BEFORE THE NATIONAL GREEN TRIBUNAL,
PRINCIPAL BENCH, NEW DELHI.

Original Application no. 295 of 2023

In the matter of

Dimpal Kumar

.....Applicants

Versus

State of Punjab &Ors.

.....Respondents

Status report on behalf of Punjab Pollution Control Board through Er. Vijay Kumar, Environmental Engineer, Punjab Pollution Control Board, Regional Office, Fatehgarh Sahib in compliance to order dated 10.10.2023.

Respectfully Showeth:

1. That briefly Sh. Dimpal Kumar has filed an application before the Hon'ble National Green Tribunal with the grievance against unregulated violation of air quality norms by 220 coal fired furnaces operating in Mandi Gobindgarh, Punjab, engaged in recycled steel production, Ceramics/Refractory, Cupola Furnaces, Forging Induction furnaces, Lead Smelting units, Rolling mills, Ply board, Milk Plant and Pyrolysis Plants by making reference of various orders passed by the Hon'ble National Green Tribunal in other cases. The application was registered as Original Application No. 295 of 2023 (Dimpal Kumar V/s State of Punjab and Others).
2. On consideration of the matter, the Hon'ble NGT has passed an order dated 21/04/2023 thereby constituting a joint committee of CPCB, State PCB and District Magistrate to undertake visit to the site, interact with stakeholders and furnish a factual and action taken report in the matter within two months by e-mail at- Judicial-ngt@gov.in preferably in the form of searchable PDF/OCR support PDF and not in the form of Image PDF. State PCB was nominated as Nodal agency for co-ordination and compliance.

It was directed vide the said order that the report may be holistic on the subject matter of restoring Environmental Quality in the critically polluted area in question.

3. That the Joint Committee has filed final report dated 7.10.2023 with the Hon'ble National Green Tribunal. After perusal of the Joint Committee report, the Hon'ble National Green Tribunal observed that the name and details of violating units have not been disclosed nor the report of IIT, Delhi referred in the joint report has been placed on record.The record further reflects that by the order dated 21.04.2023, the State PCB was directed to put to notice the effected parties. Nothing has been placed on record by the State PCB to show that the effected parties have been put to notice of these proceedings. Hence, the Punjab Pollution Control Board was directed to submit report in respect of the defaulting units and action taken against them. Para no. 5 and 6 of the order dated 10.10.2023 are reproduced herein below for kind perusal and reference of the Hon'ble National Green Tribunal:

> "5. The record further reflects that by the order dated 21.04.2023, the State PCB was directed to put to notice the effected parties. Nothing has been placed on record by the State PCB to show that the effected parties have been put to notice of these proceedings.
>
> 6. Hence, Counsel for the State PCB is directed to submit the report in this regard as also the report in respect of the details of the defaulting units and action taken against them. Let the objection/report in terms of the above order be filed within four weeks by e-mail at judicial-ngt@gov.in preferably in the form of searchable PDF/ OCR Support PDF and not in the form of Image PDF."

4. That in compliance to order dated 10.10.2023 of the Hon'ble National Green Tribunal, the para no. 8 of the reply of the Punjab Pollution Control Board dated 07.10.2023 may kindly be perused.The copy of the draft report of source apportionment study prepared by IIT, Delhi as referred in the Joint Committee report is hereby produced and is placed at **Annexure-A** for kind perusal.

5. That in further compliance to order dated 10.10.2023 of the Hon'ble National Green Tribunal, it is respectfully submitted that the Punjab

Pollution Control Board has been actively monitoring and regulating the polluting industries of Mandi Gobindgarh from time to time to ensure that they adhere to prescribed environmental standards. In this context,the action taken by the Board is summarized herein below:

a) With effect from 01.01.2022 upto 30.09.2023, the PPCB carried out 600inspections of industrial unitsofMandi Gobindgarh.

b) Out of said 600inspections carried out by the Board, 538 were found to be operating in accordance with the provisions of various pollution control laws such as the Water (Prevention & Control of Pollution) Act of 1974, the Air (Prevention & Control of Pollution) Act of 1981, and the Hazardous and Other Wastes Management Rules of 2016.

c) The remaining 62 units were found to be operating their units in violation of the provisions of Air (Prevention & Control of Pollution) Act, 1981, Water (Prevention & Control of Pollution) Act, 1974 and Hazardous & Other Waste (Management & Trans boundary Movement) Rules, 2016. Accordingly, show cause notices for violation of the Air (Prevention & Control of Pollution) Act, 1981 wasto each of these 62 units. A list containing the name of 62 units is placed at **Annexure-B**.

d) Out of the 62 violating units, the Board has imposed Environmental compensation amounting to Rs.1,92,95,000/- was upon 30 violating industrial units. The list of 30 unit is placed at **Annexure-C**.

e) 26 defaulting units were directed to furnish Bank Guarantee of different amount as an assurance to comply with the provisions of the environmental laws. A list of 26 defaulting units is hereby produced and is placed at **Annexure-D**.

f) Apart from the above 08 such units were found to highly violating the provisions of the Air (Prevention & Control of Pollution) Act, 1981. Accordingly, the Board has issued directions under the provisions of the Air (Prevention and Control of Pollution) Act, 1981 and Environment (Protection) Act, 1986 were issued by the Board for disconnection of electricity supply of the units. A list of 08 units is placed at **Annexure-E**. After the issuance of the directions by the Board, the defaulting 08 no. units have made compliance of the provisions of the environmental laws and as such the units were allowed to operate.

6. That it is pertinent to mention here that in pursuance to the orders issued by the Hon'ble NGT, relevant Stakeholder Departments and Associations were formally informed and briefed regarding the specifics and the contents of the application & proceedings issued by the Hon'ble NGT through e-mail dated 21/06/2023, which is placed as **Annexure-F**. An invitation was extended to the Stakeholder Departments & Associations to participate in the consequential meeting. The meeting was presided over by the Addl. Deputy Commissioner (G), Fatehgarh Sahib and the primary objective of the meeting was to facilitate comprehensive & authentic compilation of reports and factual data, which was to be submitted in the Hon'ble National Green Tribunal.

7. That further it is submitted that the Punjab Pollution Control Board is taking appropriate action against the defaulting units in accordance with the provisions of the Water (Prevention and Control of Pollution) Act, 1974, Air (Prevention and Control of Pollution) Act, 1981, Environment (Protection) Act, 1986 and the rules made thereunder, as and when the violations are noticed by the officers of the Board.

8. That the status report in terms of order dated 10.10.2023 is hereby submitted for kind perusal and appropriate orders of the Hon'ble National Green Tribunal.

Submitted by

Date: 25.11.2023
Place: Fatehgarh Sahib

(Vijay Kumar)
Environmental Engineer,
Punjab Pollution Control Board,
Regional Office, Fatehgarh Sahib.

Emission Inventory and Source Apportionment study of PM in Mandi Gobindgarh

Submitted to

Punjab Pollution Control Board

Prof. Sri Harsha Kota

Prof. Mukesh Khare

Prof. A.K. Nema

Department of Civil Engineering

Indian Institute of Technology Delhi

March 2023

Disclaimer

All the input data required to develop emission inventory for the city was provided by the Punjab Pollution Control Board, and IIT Delhi's team is not responsible for the quality of input activity data used in this study.

Acknowledgement

This report is a part of the project titled “Action Plan to Mitigate Particulate Matter in seven non-attainment cities of Punjab using Emission Inventory and Source Apportionment”. This project was sponsored by the Punjab Pollution Control Board to Indian Institute of Technology Delhi.

We are grateful to Prof. Adarsh Pal Vig (Chairman, PPCB), Prof. Satwinder Singh Marwaha (Ex-Chairman, PPCB), Er. G.S. Majithia (Member Secretary, PPCB), Er. Krunesh Garg (Chief Environmental Engineer, PPCB) for promptly addressing all the queries and heading to all the concerns and requests.

We sincerely thank the officials at PPCB for their immense support throughout the project, right from the field study to data collection. Special thanks to Er. Vijay Kumar (Environmental Engineer, PPCB) and Er. Rubal Goyal (Assistant Environmental Engineer, PPCB) for always being available and catering to any problems arising during the project. We would once again like to acknowledge all the PPCB officials for providing the input data for all the sources.

Sincere thanks to the entire team at IIT Delhi, who worked endlessly towards the completion of this project - Mr. Arpit Katiyar (Ph.D. Scholar); Miss Jagriti Suneja (JRF), Miss Pratika Chawla (JRF), Mr. Praneeth Pani (JRF), Mr. Urman Ali (JRF), Mr. Shubham Sharma (Ph.D. Scholar), Miss Anshika (JRF), Mr. GandhamPhanni (Pr. Assistant).

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1. INTRODUCTION

Urban air quality issues have emerged as a major concern impacting quality of life. Air pollution not only has adverse effect on health but it also has sabotage our ecosystem and economy. Rural to urban migration, growth in mobility, stubble burning, increasing power demand and industrial production are some of the common factors that had led to deterioration of air quality in urban centres. Detailed scientific studies is require for identification of major sources of air pollution and their contribution to the ambient air quality of a region, so that we can formulate new policies and implement it.

The complexities of sources and their cumulative impact on receptors are interlinked with sources, their strength, meteorology condition, elevation of release, atmospheric transformations etc. Strategies for sector specific pollutants need to be drawn from scientific evidence which will be concrete and clear. These facts can be derived from the use of multitude of techniques such as emission inventory (EI), dispersion modelling and receptor modelling. In present study emission inventory approach is adapted to identify air pollution sources and their respective contribution.

Emission Inventory is a structured collection of information about emission from pollutant in a specified area. EI permits allocation of emitted pollutants to their originating sources. A quality EI should be able to provide: a reliable estimate of total emissions of different pollutants, their spatial and temporal distribution, identification, and characterization of main sources and tracking progress towards air pollution control. In addition, EI is used for air quality modeling for developing air pollution control strategies to attain air quality standards and environmental clearance.

Policymakers and researchers are facing challenges in the formation of effective air quality management strategies in absence of structured EI. An EI is a fundamental knowledge to understand local and regional air pollution, its transportation, and impacts. Emission inventories with highly resolved temporal and spatial information are urgently needed to combat the increasing urban and regional air pollutions.

1.1. Need for Study

Rapid urbanization and industrialization have resulted in increased load on the environment. The ever-increasing demand of production has led to increase the usage of fossil fuels and their derivatives. The anthropogenic emissions result in altering the atmospheric conditions which in turn impact the local weather and climate. The effect of air pollution is not only limited to its source of generation but also effects the composition, chemistry, and life cycles in downwind regions. The problem of air pollution is more pronounced in developing countries, and they are facing huge challenge in controlling and finding mitigation measures. Recent WHO report indicated that about 6.7 million people die prematurely every year as a result of air pollution, while many more suffer from breathing ailments, heart disease, lung infections and even cancer in developing countries. India, being a developing country, is no such exemption. India was the fifth most polluted country in 2019 and accounts for almost two-thirds of the world's most polluted cities (based on $PM_{2.5}$ levels).

Mandi Gobindgarh city in the state of Punjab, India is also referred as Steel City of Punjab due to its large number of steel factories. The inhabitants of this city mainly depend on agriculture and

industrial work for their living. The concentration of pollutants depends not only on the amounts which are emitted from contaminated sources but also on the capacity of the air to either retain or scatter these pollutants. Mandi Gobindgarh city (Longitude: 76.29 and Latitude: 30.66), shows complex weather conditions and atmospheric seasonal variation making concentration fluctuates and briefly making the air pollution change spatially and temporally because of changes in meteorological and geographical conditions.

Quantifying emissions from sources in Mandi Gobindgarh city will be one of the major steps towards improving air quality. This study will help the policy makers and engineers to prepare control strategies for reduction of air pollution in the cities having similar patterns in India and attainment of $PM_{2.5}$ and PM_{10}NAAQS set by Central Pollution Control Board (CPCB). This study will able to provide contributions of different source types responsible for emission of specific pollutants and can be used as reference study to create inventory for other cities as well.

1.2 About Mandi Gobindgarh

Climate& Rainfall

The climate of Mandi Gobindgarh city is generally dry with very hot summers and frosty winters. Summer season starts from the middle of March and prevails till June and is followed by southwest monsoon season from July to second week of September. June is generally the hottest month and the city experiences hot dusty winds during the summer season. Winters start from the middle of November and last up to the second week of March. The period from the second week of September to second week of November is generally considered as transition period. The mean daily temperature varies in the range of 5.8 degree centigrade to 41.2 degree centigrade. (Department of Science Technology and Environment, 2019).The rainfall in the city increases from southwest towards the northeast. About 70% of the rainfall is received during the monsoon season i.e., from July to September. The rainfall from December to March accounts for 16% of the rainfall and the remaining 14% rainfall is received in other months of the year. The average annual rainfall is 681 mm.(Department of Science Technology and Environment, 2019).

1.3 Sources of Air Pollution in Mandi Gobindgarh

Source wise emission inventory has been prepared for PM10 and PM2.5 pollutants for the year 2019 with a resolution of 300m * 300m. All the sources are divided into major three categories namely Line sources, Area sources and Point sources in the study area.

The major sectors covered for estimation of emissions are -

1. Area Source
    i. Domestic
    ii. Stubble Burning
    iii. MSW
    iv. Construction

2. Point Source
    i. Food Joint

ii. Open Eat out
iii. Crematoria
iv. DG sets
v. Industry

3. Line Sources
    i. Vehicular emissions
    ii. Road Dust

1.4 Domestic Emissions

As per the data provided by PPCB, the population of Mandi Gobindgarh city is 138678 which is distributed in 25 wards. The city is divided into 25 wards and ward number 16 is the most populous ward with a total population of 7706 and ward number 9 is least populated with 2502 population. Majority of houses use LPG as fuel in Mandi Gobindgarh, but certain numbers of houses are also dependent on wood as a fuel for cooking purpose. Domestic emissions were estimated based on quantity and type of fuel consumed by each household and total number of households which has been provided by PPCB.

Food Joints & Open Eat Outs

Food Joints & Open Eat Outs are neglected sources of emissions during source apportionment study however their contribution to pollutants is significant. Emissions from this source are also dependent on quantity and type of fuel used. It was found that majority of food joints uses LPG as fuel with few dependent on coal and wood. In present study the emissions from these sources are estimated based on the data provided by PPCB.

Stubble Burning

In Mandi Gobindgarh city only small patches of agricultural land are present, however, the city is surrounded by agricultural area and a lot of stubble is generated during post harvesting rice and wheat seasons. Burning being the easiest and economical option for management of stubble, most of the farmers practice this resulting in production of huge smoke cloud over the area. Burning of rice stubble is more as compared to wheat because wheat can be utilized for fodder or can be tilled back into the soil. The effect of rice stubble burning is more due to the cold climate conditions.

MSW Burning

Municipal solid waste generation of the city is estimated based on population, fraction of which is collected, and burnt. The waste collected is dumped in the landfill site present at the outskirts of the city. Due to lack of collection efficiency at some places, people practice burning of MSW waste as disposal method.

Crematoria

The cremation of human bodies with wood (a religious practice) also contributes to air pollution. As per the data provided by PPCB, there are around 3 crematoriums in the city.

Construction and Demolition Activities

Mandi Gobindgarh is a small city of Punjab having population of about 1,38,678. As per the data provide by PPCB, there are no major on-going construction projects in the city. However, small construction activities are being carried out by the individual house holders / industrial units / commercial units and paving of streets by the Municipal Corporation on routine basis. A total of 87 sites are identified in the year 2019.

DG sets

Frequent power cuts lead to the use of DG sets for commercial and personal use. The low maintenance and use of lower grade of fuel lead to increase in emission from this source.

Industries

Mandi Gobindgarh is also known as steel city of Punjab because of its large number of steel factories. There are around 200 steel rolling mills that contribute 25% of the total recycled steel production of India. There are approximately 48 induction furnaces producing raw material for the rolling mills, 12 forging units catering to the needs of the steel-rolling mills, sugar, and paper industry, around 40 foundry units, 90 scrap-cutting units, and 12 oxygen plants catering to the local requirements of the industry. There are another 67 industrial units associated in addition with the steel industry. Emissions from all these industries contribute significantly towards air pollution.

Vehicles

Transport sector is one of the significant contributors to air pollution in Mandi Gobindgarh. It has been seen in Mandi Gobindgarh that the factories/industries are distributed throughout the city. Therefore, the movement of light and heavy goods/commercial vehicles carrying raw materials and the finished products can be seen throughout the city. Other category of vehicles such as 2W, 3W, 4W, Bus and others (tractors, JCBs etc.) are also found to be plying on the roads of city. Mandi Gobindgarh city is also connected to tourist destinations like Amritsar and industrial hubs like Ludhiana and Jalandhar via National Highway NH-1 which may increase the contribution of vehicular sector to the air pollution.

Road Dust

Road Dust is expected to be the one of the major contributors to PM in the air quality of Mandi Gobindgarh city. Being the steel city of Punjab and the distribution of the industries throughout the city the movement of the HCVs and LCVs can be seen throughout the city unlike a non-industrial city where usually the HCVs ply via the National Highways and the State Highways. Therefore, road dust could be a significant contributor to the air pollution. Presence of potholes on the road poorly, partially paved surfaces, movement of overloaded transport vehicles adds up to the problem.

1.5 Scope of Work

The scope of this project for IITD is to use the data provided by PPCB to carry out requisite analysis. Neither validation nor commenting on accuracy of the data provided by PPCB is in the scope of this project. Further, estimating contribution from non-municipal boundary sources to the city and inclusion of atmospheric chemistry in modelling is out of scope of this project.

1.6 Objectives of the study

The main objective of the proposed project is to estimate the contribution of various sources, such as vehicular emissions, domestic, road dust etc. on the air quality of the city and suggest measures to prevent and reduce pollution loads in the city. It is proposed to meet this main objective through the following sub objectives:

To analyse the diurnal and seasonal trends of Particulate matter.

To prepare an exhaustive emission inventory of criteria pollutants from various sources within the municipal boundary of the city.

Source apportionment of PM over the region of Mandi Gobindgarh city using the emission inventory developed based on the activity data provided by PPCB and dispersion modelling using the USEPA's AERMOD.

To identify the hotspots for PM in the city.

To provide city specific and hotpot specific action plans for Mandi Gobindgarh region.

1.7 Dispersion Modeling

Dispersion modeling for atmospheric pollutants is a mathematical simulation to know how the pollutants disperse in ambient air. The models are generally used to estimate the concentration of pollutants emitted from different sources such as industry, vehicles, burning of biomass etc. in downwind regions and can also be used to predict future concentration of these pollutants. These models find great use in policy making with a viewpoint of predicting and managing ambient air quality. These models are generally used to determine whether existing or new industries are in compliance with National Ambient Air Quality Standards (NAAQS). In the present study, modelling will be done for the entire Mandi Gobindgarh city and hotspots will be identified by running stimulations in AERMOD for the base case.

AERMOD extended from is American Meteorological Society (**A**MS) and the United States Environmental Protection Agency (**E**PA) **R**egulatory **Mod**el (AERMOD). It is a steady-state plume model which is applicable to rural or urban areas, flat or complex topography, different release heights, various combinations of pollutant sources. It is based on the Gaussian approach of dispersion modelling. The primary input data for model are emission, geometrical, meteorological and background data. It is very sensitive to the meteorological parameters like temperature, wind characteristics and cloud cover and surface attributes of the model space. AERMOD handles meteorological and terrain data in separate pre-processors known as AERMET and AERMAP respectively.

The growth and structure of the PBL is driven by the fluxes of heat and momentum, which, in turn, depend upon surface effects. The depth of this layer and the dispersion of pollutants within it are influenced on a local scale by surface characteristics such as surface roughness, albedo, and available surface moisture.

AERMET use wind direction, solar radiation, and other meteorological data as inputs and after processing the metrological data it creates outputs in form of SFL and PFL file that act as inputs for the AERMOD. AERMAP manages elevation of the terrain and generates contours maps and grids associated with receptors. Using SFL and PFL files along with emissions taken from emission inventory of the study area, simulations have been carried out. The results obtained would help us in developing and understanding of how particulate matter is being dispersed over Mandi Gobindgarh and what sources are responsible for elevated particulate matter concentration. The dominant sources in the region or hotspots would also be identified. Once the hotspots are identified, strategies to reduce the concentrations would be devised.

2. AIR QUALITY STATUS

Based on the $PM_{2.5}$ and PM_{10} data provided by PPCB, time series analysis was performed to understand the trend of data. In the present study variation in concentration of $PM_{2.5}$ and PM_{10} particles have been analysed for year 2019. Figures 1 and 2 represent the variation in monthly concentration of $PM_{2.5}$ and PM_{10} using box and whiskers plot. It can be observed from these two figures that the concentration of PM_{10} particles was quite high during November month (rice stubble burning period) as compared to April-May (wheat stubble burning period) that indicates that stubble burning of rice has more impact on ambient air quality, this can be because of higher percentage of rice stubble burning as compared to wheat and secondly rice stubble has higher ash content. Also, the harvesting period of rice is winter season that impacts the emission dispersion due prevailing inversion conditions. In inversion condition the cooler air is trapped under the warm air above that create a inversion like condition Since the vertical mixing of air happens only within this layer and the pollutants released lack enough space to disperse in the atmosphere. The potential for health effects, are pronounced during this season. From the extreme ends of boxplot graphs, it can also be noted that there was decrease in concentration value in month of December, but it was not that prominent. Graph also represents that concentration of both the particles was higher during winter months i.e., from October to January that may be because of emissions from industry and other sources were not able to disperse.

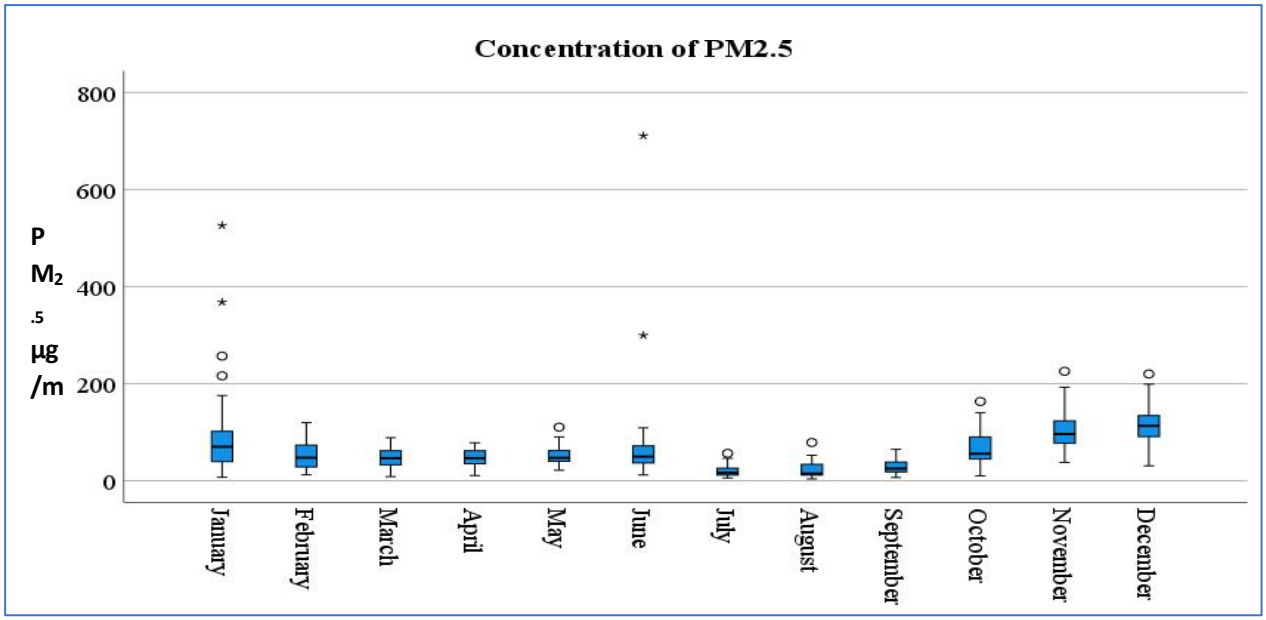

Figure 1 Monthly variation in concentration level of $PM_{2.5}$ for year 2019

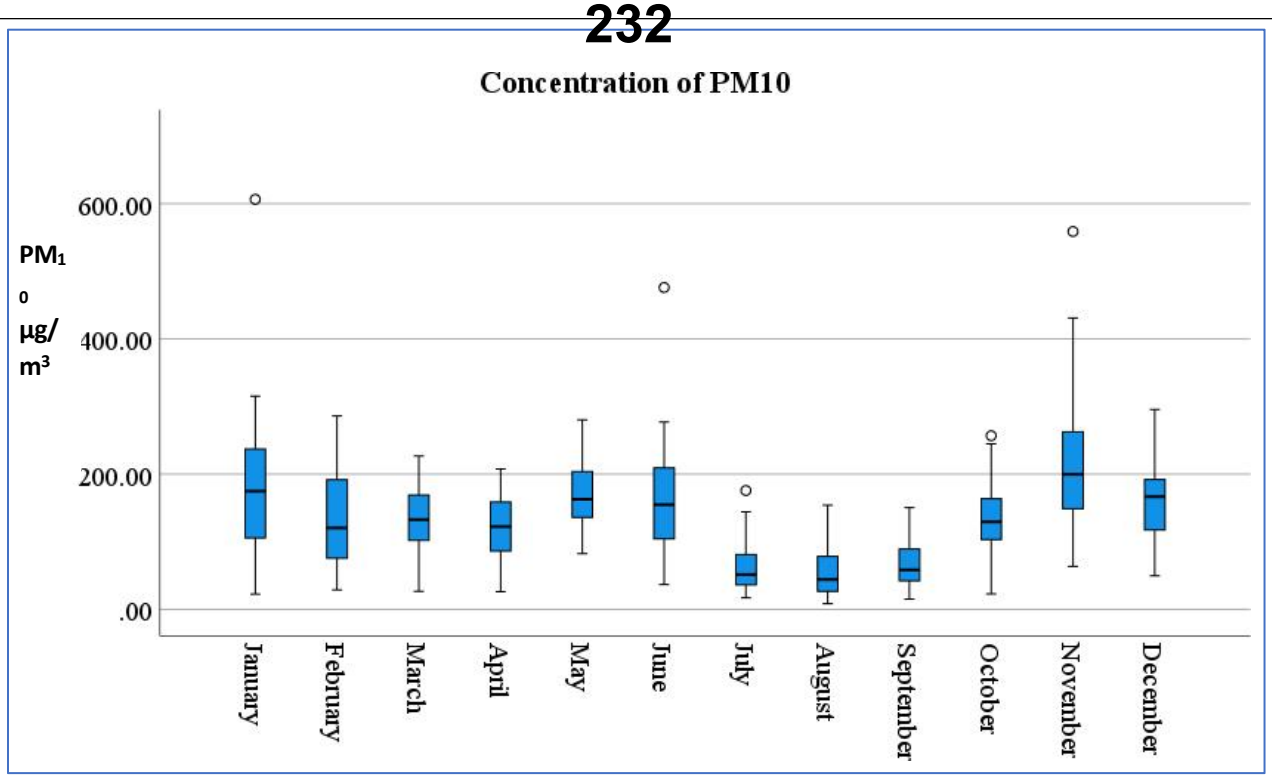

Figure 2 Monthly variation in concentration level of PM_{10} for year 2019

Further, to understand the effect of stubble burning in this region, the year is divided into five sets based on stubble burning periods. The time series graphs are plotted from 1st January to 14th April (pre wheat stubble burning period), 15th April to 27th May (wheat stubble burning period), 28th May to 22ndSeptember (post wheat stubble burning period), 23rd September to 24th November (rice stubble burning period) and 25th November to 31st December (post rice stubble burning period) as shown in Figure 3 to 7.

