Demystify smog in Delhi….
……Time to act

Centre for Science and Environment

New Delhi, February 5, 2014

City enveloped in smog, back to pre-CNG

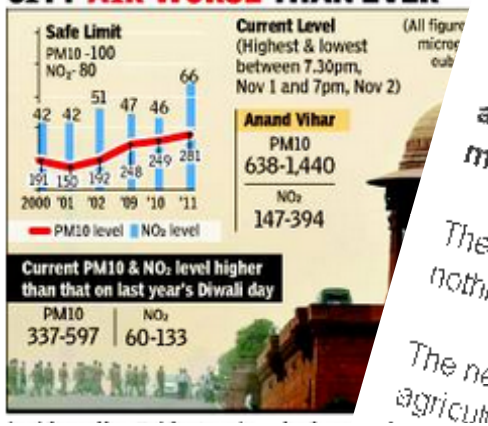
Gains Of Switch To Cleaner Fuel Frittered Away

Neha Lalchandani | TNN

New Delhi: Delhi's air pollution has reached alarming levels. For proof, just look out of the window. The grey-white 'haze' that has been covering the city since October 28, say experts, is actually smog that is linked to the rapid rise in

▶High pollution, P 6

CITY AIR WORSE THAN EVER



Delhi winter smog is not an act of God

Nov 22, 2012

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. Cool and calm weather led to fumes settling close to the ground. People held masks, scarves or handkerchiefs to their faces.

The resultant outcry in the smog-hit city had officials stubbornly insisting that this was nothing new and that it happened every

The new twist came

'सांसों' पर स्मॉग की 'स्याह' परतें

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

Smog leaves Delhi gasping for breath

TNN | Nov 3, 2012, 01.33 AM IST

poisonous gases . Not co- air quality, the judiciary (see graphic) — that emits

Smog delays Sheila Dikshit's flight to Punjab

02.44AM IST

| Punjab | NASA | flight | Flashpoint | Apex

Ludhiana trip by Delhi chief minister Sheila Dikshit in a chartered telecom industrialist family became the flashpoint of the ongoing Delhi and Punjab when the plane was delayed by nearly three hours

Disadvantage Delhi: Smog here to stay

Darpan Singh, Hindustan Times
New Delhi, November 08, 2012

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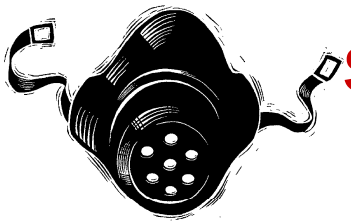
email print 0 Comments Like 3 Tweet 0

The Centre for Science and Environment (CSE), in its latest report, has delivere
The smog is here to stay. It has also warned that Delhi is in the grip of a multi-p
matter is not the only thing choking us. Nitroge



Spate of studies and mounting evidences on state of air of Delhi and India…….

February 2013: GBD findings for India: Air pollution related diseases are the fifth largest killer in India

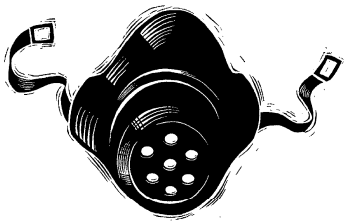
November 2013: The International Agency for Research on Cancer (IARC) and WHO declare outdoor air pollution as group 1 carcinogen

June 2012: WHO reclassifies diesel emissions as class 1 carcinogen: The International Agency for Research on Cancer (IARC), a wing of the World Health Organization (WHO), has said that diesel engine exhaust can certainly cause cancer, especially lung cancer in humans.

September 2013 NASA study -- high PM 2.5 belt stretching from Delhi south-east to Kolkata.

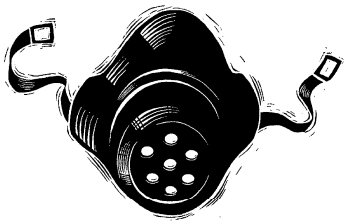
January 2014: Yale University study: 2014 Environmental Performance Index: China and India are among the worst performers at 118 and 155, respectively. Perform relatively worse on Air Quality

More studies to show Indian lungs are weaker…….



Intense global glare on Delhi and Beijing…..

……Two iconic faces of Asian growth story…



We are not that bad…. says IITM/SAFAR, one of the official monitoring agencies in Delhi

IITM SAFAR press release last week **challenges high peaks and averages reported for Delhi vis a vis Beijing…..** *Scientific Perspective on the Status of the Air Quality of Delhi……...*

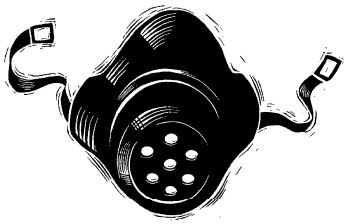
It highlights: **-- Emissions have increased by 10-20% over the last four years**. **-- But there is no systematic increase or decrease in air pollution** though -- **frequency of extreme pollution events are rising. Role of meteorology…**.

-- It concludes Delhi's peak pollution levels are lower than Beijing…..

-- During January 2014: PM2.5 levels *Hardly touched* 350 microgramme per cum; the monthly average has been 184 microgramme per cum; majority days ranged between 100-300 microgramme per cum. Ignores – even these numbers are 3-5 times the standards – unacceptable.

Concludes - "PM2.5 level remained much lower in Delhi (150-270 microgramme per cum as compared to Beijing where PM2.5 levels reached as high as 500-670 microgramme per cum between 14-17 January"….

This breeds complacency .. misses the point on serious action needed to cut air pollution risks



Let us not miss the point….

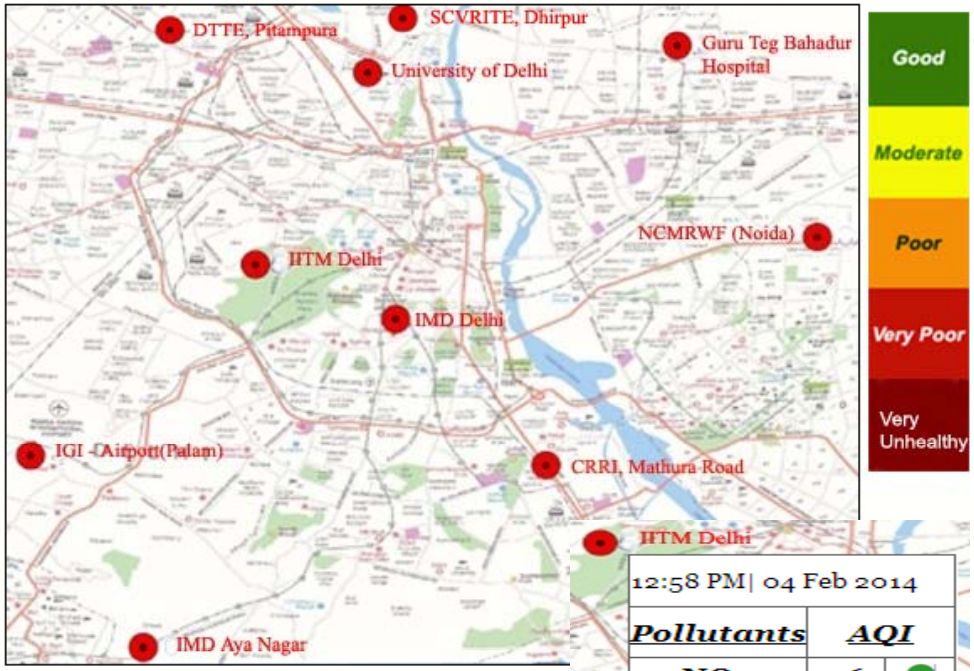
CSE has reviewed state of air quality reporting by different monitoring agencies in Delhi and emerging trends, and policy action in Delhi and Beijing to benchmark relative stringency of action to move forward…….

How much of SAFAR data is in public domain?

Online Visualization

AQI Current | Only AQI attributes are shown below in terms of | Tomorrow's Forecast

Air quality Now



IITM Delhi

12:58 PM| 04 Feb 2014

Pollutants	AQI	
NO2	46	
O3	61	
CO	119	
PM2.5	115	
PM10	198	

Source: http://safar.tropmet.res.in/

Different approach: Only air quality index and daily aggregate for PM10, PM2.5 and ozone. Continuous real time concentration for all stations are not reported. AQI is used to simplify the data for common public... Delhi government has not yet adopted AQI to define air quality bands….

Air Quality Forecast | Current Weather

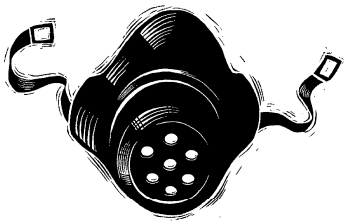
PM: 24-Hr Avg.; O_3: 8-Hr Avg.

