Clean air for every child in India: Emerging roadmap

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Centre for Science and Environment

Every Journey, Every Child: International Conference

FIA Foundation and Greater London Authority

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Disadvantage Delhi: Smog here to stay

Smog leaves Delhi gasping for breath

The Centre for Science and Environment (CSE), in its latest report, has declared the smog is here to stay. It has also warned that Delhi is in the grip of a multipronged industrial pollution crisis.

During the first week of November, Delhi went under a thick blanket of smog. The breeze nearly stopped, and the skies turned grey and dank. Cold, masks, scarves, or handkerchiefs to the ground

Gains Of Switch To Cleaner Fuel Frittered Away

City enveloped in smog, back to pre-CNG levels

Updated on Thu, 15 Nov 2012 02:00 AM IST

Should we Leave Delhi?

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Deadly Winter Pollution
Delhi: November, 2016 (afternoon)

Source: Centre for Science and Environment analysis of air quality data from Central Pollution Control Board
National crisis: More cities in grip of toxic pollution

Majority of urban population exposed to unacceptable levels of pollution. 95% of Indians are breathing air pollution levels above WHO guidelines.

PM10 profile of NAMP cities

NO2 profile of NAMP cities

Source: based on National Ambient Air Quality Status, CPCB for 2009 and 2012 (latest available)
Lessons from Delhi…

First generation action 1998-2008

Enforced Euro II emissions standards in 2000, five years ahead of schedule, Euro III in 2005; unleaded petrol
Mandated pre-mix petrol to two- and three-wheelers
Implemented largest ever CNG programme: Largest ever public transport bus and three-wheeler fleet on natural gas
Capped the number of three-wheelers
Phased out 15 year old commercial vehicles
Strengthened vehicle inspection programme (PUC)
Efforts made to bypass transit traffic
Relocated polluting industry; Stricter action on power plants; two power plants on natural gas; Ban on open burning

2008 - 2014

Metro system expanded
Close to 6000 new buses
Euro IV standards in 2010; upgraded PUC tests
Air Ambience Fund in 2009
40 km of cycle tracks with new footpaths in 2010
Marginal increase in parking prices in NDMC area
Delhi has lost its gains. After a short respite pollution curve turns upward

Particulate pollution decline and rise again due to rapid increase in vehicle numbers

Based on CPCB data

NO2 levels rising steadily

PM10 levels in microgramme per cubic metre

PM10 reduces despite vehicles increase

Massive increase in PM10 levels post 2007

Registered vehicles in lakhs

+75%

+97%


2005 2006 2007 2008 2009 2010 2011

Based on CPCB data
### Leading Risk Factors for Deaths in 2010 in India

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Deaths in Millions</th>
</tr>
</thead>
<tbody>
<tr>
<td>High blood pressure</td>
<td>1.2</td>
</tr>
<tr>
<td>Household air pollution from solid fuels</td>
<td>0.8</td>
</tr>
<tr>
<td>Tobacco smoking, including second-hand smoke</td>
<td>0.4</td>
</tr>
<tr>
<td>Ambient particulate matter pollution</td>
<td>0</td>
</tr>
<tr>
<td>High fasting plasma glucose</td>
<td>0.4</td>
</tr>
<tr>
<td>Alcohol use</td>
<td>0.8</td>
</tr>
<tr>
<td>Physical inactivity and low physical activity</td>
<td>0.4</td>
</tr>
<tr>
<td>Diet low in nuts and seeds</td>
<td>0.8</td>
</tr>
<tr>
<td>Diet high in sodium</td>
<td>0.4</td>
</tr>
<tr>
<td>Diet low in vegetables</td>
<td>0</td>
</tr>
<tr>
<td>Diet low in whole grains</td>
<td>0.4</td>
</tr>
<tr>
<td>Diet high in omega-3 fatty acids</td>
<td>0.8</td>
</tr>
<tr>
<td>Occupational risk factors for injuries</td>
<td>0.4</td>
</tr>
<tr>
<td>Childhood underweight</td>
<td>0.8</td>
</tr>
<tr>
<td>High total cholesterol</td>
<td>0.4</td>
</tr>
<tr>
<td>Lead exposure</td>
<td>0</td>
</tr>
<tr>
<td>High body-mass index</td>
<td>0.8</td>
</tr>
<tr>
<td>Suboptimal breastfeeding</td>
<td>0.4</td>
</tr>
<tr>
<td>Diet high in processed meat</td>
<td>0</td>
</tr>
</tbody>
</table>

**Ambient PM$_{2.5}$ caused an estimated 627,000 deaths in India; ~6% of all deaths in 2010**

More than 18 million healthy life years lost due to air pollution. Air pollution triggers stroke, cardiovascular and respiratory diseases, cancer.....

