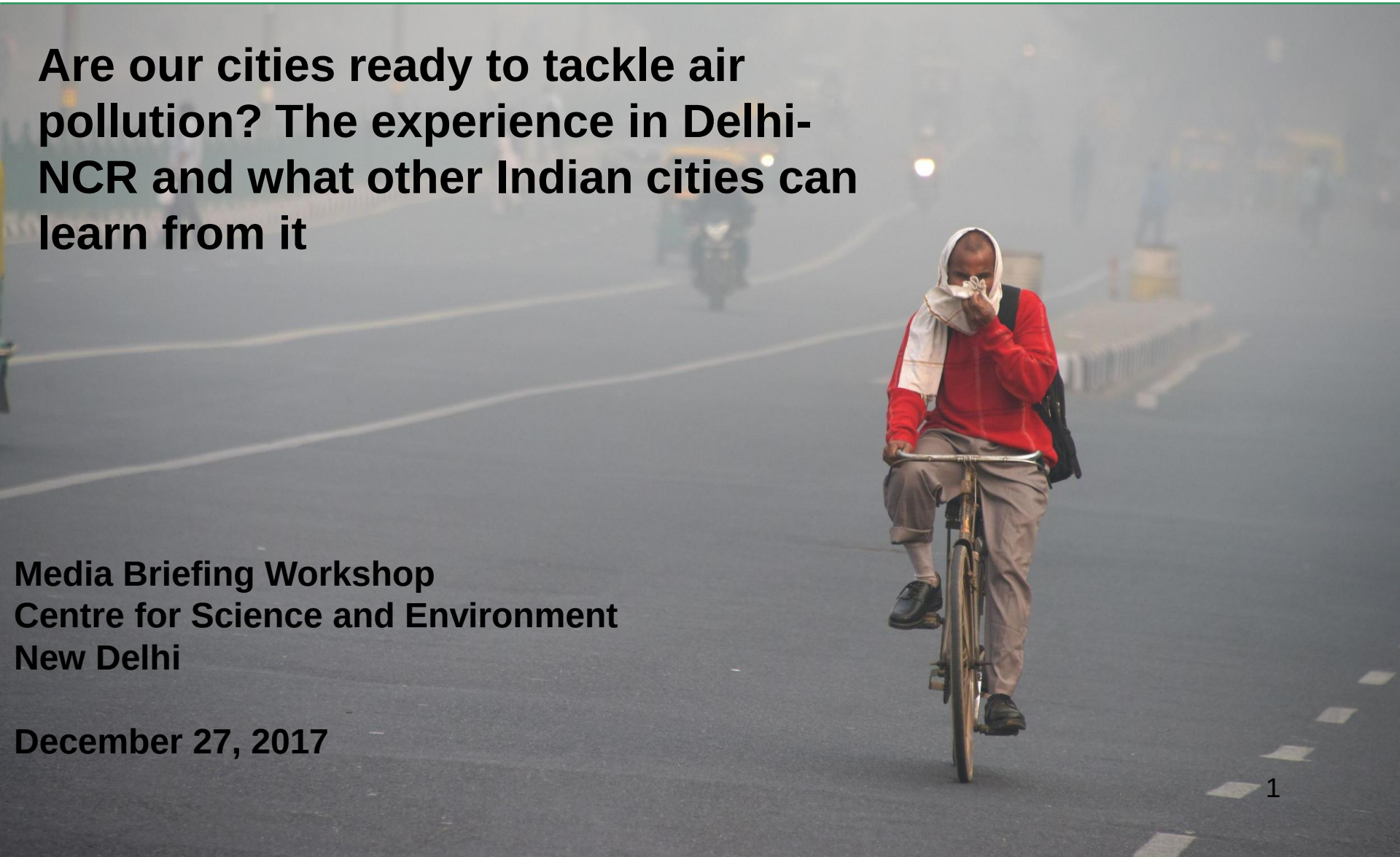
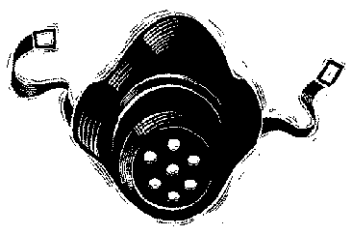
STOP THAT SMOG

Are our cities ready to tackle air pollution? The experience in Delhi-NCR and what other Indian cities can learn from it

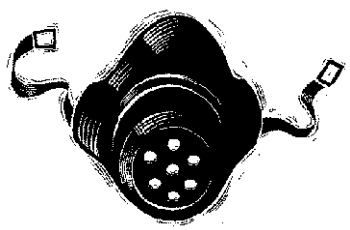


Media Briefing Workshop
Centre for Science and Environment
New Delhi

December 27, 2017



Air pollution: A national crisis

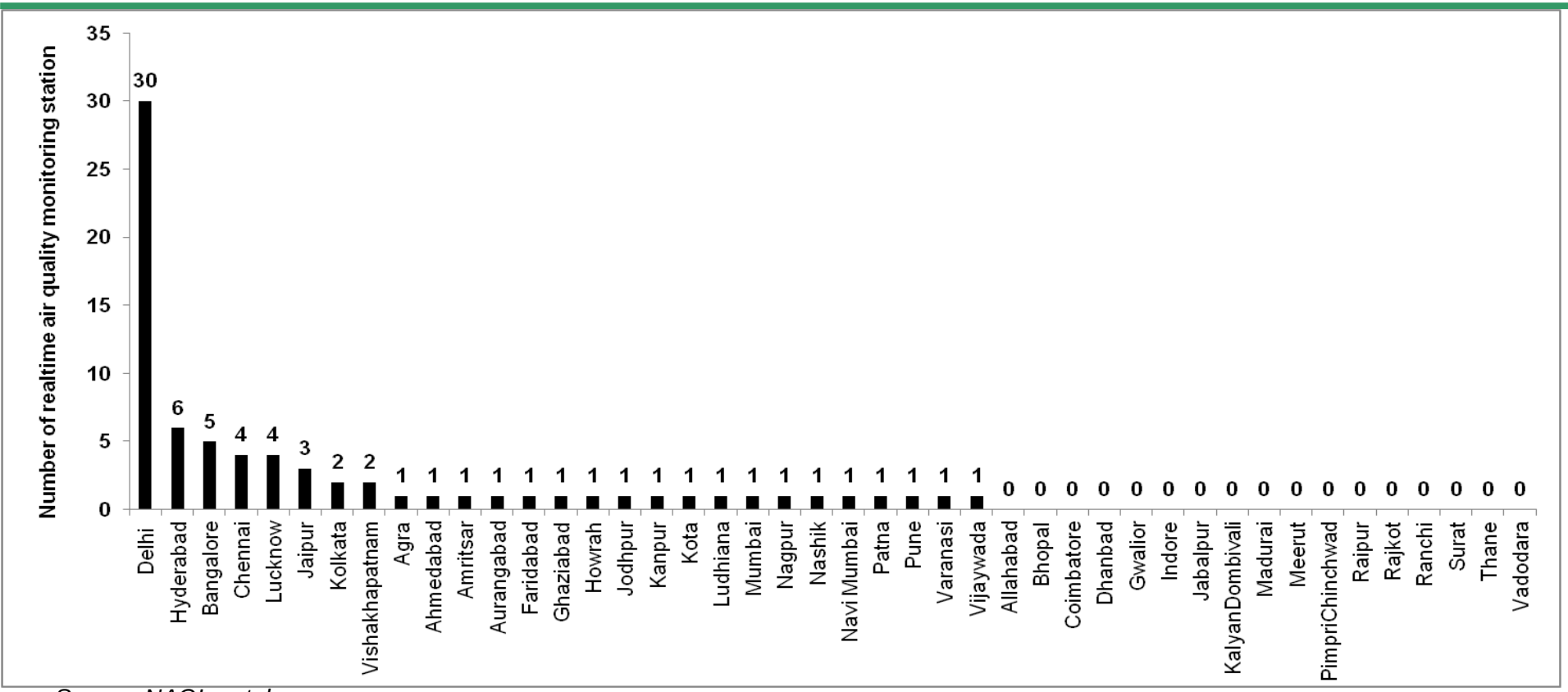


Poor air quality monitoring: We do not know enough about national air quality

-- Only 303 cities out of 6,166 Census cities and towns are monitored – a mere 5%.

-- Only 57 cities have continuous real time monitoring stations. Rest are manual that do not allow daily reporting of real time air quality data.

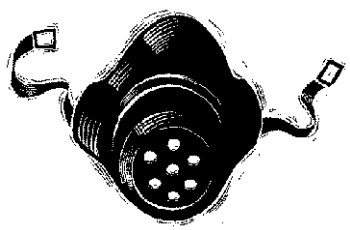
Realtime air quality monitors: Extremely inadequate. Only Delhi stands out



Source: NAQI portal

Out of the 46 cities with more than a million population:

- Delhi has the maximum number of real-time air quality monitors.
- 19 cities have just one station each
- 17 cities do not have any realtime station



Poor data capture for daily reporting of Air Quality Index

CSE analysis of Air Quality Index (AQI) reporting from 50 cities on CPCB website during November 2017:

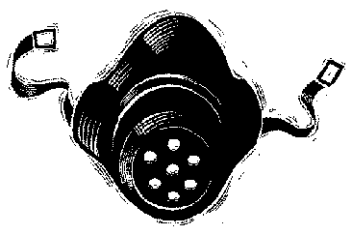
•AQI values are not published for 22 cities on a daily basis.

•Kolkata does not have any AQI data for the month of November .

• Chennai and Hyderabad have not reported AQI for 13% per cent of the days; Pune 30%; Ahmedabad 27%; Mumbai for 7% ; and Delhi 3% of the days.

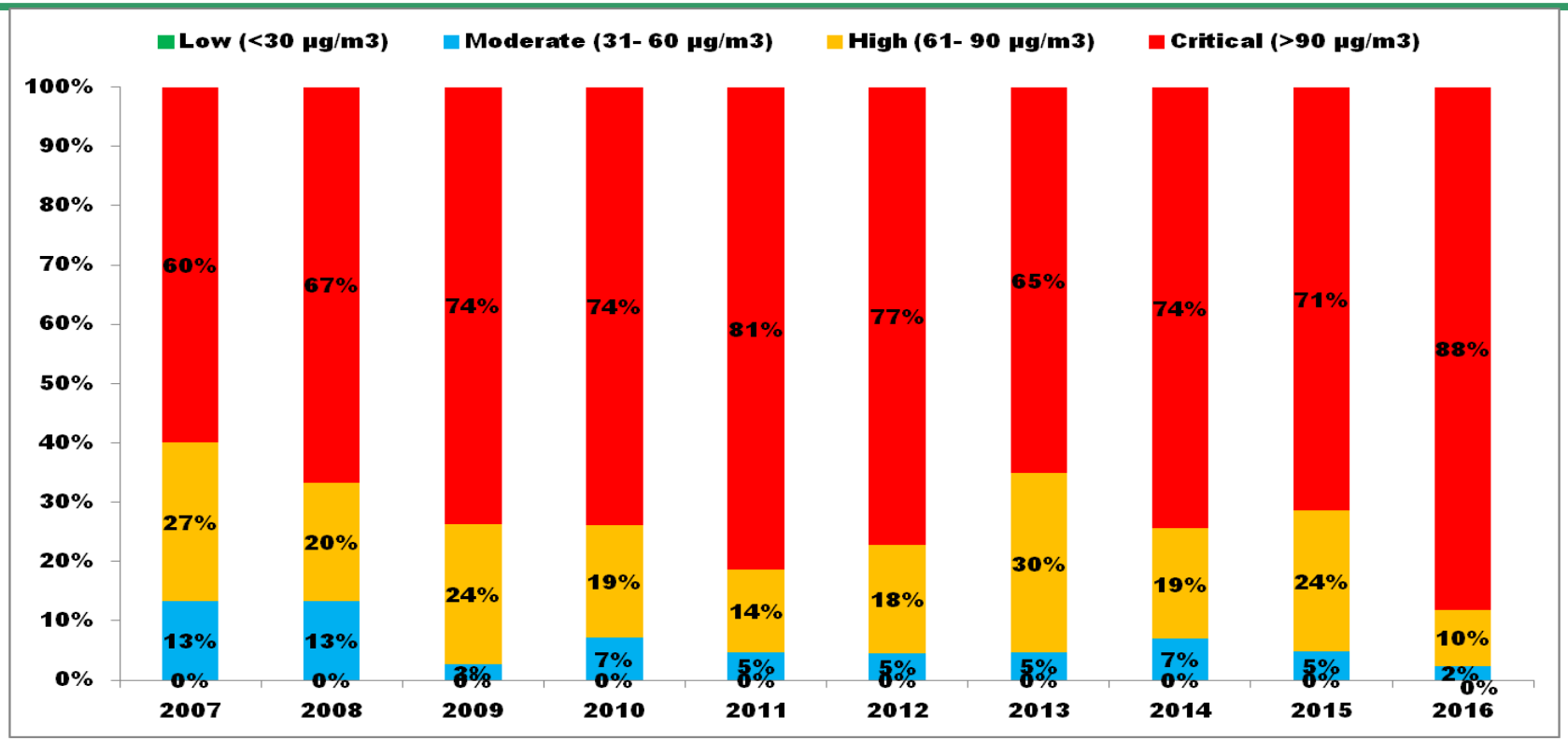
• In Dewas, Howrah, Ujjain AQI has not been reported for 80% of the days

•In many cities all real time monitors are not used for AQI reporting



How polluted are our cities?

More cities in grip of critical level of PM10



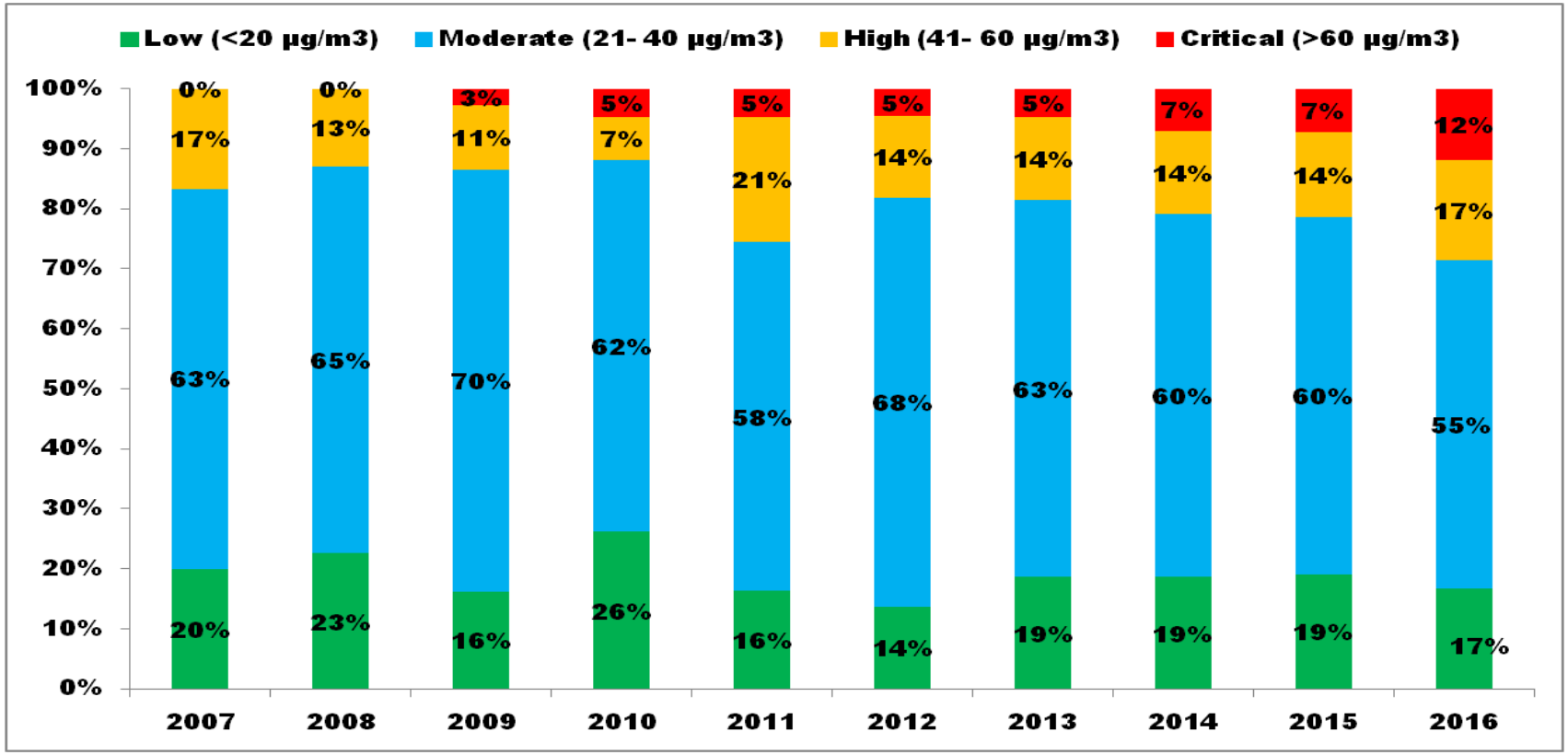
Source: Centre for Science and Environment of CPCB air quality data submitted to Rajya Sabha for 44 cities

Cities with critical level of PM10 (more than 1.5 times the standards) has increased from 60% in 2007 to 88% in 2016.

