

EPCA Report No. 26 (July 2006)

**Investigations relating to fire hazards and safety in CNG Buses
And
Supplementary report on Converted CNG Buses**

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

- 1. In response to the reports on fire incidents in CNG buses in Delhi, EPCA had constituted an expert committee on May 2, 2006 to investigate the problem.**
- 2. This report has analysed the root cause of bus fire incidents, identified the manufacturing deficiencies and defects pertaining to the engine and sub-system design/electric installations and electric wiring/gas piping and joints etc. Additionally, it also assesses the conversion deficiencies, issues related to spare parts, role of maintenance.**
- 3. The report recommends the remedial measures for the in-use CNG bus fleet, and examines the proficiency of DTC testing centers after discussing the issues with concerned agencies, OEMs and conversion agencies.**

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

Background

EPCA has been monitoring the CNG programme in Delhi since its inception. In the month of April, the media reported of fire incidents in CNG buses. EPCA expressed concern on these fire incidents and constituted an *ad hoc* committee to investigate the fire incidents in the CNG buses.

On May 2, 2006, EPCA constituted a committee under the chairmanship of Prof (Dr.) H.B Mathur (Ex-IIT, Delhi) to investigate the fire incidents in CNG buses that were reported in the press in the preceding few weeks. The committee was to hold deliberations with all concerned target groups including vehicle owners whose buses have been destroyed in the fire incidents, bus manufacturers, DTC, conversion agencies, Delhi Transport Department etc to help EPCA in understanding the cause of the fire incidents and enforce recommended remedial measures.

The terms of reference of the committee were:

- Root cause analysis of the bus fire incidents,
- Identify the manufacturing deficiencies and defects pertaining to the engine and sub-system design/electric installations and electric wiring/gas piping and joints etc.,
- Conversion deficiencies,
- Issues related to spare parts,
- Role of maintenance,
- Recommend and remedial measures for the in-use fleet,
- Examine the proficiency of DTC testing centers.

During the course of investigation, additional related questions and issues were identified, which are addressed in this report.

The committee held deliberations with officials of the following agencies.

- Ashok Leyland (bus chassis manufacturers)
- Tata Motors Ltd (bus chassis manufacturers)
- Swaraj Mazda
- Eicher Motors
- DTC (state owned public transport operators)
- Minda Impco India Ltd (Component distributors)
- CLH Gaseous Fuel Applications (component suppliers)
- Federation of Delhi Bus operators
- Nugas Technologies India Pvt Ltd (conversion agency/kit installers)
- VIP Buildcon Pvt Ltd (conversion agency/kit installers)
- Association of State Road Transport Union (ASRTU - Third party technical inspectors - TPTI)

Based on the points raised in the discussions, officials from these agencies made written submissions to the committee as requested. The Committee inspected the buses that caught fire and visited the following sites.

- DTC terminal, Hauz Khas (CNG leak test center)
- DTC terminal, Nehru Place (CNG leak test center)
- Burari Test Centre (Third party inspection center)

Findings

The Committee has submitted the following findings:

The existing CNG bus fleet

As of today there are around 10,300 CNG buses in operation in NCR of Delhi. Of these about 2,800 are converted buses. The converted buses are of older model years whose diesel engines have been converted to spark emission engines for neat CNG operation with retrofitting done by CNG kits suppliers. The two major manufacturers of dedicated CNG buses are Ashok Leyland Motors Ltd and Tata Motors Ltd, while Swaraj Mazda, Eicher Motors and Hindustan Motors are the main suppliers of mini CNG buses. Around 30 per cent (3105 units) of the buses are owned and operated by DTC while the rest 70 per cent are privately owned and operated.

In CNG bus fleet the fuel system essentially consists of a number of high pressure CNG cylinders (maximum gas pressure 200 bar), high pressure regulator (HPR) that reduces the CNG pressure in one stage to around 10 bar, low pressure regulator (LPR) in which pressure is reduced in two stages finally to 4.5 inches of water column and mixer/carburetor in which the gas air mixture, at around stoichiometric ratio, is prepared and supplied to the engine during suction at around -6.0 inches of water column.

