

Report on Clean Fuels
In Response to the Hon'ble Supreme Court
Order Dated March 26, 2001 & April 27, 2001
(In the matter of W.P.(C) No.13029 of 1985; M.C. Mehta v/s UOI & others)

July 2001

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

1.0 INTRODUCTION – Direction of the Hon’ble Supreme Court

The Hon’ble Supreme Court vide its order dated March 26,2001 directed as below:

“During the course of argument, it was contended before us that low sulphur diesel should be regarded as a clean fuel and buses be permitted to run on that. It was submitted that in some other countries ultra low sulphur diesel which has sulphur content of not more than 0.001 per cent is now available. We direct the Bhure Lal Committee to examine this question and permit the parties to submit their written representations to the Committee in this behalf. The Committee may submit a report to this Court in that behalf as also indicate as to which fuel can be regarded as ‘clean fuel’, which does not cause pollution or is otherwise injurious to health”.

The matter again came up for hearing on 27th April, 2001 when Ministry of Petroleum and Natural Gas submitted I.A. No. 116 to seek modifications of the order, dated 26th March, 2001 and after hearing the Hon’ble Supreme Court passed the following order:

“We do not think that any modification is required to be made in our earlier order. We however, wish to clarify that our order, dated 26th March, 2001 has to be read alongwith our order, dated 28th July, 1998.

Insofar as other pleas raised in this application as regards “clean fuels” are concerned, we direct that a copy of this application be sent to the Bhure Lal Committee for its examination. By our order, dated March 26, 2001 we had directed Bhure Lal Committee to submit a report to this Court regarding clean fuels. Mr. Harish N. Salve, learned Solicitor General submits that Bhure Lal Committee has construed that order to imply as if it is required to submit a report only on the question whether low sulphur diesel can be regarded as a clean fuel.

Our order dated 26th March, 2001 is explicitly clear in this behalf. Bhure Lal Committee has been asked to submit a report not only with regard to whether low sulphur diesel can be regarded as a clean fuel but also to

indicate as to which fuel can be regarded as clean fuel, as does not cause pollution or is otherwise not injurious to health. We expect the report on all these issues. The report has not been submitted by Bhure Lal Committee so far. An extension of time is sought for. Four weeks' further time is granted for the purpose.

It shall be open to the interested parties to make their representation directly before Bhure Lal Committee in support of their pleas as to what can be regarded as a clean fuel, which does not cause pollution and is otherwise not injurious to health, to assist the Committee to formulate its report.”

Accordingly, the EPCA received representations from the following parties:

- a. Ministry of Petroleum and Natural Gas (MoP&NG);
- b. Oil Companies;
- c. Society for Indian Automobile Manufacturers (SIAM) and the leading bus manufacturers, Tata Engineering and Ashok Leyland;
- d. Delhi Transport Corporation (DTC);
- e. All India Motor Transport Congress;
- f. Indian Tourists Transporters Association;
- g. Delhi Contract Bus Association;
- h. DTC Private Bus Operators Welfare Association;
- i. Indian Association of Tour Operators;
- j. SHV Energy Pvt. Ltd; and
- k. Delhi Petrol Dealers Association.

Some parties also made their presentations before EPCA in addition to their written representations. The salient points of their representations are given in the Annexure I. EPCA also discussed the matter with representatives of Tata Energy Research Institute (TERI) and Prof. Dinesh Mohan, IIT, Delhi. The views expressed by them are attached as Annexure II.

2.0 ISSUES BROUGHT OUT IN THE REPRESENTATIONS OF MINISTRY OF PETROLEUM AND NATURAL GAS

All representations were studied. Here, the issues raised in the representation of MoP&NG are summarised. The major issues emerging from them that we have commented upon are as follows:

- a. Diesel with 0.05 % (500 ppm) sulphur content and Unleaded Petrol with 1 % benzene and 0.05 % sulphur content being supplied in the NCR is equivalent to Bharat Stage II fuel and compares with fuel quality available in Japan, U.S.A. and best in South East Asia. The investment required for improvement of auto fuel quality specifications from the 2000 Indian standards (BIS 2000) to Bharat Stage II norms throughout the country and to EURO III equivalent norms are estimated to be Rs. 17,000 crores and Rs. 35,000 crores respectively at current level of cost.
- b. 0.001% (10 ppm) sulphur diesel is used in a limited way in Sweden, Germany and Switzerland. The problem of trade, logistics and absence of matching engine technology does not make it a cost effective solution.
- c. The particulate emission reduction using Bharat Stage II compliant vehicles with 0.05 % (500 ppm) sulphur diesel in comparison to 1996 emission norms is 81.25% as compared to 93.75% with CNG.
- d. Vehicle technology and fuel meet the Bharat Stage II norms. The same should therefore be allowed leaving the choice to the customer.
- e. Allocation of CNG for transport sector for Delhi is 0.15 million standard cubic metres per day (MMSCMD) and in case this allocation is to be enhanced there would be a need to divert the supply from other sectors. MoP&NG has expressed reservations to meet the growing CNG demand for the transport sector which has been estimated as 2.0 MMSCMD by June 2002. Indraprastha Gas Ltd. (IGL) has however estimated only 0.95 MMSCMD as demand by March 2002.
- f. CNG supply to Delhi is at present only through the HBJ pipeline. Disruption in pipeline can lead to non-availability of gas for single fuel mode buses.

- g. CNG will be expensive than Petrol and Diesel in the post Administrative Price Mechanism scenario that is scheduled to come into effect from 1.4.2002.

All these issues have been carefully taken into account in our examination below and we have gone beyond the direction of the Hon'ble Supreme Court to analyse what is clean fuel because of these issues. However, we have not addressed the issue of price and future cost of CNG because the countervailing health costs of air pollution need to be linked and investment and price issues cannot be examined in isolation of health costs. No estimation of these health costs has been made by the Ministry of Health or Ministry of Environment and Forests. The only estimates available are those compiled in 1991-92 by the World Bank (conservatively, Rs. 1,000 crore per annum for Delhi).

3.0 CRITICAL POLLUTANTS AND HEALTH EFFECTS

The auto exhaust includes following pollutants:

- Sulphur Dioxide (SO₂)
- Nitrogen Oxides (NO_x)
- Carbon Monoxide (CO)
- Particulates, including Diesel particulates and Sulphate particulates
- Hydrocarbons, including polycyclic aromatic hydrocarbons (PAH)
- Volatile Organic Compounds like Benzene

Based on local ambient air quality, health effects of pollutants and availability of monitoring data, it was decided to consider CO, Particulates, PAH/Aromatics, Benzene and NO_x. The health effect of the pollutants and their concentration in ambient air are given in Annexure III.

4.0 ACTIONS TAKEN SO FAR

When EPCA came into existence, the 1996 mass emission standards were in force for vehicles. Bharat Stage I emission standards were planned to be implemented with effect from April 2000. Fuel quality was also inferior in comparison to what is available now. Since its inception, EPCA continued monitoring the implementation of action points enlisted in the White Paper on Pollution in Delhi with an Action Plan and priority measures approved by the Hon'ble Supreme Court vide its order dated July 28, 1998. Due to efforts of the Hon'ble Supreme Court, there has been significant progress on several issues. The status of action on the issues arising out of the Court's directions in July 1998 and March 2001 is given in Table 1.

Table 1

Status of action on various Issues

Issue	Status in July, 1998	Status as on March 31, 2001
Fuel quality	Sulphur content in diesel 0.25 % max Sulphur content in petrol 0.10 % max Leaded petrol Benzene content in petrol 5 % max	Sulphur content in diesel 0.05 % max Sulphur content in petrol 0.05 % max Lead additive removed from petrol Benzene content in petrol less than 1%
2T oil supply	Loose supply	Pre-mixed dispensers at all petrol pumps
Adulteration of fuel	---	Commissioned one fuel testing laboratory
Emission norms	Pre-Euro norms (1996 norms)	Bharat Stage II norms
CNG Stations	9	68

Conversion of vehicles to CNG	---	130 buses, 12,000 autos 10, 000 taxis and car
Phasing out of old vehicles and conversion to clean fuels	----	Phased out commercial vehicles more than 15 years old Phased out buses 8 years old and more Replacement of pre-1990 autos /taxis with vehicles on clean fuel and conversion of post-1990 autos on clean fuel is in progress
Provision of 2 new ISBTs	-----	No progress

Fuel Quality: In 1997, the sulphur content in diesel was 0.25 %, which has been brought down to 0.05 % with effect from 1.4.2000 and made available at selected outlets in NCT. Supply of this diesel was extended to the entire NCT of Delhi from 1.3.2001 and in the entire NCR from 1.7.2001. Petrol quality has since been improved in respect of benzene and sulphur content. Petrol supply with 0.05% sulphur from 1.4.2000 and 1 % benzene from 1.11.2000 was made available in NCT of Delhi. In 1997, these parameters were 0.1 % and 5.0 % respectively.

