Presentation to the committee on auto fuel policy

Centre for Science and Environment

New Delhi, October 25, 2001

Your objective as we see it.

- Your committee has been set up because of an **environmental imperative**. It is not an oil ministry committee (*or oil industry*) but an environmental ministry committee.

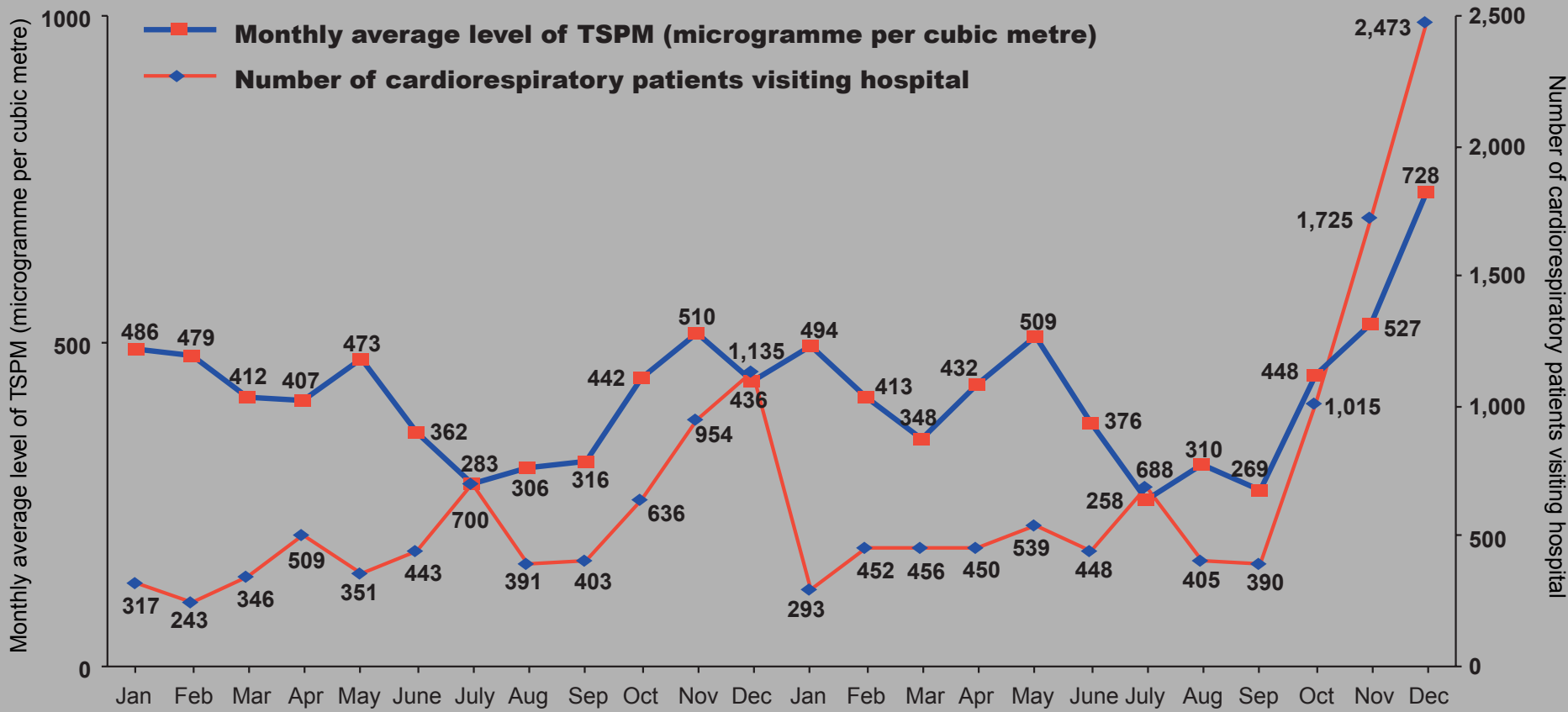
- You need to determine fuel quality and auto emission targets needed to meet **air quality targets**.

- National standards can be minimum requirement. Need stringent standards and measures for **critically polluted areas** (*not just metros*) to meet the ambient air quality standards.

Deadly costs of air pollution. Poor health for all.

Foul air and sickness

A study carried out at the All India Institute of Medical Sciences over 1997 and 1998 clearly shows that with an increase in levels of particulate pollution, more people suffer from cardiorespiratory diseases, particularly from October to December



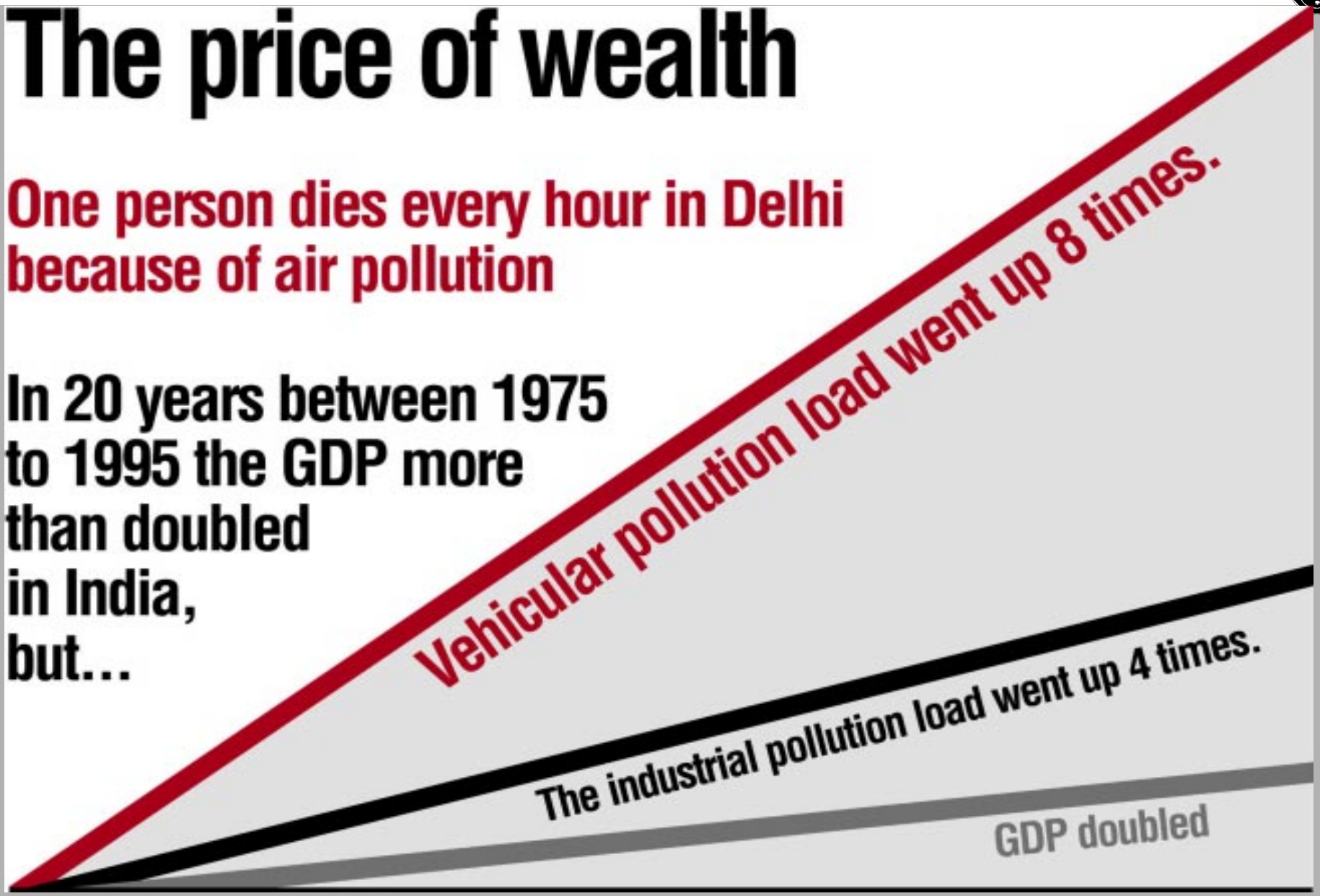
Source: J N Pande 1998, Outdoor Air Pollution and Emergency Room Visits at a Hospital in Delhi, All India Institute of Medical Sciences, *mimeo*

Vehicles contribution growing. Slow Murder.

The price of wealth

One person dies every hour in Delhi because of air pollution

In 20 years between 1975 to 1995 the GDP more than doubled in India, but…



Air pollution is growing. Not just in metros.

CPCB data shows that many cities are worse than Delhi as far as particulate pollution is concerned. In 31 cities monitored, SPM levels have recorded critical levels, that is, 1.5 times the standards. Worse RSPM levels are increasing and are much above standards in many cities.

According to WHO there is no safe level for particulate pollution. From a health point of view no standard can be defined.

Identify pollution hotspots in the country

Reaching critical levels

Number of cities with high levels of pollution in India: SPM

Zones	Number of cities monitored	Number of cities with		
		Critical Pollution (above 210 micrograms per cubic metre)	High Pollution (between 140-210 micrograms per cubic metre)	Moderate (between 70-140micrograms per cubic metre)
North	14	11	2	1
West	24	15	8	1
East	11	4	5	2
South	14	1	5	7

Source: Calculated on the basis of CPCB data

Growing pollution. Many pollutants not even measured

SO_2 levels are still low. In 23 cities SO2 levels are just above the national standards. But SO_2 contributes to formation of more deadly sulphate particles. Needs controls.

NOx levels are also low but steadily rising in many cities. About 21 cities in the country have recorded NOx levels above the national standards. This pollutant plays a catalytic role in formation of yet another serious pollutant – ozone.

Worse, many air toxins not even monitored. Benzene, Ozone, Polycyclic Aromatic Hydrocarbon.

Both CPCB and DPCC monitoring in Delhi shows benzene levels are already alarmingly high. According to WHO, no safe level for benzene.