Delhi Air Quality - 1 - 3 days advance forecast

Pollutants	Delhi Today	Attribute	Tomorrow's Forecast	Attribute	After 3 days Forecast	Attribute
PM_{10} (μgm^{-3})	305	Poor	324	Poor	336	Poor
$PM_{2.5}$ (μgm^{-3})	117	Poor	126	Poor	132	Poor
O_3 (ppb)	28	Good	31	Good	34	Good

Gaseous Pollution: Good

Particulate Pollution: Poor



Delhi has one of the most extensive official ambient air quality monitoring network …… leverage it

-- All official monitoring stations of CPCB and DPCC under national ambient air quality monitoring programme give out continuous realtime data every 15 minutes to one hour and also 24 hour averages

-- Special effort made under EPCA to improve format for official data reporting…..

-- Beijing has 35 PM2.5 monitors around the city broadcasting real-time data.

Delhi	11 (all online monitors generating real time data
Chennai	11 (5 manual and 6 online)
Kolkata	10
Hyderabad	9
Bangalore	9
Kanpur	9
Visakhapatnam	8

Real time air quality data reporting in Delhi: DPCC and CPCB

Real Time Air Quality Data

- Air Quality/Public Advisory for Delhi City
- Ambient Air Quality Data at various locations in the country

Your are here : Home | Real Time Air Quality Data

Real Time Air Quality Data

Air Quality/Public Advisory for Delhi City

Ambient Air Quality Data at various locations in the country

Air Quality / Public Advisory

Punjabi Bagh

Day	Date	Time
Tuesday	February 04, 2014	5:11 PM

Stations

CPCB	DPCC
Income Tax Office	IGI Airport
Delhi College Of Engineering	Civil Lines
Shadipur	Anand Vihar
NSIT Dwarka	R K Puram
IHBAS	Mandir Marg
	Punjabi Bagh

CPCB's monitoring network

Air Quality Monitoring Station
Income Tax Office

Parameter Name (a)	Real Time Concentration (b)	Average Concentration (8hourly/24hourly) (c)	Prescribed Standard (d)	Percentage Exceedence (e)=((c-d)/d)*100	Trend	Air Quality
NITROGEN DIOXIDE µg/m³	110 (01 DEC 2013, 23:45)	DATA TOO OLD	80		See Data	
SULFUR DIOXIDE µg/m³	4 (01 DEC 2013, 23:45)	DATA TOO OLD	80		See Data	
CARBON MONOXIDE mg/m³	2.29 (01 DEC 2013, 23:45)	DATA TOO OLD	4		See Data	
OZONE µg/m³	15 (01 DEC 2013, 23:45)	DATA TOO OLD	180		See Data	
PM2.5 µg/m³	184 (01 DEC 2013, 23:45)	DATA TOO OLD	60		See Data	

Air Quality Monitoring Station
Delhi College Of Engineering

Parameter Name (a)	Real Time Concentration (b)	Average Concentration (8hourly/24hourly) (c)	Prescribed Standard (d)	Percentage Exceedence (e)=((c-d)/d)*100	Trend	Air Quality
NITROGEN DIOXIDE µg/m³	40 (01 DEC 2013, 23:45)	DATA TOO OLD	80		See Data	
SULFUR DIOXIDE µg/m³	5 (01 DEC 2013, 23:45)	DATA TOO OLD	80		See Data	
CARBON MONOXIDE mg/m³	0.81 (01 DEC 2013, 23:45)	DATA TOO OLD	4		See Data	
OZONE µg/m³	21 (01 DEC 2013, 23:45)	DATA TOO OLD	180		See Data	

Air Quality Monitoring Station
Shadipur

Parameter Name (a)	Real Time Concentration (b)	Average Concentration (8hourly/24hourly) (c)	Prescribed Standard (d)	Percentage Exceedence (e)=((c-d)/d)*100	Trend	Air Quality
NITROGEN DIOXIDE µg/m³	57.38 (03 FEB 2014, 23:00)	19.57 (24 HOURLY)	80	NO EXCEEDANCE	See Data	
SULFUR DIOXIDE µg/m³	9.81 (03 FEB 2014, 23:00)	4.14 (24 HOURLY)	80	NO EXCEEDANCE	See Data	
CARBON MONOXIDE mg/m³	1.61 (03 FEB 2014, 23:00)	0.78 (8 HOURLY)	4	NO EXCEEDANCE	See Data	
OZONE µg/m³	13.96 (03 FEB 2014, 23:00)	16.56 (8 HOURLY)	180	NO EXCEEDANCE	See Data	
PM10 µg/m³	542.51 (03 FEB 2014, 23:00)	314.69 (24 HOURLY)	100	214.69	See Data	

Air Quality Monitoring Station
NSIT Dwarka

Parameter Name (a)	Real Time Concentration (b)	Average Concentration (8hourly/24hourly) (c)	Prescribed Standard (d)	Percentage Exceedence (e)=((c-d)/d)*100	Trend	Air Quality
NITROGEN DIOXIDE µg/m³	5.29 (04 FEB 2014, 16:30)	14.48 (24 HOURLY)	80	NO EXCEEDANCE	See Data	
SULFUR DIOXIDE µg/m³	8.13 (04 FEB 2014, 16:30)	17.27 (24 HOURLY)	80	NO EXCEEDANCE	See Data	
CARBON MONOXIDE mg/m³	0.1 (04 FEB 2014, 16:30)	1.54 (8 HOURLY)	4	NO EXCEEDANCE	See Data	
OZONE	26.38 (04 FEB 2014, 16:30)	15.57 (8 HOURLY)	180	NO EXCEEDANCE	See Data	

Air Quality Monitoring Station
IHBAS

Parameter Name (a)	Real Time Concentration (b)	Average Concentration (8hourly/24hourly) (c)	Prescribed Standard (d)	Percentage Exceedence (e)=((c-d)/d)*100	Trend	Air Quality
NITROGEN DIOXIDE µg/m³	14.53 (04 FEB 2014, 16:30)	46.25 (24 HOURLY)	80	NO EXCEEDANCE	See Data	
SULFUR DIOXIDE µg/m³	14.09 (04 FEB 2014, 16:30)	23.81 (24 HOURLY)	80	NO EXCEEDANCE	See Data	
CARBON MONOXIDE mg/m³	0.22 (04 FEB 2014, 16:30)	1.02 (8 HOURLY)	4	NO EXCEEDANCE	See Data	
PM10 µg/m³	133 (04 FEB 2014, 16:30)	2124.68 (24 HOURLY) DATA UNDER SCRUTINEY	100	NO EXCEEDANCE	See Data	

Only ITO/Pragati Maidan reports PM2.5 data – but available till Dec 1, 2013.
Other stations - real time data for gases and PM10
Back data available

Delhi Pollution Control Committee: best reporting so far…

DELHI POLLUTION CONTROL COMMITTEE
(Government of N.C.T. of Delhi)
4th Floor, I.S.B.T. Building, Kashmere Gate, Delhi - 110006
Website : http://www.dpcc.delhigovt.nic.in

REAL TIME AMBIENT AIR QUALITY DATA

Anand Vihar || Mandir Marg || Punjabi Bagh || R.K. Puram || IGI Airport || Civil Lines || Main Index

Date : Wednesday, September 25, 2013 Time (IST) : 06:09 PM

GAS CONCENTRATIONS

Air Quality Monitoring Station : R. K. Puram

Current Air Pollution Levels — Advance Search

Parameters	Date	Time (IST)	Gas Concentrations	Prescribed Standard	Remarks	View Status of last 6 hours
Ammonia	Wednesday, September 25, 2013	17:40:00	27.9 µg	400 µg/m³		Line Graph Bar Graph
Benzene	Wednesday, September 25, 2013	17:40:00	1.6 µg/m³	-		Line Graph Bar Graph
Carbon Monoxide	Wednesday, September 25, 2013	17:40:00	1.2 mg/m³	0 mg/m³		Line Graph Bar Graph
Nitrogen Dioxide	Wednesday, September 25, 2013	17:40:00	66.4 µg/m³	80 µg/m³		Line Graph Bar Graph
Nitrogen Oxide	Wednesday, September 25, 2013	17:40:00	10.8 µg/m³	-		Line Graph Bar Graph
Oxides of Nitrogen	Wednesday, September 25, 2013	17:40:00	76.3 µg/m³	-		Line Graph Bar Graph
Ozone	Wednesday, September 25, 2013	17:40:00	34.3 µg/m³	180 µg/m³		Line Graph Bar Graph
p-Xylene	Wednesday, September 25, 2013	17:40:00	2.2 µg/m³	-		Line Graph Bar Graph
Sulphur Dioxide	Wednesday, September 25, 2013	17:40:00	15.2 µg/m³	80 µg/m³		Line Graph Bar Graph
Toluene	Wednesday, September 25, 2013	17:40:00	7.8 µg/m³			Line Graph