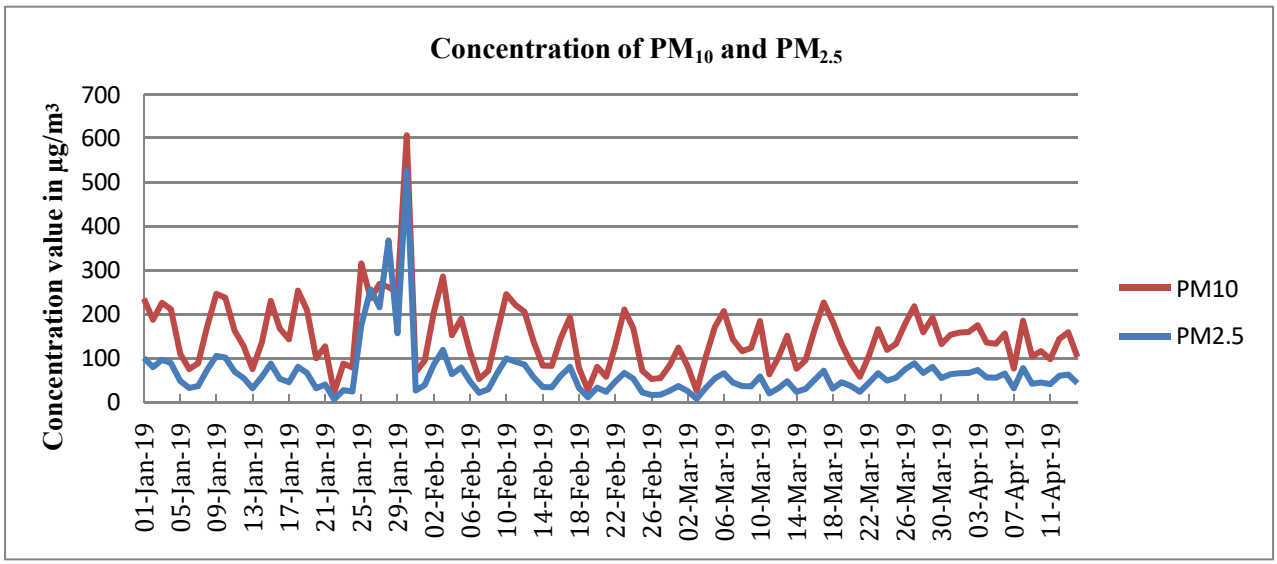

Figure 3 Concentration level of PM_{10} and $PM_{2.5}$ particles during pre-wheat stubble burning period

Same trend in the concentration values of PM_{10} and $PM_{2.5}$ can be observed in Figure 3 during pre-wheat stubble burning with the only exception on 29th January, sudden peak in PM_{10} as well as $PM_{2.5}$ concentration was observed. The concentration level of PM_{10} particles was quite high throughout the season as compared to $PM_{2.5}$ with maximum and mean values of 606 µg/m^3 and 149 µg/m^3 respectively, whereas the $PM_{2.5}$ particles showed the maximum and mean values as 526 µg/m^3 and 67 µg/m^3 respectively. Most of the time concentration values of both the particles

crossed the recommended limits and only few days were reported to be safe with minimum value of 23 µg/m^3 and 7 µg/m^3 for PM_{10} and $PM_{2.5}$ respectively.

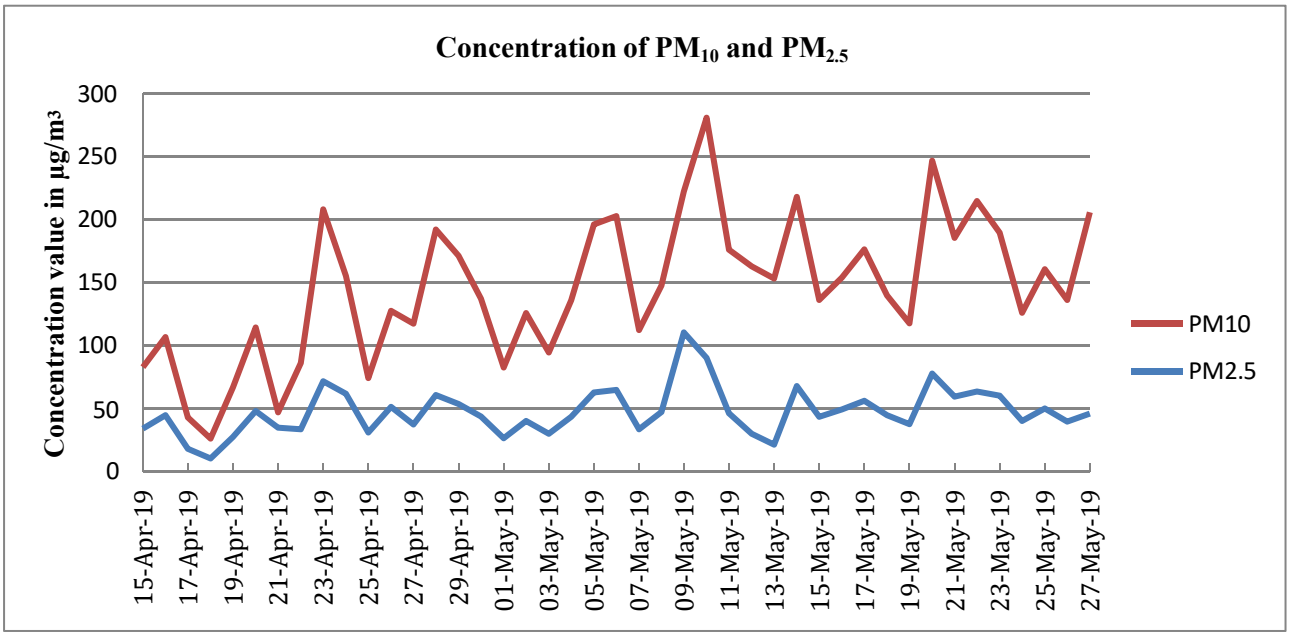

Figure 4 Concentration level of PM_{10} and $PM_{2.5}$ particles during wheat stubble burning period

The mean concentration of $PM_{2.5}$ particles remained to be 47.60 µg/m^3, with maximum and minimum values to be 110 µg/m^3 and 10.54 µg/m^3 as shown in Figure 4. The mean, maximum and minimum concentration of PM_{10} particle was 145 µg/m^3, 280 µg/m^3 and 26 µg/m^3 respectively. The minimum concentration for both the particles was within recommended limit in this season. The concentration trend during wheat stubble burning indicates that stubble burning along with other sources of emissions affect the ambient air quality. It can also be noted that PM_{10} particles emissions were greater than $PM_{2.5}$ particles.

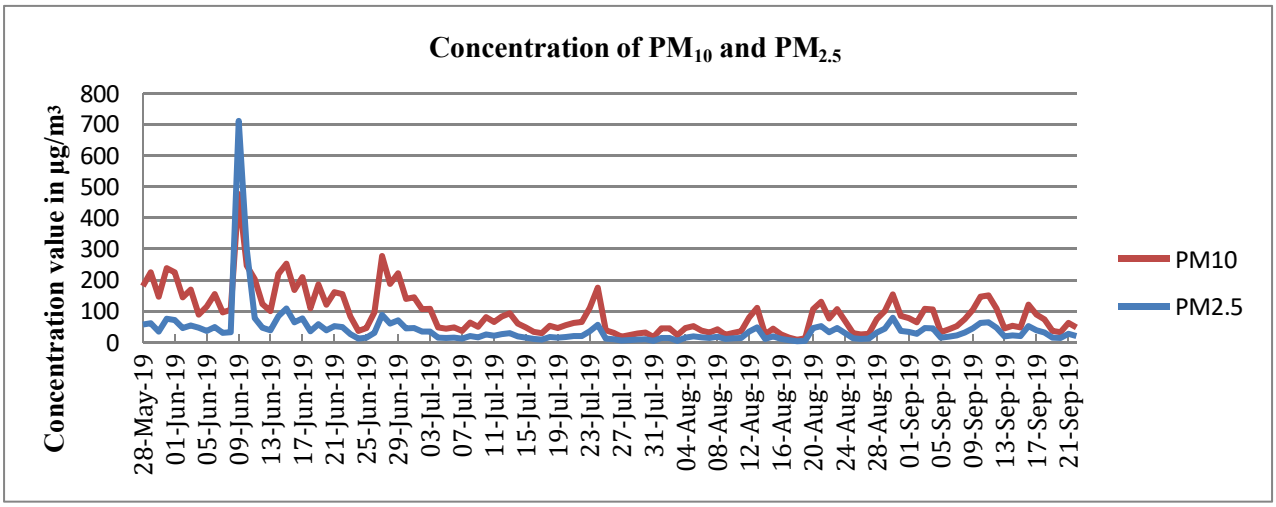

Figure 5 Concentration level of PM_{10} and $PM_{2.5}$ particles during post-wheat stubble burning period

From Figure 5 it can be noted that mean concentrations of $PM_{2.5}$ and PM_{10} remained to be 40.51 µg/m^3 and 90.42 µg/m^3 respectively, during the post wheat stubble burning period i.e., from 28th May to 22ndSeptember 2019. Sudden peak was observed with the highest value of 711 µg/m^3 and 476 µg/m^3 for $PM_{2.5}$ and PM_{10} respectively, exceptionally high concentration level of $PM_{2.5}$ was observed during this season. Concentration value decreased for both the particles during later stage of the season, one of the reasons for this could be that the July, August and first half of September

constitute the South-West monsoon season in Mandi Gobindgarh. The minimum values reported were 3.66 µg/m^3 and 8.53 µg/m^3 for $PM_{2.5}$ and PM_{10}.

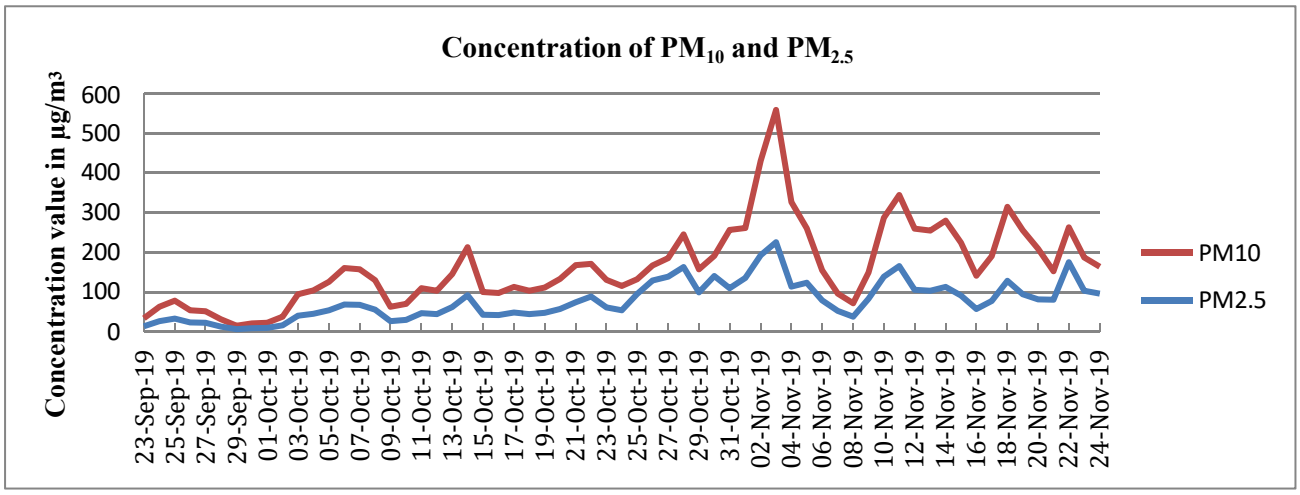

Figure 6 Concentration level of PM_{10} and $PM_{2.5}$ particles during rice stubble burning period.

Sudden rise in PM_{10} and $PM_{2.5}$ concentration level can be observed in the Figure 6, that may be due to rice stubble burning. It can also be noted that concentrations for both PM_{10} and $PM_{2.5}$ in winter season was more compared to all the other seasons (except the pre wheat stubble burning period) with maximum value of 559 µg/m^3 and 226 µg/m^3 respectively. Inversion conditions occurring during winter season which do not let pollutants to disperse can also be the reason for high concentrations. The minimum value reported was 15 µg/m^3 and 7 µg/m^3 for PM_{10} and $PM_{2.5}$ respectively, which was just after the monsoon period. The mean value for PM_{10} and $PM_{2.5}$ was 164 µg/m^{3}and 78 µg/m^3 which was highest among all the seasons.

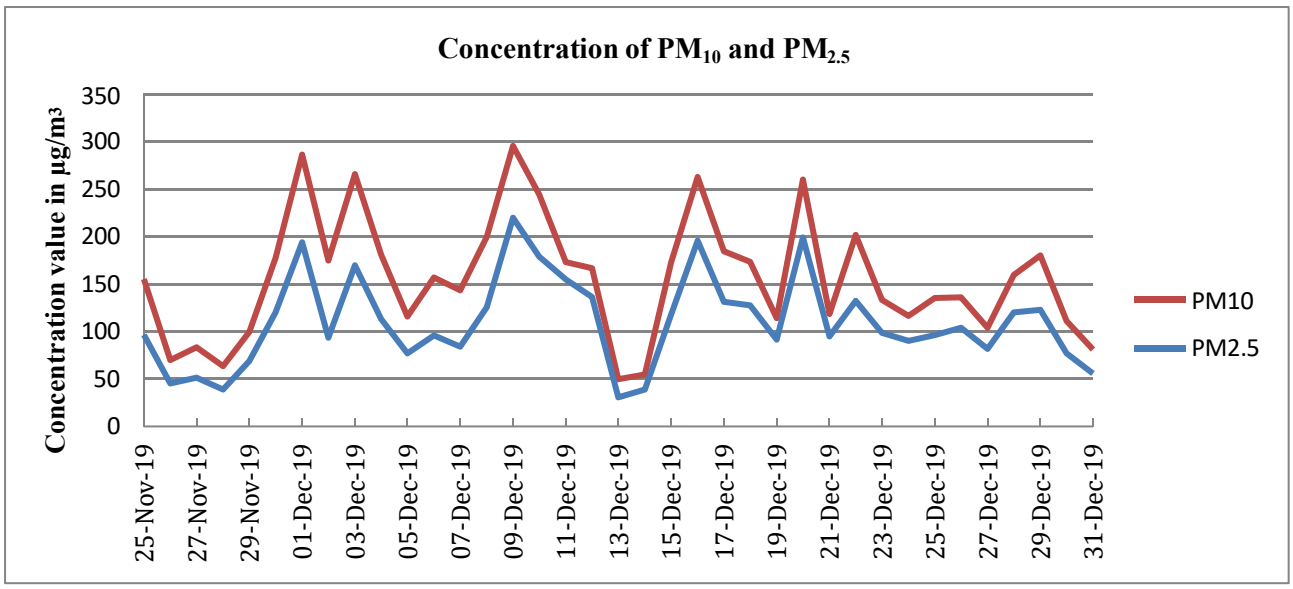

Figure 7 Concentration level of PM_{10} and $PM_{2.5}$ particles during post-rice stubble burning period

Figure 7 depicts high concentration value in month of December as well for both the particles, the value decreased in last week of the month, but decrease was not prominent. Maximum and minimum values reported were 296 µg/m^3 and 50 µg/m^3 respectively for PM_{10} and that for $PM_{2.5}$ were 220 µg/m^3 and 31 µg/m^3 respectively. The average value remained to be 157 µg/m^3 and 110 µg/m^3 for PM_{10} and $PM_{2.5}$ during this period.

3. Emission Inventory

An emission inventory is an important tool for the identification of pollutant sources and emission estimation emitted from these sources. It is a quantitative and detailed compilation of air pollutants-released in a particular time frame over a specified geographic location. Inventories provide an aid to policy planning and play a crucial role in developing mitigation plans. It also helps to keep in check on pollutants emitted, to be under the specified national standards. It is crucial to understand the strength of a source, which depends upon the location, elevation, frequency and duration of emission(CPCB,2011). Emission estimation further can be used for dispersion modelling.

Keeping this in mind, emission inventory of PM_{10} and $PM_{2.5}$ for the city of Mandi Gobindgarh city has been developed to account for the emission of air pollutants from various sources. The emission inventory for the city of Mandi Gobindgarh city has been developed for the base year 2019. The major sources covered in the city are –

1. Domestic
2. Construction
3. Stubble
4. Municipal solid waste
5. Food joints
6. Open eat outs
7. Crematoria
8. DG Sets
9. Industry
10. Vehicle (Tail Pipe Emissions)
11. Road dust (Non-Tail Pipe Emissions)

3.1 Methodology/Approach of Study

There are generally two approaches for building up emission inventories, either bottom – up approach or top – down approach. The top- down approach uses the statistical and demographic data available for a larger scale area such as a country. This method is appropriate when site - specific data is unavailable and is based on using proxy parameters such as population and is scaled down to the level of smaller geographic area such as a city. This approach may give inaccurate results as the extrapolation may be of dubious credibility. The bottom- up approach quantifies emissions using quality data of a particular source type. Emissions are estimated for individual sources and then summed up to obtain city/state/country level estimates. This requires site specific information on emission sources, activity level and emission factors and the results are more accurate than top – down approach and therefore we have used this approach for our study.

The following steps have been employed in the construction of the emission inventory using the bottom - up approach –

1. Conducting a general survey of the city
2. Listing of identified visible sources.
3. Identification of sources adjacent to and outside the city boundary
4. Conducting source specific survey to collect the activity data
5. Estimation of emission from various sources using empirical equations from literature.

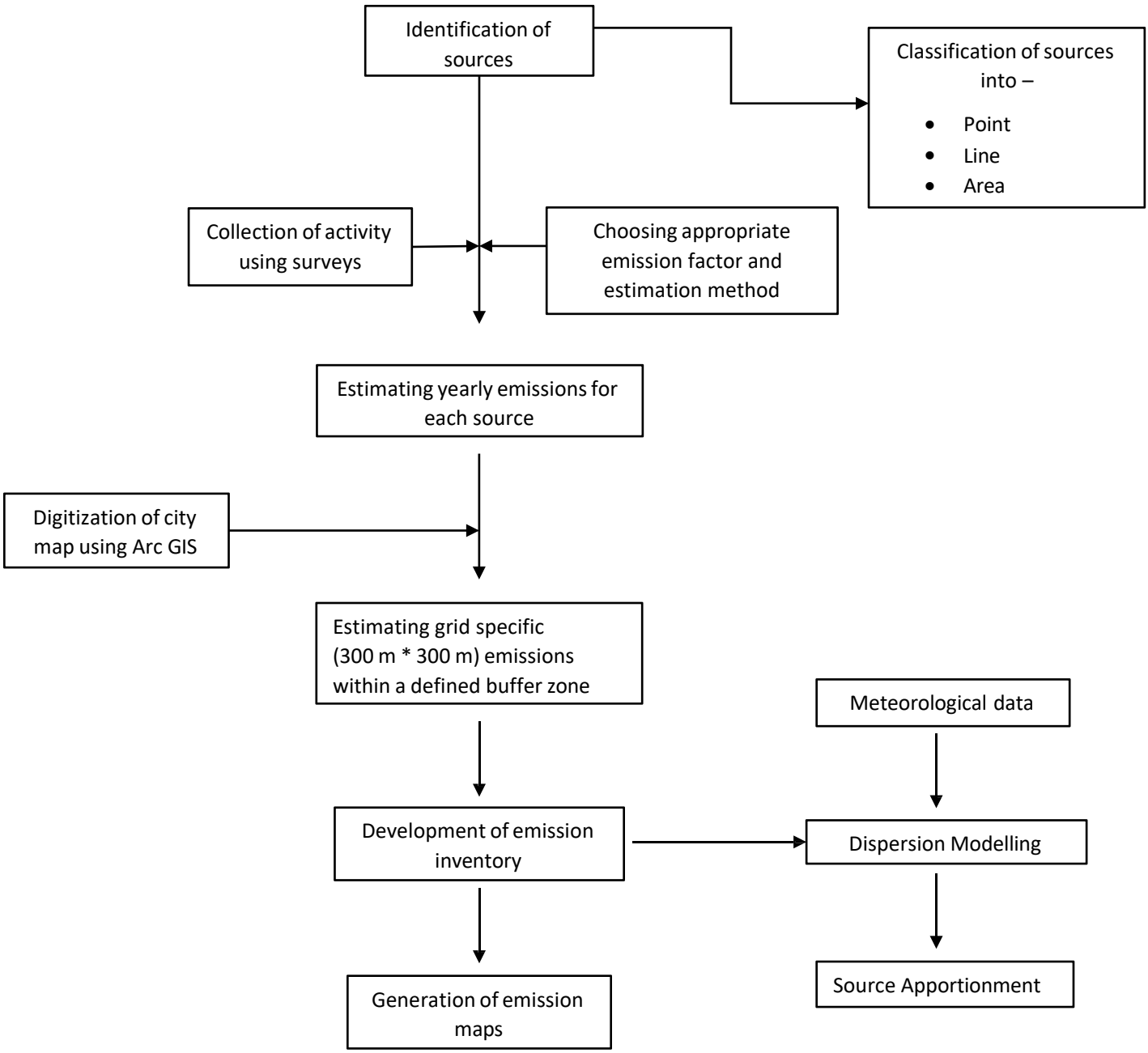

Figure 8 Overall framework for the study

The development of emission inventory started with the survey of the MGG city to identify sources of emissions and studying the traffic flow pattern of the city, along with the identification of busy intersection with heavy traffic inflow. This was done to ascertain survey spots for vehicular count. Surveys were conducted by PPCB officials to collect fuel usage data for identified pollution sources within the area falling in the 5 km boundary from the city boundary. Suitable emission factors were taken from literature depending upon fuel type and source type and substituted in empirical equations using activity data and emission factor for emission estimation:

$$\textit{Emissions} = \textit{Emission factor} * \textit{Activity data}$$

$$E = A \times EF \times (1\text{-}ER/100)$$

Where:

E = Emissions

A = Activity rate
EF = Emission factor, and
ER = Overall emission reduction efficiency, %

Where Emission Factor is a representative value that attempts to relate the quantity of a pollutant released in the atmosphere with an activity associated with the release of that pollutant. These provide the relationship between amount of pollution released and raw material processed, or units produced (Tsagatakis,2019).It is quantified as the mass of emission emitted per unit of activity. Activity data refers to the specific process of generation of emissions. It considers the type of emission source (point, line, and area) and is inclusive of factors such as population, household number, the type and quantity of fuel used, frequency of emission generation events etc. (Gibe & Cayetano,2017).

3.2 Data Collection

As per PPCB "The information for activity data was obtained by conducting primary survey, through personal interviews, household survey, traffic count survey, collecting data from industries etc. This gives a reliant database, complemented by a secondary source of information which aids in quantification of the total pollutant emission. Data collection was done by the PPCB team at Mandi Gobindgarh city office. Data for sources such as domestic, food joints, construction was collected ward wise. Door to door households Survey was conducted. Petrol pump surveys were done at numerous locations to ascertain the vehicle composition on the roads of Mandi Gobindgarh city. These locations were determined based on the influx of traffic volume studied during the site visit. Road dust estimation was also done at few locations. Data from industries was collected by visiting the industrial units physically. Where data was not available appropriate surrogate data has been used."

Table 1 Emission factors used in the study.

Source		Units	PM_{10}			$PM_{2.5}$
Cremation		kg/ton	17.3			-
Domestic/	Wood	g/kg	6.77			4.6
Food joints/	Cow dung	g/kg	10.5			4.4
Open eat outs	LPG	g/lit	2.1			0.33
DG Set		g/kwh	1.34			1.139
Industry	FO	kg/ton	-			0.65
	Diesel	kg/ton	-			0.97
	Wood	kg/ton	-			1.5
	Coal	kg/ton	-			1.36
Vehicle	Vintage	years	5	10	15	
	2W	g/km	0.015	0.035	0.035	
	3W	g/km	0.0364	0.0455	0.091	
	Buses (diesel)	g/km	1.075	1.213	2.013	
	4 wheelers (petrol)	g/km	0.002	0.006	0.008	

	4 wheelers Cars (Diesel)	g/km	0.015	0.06	0.06	
	HCV (Diesel)	g/km	1.24	1.96	1.96	
	LCV (Diesel)	g/km	0.475	0.475	0.475	
	Others	g/km	1.24	1.24	1.24	
Construction	TSP =1.2 tons/acre-month		0.35*TSP Emission			0.06*TSP Emissions
MSW Burning		g/kg	11.9			9.8

Note: The emission factors were taken from the US EPA's AP42 document (https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-compilation-air-emissions-factors), TERI (2020), ARAI (2008) and SAFAR (2018).

3.3. Classification of sources

The sources of $PM_{2.5}$ and PM_{10} identified in Mandi Gobindgarh city have been classified as area source, point source and line source as stated under.

Point Sources – Sources which emit pollutants from an individual facility. The emission characteristics vary depending upon fuel usage and duration of fuel usage. These have the attribute of location, having x and y coordinate, associated with them.

Area Sources – Area sources are sources made up of smaller individual stationary units which by themselves do not emit much pollution but when taken together make up as an appreciable pollution contributor.

Line Sources – Non – stationary sources are called line sources or mobile sources. These exhibit line type of geography. This includes emission from on road vehicular tail pipes, road dust and off – road sources include aircraft, trains etc.

