

Experience of Air Pollution Control in Last Two Decades in India



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Important Act

DEALING WITH AIR POLLUTION CONTROL IN INDIA

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

Major Air Pollution Issues in India

1. Major Cities (53 non-attainment areas mainly due to vehicular pollution)
2. 24 – Critically polluted area (Industrial Air Pollution)
3. Indoor Air Pollution (Rural Area) and Air Pollution in work zone area

Reasons for High Air Pollution in India


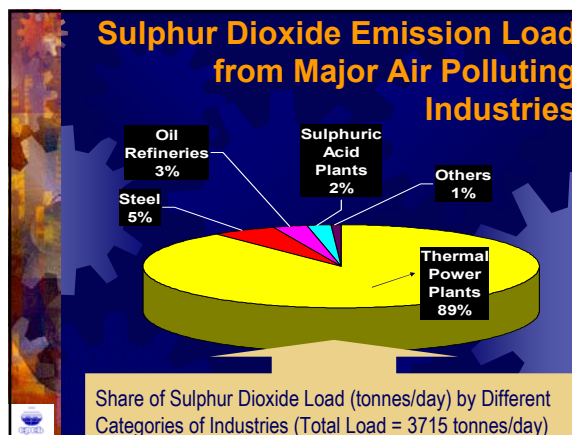
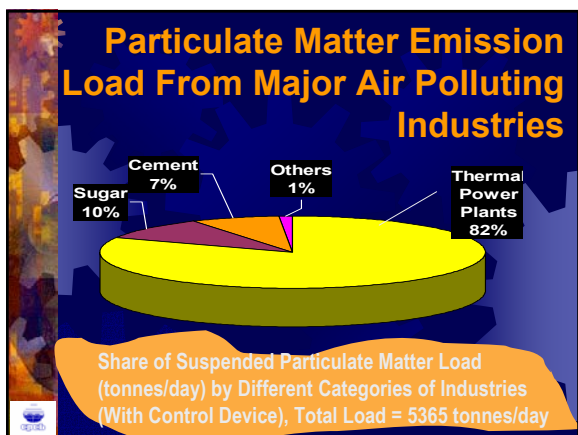
- Quality of fuel (coal, diesel, petrol, fuel oil)
- Toxic and hazardous air pollutants emission from chemical industries, (pesticides, dye and dye intermediate, pharmaceutical etc) specially located in industrial estates (Gujarat, Maharashtra, A.P. and Tamil Nadu)
- Use of high ash coal for power generation
- Siting of small industries specially industrial estates
- No pollution preventive step taken (early stage of industrialization)

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Reasons for High Air Pollution in India

- Predominance of 2-stroke in use vehicles
- Uncontrolled growth of vehicle population and poor i/m system for in use vehicle
- Inadequate pollution prevention and control system in small/ medium scale industry (s.M.S) (brick kiln, foundry, stone crusher etc.)
- Poor compliance of standard in s.M.S.
- Large number of polluting genset operating in commercial area

Inventory of Industrial Emissions

List of Critically Polluted Areas (Identified During Eighties)

S. NO.	AREA	TYPE OF POLLUTING INDUSTRIES
01.	Singrauli	- Power Plants, Mining, Aluminium Industry
02.	Korba	- Power Plants, Mining, Aluminium Industry
03.	Vapi	- Chemical Industries
04.	Greater Cochin	- Oil Refineries, Chemical, Metallurgical Industries
05.	Vishakhapatnam	- Oil Refinery, Chemical, Steel Plants
06.	Howrah	- Foundry, Rolling Mills, Vehicles
07.	Durgapur	- Chemical Industries, Power Plants, Steel Plants
08.	Ankaleswar	- Chemical Industries

Contd...

List of Critically Polluted Areas (Identified During Eighties)

S. NO.	AREA	TYPE OF POLLUTING INDUSTRIES
09.	Manali	- Oil Refineries, Chemical & Fertilizer Industries
10.	Chembur	- Power Plants, Refineries, Fertilizer Industry
11.	Mandi Govindgarh	- Secondary Steel Industry
12.	Dhanbad	- Mining, Coke Oven
13.	Pali	- Cotton Textile, Dyeing
14.	Nagafgarh Drain Basin	- Power Plants, Vehicles
15.	Angul - Talcher	- Mining, Aluminium Plants, Thermal Power Plants
16.	Bhadravati	- Iron & Steel, Paper Industry

Contd...

List of Critically Polluted Areas (Identified During Eighties)

S. NO.	AREA	TYPE OF POLLUTING INDUSTRIES
17.	Digboi	- Oil Refinery
18.	Jodhpur	- Cotton Textile, Dye
19.	Kala - Amb	- Paper, Electroplating
20.	Nagda - Ratlam	- Viscose Rayon, Caustic, Dyes Distillery
21.	North Arcot	- Tanneries
22.	Parwanoo	- Food Processing Unit, Electroplating
23.	Patancheru - Bollaram	- Organic Chemical Paints, Petrochemical Industry
24.	Tarapur	- Chemical Industries


Critically Polluted Areas (2004)

S. NO.	AREA	TYPE OF POLLUTING INDUSTRIES
01.	Panipat	- Power Plants, Refinery, Petrochemical, Fertilizer, S.S.I.
02.	Mangalore	- Refinery, Petrochemical, Pesticides, S.S.I.
03.	Cuddalore	- Chemical Units, Petrochemical, Pesticides




Air Polluting Industries in Small Scale Industry Sector

S. No.	INDUSTRY	STANDARD NOTIFIED UNDER E.P. ACT	DEVELOPMENT OF CLEEN TECHNOLOGY / POLLUTION PREVENTION TECHNOLOGY
01.	Arc Furnace	-	Yes
02.	Bagasse Fired Boilers	GSR 475 (E), 5 th May, 1992	Yes
03.	Battery Manufacturing Unit	GSR 7, 22 nd December, 1998	Yes
04.	Beehive Hard Coke Oven	GSR 176 (E) 2 nd April, 1996	Yes
05.	Briquette Industry (Coal)	GSR 176 (E) 2 nd April, 1996	Yes
06.	Boilers (Small)	GSR 176 (E) 2 nd April, 1996	Yes
07.	Brick Kilns	GSR 682 (E), 5 th October, 1999	Yes
08.	Ceramic Industry	GSR 475 (E), 5 th May, 1992	Yes
09.	Coke Ovens	S.O. 64 (E), 18 th January 1988	Yes
10.	Cupola Furnace	GSR 176 (E) 2 nd April, 1996	Yes
11.	Foundries	GSR 742 (E), 30 th August, 1990	Yes
12.	Hot Mix Plants	-	-
13.	Lime Kilns	GSR 92 (E), 21 st February, 1991	Yes
14.	Soft Coke Industries	GSR 176 (E) 2 nd April, 1996	Yes
15.	Stone Crushing Unit	GSR 742 (E), 30 th August, 1990	Yes