Air pollution is the 5th largest killer in India.......
Close to 20% of world children live in India; Children are 40% of India’s population and 34% of urban population

Every eighth child (0-6 years) in India lives in slums; 15% are homeless

Children more susceptible -- low breathing zone; time spent outdoors; immature immunity; developing organs.............

Studies in India have found
-- very high respiratory symptoms;
-- lung function deficit;
-- 4 times more Attention-deficit hyperactivity disorder (ADHD) in children chronically exposed to high level of vehicular pollution;
-- link between air pollution and low vitamin D status of infants and toddlers

Bangalore: Increased prevalence of asthma in children of lower socio economic classes. Children from heavy traffic region and low socioeconomic population had much higher prevalence. (H Paramesh)
Health of children compromised......

2012 epidemiological study on children in Delhi (CPCB and Chittaranjan National Cancer Institute of Kolkata):
-- Covered about **12,000 school-going children from 36 schools.**

-- **Every third child has reduced lung function.** Sputum of Delhi’s children contains four times more iron-laden macrophages than those from cleaner environs, indicating pulmonary hemorrhage.

-- **The levels of these biomarkers in children have been found to be higher in areas with high PM10 levels.**
Alveolar macrophage - biomarker of air pollution

Exposed group; Kolkata taxi driver

Increase in AM number

Control area: Sundarbans

Larger AM – particle laden

Sputum cytology of a 14-year old girl, showing abundance of particle laden AM – as bad as occupationally exposed taxi driver

Source: CNCI
Evidences from the images of sputum in children

Sputum of children chronically exposed to Delhi’s air pollution showing increase in the number of eosinophils (a) and neutrophils (b) indicating allergic and inflammatory reactions in the airways.

Photomicrographs of sputum of school children of Delhi (c, d) showing increase in the number of lymphocytes suggestive of respiratory viral infection.
Look at these black spots on the lung. The unfortunate owner lives in Delhi and has been breathing polluted air. Air full of carbon particles which accumulate in the lungs (black spots). What you can’t see is a cocktail of gases and tiny particles, even smaller than carbon that get into our bodies. Actually, you are getting polluted.
Ambient air quality vs Exposure

Union Ministry of Health and Family Welfare
Report of Steering committee on air pollution and health related Issues’,

More important to know how close we are to the pollution source, what are we inhaling, and how much time we spend close to the pollution source than what occurs generally in the air that is influenced by climate and weather.

Shift from concentration management to exposure management

Ambient concentrations do not always well represent human exposures,

Ambient concentration is not a good surrogate for total air pollution risk, -- cannot indicate exposure and health outcome

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Chennai
PM$_{2.5}$ emission apportionment

- VEH: 45%
- IND: 20%
- HH: 6%
- CON: 1%
- OWB: 3%
- GSET: 2%
- BK: 7%
- DUST: 12%

Source: S Guttikunda – SIM
Action on Power Plant and Industry

- Badarpur Power Plant
- Flyash dumping site

Emissions standards for power plants tightened

SOx and NOx standards for industry in 2017

Delhi - All except one coal power plants shut. The remaining to close in 2018

Fly ash pond to be reclaimed

Delhi bans polluting industrial fuels -- petcoke and furnace oil
Action to control open burning and biomass burning

Open waste burning
- Penalty of Rs. 5000/- for each violation in Delhi-NCR.
- To change waste management paradigm

Farm fires
In-situ
Subsidy for tillers to mix waste straw with soil - mulching
Make Biochar with straw

Ex-situ
Biomass based Power plants
Make pellets and other products

Source: NASA Satellite Image
Chronic exposure in schools when midday meals are cooked

• CSE study in Gaya (2016): Monitoring of *anganwadis schools* at the time of cooking of midday meals
• **Average exposure:** 2524 microgramme per cum
• **Direct stove exposure:** 4906 microgramme per cum

**Need access to clean energy**

Government policy to shift LPG subsidy to poor households

CPCB 2014 Draft Indoor Air Pollution and Monitoring Guidelines
Dousing dust particles from Construction and Demolition to control particles

Notifies first ever rules construction and demolition waste management.

