

# Emission Inventory in India



**Central Pollution Control Board  
(National Implementing Agency)  
Ministry of Environment & Forests  
(National Focal Point)  
Govt. of India  
New Delhi**

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**Presentation in Training Workshop on Emission Inventory, Emission Scenario and Modeling under Malé Declaration held from Jan 28<sup>th</sup> to 1<sup>st</sup> Feb 2008 at UNEP RRCAP, Pathumthani, Thailand.**



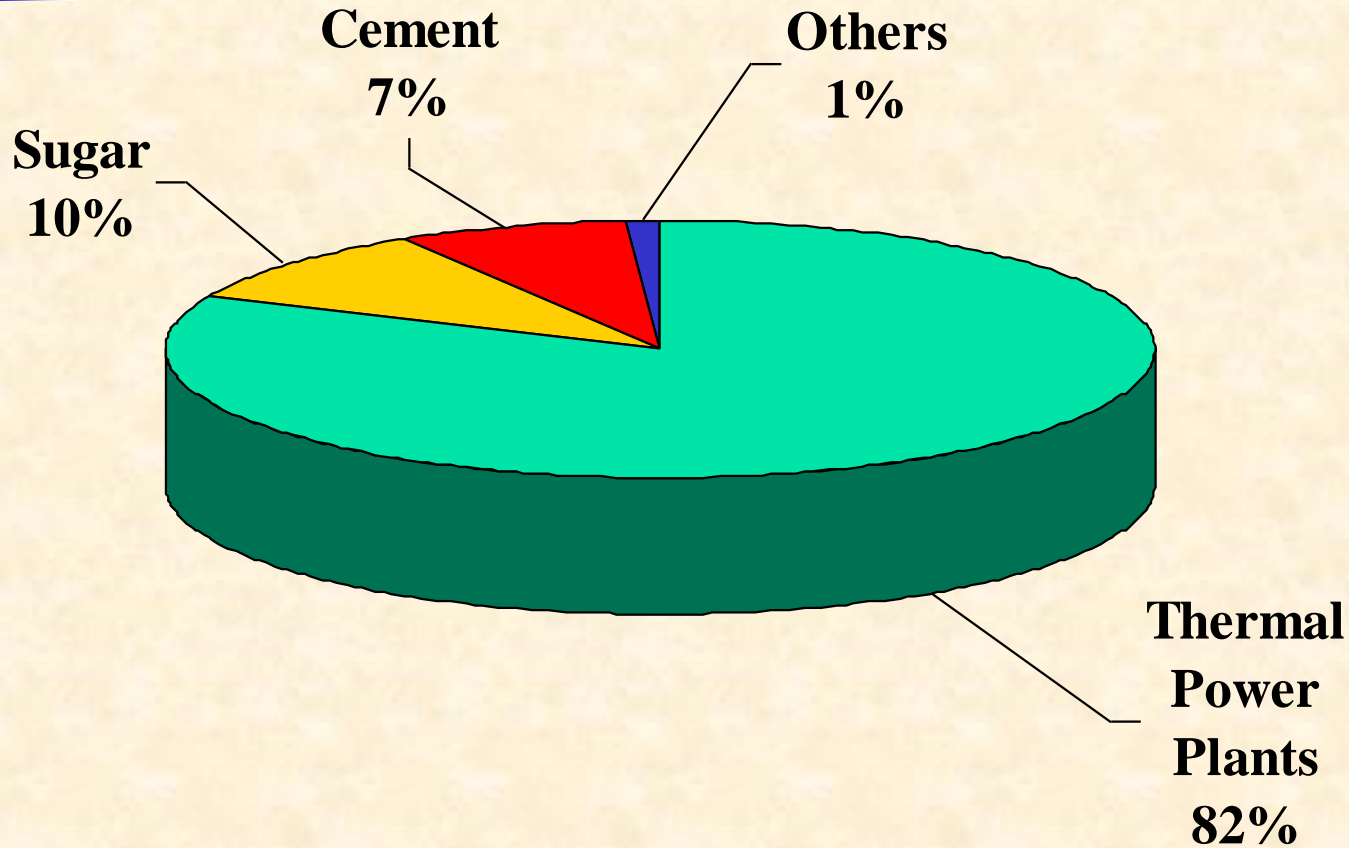
# Progress Since Last Intergovernmental Meeting

