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Analysis of Air Quality Parameters: A review

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Abstract*—*Particulate Matter (PM) and trace elements in ambient air of tier I cities in India are increasing and health effects are already started observing by many receptors in and around India. Major portion of PM and trace elements are originating form urban area especially transportation and on the industries associated with vehicles. Worst situation and adverse effects are observed in city of pune in last decade. It is noted that every citizen of pune city posses at least on vehicles comprising of 35 lakhs of vehicles in entire city, Asthama, chronic bronchitis and other respiratory diseases are seen along with heart and nervous systems diseases arising form PM and Trace elements like Lead. Lead being toxic contaminant in PM is Major threat associated with lungs and other respiratory systems. It is observed that lead in ambient monitoring is not been done in pune and need attention by air quality engineers, officials of transportation department and planners of city. The proposed research work envisages measurement of the concentration of PM as Per National Ambient Air Quality Standard (NAAQS) at Katraj Junction/Square on Pune Satara Road and Chemical characterization of trace element i.e. Lead found in PM using spectroscopy. This shall enable air quality engineers to identify the sources i.e Source Apportionment of Lead as well as PM by adopting source apportionment studies in the future. The Outcome of Proposed study shall help government authorities to make use of the results for zoning policy decision making and effective urban transportion planning to better environmental management in the city of pune.

Keywords–Particulate Matter (PM) , Trace elements, NAAQS

I. INTRODUCTION

A .General

Air pollution: The presence of contaminants or pollutant substances in the air that interfere with human health or welfare, or produce other harmful environmental effects.

What is a Contaminant? The definition of air pollution considered at the beginning of this chapter included the term "contaminants." This is arguably even more daunting than "pollutant." If you were told your yard, your home, your neighborhood, or your air is contaminated, it is very likely that you would be greatly troubled. You would probably want to know the extent of the contamination, its source, what harm you may have already suffered from it, and what you can do to reduce it. Contamination is also a term that is applied differently by scientists and the general public, as well as among scientists from different disciplines. So, then, what is contamination? The dictionary8 definition of the verb "contaminate" reads something like "to corrupt by contact or association," or"to make inferior, impure, or unfit." These are fairly good descriptions of what environmental contaminants do. When they come into contact with people, ecosystems, crops, materials, or anything that society values, they cause harm. They make resources less valuable or less fit to perform their useful purposes.

From an air quality perspective, contamination is usually meant to be "chemical contamination" and this most often is within the context of human health. However, air pollution abatement laws and programs have recognized that effects beyond health are also important, especially welfare protection. Thus, public health is usually the principal driver for assessing and controlling environmental contaminants, but ecosystems are also important receptors of contaminants. Contaminants also impact structures and other engineered systems, including historically and culturally important monuments and icons, such as the contaminants in rainfall (e.g. nitrates and sulfates) that render it more corrosive than would normally be expected (i.e. acid rain).

To comply with the November 12, 2008 revision to the National Ambient Air Quality Standard (NAAQS) for lead, the Alaska Department of Environmental Conservation (ADEC), Division of Air Quality, Air Monitoring & Quality Assurance Section established a lead monitoring program. The purpose of this Standard Operating Procedure (SOP) document is to describe the field procedures used to sample for lead in Total Suspended Particulate (TSP) that is particulate matter which is suspended in ambient air and has a mean aerodynamic diameter of up to 25 to 50 micrometers. The objective of this SOP is to formalize procedures to insure the consistent collection of samples and data that meet the data quality required by the revised NAAQS for lead. This SOP manual will encompass all aspects of field operations associated with the collection of the TSP samples. The federal reference method for the determination of suspended particulate matter in the atmosphere (High-Volume Method) is presented in 40 CFR Part 50, Appendix B. Sampler siting, operation and quality assurance regulations are presented in 40 CFR Part 58. The operating procedures presented in this SOP are derived from the above cited regulations, guidance presented in equipment manufacturer instructions, and the EPA Quality Assurance Handbook for Air Pollution Measurement Systems Volumes I and II.

II. LITERATURE REVIEW

The extensive literature review was carried out by referring standard journals and conference proceedings. The major work carried out by different researchers are summarized below.