Air Polluting Industries for which Emission Standard Developed and Enforced by SPCB

S. No.	INDUSTRY	STANDARD NOTIFIED
01.	Aluminium Industries	GSR 742 (E), 30 th August, 1990
02.	Asbestos Products	GSR 913 (E), 24 th October, 1989
03.	Carbon Black Industries	S.O. 64 (E), 18 th January, 1988
04.	Calcium Carbide Plant	S.O. 64 (E), 18 th January, 1988
05.	Cement Industries	S.O. 393 (3), 16 th April, 1987
06.	Copper, Lead and Zinc Smelting	S.O. 64 (E), 18 th January 1988
07.	Coal Mines	Evolved by CPCB
08.	Coal Washerries	GSR 7, 27 th December, 1998
09.	Glass Industries	GSR 93 (E), 21 st February, 1991
10.	Integrated Iron & Steel	S.O. 64 (E), 18 th January, 1988



Air Polluting Industries for which Emission Standard Developed and Enforced by SPCB

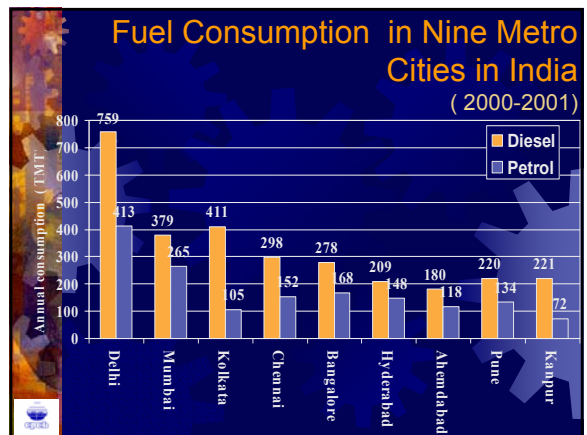
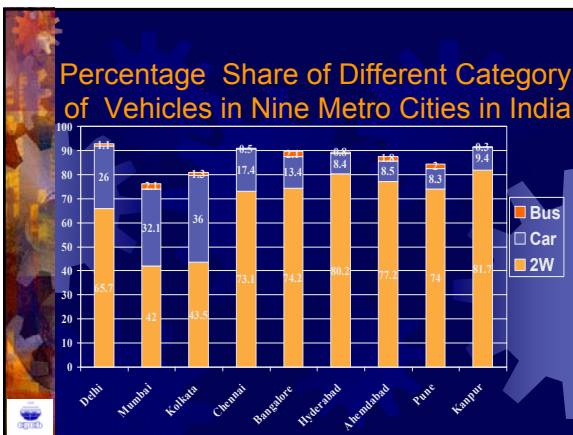
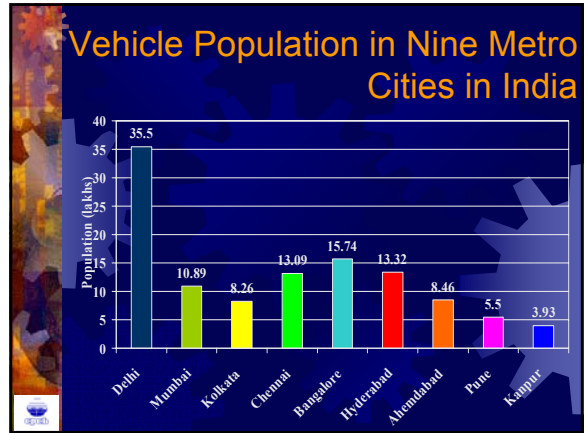
S. No.	INDUSTRY	STANDARD NOTIFIED
11.	Nitric Acid Plants	S.O. 65 (E), 18 th January 1988
12.	Oil Refineries	GSR 742 (E), 30 th August, 1990
13.	Oil Drilling and Gas Extraction Industry	GSR 176 (E) April, 1996
14.	Sulphuric Acid Plants	S.O. 64 (E), 18 th January, 1988
15.	Thermal Power Plant – Coal Based	S.O. 8 (E), 3 rd January, 1983
16.	Thermal Power Plant – Gas Based	GSR 7, 22 nd December, 1998
17.	Stand alone Coke Oven Plants	-

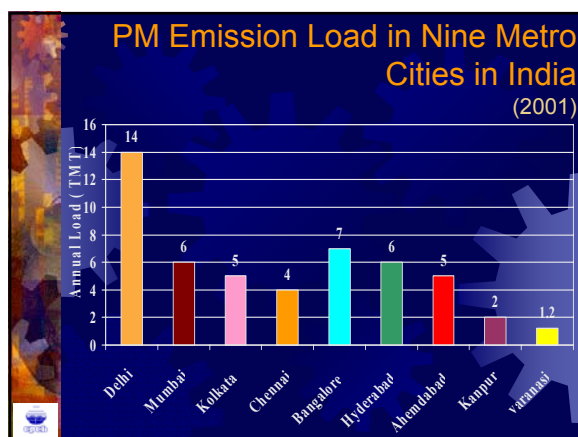
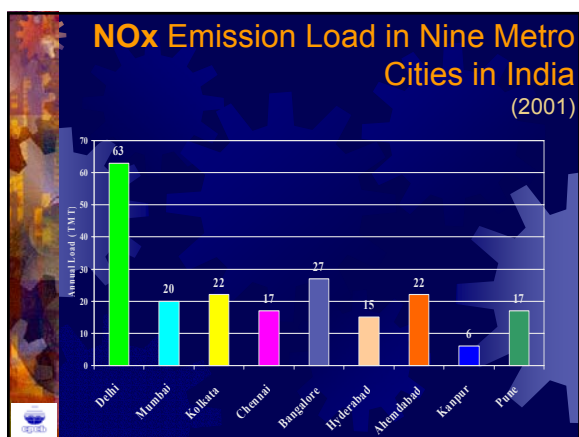
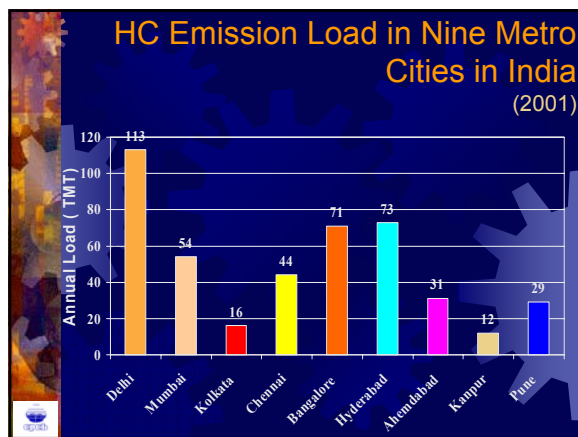
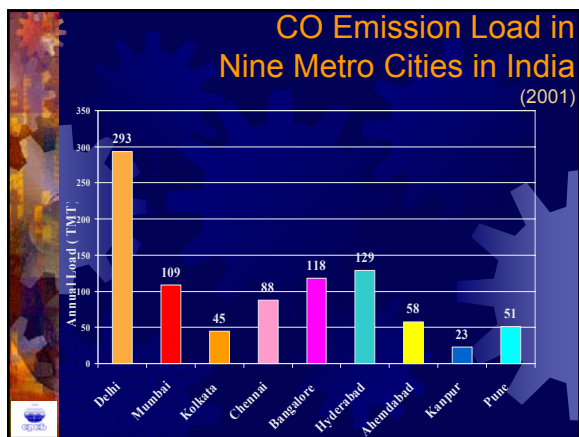