•Drastic fall in number of cities complying with standard -- from 13% in 2007 to 2% in 2016.

•There are no cities in the low pollution category (50% below the standard)

NO2 – an emerging problem

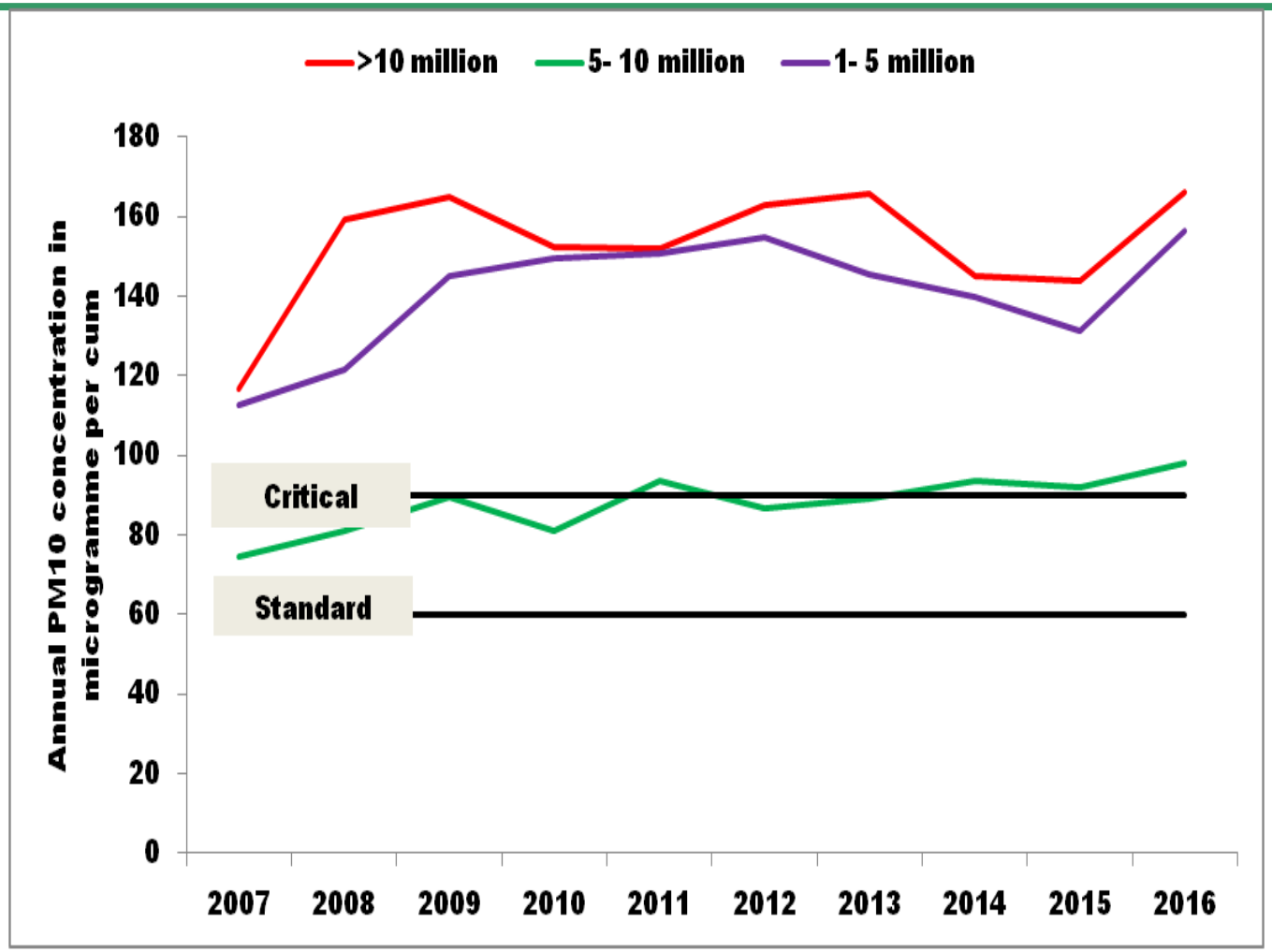


Source: Centre for Science and Environment of CPCB air quality data submitted to Rajya Sabha for 44 cities

- Cities with NO2 levels exceeding annual average standards has increased from 17%in 2007 to 29% in 2016. In 2007 not a single city was in critical category. In 2016 there 12% cities are.

- NO2 hotspots -- Amritsar, Aurangabad, Delhi, Faridabad, Jaipur, Kolkata, Meerut, Navi Mumbai, PimpriChinchwad, Pune, Thane, and Vijaywada

High risk to urban population

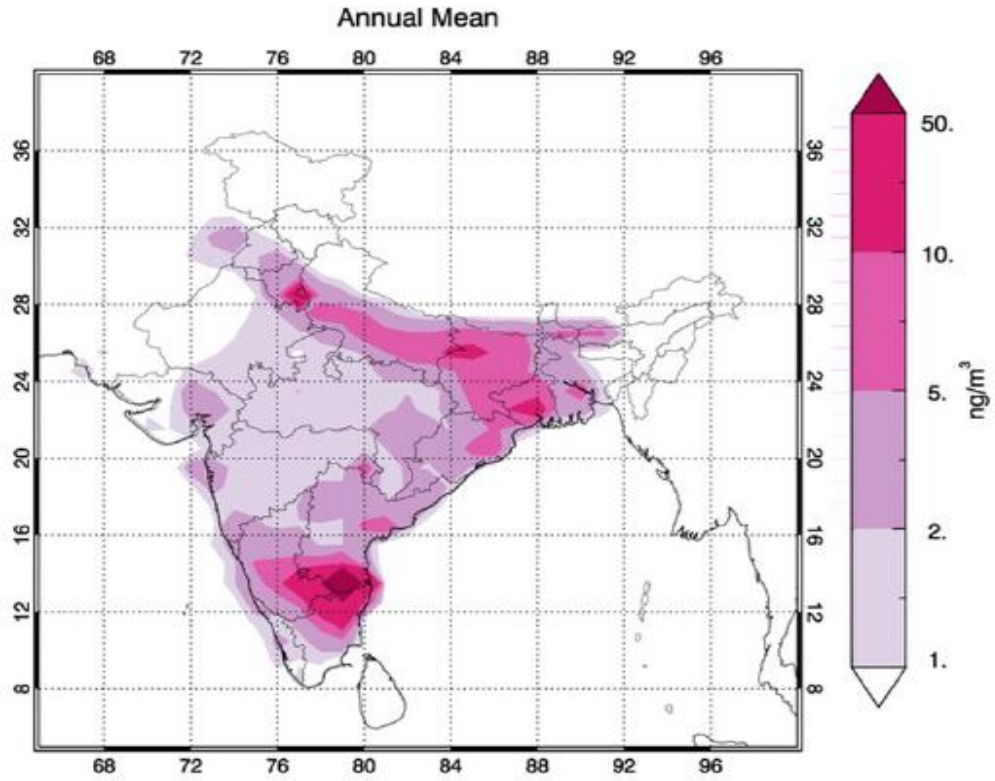


44 big cities with close to 40% of urban population, of which 91% live in cities with PM10 levels exceeding standards

Source: Centre for Science and Environment of CPCB air quality data submitted to Rajya Sabha for 44 cities

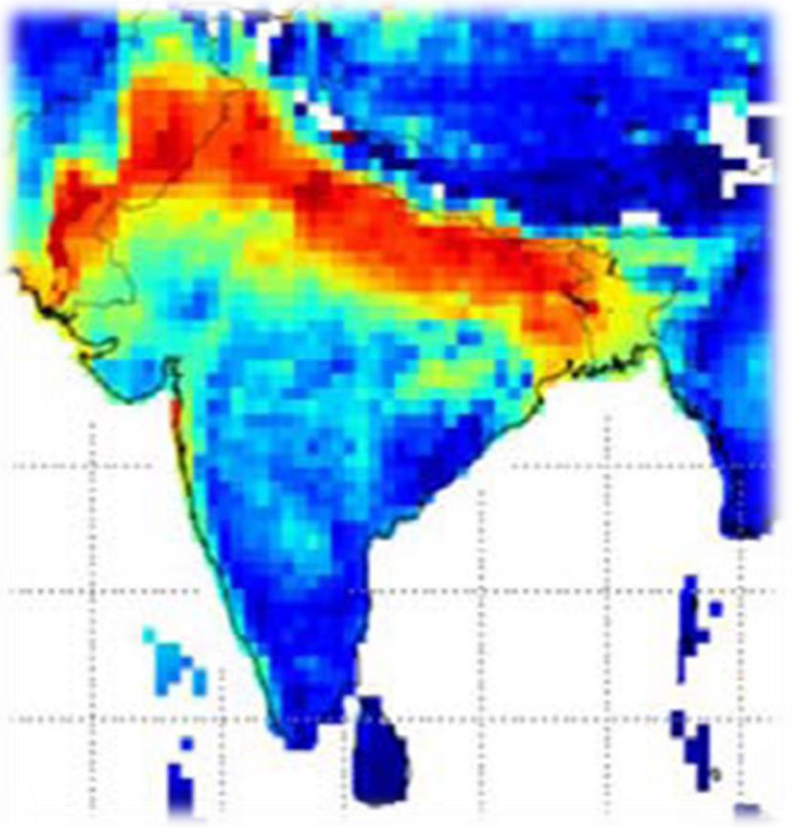
Regional challenge

Annual PM2.5 mean



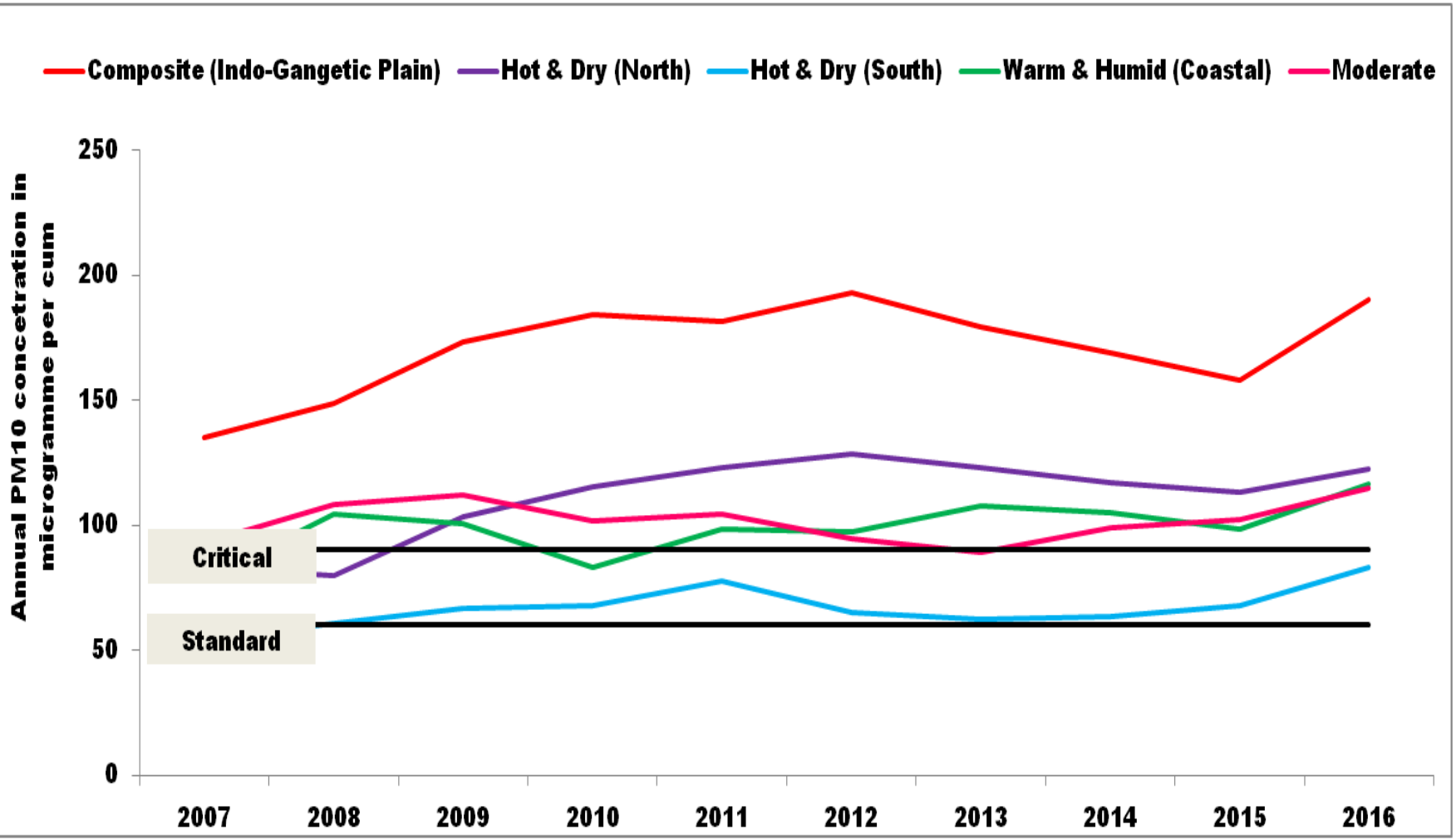
Source2015, Norwegian Institute for Air Research, International Institute for Applied Systems Analysis, IITM

Daily PM2.5 mean



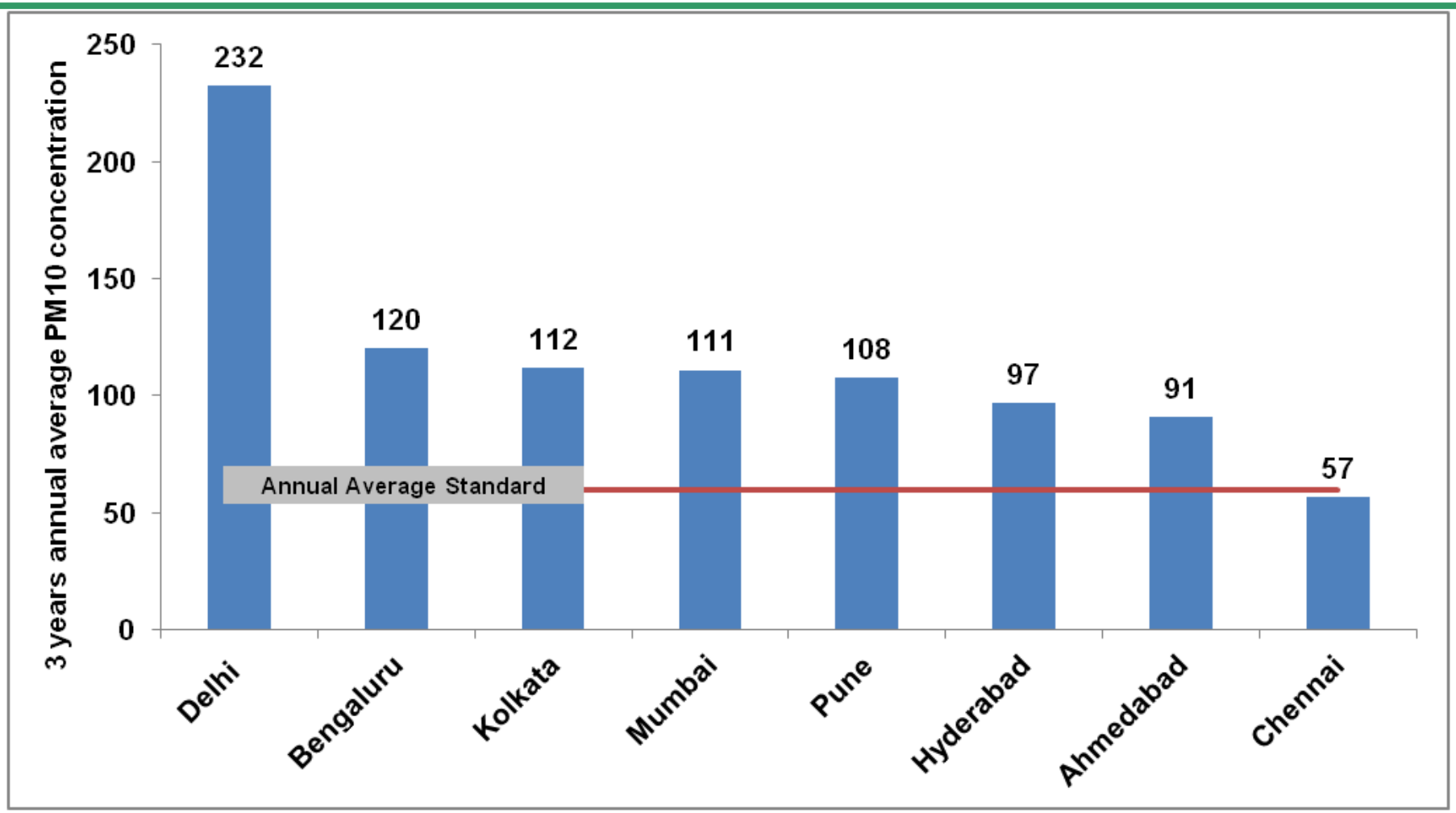
Source: Sagnik Dey 2016, Indian Institute of Technology Delhi,

