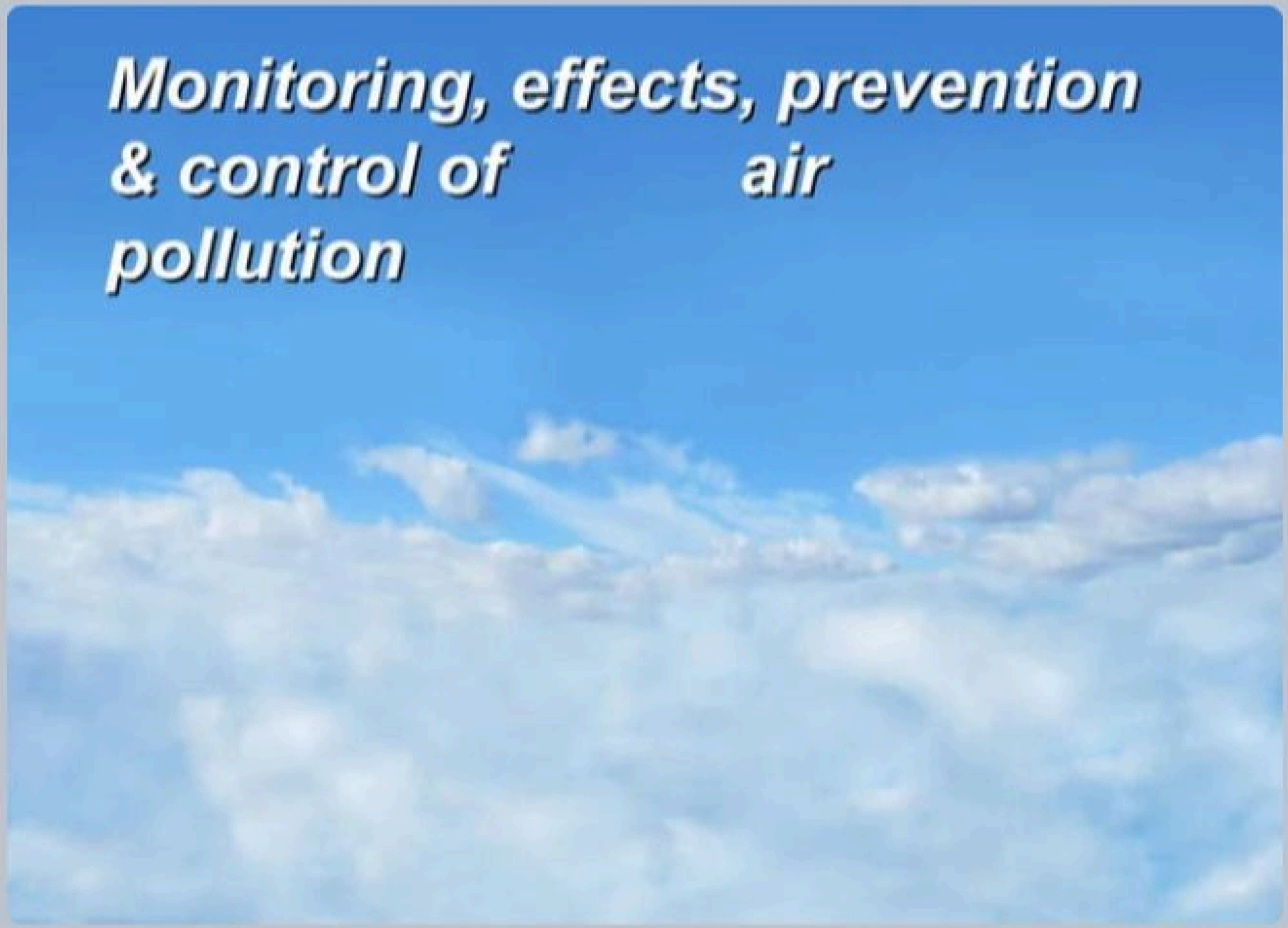

Monitoring, effects, prevention
& control of air
pollution

Monitoring of air pollution

- Monitoring is done to keep a track on quality of air with a view to collect information & improve it.
- The best indicators are – SO_2, smoke & suspended particles.
- These are monitored on a daily basis and the results are collected by a central agency

1) SO_2- Major contaminant in urban & industrial areas which is measured by colorimetry, conductivity, coulometry & amperometry.