Mr. B. A. Begum et al [01] studied, "Assessment of Particulate Air Pollution at Kalabagan and Shisumela Area Along the Mirpur Road, Dhaka" said that Characteristics of airborne particulate matter (PM2.5 and PM10) and black carbon (BC) concentrations have been studied at Kalabagan and Shishumela sites along Mirpur corridor in Dhaka city. These sites are the major road junction of Mirpur corridor and

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can represent urban background. Both PM2.5 and PM10 fractions were collected simultaneously from both sites by using Air Metrics samplers. The samplings were done for 7 days from the 19-25 January and 5 days from 27- 31 January 2009 at Kalabagan and Shisumela sites respectively. It was found that the ambient PM2.5 and PM10 concentrations were much higher than the daily Bangladesh National Ambient Air Quality Standard. From reconstructed mass (RCM) method, it was found that about 90% of PM2.5 mass comes from anthropogenic sources like motor vehicles, diesel powered generator and biomass burning sources. Since the samplings were carried out during the wintertime, the long-range transport is also expected to contribute to increase the fine PM mass.

Saikat Ghosh et al [02] studied "An investigation of potential regional and local source regions affecting fine particulate matter concentrations in Delhi, India said that potential regional and local sources influencing PM2.5 (particulate matter with an aerodynamic diameter >2.5 μm) concentrations in Delhi, India, are identified and their possible impact evaluated through diverse approaches based on study of variability of synoptic and local airflow patterns that transport aerosol concentrations from these emission sources to an urban receptor site inDelhi, India. Trajectory clustering of 72-hr and 48-hr back trajectories simulated at arrival heights of 500 m and 100 m, respectively, every hour for representative years 2008–2010 are used to assess the relative influence of long-distance, regional, and subregional sources on this site. Nonparametric statistical procedures are employed on trajectory clusters to better delineate various distinct regional pollutant source regions. Trajectory clustering and concentration-weighted trajectory (CWT) analyses indicate that regional and subregional PM2.5 emission sources in neighboring country of Pakistan and adjacent states of Punjab, Haryana, and Uttar Pradesh contribute significantly to the total surplus of aerosol concentrations in the Delhi region. Conditional probability function and Bayesian approach used to identify local source regions have established substantial influence from highly urbanized satellite towns located southwest (above 25%) and southeast (above 45%) of receptor location. There is significant seasonal variability in synoptic and local air circulation patterns, which is discerned in variability in seasonal concentrations. Mean of daily averaged PM2.5 concentrations at the Income Tax Office (ITO) receptor site over Delhi at 95% confidence level is highest in winter, ranging between 209 and 185 μg m−3 for the entire study period. The annual variability in air transport pathways is more in winter than in other seasons. Year-to-year variability is present in aerosol concentrations, especially during winter, with standard deviations varying from a minimum of 60 μg m−3 in winter 2009 to a maximum of 109 μg m−3 in winter 2010.

[03]The study shows that implementing certain transport related changes by 2020 can potentially save 27 percent of permture deaths (5870) in six cities annually and induce an estimated annual reduction of about 16.8 million tons of CO2 in the six cities. Air quality of Pune, chennai, Indore, Ahmedabad, Surat and Rajkot were analysed with the help of available data and modelling tools to arrive at this conclusion . the report has suggested significant changes in the transport system in these cities including an increase in the non – motorized transport (Cycling and biking) shares by about 20 percent, increase in the public transport shares by about 20 percent (for the trips) using alternative fuel for the public transport and 3 wheelers, a potential 50 percent reduction in the road dust, a technology change in the brick kilns improving the efficiency and reducing the emissions by about 50 percent and a reduction of about 20 percent of the truck movement in the city limits.

[04]A report by the Central Pollution Control Board (CPCB) has expressed concern over air pollution in Pune due to dust and vehicle emissions, and had called for raising the standards of road infrastructure and public transport in the city. The report, Air quality monitoring, emission inventory andsource apportionment study for Indian cities: national summary report', was published recently, based on the results of a study carried out in Bangalore, Chennai, Delhi, Kanpur, Mumbai and Pune. The primary focus of the study was on repairable particulate matter (PM10) or dust, although it also deals with other pollutants. The report is intended to provide a scientific base to policy makers and stakeholders. City – based Automotive Research Association of India (ARAI) took Part in the study. Its team Consisted of MK Chaudhari. AA Baikerikar, UjjwalaKalre, MoqtikBawase, SA Varade and PN Pawar. The report says that the public transportation system in pune is inadequate. This increases the use of personal vehicles, which in turn contributes to road dust and vehicle emissions. An effective mass transport system must be set up to curb the tendency to own personal vehicles. It noted that the average occupancy to public transport would reduce dust and nitrogen oxide. Continuous power supply must also be ensured to avoid use of non- industrialgenerators to help emission reduction, according to the report. In the action plan for pune, the report recommends that the P>M10 of 10 micron size or small dust Particles could be reduced if the road quality is improved. It notes that mechanized sweeping and watering give higher benefits, but its implementation is difficult. Wall – to- wall pavements and roads can yield benefits if implemented on all major and minor roads. Road infrastructure needs to be set up and maintained as per national or international standards. Guidelines should be made for the quality of roads based on traffic patterns. According to IITM, the black carbon and the particulate matter 2.5, including fine dust particles that can only be seen with an electron microscope and are more dangerous for health , have increased . Earlier last year, the pollution level in areas like Hadapsar, Shivijinagar and Katraj were so high that they posed serious health to people with respiratory conditions.

