



ENVIS-IITM NEWSLETTER

Indian Institute of Tropical Meteorology, Pune
Atmospheric Pollution & Climate Change
(The project of Ministry of Environment, Forest & Climate Change, Govt. of India)

SAFAR-Pune EMISSION INVENTORY 2020

MAJOR SOURCES OF EMISSION IN 'PM_{2.5} (%)'



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Editorial

Clean air is a basic necessity for human health and well-being. As the air pollution is increasing a wave of stress spreads through the society. When the local concentrations of air pollutants exceed certain threshold limit, it can have adverse effect on the health of human beings, plants and animals. Most of the mega-cities all over the world are experiencing the deterioration of air quality, including the second-largest city in Maharashtra and the ninth largest city in the country is Pune. Indian Institute of Tropical Meteorology (IITM) Pune under the Ministry of Earth Sciences along with experts and researchers from Utkal University, Bhubneshwar, Environmental science Department of Savitribai Phule Pune University, Environmental Information System (ENVIS) Resource Partners of MoEFCC , and other colleges in Pune; are conducting an emission inventory campaign. Emission Inventory is an accounting of the amount of pollutants discharged into the atmosphere. It usually contains the total emissions for one or more specific greenhouse gases or air pollutants, originating from all source categories in a certain geographical area and within a specified time span, usually a specific year. Emission Inventory is the pioneer stage to control the rising air pollution. It could also be used for air quality management and formulating environmental policy. To deeply understand the air pollution scenario of Pune, this emission inventory will identify the latest sources of pollution which are contributing towards the 'poor' air quality. This newsletter will give a partial view of the ongoing emission inventory at Pune.

- Dr. Gufran Beig

Pune Emission Inventory 2019

1. Air Pollution Scenario in Pune

Air pollution is one of the major problems faced by many urban cities across the country. Pune is amongst the fastest growing cities in the country. The city's air quality could soon be as bad as that in Delhi, courtesy heavy vehicular emission.

According to the Indian Institute of Tropical Meteorology (IITM) data, the city's air pollution has increased by 35.7% since 2010. The percentage of pollutants in the air from vehicular emission has increased manifold as compared to that from other sources. According to 2013 Pune Emission Inventory the major cause of pollution in is transport. The sources of air pollution varies each year to know the ground level sources of emissions an intensive emission inventory is needed.



Pollutants in Pune's air cross permissible limits

Pune has four times more polluted air than the standards set by the World Health Organization (WHO). Emissions from the transport sector will continue to be the highest contributor to the city's pollution level, unless steps are taken to improve public transport system and reduce vehicular pollution.

An emission Inventory is the pioneer stage to control the rising air pollution. The emission inventory needs to be implemented through which further action is planned or structured which helps in combating air pollution. This is an important stage which needs to be executed by well trained professionals to know the exact state of the state of the emissions in the environment. IITM has carried out many successful emission inventories which provided a strong base for choosing critical parameters for Air Quality Forecasting System (prevention by intervention)-SAFAR.

This program, provides city air quality-over all city pollution and location specific air quality (a relative contribution of different environments in a city) for major cities of India like Delhi, Pune, Mumbai and Ahmadabad. While conducting the emission inventories for these metro cities, the institute recognized the need of skilled professionals to carry out the inventories.

2. Developing an Emission Inventory

Emission is the term used to describe the gases and particles which are emitted by various sources. An emission inventory is a listing, by source, of the amounts of pollutants actually or potentially discharged. Pollutants are added to the environment through emissions of various natural as well as anthropogenic sources. We must know that what quantities of air pollutants are emitted and where do they come from? The best way to answer these questions is to prepare an air pollutant emission inventory. Emission inventories are now regarded as indispensable tools for a wide range of environmental measures such as management of chemicals as well as the prevention of air pollution.