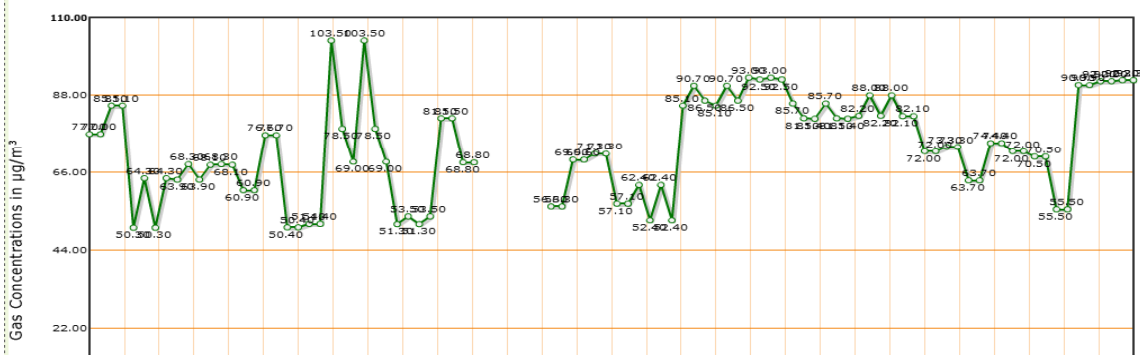
-- User friendly
-- Station wise Continuous realtime hourly update
-- 24 hour average data
-- Back data available

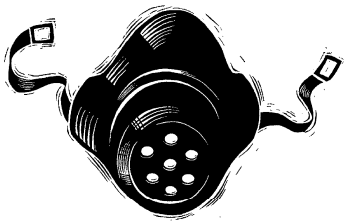
-- However, some hotspot stations (IGI, Civil Lines, Anand Vihar) show chronic maintenance issues
-- **Continuous data is available for R K Puram, Mandir Marg and Punjabi Bagh for the winter months**

Air Quality Monitoring Station : R. K. Puram

Oxides of Nitrogen for last 24 hours

Standard : N/A





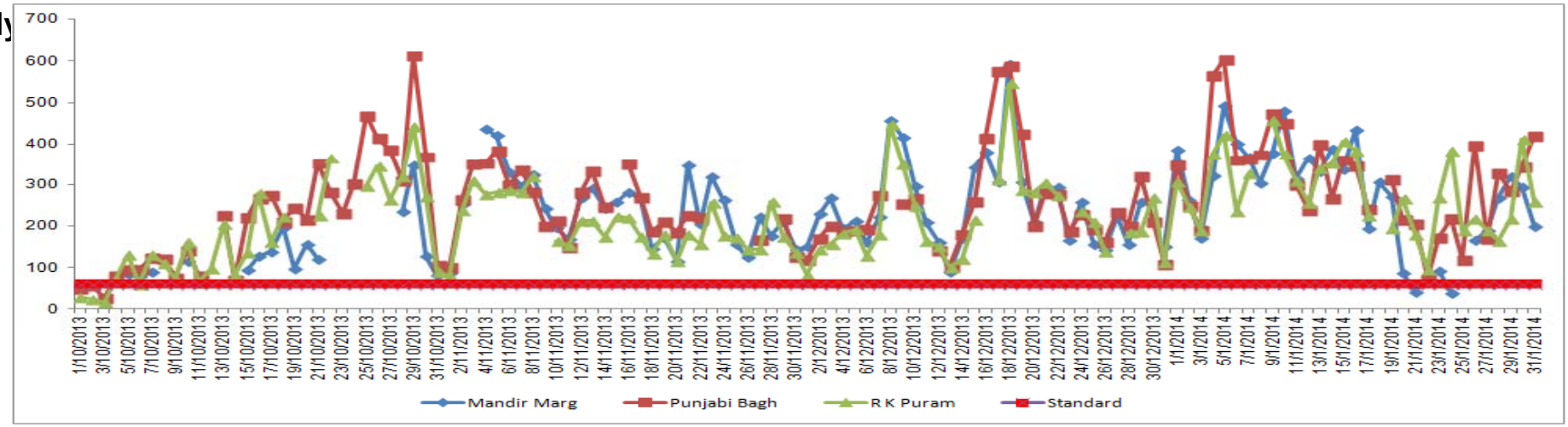
Key highlights of the trends in actual concentration this winter …….

Delhi winter pollution: High levels and high peaks

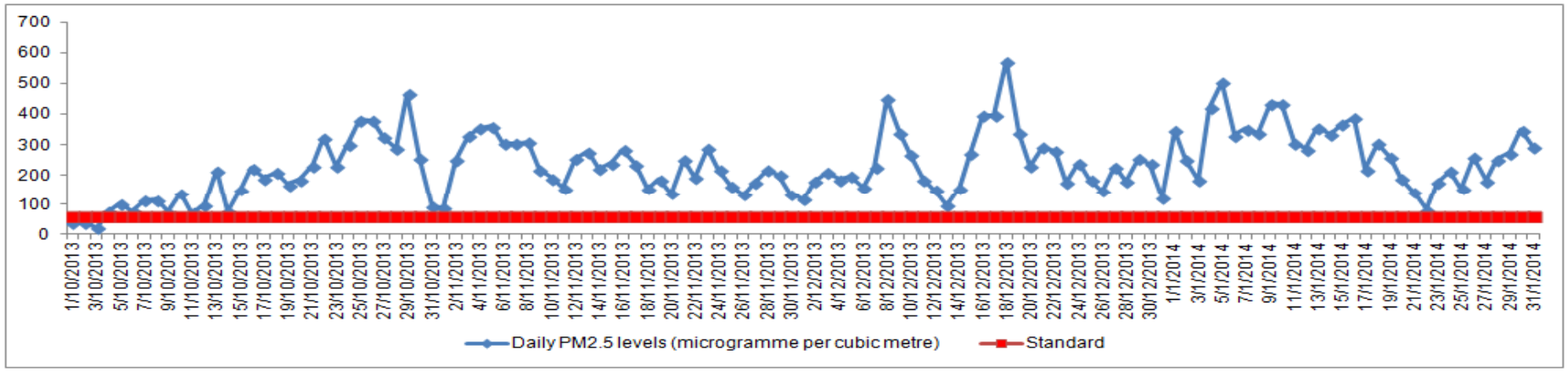
During the past 4 months, PM2.5 levels exceeded the standard by 1-2 times at lower range and 4 to 7 times at higher range.

- On two occasions (December 18th and January 5) exceeded by 10 and 8 times respectively

Daily

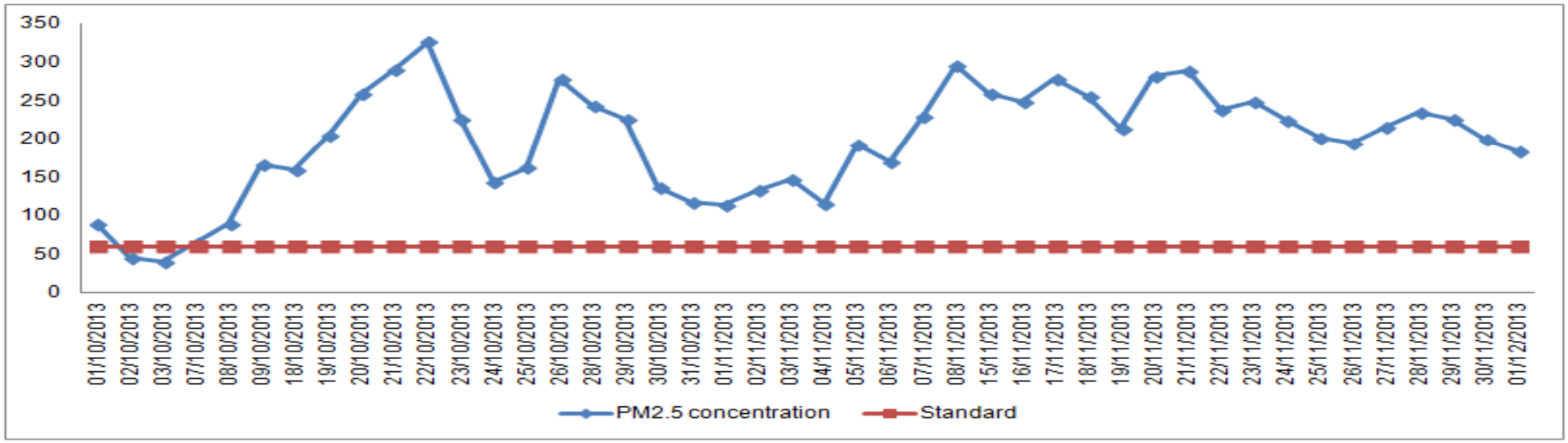


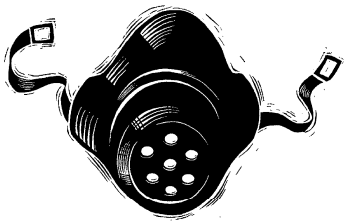
Daily PM2.5 levels (average of three monitoring stations) (Max hit – 575 microgramme per cum)



PM2.5 concentration at CPCB (ITO) monitoring stations

CPCB monitoring stations ITO (Pragati Maidan) (I Oct, 2013 – Dec 1. 2013)

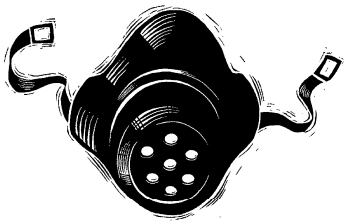




How high do pollution peaks go on a daily basis? One third of days levels are 500% higher than the standards……

Air quality (PM2.5 concentration)	No. of days	Days (%)
Within PM2.5 standard of 60 microgramme per cubic metre	3	2
Upto 50% of the standard (60-90 microgramme per cubic metre)	7	6
50-100% of the standard (90-120 microgramme per cubic metre)	7	6
100-300% of the standard (120-240 microgramme per cubic metre)	51	41
300-500% of the standard (240-360 microgramme per cubic metre)	41	33
Above 360 microgramme per cubic metre	14	11

Source: CSE based on real time PM2.5 data of DPCC 3 stations – Mandir Marg, Punjabi Bagh and R. K. Puram



Very high exceedance….