Climate and weather aggravate pollution concentration
Land locked Indo Gangetic plains and North India have highest concentration



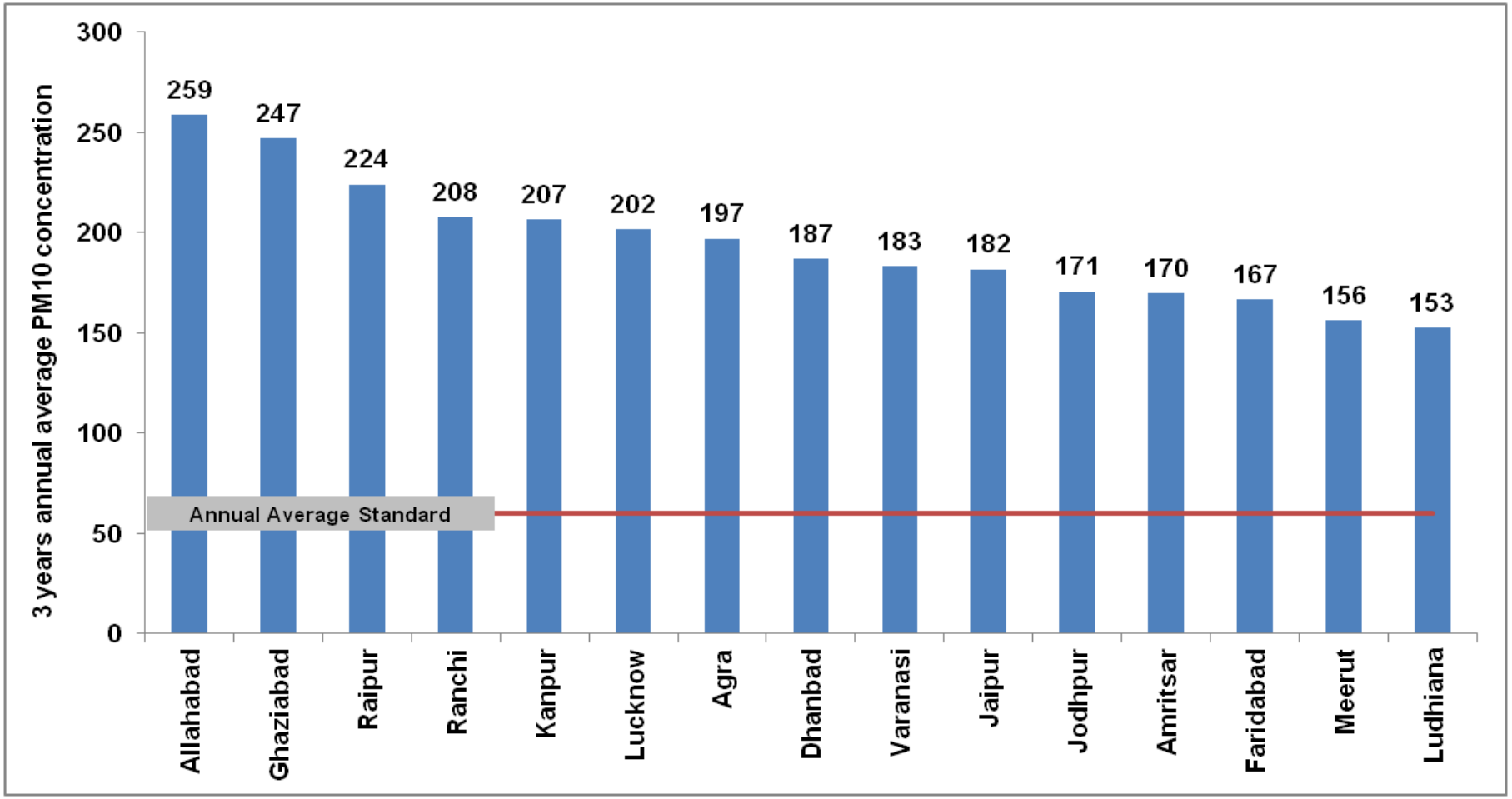
Source: Centre for Science and Environment of CPCB air quality data submitted to Rajya Sabha for 44 cities

Big vs small cities
(1) Ranking of big Cities– PM 10



Source: Centre for Science and Environment of CPCB air quality data submitted to Rajya Sabha for 44 cities

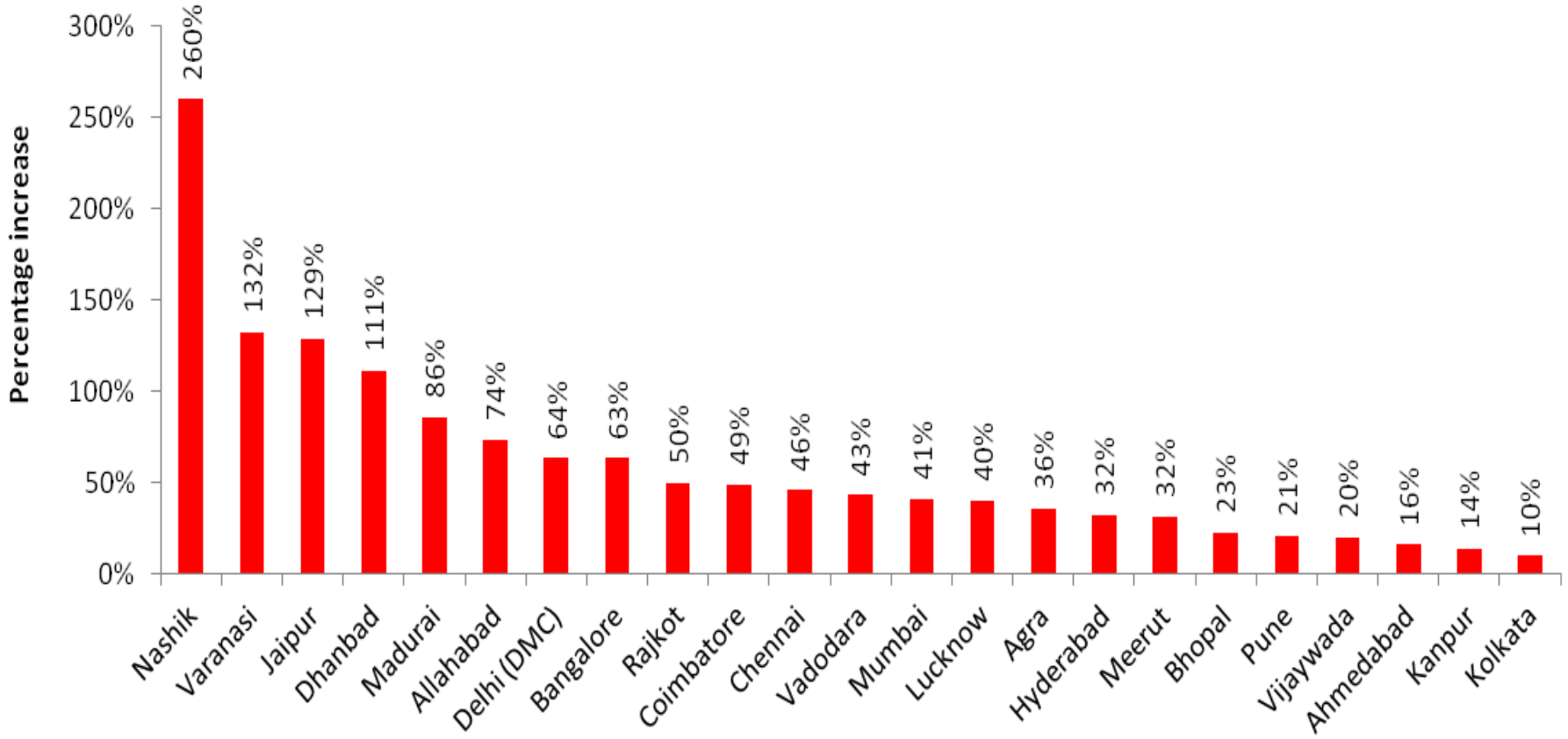
Big vs small
(2) Ranking of smaller cities– PM 10



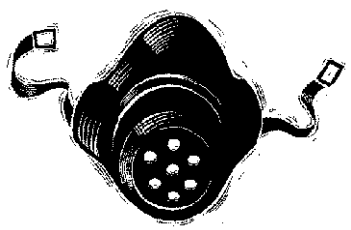
Source: Centre for Science and Environment of CPCB air quality data submitted to Rajya Sabha for 44 cities

Cities with rising PM10 trend

28 cities out of 44 million plus cities show increasing trend of PM10 concentration between 2007 and 2016



Source: Centre for Science and Environment of CPCB air quality data submitted to Rajya Sabha for 44 cities



Stable and Declining PM10 trend

Cities with mixed trend: Delhi, Chennai, Hyderabad, Bengaluru and smaller cities like Surat, Pune, Thane etc

Cities with stable but high trends:

•Mumbai, Nagpur, Ahmedabad, Faridabad, Kanpur, and Jodhpur.

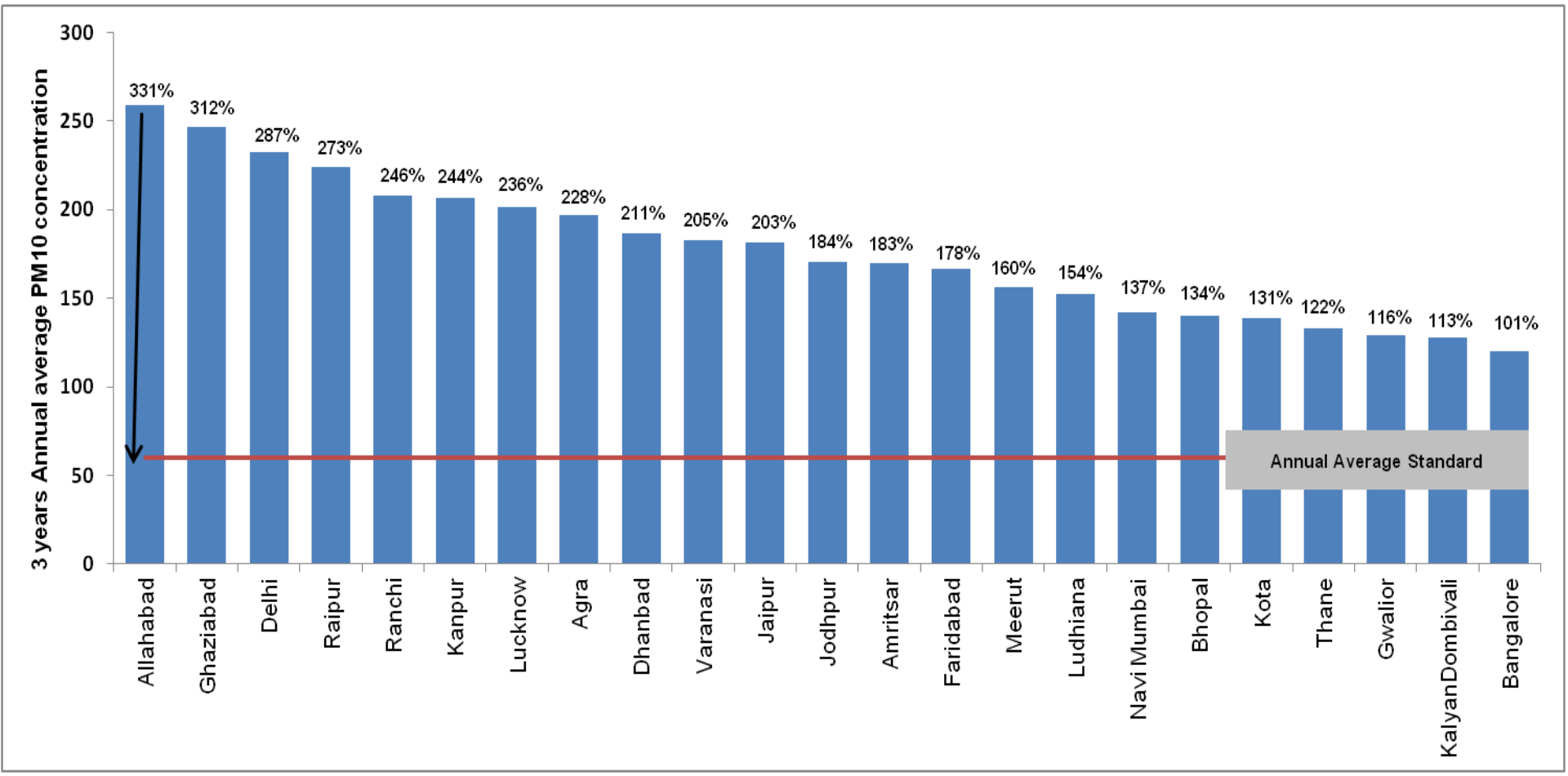
Cities with declining trend:

•Amritsar, Coimbatore, Gwalior, Howrah, Indore, Jabalpur, Kolkata, Ludhiana, Raipur and Vishakhapatnam.

•Need riders. Often a reflection of changes in location of monitoring stations. Also monitors being used for reporting data.