[05] Ambient air quality monitoring carried out at various cities/towns in the country, under National Air Monitoring Programed (NAMP) provide air quality data that form the basis for identification of areas with high air pollution levels and in planning the strategies & development of action plans for control & abatement of air pollution. Data generated over the years reveal that particulate matter (SPM& RSPM) are exceeding more than the permissible levels at many locations, particularly in urban areas. Air pollution problem becomes complex due to multiplicity and complexity of air polluting sources(e.g. industries, automobiles, generator sets, domestic fuel burning, road side dusts, construction, automobiles, generator sets, domestic fuel burning, road side dusts, construction activities,etc.)A cost- effective approach for improving air quality in polluted areas involves.(i) identification of emission sources; (ii) assessment of extent of contribution of these sources on ambient environment; (iii)

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prioritizing the sources that need to be tackled; (iv) evaluate various options for controlling the sources with regard to feasibility and economic viability: and (v) formulation and implementation of most appropriate action plans. Source apportionment study, which is primarily based on measurements and tracking down the sources through receptormodeling, helps in identifying the sources & extent of their contribution. The Auto fuel Policy document of Government of India also recommended for carrying out source apportionment studies.

III. THEOROTICAL CONTENT

HEALTH EFFECTS OF TRAFFIC ORIGINATED AIR POLLUTANTS

Atmospheric pollutants can cause both acute and chronic effects on human health. CO is a suffocating pollutant which reacts with hemoglobin in the blood forming carboxyl hemoglobin (COHb) and thereby reduces the oxygen carrying capacity of blood. Short-term exposure to high CO concentrations can cause an acute health impact. Benzene compounds have a cumulative effect on human health. Long term exposure to high benzene levels can cause risk of cancer. Oxides of nitrogen are responsible for both short and long term health effects like altered lung function, respiratory illness and lung tissue damage. Particle size is an important consideration because particles in certain size ranges have profound effect on human health. shows the deposition of particles in the respiratory system. Smaller the size of the particle it is likely to penetrate deeper in the lungs.

TRAFFIC DATA

Air quality models require detailed information on traffic volume, fleet composition, and average travel speed. Traffic volume data are hourly average values of manual counts performed at selected street during the study period. Traffic counts were performed every day during 1st December, 2012 to 31st January, 2013 and the time span chosen for study is everyday 9:00 to 13:00 (Morning) and 16:00 to 20:00 (Evening) to capture the peak hours.

EMISSIONS

Vehicular emissions were calculated using the hourly traffic volume and the average emission factors. The source strength was computed for each of the pollutant as: Q (g - km-1hr-1) = N (hr-1) x EF (g - km-1) In the present study, average emission factors were compiled from various literatures including regulatory agencies like Central Pollution Control Board (CPCB) and research institutes like Automotive Research Association of India (ARAI), National Environmental Engineering Research Institute (NEERI), etc.

METEOROLOGICAL DATA

Meteorological data for this research work is collected using an Automatic Weather Station (AWS) (Oregon Scientific, Model: WMR200) which provided with the prevailing meteorological conditions at the measurement site.
The meteorological parameters monitored include: Temperature, Wind speed (Rooftop level), and Wind Direction.

URBAN BACKGROUND MEASUREMENTS

The background concentration of pollutants plays a vital role in urban air quality modeling. Rooftop measurement method is employed to determine the background concentration of pollutants under consideration namely PM10, SPM and NO2. Background concentrations were determined using High volume method. OSPM further requires background concentration of ozone as input, due to unavailability of resources for measurement of ozone a constant value of 21.15 ppb has been used for the calculations .

STATISTICAL ANALYSIS

Model performance was evaluated using statistical analysis.value indicates the degree to which observed concentrations are accurately predicted by the model. In other words, it is a measure of degree to which the model predictions are error free. Correlation coefficient (R), explains the degree to which fluctuations in observed concentrations are followed by fluctuations in predicted concentrations. It varies between $+1 < R < -1$, where ±1 indicating a perfect correlation and 0 indicating no Correlation at all . FB is a measure of agreement between mean concentrations and it ranges between +2 and -2

IV. CONCLUSION

1. The Air quality is dependent on the traffic intensity
2. The parameters of air are varies with the sources of pollutants.

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