Premixed Oil Dispensers: To ensure use of 2% 2T Oil supply for two/three wheelers, supply of pre-mixed fuel (2T oil & petrol) from all petrol pumps was directed by EPCA from 1.1.1999. The MoP&NG has provided pre-mix dispensers at all petrol pumps in NCT of Delhi.

Measures to Prevent Adulteration of Fuels: EPCA feels that maintaining quality of fuel is equally important. To check quality of fuels, one independent fuel-testing laboratory has been commissioned at NOIDA. EPCA had asked MOP&NG to take measures to prevent fuel adulteration. The MoP&NG has taken

preventive measures, which include issuance of the Solvent, Raffinate and Slop (acquisition, sale, storage and prevention of use in automobiles) order, 2000; and the Naphtha (acquisition, sale, storage and prevention of use in automobiles) order, 2000. While the Naphtha order is in various stages of implementation, the order on solvents remains dormant. The effectiveness of these measures is not known.

Improvement in Vehicle Technology: The Hon'ble Supreme Court has directed registration of Bharat Stage I (Euro I) compliant light vehicles from 1.6.1999 and Bharat Stage II (Euro II) compliant light vehicles from 1.4.2000.

Conversion of vehicles to CNG: IGL has provided 71 CNG stations. As per the latest information available with us, 1600 buses, 25,000 autos and 10,000 cars including 1100 taxis are operating on CNG. Number of CNG vehicles and consumption of CNG is on the rise.

Provision of NEW ISBTs: In order to ensure that the interstate buses do not enter the city, it was proposed to have two more interstate bus terminals at the periphery of the city. The EPCA took up the matter with Transport Department, Government of NCT of Delhi to set up two ISBTs at North and South-West border.

However, construction of these ISBTs is yet to start due to delay in allotment/handing over of land by the Delhi Development Authority. During discussion, it transpired that DDA has not handed over possession of land at Dwarka though necessary payment of Rs. 8.0 crore has already been made to DDA by Transport Department. In case of ISBT at North border, the land at Narela is yet to be allotted by the DDA to Transport Department.

5.0 NEED FOR COMPREHENSIVE AND INTEGRATED APPROACH

Although the vehicular population in Delhi has been rapidly increasing, it has been possible to arrest runaway increase in pollution levels because of measures taken till now to control vehicular pollution. But, even these measures will not be enough to achieve the desired air quality standards unless a comprehensive and integrated approach is taken.

Due to high levels of Respirable Particulate Matter (RSPM) of less than 10 micron size in the ambient air, also called PM₁₀, Delhi is an air pollution hot spot area and requires a special approach to tackle air pollution in addition to the steps already initiated. The integrated approach for tackling vehicular pollution should essentially entail the following components:

- i. Augmentation and improvement of public transport system (e.g. modern city bus on clean fuel). (Action:GNCTD)
- ii. Restriction on use of private transport through fiscal and other means. (Action:GNCTD)
- iii. Optimisation of traffic flow and improvement in traffic management including a properly defined and priced parking system (e.g. area traffic control system, no-traffic zone, green corridors, removal of encroachment on roads, regulation of construction activities and digging of roads). (Action:GNCTD)
- iv. Comprehensive and periodic inspection and certification system for on-road vehicles. (Action:GNCTD)
- v. Fixing of life span for vehicles, including private vehicles. (Action: Ministry of Road Transport and Highways)
- vi. Phasing out of grossly polluting vehicles. (Action:GNCTD)
- vii. Fuel quality improvement (e.g. benzene and aromatics in petrol, reformulated gasoline with oxygenates/additives, reduction of sulphur in diesel). (Action: MoP&NG)
- viii. Tighter vehicular emission norms than national norms. (Action: Ministry of Road Transport and Highways and GNCTD)

- ix. Improvement in vehicle technology (e.g. restriction on the 2 stroke engines, emission warranty and recall systems, on-board diagnostic systems). (Action: Ministry of Road Transport and Highways and GNCTD)
- x. Controlling adulteration of fuel. (Action: MoP&NG, GNCTD and oil companies)
- xi. Checking evaporative emissions from storage tanks and fuel distribution system. (Action: MoP&NG)
- xii. Bye pass roads for Delhi. (Action:GNCTD)
- xiii. Stoppage of Interstate Buses on periphery of Delhi. (Action:GNCTD)
- xiv. Setting up of a Unified Urban Transport Authority in place of existing multiplicity of agencies for policy planning and management of urban transport in Delhi. (Action: Ministry of Urban Affairs, Ministry of Road Transport and Highways and GNCTD)
- xv. Development and implementation of a pollution control strategy for the entire Delhi Metropolitan Area as a priority air pollution control area. (Action: Ministry of Urban Affairs, GNCTD/DPCC)

6.0 EXAMINATION OF ISSUES

6.1 Clean Fuels

- (i) The definition of “Clean Fuel” needs to be addressed in the context of quality of fuels available, availability of emission control technologies, prevailing environmental conditions and existing knowledge of health effects of air pollutants.
- (ii) Among the hydrocarbon fuels, which are commonly used for automobiles, it is not possible to specify a “clean fuel” which does not cause pollution or is not otherwise injurious to health. The hydrocarbon fuels are inherently polluting in nature because of their chemical composition. The pollution potential of the hydrocarbon fuels depends on the ratio of carbon to hydrogen atoms. Petrol and diesel belong to the long-chain hydrocarbons with larger number of carbon atoms forming the chain with hydrogen

atoms. On the other hand, fuels like CNG, LPG and propane belong to the group of short-chain hydrocarbons having lesser number of carbon atoms. Hence, the latter are less polluting. This factor together with the combined effect of fuel characteristics, fuel additives and exhaust treatment systems in automobiles as well as secondary pollutants generated through atmospheric reactions is the reason for air pollution and its health effect caused by automobile emissions.

- (iii) Non-hydrocarbon fuels such as electricity, solar energy and fuel cells do not emit noxious pollutants. As such, these fuels can be regarded as clean fuels. However, these fuels are still in various stages of experimentation and are not yet commercially available for automobiles.
- (iv) All over the world, initiatives have been taken to improve the quality of diesel and petrol and make use of less polluting short chain hydrocarbon fuels like CNG, LPG and propane. Improvement in fuel quality is also achieved through removal/reduction of emission related constituents in the fuels such as sulphur and PAH in diesel and sulphur, lead, benzene and other aromatics in petrol. Further reduction of emissions is obtained through improved engine technology and exhaust treatment systems.
- (v) Considering the severity of air pollution in the National Capital Territory of Delhi as predominantly contributed by vehicular emissions, some important steps have been taken with the intervention of the Hon'ble Supreme Court. These include improvement in quality of diesel and petrol and use of CNG.
- (vi) For the National Capital Territory of Delhi, the hydrocarbon fuels which are available and which can be regarded as 'environmentally acceptable fuels' under the prevailing pollution levels and available emission control technologies include the following:
 - Compressed Natural Gas (CNG)
 - Liquefied Petroleum Gas (LPG)
 - Propane

- (vii) As regards petrol, phasing out of lead and reduction of benzene have considerably improved the quality of fuel. However, to call it as an environmentally acceptable fuel, it is necessary to use catalytic converters for treatment of exhaust gases, assure non-adulteration and further reduce polluting constituents such as sulphur, aromatics and olefins.
- (viii) As regards diesel, which is the most consumed fuel in the NCR, sulphur content has been reduced to 0.05 per cent (500 ppm) so as to make it amenable to Bharat Stage II (EURO-II akin) emission control norms. However, in view of the special measures required for pollution control in the NCT of Delhi, particularly for reduction of particulates and organics, low sulphur diesel with 0.05 % sulphur content cannot be regarded as environmentally acceptable fuel since it does not permit effective use of exhaust treatment devices like particulate traps. Evidently, there is need for further improvement in quality of diesel as also of measures to prevent adulteration.
- (ix) Ultra-low sulphur diesel (ULSD) with 0.001 % (10 ppm) sulphur and low PAH content will be significantly less polluting provided it is used in combination with particulate traps and catalytic converters. It will also be necessary to undertake measures that ULSD does not get adulterated with low quality diesel or other adulterants. In such a situation ULSD can be regarded as an environmentally acceptable fuel. As of now however, ULSD is not available in the country. It will have to be either imported or the refineries will have to be given time to produce ULSD.

