A Regulatory Framework for Control of Air Pollution in India - A Country Report

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ABSTRACT : Air pollution has been aggravated by developments that occurs due to growing cities, increasing traffic, rapid economic development, industrialization, and higher levels of energy consumption. The high influx of population to urban areas, increase in consumption patterns, unplanned urban and industrial development has led to the problem of air pollution. Currently, in India, air pollution is widespread in urban areas where vehicles are the major contributors and in a few other areas with a high concentration of industries and thermal power plants. Vehicular emissions are of particular concern since these are pedestrian level sources and thus have the maximum impact on the general population. India has witnessed a phenomenal increase in the number of industries and vehicles in the last decade, along with the mushrooming of cities. As a consequence, there has been a dramatic deterioration in the quality of urban air in most regions of the country particularly in big cities like Delhi, Mumbai, Kolkatta and Chennai. The outdated and inefficient refining process in India is largely responsible for the bad quality fuel and high vehicular emissions. Diesel in India contains high level of sulphur as compared to developed countries of the world. Sulphur in diesel form small particulates which are the cause of carcinogenic polycyclic aromatic hydrocarbons.

KEYWORDS: Air pollution, Regulatory framework, Central Pollution Control Board, Industrialization.

1 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. Apart from rapid industrialization, urbanization has resulted in the emergence of industrial centers without a corresponding growth in civic amenities and pollution control mechanisms. In India all vehicles need emission certification. In most countries that have been able to control vehicular pollution to a substantial extent, Inspection & Maintenance of all categories of vehicles have been one of the chief tools used. Developing countries in the South East Asian region, which till a few years back had severe air pollution problem have introduced an I&M system and also effective traffic management. Use of poor quality fuels, substandard vehicle technology and congestion are major problems. Petrol vehicles that run on adulterated or poorly refined fuel are the greatest sources of greenhouse gases like hydrocarbons (HCs) and carbon dioxide (CO_2). Since unleaded petrol had been introduced in a limited way, till recently lead emissions from petrol vehicles were also high. Fig 1 shows the share of particulate & SO_2 in ambient air, as well as the technologies used.

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India is making serious efforts to put in place a regulatory framework for air pollution management.

2 CHALLENGES IN AIR POLLUTION :

Some of the followings are becoming challenges to monitor and control the cause of air pollution.

- Human Migration
- Coal burning industries
- Diesel driven vehicles
- Vehicular emission (Traffic Pollution)
- Waste deposit Lagos
- Legislation harmonization; nationally and/or regionally
- Harmonization of methodologies, researches, databases & standards

2.1 *Trends in Urban Outdoor Air Pollution*

2.1.1 *Developed Countries :*

SO_2 : Decreasing, often below WHO guidelines
PM : coarse fraction decreasing, fine and ultrafine increasing
NO_x, O_3 : constant or increasing often above WHO guidelines

2.1.2 *Developing Countries, countries in transition:*

SO_2 : Increasing, often above WHO guidelines
PM : Increasing
NO_x, O_3 : increasing often below WHO guidelines

2.2 Trends in Indoor Air Pollution

2.2.1 *Developed Countries :*

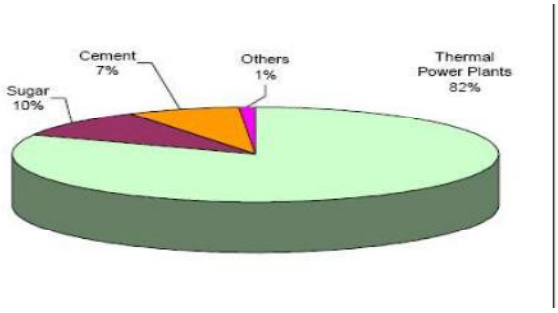
- Indoor air pollution related to ambient air pollution
- Environmental Tobbacco Smoke decreasing ?
- NO_x – sources may exist and constitute a problem
- Mould constitutes a serious problem in temperature / humid climates
- Sick building syndrome
- Multichemical sensitivity