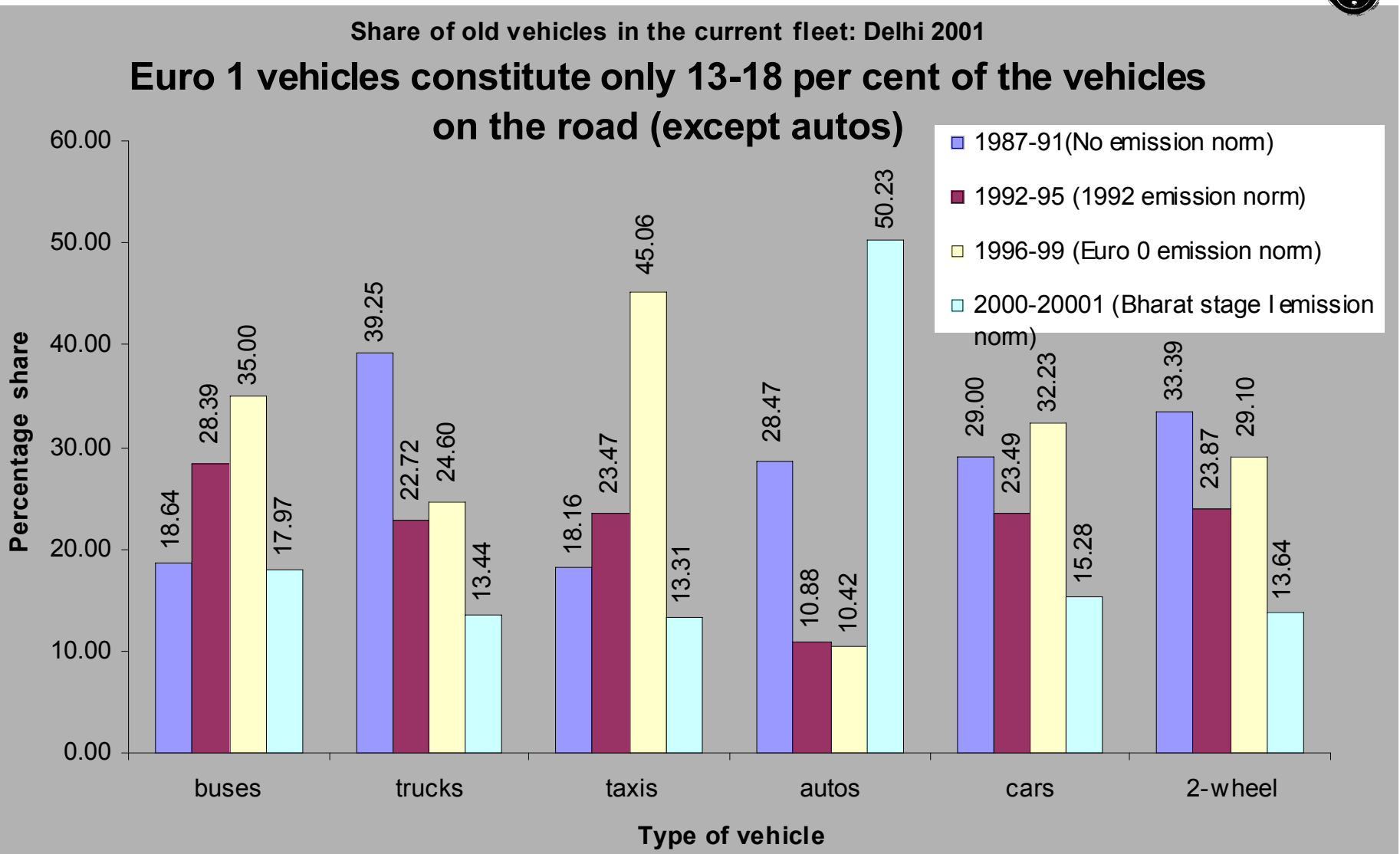
Why controlling air pollution needs hard action

- **We have large numbers of old vehicles with very poor norms on the road today. We cannot get rid of them fast. The option is to phase in much better vehicles as fast as possible. The incremental option is not for us.**

- Till 1991 there were no emission norms. The 1996 norms were Euro-0 norms. Even in Delhi, which has age restriction on commercial vehicles the oldest fleet will conform to Euro-0 emission norms in 2011 and Euro 1 norms in 2015.

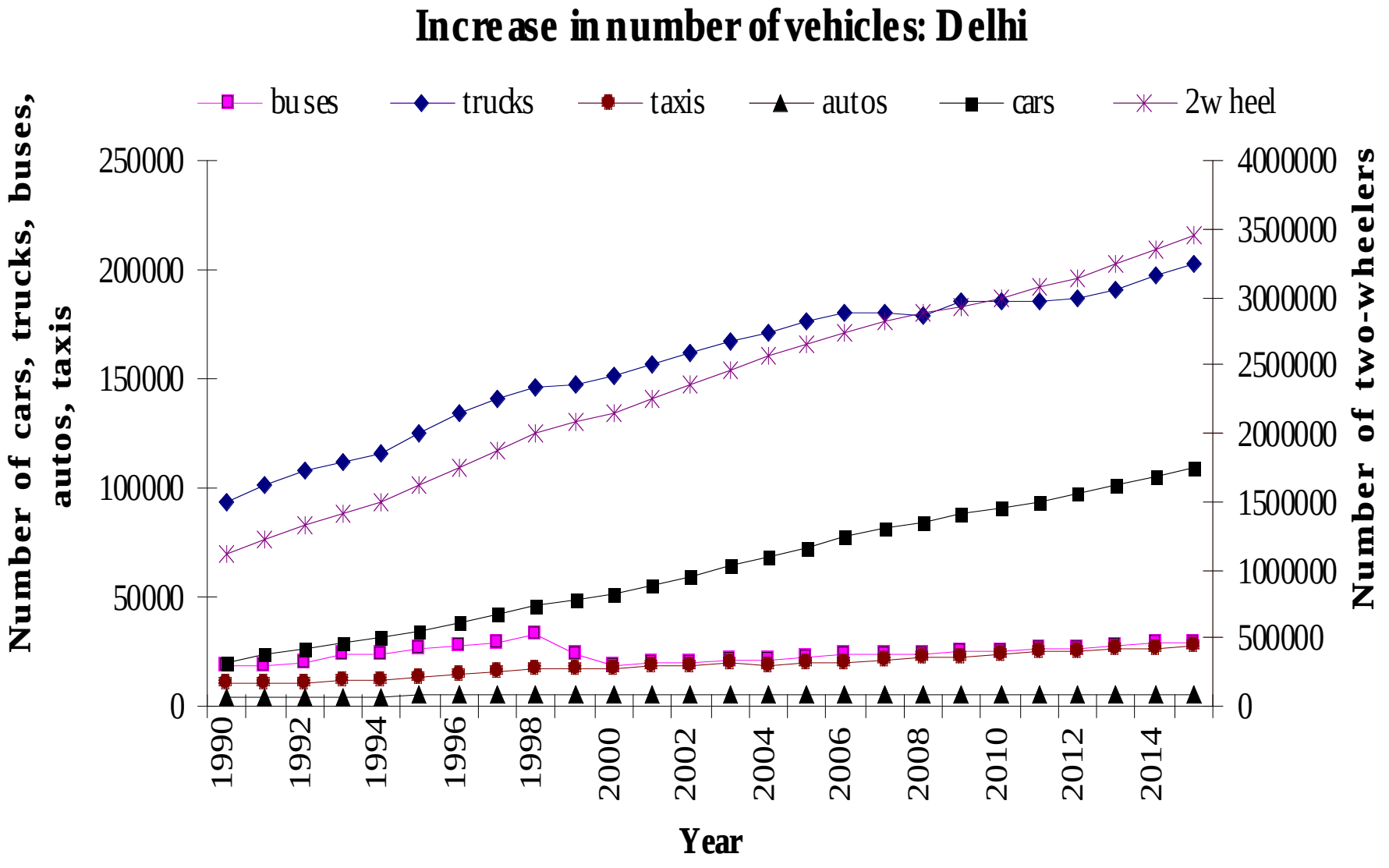
2. **Private vehicle numbers are growing by leaps. We are making no serious investment in public transport. Or in restricting private vehicles**

Need to phase in new standards fast.



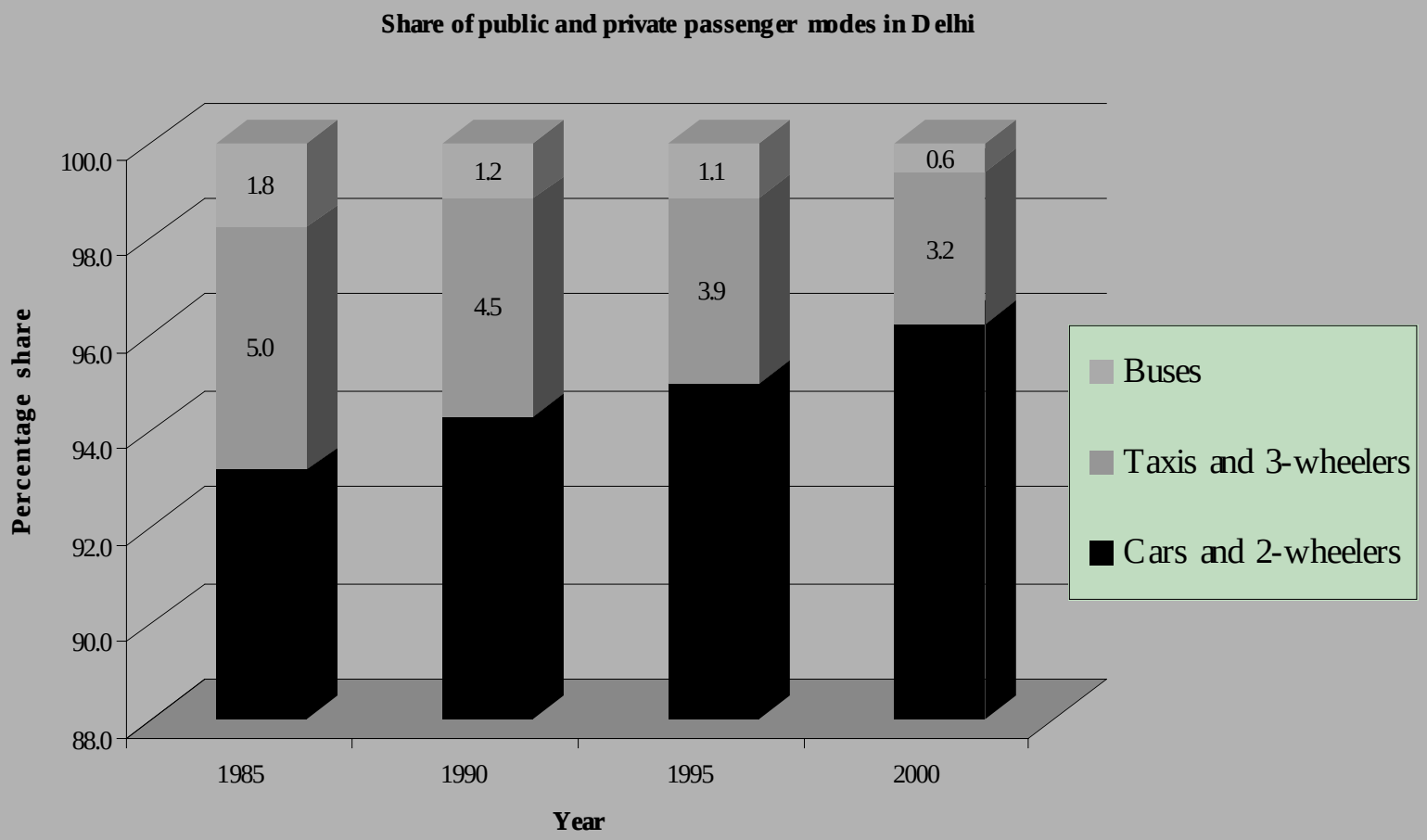
Source: Calculations based on data provided by State Transport Authority, Delhi

Why the incremental approach will not work: large numbers of vehicles and growing fast



Source: calculations based on STA data

Share of private vehicles increasing. No efforts to control or restrict numbers.



Why incremental approaches will not work….