•Difficult to explain trends in most cities

Reduction targets to meet PM 10 standards



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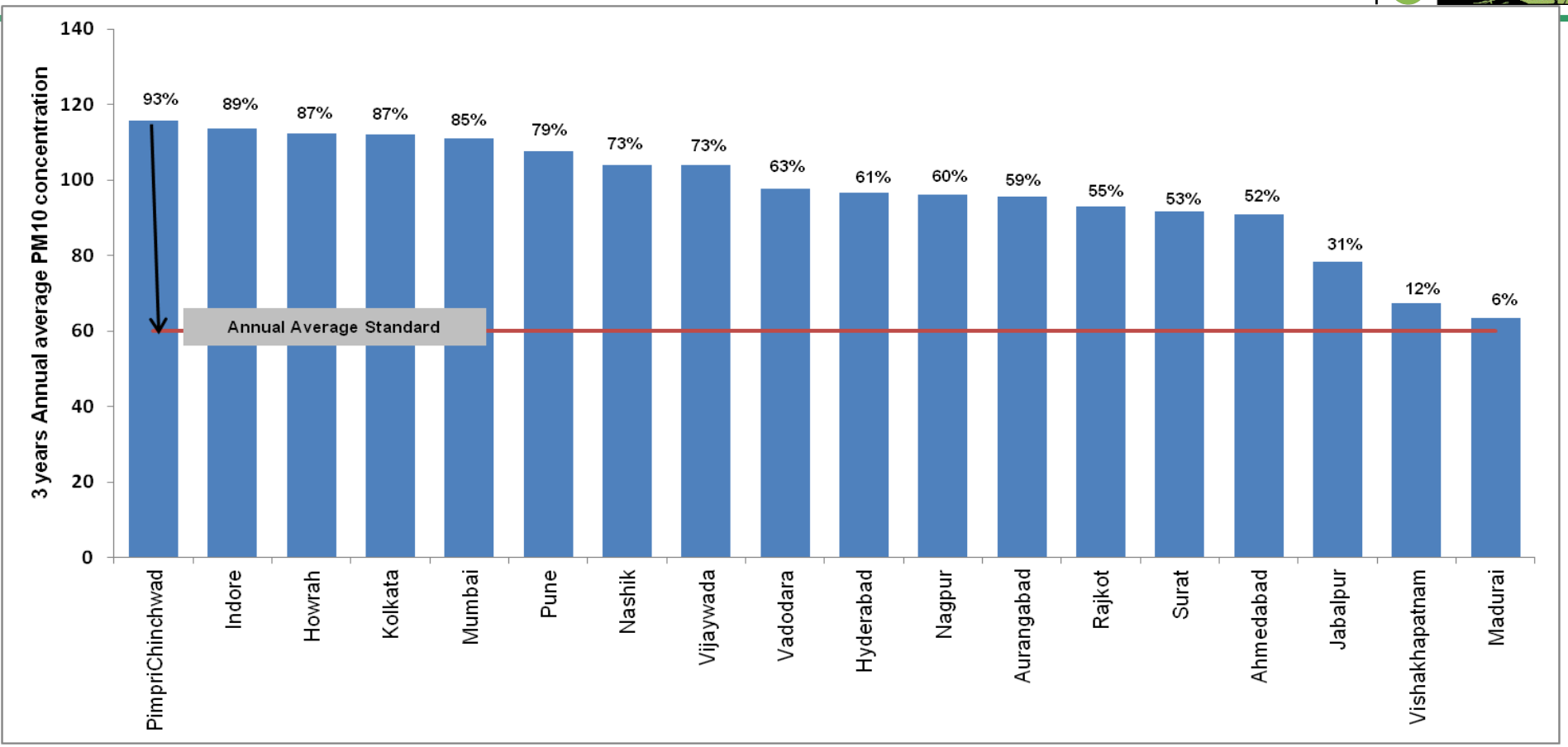
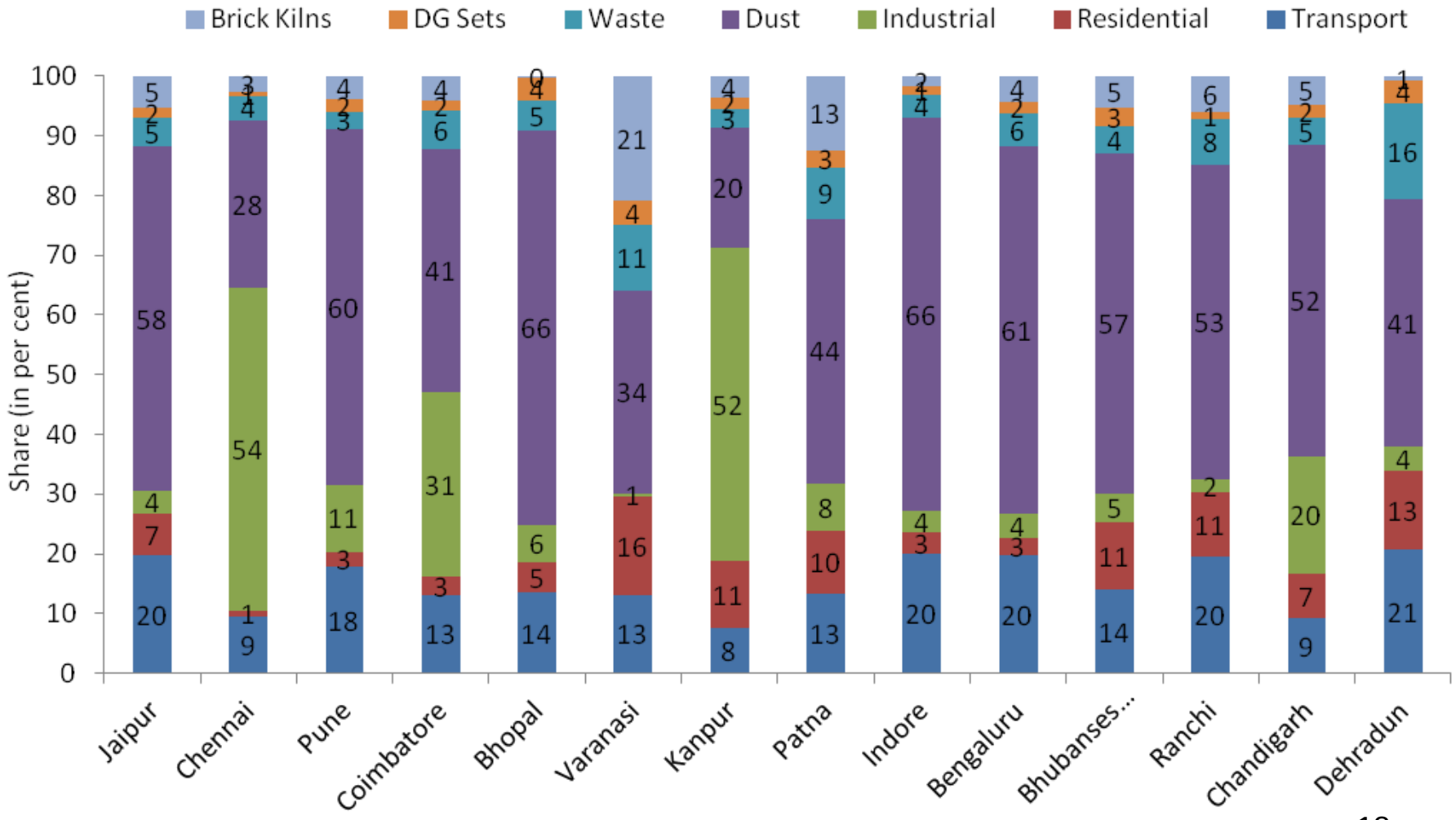
Reduction targets to meet PM 10 standards



Source: Centre for Science and Environment of CPCB air quality data submitted to Rajya Sabha for 44 cities

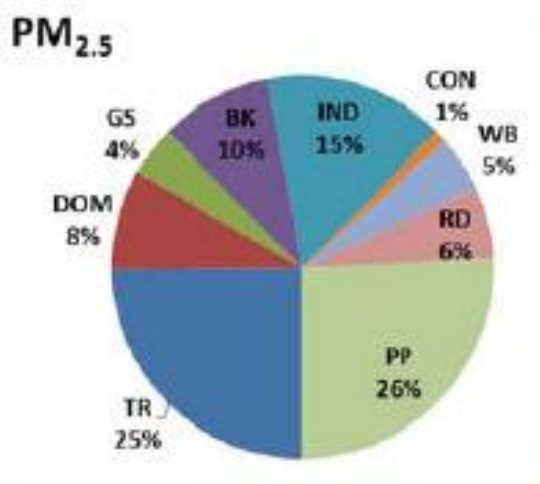
Where is pollution coming from…???



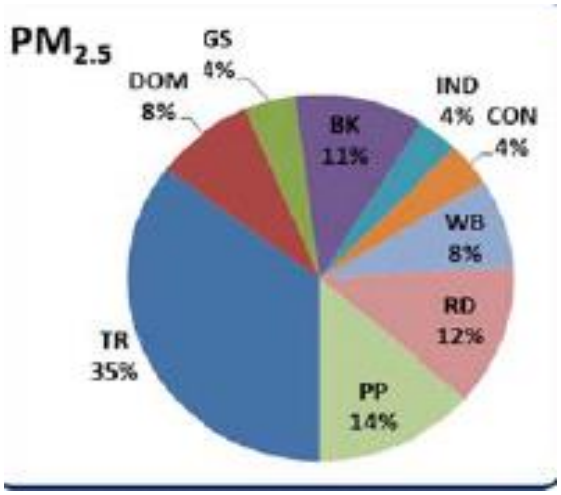
Source: Urban Emissions, 2017, http://www.urbanemissions.info/wp-content/uploads/apna/frontpage/index.html

Where is pollution coming from?

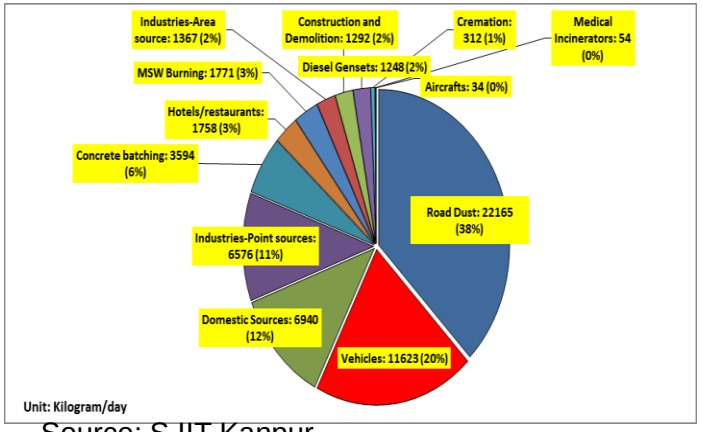
Ahmedabad



Chennai

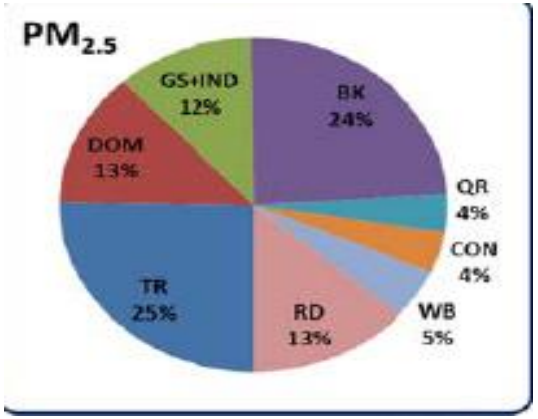


Delhi

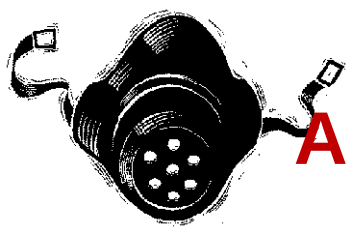


Source: S IIT Kanpur

Pune



Source: S Guttikunda, SIM Air , 2012 and IIT Kanpur 2015



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.

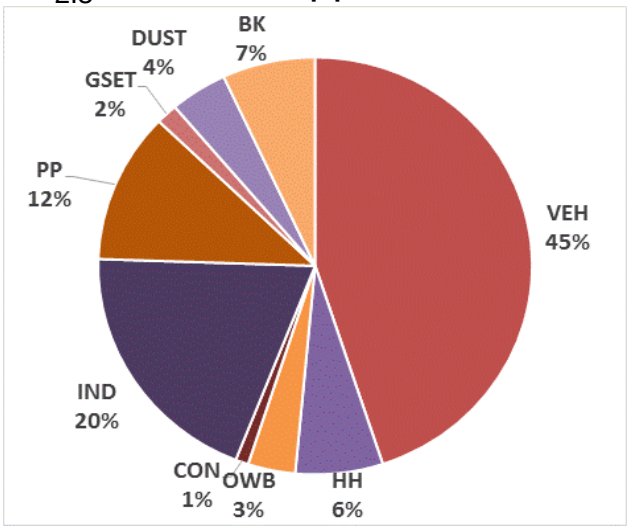
Shift from concentration management to exposure management

Ambient concentrations do not always well represent human exposures,

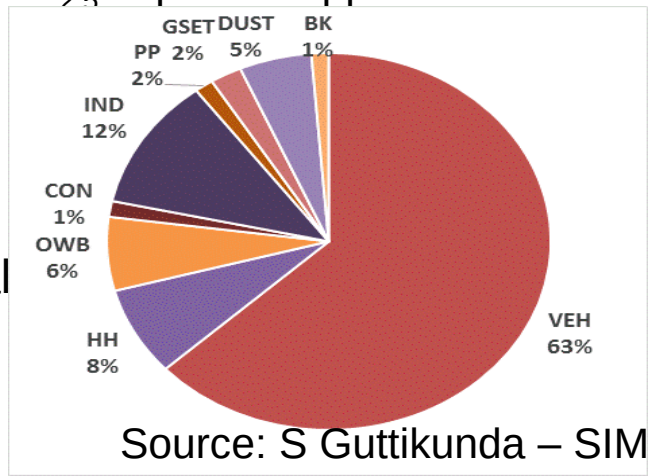
Ambient concentration is not a good surrogate for total air pollution risk, -- cannot indicate exposure and health outcome

Chennai

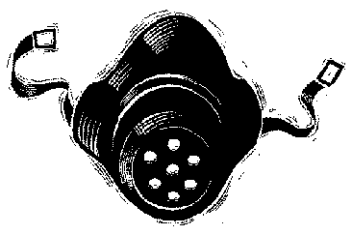
$PM_{2.5}$ emission apportionment



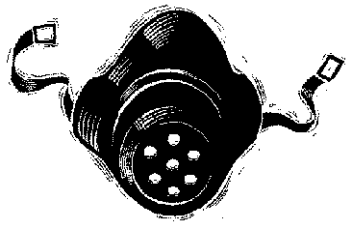
$PM_{2.5}$ exposure apportionment



Source: S Guttikunda – SIM



Our health is non-negotiable



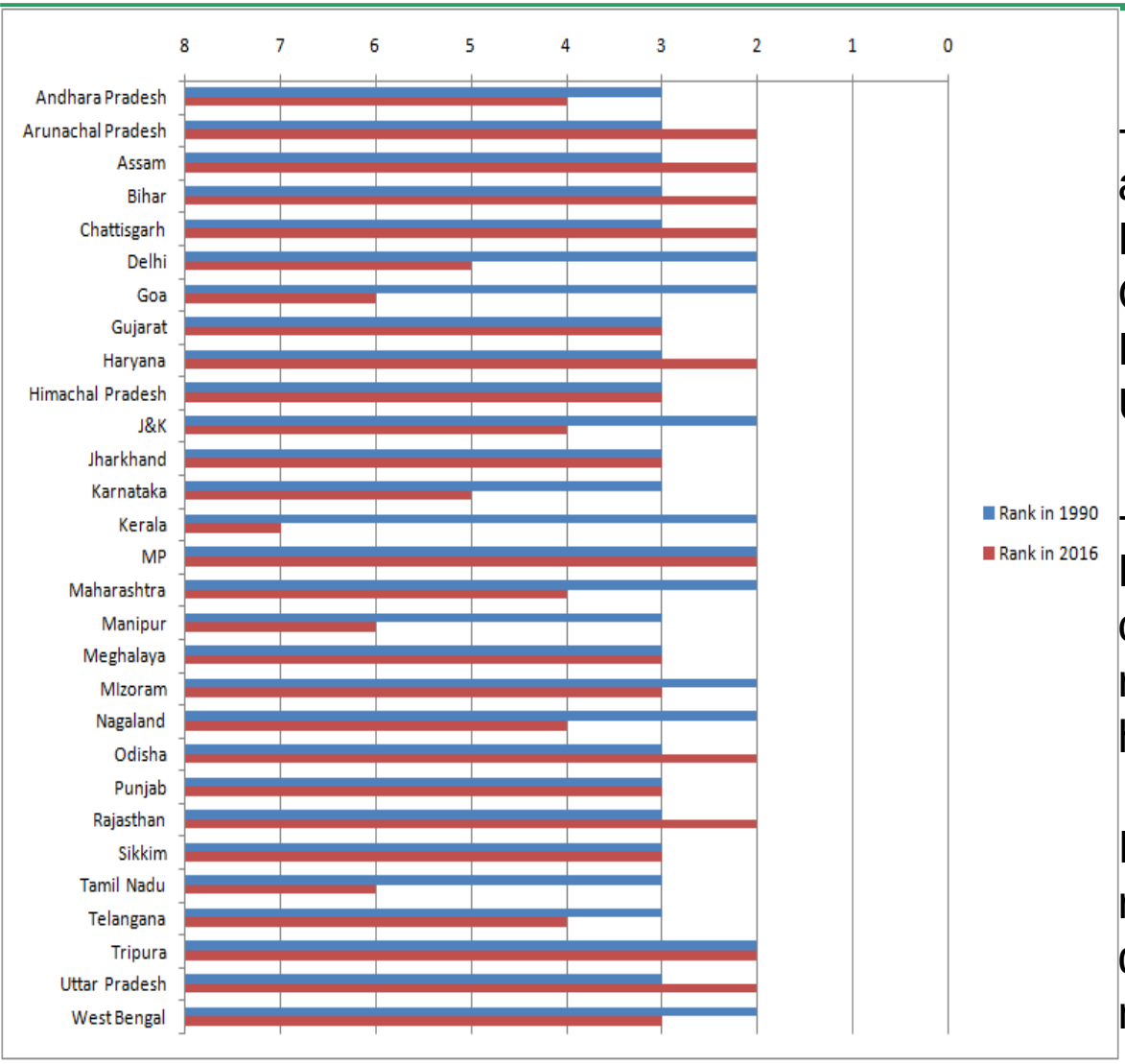
Very high disease burden

- **Global burden of disease (GBD) February 2017** Of more than total global 4.2 million early deaths -- 1.1 million deaths occur in India alone. More than a quarter of the global deaths.

- While early deaths related to PM2.5 in China have increased by 17.22 % since 1990, in India these have increased by 48%.

- **Journal of Indian Pediatrics (Dr SK Chhabra 2017):** Indian children growing with smaller lungs. Both boys and girls have lungs that are about 10 per cent smaller when they become adults in India.