2.2.2 *Developing Countries, Countries in Transition :*

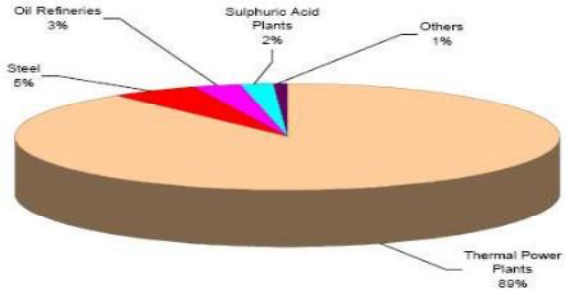
- PM concentrations due to open fire cooking and heating by a factor of 10 to 20 above the ambient concentrations in urban areas

- Enhanced SO_2 and CO concentrations
- Environmental Tobacco Smoke increasing

2.3 *Emission Inventory*



Share of Suspended Particulate Matter Load (tonnes/day) by Different Categories of Industries (With Control Device), Total Load = 5365 tonnes/day



Share of Sulphur Dioxide Load (tonnes/day) by Different Categories of Industries (Total Load = 3715 tonnes/day)

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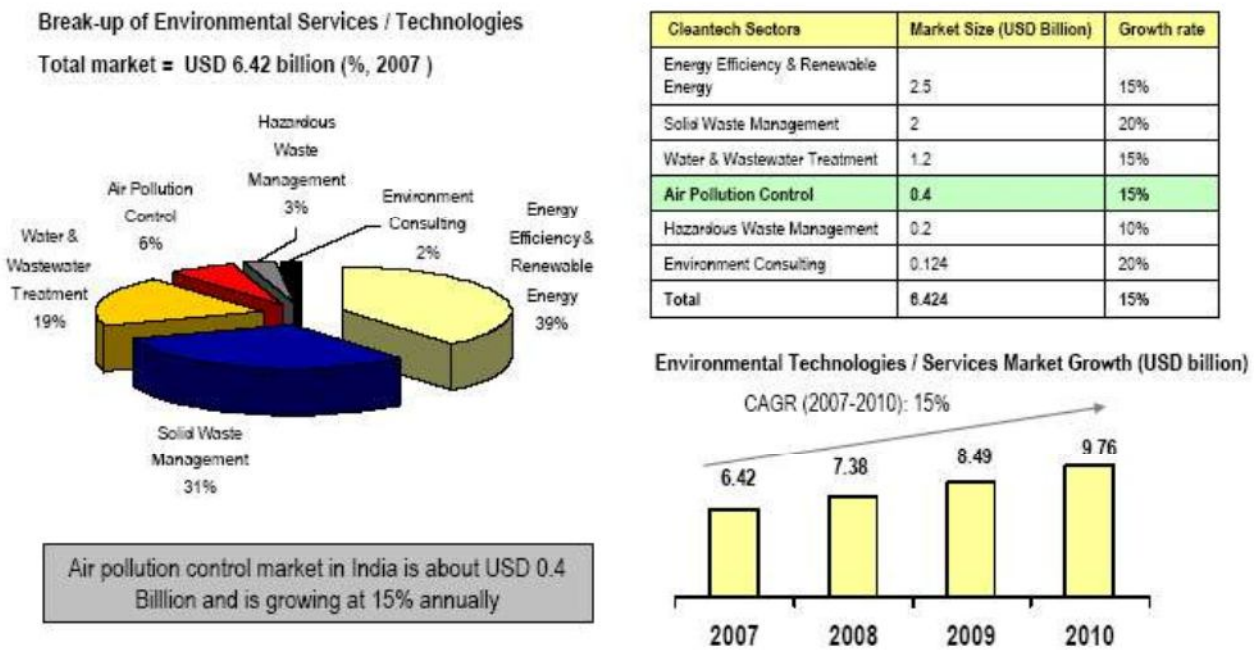