A closed-loop air-fuel ratio controller using engine manifold pressure sensor, exhaust gas oxygen sensor and engine rpm sensor, constantly targets stoichiometric air fuel mixture and this along with three-way catalytic converter achieves high degree of emissions control.

CNG Buses - fire hazard

- i. CNG is inherently a very safe fuel. It has a self-ignition temperature of 540°C, which is much higher than that of gasoline or diesel oil. It is lighter than air and therefore unlike diesel and gasoline it does not accumulate around the leak. Moreover mixtures of natural gas and air are inflammable in a narrow range of gas concentrations between 5 and 15 per cent by volume. Small gas leaks are unlikely to cause fire, as the gas would disperse upwards before reaching the flammable concentration.
- ii. However bulk/continuous release of gas from the fuel system of the bus has the potential to cause fire. Fire can be triggered by a short circuit in the electrical system of the bus or by the formation of a hot spot in the system. Manufacturing deficiencies, poor maintenance, use of substandard components can contribute to
 - a. **bulk/continuous gas leakage**
 - b. **sparking due to short circuit**
 - c. **formation of hot spots/overheating of certain components.**Their combination can lead to fire incidents in the buses.
- iii. Study of incidents of CNG bus fires in Delhi have shown that the root causes have been

- a. **Short circuit in the electric wiring system** resulting in sparking
 - b. **Short circuited battery cables** resulting in sparking
 - c. **Damage to high pressure gas piping** resulting in bulk release of gas
 - d. **Pulling-out of high-pressure gas pipes** from their fittings due to insufficient flexibility in the high-pressure gas piping resulting in bulk release of gas.
 - e. **Failure of pressure relief device** resulting in uncontrolled release of gas.
 - f. **Faulty routing of electric wiring harness** and jumbling of the wires along with CNG piping in close proximity of the engine compartment.
 - g. **Maintenance lapses** with regard to HT leads, safety gadgets, rubber hoses, radiator and exhaust manifold cooling system and coolants etc
 - h. **Substandard and ill maintained components** such as HPR, LPR, mixers etc resulting in continuous gas leakage
- iv. There have been some recent firing incidents (May-June, 2006 in converted CNG buses). The converted buses had their original old diesel engine modified to spark ignition mode of operation and a conversion kit fitted by a converting agency. The engines in most of these buses are in bad shape and gas leakage even from the engine cylinder head has been reported. The converted buses are likely to pose maximum safety risk and fire hazards in time to come as they have worn out old modified diesel engines, improper maintenance, spurious and substandard replacements components and no aftersale service facility from the converters.
- v. Achieving a high quality of performance, fuel economy, reduced emissions and above all durability and safety from CNG buses requires a multi-dimensional approach involving
- a. **Improvements in engineering design** including selection of proper materials and system layout by the manufacturers
 - b. **Proper upkeep and maintenance** by the transporters/owners.
 - c. **Adequate inspection and enforcement** of safety norms and regulations by the regulating agencies
 - d. **Standardisation of CNG quality/specifications** for ensuring proper quality of the gas being supplied to the vehicles

It requires engine manufacturers, vehicle owners, DTC, CNG suppliers (GAIL), regulating authority (STA) and inspection authority ARAI/ASRTU to work in tandem and remove the deficiencies in the design of the engine/sub-systems and lay out, in the fleet operation and maintenance.

While with commendable efforts, Delhi has successfully changed the public road transport system of the city from diesel to CNG and rightly boasts of establishing the largest CNG bus fleet in the world, the still greater challenge of achieving the required quality and safety in the operation of the fleet has yet to be squarely met. Sporadic incidents of fire in CNG buses, widespread leakage of gas from the on-board cylinders and accompanying high pressure gas system, poor fuel economy, frequent engine breakdowns, high cost of spares and outdated engineering design, poor maintenance of the fleets, are problems which if not addressed urgently and in all sincerity, could put a question mark on the sustainability and safety of the CNG programme. All stakeholders must therefore take them very seriously and undertake concerted efforts to mitigate them.