3. All our cities have mixed fleets. We need a strategy for each pollutant and for each vehicle type.

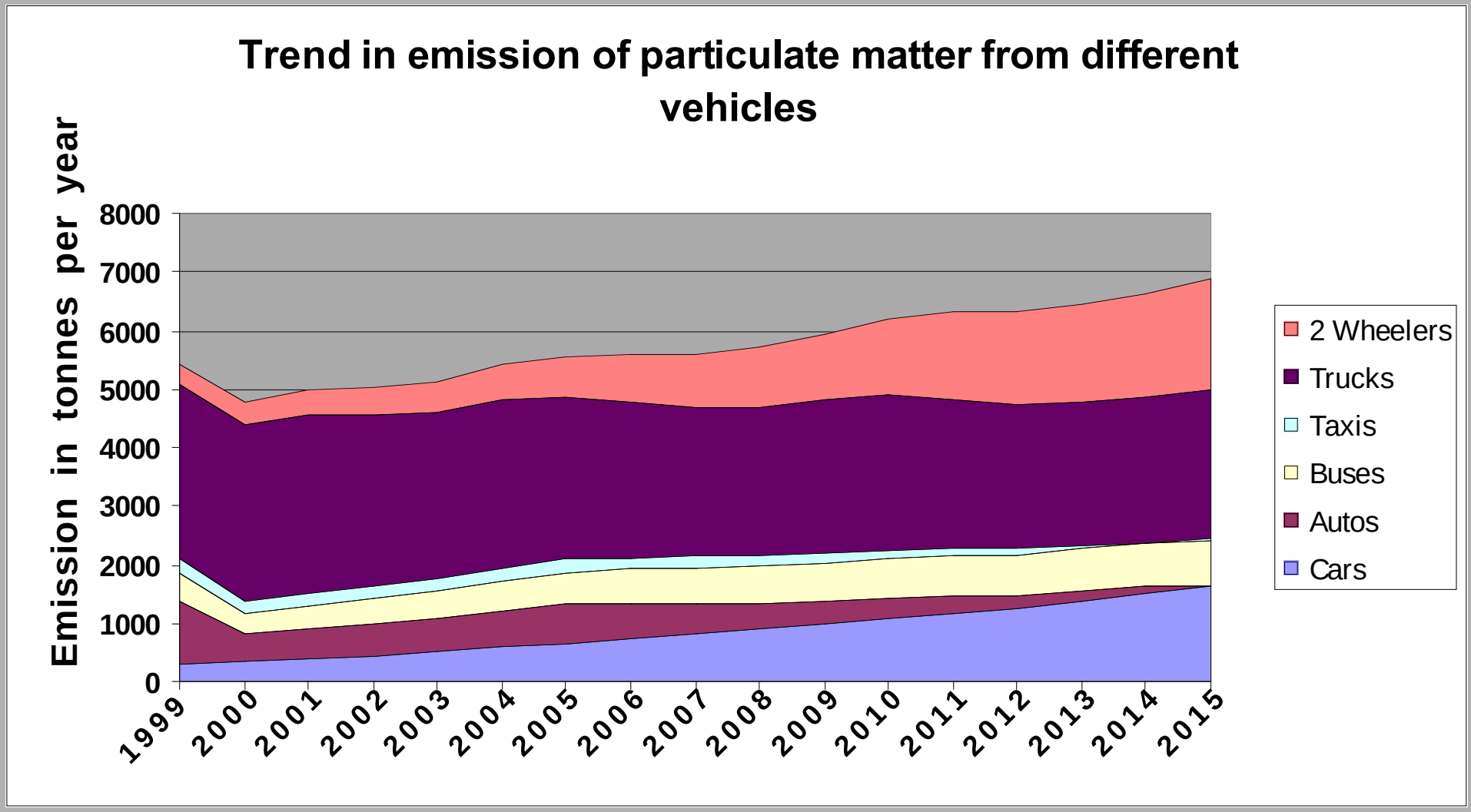
For instance: Delhi we have achieved:

- Improvements in emission norms for private vehicles; 5 year advancement.
- Restricting numbers and improvement in emission norms for autos;
- Restricting age limit and increasing numbers of public transport vehicles and improvement in their emission norms;

But still need drastic action to control pollution from:

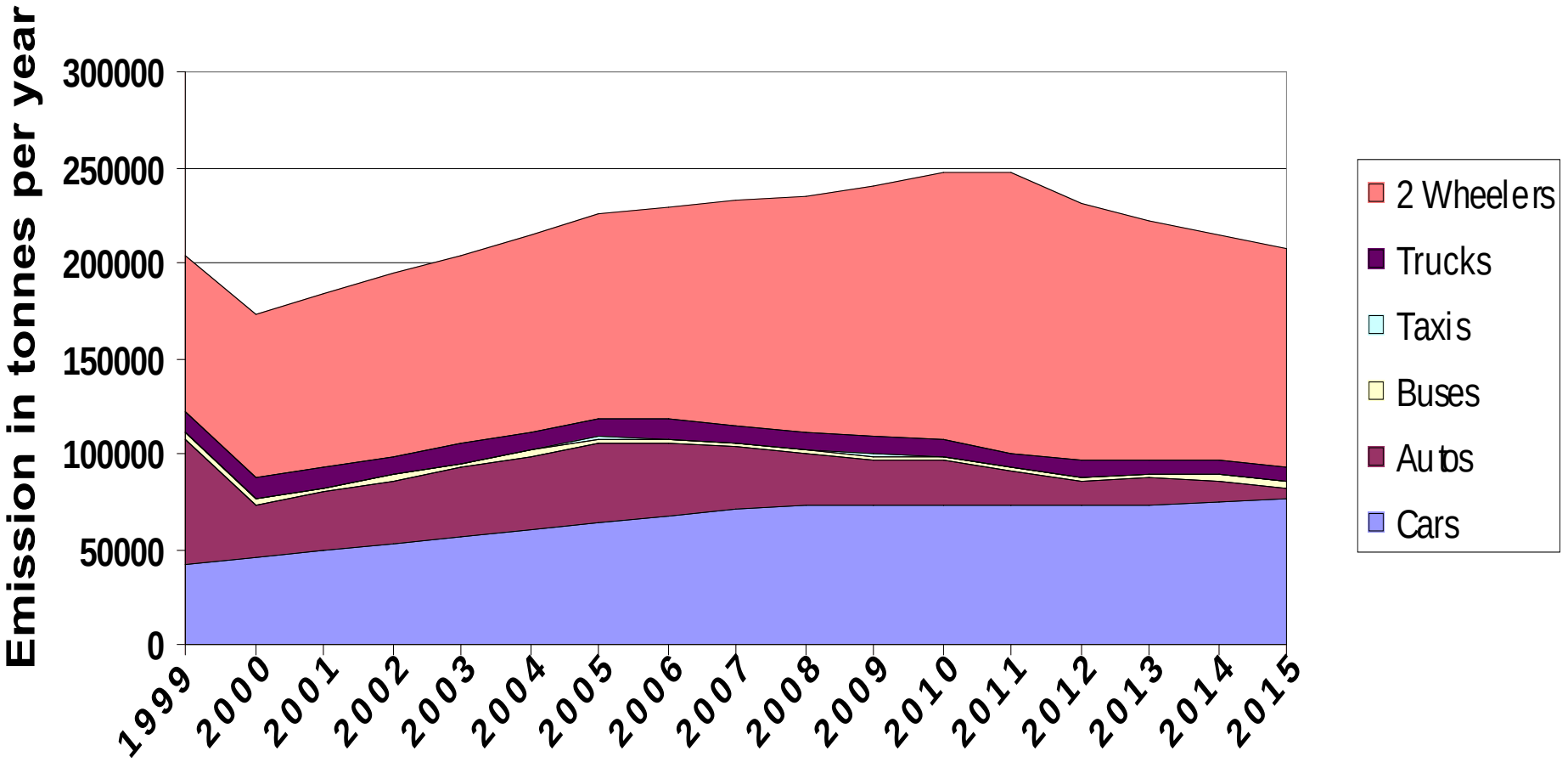
- Trucks;
- Two-wheelers.

CSE EMISSON MODEL: PM

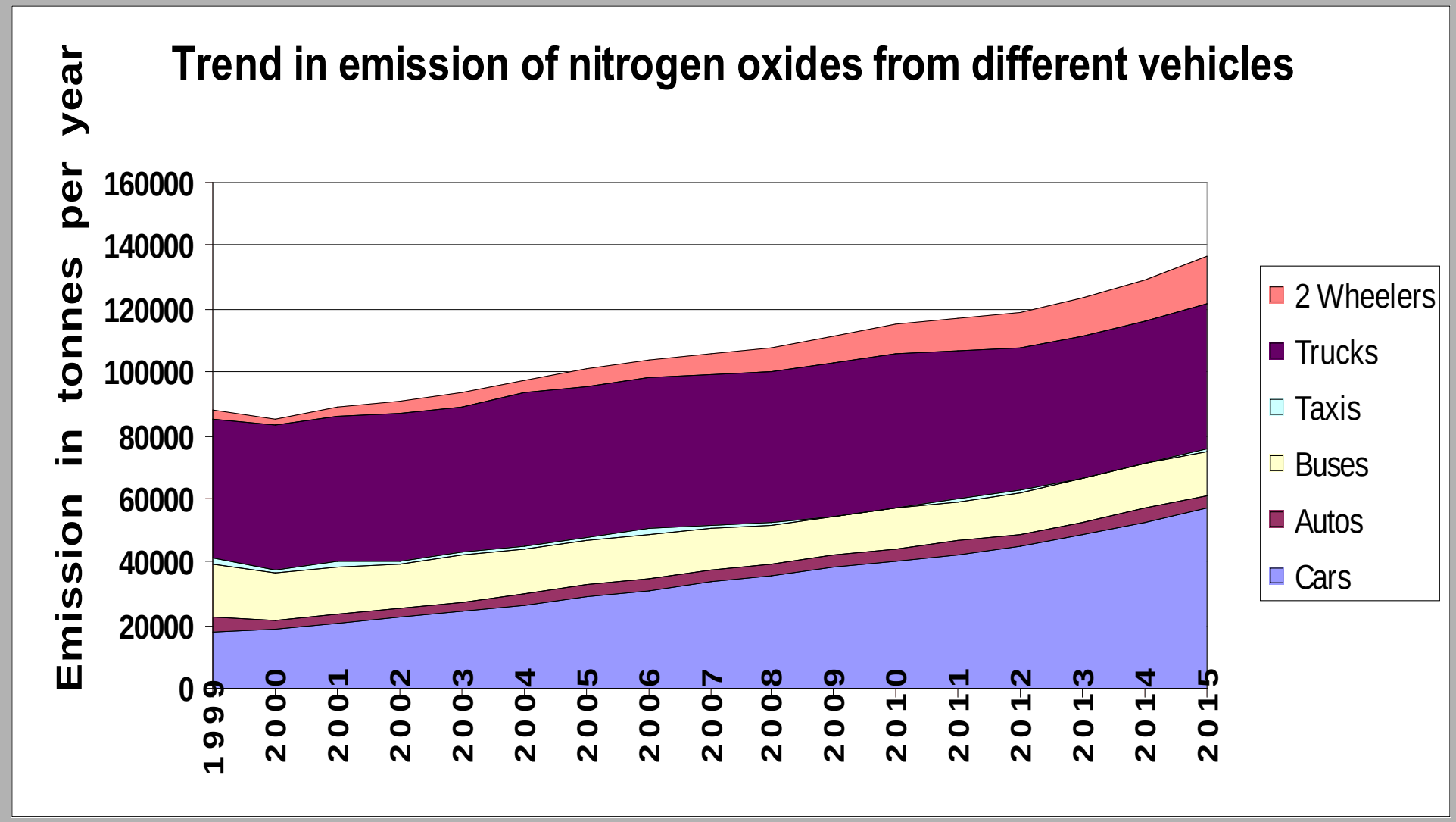


CSE EMISSION MODEL: hydrocarbons

Trend in emission of hydrocarbons from different vehicles



CSE EMISSION MODEL: NOx



Problems in managing air pollution

4. **There is no national action plan to deal with air pollution. Air pollution law is also very weak. No punitive actions for state governments for not meeting the ambient air quality norms.**

In the US, the clean air act forces the federal government to intervene in case regional air quality standards cannot be met and federal government can penalise state governments by restricting federal aid for roads, etc.