Analysis of **daily 24 hour average PM2.5 levels (123 days from October 1 2013 – January 31) as continuously available from DPCC website shows:**

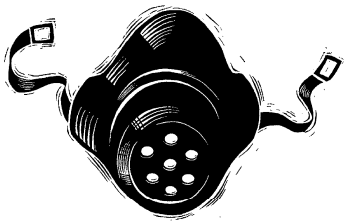
-- Only on 3 days (2% of days monitored) Delhi could meet the standard.

-- On 41 days (33%) daily levels were 500 per cent higher than the standard.

-- On 17 days (14%) levels were higher than 350 microgramme per cum which is close to the highest reported by IITM-SAFAR for January.

-- There can be very legitimate reasons for variation among stations depending on locations, meteorology, and local conditions.

But Delhi must take the advantage of the extensive network and the larger data base of all monitoring agencies to drive action.



We looked at Beijing to understand policy response to air pollution crisis…….

Delhi loses air pollution control race to Beijing

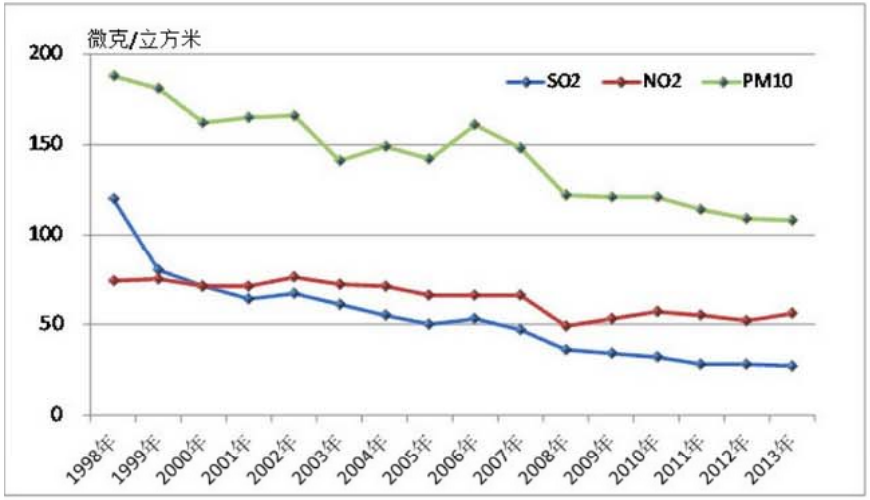
Beijing: PM10 levels have decreased by about 40 per cent from 2000 to 2013.

Delhi: PM10 levels have increased by about 47 per cent from 2000 to 2011. PM10 levels in Delhi are nearly double that of Beijing.

Air pollution trend in Delhi and Beijing: snapshots

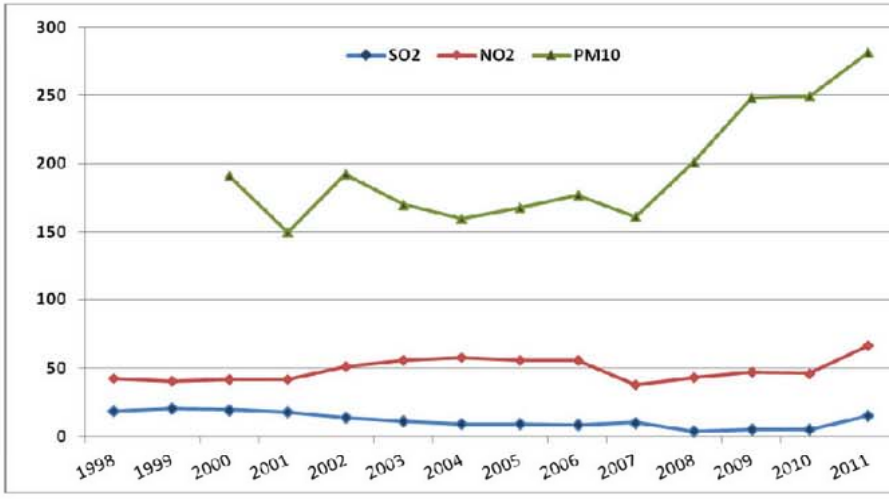
PM10, NO2 and SO2 trend in Beijing and Delhi

Beijing



Source: Beijing Environmental Protection Bureau

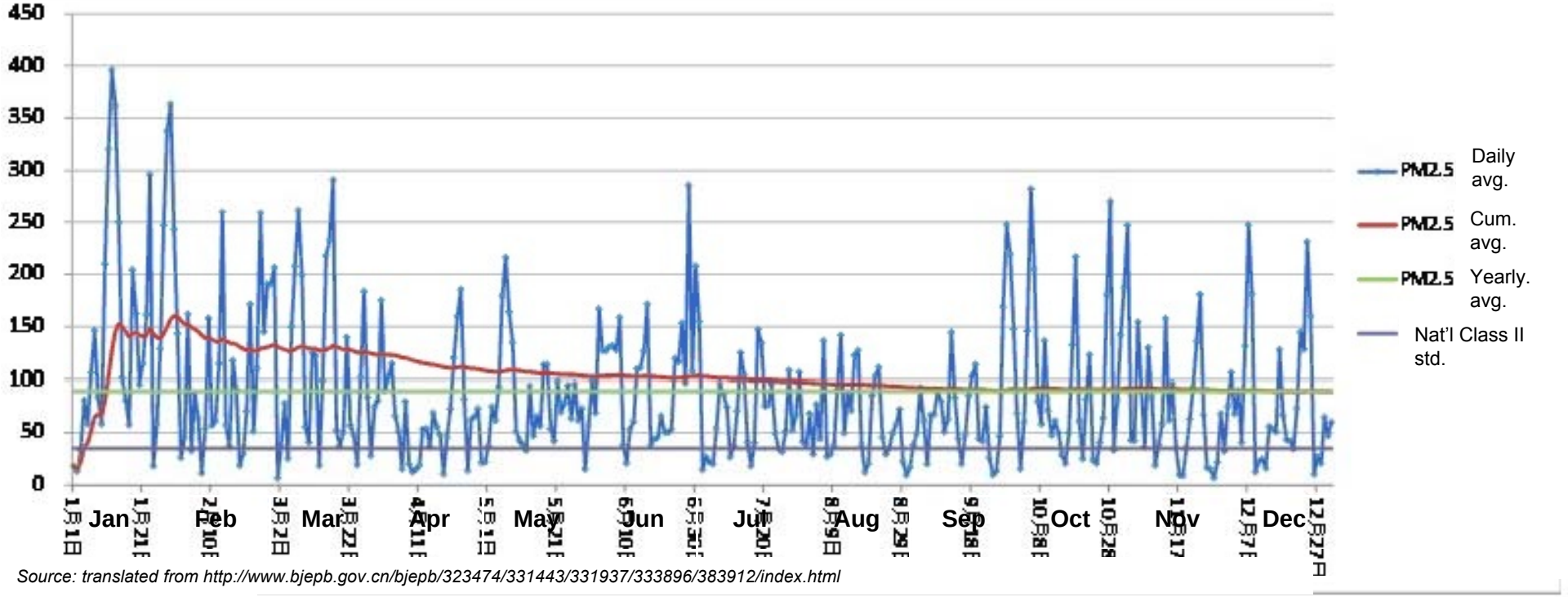
Delhi



Source: Dept of Environment, Govt. of NCT Delhi

2013 is the first full year for which Beijing EPB reported PM2.5 readings…….

Beijing 2013 PM2.5 Daily Averages

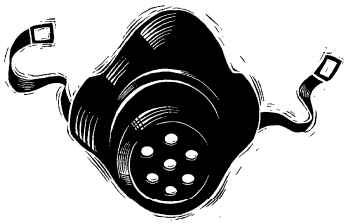


Source: translated from http://www.bjepb.gov.cn/bjepb/323474/331443/331937/333896/383912/index.html

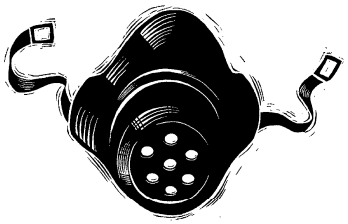
Daily peaks are still high – hitting 400 microgramme cum. On smog episode days single location can show higher levels

Annual average is about 90 microgramme cum

They still have high smog episodes with high peaks… but taking hard decisions…….