Table 2 Classification of Sources into different categories

AREA	POINT	LINE
Domestic	Industry	Vehicular emissions
Food joints	Open eat outs	Road Dust
MSW	DG sets	
Crematoria		
Construction		

To visualise the emissions, and understand their geographic distribution, gridded emission inventory has been developed. ArcMap ver10.7 tool of ArcGIS software has been employed for this purpose. Gridded emission inventories translate the data estimated into a spatially resolved data, which aids in its visualisation. The representation of inventories in a gridded structure helps us to identify the emission output from various sources a particular area. It is important to understand the emission load source is generating; it is equally important to determine the hotspots generated in the city from these sources. These further help in the execution of source specific policies meant for

pollution reduction. Spatial emission mapping is done to bridge the emission data and air quality models, which utilises the spatially resolved data as an input. This input are uses to estimate atmospheric concentration and depositions help in determination of dispersion patterns and the area under impact (EMEP-EEA, 2016). For point sources such as industries, emissions are compiled based on data available and prepared by PPCB. The attribute of geographic location and emission magnitude enable it to be well characterised spatially. Sources which are wider in distribution such as domestic emissions, classified as area source, are lacking in the individual unit location specific emissions magnitude. For such sources, the emission maps are based on surrogate/ proxy data available. The method emission estimation depends upon the type of data available (Tsagatakis, 2019).

3.4 Study area

The city of Mandi Gobindgarh has an area of 5.54 sq. km. The scanned copy of the ward map was made available by PPCB to IITD which was then digitised, and ward area was estimated. Figure 9 represents the ward map of the city. The entire city was divided into grids of 300m * 300m resolution. The ward map of the city has been prepared in the Projected Coordinate System - WGS_1984_UTM_Zone_43N and uses GCS_WGS_1984 projection as well.

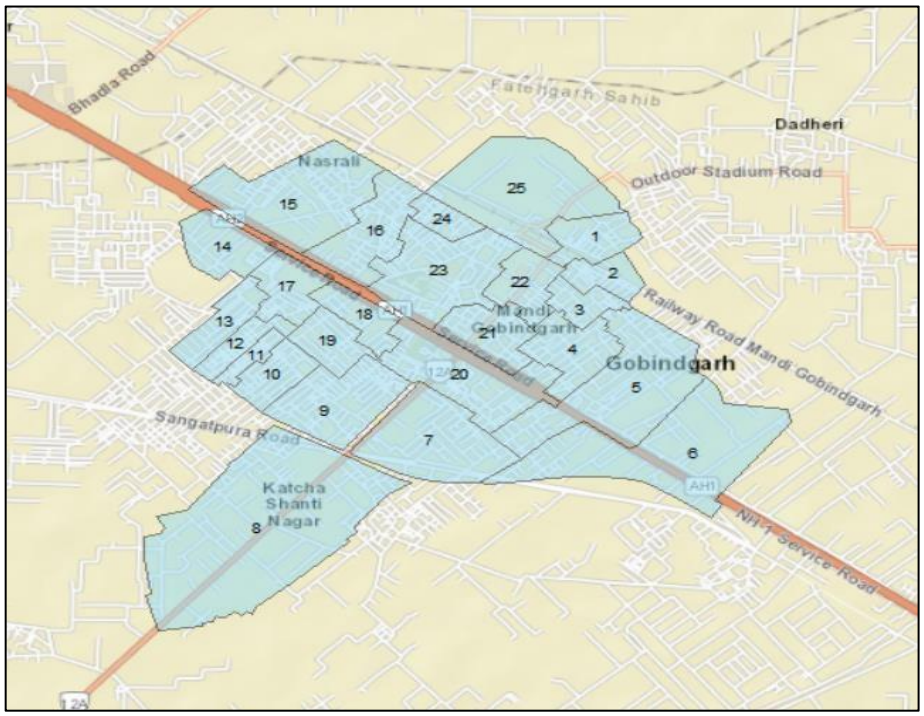

Figure 9 Ward map of Mandi Gobindgarh city

3.5 Emission estimation and Gridded Inventory

A general guideline was followed in developing gridded inventories -

In area sources, for the spatial allocation of data into grids, the emissions for area sources were estimated for the entire ward. Emissions per unit area in each ward were determined. This was done by dividing the emissions by the area of each ward.

Emission density (kg/year/m^2) = Emissions of ward (kg/year) / Ward area (m^2)

A uniform grid of 300m*300m was overlaid on the ward map. The gridded emissions were determined based on the fraction of the area of the ward falling inside the grid and emission density.

.

$$= \sum(\boldsymbol{area\ of\ the\ fraction\ of\ ward\ i\ in\ the\ grid\ x\ emission\ density\ of\ ward\ i})$$

=

Where, N = no. of wards in the grid

The point sources, having the attribute of coordinates, are allocated to their respective overlaying grid. This allots the emission magnitude to the grid. If there is more than a single point source lying in a single grid, then the emissions are summarised for that grid.

For Line sources, using ArcGIS tool, the road length falling under each grid was calculated from the digitized maps. The information obtained from traffic counts from various locations was considered. This was translated into traffic flow throughout the city. The road network was then divided into smaller roads based on major traffic intersections. The emissions were estimated per unit length of the road. Emissions in each grid were determined on the road length falling in that grid.

Source specific methodology is stated as below –

Domestic

A detailed household survey was conducted in Mandi Gobindgarh city by the PPCB and IIT Delhi team. A survey of 1250 houses was done which covers approximately 4-5% of the houses. To conduct the survey a detailed questionnaire comprising of the details of the different types of fuel usage was prepared. The survey team then conducted the door-to-door survey with one condition to survey at least 35 houses in each ward. Another important thing which was kept in mind was that the surveyed houses should be well dispersed in the ward to improve the representativeness of the sample. It was observed that the different types of fuel used by the inhabitants were LPG and wood. It is observed that almost 99.3 % of households use LPG as their primary fuel in summer. It was observed that the usage of other secondary fuels such as wood was negligible during summer however, in winter 8.6 % of the households also used wood as fuel. This wood was mainly used in the winter season for combating the extreme cold temperatures and for cooking winter special Punjabi cuisines. The emission estimation equation employed is as follows:

Emission = Fuel consumed per year per household *no. of households *Emission Factor

Emission Factor for wood, cow dung and LPG were taken from Reddy and Venkataraman (2002), CPCB (2011),AP-42 USEPA (1995)and Sharma et al. (2016).

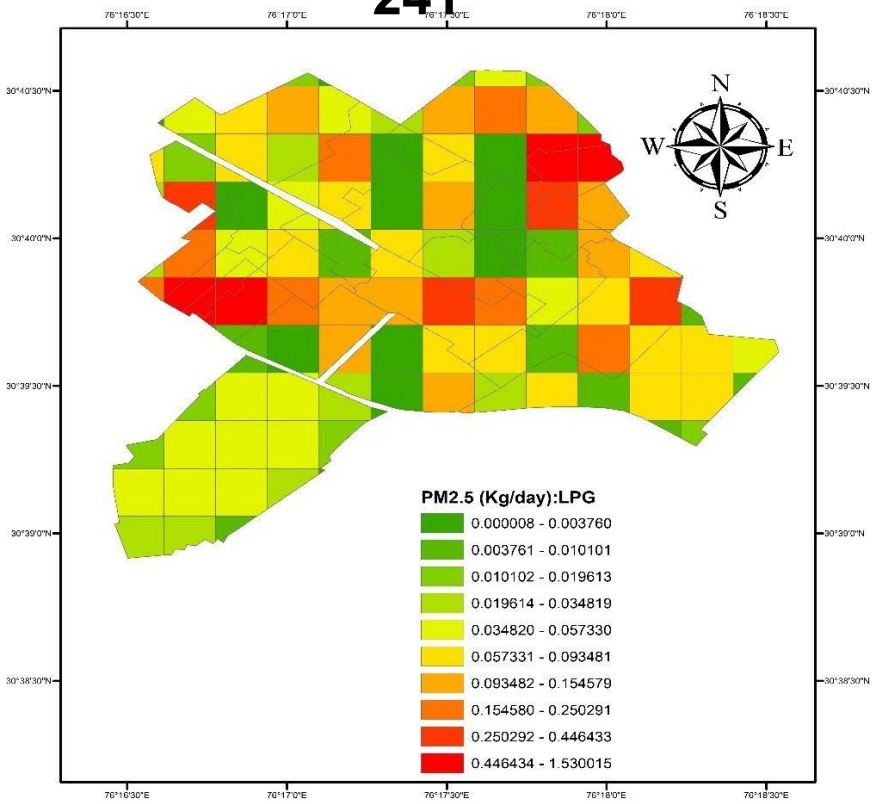

Figure 10 Map showing Domestic gridded $PM_{2.5}$ emissions in summer

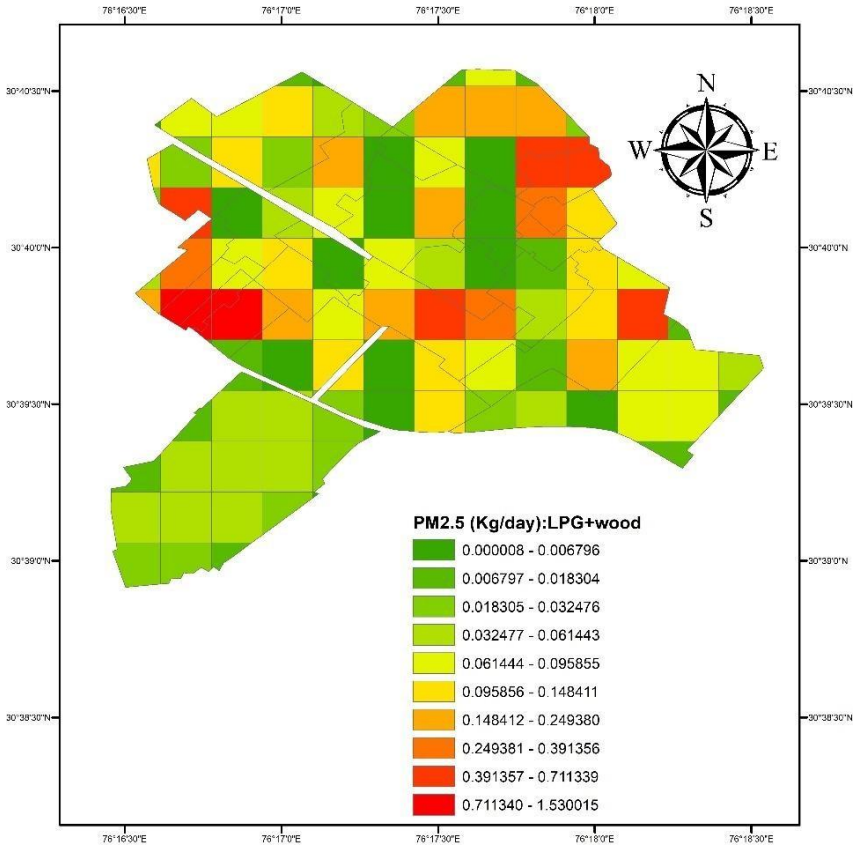

Figure 11 Map showing Domestic gridded $PM_{2.5}$ emissions in winter

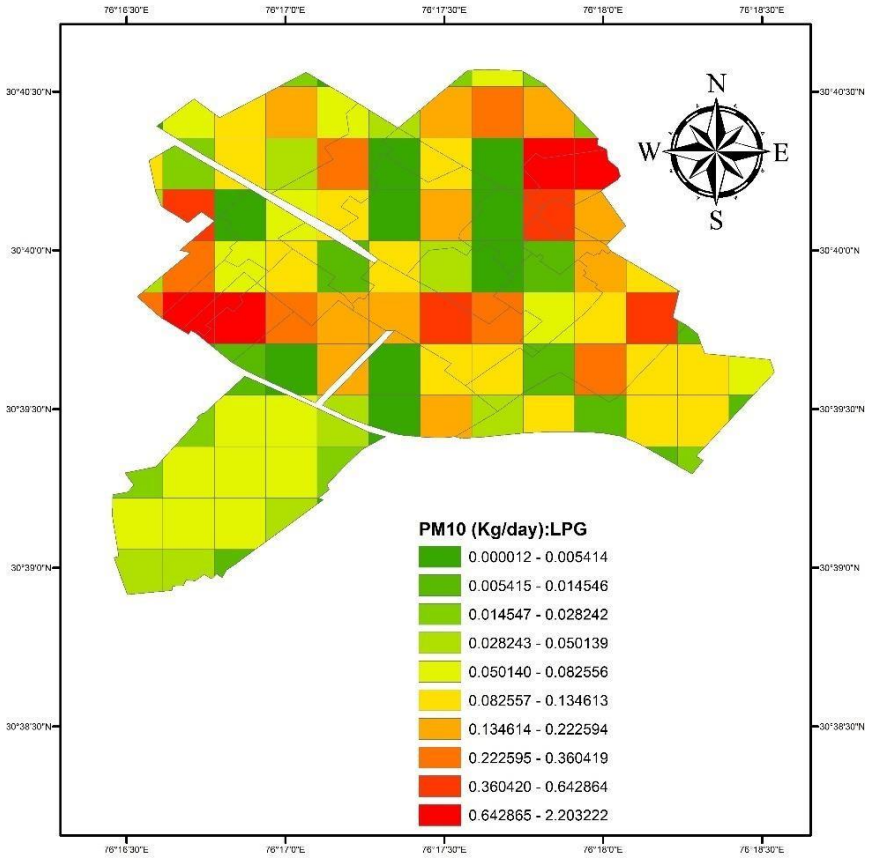

Figure 12 Map showing Domestic gridded PM_{10} emissions in summer

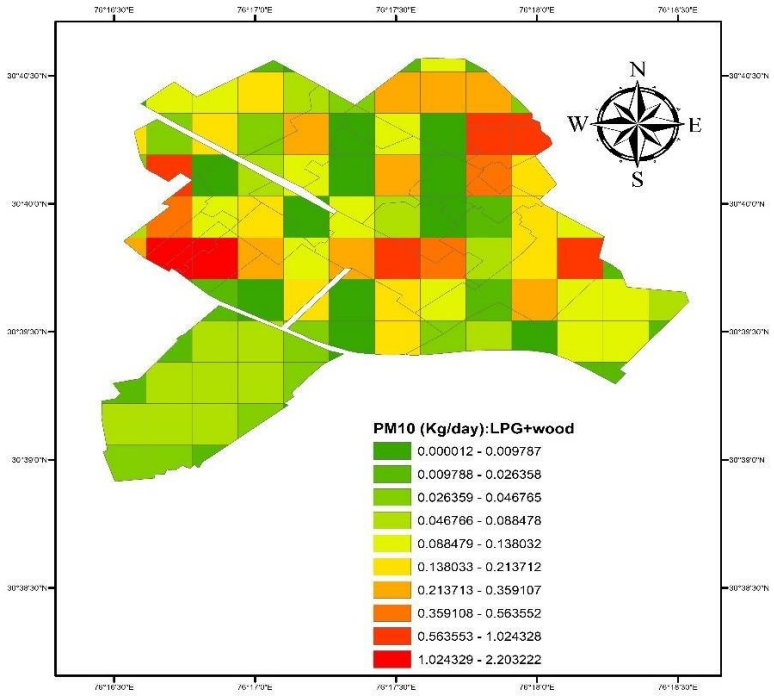

Figure 13 Map showing Domestic gridded PM_{10} emissions in winter

Construction

Construction is one of the major contributors to dust emissions in a city, though it is a temporary source, it can have an immense impact on the local air quality. The amount of PM released depends directly upon the area under construction and the duration for which construction has been carried out. The estimation was done as per AP-42 USEPA (1995) method.

E = Area of construction activity (acres) * duration of activity (months)* emission factor

The time in months was taken based on the no. of working hours throughout the year. The emission load for PM_{10} was 942.73 kg/year and for $PM_{2.5}$ was 161.61 kg/year. Based on the available data for area under construction at each location, emissions were estimated. Emission factors were adopted from AP-42 USEPA (1995) and Sharma et al. (2016).

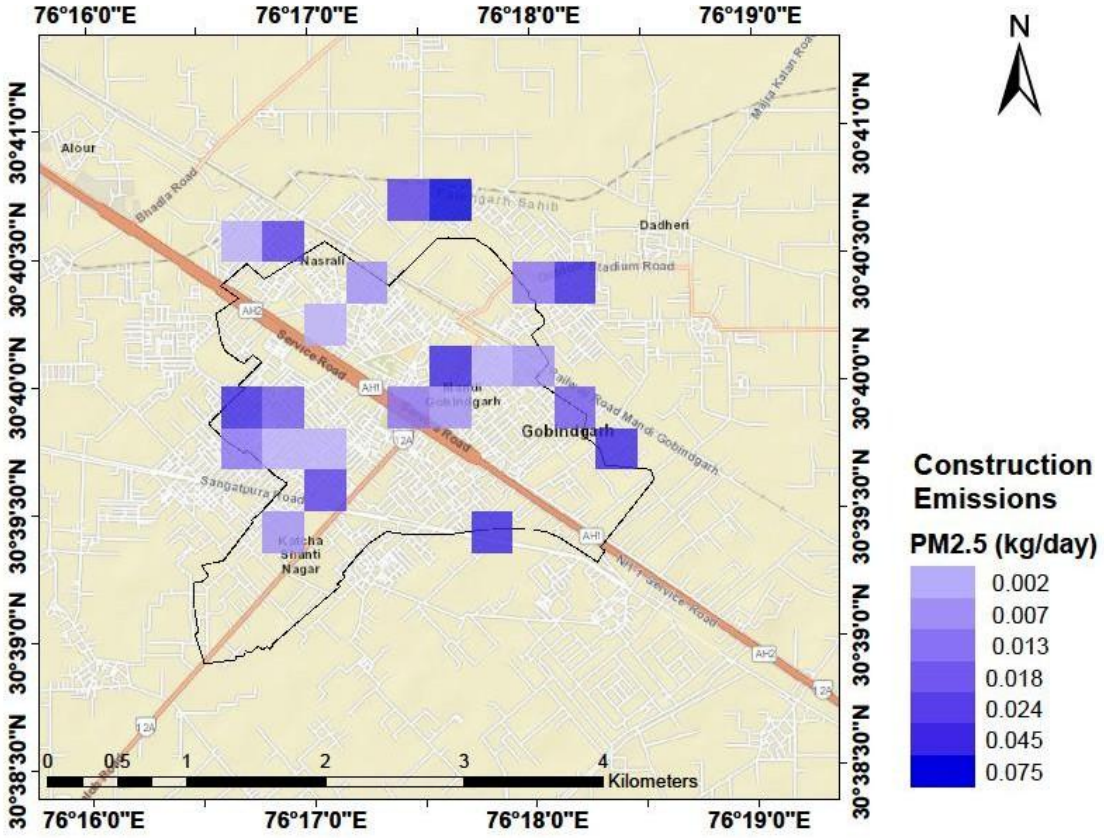

Figure 14 Map showing Construction $PM_{2.5}$ emissions per grid.

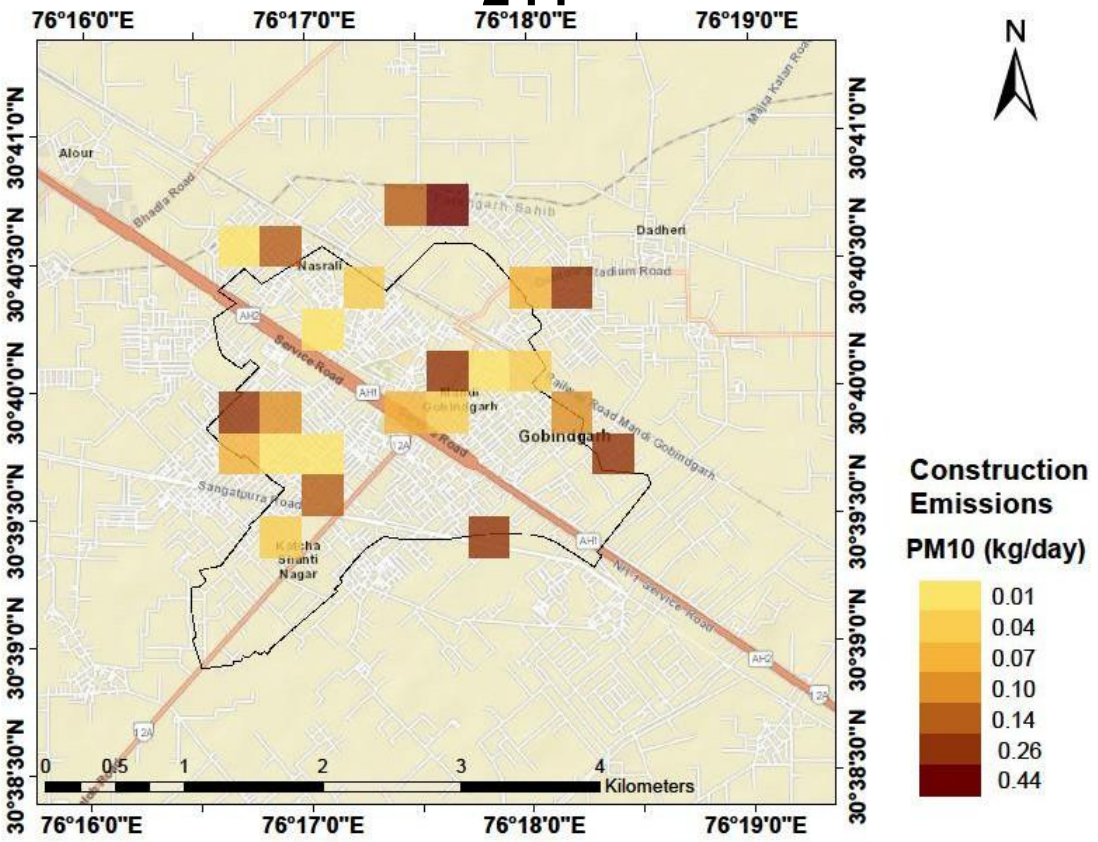

Figure 15 Map showing Construction PM_{10} emissions per grid.

Stubble burning

Stubble burning is an important source of emission from Punjab. As the burning season occurs twice in a year, the gridded emissions were also made separately for those two periods. This study was done in 5km radius from the city boundary to accommodate the stubble burning occurring around the city. The area under stubble burning, was provided as a processed map using satellite imagery provided by PPCB. The study period for wheat burning was taken from 15 April 2020 to 27 May 2020 (43 days) and that for rice burning was taken from 27 September 2019 to 24 November 2019 (63 days). The area under wheat stubble burning was 6246.9 hectare and that under rice stubble burning was 7176.28 hectare.

As per the maps provided by PPCB, no stubble burning activity is happening within the city. Further, the data provided by PPCB to estimate the stubble emissions does not have information regarding duration of burning and time at which a particular field is burning. The given data only provided the information of the field area burnt. Considering this, the proper estimation of contribution of stubble to the particulate concentration in the city is not possible. Hence, simulation results during stubble burning are not included in this report.

Municipal Solid waste

Refuse burning and municipal solid waste burning is a common site as waste management practices are not efficiently practised in the country. The gridded emissions estimation method was largely like that of domestic emissions, but the population data was taken as a surrogate to estimate the emissions.

Population for the year 2019 was projected based on the population data provided by PPCB. To calculate the emissions from solid waste burning the following equation has been adopted:

Population density (person/m^2) = Population of the ward/ area of the ward.

Population in each grid was determined. Then this population was substituted in the equation below to determine the waste burnt in each grid.

$$\textit{Waste Burnt} = MSWp \times P \times (1- Fcoll.) \times Bfrac$$

Where, MSWp = waste produced per capita, P = population of the ward,
Fcoll. = collection efficiency, Bfrac = fraction of waste burnt.
Collection efficiency was taken as 0.68 and fraction of waste burned was taken as 0.6 (Sharma and Kumar,2016)

Emissions = Waste burnt *Emission Factor

The overall emission from Municipal waste burning were estimated to be 44,890 kg/year for $PM_{2.5}$ and that for PM_{10} were 54,510 kg/year.

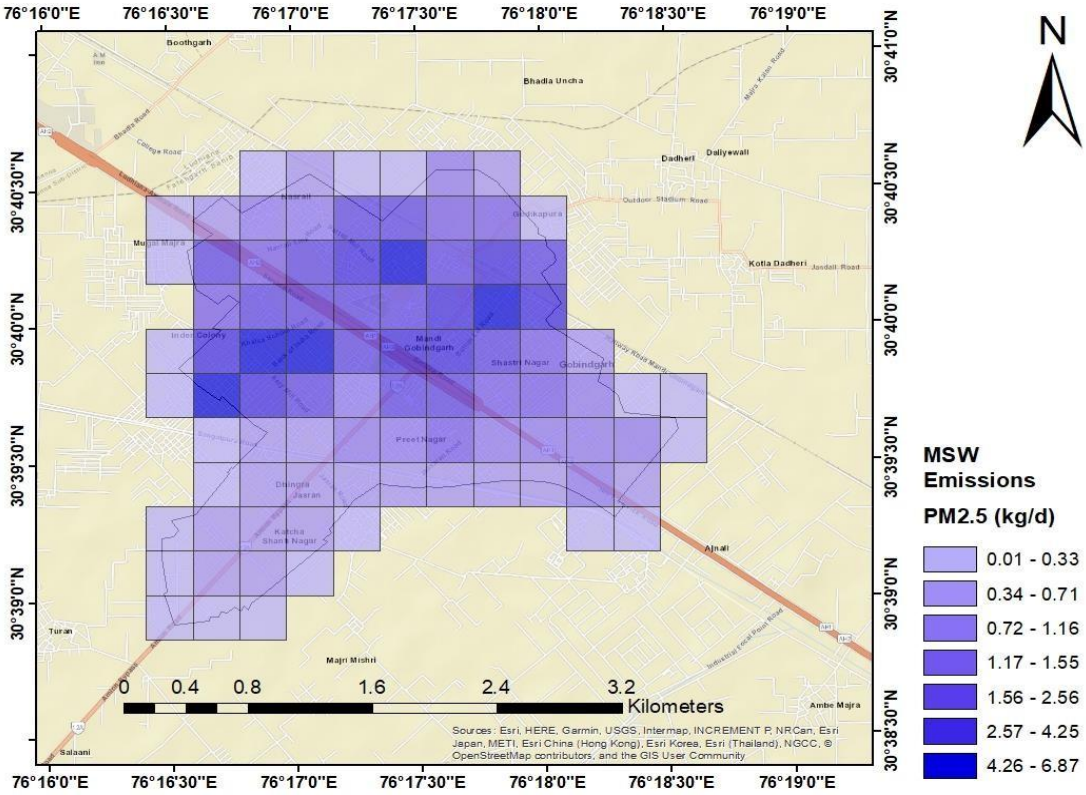

Figure 16 Map showing MSW $PM_{2.5}$ emissions per grid.