In India, air pollution is unchecked till the courts intervene.

Problems in controlling air pollution

5. Current and even future fuel quality norms are poor. No push to automakers to improve technology. They can and must. But buck-passing continues.

Court action in Delhi has set an important precedent: National standards are a minimum requirement. Special standards can be designed for more polluted hotspots like Delhi.

The proposed fuel norms under consideration for 2005 are at best by the government's own admission, close to only Euro II fuel standards (European standards of 1996).

Fuel quality norms: current and proposed will keep us behind technology.

TREND IN FUEL QUALITY IMPROVEMENTS IN INDIA SINCE 1996

The fuel standards that the Indian government is proposing to meet 2005 aims to bring Indian fuel quality close to only Euro II fuel standards. This will keep India 10 years behind time

Environment related fuel quality parameters	India 1996-2000	Fuel Quality in Delhi (Present)	Recommen-ded for 2005	World best standards
PETROL				
Benzene (v%)	3-5	**1.0**	**1.0**	**1.0** (California present)
Aromatics (v%)	Not specified	Not specified	**45**	**25** (California present)
Sulphur (ppm)	**2000**	**500**	**300**	**50** ppm by 2004 (California)
Oxygen wt % max	2.7	**2.7**	**2.0**	Get rid of requirement*
Olefins vol %	Not specified	Not specified	**18**	**6** (California present)
Lead	0.013		**0.005**	

***Chose safe oxygenate or opt for other refining methods**

Fuel quality….

TREND IN FUEL QUALITY IMPROVEMENTS IN INDIA SINCE 1996

The fuel standards that the Indian government is proposing to meet 2005 aims to bring Indian fuel quality close to only Euro II fuel standards. This will keep India 10 years behind time

Environment related fuel quality parameters	India 1996-2000	Fuel Quality in Delhi (Present)	Recommen-ded 2005	World best standards
DIESEL **Sulphur (ppm)**	**10000** (2500)	**500**	**500**	**10** (Swedish Class I diesel)
Cetane number	**42**	**48**	**50**	**50** (EU)
Polycyclic aromatics (wt %)	Not specified	Not specified	**10**	**0.12** % by volume (Swedish Class I diesel)

Source: Anon, 2001, Transport fuel quality for year 2005, Central Pollution Control Board, December

Auto fuel strategy is critical.

Need to address the concerns of toxic effects of fuels and to promote synergy of fuel and vehicular technology.

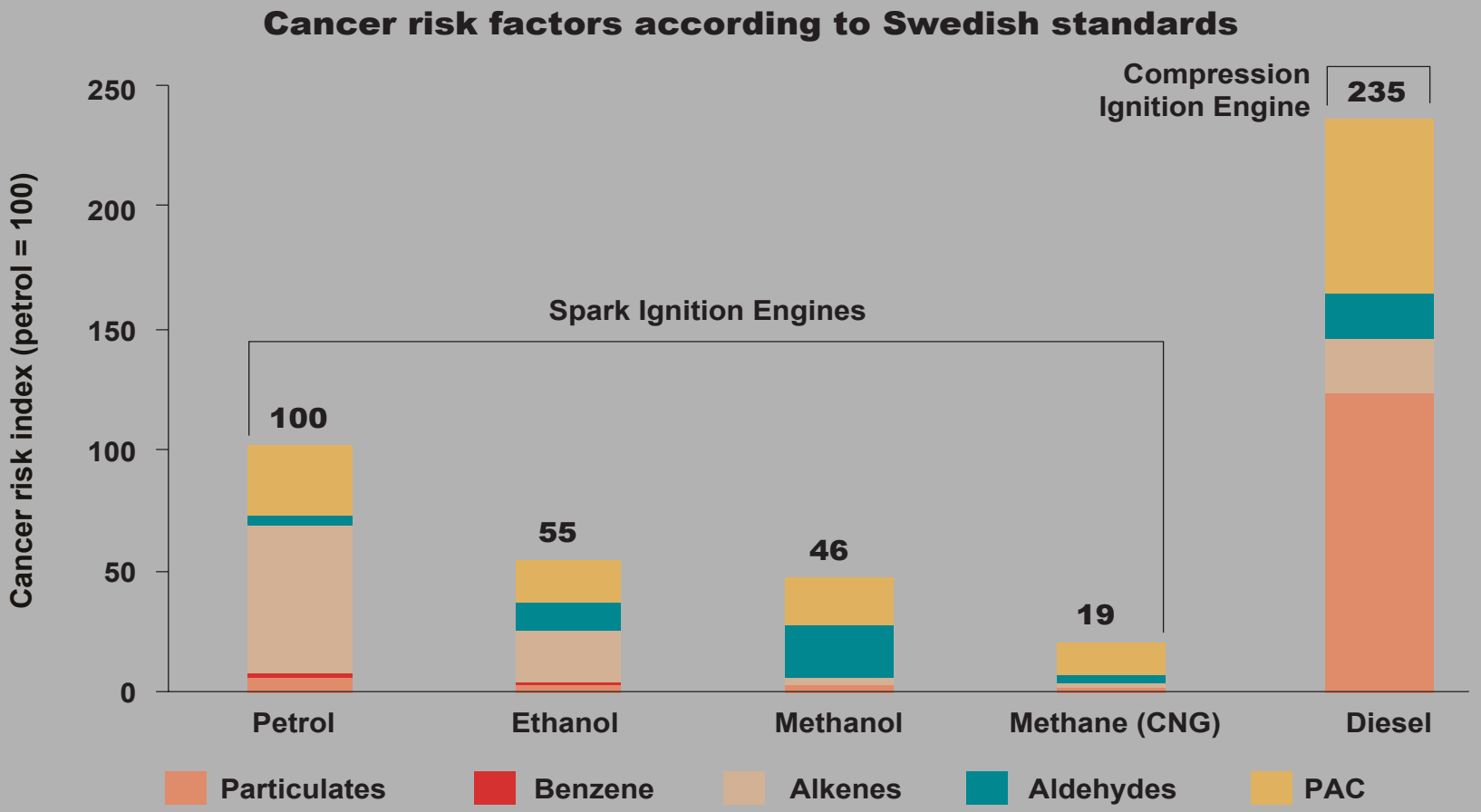
Objective of any fuel quality improvement programme will have to be:

- Lowering the toxic effect of emissions,
- Enable application of more advanced vehicle technology,
- Enable application of advanced after-treatment systems.

Health impact of different fuels needs to be considered.

The cancer index...

It is possible to quantify toxic risks from different emission sources and capture it in a cancer index to rate emissions and fuels



Source: *Peter Ahlvik and Ake Brandberg 1999*, Cancer Risk Index for Passenger Cars in India, *Ecotraffic R&D AB, STockholm, Sweden*

Auto fuels: public health concerns with fuels….petrol

Key concerns in petrol

- **Very high level of benzene emissions:**

We have weak standards for benzene and none for total aromatics in petrol. Fuel specifications notified in 1997 mandated benzene level of 5 per cent for the country and 3 percent for metros from 2000 onwards. The Supreme court has recently ordered lowering benzene supplied to Delhi to 1 percent. But there is still no cap on total aromatic content.

High benzene levels found in Delhi. Problem in other cities as well. We have large numbers of two-stroke engines with high level of unburned hydrocarbons and other vehicles without cat convertors.

- **Harmful effects of oxygenates**: If oxygenates are added to petrol to keep the benzene and total aromatics content as low as possible, if not selected judiciously could also create public health and environmental problems.

Fuels: issues and concerns…. MTBE

- An oxygen content of 2.7 per cent has been permitted in India without specifying the acceptable oxygenates. Refineries are going in for MTBE without taking note of the harm that this has caused to the environment in countries where this has been widely used.

- MTBE is recognised as a major groundwater contaminant. Its health concerns are growing. But more importantly the water becomes undrinkable.

- **Over 90 per cent of Indian drinking water depends on groundwater. Can we afford to take the risk?**

Concerns in fuels……total aromatics

- **Need to limit total aromatics and benzene in any petrol reformulation programme.**

- The total aromatics content in Indian unleaded petrol is reported to be as high as 48 percent. **Even if the benzene content is controlled at 1 percent, benzene emission will still be high. Combustion of other aromatics such as toluene and xylene produces benzene. Therefore, worldwide efforts are on to lower both benzene and total aromatics in the petrol at the same time.**

- **According to WHO, reduction of aromatics from 45 percent to 20 percent can lead to 42 per cent reduction in benzene emissions** (Dieter Schwela and Olivier Zali (ed.) 1999, Urban Traffic Pollution, World Health Organisation, Geneva, p139).

Concerns with fuel: diesel

- **Sulphur levels**
- **Polycyclic aromatic content**

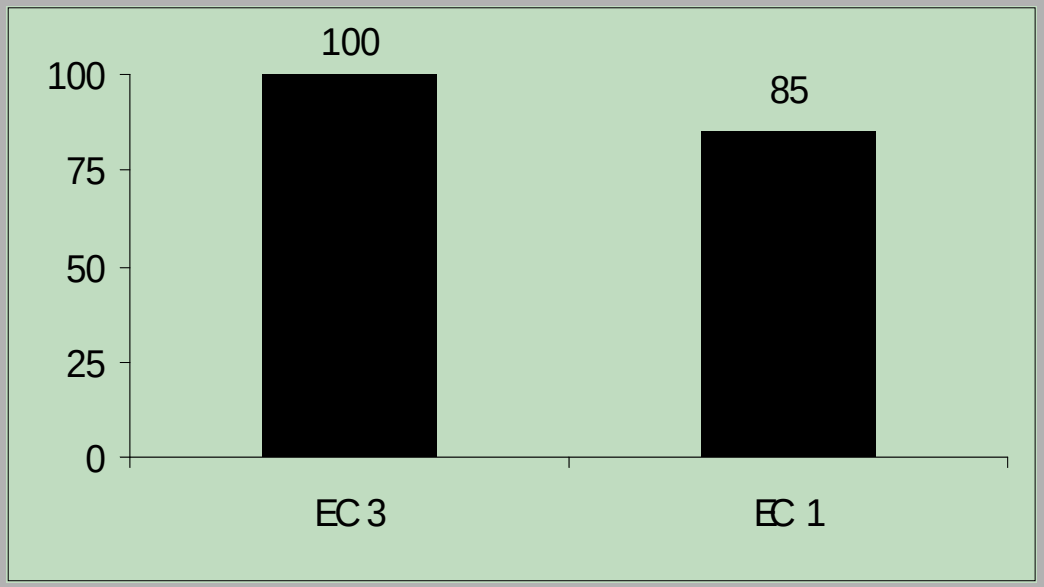
Sulphur levels

Best diesel *by itself* does not reduce particulate and other toxic emissions if used in existing or even improved engine technologies.