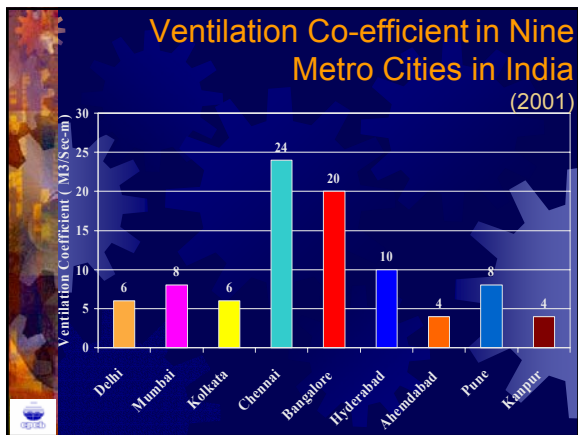
Emission Load Reduction from Major Air Polluting Industries

Name of the Industry	Present Production	Emission during Eighties	Present Emission - 2003	% Reduction
Thermal Power Plant	62,000 MW	1,76,582 MT / Day (PM)	4,374 MT / Day (PM)	97.52
Oil Refinery	123 MMTPA	2,250 MT / Day (SO ₂)	175 MT / Day (SO ₂)	92.22
Aluminium Smelter	1,905 MT / Day	35.1 MT / Day (F)	3.1 MT / Day (F)	91.17
Cement Industry	3,30,788 MT / Day	1,18,422 MT / Day (PM)	397 MT / Day (PM)	99.66

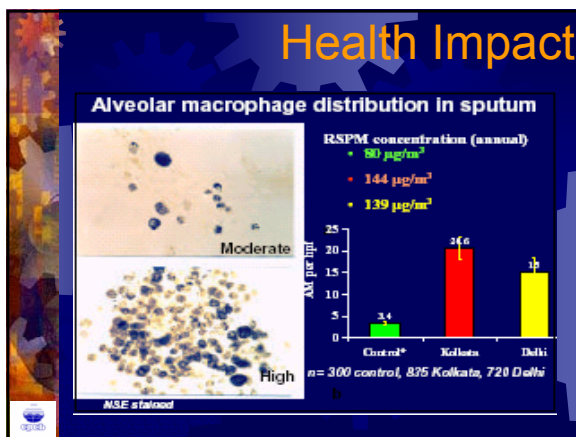
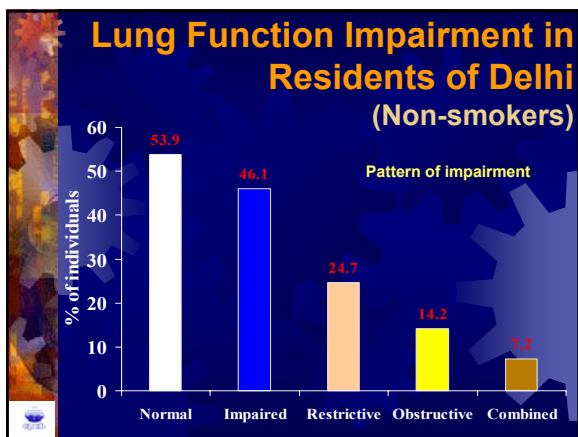
Inventory of Vehicular Emissions







- ### Epidemiological Studies Initiated by CPCB in India
1. Epidemiological Study to find the Effect of Air Pollutants especially Respirable Suspended Particulate Matter (RSPM) and other carcinogens on Human Health in Delhi – CNCI, Kolkata
 2. Study on Ambient Air Quality, Respiratory Symptoms and Lung Function of Children in Delhi – CNCI, Kolkata
 3. Effects of Environmental Pollution on the Status of Human Health of Delhi Residents – AIIMS, New Delhi
 4. Human Risk Assessment Studies in Asbestos Industries in India- ITRC, Lucknow
 5. The Environmental benefits Mapping and Analysis Program for International Applications (BenMAP - International) Training and Demonstration in India - USEPA



Ambient Air Quality Standard

National Ambient Air Quality Standards (Naaqs) (1982, 1994)

Pollutant	Time Weighted Average	Concentration in Ambient Air			Method of Measurement
		Industrial Area	Residential, Rural and other Areas	Sensitive Area	
Sulphur Dioxide (SO ₂)	Annual Average*	80 µg/m ³	80 µg/m ³	15 µg/m ³	1. Improved West and Gaeke Method 2. Ultraviolet Fluorescence
	24 Hours Average**	120 µg/m ³	80 µg/m ³	30 µg/m ³	
Oxides of Nitrogen as NO ₂	Annual Average*	80 µg/m ³	80 µg/m ³	15 µg/m ³	1. Jacob & Hochheiser modified (NaOH-NaK ₂ S ₂ O ₈) Method 2. Gas Phase Chemiluminescence
	24 Hours Average**	120 µg/m ³	80 µg/m ³	30 µg/m ³	
Suspended Particulate Matter (SPM)	Annual Average*	360 µg/m ³	140 µg/m ³	70 µg/m ³	High Volume Sampling (Average flow rate not less than 1.1m ³ /minute)
	24 Hours Average**	500 µg/m ³	200 µg/m ³	100 µg/m ³	
Respirable Particulate Matter (Size less than 5µm) (RSP)	Annual Average*	120 µg/m ³	60 µg/m ³	50 µg/m ³	Respirable Particulate Matter Sampler
	24 Hours Average**	180 µg/m ³	100 µg/m ³	75 µg/m ³	
Ozone (O ₃) (µg/m ³) (AAS Method)	Annual Average*	1.0 µg/m ³	0.75 µg/m ³	0.50 µg/m ³	AAS Method after sampling using EPM 2000 or equivalent filter paper
	24 Hour Average**	1.5 µg/m ³	1.0 µg/m ³	0.75 µg/m ³	
Carbon Monoxide (CO)	8 Hours Average**	5.0 mg/m ³	2.0 mg/m ³	1.0 mg/m ³	Non dispersive Infrared Spectroscopy
	1 Hour Average	10.0 mg/m ³	4.0 mg/m ³	2.0 mg/m ³	
Ammonia (NH ₃)	Annual Average*	0.1 mg/m ³			
	24 Hour Average**	0.4 mg/m ³			

* Annual Average: Year of 365 days. For automobiles in a year there is a week of 24 hours in winter season.
** 24 hours for a year means 24 hours for 24 days in a year. However, 24 hours for a year means 24 hours for two consecutive days.

