Are our cities BSVI ready? Setting the agenda

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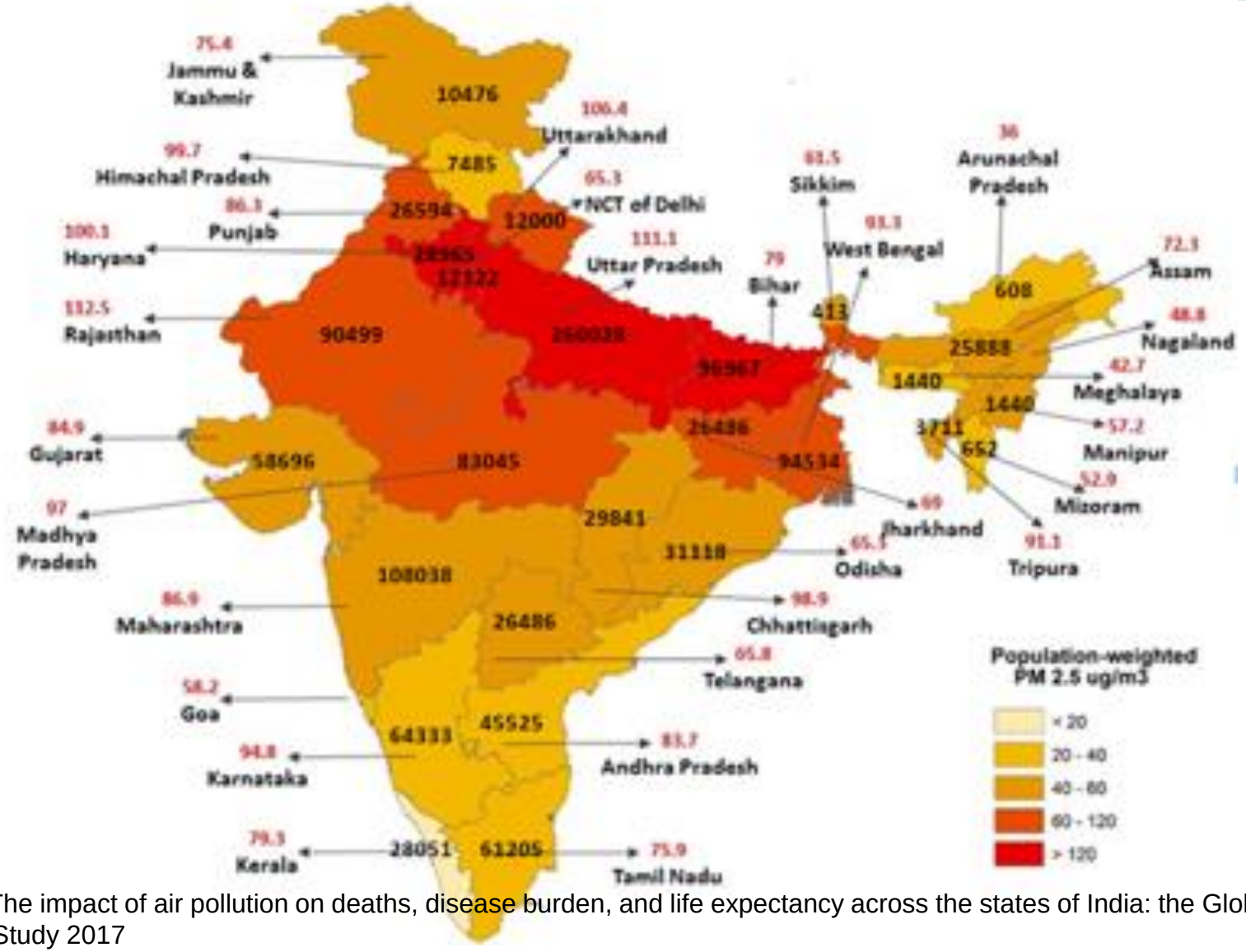
Centre for Science and Environment

Are our cities Bharat Stage-VI ready?
An Orientation Workshop on
Advancing On-road Emissions

A joint initiative of the Department of Transport, Government of West Bengal and Centre for Science and Environment (CSE), New Delhi

Kolkata, March 5, 2020

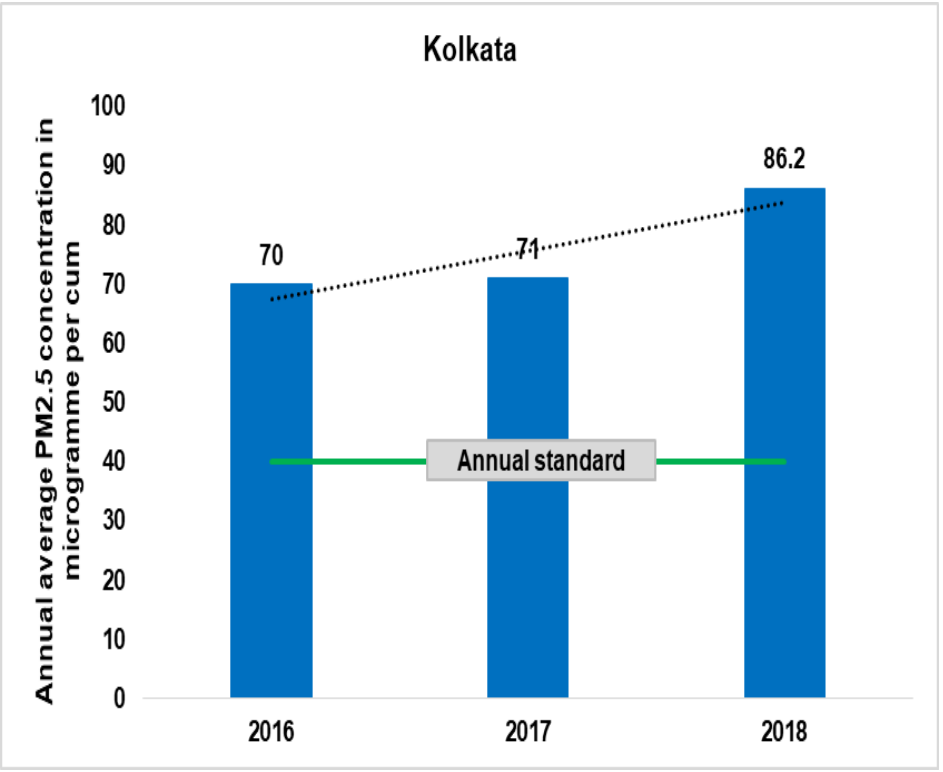
Health is a leveler

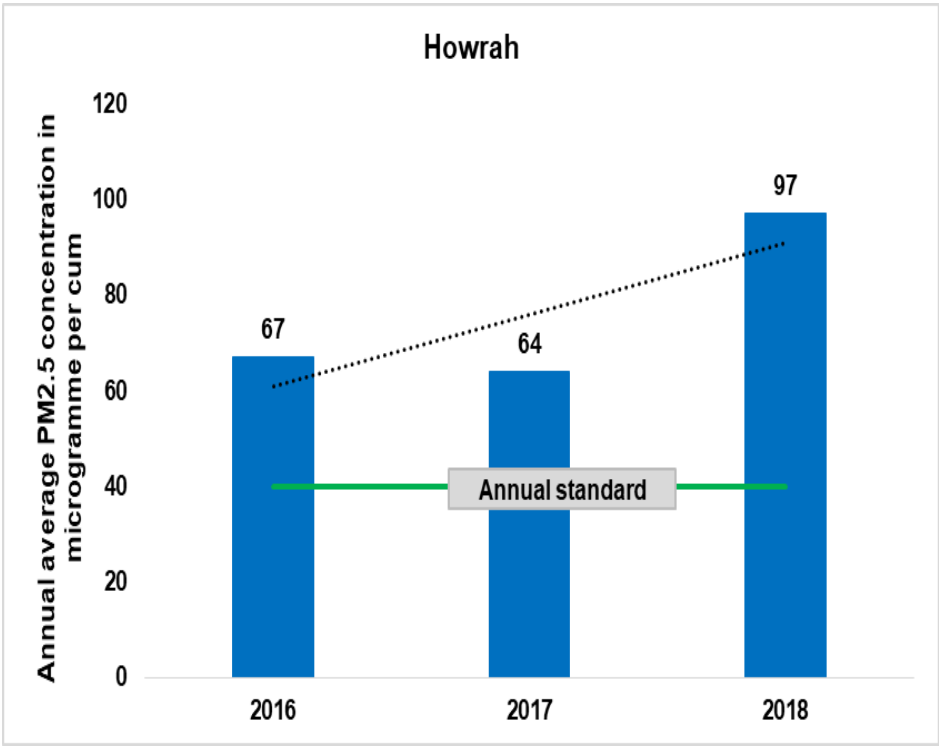


Source: The impact of air pollution on deaths, disease burden, and life expectancy across the states of India: the Global Burden of Disease Study 2017

Air pollution challenge

PM2.5 trend

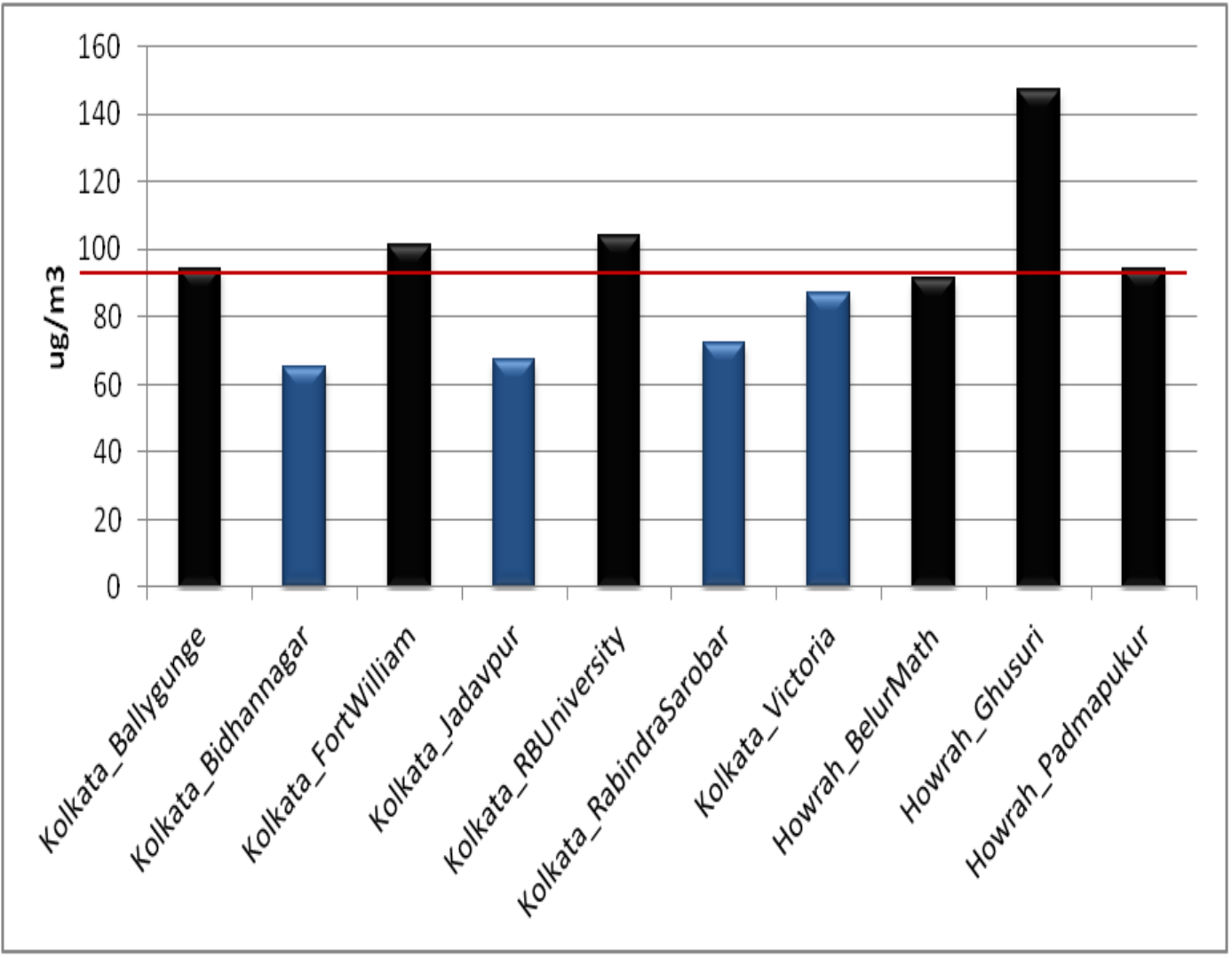




- Kolkata needs 47.1 per cent reduction and Howrah 47.4 per cent reduction to meet the PM2.5 annual standard

Source: Based on the data available on CPCB Envis centre

Pollution hotspots (PM2.5)



6 out 10 stations have higher average levels than twin-city's mean

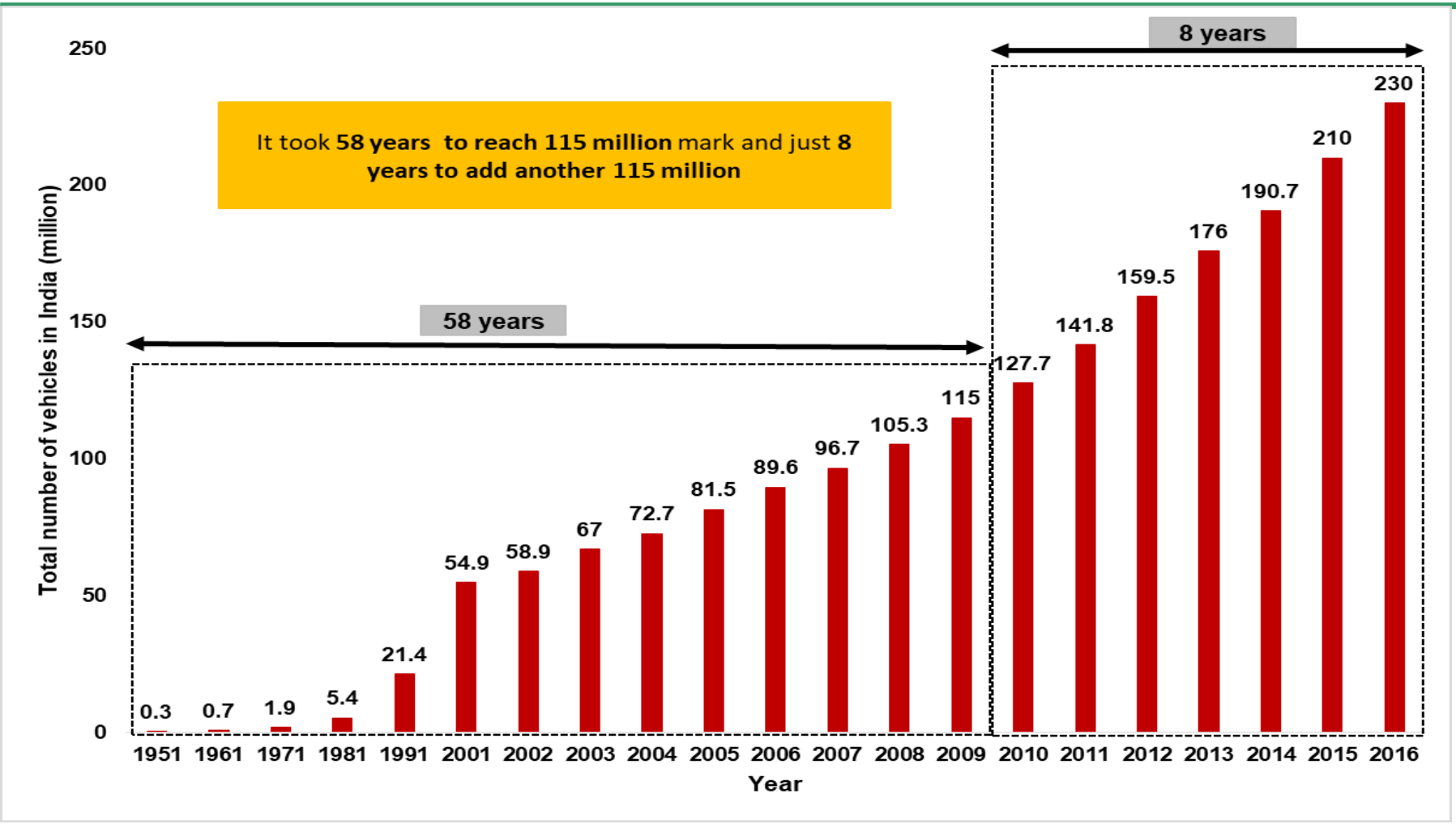
Data from 1-Oct, 2019 to 31-Jan, 2020

Data availability

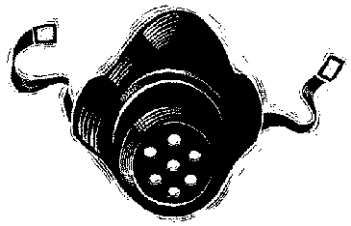
Except RB University all stations have over 95% data
RB University has 75% data