We asked -- what if -- Delhi followed the same air quality classification and health alert system of Beijing to inform people on a daily basis this winter?



Every second day would have been a "heavily polluted" or a "severely polluted" day….

As per the Beijing AQI…

In Delhi (in last 4 months):

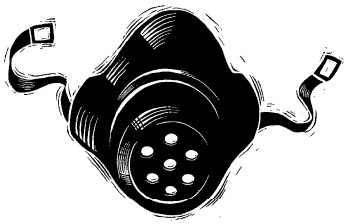
-- Only 1 day would have met excellent mark; 4 days good;

-- 10 days slightly polluted (8%); 10 days moderately polluted (8%)

-- 45 heavily polluted (37%); 51 severely polluted (41%)

-- 2 days worse than severely polluted days (exceeding 500 microgramme per cubic metre)

Air quality grade as per China AQI	PM2.5 (24 hourly levels) microgramme per cubic metre	No. of days (Delhi's PM2.5 levels)
Excellent	35	1
Good	35-75	4
Slightly polluted	75-115	10
Moderately polluted	115-150	10
Heavily polluted	150-250	45
Severely polluted	250-500	51
	>500	2

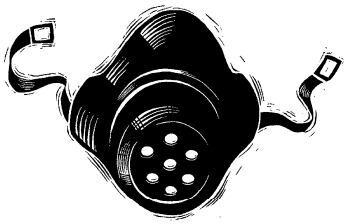


What if Delhi followed the same air quality index and health alert system as the US for PM2.5?

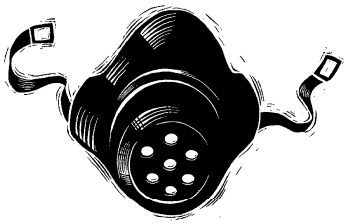
As per the US AQI…

-- Not a single day with good air quality
-- only 1 day moderate; 2 days unhealthy (SG)
-- 22 days unhealthy (18%)
-- 45 very unhealthy (37%)
-- 36 hazardous (29%)
-- 17 days hazardous or significant harm level (14%)

Air quality grade as per US	PM2.5 (24 hourly levels) microgramme per cubic metre	No. of days (Delhi's PM2.5 levels)
Good	12	0
Moderate	Up to 35.4	1
Unhealthy (SG)	55.4	2
Unhealthy	150.4	22
Very unhealthy	250.4	45
Hazardous	350.4	36
Hazardous (significant harm level)	500.4	15
	>500	2



What other governments do?



Beijing: informs people with health alerts. Takes emergency measures….

Pollution contingency plan in Beijing

Air pollution alerts via local radio, television, newspaper and social media platforms. Health alerts -- how individuals should protect themselves from the harmful effects of air pollution.

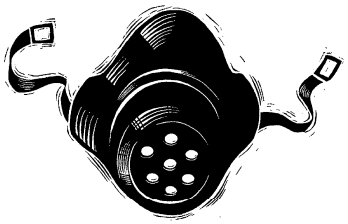
The plan stipulates that when there is heavy pollution for three consecutive days, highest **red alert** will be issued. Kindergartens, primary and middle schools will close. 80% of government-owned cars to be taken off the roads.

Private cars to be allowed on alternate days according to numbers on their registration plates.

Freight vehicles and those transporting material for construction sites will be barred.

Polluting factories to cut their emissions or shut down completely when the orange warning signal is issued.

Construction sites tp halt excavation and demolition operations. Ban on barbeques and fireworks on heavily polluted days.



Health alert and contingency plan in the US…..

RULE 701. AIR POLLUTION EMERGENCY CONTINGENCY ACTIONS (For PM and ozone pollution)

Stage 2-3 level of alert

Inform School officials, local and state law enforcement agencies; public safety personnel; --- **Discontinue prolonged, vigorous outdoor exercise lasting longer than one hour**. Those with heart or lung disease to avoid outdoor activity.

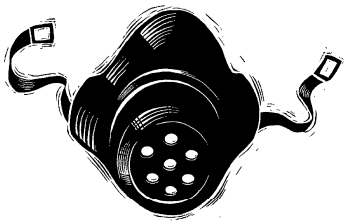
Industrial units: Reduce combined emissions for VOC's, NOx, and SOx, **by at least 20 percent of normal weekday operations**.

Reduce fleet vehicle miles traveled by at least 20 percent of normal week day operations.

For employees -- request ridesharing and telecommuting

Liquid or solid fossil fuel shall not be burned in electric power generating systems unless a force majeure natural gas curtailment is in effect

Suspension of programs which involve physical exertion recreation facilities; **Recommend all non-emergency driving be discontinued** as soon as possible.

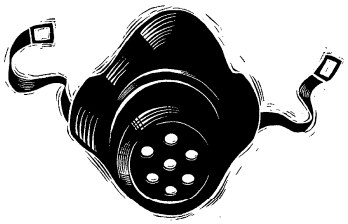


Hong Kong issues health alert…..

Environment Protection Department, Hong Kong implements roadside air quality and health index for those who need to spend several hours continuously each day in busy streets.

Very high pollution days – People especially Children and the elderly with existing heart or respiratory illnesses are advised to reduce to the minimum outdoor physical exertion, and to reduce to the minimum the time of their stay outdoors, especially in areas with heavy traffic

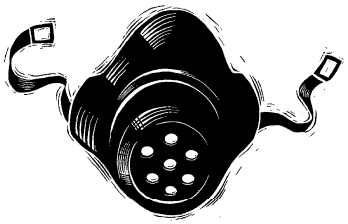
Employers of outdoor workers performing heavy manual work are advised to assess the risk of outdoor work, and take appropriate preventive measures to protect the health



What about Delhi?????

Nothing so far…

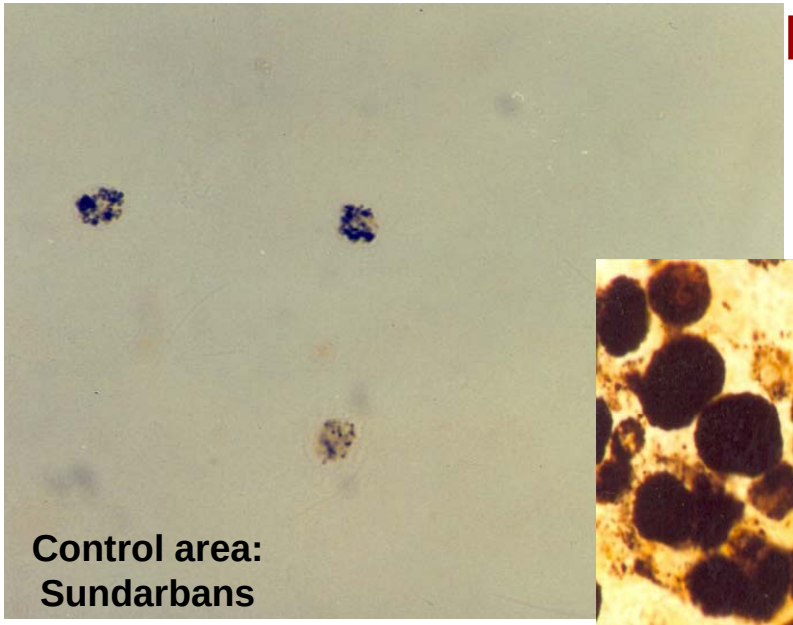
……Air quality index and health alert under discussion….



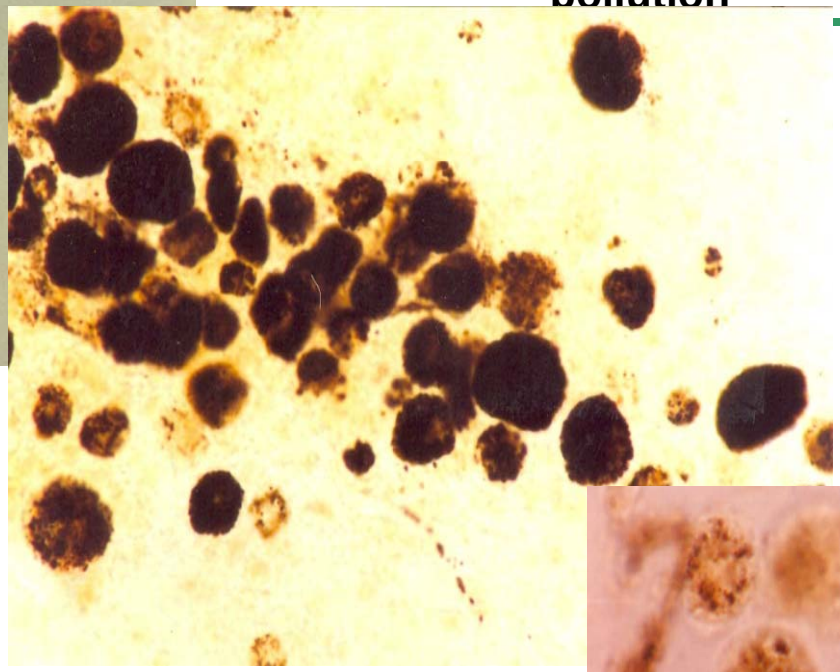
Ignoring health information in Delhi…….