Figure 1

3 AIR QUALITY MANAGEMENT

3.1 *Institution Mechanism*

- Central Level
  - Ministry of Environment & Forests
  - Central Pollution Control Board
  - Environment Pollution Control Authority
  - Ministry of Petroleum & Natural Gas
  - Ministry of Road Transport & Highways
  - Other Central Ministries/Agencies
  - R&D Centers & other Institutions

- State Level
  - Department of Environment
  - Pollution Control Board/Committees
  - Local Bodies/Authorities

3.2 *Legislation*

3.2.1 *Major Acts In India For Air Pollution Control*

- Air (Prevention and Control of Pollution) Act, 1981
- Environmental Protection Act, 1986
- Factory Act (Occupational Health) 1987

MoEF, constituted in 1985, is the nodal agency in the administrative structure of the Central Government responsible for AQM. Different ministries, boards, and organizations responsible for AQM are shown in Figure 2. MoEF, CPCB, and SPCBs form the regulatory and administrative core, while other ministries and bodies are also involved through various functions, policies, and schemes to promote AQM. In addition, there is a network of government and nongovernmental institutions, organizations and laboratories involved in monitoring, reporting, and conduct of AQM studies. (CPCB, 2004a)

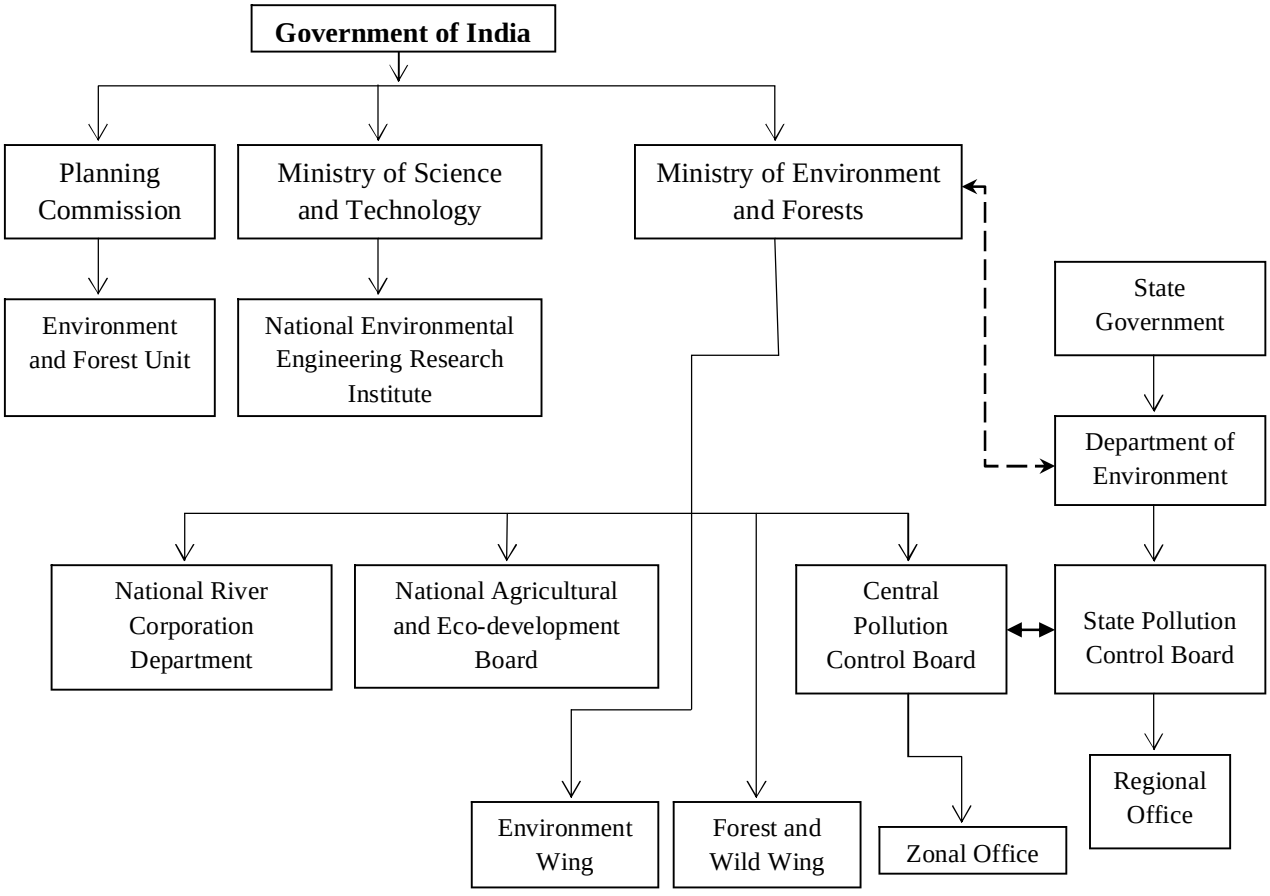

Figure 2 Air Quality Management Structure in India

The Government of India enacted the APA in 1981 to arrest the deterioration in air quality. The act prescribes various functions for CPCB at the apex level and SPCB at the state level. The main functions of CPCB are as follows: (Sengupta, B., 2004)

- To advise the Central Government on any matter concerning the improvement of air quality and the prevention, control, and abatement of air pollution.
- To plan and cause to be executed a nationwide program for the prevention, control, and abatement of air pollution.
- To provide technical assistance and guidance to SPCB.
- To carry out and sponsor investigations and research related to air pollution prevention, control, and abatement of air pollution.
- To collect, compile, and publish technical and statistical data related to air pollution; and
- To lay down standards for the quality of air and emission quantities.

The main functions of SPCB are as follows:

- To plan a comprehensive program for prevention, control, or abatement of air pollution and to secure the execution thereof.
- To advise the state Government on any matter concerning prevention, control, and abatement of air pollution.
- To collect and disseminate information related to air pollution.
- To collaborate with CPCB in program related to prevention, control, and abatement of air pollution.