Source: Based on data available on CPCB online portal

Why leapfrog? To stay ahead of the pollution curve



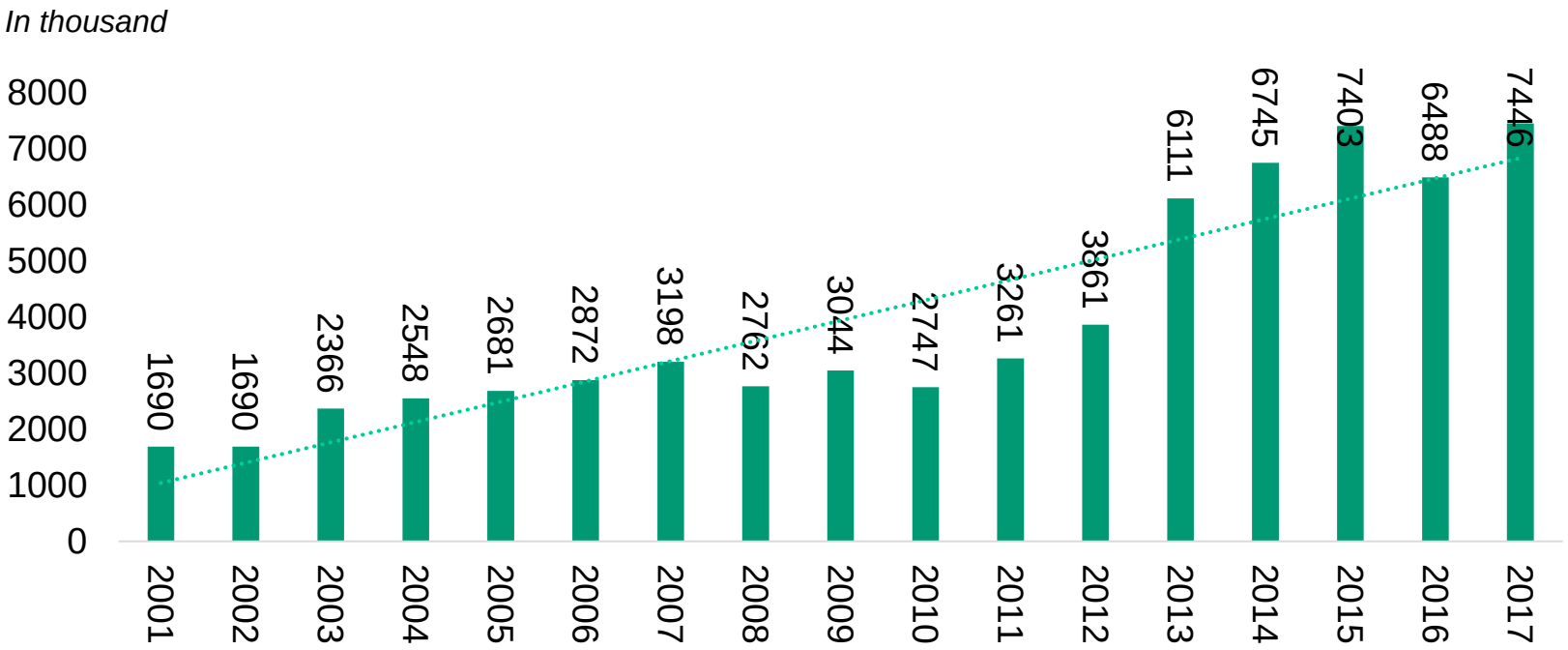
Source: 2016, Road Transport Yearbook, MoRTH



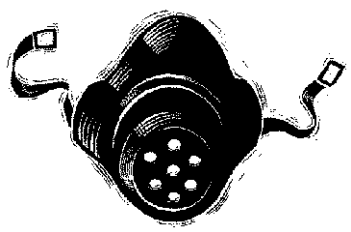
Rapid motorisation

Trend in total registered vehicles in West Bengal

- 2001-17, registered vehicles increased at a Compound Annual Growth Rate (CAGR) of 9 percent annually.
- 2000- 2010: 38 percent increase
- 2010-17 : 171 percent – nearly doubled

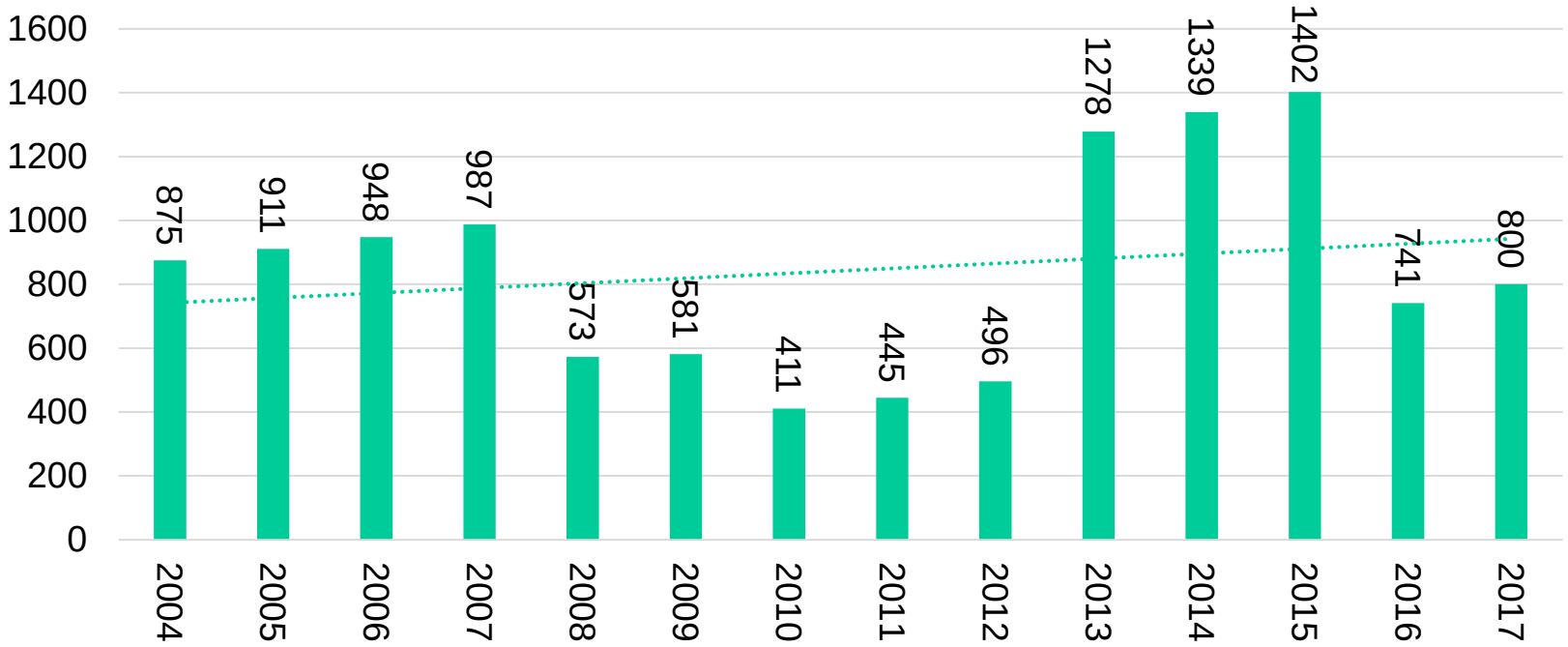


Source: Road Transport Year Book 2015-16 and 2016-17, Ministry of Road Transport and Highways, GoI



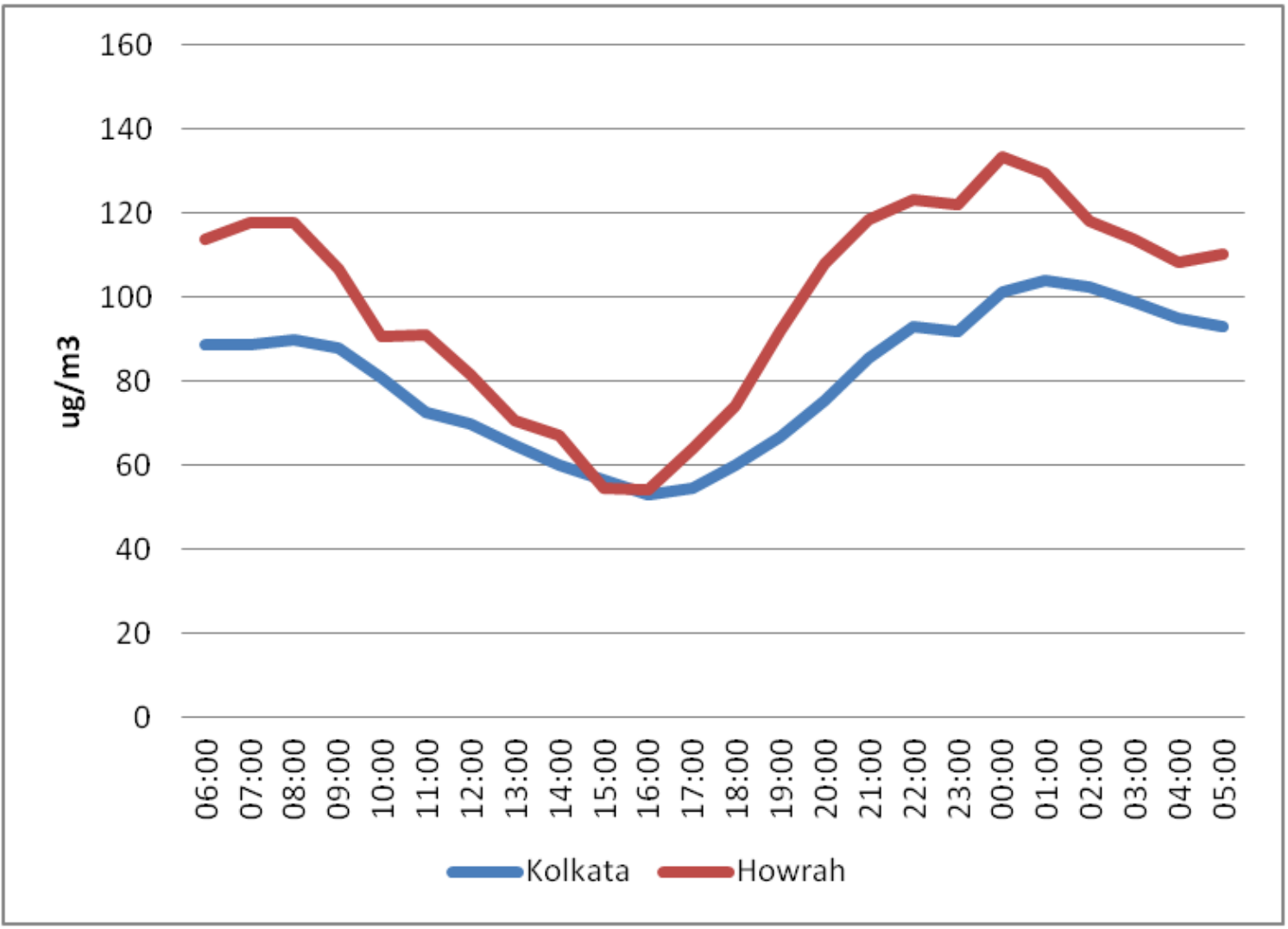
Motorisation in Kolkata

- Undulating trend and low CAGR due to attrition of 15 years old vehicles



Source: Road Transport Year Book 2015-16 and 2016-17, Ministry of Ro

Kolkata and Howrah
Traffic and hourly pollution
Hourly PM2.5 trends



Morning peak around

8-9 AM

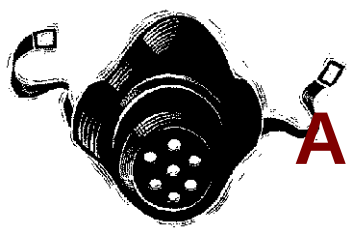
Night peak around

12-1 AM

Typical weekday

27-31 Jan 2020

Source: Based on data available on CPCB online portal



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.

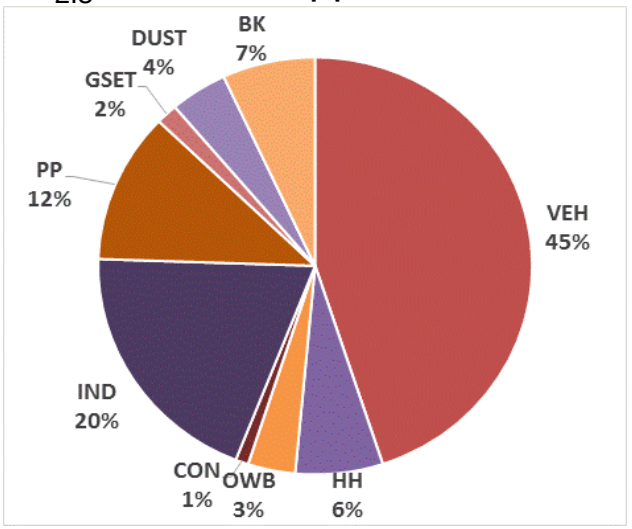
Shift from concentration management to exposure management

Ambient concentrations do not always well represent human exposures,

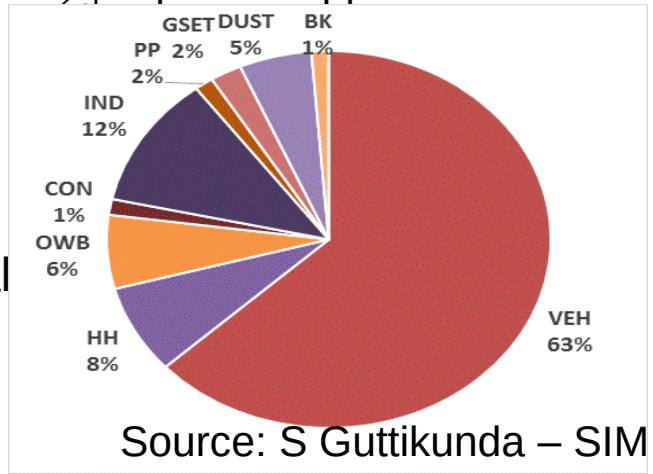
Ambient concentration is not a good surrogate for total air pollution risk, -- cannot indicate exposure and health outcome

Chennai

$PM_{2.5}$ emission apportionment

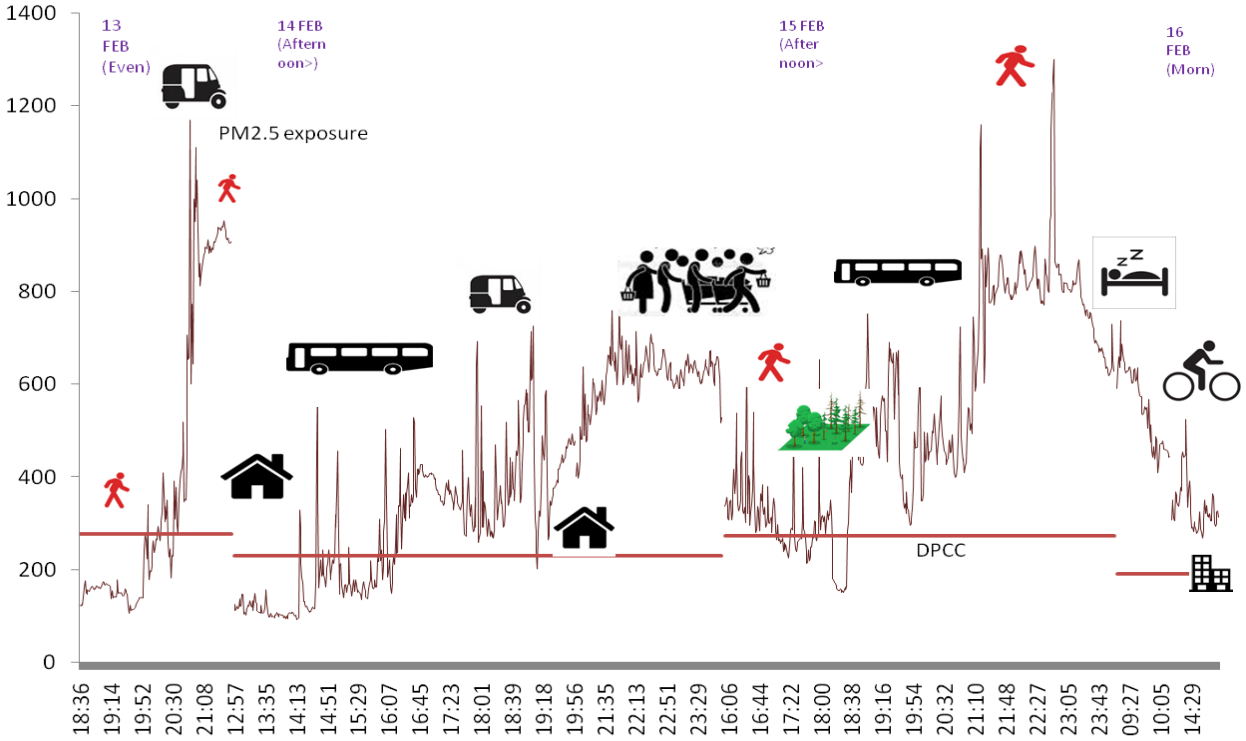


$PM_{2.5}$ exposure apportionment



Source: S Guttikunda – SIM

How much pollution we breathe while travelling?