In case of commercial vehicles operating in or out of NCT of Delhi which cannot be converted to use of environmentally acceptable fuels because of practical reasons like plying outside Delhi where such fuels are not available, 0.05 % sulphur diesel compatible to Bharat Stage II emission norms may be regarded as “transitional fuel” permitted for a limited period. This period should be as short as possible because of adverse public health effects. A time bound programme should be drawn up to reduce the

sulphur content down to a level at which exhaust treatment system including particulate traps can be effectively used. This level will have to be 0.003 % (30 ppm) Sulphur or less. The PAH content should also be reduced.

- (x) In case of liquid fuels, like petrol and diesel, it is vital that the MoP&NG takes effective measures to control adulteration. Otherwise, the purity of these fuels will be lost and effectiveness and durability of exhaust treatment devices will be severely affected.
- (xi) The Government should make plans to promote all environmentally acceptable gaseous and liquid fuels for the Delhi Metropolitan area as also continue efforts to improve the quality of various fuels and the relevant exhaust treatment devices and improvements in engine technology so that different options can compete in the market. This will require, inter-alia, expeditious clearances of new technologies and arrangements for supply of fuels. (For example, TVS Suzuki has developed an LPG driven two-wheeler, which is still awaiting clearance of the Chief Controller of Explosives.)

6.2 CNG Availability

MoP&NG has indicated that conversion of the entire public transport fleet to CNG may not be sustainable in medium/long term. In case the entire public transport in Delhi is to be on CNG, then there will be consequent cancellation of allocation of natural gas to industries, power sector and fertiliser units which are being fed from the existing gas pipeline system.

The contention of the MoP&NG on availability of CNG is not convincing to us. The HBJ pipeline has a capacity of 33.4 million standard cubic metres per day (MMSCMD). Delhi has been given an allocation of 3.08 MMSCMD, the breakup of which is as follows:

Power Sector	: 2.60 MMSCMD
Others	: 0.48 MMSCMD (0.15 MMSCMD for transport; 0.33 MMSCMD for households)

There is no shortage of gas as such but an enhanced and adequate allocation for Delhi / transport sector is needed to protect public health and environment. This allocation should keep pace with the demand.

The Supreme Court has intervened earlier to allocate the supply of natural gas to the Mathura Refinery and industries located in the Taj Trapezium Zone in order to protect the Taj Mahal from the effects of air pollution (M C Mehta vs Union of India and Others, Writ Petition (Civil) No. 13381 of 1984, Justices Kuldeep Singh and Faizuddin). As fertiliser and power plants have provisions for alternate fuel, the allocation for transport can be increased by reducing the allocation for households, power plants and fertilisers till additional supply becomes available. This will not make any material difference to these sectors.

6.3 CNG distribution infrastructure

The current infrastructure for CNG distribution to the city's transport sector is, however, proving to be a constraint because of:

- (a) Lack of compression capacity at the gas refuelling stations;
- (b) Poor distribution of refuelling stations across the city; and,
- (c) Holding back on investments till build-up of demand leading to inadequate infrastructure and consequent long queues.

The IGL has assured EPCA that all its 44 daughter stations as on April 2001 will be converted to daughter-booster stations by August 2001. Moreover, the company plans to expand the number of stations to 90 by March 2002 each with adequate compression capacity as follows:

Status as on April 2001

Zone/Stations	East	West	North	South	Centra l	Total
Mother – IGL	0	0	2	3	0	5
Mother – DTC	0	0	1	2	0	3
Online	0	0	1	8	4	13
Daughter	9	7	5	17	6	44
Daughter-booster	0	1	1	0	1	3
Total	9	8	10	30	11	68

Planned Status as on March 2002

Zone/Station	East	West	North	South	Centra l	Total
Mother	3	3	9	25	8	48
Daughter-booster	8	8	10	9	7	42
Total	11	11	19	34	15	90

It is important that these plans are implemented speedily to avoid harassment to the public of long delays in refuelling. There are very few dispensing stations and very few daughter-booster stations in East, West and North Delhi, where a large proportion of the demand exists. It is equally important that the dispensing stations are properly dispersed across the city and daughter-booster stations are provided uniformly and in larger numbers in underserved areas. The MoP&NG and IGL need to ensure that these plans are implemented by December 2001 instead of March 2002 and put in motion plans to ensure that the future CNG

distribution infrastructure stays ahead of the growing demand and takes into account turnaround time of vehicles at the dispensing stations.

6.4 Security of CNG supply and storage

MoP&NG says that there will be uncertainty in maintaining uninterrupted supply of gas in situations when gas processing plant or pipeline fails, the crucial links in the single supply chain. Disruption of gas pipelines is a remote possibility. They are designed to continue in operation at reduced capacity even if there is a failure in, say, a pumping station. Moreover, the pipeline itself stores a considerable quantity of gas. But in order to deal with emergency situations, contingency plans should be prepared by MoP&NG and IGL and implemented speedily. These plans should include:

- (a) Policy to give first priority to the city bus fleet in the event of gas supply disruption; and,
- (b) Establishment of gas storage facilities in the form of LNG to contain enough supply.

Gas storage is routinely undertaken in several cold climate countries to meet the peak demand for gas during the winter season. During off-peak periods, part of the pipeline gas is converted to liquefied natural gas (LNG), which is then stored in large tanks. The LNG is then revaporised and injected into the gas distribution system to meet peak demand. A similar facility could be considered for Delhi in case of a long interruption in gas supply. MoP&NG and IGL may be asked to present their plan to ensure security of CNG supply and storage.

6.5 Meeting the September 30, 2001 Deadline

Our discussion with bus manufacturers has revealed that some of the 7,000-odd buses for which orders have been placed will not be in service by September 30, 2001. Among the reasons for delay are the non-availability of CNG cylinders and the time taken in building the bus body after the chassis has been delivered. Only

a few orders have been received for retrofitting old diesel buses with new CNG engines. Some 4,000-odd buses are also awaiting conversion but the conversion agencies are having difficulties with their certification from the relevant agencies and new agencies that have applied for conversion have not been authorised.

In order to avoid disruption of public transport operations, we are unhappily constrained to recommend that existing diesel buses be allowed to operate beyond 30.9.2001 and this date may be fixed taking into account a reasonable period for delivery of chassis and 2-3 months for building of bodies. The bus manufacturers may be asked to provide their production schedule to meet the orders placed. Meanwhile, the MoP&NG and the IGL should streamline their distribution and supply and the Ministry of Road Transport and Highways, GAIL and IGL should implement the safety measures as outlined in our Report regarding Standards for CNG Vehicles and Refilling Stations. This will help to bring induction of CNG buses on road, expansion of CNG distribution infrastructure and safety measures in tandem

Beyond this extended period required for delivery of built in buses, ideally, all diesel operation of city buses should be stopped. In the interest of the commuting public, however, and in order that bus operators do not delay making payment and taking delivery of their new buses, we think there should be an adequate disincentive for any diesel operation thereafter. We recommend that the Hon'ble Supreme Court may fix a deterrent financial penalty to be taken from all bus operators who come for change in their permits to CNG beyond that date for a further period of 3 months. All diesel operation of city buses should be disallowed thereafter.

These recommendations should apply to all those operators who are obtaining new CNG buses or new CNG engines for their existing buses.

