA	NA	NA
IP3.5	Monitoring of industrial emission including real time online monitoring through OCEMS (Online Continuous Emission Monitoring System) and live camera feed and totake action against non-complying industrial units	UPPCB	No.	30	Continuous process	30	yes	All such air polluting industries have installed OCEMS besides one industry and covered in non-complying units. A show cause notice has been issued to it by HO	NA	NA		NA	NA	NA	NA
IP4	**Clean fuel in industries**														

Action Point Code	Action Point	Department/ Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs. Lakh)	Additional Funds Required (Rs. Lakh)		Source of Funding
IP4.1	Introduction and shifting towards cleaner fuels in industries where PNG supply is available	Department of Infrasructure and Industrial Development/UPSIDA/GGIL	No.	25	31.03.2022	NA	NO	In industrial clusters of district Meerut PNG supply has be started and industries are being motivate to convert their conventional fuel to PNG. It is to be said that in industrial cluster of district Meerut no such big industry is operational. only small/tiny scale industries are being operated with small capacity boilers less than 1 TPH.	NA	NA		NA	NA	NA	NA

Action Point Code	Action Point	Department/ Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs. Lakh)	Additional Funds Required (Rs. Lakh)		Source of Funding
IP4.2	Conversion to CNG/PNG from wood / coal and other agro and fossil fuels.	Department of Infrastructure and Industrial Development/UPSIDA/GGIL	No.	30	31.03.2022	NA	NO	In industrial clusters of district Meerut PNG supply has be started and industries are being motivate to convert their conventional fuel to PNG. It is to be said that in industrial cluster of district Meerut no such big industry is operational. only small/tiny scale industries are being operated with small capacity boilers less than 1 TPH.	NA	NA		NA	NA	NA	NA
IP4.4	Establish a protocol for using cleaner fuels & technology in industries	Department of Environment, Forest & Climate Change U.P. & UPPCB	Yes	NA	NA	NA	Yes	Yes							

Action Point Code	Action Point	Department/ Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs. Lakh)	Additional Funds Required (Rs. Lakh)		Source of Funding
IP4.5	Restriction on using un-authorised fuels in industries such as rubber, polythene, cotton bags, etc. and other dirty fuels.	UPSIDA/ DIC/UPP CB	**Yes**	**NA**	**Achieved**	**NA**	**Yes**	Already restricted on using unauthorised fuels in industries and actions are being taken on defaulters as per norms.							**UPPC B Fund**
IP4.8	Preparation and implementation of Industrial hotspot action plan	UPPCB, UPSIDA & DI	Yes	3	15.10.202 0	NA	Yes	Progress of implementatio n	NA	NA		NA	NA	N A	NA
IP5	**Control of air pollution from Brick kilns**														
IP5.1	Adapting new technologies for Brick kilns	UPPCB	No.	238	31.03.202 1	238	yes	238 brick kilns are situated in Meerut out of which 88 brick kilns are converted in new technology i.eZig-Zag. In addition to above the Closure order have issued to 111 brick kilnsi.e non converted to Zig-Zag Technology and 43 brick kilns are lying self-closed.		NA		NA	NA	N A	UPPC B Fund

Action Point Code	Action Point	Department/ Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs. Lakh)	Additional Funds Required (Rs. Lakh)		Source of Funding
IP5.2	identification of brick kilns and their regular monitoring including use of designated fuel and closure of unauthorized units.	UPPCB	Yes	238		238	Yes	Regular monitoring and identification of brick kilns for use of designated fuel is being done by this office time to time and action taken against unauthorized brick kilns.		NA		NA	NA	NA	UPPCB Fund
IP5.3	Conversion of natural draft brick kilns to Force/ induced draft.	UPPCB	No	238	31.03.2021	238	Yes	238 brick kilns are situated in Meerut out of which 88 brick kilns are converted in new technology i.eZig-Zag. In addition to above the Closure order issued to 111 brick kilnsi.e non converted to Zig-Zag Technology and 43 brick kilns are lying self-closed and not allowed for operation of such brick kilns which are not converted in		NA		NA	NA	NA	UPPCB Fund

Action Point Code	Action Point	Department/ Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs. Lakh)	Additional Funds Required (Rs. Lakh)		Source of Funding
								natural draft to induced draft technology.							
IP5.4	Closure of unauthorized units by seeking the possibility for shifting of kilns outside corporation limits. This should be replaced as "Closure of brick kilns not conforming the siting guidelines of UP Govt." as shifting is not possible	UPPCB	Nil	Nil	Nil	Nil	Nil	If this type of situation is identified then immediate action shall be initiated.		NA		NA	NA	N A	
IP5.5	Prescribe design specifications for improved kilns and ensure compliance checking to know that conversion has actually taken place.	UPPCB	Yes	238	31.03.2021		Yes	All the officers have been instructed to ensure compliance for checking to know that brick klins actually converted into prescribed design or not. In case of defaulting action shall be taken.		NA		NA	NA	N A	UPPCB Fund
IP5.6	To identify the clusters of brick kilns including upwind & downwind monitoring locations for ambient air quality monitoring	UPPCB	No.	NA	Dec.2020	NA	NA	upwind& downwind monitoring locations for ambient air quality monitoring of clusters of brick klins		NA		NA	NA	N A	

Action Point Code	Action Point	Department/ Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs. Lakh)	Additional Funds Required (Rs. Lakh)		Source of Funding
								shall be identified with in 60 days.							
IP5.7	To impose cluster pollution responsibility conditions in the Consent to Operate of brick kilns in the clusters after due consultation with brick kilns operators	UPPCB	No.	NA	Dec.2020	NA	NA	This is policy matter and suggest at HO Level.		NA		NA	NA	N A	
IP11	**Control of air pollution from generator sets**														
IP11.1	Allow only DG sets meeting emission and design of chimney/ exhaust, acoustic enclosures standards to operate	UPPCB/ Nagar Nigam/Electrical Safety Department	Yes	NA	NA	NA	Yes	Yes and industries are equiped with DG sets having accoustic enclosure and appropriate height of chimneys.	NA	NA		NA	NA	N A	UPPCB Fund
IP11.2	Curtail use of DG Sets in social events by providing temporary electric connections and uninterrupted power supply	U.P. Power Corporation Ltd.	**Yes**				**Yes**	It is to intimate that there is no load shedding in Meerut town and UPPCL is making available 24 hrs supply to the consumers. It is further to add that on occasion of any social							**PVVNL Funding**

Action Point Code	Action Point	Department/ Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs. Lakh)	Additional Funds Required (Rs. Lakh)		Source of Funding
								event in Meerut town temporary connection arereleased on demand of organisers.							
IP12	**Control of air pollution from waste incineration**														
IP12.2	Implement CEMS for incinerators and provide data on emissions on an open platform	Nagar Nigam/UPPCB/CPCB	No.	**1**	Achieved	**NA**	**NA**	Only one incinerator is situated in Meerut and provide the data of emission to CPCB or UPPCB and on an open platform under process.							
IP13	**Renewable Energy**														
IP13.2	Identify and target commercial and industrial establishments for installation of roof top solar system	Non-Conventional Energy Development Agency (NEDA)	MW	2 MW	31-03-2025	0.4 MW	No	No	Not Required	NA		NA	NA	NA	Departmental funding

Action Point Code	Action Point	Department/ Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs. Lakh)	Additional Funds Required (Rs. Lakh)		Source of Funding
IP13.4	Organise consumer outreach programme for roof top solar programme	Non-Conventional Energy Development Agency (NEDA)	YES	40 NO. SEMINAR/ MEETING TO BE ORGANISED along with Lectures and Literature, & refreshment to all related targeted groups/consumers.	31-03-2025	8 NO	No	Details on the action undertaken	80 Lacs	NO		No	NO	80 Lacs	World bank Sources.
IP14	**Accelerate the technological transformation of enterprises and improve their technological innovation capabilities**														
IP14.1	Establishment of Knowledge Centre for promotion of technological transformation for desulfurization, denitrification, efficient dust removal, volatile organic compound control, diesel engine (vehicle) emission purification, environmental monitoring, and new energy vehicles, smart grids, etc.	UPSIDA, DIC, Industrial Associations, Transport Department	Yes	Establishment of Knowledge Centre with the help of Educational Institute/Consultancy Firms	31-08-2021										Development authority funding

Action Point Code	Action Point	Department/ Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs. Lakh)	Additional Funds Required (Rs. Lakh)		Source of Funding
IP14.2	Conduct clean production audits on key industries such as Paper & Pulp, Sugar, Dying &Distillery sector, Slaughter house	UPPCB/UPSIDA/DIC/Individual Industries	Yes	31.03.2022				Clean production audits on key industries such as Paper & Pulp, Sugar, Dying &Distillery sector, Slaughter house shall be done up to 31.03.2022	NA	NA		NA	NA	NA	individual industriesd
IP14.3	Promote Circular Economy- Encourage the development of industrial clusters, implement circular transformation, promote energy cascade utilization, water recycling, waste exchange and utilization, and land conservation and intensive utilization and build circular industries system. Promote the co-processing of waste in industrial kilns and blast furnaces such as cement and steel. Vigorously develop the remanufacturing of mechanical and electrical products and promote the development of the resource recycling industry.	UPPCB/UPSIDA/DIC/Individual Industries	Yes	yes	31.03.2024			Yes	NA	NA		NA	NA	NA	