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## Monitoring

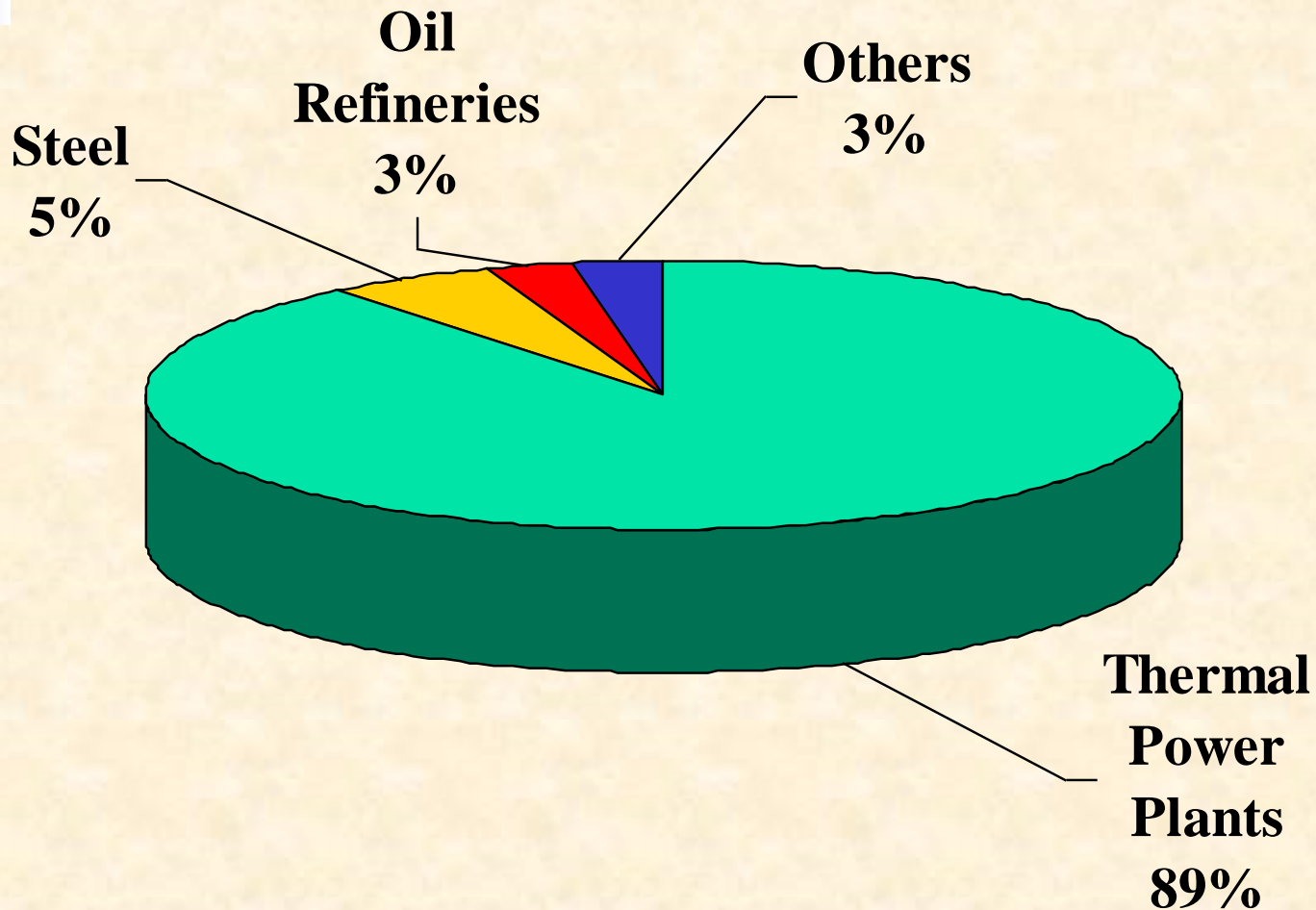
- **Parameters –**
  - **SO<sub>2</sub>, NO<sub>2</sub>, RSPM monitoring being continued at Sunderbans**
  - **Planning to initiate ozone monitoring and meteorological data of IMD station at Sunderbans**
  