Recommendations of the expert committee

Based on the discussions with various stakeholders, the written submissions received and observation made during the site visits, the following conclusions and remedial recommendations are made.

1. **Chassis manufacturers:** The two major manufacturers of CNG buses are Ashok Leyland whose contribution to Delhi CNG fleet is around 3,000 buses – 1,730 with DTC and remaining with the private owners and Tata Motors having 1360 buses with DTC and around 2,000 with private owners. It was noted that both the manufacturers have carried out considerable improvements in their product over the years, have also been organising camps periodically to carry out training and awareness programmes for the owners and operators of the vehicles as also free checking of their on-road vehicles. They have also expressed their willingness to participate in any periodic inspection programmes that may be proposed to check the gas leakage and fitness of the vehicles. They have also expressed their willingness to consider any further design and layout improvements that may enhance the safety of the vehicles. The recommended improvements are as follows:
 - i. **Engine cylinder head failure:** This has been a persistent problem with Ashok Leyland buses. Their attention was drawn to this problem in EPCA report number 15 (July 2005). In their action taken report to EPCA dated November 30, 2005 they had informed that they were replacing free of cost the old cylinder heads with a modified design (sleeveless type) and that the exercise would be completed by May 2006. However, the replacement of modified cylinder heads is still pending in around 525 buses. This must be completed at the latest by August 31, 2006.
 - ii. **Engine starting problem:** It has been reported by the end users that the Leyland buses have an inherent starting problem. The DC-DC converter often fails to give the required 12V output needed for the ignition system. It needs to be improved upon/upgraded. All probable factors relating to engine starting problem must be carefully looked into by their R&D section and remedial measures be identified and implemented at the latest by August 31, 2006.
 - iii. **Frequent failure of silencer mufflers, steering mounting bracket, front road springs:** This malady has been reported by the end-users of Leyland buses. It may be due to faulty design/improper material used. Necessary design improvements need to be effected and implemented at the latest by August 31, 2006.
 - iv. **Overheating of the engine and excessive lube oil consumption:** This is yet another problem reported in Ashok Leyland buses. It is again an engineering design problem, which must be tackled at the earliest; carrying out necessary adjustment/replacements of the components involved (pistons/rings) may be identified and implemented by August 31, 2006 latest.
 - v. **Rerouting of electrical wiring harness:** It has been observed that the routing of electrical wiring harness in case of the older Tata CNG buses in the left side portion of the engine jumbling with the gas pipelines and in close proximity to the engine exhaust system poses a safety hazard and the combination can trigger a fire. Re-routing of the electrical wiring harness by bringing out of the engine compartment to the extent possible

must be carried out by the manufacturer on priority basis on all the on-road buses by **August 31, 2006 latest.**