Air Pollution high risk factor in Indian states (1990 vs 2016)



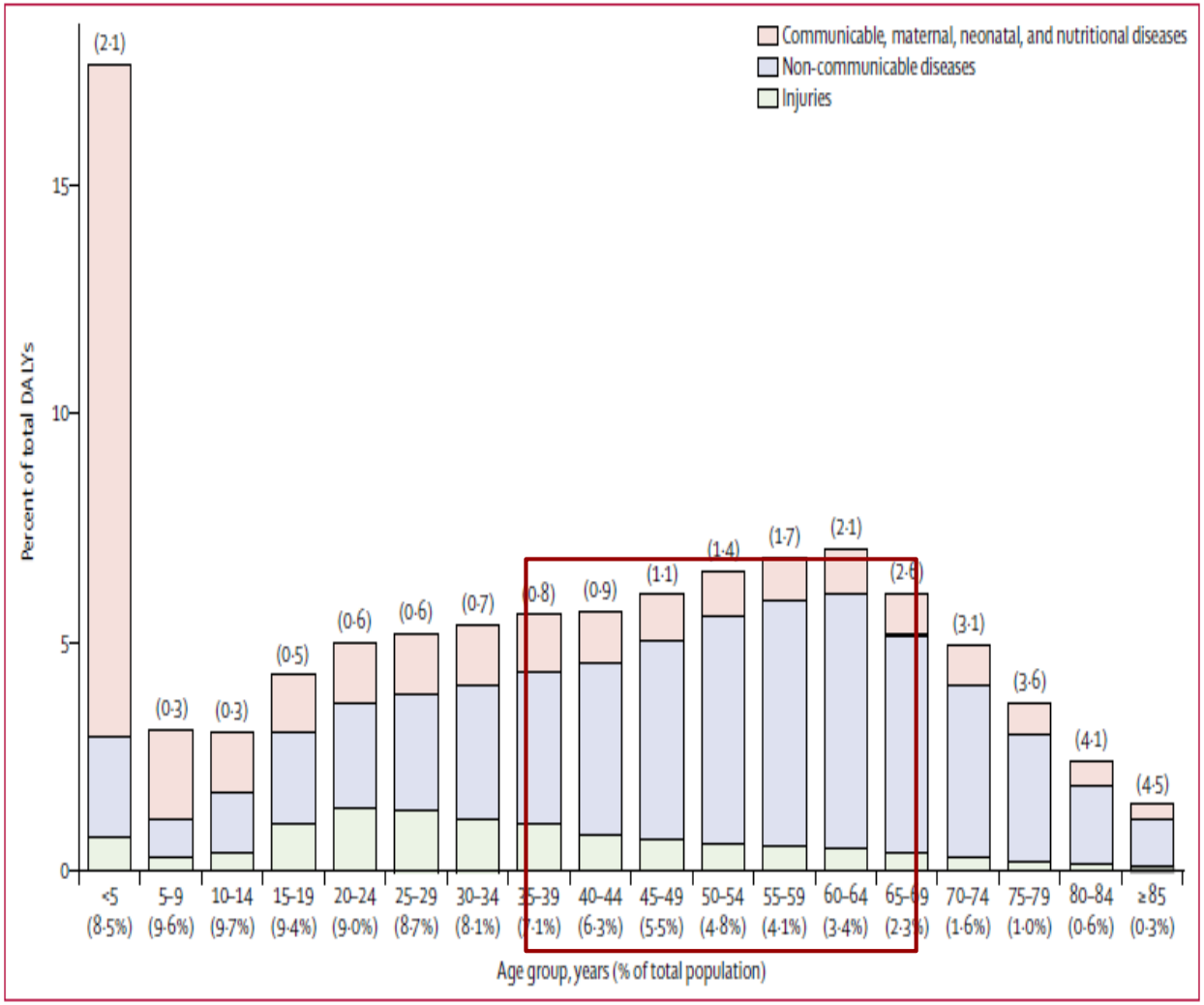
Source: India's Health of Nation's States Report, 2017: IHME-ICMR

-- Relative rank of air pollution as a risk factor went up in Arunachal Pradesh, Assam, Bihar, Chattisgarh, Haryana, Himachal Pradesh, Odisha, Rajasthan and Uttar Pradesh.

-- In Delhi, Maharasthra, West Bengal though lowered -- cardiovascular diseases, chronic respiratory diseases, and cancers have increased substantially.

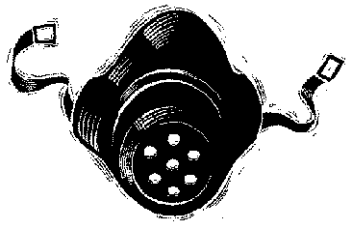
In Delhi COPD has moved from rank 13 to rank 3. Ischemic heart disease gone up from rank 5 to number 1 etc.

Most productive age group highly vulnerable

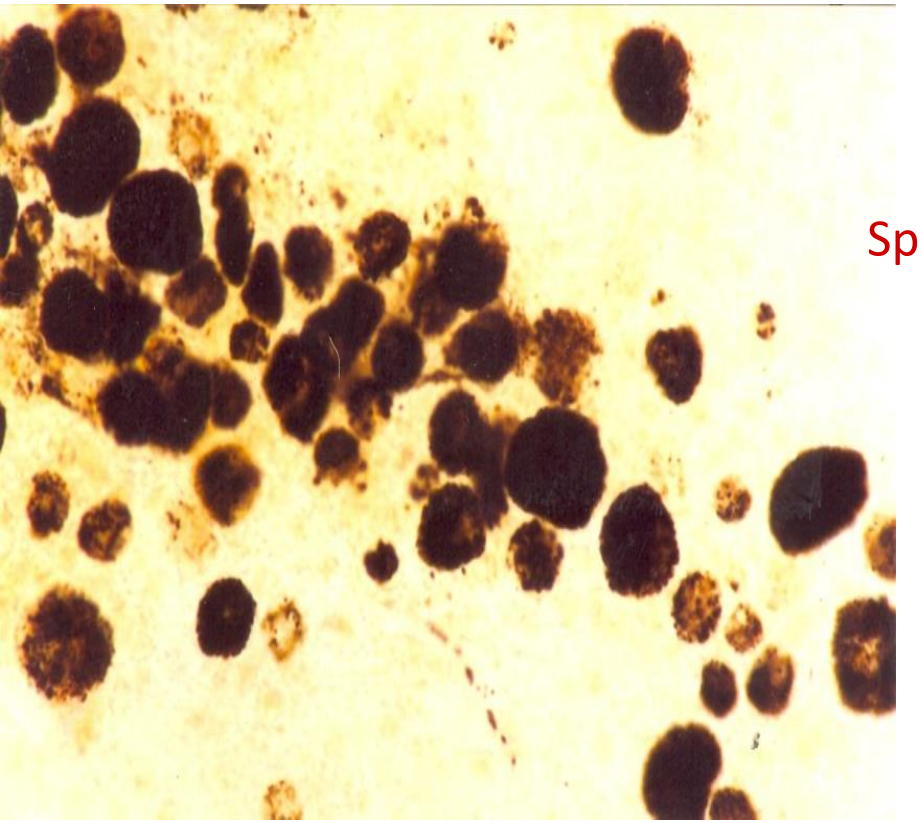


Age group between ages 35 and 60 most vulnerable to non-communcable diseases. Increases vulnerability to air pollution

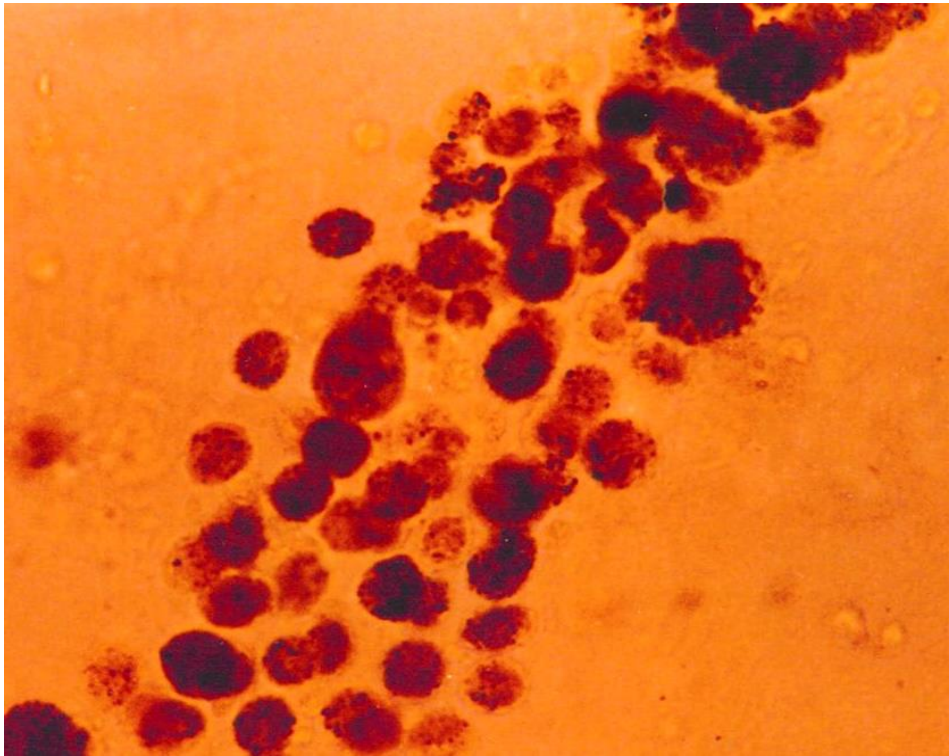
Source: India State Level Disease Burden,Lancet, 2017



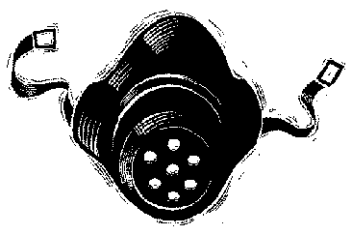
Sputum cytology of a taxi driver



Sputum cytology of a 14-year old girl in Delhi



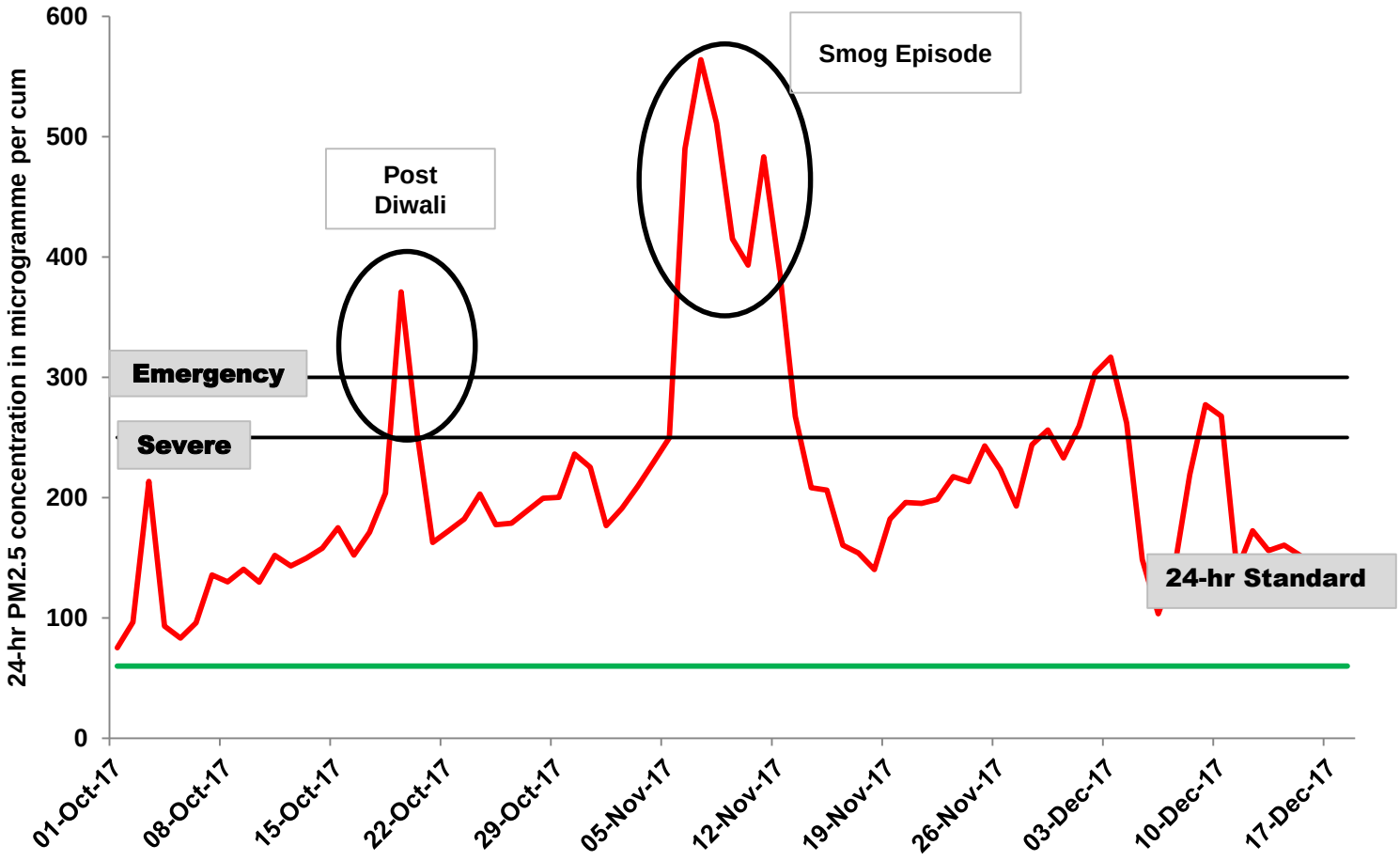
Source: CNCI



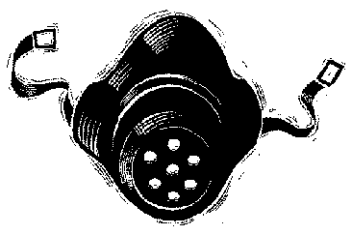
Delhi story

Deadly winter smog

Daily PM2.5 concentration based on Air Quality Index –2017 winter



Source: CSE's analysis of CPCB air quality data



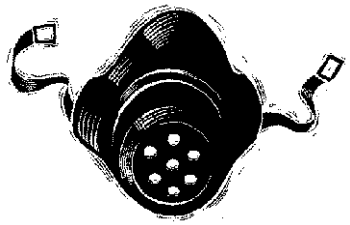
Supreme Court asks Government: "*Do you have a plan before city shuts down?*"

National Air Quality Index and Health advisory

AQI Category (Range)	PM_{10} 24-hr	$PM_{2.5}$ 24-hr	NO_2 24-hr	O_3 8-hr	CO 8-hr (mg/m^3)	SO_2 24-hr	NH_3 24-hr	Pb 24-hr
Good (0-50)	0-50	0-30	0-40	0-50	0-1.0	0-40	0-200	0-0.5
Satisfactory (51-100)	51-100	31-60	41-80	51-100	1.1-2.0	41-80	201-400	0.5 –1.0
Moderately polluted (101-200)	101-250	61-90	81-180	101-168	2.1- 10	81-380	401-800	1.1-2.0
Poor (201-300)	251-350	91-120	181-280	169-208	10-17	381-800	801-1200	2.1-3.0
Very poor (301-400)	351-430	121-250	281-400	209-748*	17-34	801-1600	1200-1800	3.1-3.5
Severe (401-500)	430 +	250+	400+	748+*	34+	1600+	1800+	3.5+

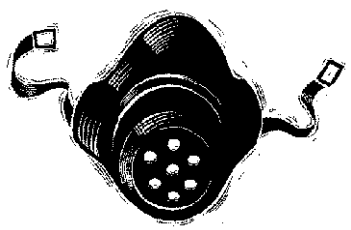
AQI	Associated Health Impacts
Good(0–50))	Minimal Impact
Satisfactory (51–100)	May cause minor breathing discomfort to sensitive people
Moderately polluted (101–200)	May cause breathing discomfort to the people with lung disease such as asthma and discomfort to people with heart disease, children and older adults
Poor (201–300)	May cause breathing discomfort to people on prolonged exposure and discomfort to people with heart disease
Very Poor (301–400)	May cause respiratory illness to the people on prolonged exposure. Effect may be more pronounced in people with lung and heart diseases
Severe (401-500)	May cause respiratory effects even on healthy people and serious health impacts on people with lung/heart diseases. The health impacts may be experienced even during light physical activity

Graded response action plan notified



Graded Response Action Plan

Moderate – When PM2.5 is between 61-90 µg/m3 or PM10 is between 101-250 µg/m3	1. Stringently enforce/stop garbage burning in landfills 2. Close/stringently enforce all pollution control regulations in brick kilns and industries 3. Stringently enforce pollution control in thermal power plants through PCB monitoring 4. Do periodic mechanized sweeping on roads
Poor – When PM2.5 levels are between 91-120 µg/m3 or PM10 levels are between 251-350 µg/m3	5. Strict vigilance and no tolerance for visible emissions 6. Strict vigilance and enforcement of PUC norms 7. Stringently enforce rules for dust control in construction activities and close non-compliant sites 8. Deploy traffic police for smooth traffic flow at identified vulnerable areas 9. Strictly enforce Supreme Court order on diversion of non-destined truck traffic 10. Strictly enforce Supreme Court ban on firecrackers 11. Information dissemination Social media, mobile Apps should be used to inform people
Very Poor - When PM2.5 levels are between 121-250 µg/m3 or PM10 levels are between 351-430 µg/m3	1. Stop use of diesel generator sets 2. Enhance parking fee by 3-4 times 3. Increase bus and metro services by augmenting contract buses and increasing frequency of service 4. Stop use of coal/firewood in hotels and open eateries 5. Residential Welfare Associations and individual house owners to provide electric heaters during winter to security staff to avoid open burning by them 6. Alert in newspapers/TV/radio to advise people with respiratory and cardiac patients to avoid polluted areas and restrict outdoor movement.
Severe - When PM2.5 levels are above 250 µg/m3 or PM10 levels are above 430 µg/m3	1. Close brick kilns, Hot Mix plants, Stone Crushers 2. Shut down Badarpur power plant 3. Intensify public transport services. Introduce differential rates to encourage off-peak travel. 3. Increase frequency of mechanized cleaning of road and sprinkling of water on roads. Identify road stretches with high dust generation.
Severe + or Emergency - When PM2.5 levels cross 300 µg/m3 or PM10 levels cross 500 µg/m3 (5 times above the standard) and persist for 48 hours or more	1. Stop entry of truck traffic into Delhi (except essential commodities 2. Stop construction activities 3. Introduce odd and even scheme for private vehicles based on license plate numbers and minimize exemptions 4. Task Force to take decision on any additional steps including shutting of schools

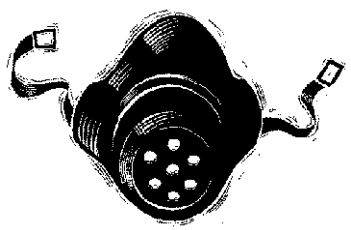


Comprehensive Action Plan

- First ever mandatory plan with short, medium and long term measures for all key pollution sources --- vehicles and fuels; public transport and mobility, industries and brick kilns, power plants, waste burning, construction activities, diesel generator sets, road dust, crop burning, domestic fuels etc.