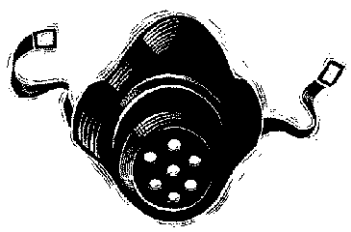


Studies on traffic exposure and health impact

Impact of traffic pollution on new born babies – low birth weight (British Medical Journal January 2020)

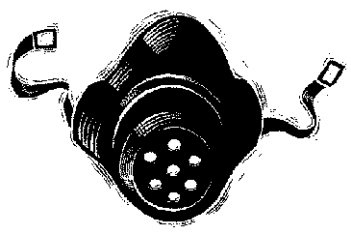
Increased risk of cardiac arrest due to exposure to air pollution (Lancet Planetary Health 2020)

Source: Based on CSE exposure monitoring and DPCC data for ambient levels

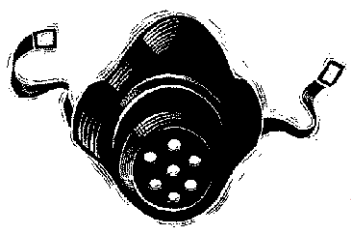


Clean air action plan for seven non-attainment cities and on-road emissions management

- **Ensure on-schedule implementation of BSVI** emission and fuel quality standards from April 1, 2020
- **Provide adequate/optimum number of PUC centres** Link PUC certifite with annual vehicle insurance for full compliance;
- **Audit of PUC centres**
- **Inspect and remove visibly polluting vehicles**; impose penalty; awareness drive
- **Modern centralised vehicle inspection centres** for commercial & diesel vehicles
- **Implement remote sensing of vehicles** for BSVI preparedness
- **Phase out old vehicles and develop scrappage policy**
- **Install vehicle frequency identification tag,** RFID based toll or entry tax collection.
- **Implement state level electric vehicle policy and prgramme f**or two-wheelers, three-wheelers, paratransit, buses and large delivery fleet



Towards BSVI…..



Bharat Stage VI roll out: April 1 milestones…...

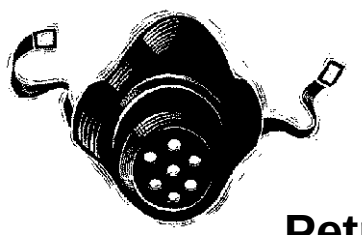
April 1: 2018: BSVI fuels (10 ppm sulphur fuels) in Delhi

April 1 2019: BSVI fuels in National Capital Region (NCR)

April 1, 2020: **The big leap**

- **Entire country to move to BSVI emissions standards** for vehicles and fuels

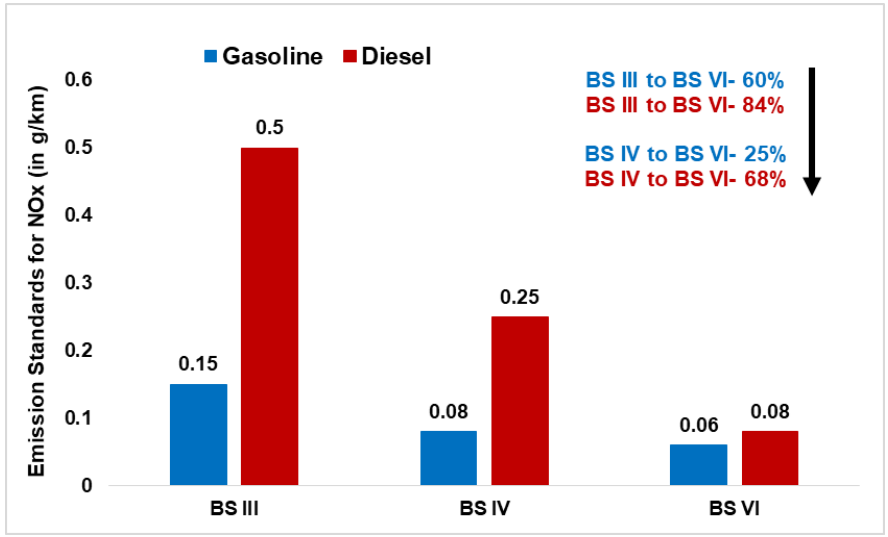
- **April 1, 2020, all vehicle models to meet BSVI;** No extra time for older models (Supreme Court directive)



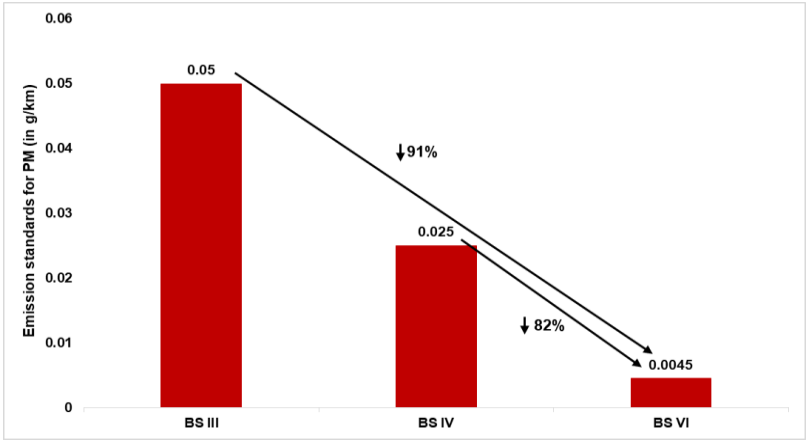
BS Standards

2005-2020: Deep cuts

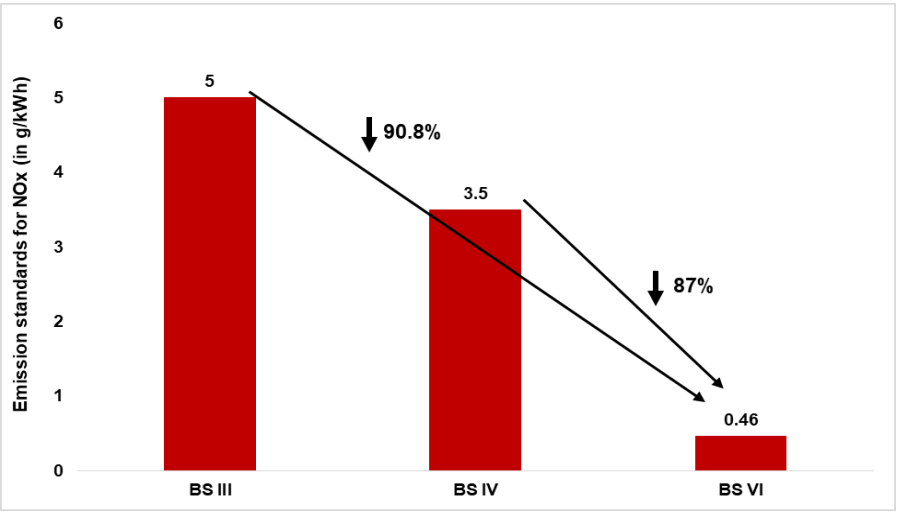
Petrol cars-- NOx



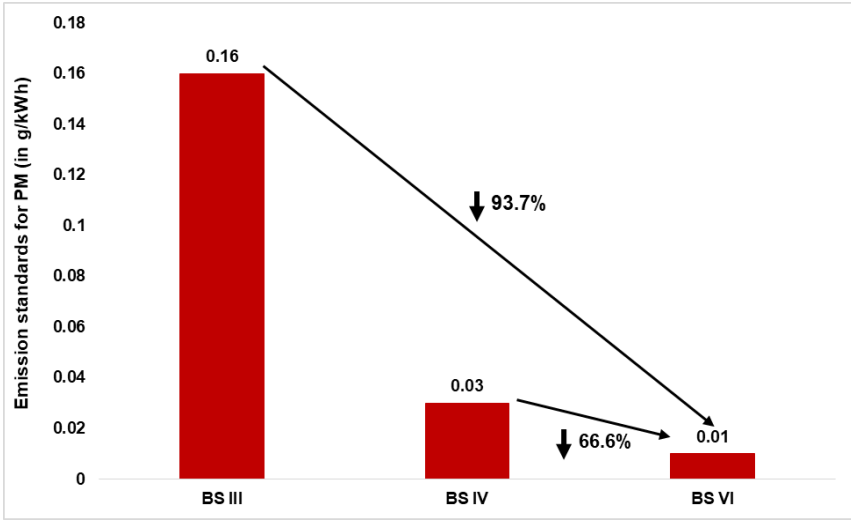
Diesel cars-- PM



HDV-- NOx

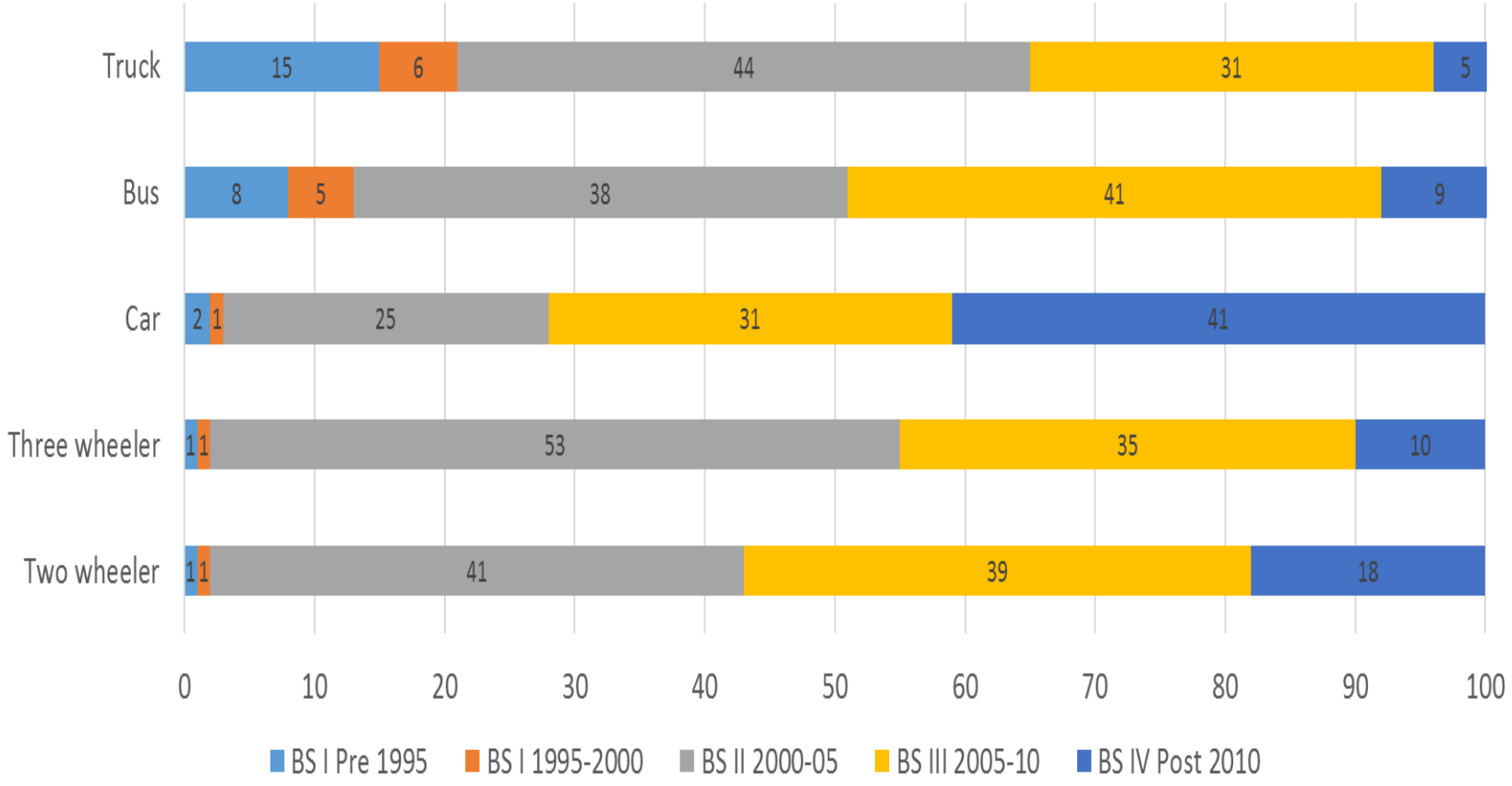


HDV-- PM

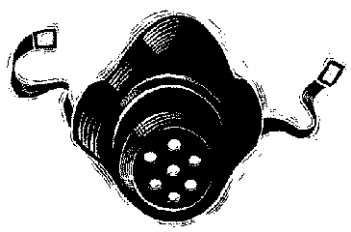


Vehicle vintage in Kolkata

15 year old commerial vehicles phased out

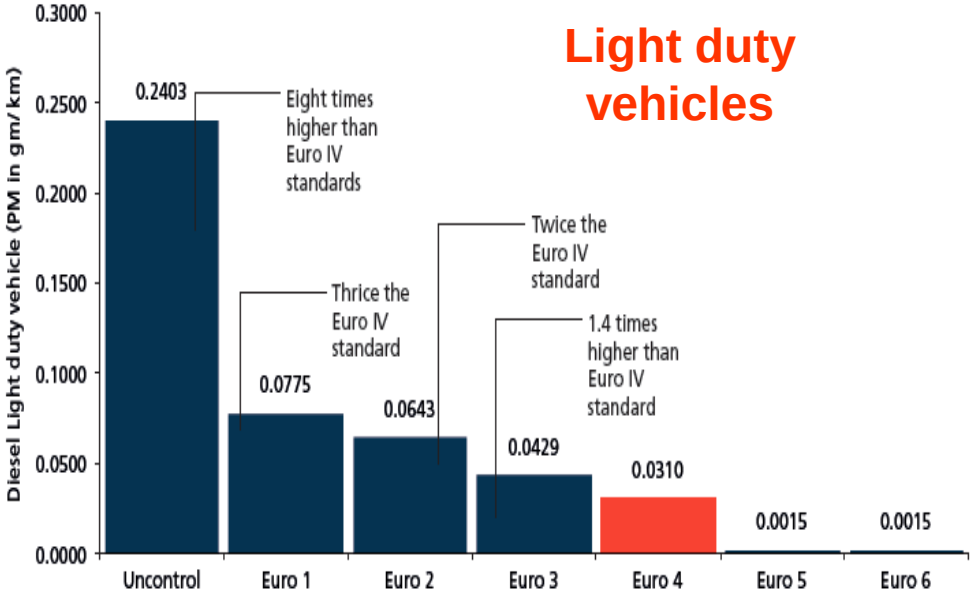


Source: Central Pollution Control Board, 2015, Status of pollution generated from road transport in six mega cities, http://www.indiaenvironmentportal.org.in/content/423219/status-of-pollution-generated-from-road-transport-in-six-mega-cities/

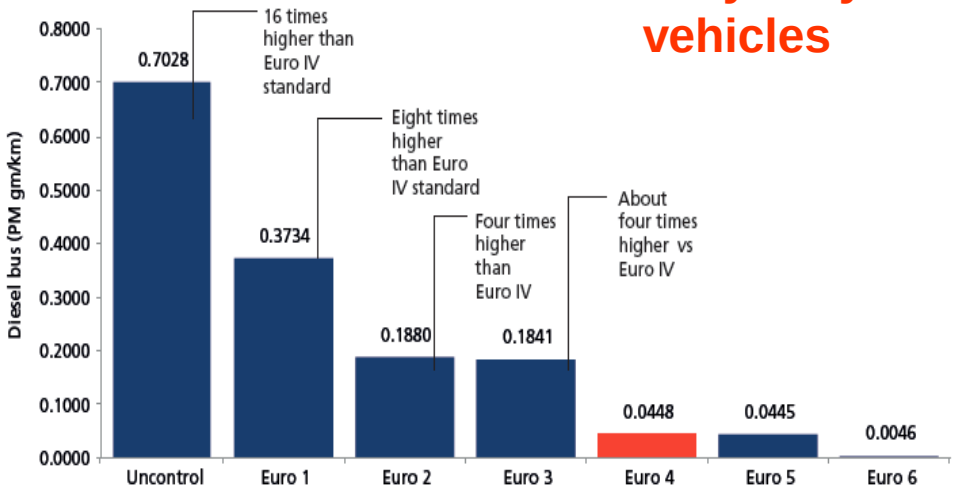


Challenge of Old vehicles

Light duty vehicles

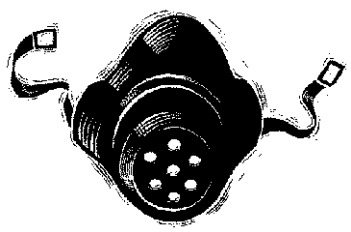


Heavy duty vehicles



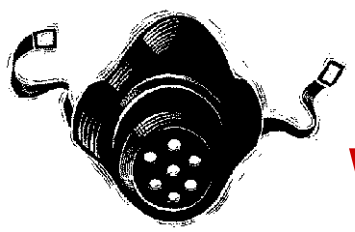
Source: Based on ICCT data

Addressing gross polluters
But gross pollution also becoming invisible now



Clean fuel helps…..

