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Monitoring Ambient Air Quality [AAQ]

Vinod N.Sambrani
Institute of Management Studies, Davangere University, Davangere, Karnataka, India.

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ABSTRACT
Ambient (outdoor) air pollution is now recognized as an important problem, both nationally and internationally. Air pollution is harming our health and that of our children and parents. The young and old are particularly vulnerable to the effects of air pollution. Air pollution causes many harmful effects, ranging from premature death, to headaches, coughing and asthma attacks. But it is easy to forget that we are contributing to the air pollution as we drive our vehicles, or potentially harmful pollutants spew out of the chimneys of huge factories, We think that pollutants simply blow away, but under some conditions they may be inhaled, minutes or hours later. That is we are careless about air pollution and its impact on health. The need of the hour is to ensure that our air is clean for us and for our future generations, we need to reduce emissions of pollutants into the air. Government bodies develop regional air plans and education programs aimed at reducing pollution, central government is developing vehicle emissions standards, national environmental standards and new fuel regulations to monitor and keep the air pollution under control and improve the quality of air.

Introduction

Industrialization and urbanization have resulted in a profound deterioration of India's air quality. India's most severe environmental problem, come in several forms, including vehicular emissions and untreated industrial smoke, that change the composition of atmosphere and affect the biotic environment. Urbanization has resulted in the emergence of industrial centers without a corresponding growth in civic amenities and pollution control mechanisms. Various contaminants continuously enter the atmosphere through natural and man-made processes and these contaminants interact with the environment to cause disease, toxicity, environmental decay and are labeled as pollutant and are injurious to human beings other living creatures and the environment. Air pollutants and can be either particles, liquids or gaseous in nature (Alias M. et al, 2007).

Air has a relative constant composition of gases and is utilized by most of the living organisms in respiration to liberate chemical energy for their survival. This composition determines its quality. The air quality has been changing in the recent few years endangering the life and the environment. In order to stop the deterioration in air quality, Government of Indian has enacted Air (Prevention & Control of Pollution) Act in 1981. The responsibility has been further emphasized under Environment (Protection) Act, 1986. It is necessary to assess the present and anticipated air pollution through continuous air quality survey/monitoring programs. Therefore, Central Pollution Control Board had started National Ambient Air Quality Monitoring (NAAQM) Network during 1984 - 85 at national level. NAAQM is now called as National Air Quality Monitoring Programme (NAMP).

Air pollutants can be classified as primary or secondary pollutants. The primary air pollutants are harmful chemicals which directly enter the air due to natural events of human activities. A secondary air pollutant is a harmful chemical produced in the air due to chemical reaction between two or more components. That is primary pollutant combines with some component of the atmosphere to produce a secondary pollutant (Naik S., 2005).The ambient air quality monitoring involves measurement of a number of air pollutants at number of locations. Air quality monitoring involves considering the common urban air pollutants, such as Suspended Particulate Matter (SPM), Respirable Suspended Particulate Matter (RSPM), Sulphur Dioxide (SO_2), Oxides of Nitrogen (NOx), and Carbon Monoxide (CO) etc. In this paper AAQ limits are measured in Tata Marcopolo company, Dharwad, Karnataka, India.

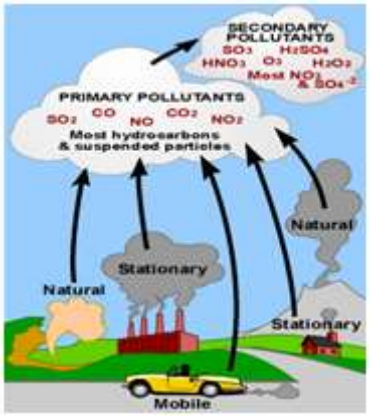


Figure 1: Types and sources of air pollutants

What is air quality?