6.5a Converted Buses

In regard to converted buses, where existing engines are being adapted to CNG by means of a conversion kit, we have in our report to the Hon'ble Supreme Court in regard to Standards for CNG Vehicles and Refilling Stations, expressed our reservations with the technology being used. In case it is decided, in light of our recommendation, to permit such bus operators as have booked conversion orders for CNG buses to withdraw and apply instead for retrofitment with a new CNG engine or for a new CNG bus, we would recommend a grace period of two months to accommodate the delay.

6.6 Interstate and Tourist Bus Transport Operations

CNG is not available outside Delhi and hence conversion of interstate and tourist buses to CNG poses a problem. If such buses are converted to CNG, they would not be able to move out of Delhi due to supply constraints except perhaps to the Taj Trapezium area where natural gas is available. Ideally, other State buses entering Delhi should run on CNG, or at best, on Bharat Stage II engines only. But this is not feasible because of the lack of CNG supply, and of 0.05% sulphur diesel supply till 2005 across the country, as recommended in the report of the Inter-Ministerial Task Force on Road Map for Vehicular Emissions and Auto Fuel Quality Standards submitted in March 2001. The recommendations of this report have yet to be accepted by the government. Since interstate buses would continue to ply to and through Delhi without change to CNG, an order restricting Delhi buses on interstate routes would have the effect of shifting their trade to their competitors; or, the buses would seek registration in neighbouring districts outside Delhi. Since the intention is not to affect livelihoods and trade, it is recommended that only buses, taxis and auto rickshaws plying on Stage Carriage and Chartered Carriage permits given for Delhi be covered by the CNG order. This would limit the movement of chartered buses on intercity routes on temporary permits. However, this requirement can be easily met by chartered buses on tourist permits, meant legitimately for plying interstate routes.

In order to prevent Chartered Carriage bus operators taking advantage of this loophole, and begin converting to Tourist Permits, or obtaining Interstate Stage Carriage Permits, we would like to suggest a ceiling be put on the number of Tourist permits given by the State Transport Authority equivalent to 1.5 times the normal annual growth rate of this category over the last five years (which we think would be reasonable to take care of those who currently ply mainly on interstate routes on temporary permits).

Meantime, the government of GNCTD should implement the July 28, 1998 order of the Hon'ble Supreme Court to speedily build new Inter-State Bus Terminals (ISBTs) in the North and Southwest to avoid pollution due to entry of inter-state buses in a time bound manner. This point is strongly emphasised because the entry of inter-state buses defeats the intent of the order.

6.7 Financial Incentives for Promoting the Use of CNG in Buses

The level of technology used by conversion companies is not satisfactory either in terms of emissions or in terms of safety (see EPCA Report on Standards for CNG Vehicles and Refilling Stations). To make sure that moving to CNG provides the maximum benefits in terms of both safety and emissions, it is important to encourage bus operators to buy new OEM CNG buses (CNG buses produced by bus manufacturers) or get their old diesel buses retrofitted (that is, replacement of the old diesel engine with a new CNG engine). If converted buses are to be allowed on the road, then appropriate measures should be undertaken by the Ministry of Road Transport & Highways and the GNCTD to improve the emission norms and safety procedures and establish a periodic inspection system as outlined in our Report on Standards for CNG Conversion.

Financial incentives for bus operators will help to smoothen the transition to CNG in a manner that safe and ultra low emission vehicles can come on the road. Financial incentives for CNG buses are justifiable on the grounds that they

provide an important public service and will greatly reduce public health costs of the transport sector.

In order to reduce the high capital cost of CNG buses and the price difference between a new diesel bus and a new CNG bus, the Central and the state governments should exempt CNG buses from excise and sales tax, respectively. While the Central government charges an excise tax of 16 % on the CNG chassis, the Delhi government charges sales tax of 12 % on both the chassis and the body. The Supreme Court order to move the city bus fleet to CNG will result in a tax windfall for the two governments. In the interest of public services and public health, exemption from excise and sales tax and provision of soft, low-interest loan to bus owners will encourage the move to this cleaner technology. To sustain this transition, the incentives should be provided for a long enough time, which should not be less than three years.

We recommend that the state government tax private vehicles like cars and two-wheelers to recover the subsidy given to encourage CNG buses. The existing road tax in Delhi is much lower than those in the other metros even though Delhi has more vehicles than Mumbai, Chennai and Kolkata combined. The road tax for cars and scooters in particular is very low in Delhi. Given the fact that these private vehicles occupy a disproportionate amount of space compared to the passenger trips they provide in relation to buses, their road tax should be increased. Today, buses pay a much higher road tax per km of operation than a car. Every year, some 60,000 cars and 115,000 two-wheelers get added to Delhi's pool of vehicles. Even a one-time increase of Rs 7,500 in the road tax for cars and Rs 2,000 for two-wheelers will fetch the Delhi government Rs 45 crore and Rs 23 crore, respectively – a total of Rs 68 crore every year. In this way, private vehicle owners can cross-subsidise the users of public transport who make a much better use of road space. The government can easily provide a subsidy of Rs 200-300 crore without losing its existing revenue. In addition, the price of diesel in Delhi is less than that in Chennai, Mumbai or even Noida (UP).

An increase of Re. 1.00 tax on diesel has the potential to raise annual revenues of about Rs. 125-150 crore. In this way, the government would be implementing the Polluter Pays Principle by taxing a polluting fuel to encourage the use of an environmentally acceptable fuel.

To make sure that better CNG technology is adopted, these incentives should be provided only to new OEM or retrofitted CNG buses and not to converted buses.

7.0 Recommendations

- (i) The hydrocarbon fuels are inherently polluting and hence such fuels cannot be regarded as 'clean fuels' and totally non-injurious to health. The effort is to constantly improve the fuel and engine technology of automobiles to reduce the effect. However, among these fuels, CNG, LPG and Propane can be regarded as environmentally acceptable fuels in the NCT of Delhi as explained in the preceding paragraphs.
- (ii) To get better emission control in petrol-driven vehicles, it is necessary to improve fuel quality, as explained in preceding paragraphs, use catalytic convertors and ensure that fuel is not adulterated.
- (iii) In view of the special measures needed for pollution control in the NCT of Delhi, low sulphur diesel with 0.05 % (500 ppm) sulphur cannot be regarded as an environmentally acceptable fuel.
- (iv) In the context of NCT of Delhi, there is need to bring public passenger transport (city buses, autos, taxis) as early as possible on CNG. For vehicles which cannot be converted to CNG for practical reasons, 0.05 percent sulphur diesel may be permitted as a Transitional Fuel for a limited period of time to be kept as short as possible for public health reasons.
- (v) Ultra-low sulphur diesel (with 0.001 % sulphur) and low PAH content in combination with Continuously Regenerating Traps (CRT) and catalytic convertors can be regarded as environmentally acceptable fuel in the NCT

of Delhi provided it does not get adulterated with low quality diesel or other adulterants. However, it is not available.

- (vi) The government should make plans to promote all environmentally acceptable fuels for the NCR as also plans to improve quality of other fuels with the relevant exhaust treatment devices and engine technology so that different options can compete in the market. This should be coordinated by the Ministry of Environment and Forests along with the concerned ministries i.e. Ministry of Road Transport & Highways, Ministry of Petroleum & Natural Gas and Chief Controller of Explosives.
- (vii) MoP&NG should provide an adequate and enhanced allocation of natural gas for Delhi's transport sector and this allocation should keep pace with the growing demand (MoP&NG).
- (viii) Current infrastructure for CNG distribution should be strengthened and increased from its total 71 dispensing stations including 38 daughter stations, as on July 2001 to 90 dispensing stations by December 2001, all consisting of mother/on-line stations and daughter-booster stations, with a proper distribution across the city. IGL should ensure gas pressure of more than 200 bars in all the CNG stations. (MoP&NG and IGL).
- (ix) Plans for future distribution infrastructure should be set into motion to ensure that it stays ahead of the growing demand and takes into account turn around time of vehicles at the dispensing stations (MoP&NG and IGL).
- (x) As taxis and autos are on dual fuel mode, contingency plans to deal with the eventuality of disruption in gas supply for buses should be prepared and a plan of action should be filed in the Hon'ble Supreme Court. (MoP&NG and IGL)
- (xi) The date for stopping all diesel operations by commercial passenger transport in the city may be extended beyond 30.9.2001 by the amount of time it reasonably takes for delivery of chassis and bodies. The bus manufacturers may be asked to furnish their production schedule for the orders placed. Those who still continue to ply on diesel beyond that date

may be allowed to do so, for a further period of 3 months, in the interest of the commuting public, but should be fined heavily and punitively. (GNCTD)