- **On-road vehicles will spew less particles;** Sulphur contributes to formation of particles
- **Sulphur dioxide emissions** is also directly proportional to the amount of sulphur in fuel
- **10 ppm sulphur fuels allow emissions control systems of on-road diesel vehicles to perform more efficiently**
- **Less engine wear-and-tear for all that can reduce emissions**
- **Petrol vehicles will also benefit:** Sulphur reduces the efficiency of catalysts and adversely affects heated exhaust gas oxygen sensors.
- **Opens up opportunity for retro-fitment of advanced emissions control systems**



Why BSVI is disruptive?

Manufacturing level

- **Difference between petrol and diesel emissions narrowing down – but gap remains**

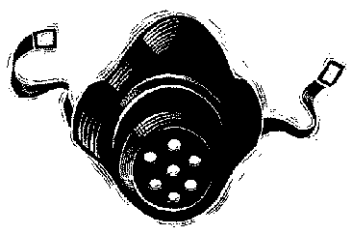
- **Along with PM mass emissions particle number count standard adopted for** diesel vehicles

- **Vehicles to be tested for real world emissions –** over the driving pattern of vehicles on road

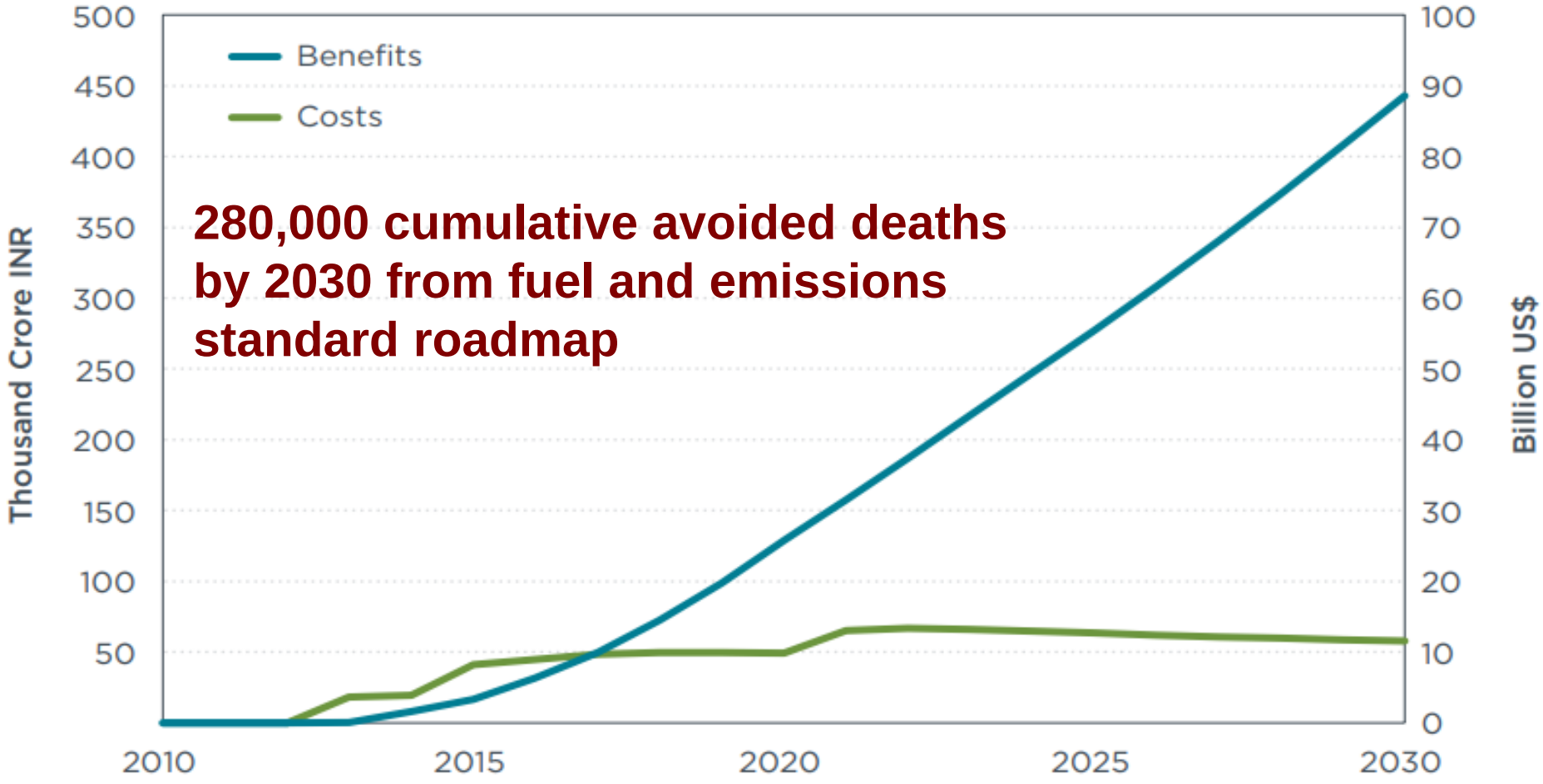
- **Paradigm shift in diesel emissions control system:** Diesel particulate filters (DPF); lean NOx traps (LNT), selective catalytic reduction (SCR) and exhaust gas recirculation (EGR) for Nox control etc

- **Two wheeler standards to become significantly more stringent:** NOx and hydrocarbon will be regulated separately; evaporative standards; OBD

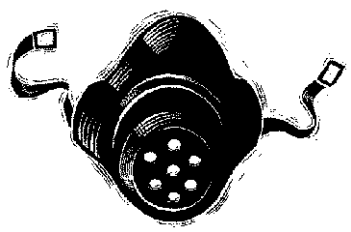
- **In-service compliance regulations**



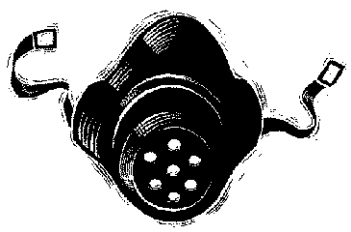
Benefits much higher than the costs



Source: International Council On Clean Transportation



How do we inspect and maintain vehicles today?



Why PUC?

Strategy for promoting good maintenance – vehicles should not emit more than they are designed to emit

- Originally designed for old carburettor technology and older generation diesel vehicles
- Targeted to catch gross polluters

PUC norms reformed in stages to respond to evolving technologies

Petrol – **Cars:** Two speed idle test; CO and HC;

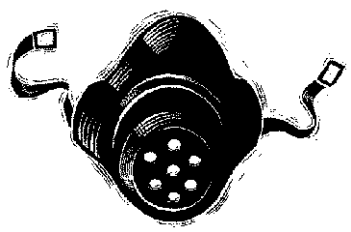
Lambda test

Two-wheelers: HC and CO – BSVI onwards Lambda test

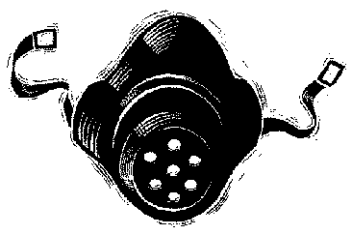
Diesel vehicles – Smoke density test (with RPM, oil temperature etc)

Smoke density norms tightened for BSVI (27 HSU)

Need authentic and credible test for effectiveness of the programme



Agenda for PUC reforms : Lessons and observations from field in Delhi and NCR



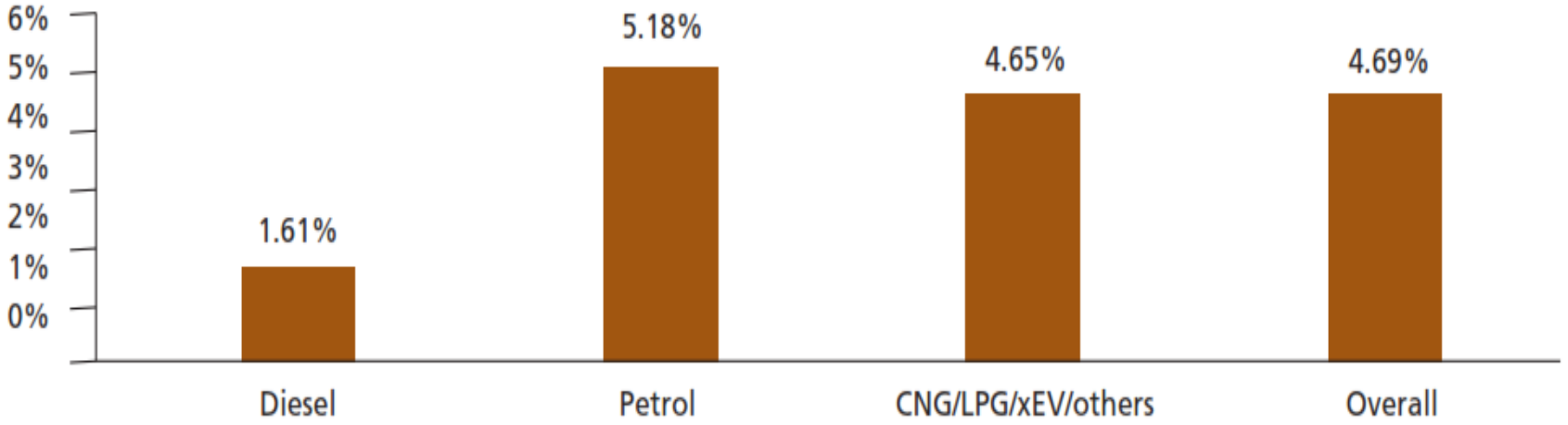
Very poor compliance

- Only 23% of vehicles in Delhi turn up for tests
- Similar data for other NCR towns are not available

Poor failure rate – nearly all vehicle pass

- **Delhi:** Only 1.68% of diesel vehicles failed the smoke density tests and about 4.5% of petrol vehicles failed the CO and HC tests.
- **Global approach**: identify 15-20% of the most polluting vehicles.
- Failed tests are often not recorded as vehicle owners refuse to pay the test fee if their vehicles fail.

Graph 2: Failure Rate by Fuel Type in Delhi

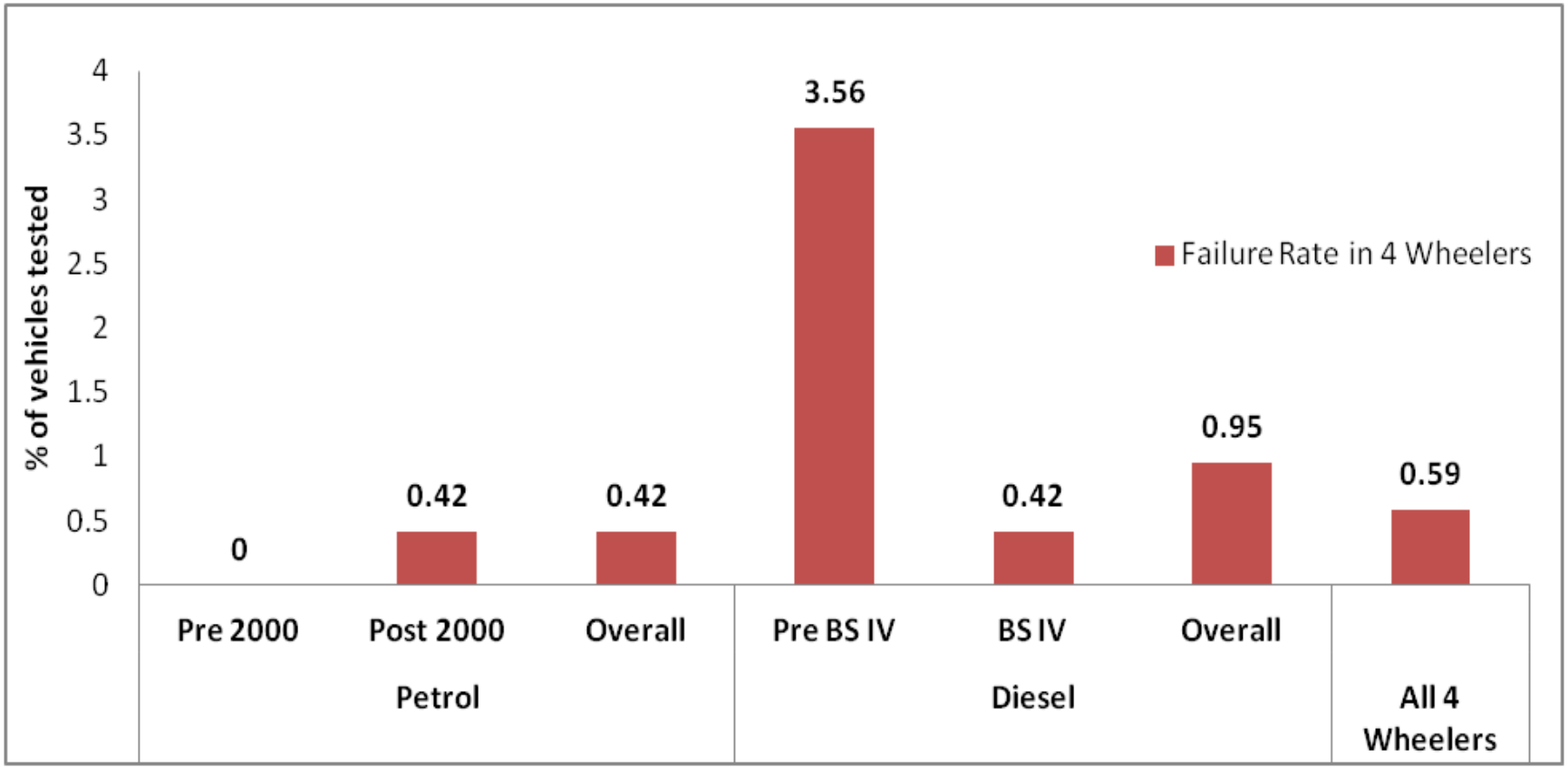


Source: Analysis of data provided by the Department of Transport, Govt. of NCT of Delhi in 2016-17.

Failure rate – UP NCR

Less than 1%

Failure rate in four wheelers in Uttar Pradesh (in % of vehicles tested)



Source: Department of Transport, Government f Uttar Pradesh

Observed malpractices

Haryana NCR

Broken non-functioning testing equipment was a common sight across Rohtak.

Smoke meter was not connected to the computer.