The term "air quality" means the state of the air around us. Good air quality refers to clean, clear, unpolluted air. Clean air is essential to maintaining the delicate balance of life on this planet, not just for humans, but wildlife, vegetation, water and soil. Poor air quality is a result of a number of factors, including emissions from various sources, both natural and "human-caused." Poor air quality occurs when pollutants reach high enough concentrations to endanger human health and the environment. Our everyday choices, such as driving cars, smoke

Tele:
E-mail addresses: vnsambrani@yahoo.com

from factories and burning wood, can have a significant impact on air quality.

Ambient Air Quality

Ambient air quality refers to the quality of outdoor air in our surrounding environment. It is typically measured near ground level, away from direct sources of pollution.

The air quality in work environment – the ambient air – can affect more than just the health of the workforce. A polluted environment can erode organisations competitive edge and cloud the corporate image. Air pollution can destroy local ecosystems and biodiversity, leaving a long-term environmental legacy.

Air (Prevention and Control of Pollution) Act 1981

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

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

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

1. To plan a comprehensive program for prevention, control and abatement of air pollution and to secure the execution thereof;
2. To advise the State Government on any matter concerning prevention, control and abatement of air pollution.
3. To collect and disseminate information related to air pollution.
4. To collaborate with Central Pollution Control Board in program related to prevention, control and abatement of air pollution; and
5. To inspect air pollution control areas, assess quality of air and to take steps for prevention, control and abatement of air pollution in such areas.

National Ambient Air Quality Standards (NAAQS)

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

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

Air Quality Monitoring

Ambient air quality monitoring is required to determine the existing quality of air, evaluation of the effectiveness of control programme and to identify areas in need of restoration and their prioritization.

National Air Quality Monitoring Program (N.A.M.P.)

Central Pollution Control Board initiated National Ambient Air Quality Monitoring (NAAQM) program in the year 1984 with 7 stations at Agra and Anpara. Subsequently the programme was renamed as National Air Monitoring Programme (N.A.M.P.). The number of monitoring stations under N.A.M.P. has increased, steadily, to 308 operating stations by 2006 covering 115 cities/towns in 25 States and 4 Union Territories of the country.

Objectives of National Air Quality Monitoring Program

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

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

Under N.A.M.P., four air pollutants *viz.*, Sulphur Dioxide (SO_2), Oxides of Nitrogen as NO_X and Suspended Particulate Matter (SPM) and Respirable Suspended Particulate Matter (RSPM/PM10), have been identified for regular monitoring. Additional parameters such as Respirable Lead and other toxic trace metals, Hydrogen Sulphide (H_2S), Ammonia (NH_3) and Polycyclic Aromatic Hydrocarbons (PAHs) are also being monitored

Air quality is categorized in terms of low, moderate, high and critical. The concentration ranges for different levels have been selected based on the Notified Standards for different pollutants and area classes by calculating an "Excedence Factor" (the ratio of annual mean concentration of a pollutant with that of a respective standard).

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

The four types of air quality are:

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

We can also calculate the Air Quality Index (AQI), a useful tool devised to simplify interpretation of data. The quality of air in the study area can be estimated from the air quality index. The air quality index is calculated from the observed SO_2, NO_x and PM10 and values using the formula;

$AQI = ¼ \times (ISO_2 / SSO_2 + INO_X / SNO_X + IPM10 / SPM10) \times 100$

Where:

ISO_2, INO_X and IPM10, = Individual values of sulphur dioxide, nitrogen oxide and particulate matter, respectively. SSO_2, SNO_X and SPM10 = Standards of ambient air quality.

