AIR QUALITY MANAGEMENT

Air quality standards – Air quality monitoring – Air Pollution indices – Air Pollution Control efforts – Zoning – Town Planning – Regulation for New Industries, Legislation and Enforcement

AIR QUALITY STANDARDS

Objectives of air quality standards

- To indicate the levels of air quality necessary with an adequate margin of safety to protect the public health, vegetation and property;
- To assist in establishing priorities for abatement and control of pollutant level;
- To provide uniform yardstick for assessing air quality at national level;
- To indicate the need and extent of monitoring programme. The revised National Ambient Air Quality Standards notified on November 2009 is depicted below

Revised National Ambient Air Quality Standards

The Ministry of Environment and Forest (MoEF), Govt of India, vide gezette notification, G.S.R826 (E), dated 16.11.2009 have notified the National Ambient Air Quality Standards by amending the Environment (Protection) Rules 1986.

The following are the major changes have been effected.

1. As against **three** [(i) **Industrial Area** (ii) **Residential, Rural & other areas** (iii) **Sensitive Area]** areas, the new standards is applicable for only two areas viz. (i) Industrial ,Residential , Rural, and other areas (ii) Ecologically Sensitive Area (Notified by Central Government)
2. The Industrial area, Residential, Rural, and other areas have been clubbed, Ecologically Sensitive area to be notified by Central Government.
3. The new parameters included are particulate matter size less than 2.5 µm **OR** PM2.5 $\mu g/M^3$, Ozone, ammonia (NH_3), Benzene **,** Benzo(a)pyrene(BaP) , Arsenic (As) and Nickel (Ni)
4. Ambient air quality data generated under National Ambient Air Quality Monitoring Programme (NAMP) has been compared with revised national ambient air quality standards for the year 2010-11

Sl. No	Pollutant	Time Weighted Average	New Standards (Schedule VII, Rule 3 (3B) 16th Nov 2009 Concentration in ambient air		Methods of measurement
			Industrial Area Residential, Rural & other Areas	Ecologically sensitive area (Notified by Central Govt)	
1	Sulphur Dioxide (SO2)	Annual Avg*	50.0 µg/m3	20.0 µg/m3	-Improved West and Gaeke method -Ultraviolet fluorescence
		24 hours**	80.0 µg/m3	80.0 µg/m3	
2	Oxides of Nitrogen as NO2	Annual Avg*	40.0 µg/m3	30.0 µg/m3	-Modified Jocob and Hochheise (Sodium Arsenite) -Chemiluminescence
		24 hours**	80.0 µg/m3	80.0 µg/m3	
3	Particulate matter (size less than 10µm)	Annual Avg*	60.0 µg/m3	60.0 µg/m3	-Gravimetric -TOEM -Beta attenuation
		24 hours**	100.0 µg/m3	100.0 µg/m3	
4	Particulate matter (size less than 2.5 µm	Annual Avg*	40.0 µg/m3	40.0 µg/m3	-Gravimetric -TOEM -Beta attenuation
		24 hours**	60.0 µg/m3	60.0 µg/m3	
5	Lead (Pb)	Annual Avg*	0.50 µg/m3	0.50 µg/m3	-AAS/ICP method for sampling on EPM2000 or Equivalent Filter paper -ED-XRF using Teflon filter paper
		24 hours**	1.0 µg/m3	1.0 µg/m3	
6	Carbon	8 hours**	2.0 mg/m3	2.0 mg/m3	-Non Dispersive Infra Red (NDIR)

	Monoxide (CO)	1 hour	4.0 mg/m3	4.0 mg/m3	spectroscopy
7	Ozone	8 hours**	100.0 µg/m3	100.0 µg/m3	-Photometric
		1 hour	180.0 µg/m3	180.0 µg/m3	-Chemiluminescence
		24 hours**	60.0 µg/m3	60.0 µg/m3	-Chemical method
8	Ammonia	Annual Avg*	100.0 µg/m3	100.0 µg/m3	-Chemiluminescence
	(NH3)	24 hours**	400.0µg/m3	400.0 µg/m3	-Indo-Phenol Blue method
9	Benzene	Annual Avg*	5.0 µg/m3	5.0 µg/m3	-GC based continuous analyzer -Adsorption/desorption followed by GC analysis
10	Benzo(a) pyrene	Annual Avg*	1.0 ng/m3	1.0 ng/m3	-Solvent extraction followed by GC/HPLC extraction
11	Arsenic	Annual Avg*	6.0 ng/m3	6.0 ng/m3	AAS/ICP method for sampling on EPM2000 OR Equivalent Filter paper
12	Nickel		20.0 ng/m3	20.0 ng/m3	-AAS/ICP method for sampling on EPM2000 OR Equivalent Filter paper

- *Annual Arithmetic mean of minimum 104 measurements in a year taken twice a Week 24 hourly at uniform interval,
- ** 24 hourly / 8 hourly or 1 hourly monitored values as applicable shall be complied with 98 % of the time in a year. However, 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

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

Objectives of Air Quality Monitoring

Major objectives for air quality monitoring

(i) Background Data

In order to generate background data, air quality monitoring is conducted to assess existing level of contamination and to asses possible effects of air contamination occurring in future.

(ii) Status and Trend Evaluation

The objective is to determine air pollution status and trend information from any continuous air quality monitoring programme. The information is used to determine, whether pollution control strategies as advised by implementing authority are giving acceptable values that is lowering of pollution levels or new or additional control are required to achieve acceptable levels.