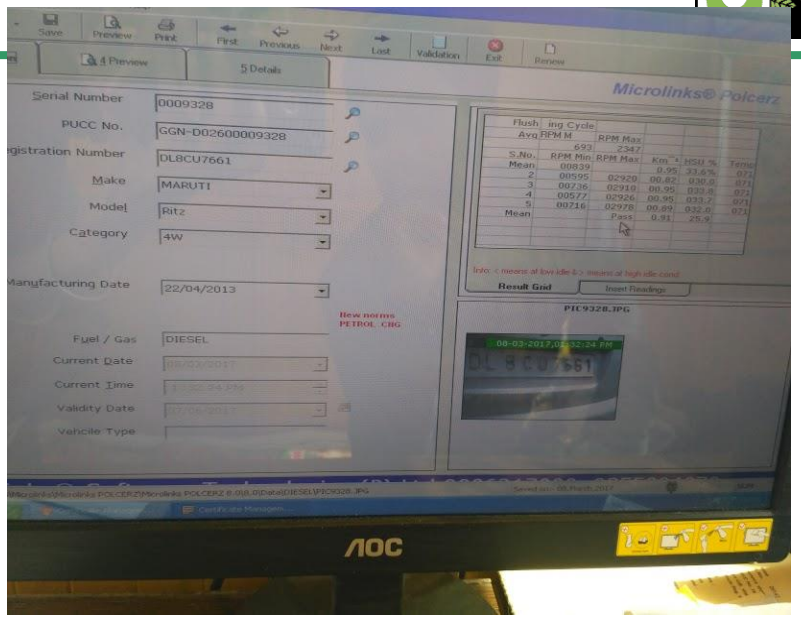
Still issued a pass certificate

Dev Raj PUCC, Rohtak, Centre code- RTKD-0080

Enforcement challenges

Haryana NCR

Indrsuddha Associate PUCC, Faridabad, Centre code- FBDD0061



Vishesh PUCC, Gurgaon, Centre code- GGNP02997

This PUC centre had a **non-functioning diesel smoke meter**.

The centre still issued a pass certificate

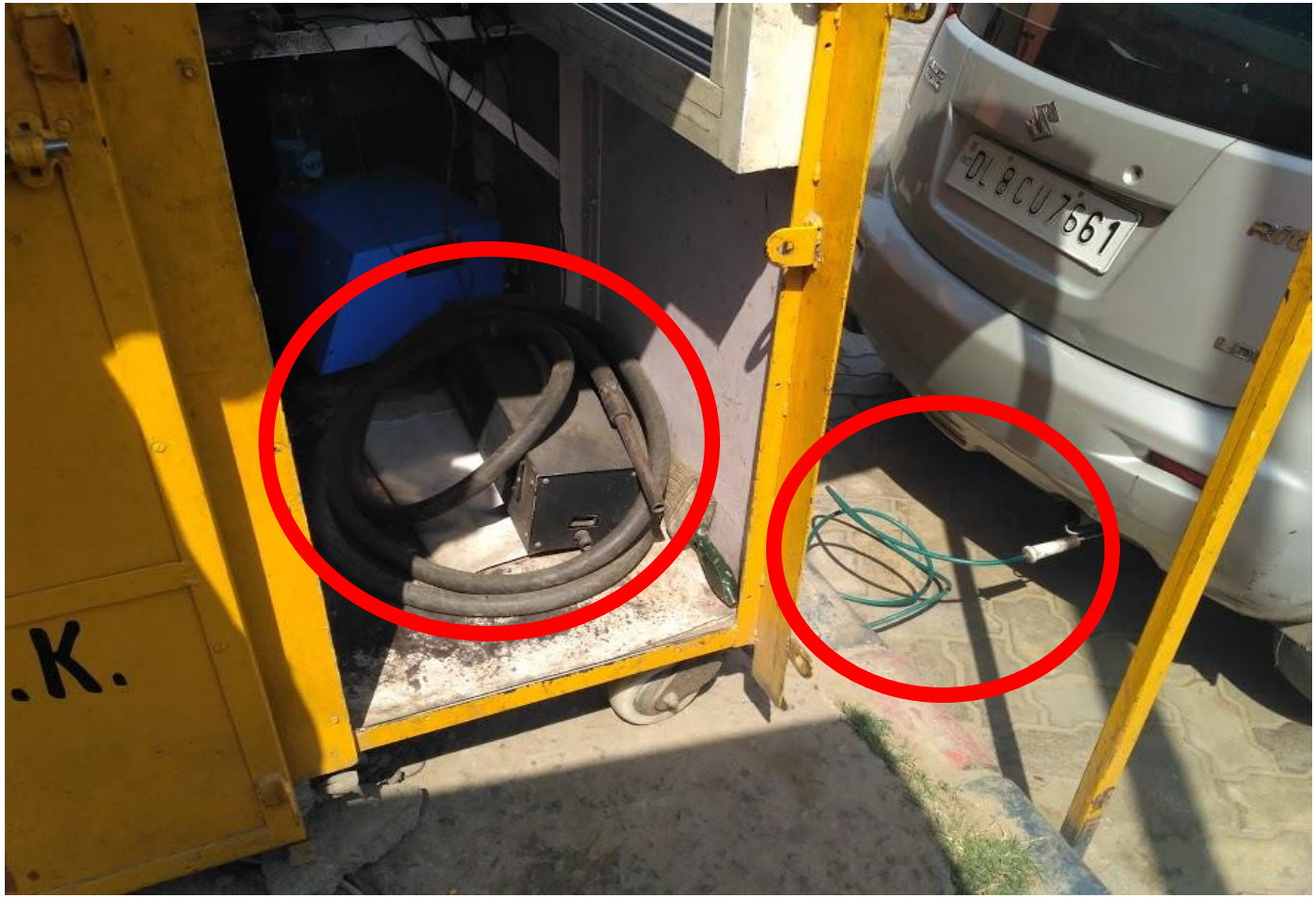
The image shows fake software called "**certificate management programme**".

The diesel-testing equipment was turned off when the operator showed these readings.

This is a common software found across PUC centres

Improper Testing Procedure

Haryana NCR



- PUC Operators often have **no working knowledge of** operations
- PUC centres still issue valid PUC pass certification using **manipulative software**

Testing of a decoy test vehicle using a petrol emission analyzer in Gurgaon, Haryana

Fake PUC Certification – Fly-by night business? Haryana - NCR

- Around the state borders of NCR states, **many illegal PUC centres** operate
- Use fake software

Fly-by night PUC station on NH-8, in Rewari district, Haryana

Erroneous values

Maximum RPM in TEST 1 recorded is lower than Idle RPM?

POLLUTION UNDER CONTROL CERTIFICATE
Issued By: MUMBAI (WEST)
Authorised by Motor Vehicles Department, Maharashtra

TEST RESULT : PASS
VALID TILL: 23/Jan/2021

Certificate Sl. No.:	MH00200190001543
Registration No.:	**MH46AF9966**
Chassis No.:	MA1ZN2GHKF1J72966
Engine No.:	GHF1J52973
Class of Vehicle:	Goods Carrier
Make:	MAHINDRA & MAHINDRA LIMITED
Model:	BOLERO PICK UOP FB 2WDBSIII
Vehicle Category:	LIGHT GOODS VEHICLE
Date of Registration:	22/Oct/2015
Emission Norms:	BHARAT STAGE IV
Fuel:	DIESEL
Date of Testing:	24/Jan/2020

DIESEL DRIVEN VEHICLES
Certified that the vehicle conforms to the standards prescribed under rule 115(2) of CMV Rules 1989

FUEL	Light Absorption Coefficient (Permissible Limit)	Measured Value
DIESEL	1.62	0.01

Time of Testing: 13:35:21
Fee Charged: Rs.110.0

Auto Emission Testing Centre Code: MH0020019
Testing Centre Name: ANMOL MOBILE PUC CENTRE
Centre Address: C/5,SAHAYOG, RATAN NAGAR, 4BUNGLOW
Test Conducted By: CHETAN NAIK

TEST RESULT FOR DIESEL VEHICLE

	IDLE RPM	MAX RPM	K_VALUE	OIL TEMP
TEST 1	857.0	844.0	0.01	81.0
TEST 2	840.0	987.0	0.01	83.0
TEST 3	822.0	1298.0	0.01	85.0
AVG	839.66667	1043.0	0.01	83.0

To check.

This is a computer generated certificate and does not require signature
Fuel Norms entered by PUC center MH0020019 manualy,Please visit RTO and correct norms

BS-IV vehicle reporting zero values; do equipments have sensitivity issues?

POLLUTION UNDER CONTROL CERTIFICATE
Issued By: MUMBAI (WEST)
Authorised by Motor Vehicles Department, Maharashtra

TEST RESULT : PASS
VALID TILL: 23/Jan/2021

Certificate Sl. No.:	MH00200170004119
Registration No.:	**MH02EZ8234**
Chassis No.:	MALAF51CLJM023645
Engine No.:	G4HGJM971862
Class of Vehicle:	Motor Car
Make:	HYUNDAI MOTOR INDIA LTD
Model:	AHAN00G11M52W04
Vehicle Category:	LIGHT MOTOR VEHICLE
Date of Registration:	16/Jan/2019
Emission Norms:	BHARAT STAGE IV
Fuel:	PETROL
Date of Testing:	24/Jan/2020

PETROL/CNG/LPG DRIVEN VEHICLES
Certified that the vehicle conforms to the standards prescr
under rule 115(2) of CMV Rules 1989
CO Level at Idling(% Volume) (PPM)
HC Level at idling (RPM)

FUEL	Prescribed Standard CO	Measured Value	Prescribed Standard HC	Me
PETROL	0.3	0.0	200.0	

At High idle RPM 2500±200 Measured RPM...

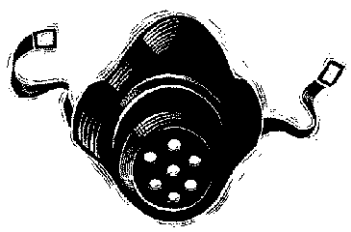
CO%		Lambda λ (RPM-2500
Prescribed	Actual	Prescribed
0.2	0.0	0.97-1.03

Time of Testing:	13:25:23
Fee Charged:	Rs.90.0

Auto Emission Testing Centre Code: MH0020017
Testing Centre Name: ANMOL MOBILE PUC CENTRE
Centre Address: C/5, SAHYOG,RATAN NAGAR,FOUR BUNGLOW,
Test Conducted By: CHETAN NAIK

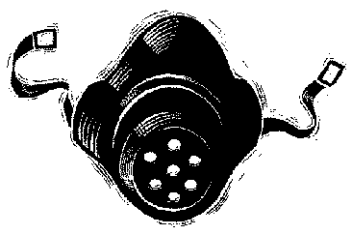
TEST RESULT FOR PETROL/CNG/LPG VEHICLE

	MEASURED VALUE	UNIT
CO	0.0	%
CO-CORRECTED	0.0	%
HC	0.0	PPM
CO2	10.1	%
O2	0.29	%
RPM	2500.0	
OIL TEMP	0.0	DEGREE CENTEGRATE



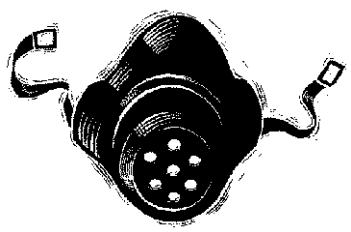
Institutional challenges

- Lack of qualified and skilled PUC operators
- Lack of knowledge of proper testing procedures
- Improper testing and manual data reporting
- Non-functioning equipment
- Updated calibration certificates not available
- Numerous PUC centres - Very few inspectors for strong oversight of centres - (Delhi – 971 centres; 28 inspectors)



Challenges

- Problem of quality control and assurance; Link with licensing
- Poor data recording and reporting;
- Evaluation of PUC emissions databases to assess usability for enforcement and monitoring
- Improve compliance with the programme
- Poor failure rate – nearly all vehicle pass
- Current smoke density test for diesel vehicles ineffectual
- Legal framework for monitoring PUC centres weak
- Concerns about skills of operators



Assessment in Delhi-NCR led to changes

- Overall enforcement has improved
- Updated PUC status and Vahan database linked
- Car owners get automatic alert for renewal of PUC certificates
- Compliance has improved (penalty has helped)
- Directive to link PUC with annual vehicle insurance

- Even with uniform software for recording this data, the back-end database maintenance needs improvement;
- Does not record important fields such as year of manufacture/registration, vehicle type, fuel type or other such fields

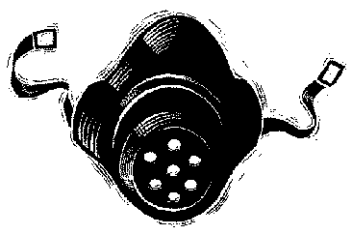
PUC centres to adapt to new PUC norms for BSVI vehicles

SI Engine Passenger cars		
	CO in %	**HC in ppm**
Pre BS II	3.0	1500
BS-II, BS-III	0.5	750
BS IV & VI^ (Petrol/CNG/LPG)	Idle 0.3. H idle 0.2#	Idle 200
BS-VI^ (CNG/LPG)	**Idle 0.3 . H idle…**	**Idle 200**
BS IV & VI^ (CNG/LPG/Petrol) lambda test	**1+/-0.03 or as declared by vehicle manufacturer**	

SI Engine Two / three wheelers		
	CO in %	**HC in ppm**
Pre 2000 (2/4-stroke)	4.5	9000
Post 2000 (2-stroke)	3.5	6000
Post 2000 (4-stroke)	3.5	4500
Petrol BS-VI^	Idle 0.5/ H Idle 0.3	500
CNG BS-VI^	**0.5 idle**	**500**

CI Engine Diesel	Maximum Smoke density	
	Light absorpt. coefficient (1/m)	Hartidge Units (HSU)
Pre-BS-IV All diesel	2.45	65
BS-IV All diesel	1.62	50
BS-VI^ 4 wheeler diesel	**0.7**	**26**
BS-VI^ 2/3 wheeler diesel	**1.5 (two-wheelers (lambda test)**	**48**

Source: November 26, 2019, MoRTH Notification G.S.R. 881(E), https://morth.nic.in/sites/default/files/notifications_document/G.S.R.%20881%28E%29%2026th%20November%202019%20BS%20VI.pdf