Sensitive Areas

Sensitive area may include the following:

- 1) 10 kms all around the periphery of health resorts so notified by State Pollution Control Boards in consultation with department of public health of the concerned state.
- 2) 10 kms all around the periphery of biosphere reserves, sanctities and national parks, so notified by Ministry of Environment and Forest or concerned states.
- 3) 5 kms all around the periphery of an archeological monument declared to be of national importance or otherwise so notified A.S.I. in consultation with State Pollution Control Boards.
- 4) Areas where some delicate or sensitive to air pollution crops/important to the agriculture/horticulture of that area are grown so notified by State Pollution Control Boards in consultation with department of agriculture/horticulture of concerned state.
- 5) 5 kms around the periphery of centers of tourism and/or pilgrim due to their religious, historical, scenic or other attractions, so notified by department of tourism of the concerned state with State Pollution Control Boards.

Air Quality Monitoring

National Air Quality Monitoring (NAQM)

- Started in 1984 - 7 Station (Manual Station)
- By 2000 - Increased to 295 Stations (Operated and Maintained by SPCB /CPCB / Universities, etc. and funded by CPCB)
- Monitoring in Delhi
 - 3 Continuous AQMS
 - 2 Mobile Vans
 - 6 Manual AQMS
 - 6 Integrated Air Quality Monitoring Station being set up
- About 200 continuous stations maintained by large scale industries.

Air Quality Monitoring Parameters Monitored

Criteria Pollutants

SPM
RSPM / PM₁₀
CO

SO₂
NO_x
Pb

Specific Pollutants

Poly aromatic Hydrocarbons
Benzene / Xylene / Toluene
Ground level ozone (24 hourly, 8 hourly, 1 hourly)

Non-Attainment Areas

Observed Annual Mean Concentration of a Criterion Pollutant

Exceedence Factor = $\frac{\text{Observed Annual Mean Concentration of a Criterion Pollutant}}{\text{Annual Standard for the Respective Pollutant and Area Class}}$

The Four Air Quality Categories are:

- Critical Pollution (C): When EF is more than 1.5;
- High Pollution (H): When EF is between 1.0 - 1.5;
- Moderate Pollution (M): When EF is between 0.5 - 1.0;
- Low Pollution (L): When the EF is less than 0.5.

Air Quality Status of India During 2003


Pollutants	Industrial				Residential			
	L	M	H	C	L	M	H	C
Sulphur dioxide	98 %	2 %	-	-	98 %	2%	-	-
Nitrogen dioxide	85 %	12%	3%	-	70%	25%	5%	-
Respirable Suspended Particulate Matter	13 %	37%	28%	22%	2%	17%	28%	53%
Suspended Particulate Matter	31%	46%	18%	2%	5%	17%	26%	52%

Major Initiatives Taken for Air Pollution Control in India (DURING LAST TWO DECADES)

- Evolved National Ambient Air Quality Standards based on health impact (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 24 problem areas.
- Improvement in Vehicular Technology (Euro-I, Euro-II, 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 from 1.2.2000.

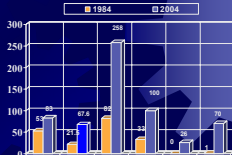
Major Initiatives Taken for Air Pollution Control in India (DURING LAST TWO DECADES)

- Pollution Under Control (PUC) certificate for all vehicles CNG - All commercial vehicles to operate on CNG in Delhi.
- Coal beneficiation/clean coal technology –notification regarding use of beneficiated coal in T.P.P.
- Pollution control in Taj Trapezium Zones (Natural gas to foundries, monitoring of air quality, etc.)
- 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.

Achievements in Air Pollution Control in Coal Based Thermal Power Plants

- Installation of Electrostatic Precipitators in place of M.D.C.
- Adoption alternate ash disposal systems such Dry disposal/ MCSD/HCS
- Use of beneficiated coal in Power Station located in critically polluted areas
- Utilisation of flyash (Nil to 26%)
- Promotion of clean coal technologies such FBC and Supercritical boilers (reduction of GHG) for power generation.



Category	1984	2004
Subcritical (1000 MW)	100	100
Subcritical (500 MW)	100	100
Subcritical (200 MW)	100	100
Subcritical (100 MW)	100	100
Subcritical (50 MW)	100	100
Subcritical (25 MW)	100	100
Subcritical (10 MW)	100	100
Subcritical (5 MW)	100	100
Subcritical (2.5 MW)	100	100
Subcritical (1.25 MW)	100	100
Subcritical (0.625 MW)	100	100
Subcritical (0.3125 MW)	100	100
Subcritical (0.15625 MW)	100	100
Subcritical (0.078125 MW)	100	100
Subcritical (0.0390625 MW)	100	100
Subcritical (0.01953125 MW)	100	100
Subcritical (0.009765625 MW)	100	100
Subcritical (0.0048828125 MW)	100	100
Subcritical (0.00244140625 MW)	100	100
Subcritical (0.001220703125 MW)	100	100
Subcritical (0.0006103515625 MW)	100	100
Subcritical (0.00030517578125 MW)	100	100
Subcritical (0.000152587890625 MW)	100	100
Subcritical (0.0000762939453125 MW)	100	100
Subcritical (0.00003814697265625 MW)	100	100
Subcritical (0.000019073486328125 MW)	100	100
Subcritical (0.0000095367431640625 MW)	100	100
Subcritical (0.00000476837158203125 MW)	100	100
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Achievements in Air Pollution Control From Oil Refineries

Oil Refineries in India: Overview

- 17 petroleum refineries of various size, age and product ranges having crude throughput capacity of about 123 Million Metric Tonnes per Annum (MMTPA)
- Smallest (Digboi – 0.65 MMTPA) and largest (Jamnagar – 27 MMTPA) operating refinery in the world
- Phenomenal growth – Refining capacity increased from 30 MMTPA in 1980 to 123 MMTPA in 2004
- Technological upgradation in refining processes during the last decade for providing improved fuel quality (Hydro desulphurization unit, unleaded petrol, low Benzene Petrol etc.)