- Action with deadlines, and makes agencies responsible for implementation

- According to this plan, Delhi-NCR needs to reduce annual average PM2.5 levels by at least 74 per cent to meet clean air standards



Implementation of Graded Response Action Plan (GRAP) begins

- **Action for very poor category to prevail throughout winter –** Badarpur power plant and brick kilns closed; diesel generator sets not allowed in Delhi; stringent action on waste, construction and road dust

- **November 7-13 smog episode:** Action for severe category kicks in – trucks and construction activities stopped; stone crushers and hot mix plants shut; parking charges increased 4 times; solid fuels not allowed in open eateries and resturaunts

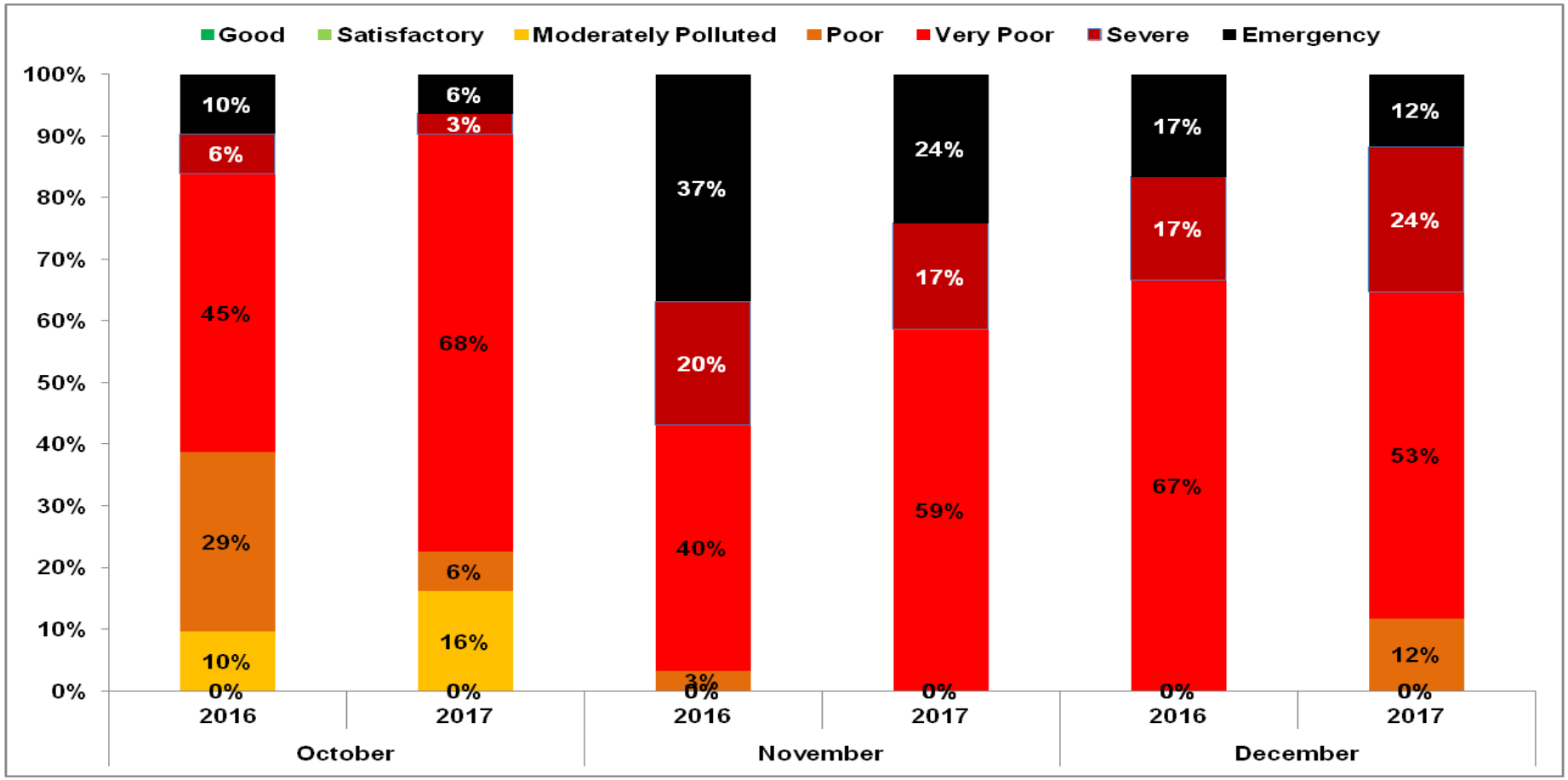
- **Ongoing action – part of comprehensive action plan:**

  -- Environment compensation charge to be paid by each and every truck entering Delhi

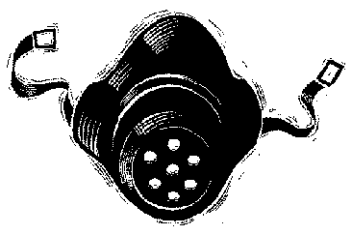
  -- Ban on dirty industrial fuels of petcoke and furnace oil

  -- Environment pollution charge on large diesel cars and SUVs.

GRAP has made a difference

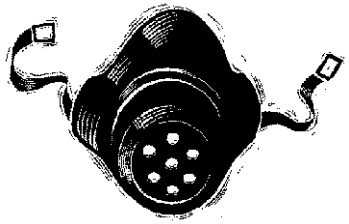


Source: CSE's analysis of CPCB air quality data, based on 4 stations Mandir Marg, RK Puram, Punjabi Bagh and Anand Vihar



Longer term action

(1) Action on dirty industrial fuels



Furnace Oil and Petroleum Coke

(Left) Sample of Fuel/ Furnace Oil

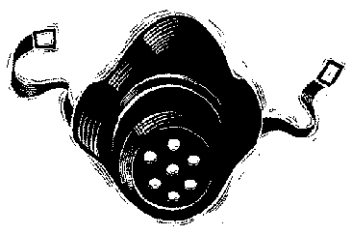
(**Bottom)** Sample of Petroleum Coke

EPCA-CSE investigation: Extremely high sulphur levels -- more than 20,000 ppm to 74,000 ppm in contrast to only 50 ppm sulphur in BS-IV transport fuels

Import of Petcoke increased more than 14 times, since 2010-11 -- Compounded Annual Growth Rate of 45.92%.

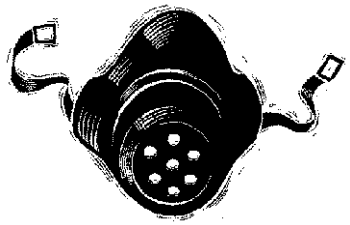
Lower prices incite its use. Under GST, these fuels are in 18% slab. But Input tax under GST is credited back to the industry, -- effective tax rate is 0%

Cleaner alternatives such as Natural Gas and Electricity are taxed high – as high as 26% in some states.



India has become the dump yard

- In the US, the use of PetCoke in power generation has plummeted due to heavy restrictions.
- Until 2014, China was the biggest buyer of US Petcoke. But sulphur restrictions and local bans on new power plants have closed this supply from US.
- Import of pet coke is under the Open General Licence (OGL). Not restricted like other Hazardous substances
- The MOEFCC has submitted in its affidavit to the Supreme Court that it is considering regulation petcoke imports.
- Strong industry opposition
- Supreme Court observed – India is becoming world’s dustbin..

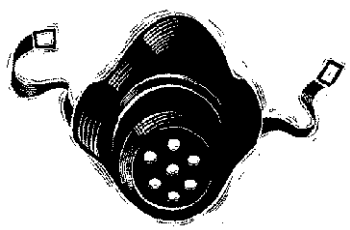


National spin off from Delhi action – national emissions standards

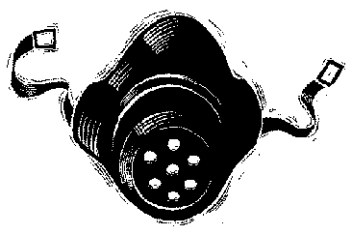
Supreme Court Directive October 24, 2017

- Banned use and sale of these fuels in Haryana, Rajasthan and Uttar Pradesh from November 1, 2017, in addition to Delhi, where it has been banned since 1998.
- Directed MoEFCC to notify national standards for NOx and SOx for 34 groups of industries. To be implemented by December 31, 2017.
- MoEFCC has been fined an amount of Rs 2 lakh for consistent inaction in this regard
- Excerpt from Supreme Court Order dated November 17, 2017 –

  "…*We may note that pollution caused by pet coke and furnace oil is not a problem confined only to the NCR region but appears to be a problem faced by almost all the States and Union Territories in the country… we request all the State Governments and Union Territories to consider taking similar measures …*"

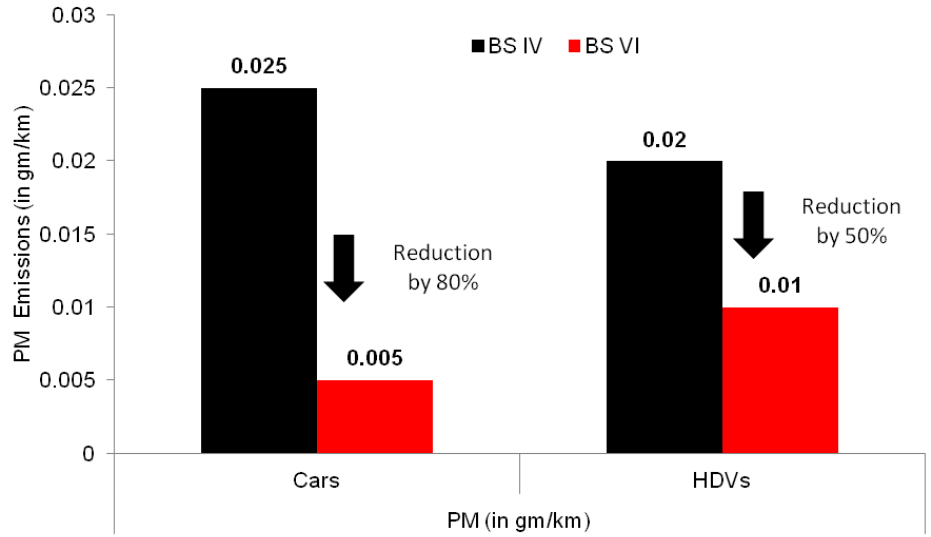


(2) Action on vehicles

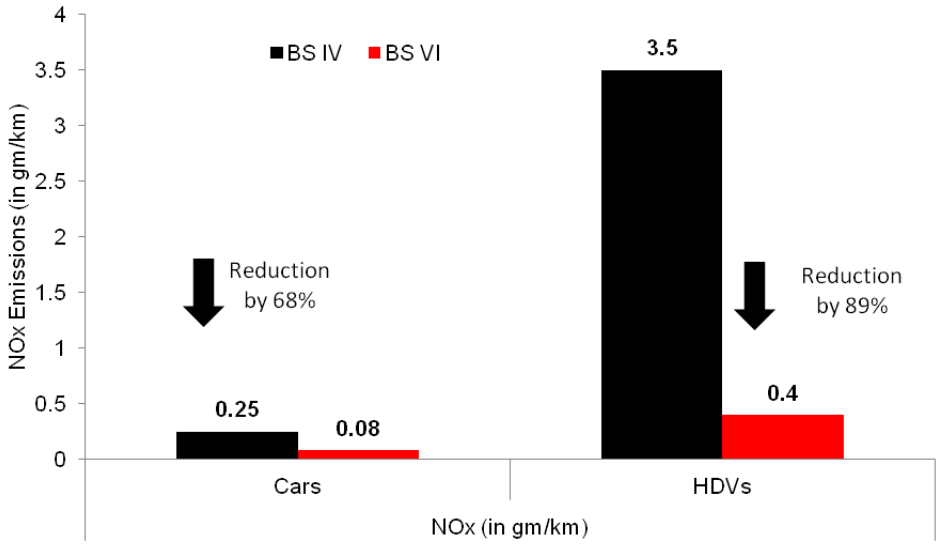


India to leapfrog to Euro VI standards by April 2020…
Delhi to advance BS VI fuels by 2 years…

PM



NOx



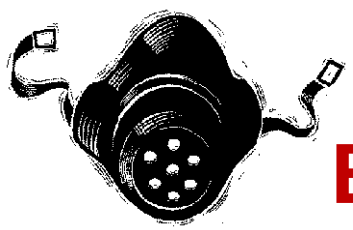
-- Diesel cars: NOx emissions will reduce by 68%, PM by 80%.

-- Trucks and buses: NOx emission will reduce by 89% and PM emissions by 50%.

-- To be implemented along with real world driving emissions monitoring

-- Delhi to have BSIV fuels by April 2018; will reduce on road emissions

-- To decide time frame for stopping production of BSIV vehicles for quick transition to BSVI in April 2020



On-road emissions
EPCA investigates PUC system

- Only 23% of vehicles in Delhi come for PUC test
- Only 2% vehicles fail
- Lack of qualified and skilled PUC operators
- Lack of knowledge of proper testing procedures
- Improper testing and manual data reporting
- Non-functioning equipment; use of fake software
- Updated calibration certificates not available
- Very few inspectors for strong oversight of centres
- Numerous PUC centres

Supreme Court directs linking of annual vehicle insurance with valid PUC certificates across the country. Also other measures recommended by EPCA

Observed malpractices
NCR

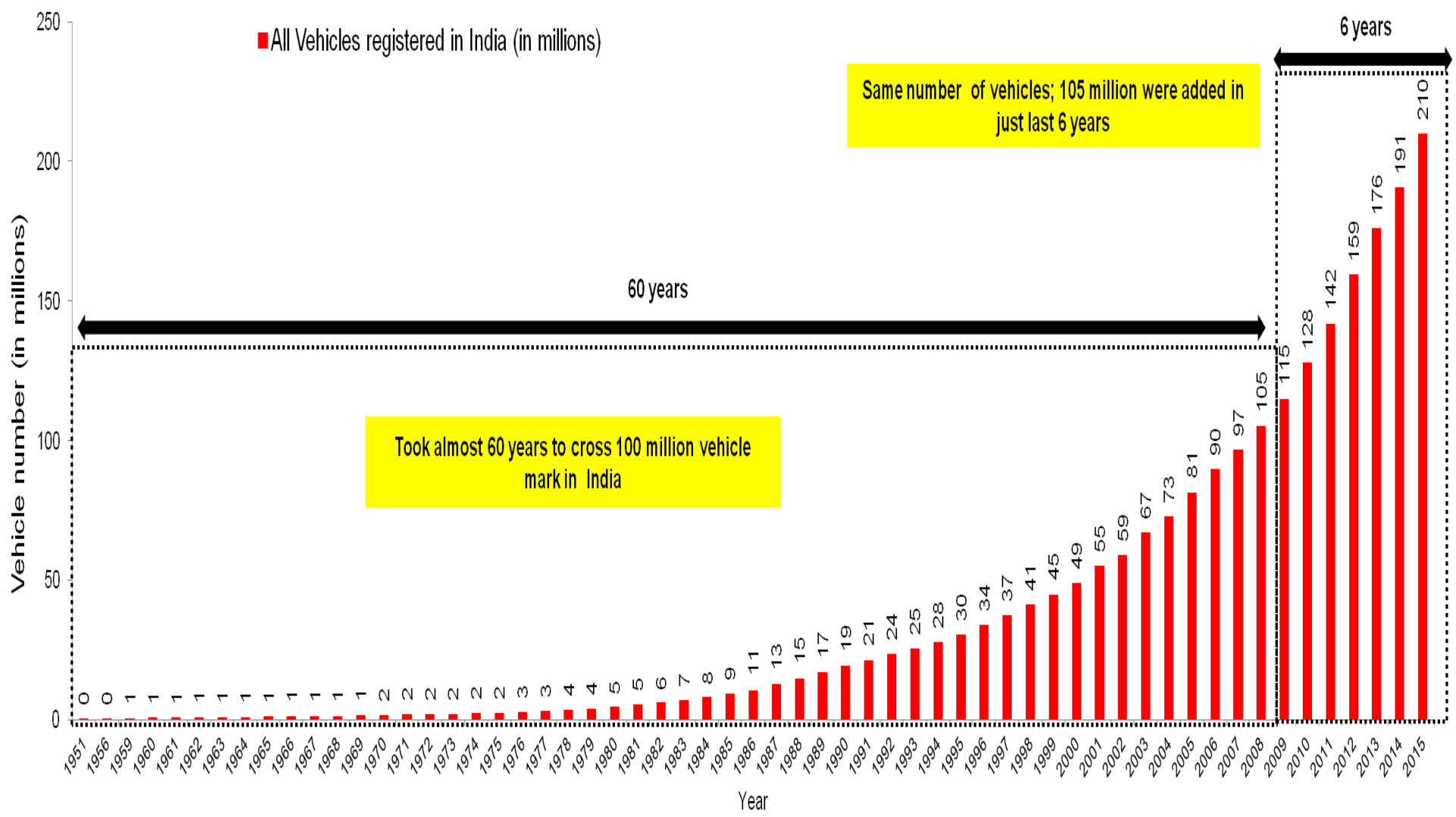
Narendra Prayavaran Sewa Samiti, Bulandshahr,
Centre code- 687

A fake PUC certificate was issued for the decoy diesel vehicle by the PUC centre which did not have any test equipment.