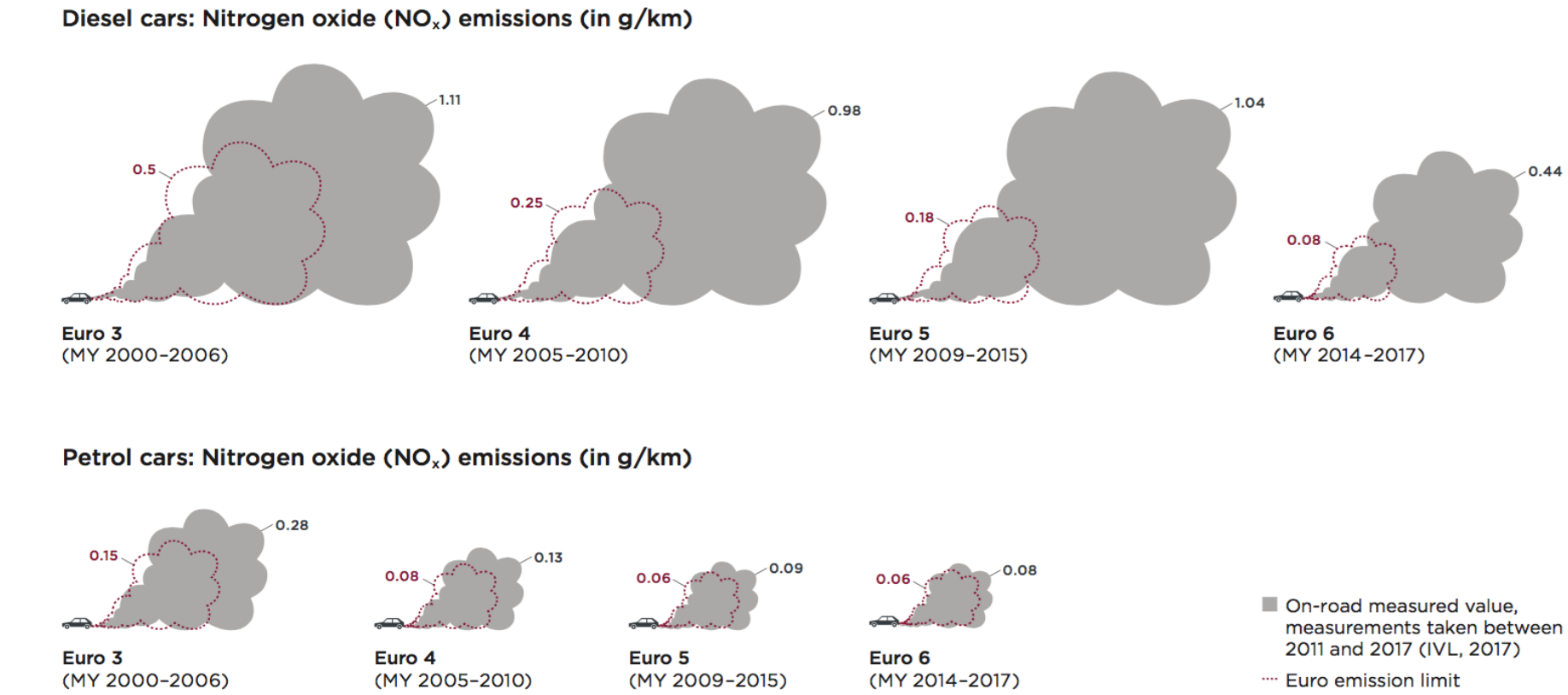
Going beyond PUC…

Global learning curve on BSVI: Huge risks if not done properly…

Europe: Challenge of real world emissions

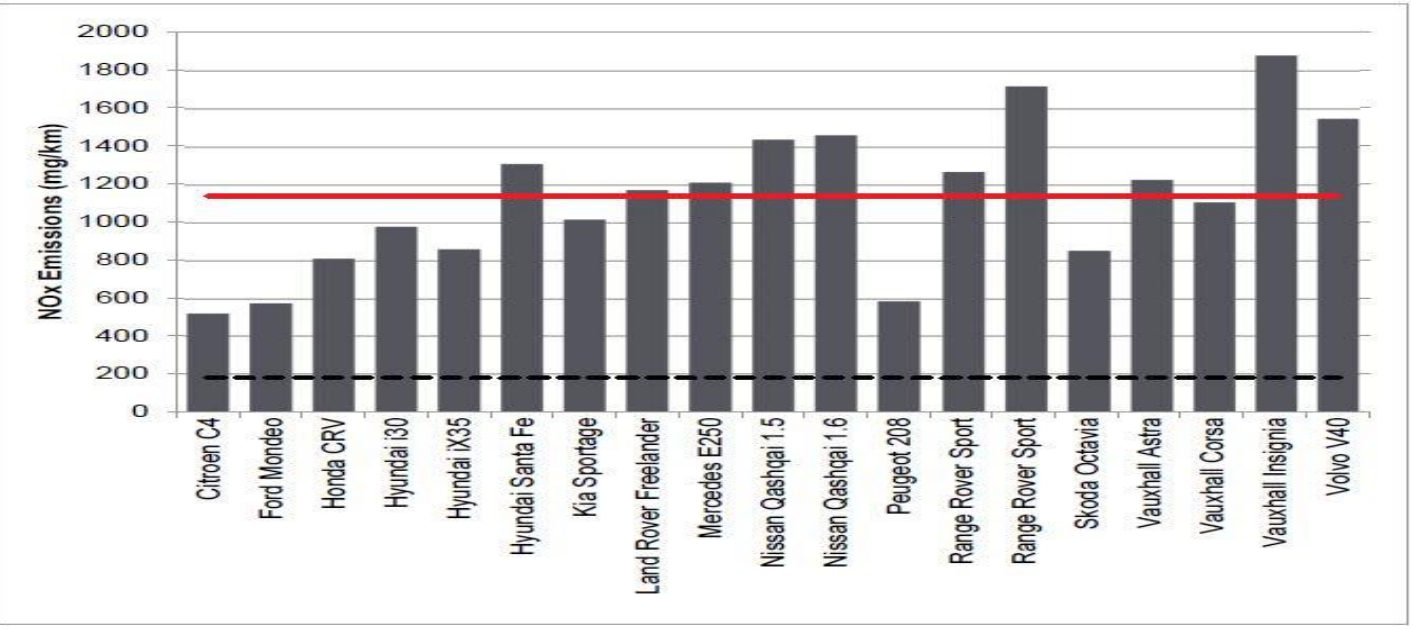
NO_X EMISSIONS FROM EU CARS: REAL-WORLD VS OFFICIAL VALUES

Eliminate gap between certification and real world vehicular emissions

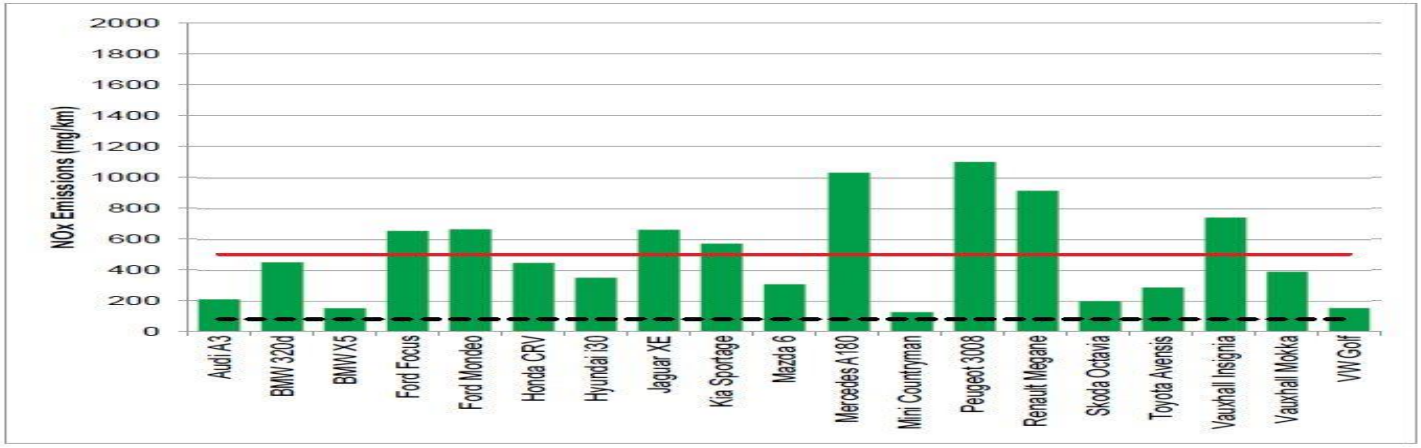


Source: FIA Foundation

Unacceptably high emissions from diesel cars in Europe

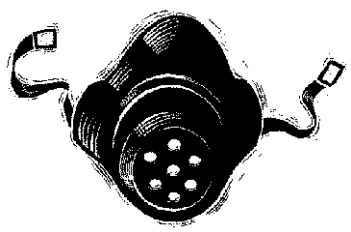


Real world NOx emissions of Euro 5 vehicles



Real world NOx emissions of Euro 6 vehicles

Source: April 2016, Vehicle Emissions Testing Programme, Secretary of State Transport, UK



Global action on diesel cars
Diesel car sales down

London: Pre Euro VI cars not to be allowed inside the ultra low emissions zone in Central London.

France: Euro VI diesel cars not included in new category 1 colour coding scheme that classifies vehicles according to emissions. To “progressively” ban diesel vehicles.

Paris: To phase out pre-2011 diesel cars by the end of the decade.

Madrid: To ban polluting diesel cars from the city centre from 2020.

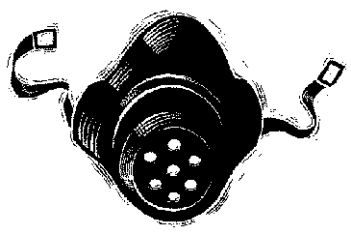
Netherlands: In 1998 the Third National Environment Policy targeted to reduce diesel share to only 5% in 2010. Dutch registration and circulation taxes for diesel cars are prohibitive. Share of diesel cars lower than EU average.

Brazil Sales of diesel passenger cars and commercial vehicles below 1,000 kg are banned

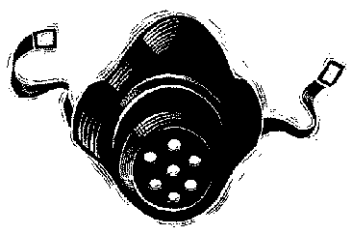
Beijing has banned diesel cars as a pollution control measure.

China has the lowest diesel car penetration at less than 1%. China taxes do not differentiate between petrol and diesel fuel.

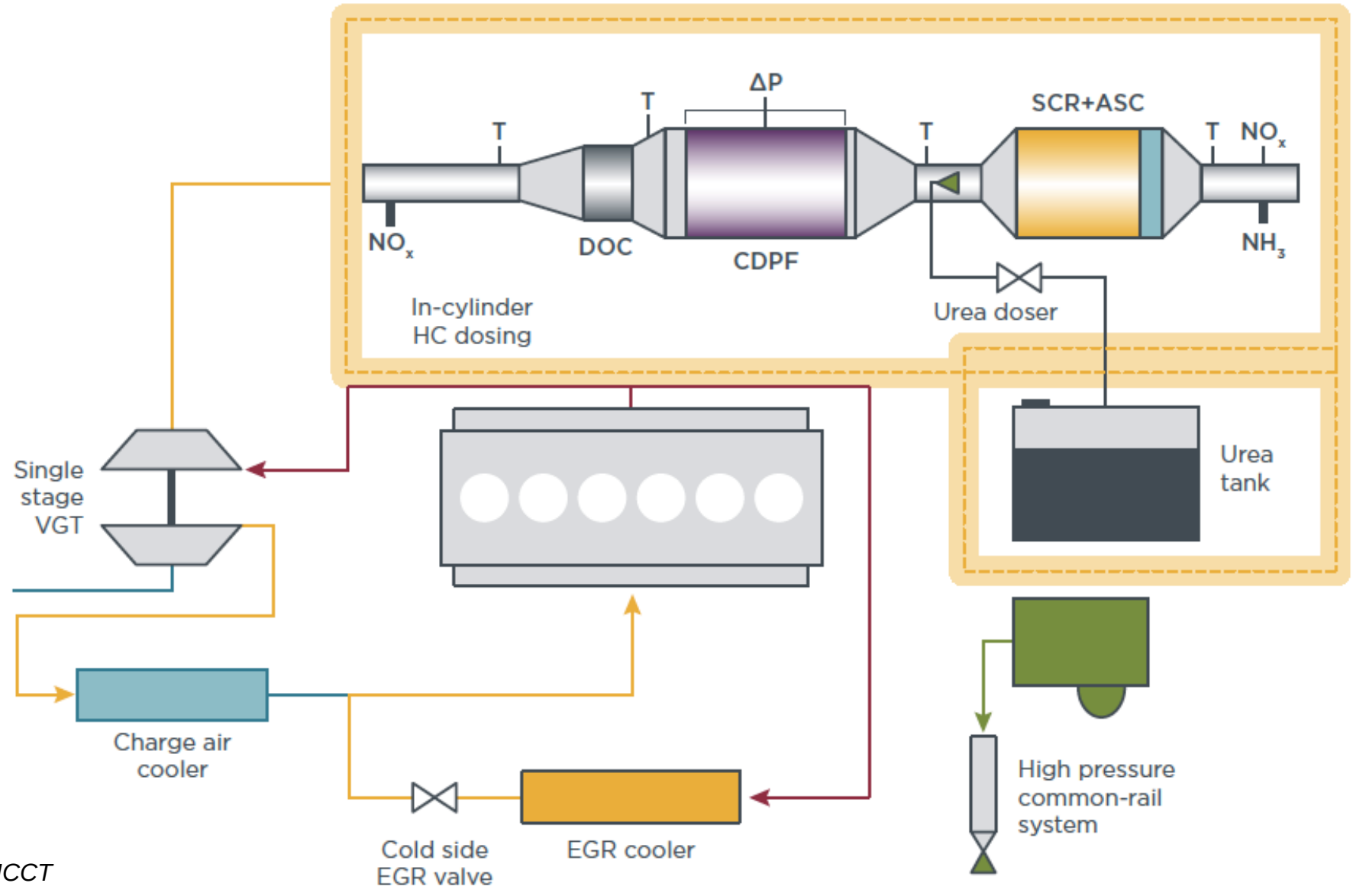
Sri Lanka has imposed several times higher duties for diesel cars compared to petrol cars and have reduced diesel car sales.



What happened in Europe after dieselgate? Focus shifts to real world emissions



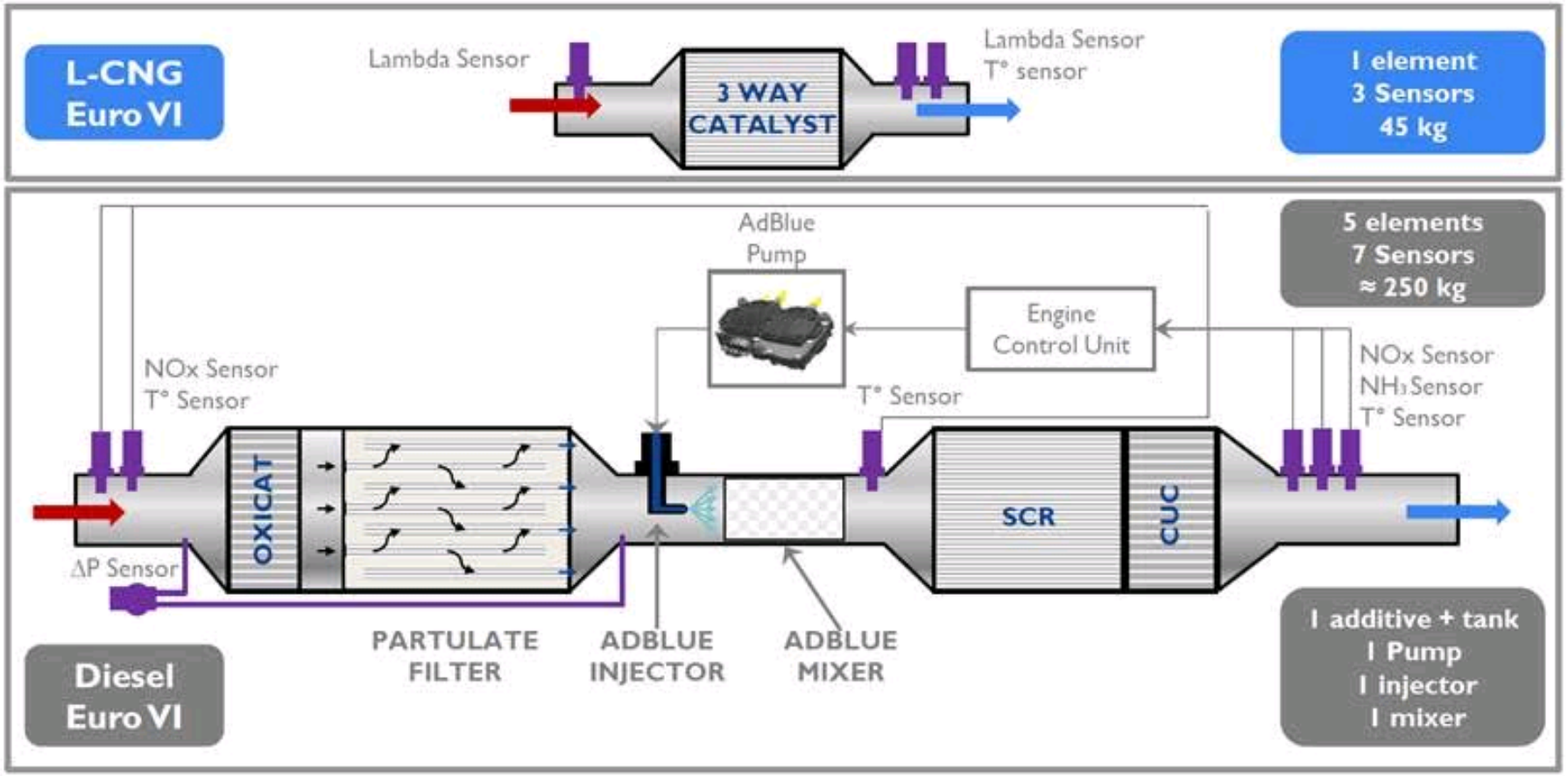
Paradigm shift
Expected BS VI after-treatment systems for diesel buses/trucks