Specifications and standards for recycled material

Mandate to use minimum of 2% recycled products from construction waste in all future contracts for building works and 10% recycled products for road works

Delhi has installed capacity to recycle 50-60% of C&D Waste; Ahmedabad -- 42%; Bengaluru – 37%
Motorisation and dieselisation

Need stringent and preventive action and decision here to influence the future stock -- several times higher than the legacy stock.

Share of diesel cars in new car sales

Source: CSE
Vehicles are most consistent and dominant source in Delhi

Kanpur IIT study states -- vehicles are the most consistent and dominant source of pollution throughout the year while most others are variable.

HEI – Maximum impact of vehicular pollution upto 500 meters from roadside – 55-60% of Delhi’s population within that range.

Particles from coal and diesel are more harmful than wind blown dust. These increase ischemic heart disease related deaths. GBD for India attributes half of air pollution deaths to heart disease.

ICCT- 4 times greater cancer risk in Delhi from diesel cars than petrol cars; More than 280,000 avoidable cancers in Delhi NCR caused by diesel exhaust (based on emissions estimates of IIT Kanpur study)
ICCT-ICAT study

Real world emissions from diesel cars and SUVs alarming

-- Real world NOx emissions from small diesel car three—six times the standard; but 9 to 12 times the small petrol car.

-- NOx emissions from petrol car are much lower—about 0.5-0.7 times the Euro IV standard.

-- Real-world NOx emissions from diesel SUV are 4-6 times higher than the standard.

Adding one diesel SUV is equal to adding 25 to 65 small petrol cars.
Polluted cities make transition from diesel to CNG to run public transport

**Current emissions standards:** Euro IV nation-wide

India to skip Euro V and leapfrog directly to Euro VI with in-compliance regulations in 2020

**Action on diesel in Delhi and National Capital Region:**

-- Environment Compensation Charge paid by each truck entering Delhi region daily

-- Environment Pollution Charge on each big diesel car and SUV sold in the region

-- Ban on 10 year old diesel cars and other vehicles

-- Air Ambience Tax on each litre of diesel sold in Delhi
Weak link between air pollution and mobility action

Cities are losing battle of car-bulge: The rapid increase in vehicles is destroying all gains of air pollution and health

Cars occupy more road space, carry fewer people, pollute more, guzzle more fuel.

They edge out public transport users, pedestrians, bicycles, cycle rickshaws ..
Car centric road design locks in enormous pollution

Engineering changes once made cannot be reversed easily... It permanently decides our travel choices.
Transit Oriented Development Policy
National Habitat Standard Mission of the Ministry of Urban Development

Guidelines for compact mixed land use

-- 95% of residences should have daily needs retail, parks, primary schools and recreational areas accessible within 400m walking distance.

-- 95% residences should have access to employment and public and institutional services by public transport or bicycle or walk or combination of two or more.

-- At least 85% of all streets to have mixed use development.

<table>
<thead>
<tr>
<th>Hierarchy of Facilities</th>
<th>Accessibility Standard from each home/ work place.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRTS Station</td>
<td>Approx. 800 m or 10 min walk</td>
</tr>
<tr>
<td>Metro feeder/ HOV feeder Stop</td>
<td>Approx. 400 m or 5 min walk</td>
</tr>
<tr>
<td>Bus Stop</td>
<td>Approx. 400 m or 5 min walk</td>
</tr>
<tr>
<td>IPT/ auto-rickshaw Stand</td>
<td>Approx. 250 m or 3 min walk</td>
</tr>
<tr>
<td>Cycle Rickshaw Stand</td>
<td>Approx. 250 m or 3 min walk</td>
</tr>
<tr>
<td>Cycle Rental Stand</td>
<td>Approx. 250 m or 3 min walk</td>
</tr>
<tr>
<td>Shared private parking garage</td>
<td>Approx. 500 m or 6 min walk</td>
</tr>
</tbody>
</table>
Majority in Indian cities still use public transport: An opportunity