Objectives of the Study

The major objectives of the study are as below:

1. Assessment of air pollution concentrations at different locations with varying sources of pollution;

Particulars	Details
Monitoring for	Ambient Air Quality
Sampling Procedure	As per IS/APHA/EPA Guidelines
Sampling Location	1. In-between Painting Section (Jiggs) 2. Painting Booth, In-between LCV Jiggs 3. Chassis Preparation, In-between MCV Jiggs and Machine Shop
Receptor Height	1.50 meters from the ground
Duration	24 Hours
Method of measurement	Improved west and Gaeke Method
Limits	As per revised National Ambient Air Quality Standards of GSR826(E),dated 16/11/2009

Test Report

Table2: Data Collected for SO_2, NO_X and PM10 at Different Locations

Month	Location → / Parameters ↓	In-between Painting Section (Jiggs) & Painting Booth	In-between LCV Jiggs & Chassis Preparation	In-between MCV Jiggs & Machine Shop	Limit
Feb 2012	Sulphur Di-Oxide (SO_2)	11.35	4.98	6.0	80
	Nitrogen Di-Oxide (NO_2)	12.50	12.5	12.92	80
	Particulate Matter less than 10 µm	79.6	77	78.9	100
March 2012	Sulphur Di-Oxide (SO_2)	6.77	10.98	12	80
	Nitrogen Di-Oxide (NO_2)	10.31	13.5	14.92	80
	Particulate Matter less than 10 µm	69.4	78.5	79.5	100
April 2012	Sulphur Di-Oxide (SO_2)	10.31	10.42	10.63	80
	Nitrogen Di-Oxide (NO_2)	10.42	11.56	11.77	80
	Particulate Matter less than 10 µm	68.7	76	73.9	100
May 2012	Sulphur Di-Oxide (SO_2)	8.0	10.80	12.5	80
	Nitrogen Di-Oxide (NO_2)	7.5	10.63	10.83	80
	Particulate Matter less than 10 µm	56.4	69.7	67.0	100
June 2012	Sulphur Di-Oxide (SO_2)	8.0	10.42	10.63	80
	Nitrogen Di-Oxide (NO_2)	7.5	11.56	11.77	80
	Particulate Matter less than 10 µm	76	71.5	68	100
July 2012	Sulphur Di-Oxide (SO_2)	8	12.8	13.8	80
	Nitrogen Di-Oxide (NO_2)	7.5	10.5	12.6	80
	Particulate Matter less than 10 µm	65	80.3	64.2	100

Calculation of AQI

Table 3: Status of AAQ

Location	Sulphur Dioxide (SO_2)	Nitrogen Dioxide (NO_2)	Particulate Matter less than 10 µm	AQI	Ambient Air Quality
In-between Painting Section (Jiggs) & Painting Booth	8.738	9.288	69.183	22.925	Clean
In-between LCV Jiggs & Chassis Preparation	10.066	11.708	75.5	25.675	Fairly Clean
In-between MCV Jiggs & Machine Shop	10.926	12.468	71.916	25.275	Fairly Clean

Calculation of Excedence Factor

Table 3: Excedence Factor to Calculate AAQ

Location	Sulphur Dioxide(SO_2)	Nitrogen Dioxide (NO_2)	Particulate Matter less than 10 µm
In-between Painting Section (Jiggs) & Painting Booth	8.738	9.288	69.183
Excedence Factor	0.11	0.116	0.57
Result	Low pollution (L)	Low pollution (L)	Moderate pollution (M)
In-between LCV Jiggs & Chassis Preparation	10.066	11.708	75.5
Excedence Factor	0.126	0.146	0.63
Result	Low pollution (L)	Low pollution (L)	Moderate pollution (M)
In-between MCV Jiggs & Machine Shop	10.926	12.468	71.916
Excedence Factor	0.136	0.156	0.59
Result	Low pollution (L)	Low pollution (L)	Moderate pollution (M)

Annexure

NATIONAL AMBIENT AIR QUALITY STANDARDS
CENTRAL POLLUTION CONTROL BOARD
NOTIFICATION

New Delhi, the 18th November, 2009

No. B-29016/20/90/PCI-L—In exercise of the powers conferred by Sub-section (2) (h) of section 16 of the Air (Prevention and Control of Pollution) Act, 1981 (Act No.14 of 1981), and in supersession of the Notification No(s). S.O. 384(E), dated 11th April, 1994 and S.O. 935(E), dated 14th October, 1998, the Central Pollution Control Board hereby notify the National Ambient Air Quality Standards with immediate effect, namely:-

