Pilot project on the Inspection and Certification (I&C) Center at Burari, Delhi:
Introduction of loaded mode test procedures for measurement of in-use emissions

(**In the matter of W.P.(C) No.13029 of 1985; M.C. Mehta v/s UOI & others**)

August 2004

Environment Pollution (Prevention & Control) Authority
for the National Capital Region

Executive summary

From time to time the Hon'ble Supreme Court has examined the issue of vehicle inspection programme in Delhi and given appropriate directions. The key orders include the July 28, 1998 order that had directed the Delhi government to strengthen vehicle inspection programme. Subsequently, in its order dated February 14, 2003 the Hon'ble court had directed the Environment Pollution (Prevention and Control) Authority (EPCA) to respond to the I.A No. 179 filed by the *Amicus Curiae*. This IA had stated that the "pollution under check" system being operated by the Delhi transport department leaves much to be desired.

Since then EPCA has been monitoring this matter. Detailed examination of the current PUC system revealed that some key parameters and pollutants that have serious bearing on in-use emissions and pollution levels are not included in the current in-use inspection. While particulate levels are still very high in Delhi NOx levels have begun to rise as well. This requires urgent action to control these pollutants from the in-use fleet as well.

Transport department of Delhi has signed an agreement with the Automotive Research Association of India (ARAI), Pune to set up the pilot demonstration project on inspection and certification centre for commercial vehicles at Burari. This plan must be expanded to include facilities that will enable more advanced test procedures for measurement of key pollutants. EPCA held meeting with ARAI on July 17, 2004 to discuss modification of the plan to include facilities that will enable measurement of emissions including nitrogen oxide from CNG commercial vehicles and particulate/smoke emissions from diesel commercial vehicles. In the subsequent meeting held on August 14, 2004 the following was agreed upon:

CNG buses:

- Loaded mode test procedures on chassis dynamometer to measure five gases – carbon monoxide (CO), hydrocarbon (HC), Nitrogen oxide (NOx), carbon dioxide (CO2), oxygen (O2). ARAI to develop short test procedures appropriate for regular I/M of all CNG buses.

Diesel commercial vehicles:

- To implement smoke opacity tests on chassis dynamometer for all diesel commercial vehicles. ARAI to develop short test procedures appropriate for regular I/M of all heavy-duty diesel commercial vehicles.

- To give a plan for phasing in of PM and NOx measurement in diesel commercial vehicles.

Number of chassis dynamometer and lanes should be planned keeping in view the fact that all heavy-duty commercial vehicles both CNG buses and diesel vehicles would have to undergo loaded mode test in Burari.

Timeline for implementation

It has been decided that ARAI along with the Delhi government will implement and complete the project for full commercial operation by December 2005.

Following direction is sought:

- ARAI and Delhi government be directed to implement loaded mode test procedures for emissions measurement as agreed, in CNG and diesel commercial vehicles and this must be completed for full commercial operation by December 2005.
- ARAI be directed to give a detailed technical plan and task flow with deadlines to implement loaded mode tests to EPCA.
- In the meantime, as agreed, the PUC upgrade scheduled for implementation from October 2004 should include mandatory lambda measurement to test the health of the catalytic converters in CNG buses.

Subsequently, ARAI to give technical plans for the other two I&C centers targeting different vehicle segments, that have been planned by the Delhi government.

ARAI to develop a variant of the simple loaded mode test procedures already developed for two-wheelers for application in three-wheelers.

Detailed report

1. EPCA's mandate

From time to time the Hon'ble Supreme Court has examined the issue of vehicle inspection programme in Delhi and given appropriate directions. The key orders include the July 28, 1998 order that had directed the Delhi government to strengthen vehicle inspection programme. Subsequently, in its order dated February 14, 2003 the Hon'ble court gave direction to the Environment Pollution (Prevention and Control) Authority (EPCA) to respond to the I.A No. 179 filed by the *Amicus Curiae*. This IA had stated that the "pollution under check" system being operated by the Delhi transport department leaves much to be desired. It is submitted that Bhure Lal committee be directed to examine the system, define the in-use emissions norms and to direct any improvements it considers appropriate."

Since then EPCA has been monitoring this matter. Detailed examination of the current PUC system revealed that some key parameters and pollutants that have serious bearing on in-use emissions and pollution levels are still not included in the current in-use inspection. These will have to be included especially in the vehicle inspection programme for the commercial vehicles on a priority basis to address the following concerns:

- While particulate levels are still very high in Delhi NOx levels have begun to rise as well. This requires urgent action to control these pollutants from the in-use fleet.