Action Point Code	Action Point	Department/ Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs. Lakh)	Additional Funds Required (Rs. Lakh)		Source of Funding
IP14.4	Vigorously cultivate energy conservation and environmental protection industries	UPPCB/UPSIDA/DIC/Individual Industries	Yes	yes	31.03.2024			Yes	NA	NA		NA	NA	NA	
***In case timeline extends to more than one year the annual targets must be fixed.**															
****Mention specific numeric identity to the attachment. Example- Attachment-1**															

WASTE AND BIOMASS- DUMPING AND BURNING

Action Point Code	Action Point	Department/ Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs.	Additional Funds Required (Rs. Lakh)	Source of Funding
BB1	**Biomass Burning**													
BB1.1	Regular check and control of burning of municipal solid wastes	Nagar Nigam	No.	90 Wards	Regular activity	NA	Yes	Dedicated GRAP enforcement teams work constituted during GRAP in the district all fielded level officer have been directed to report burning in their areas. Penalties/FIR are being imposed accordingly in compliance of Hon'ble NGT orders 12 FIR has been lodged till now.	NA	NA	NA	N A	NA	MNN Funding
BB1.2	Defaulters for open burning to be imposed fines	Nagar Nigam	No.	NA	Regular activity	NA	NA	surprise inspections are being done by the dept and find the open burning sites penalties/fine has imposed and FIR is being lodged. Total 12 F.I.R. has been lodged till now.	NA	NA	NA	N A	NA	MNN Funding
BB1.3	Identify Garbage burning locations	Nagar Nigam	Number	0	Regular activity	NA	NA	All inspectors have been instructed by the dept. to identify the garbage burning cases during the survey and action taken against defaulters time to time.	NA	NA	NA	N A	NA	MNN Funding

Action Point Code	Action Point	Department/ Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs.	Additional Funds Required (Rs. Lakh)	Source of Funding
BB1.4	Prohibition/complete ban on garbage burning.	Nagar Nigam	Yes	0	Regular activity	NA	NA	All inspectors have been instructed by the dept. to identify the garbage burning cases during the servey and action taken against defaulters' time to time and panelise the fine or lodged FIR to prevent the garbage burning cases.	NA	NA	NA	NA	NA	MNN Funding
BB1.5	Launch extensive drive against open burning of bio-mass, crop residue, garbage, leaves, etc.	Nagar Nigam/Agriculture Department/District Administration	NO	NA	Regular activity	NA	NO	Extensive drive for open burning is being done by the dept time to time and panelise the fine as well as lodged FIR against the defaulters.	NA	NA	NA	NA	NA	NA
BB1.6	Construction of advanced waste management Site.	Nagar Nigam	yes	1	Achieved	NA	Yes	Solid waste disposal site at village gawadikilla road Meerut has been developed.	NA	NA	NA	NA	NA	MNN Funding
BB1.7	Regular collection and control of municipal solid wastes.	Nagar Nigam	Yes	90 ward	Regular activity	NA		169 vehicles of MNN collected the segregated waste door to door in its all wards however due to lack of proper scientific disposal site the dumping of waste is being done on temporary sites and segregating is being initiated.	NA	NA	NA	NA	NA	MNN Funding

Action Point Code	Action Point	Department/ Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs.	Additional Funds Required (Rs. Lakh)	Source of Funding
BB1.8	Providing Organic Waste Compost machines, decentralization of processing of Waste, dry waste collection centres.	Nagar Nigam	No.	2	31.03.2021	NA	Yes	Two decentralised processing place has been identified 1 Naglatasi and 2 Rangolimandaproad.	NA	NA	NA	NA	NA	MNN Funding
BB1.9	Awareness for controlling of burning of agricultural waste and crop residues.	Nagar Nigam/Agriculture Department/District Administration	No.	105 [92 N.P.,12 Block,01 district level]	31.03.2021	105 [92 N.P.,12 Block,01 district level]	NO	Details of the awareness drives including dates and images	6.02	NA	NA	NA	NA	MNN Funding
BB 1.10	No plot should be left open more than 02 years and planting of trees must be mandatory on vacant plots.	Nagar Nigam/MDA/Forest Department	Number (2)	NA	31.03.2021	NA	Yes	No plots vacant at present but in future all open plots shall be planted of trees.	NA	NA	NA	NA	NA	Development authority fund
BB 1.12	Mapping of legacy waste and waste dumping sites in the city	Nagar Nigam/Development Authority	No.	3	31.03.2023	1	Yes	Three sites are developed in Meerut out of which one site is already being cleaned and another two also cleaned up to 31.03.2023	NA	NA	NA	NA	NA	MNN Funding

Action Point Code	Action Point	Department/ Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs.	Additional Funds Required (Rs. Lakh)	Source of Funding
BB 1.13	Bioremediation/ bio-mining of legacy waste	Nagar Nigam/Development Authority	MT of legacy waste	7 lakh MT	31.03.2023	NA	Yes	3 Lakh MT of legacy waste already bio-remediate and 7 lakh MT of legacy waste is under process for bio-remediation.	NA	NA	NA	NA	NA	MNN Funding
BB 1.14	Development and implementation of integrated door to door waste collection system with GPS mounted waste collection vehicles and mobile App to facilitate the households	Nagar Nigam/Development Authority	No. of wards	90 wards	31.03.2021	NA	Yes	169 vehicles collected the segregated waste door to door and enabled the all vehicles with GPS mounted and mobile app to facilitate the household up to 31.03.2021.	NA	NA	NA	NA	NA	MNN Funding

Action Point Code	Action Point	Department/ Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs.	Additional Funds Required (Rs. Lakh)	Source of Funding
BB 1.15	EPR compliance for plastic waste	Nagar Nigam & UPPCB	No. of units/ quantity		31.03.2022			At present plastic waste is being segregating by Nagar Nigam and handling over to waste to energy plant established by M/s Bijender energy partapurMeerut/ EPR shall be compliance for plastic waste generating/brand owner/producer/ multi-layerpackaging up to 31/3/2022.						MNN Funding
BB 1.16	Preparation and implementation of Waste Burning hotspot action plan	Nagar Nigam/Development Authority	Yes	3	15.10.2020	NA	Yes	Progress of implementation	NA	NA	NA	NA	NA	NA
BB2	**Ensure segregation of waste at source**	Nagar Nigam	No. of wards	90 wards	31.03.2021	NA	Yes	Efforts is being done by the dept and ensure the segregation of waste at source. In this regard dept organize workshop or campaign at the colonies/wards level for awareness of household.	NA	NA	NA	NA	NA	MNN Funding
BB3	**Proper collection of Horticulture waste and its disposal**	Horticulture Department/Nagar Nigam/MD	Yes	6	03-07-2020 UPTO 31-03-2021	6	Yes	1-Govt. Nursery machri-3 2-Govt. Circuit House-3	NA	NA	NA	NA	NA	Horticulture Dept Fund

Action Point Code	Action Point	Department/ Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs.	Additional Funds Required (Rs. Lakh)	Source of Funding
	following composting-cumgardening approach	A												
BB4	**Recycling plants for dry waste.**	Nagar Nigam	No. of plants	1	31.03.2022		Yes	Recycling plant for dry waste is under process and the project may be completed after the approval of govt may be up to 31.03.2022	NA	NA	NA	NA	NA	MNN Funding
BB 10.2	Adopt roadmap for zero landfill policy to promote decentralized waste segregation, reuse and recycling	Nagar Nigam	Text		ongoing		Yes	Nagar Nigam Meerut has already adopted zero land fill policy where its inert is reused, compost is distributed to farmer and R.D.F. is supplied to waste to energy plant for electricity generation on P.P.P. Model.	NA	NA	NA	NA	NA	MNN Funding

Action Point Code	Action Point	Department/ Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs.	Additional Funds Required (Rs. Lakh)	Source of Funding
BB11	**Fire crackers—regulate to control their usage**	District Administration	Text	NA	NA	NA	Yes	By publishing public notice in daily addition newspapers UPPCB appeals time to time for not using fire crackers which are generating smokes the same is also being done by district administration. Movements and campaigns are regularly run by district administration and defaulters are being penalized too as per order of Hon'ble supreme court.	NA	NA	NA	NA	NA	
DF1	**Domestic Fuel**													
DF1.1	Increasing the LPG connections in low income strata.	Food & Civil Supply Department	82 gas agencies	154872 gas connections	Oct.2019	NA	Yes	154872 LPG connection has been already distributed against 150000 and target already achieved	NA	NA	NA	NA	NA	Central Govt.
DF1.2	Ensuring promotion and use of cleaner fuel (i.e. LPG) instead of coal fired chulas or fire-woods in	Food & Civil Supply Department/Nagar Nigam/District Administration	82 gas agencies	686443 gas connections	31.07.2020	NA	Yes	686443 gas connections has been distributed by the dept and target already achieved.	NA	NA	NA	NA	NA	Central Govt.

Action Point Code	Action Point	Department/ Agency	Field type	Total Target	Target Date (Timeline)	*Annual Target	**Attachment No.	Attachment Contents	Total Fund required (Rs. Lakh)	Total Funds Allocated (Rs. Lakh)	Funds released (Rs. Lakh)	Funds Utilized (Rs.	Additional Funds Required (Rs. Lakh)	Source of Funding
	the hotels and open spaces													
DF1.8	Implementation of PradhanMantriUjjwalaYojana (PMUY)	Food & Civil Supply Department	82 gas agencies	154872 gas connections	Oct.2019	NA	Yes	154872 LPG connections has been already distributed against 150000 connections under PradhanMantriUjjwalaYojana (PMUY) and target already achieved	NA	NA	NA	NA	NA	Central Govt.
DF1.9	Shift to LPG from solid fuel & kerosene for domestic applications	Food & Civil Supply Department	11 kerosene outlet	858702 households	31.07.2020	NA	Yes	Kerosene outlets in Meerut has been closed by the dept and Promote the LPG gas for households.	NA	NA	NA	NA	NA	Central Govt.

