Taming on-road emissions in the real world: Setting the agenda for action

Anumita Roychowdhury
Centre for Science and Environment

CSE Webinar: Road to cleaner emissions: New generation and advanced strategies to monitor emissions from on-road vehicles

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New vehicle technology changing rapidly in India

India leapfrogs to BSVI emissions standards

• Emissions gap between petrol and diesel cars reduced but not eliminated

• Particle number count standard introduced; Paradigm shift in diesel emissions control systems

• Two wheeler standards significantly more stringent: (NOx and hydrocarbon regulated separately; evaporative standards; OBD etc)

• Real world Driving Emissions (RDE) regulations -- for certification and in-use testing for compliance

• In-service compliance regulations - Adoption of confirmatory factor

• To move towards more exacting test cycles WLTP

• And more …. Awaiting full alignment with reform packages in Europe in 2023
What about emissions from on-road vehicles in the real world?

The current system of scrutiny

In-use vehicles

Commercial vehicles

Fitness certificate

Private vehicles

No Periodic fitness/re-registration

Pollution under control (PUC) checks

New vehicles: Fitness 2 years
Old vehicles: 1 year

Re-registration after 15 years
No fitness required up to 15 years

Source: CPCB
Pollution Under Control
Certificate: The basic scrutiny

Idle emissions testing

**Petrol/LPG/CNG vehicles:** Idle speed testing; Measure carbon monoxide (CO), and hydrocarbon (HC) concentration in exhaust.

**Diesel vehicles:** Free acceleration mode or smoke opacity test for diesel vehicles.

Repair and retest if vehicles fail.

Test data from PUC centres linked with central server and centralized vehicles data base (VAHAN) of the Ministry of Road Transport and Highways to prevent manual interference.
Challenging to make it work...

Lessons from states: Audit of PUC system in multiple states:

Poor compliance – not all vehicles go for physical test
Improper testing and manual data reporting
Non-functioning equipment
Updated calibration certificates not available
Lack of knowledge of proper testing procedures
Lack of qualified and skilled PUC operators
Problem of quality control and assurance
Oversight of numerous PUC centres challenging
PUC: Challenges

• Poor data recording and reporting

• Poor failure rate – nearly all vehicle pass

• Smoke density test for diesel vehicles ineffectual

• PUC results do not correlate well with vehicle certification data;

• Not reliable for BS IV and beyond vehicles with more advanced emissions control systems as under BSVI regime.

• Monitoring framework for monitoring PUC centres weak
Observed challenges

Broken non-functioning testing equipment was a common sight across Rohtak (2017 audit).

Smoke meter was not connected to the computer.

Still issued a pass certificate

Rohtak
Diesel vehicle testing

• Improper probe insertion
• Flushing done with probe inside the exhaust pipe
• Probe often has varied shapes
Enforcement challenges

Faridabad 2017,

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

The centre still issued a pass certificate

Gurgaon 2017

Fake software called “**certificate management programme**”. -- common software found across several PUC centres
Improper testing procedures

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 (2017)
Fake PUC certification – fly by night business

- Along the state borders of NCR, many illegal PUC centres operate
- Use fake software

Rewari district, Haryana (2017)
Erroneous values
Maximum RPM in TEST 1 lower than Idle RPM?

BS-IV vehicle reporting zero values
More PUC reforms

MoRTH June 14, 2021 notification:

- Uniform PUC certification format,
- Linking PUC database with national register,
- Concept of rejection slip introduced for the first time,
- IT enabled enforcement,
- QR code to be printed on the form
- Provide information about the PUC centre

- Earlier directive to link PUC with annual vehicle insurance
Massive digitization: But data does not help

Even with uniform software for recording PUC data, there is no system for maintaining and analyzing back-end database.

Several important fields such as year of manufacture/registration, vehicle type, fuel type or other such fields, are not recorded.

There is no system or capacity for data analytics to provide feedback to improve performance.

Mismatch between basic PUC system and new generation regulatory requirements for real world emissions surveillance and control – How do we move forward?
10 Model I&C Test Centers being established.

Centralised automated vehicle inspection centres for commercial vehicles

Source: ARAI
Towards next generation challenges and strategies to keep vehicles low emitting during useful life on road
Dieselgate: global alert
Unacceptably high emissions from diesel cars

Real world NOx emissions from Euro 5 vehicles

Global response:

-- Certification testing reformed

-- Focus shifts to real world emissions monitoring, on board diagnostic and remote sensing measurements, remote monitoring of on-road fleet

Real world NOx emissions from Euro 6 vehicles

Source: April 2016, Vehicle Emissions Testing Programme, Secretary of State Transport, UK
What about India?
Nascent steps beyond PUC in India

- **Rule on OBD**: Check MIL light: *(MORTH notification G.S.R. 881(E), 26th November, 2019)*: No PUC test if the On Board Diagnostics (OBD) Malfunction Indication Lamp (MIL) of BS IV and BS VI vehicle is on -- Vehicle to be tested after repair or servicing

- **Vehicle recall**: MORTH G.S.R. 173(E) 11th March, 2021: *Defective Motor Vehicles and Recall Notice; Vehicle recall portal; Recall notice; Rectification of recall products; Imposition of fines per number of vehicles recalled*

- **Step towards remote sensing**: AIS rules in the making
Clean air action plans under NCAP provide for remote sensing

Clean air action plans of several cities include remote sensing

**West Bengal:** Asansol, Barrackpore, Durgapur, Haldia, Raniganj have mentioned expanding the existing pilot on remote sensing for monitoring of emissions from in-use vehicles in Kolkata to upgrade inspection of on-road vehicles.
Kolkata- is already reporting action taken on RSD

**Mumbai:** Installation of Remote Sensor based PUC systems

**Odisha:** Bhubaneswar has included remote sensing in their clean air action plan

**Delhi** mandated by the Supreme Court to implement RSD
Remote sensing: First generation

Nascent beginning: 2004-05
• MoRTH had set up committee under ARAI to make recommendations on inspection and certification centres in India.