- vi. **Tapping of 12 V terminal from a 24 V battery bank:** In Tata buses 12V supply line provision from the battery bank has been made to start the vehicle in case of malfunctioning of DC-DC converter. In absence of a fuse box in the circuit and with the existing wiring arrangement, the circuit continues to have flow of current from the battery to the 12V circuit even when the main switch is put off. A short circuit/sparking in the circuit can lead to bus fire in case of accompanying gas leakage. The manufacturer must take remedial measures by either providing proper protections or removing the 12V tapping connection. This needs immediate attention and implementation of the remedial action in all in-use Tata CNG buses, must be completed by August 31, 2006 latest.
- vii. **Exhaust manifold design:** In the Tata vehicles the exhaust manifolds are reported to crack while in use posing a very serious fire hazard. The manufacturer should look into the problem and take remedial measures including the replacement of all the exhaust manifold where cracks have developed, free of cost by August 31, 2006 latest.
- viii. **Gas Leakage:** Leakage of the CNG from HPR, mixer, LPR, high-pressure gas pipe joints is a persistent problem, which poses a serious safety hazard and increases fire proneness of the vehicles. In Tata buses HPR, mixer, LPR, receptacle and three-way valve have been identified as the most common components from which gas leaks. During TPTI inspection 50 per cent of the non-compliant buses leakage was found to be the major problem. Tata Motors have carried out some replacements of these components with better quality units, on the vehicles under warranty. For the older vehicles (2001-2004) similar replacement is required at the earliest. The manufacturers may look into the matter and come out with appropriate schemes for implementing it in liaison with DTC/private bus owner's federation. This may please be implemented by August 31, 2006.
- ix. **Self-starter functioning without dust cap on:** This malady was observed in Swaraj Mazda buses during TPTI. The manufacturers should rectify this problem in all their on-road buses by August 31, 2006 latest.
- x. **Minimum gap between CNG cylinder valves and bus body structures:** According to TPTI report the required minimum gap was not being maintained in Swaraj Mazda buses. The manufacturer should take remedial actions and complete the work in all their buses by August 31, 2006 latest.
- xi. **CNG leakage from solenoid valve:** This has been found to be a frequent problem in Swaraj Mazda buses. The manufacturer may make necessary design changes/upgradation to overcome this problem. This should be completed by August 31, 2006 latest.
- xii. **CNG cylinder mountings:** In the in-use Swaraj Mazda buses CNG cylinder mountings are generally found broken/damaged. The design of the mountings needs improvement/upgradation. Necessary design changes should be carried and implemented to overcome this problem by August 31, 2006.
- xiii. **Replacement of gas pipes and joints:** In the recent incidents of fire in an Eicher bus at Ahmedabad it was noted that there was widespread leakage of gas. The manufacturer has decided to put stainless steel and swage log joints in all their buses. They should carry out this replacement in all their on-road buses by August 31, 2006 latest.

- xiv. **Misfiring:** This is a common occurrence in both makes of the buses. The resulting high temperature in the catalytic converter destroys the catalyst rendering the catalytic converter ineffective with consequent increase in exhaust emissions. The manufacturers should come out with effective measures to contain this problem.
 - xv. **Electronic distributor-less ignition system:** The conventional ignition system with mechanical distributor and high voltage wires is known to cause trouble in heavy-duty CNG vehicles as sparking in the system leads to fire incidents. Coil in plug is the preferred design in heavy-duty CNG engines abroad. It is high time the manufacturers adopt this technology for improving the performance of the vehicle and minimizing its fire proneness.
 - xvi. **CNG fuel injection with close loop control with OBD facilities:** It is high time that the manufacturers should stop using the older generation CNG vehicle system of mechanical fuel metering with the advanced technology of fuel injection with close loop control. Even a private CNG converter agency in Delhi has recently got their converted vehicle with such a system tested and approved at ARAI. Use of such a technology betters engine performance and fuel economy and reduces exhaust emission much beyond Euro IV levels.
 - xvii. **Spare parts and essential components:** One of the common complaints of private vehicle owners as well as bulk users (DTC) is lack of availability and high prices of major original components in the retail market. This is leading to a widespread use of cheaper duplicate components, which is having an adverse effect on the performance, durability and safety of the vehicle. While the manufacturers have taken some remedial steps much more action on an on-going basis is required. DTC has submitted a long list of component/items the prices of which as charged by the two principal vehicle manufacturers are much higher than the prevailing market prices/ASRTU-RC net rates. These lists have been forwarded to the concerned manufacturers. They should liaison with DTC and come out with a mutually agreed AMC (to include cost of replacement), rationalise the pricing policy and increase the warranty period, taking into account the prevailing conditions and constraints of the end-users.
 - xviii. **Buy-back scheme for old and converted vehicles:** Older OEM/converted buses are in bad shape because of the then in-use technology constraints, improper maintenance and upkeep, use of sub-standard components and lack of enforcement of I/M measures. It will be in the fitness of things if manufacturers come out with appropriate buy-back scheme to help replace such vehicles with the newer models. This will help modernize the CNG fleet, get better performance and fuel economy and also greater reliability and safety.
2. **Directions on Inspection and Maintenance of CNG buses:** There are many weaknesses in the existing inspection and maintenance practices being followed for the CNG bus fleet, which need immediate remedial action. These include the following
- i. **Periodic testing centres:** The committee visited (with advance notice) some of the test centers set up by DTC and also held discussion with the staff there as also with the private bus owners. The functioning of the test centres need improvement with the introduction of proper system of operation, data recording and data retrieval and analysis. Moreover

carrying out a mere leak test doesn't serve the full purpose of safety assessment. What is required is that along with leak test, there should also be testing of electrical system for proper routing, insulation and fouling, and fitment of fuses checking condition of CNG hoses, tightness of CNG cylinder mountings, condition of gas pipes, and functioning of all gauges in instrument panel etc.