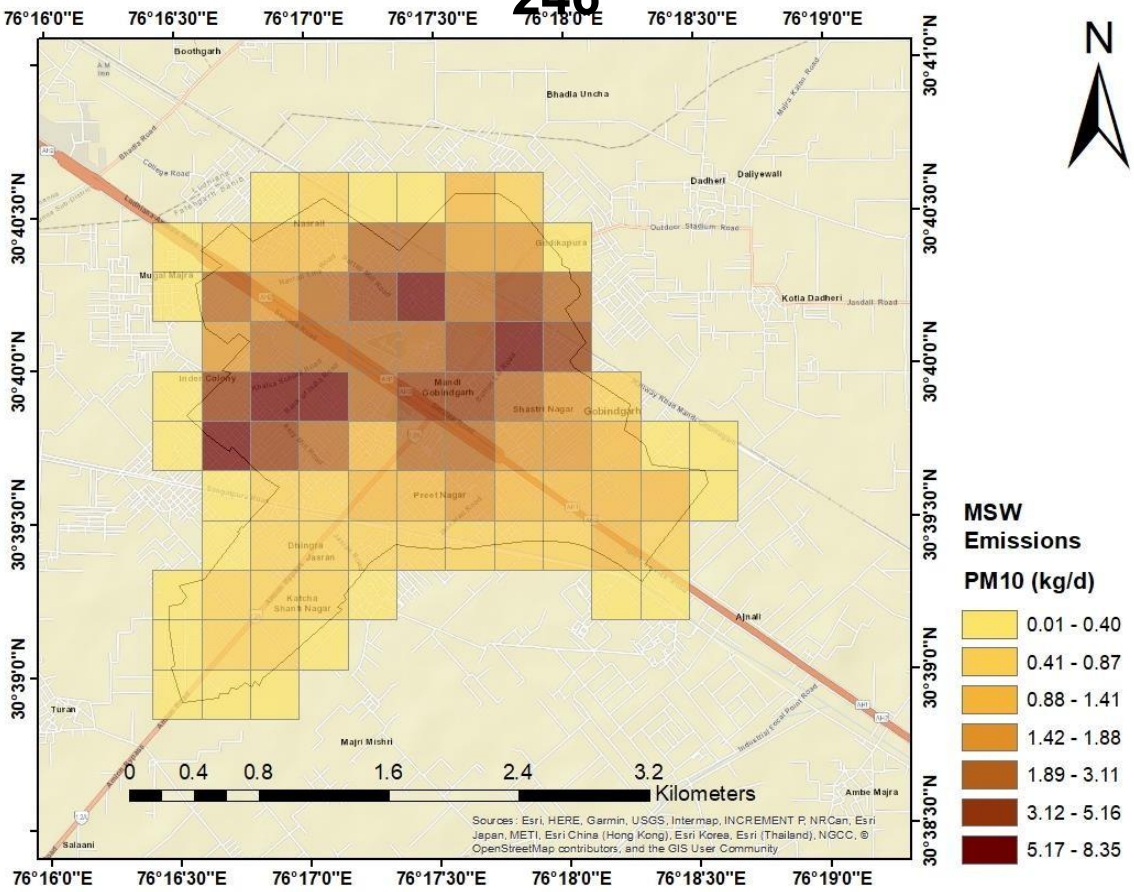

Figure 17 Map showing MSW PM_{10} emissions per grid.

Food Joints

The eateries in the city, which includes hotels, restaurants and dhabas were surveyed, to estimate the emissions from each of these relevant categories. Total 50 food joints present in the city were surveyed by PPCB. LPG, coal and wood were the predominantly used fuel in the city. These food joints consumed a total 48,507 lt of LPG; 180 kg of coal; 15 kg of wood. The emission load from this source amounts to 104.6 kg/year for PM_{10} and for $PM_{2.5}$ it is 17.7 kg/year. Emission factors were taken from Reddy and Venkataraman (2002), CPCB (2011), AP-42 USEPA (1995) and Sharma et al. (2016).

Emission = Fuel consumed in each hotel per year * Emission Factor

The gridded emissions for food joints in the city were also estimated in the same way as those for domestic emissions.

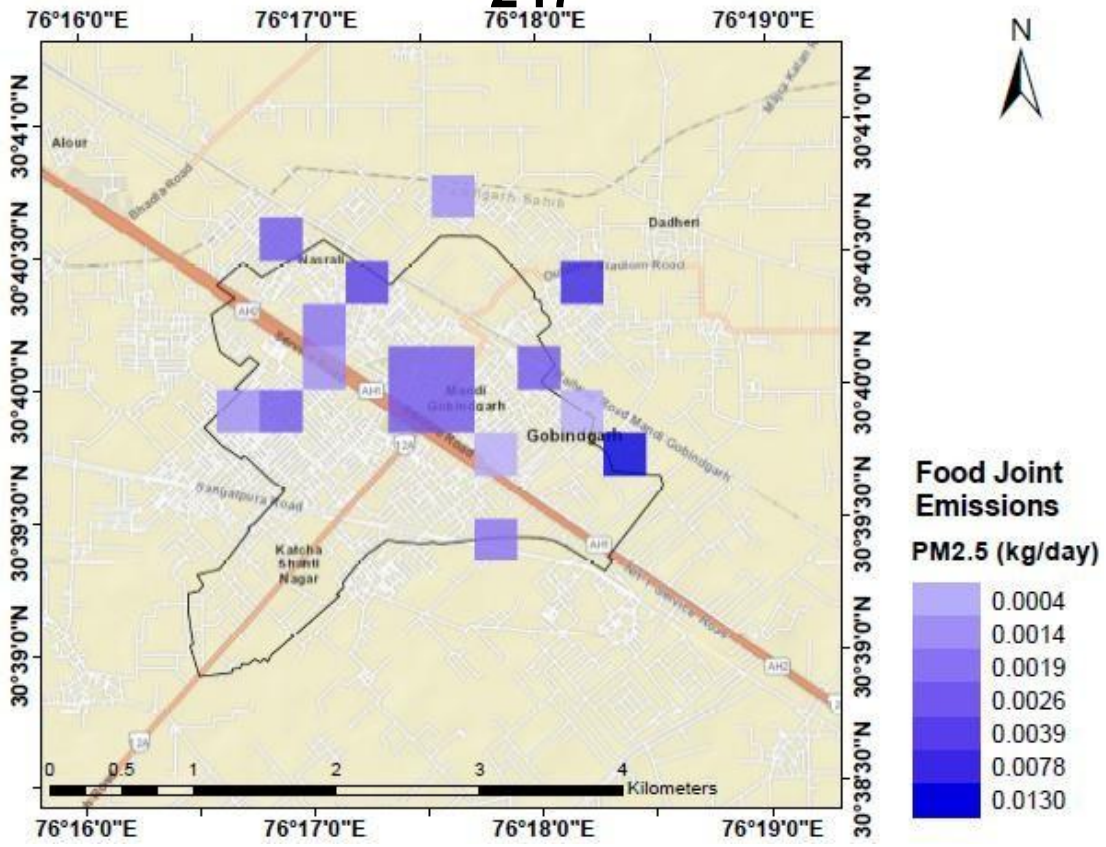

Figure 18 Map showing Food joints $PM_{2.5}$ emissions per grid.

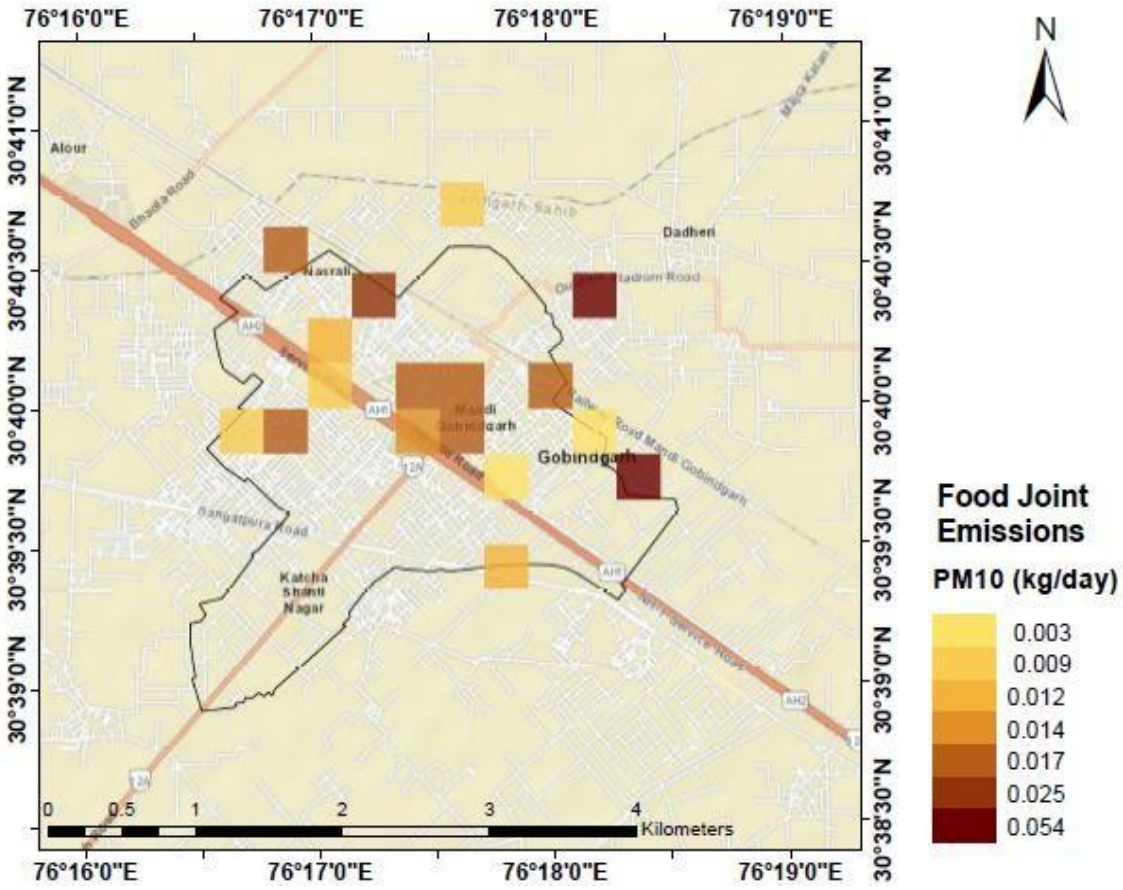

Figure 19 Map showing Food joints PM_{10} emissions per grid.

Open eat outs

This source identifies with the street vendors plying on roads. All the street food vendors in the city were surveyed and the collected data was provided by PPCB. The emissions are estimated in a similar fashion as from households and food joints. The main fuel consumed was LPG amounting to 55204 kg/year. The total emission load from this source for PM_{10} amounts to 115.55 kg/year and for $PM_{2.5}$ it is around 18.15 kg/year. Emission factors were taken from Reddy and Venkataraman (2002) and CPCB (2011).

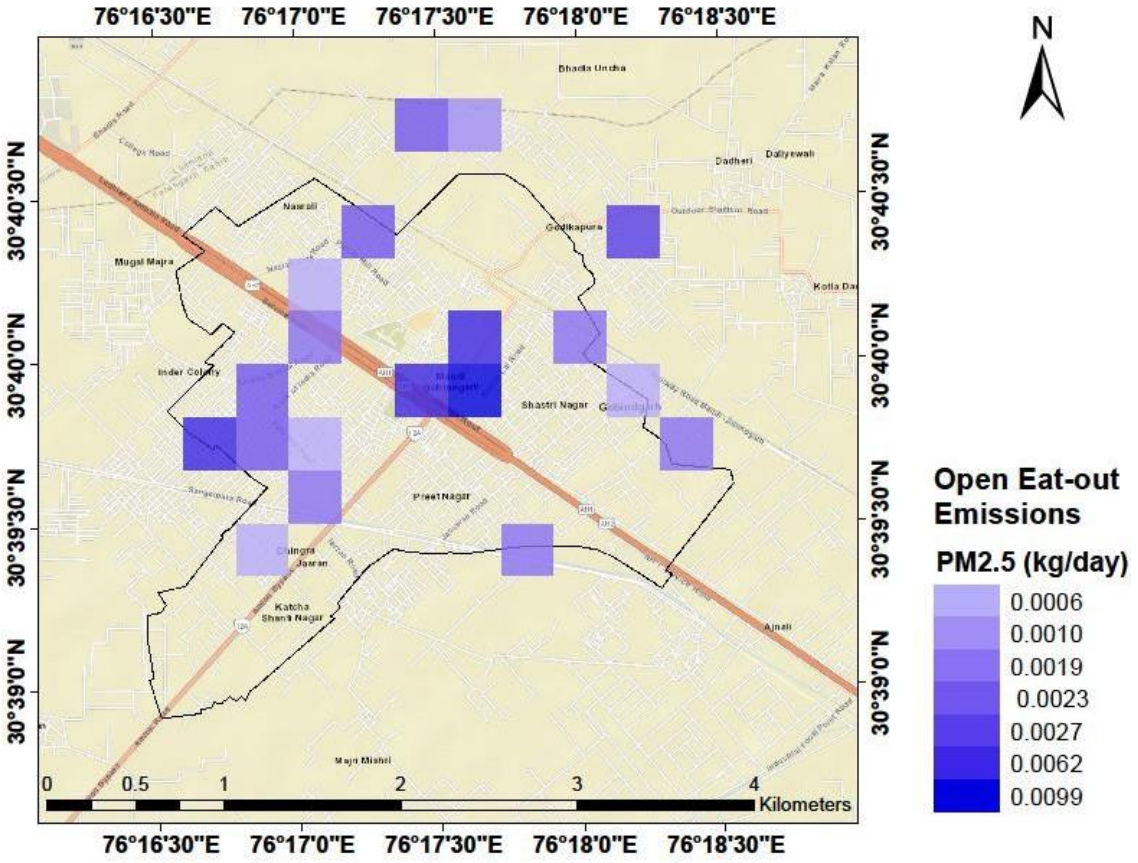

Figure 20 Map showing Open Eat Outs $PM_{2.5}$ emissions per grid.

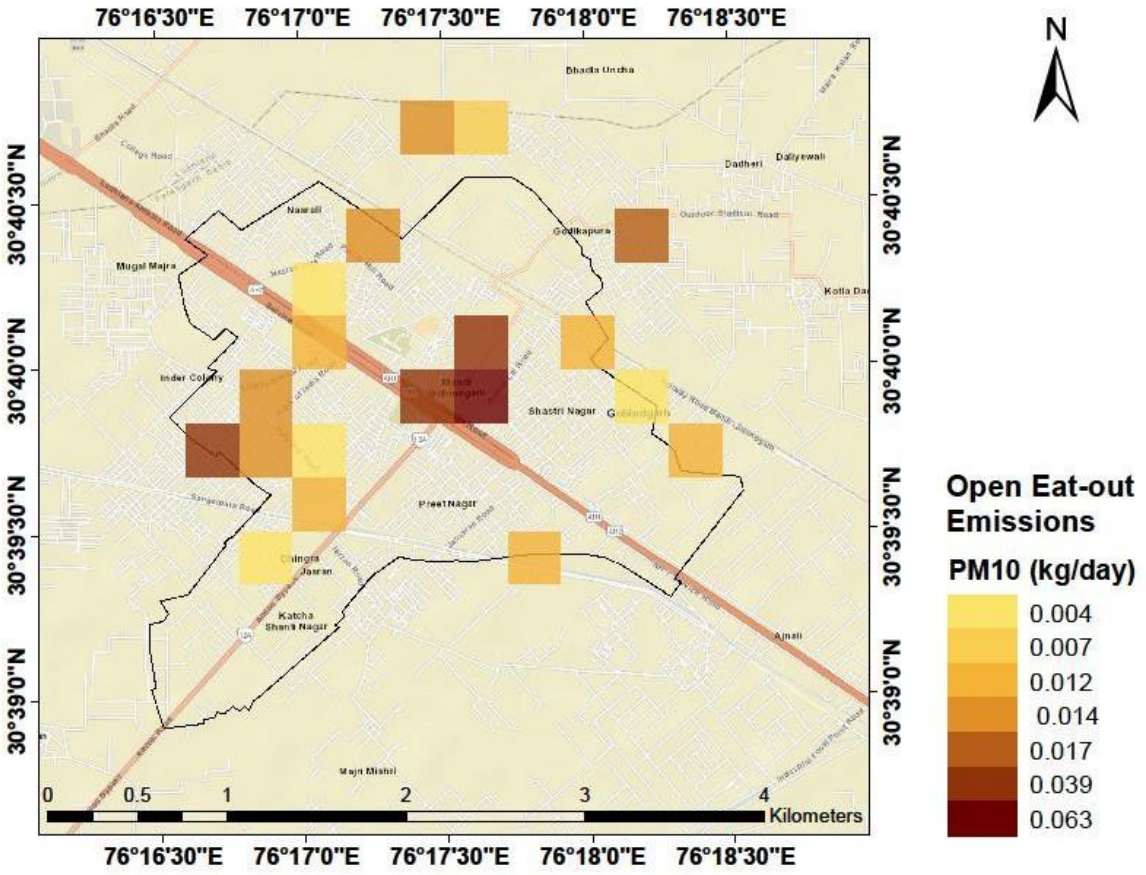

Figure 21 Map showing Open eat outs PM_{10} emissions per grid.

Crematoria

A relevant quantity of wood is used up in each cremation ceremony releasing significant amount of Particulate Matter. Though electric crematoria have been introduced in the country, the cost involved, and religious reasons make them an unpopular option. In Mandi Gobindgarhcity there 3 cremation grounds spread across the city which are non – electric, hence these are operated by burning of wood. Each cremation uses up to 0.3 tons of wood. The data for number of bodies burned each day was provided by PPCB. The emission load for PM_{10} stands at170491.5 kg/year and 11593.422 kg/year for $PM_{2.5}$. Emission factor for PM_{10} was adopted from AP-42 USEPA (1995)and for $PM_{2.5}$ it was taken as 68% of PM_{10} as per TERI (2020).

Emission = No. of bodies burned per year * amount of wood used in each cremation* Emission Factor

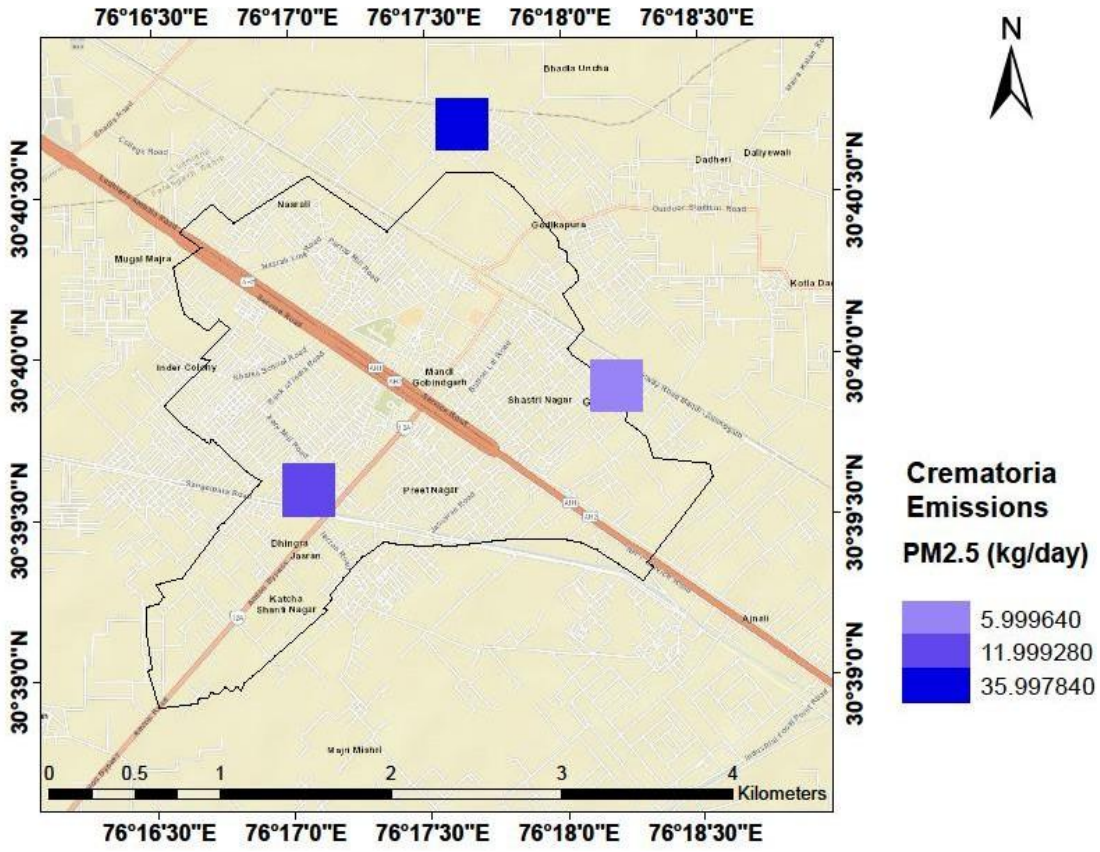

Figure 22 Map showing Crematoria $PM_{2.5}$ emissions per grid.

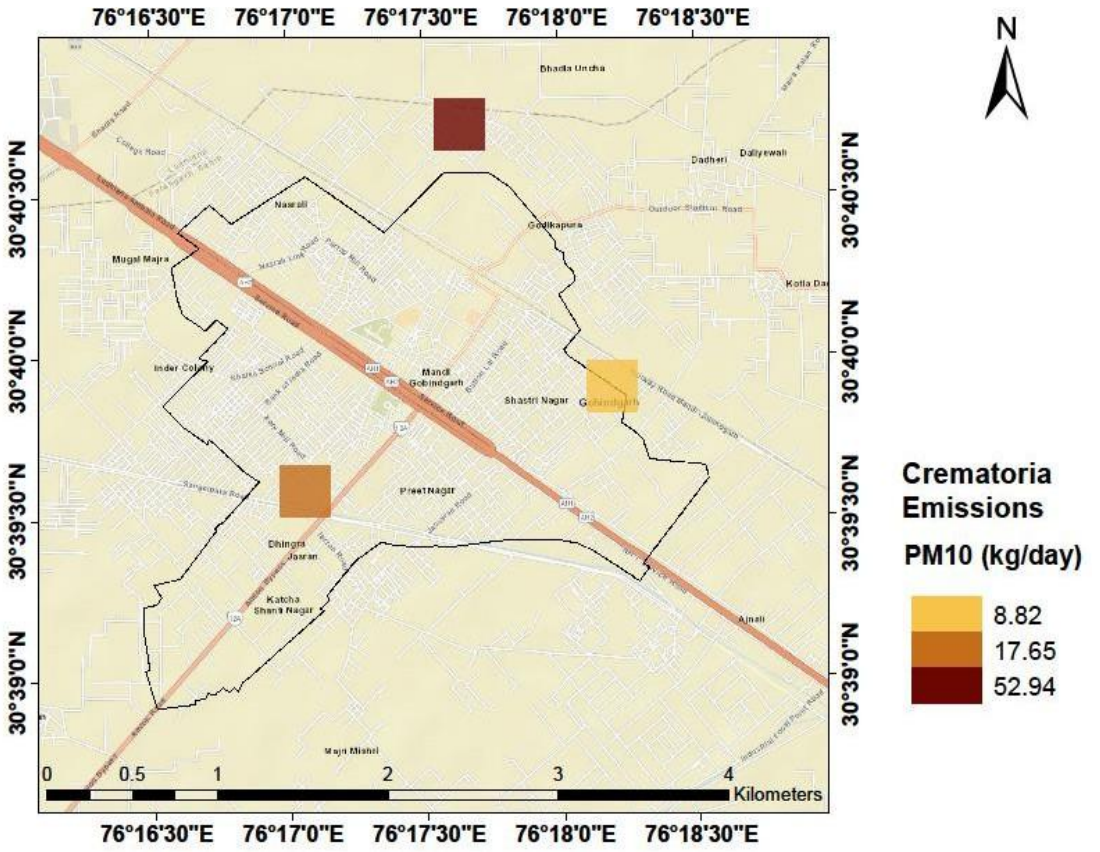

Figure 23 Map showing Crematoria PM_{10} emissions per grid.

DG Sets

Power outages in the country arose the need to use Diesel Generator sets not only in housing but also in industries, infrastructure, IT, events, and entertainment as well as other sectors. They provide quick power supply as a backup and ease out the unreliability of power supplies in any area. For Mandi Gobindgarh, the location, and data of each of the DG sets was made available by PPCB. There are around 22DG sets employed in the city in hospitals, schools and colleges facing a power cut of an hour a day. The emission load for DG sets in the city of Mandi Gobindgarh amounted to 244.06 kg/year for PM_{10} and 207.452 kg/year for $PM_{2.5}$.The emission factors were taken from Sharma et al. (2016).

$$E\ (g/day) = Energy\ (kWh) * Emission\ Factor$$

E = Emissions

$$E(kWh) = C \times W\ (hrs)$$

Where, E = Energy

C = Installed capacity (kW)

W = Working/operating hours,

The Capacity (C) for DG sets was calculated by:

$$C(kW) = P(kVA) \times PE$$

Where, P = Apparent power (kVA)

PE = Power factor, 0.8 in this case (i.e., 80 per cent of apparent power is converted to working power)

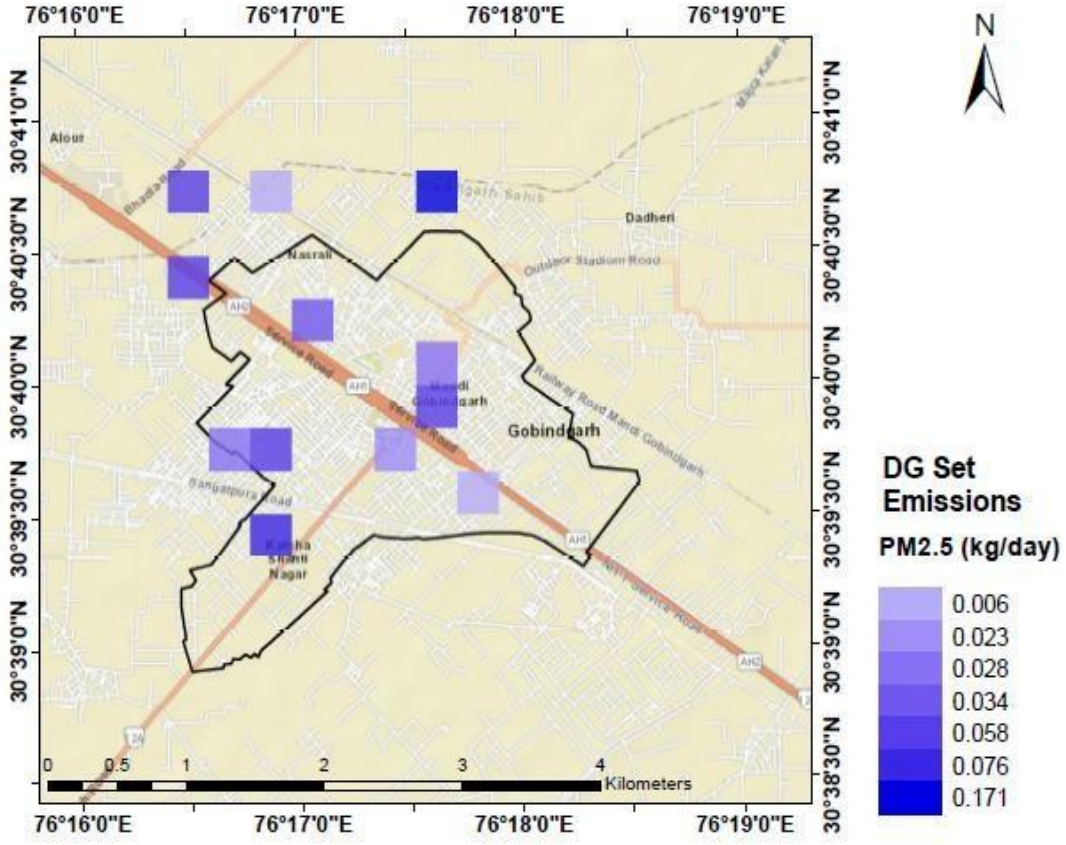

Figure 24 Map showing DG sets $PM_{2.5}$ emissions per grid.