AIR QUALITY DATA

Action Code	Action Point	Field type	Attachment	Attachment Contents
AQ1.1	Monthly averages for PM2.5 (In µg/m3)	Number (12)	Yes	
AQ1.2	Monthly averages for PM10 (In µg/m3)	Number (12)	Yes	
AQ1.3	Monthly averages for SO2 (In µg/m3)	Number (12)	Yes	
AQ1.4	Monthly averages for NO2 (In µg/m3)	Number (12)	Yes	
AQ1.5	Annual averages for PM2.5 (In µg/m3)	Number (1)	Yes	
AQ1.6	Annual averages for PM10 (In µg/m3)	Number (1)	Yes	
AQ1.7	Annual averages for SO2 (In µg/m3)	Number (1)	Yes	
AQ1.8	Annual averages for NO2 (In µg/m3)	Number (1)	Yes	
AQ1.9	Monthly Meterological Data		Yes	Monthly Meteorological Data Attached

Plantation Scheme based on wind pattern of Meerut city

U.P. Pollution Control Board prepared air action plans for Meerut city of Uttar Pradesh. The Action Plans comprises of 06 Major categories as given below:-

a. Vehicle Emission Control
b. Suspension of Road Dust and Fugitive Emission Control
c. Control of Emissions form Biomass/ Crop residue/ Garbage/ Municipal Solid Waste burning
d. Control of Industrial Emissions
e. Control of Air Pollution from constructions and demolition activities.
f. Other Steps to Control Air Pollution.

The main action points of this plan to mitigate pollution are to prepare plan for creation of green buffers along the traffic corridors and Plantation of specific types of species of plants which are helpful in pollution control and develop the tree plantation by Miyawaki forest for mitigation of air pollution based upon location of pollution sources and Wind rose data.

MIYAWAKI FOREST DEVELOPMENT:

The 'Miyawaki Method' is a unique technique to grow forests. Under the approach, dozens of native species are planted in the same area, close to each other which ensures that the plants receive sunlight only from the top and grow upwards than sideways. It requires very little space in which plants grow ten times faster and the forest becomes maintenance-free in approx three years.

Training program to develop Miyawaki Forest is given http://www.upecp.in or scan the QR-code given bellow:

CLIMATE OF THE CITY:

Being on the Northern part of India and next to New Delhi, Meerut has a monsoon influenced humid subtropical climate characterized by very hot summers and cool winters. Summers last from early April to late June during and are extremely hot, with temperatures reaching 43 °C. The monsoon arrives in late June and continues till the middle of September.

Temperatures rise again in October and the city then has a mild, dry winter season from late October to the middle of March. Lowest temperature recorded is 0.5 °C. Rainfall is about 80 cm to 100 cm per annum, which is suitable for growing crops. Most of the rainfall is received during the monsoon. Humidity varies in a range from 30% to 100%.

SOIL PROFILE:

Meerut district lies between 28°57' to 29°02' North latitude and 77°40' to 77°45' East longitude in the Indo-Gangetic plains of India. The river Ganges forms the eastern boundary and separates the district from Moradabad and river Hindon forms the western boundary and separates the district from Baghpat. According to soil profile the Meerut district can be divided into 3 morpho units viz .

(i) Alluvial Plain

1. Deep, loamy soils and slightly eroded.
2. Deep, loamy soils and slightly eroded associated with silty soils.
3. Deep, fine soils moderately saline and sodicity associated with loamy soils, slightly eroded.
4. Deep, loamy soils, moderate salinity and sodicity associated with loamy soils with moderate salinity and strong sodicity.
5. Deep, silty soils associated with loamy soils slightly eroded.

(ii) Older Alluvial Plain

6. Deep, loamy soils and slightly eroded associated with stratified loamy soils slightly eroded.

(iii) Active Flood Plain

7. Deep, sandy soils with moderate flooding associated with stratified loamy soils and slight flooding.

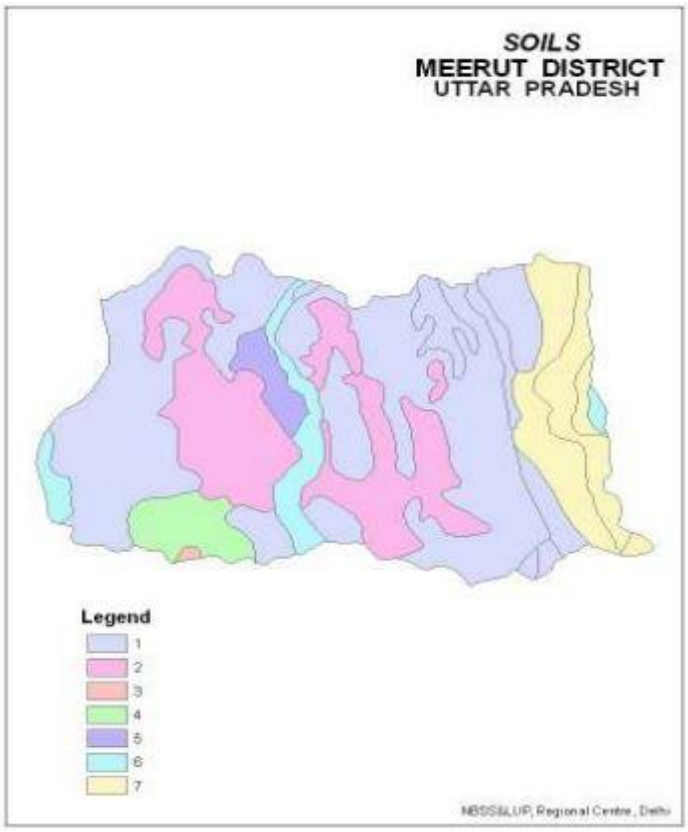


Figure 62: Soil Profile

EXISTING FOREST COVER:

There is a net increase of 0.41 sq.km has been observed in the State compared to the previous assessment which can be attributed to plantation and conservation. Forest outside Green wash areas have seen a considerable increase. The latest Forest Survey of India (FSI) state of the forest report shows that the overall forest cover of Meerut district has increased — from 2.67% in 2019 to 2017.

According to the FSI report, all trees with canopy density of over 10%, having an extent of more than one hectare and falling on forest, private, community or institutional land, are reflected in the assessment report. Barring the change in geographical areas, the so-called "increase" in forest cover has raised concerns among environmentalists as the forest department sets itself a high plantation target each year and claims a 80% to 90% survival rate of saplings. According to 2019 assessment the forest area of Meerut and its nearby district are given below:

District Name	Geographical Area (sq.km)	2019 Assessment (sq.km)				%GA	Change wrt 2017	Scrub
		V. Dense Forest	M. Dense Forest	Open Forest	Total			
Meerut	2559	0.00	34.00	34.41	68.41	2.67	0.41	0

(Source- The State of Forest Report, 2019, Forest Survey of India)

SENSITIVE AREAS OF THE CITY:

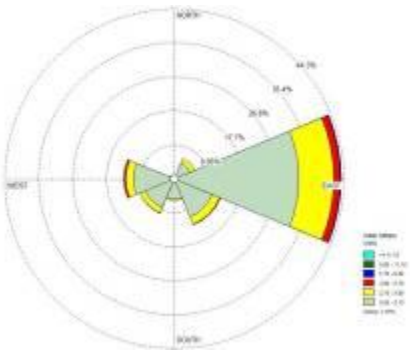
HASTINAPUR WILDLIFE SANCTUARY: Hastinapur Wildlife Sanctuary is a protected area in the Gangetic plains, located on the banks of Ganga River about **27 km of North-East direction** from Meerut city boundary. It has many beautiful and picturesque spots. It is one of the largest sanctuaries with an area of 2073 sq.km. It attracts many zoologists, ornithologists and tourists because of its rich bio-diversity. It is an abode for a range of vertebrates, invertebrates, birds and rare species of plants and trees. With the wild animal population of species like Cheetal, antelope, Sambhar, blue bull, different types of birds, leopard, hyena and wild cats amongst others, this sanctuary is also a house of alligators.

Figure 63: Location of Hastinapur Wildlife

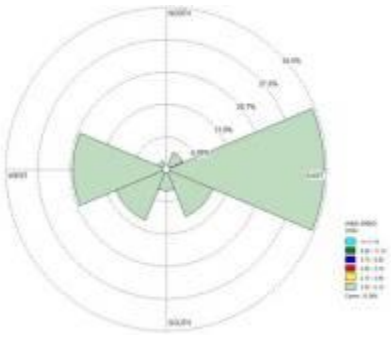
This sanctuary is also ground for the famous Sagon tree, used in making furniture while its leaves are dried and converted in to plates.