ii. **Involvement of manufacturers in periodic testing:** The two major manufacturers Tata Motors and Ashok Leyland and some of the converter have between them around 22 authorised service centres/workshops for CNG buses in Delhi. They have trained manpower; diagnostic tools testing and repair facilities there. It is suggested that these facilities should be availed by involving them in the present programme of mandatory quarterly checking of the CNG buses. The scope of testing should be increased to include leakage checking, inspection of wiring harness checking for high tension leads for possible current leakage, checking conditions hoses, tightness of CNG cylinder mountings, conditions of gas pipes and joints, functioning of all gauges in the instrumental panel, battery cut off switch, current limiting devices, dust cap/plug etc. They have agreed to undertake these at a nominal cost of Rs. 300/ per bus, which will also include minor repairs/adjustments wherever, required. The cost of replacement of the faulty components/fittings would obviously be extra. The manufacturers are agreeable to the suggestion and during the discussions they have shown willingness to undertake the work of periodic testing and required repairs also at a nominal charge of Rs. 300 (cost of component replacement if required extra). Details of the scheme with proper checks and balances may be worked out by the manufacturers, converters, Federation of Delhi Bus operators, DTC and STA for implementation by August 31, 2006 latest.

iii. **Major I/M lapses observed:** The following are some of the major I/M lapses observed in the on-road buses.

- Modifications carried out in wiring harness-extra wire is connected from battery to self-starter directly by-passing the battery cut off switch.
- HT cables, Rubber Hoses in gas system are not replaced after their specified life.
- Electric wires are tempered for additional lighting and music system, are found cut and joined without proper insulation.
- Coolant of specified composition and quality is not used/replaced leading to overheating and subsequent exhaust manifold cracking.
- Solenoid control rubber pipes found missing in most of the vehicles.
- Choked air cleaner elements.
- Non-functioning/expired safety gadgets such as fire extinguishers, fuses replaced with thick wire.
- ARAI preventive maintenance schedule as specified for daily/weekly/monthly checks not being followed in practice.
- Daily leak test using a automatic gas leak detector on every bus before it leaves the depot is not being implemented.

These are very serious I/M lapses, which can lead to impair safety and increase the fire proneness on the on-road buses.

iv. **Mobile I/M facility:** It is strongly recommended that a mobile test facility should be put in place by STA/DTC at the earliest to carry out surprise checks on the fitness of the on-road vehicles. This will go a long way in

ensuring proper implementation of maintenance procedures and practices by the vehicle owners. This recommendation was made in EPCA report number 15 (July 2005) also but appears to have not yet been implemented. STA/DTC should now implement it by August 31, 2006 latest.

- v. **Constitution of a Steering Committee:** A duly constituted steering committee shall monitor the periodic inspection and maintenance programme as also the functioning of the manufacturers/converters authorize workshops and report to EPCA about any deficiencies found. All buses have to get periodic testing and repairs only from authorised manufacturers/converters workshops. If after the necessary periodic testing and repairs any bus fails in the annual fitness test or in a surprise test the workshop where the periodic testing and repair was done will have to rectify the cause of failure free of cost. The steering committee will oversee the entire I/M programme.

EPCA's recommendations

EPCA takes very serious note of the findings of the expert committee on bus fire incidents. Discussions on safety have been going on for a long time. But EPCA expresses serious displeasure over the fact that action on this front has remained unsatisfactory and the problem of safety has continued to persist. The CNG programme has contributed significantly towards cleaning up of air in Delhi. All efforts should be made to improve the quality of the programme to maximize the environmental and public health benefit from this programme. There cannot be any compromise on the safety features of the CNG buses.