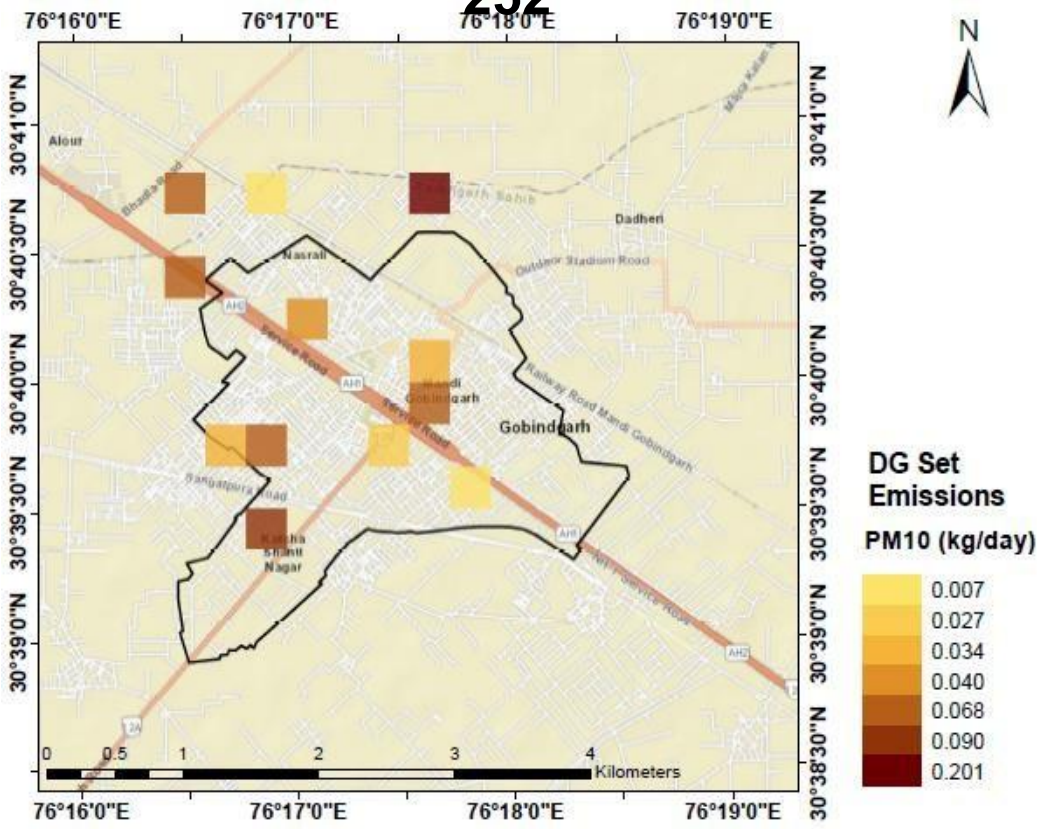

Figure 25 Map showing DG sets PM_{10} emissions per grid

Industry

Methodology for industry for estimation of emission load is based on the type of industry and type of fuel used and by using the Indian studies emission factor calculate the emission load per grid. Majorly industries related to metal works are present around the city. The emissions load for $PM_{2.5}$was estimated to be 147925.27 kg/year. The major fuel consumed were Coal, Fuel Oil and Wood. The emission for 211 industries falling in the buffer area were estimated for which data was provided by PPCB.

Emissions for industries can be based on either the fuel consumed orbased on the production capacity, or the flow rate and pollutant concentration released from the stack. The emissions in this particular inventory are based on the amount of fuel consumed by every industry throughout the year times the fuel specific emission factor which were adopted from SAFAR (2018).

$$E = A * Emission\ Factor * (1 - ER/100)$$

Where, A = Amount of fuel consumed

ER = Emission reduction

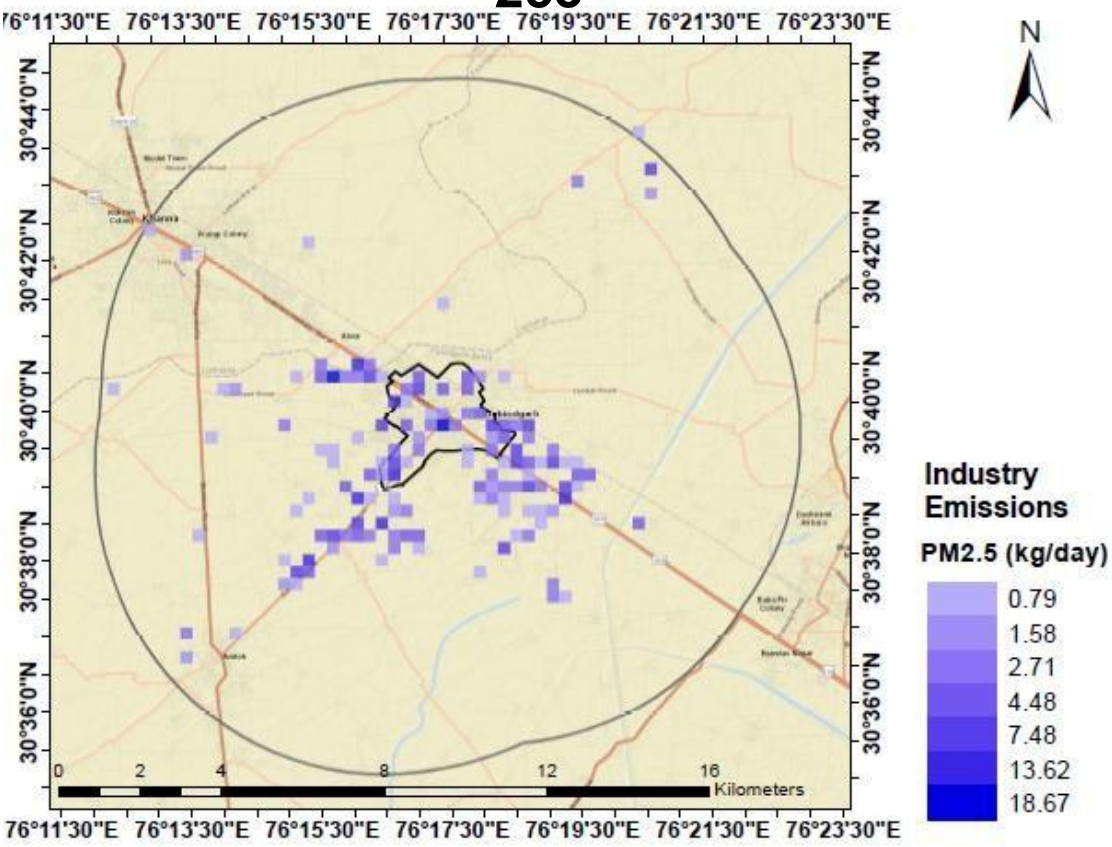

Figure 26 Map showing industrial $PM_{2.5}$ emissions per grid.

Vehicles

Figure 25 shows the road network in the city. Emissions for vehicles plying on the roads of Mandi Gobindgarh city were determined based on the following equation:

$$E = \sum n_i * VKT_i * EF_i$$

=

Where i: the category of vehicles viz. 2W, 3W, 4W, LCVs, HCVs, Buses, Others etc.

n: number of vehicles belonging to a category.

VKT: Vehicle Kilometre Travel

EF: Emission Factors

The emission factors depend on the category, age, type of fuel, and the engine capacity of the vehicle. The emission factors estimated by ARAI (2008) has incorporated all the above parameters.

For the VKT calculation the traffic flow diagram in the city was prepared to analyse the actual movement of traffic in the city. The video recordings were done for one weekday and one weekend on all the important locations identified by the IIT Delhi group. These video recordings were then analysed to draw the traffic flow diagram for the different category of vehicles in the city.

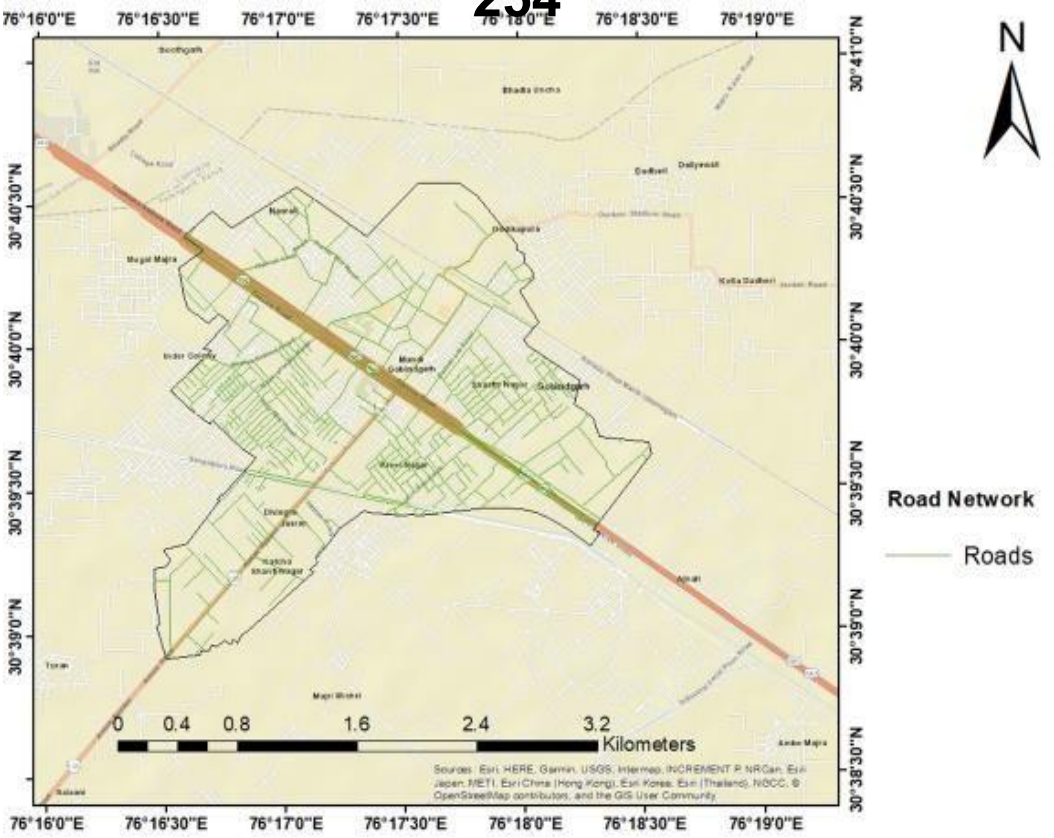

Figure 27 Road network in the city.

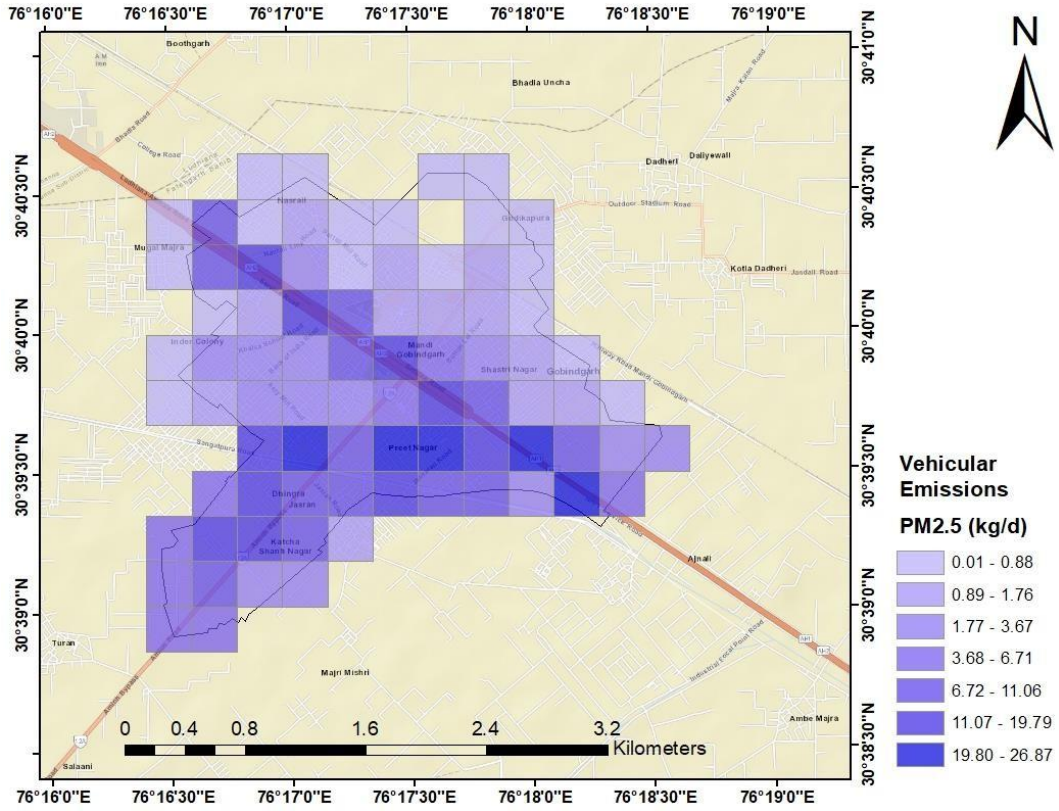

Figure 28 Map showing Vehicular $PM_{2.5}$ emissions per grid.

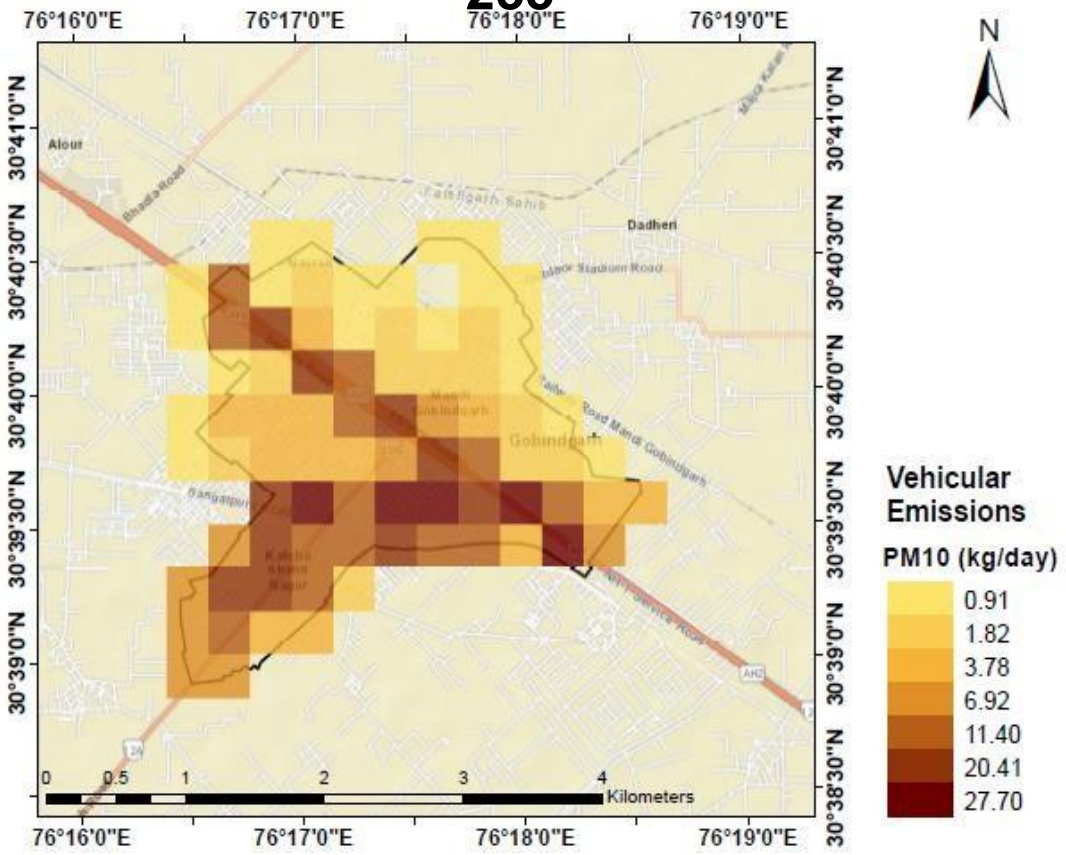

Figure 29 Map showing Vehicular PM_{10} emissions per grid.

Road Dust

Road dust was estimated based on the following equation –

Road Dust emissions Estimation:

$$E = \sum \boldsymbol{n_i} * \boldsymbol{VKT_i} * \boldsymbol{EF_i}$$

=

$$\boldsymbol{EF = k * sl^{0.91} * W^{1.02} * (1 - \frac{P}{N})}$$

Where,k: constant

sl: silt loading (gm/m2)

W: weight of the vehicle

P: Number of wet days in a year

N: total number of days in a year

Road dust sampling were done at various locations identified by the IIT Delhi group. The samples collected by PPCB were then sieve analysed to calculate the silt loading. The VKT calculations were then done from the vehicle flow diagram.

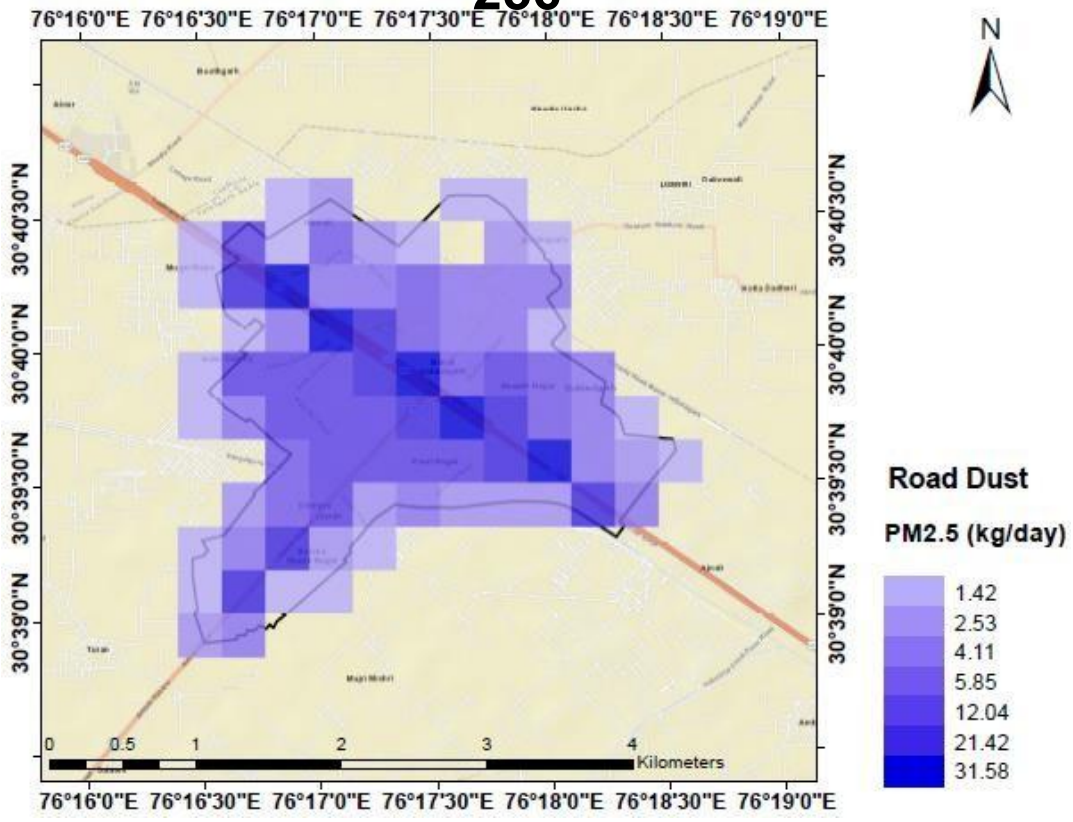

Figure 30 Map showing Road Dust $PM_{2.5}$ emissions per grid.

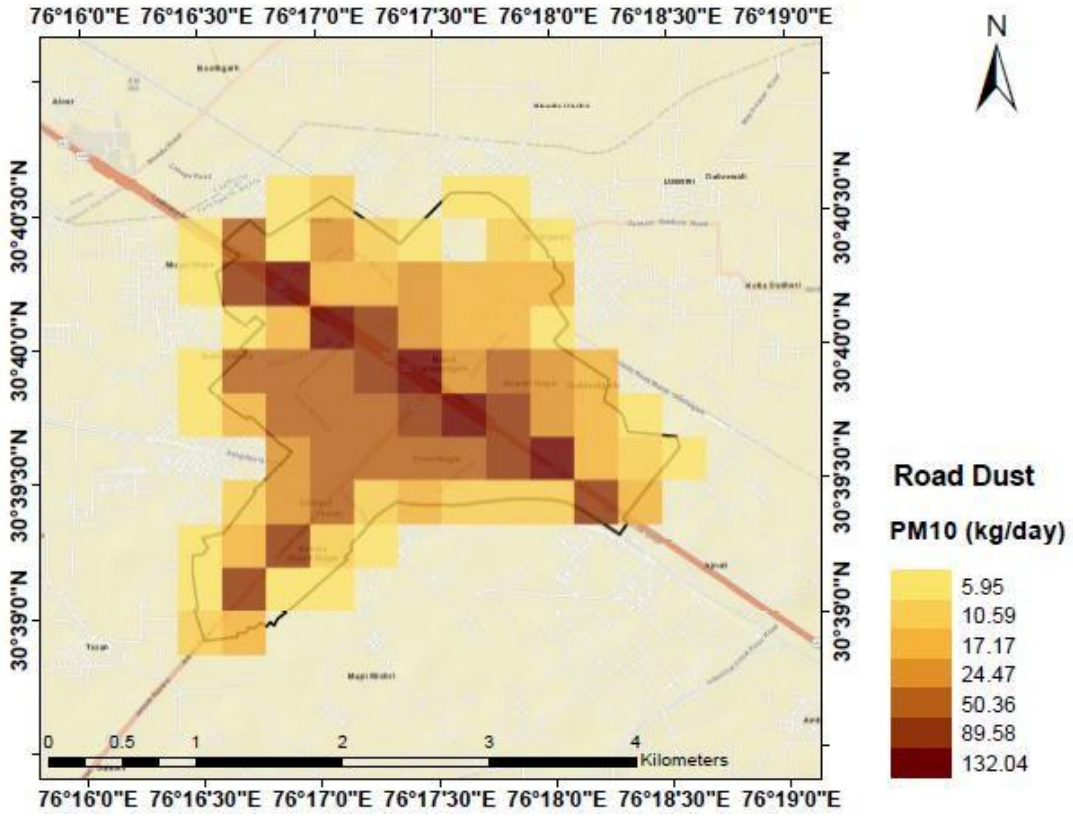

Figure 31 Map showing Road Dust PM_{10} emissions per grid.

Figures 30 and 31clearly shows $PM_{2.5}$ and PM_{10} emission distribution in city from different sources respectively. The major source of $PM_{2.5}$in the Mandi Gobindgarh city was estimated to be the road dust followed by vehicular sector followed by industrial sector and then by MSW. The other sources, such as domestic, crematoria, industries, construction, DGsets, brick kiln, food joints, open

eat outs, incinerator, contribute far less. The major source of PM_{10}in the Mandi Gobindgarh city was found to be road dust which is followed by industries and then vehicle. Other sources contribute relatively less to the total PM_{10} emission load.

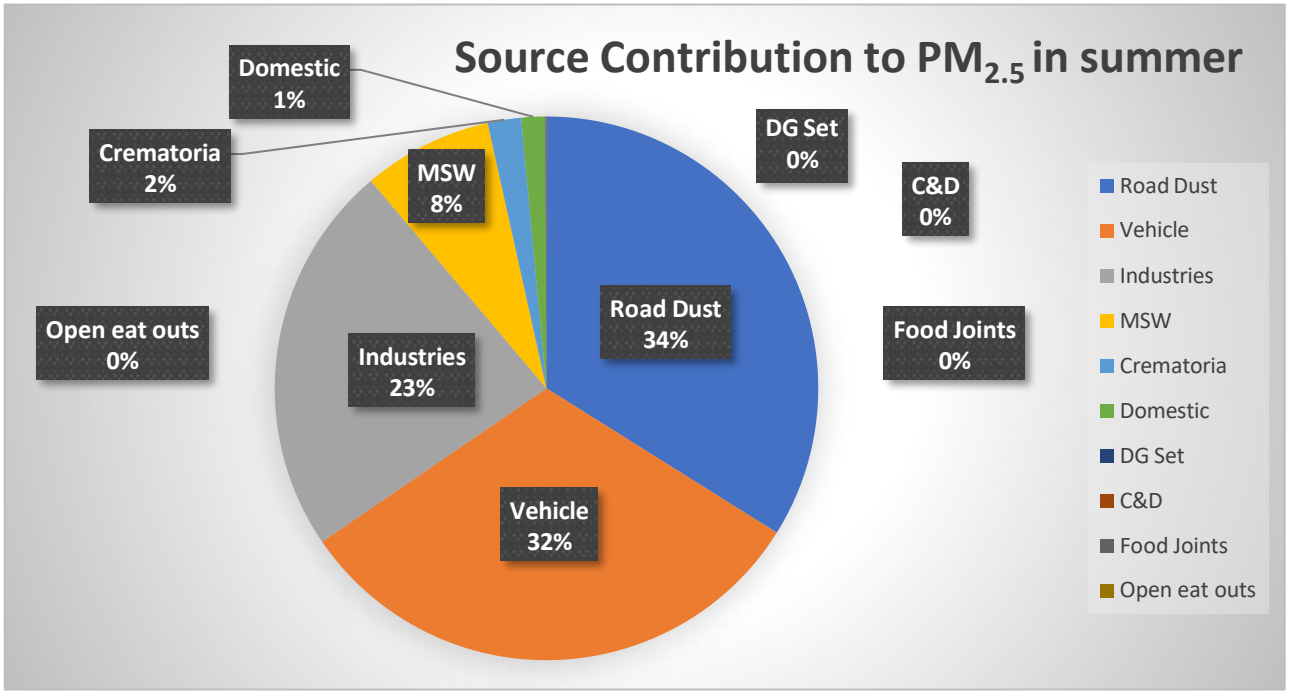

Figure 32 Chart showing the contribution of various sources to the total emissions of $PM_{2.5}$ in summer.