- 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.

MoEF constituted the Environment Pollution (Prevention and Control) Authority (EPCA) for the National Capital Region (NCR) in 1998. EPCA was given sweeping powers; it was enabled to take the necessary steps to ensure compliance with directions of different agencies. EPCA could take up matters on its own or receive complaints. It was also given extensive powers of search, entry, inspection, and seizure (CSE 2005). CPCB laid down national standards on ambient air quality and source specific emission standards for implementation at the local levels through the concerned officials of SPCBs.

In recent years, the judiciary has been playing an important role in promoting AQM initiatives through judicial interventions on public grievances voiced in public interest litigations (PILs)/writ petitions on air pollution. A number of judgments relating to stringent vehicle emission norms, fuel quality, introduction of cleaner fuels, phasing out of older vehicles, and shifting of hazardous industries have provided a great deal of momentum to the efforts for improvement of air quality.

3.3 *Ambient Air Quality Standards*

CPCB is responsible for setting National Ambient Air Quality Standards (NAAQS). The NAAQSR published by CPCB in 2004 stated that ambient air quality objectives/standards are prerequisite to develop a management program for the effective management of ambient air quality and to reduce the damaging effects of air pollution. The objectives of air quality standards are (NAAQS, 2004)

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

These standards are based on land use and other factors of the area. The guidelines for declaring sensitive areas are as follows:

Sensitive areas may include the following: (HEI, 2004)

1. 10 kms around the periphery of health resorts as notified by SPCBs and in consultation with the Department of Public Health of the concerned state;
2. 10 kms around the periphery of biosphere reserves, sanctuaries, and national parks, so notified by MoEF or concerned states;
3. 5 kms around the periphery of an archeological monument declared to be of national importance or otherwise, so notified in consultation with SPCBs;
4. Areas where some delicate or sensitive to air pollution crops/important to the agriculture/horticulture of that area are grown, so notified by SPCBs and in consultation with the Department of Agriculture/Horticulture of the concerned state; and
5. 5 kms around the periphery of centers of tourism and/or pilgrimage due to their religious, historical, scenic, or other attractions, so notified by the Department of Tourism of the concerned state with SPCBs.