But lowering sulphur levels **allows the use of after-treatment systems** like particulate traps and then becomes effective in controlling emissions.

Lowering sulphur content does not reduce emissions *per se*.

Differences in emissions from Swedish buses using EC1 and EC3 diesel. Moving from 3000 ppm sulphur diesel (like most of India) to the best diesel of 10 ppm sulphur diesel gives you a mere 15 per cent reduction.

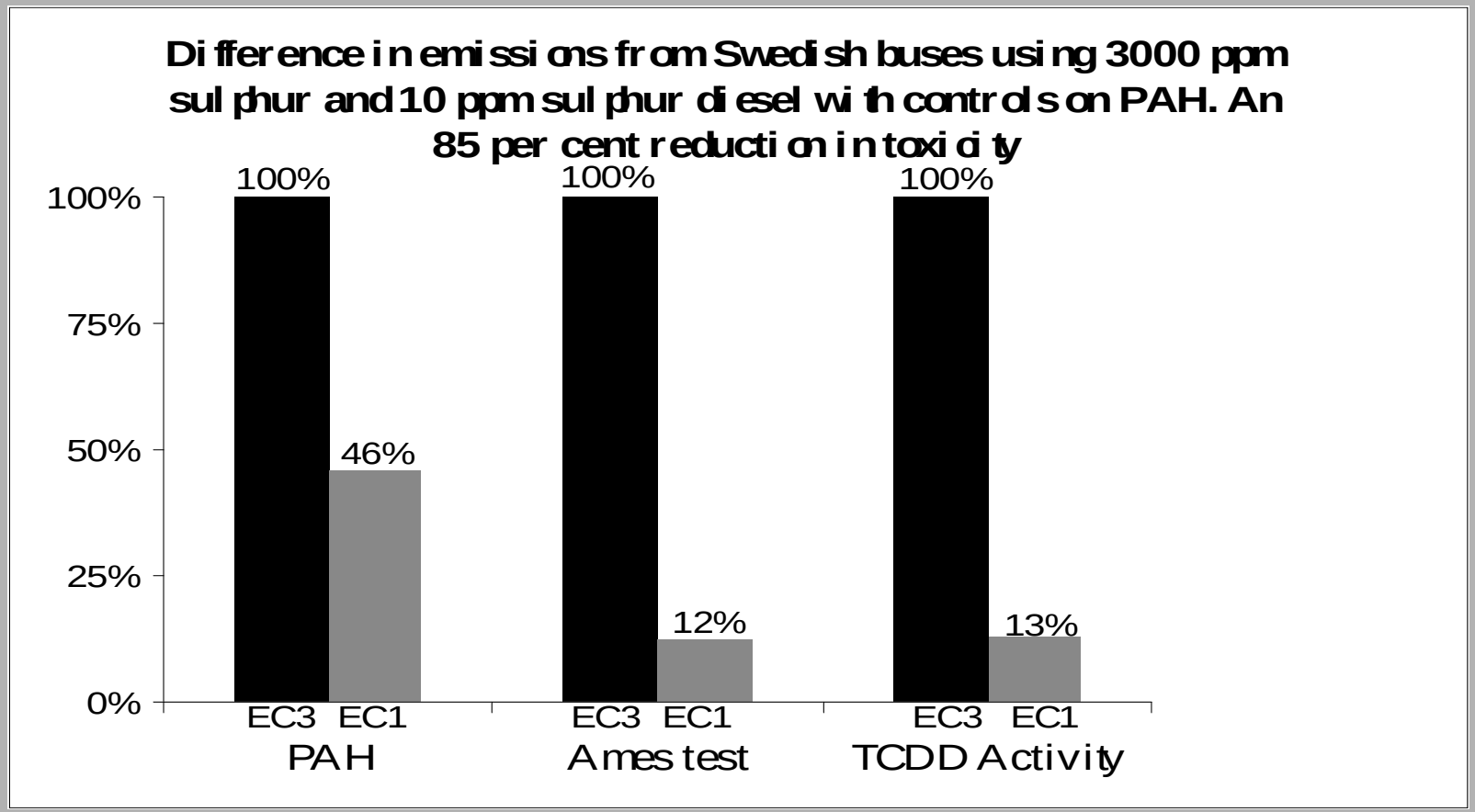


Note: EC 3 diesel – sulphur content of 3000 ppm and no limit on polycyclic aromatic hydrocarbons

(PAH) content EC 1 diesel – sulphur content of 10 ppm and PAH content of 0.02 per cent.

Source: Anon 1998, Ecotraffic, Sweden, *mimeo*

But controls on PAH leads to major gains in reduction of toxicity of diesel.



Note: **EC1 – Environmental class 1 diesel EC3 – Environmental class 3 diesel**

Ames Test and TCDD Activity – a measure of mutagenicity (that is, the potential to disrupt the genetic set up of humans)

Source: **Anon 1998, Ecotraffic, Sweden, *mimeo.***

Diesel: sulphur content and emissions

IMPACT OF REDUCING SULPHUR ON EMISSIONS

Tests done all across the world show small decrease in particulate emissions even with large reduction in sulphur content of diesel

Country	Reduction in diesel sulphur content	Reduction in particulate emissions
European Auto Oil Programme	From 300 ppm to 30 ppm	9 per cent
Study by US-based Southwest Research Institute	From 300 ppm to 10 ppm	**21.6** per cent Number of particles larger than 0.1 micron went down with reduction in sulphur levels, but number of particles smaller than 0.1 micron went up.
Motor Test Centre, Sweden	**3000** ppm to **50** ppm **3000** ppm to **10** ppm	**5-12** per cent **14-22** per cent

Auto fuel policy
CSE's recommendations

IMPACT OF REDUCING SULPHUR ON EMISSIONS

Tests done all across the world show small decrease in particulate emissions even with large reduction in sulphur content of diesel

Country	Reduction in diesel sulphur content	Reduction in particulate emissions
Hong Kong	355 ppm to 35 ppm	4.4 per cent
New Zealand	From 500 ppm to 50 ppm From 350 ppm to 10 ppm.	5.1 per cent Number of particles emitted by an Euro I heavy-duty diesel engine increased Euro II diesel engine emitted more particles smaller than 56 nanometre when running on 10 ppm sulphur diesel than on 50 ppm sulphur diesel

Diesel: at what level of sulphur do particulate traps work? 500 ppm or 30 ppm and less?

Particulate traps do not work in high sulphur fuels. Because of this countries are mandating **cuts in sulphur levels to phase in state of the art after-treatment system techologies.**

EU has mandated maximum sulphur level of 50 ppm by 2005. Proposals to introduce 10 ppm sulphur diesel. Sweden, Germany, and UK have already introduced ULSD (10-50 ppm sulpfur) in advance through fiscal incentives.

The US has mandated in 2000 that most diesel fuel should be 15 ppm by 2006.

Reducing sulphur in diesel..

Wherever huge investments have been made to get diesel with sulphur content of 10 ppm to 15 ppm, it has come as a package with technology – very low sulphur and PAH diesel together with good engines, constantly regenerating traps and de-NOx catalyst.

Fuel sulphur in ppm	PM emission in gram per g/bhp-hr	Percentage increase in PM emission relative to 3 ppm sulphur diesel
3	0.003	0
7	0.006	100
15	0.009	200
30	0.017	470
150	0.071	2300
Tier 2 emission Standard (2004-2009)	0.01	

Note: PM – particulate matter; g/bhp-hr – grammes per brakehorsepower-hour; ppm – parts per million.
All tests done under the supplemental test procedure of the US EPA
Source: Anon 2000, *Regulatory Impact Analysis: Heavy-duty Engine and Vehicle Standards and Highway Diesel Fuel Sulphur Control Requirements*, United States Environmental Protection Agency, Washington DC, December.

The challenge: identify leapfrogging options. Examine alternative fuels as one option

- Slow incremental process of improving engine and fuel standards is possible in countries in the forefront of technology. Not in India that is lagging behind by more than 10 years.

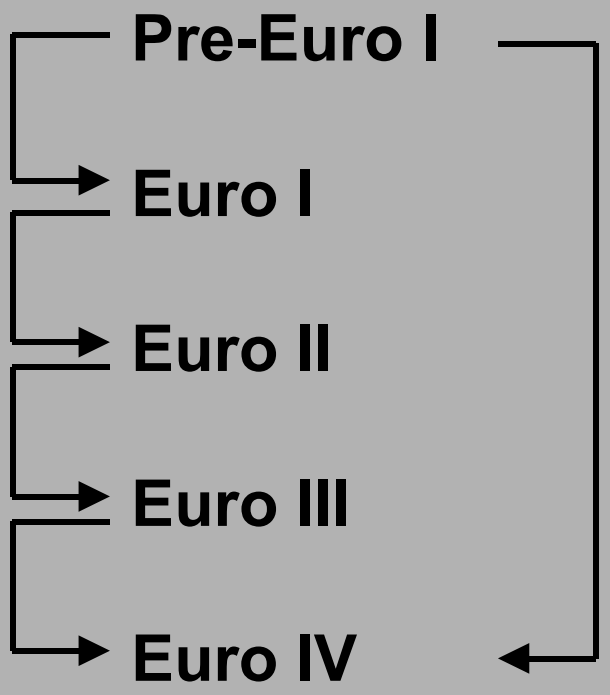
- But making this quantum leap with the help of conventional fuels is going to be far more expensive than that based on an alternative fuel strategy.

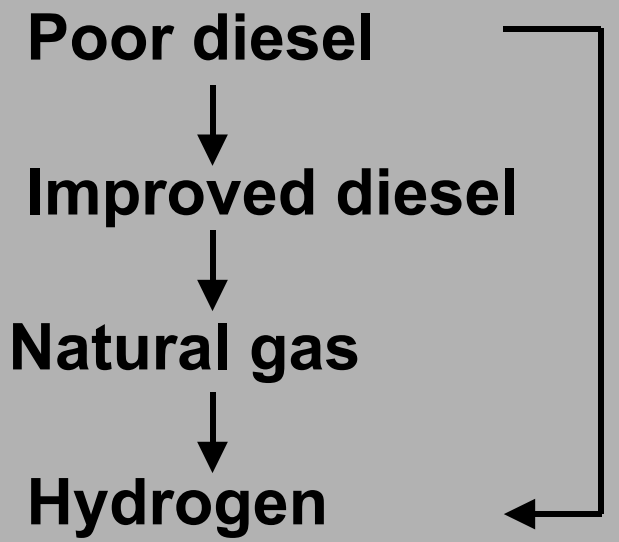
- The Supreme court order of moving the entire public transport including all taxis, autos and buses to CNG or other clean fuel in Delhi is the first ever step towards a quantum leap.

Strategies to technology leapfrogging

A KEY QUESTION

Do we have to go through the same stages of environmental management that the West went through or can we leapfrog?





CNG allows us to advance emission norms by 8 years. Get breathing space.

