Status of Air Pollution in Bangladesh

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Air pollution

Scenario

- *Rapid urbanization*
- *Increased economic activity*
- *High population density*
- *Traffic congestion*

Perception

- *High particulate matter especially in dry seasons*
- *Occurrence of haze in winter*
- *Blackening of city air and eye irritation and choking smell**
- *Increased incident of respiratory diseases (asthma, bronchitis, lower respiratory track infection, etc.)*

*Situation has improved significantly in recent days

TYPES OF AIR POLLUTION

- **PERSONAL,OCCUPATIONAL, COMMUNITY**
- **GASEOUS SUBSTANCES : Gases, Vapours (SO_x, NO_x, CO, Ozone, NH_3, Reactive hydrocarbons, Benzopyrene, Aldehydes, Phenols and others)**
- **PARTICULATE MATTER: Dust, Fly ash, Smoke, Shoot, Droplets, Mist, Fog, Fumes, Aerosol**

VARIOUS SOURCES OF AIR POLLUTION

ANTHROPOGENIC SOURCES

- RAPID URBANIZATION
- VEHICULAR AND INDUSTRIAL EMISSIONS
- UNPLANNED INDUSTRIAL DEVELOPMENT
- BRICK KILNS
- BIOMASS BURNING
- POWER PLANTS
- INCENARATION OF MUNICIPAL GARBAGE
- AIR CRAFTS
- RALWAY ENGINES
- SOLID WASTE DISPOSAL SITES
- DUST FROM CONSTRUCTION WORK
- OTHER SOURCES PRODUCED DUE TO TREMENDOUS PRESSURE OF POPULATION

NATURAL SOURCES

- WIND BLOWN DUST,
- SEA SPRAY
- FOREST FIRES

SCALE OF EFFECTS OF AIR POLLUTION

- **LOCAL**
- **REGIONAL**
- **GLOBAL**

What is the most important pollutant?

- **The most serious pollutant of concern in Bangladesh is respirable and fine particulate matter, PM_{10} (particles with an aerodynamic diameter less than 10 microns) and $PM_{2.5}$ (particles with an aerodynamic diameter less than 2.5 microns).**

AIRBORNE PARTICULATE MATTER (APM) HEALTH EFFECTS

- PM10 Inhalable
- PM2.5 Resirable
- Smaller particles enter deeper into the lungs and Causes Inflammation
- PM10 Particles Aggravate Health Problems such as Asthma
- PM2.5 Particles contribute to premature Mortality and Hospital Admissions
- Linked with higher mortality rates from other causes including cancer and heart disease.
- Health cost related to the atmospheric pollution in Dhaka is estimated to be about US $ 200-800 million per year, or 0.7%-3.0% of Gross Development Product (GDP).

Excess deaths/years due to air pollution

- 60,000 in US
- 10,000 in UK
- ~8,000 in Dhaka City

Air Quality Parameters

- PM (PM_{10}, $PM_{2.5}$)
- SO_x
- NO_x
- CO and CO_2
- Ozone
- VOC,s
- PCB's
- PAH
- acid deposition
- visibility
- Trace elements in PM's etc.

Air Quality Monitoring Programme

- Recently established one continuous monitoring station in Dhaka by DoE (Criteria pollutants)
- BAEC has two station (only PM) in Dhaka, one in Rajshahi and one in Khulna sampling twice weekly
- Trans boundary air pollution studies under UNEP assistance (SPM, PM10, SOx, NOx, etc.)
- Some information on temporal and spatial trend (only for Dhaka)
- Limited study on chemical characterization and source apportionment
- Delay in reporting data
- Virtually no data on indoor air quality

Challenges

- Improve quality and quantity of environmental data
- Characterization and apportion sources
- Assessment of occupational and community exposure (inhalation, dermal)
- Improve health information collection
- Stakeholders and public participation
- Awareness and advocacy in environmental pollution issues

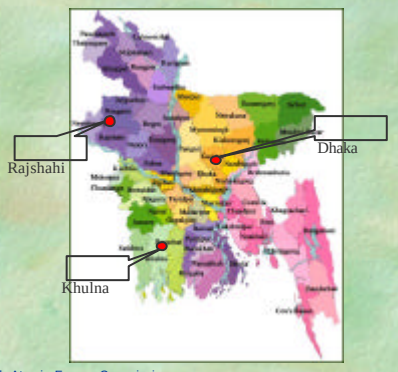
Monitoring of Air Quality (BAEC)