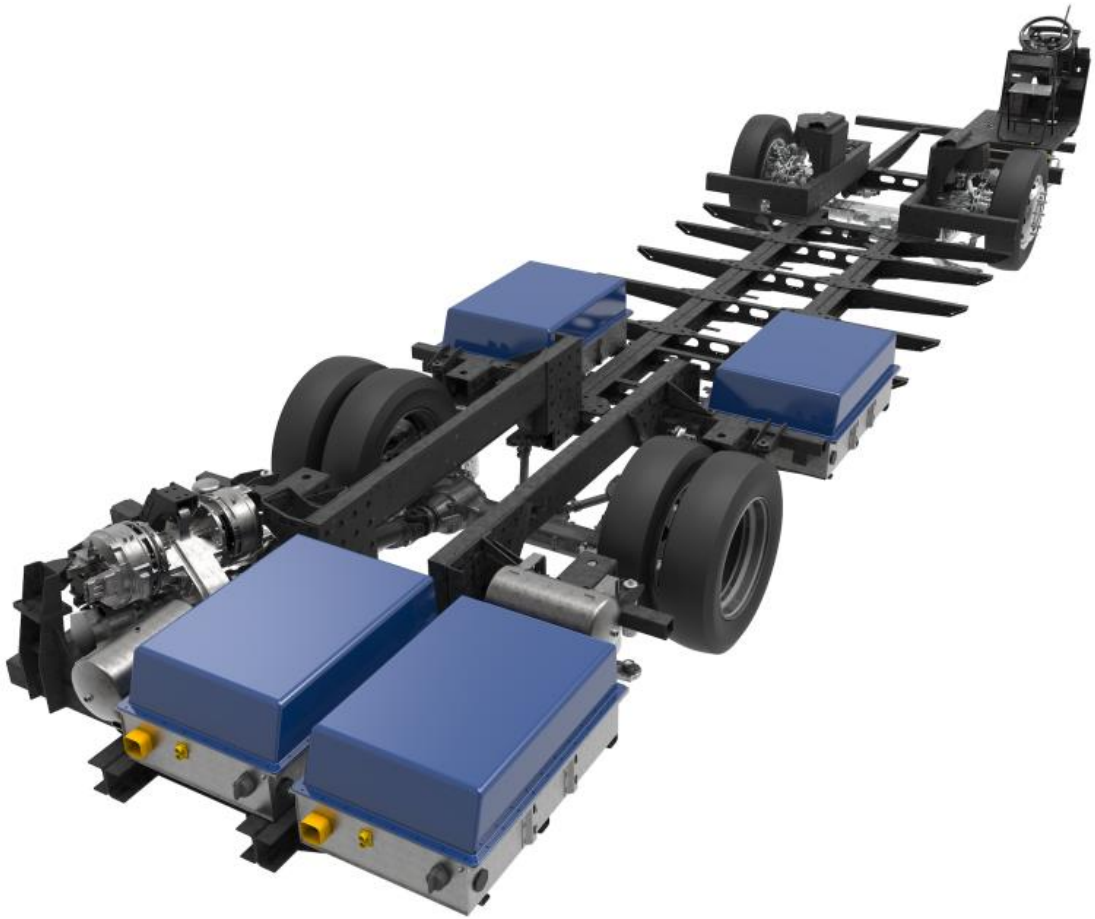
Technology pathways for diesel and CNG

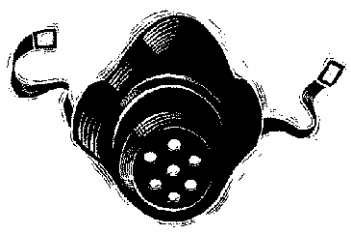
IVECO Stralis Natural Power

Environmental benefits – Simple EATS



Electric





Euro VI+ strategy
Spate of regulatory reforms

Package one: RDE Act 1, 2016:

Real world Driving Emissions (RDE) test for monitoring purposes

Package 2: RDE Act 2 – September 2017:

RDE testing included in type approvals. RDE measurements of NOx made compulsory; Conformity factor for NOx emissions.

Package 3 - RDE Act 3:

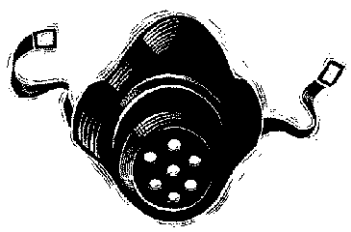
RDE testing with PEMS included Particle Number emissions
Real-world emission performance of cars disclosed by manufacturers
Not to Exceed Emission Limit (NTE) limit.

Package 4 - RDE Act 4 - 2020:

In-service conformity" testing.
Market surveillance authority independent of the type approval authority.
Reduce conformity factor in RDE measurements, from 1.50 to 1.43 (for NOx) -- to be further reduce to 1 by 2023.

Other reforms -- Worldwide Harmonised Light Vehicle Test Procedure (WLTP)

Fuel consumption meter



Whither India?

AIS 137 -- India poised for further reforms in 2023: Get it right

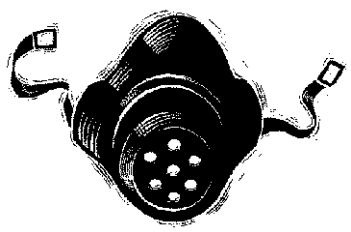
Heavy-duty vehicles

- 1st April, 2020: **emission measurement using portable emissions measurement** systems (PEMS) for on-road data collection
- 1st April, 2023: **In-service conformity factor** to be applicable.
- 1st April 2023: Vehicle to meet requirements of in-service compliance from 1st April, 2023.
- **World Not-To-Exceed (WNTE):** Off-cycle laboratory testing limits for gaseous and particulate exhaust emissions limits specified

Light duty

- **In-Service Conformity** as per AIS137
- **Real Driving Emissions:** From 1st April, 2020, for data collection and from 1st April, 2023 real world driving cycle emission conformity to be applicable.
- **Not-to-exceed Emission Limits** based on conformity factors to be assessed by 2023

Source: BSVI Notification, G.S.R. 889(E). 16th September, 2016



Missing links in India

RDE proposal not aligned with Euro 6 d:

Not clear if particle number will be included in RDE

No decision on confirmatory factor

Market surveillance and an independent verification testing and inspection by regulatory authorities of in-use vehicles and components are missing

WLTP not yet adopted – RDE testing should be validated against WLTP; MIDC is weak

Public disclosure: AIS 137 says - **manufacturer shall ensure that information is made available** on a publicly accessible website without costs. But government and testing agencies should also release data. Disclose RDE results.

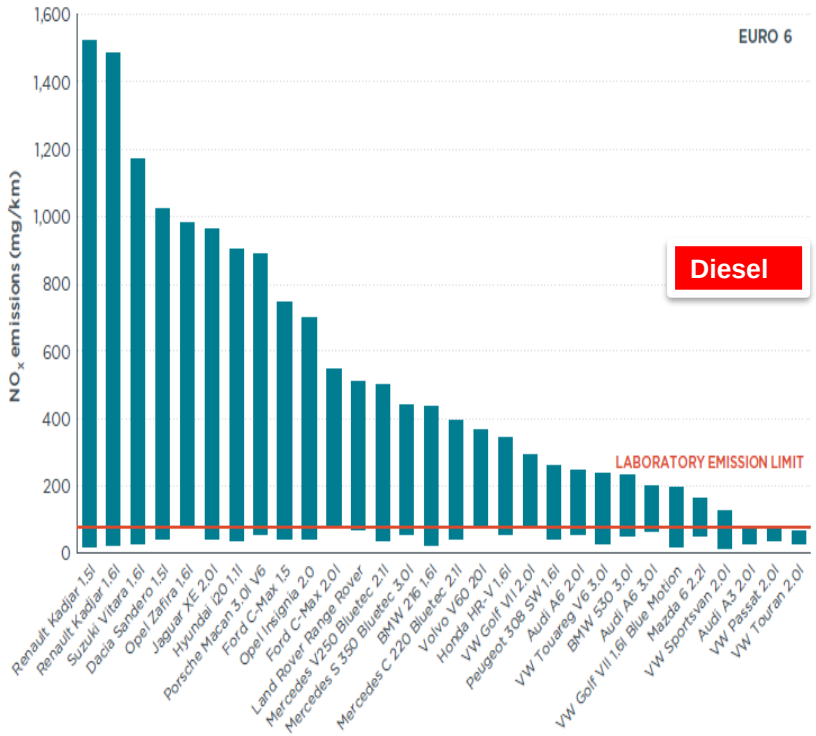
Define test trip on roads as per the package 4 of Europe or increase the weighing factor in the urban driving category to promote in-cylinder or EGR based NOx reduction strategies at low load, that SCR system will not reduce.

On-board fuel consumption meter not included yet

Making a difference

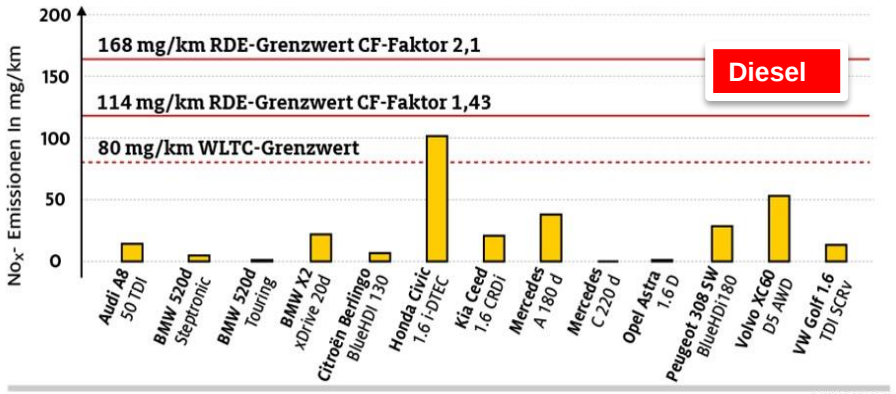
Real World NOx emissions from light duty vehicles in Europe

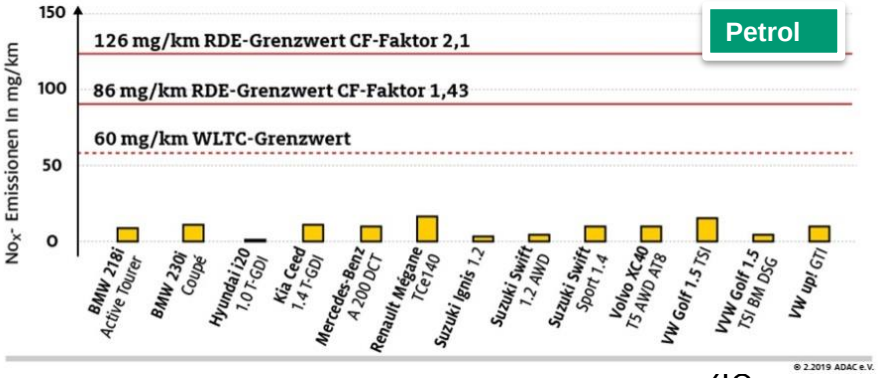
Real-World NOx Emissions Euro 6 diesel cars (published in 2016)*



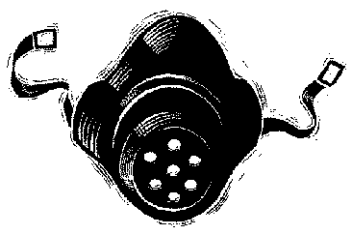
Real-World NOx Emissions Euro 6 diesel cars (published in 2019)**

February 2019: the German automobile club ADAC published on-road emission results for 26 diesel and gasoline cars. NOx emissions far below the regulatory limit

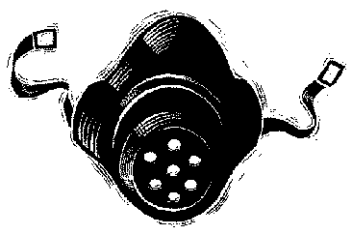




*Source: * ICCT 2016, NOX emissions from heavy-duty and light-duty diesel vehicles in the EU: Comparison of real-world performance and current type-approval requirements*
*** Tests by Germany's ADAC (Allgemeine Deutsche Automobil-Club), More info (in German) is at www.adac.de/rund-ums-fahrzeug/abgas-diesel-fahrverbote/dieselkauf-abgasnorm/rde-messungen-cf-faktor .*



BSVI readiness of I/M regime for on-road surveillance…

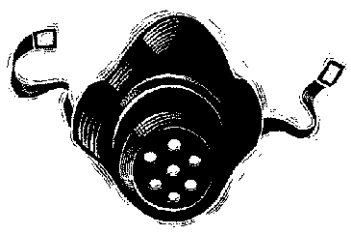


On-road emissions management

PUC is not relevant for new generation emissions control technologies.

Global trend

- **Tightening of in-use inspection: UK:** If DPF fitted vehicles emit smoke of any colour it is considered a major defect. (Smoke limit to 27 HSU in 2014)
- **Checklist for physical checks:** Check if any emission control equipment fitted by the manufacturer is missing, modified or defective (DPF, Oxidation Catalysts and SCR valves). This is a major defect.
- **OBD integration:** Integrated on-board diagnostic systems with I/M programme. MIL is part of the test and will be a major defect if it is inoperative or indicates a malfunction. Checking if OBD is working (US)
- **Remote sensing measurements:** More efficient way of screening lrge fleet size



What must change in our cities?

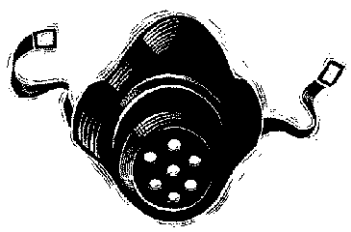
Physical checks of diesel particulate filter (DPF), Selective Catalytic Reduction (SCR), exhaust gas recirculation system (EGR) and on board diagnostic system (OBD)

Diesel vehicles: Checking diesel particulate filter (DPF)
Physical checks for hole, damage in DPF housing; temperature and pressure sensors in appropriate ports (according to manufacturers manual); no damage to wiring harness

DPF tampering: Ensure no sign of tampering to modify exhaust gas flow to or from DPF; Match the DPF part number and manufacturer number

SCR: Check for damage; Temperature and Nox sensor; damage to wiring harnes; AUS injector in appropriate port; verify injectors; damage to wiring harness; Confirm no tampering

Intergrate on-board Diagnostic System (OBD): Need diagnostic tool SAE J 1939 standard for OBD port; Run ignition key to ON position – drive display should operate according to manufacturers specifications; all LEDs should function; check for no broken indicators;verify that no pending maintenance requests or active fault codes are present. etc



Need advancement

- Be familiar with the schematics of the BS VI vehicle and exhaust system.
- Train personnel about failed components—e.g., EGR, DPF, SCR, and other inspection components—and different types of failures and to recognize them visually during inspection.
- Know how to use the appropriate OBD connector, depending on the port on the vehicle.
- Personnel must use the software to retrieve all measurement values from a vehicle’s OBD.
- They must know how to interpret the malfunction indicator light and OBD indicators on the dashboard of the vehicle using the manufacturer’s manual.

(ICCT)

Prevent cheating and tampering

EGR tampering

External zapping device

- External black box plugged behind EOBD socket

Mechanical tampering

- Physical change in engine compartment
- blocking gas tube with a baffle
- sealing hose to the vacuum actuator

DPF removed

- Missing part or visible alteration (e. g. welding seam) of exhaust pipe
- Soot in exhaust of a Euro 5/6 vehicle, may indicate DPF removal (an indication, no proof for manipulation)

DPF gutted

- Soot in exhaust of a vehicle, may indicate DPF removal

Source: CITA 2019, Tampering of Emission Control Systems, Informal document GRPE-78-04, 78th GRPE, 8-11 January 2019, UN

SCR tampering

SCR disconnected and ECU emulator

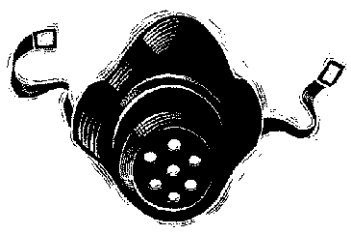
- Reagent tank gauge showing exactly 25%, 50%, 75% or 100%
- Reagent tank empty or level does not correspond with gauge
- Crystallisation and/or rust around the AdBlue tank cap and/or filler pipe when cap removed
- Fuse removed/blown from SCR system
- Modified wires in the harness
- Soldered wires
- Electronic device fitted in OBD-port or with wires spliced into the wiring from SCR ECU may be an emulator

Source: CITA 2019, Tampering of Emission Control Systems, Informal document GRPE-78-04, 78th GRPE, 8-11 January 2019, UN

Maintenance challenge

- **Expensive after treatment systems; Good maintenance to reduce cost of repair**
- **Sensitise drivers, mechanics, about DPF and SCR and their working**
- **Specialised maintenance – maintenance intervals and schedule**
- **Inspection protocol**
- **Working of SCR:** Frequency of urea refill and cost of urea: AdBlue consumption to vary across models -- A heavy vehicle with a mileage of 5km/litre will need approx. 12 litres of AdBlue per 1,000 km; With truck tank capacity of over 40 litres, to cover approx 3500 km with tank full of AdBlue.