INDIAN TEST RESULTS

Test results from Ashok Leyland shows that a stoichiometric CNG bus fitted with a three-way catalyst is far ahead of a comparable diesel bus. It meets the Euro IV norms for both particulate matter and oxides of nitrogen. Even carbon monoxide emission is better than Euro II norms

	Year of implementation	Particulate matter	Hydrocarbon	Nitrogen oxides	Carbon monoxide
Euro I	**1993**	0.4	1.23	9.0	4.9
Euro II	**1996**	0.15	1.1	7.0	4.0
Euro III	**2000**	0.10	0.66	5.0	2.1
Euro IV	**2005**	0.02	0.46	3.5	1.50
Emissions from CNG bus of Ashok Leyland (stoichiometric engine with a three-way catalytic converter)		0.014	**0.04 (non-methane hydrocarbon)**	3.24	3.12

Note: All figures in gramme per kilowatt-hour

Source: R Ramakrishnan 2001, CNG – The Clean and Cost-effective Fuel for Delhi Vehicles, *mimeo*.

Gaseous fuels…eliminate adulteration

Gaseous fuels can also eliminate the problem of fuel adulteration which is a very serious problem in India.

Even if we get the best quality diesel, we would need strong regulatory measures to ensure that the fuel does not get adulterated and the particulate traps are cleaned and regenerated when required.

CNG: myths and facts

A number of issues have been raised:

- **It is not available.**
- **It is not safe.**
- **It is not environmentally friendly. Emissions are high.**

Please see our booklet: The smokescreen of lies: myths and facts about CNG.

For instance: allocation not availability the issue. Delhi vehicles have been allocated less gas than the middle class cooking gas allocation where the switch is from LPG to CNG. Need to displace diesel. Etc……

Need fiscal incentives

Cost a factor in all our proposals: ULSD or CNG. Need fiscal policies to make clean technologies competitive. Need to factor in health costs. Never done till now.

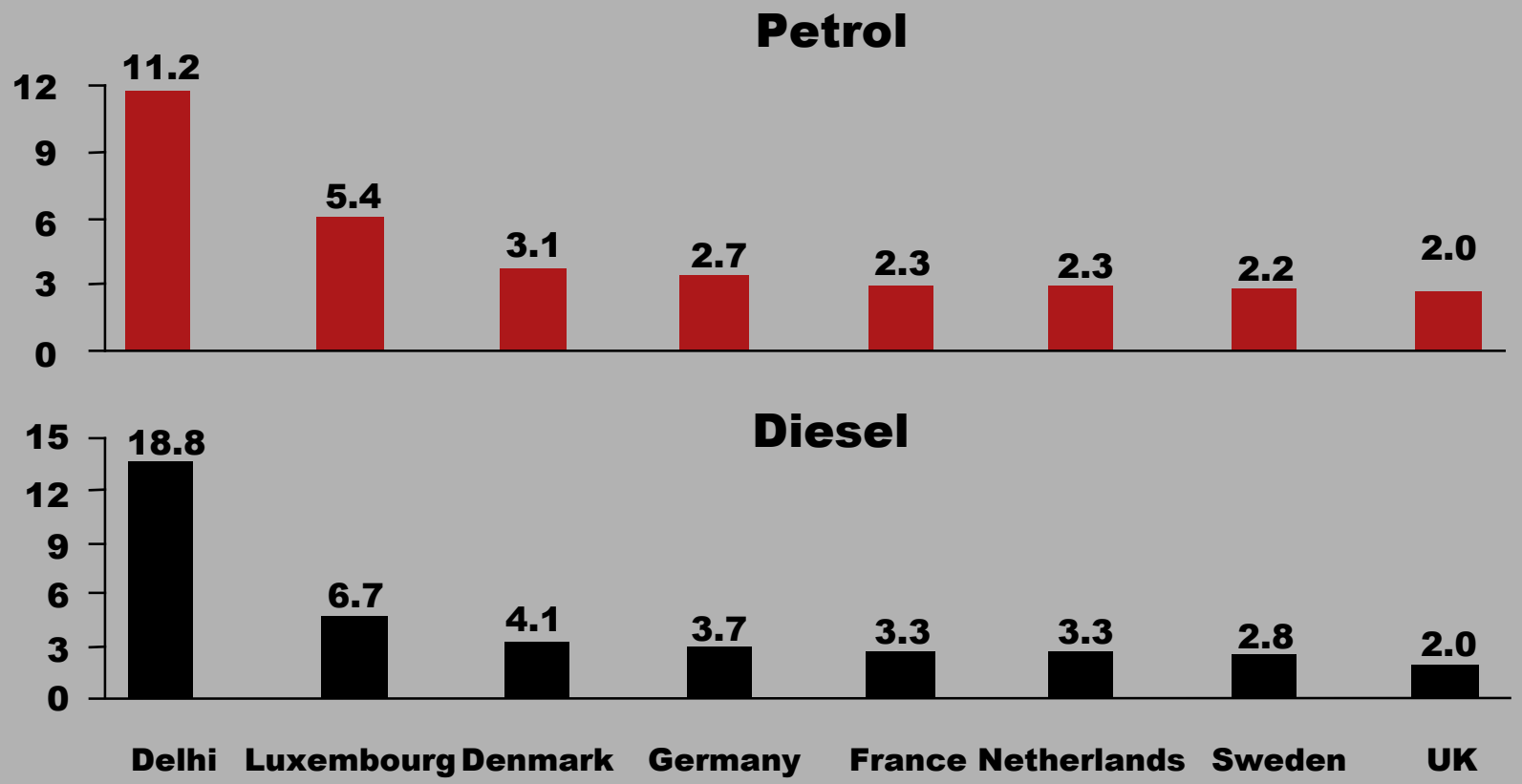
Market for all advanced technologies: ULSD (with traps), CNG, LPG, ethanol… is very hostile. Need official policy to promote the transition.

Can be done. Need to tax the bad. Promote the good.

Auto fuel policy
CSE's recommendations

Fuel comes cheap in India

The ratio between per capita GDP and fuel prices show that fuel comes cheap in India than in EU countries. The difference is stark in case of diesel. World over governments relate fuel taxes to GDP. Ratio of per capita GDP and fuel prices show how much more or less the citizens are paying for fuels in relation to per capita GDP. Lower the ratio higher the tax level.



Source: Calculations based on Anon 2000, EU Vehicle and Fuel Tax Policy, Swedish EPA.

Subsidise technology transition by taxing the bad

Delhi has the highest per capita income and the lowest diesel prices compared to other metros.

Entire CNG conversion could have been funded by bringing diesel prices at par with other metros.

In 1998-99, diesel sale in Delhi was 1,451 million litres. **An additional sales tax of Re 1 in 1999 and 2000 would have fetched about Rs 300 crore.** Increasing the price of diesel to that of Mumbai would have netted the government over Rs. 450 crore in one year.

Road taxes for cars and scooters in Delhi are very low. The road tax for cars in Chennai is twice that of Delhi.

Our recommendations: need for serious and urgent action. Incremental change will not do.

1. **Need for advancing fuel quality and emission standards.Need to catch up fast with state of the art technology. We have no choice.**

   All prediction scenarios show grim situation unless we take strong action. Fast.

Delhi as a case study.

Studies conducted by both CPCB and CSE shows that even with all interventions and proposed actions, air pollution will not be not controlled in the near future.

CPCB's assessment of pollution load trend

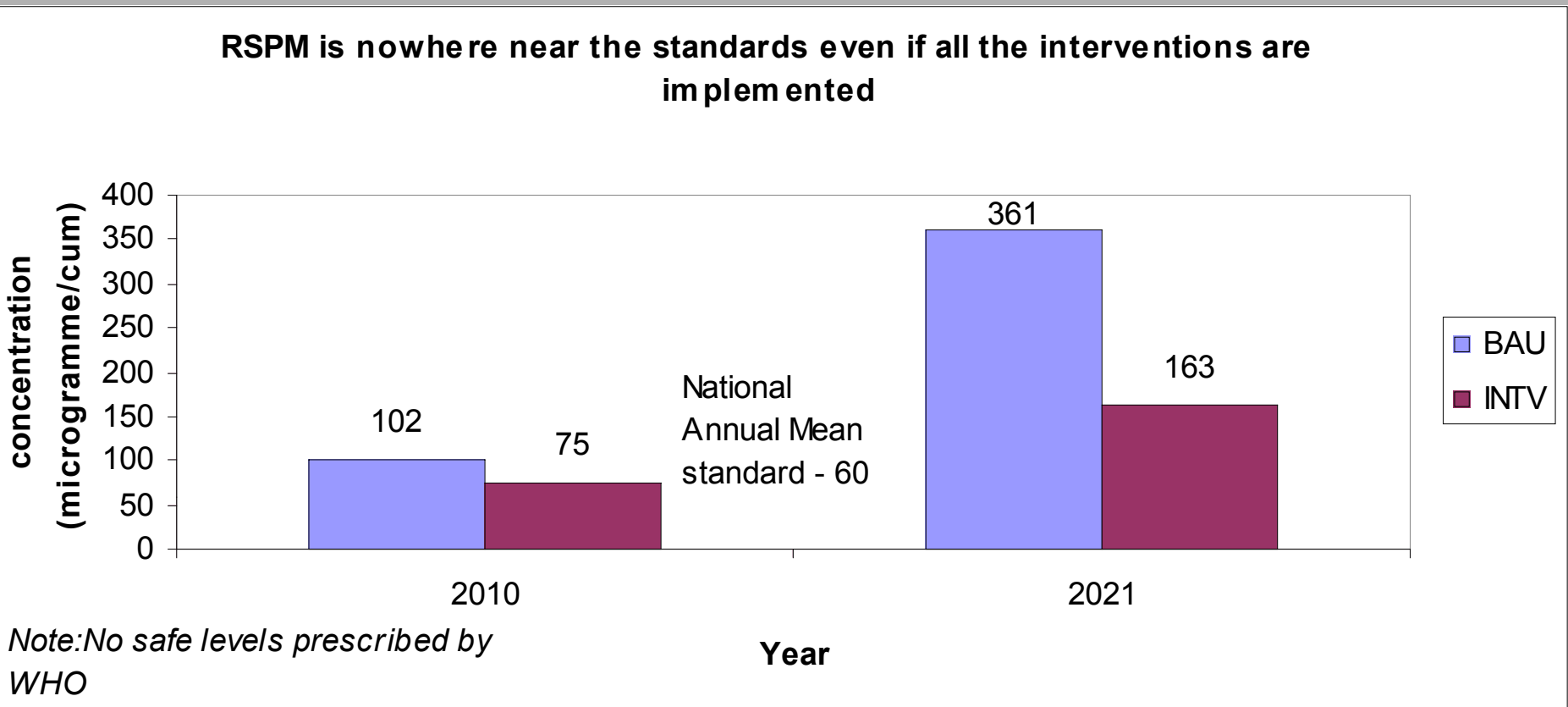
Scenario I: Impact of the following interventions in 2010

- Euro II fuel quality
- Alternate fuel (CNG) for autos, taxis and buses
- Euro III vehicular technology
- Phasing out older vehicles