Air Pollutant	**Time-weighted Average**	**India ($\mu g/m^3$)[a,b]**			**WHO[c] ($\mu g/m^3$)**	**USEPA July 1997 ($\mu g/m^3$)**
		Industrial	**Residential**	**Sensitive**		
NO_2	Annual	80.00	60.00	15.00	40.00	100.00
	24 hours	120.00	80.00	30.00		
SO_2	Annual	80.00	60.00	15.00	50.00	80.00
	24 hours	120.00	80.00	30.00	20.00	365.00
CO	8 hours	5,000.00	2,000.00	1,000.00	10,000.00(d)	10,000.00
	1 hour	10,000.00	4,000.00	2,0000.00	30,000.00(d)	40,000.00
Pb	Annual	1.00	0.75	0.50	0.50(d)	1.50
	24 hours	1.50	1.00	0.75		
PM_{10}	Annual	12.00	60.00	50.00	20.00	

	24 hours	150.00	100.00	75.00	50.00	150.00
SPM	Annual	360.00	140.00	70.00		
	24 hours	500.00	200.00	100.00		
NH_3	Annual		100.00			
			400.00			

Source : WHO (2006), WHO (2000), US EPA

CO = Carbon monoxide; NH_3 = ammonia; NO_2 = Nitrogen dioxide; Pb = lead; PM_{10} = particulate matter with diameter less than 10 micrograms; SO_2 = sulfur dioxide; SPM = suspended particulate matter; USEPA = United States Environmental Protection Agency; WHO = World Health Organization; and ($\mu g/m^3$) = micrograms per cubic meter

[a] Annual average of minimum of 104 measurements in a ye3ar, taken twice a week, 24 hourly uniform intervals

[b] 4-hourly/8-hourly values should be met 98% of the time in a year, it could exceed 2% of the time but not on 2 consecutive days.

[c] WHO 2006

[d] WHO 2000

Table 1 Comparison of India's NAAQS with WHO and US EPA

4 MAJOR INITIATIVES TAKEN FOR AIR POLLUTION CONTROL IN INDIA (DURING LAST TWO DECADES)

- National ambient air quality standards based on health impact evolved (1982, 1994).
- Emission standards for air polluting industries developed for major industries
- Implementation of standards in 17 categories of highly polluting industries and other small/medium scale industries (stone crushers, brick kiln, re-rolling mills, etc.).
- Action plan implementation and pollution control in identified 24 problem areas.
- Improvement in vehicular technology (Bharat-1, Bharat-2, CNG vehicles, 4 stroke engines, etc.)
- Improvement in fuel quality -diesel with low sulfur content (0.25 in whole country and 0.05 in metro cities)
- Gasoline -lead phased-out throughout the country since 2000
- Pollution Under Control (PUC) certificate for all vehicles
- All commercial vehicles to operate on CNG in Delhi
- Coal beneficiation/clean coal technology –notification regarding use of beneficiated coal in T.P.P.
- Air Quality Monitoring at National Level (295 stations spread over 93 cities)
- Air Quality Index for public Information
- Air Quality Data on TV channels and daily news papers for public awareness

5 EMERGING NEW AREAS FOR AIR POLLUTION CONTROL IN INDIA

- Development of Low Cost ash removal technology from Coal and promotion of Clean Coal Technologies (IGCC, PFBC, etc.)
- Technology for reduction of Fluoride emission (primary & Secondary) from pot room of Aluminium Industries using Soderberg Technology
- Development of NOx control Standard for Thermal Power Plants and Refineries