Sampling locations
- Dhaka (two sites)
- Rajshahi (one site)
- Khulna (one site)

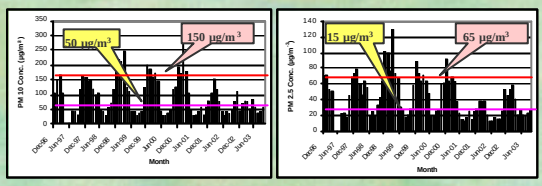
Sampler
- GENT type sampler

Method of Analysis
- Mass by weighing
- BC by Reflectance measurement
- Elemental Concentration by PIXE
- Source apportionment by PMF (Receptor Modeling)

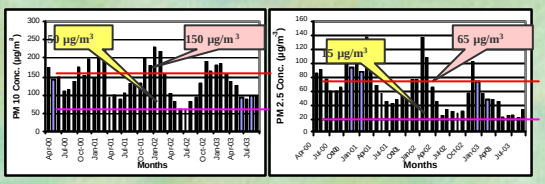
Location of sampling sites in Bangladesh



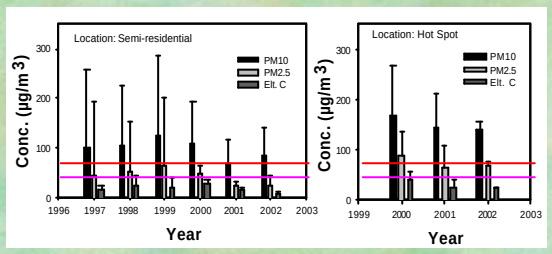
Monthly 24-hour average PM (Data From Semi-residential Area, Dhaka)



Monthly 24-hour average PM (Data From Hot-spot Area, Dhaka)



Historical trend in air pollution in Dhaka city

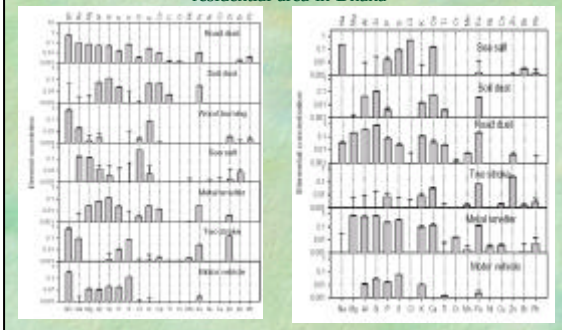


Monitoring of Air Quality

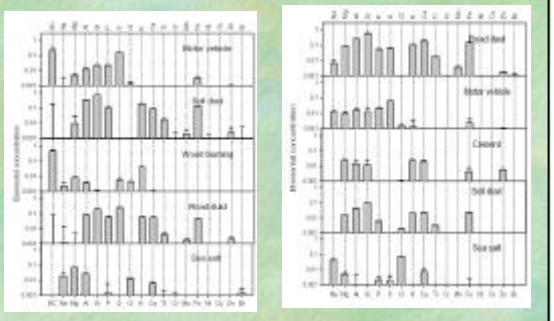
Yearly average concentration in ng/m³ of Pb in different PM fractions in Dhaka

Year	Fine Fraction (PM2.5)		Coarse Fraction (PM2.5-PM10)		PM10	
	Mean	SD	Mean	SD	Mean	SD
1994	312	485	210	376	522	614
1997	256	532	205	563	461	775
1998	370	636	137	209	507	669
1999	225	370	117	199	342	420
2000	106	179	53.6	69.9	160	192
2001	137	99	118	115	254	206

Source compositions for fine and coarse PM at semi-residential area in Dhaka



Source compositions for fine and coarse PM at semi-residential area in Rajshahi



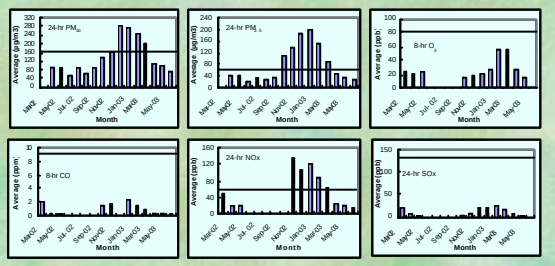
Average percentage contributions of the sources at semi-residential sites of Dhaka and Rajshahi