Emerging evidences of health impacts in India……

Alveolar macrophage - biomarker of air pollution



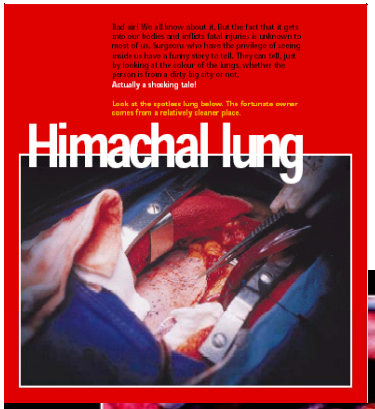
Control area: Sundarbans

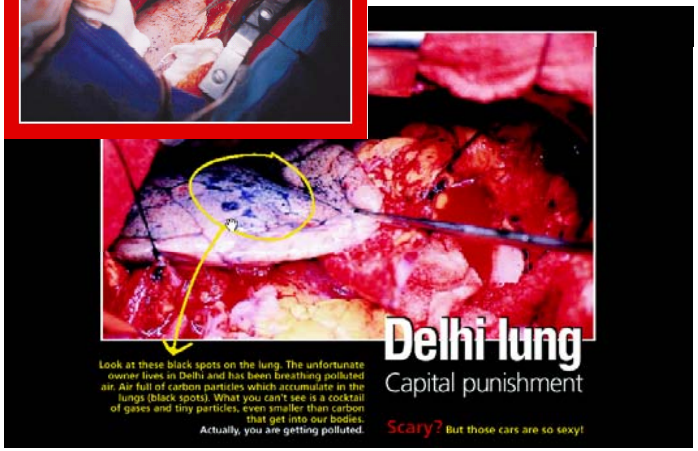


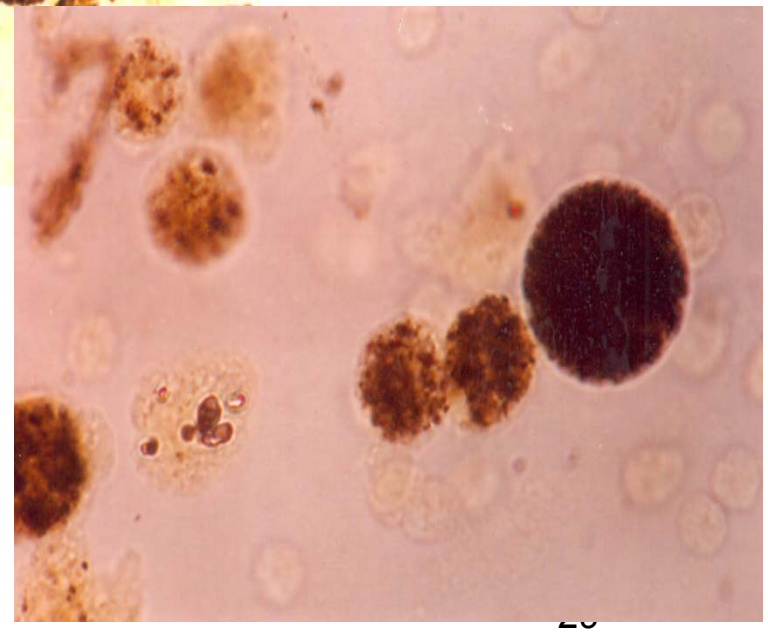
Exposed group; Kolkata taxi driver

Increase in AM number

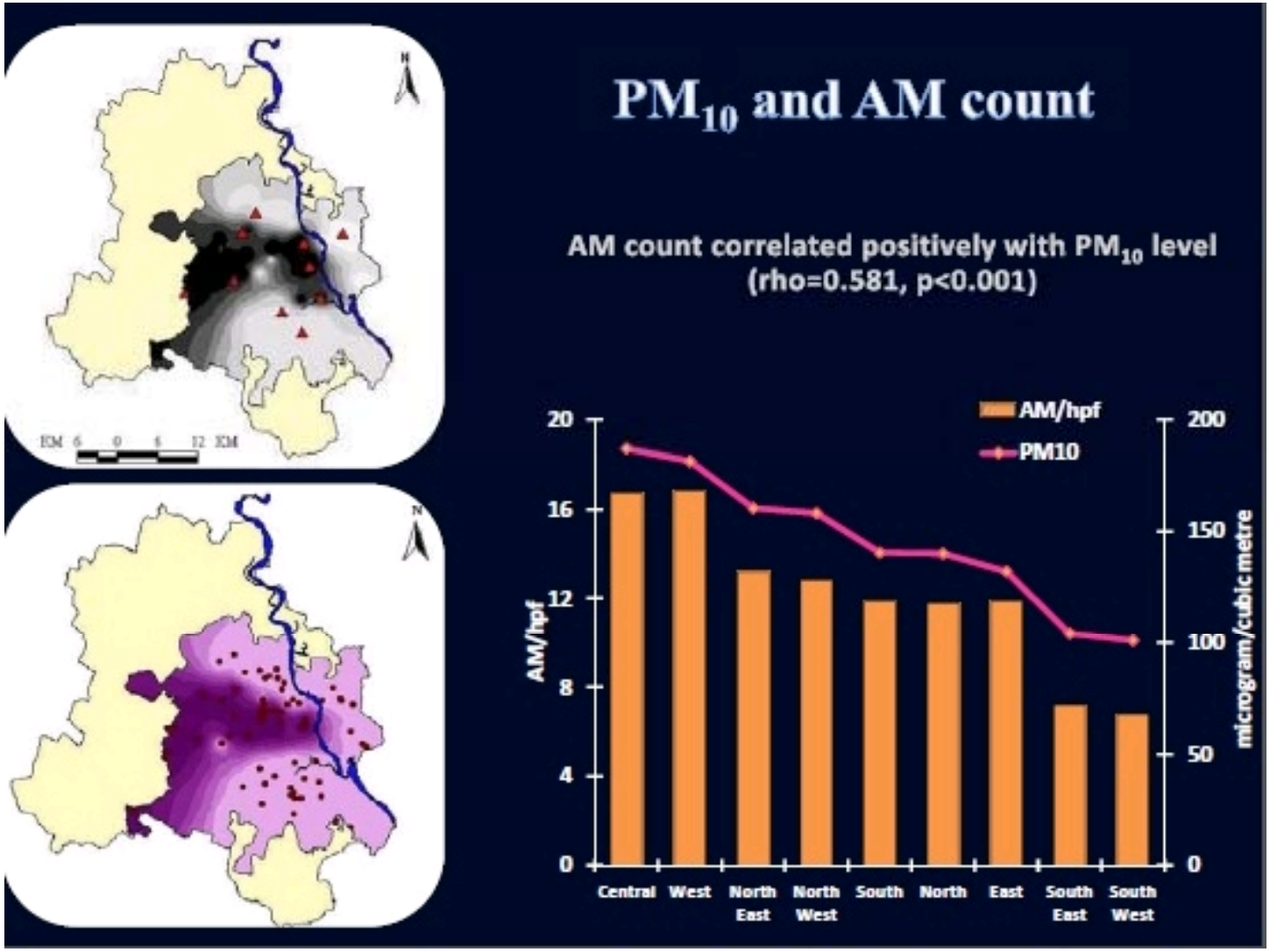
Larger AM – particle laden

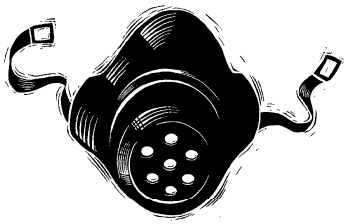






Co-relating health evidence with air pollution





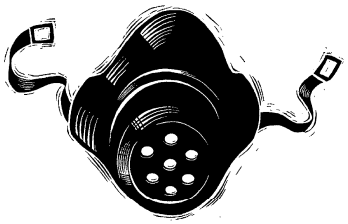
Scary evidences….

2012 epidemiological study on children in Delhi (CPCB and Chittaranjan National Cancer Institute of Kolkata): Covered **11,628 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**.

2013 Jawaharlal Nehru University study: -- maximum of 39,780 excess cancer cases might occur due to lifetime inhalation and exposure to the PAH concentrations.