(iii) Environment Exposure Level Determination

The air quality monitoring and survey concern itself with systematic study of considerable segment of environment to define inter-relationship of source of pollution, atmospheric parameter and measurable manifestations in order to evaluate the character and magnitude of existing problem.

(iv) Scavenging Behaviour of Environment

To understand natural scavenging or cleansing process undergoing in the environment through pollution dilution, dispersion, wind movement, dry deposition, precipitation and chemical transformation of pollutants generated.

(v) Air Quality Management

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

National Air Monitoring Programme (N.A.M.P.)

Central Pollution Control Board initiated National Ambient Air Quality Monitoring (NAAQM) programme 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 295 by 2000-01 covering 98 cities/towns in 29 States and 3 Union Territories of the country.

Objectives of the N.A.M.P.

- To continue ongoing process of producing periodic evaluation of air pollution situation in urban areas of the country.
- To determine status and trend in ambient air quality and effects of air pollution in urban environment
- To estimate the future worsening or improvement of air quality and to obtain the knowledge and understanding necessary for developing preventive and corrective measures.
- 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.
- To ascertain whether the prescribed ambient air quality standards are violated and to assess health hazard, damage to materials and to control and regulate pollution from various sources.
- The monitoring of pollutants is carried out for 24 hours (4-hourly sampling for gaseous pollutants and 8-hourly sampling for particulate matter) with a frequency of twice a week, to have 104 observations in a year.

GUIDELINES FOR MONITORING

For setting up of any ambient air quality monitoring station, the most important thing to be considered prior to commencement of actual monitoring is to collect its background information.

Background Information

The background information that needs to be collected includes details of sources and emissions, health status, demography, population growth, land use pattern, epidemiological studies. Such prior information will provide immense help to identify the likely effects and in particular health impacts resulting from population exposure to air pollutants.

(i) Sources and Emissions

Sources in a city include vehicles, industries, domestic etc. In an industrial area, information should be obtained on the type of industries including their number, fuel used, composition of fuel, pollutants emitted etc. Information on number and distribution of sources should be collected. This information will help in identifying which pollutants can be expected in an area and thus should be measured. In case of industrial stacks, locations of maximum ground level concentrations should be determined by modeling. The stations should be located at locations where maximum ground level concentrations are expected. Information on type and number of vehicles should be obtained. Information on domestic fuel that is used in household should be obtained. Pollution load emanating from these sources should be estimated so as to identify sources that are generating significant amount of pollution.

(ii) Health and Demographic Information

Investigations shall be carried out based on the public complaints received from an area related to air pollution. If the results of such investigations reveal that the level are high that area can be considered for ambient air quality monitoring. Areas where population density is high (more than one million) can be considered for locating monitoring stations. Information on age and socio-economic status of population is also important for making a decision on initiation of ambient air quality monitoring. Location of monitoring station in such areas will help in finding exposure levels to population which can be used further in epidemiological studies to evaluate health effects of air pollutants.

(iii) Meteorological Information

Meteorological data with respect to temperature, relative humidity, wind speed and direction should be collected. Predominant wind direction plays an important role in determining location of monitoring stations. Due to effects such as land and sea breezes, valley effects etc. it is important to collect local meteorological data specific to the site. The monitoring stations should be located in areas that are downwind from the sources. Mixing height data should also be collected. Mixing height data can be collected from Indian Meteorological Department. Information on duration of various seasons in a year is also important. Measurement frequency should be such that monitoring is done in all the seasons so that all seasonal variations are included in computing annual average.

(iv) Topographical Information

Local winds and stability conditions are affected by topography. In river valleys there is increased tendency of developing inversions. More number of monitoring stations should be located in areas where spatial variations in concentrations are large. Mountains, hills, water bodies also affect dispersion of pollutants.

(v) Previous Air Quality Information

Any previous information collected on ambient air quality can serve as a basis for selecting areas where monitoring should be conducted and previous studies may include data collected for any health studies etc. Previous studies can be used to estimate the magnitude of the problem. Once the background information is collected, the ambient air quality monitoring is to be initiated and selection of type of pollutant to be measured, number and distribution of monitoring stations etc. should be made.

COMPONENTS OF MONITORING

The following parameters need to be decided for carrying out ambient air quality monitoring.

Number and Distribution of Monitoring Locations

Knowledge of existing air pollutants levels and pattern within the area are essential for deciding number and distribution of stations. Isopleths distribution of an ambient concentrations determined from modeling or previous air quality information can be used to determine number and distribution of stations. When isopleths maps are not available information of emission densities and land use pattern may be used with windrose data to determine areas of expected higher concentrations. The number of monitoring stations in a city can be selected based on background information collected on sources and emissions, Population figures which can be used as indicators of region variability of the pollutants concentration

The no. of sampling sites depends on

- Size of the area to be covered
- The variability of pollutant concentration over the area to be covered
- The data requirements, which are related to the monitoring
- Pollutant to be monitored and
- Population figures which can be used as indicators of criticality both from view of likely air quality deterioration as also health implications.

For other monitoring objectives, particularly in relation to epidemiological studies, the nos. will have to be increased.

There are several other modifying factors as follows:

- In highly industrialized cities the no. of stations for SPM and SO2 must be increased.
- In areas, where large amounts of heavy fuels are used the no. of stations for SO2 should be more or vice-versa.
- In regions with irregular terrain, increase the no. of stations. □ In cities with extremely heavy traffic the no. of stations for NOX , Oxidants and CO may need to be doubled.
- In cities with low traffic and a population of > 4 million, the no. of station for SO2 , NOX and CO can be reduced.