WINDFLOW PATTERN- WINDROSE:

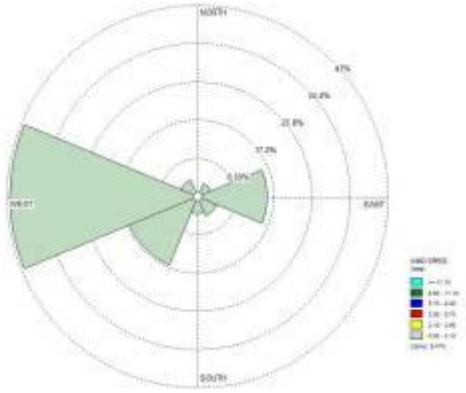
The wind rose for the four seasons have been plotted which indicate that the predominant wind direction is blowing from East, Northeast and Southeast direction. The wind pattern is very helpful in siting the locations preferable for plantation so that they may act as barriers to air pollution in the downwind direction.



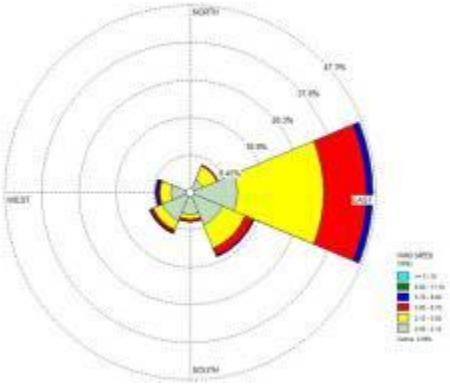
Winter season (Jan- Feb)



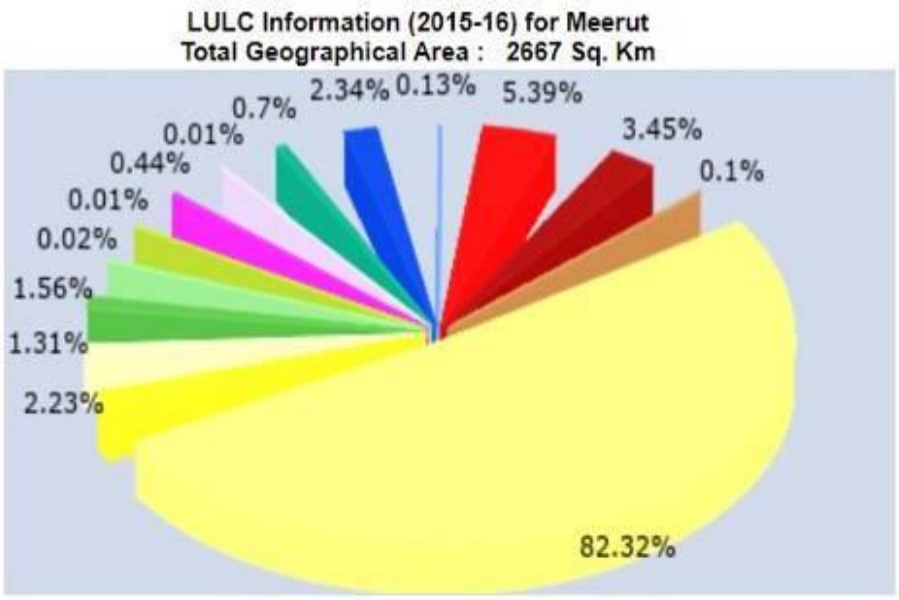
Summer season (March-May)



Monsoon season (June- September)



Post-monsoon (October – December)



LULC Class	Area (Sq.Km)	LULC Class	Area (Sq.Km)
Builtup,Urban	143.86	Builtup,Rural	91.93
Builtup,Mining	2.57	Agriculture,Crop land	2195.44
Agriculture,Plantation	59.44	Agriculture,Fallow	34.82
Forest,Deciduous	41.64	Forest,Scrub Forest	0.41
Grass/Grazing	0.27	Barren/unculturable/ Wastelands, Scrub land	11.81
Barren/unculturable/ Wastelands, Sandy area	0.36	Wetlands/Water Bodies, Inland Wetland	18.76
Wetlands/Water Bodies, River/Stream/canals	62.29	Wetlands/Water Bodies, Reservoir/Lakes/Ponds	3.39

Figure 3: LULC for Meerut

Description of Land use/Land cover distribution of Meerut

Category	Agriculture				Barren/uncultivable/wastelands			Built up			Forest	Wetlands/water bodies		
	Crop Land	Current Shifting Cultivation	Fallow	Plantation	Gullied/ Ravinous land	Salt affected land	Scrub land	Mining	Urban	Rural	Scrub Forest	Inland wetlands	River/ Streams/Canals	Water bodies
Area (in sq.km)	2198.66	0.00	44.76	55.00	0.00	0.00	11.41	0.97	135.91	41.66	0.41	17.44	64.32	3.35

(Source-https://bhuvan-app1.nrsc.gov.in/2dresources/thematic/LULC502/MAP/UP.pdf)

As per the district wise distribution of Land use/Land coverof Uttar Pradesh data(2011-2012) available in **Bhuvan- Indian Geo Platform of ISRO,** for Meerutthere is 2198.66 sq. km land as crop land out of total geographical area of the district and 44.76 sq.km land is Fallow Land and 55.00 sq.km is already under Plantation, which should be maintained. There is also 11.41sq.km land left as Scrub land which comes under wasteland category. There is Forest land also available in the district as Scrub forest which is 0.41 sq.km out of total geographical area . Therefore, Barren/uncultivable/waste land available in the upwind and downwind directions of the wind shall be identified for developing green belt to curb the rising level of air pollutants in the city.

TREE PLANTATION STRATEGY:

Objectives of Tree Plantation Strategy

- ✓ Climatic amelioration
- ✓ Check in air & noise pollution
- ✓ Check in soil erosion and reduce water logging
- ✓ Moderating the effect of wind and incoming radiation
- ✓ Aesthetics, shade and ornamentation.

Actions which can be taken in account to curb the emission of dust and other particulate matter in the district:

- Proposal for speeding up the process of developing green belt around the Construction sites of townships and Buildings being constructed towards prominent downwind direction of wind as they have already obtained EC from SEAC/SEIAA and to also produce the 6-monthly Compliance report.
- Development of green belt around the existing brick kiln sites and other air polluting sources located within the city.
- Development of green belt around the outskirts of existing park, Parking areas, Market areas etc.
- Proposal for developing wind break between residential and industrial area.

- Other places which found suitable for proposing plantation- Meerut International Institute of Technology and other institutions free areas, along the Delhi-Meerut expressway and Meerut- Garh Road, along the Railway Tracks and bus stations of the District.
- Plantation of Trees on the flood plain zone to check the soil erosion at the time of floods and enhance the riparian vegetation along with the small ponds and marshy areas found for their restoration of rejuvenation. List of marshy areas to be rejuvenated by turning them into green spaces is given in this report.
- Unauthorized dump sites to be cleared of the wastes and then after restoring the quality of soil and making it fit for plantation should be turned green. List is attached here in this report
- Abandoned brick kiln sites should be turned green after getting clearance of its ownership and permission from the owner.
- To identify the proposed developments plan for the city like URBAN AND RURAL PLANNING DEPARTMENT, UTTAR PRADESH has developed Master Plan- 2001-2021 for Meerut City which is given below. This Master plan will help in identifying the available places for proposing plantation scheme as to avoid any contradiction in both the schemes.