• Field trial of remote sensing in Delhi and Pune

Initial challenges:
• Technology not mature

• Measuring emissions from 2 and 3-wheelers challenging --devices not aligned with the tailpipes of small vehicles -- relatively smaller plumes of emissions that decay fast before a minimum number of readings can be taken. Capture rate low.

• Out of total measurements in the pilot scheme, 92% of total results for cars and 78% of total results for buses and trucks were valid. But for two wheelers, only 28% of the results were valid. (ARAI Report of the Technical Committee on Inspection and Certification System in India for MORTH)

• More innovation needed.
Second generation Catalyst: Supreme Court directives for clean air action

- **SC Directive - May 10, 2018:** “Remote sensing screening of emissions has been found to be extremely effective in Kolkata and it would be of considerable utility in .. Delhi. …. take instructions in this regard for NCT of Delhi.

- **SC Directive July 8, 2019:** A report has been filed by International Centre for Automotive Technology (ICAT)….. and it is a finding of the ICAT that it is effective method to check the pollution. …. the technology is found to be working well in Kolkata also. EPCA to consider and submit a Report.
  
  – EPCA states: ‘If implemented, remote sensing can dramatically alter the way we monitor emissions from on-road vehicles and allow more efficient screening of highly polluting vehicles.’

Steps outlined and taken on board

EPCA recommendations taken on board and notices issued:

Union Ministry of Road Transport and Highways (MoRTH)

- Plan for implementation of Remote Sensing -- suggested agencies and time-lines

- Frame rules under Central Motor Vehicle Act and Rules to define the scope and use of remote sensing for monitoring and enforcement

- Notify gross polluter threshold under CMVR as recommended by ICAT

- Technical guidance on designing of the programme, (equipment, networking and data sharing, site selection, O&M etc)

- Global tender for purchase of 5 machines for Delhi

- Finalisation of site and sampling plan

- Issue guidance on industry standard on remote sensing
Steps outlined and taken on board

Department of Transport, NCT Delhi:

- **Issue global tender for procurement of remote sensing equipment and its operations**: Procure five.

- **Availability of equipment** - capable of measuring NO, NO₂, HC, CO, CO₂, opacity at a minimum. N₂O, NH₃, SO₂, and CH₄ desired, not necessary.

- Do a site selection and sampling plan

- Set up system for management of data and network

- **Software system to automatically issue a warning to all vehicle owners whose** vehicles exceed high emitter threshold even once.

- National Informatics Centre (NIC) may develop integrated platform necessary for this

- As per Open Government Data initiative, emissions data to be **released** for analysis of emissions trends, identify systemic problems etc.
Framing of Rules

Action at central level: MORTH drafts rules

  - Requirements for the RSD
  - Pollutants to be measured
  - Requirements for ambient weather and site condition testing:
    - To be GPS enabled
    - Parameters to be recorded
    - Test parameters and provision of threshold levels
    - Calibration checks
    - System requirements
    - And more……

To be taken forward for implementation
2009: Calcutta High Court had directed a phase out of older vehicles it had also directed improvement in in-use emissions surveillance.

Source: CSE field visit
Tap the global learning curve to build the India programme
Rapid advancement

- Spotting and chasing visibly polluting vehicles to take them for compliance testing for short test on dynamometer

- Small volume testing on dynamometer

- Vehicles tested with portable emissions monitors (PEMS) as part of real world emissions monitoring – low volume

- Remote sensing – high volume fleet-wide screening – large volume

- OBD monitoring and remote OBD installation and management regulations - Platform can monitor vehicle speed, fuel consumption, NOx emission and more parameters in real time. –large volumes

- As OBD is integrated with surveillance programme, remote sensing, PEMS etc can help to establish the reliability of OBD
A lot is possible

Europe, US, China, Hong Kong, Korea, Mexico city... and more

• Fleet emissions monitoring; identification of worst emitters for compliance testing and enforcement

• More pollutants under scrutiny – NO, NO2, HC, CO2, CO, opacity and PM

• More representative of real-world emissions

• Enables surveillance of emissions fraud and high real world emissions

• Assess performance of vehicle technology on road -- detects inherent technical defect, system failure, deterioration overtime

• Supports implementation of policy measures to reduce vehicular pollution -- low-emissions zones, vehicle phase out and scrappage schemes

• More steps: standardisation of application and data analytics, siting, weather conditions, and other technical application etc
Next steps in India

- **MoRTH rules**: -- AIS rules for remote sensing in place; create technical guidance & guidelines for cities; standardise systems

- **Roadmap for implementation**: Champion cities can implement and create the infrastructure to demonstrate

- **Compliance system** -- high emitters to report for a more improved loaded test at centralized & automated testing centers. Prioritise commercial vehicles
  - Upgrade I/C centres (like Juljuli, Burari) to be equipped with simple dynamometers to measure emissions that is not possible under PUC
  - Personal vehicles can be notified for repair and retest

- **Develop penal and enforcement action**

- **Capacity and infrastructure for data analytics and feedback** – fleet profiling, clean and dirty screening, use of data to develop real-world emissions factors, improve accuracy of emissions models, forecast etc
Thank You