Even today majority in our cities walk, cycle and use public transport

Most people are too poor to even use public transport

Compact city design that has reduced distances

Some cities have invested in public transport – to improve quality of service

Public transport cannot work if people and children are victims of road accidents

- **2015**: Total of 1,374 accidents and 400 deaths a day on Indian roads; 12,589 children below the age of 17 killed, - 8.6% of total road crash fatalities

- **43 children die in road accidents on Indian roads daily.**
Wrong road design force unsafe crossing

Public transport needs safe walk access

Source: Delhi Traffic Police
Street design norms can make streets safe and accessible

- Implement street design guidelines
Bhubaneswar: Designing smart and child-friendly city

Integrating play space into wider design of public realm: sense of security

Janpath, Bhubaneswar re-imagined with child-friendly features
Obese and over-weight: Health impact of car centric mobility

- Among school children -- prevalence of overweight up to 25%; obesity up to 11.3%
- Rich private schools of Delhi: 29-32% of children (14-18 years) are overweight.
- Urban slums: over 32% of poor children under 5 years of age are underweight and 39.6% are stunted.

CSE survey of mobility
- Only 30.5% students of urban schools choose school transport/public transport for travel,
- 84.2% of students of rural schools choose school transport/public transport for travel.
- 69.5% of students of urban schools travel by private vehicles.

After CSE environmental audit in schools
In several schools, students started choosing public transport. In one school, students travelling by bus increased from 36% to 68%.
Mount Litera Zee School, Jamshedpur: After the sensitization programme, 90% of students shifted to school transport.
Parks or Parking lots ?!

People cannot go for a walk and children cannot play in parks

Cars parked inside a park in Phase 1, Mohali
Towards car restraint measures

Indian Cities framing parking policy as car restraint measure

Unlimited and free parking incites more car ownership and usage - pollution and energy guzzling

Parking takes away space from walkways and green areas; leads to inequitous use of land -- A car gets more space (23-26 sqm) to park than poor households get land to make houses (18-25 sq m).

Delhi Master Plan amended to include parking management district approach:

Draft parking policy of Delhi: Proof of parking; residential parking permits; high and variable parking charges, etc
Delhi: Benefits from temporary ban on cars -- odd and even scheme (January 2016)

**Benefits:** Bus passengers increased by 8%; Fleet utilization up from 84% in normal days to 95%; Petrol and diesel sales dropped by 4.7% and 7.8%; Average journey speed increased; Average occupancy in personal cars increased from 1.4 to 2.1

Need mobility transition to sustain these gains

Aerosol Optical Depth: Pre Odd-Even Trial December 18 to 31, 2015

Aerosol Optical Depth: During Odd-Even Trial January 1 to 15, 2016

<table>
<thead>
<tr>
<th>Good</th>
<th>Bad</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 0.3</td>
<td>&gt; 0.90</td>
</tr>
<tr>
<td>0.3 to 0.45</td>
<td></td>
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<tr>
<td>0.45 to 0.60</td>
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<tr>
<td>0.60 to 0.75</td>
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<tr>
<td>0.75 to 0.90</td>
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<td>&gt; 0.90</td>
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Can we bend the pollution curve? Lesson from this winter
Roadmap to maximise health and climate benefits from air pollution control
Reduce toxic risk for children

Need legal compliance framework for clean air target and action plan

Reduce emissions from vehicles
  - Leapfrog emissions standards to Euro VI; Roadmap for electric mobility
  - Reinvent mobility – link with urban planning, design and child safety

Reduce emissions from power plants
  - Implement new emissions standards for power plants
  - Shift to natural gas for power

Reduce emissions from air polluting industry
  - Implement new standards for NOx and SOx for industry
  - Reduce usage of petcoke, furnace oil and other dirty fuels

Reduce emissions from generator sets
  - Improve access to grid based clean power
  - Tighter emission standards for generator sets
  - Energy efficiency measures to reduce electricity demand

Action on open burning
  - Monitoring and awareness campaign; waste management

Road dust and construction activities
  - Adopt dust control measures for construction industry, roads, and traffic

Adopt fiscal measures for change
Thank You