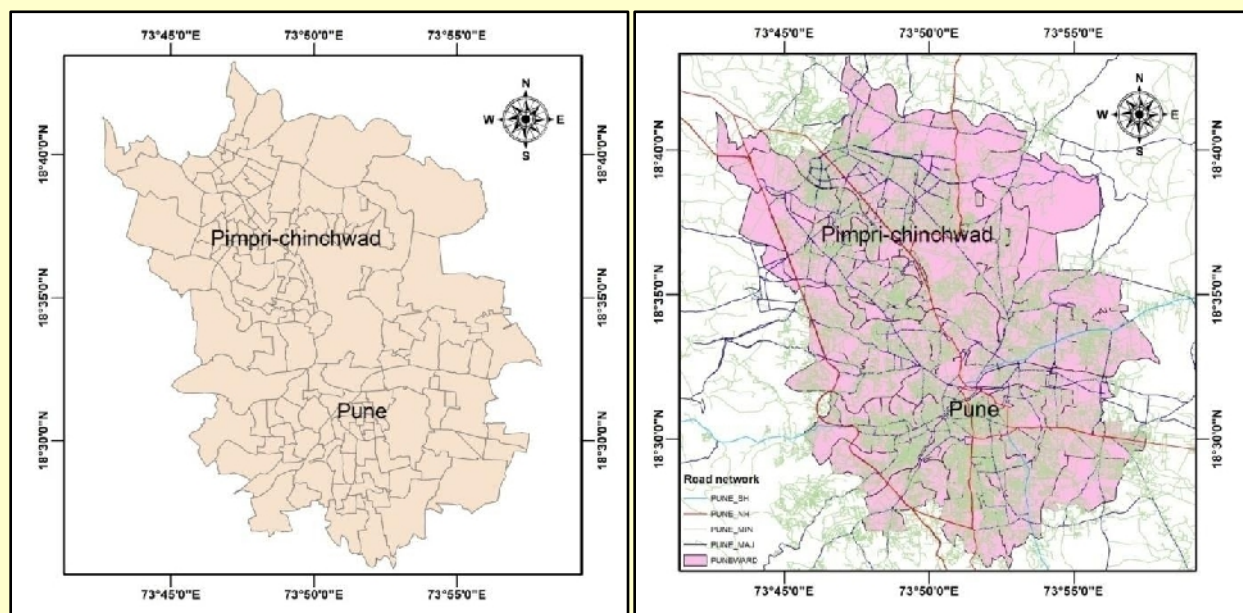
Various Emission Sources

Emission scenario of each city differs according to the type of Emission sources. Primary surveys for varied sources in the city are used for estimation of all major activities which are polluting the air. These are used in association with emission factor for building Emission Inventory. The study for this year's EI involved preparation of detailed emission inventory with estimation of emissions from various activities such as vehicular, industrial, residential, commercial, etc. Air Quality monitoring is not as simple as it looks; it's debatable to represent city air quality based on single station value or single hour data. The emission inventory helps in knowing and understanding these microenvironments and the sources of air emissions in it. Ground level data about emissions from as many as 26 different sources of pollution was collected throughout the city, as part of three-month campaign to prepare an emission inventory.

3. Pune Emission Inventory 2019

After successful Delhi emission inventory campaign 2018 this year Indian Institute of Tropical Meteorology (IITM) Pune under the Ministry of Earth Sciences. The experts and researchers from Utkal University, Bhubneshwar, Environmental science Department of Savitribai Phule Pune University, Environmental Information System (ENVIS) Resource Partners of MoEFCC , and other colleges in Pune. All experts are actively leading the Emission Inventory campaign involving around 100-180 students under supervision of group of scientists graphed all possible local sources of air pollution with around hours of work.

The main focus of the campaign is to generate missing primary data, validate some uncertain secondary data and to collect the available secondary data.