Achievements in Air Pollution Control from Oil Refineries

Existing Pollution Control Scenario

- Emission standards (notified in 1986) cover emissions of Sulphur Dioxide (SO₂) only
- Refineries emit about 175 tonnes / day of SO₂
- Minimizing SO₂ emissions – Option in use are: (i) Blending of crude; (ii) Use of low sulphur fuels; (iii) High efficiency SRU (+99%); and (iv) Adequate Stack Height

Recent Initiatives

- Emission standards being revised to include additional parameters viz. NO_x and VOCs, Leak Detection and Repair (LDAR) programme being incorporated to reduce fugitive emissions of VOCs.
- Continuous improvement in the fuel quality (Sulphur in diesel 2500 ppm to 350 ppm)
- Improvement beyond regulatory compliance (CREP)



Road Map for Industrial Pollution Control

(Formulation Of Charter On Corporate Responsibility For Environmental Protection For 17 Categories Of Industries)

Major Action Points:

Aluminium Industry

- Revision of fluoride emission standard by Dec 2005 and 2010.
- Phasing out of wet scrubbing system for fluoride by Dec 2006.
- Allowing new poltines only with pre baked technology.

Cement Industry

- Augmentation of existing pollution control devices.
- Plant located in critically polluted areas or urban areas to meet PM emission standard of 100mg/m³ Load based standard for Cement Kiln.



Road Map for Industrial Pollution Control

(Formulation Of Charter On Corporate Responsibility For Environmental Protection For 17 Categories Of Industries)

Major Action Points:

Chlor- Alkali Industry

- Total mercury released to environment at 2gm/t of product by Dec2005
- Switch over to membrane cell technology in a time bound manner.

Copper Industry

- To meet SO₂ emission limit (2kg/tonne of H₂SO₄ produced). 50 mg/Nm³ of acid mist by December 2005.

Dyes & Dye intermediates

- Minimisation of loss of VOC (Solvent recovery of at least 90%)
- Scrubbing system for SO₂ & NO_x emissions to be upgraded by July 2003





Road Map for Industrial Pollution Control

(Formulation Of Charter On Corporate Responsibility For Environmental Protection For 17 Categories Of Industries)

Fertilizer Industry:


- All upcoming urea plant to have urea prilling towers based on natural draft to minimize urea dust emission.
- The existing urea plants with forced draft prilling towers will have to install appropriate dust control system by June 2003.
- Sulphuric acid plants SCSA system to DCDA system by March 2004.

Integrated Iron & Steel:

- Reducing fugitive emissions in coke oven plants & steel melting shop by December 2005 & March 2008 respectively.
- Direct injection of reducing agent in blast furnace.

Oil refineries:

- All refineries located in critically polluted areas to submit action plan for phase wise reduction of SO₂ emission.
- Future refineries to have sulphur recovery units with minimum 99 % efficiency.
- New refineries to install low NOx burners.



Road Map for Industrial Pollution Control


(Formulation Of Charter On Corporate Responsibility For Environmental Protection For 17 Categories Of Industries)

Pesticide Industry:

- For air pollution control from process, scrubber efficiency to be more than 90%.
- Industry to adopt standard engineering practices for control of fugitive emissions.
- Hazardous waste Incinerators to be upgraded to meet CPCB norms.

Petro- Chemicals Industry

- Action Plan to be submitted for improving thermal efficiency & Control of NOx and handling of halogenated organics.
- Fugitive emissions of carcinogenic compounds to be controlled by closed vapours collection & recovery system.



Road Map for Industrial Pollution Control

(Formulation Of Charter On Corporate Responsibility For Environmental Protection For 17 Categories Of Industries)

Pharmaceuticals Industry


- Control of hazardous air pollutants & odorous compounds by Dec 2004.

Pulp & Paper Industry:

- Installation of odor control system within four yrs.

Sugar Industry:

- To install ESP/ bag filter/ high efficiency scrubber to comply with standard of 150 mg/nm³.



Road Map for Industrial Pollution Control

(Formulation Of Charter On Corporate Responsibility For Environmental Protection For 17 Categories Of Industries)

Thermal Power Plants:

- Implementation of environmental standards in non-compliant power plants by Dec 2005.
- New Expansions power plants to meet PM standard of 100 mg/nm³.
- Development of SO₂, NOx, mercury & other toxic heavy metal emission standard by Dec 2005
- Review of stack height requirement based on micro metrological data.

Zinc Industry:

- Meeting SO₂ emission limit (2 kg/tonne of H₂SO₄ produced), 50 mg/nm³ of acid mist by Dec 2006.

Vehicular Pollution Control Initiatives

Norms	Cities of Implementation	Implementation
1991 emission norms	Throughout the country	1.4.1991/92
1996 emission norms	Throughout the country	1.4.1996
Cat converter norms (for passenger cars)	45 cities	1.10.1998
India stage 2000 norms	Throughout the country	1.4.2000
Bharat stage-II norms	11 cities	2000-2003
	Throughout the country	1.4.2005
Bharat stage-III norms	11 cities	1.4.2005
	Throughout the country	1.4.2010
Bharat stage-IV norms	11 cities	1.4.2010
	Throughout the country	To be decided

Measures for Controlling Vehicular Pollution

New Vehicles

Vehicular technology:

- Upgrade Vehicular technology to meet stricter emission norms.

Fuel quality:

- Improvement in the fuel quality to meet stricter emission norms and meet with vehicular technology.

Alternate Fuels:

- Use of Alternate fuels like CNG/LPG/ Battery etc.

Measures for Controlling Vehicular Pollution

In-Use Vehicles

- Regular maintenance of the vehicles to meet PUC norms.
- Inspection & Maintenance Programme
- Phasing out of grossly polluting vehicles.
- Use of pre-mixed 2-T oil.
- Use of ethanol blended Fuel, bio-diesel, additives.
- Traffic management
- Use of Efficient Public Transport system.
- Use of fiscal measures.