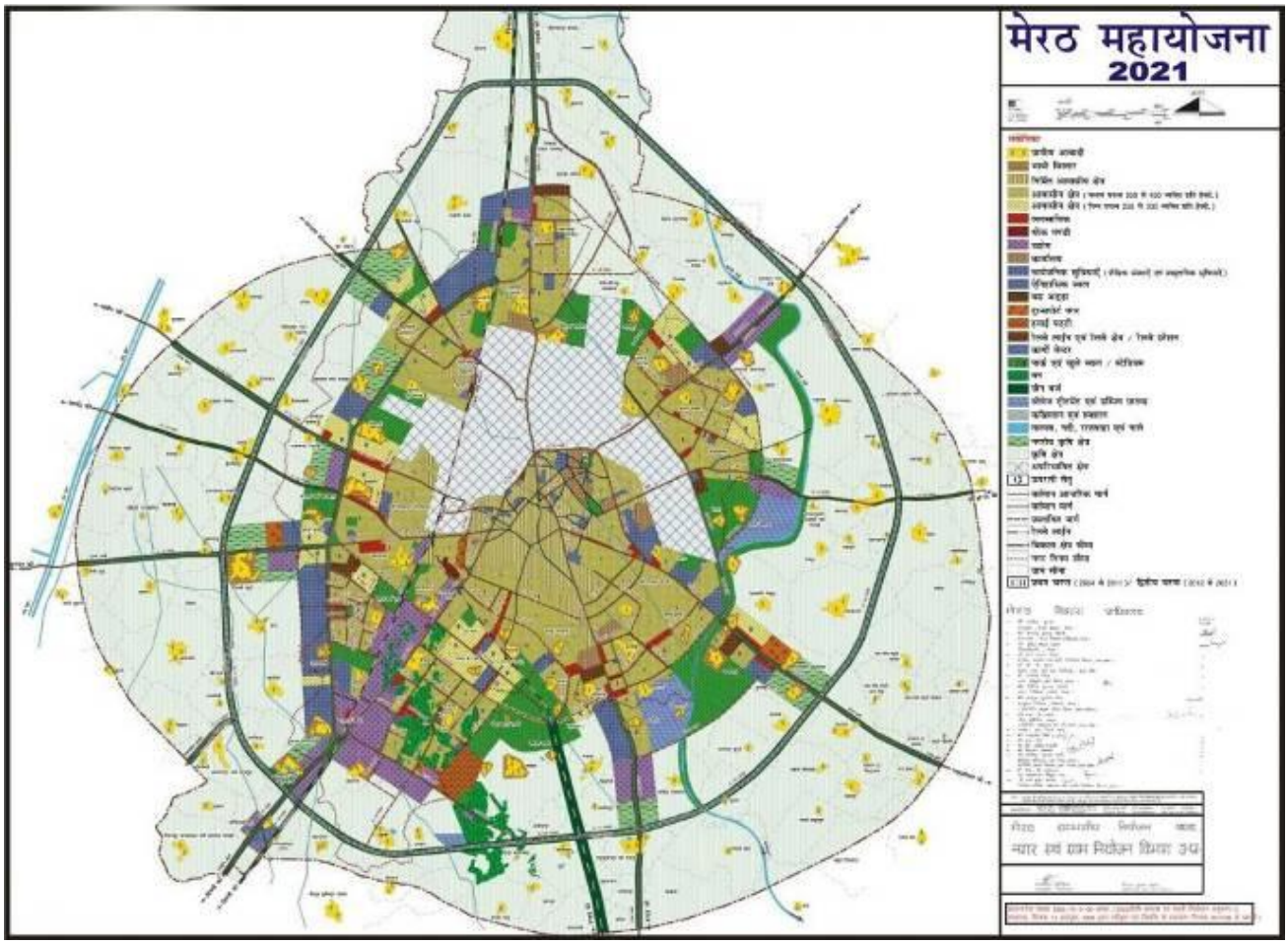


Figure 4: Master Plan for Meerut City

Slum and squatter settlements in Meerut are growing at alarming rates due to increased infrastructure development. The general composition of majority of slums comprises of scheduled tribes, scheduled caste, and other backward classes, forming the weaker section of the

society. From habitation point of view, slums located in the low lying areas, along open drains/nallah, tank beds and hazardous/toxic sites are susceptible to inundation, and other forms of disasters.

Meerut being one of the most significant industrial cities of the state. It has slum population of 7,22,281 which is 59% of total population of the Meerut city population that accounts for 12,15,339.From amenities view, slums do not have access drinking water sources and households lack connectivity to storm water drainage system and with no underground sewer system, even not a proper facility of cooking requirements hence they rely on biomass/coal burning to cook their food which should be replaced with the supply of LPG.

City Population	**Slum Population**	**% of slum population to city population**	**Total Area under slums (Ha)**	**% of slum area to city area**
1215339	722281	59%	1325	9

(*Source: Census 2011, RAY Primary Survey,2011*)

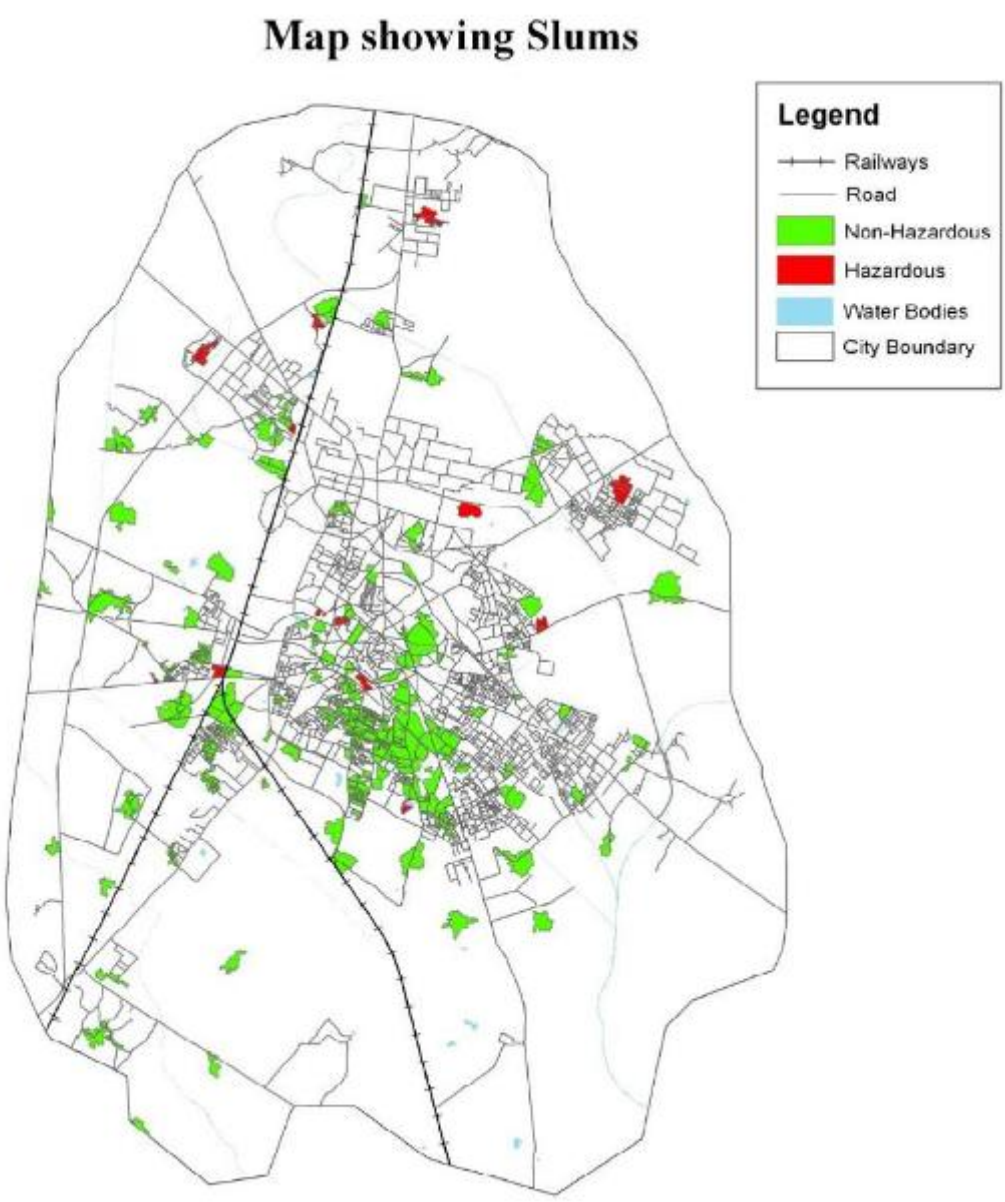


Figure 5: Location of Slum Area of Meerut

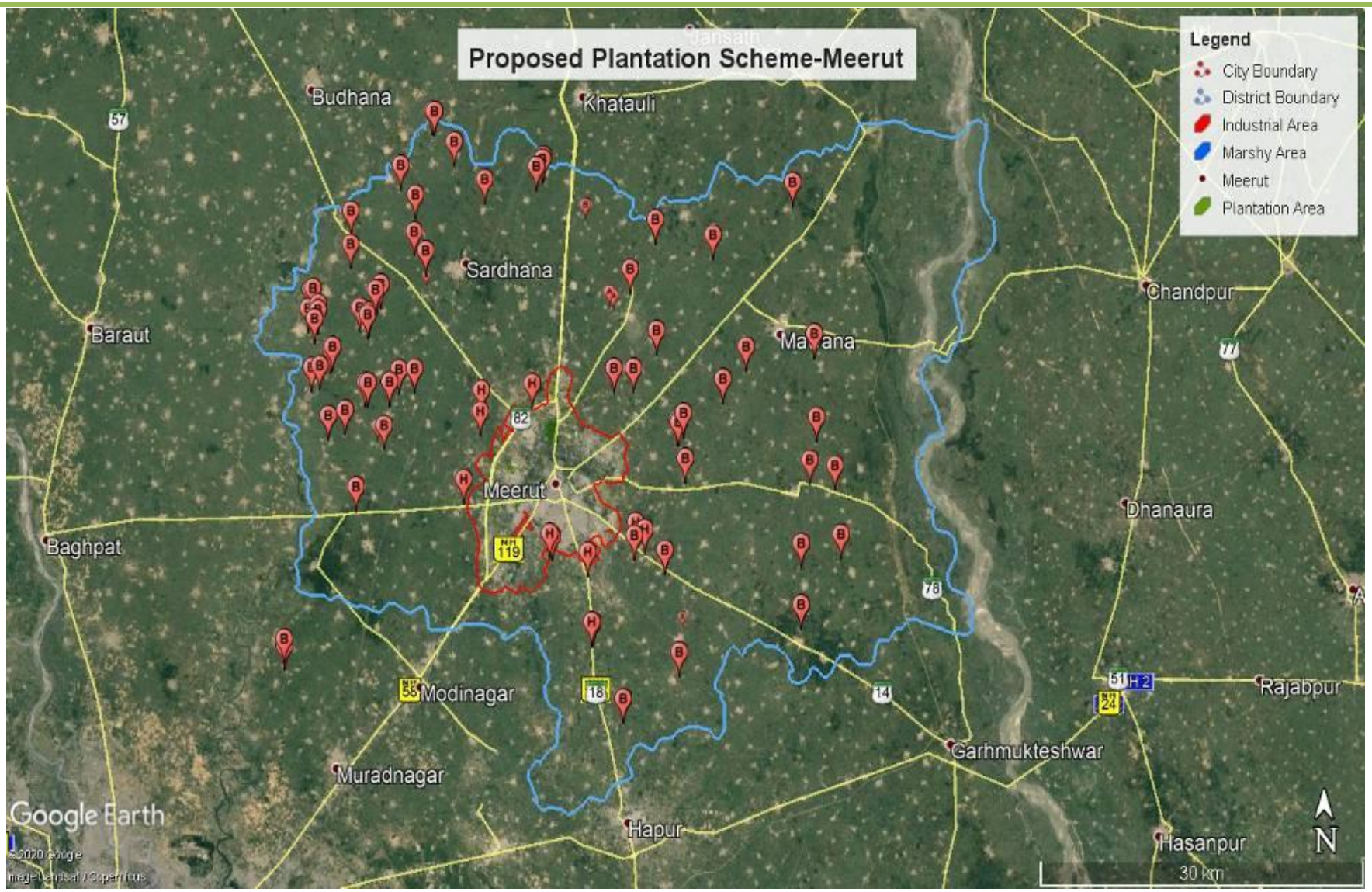


Figure 6: Satellite imagery showing Polluting sources and Proposed Plantation on Potential sites located on the outskirts and within the Meerut District