NATIONAL AMBIENT AIR QUALITY STANDARDS

S. No.	Pollutant	Time Weighted Average	Concentration in Ambient Air		
			Industrial, Residential, Rural and Other Area	Ecologically Sensitive Area (notified by Central Government)	Methods of Measurement
(1)	(2)	(3)	(4)	(5)	(6)
1	Sulphur Dioxide (SO_2), µg/m³	Annual*	50	20	- Improved West and Gaeke
		24 hours**	80	80	-Ultraviolet fluorescence
2	Nitrogen Dioxide (NO_2), µg/m³	Annual*	40	30	- Modified Jacob & Hochheiser (Na-Arsenite)
		24 hours**	80	80	- Chemiluminescence
3	Particulate Matter (size less than 10µm) or PM_{10} µg/m³	Annual*	60	60	- Gravimetric - TOEM
		24 hours**	100	100	- Beta attenuation
4	Particulate Matter (size less than 2.5µm) or $PM_{2.5}$ µg/m³	Annual*	40	40	- Gravimetric - TOEM
		24 hours**	60	60	- Beta attenuation
5	Ozone (O_3) µg/m³	8 hours**	100	100	- UV photometric - Chemilminescence
		1 hour**	180	180	- Chemical Method
6	Lead (Pb) µg/m³	Annual*	0.50	0.50	- AAS /ICP method after sampling on EPM 2000 or equivalent filter paper - ED-XRF using Teflon filter
		24 hours**	1.0	1.0	
7	Carbon Monoxide (CO) mg/m³	8 hours**	02	02	- Non Dispersive Infra Red (NDIR) spectroscopy
		1 hour**	04	04	
8	Ammonia (NH_3) µg/m³	Annual*	100	100	-Chemiluminescence -Indophenol blue method
		24 hours**	400	400	

CENTRAL POLLUTION CONTROL BOARD
National Ambient Air Quality Standards
NOTIFICATION
Delhi, the 11th April, 1994

S.O. 384(E). -The Central Pollution Control Board in exercise of its powers conferred under section 16 (2) (h) of the Air (Prevention and Control of Pollution) Act,1981(14 of 1981) hereby notify the National Ambient Air Quality Standards with immediate effect.

SCHEDULE-1

Pollutant	**Time Weighted average**	**Concentration in ambient air**			**Method of measurement**
		Industrial Area	Residential. Rural & other areas,	Sensitive Area	
1	2	3	4	5	6
Sulphur Dioxide (SO2)	Annual Average*	80 µg/m³	60µg/m ³	15 µg/m³	1. Improved West and Gacke method
	24 hours **	120 µg/m³	80 µg/m³	30µg/m³	2. Ultraviolet fluorescence
Oxides of Nitrogen as N02	Annual Average*	80 µg/m³	60µg/m ³	15 µg/m³	1. Jacob & Hochheiser modified (Na-Arsenite) Method
	24 hours **	120 µg/m³	80 µg/m³	30µg/m³	2. Gas Phase Chemiluminescence
Suspended Particulate Matter (SPM)	Annual Average*	360 µg/m³	140 µg/m³	70 µg/m³	(Average flow rate not less than 1.1 m ³/minute)
	24 hours **	500 µg/m³	200 µg/m³	100 µg/m³	
Respirable Particulate matter (size less than10 um)(RPM)	Annual Average*	120 µg/m³	60µg/m ³	50µg/m ³	
	24 hours **	150µg/m ³	100µg/m ³	75µg/m ³	
Lead (Pb)	Annual Average*	1.0µg/m ³	0.75µg/m ³	0.50µg/m ³	AAS Method after sampling using EPM 2000 or equivalent filter paper
	24 hours **	1.5µg/m ³	1.00µg/m ³	0.75µg/m ³	
Carbon Monoxide (CO)	8 hours	5.0µg/m ³	2.0µg/m ³	1.0µg/m ³	
	I hour	10.0µg/m ³	4.0µg/m ³	2.0µg/m ³	Non dispersive infrared spectroscopy

***** Annual Arithmetic mean of minimum 104 measurements in a year taken twice a week 24 hourly at uniform interval
** 24 boudy/8 hourly values should be met 98% of the time in a year. However, 2% of the time, it may exceed but not on two consecutive days.