- **No. of Stations**
  - **Discussions being held with SPCBs/PCCs to increase no. of stations in bordering areas**
  
- **Advisory Committee revised**
  
- **Awareness**
  - **Data of Sunderbans is entered in online software Environmental Data Bank of CPCB**
  - **Information and link to Male' Declaration displayed on CPCB website.**

# Industrial Emission Inventory



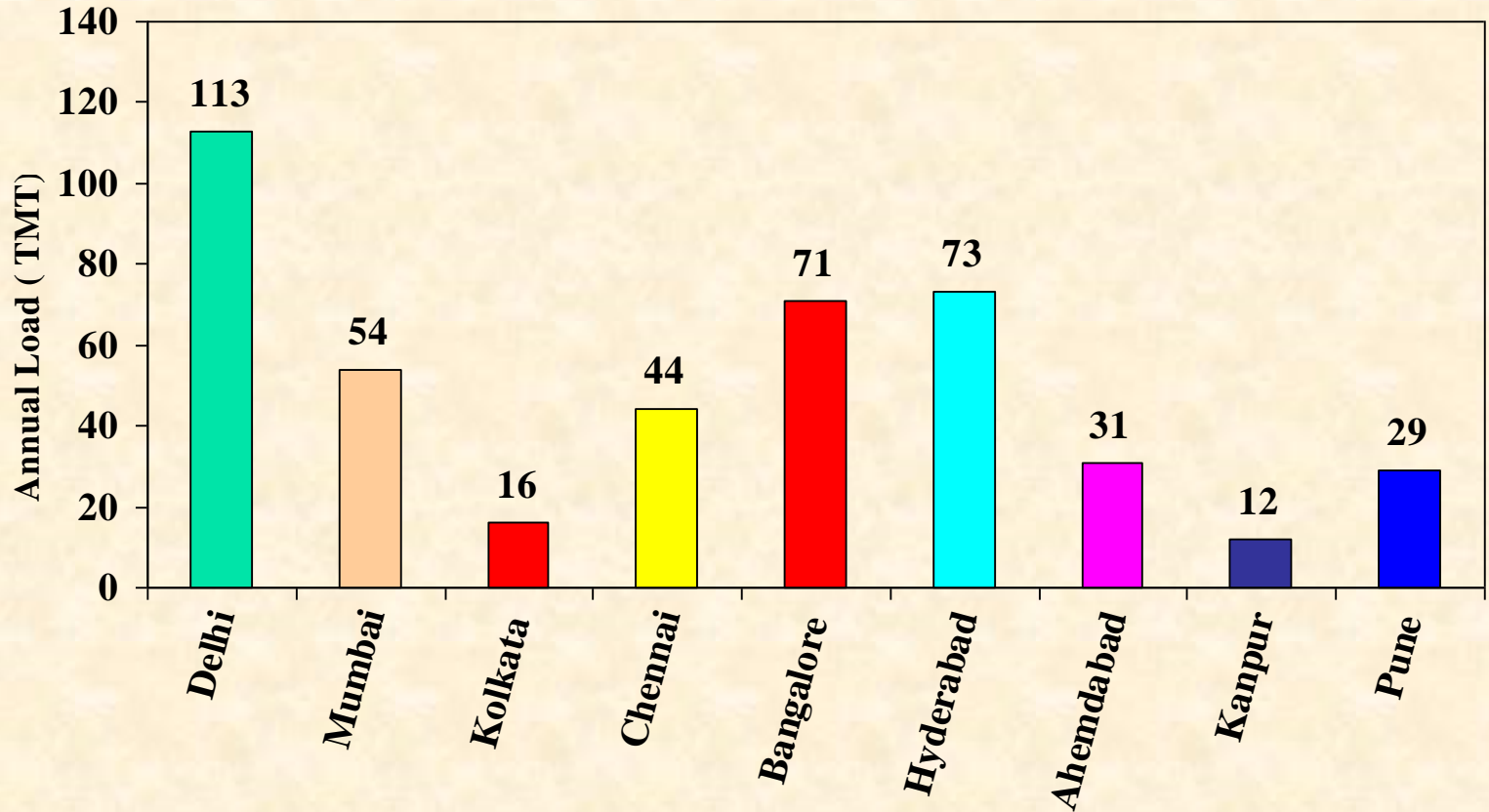
**Particulate Matter from Different Categories of Industries**