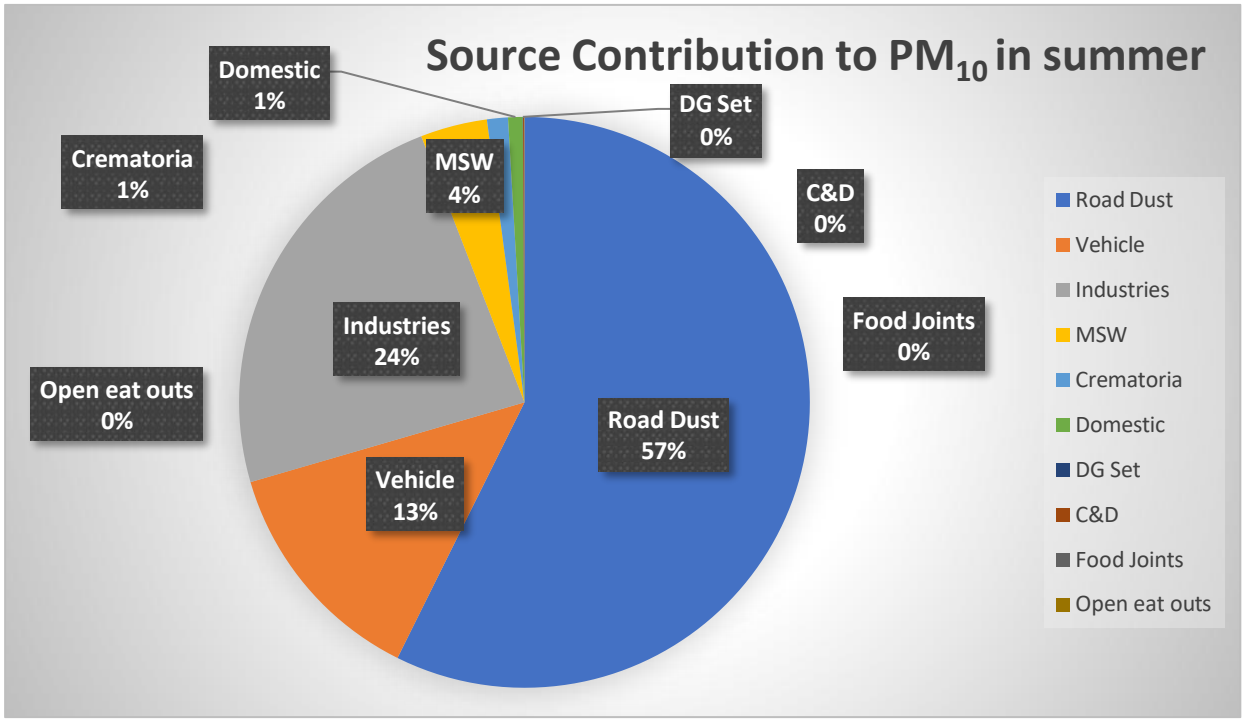

Figure 33 Chart showing the contribution of various sources to the total emissions of PM_{10} in summer.

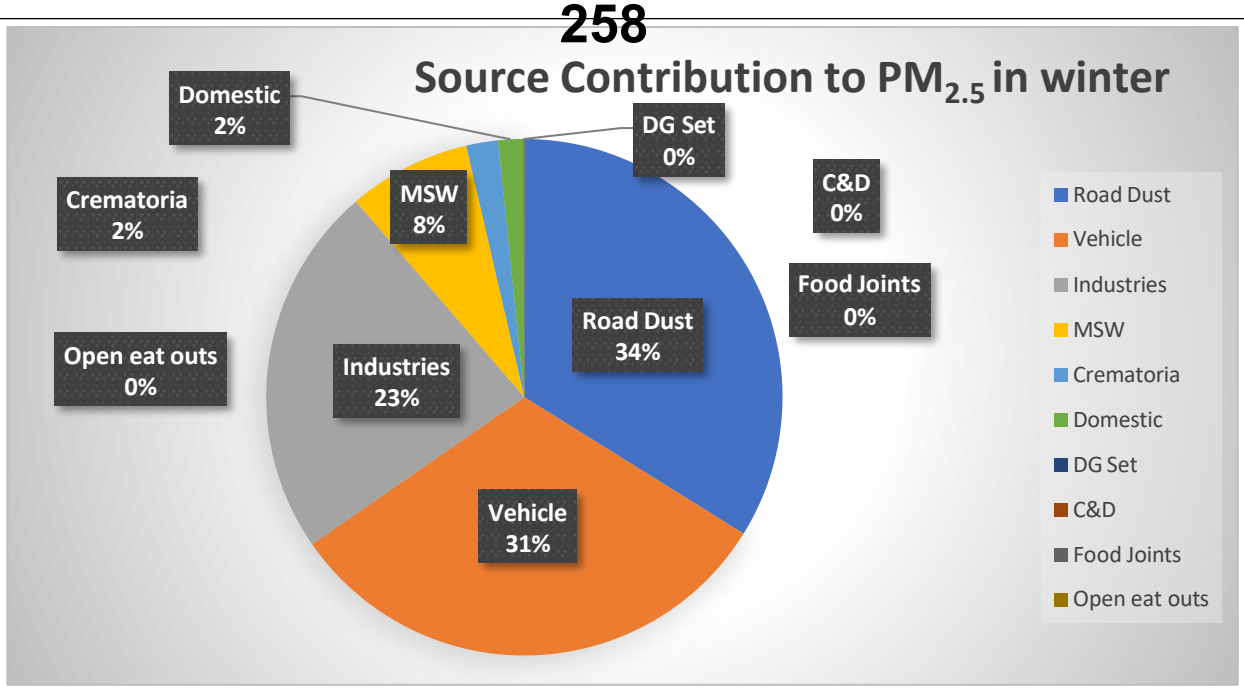

Figure 34 Chart showing the contribution of various sources to the total emissions of $PM_{2.5}$ in winter.

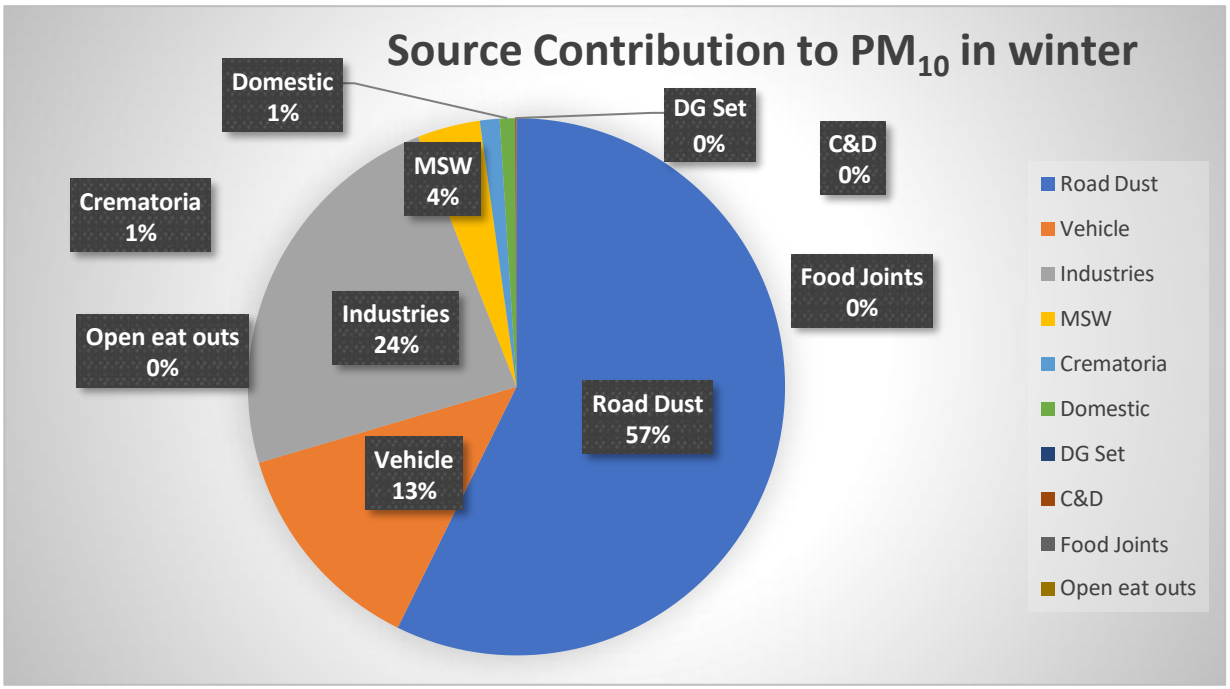

Figure 35 Chart showing the contribution of various sources to the total emissions of PM_{10} in winter.

4. Dispersion Modelling& Source Apportionment

4.1 Dispersion Modelling

The atmosphere is an extremely complex reactive system in which various physical and chemical processes occur. Ambient measurements give a brief glimpse of the prevailing atmospheric conditions at a particular location and time. These measurements are often difficult to interpret, and these measurements cannot be used directly by the policymakers to establish an effective strategy to solve the air quality problem. The understanding of an individual atmospheric process does not give an understanding of the atmosphere i.e., numerous processes are happening in the atmosphere simultaneously. Hence, for a better understanding of the atmosphere integration of all these atmospheric processes and their interactions should be considered. Therefore, modeling comes into the picture.

Atmospheric models can be divided into two types:

A. Physical Models
B. Mathematical Models

A. Physical models are used to simulate atmospheric processes by means of a small-scale representation of the actual system, for example, a small-scale model/replica of an urban area or a wind tunnel. The problems associated with such type of model are cost effectiveness, inaccurate incorporation of the physical forces which may vary significantly with scale. Hence, such models are of very limited use.
B. Mathematical models of atmospheric behaviour can broadly be classified into two types:
    - Models based on statistical analysis of data.
    - Modelsbased on the fundamental description of atmospheric physical and chemical processes

Most regions contain several monitoring stations operated by governmental authorities at which 1 hr to daily average concentration levels are measured and reported. A great deal of information is potentially available in these enormous databases, and statistical analysis of such data can provide valuable insights. An example of how such data can be used is a simple forecast model, where, for a certain region, concentration levels in the next few hours are given as a statistical function of current concentrations and other variables from correlations among past measurements and concentration trends. Statistical models take advantage of the available databases and are relatively simple to apply. However, their reliance on past data is also their major weakness. Because these models do not explicitly describe causal relationships, they cannot be reliably extrapolated beyond the bounds of the data from which they were derived. As a result, statistically based models are not ideally suited to the task of predicting the impact of significant changes in emissions. Hence, models based on fundamental description of atmospheric physical and chemical processes are of prime use.

The mathematical model provides the necessary framework for the integration of our understanding of various atmospheric processes and their interactions. An approach involving the combination of state-of-the-science measurements and state-of-the-art models is the best towards an attempt to understand the complex atmosphere.

The general form of the Gaussian Plume Equation can be written as:

$$C(x, y, z; H) = \frac{Q}{2\pi\sigma_y\sigma_z u} \cdot e^{\left\{-\frac{y^2}{2\sigma_y}\right\}} \cdot \left(e^{\left\{-\frac{1}{2}\left(\frac{z-H}{\sigma_z}\right)^2\right\}} + e^{\left\{-\frac{1}{2}\left(\frac{z+H}{\sigma_z}\right)^2\right\}}\right)$$

Where

C = pollutant concentration (mass/volume)

Q = emission rate from the point source (mass/time)

z = receptor height above ground (m)

u = mean horizontal wind speed (m/s)

H = effective stack height (m)

= the sum of the physical stack height (h) and the plume rise (Δh)

σ_y and σ_z = horizontal and vertical dispersion coefficients (m) at a distance x from the source

x and y = downwind and lateral distances from the source to the receptor point (m)

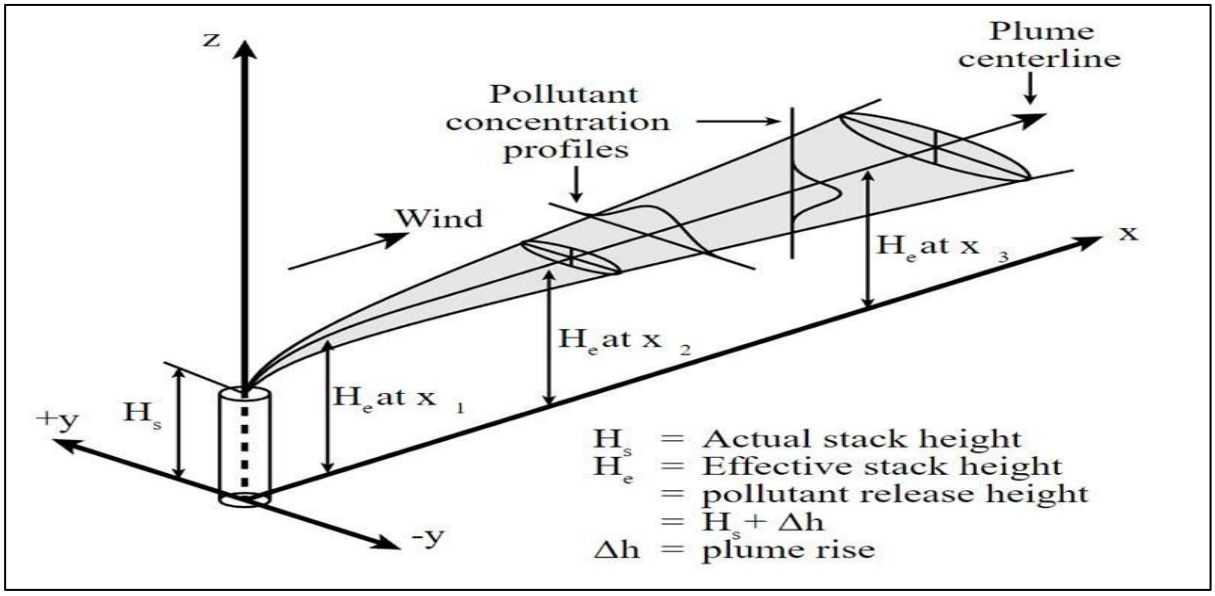

Figure 36 Parameters associated with the plume rise

4.2 Types of Models used in our analysis

The following discusses the different types of models along with their governing equations.

AERMOD

AERMOD stands for American Meteorological Society/ Environmental Protection Agency Regulatory Model. It is a regulatory model developed by USEPA (United States Environment Protection Agency) that has been rampantly used in all over the world both for research and regulatory purposes. AERMOD is a steady-state Gaussian plume model that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including treatment of both surface and elevated sources, and both simple and complex terrain (USEPA AERMOD manual). The major components of AERMOD are:

1. AERMET – a meteorological pre-processor

2. AERMAP – a terrain data pre-processor
3. AERMOD – a dispersion model

AERMIC meteorological pre-processor (AERMET) provides AERMOD with meteorological information it needs to characterize the planetary boundary layer (PBL). The AERMIC terrain pre-processor (AERMAP) characterizes the terrain and generates receptor grids for the dispersion model (AERMOD). AERMET uses meteorological data and surface characteristics to calculate boundary layer parameters (e.g. mixing height, friction velocity, etc.) needed by AERMOD.

ISC-AERMOD and CALPUFF are two modelling system which is recommended by USEPA (United States Environmental Protection Agency) for State Implementation Plan (SIP) purposes. Before AERMOD, there were ISCST3 and ISC-PRIME, two popular models were there for regulatory purposes but ISC-AERMOD is more advanced model comprising both ISCST3 and ISC-PRIME for assessment of pollution concentration and deposition from a wide variety of sources.

AERMOD constructs vertical profiles of required meteorological variables based on measurements and extrapolations of those measurements using similarity (scaling) relationships. Vertical profiles of wind speed, wind direction, turbulence, temperature, and temperature gradient are estimated using all available meteorological observations. It is applicable on both rural and urban areas, on flat or complex (flat + elevated) terrain and multiple sources (point, area, flare, volume) of emissions(Cimorelli et al.,2005)

WRF

WRF stands for Weather Research and Forecasting (WRF) model. It is a numerical weather prediction (NWP) and atmospheric simulation system designed for both research and operational applications. WRF reflects flexible, state-of-the-art, portable code that is efficient in computing environments ranging from massively parallel supercomputers to other computing machines. NWP is Physics based model which is based on several governing equations to get the values of the meteorological parameters.

The meteorological parameter for the city is generated from the WRF model. This was done because there were a lot of missing values in the station data and for some of the non-attainment city, the meteorological station was not present. Once the meteorological parameters were generated then these parameters were used to estimate the concentration in the city using the dispersion model AERMOD.

AERMOD Outputs

The hourly simulations were carried out for the year 2019 using AERMOD which is a dispersion model and stands for stands for American Meteorological Society/ Environmental Protection Agency Regulatory Model. The emissions of all sources are estimated based on the activity data which is solely based on the survey data provided to IIT Delhi team by PPCB which is not season specific. Hence the emissions section into the model were constant throughout the year 2019 and unlike meteorology which varies as a function of time. The meteorology has been estimated using WRF (Weather Research and Forecasting Model). The AERMOD simulation was carried out for each hour of the year 2019.

4.2 Source Apportionment

To better understand the contribution of various sources to the total concentration of $PM_{2.5}$, the city was divided into four quadrants and a single location from each of the sectors was identified. The quadrants were labelled in an anticlockwise manner.These coordinates are a representative of the quadrant and help in better understanding of the contribution of different sources at that location.

The identified locations are as shown in the Figure 35.

Figure 37 Division of city into four quadrants and their respective study coordinates.

The contribution of concentration by different sources was studied at these locations. As the emissions provided by PPCB did not vary with season, to study the contributions of various sources to predicted concentrations, the entire duration was divided into two periods: Pre-monsoon (1st March to 30th May) and post-monsoon (1st August to 30th November). During Pre-monsoon, as shown in figure 36 below, the highest contributors to $PM_{2.5}$ at four different locations were found to be Vehicles (41%), Industry (43%), Road Dust (33%), and Road Dust (40%) at locations 1, 2, 3, and 4 respectively. During post-monsoon, as shown in the figure 37 below, the highest contributor to $PM_{2.5}$ concentration was Vehicles (37%), Industry (42%), Road Dust (33%), Vehicles (32%), at locations 1, 2, 3 and 4, respectively. During Pre-monsoon, as shown in figure 38 below, the highest contributors to PM_{10} at four different locations were found to be Road Dust with the contributions of 50%, 43%, 55%, 62% at locations 1, 2, 3, and 4 respectively. Similarly, during post-monsoon, as shown in the figure 39 below, the highest contributor to PM_{10} concentration was again Road Dust with contributions of 57%, 43%, 54%, 50% at locations 1, 2, 3 and 4, respectively. Further, this also indicates that there are no major seasonal effects on contributions of different sources. However, this conclusion could be due to non-seasonal dependent emissions provided by PPCB.

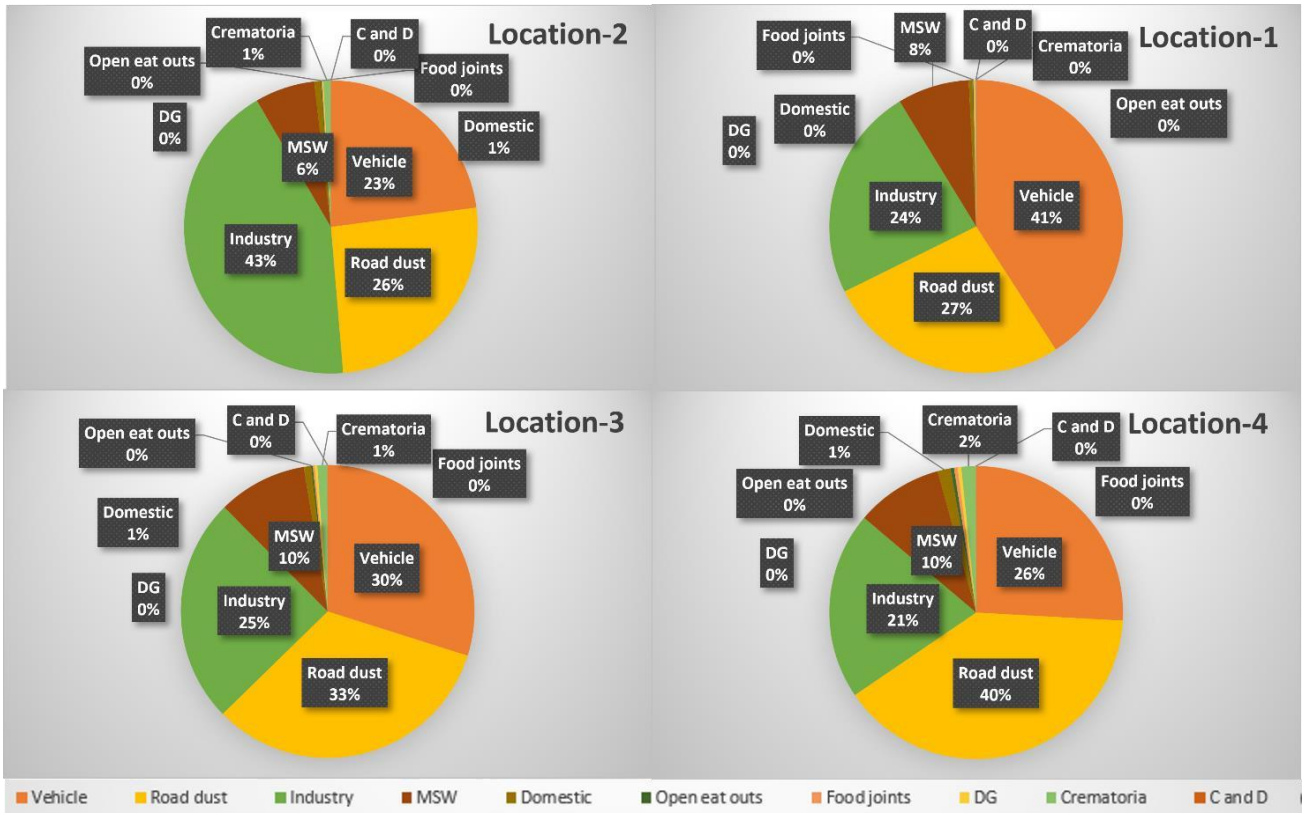

Figure 38 Contribution of different sources to $PM_{2.5}$at the four locations during pre-monsoon

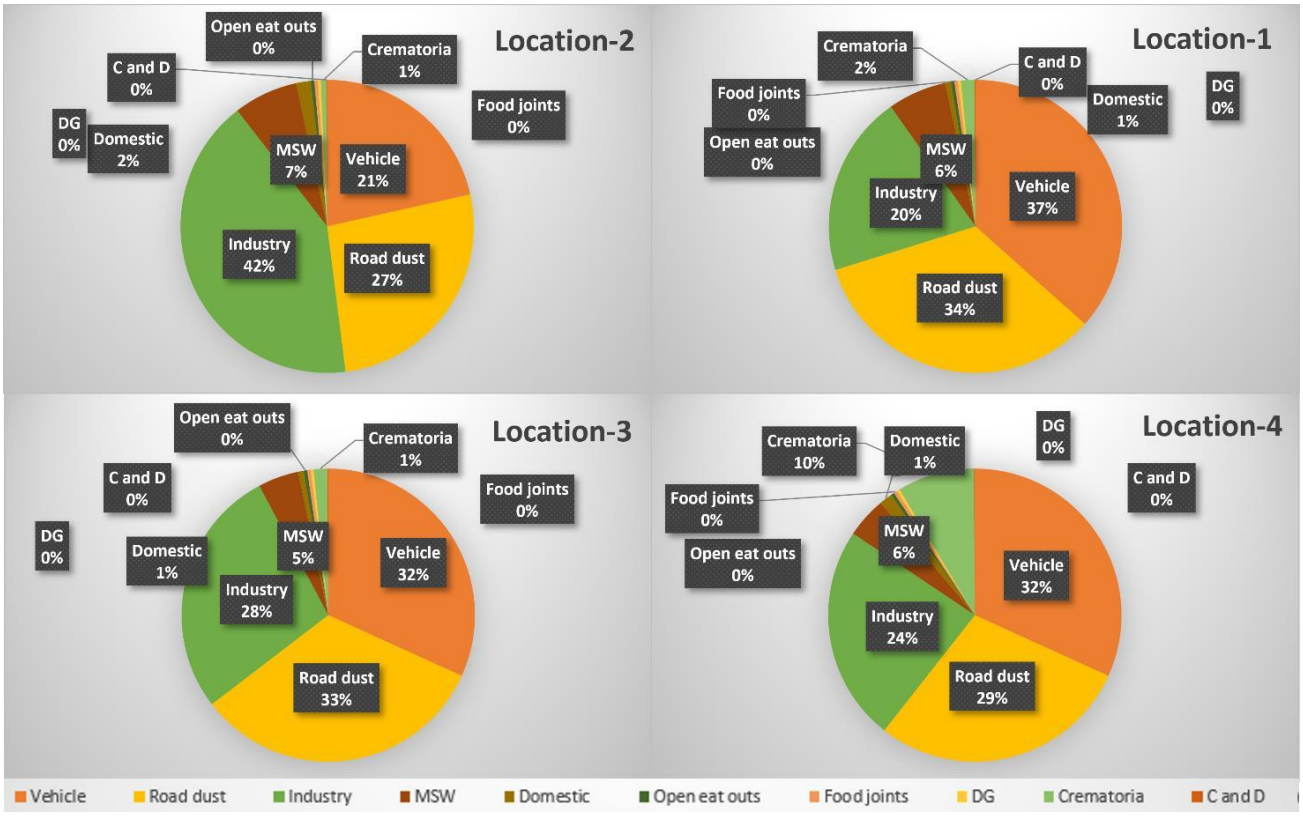

Figure 39 Contribution of different sources to $PM_{2.5}$at the four locations during post-monsoon