2) Smoke index- A known volume of air is filtered through a white filter paper under specified conditions & the stain is measured by photoelectric meter & expressed as µg/m3 of air.

3) Grit & dust measurement – Deposit gauge collect grit, dust & other solids which are analysed monthly.

4) Haze- It is traditionally an atmospheric phenomenon where dust, smoke and other dry particles obscure the clarity of the sky.

•**5) Air quality index –** It is an index (that is, a numerical value or ratio derived from a series of observations) for reporting daily air quality.

•It tells us how clean or polluted our air is, and what associated health effects might be a concern for us.

•AQI calculated for five major air pollutants regulated by the Clean Air Act: ground-level ozone, particle pollution (also known as particulate matter), carbon monoxide, sulfur dioxide, & nitrogen dioxide.

Air Quality Index (AQI) Values	Levels of Health Concern	Colors
When the AQI is in this range:	*...air quality conditions are:*	*...as symbolized by this color:*
0 to 50	Good	Green
51 to 100	Moderate	Yellow
101 to 150	Unhealthy for Sensitive Groups	Orange
151 to 200	Unhealthy	Red
201 to 300	Very Unhealthy	Purple
301 to 500	Hazardous	Maroon

- The WHO (1987) in its publication air quality for guidelines for Europe has described approved methods of determining the concentration of common air pollutants and their health hazards.
- The emphasis in the guideline is placed on exposure since this element that can be controlled to lessen the dose and hence lessen the response.
- The starting point for derivation of guideline was to define the lowest concentration at which adverse effects are observed.
- On the basis of evidence concerning adverse effects, judgements about the protection factors needed to minimize health risks were made

Substance	Time weighted average	Averaging time
Cadmium	5 ng/1m3	1 yr
Carbon monoxide	100 mg/m3	15 mins
	60 mg/m3	30 mins
	30 mg/m3	1 hr
	10 mg/m3	8 hrs
Nitrogen dioxide	200 µg/m3	1 hr
	40 µg/m	1 yr
Ozone	150-200 µg/m3	1 hr
	100-120 µg/m3	8 hrs
SO2	500 µg/m3	10 mins
	350 µg/m3	1 hr

Air pollution monitoring in India

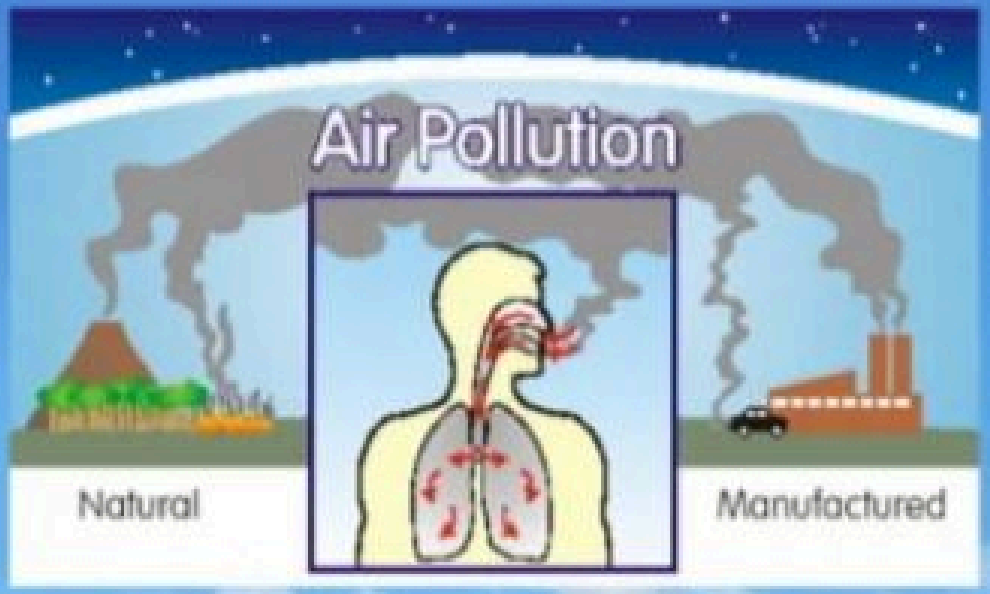
- The national air quality monitoring programme sponsored by the central pollution control board since 1990 has generated database over last 14 years in 10 major Indian cities.
- The trend analysis showed that suspended particulate matter (SPM) exceeds the cpcb standards in all the cities of the time throughout the year.
- The concentration ratio of p<10 fraction (human respirable particles) to the total spm varies between 30% to 60%, with coastal cities showing highest percentages.