# Industrial Emission Inventory (contd.)



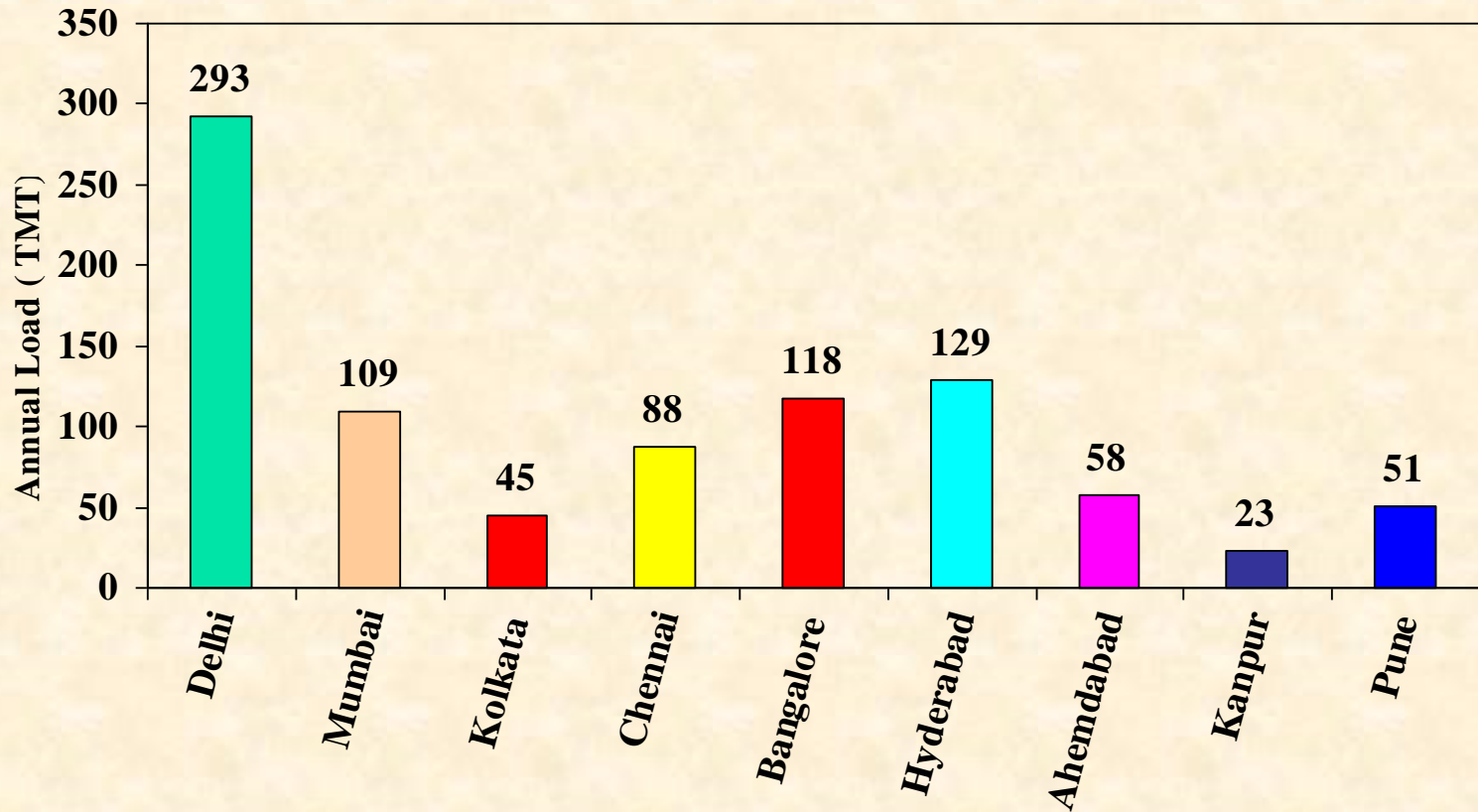
**Sulphur Dioxide from Different Categories of Industries**