Chaman Prayavaran Sewa Samiti, Anoopshahr, Bulandshahr,
Centre code- 908

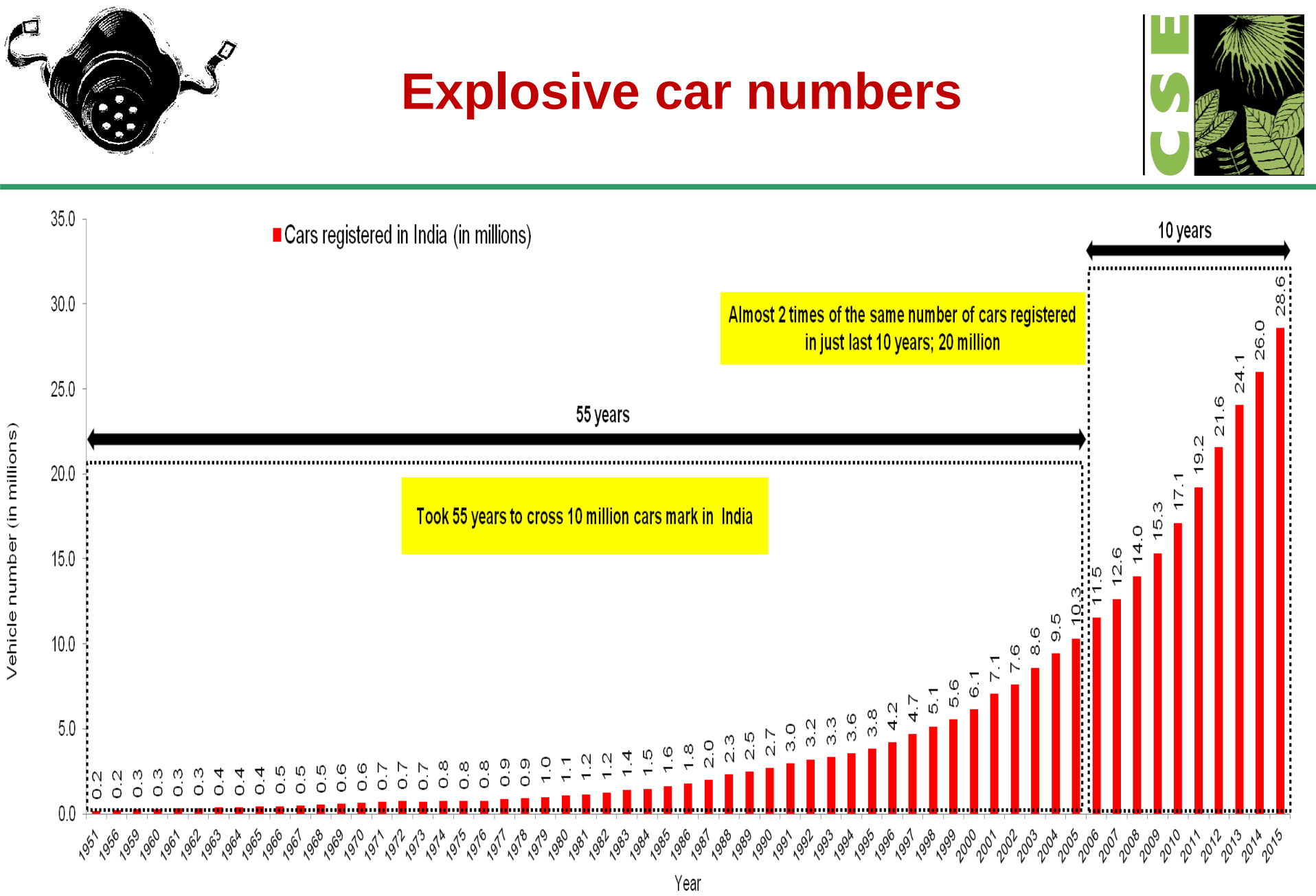
There was no testing equipment in this centre at the time of inspection. It only had a computer and printer to issue PUC certificate.

Need national action on vehicles to reduce impact of rapid motorisation



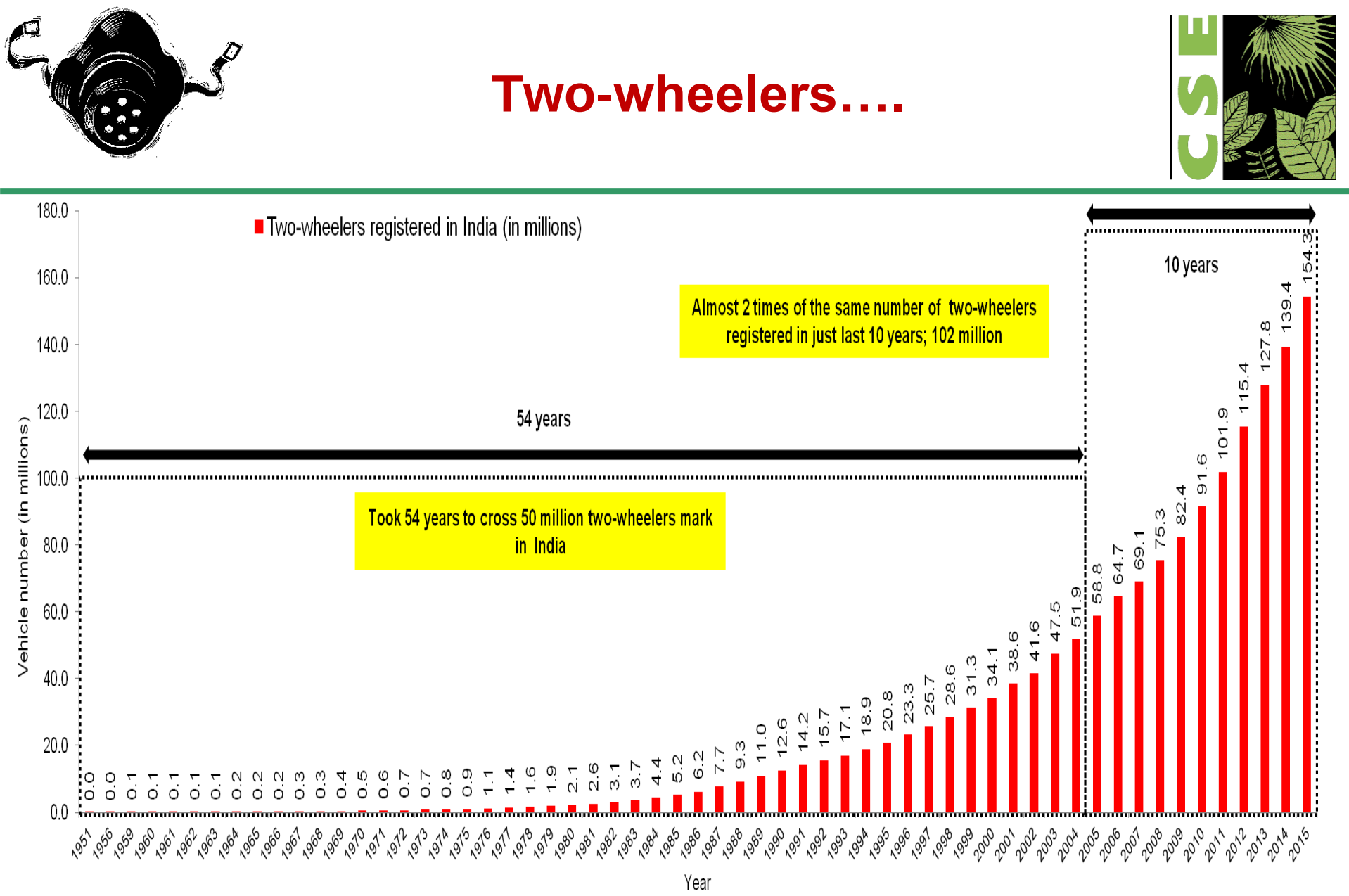
Source: 2016, Road Transport Yearbook, MoRTH

Explosive car numbers



Source: 2016, Road Transport Yearbook, MoRTH

Two-wheelers….



Source: 2016, Road Transport Yearbook, MoRTH

Action on trucks

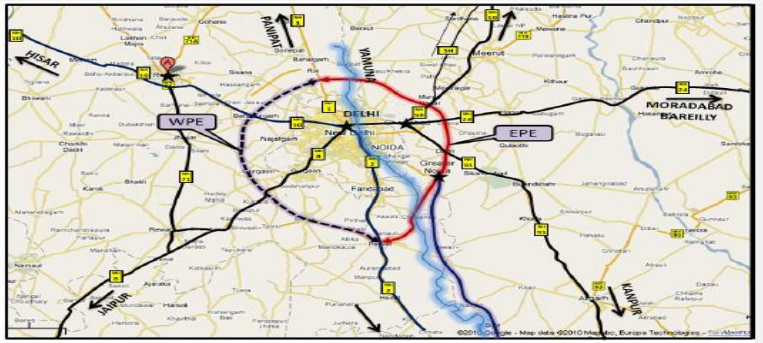
- Environment compensation charge on each truck entry into city
- Reduction in truck numbers after doubling of ECC.
- Entry of pre-2006 registered trucks banned in Delhi.
- Non-destined trucks being diverted by the Haryana and UP government - an average of 6,300 trucks daily.
- Installation of RFID and Weigh in motion brides
- Up-gradation of bypasses available to divert the entry of non-destined trucks into Delhi.

KUNDLI – MANESAR STRETCH (WESTERN PERIPHERAL EXPRESSWAY)

STATUS REPORT FOR EPCA

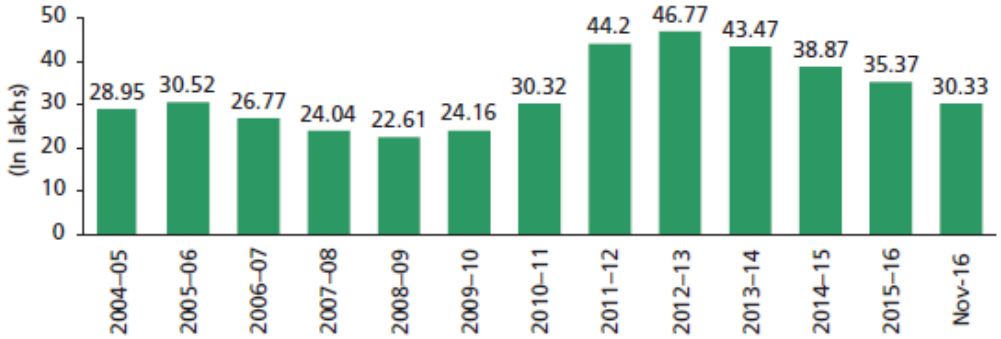
EASTERN PERIPHERAL EXPRESSWAY

STATUS REPORT FOR EPCA



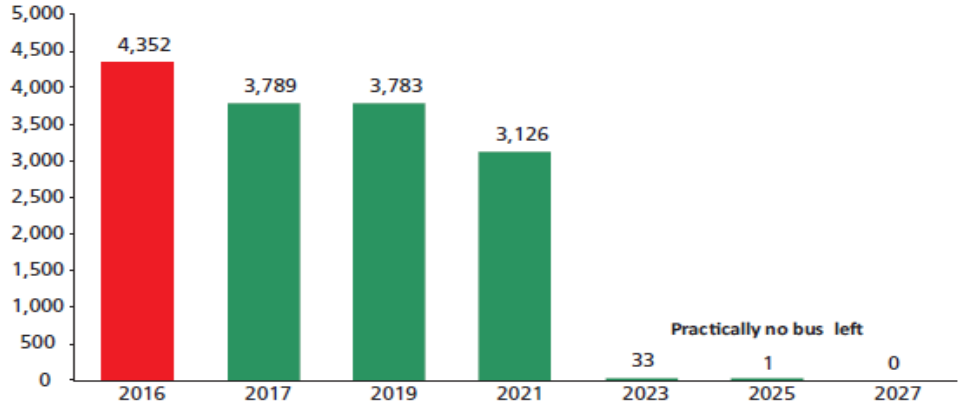
Public transport remains the most difficult challenge
Lesson from Delhi bus system

Graph 4: Trend in daily ridership in DTC buses



Source: DTC Operational Statistics, November 2016

Graph 8: Projected fleet size of DTC



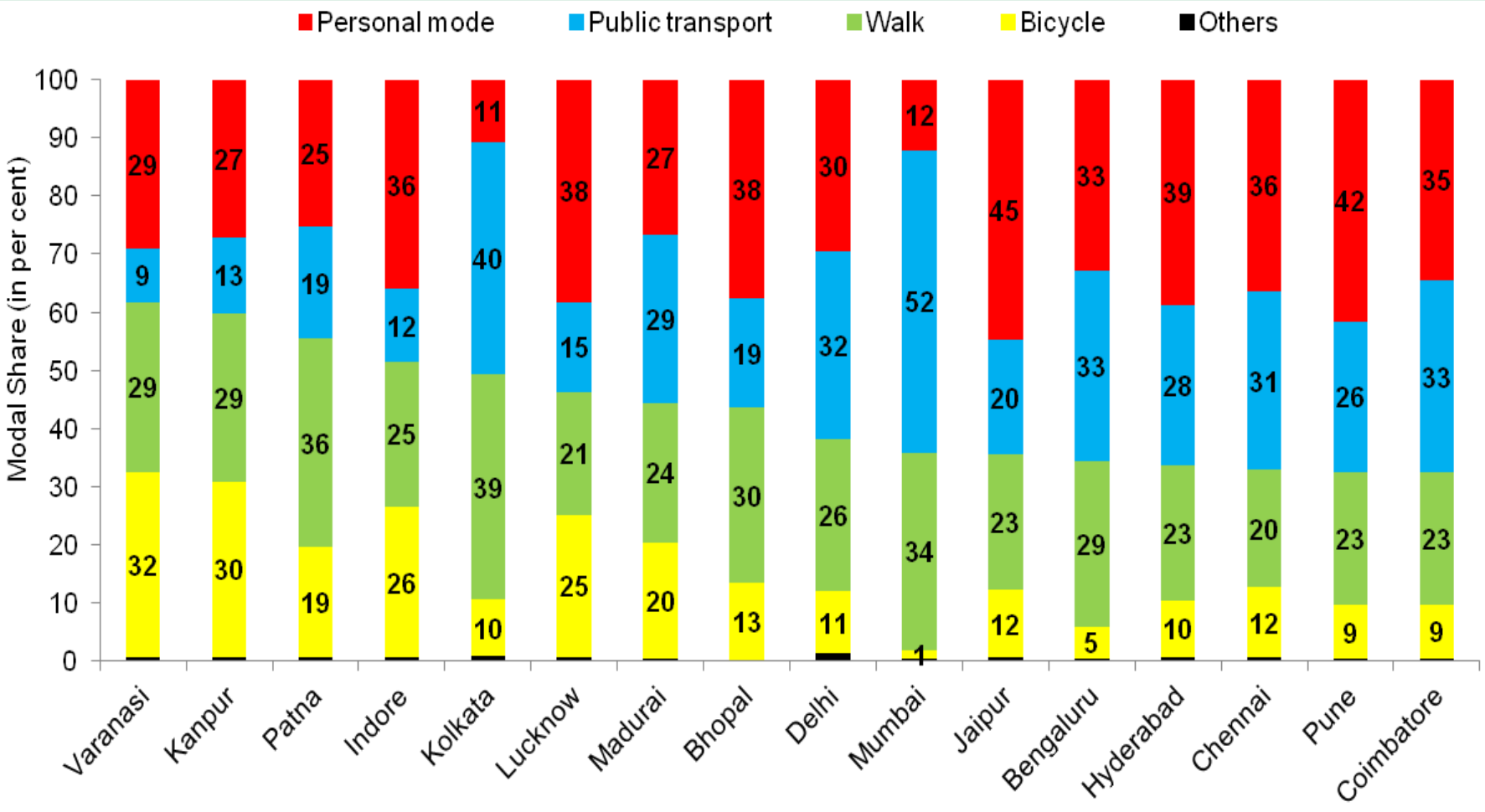
Note: Assumed lifetime of buses, as per DTC standards, is 12 years
Source: CSE analysis

Delhi Transport Corporation has suffered 35% loss in daily passenger ridership since 2012-13

Dropped from 47 lakh per day in 2012-13 to 30 lakh per day in 2016. -- A daily loss of about 17 lakh passengers!!