Source profile	Dhaka		Rajshahi	
	Coarse particle	Fine particle	Coarse particle	Fine particle
Sea salt	4.45	1.00	12.66	13.9
Soil dust	43.0	10.2	44.1	1.88
Road dust	7.30	19.4	14.2	5.29
Two stroke	3.78	9.36		
Metal Smelter	1.21	9.96		
Motor vehicle	40.2	38.2	23.2	28.5
Biomass burning/ Brick kiln		11.9		
Construction			5.87	50.4

Air quality monitoring (AQMP, DoE)

- Air Quality Parameters
  - PM_{10}, $PM_{2.5}$, NO_x, SO_2, CO and Ozone
- Chemical Characterization
  - *Time series analysis*
  - *Correlation analysis*
- Source Identification and Apportionment
- Long Range Transport Studies

Monthly average concentrations of different pollutants (AQMP, DoE)



National Programme to address air pollution

- Department of Environment (DOE) has established a CAM station under Air Quality Management Project (AQMP)
  - Monitoring PM10, PM2.5, NO_x, SO_x, O_3, CO, CO_2, VOC's, etc.
- DoE is working on revising the existing Air quality standard and Vehicular emission standards based on local conditions and present day scientific information.
- Important decision by the Govt. to reduce Air pollution
  - Ban on two-stroke engine driven vehicles to ply on Dhaka
  - Ban on Buses/Trucks older than 20 years to ply on Dhaka
  - Ban on import of reconditioned cars older than 5 years

Recent Government Action

- Introduction of unleaded gasoline from 1st July, 1999.
- Banning import of two-stroke engines.
- Phase-wise plans to take two-stroke 3-wheelers off the roads, finally banning these vehicles in Dhaka from 1st January 2003.
- Banning of buses older than 20 years and trucks older than 25 years in Bangladesh from 1st January 2002.
- Increased use of Compressed Natural Gas (CNG), considered a clean fuel, in vehicles instead of gasoline.

Recent Government Action Cont'd

- Decrease traffic congestions by reducing the number of non-motorized vehicles, and by restricting the movement of such vehicles within certain areas of the city, and during specific periods of the day.
- Banning operation of commercial trucks in Dhaka City during day time (8am – 10pm).
- Improving the mass-transport system within the urban areas, traffic signals and road dividers, and increasing parking facilities to reduce traffic congestions.

Recent Government Action Cont'd

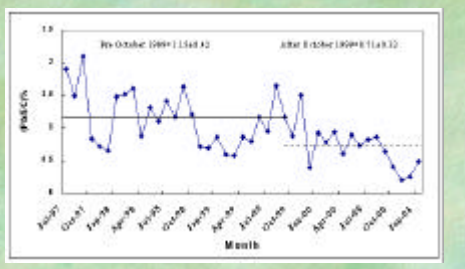
- Introduction of minimum standards for lube oil to be used in different types of vehicles.
- Regular monitoring of the ambient air quality and release of information for public awareness.
- Government is currently preparing a comprehensive air quality management plan to improve air quality in the future.
- Marketing of coloured kerosene from 1st July 2003 to stop fuel adulteration

National Ambient Air Quality Standards

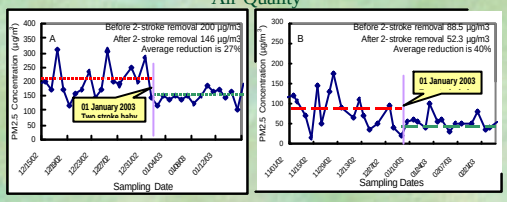
Pollutant	Objective	Averaging Time
CO	10 mg/m3; (9 p.p.m) (a)	8-hour
	40 mg/m3; (35 ppm) (a)	Annual
Lead	0.5 µg/m3	Annual (i)
NO2	100 µg/m3; (0.053 ppm)	Annual
PM-10	50 µg/m3	Annual (b)
	150 µg/m3	24-hour (g)
PM-2.5	15 µg/m3	Annual (f)
	65 µg/m3	24-hour (h)
Ozone	235 µg/m3; (0.12 ppm)	1-hour (d)
	157 µg/m3; (0.08 ppm)	8-hour (e)
SO2	80 µg/m3; (0.03 p.p.m)	Annual
	365 µg/m3; (0.14 ppm)	24-hour (a)

a) Not to be exceeded more than once per year
b) The objective is attained when the annual arithmetic mean is less than or equal to 50 ug/m3.
c) The objective is attained when the expected number of days per calendar year with a 24-hour average of 150 µg/m3 is equal to or less than 1.
d) The objective is attained when the expected number of days per calendar year with the maximum hourly average of 0.12 ppm is equal to or less than 1.
e) 3-year average of annual 4th highest concentration
f) Spatially averaged over designated monitors
g) The form is the 99th percentile.
h) The form is the 98th percentile.
i) Annual arithmetic average based on lead analysis of TSP samples operated on an every 6th day schedule.