  Cars?
- **Infrastructre for urea - highways**
- **Quality benchmarks**
- **Action against tampering and cheating devices**



Management of urea dispensation

Oil companies – IOC AUS 32 Quality requirements as per ISO 22241-1

Need auto grade urea dispensation network tied to retail outlets of oil companies in cities and highways

Need certification system

Source: IOC R&D Centre

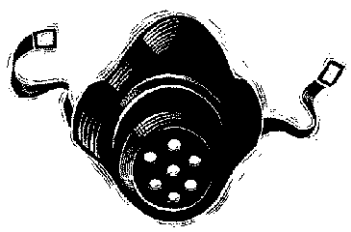
Urea content		**31.8 – 33.2**	**% by weight**
Alkalinity as NH3	max.	0.2	% by weight
Biuret	**max.**	**0.3**	**% by weight**
Insolubles	max.	20	mg/kg
Aldehyde	max.	5	mg/kg
Phosphate (PO_4)	max.	0.5	mg/kg
Aluminum	max.	0.5	mg/kg
Calcium	max.	0.5	mg/kg
Iron	max.	0.5	mg/kg
Copper	max.	0.2	mg/kg
Zinc	max.	0.2	mg/kg
Chromium	max.	0.2	mg/kg
Nickel	max.	0.2	mg/kg
Magnesium	max.	0.5	mg/kg
Sodium	max.	0.5	mg/kg
Potassium	max.	0.5	mg/kg
Density at 20°C		1087.0 - 1093.0	kg/m3
Refractive index at 20°C		1.3814 - 1.3843	(-)
Identity		identical to reference	(-)

Why quality of autograde urea matters?

Use of contaminated/off-spec urea will lead to:

- Deposit formation in urea supply and dosing system
- Blockage of injector nozzles
- Catalyst poisoning leading to permanent damage or reduction in efficiency
- Loss of warranty for SCR system
- Fitness approval issue
- Serious environmental penalty

Source: IOC R&D Centre



Next generation I/M…….

Advancing to remote sensing Kolkata has pioneered this

Delhi: ICAT pilot; MORTH-ARAI to develop guidelines
To develop threshold limit to pull out gross polluters
How to use this for compliance

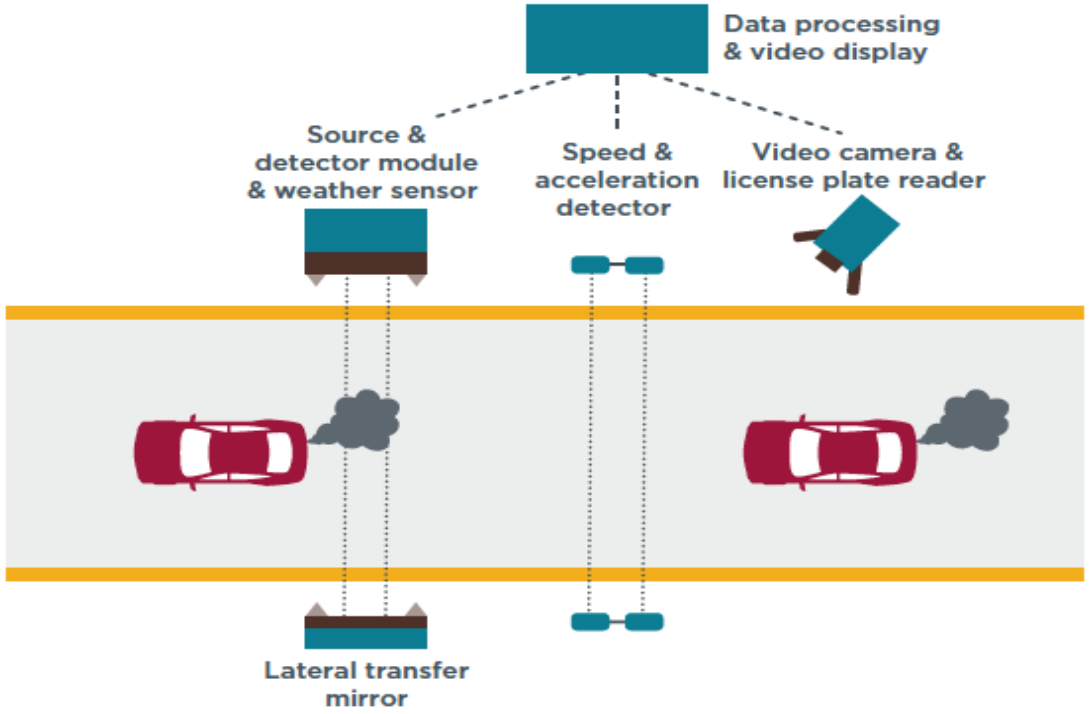
Source: CSE field visit

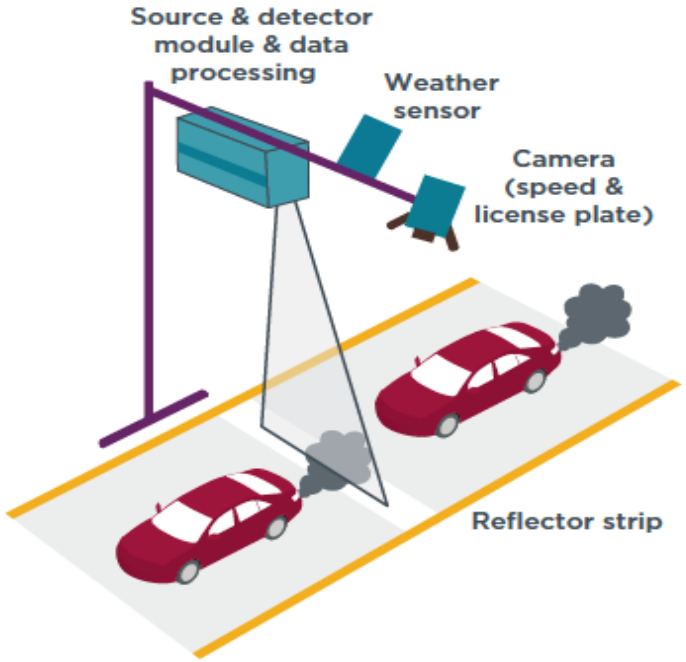
Approaches to remote sensing

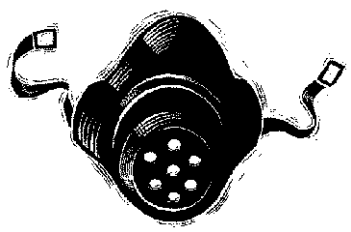
Cross-road and top-down approaches

-- Consists of a light source with reflecting strip/mirror and light detector, speed and acceleration detectors, plate number recorder, weather sensor.

-- Data processing system - telemetry equipment, display equipment, data server, video data server, backup server, router, network printer, mobile workstation, firewall, etc.







Remote sensing

China:

- **Remote sensing since 2005**: --

  22 removable remote sensing devices and 27 fixed remote sensing devices in Beijing.

  Vehicles that exceeds remote sensing standard go to smog station for retest;

  Fined if exceeds again.

- **Remote sensing method for HDV** is used to analyze and evaluate the vehicle.

- **Beijing, 2017:** Local standard Rapid Testing of NOx and Limit Value Method for Heavy-Duty Vehicles**.** In-use vehicles that fail to meet the NOX emission standard are punished and fined directly; PEMS inspection carried out.

Source: FU Lu, China Director, Clean Air Asia, China's Progress in Vehicle Emission Control (2013-2017), Presentation at the CSE Workshop, September 4-5, 2018, Delhi, India,

Remote sensing initiative in Europe

THE TRUE RATING

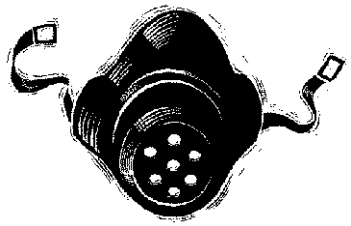
Colour system

- **Green** – good - lowest available in-use emissions
- **Yellow:** Moderate
- **Red** – poor - emissions are 3 times or more than the latest emission limits.

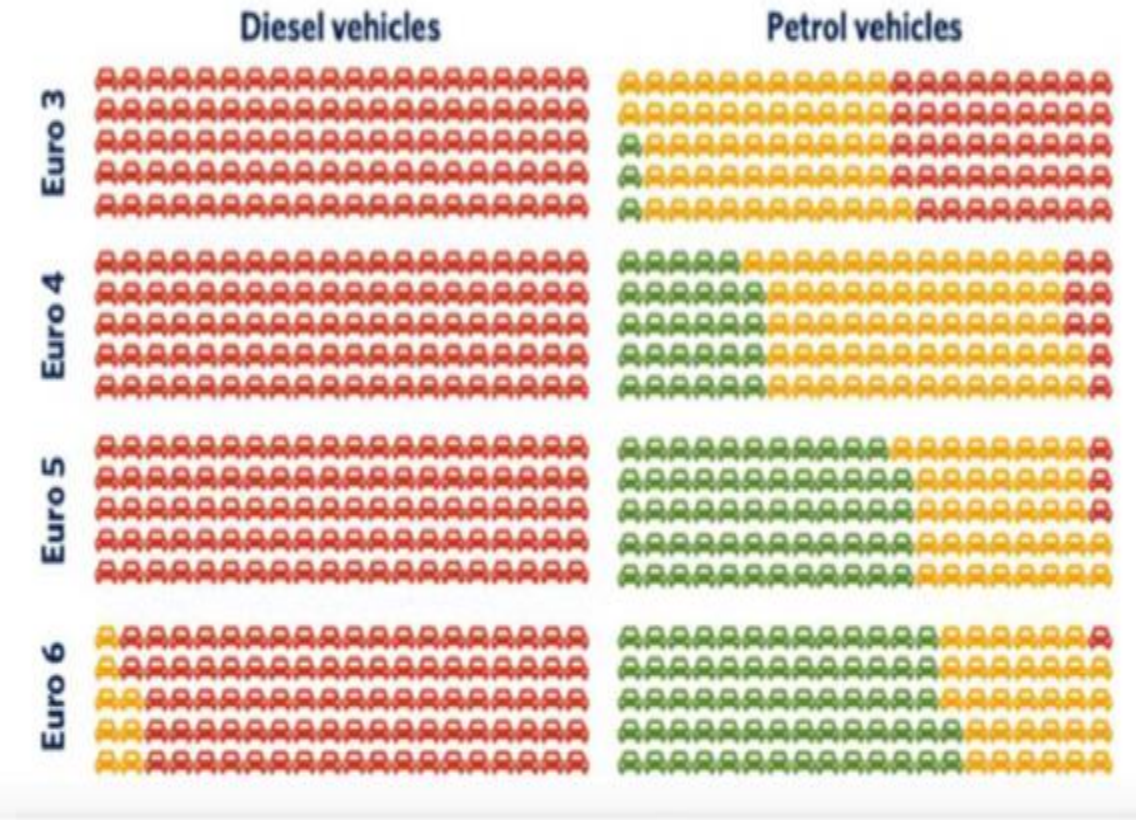
- Informative for consumers, policymakers and manufacturers

- First results launched June 6th 2018.

Source: The Real Urban Emissions Initiative (TRUE) March 2019, http://www.airqualityandmobility.org/PCFV/PDF/TheRealUrbanE



Fleet profiling

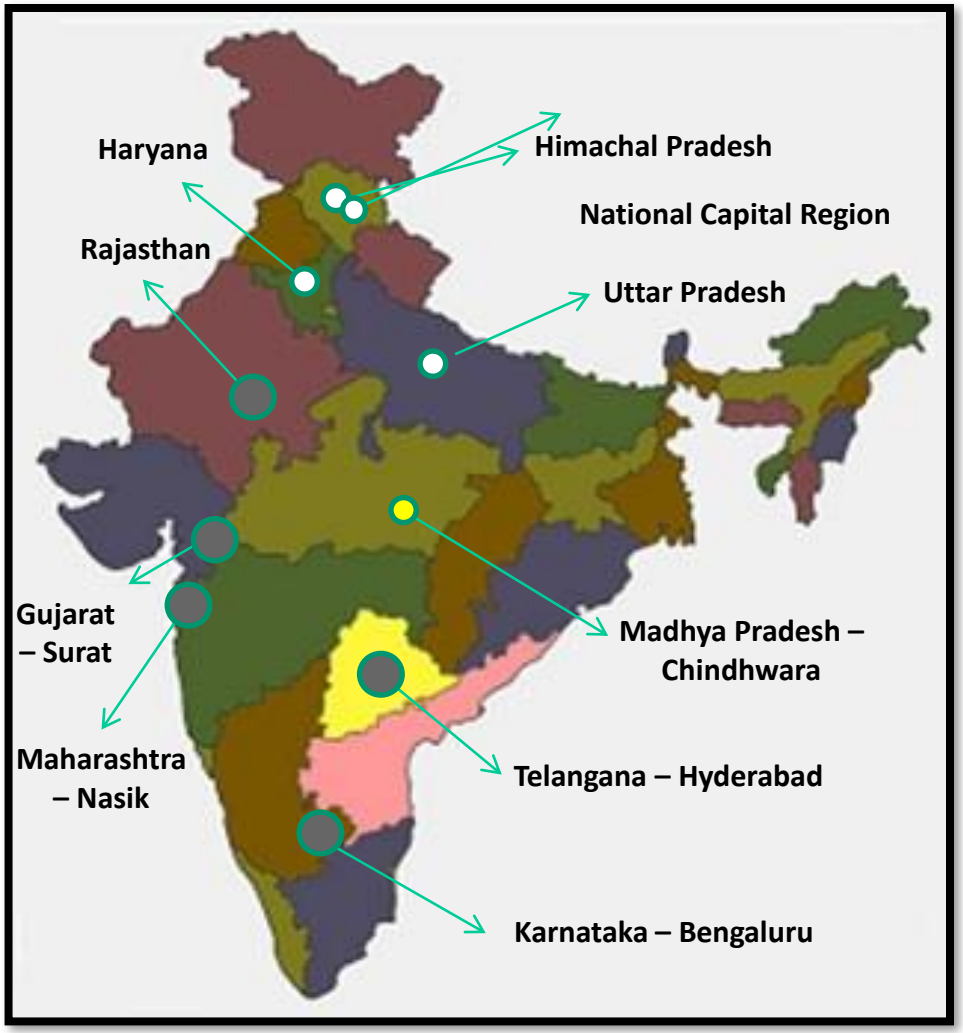


- NOx emissions are systematically much higher for diesel cars, even for the newest Euro 6 models
- All Euro 6 diesel models exceeded Euro 6 diesel NOx emissions type-approval limits
- Remote sensing results are consistent with laboratory testing conducted by Transport for London

Source: The Real Urban Emissions Initiative (TRUE) March 2019, http://www.airqualityandmobility.org/PCFV/PDF/TheRealUrbanEmissionsInitiative.pdf

Centralised inspection test centers

10 Model I&C Test Centers being established..

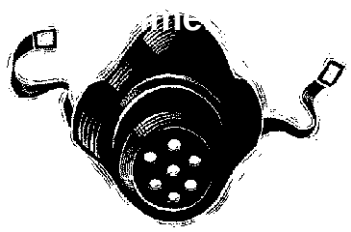


- Centers to be facilitated by ARAI
- Centers to be facilitated by iCAT
- Center to be facilitated by SIAM

Leverage them strategically; Need other supportive measures for basic screening

Need plan for West bengal

Source: ARAI



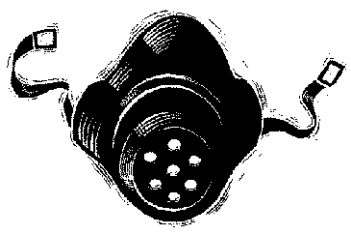
Way forward

National level

- Align with latest package of Europe to reduce gap between lab and real world
- Adopt WLTP
- Strengthen compliance and testing regulations for effective real-world emissions performance – need effective in-use conformity factor
- In-service compliance programme for LDVs
- Public disclosure and independent verification
- Compliance, Penalty, emissions warranty and recall
- Amend CMVR to enable remote sensing and OBD
- Build Urea refilling infrastructure and certification for quality control

State level

- Upgrade vehicle inspection programme – I&C centres
- OBD integration with I/M programme; enable implementation of remote sensing monitoring, physical verification of emissions control system
- Maintenance protocol for bus corporations and truck operations
- Cheat device rules to prevent tampering with emissions control system
- Service centres and workshops; Authorisation for quality control
- Urea dispensation network



Thank You