CNG vehicles

- It has been brought to EPCA's notice that the CNG vehicles might be emitting high NOx on account of poor maintenance. The current vehicle inspection programme is too weak to monitor this. Under the current PUC tests only CO is

monitored. From October 2004, HC test will also be introduced. But these are not adequate to check increase in NOx emissions. Moreover, reducing CO and HC emissions by delaying the ignition timing and leaning out the air/fuel mixture can increase NOx. Therefore, it is necessary that NOx is measured to prevent any such downside. But NOx emissions cannot be measured under the current PUC idle test procedures as NOx emissions are negligible under engine idle conditions. Therefore, tests will have to be conducted on chassis dynamometer to apply load on the engine to enable NOx measurement.

- These tests are also essential to ensure that the three-way cat converters in buses are working. As recent reports have shown that in many buses cat converters have crossed their certified life of 80,000 km and are not effective. Making replacement of three-way catalytic converters mandatory in all CNG buses after the expiry of their certified life of 80,000 km can be prohibitive keeping in view the huge costs of cat converters (Rs 35,000 to Rs 45, 000 per cat converter as quoted by the bus manufacturer). Therefore, it is very important to link replacement of cat converters with effective screening of the buses on the basis of a rigorous inspection that requires measurement of CO, HC, CO2 NOx, O2 and other requisite parameters.

  Given the unique features of Delhi's traffic, -- such a large fleet of CNG buses, it will not be appropriate to argue against loaded mode test procedures for in-use inspection on the grounds that these tests are not in vogue in Europe. These tests are more common in the US and Mexico. No other city in the world has 10,200 CNG buses. Heavy-duty dyno test for in-use heavy-duty spark ignition engines are in application in the US and Mexico.

  There are no international loaded tests procedures available for CNG three-wheelers. ARAI however has taken the lead to develop simple loaded test for two-wheelers. A variant of this can be developed for three-wheelers as well. But these tests will have to be developed and enforced.

Diesel vehicles

i) Similarly, there is serious concern over the high emissions of particulates and NOx emissions from in-use diesel vehicles. Studies have confirmed that the free acceleration smoke test that we do currently is very inappropriate for monitoring particulate emissions. While the test in itself is vulnerable to manipulation and is easy to cheat, it is also not effective in monitoring fine particulate emissions from diesel vehicles. It is therefore important that we develop short dyno test procedures for in-use diesel vehicles in which both smoke and particulate matters are measured. Test procedures for PM measurements will also enable NOx measurements in diesel vehicles. It is possible to draw lessons from the work that is in progress in the Australia, the US, and in Bangkok on measuring pm from diesel vehicles.

   However, it is important to note that particulate emissions measurement from in-use diesel vehicles is still emerging and have not begun as part of the regular I/M programme anywhere in the world except in New South Wales, Australia. In Australia PM and NOx tests are being enforced through

voluntary schemes. It will be a while (in a year's time) for these tests and equipment to become commercially viable. NOx measurement will also become viable when PM measurement is possible.

In the near term therefore, it is possible to make the smoke measurements more rigorous by conducting them on a chassis dynamometer. We can immediately begin with the smoke opacity test on a chassis dynamometer and simultaneously develop a phase-in plan for particulate measurement and keep provision for upgrading to tests for PM and NOx.

In this context EPCA would like to draw attention to the fact that on various occasions the Delhi government has informed the Court about their plans to set up three centralized I&C centers and about the plan to set up a pilot demonstration project on inspection and certification programme for commercial vehicles at the Burari in Delhi. Delhi government has committed in its affidavit of October 2003 to the Supreme Court that, "Efforts are on to upgrade the vehicle inspection system at the vehicle inspection unit at Burari with the installation of a chassis dynamometer for loaded testing of vehicles. A plan has been worked out on consultation with the Automotive Research Association of India…"

Moreover, Delhi government in its affidavit of December 16, 2003 has proposed as one of its schemes -- state-of-the-art inspection and certification center to utilise the amount of Rs 300 million (generated from the daily penalty on diesel buses collected during 2002) which is now at the disposal of the Delhi government. The government has submitted proposals for these schemes in response to the Supreme Court's directions to formulate pollution abatement schemes that can be funded from this corpus fund. Therefore, resources are available for fundamental upgrade of the inspection centre.

2. EPCA's intervention

Transport department of Delhi has signed an agreement with the Automotive Research Association of India (ARAI), Pune to provide the plan and technical assistance to set up the pilot demonstration project on inspection and certification centre at Burari. The plan that has been prepared includes facilities for both vehicle fitness and emissions tests. But the emissions test component is based on the current PUC system. EPCA has therefore intervened to demand addition of facilities that are required to measure emissions including NOx and PM.

EPCA held meeting with ARAI on July 17, 2004 to discuss modification of the inspection and certification plan for the Burari inspection centre to include measurement of NOx emissions from CNG commercial vehicles and particulate/smoke emissions from diesel commercial vehicles. It was agreed that ARAI would provide the plan for introduction of these emissions measurements in the meeting scheduled for August 14, 2004.