Average monthly (Pb/EC)% ratios versus time for the Period July 1997 – December 2000



Impact of Banning Two-Stroke Baby Taxis on Air Quality



Effect of banning two-stroke baby taxi on air quality of Dhaka city (A – Data from CAMS, DoE; B – Data from Farmgate, BAEC)

AQI in Dhaka

- The Air Quality Index (AQI) is one of the objectives of AQMP.
- DoE decided to adopt the USEPA Air Quality Index with some modifications (stakeholders workshops, meeting with different experts).

Reason:

- Adopted USEPA air quality standard for Bangladesh and AQI is linked with air quality standard
- USEPA AQI is based on extensive epidemiological study and such data is not available in Bangladesh

Modifications are in:

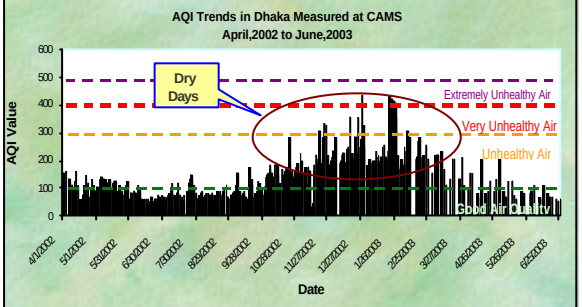
1. Category
2. Without health cautionary statement
3. Without forecast [Only for at this stage]

Modifications

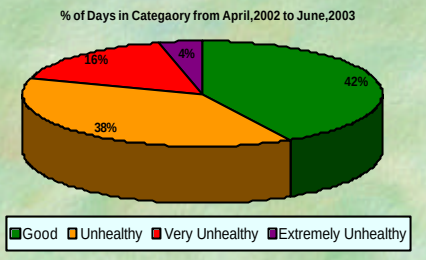
AQI Values	USEPA AQI Level of Health concerns	Colours
0 - 50	GOOD	GREEN
51- 100	MODERATE	YELLOW
101-150	UNHEALTHY FOR SENSITIVE GROUP	ORANGE
151-200	UNHEALTHY	RED
201-300	VERY UNHEALTHY	PURPLE
301-500	HAZARDOUS	MAROON

AQI Values	Proposed AQI for Dhaka Level of Health Concerns English	Bangala	Colours
0 - 100	GOOD	BHALO	GREEN
101 – 200	UNHEALTHY	ASHASTHAKAR	ORANGE
201 – 300	VERY UNHEALTHY	KHUB ASHASTHAKAR	RED
301 – 500	EKTREMELY UNHEALTHY	ATTANTA ASHASTHAKAR	PURPLE

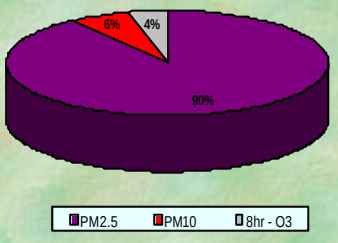
AQI Trends in Dhaka



AQI Trends in Dhaka



Frequency of Responsible Pollutant



Purpose of AQI release

- To inform people about air quality conditions
- Promote public interest and action to reduce emissions
- Encourage people to support the AQMP & DoE programs

National Programme to Address Air Pollution

Fuel switching

Bangladesh Petroleum Corporation started a project to use Compressed Natural Gas (CNG) in vehicles instead of gasoline.

Air Quality Management Project (AQMP)

The DoE has undertaken a project on Air Quality Management, funded by he World Bank. The project has the following two components:

Component-1: Enforcement, Standards, and Pilot Control Programs
Component-2: Air Quality Monitoring and Evaluation

Dhaka Urban Transport Project- DUTP

Improvement of the city traffic. One component of the project ai ming at the reduction of air pollution problem at Dhaka. The major components are:

- **Traffic signals**
- **Introduction of one-way roads**
- **Improving parking facilities**
- **Coordination of different vehicular modes**
- **Separate lanes for different speed traffic**
- **Promotion of CNG use**

Thank You

END