The *World Allergy Organisation (WAO) Journal* also published in 2013: reported high respiratory disorder symptoms in students residing in Chandni Chowk (66 per cent) in north Delhi, Mayapuri (59 per cent) in west Delhi and Sarojini Nagar (46 per cent) in south Delhi. Heavy traffic movement has been found to be the factor

Allergy symptoms will increase with rising pollution levels



Mounting evidences -- since 2000 at least one health study has been published in Delhi…

Delhi has generated evidences nearly every year over the last decade……

- **1999: Effect of air pollution on respiratory system of auto rickshaw drivers** Showed symptoms of cough (77%), eye irritation (80%), breathlessness (54%), throat irritation (25%), headache (6%) and passage of black sputum in the morning (22%). (*IJOEM* **1999**)
- **2000: Prevalence of chronic respiratory symptoms**(i.e., cough, phlegm, breathlessness and wheezing) and airway diseases(i.e. chronic obstructive pulmonary disease/chronic bronchitis and bronchial asthma). (VPCI 2000)

2002: Air pollution and emergency room visits – Emergency room visits for asthma, COAD, and acute coronary events increased by 21.3 per cent, 24.9 per cent, and 24.3 per cent respectively (J N Pande et al, 2002)

- **2002: Cytogenetic investigations on peripheral blood lymphocytes**: The vehicular fumes found to be genotoxic (Int J Hum Genet 2002)

2002: Children living in areas of high atmospheric pollution are at risk of developing vitamin D deficiency rickets and should be offered vitamin D supplements (K S Agarwal 2002)

2003: Significantly high incidence of eye symptoms and disorders in areas with high pollution levels. Very high levels of sub-clinical ocular surface changes among persons travelling in highly polluted areas %42 -- males and 50% females complaining of redness and irritation compared to 20% males and 26% females of the control group. R Saxena et al 2003)

2003: Traffic policemen and benzene exposure -- in Delhi, Dehardun, Haridwar, Saharanpur, Muzaffarnagar and Meerut) monitored for benzene exposure. Creatinine values were alarming in Delhi policemen. Urinary phenol was very high in Delhi and Meerut policemen (Industrial Health 2003, 41)

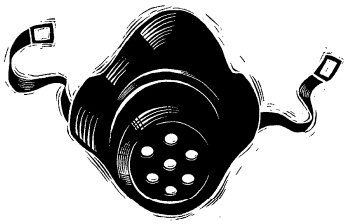
- **2003**-- **Traffic controllers face the risk of exposure to benzene** present in the ambient air as a component of fuel exhaust. (Y Verma et al 2003)
- -- Daily Exposure to Air Pollutants in Indoor, Outdoor and In-vehicle Micro-environments indicates Housewives and female workers being the most exposed groups. (R K Prasad et al 2003)

2006-- Winter months have greater exposure risk as pollutants as pollution often get trapped in the lower layers of the atmosphere (R Agarwal et al 2006)

- **2007: People traveling in highly polluted areas and exposed to high level of air pollutants** are likely to suffer from **significantly high incidence of subclinical ocular surface disorders** (IJOEM2007)

- **2007: -- Symptoms such as redness, watering, irritation, strain, blurring and photophobia** were shown by 78% subjects of the study group as compared to 45% of the control group (S K Gupta 2007).
- **Gaseous pollutants in spite of being lower than the standards, had significant impact** on human health, especially during winter (G J Nidhi 2007)

2008: The air pollution levels of ozone, NO2 and RSPM increase respiratory disease related hospital visits by 24%, 13% and 3%, respectively. (G J Nidhi 2008)



Delhi's mounting evidences …

2010

-- 33% of Delhiites have one or more respiratory symptoms; lung function impaired in 40% of residents. (National Chittaranjan Cancer Research Institute/CPCB)

-- Lung Function compromised in 43.5% of schoolchildren of the urban area compared to 25.7% of the control group. The urban children had increased prevalence of restrictive (20.3% vs. 14.3% in control), obstructive (13.6% vs. 8%) as well as combined (both obstructive and restrictive). (S Siddique et al 2010)

-- 32.1% of children in Delhi suffered from respiratory problems in contrast to 18.2% of rural children (control). The respiratory symptoms were more prevalent in girls than in boys. (S Siddique 2010)

-- **Air pollution linked with ADHD:** was found in 11.0% of urban children in contrast to 2.7% of the control group. Major risk factors were male gender, lower socioeconomic status, 12-14 year age group, and PM(10) level in breathing air. ADHD was more prevalent among boys both in urban and rural areas. (Siddique S et al 2010)

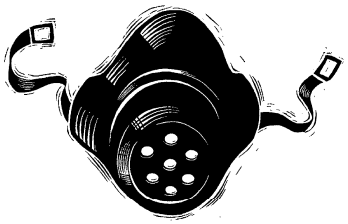
2011:

-- Increase in respiratory ailments and hospital admissions due to PM, ozone and NO2 pollution. Effects strongest among those individuals who spend a disproportionate share of their time out-of-doors. (Atmospheric Environment 2011). Vallabhbhai Patel Chest Institute found high respiratory symptoms in high pollution areas. Now studying the ozone link.

International agencies

1997 – World Bank -- -- More deaths occur at younger ages in Delhi and because the impact of air pollution is greater at younger ages in Delhi than in Philadelphia (M L Cropper et al (1997)

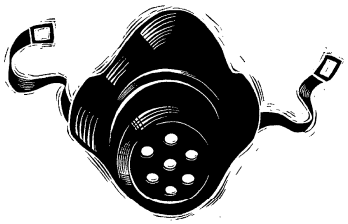
2011: Health Effect Institute study in Delhi: approx.*0.15% to 0.17% increase in mortality per 10 µg/m3 PM10* (~0.3%/ 20 µg/m3). In Delhi where overall deaths are 100,000 annually even this increase can translate into 3000 additional premature deaths annually due to air pollution related diseases (HEI 2010)



Whither action?

Both Delhi and Beijing started neck to neck with their respective first phase of action to combat air pollution, but Delhi lost steam midway.

Chinese capital has moved forward to take harder decisions. Still finding difficult to meet the standards…….



What has Delhi achieved?

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

Second generation action 2008 - 2014

Metro system expanded

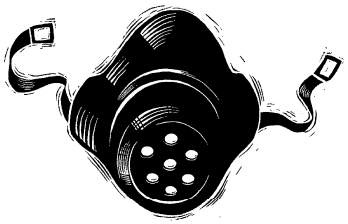
Close to 6000 new buses

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



What has Beijing achieved?

Lesson – need even harder decisions

First generation action – until Beijing Olympics (2000- 2008)

Implementation of **Euro IV emissions standards**

Ban on registration of diesel car in 2003

Advanced I/M programme - two speed idle tests and advanced tests on chassis dynamometer

Restrictions on Euro III heavy duty vehicles; **Euro I cars are labelled yellow** and their movement in the city is restricted – **also scrapped**

20,000 buses introduced by 2008 (including CNG buses)

Metro and light railway introduced

Restrictions based on odd and even number vehicles introduced

Stringent control industry, power plants, construction industry; heating systems etc

Second generation action – post Beijing Olympics 2008-2014

Cap on number of cars that can be sold in a year

Euro V emissions standards and fuel will 10 ppm sulphur introduced for buses and municipal fleet in Feb 2013

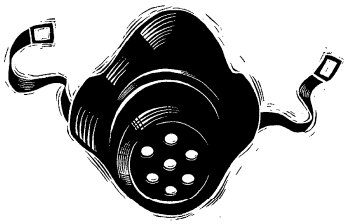
Vehicle inspection using remote sensing technology

Increased parking fee in Feb 2011

Increased total length of subway and light railway to 456 km by Sept 201

Increased **subsidy for scrappage** of old vehicles

Promoting CNG, electric vehicles and hybrids etc



It is not about Beijing and Delhi… But Delhi and other Indian cities…..

There are cities that are more polluted than Delhi… It is a national crisis

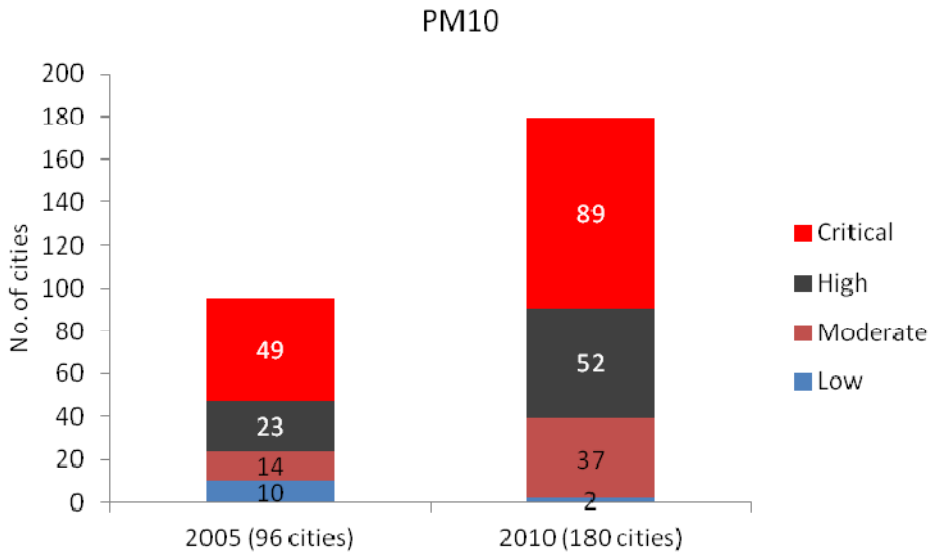
Killer particles ….Cities with critical pollution level increasing