- Prevention and control of Fugitive Emission in Cement Industry, development of good practice guidelines
- Use of high calorific value Hazardous Waste including Petroleum Coke in Cement Kiln
- Low Cost Flue Gas Desulphurization Technology for Thermal Power Plants
- Technology Development of Fugitive Emission Control from Coke Oven Plants of Iron & Steel Industry (PLL, PLD)
- Development of Technology and Standard to control emission of VOC, Methyl Chloride, P2O5, HCl etc. From Pesticide Industry
- Development of Odor Control Technology for Paper & Pulp industry and Standardization the method of odor measurement
- Fluidized Bed Combustion (FBC/CFBC) technology for Solid Fuel containing Higher Ash
- Low Cost Flue Gas Desulphurization Technology for Thermal Power Plants
- Technology Development of Fugitive Emission Control from Coke Oven Plants of Iron & Steel Industry (PLL, PLD)
- Development of Technology for low cost Catalytic Converter.
- Technology for NOx/ HC control from large Stationary Diesel Engine.
- Development of improved design of Incinerators for Hazardous Waste.
- Control on emission of Fine Particulate Matter (PM 2.5) from Engine using LPG,CNG, Low Sulphur Diesel, Low Sulphur Petrol etc.
- Apportionment Study for Fine Particulate Matter (PM10, PM2.5) in major cities
- Technology for Mercury Emission Control from Thermal Power Plants.
- Development of methodology for measurement of hazardous Organic Compounds.
- Development of Calibration Laboratory for Calibration of Air Quality Analyzers in Regional Labs. of CPCB.
- Noise and Emission Control System for Small DG Sets (<200 KW)
- Development of Stack Height Guidelines for Thermal Power Plants and Industries using ventilation co-efficient of different regions in the country.

6 CONCLUSIONS

The major metropolitan cities in India are facing severe air pollution problems. Critical levels of PM10 and SPM exist in many cities. SO2, NOx, and lead levels in ambient air are decreasing in most cities due to the measures taken such as reduction of sulfur in fuel and introduction of unleaded petrol. However, continuing severe levels of air pollution are leading to high incidence of respiratory diseases, cancer, and heart diseases. Major economic costs are associated with the health impacts of poor air quality.

Vehicles have been identified as the major source of air pollutants in the largest cities. The reasons for high rates of vehicle emissions include poor fuel quality, high vehicular density, the large number of old vehicles, inadequate I&M system, poor vehicle design, fuel adulteration, improper traffic management, and inadequate mass transport systems. Clearly, control of vehicle emissions in the large cities needs to be highly prioritized. India has identified many issues and is working toward addressing most aspects, although ensuring effective implementation is always a challenge. Strategies that need to be effectively implemented include the promotion of public transport and MRTS together with traffic planning and management. In addition, taxes on fuels and vehicles, stringent emission norms and fuel quality specifications, promotion of cleaner fuels

such as CNG, replacement of 2- stroke engines, and a strengthening of the I&M system, are in use.

Industrial sources, both large- and small-scale units, also need to be targeted to reduce air pollution. These include promotion of cleaner technologies, strengthening and effectively implementing emission standards, and introducing economic incentives to reduce or avoid emissions. Emphasis should be given to waste minimization and utilization. In addition, non-point sources of pollution also need to be addressed adequately. A comprehensive urban AQM strategy should be formulated using information related to urban planning, ambient air quality, emission inventory, and air quality dispersion models. Strengthening the monitoring network and institutional capabilities would facilitate an improvement in the enforcement mechanism.

With the enactment of the central legislation for prevention and control of air pollution in 1981, air quality issues received countrywide attention. However, it took several years to build up the monitoring facilities and to create a database on air quality status and trends. NAMP initiated by CPCB in collaboration with NEERI and SPCBs led to a beginning of air quality monitoring network in 1984. Over the years, monitoring stations have increased in numbers and the capabilities for monitoring have improved. Dissemination of air quality data through the media has helped in raising awareness of air quality issues. With the increasing awareness, the public demand for air pollution control increased and it was reflected in the representations and public interest litigations and petitions. Judicial interventions in response to the litigations and petitions also helped enforce air pollution control measures, tighten emission standards, and switch to cleaner fuels, and the relocation of polluting industries.

The SC‘s intervention demonstrated the need for a more structured national-level system of AQM. The city-specific model of management, compliance, and enforcement is still very weak. To achieve its goal in achieving clean air, India must establish a legal framework to ensure the enforcement of agreed measures. Although considerable progress has been made in recent years, much of this progress has been based on a series of individual actions

Acknowledgement : The contents of the country report presented in this paper are taken from the papers/literature mentioned in the references.

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