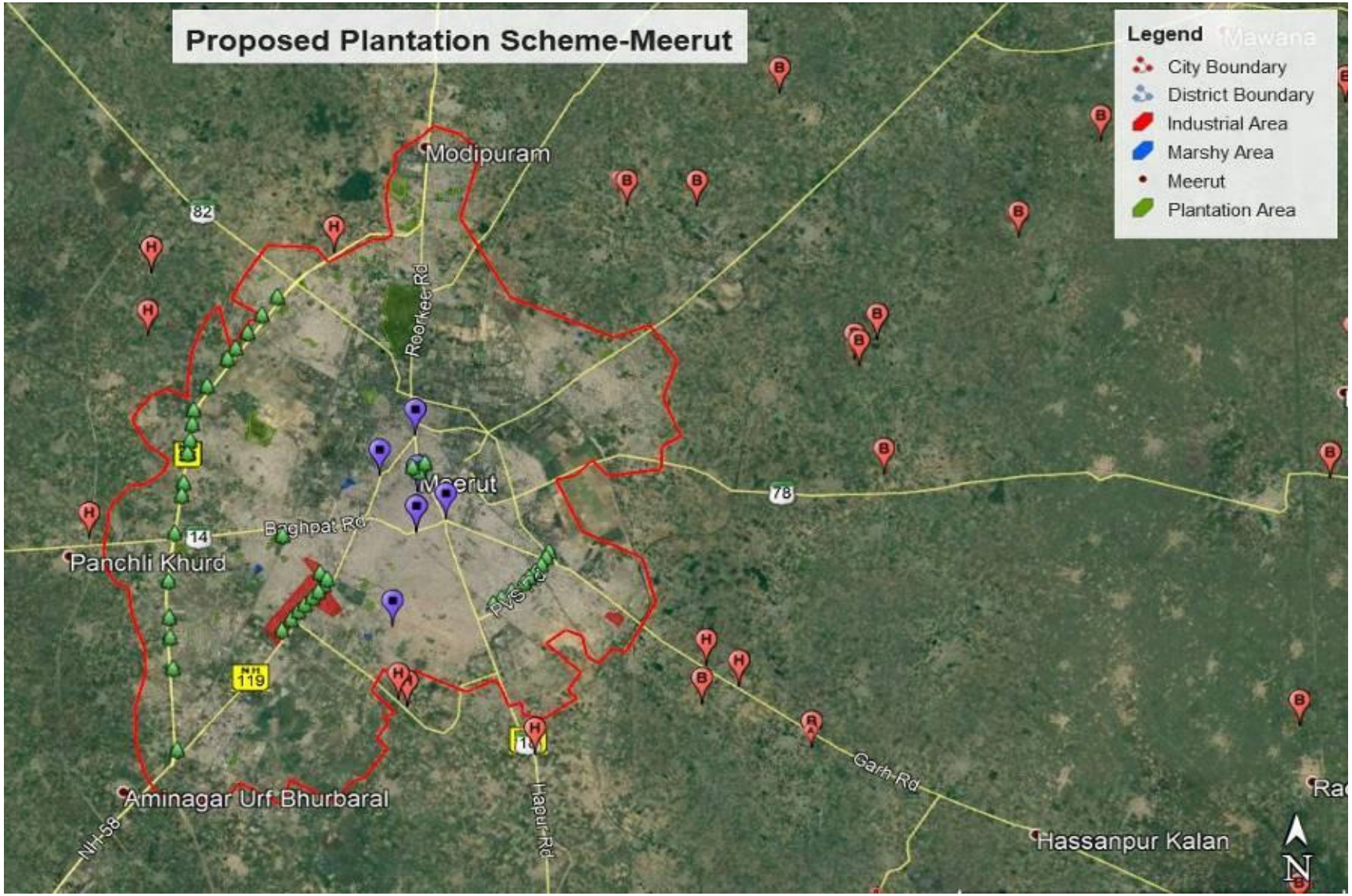


Figure 7: Satellite imagery showing Polluting sources and Proposed Plantation on Potential sites located on the outskirts and within the Meerut City

Following sites have been identified on the basis prominent Upwind and downwind wind flow pattern on which plantation is proposed to curb the rising level of PM_{10} in Meerut. In addition to these sites, following the direction prominent wind flow pattern, sites will be identified within the city between the habitation to create small oxygen pockets which will also help in lowering the rising level of pollutants being emitted from the major congestion points of the city.

Sites identified for proposing Plantation towards Upwind and Downwind directions

Towards Upwind Direction **North, North-West, West And South-West**				
Sr. Nos.	**Identified Site**	**Latitudes**	**Longitudes**	**Area (In Hectares)**
1.	Modipuram	29° 3'27.51"N	77°42'4.66"E	24.9
2.	Ishwar Nagar	29° 1'31.05"N	77°42'6.75"E	149
3.	Near Meerut bypass road	29° 2'53.52"N	77°42'17.43"E	3.16
4.	Near Ansal city	29° 2'49.68"N	77°42'11.76"E	5.18
5.	Near Sarvhit Hospital	29° 3'9.73"N	77°42'24.34"E	0.98
6.	Near Sarvhit Hospital	29° 3'5.49"N	77°42'17.97"E	1.35
7.	Near Dantal	29° 2'22.02"N	77°41'29.55"E	1.27
8.	Near Dantal	29° 2'18.70"N	77°41'36.19"E	0.53
9.	Near Shradhapuri phase-1	29° 1'56.79"N	77°41'20.94"E	2.41
10.	Near Hari Nagar	29° 2'7.06"N	77°41'4.92"E	1.49
11.	New Sainik Colony	29° 2'0.39"N	77°40'30.82"E	3.52
12.	Nangla Tashi	29° 2'5.84"N	77°39'55.14"E	1.96
13.	Kanker Khera	29° 1'35.04"N	77°41'11.15"E	0.99
14.	Near Defence Enclave	29° 1'38.07"N	77°40'13.94"E	5.36

15.	Shivlok Puri	29° 1'24.17"N	77°41'13.61"E	0.89
16.	Sadhu Nagar	29° 1'5.11"N	77°40'41.49"E	1.52
17.	Sadhu Nagar	29° 1'8.65"N	77°40'35.96"E	1.0
18.	Near Rajban Bazaar	29° 0'17.34"N	77°41'35.64"E	8.49
19.	Near New Sainik Vihar	28°59'45.82"N	77°39'52.33"E	37.1
20.	Near Purwa Fateh Nagar	28°59'9.89"N	77°41'48.69"E	1.1
21.	Near Rishi Nagar	28°57'58.98"N	77°38'35.45"E	5.24
22.	Near Jaswant Nagar	28°58'9.11"N	77°40'5.84"E	2.9
23.	Near Multan Nagar	28°58'14.20"N	77°40'18.59"E	0.89
24.	Jawahar Nagar	28°58'21.77"N	77°41'30.40"E	0.28
25.	Jawahar Nagar	28°58'24.61"N	77°41'35.10"E	0.32
26.	Muftiyan	28°58'1.98"N	77°41'59.69"E	1.25
27.	Muftiyan	28°58'1.08"N	77°42'4.84"E	0.17
28.	Near Pilokhari Maharaj Mandir	28°57'51.10"N	77°42'19.99"E	0.46
29.	Near Indra Nagar	28°57'44.03"N	77°41'54.47"E	0.43
30.	Near Lalla Pur	28°57'49.78"N	77°40'14.85"E	0.99
31.	Near Paper Mill Colony	28°57'40.58"N	77°39'50.56"E	1.65
32.	Putha Village Ghata	28°56'56.96"N	77°39'10.38"E	1.48
33.	EIDGHAH LISARI	28°56'52.80"N	77°41'57.43"E	0.29
34.	Madhav Puram	28°57'7.38"N	77°41'37.17"E	3.22
35.	Sector 4, MDAr	28°54'47.65"N	77°39'27.13"E	2.22
36.	Nangla Sher Khan	28°56'7.10"N	77°41'28.90"E	0.36