- (xii) Buses, taxis and auto rickshaws plying on Stage Carriage and Chartered Carriage permits given for Delhi be covered by the CNG order. This would limit the movement of chartered buses on intercity routes on temporary permits. This requirement can be met by chartered buses on tourist permits, meant legitimately for plying interstate routes (GNCTD).
- (xiii) In order to prevent Chartered Carriage bus operators taking advantage of this loophole, and begin converting to Tourist Permits, or obtaining Interstate Stage Carriage Permits, a ceiling be put on the number of Tourist permits given by the STA, equivalent to 1.5 times the normal annual growth rate of this category for the last five years (which we think would be reasonable to take care of those who currently ply mainly on interstate routes on temporary permits) (GNCTD).
- (xiv) The government of GNCTD should implement the July 28, 1998 order of the Hon'ble Supreme Court to speedily build new Inter-State Bus Terminals (ISBTs) in the North and Southwest to avoid pollution due to entry of inter-state buses in a time bound manner. This point is strongly emphasised because the entry of inter-state buses defeats the intent of the order (GNCTD).
- (xv) Financial incentives should be provided to bus operators purchasing new OEM and retrofitted CNG buses in the form of sales tax and excise tax exemption and low-interest loans with the subsidies ideally recovered from enhanced road taxes on private vehicles like cars and scooters and tax on diesel (Ministry of Finance, Govt. of India and GNCTD).
- (xvi) An integrated plan to achieve clean air, which includes a comprehensive plan of action for controlling vehicular pollution whose components are described in para 5 above should be prepared within a defined period of time and adopted. The Ministry of Environment and Forests should co-

ordinate this effort along with concerned Central Ministries and with GNCTD.

SUMMARY OF REPRESENTATIONS

A. Ministry of Petroleum and Natural Gas (MoP&NG)

The MoP&NG has brought forward the following points for consideration of the Authority:

- i. The CNG Stations, set up as per the Initial demand forecasts, are well equipped to meet the demand of the CNG buses that are already plying. The existing stations will be strengthened and additional stations will be put up to meet the future demand of the city buses adequately. The queuing of vehicles at the CNG stations is mainly on account of autos, whose demand of CNG has welled because of pricing advantage, and not necessarily under the orders of Hon'ble Supreme Court.
- ii. As a matter of policy, in our country European model of vehicular emission standards and auto fuel specifications has been followed. The European model has been endorsed by the Supreme Court also in its various orders. As per this, the auto fuel that matches the engine technology to give specified emission needs to be considered.
- iii. In the developed world (Europe, North America etc.) and elsewhere, vehicular emission standards and auto fuel quality necessary to meet the standards alone are prescribed, giving choice to the manufacturers, owners and operators of motor vehicles to choose the vehicle type and the fuel. As per information available, no city in the world has converted its entire public transport fleet to CNG mode.
- iv. As per the suggestions of the EPCA in its 9th report, an inter-Ministerial Task Force, has prepared a road map for extension/adoption of Euro-II/Euro-III equivalent emission norms. After examining all aspects of the subject, the Task Force has recommended the road map, which is now under consideration of the Government.
- v. Because of higher initial and the subsequent maintenance costs of CNG vehicles, its lower energy efficiency compared to diesel, non-competitiveness vis-à-vis liquid fuels in the market determined

- pricing scenario, higher cost of distribution and dispensing, higher safety requirement and the uncertainties in maintaining uninterrupted supply in situations of breakdowns of the gas processing facilities or the pipeline, CNG as the only fuel for city public transport fleet may not be sustainable in the medium/long term. Further, the success of retrofitment is not proven and there are problems reported in retrofitment of CNG kits in old diesel buses, in other countries.
- vi. Vide Supreme Court order of July, 1998, taxis and autos were directed to be converted to clean fuels. Unleaded petrol with low benzene has been accepted as clean fuel. However, Supreme Court order of 26.3.2001 makes it mandatory to convert taxis and autos to CNG mode, which will put extra pressure on the CNG service stations.
 - vii. If the conversion of vehicles to CNG modes as per the present trend continues, as per the assessment of MoP&NG, the requirement of CNG in Delhi may be as high as 2 MMSCMD by June 2002 so as to cater to the needs of 232000 vehicles, including 12000 buses, 150000 light transport vehicles and 70000 private cars. The total requirement of CNG for these vehicles will be around 12 times from the existing allocation made to Delhi for transportation sector. This additional supply of CNG will require major improvements in system including upgradation of existing gas pipeline system from Hazira to Dadri and Delhi. If the entire requirement of public transport in Delhi is to be met by CNG, then there will be a consequent cancellation of allocation of natural gas to other sectors including power and fertiliser. Thus there will be a serious impact on other projects, which provide power and fertilizer to Northern India.
 - viii. The position in regard to the technology of on-road diesel vehicles and diesel quality in Delhi at the time of passing of Supreme Court order on CNG in July, 1998, has changed substantially. Now, Euro-II equivalent diesel is available and Euro-II equivalent emission compliant buses can be supplied by the auto industry. Conversion of the existing fleet to Euro-II emission compliant fleet would mean taking a jump from pre-Euro to the second phase of Euro technology i.e. a jump of more than two technologies. The cost-benefit of allowing Bharat Stage-II emission compliant transport diesel vehicles in Delhi has not been considered as yet. The same needs to be considered.
 - ix. Conversion of the existing bus fleet to Bharat Stage-II emission compliant fleet alone will reduce the particulate emission by over 80% as compared to pre EURO norms. In case of CNG vehicles, the reduction will be around 93.7%. Therefore the combination can

bring the particulate matter in Delhi ambient air within the safe prescribed limits.

- x. As we are at Euro-II engine technology level presently, in the absence of the engine technologies matching 50 ppm or 10 ppm sulphur diesel, its use will not be cost effective and implementable at this stage.
- xi. Conversion of the existing bus fleet to a mixed fleet of CNG and Bharat stage II compliant diesel buses could reduce particulate emissions by 85% to 90%. Such a mixed fleet option may be more reliable, sustainable and in line with the international practice. Once this change has been effected, an impact assessment study of the change should form the basis of considering action for further improvement.

On May 4, 2001, MoP&NG filed additional submissions, which are as follows:

- i. That unleaded and low benzene petrol combined with new auto engine and Bharat Stage-II compliant four wheeler engine meets the requirement of the Order dated 26.03.2001 of Hon'ble Supreme Court;
- ii. That 0.05% max. sulphur diesel in combination with Bharat Stage-II engine technology meets the requirement of order dated 26.03.2001 of Hon'ble Supreme Court
- iii. Bharat Stage-I emission compliant taxis which have been registered during the period 01.06.1999 to 31.03.2000 and the Bharat Stage-II emission compliant taxis registered after 01.04.2000, in terms of the Order dated 29th April, 1999 (as modified by the Order dated 13th May, 1999), do not need conversion to CNG mode;
- iv. That Bharat Stage-II emission compliant taxis can continue to be registered in terms of Order dated 29th April, 1999 as modified by the Order dated 13th May, 1999;
- v. That old autos have the option of replacement to CNG mode or by new petrol engine;
- vi. That pre-Euro-I taxis have the option of replacement/conversion to CNG mode or by Bharat Stage-II emission compliant petrol engine; and
- vii. That the following clarifications/modifications are necessary in the direction contained in para 10 of the Hon'ble Supreme Court Order dated 26.03.2001;
 - Light commercial vehicles other than autos, taxis and city buses (the categories that were covered under the Court order of 28.07.1998) have the option of conversion/

replacement to CNG mode or by new Bharat Stage-II emission compliant engines;

- Heavy commercial vehicles (trucks, buses etc.) that ply on Inter-State/All India/National permits will be governed by the All India mass emission norms, prescribed by the Ministry of Road Transport & Highways from time to time.