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

[F.N.B-33014/4/90]
D. K. BISWAS, Chairman

To assess the status of air pollution to adjudge the effectiveness of air pollution control strategies and long term management of air pollution.

Table 1: Air Quality Category Based On Air Quality Index

Category	AQI of ambient air	AQI of ambient air Description of ambient air quality
I	<10	Very clean
II	Between 10-25	Clean
III	Between 25-50	Fairly clean
IV	Between 50-75	Moderately polluted
V	Between 75-100	Polluted
VI	Between 100-125	Heavily polluted
VII	Beyond 125	Severely polluted

Tata Marco Polo

The state-of-the-art bus manufacturing facility of Tata Marcopolo Motors at Dharwad (Karnataka) is a 51:49 joint venture of Tata Motors and Marcopolo of Brazil. The Dharwad plant caters to India's growing need for world-class fully built buses for intra-city and inter-city transportation with international standard comfort, quality and safety.

The plant produces a comprehensive range of buses. The range, are marketed under the 'Starbus' and 'Globus' brands, includes 16- to 54-seater standard buses, 18- and 45-seater luxury buses, luxury coaches and low-floor city buses. The plant, spread over about 123 acres, has a capacity to produce 30,000 units a year. The joint venture has already invested about Rs200 crore.

The study to monitor Ambient Air Quality was conducted in the plant at several locations. The data is collected to monitor Ambient Air Quality (AAQ) at different locations within the factory premises, three different locations were selected to measure the AAQ. The locations selected are;

1. In-between Painting Section (Jiggs) and Painting Booth
2. In-between LCV (Light Commercial Vehicle) Jiggs and Chassis Preparation
3. In-between MCV (Medium Commercial Vehicle) Jiggs and Machine Shop

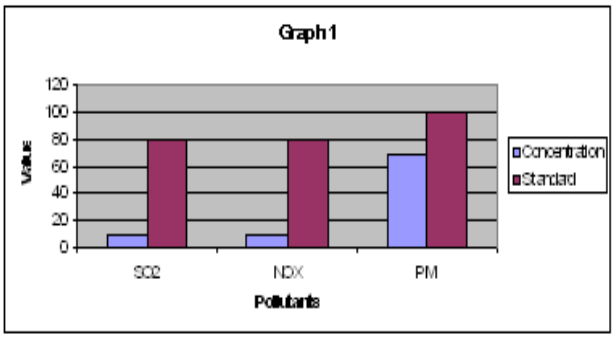
The parameters selected for measuring AAQ are;

a. SOX – Oxides of Sulphur (Ex. SO_2 – Sulphur dioxide)
b. NOX - Oxides of Nitrogen (Ex. NO_2 – Nitrogen dioxide)
c. RSPM10- Respirable Suspended Particulate Matter of size less than10µm

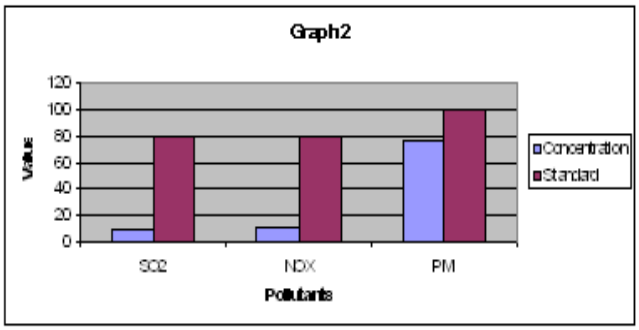
Particulate matter has a wide range of sources and chemical constituents. Primary particulates are those directly emitted from a source, including combustion and mechanical sources. Secondary particulates are formed in the atmosphere as a result of chemical reactions between the constituent gases (ammonia and oxides of nitrogen or sulphur dioxide). Particulates evolve and mix in the atmosphere and may contain a range of substances including carbon, small amounts of ammonium sulphate or nitrate as well as metals, organic compounds or mineral components, depending on source. These particulates suspend in the air and cause serious health problems to the workers as they breathe the air containing these particulates. These particulates also pollute the environment.