37.	Nangla Sher Khan	28°56'12.62"N	77°41'19.68"E	0.84
38.	Near Rafiq Pura	28°57'16.22"N	77°42'5.15"E	1.41
39.	Bobbywali Colony	28°57'53.44"N	77°39'31.27"E	1.55
40.	Malyana	28°58'3.21"N	77°40'0.86"E	0.56
41.	Madhav Puram	28°57'26.51"N	77°41'31.22"E	1.84
Total Area				**280.55**
TOWARDS DOWNWIND DIRECTION **South, South-East, East and North-East**				
Sr. Nos.	**Identified Site**	**Latitudes**	**Longitudes**	**Area (In Hectares)**
1.	Near Irrigation Colony	29° 3'24.56"N	77°42'54.21"E	1.67
2.	Near Pallavpuram	29° 3'17.10"N	77°42'42.89"E	1.27
3.	Pallavpuram	29° 3'24.71"N	77°43'1.67"E	0.58
4.	Pallavpuram	29° 2'58.65"N	77°42'56.18"E	0.87
5.	Near Sheelkunj	29° 2'41.54"N	77°43'5.69"E	1.11
6.	Ekta Nagar	29° 2'8.30"N	77°42'45.14"E	0.51
7.	Rakshapuram	29° 0'56.74"N	77°45'23.68"E	4.18
8.	Defence Colony	29° 0'42.27"N	77°44'39.50"E	2.89
9.	Prabhat Nagar	28°59'33.04"N	77°43'47.62"E	0.71
10.	Balwant Nagar	28°58'36.19"N	77°43'45.76"E	0.75
11.	Near Ganga Nagar	29° 0'2.95"N	77°45'30.10"E	2.0
12.	Kaserukhera	29° 0'12.94"N	77°44'14.59"E	7.33
13.	Near Ashok Nagar	28°58'30.95"N	77°43'42.53"E	0.35
14.	Near Kalyan	28°57'59.22"N	77°43'46.05"E	1.35
15.	Near Islamabad	28°58'4.92"N	77°42'54.00"E	0.64
16.	Near Preet Vihar	28°58'3.47"N	77°43'15.98"E	0.96

	Colony			
17.	Shastri Nagar	28°57'33.25"N	77°44'31.46"E	0.30
18.	Ansal Colony	28°57'5.84"N	77°44'15.23"E	1.69
19.	Devi Nagar	28°58'26.26"N	77°42'52.36"E	1.24
20.	Near Police Traning Center	28°56'27.48"N	77°43'35.48"E	2.28
21.	Near Ahmad Nagar	28°57'17.45"N	77°43'14.59"E	2.25
Total Area				**34.93**

As per the locations identified towards the prominent upwind and downwind directions given above in the table, total area proposed for plantation and maintenance of the vegetation in Upwind direction is approximately 280.55 ha similarly towards downwind directions is approximately 34.93 ha which comes upto the total of **315.48 ha**.

Abandoned Brick Kiln sites proposed for Plantation

Above given is the list of abandoned brick kiln sites which could be considered for plantation along with the other areas proposed for plantation as this city has high demands of other activities these pockets of place should be considered for creating oxygen pockets.

Sr. Nos.	Brick Kilns	Latitudes	Longitudes
1.	A BK S-1	29° 7'3.64"N	77°45'26.27"E
2.	A BK S-2	29° 6'52.95"N	77°45'39.26"E
3.	A BK S-3	29° 5'38.53"N	77°31'36.51"E
4.	A BK S-4	29° 2'57.29"N	77°31'20.09"E
5.	A BK S-5	29° 0'58.66"N	77°32'9.56"E
6.	A BK S-6	28°54'58.92"N	77°48'37.78"E
7.	A BK S-7	29° 0'50.57"N	77°49'19.61"E
8.	A BK S-8	29° 3'21.42"N	77°45'33.52"E

Marshy areas sites proposed for Plantation

S.N.	Direction	Site	Lat	Long	Area
1.	NE	Near Irrigation Colony	29° 3'16.68"N	77°43'4.19"E	0.25
2.	NE	Near Gangotri Colony	29° 1'48.50"N	77°43'0.79"E	0.18
3.	NE	Amehra Adipur	29° 1'12.80"N	77°44'56.61"E	0.42
4.	NE	Amehra Adipur	29° 1'5.57"N	77°44'53.55"E	0.19
5.	E	GandhiNagar	28°58'39.50"N	77°43'22.72"E	0.16
6.	SE	Near Ajanta Colony	28°57'48.98"N	77°44'39.32"E	5.13
7.	SE	KAjipur	28°56'26.89"N	77°44'5.90"E	0.87
8.	SE	Near Jahidpur	28°55'38.89"N	77°43'58.94"E	8.35
9.	SE	Zakir Colony	28°56'57.11"N	77°42'46.59"E	1.44
10.	SE	Near Ahmad Nagar	28°57'2.16"N	77°43'19.83"E	0.52
11.	SW	Mohkam Pur	28°57'12.99"N	77°40'14.15"E	0.32
12.	SW	Jaswant Nagar	28°57'40.85"N	77°39'50.22"E	1.65
13.	SW	Saraswati Lok	28°56'40.22"N	77°41'34.79"E	1.64
14.	NW	Maqbara Diggi	28°58'59.56"N	77°41'17.31"E	2.0
15.	NW	Prempuri	28°58'54.95"N	77°41'12.39"E	1.17
Total Area			**24.29**		

Waste dump sites proposed for Plantation

S.N.	Direction	Site	Lat	Long	Area
1.	SW	Village- Ganwadi	28°53’25.3” N	77°35’31.3”E	8
2.	SE	Lohiya Nagar Village- Ghosipur, Hapur Road, Meerut	28^{0}53'25.3"N	77^{0}44'16.1"E	0.291
3.	SW	Mangatpuram, delhi road, Meerut	28^{0}56'54"N	77^{0}41'16"E	3.6
Total Area			**11.89 ha**		

Above two tables were given with the details of marshy areas and waste dump sites found during marking using Google Earth pro. All identified sites form Google Earth should be verified for their current status and authorization whether these are legal or illegal in nature for carrying out the plantation activities.

As plants are universal sink for air pollutants, they trap the carbon dioxide and store it within them as reserve food material. Plants being the initial acceptors of air pollutants act as a scavenger to the pollutants. Leaves provide surface area for impingement, absorption and adsorption of air pollutants as well settlement for dust particles in the atmosphere equally. Few plants are sensitive to certain air pollutants while others are tolerant. The plants sensitive to pollutants act as pollution indicators while the plants tolerant to pollutants act as sink. While selecting the species for pollution control the following are the important characteristics that should be considered. Plants should be evergreen, large leaved, rough bark, indigenous, ecologically compatible, low water requirement, minimum care, high absorption of pollutants, resistant pollutants, agro-climatic suitability, height and spread, canopy architecture, growth rate and habit (straight undivided trunk), aesthetic effect (foliage, conspicuous and attractive flower colour), pollution tolerance and dust scavenging capacity. Hence, plantation needs to be done on haul routes to curb air pollution in respect to dust emission.

Selection of Plants for Greenbelts:

Main limitation for plants to function as scavenger of pollutants are- Plants interaction to air pollutants, sensitivity to pollutants, climatic conditions and soil characteristics. While making choice of plants species for plantation in green belts, due consideration has to be given to the natural factor of bio-climate. Character of plants

mainly considered for affecting absorption of pollutant gases and removal of dust particle are as follows.

Major Pollutants	Varieties of Trees	Varieties of Bushes
Particulate Matter	Cassia siamea (Kassod tree), Siris, Chitwan, Kadamb, Neem, Sheesham, Mahua, Amaltas, Ficus (Peepal and Banyan)	Kadi Patta, Croton, Tecoma stans, Cassia glauca, Dhak
Sulphur oxides	Siris, Arroo, Chitwan, Kadamb, Neem, Bamboo, Mahuli, Semal, Mahua, Tamarind, Ficus	Amla, Dhak, Subabool,
Nitrogen oxides	Chilbil, Mangifera indica (aam), Siris, Mahua, Jamun, Neem, Sheesham	Mahuli, Subabool, Dhak,

For absorption of gases:

- Tolerance towards pollutants in question, at concentration, that are not too high to be instantaneously lethal
- Longer duration of foliage
- Freely exposed foliage
- Adequate height of crown
- Openness of foliage in canopy
- Big leaves (long and broad laminar surface)
- Large number of stomatal apertures

For Removal of Suspended Particular matter:

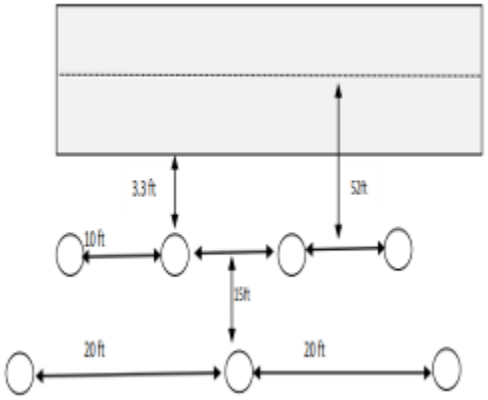
- Height and spread of crown.
- Leaves supported on firm petiole
- Abundance of surface on bark and foliage
- Roughness of bark
- Abundance of axillaries hairs
- Hairs or scales on laminar surface
- Protected Stomata

Selection of Plants for Greenbelts:

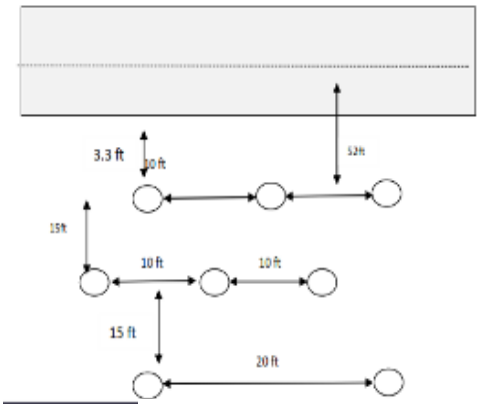
The main limitation for plants to function as scavenger of pollutants are, plant's interaction to air pollutants, sensitivity to pollutants, climatic conditions and soil characteristics. While making choice of plants species for plantation in green belts, due consideration has to be given to the natural factor of bio-climate. Character of plants mainly considered for affecting absorption of pollutant gases and removal of dust particle are as follows.

a. **Plantation pattern:**

- The first row along the highways will be of small to medium size ornamental trees
- Subsequent rows depending on the availability of width will comprise of ornamental and/or shade bearing species of medium height more than those in the first row.
- In rural sections the last row shall always be shade bearing tall trees.
- Plantation shall be done in a staggered (zigzag) manner.