B. Oil Companies

Representatives of oil companies made a presentation on clean fuels. The salient points of their presentation are:

- i. The term Clean Fuel denotes a fuel which is required to facilitate meeting the emission norms for any given category of vehicle/engine technology;
- ii. Over the past 5 years, substantial improvements have been brought about in the quality of petrol and diesel. In regard to benzene content in petrol and sulphur content in diesel, the quality of fuel in NCR is comparable with best of the world;
- iii. The petrol & diesel being supplied in Delhi are corresponding to the requirements of the Euro-II equivalent emission technology and can be regarded as Clean Fuel;
- iv. Unleaded, low benzene petrol combined with four stroke 3-wheeler engine, gives tail pipe emissions lower by 96% (CO) and 84% (HC + Nox) when compared with old two stroke engine autos;
- v. Unleaded, low benzene petrol combined with Euro-II technology in passenger cars will also give substantial reduction in emission over the old vehicles;
- vi. 500 ppm sulphur diesel combined with Euro-II technology reduces the particulate emissions by more than 80% over the on-road vehicles of old technology; and
- vii. Oil companies remain committed to supply quality fuels to the customer to meet the laid down emission standards.

The oil companies were of the opinion that unleaded, low benzene petrol being supplied in Delhi is Clean Petrol as has also been observed by Hon'ble Supreme Court in its Order dated 26th March, 2001. Also, 500 ppm sulphur diesel meeting Euro-II requirement as presently being supplied in NCT is also Clean Diesel Fuel.

C. Society for Indian Automobile Manufacturers (SIAM) and bus chassis manufacturers

- i. Presently, 500 ppm (0.05%) sulphur diesel is available in NCT, Delhi. The Government has planned to supply this diesel in the

entire NCR by June 30, 2001. Reduction of sulphur content in diesel from 2500 ppm to 500 ppm reduces the particulate matter emission from a vehicle (PM) by about 30%. The benefit (of a clean fuel) is available to new as well as existing vehicles.

- ii. With impending introduction of Bharat Stage II (Euro II) emission norms to be effective from 24, October, 2001, the reduction in PM emission of new engine would be to the extent of 85% compared to pre-1996 engines. Further reduction of sulphur from existing 500 ppm to 10 ppm will reduce the PM by another 10%. This will reduce the PM emission of a new Euro II engine to the extent of 86.5% compared to 1996 engines; and
- iii. The availability of ULSD (10 ppm) allows the fitment of particulate traps.
- iv. That the Euro II engine when runs on ultra low sulphur diesel (10 ppm sulphur) with electronic diesel control and after treatment device including particulate traps will be as good as a CNG engine in respect of PM.

The SIAM was of the opinion that option of CNG and ULSD may be considered to reduce the PM emission leaving choice of technology with the manufactures.

C1. Representation of Ashok Leyland

- i. For the soot filters (particulate trap) to be effective, sulphur content in diesel should be 150 ppm.
- ii. Catalytic convertor manufacturers indicate, based on their worldwide experience that the estimated PM emission level is still likely to be higher than the CNG and pollution reduction will only be on PM and not on the other pollutants.
- iii. The combination of engine and soot filters are to be tried in Indian conditions to understand the actual pollution reduction, performance and consistency. There may be need for additional maintenance for engine and filters.
- iv. According to Ashok Leyland the Euro II chassis will cost Rs 75,000 over and above the cost of Euro I chassis. With Euro II engine and soot filters the cost will be US\$ 4000 in addition (exclusive of taxes)

C2 Tata Engineering

- i. According to Tata Engineering the after treatment device manufacturer, namely M/s Engelhard of USA, has stated that their catalytic soot filters (CSF) can be used upto 350 ppm sulphur

diesel. However, the filter efficiency will be low at higher sulphur content and will improve substantially as the sulphur level goes down.

- ii. The CSF needs to be cleaned periodically by blowing pressurized air to remove ash deposition. In USA, the cleaning is done generally at 6 months interval but in India the cleaning may have to be done at shorter intervals of 3 months or less.
- iii. According to Tata Engineering, the current TATA CNG bus engine actually emits around 0.03 gm/kwh of PM.
- iv. Tata Engineering confirms its capability to supply diesel engine bus chassis conforming to Euro II norms but require a lead time of six months from the date of official notification of Bharat Stage II norms applicable for Delhi where 500 ppm sulphur diesel is already available.
- v. But however, the Tata Engineering Euro II bus chassis fitted with CSF filters could be produced commercially from about 2 years time from now. This is because after treatment devices have to be tailored for specific engine application, validation tests made and consistency established for filter life for Indian operating conditions.
- vi. Tata Engineering Euro II bus chassis would cost about Rs 70,000 more than the current Euro I bus chassis (exclusive of taxes). The CSF, according to M/s Englehard will cost ex USA price upwards of US\$ 3500. In addition, there would be delivery costs etc. M/s Johnson Mathey indicated for Continuously Regenerative Trap (CRT) a price of UK pounds 3000 plus delivery etc. Over and above there would be costs of engine electronics. As these are indicative figures, the final cost for the trap to be attached to a Euro II diesel engine cannot be worked out at this preliminary stage.
- vii. M/s Johnson Mathey another manufacture of soot filter has recommended that only 10 ppm sulphur fuel can be used with CRT.

On May 12, 2001, **Tata Engineering** again filed additional submissions, which are as follows:

A presentation was made on the issue of clean fuel arising out of the Hon'ble Supreme Court order, dated 26th March, 2001 and 27th April, 2001 by M/s Tata Engineering. M/s Tata Engineering submitted that diesel containing 0.05% Sulphur may be considered as "Clean fuel" for the following reasons:

- a. The term "Clean fuel" originates from the Clean Air Act Amendments of 1990 enacted in the U.S.A. "Clean Alternative Fuel" has been defined in Para 'C' of the said Act under Section 241 as follows:

“The term “clean alternative fuel” means any fuel including methanol, ethanol, or other alcohols (including any mixture thereof containing 85 percent or more by volume of such alcohol with gasoline or other fuels), reformulated gasoline, diesel, natural gas, liquefied petroleum gas, and hydrogen or power source (including electricity) used in a clean-fuel vehicle that complies with the standards and requirements applicable to such vehicles under this title when using such fuel or power source”.

The U.S. Energy Information Administration/Alternative to Traditional Transportation Fuels, 1994 also defines clean alternative fuel as :

“Any fuel including methanol, ethanol, or other alcohols (including any mixture thereof containing 85 percent or more by volume of such alcohol with gasoline or other fuels), reformulated gasoline, diesel, natural gas liquefied petroleum gases, and hydrogen or power source (including electricity) used in a clean vehicle that complies with the standards and requirements of the Clean Air Act Amendments of 1990.”

It is clear from a reading of both the above definitions, that “clean fuel” means any fuel, including diesel, which can be used in a vehicle in order to enable the vehicle to comply with the stringent emission standards in force.

The emission standards for heavy-duty diesel vehicles are met in U.S.A., using diesel containing 0.05% Sulphur. This was the quality of diesel fuel required in U.S.A. from 1994 onwards in order to meet the emission standards, and continues to remain the quality of diesel being used in U.S.A. even today. In fact, as per the emission norms, the quality of diesel fuel containing 0.05% sulphur will continue till the year 2004. The quality of diesel fuel will be required to be improved only from the year 2006 to meet the tighter norms, which will then be brought into force. It is, therefore, clear that as per U.S. legislation, diesel fuel containing 0.05% sulphur is regarded as a “clean fuel”.