In view of the findings of the expert committee EPCA would like to make the following recommendations and seek directions. Non-implementation of these measures will invite strong action. Implementation of the following remedial plan would then have to be made conditional to purchase of new buses:

1. **Directions for the bus manufacturers:** EPCA takes on board all the recommendations of the expert committee that have been made for the two bus manufacturers Tata Motors and Ashok Leyland and directs implementation of the remedial measures proposed with specific deadlines. These proposals and deadlines have been decided in consultation with the bus manufacturers.

Ashok Leyland

1.1. Engine cylinder head failure: The replacement of modified cylinder heads in Ashok Leyland buses – a persistent problem - is still pending in around 525 buses. This must be completed at the latest by August 31, 2006.

1.2 Engine starting problem: All probable factors relating to engine starting problem must be carefully looked into by the R&D section of the Ashok Leyland and remedial measures be identified and implemented at the latest by August 31, 2006.

1.3 Frequent failure of silencer mufflers, steering mounting bracket, front road springs: Necessary design improvements need to be effected to address these problems in Ashok Leyland buses be implemented at the latest by August 31, 2006.

1.4 Overheating of the engine and excessive lube oil consumption: This engineering problem yet again reported in Ashok Leyland buses must be tackled

at the earliest; carrying out necessary adjustment/replacements of the components involved (pistons/rings) and implemented by August 31, 2006 latest.

Tata Motors

1.5 Rerouting of electrical wiring harness: The routing of electrical wiring harness in older Tata CNG buses on the left of the engine is jumbled with the gas pipelines and is close to the engine exhaust system. This is a safety hazard and can trigger a fire. Re-routing of the electrical wiring harness by bringing out of the engine compartment to the extent possible must be carried out by the manufacturer on priority basis on all the on-road buses by August 31, 2006 latest.

1.6 Tapping of 12 V terminal from a 24 V battery bank: In Tata buses this needs immediate attention and implementation of the remedial action in all in-use Tata CNG buses, must be completed by August 31, 2006 latest.

1.7 Exhaust manifold design: In the Tata vehicles the exhaust manifolds are reported to crack while in use posing a very serious fire hazard. The manufacturer should look into the problem and take remedial measures including the replacement of all the exhaust manifold where cracks have developed, free of cost by August 31, 2006 latest.

1.8 Gas Leakage: In Tata buses HPR, mixer, LPR, receptacle and three-way valve have been identified as the most common components from which gas leaks. Tata Motors have carried out some replacements of these components with better quality units, on the vehicles under warranty. For the older vehicles (2001-2004) similar replacement is required at the earliest. This may please be implemented by August 31, 2006.

1.9 Self-starter functioning without dust cap on: This malady was observed in Swaraj Mazda buses during TPTI. The manufacturers should rectify this problem in all their on-road buses by August 31, 2006 latest.

1.10 Minimum gap between CNG cylinder valves and bus body structures: According to TPTI report the required minimum gap was not being maintained in Swaraj Mazda buses. The manufacturer should take remedial actions and complete the work in all their buses by August 31, 2006 latest.

1.11 CNG leakage from solenoid valve: This has been found to be a frequent problem in Swaraj Mazda buses. The manufacturer may make necessary design changes/upgradation by August 31, 2006 latest.

1.12 CNG cylinder mountings: In the in-use Swaraj Mazda buses CNG cylinder mountings are generally found broken/damaged. Necessary design changes should be carried and implemented to overcome this problem by August 31, 2006.

1.13 Replacement of gas pipes and joints: In the recent incidents of fire in an Eicher bus at Ahmedabad it was noted that there was widespread leakage of gas. The manufacturer has decided to put stainless steel and swage log joints in all their buses. They should carry out this replacement in all their on-road buses by August 31, 2006 latest.

2. **Direction to Delhi Transport Corporation (DTC) and the bus manufacturers to finalise Annual Maintenance Contract (AMC) for the bus fleet by August 31, 2006:**

Annual maintenance contract between DTC and the bus manufacturers is important to strengthen the maintenance regime for the buses. The bus manufacturers must finalise AMC on mutually agreed terms and at a reasonable cost. This should be based on rationalised pricing policy for components and increased warranty period. The AMC should take into account the prevailing conditions and constraints of the end-users.