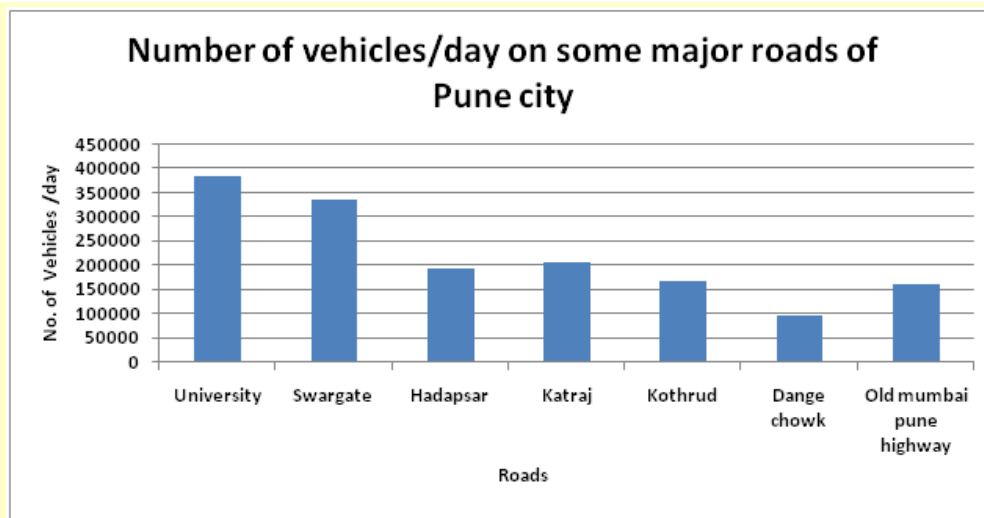
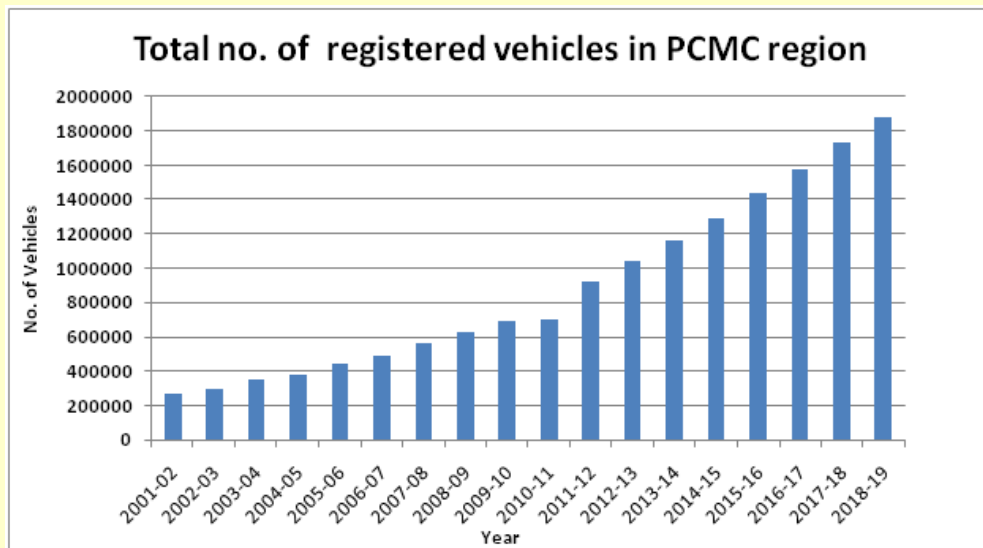
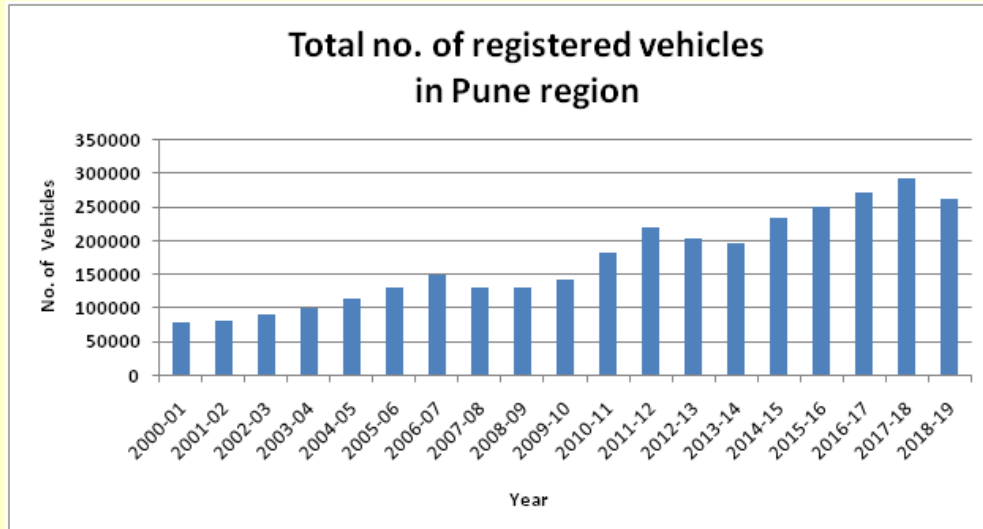
Study Area of Pune Emission Inventory

Road network over Pune city

The study area includes Pune municipal corporation area limits and Pimpri-Chinchwad Municipal Corporation area limits. Approximately 20,000 samples have been collected from Transport, commercial and Residential sector. About 2-4 thousand representative samples were collected from slum pockets.

The major sources included in the present inventory development are transport, fossil fuel, combustion in industries along with kerosene, LPG, coal and other bio-fuel burning in slum cooking, street vendors, hotels etc. in PMR. In the current inventory development, we have followed “bottom up” approach to improve the accuracy, reliability and uncertainty of inventory.

The recent scenario of Pune with its increased no. of vehicles is as below -





Inauguration of Emission Inventory Campaign Pune-2019

4. Methodology for Emission Inventory

Emissions are derived from various factors such as socio-economic structure; land use, spatial and temporal distribution of source activities with respect to pollutants.