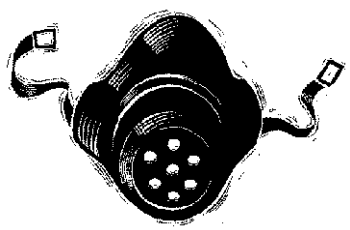
If not addressed Delhi may not have any bus left in 2025.

Yet majority in our cities walk cycle and use public transport



Note: Personal mode – Two wheelers and Cars, Public Transport: Bus, Train, IPT

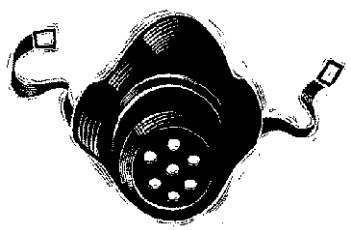
Source: Census of India, 2011



(3) Action on power pants

Delhi: Coal power free

Source: Google Earth



Action on Coal Based Power Plants

Delhi and NCR

•Under Graded Response Action Plan coal based Badarpur power plant has been shut for winter. It will be permanently shut from July 2018.

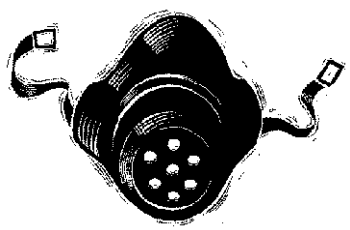
•To augment natural gas supply to power plants in NCR

•**Push back on thermal power plant standard**

Revised standards for coal based Thermal Power Plants were notified by MOEF in December 2015– to be implemented by December 7, 2017

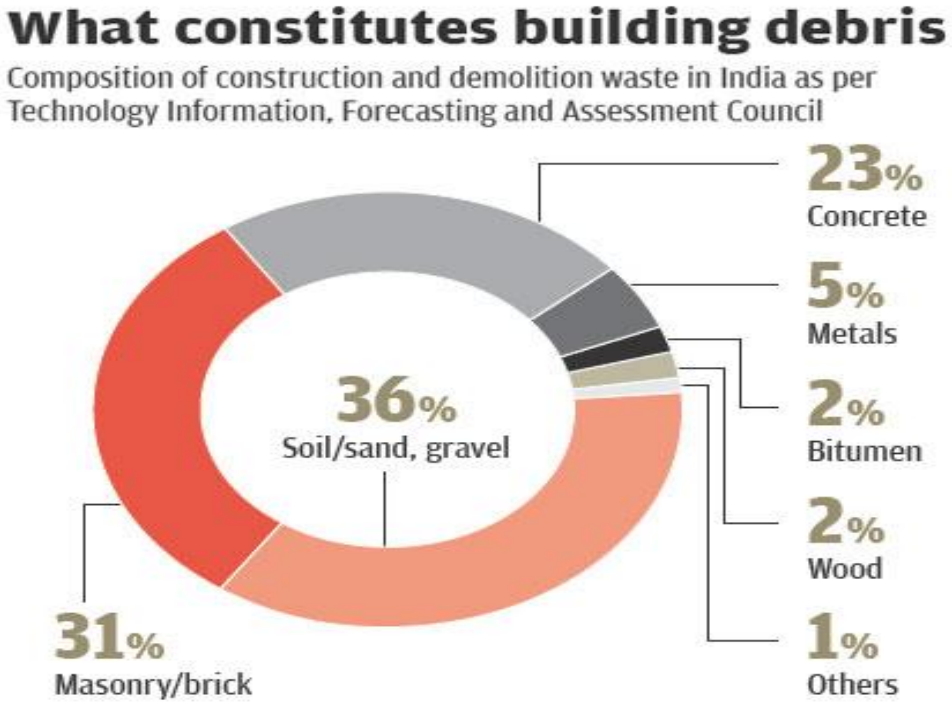
MoEF& CC and Central Electricity Authority, along with the power industry seeking extension of deadline to 2022-24 – more than 7 years delay.

Unacceptable. Pollution will increase by 50 percent in the next 10 years if delayed



(4) Action on construction and waste burning

Dust Control from Construction and Demolition….



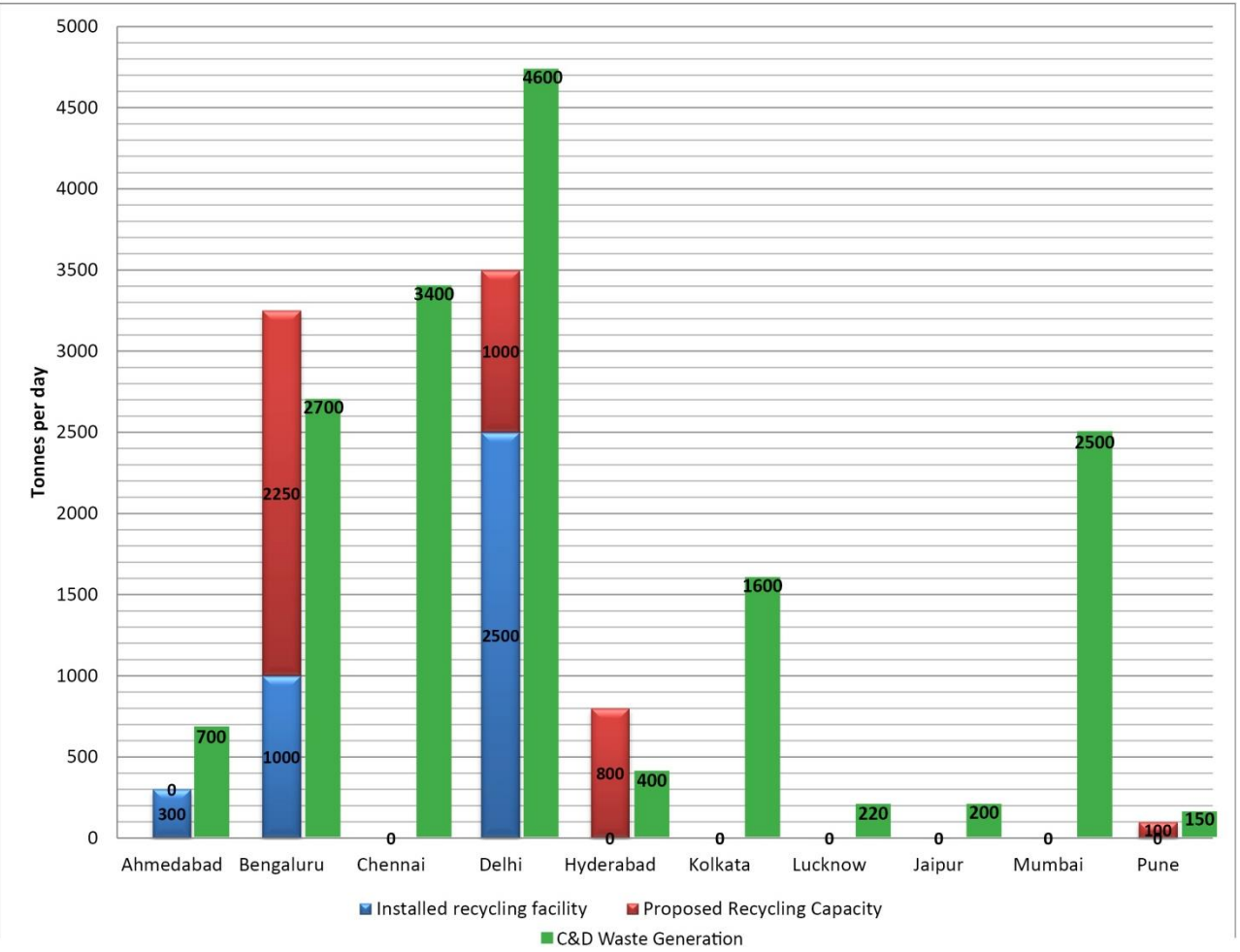
Fugitive dust from mismanaged construction and demolition (C&D) waste

EPCA check list for inspection of dust control measures

Ministry of Environment and Forests and Climate Change has notified rules and regulations for construction and demolition waste management.

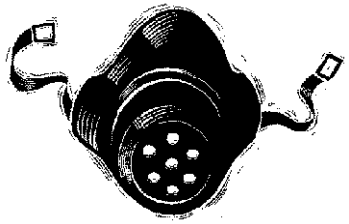
Bureau of Indian standards finalised specifications for recycled material

C&D Recycling Infrastructure



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

Government mandates use of a minimum Recycled products from construction waste in all future contracts for building works and 10 per cent recycled products for road works



Waste burning

Solid waste management rules – Poorly enforced

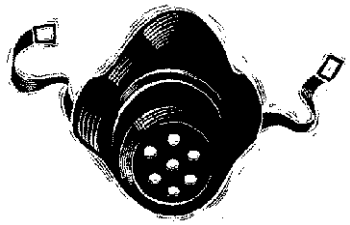
•Delhi government has imposed a penalty of Rs. 5000/- for open waste burning and Rs. 50,000/- for not covering the construction sites.

Make households and institutions accountable for decentralised management, segregation, reuse and recycle,

Charge and penalty

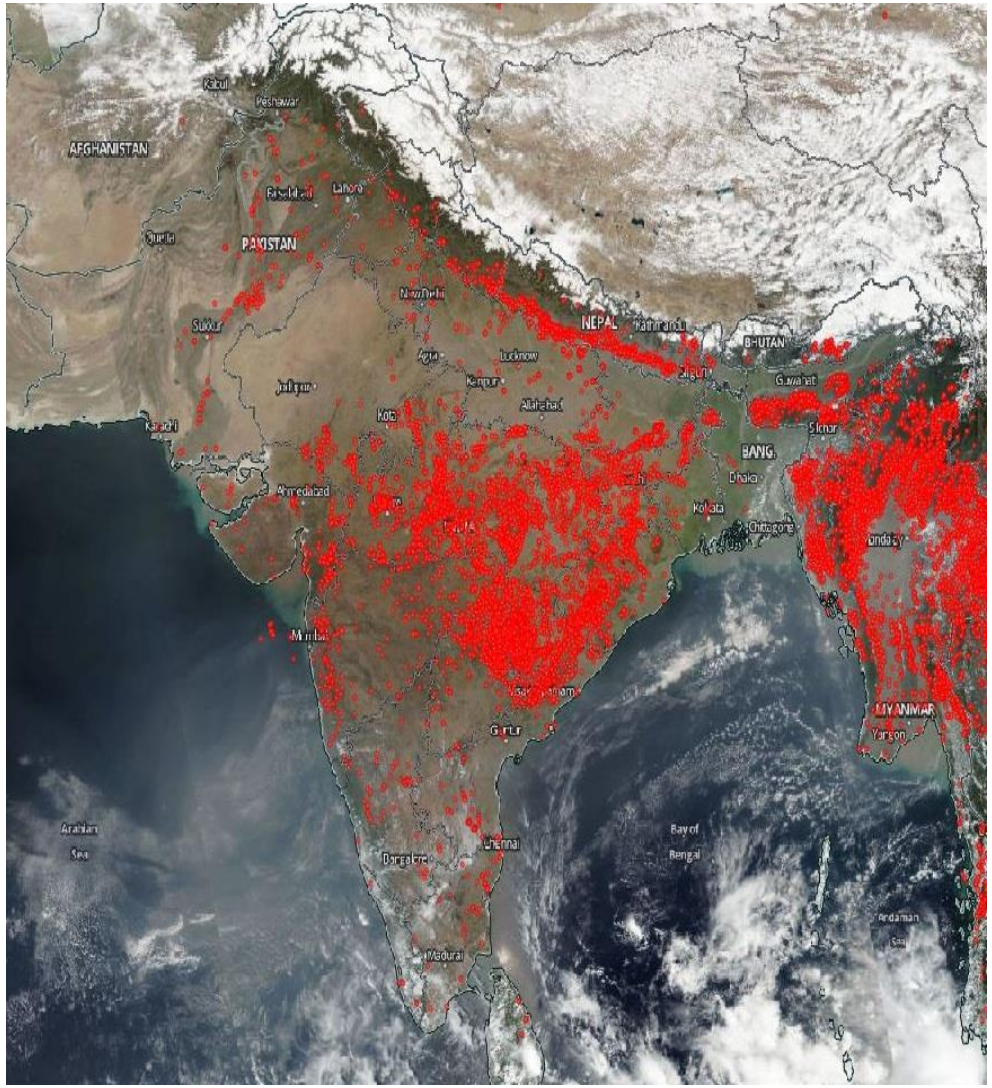
Need No landfill policy

'*Not In My Backyard*' – an opportunity



(5) Action on crop burning

Crop Reside Burning – A Pan-India issue



Satellite Image of India on April 11, 2017, where each red dot indicates a biomass based fire. Source: NASA MODIS data

- Total crop residue burnt estimated at 100 Million Tonnes/yr in 2008-09
- More than half of this burning happens in 3 states – Punjab, Haryana and Uttar Pradesh
- Crop residue burning on the rise in Madhya Pradesh, Chhattisgarh, Jharkhand, Odisha, Maharashtra and Telangana, amongst others
- 40% of all crop residue burning is attributable to Paddy Straw, 22% to Wheat Residue and 20% to Sugarcane
- Satellite imaging and remote sensing data show large-scale biomass burning during April and May as well
- Short crop cycle, mechanisation, shortage f labour, cropping pattern are contributing to this trend.

Solutions are known. Implementation requires scale and support

In field solution

Mulch and mix with soil; Can reduce fertiliser cost for farmers

Provide subsidy for agricultural implements and promote co-ownership of implements

Ex-situ solution

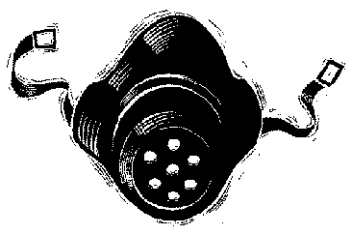
Utilize crop-residues fuel in biomass-based power plants

Use of crop residues for production of biofuels and fertilizers

Utilize as raw material for biomass pellets and other uses

R&D and crop diversification

Create a uniform decentralized mechanism for the collection, storage and commercial sale of crop residue



Need national comprehensive plan and stringent action

Improve air quality monitoring ; Implement smog alert & emergency action

Reduce emissions from vehicles

- Complete transition to BSVI emissions standards by April 2020
- Scale up public transport, walking and cycling; restrain car usage

Reduce emissions from power plants

- Implement new emissions standards without delay
- Shift to natural gas for power – insist GOI provides clean and cheaper gas

Reduce emissions from air polluting industry

- Ban pet coke and furnace oil; implement industrial NOx and SOx standards

Reduce emissions from generator sets

- Tighter emission standards for generator sets
- Improve electricity access; Energy efficiency measures

Action on open burning

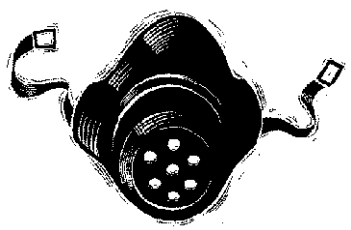
- Decentralised segregation, reuse, recycling and zero landfill approach

Road dust and construction activities

- Adopt dust control measures for construction industry, and roads

Control episodic pollution from crop residue burning

Need legal compliance frame work to meet clean air target



Stand behind change

- Recognise the actions – small as they may seem – to change the trajectory
- Politics of change – Public messaging and denial; Need strong advocacy capacity
- Resource mobilisation for change: Innovative financing
- Need big answers:

This is the second coming

Thank You