Emission Norms for Passenger Cars

Norms	CO (g/km)	HC+ NO _x (g/km)
1991Norms	14.3-27.1	2.0(Only HC)
1996 Norms	8.68-12.40	3.00-4.36
1998Norms	4.34-6.20	1.50-2.18
India stage 2000 norms	2.72	0.97
Bharat stage-II	2.2	0.5
Bharat Stage-III	2.3	0.35(combined)
Bharat Stage-IV	1.0	0.18(combined)

Emission Norms for Heavy Diesel Vehicles

Norms	CO (g/kwhr)	HC (g/kwhr)	NOx (g/kwhr)	PM (g/kwhr)
1991 Norms	14	3.5	18	-
1996 Norms	11.2	2.4	14.4	-
India stage 2000 norms	4.5	1.1	8.0	0.36
Bharat stage-II	4.0	1.1	7.0	0.15
Bharat Stage-III	2.1	1.6	5.0	0.10
Bharat Stage-IV	1.5	0.96	3.5	0.02

Diesel Specification in India

YEAR	1996	2000	2005	2010
Cetane No, Min	45	48	48	51
Sulphur % W/w, Max	0.50	0.25 0.05 (METRO)	0.05	0.035
Distillation T95	-	370	370	360
Polyaromatic	-	-	-	11

Gasoline Specification in India


	35-70	-	35-60	60
RVP at 38deg.c,kpa				
BENZENE %by Vol.,Max	5.0	5.0 3.0 (metros)	3.0 (all) 1.0 (metro)	1.0
Lead G/m3, Max	0.15%(low pb) 0.013%(unleaded)	0.013	0.013	0.005
Sulphur %by Mass,max	0.10(unleaded)	0.10	0.05	0.015
Aromatics % v/v., Max	-	-	45	42
Oxygen %by Vol.,max	-	-	2.0	2.7

Present and Proposed Emission Norms for in-use Vehicles

S.No	Vehicle type	Present		Proposed	
		CO %	HC (ppm)	CO %	HC (ppm)
1	2 Wheelers (2/4 stroke) & 3 wheelers (Pre year 2000)	4.5	-	4.5	9000
2	2 Wheelers (2-stroke) & 3 wheelers (Post year 2000)	4.5	-	3.5	6000
3	2 & 3 Wheelers (4 stroke) (Post year 2000)	4.5	-	3.5	4500
4	4 wheeler vehicles (Post year 2000) (Petrol/ CNG/LPG)	3.0	-	3.0	1500
5	Bharat Stage-II compliant Passenger cars/CNG Buses/ LPG (Fitted with 3 way closed loop catalytic converter)	3.0	-	0.5	750


Road Map for In-Use / Old Vehicles for the Entire Country

- **New PUC Checking System for all categories of vehicles**
To be put in place by 1.4.2005.
- **Inspection & Maintenance (I&M) System for all categories of vehicles**
To be put in place by 1.4.2010.
- **Performance checking system of catalytic converters and conversion kits already installed in vehicles**
To be put in place by 1.4.2007.
- **Augmentation of city public transport system**
To be undertaken by the local authorities /State Governments Corporations immediately and completed by 1.4.2005.



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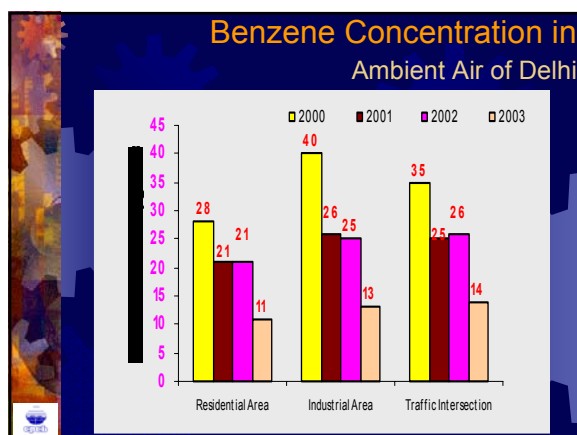
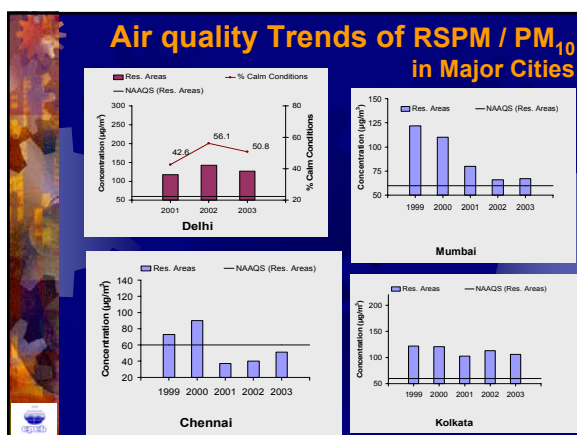
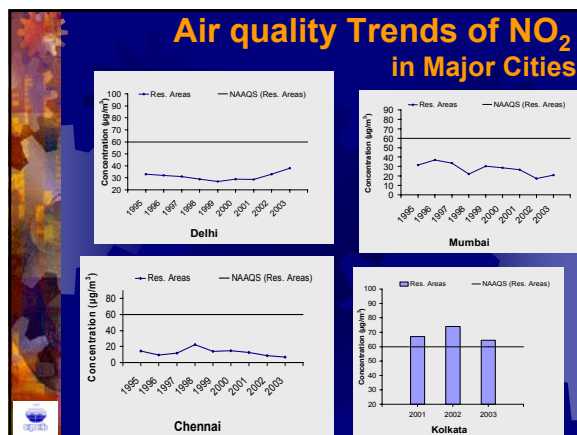
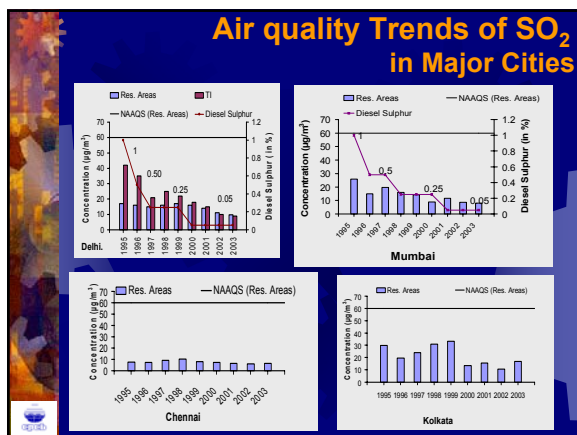
Road Map for In-Use / Old Vehicles for the National Capital Territory of Delhi (NCT)