Scenario II: Impact of the following interventions in 2021

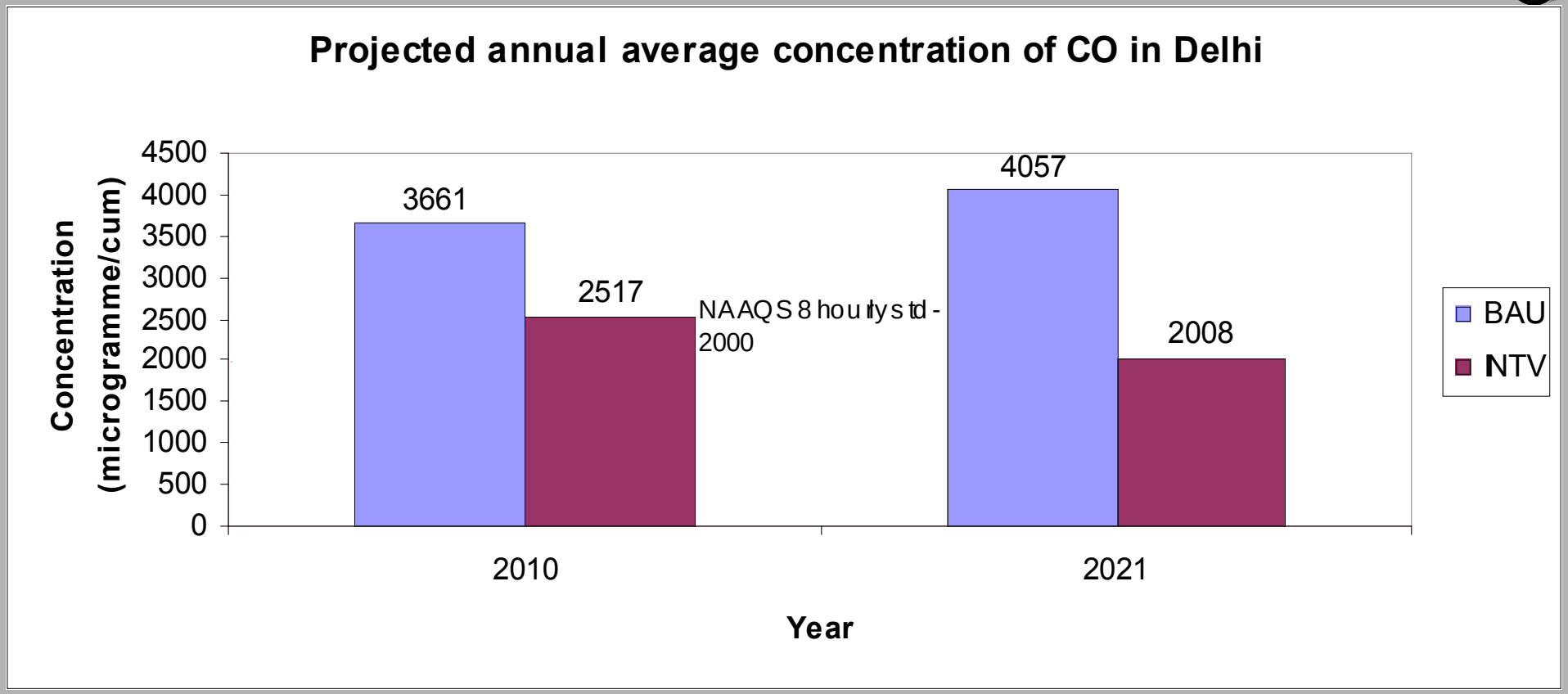
- Euro IV plus fuel quality
- Alternate fuel (CNG) for autos, taxis and buses
- Euro IV vehicular technology with proper Inspection and Maintenance
- 40 percent reduction considered for cars, 20 per cent for trucks, Multiutility vehicles and light commercial vehicles due to inspection and maintenance
- Phasing out of older vehicles

CPCB's assessment: RSPM



Note:No safe levels prescribed by WHO

CPCB's assessment: CO

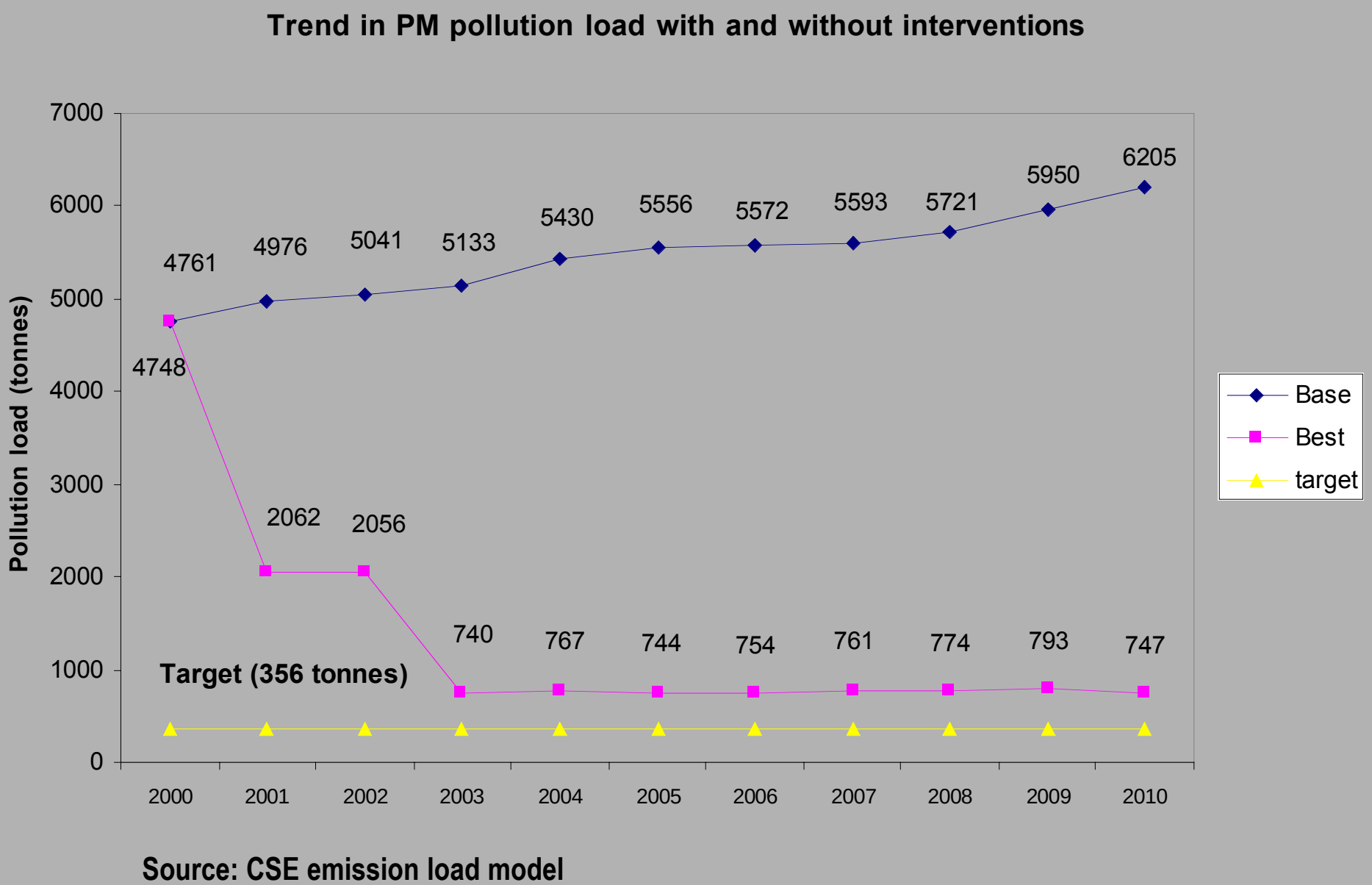


CSE's assessment of impact of fuel strategies on pollution load
INTERVENTIONS

The 25 possible interventions to reduce vehicular pollution load in Delhi

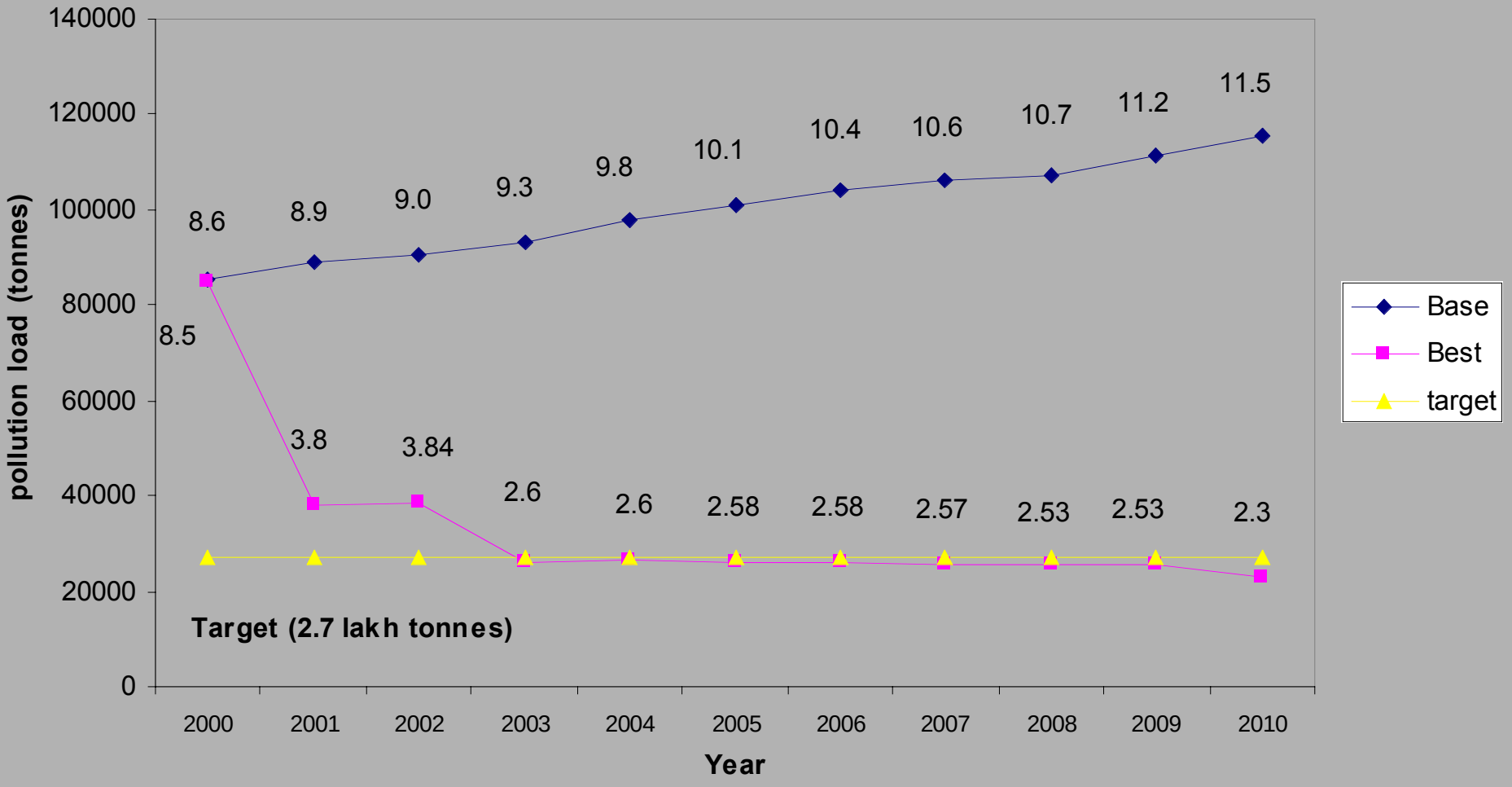
1. Apply stringent norms and implement them quikly
2. Phase two stroke two-wheelers in favour of four-stroke two-wheelers
3. Retrofit catalytic converters on all petrol cars manufactured before 1996.
4. Ensure that all diesel good vehicles that operate within Delhi limits have a particulate trap installed
5. Ensure that all diesel good vehicles registered in Delhi have a de-Nox catalytic converter
6. Move all city buses to CNG
7. Move all three wheelers on CNG
8. Move all taxis to CNG
9. Move all light duty vehicles on CNG
10. Provide 30 ppm sulphur diesel fuel
11. Provide 30 ppm sulphur petrol fuel
12. Provide 10 percent ethanol-blended petrol
13. Stop registration of diesel private cars
14. Create incentives to move the private cars fleet towards CNG
15. Create incentives to promote the introduction of zero emission two-wheelers
16. Restrict the age of cars of tweleve years
17. Restrict the age of two-wheelers to twelve years
18. Begin a programme to weed out 50 percent of the gross polluting vehicles per year
19. Establish an emissions warranty and recall system
20. Establish a mass rapid transit system (MRTS) to reduce vehicle utilization
21. Increase parking fees and another measures to reduce vehicles utilization
22. Increase the bus flet to reduce vehicle utilization
23. Construct a bypass to divert interstate good vehicles traffic
24. Implement financial increases to limit vehicle population growth
25. Establish a pollution alert system