Conclusion

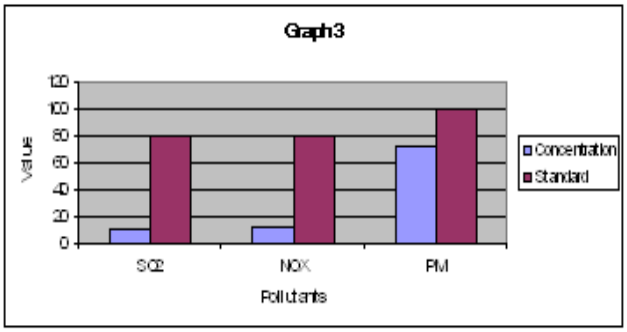
AQI values and excedence factor show that the premises is not polluted, however the excedence factor for particulate matter less than 10 µm shows a higher value resulting in moderate pollution, but is within the limit prescribed by the pollution board, further from the graphs it is evident that all the pollutants levels are well below the prescribed limits set by the pollution board. It means that the company is taking all the measures to control the levels of all the pollutants discharged into the atmosphere, thereby protecting the environment, the health and safety of the worker working in the above mentioned locations or sections. The status of ambient air is good and clean. Workers are also provided with safety equipments like hand gloves, protective goggles, industrial shoes etc., workers are also trained to work efficiently in these sections. The need of the hour is to sustain the present condition and keep the working environment and the surrounding area clean and less polluted.



Graph 1: Pollutants Level- In-between Painting Section (Jiggs) & Painting Booth



Graph 2: Pollutants Level- In-between LCV Jiggs and Chassis Preparation



Graph 3: Pollutants Level - In-between MCV Jiggs and Machine Shop

Reference

1. http://www.epa.gov/apti/course422/ap2.html
2. http://dpcc.delhigovt.nic.in/noisestd.htm
3. http://pediatrics.aappublications.org
4. http://cpcb.nic.in/Introduction.php
5. http://www.epa.gov/air/index.html
6. http://www.sgsgroup.in
7. http://www.epa.gov/airquality/ozonepollution
8. http://www2.gov.bc.ca/
9. Pednekar. Mahesh IJT University, Rajasthan and Dr. Jha Nishikant ,JIT University, Rajasthan ,Corporate Social Responsibility & Business Strategy - A Case Study on the Tata Group under Mr Ratan Tata -,
10. Tata CSR Presentation ,Scribd.com

11. Radha Bengeri, Krishna Agro Tech Pvt. Ltd, Hubli.
12. Ethics, Business And Society Managing Responsibly- SAGE Publications Asia-Pacific Pte Ltd.Singapore
13. Corporate Social Responsibility- Towards a Sustainable Future, White Paper –KPMG India
14. Review of air quality management system in India.
15. National ambient air quality objectives for particulate matter, Science Assessment document. (1998).
16. Air pollutants and air quality terms, Air quality monitoring network, 2008.
17. CENTRAL POLLUTION CONTROL BOARD MINISTRY OF ENVIRONMENT & FORESTS www.cpcb.nic.in
18. CPCB, Air quality status & trends in India, CPCB publication NAAQMS/14/1999-2000
19. Guidelines for air quality, World health organization publication, Geneva
20. Ministry of Road Transport and Highways, Govt. of India, website http://morth.nic.in/motorstat/mt2.pd