Summary of SPM levels during the year 2006 in Vijayawada

Location	Type of area	Average in µg/m3	Std dev	n	Air quality	% vio
Auto nagar	I	242	30	89	M	0
Benz circle	R	178	20	101	H	17

Effects of air pollution

Health aspects



Social & economic aspects

Health aspects

- The health effects of air pollution are both immediate & delayed.
- The immediate are borne by the respiratory system, the resulting state is acute bronchitis.
- If air pollution is intense, it may result even in death by suffocation
- The delayed effects most commonly linked with air pollution are chronic bronchitis, lung cancer, bronchial asthma, emphysema and respiratory allergies.

Table 1. **Mechanisms by which some key pollutants in smoke from domestic sources may increase the risk of respiratory and other health problems**

Pollutant	Mechanism	Potential health effects
Particules (small particles less than 10 microns, and particularly less than 2.5 microns aerodynamic diameter)	• Acute: bronchial irritation, inflammation and increased reactivity • Reduced mucociliary clearance • Reduced macrophage response and (?) reduced local immunity • (?) Fibrotic reaction	• Wheezing, exacerbation of asthma • Respiratory infections • Chronic bronchitis and chronic obstructive pulmonary disease • Exacerbation of chronic obstructive pulmonary disease
Carbon monoxide	• Binding with haemoglobin to produce carboxy haemoglobin, which reduces oxygen delivery to key organs and the developing fetus.	• Low birth weight (fetal carboxy-haemoglobin 2–10% or higher) • Increase in perinatal deaths
Polycyclic aromatic hydrocarbons, e.g. benzo[*a*]pyrene	• Carcinogenic	• Lung cancer • Cancer of mouth, nasopharynx and larynx
Nitrogen dioxide	• Acute exposure increases bronchial reactivity • Longer term exposure increases susceptibility to bacterial and viral lung infections	• Wheezing and exacerbation of asthma • Respiratory infections • Reduced lung function in children
Sulphur dioxide	• Acute exposure increases bronchial reactivity • Longer term: difficult to dissociate from effects of particles	• Wheezing and exacerbation of asthma • Exacerbation of chronic obstructive pulmonary disease, cardiovascular disease
Biomass smoke condensates including polycyclic aromatics and metal ions	• Absorption of toxins into lens, leading to oxidative changes	• Cataract

Social & economic effects

- These comprise global warming, destruction of plant & animal life, corrosion of metals, acid rain, corrosion of metals, cost of cleaning & maintenance, aesthetic nuisance visibility in towns.

Table 1.2. Representative environmental effects of air pollutants.

Pollutant	*Representative Environmental Effects*
Ozone	Crop damage, damage to trees and decreased resistance to disease for both crops and other plants.
Carbon Monoxide	Similar health effects on animals as on humans.
Nitrogen Oxides	Acid rain, visibility degradation, particle formation, contribution towards ozone formation.
Particulate Matter	Visibility degradation and monument and building soiling, safety effects for aircraft from reduced visibility.
Volatile Organic Compounds	Contribution towards ozone formation, odors and some direct effect on buildings and plants.

Prevention & control of air pollution

The WHO has recommended the following procedures for the prevention & control of air pollution-

- **Contaminant-** That is prevention of escape of toxic substances into ambient air by using techniques like enclosures, ventilation, disinfection of air (U.V radiation, chemical mist)
- **Replacement-** Replacing a technological process causing air pollution by a new process that does not. For example usage of unleaded petrol.
- **Dilution-** It is valid so long as it is within the self-cleaning capacity of the environment. The establishment of 'green belts' between industrial & residential areas will control the air pollution to some extent.

•**Legislation-** Air pollution is controlled in many countries by suitable legislation. Eg- Clean Air Act. Legislation covers such matters as height of chimneys, powers to local authorities to carry out investigations, research & education concerning air pollution, creation of smokeless zones & enforcement of standard for ambient air quality.

In the year 1981 the Govt. of India have enacted 'The Air (Prevention & Control of Pollution) Act' to decrease air pollution.

•**International action-** The WHO established an international network of laboratories for the monitoring & study of air pollution. The network consists of 2 international centes at London and Washington, 3 at Moscow, Nagpur & Tokyo & 20 in various parts of the world. These centres will issue warnings where & when necessary.