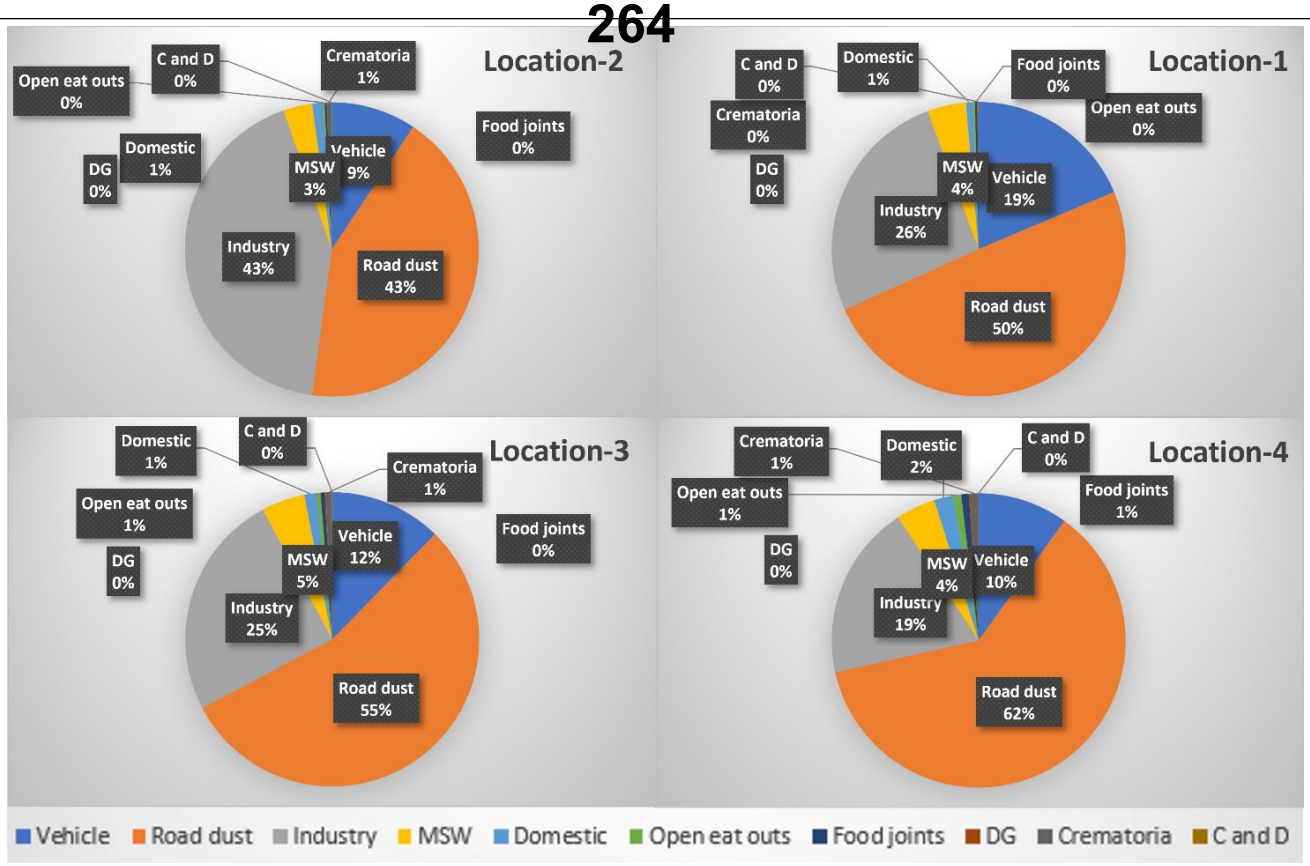

Figure 40 Contribution of different sources to PM_{10} at the four locations during pre-monsoon

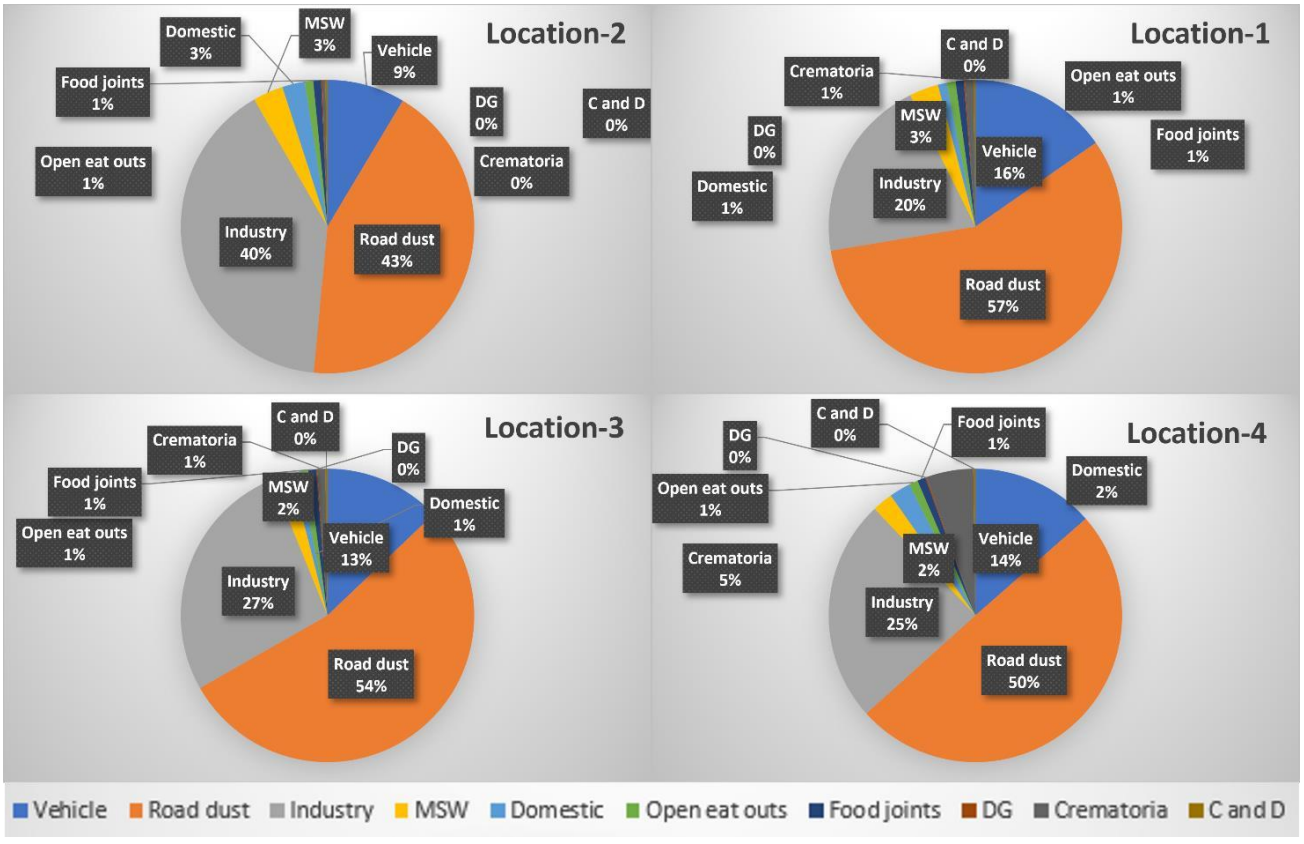

Figure 41 Contribution of different sources to PM_{10} at the four locations during post-monsoon

5. Hotspots Identification & Action Plan to improve the air quality

The major air pollution sources for PM in the city are vehicles, road dust, MSW burning, and industries. Following recommendations/suggestions may be adopted for abating the air pollution levels in the city.

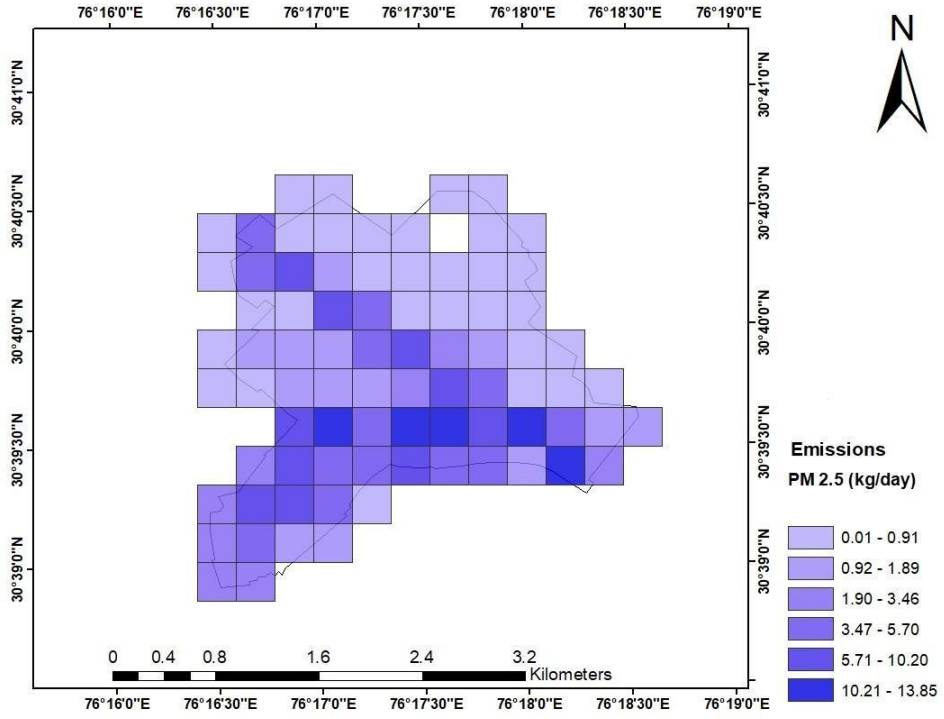

Figure 42 Emission map of total $PM_{2.5}$for the Mandi Gobindgarh

Hotspot specific recommendations:

1. It is seen that a heavy movement of commercial vehicles (HCVs and LCVs) within the city on all the major roads there by leading to the tail pipe emissions. A heavy congestion of vehicles can be seen on the major roads of wards 21 and 22 especially on the state highway near the under bridge of the national highway. This congestion leads to traffic which also adds on to the unnecessary tail pipe emissions within the city. Following recommendations may be adopted.
    a. The congestion mentioned above is mainly due to the untimely movement of the commercial vehicles (HCVs and LCVs). Hence, this needs to be regulated. Unlike other cities the movement of commercial vehicles cannot be banned throughout the day instead their movement may be banned during the peak hours i.e., from 7 am to 11 am in the morning and 5 pm to 9 pm in the evening. Addressing to the above recommendation

may reduce the PM10 emissions by 26%-30% and PM2.5 emissions by 18%-22% in the city.

b. Also, other alternate routes need to be prepared especially for the heavy congestion areas because it leads to the traffic jams which in turn leads to unnecessary tail pipe emissions.
c. Sprinkling/spraying of treated STP water at regular intervals (more frequently during the time when movement of commercial vehicles is allowed) may be done. This will help in decreasing the resuspension of road dust.
d. The regulating agencies needs to be more cautious especially during the winter season when the meteorological conditions are very bad leading to a very shallow PBL.
e. Heavy vehicles movements and parking along the side lines of National Highway-44 and along the Amloh road is major cause of air pollution in its vicinity. Therefore, designated parking facility along with the required number of weighing bridges may be made available.

2. As identified during the survey of the city following roads were found to be unpaved (Ambey Majra Road- 3 Km, Ajnali Road- 3 Km, Jassran Road-3 Km, Kuchha shanti Nagar-7 Km, Iqbal Nagar- 3 Km, Sant Nagar- 2 Km, Sukha Singh Colony-3 Km and Talwara Road-1 Km). This may be paved to combat the road dust emissions. Meanwhile, very frequent sprinkling/spraying of treated STP water (more frequently during the time when movement of commercial vehicles is allowed) may be done in this area to prevent road dust resuspension.

General/City wide Recommendations

1. Mandi Gobindgarh is known as the steel city of Punjab. Most of the industries are located outside the MC limits of the city. However, then also there are many industries located within the city limits. Most of the industries located inside the city are located on the main highways which are passing through the city. A cluster of the industries can be seen in the wards 6, 8, 15, 16, 21, 22, 25. Due to distribution of industries within the city a large movement of HCVs and LCVs can be seen within the city to facilitate the movement of the raw materials and finished products in and out of the city. This leads to extra tail pipe and road dust emissions.Hence, steps may be taken for the relocation of industries outside the city limits or in other area suitable as decided by the administrative authorities.
2. Around 55 % of the vehicles surveyed were diesel fuel powered vehicles, followed by 42 % petrol vehicles and around 3% of the vehicles were powered by CNG. Thus,
    a. Use of CNG may be promoted.
    b. Use of e-vehicles may be promoted among the public. This could be done by incentivizing the public on the purchase of e-vehicles.

c. Public Transportation may be redesigned in the city with the introduction of minibuses to be operated on CNG especially on the busy routes.
d. There could be a policy change and infrastructure development (such as the charging stations) for electric vehicle usage in the future.
e. Compliance of vehicles with the BS norms could be checked for. Regular pollution under control certificate check should be done and vehicles not adhering with the norms may be strictly penalized.
f. Age of the vehicles may be strictly monitored, as per government of India norms.
g. New cycling lanes may be constructed in the city to promote the use of non-motorized bikes and e-bikes.
h. Prevent parking of vehicles in non-designated areas.
i. Certain zones could be declared as vehicle free such as busy markets.
j. There could be promotion of battery-operated rickshaws.

3. Road dust resuspension is another source of concern in Mandi Gobindgarh city. Following measures maybe adopted.
   a) Regular sprinkling of treated STP water can be done.
   b) Regular cleaning of roads using mechanical sweepers could be done on heavy congestion areas.
   c) End to end pavement of roads could be done especially for the unpaved roads mentioned above.
4. All the weighing bridges shall be re-located outside the city limits to avoid parking / movement of heavy vehicles. All the major roads with heavy traffic movement should be checked regularly for potholes and repair/patchwork should be carried out immediately.
5. CNG operated e-rickshaw/CNG based School & College buses may be encouraged within the city limits. Also, all the roadsides/shoulders must be stabilized with concrete paver blocks within the city limits along with the proper drainage system.
6. Use of LPG for cooking purpose may be promoted in certain sections of the society by providing subsidies and dependence on traditional fuels should be decreased. It is seen that other fuels such as wood, cow dung etc. is used by the residents of the people of ward 2 and ward 3. The low per capita income of the people living in these wards confirms the lack of availability and awareness towards the use of LPG.
7. Wood is traditionally used in crematoria, and it is the main cause of emissions from the burning pyre. So, use of electric cremation may be promoted by setting up new electronic crematoria and by making the public more aware.

8. Guidelines for construction sites for monitoring and to control dust emission may be formulated. Meanwhile CPCB guidelines for Construction and Demolition may be adopted.Also, air quality monitoring may be carried out at all the construction site and real time data could be shared with PPCB which can be used to monitor the compliance with the norms. Also,during construction and demolition following measures may be adopted:
    a. A protocol should be established stating that the construction activity should not be carried out during unfavourable meteorology conditions-especially during winter.
    b. Use of sheets/wind barriers should be promoted to avoid the dispersion of pollutants emitted from the construction activities. CPCB norms should be added.
9. There could be an increase in the promotion of green energy alternatives such as solar panels in residential as well as commercial buildings. Also, DG sets could be regularly inspected and properly maintained. Emissions limits as advised by CPCB may be strictly adhered to.
10. The industries lying outside the industrial area may be shifted to the designated industrial area for the better management by PPCB.
11. PPCB may conduct various campaigns which should educate public on the seriousness andthe impacts on health caused due to the pollution.
12. Increasing public transport in this city could be beneficial as hardly 3% of the total vehicles plying in the city are buses. Further,
    a. The busy routes in the city may be identified and the introduction of CNG driven buses on the busy routes of the city may be done.
    b. Introduction of a metro on the busy route may be done.
13. Punjab is famous for its stubble burning menace and is considered responsible for polluting cities downwind. Following suggestions may be adopted:
    a. Stubble burning could be seriously discouraged and farmers could be educated and made aware of the menace it causes.
    b. Farmers needs to be made aware with the alternatives to burning of stubble and various government schemes such as Happy Seeder Machine offered by the state government to the Punjab Farmers.
    c. Farmers may be elucidated about projects where stubble is utilized as a resource –such as the one where NHAI is using the stubble for road filling.
    d. Use of stubble as a fuel e.g., in cement industry can be promoted.
    e. Stubble can be utilized in mushroom farming.
    f. It can also be used as a fodder for cattle.
    g. Private players collecting the stubble may be promoted by the government.

6. Limitations of the Study

The limitations of this study are listed below:

1) The activity data (raw data) is based on the survey forms provided to IIT Delhi team by PPCB for the various sources identified. Hence, the accuracy of the inventory is dependent on the quality of the data, the number of survey forms for each source and the representativeness of the survey data.
2) The vehicle activity data has the following limitations:
   a. For calculating the vehicle flow pattern, the video recording for 5-intersections were analysed for 1-weekday and 1-weekend. The average of this 2-days vehicle count datais then assumed to be uniform for 365 days which in real scenario will not be the case.Hence, the seasonal variation on the vehicular emissions is out of the ambit of this study.
   b. The vehicular tail pipe emissions may also depend on the speed of the vehicle which was not provided.
   c. The vehicle flow pattern is drawn considering only 5-intersections which are located mainly in the central region of the city. This may be alimitation since the vehicle flow pattern may not representative.
3) The road dust activity data has the following limitations:
   a. While calculating the emission factors for a stretch of the road the silt loading of that particular stretch needs to be estimated. As PPCB provided the road dust sampling analysis at only few locations, the silt loading data for the entire city roads were estimated using these locations data, which might not be representative.
   b. The vehicular road dust emissions may also depend on the speed of the vehicle which was not available.
4) The data provided by PPCB to the IIT Delhi team to estimate the stubble emissions does not have information regarding duration of burning and time at which a particular field is burning. The given data only provided the information of the field area burnt. Considering this, the proper estimation of contribution of stubble to the particulate concentration in the city is not possible.
5) The scope of this study was restricted to carrying out source apportionment using dispersion modelling. However, in this approach emissions from some sources such as MSW burning etc., might be underestimated. However, to support the recommendations from this study a field campaign with regulatory grade equipment followed by receptor-oriented source apportionment may be carried out in future in the identified hotspots.

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Annexure-B

List of Non-Complying Industries (01.01.2022 to 30.09.2023)

Sr. No.	Name of Industry & Address	Date of Visit	Not Complying
1	Sabri Steels Village Kukar Majra, Behind Gurudwara Sahib, Mandi Ghobindgarh	11/07/2023	Not Complying
2	Arjas Modern Steels Private Limited G.T. Road, Mandi Gobindgarh	06/06/2023	Not Complying
3	Fortune Metals Ltd. Talwara Road, Mandi Gobindgarh	06/06/2023	Not Complying
4	Oasis Enterprises Pvt. Ltd. Talwara Road, Mandi Gobindgarh	06/06/2023	Not Complying
5	Sona Castings (P) Ltd. G.T. Road, Sirhind Side, Mandi Gobindgarh	06/06/2023	Not Complying
6	H-Dev Developers Pvt. Ltd. Village-Mohanpur, Opp. KFC	05/06/2023	Not Complying
7	Amar Forging Vill Kumbh, Amloh Road, Mandi Gobindgarh	24/05/2023	Not Complying
8	Fortune Metals Ltd. Talwara Road, Mandi Gobindgarh	14/05/2023	Not Complying
9	Bhawani Industries Pvt Ltd. Vill Ajnali, Backside Focal Point, Mandi Gobindgarh	13/05/2023	Not Complying
10	Nabha Steel & Metals G.T. Road, Sirhind Side, RIMT University Road, Mandi Gobindgarh	12/05/2023	Not Complying
11	Oasis Enterprises Pvt. Ltd. Talwara Road, Mandi Gobindgarh	11/05/2023	Not Complying
12	A.R. Castings Pvt. Ltd. R.G. Mill Road, Sirhind Side, Mandi Gobindgarh	08/05/2023	Not Complying
13	Good Time Resort Opp. Radha Swami Satsang Bhawan, G.T. Road	08/05/2023	Not Complying
14	Kular Colllage of Nursing (A Unit of Kular Medical Education and Research Society) Bija, Kishangarh	08/05/2023	Not Complying
15	PPR Construction (Khanna City Centre) G. T Road	08/05/2023	Not Complying
16	Jogindra Casting (P) Ltd. G.T. Road, Sirhind Side, Mandi Gobindgarh	05/05/2023	Not Complying
17	Regal Alloys (P) Ltd. Vill. Kumbh, Amloh Road, Mandi Gobindgarh	18/04/2023	Not Complying
18	Moonlight Tools Pvt. Ltd. Village Jaspalon, G.T. Road	03/03/2023	Not Complying
19	Shree Balaji Steel Industries (L/o Sulakhan Steel Industries) Peer Gaju Shah Road, Alour	09/02/2023	Not Complying
20	Madhav KRG Environmental Solutions Private Limited Village Bhadalthuha, Amloh	07/02/2023	Not Complying
21	Mohindra Alloys G.T. Road, Mughal Majra, Mandi Gobindgarh	25/01/2023	Not Complying
22	Shri Shyam Steel And Wire Industries Near Harbans Cold Store, Village Tooran, Amloh Road, Mandi Gobindgarh	30/12/2022	Not Complying
23	Sona Castings (P) Ltd. G.T. Road, Sirhind Side, Mandi Gobindgarh	19/12/2022	Not Complying
24	Chanakya Dairy Products (P) Ltd. A-4-6, Focal Point, Mandi Gobindgarh	16/12/2022	Not Complying

Annexure-B

Sr. No.	Name of Industry & Address	Date of Visit	Not Complying
25	Shree Ganpati Body Builders Village Bhadla Neecha	14/12/2022	Not Complying
26	Lord Mahavir Industries Pvt.Ltd. Gian TMT Road, Vill. Talwara, Sirhind Side, Mandi Gobindgarh.	09/12/2022	Not Complying
27	Neelkanth Strips Pvt. Ltd. Opp. PWD Restaurant, G.T. Road, Sirhind	05/12/2022	Not Complying
28	Coldrip Steels Pvt. Ltd. G.T. Road, Sirhind Side, Mandi Gobindgarh	02/12/2022	Not Complying
29	Pioneer Strips Ltd. R.G. Mill Road, Mandi Gobindgarh	30/11/2022	Not Complying
30	Modern Automotives Ltd. Vill. Chattarpura, Near Focal Point, Mandi Gobindgarh	25/11/2022	Not Complying
31	Gaurav Steel Industries Old Radha Swami Satsang Bhawan Road, , Mandi Gobindgarh	23/11/2022	Not Complying
32	Hans Steel Rolling Mill G.T. Road, Alour	15/11/2022	Not Complying
33	K.L. Alloys Pvt. Ltd. G.T. Road, Talwara Road, Mandi Gobindgarh	07/11/2022	Not Complying
34	Durga Multimetal (P) Ltd. Village Chattarpura, Mandi Gobindgarh	03/11/2022	Not Complying
35	R.D. Ispat (Shree Salasar Ispat Udyog l/o Rahul Enterprises) Vill. Kumbran, Near Gas Plant, Mandi Gobindgarh	03/11/2022	Not Complying
36	Kanha Concast Vill Ambey Majra, Chattarpura Road, Mandi Gobindgarh	02/11/2022	Not Complying
37	R.P Concast (FormalyAPS Internationa)l Peer Gajju Shah Road, Mugal Majra, Mandi Gobindgarh	31/10/2022	Not Complying
38	Mata Alloys Pvt. Ltd (Punia Alloys) Vill Wazirabad, Ambey Majra Road, Mandi Gobindgarh	10/10/2022	Not Complying
39	Nisha Steel Rolling Mills (formerly known as Bright Steel Rolling Mills) Badinpur Road, Vill. Mughal Majra, Mandi Gobindgarh	28/09/2022	Not Complying
40	Ajanta Steel Corporation Nasrali Road, Mandi Gobindgarh	08/09/2022	Not Complying
41	Jogindra Casting (P) Ltd. G.T. Road, Sirhind Side, Mandi Gobindgarh	26/08/2022	Not Complying
42	Fortune Metals Ltd. Talwara Road, Mandi Gobindgarh	08/08/2022	Not Complying
43	Evit Steels Private Limited L/o Mittal Ceramics Vill. Kumbh, Near Hind Alloys, Mandi Gobindgarh	04/08/2022	Not Complying
44	Fortune Metals Ltd. Talwara Road, Mandi Gobindgarh	03/07/2022	Not Complying
45	Madhav KRG Environmental Solutions Private Limited Village Bhadalthuha, Amloh	09/06/2022	Not Complying
46	Santosh Castings Works L/o King Steel Opp. Doaba Mill, Amloh Road, Mandi Gobindgarh	30/05/2022	Not Complying
47	Shree Ganesh Steel Rolling Mills Khanna Side, Amloh, Mandi Gobindgarh	26/05/2022	Not Complying
48	P.P Casting Village Kumbh, Amloh Road, Mandi Gobindgarh	12/05/2022	Not Complying
49	Jaisleen Ceramics Vill. Majri Mishriwali, Mandi Gobindgarh	11/05/2022	Not Complying

Annexure-B

Sr. No.	Name of Industry & Address	Date of Visit	Not Complying
50	Gill Trading Co. Bidhi Chand Colony, Mandi Gobindgarh	27/04/2022	Not Complying
51	Drolia Steels Hadda Rodi Road, GT Road	22/04/2022	Not Complying
52	Arjas Modern Steels Private Limited G.T. Road, Mandi Gobindgarh	20/04/2022	Not Complying
53	Khan Metals Bidhi Chand Colony, Ward no. 15, Mandi Gobindgarh	13/04/2022	Not Complying
54	Shree Ganesh Alloys and Metals Mugal Majra, Mandi Gobindgarh	12/04/2022	Not Complying
55	Madhav KRG Environmental Solutions Private Limited Village Bhadalthuha, Amloh	31/03/2022	Not Complying
56	Evit Steels Private Limited L/o Mittal Ceramics Vill. Kumbh, Near Hind Alloys, Mandi Gobindgarh	30/03/2022	Not Complying
57	Talasri Steels Pvt. Ltd. Vill. Jalalpur, Amloh Road, Mandi Gobindgarh	30/03/2022	Not Complying
58	Jagat Metals (P) Ltd. Vill. Ambay Majra, Near 220 KV power Station, Mandi Gobindgarh	28/03/2022	Not Complying
59	Arjas Modern Steels Private Limited G.T. Road, Mandi Gobindgarh	25/02/2022	Not Complying
60	Shree Ganesh Alloys and Metals Mugal Majra, Mandi Gobindgarh	25/02/2022	Not Complying
61	Chandigarh Castings Pvt. Ltd., Vill. Ambey Majra, G.T. Road, Mandi Gobindgarh	15/11/2021	Not Complying
62	Mahadev Petrochemicals, Plot No. D-116 (P), Focal Point, Mandi Gobindgarh	02/02/2021	Not Complying