CSE's emission load model: PM



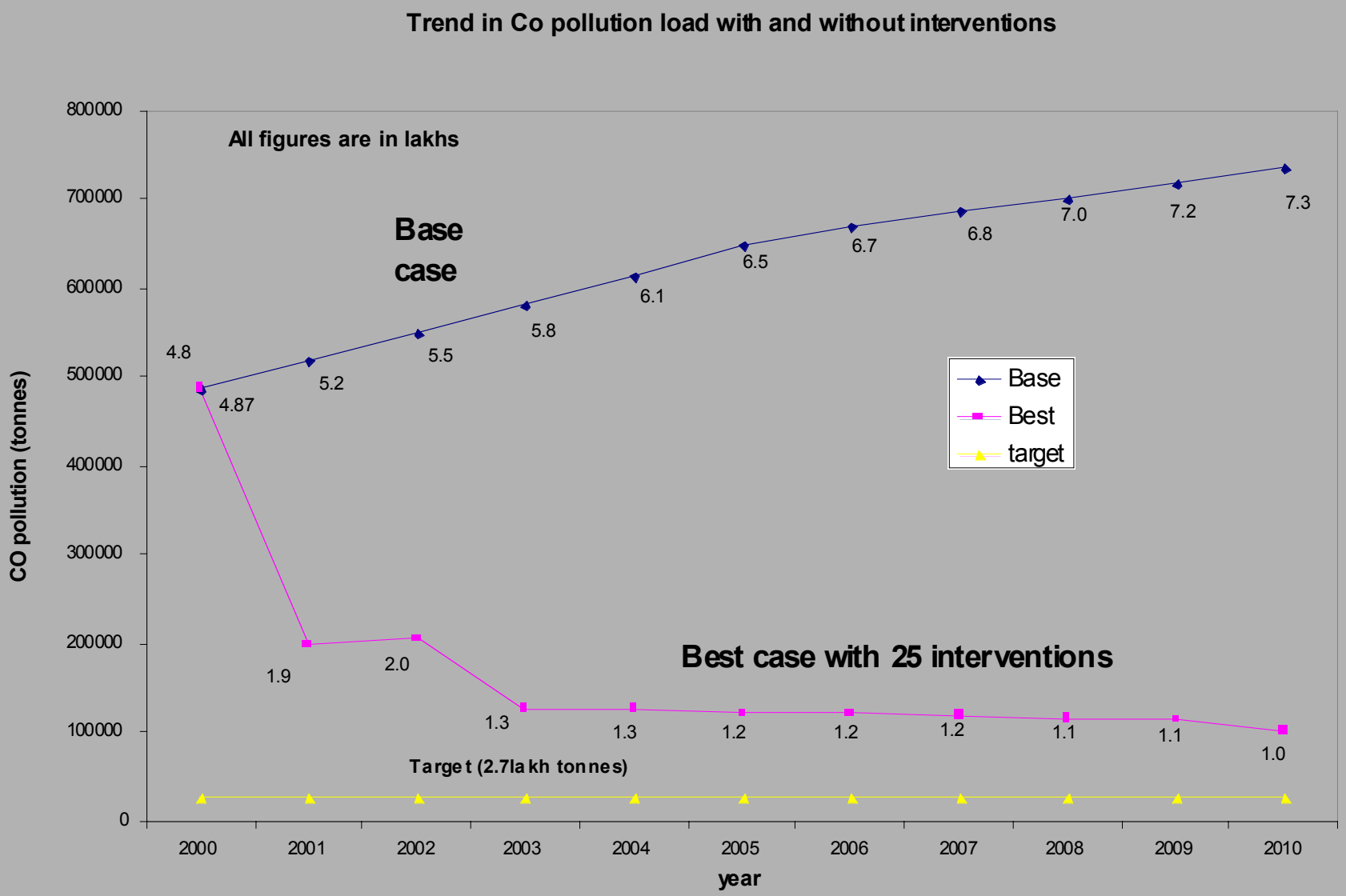
Source: CSE emission load model

CSE's emission load model: NOx



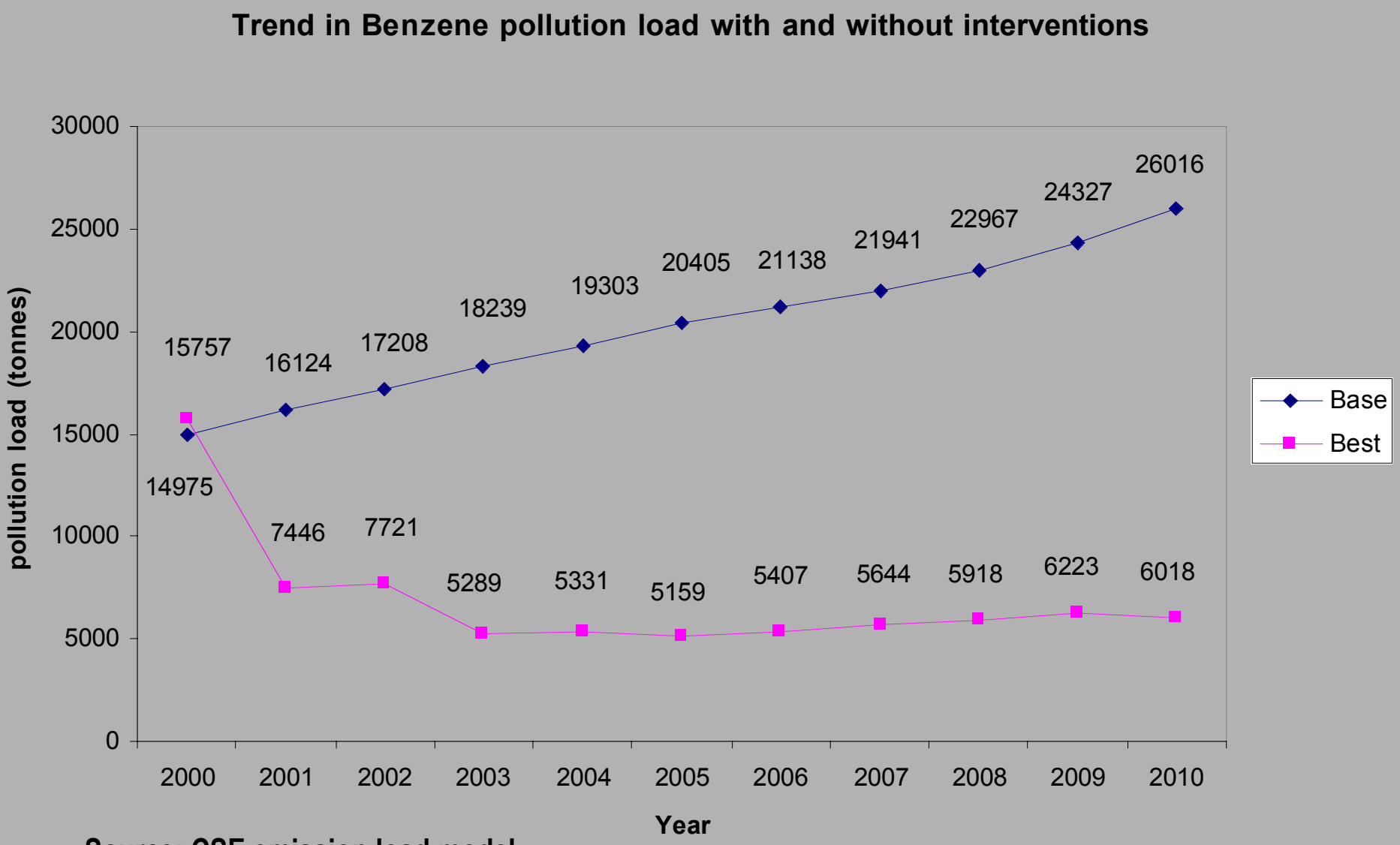
Source: CSE's emission load model

CSE's emission load model: CO



Source: CSE emission load model

CSE's emission load model: benzene



Source: CSE emission load model

Our recommendations….

2. Introduce special fuel and emission standards for pollution hot spots in the country.

3. Make Euro IV fuel and vehicle technology mandatory in pollution hotspots by 2004-2005.

Our recommendations

4. In diesel take the quantum jump. Introduce diesel with less than 30 ppm sulphur (ideally 15-10 ppm) to enable application of particulate traps.

5. Lower total aromatics (PAH) in diesel and also aromatics and benzene in petrol drastically to reduce toxicity.

6. Invoke precautionary measures and ban MTBE.

7. Provide fiscal incentive to advance compliance with advanced standards.

Our recommendations

8. Promote alternative fuels to make a quantum leap. Prepare city-wise plan for introduction of alternative fuels like CNG, LPG, ethanol, electric vehicles etc and target a sizeable section of the vehicle population to move to alternative fuels and make necessary allocation to meet the transport demand.

10. Notify more enhanced standards (tighter than the conventional fuel standards) for alternative fuel vehicles.

11. Design fiscal incentives to promote alternative fuelled technology.

Our recommendations

12. Improve air quality surveillance system in all cities. Introduce pollutants like benzene, ozone and PAH.

13. Develop smog alert system for cities along with pollution emergency measures for an immediate local impact.

14. Involve civil society in standards-making process. (no member of civil society on this committee??)

Much more needs to be done. … road map

….. Design effective strategies to deal with emissions from **in-use vehicles**. Comprehensive **inspection programme** for in-use vehicles must come along with legally enforceable **emissions warranty and recall programme** from the manufacturers and tighter in-use emissions standards. Design appropriate fiscal measures to encourage **fast replacement** of old vehicles. Develop comprehensive transportation plan to control number of private vehicles and **promote public transport**. Use command and control measures to discourage ownership and usage of private vehicles.

But most importantly, from this committee, we need a progressive (bold) report which sets the road map for the future. No soft options left.