3. Direction to set up mobile vehicle inspection and maintenance (I/M) facility:

It is strongly recommended that a mobile test facility should be put in place by the Department of Transport, NCT Delhi, and DTC at the earliest to carry out surprise checks on the fitness of the on-road vehicles. This will go a long way in ensuring proper implementation of maintenance procedures and practices by the vehicle owners. This should now implement it by August 31, 2006 latest.

4. Department of transport NCT Delhi to ensure that CNG buses including the converted buses undergo three comprehensive and improved I/M check ups one in each quarter of the year at the authorized and designated workshops.

The quarterly inspection should include leakage checking, inspection of wiring harness checking for high tension leads for possible current leakage, checking conditions hoses, tightness of CNG cylinder mountings, conditions of gas pipes and joints, functioning of all gauges in the instrumental panel, battery cut off switch, current limiting devices, dust cap/plug etc.

The conversion agencies will also undertake these I/M check which will include minor repairs and adjustment wherever required, tuning of the engine, at a nominal cost of Rs 300/ per bus per quarterly check up. The cost of replacement of the faulty components/fittings would be extra.

5. Direction to constitute a Steering Committee to oversee the implementation of the above mentioned directions

Transport department, Govt. of NCT of Delhi must set a steering committee to monitor the inspection programme and safety remedial measures for CNG buses. A duly constituted steering committee shall monitor the periodic inspection and maintenance programme as also the functioning of the authorized workshops of manufacturers, converters, and DTC and report to EPCA about any deficiencies found. The steering committee will oversee the entire I/M programme for CNG buses.

EPCA Report (August 2006)
A Report On Converted CNG Buses

Supplementary report

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

Environment Pollution (protection and Control) Authority
for the National Capital Region

Introduction

The expert committee set up by EPCA under the chairmanship of Dr H B Mathur to examine the CNG bus fire incidents has brought to the notice of EPCA the special concern over the conversion of the old diesel bus in Delhi. There are around 2800 converted CNG buses on the road. The converted buses are of older model years whose diesel engines were converted to spark ignition engines for neat CNG operation, by CNG kit supplier. Though no more diesel buses are left in Delhi for conversion and therefore the need for new conversion of old buses do not exist any more, it is still important to set up a system of the inspection and maintenance for the existing converted fleet in Delhi.

EPCA would like to note that it is important to create an appropriate model of inspection and maintenance for the existing fleet of converted CNG buses in Delhi in view of the fact that a few other Indian cities have kept conversion as one of the options in their respective CNG programme. Therefore, a proper institutional and management framework for the supervision of conversion business is needed to ensure a good programme.

The expert committee has noted serious lapses in conversion practices that has grossly undermined the safety and emissions features of the buses. Immediate corrective measures are needed if these buses are to be allowed on the roads.

Key findings of the expert committee

The expert committee has examined this matter. Findings and recommendations are as follow:

The major kit converters involved are M/s Nugas Technologies India Pvt. Ltd, M/s VIP Buildcon Pvt. Ltd, M/s DD. Industries Ltd, M/s Srimankar Gs Car Services Pvt. Ltd, M/s Rare Technologies, M/s Minda Impco Ltd and a few others. The converted buses had their old diesel engines modified and a conversion kit fitted by the converting agencies in their respective workshops. Almost all conversions in Delhi were completed by 2002 and with little or no business of conversions, thereafter most of the converters shifted their business and workshops elsewhere.

While some of the converters did a good job of conversion, used standard imported components and fittings, some others did a shabby job, committed various irregularities and got involved in unnecessary litigations. The ground reality is that the converted buses did not get the benefit of after sale service and supply of genuine components from the converter workshops all these years and consequently they had to fall back upon road side mechanics and use of duplicate/spurious replacement components.

As a consequence the condition of the engines in most of these buses is in bad shape and gas leakages even from engine cylinder head, spark plug etc has been reported. No record of the condition of their engines at the time of conversion and the kilometrage covered till then, is available. In the last three to four years of their operation on CNG they have covered at an average around 3-4 lakh additional kilometers.