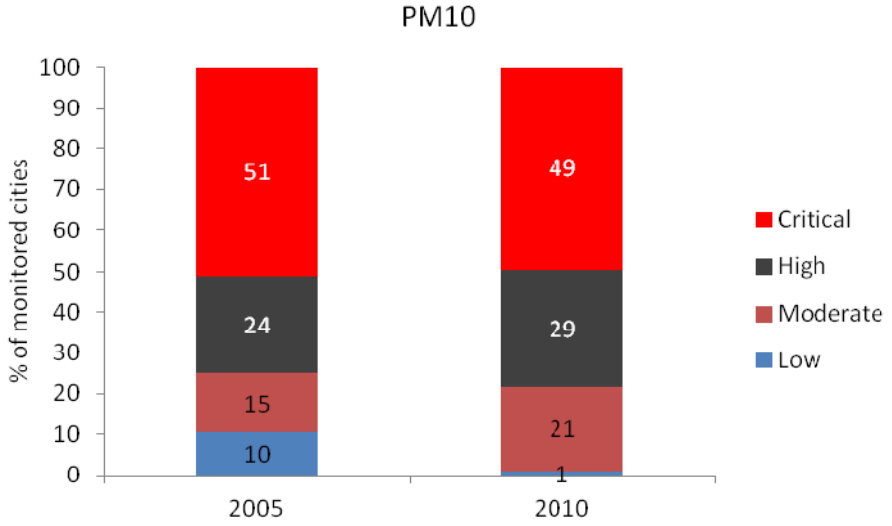
PM10 exceedances in cities (2005 and 2010)

-- PM10 monitoring increased from 96 cities in 2005 to 180 cities in 2010.

-- Low polluted cities fallen from 10 to 2. But the number of critically polluted cities (1.5 times the standards) have increased from 49 to 89 cities.

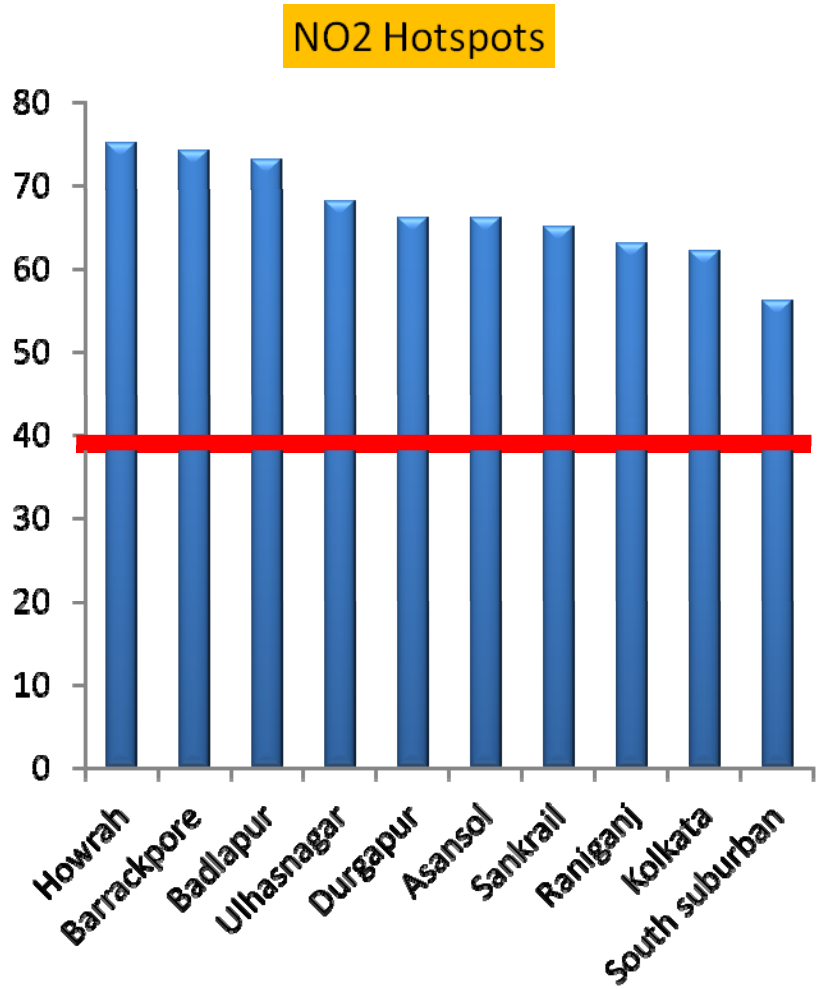
-- In 2005 – 75% of cities exceeded the standard. In 2010 about 78% of cities have exceeded the standard.

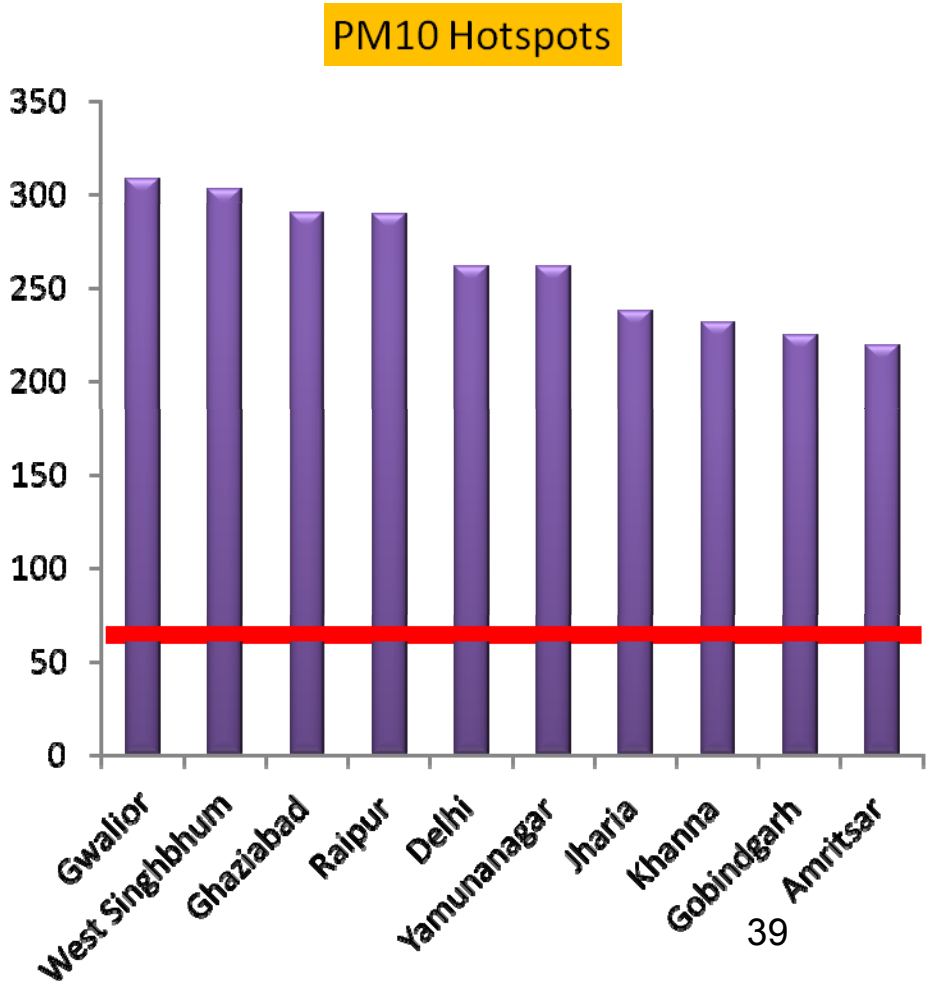


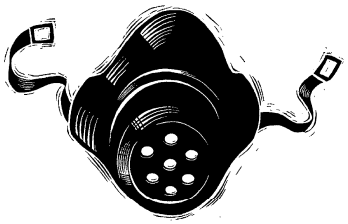


Source: CSE computation based on CPCB data

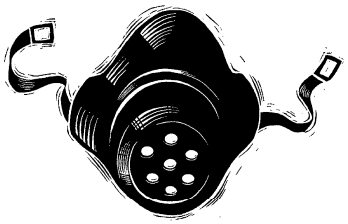
Pollution hot spots
Smaller towns are getting more polluted than the metros







Need urgent action….



Our cities need upscaled transition

Implement daily health alerts to help people take precaution. Integrate data from all monitoring stations to build robust public information system

Implement contingency plan to reduce peak levels

Implement second generation action plan to meet clean air standards by the end of the plan period. this must include:

Time bound improvement in public transport integrated with walking and cycling

Integrate transportation with land-use planning

Road pricing and taxation to reduce dependence on personal vehicles

Parking policy and charges

Leapfrog quickly to Euro V/VI standards

Check dieselisation

This needs support. Must not be allowed to fail..

Thank You