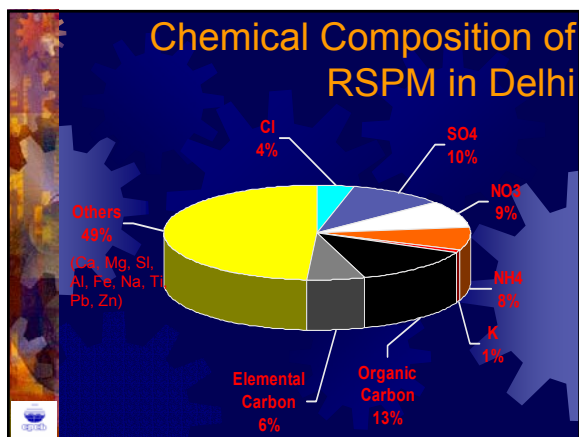
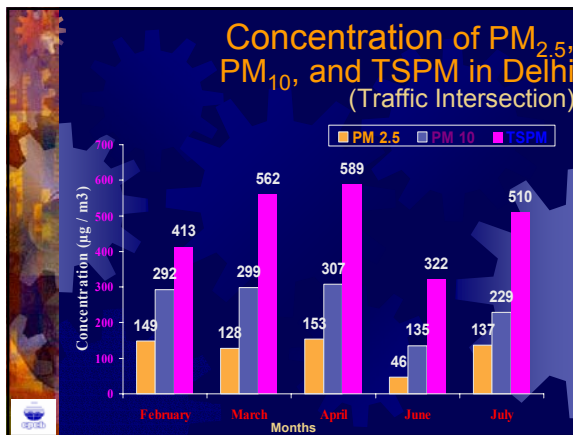
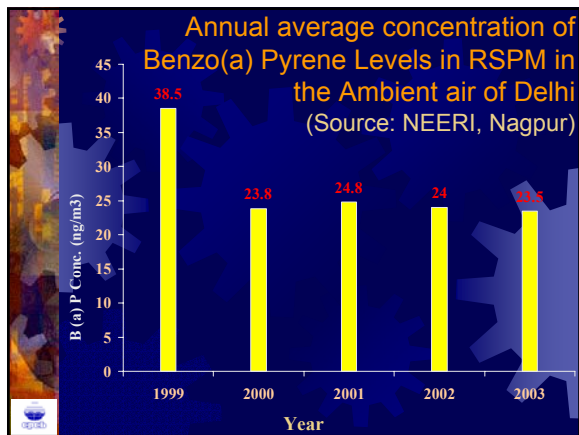
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To be put in place by 1.4.2005.
- **Performance checking system of catalytic converters and conversion kits already installed in vehicles**
To be put in place by 1.10.2004.



Impact of Steps taken for Air Pollution Control on Ambient Air Quality







Delhi: Air Quality Improvement Plan (AQIP) Chronology of Actions

1994-95: Transport

- Introduction of Catalytic Converters and Unleaded petrol

1996: Transport & Industry

- Fuel Quality: 0.5% S diesel introduced
- CNG vehicles and catalytic converters for government petrol vehicles, excluding public transport introduced (but unsuccessful)
- Closure of 168 hazardous industries, including stone crushers completed
- Lower Sulphur content in coal (0.4% S) and oil for industrial use (1.8%) introduced

1997: Industry

- Relocation of 513 industries
- 337 hazardous category industries shifted (total of 1160 industries closed or relocated including hot mix plants, arc induction furnaces, brick kilns)

Conti...

Delhi: Air Quality Improvement Plan (AQIP)
Chronology of Actions

1998: Transport

- Supply of only premix petrol in all petrol filling stations to two stroke engine vehicles; ban on supply of loose 2T oils
- Phasing out/ban on old commercial/transport vehicles (>15 yrs)
- Start of major construction program: flyovers plus the Delhi metro

1999: Transport

- Registration of only EURO II 3-wheelers and diesel taxis
- Restricting the plying of goods vehicles during the day
- Diesel sulphur reduced to 0.25%

Conti...

Delhi: Air Quality Improvement Plan (AQIP)
Chronology of Actions

2000: Transport, Industry & Urban

- Diesel and gasoline sulphur reduced to 0.05% in selected outlets
- Replacement of all pre-1990 3-wheelers and taxis with new vehicles on clean fuels
- All private 4-wheeled vehicles to conform to Euro II
- Buses more than 8 Yrs phased out or to ply on CNG
- The three coal based power plants to switch over to beneficiated coal
- Piped NG by March 2000 to 1311 domestic, 9 small, and 3 large commercial establishments Conti...

Delhi: Air Quality Improvement Plan (AQIP)
Chronology of Actions

2001: Transport, Industry & Urban

- Replacement of all post-1990 3-wheelers and taxis with new vehicles on clean fuels
- Sulphur content in diesel further reduced to 0.05% in select outlets
- Number of CNG vehicles as follows: 14000 3-w; 2200 taxis; 400 buses; 250 RTVs; 9500 private (26350 total)
- Piped NG by March to 2821 domestic, 15 small and 5 large commercial establishments
- Hazardous Industry closure continues: total of 3538 closed

Conti...

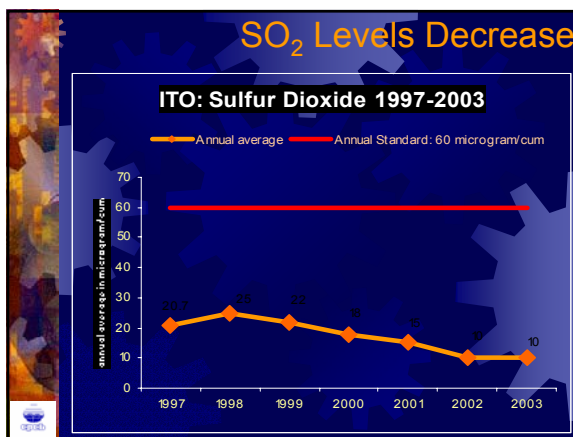
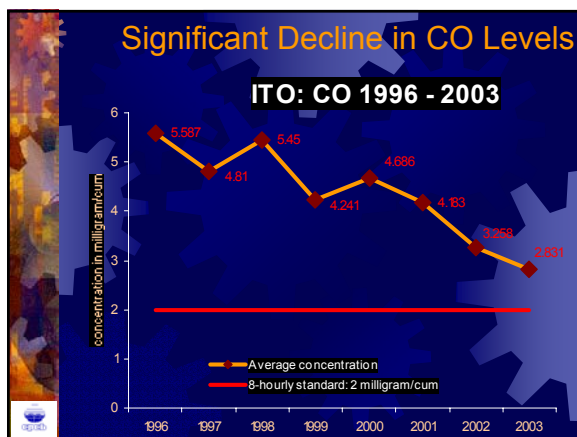
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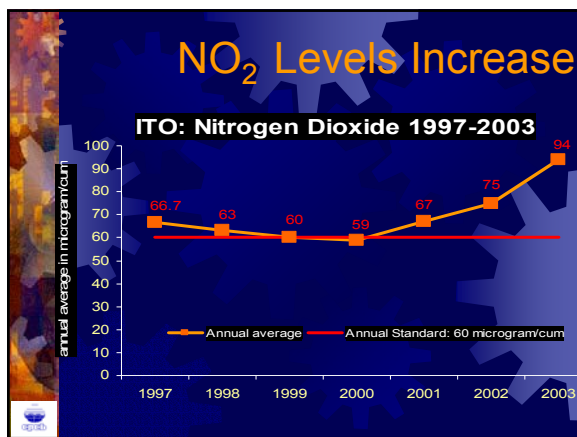
2002: Transport & Urban