In this regard a series of meetings were held with the available converter agencies. VIP Buildcon Pvt. Ltd, Nugas Technologies Pvt. Ltd and DD Industries Ltd expressed their willingness to take up quarterly inspection and maintenance work of the converted buses and also to come out with a scheme of yearly AMC (Annual Maintenance Contract) for the benefit

of the bus owners, to take care of their regular operational repairs/checks/adjustments needs.

These buses having worn out old modified diesel engines, improper maintenance, spurious and substandard components and no after sale service facilities from the converters, are likely to pose maximum safety risks and fire hazards in time to come.

Recommendations

EPCA has taken very serious note of the fact that the conversion agencies have failed to provide after sale service and support for maintenance and repair to the converted CNG buses and their operators. This has seriously compromised the safety features of these buses. According to the directive of the Hon'ble Supreme Court no diesel bus can ply in Delhi and as a result there is no old diesel bus left in the city that may need to be converted. While conversion of old diesel buses is no longer needed in Delhi, a few other cities are considering this option. In view of that it is important that Delhi implements a strong regulatory and enforcement model for the conversion agencies to ensure a good quality programme. Therefore, for the existing fleet of nearly 2800 converted CNG buses in the city the conversion agencies be directed to implement the following. If these are not implemented conversion of old vehicles will have to be discouraged.

1. Inspection of buses thrice a year in authorized workshop and make conversion agencies responsible for carrying out detailed checks: The converted buses will undergo three comprehensive I/M check ups one in each quarter of the year at the authorized designated workshops. This is conditional to obtaining the annual fitness certificate. The rigorous Inspection and Maintenance (I/M) programme of the converted buses must involve the conversion agencies and their workshop facilities. The quarterly inspection would include leakage checking, inspection of wiring harness checking for high tension leads for possible current leakage, checking conditions hoses, tightness of CNG cylinder mountings, conditions of gas pipes and joints, functioning of all gauges in the instrumental panel, battery cut off switch, current limiting devices, dust cap/plug etc. If any problem is detected the bus operator will have to get it rectified it from the conversion agencies and produce a proof to obtain the I/M certificate.

2. Carry out repairs at nominal costs: The converters will undertake these I/M check which will also include minor repairs and adjustment wherever required, tuning of the engine, at a nominal cost of Rs 300/ per bus per quarterly check up. The cost of replacement of the faulty components/fittings would be extra.

3. The conversion agencies will submit to EPCA latest by August 31 2006 the rate list for key spare parts and components of various subsystems such as the fuel system, electrical ignition system etc as also the names and addresses of the authorized suppliers of these spare parts and components.

4. The converters will display in their workshops a price list for various components and fittings as also of various replacement costs. Detailed price list for all possible repairs and replacements for the damaged kit component would also be worked out and displayed. These price lists will be submitted for the scrutiny and approval of EPCA. A typical price list for most commonly encountered replacements submitted for consideration is reproduced below. Detailed price list for all possible repairs and replacement for the damaged kit components would also be worked out and displayed in their workshops. The bus owners will have the benefit of inspection,

maintenance and replacement of components under one roof at reasonable price, provide by the converters.

5 The converters will give an undertaking that they will provide after-sales service facilities to the converted buses for as long as the buses are on road.

There should be annual maintenance contracts including rationalized pricing policy for the replacement components and their easy availability that will be ensured by the converters. If after the necessary periodic testing and repairs at the converters workshop a bus fails in the annual fitness test or in a surprise test arranged by Department of Transport, the workshop where the periodic testing and repair was done will have to rectify the cause of failure free of cost.

6. A duly constituted steering committee will monitor the periodic inspection and maintenance programme as also the functioning of the converters workshops and the manufacturers authorized workshops and report to EPCA about any deficiencies found.

7. The converter agencies will get back to EPCA latest by August 31 2006 with an annual maintenance contract (AMC) offer for converted buses including rationalized pricing policy for replacement components of various subsystems. The terms and conditions of the AMC should spell out clearly the accountability of conversion agencies and include an appropriate penalty clause for deficiency in service.