Some Glimpses of Survey for Transport and Slum Region of Pune

Development of emission inventory is a complex process due to numerous, diverse and widely dispersed emission sources in a metropolitan city and requires huge amount of high resolution activity data, emission factors along with knowledge of fundamental scientific processes. For understanding the Air Quality of any place, there are a few major pollutants whose emissions need to be understood in detail. These are Oxides of Nitrogen (NO_x), Carbon Monoxide (CO), Black Carbon (BC), Organic Carbon (OC), Particulate Matter 2.5 and PM 10: Sulfur Dioxide (SO₂) and Volatile Organic Compounds (VOCs). In addition to using data from secondary sources of information, activity data were also obtained, wherever necessary, through primary surveys covering, questionnaire surveys, personal interviews, house-to-house surveys, actual traffic counts, etc. While this approach provides reasonable quality of data on emission estimates, resolutions with respect to time and space are limited in view of resources and available time frame. As greater prominence was set on primary surveys around monitoring locations. Primary surveys within zone of influence around each monitoring location were planned to identify all significant pollution sources and also collect activity data through personal interviews. Emission of a particular pollutant from a particular source category is estimated as a product of activity data, EF, application of combustion technology and removal efficiency of emission control. To

calculate the total emissions of that pollutant from all the sources are summed over all sources categories.

No.	Sectors	Important Factors and data
1	Transport	<ul style="list-style-type: none"> Category, Fuel Type & Quantity Vehicle/hour/Road type/VKT
2	Slum	<ul style="list-style-type: none"> Type and Fuel used Quantity for cooking
3	Brick Industry	<ul style="list-style-type: none"> Type, Technology and Fuel used Quantity
4	Street Vendor	<ul style="list-style-type: none"> Type and Fuel Quantity Coal for Tandoor
5	Hotel (Dhabas)	<ul style="list-style-type: none"> Type of Fuel & Quantity used for cooking
6	Construction Sites	<ul style="list-style-type: none"> Type of Fuel & Quantity used for cooking activity
7	Speed Breaker	<ul style="list-style-type: none"> No. of Speed Breakers per Km Road Type
8	Major Hospitals	<ul style="list-style-type: none"> Number of outdoor patients Vehicle load and DG sets
9	Tourist places	<ul style="list-style-type: none"> Tourist Load, Vehicle load
10	Shopping Malls	<ul style="list-style-type: none"> No. of vehicle parked
11	Traffic Junctions	<ul style="list-style-type: none"> No. of Traffic Junctions
12	Railway Stations	<ul style="list-style-type: none"> Passenger load Vehicle load in station area
13	Airport	<ul style="list-style-type: none"> Vehicle No. (Delhi & Out-side vehicle No.)
14	Industry	<ul style="list-style-type: none"> Type, Technology and Fuel used
15	Local Transport (Ola/Uber/Taxi)	<ul style="list-style-type: none"> Km run per day and Numbers
16	Household	<ul style="list-style-type: none"> Type of fuel used
17	Waste Burning	<ul style="list-style-type: none"> Quantity per capita
18	Biomedical Waste	<ul style="list-style-type: none"> Quantity generated
19	Power plant	<ul style="list-style-type: none"> Technology used, Coal used
20	Crematorium	<ul style="list-style-type: none"> Spatial locations, No. of Cases
21	Large hotels	<ul style="list-style-type: none"> Fuel used for cooking
22	Large school/college	<ul style="list-style-type: none"> Students no. & Travel load
23	Wind Blown Road Dust	<ul style="list-style-type: none"> Road condition, vehicle load etc.
24	Diesel Generator	<ul style="list-style-type: none"> Fuel used for no. of hours
25	Mobile tower	<ul style="list-style-type: none"> Fuel Used & numbers
26	Routine Milk & Vegetable Van	<ul style="list-style-type: none"> No of vehicle (outside)

Diurnal traffic count surveys on different categories of roads, No. of vehicles on some major roads, along with personal interviews at parking lots/petrol pumps with vehicle owners for obtaining data on fuel use, vehicle kilometer travelled per day, etc. The data being collected by volunteer's which include all possible sources of emissions-from crop burning to wood burning. The city has been divided into grids measuring 400 meter × 400 meter. In each grid, pollution will be mapped in terms of sources such as slums, small-scale industries, road conditions, traffic congestion, vendors, population density, vehicle density, road conditions and potential of dust lifting based on paved and unpaved areas. For the purpose of effective science based air quality management and robust forecast is a need of the hour, which can be achieved through comprehensive approach build upon four key areas, viz.

1. Air quality monitoring 2. Development of emission inventories 3. Atmospheric chemistry-transport modeling and 4. Development of control strategies. Thus, an inventory provides basic information of sources and sink of different gases along with information like what gases to mitigate, how to mitigate, when to mitigate and where the mitigation action should be allocated. The information & data for this newsletter is contributed by **Ms. Shruti Dole, Scientific Asst., SAFAR.**

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