Following this EPCA wrote a letter to the Commissioner Transport, Delhi, on July 22, 2004 and communicated the following:

- EPCA has reviewed the agreement on the' *Pilot Demonstration System on the Inspection and Certification (I&C) Center at Burari'* between the Transport

Department, NCT Delhi, and the Automotive Research Association of India, Pune.

- EPCA has noted with concern that the I&C plan which includes both vehicle fitness and emissions tests is very weak on emissions test component. It is a status quo plan as it is based on the current provisions of PUC. This does not address the problem of NOx and PM emissions from in-use commercial fleet.
- EPCA wanted to withhold the tendering process based on the current plan till the plan was revised to address these additional concerns. However, in view of the difficulties explained by the Delhi government EPCA has allowed the first phase of the tendering to commence. But EPCA insisted that simultaneously the process of including the advance emissions tests as recommended by EPCA be initiated so that the entire I&C programme is implemented within the same time frame.
- EPCA has recommended inclusion of loaded mode test to enable NOx measurement in CNG buses and NOx and particulates in diesel vehicles. Once these emissions tests and the details of equipments, specifications and costs are finalised a second tender may be issued immediately. Sufficient provision should be kept in the design of the centre to be able to integrate the second phase of the programme.
- ARAI and Delhi government have been asked to provide the details with regard to the type of loaded mode tests to be conducted. ARAI may also provide the plan for smoke opacity test on dynamometer for diesel vehicles. ARAI was further expected to provide the details regarding the equipments, instrument specifications and costs and integrate the advanced emissions testing system with the overall plan and flow chart of the inspection lanes of the Burari centre.
- In the meantime the PUC upgrade that is planned from October 2004 should include mandatory lambda measurement, check for response time of the lambda control system, inspection of close loop system and catalytic converters for CNG vehicles. This, EPCA felt was important, in view of the recent reports that three-way catalytic converters, that are needed to maintain low emissions levels in CNG buses, are either not working in many buses or have been physically removed.

3. EPCA's observations

A meeting was held with ARAI on August 14, 2004. During this meeting ARAI informed that they have appointed the US based Environmental Systems Products Inc., USA as a consultant to provide technical assistance, and implement the I&C project in Burari.

Following decisions were taken:

CNG buses:

- Loaded mode test procedures on chassis dynamometer to measure five gases – carbon monoxide (CO), hydrocarbon (HC), Nitrogen oxide (NOx), carbon dioxide (CO2), oxygen (O2). ARAI to develop short test procedures appropriate for regular I/M of all CNG buses.

CNG three-wheelers:

- To develop a variant of the simple loaded mode test procedures already developed for two-wheelers by ARAI for application in three-wheelers.

Diesel commercial vehicles:

- To implement smoke opacity tests on chassis dynamometer for all diesel commercial vehicles. ARAI to develop short test procedures appropriate for regular I/M of all heavy-duty diesel commercial vehicles.

- To give a plan for phasing in of PM and NOx measurement in diesel commercial vehicles.

Number of chassis dynamometer and lanes should be planned keeping in view the fact that all heavy-duty commercial vehicles both CNG buses and diesel vehicles would have to undergo loaded mode test in Burari.

Timeline for implementation

It has been decided that ARAI along with the Delhi government will implement and complete the project for full commercial operation by December 2005.

Subsequently, ARAI to give technical plans for the other two I&C centers targeting different vehicle segments, that have been planned by the Delhi government.

ARAI to develop a variant of the simple loaded mode test procedures already developed for two-wheelers for application in three-wheelers.

4. Recommendations

EPCA seeks the following direction from the Hon'ble Court:

- Delhi government along with ARAI be directed to implement loaded mode test procedures for emissions measurement as agreed, in CNG and diesel commercial vehicles and this must be completed for full commercial operation by December 2005.

- ARAI be directed to give a detailed technical plan and task flow with deadlines to implement loaded mode tests to EPCA.

- In the meantime, as agreed, the PUC upgrade scheduled for implementation from October 2004 should include mandatory lambda measurement to test the health of the cat converters in CNG buses.

Subsequently, ARAI to give technical plans for the other two I&C centers targeting different vehicle segments, that have been planned by the Delhi government.

ARAI to develop a variant of the simple loaded mode test procedures already developed for two-wheelers for application in three-wheelers.

ARAI should be directed to give a detailed plan and task flow with deadlines to implement the tests agreed with:

CNG buses:

- Loaded mode test procedures on chassis dynamometer to measure five gases – carbon monoxide (CO), hydrocarbon (HC), Nitrogen oxide (NOx), carbon dioxide (CO2), oxygen (O2). ARAI to develop short test procedures appropriate for regular I/M on all CNG buses.

Diesel commercial vehicles:

- To implement smoke opacity tests on chassis dynamometer for all diesel commercial vehicles. ARAI to develop short test procedures appropriate for regular I/M on all heavy-duty diesel commercial vehicles.
- To give a plan for phasing in of PM and NOx measurement in diesel commercial vehicles.