Annexure-C

List of Non-Complying Industries on which Environmental Compensation Imposed

Sr. No.	Industry Name	Date of Visit	Action taken Under Section	Environmental Compensation
1	Fortune Metals Ltd., Talwara Road, Mandi Gobindgarh	03/07/2022	U/s 31-A of Air Act, 1981	1668750
2	Oasis Enterprises Pvt. Ltd., Talwara Road, Mandi Gobindgarh	06/06/2023	U/s 31-A of Air Act, 1981	600000
3	P.P Casting, Village Kumbh, Amloh Road, Mandi Gobindgarh	12/05/2022	HWM Rules, 2016	100000
4	Mata Alloys Pvt. Ltd (Punia Alloys), Vill Wazirabad, Ambey Majra Road, Mandi Gobindgarh	10/10/2022	U/s 5 of EPA Act, 1986	500000
5	Nabha Steel & Metals, G.T. Road, Sirhind Side, RIMT University Road, Mandi Gobindgarh	12/05/2023	U/s 31-A of Air Act, 1981	712500
6	Mohindra Alloys, G.T. Road, Mughal Majra, Mandi Gobindgarh	25/01/2023	U/s 31-A of Air Act, 1981	50000
7	Madhav KRG Environmental Solutions Private Limited, Village Bhadalthuha, Amloh	09/06/2022	HWM Rules, 2016	5000000
8	Arjas Modern Steels Private Limited, G.T. Road, Mandi Gobindgarh	25/02/2022	U/s 31-A of Air Act, 1981	1200000
9	Chandigarh Castings Pvt. Ltd., Vill. Ambey Majra, G.T. Road, Mandi Gobindgarh	15/11/2021	U/s 31-A of Air Act, 1981	62500
10	Madhav KRG Environmental Solutions Private Limited, Village Bhadalthuha, Amloh	31/03/2022	HWM Rules, 2016	450000
11	Durga Multimetal (P) Ltd., Village Chattarpura, Mandi Gobindgarh	03/11/2022	U/s 31-A of Air Act, 1981	250000
12	Arjas Modern Steels Private Limited, G.T. Road, Mandi Gobindgarh	25/02/2022	U/s 31-A of Air Act, 1981	350000
13	Kanha Concast, Vill Ambey Majra, Chattarpura Road, Mandi Gobindgarh	02/11/2022	U/s 31-A of Air Act, 1981	75000
14	R.D. Ispat (Shree Salasar Ispat Udyog l/o Rahul Enterprises), Vill. Kumbran, Near Gas Plant, Mandi Gobindgarh	03/11/2022	U/s 33-A of Water Act, 1974 and 31-A of Air Act, 1981	400000
15	Madhav KRG Limited, Vill Akalgarh, Amloh Bhadson Road, Neat Toll Plaza, Amloh	31/12/2022	U/s 31-A of Air Act, 1981	720000
16	R.P Concast (Formaly APS International), Peer Gajju Shah Road, Mugal Majra, Mandi Gobindgarh	31/10/2022	U/s 31-A of Air Act, 1981	281250
17	Regal Alloys (P) Ltd., Vill. Kumbh, Amloh Road, Mandi Gobindgarh	18/04/2023	HWM Rules, 2016	500000
18	Arjas Modern Steels Private Limited, G.T. Road, Mandi Gobindgarh	20/04/2022	U/s 31-A of Air Act, 1981	1800000

Annexure-C

Sr. No.	Industry Name	Date of Visit	Action taken Under Section	Environmental Compensation
19	Lord Mahavir Industries Pvt.Ltd., Gian TMT Road, Vill. Talwara, Sirhind Side, Mandi Gobindgarh.	09/12/2022	HWM Rules, 2016	200000
20	Talasri Steels Pvt. Ltd., Vill. Jalalpur, Amloh Road, Mandi Gobindgarh	30/03/2022	U/s 31-A of Air Act, 1981	300000
21	Evit Steels Private Limited L/o Mittal Ceramics, Vill. Kumbh, Near Hind Alloys, Mandi Gobindgarh	04/08/2022	U/s 5 of EPA Act, 1986	400000
22	Jagat Metals (P) Ltd.,Vill. Ambay Majra, Near 220 KV power Station, Mandi Gobindgarh	28/03/2022	U/s 31-A of Air Act, 1981	75000
23	Arjas Modern Steels Private Limited, G.T. Road, Mandi Gobindgarh	20/04/2022	U/s 31-A of Air Act, 1981	600000
24	Madhav KRG Environmental Solutions Private Limited, Village Bhadalthuha, Amloh	07/02/2023	U/s 25/26 of Water Act, 1974 and u/s 21 of Air Act, 1981 as well as under HWM Rules, 2016	800000
25	Arjas Modern Steels Private Limited, G.T. Road, Mandi Gobindgarh	25/02/2022	U/s 31-A of Air Act, 1981	600000
26	Arjas Modern Steels Private Limited, G.T. Road, Mandi Gobindgarh	20/04/2022	U/s 31-A of Air Act, 1981	600000
27	Hans Steel Rolling Mill, G.T. Road, Alour	15/11/2022	U/s 31-A of Air Act, 1981	400000
28	Mahadev Petrochemicals, Plot No. D-116 (P), Focal Point, Mandi Gobindgarh	02/02/2021	HWM Rules, 2016	100000
29	Jaisleen Ceramics, Vill. Majri Mishriwali, Mandi Gobindgarh	11/05/2022	U/s 31-A of Air Act, 1981	100000
30	K.L. Alloys Pvt. Ltd., G.T. Road, Talwara Road, Mandi Gobindgarh	07/11/2022	HWM Rules, 2016	400000
		Total		**19295000**

Annexure-D

List of Non-Complying Industries on which Bank Guarantee imposed

Sr. No.	Industry Name	Date of Visit	Action taken Under Section	Bank Guarantee
1	Shree Balaji Steel Industries (L/o Sulakhan Steel Industries), Peer Gaju Shah Road, Alour	09/02/2023	U/s 31-A of Air Act, 1981	50000
2	Shri Shyam Steel And Wire Industries, Near Harbans Cold Store, Village Tooran, Amloh Road, Mandi Gobindgarh	30/12/2022	U/s 33-A of Water Act, 1974 and 31-A of Air Act, 1981	50000
3	Arjas Modern Steels Private Limited, G.T. Road, Mandi Gobindgarh	06/06/2023	U/s 31-A of Air Act, 1981	2000000
4	Nabha Steel & Metals, G.T. Road, Sirhind Side, RIMT University Road, Mandi Gobindgarh	12/05/2023	U/s 31-A of Air Act, 1981	500000
5	Jogindra Casting (P) Ltd., G.T. Road, Sirhind Side, Mandi Gobindgarh	26/08/2022	Not Complying with the EC condition	1000000
6	Moonlight Tools Pvt. Ltd., Village Jaspalon, G.T. Road	03/03/2023	U/s 21 of Air Act, 1981	200000
7	Neelkanth Strips Pvt. Ltd., Opp. PWD Restaurant, G.T. Road, Sirhind	05/12/2022	U/s 33-A of Water Act, 1974 and 31-A of Air Act, 1981	50000
8	Modern Automotives Ltd., Vill. Chattarpura, Near Focal Point, Mandi Gobindgarh	25/11/2022	U/s 31-A of Air Act, 1981	1000000
9	Chanakya Dairy Products (P) Ltd., A-4-6, Focal Point, Mandi Gobindgarh	16/12/2022	U/s 33-A of Water Act, 1974 and 31-A of Air Act, 1981	1000000
10	Bhawani Industries Pvt. Ltd., Village Ajnali, Near Focal Point, Mandi Gobindgarh	13/05/2023	U/s 31-A of Air Act, 1981	200000
11	Kular Colllage of Nursing (A Unit of Kular Medical Education and Research Society), Bija, Kishangarh	08/05/2023	BMW Rules, 2016	200000
12	A.R. Castings Pvt. Ltd., R.G. Mill Road, Sirhind Side, Mandi Gobindgarh	08/05/2023	U/s 31-A of Air Act, 1981	500000
13	Ajanta Steel Corporation, Nasrali Road, Mandi Gobindgarh	08/09/2022	U/s 21 of Air Act, 1981	50000
14	Nisha Steel Rolling Mills (formerly known as Bright Steel Rolling Mills), Badinpur Road, Vill. Mughal Majra, Mandi Gobindgarh	28/09/2022	U/s 31-A of Air Act, 1981	25000
15	Coldrip Steels Pvt. Ltd., G.T. Road, Sirhind Side, Mandi Gobindgarh	02/12/2022	U/s 33-A of Water Act, 1974 and 31-A of Air Act, 1981	50000
16	Shree Ganpati Body Builders, Village Bhadla Neecha	14/12/2022	U/s 33-A of Water Act, 1974 and 31-A of Air Act, 1981	200000
17	Garg Machine Tools, D-64,65, Focal Point, Mandi Gobindgarh	23/11/2022	U/s 33-A of Water Act, 1974	50000
18	Oasis Enterprises Pvt. Ltd., Talwara Road, Mandi Gobindgarh	11/05/2023	U/s 25/26 of Water Act, 1974 and u/s 21 of Air Act, 1981	2000000

Annexure-D

Sr. No.	Industry Name	Date of Visit	Action taken Under Section	Bank Guarantee
19	Pioneer Strips Ltd., R.G. Mill Road, Mandi Gobindgarh	30/11/2022	U/s 33-A of Water Act, 1974	50000
20	Amar Forging, Vill Kumbh, Amloh Road, Mandi Gobindgarh	24/05/2023	U/s 33-A of Water Act, 1974	200000
21	Khan Metals, Bidhi Chand Colony, Ward no. 15, Mandi Gobindgarh	13/04/2022	U/s 31-A of Air Act, 1981	50000
22	Drolia Steels, Hadda Rodi Road, GT Road	22/04/2022	U/s 31-A of Air Act, 1981	100000
23	Evit Steels Private Limited L/o Mittal Ceramics, Vill. Kumbh, Near Hind Alloys, Mandi Gobindgarh	04/08/2022	U/s 5 of EPA Act, 1986	200000
24	PPR Construction (Khanna City Centre), G. T Road	08/05/2023	U/s 33-A of Water Act, 1974 and 31-A of Air Act, 1981	500000
25	Good Time Resort, Opp. Radha Swami Satsang Bhawan, G.T. Road	08/05/2023	U/s 31-A of Air Act, 1981	50000
26	H-Dev Developers Pvt. Ltd. (Unit-M/s Kings Castle Resorts), Village-Mohanpur, Opp. KFC	05/06/2023	U/s 33-A of Water Act, 1974 and 31-A of Air Act, 1981	200000
		Total		**10475000**

Annexure-E

List of Non-Complying Industries to whom directions were issued to disconnect the Electric supply

Sr. No.	Industry Name	Date of Visit	Action taken Under Section	Disconnection/ Closure
1	Sabri Steels, Village Kukar Majra, Behind Gurudwara Sahib, Mandi Gobindgarh	11/07/2023	U/s 31-A of Air Act, 1981	Power Disconnection
2	Sona Castings (P) Ltd., G.T. Road, Sirhind Side, Mandi Gobindgarh	19/12/2022	U/s 33-A of Water Act, 1974 and 31-A of Air Act, 1981	Power Disconnection
3	Santosh Castings, Opp. Doaba Mill, Amloh Road, Mandi Gobindgarh	30/05/2022	U/s 31-A of Air Act, 1981	Power Disconnection
4	Evit Steels Private Limited L/o Mittal Ceramics, Vill. Kumbh, Near Hind Alloys, Mandi Gobindgarh	30/03/2022	U/s 31-A of Air Act, 1981	Power Disconnection
5	Madhav KRG Environmental Solutions Private Limited, Village Bhadalthuha, Amloh	31/03/2022	HWM Rules, 2016	Power Disconnection
6	Shree Ganesh Steel Rolling Mills, Khanna Side, Amloh, Mandi Gobindgarh	26/05/2022	U/s 31-A of Air Act, 1981	Power Disconnection
7	Shree Ganesh Alloys and Metals, Mugal Majra, Mandi Gobindgarh	12/04/2022	U/s 31-A of Air Act, 1981	Power Disconnection
8	Gill Trading Co., Bidhi Chand Colony, Mandi Gobindgarh	27/04/2022	U/s 31-A of Air Act, 1981	Power Disconnection

Gmail

Important NGT Matter: Meeting with the stakeholders w.r.t. OA no. 295 of 2023 titles as Dimple Kumar versus State of Punjab and Ors

1 message

Environmental Engineer RO Fatehgarh Sahib <eerofgs@gmail.com> 21 June 2023 at 01:09
To: sdmamloh <sdmamloh@yahoo.com>, jagdish_cpcb@rediffmail.com, MC Mandi Gobindgarh <mcgvg@ymail.com>, All India Steel Re-Roller Association <aisramgg@gmail.com>, "President, MG Induction Furnace A." <GYANTMT@gmail.com>, "President, Small Scale Steel Re-Rollers Association, Mandi Gobindgarh" <Sssra2015@yahoo.com>
Cc: "Additional Deputy Commissioner(G)" <adc.fth@punjab.gov.in>, "ADC (UD) Fatehgarh Sahib" <adcudfatehgarh@gmail.com>, ppcb Zop <ppcbzop2@ymail.com>, Amrik Singh <amrik64singh@rediffmail.com>

Respected Sir,
Please find enclosed letter w.r.t. Meeting with the stakeholders w.r.t. OA no. 295 of 2023 titles as Dimple Kumar versus State of Punjab and Ors.

With Regards,

Environmental Engineer,
Punjab Pollution Control Board,
Regional Office, Opp. Floating Restaurant, NISST Building,
G.T. Road, Mandi Gobindgarh, Fatehgarh Sahib
Telefax-01765-242400

2 attachments

Orders 21-04-2023.pdf
165K

Letter to stakeholders 21-06-2023.pdf
590K

ਪੰਜਾਬ ਪ੍ਰਦੂਸ਼ਣ ਰੋਕਥਾਮ ਬੋਰਡ
PUNJAB POLLUTION CONTROL BOARD
Regional Office, NISST Building, G.T Road, Opposite Floating Restaurant, Mandi Gobindgarh.
Email- eerofgs@gmail.com

LiFE Lifestyle for Environment

No.....1091...-96 Dated..21/6/23

To

Sub-Division Magistrate, Amloh
Sh. JP Meena, Sc 'D', CPCB, Chandigarh
EO, MC, Mandi Gobindgarh
The President, AISRA, Mandi Gobindgarh
The President, SMASRA, Mandi Gobindgarh
The President, Induction Furnace Association, Mandi Gobindgarh

Subject: **Meeting with the stakeholders w.r.t. OA no. 295 of 2023 titles as Dimple Kumar versus State of Punjab and Ors.**

Reference: Order dated 21/04/2023 passed by the Hon'ble NGT.

It is to inform that the Applicant i.e. Dimpal Kumar has filed the subject cited Application before the Hon'ble Tribunal with grievance against unregulated violation of air quality norms by 220 coal fired furnaces operating in Mandi Gobindgarh, engaged in recycled steel production, Ceramics/Refractory, Cupola Furnaces, Forging Induction Furnaces, Lead smelting units, rolling mills, ply board, Milk Plant and pyrolysis Plants.

Vide Order dated 21/04/2023, the Hon'ble Tribunal has constituted a Joint Committee comprising of the CPCB, Punjab Pollution Control Board and District Magistrate to undertake visit to the site, interact with stake holders and furnish a factual and action taken report in the matter within two months.

In compliance to the orders of the Hon'ble NGT, a meeting will be held under the Chairmanship of Additional Deputy Commission (G) on 22/06/2023 at 10:00 AM in the Committee room of DC Office.

It is requested to attend the meeting alongwith your suggestions so that the factual and action taken report in the matter may be submitted to the Hon'ble NGT.

The next date of hearing has been fixed on 14/07/2023 for further concentration of the Hon'ble NGT.

DA/Above

21/06

Environmental Engineer

Endst. No. 1097 **Dated.** 21/6/23

A copy of the above is forwarded to Additional Deputy Commission (G), Fatehgarh Sahib for information, please.

21/06

Environmental Engineer

Endst. No. 1098 **Dated.** 21/6/23

A copy of the above is forwarded to SEE, Zonal Office-2, Punjab Pollution Control Board, Patiala for information, please.

21/06

Environmental Engineer

Endst. No. 1098 **Dated.** 21/6/23

A copy of the above is forwarded to Senior Law Officer, Head Office, Punjab Pollution Control Board, Patiala in reference to letter no. 12826 dated 05/06/2023 for information, please.

21/06

Environmental Engineer

ਪੰਜਾਬ ਪ੍ਰਦੂਸ਼ਣ ਰੋਕਥਾਮ ਬੋਰਡ
PUNJAB POLLUTION CONTROL BOARD
Regional Office, NISST Building, G.T Road, Opposite Floating Restaurant, Mandi Gobindgarh.
Email- eerofgs@gmail.com

No 1206-10 **Through Email** Dated 03/07/2023

To

NGT Matter

Sh. JP Meena, Sc 'D', CPCB, Chandigarh
EO, MC, Mandi Gobindgarh
The President, AISRA, Mandi Gobindgarh
The President, SMASRA, Mandi Gobindgarh
The President, Induction Furnace Association, Mandi Gobindgarh

Subject: **Proceedings of meeting held under the Chairmanship of Additional Deputy Commissioner, Fatehgarh Sahib on 22.06.2023 with the stakeholder Departments w.r.t. OA no. 295 of 2023 titles as Dimple Kumar versus State of Punjab and Ors.**

Reference: Order dated 21/04/2023 passed by the Hon'ble NGT.

Please find enclosed herewith the Proceedings of meeting held under the Chairmanship of Additional Deputy Commissioner, Fatehgarh Sahib on 22.06.2023 with the stakeholder Departments w.r.t. OA no. 295 of 2023 titles as Dimple Kumar versus State of Punjab and Ors.

This is for your information and further necessary action, please.

DA/As above.

03/07/23
Environmental Engineer

Endst. No. 1211 **Dated.** 03/07/2023

A copy of the above is forwarded to Additional Deputy Commission (G), Fatehgarh Sahib for information, please.

DA/As above.

3/07/23
Environmental Engineer

Endst. No. 1212 **Dated.** 03/07/2023

A copy of the above is forwarded to Sub-Division Magistrate, Amloh for information, please.

DA/As above.

3/07/23
Environmental Engineer

Endst. No. 1213 **Dated.** 03/07/2023

A copy of the above is forwarded to SEE, Zonal Office-2, Patiala for information, please.

DA/As above.

3/07/23
Environmental Engineer

Subject: **Proceedings of meeting held under the Chairmanship of Additional Deputy Commissioner, Fatehgarh Sahib on 22.06.2023 with the stakeholder Departments w.r.t. OA no. 295 of 2023 titles as Dimple Kumar versus State of Punjab and Ors.**

The following stakeholder department and representative of the industrial association members were present in the meeting

1. Er. J.P Meena, Scientist 'D', CPCB, RD, Chandigarh
2. Er. Vijay Kumar, Environmental Engineer, PPCB, Regional Office, Fatehgarh Sahib
3. Er. Rubal Goyal, Assistant Environmental Engineer, PPCB
4. Er. Pritpal Kaur, Assistant Environmental Engineer, PPCB
5. Er. Malkit Singh, Junior Environmental Engineer, PPCB
6. Sh. Gurwinder Pal Singh JE (M), M.C. Mandi Gobindgarh
7. Sh. Rajan Garg, Vice President, Small Scale Steel Re-Rollers Association (SMASRA)
8. Sh. Mohinder Gupta, President, Induction Furnace Association
9. Sh. B.C. Verma, E.O. All India Steel Rollers Association
10. Sh. Rajiv Sood, President, All India Steel Rollers Association (AISRA)
11. Sh. Darshan Singh Lalas, General Secretary, Small Scale Steel Re-Rollers Association
12. Sh. Jagmohan Data, Member, Small Scale Steel Re-Rollers Association (SMASRA)
13. Sh. Gaurav Jain, Member, All India Steel Rollers Association
14. Sh. Bhavya Gopta, IRM Energy Ltd. Mandi Gobindgarh

At the outset of the meeting, the officer of the Punjab Pollution Control Board apprised that the applicant Sh. Dimpal Kumar has filed OA no. 295 of 2023 before the National Green Tribunal Act, 2010 complaining against unregulated violation of air quality norms by 220 coal fired furnaces operating in Mandi Gobindgarh, Punjab, engaged in recycled steel production, Ceramics/Refractory, Cupola Furnaces, Forging Induction furnaces, Lead Smelting units, Rolling mills, Ply board Milk Plant and Pyrolysi9s Plants. The applicant has referred to earlier orders of this Tribunal dated 08.10.2018 in O.A. No. 681/2018, News Item Published In 'The Times of India' Authored by Shri. Vishwa Mohan Titled "NCAP with Multiple Timelines to Clear Air in 102 Cities to be released around August 15", order of this Tribunal dated 01.10.2020 in O.A. No. 924/2019, Neeraj Goyal vs. State of Punjab, order of this Tribunal dated 10.07.2019 in O.A. No. 1038/2018, News item published in "The Asian Age" Authored by Sanjay Kaw Titled "CPCB to rank industrial units on pollution levels". Further, the applicant has submitted that carrying capacity has not been assessed till now and air quality remains polluted as shown by the ambient air quality status of January-February, 2022.

He further informed that the Hon'ble NGT has passed an order date 21/04/2023 constituting a joint committee of CPCB, State PCB and District Magistrate to undertake visit to the site, interact with stakeholders and furnish a factual and action taken report in the matter.The next date of the hearing has been fixed on 14.07.2023 before the Hon'ble NGT.

The Additional Deputy Commissioner, Fatehgarh Sahib has requested the stakeholders to give their suggestions for adoption of PNG gas in the industries which are using coal or other conventional fuel and measures to be adopted by the industries and concerned departments so that the Ambient Air Quality of the Mandi Gobindgarh can be improved.

Sh. Rajan Garg, President of SMASRA apprised the house that as per the earlier directions given by the Hon'ble NGT in OA no. 924/2019 titled as Neeraj Goyal vs State of Punjab and Punjab Pollution Control Board, rolling mills of Mandi Gobindgarh had started the shifting of their units from coal to PNG and about 80 % of the units have been converted on the PNG. Further, earlier the price of the PNG was about Rs. 19/m3 and now the price of the PNG is about Rs. 50/ m3 whereas the price of the coal is about Rs. 12/Kg as such it is not possible for the industries to run their unit on PNG due to heavy financial loss. About 20% of the industries which had earlier shifted their units on PNG have been closed on its units permanently and removed their plant and machinery from the site. As per directions of the Punjab Pollution Control Board about 40 industries have been again shifted on coal from PNG. He also informed that air pollution is not contributed by the rolling mills on coal but the other factors like road dust, vehicular emissions burning of scrap, traffic concessions, traffic jams, poor conditions of industrial roads, uncontrolled construction activity etc. are contributing significant air pollution in the Mandi Gobindgarh. As such the authorities of NHAI, PWD and MC should be accounted for contribution in the air pollution as the road conditions of Mandi Gobindgarh are very poor and deteriorated. Source Apportionment study to determine carrying capacity of the Mandi Gobindgarh should be published and action plan as per the suggestion of the said study should be prepared and implemented in time bound manners and the responsibility of the concerned industries and department should be fixed. He suggested that ambient air quality before shifting of the industries on PNG, after shifting of the industries on PNG and again shifting on coal from PNG should be analyzed so that effect of shifting of industries PNG may be ascertained. (Annexure-A).

Sh. Mohinder Gupta, President of Induction furnaces informed that Mandi Gobindgarh is an industrial town and more than 600 industries are running within the radius of 5 Km. Mandi Gobindgarh is known as Steel City of Punjab or "Loha Mandi" due to its large number of steel factories. Apart from the industrial pollution, there is significant roll of vehicular emissions for increasing the air pollution in the Mandi Gobindgarh. About 18000 heavy loaded vehicles are entering and leaving the

Mandi Gobindgarh daily. Most of the vehicles are more 10-12 years old with very bad conditions and emitting significant emissions in the atmosphere.

The representative of the MC, Mandi Gobindgarh informed that it has purchased anti-smog gun to reduce the air pollution. He also informed that sprinkling of treated domestic effluent of the STP is being carried out in different hot spots to suppress the dust emissions. Mechanical Sweeping will be purchased shortly as all the paper formalities like tendering etc. have been completed.

The representative of the IRM Energy which is PNG gas provider in the Mandi Gobindgarh informed that their company providing PNG gas at the lowest price as compared to the other Districts of the Punjab. It has laid its gas pipeline network in entire industrial cluster of Mandi Gobindgarh after the NGT order and PPCB mandate to Industries to shift from coal to PNG. Now the PNG pipeline network is available at the door step to all the industries in Mandi Gobindgarh. IRMEL has reduced its prices by 16% in last few months and it will further be reduced in next few months also. IRMEL has commissioned 171 nos. of industries on PNG and 77 nos of industries have registered but they are not ready for taking gas connection. As on 23/06/2023, out of this 171 PNG using industries, 44 nos of industries have been shifted back to polluting fuels like Coal and FO.

After hearing of the industrial associations and stakeholder departments, the ADC (G) decided that the field visits of the area including industries will be conducted with the various stakeholder departments like Central Pollution Control Board, Punjab Pollution Control Board, District Administration, Municipal Councils and representative of the industries so that the factual position of the Mandi Gobindgarh with respect to the air pollution may be ascertained and action taken report on the basis of the field visits may be prepared and sent to the Hon'ble NGT.

The meeting was ended with vote of thanks of the Chair.

Additional Deputy Commissioner (G)
Fatehgarh Sahib

Attendance Sheet

Meeting held under the Chairmanship of Additional Deputy Commissioner, Fatehgarh Sahib on 22/06/2023 with the stakeholders w.r.t. OA no. 295 of 2023 titles as Dimple Kumar versusState of Punjab and Ors.

SN.	Name of the person and Department	Mobile no/ and e-mail	Sign
1.	Er. Vijay Kumar, EE, PPCB	9872942031 eerofgee gmail.com	[signature]
2.	Er Rubal Goyal, AEE PPCB	9988778461	[signature]
3.	Er. Prabpal Kaur, AEE, PPCB	8146662558	[signature]
4.	Er. Malkit Singh, JEE, PPCB	98147-41568	[signature]
5.	Er. J.P. Meena, Scientist-D CPCB RD, Chandigarh	6395115414	[signature]
6.	B.C. Verma EO, AISRA	98886-58860	[signature]
7.	Darshan Gen Sec SMASRA	96468.00094	[signature]
8.	Jagmohan Data, Data Udyog	9780023480	[signature]
9.	Rajan Garg SM ASRA	9646128727	[signature]
10.	Pawan Jain. AISRA	9815459000	[signature]
11.	Gurvinder Pal Singh, JE(Civ) MC, Mgg	9888085005	[signature]
12.	Bhavya Gupta DRM Energy Ltd	9512430058	[signature]
13.	Rajiv Sood, President SMASRA		[signature]
14.	Mohinder Gupta, President Furnace		[signature]
15.			
16.			
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