(Option 1) Two-row Plantation



(Option 2) Three-row Plantation

Plantation pattern

Specification	I row	II row	III row
Spacing between plant to plant	10 ft	10 ft	20 ft
Canopy Shape & Size	Cylindrical/oblong with small CSA	Round/oblong with medium CSA	Spreading with medium CSA
Spacing between rows	-	15 ft	15 ft
Size of the pits	60 X 60 X 60 cm	60 X 60 X 60 cm	60 X 60 X 60 cm
Height of the plant	1.5 m to 2 m	More than 2m	More than 3m

To develop a plantation matrix various characteristics of plant species are taken into considerations like tolerance factor, ecologically compatible, growth rate of plant species, canopy surface area, leaf area, stomatal index, canopy shape, flowering seasonality and utility etc. and score obtained by varieties of species of trees and bushes naturally found in that region. The species which scored high are preferred over the species scored less for the plantation to curb air pollution

Matrix for plant selection

S.No.	Characteristic	Score	Remarks
1.	Tolerance/stressed	1/0	Any species which have shown tolerance for primary pollutants of vehicular emission will be rated tolerant and given a fixed score of 1 mark and sensitive species are given 0 mark.
2.	Evergreen	1/0.5/0	Evergreen tree/shrubs have been given 1 marks, semi deciduous have been given 0.5 marks and deciduous have got 0 mark.
3.	Growth rate	1/0.5/0	Growth rate of trees/ shrubs have been classified in to three categories. Fast- 1 mark for the trees which grow in a very short span of time. Quick 0.5 mark for the trees which grow in a very short span of time. Slow-0 mark for the trees which grow in a very short span of time.
4.	Canopy surface	1	Trees/ shrubs with highest canopy surface have been given 1 mark and others have been rated relative to the tree /shrubs with highest CS.
5.	Leaf area	1	Trees/ shrubs with highest leaf area have been given 1 mark and others have been rated relative to the tree /shrubs with highest LA.
6.	Stomatal index.	1	Trees/ shrubs with highest stomatal index have been given 1 mark and others have been rated relative to the tree /shrubs with highest SI.
7.	Canopy shape- Spreading/Round	1/0.75/0.	Spreading-1 mark

	/oblong/Flat crown/Conical	5/0.25/0	Round -0.75 mark Oblong-0.5 mark Flat crown-0.25 mark Conical-0 mark
8.	Flowering seasonality	0.5	Tree/shrubs having the round year flowering season have been given 0.5 marks and others have been rated relative to them.
9.	Utility	1	Trees with highest recorded uses have been given 1 mark and others have been rated relative to the tree /shrubs with highest uses.
10.	Total	8.5	

Recommended Pattern of Plantation for the congested streets:

As these congested streets have a local scenario due to emission of pollutants from vehicle exhausts which could not escape concrete lanes and narrow streets and causes deterioration in the local air quality. Hence, low hedges/ green barriers which have an impermeable core are recommended between the traffic lanes and the footpath along with the isolated trees every here and there.

Recommended Species for Various Soil Types:

Selection of suitable plant species for the plantation downwind direction to curb the dust emitted in the city and upwind direction to ensure the entry of filtered wind into the city is the key of successful plantation programme. Given below are the few species suitable for plantation according the soil types found in that region.

Suitable species for different soil types.

Soil Type	Suitable Species
Clay Soil	*Azadirachata indica, Pongamia pinnata, Swietenia mahagoni, Pterocarpus marsupium, Terminalia tomentosa, Melia dubia, Delbergia latifolia, Delbergia sissoo*
Red soil with 10 ft minimum soil depth	*Swietenia mahagoni, Pterocarpus marsupium, Terminalia tomentosa, Melia dubia, Delbergia latifolia, Azadirachata indica, Pongamia pinnata, Ailanthus exceisa*
Red soil with 5 ft minimum soil depth	*Tectona grandis, Swietenia mahagoni, Santalum album, Pterocarpus marsupium, Delbergia latifolia, Azadirachata indica, Melia dubia, Ailanthus exceisa*

Alluvial soil	*Tectona grandis, Swietenia mahagoni, Pterocarpus marsupium, , Melia dubia, Delbergia latifolia, Neolamarckia cadamba, Pongamia pinnata*
Uncultivable soil	*Azadirachata indica, Albezia lebbeck, Delbergia sissoo, Ailanthus exceisa, Pterocarpus santanalius*

Plants experience physiological changes before getting damaged when the leaves are exposed to air pollutants. The tolerant species are preferred over the sensitive species for plantation. To analyze the species, various variables are used like Air Pollution Tolerance Index (APTI) which is based on biochemical parameters, Anticipated Performance Index (API) which is based on biological and socio-economic aspect of a plant. The carbon trapping and dust accumulating potential also varies from species to species.

APTI score of different trees and their efficacy in Pollution control.

S. Nos.	Botanical Name	Family	Common Name	APTI	Effective in Control
1.	*Cassia siamea*	*Caesalpiniodeae*	*Kassod tree*	*10.41*	*Dust*
2.	*Albizia lebbeck*	*Fabaceae*	*Siris tree*	*15.9*	*Air pollution*
3.	*Alstonia scholaris*	*Apocynaceae*	*Chitwan tree (Blackboard tree)*	*6.6*	*Dust*
4.	*Neolamarckia cadamba*	*Rubiaceae*	*Kadamb tree (Burflower tree)*	*15.5*	*Dust*
5.	*Azadirachta indica*	*Meliaceae*	*Neem tree*	*18.73*	*Dust, air pollution and Noise pollution*
6.	*Dalbergia sissoo*	*Papilionaceae*	*Sheesham*	*16.59*	*Air pollution Noise pollution*
7.	*Madhuca indica*	*Sapotaceae*	*Mahua*	*22.57*	*Air pollution*
8.	*Mangifera indica*	*Anacardiaceae*	*Mango*	*20.80*	*Air pollution*
9.	*Bougainvillea spectabilis*	*Nyctaginaceae*	*Booganbel*	*20.32*	*Air pollution*
10.	*Nerium indicum*	*Apocynaceae*	*Kaner*	*18.94*	*Air pollution*
11.	*Ficus benghalensis*	*Moraceae*	*Banyan*	*15.92*	*Air pollution, noise pollution*
12.	*Ficus religiosa*	*Moraceae*	*Peepal*	*12.41*	*Air pollution, noise pollution*

Significance of Plantation in city:

According to the UN World Health Organization (WHO), about 90% of the global population living in cities in 2014 was exposed to particulate matter that exceeded the WHO air quality guidelines. The UN agency estimates that outdoor air pollution caused three million premature deaths in 2012, with the vast majority occurring in low- to middle-income nations.

The WHO Health Statistics 2016 says air pollution is "caused by inefficient energy production, distribution and use, especially in the industrial, transportation and building sectors, and by poor waste management". It adds that transport systems based primarily on individual motorized transport can lead to further deterioration in air quality. As everyone within an urban area breathes the same air, the pollution does not discriminate - both rich and poor are exposed to the dangers. But, it adds, people living near the source or busy roads are more exposed and more affected. The WHO says that the air quality in many cities is not monitored, making it difficult to get an accurate understanding of the global impact of air pollution. However, planting trees in an urban setting is not without potential pitfalls. One is regarding the flow of air in heavily polluted streets, particularly ones with large volumes of traffic. Thick canopies can limit the circulation of air, trapping the poor-quality air at low levels, where people breathe but if plantation done in a manner that instead of restricting the air flow it will facilitate the movement of air and also reduce the concentration of pollutants, that should be encouraged.

Trees help by removing (sequestering) CO_2 from the atmosphere during photosynthesis to form carbohydrates that are used in plant structure/function and return oxygen back into the atmosphere as a byproduct. Roughly half of the greenhouse effect is caused by CO_2. Therefore, trees act as carbon sinks, alleviating the greenhouse effect.On average, one acre of new forest can sequester about 2.5 tons of carbon annually. Young trees absorb CO_2 at a rate of 5.9kg per tree each year. Trees reach their most productive stage of carbon storage at about 10 years at which point they are estimated to absorb 21.8kg of CO_2 per year.

Trees also reduce the greenhouse effect by shading houses and office buildings. This reduces the need for air conditioning by up to 30 percent which in turn reduces the amount of fossil fuels burned to produce electricity. The combination of CO_2 removal from the atmosphere, carbon storage in wood and the cooling effect makes trees extremely efficient tools in fighting the greenhouse effect. Planting trees remains one of the most cost-effective means of drawing excess CO_2 from the atmosphere. Especially, the urban vegetation plays a multitude of different roles in the urban environment as they provide shade, absorb and store carbon dioxide, mitigate the urban heat island effect, affect noise hindrance, enrich the urban biodiversity etc. in addition, trees and urban vegetation play a great role in enhancing the aesthetical and emotional value.

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