# Vehicular Emission Inventory



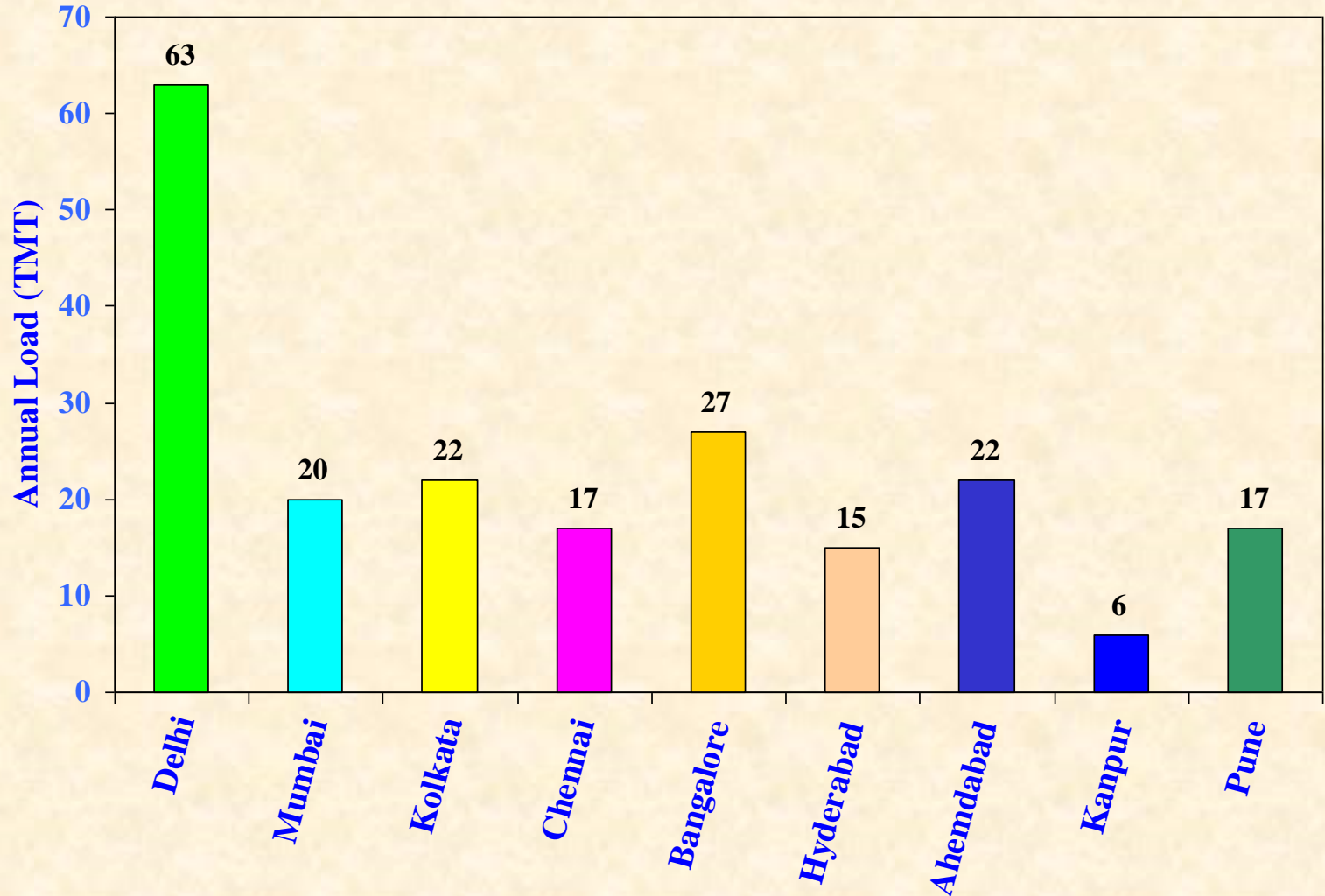
**HC emission load in Nine Metro cities in India**