- b. It is pertinent to point out that the U.S. Emission Standards for heavy-duty diesel vehicles correspond to the Euro-II norms which have now been legislated even in India for commercial vehicles and which are to come into force in Delhi from 24th October, 2001. Tata Engineering, therefore, submits that diesel containing 0.05% Sulphur would definitely qualify as a “clean fuel”, as the same is regarded under U.S. legislation as a “clean fuel” even today.
- c. It is pertinent to point out in this context that the quality of diesel has improved in the NCR dramatically in recent times, as a result of

the various Orders passed by the Hon'ble Supreme Court of India in this regard. As recently as 31st March 1996, the diesel used in the NCR contained 1.0% (10,000 ppm) Sulphur content. This was reduced to 0.5% Sulphur content from 1st April 1996, which was improved further from 1st April 1998 in the NCT to 0.25% Sulphur. From 1st April 2000, gradually, the NCT has been moving towards 0.05% (500 ppm) Sulphur, which will now be available in the entire NCR from 30th June 2001. This shows that over a period of just 5 years, pursuant to the various Orders passed by the Hon'ble Supreme Court, the quality of diesel fuel has improved by 20 times. This must be juxtaposed with the improvement in the emission standards in the NCR during the same period. When one compares the 1996 emission norms for heavy-duty diesel vehicles with the EURO II norms, which have just been notified to come into force from 24th October 2001, one finds that there is a dramatic improvement in the quality of emissions. For example, the `1996 norms specified no limits in regard to particulate emission and, as a result there was uncontrolled emission of as much as 1 gm/kwh of particulates during the said period. Under the EURO II norms, these have been dramatically improved to the level of 0.15 gms/kwh. Similarly the Nox emissions have been cut by half from 14.4 gms/kwh to 7 gms/kwh.

- d. While there can be no absolute definition of what constitutes a `clean fuel', the most advanced economy of the world, the U.S.A. has legislated that fuels are clean or unclean, depending on whether the exhaust emission from the tailpipe of the vehicle meets or does not meet the stringent emission norms. Tata Engineering submits that improved fuel quality, for example, 0.05% (500 ppm) Sulphur, coupled with matching advanced EURO II engine technology, makes for clean vehicles and clean fuels, which together can result in clean air for the residents of the NCR.
- e. It may be noted that the quality of diesel fuel being used in the NCR today, namely, diesel containing 0.05% sulphur is also at present being used in advanced world economies, like in the U.S.A., Japan and South Korea. The same diesel was being used in the European Union till 1st January 2001, when it introduced diesel containing 0.035% sulphur as it moved to EURO III norms from 1st January 2001. It is also pertinent to point out that other advanced world economies use diesel of a far inferior quality than that being used in the NCR, namely, Australia, which uses diesel containing 0.15% sulphur, New Zealand : 0.3%, Singapore : 0.3%, South Africa : 0.55%, Taiwan : 1%, Thailand : 0.25% etc.
- f. Whilst deciding the issue of what constitutes `clean fuels' in the context of diesel, it is also pertinent to point out that the quality of petrol with 1% benzene available in the NCR also contains 0.05% sulphur.

In the light of what has been submitted herein above, Tata Engineering states that diesel containing 0.05% (500 ppm) Sulphur is a 'clean fuel'. When this diesel is used in combination with vehicles, which comply with Bharat Stage II/EURO II norms, the emissions are so low that the same would not cause pollution or be injurious to human health.

D. Delhi Transport Corporation (DTC)

- i. DTC has nearly 750 buses which operate on Inter-state routes and all other State undertakings like UP, Rajasthan, Haryana, Uttaranchal, Punjab, Himachal Pradesh, J & K etc also operate buses into Delhi. Many of the routes are long and there is no CNG available at any of these locations. DTC is using low sulphur diesel of 0.05 sulphur content. It would not be operationally possible to start Inter-state operations on CNG except in the NCR region. Even if CNG is to be made compulsory in NCR there will be a need to set up filling stations and repair facilities for CNG vehicles. In view of this it is suggested that on Inter-state routes, all Inter-State route buses including those of DTC may be allowed to ply using low sulphur diesel of 0.05%.
- ii. The State Transport undertakings ply over 8 year old buses also into the city. DTC may also be allowed to ply over 8 years old buses on Inter-state routes.
- iii. The chassis manufacturers should be directed to come out with Euro-II/III diesel engine at the earliest so that low sulphur diesel can be effectively used. Since the price of such diesel engine would be much higher than the current Euro-I engine, it would compete effectively with the CNG engine, which may make the acceptability of CNG engine a better proposition for private operators, who are currently complaining of the high cost of CNG chassis versus the diesel Euro-I chassis.
- iv. In case of CNG, the DTC shall be dependent on only one source of CNG gas namely Indraprastha Gas Limited. In the event of any untoward accident and breakdown of gas supply, the entire public transport operation can be paralysed leading to instant mob reaction and damage to public property. There have been occasions recently when accidents have stopped gas supply for many hours. When the city will be dependent on single fuel mode for public transport, it is imperative that multiple sources of supply are ensured, to avoid any calamity in future. It is suggested that other sources of CNG gas supply may be ensured to guarantee constant supply of gas for public transport.
- v. Measures to promote public transport using clean fuels need to be introduced to restrict increasing use of personalised vehicles like

scooters, motorcycle and cars. This can be done by charging a “pollution tax” on these vehicles, which should be used to promote public transport infrastructure.

E. All India Motor Transport Congress

The Congress said that the Hon’ble Supreme Court’s order dated March 26, 2001 appears to be applicable for all the commercial vehicles. The Congress was of the opinion that the commercial vehicles engaged in goods transport should be kept out of the purview of the Hon’ble Supreme Court order.

F Indian Tourist Transporters Association

- i. The tourist coaches are used not more than 20% of their total mileage within the city of Delhi and the vehicles are properly maintained. Therefore, these buses are far less polluting than others under normal circumstances. As such, these buses may be exempted from the 8 years age bar.
- ii. The coaches purchased and put to operation by the operators prior to the Supreme Court’s order dated July 28, 1998 and cars purchased and put to operation prior to the order dated April 29, 1999 should not be brought under the purview of the subsequent orders. These vehicles should be permitted to complete their age as commercial vehicles as per the provision under the Motor Vehicles Act and to save avoidable wastage. Similarly, the tourist taxis registered outside Delhi, but within NCR prior to the order dated January 31, 2001 should also be given exemption and allowed to complete their commercial life span
- iii. The diesel vehicles were registered by the Govt. after passage of the Hon’ble Supreme Court’s order dated July 28, 1998. The operators cannot be held responsible for the omissions on the part of the Government of Delhi and Government of India.
- iv. The manufacturers of CNG vehicles and the Company engaged in conversion of vehicles to CNG mode should be asked to file affidavits that they will supply the chassis or convert the buses by September 30, 2001 against which the deposits have been accepted.
- v. The CNG is not available outside Delhi and Ministry of Petroleum, Government of India have no plan to make CNG available outside the NCR in the next 5-10 years. Therefore, the tourist coaches should be allowed to operate on low sulphur diesel (0.05% sulphur content), which is now available in Delhi.
- vi. Any such radical changes required to be brought in should be brought in a phased manner.

- vii. In the case of tourist taxis, the cars meeting Euro-II norms have been permitted to operate. Similarly, the buses meeting Euro-II norms should also be permitted, as it is possible with the low sulphur diesel available in Delhi to meet the emission norms by replacing those engines with Euro-II compliant engines.

G. Delhi Contract Bus Association

The Association submitted that CNG is not available out side Delhi, and it is not likely to be made available in near future. As such, their buses plying as interstate/tourist buses, if converted to CNG mode, cannot ply out side Delhi. They further said that inter state buses/ tourist buses runs in hilly areas like Badrinath, Kedarnath, etc. The CNG buses and existing buses converted to CNG mode cannot ply at such places due to incompetence (lower energy efficiency) of CNG buses.

In view of the above, the Association prayed that ultra low sulphur diesel with sulphur content 0.05 % be allowed to these carriage buses enabling them to perform their contracts outside Delhi. They said that if entire public transport system of Delhi is converted to single fuel mode, this carries certain risks and other problems.

H. DTC Private Bus Operators Welfare Association

The Association stated that they have already replaced 8 year old buses with new buses and as such most of their buses are 1 to 3 years old. There is no justification to discontinue these at this stage and the buses should be permitted to complete their lives as commercial vehicle provided under the Central Motor Vehicle Act to save the avoidable wastage of large investment. Conversion of the existing buses is not practical as the only agency (M/S Nugas technology) engaged in the business is neither authenticated nor fully certified by the competent authority. It was also submitted that no packages of relief been provided to the operators by the Govt. There is shortage of CNG and filling stations in the city resulting in long queues of the vehicles at CNG stations.

Under prevailing circumstances, the Association requested that the latest fuel available in city (0.05 % diesel) may be declared as clean fuel.

I. Indian Association of Tour Operators

The Association has 500 buses, which operates on inter state routes. Citing reference of a study by IIT Delhi, they pleaded that low sulphur diesel with sulphur content 0.05 % may be considered as cleaner fuel.