- 94 CNG stations setup up to March
- All diesel buses phased-out / converted to CNG.
- Number of CNG vehicles as follows: 35678 3-w; 4816 taxis; 4231 buses; 2165 RTVs; 10350 private (57240 total)
- Piped NG by March to 4111 domestic, 37 small, and 5 large commercial establishments
- 16340 non-destined good vehicles turned away from entering Delhi between July and November

Delhi

Emission Norms	
Norms	Year
1996 norms	1996
1998 norms (Cat-Con Norms)	1998
India Stage-I (Euro-I)	1999
Bharat Stage-II (Euro-II)	2000/01
Fuel Quality	
Quality	year
0.5% S diesel	1996
0.25% S diesel	1999
0.05% S diesel	2001/02
Unleaded petrol	1998
Low Smoke 2T oil	1998
Other measures	
CNG Vehicles	80,000 (2002)
Pre-mixed 2 T oil	1996
Phasing out of 15 year old vehicles	1998





- ### Emerging New Areas for Air Pollution Control in India
1. Development of Air Quality Standards / Guidelines for Hazardous Air Pollutants (HAP)
 2. Development of Low Cost ash removal technology from Coal and promotion of Clean Coal Technologies (IGCC, PFBC, etc.)
 3. Technology for reduction of Fluoride emission (primary & Secondary) from pot room of Aluminium Industries using Soderberg Technology.
 4. Development of NO_x control Standard for Thermal Power Plants and Refineries.
 5. Prevention and control of Fugitive Emission in Cement Industry, development of good practice guidelines.
 6. Use of high calorific value Hazardous Waste including Petroleum Coke in Cement Kiln.
- Contd..**

- ### Emerging New Areas for Air Pollution Control in India
7. Low Cost Flue Gas Desulphurisation Technology for Thermal Power Plants.
 8. Technology Development of Fugitive Emission Control from Coke Oven Plants of Iron & Steel Industry (PLL,PLD).
 9. Detoxification and destruction of high COD waste of Pesticide Industry – Guidelines for Incinerator.
 10. Development of Technology and Standard to control emission of VOC, Methyl Chloride, P₂O₅, HCl etc. from Pesticide Industry.
 11. Development of Odor Control Technology for Paper & Pulp industry and Standardization the method of odor measurement.
 12. Fluidized Bed Combustion (FBC/CFBC) technology for Solid Fuel containing Higher Ash.
- Contd..**

- ### Emerging New Areas for Air Pollution Control in India
13. Indigenous Development of continuous monitoring system for PM, PM₁₀, NO_x, HC.
 14. Development of Technology for low cost Catalytic Converter.
 15. Technology for NO_x / HC control from large Stationary Diesel Engine.
 16. Development of improved design of Incinerators for Hazardous Waste.
 17. Studies on Emission of Fine Particulate Matter (PM_{2.5}) from Engine using LPG,CNG,Low Sulphur Diesel, Low Sulphur Petrol etc. and development of Emission Factor for the same.
 18. Source Apportionment Study for Fine Particulate Matter (PM₁₀, PM_{2.5}) in major cities
 19. Technology for Mercury Emission Control from Thermal Power Plants.
- Contd..**

Emerging New Areas for Air Pollution Control in India

20. Development of Methodology for measurement of hazardous Organic Compounds.
21. Development of Calibration Laboratory for Calibration of Air Quality Analyzers in Regional Labs. Of NEERI/CPCB.
22. Noise and Emission Control System for Small DG Sets (<200 KW)
23. Development of Stack Height Guidelines for Thermal Power Plants and Industries using ventilation co-efficient of different regions in the country.

Potential Areas for Carbon Emission Reduction in India

- Super critical boilers for power generation.
- Atmospheric fluidized bed combustion (A.F.B.C.) for power generation.
- Integrated Gasification Combined Cycle (I.G.C.C.) for coal gasification and power generation.
- Direct reduction of Iron Ore (D.R.I.) for steel making.
- Dry quenching of Coke for Coke preparation.
- Basic Oxygen Furnace (B.O.F.) for steel making
- Ultra high power electric arc furnace.
- Dry precalcination kilns for clinker production in Cement Industry.
- Dry suspension preheater kilns.

Contd...

Potential Areas for Carbon Reduction in India

- Cogeneration of power in sugar industry.
- Combined cycle power plants in Gas based power station.
- Diesel Engine based power plants close to load centres.
- Use of beneficiated Coal.
- Energy efficiency in Caustic Soda, Cement and Aluminium production.
- T & D loss reduction in power generation.
- Euro III / Euro IV vehicles for vehicular pollution control.
- More use of fly ash , BF Slag in cement making
- Use of alternative fuels in cement kilns.
- Exploitation & utilization of Coal – Bed - Methane

Recommendation for Improvement of Air Quality in India

1. Major thrust should be given to control of Air Pollution from large number of Small Scale Air polluting industries.
2. Development and Enforcement of Ambient Air Quality Standard for Hazardous Air Pollutants (HAP).
3. Development of Emissions Standard for Toxic Air Pollutants for Pesticides, Pharmaceutical and Dye & Dye Intermediate Industry.
4. List of Critically Polluted areas to be reviewed and new areas like Cuddalore, Mangalore, Panipat etc to be included.
5. Clean Coal Technologies to be promoted specially use of beneficiated coal for power generation.
6. Air Pollution from coal based power plant specially SO₂, NO_x, Hg & F emission should be given priority as power generation is going to be increased from 120, 000 MW to 1,500,000 MW by 2050.

Contd...

Recommendation for Improvement of Air Quality in India

7. NO_x, CO & HC emission from small generating sets to be assessed and controlled.
8. Inspection and Maintenance system for in use vehicles to be augmented.
9. Source Apportionment Studies (SA) which has been initiated for 6 cities should be done for other cities where air quality is exceeded.
10. Continuous Air Quality Monitoring Stations installed by industries (around 200 nos.) should be included in CPCB monitoring network after proper calibration of analysers.
11. Regional Calibration Laboratories for Air Quality Monitoring instruments to be setup.
12. Impact of Implementation of EURO III / Bharat Stage III emission and fuel quality norms on Air Environment to be assessed in terms of pollution load reduction.
13. Fuel adulteration to be checked and periodic sampling of fuel samples to be sent to Independent Fuel testing laboratory.



Thank
You