# Vehicular Emission Inventory (contd.)



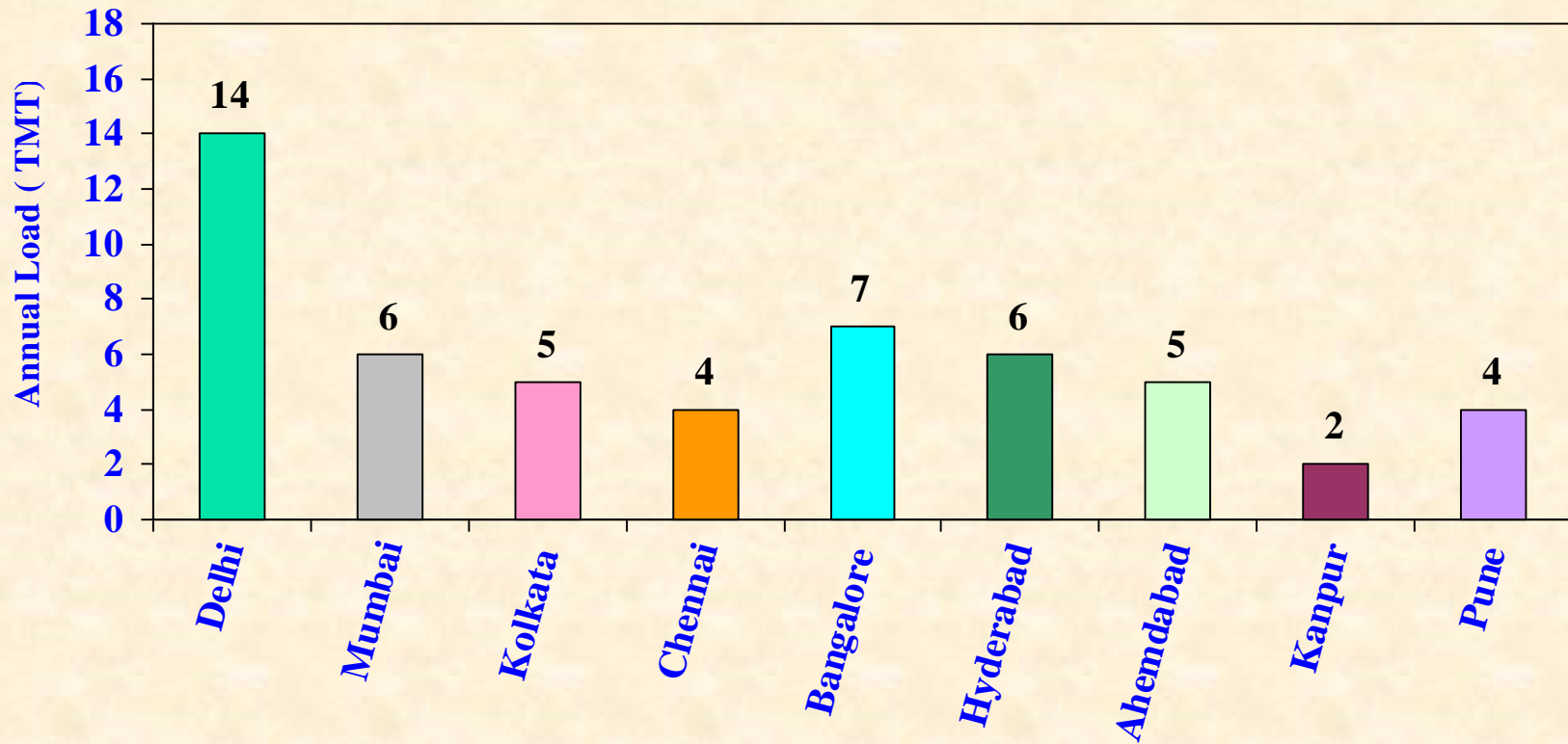
**CO emission load in Nine Metro cities in India**

# Vehicular Emission Inventory (contd.)



**NOx emission load in Nine Metro Cities in India**

# Vehicular Emission Inventory (contd.)



**PM emission load in Nine Metro Cities in India**





# Methodology

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$$P(i,y) = \sum (j) \sum (ky) N(j,ky) KT(j) DF(i,j,ky) EF(i,j,ky).10^{-9}$$