J. SHV Energy Pvt. Ltd.

M/s SHV Energy Pvt. Ltd. made a presentation on LPG as most preferred and clean auto fuel. The emissions from LPG will be more or less same as compared to the emissions from CNG vehicles. Globally number of vehicles operating on LPG is five times over the CNG vehicles. The investment required in setting up LPG stations is 10 times less than that of CNG stations. The infrastructure of LPG can be set up at any place because no pipeline or mother station is required. The filling time in LPG is comparable with petrol or diesel whereas in CNG it depends upon the availability of the compressor. The LPG tank pressures are at 2-7 bars atmospheric pressure whereas CNG tank pressure is 200 bars. The volume of LPG tank and weight is much more lighter than CNG tank. Due to weight of CNG tank a dead weightage is added into the vehicle. Heavy-duty vehicles use LPG in the liquid form and not in the vapour form and as such there is no loss of power whereas in CNG carburetors are used which reduces power by 20 per cent.

K Delhi Petrol Dealers Association

The representative from Delhi Petrol Dealer's Association presented a memorandum to the Authority requesting that the Authority should also consider the claim of other clean fuel like extra low sulphur High Speed Diesel before deciding about clean fuel. They requested that diesel should be considered as a workable fuel in NCT Delhi and it will provide better economics as the cost of the diesel bus is less than that of CNG bus and as such the charges will also be less. They pointed out that in all 322 petrol pumps are dispensing diesel in all parts of the city and if diesel is used as fuel there will be no question of any queue or time wasted in getting the tanks filled up in comparison to CNG.

A. PRESENTATION BY TERI

Dr. Ranjan K. Bose, Sr. Fellow, TERI made a presentation on clean fuels. The salient points of the presentation are as follows:

- i) It was suggested the Govt. may continue with the programme of introducing new CNG buses.
- ii) TERI was of the opinion that it may not be practical to only use CNG as a single mode fuel and, maintain and augment bus fleet strength. There is need to explore retrofit options of less than 8 year old diesel buses with DOC (diesel oxidation catalyst) with 500 ppm sulphur diesel. In case, CNG buses are not available in required numbers within the time frame, option could be to introduce new Euro II compliant diesel buses with DOC with 500ppm sulphur.
- iii) A comparative evaluation of exhaust emissions of Indian buses equipped with after exhaust treatment devices and powered by alternative fuels, like ULSD and CNG should be carried out.
- iv) True cost of supply of alternative fuels may be worked out.
- v) Institutional capacity to measure emissions of finer particles should be developed.
- vi) There is need to set emission norms for service providers.

B. Presentation by Dr. Dinesh Mohan

- i) The Authority should not prescribe the use of specific fuels. It can prescribe the emission standard for vehicles in use. This should be based on technologies available or expected in the future and a sound cost benefit analysis.
- ii) There is no agreement on the fuels to be used in a widespread manner even for Euro-IV and Euro-V standards in Europe. Therefore, we should not be opting for any one technology for the whole fleet. The fleet in Delhi should be replaced slowly with the best technology available with the manufacturers from year to year (say 10% per year). If we convert all our vehicle to one technology in 2001, we may land up with trouble in the future. We will also not be able to move to newer technology for another 5-10 years after that.
- iii) Very little research has been done on particles smaller than 2 microns and their effects on lungs and cells of the body. Scientists believe that some of the future technologies and fuels may increase the number of smaller particles and nanoparticles which may turn out to be very injurious to health. Very little medical evidence is available on these issues at present.

- iv) No technologies should be used which obstruct the use of low floor urban buses. The present retrofitting technology fits buses with cylinders under the floor. This method prohibits the introduction of low floor buses. CNG buses must use cylinders, which are fitted to the top of the buses so that the bus floor can be lower. Unless it is done we will never have an efficient bus system in Delhi.
- v) The bus fares cannot be higher than the use of two-wheelers. At present this is approximately 0.75 paisa per km. If the fare is higher than the running cost of two-wheelers, there would be an increase in use of two-wheelers. It has been estimated that if only 10% of present bus users shift to two-wheelers, it will be like adding 10,000 extra buses on the roads of Delhi. This will be bad for congestion, safety and pollution.
- vi) An expert committee must first decide what is the maximum cost of bus an operator can afford, based on the fare paying capacity of Delhi citizens. Then an estimate has to be made for the maximum subsidy that can be raised by the government of Delhi for public transport. This subsidy has to be raised from the car users of Delhi and may involve taxes based on the "polluter pays principle". We may have to institute a substantive increase in registration tax of cars and two-wheelers and may even have to charge a progressive transportation tax in Delhi. Based on these calculations and a cost benefit analysis, manufacturers could then be asked to provide the best technology for the specific costs and emission norms.
- vii) Providing bicycle tracks, walk ways etc., should be the integral part of strategy to control pollution.

CRITICAL POLLUTANTS AND HEALTH EFFECTS

The auto exhaust contains following pollutants:

- Sulphur Dioxide (SO₂)
- Nitrogen Dioxide (NO_x)
- Carbon Monoxide (CO)
- Particulates – Diesel particulates and Sulphur particulates
- PAH
- Volatile Organic Compounds like Benzene

Based on local ambient air quality, health effects of pollutants and availability of monitoring data, it was decided to consider CO, Particulates, PAH/Aromatics, Benzene and NO_x.

Sulphur Dioxide: During combustion the sulphur combines with oxygen to form sulphur dioxide gas and fine particles which is emitted in to the atmosphere with other products of combustion. Exposure to sulphur dioxide causes mucosal edema of airways, reducing the mucociliary activity leading to increased cough, lower respiratory tract infection (LRTI) and bronchitis.

The annual average concentrations of SO₂ ranged between 18 µg/m³ and 42 µg/m³. The long tem average SO₂ concentrations are fairly low as compared to national ambient air quality standard (NAAQS) of 60 µg/m³.

Nitrogen Dioxide: Nitrogen dioxide, the most toxic oxide of nitrogen is a deep lung irritant that damages the delicate cells of the lining of the lungs.

The annual average concentrations of Nitrogen dioxide vary between 59 µg/m³ and 75 µg/m³. Annual average concentration of NO₂ was below the NAAQS (60 µg/m³) during the year 2000. However, 24-hourly average value exceeded the NAAQS (80 µg/m³).

Carbon Monoxide: The symptoms of CO pollution are headache, dizziness, drowsiness, and nausea. The body systems most affected are the ones most dependant on a steady supply of oxygen: the brain, the heart, and in women the developing foetus.

The annual average concentrations of CO range between 39216 µg/m³ and 5587 µg/m³ during the period 1995 to 2000. The percentage violation of the NAAS (8-hourly average) was more than 70% during all the years of monitoring.

Particulates: The health effects of particulate pollution include an aggravation of bronchitis with preexisting respiratory illness, small but significant change in lung. Long term exposure cause damage to lung tissue, which contributes to chronic respiratory disease, cancer, and premature illness and death.

Annual average concentrations of particulates exceeded the NAAQS ($140 \mu\text{g}/\text{m}^3$) in all the years. Percentage violation of the NAAQS (24-hourly Average) was more than 95% in all the years.

Respirable Suspended Particulate Matter RSPM/PM₁₀: Annual average concentrations of RSPM ranges between 39% to 52% of the annual average concentrations of SPM. Annual average concentrations exceeded the NAAQS (Annual average $60 \mu\text{g}/\text{m}^3$) during 1998, 1999 and 2000. Percentage violation of NAAQS (24-hourly average) was more than 80% in 1999 and 2000.

Benzene : Long term exposure to benzene in air causes leukemia in human beings. Exposure to benzene is linked to genetic changes, increased proliferation of bone marrow cells and occurrence of certain chromosomal aberrations in humans and animals. The International Agency for Research on Cancer (IARC) has listed benzene as carcinogenic to humans. A number of noncancer health effects are associated with benzene exposure such as disorders of blood, harmful effects on bone marrow, anaemia and reduced abilities of blood to clot, damage to immune system and a reproductive and developmental toxicant

CPCB measurements carried out in August 98 and November, 98 show values in the range of $88\text{-}195 \mu\text{g}/\text{m}^3$.