Where

**P(i,y)** - annual emission of pollutant **i** in year **y** (thousand tonnes per year)

**N(j,ky)** - number of vehicles of a particular type **j** and age **ky** in year **y**

**KT (j)** - kilometers traveled for a type of vehicle **j**, km/year

**DT(i,j,ky)** - Deterioration factor for component **i** in vehicle type **j** and age **ky** in year **y**

**EF(i,j,ky)** - Emission factor for component **i** in new vehicle type **j** and age **ky** in year **y**, gm/km

**i** –pollutant component

**j** – type of vehicle

**ky** – age of vehicle in year **y**

Source: Transport Fuel Quality for Year 2005, CPCB Report



# Source Apportionment in Six Cities

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- **Cities:- Delhi, Mumbai, Chennai, Bangalore, Kanpur and Pune**
  
- **Scope of Work**
  - **Source Apportionment of PM<sub>10</sub> and PM<sub>2.5</sub> using CMB model**
  
  - **Development of Emission Factors for Vehicular Sources**
  
  - **Development of Source Profiles for Vehicular Sources**
  
  - **Development of Source Profiles for Non-vehicular Sources**
  
  - **Emission Inventory for line, point and area sources**
  
  - **Source Dispersion Modeling- to analyse impact of various control options**
  
  - **Final Outcome – Detailed road-map , short term and long term measures based on cost-effectiveness analysis**



# Emission Inventory

- Identify sources of emission under broad categories of point, area and line sources
  - Parameters – PM<sub>10</sub>, PM<sub>2.5</sub>, CO, SO<sub>2</sub>, NO<sub>x</sub>, HC
  - Collection of secondary data on industrial, domestic, commercial, vehicular emissions etc
  - Collection of primary data on different types of vehicles, average distance traveled etc.
  - Primary data collection on various industrial, domestic and commercial sources for zone of influence ( 2km x 2km) around each monitoring stations
  - EF – vehicles – ARAI study, other sources – common EFs based on literature survey.
  - City level emission inventory based on secondary data will be refined based on data generated from primary surveys
  - Study under progress



# Draft Emission Factors for Indian Vehicles

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- In-use vehicles of different vintages (Viz, 1991-96, 1996-2000, Post 2000 and Post 2005) were included in the test matrix to understand the effect of technology, fuels on emission factors and give appropriate representation to all kinds of vehicles plying on Indian roads
- The project involved Exhaust Emission testing of in-use 2 Wheelers, 3 Wheelers, Passenger Cars, LCVs and HCVs on Chassis dynamometer.
- The committee decided to adopt the Indian Driving cycle for 2-W, 3-W and Pre-2000 4W. Modified Indian Driving cycle was used for testing for post-2000 4W.
- Parameters measured were CO, HC, NO<sub>x</sub>, CO<sub>2</sub> and PM, emissions of PAH, Benzene, 1,3-Butadiene, Aldehydes and Ketones and expressed in mg/km.
- Draft Emission Factors put on CPCB website for comments.



# Source Profiling of Vehicular Emissions

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- **Source Profiling of Vehicular Emissions**
- **Vehicle matrix based on engine technology, vintage and fuel type**
- **Mass Emission tests on each vehicle**
- **Gravimetric analysis and chemical characterization of particulate matter (elements, OC, EC, ions, molecular markers)**
- **Study under progress**



# Source Profiling of Non-vehicular Sources

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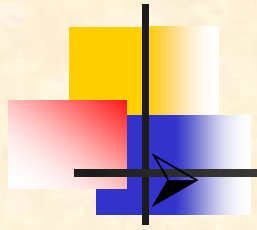
- Identified ~45 sources including city specific sources where source apportionment study is being carried out ( eg. Kerosene combustion, paved road dust etc.)
- Sampling and analysis of combustion and non-combustion sources
- Chemical analysis of samples collected
- Source Profile database development
- Study under progress



# Emission Inventory under Malé Declaration

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- Emission inventory under Malé Declaration is being carried out for SO<sub>2</sub>, NO<sub>x</sub>, PM<sub>10</sub>, PM<sub>2.5</sub>, NH<sub>3</sub>, CO, NMVOCs using Malé Declaration emission inventory manual
- Data collection under progress



**Thanks**