

**For information**

**Comprehensive Control of Diesel Vehicle Emissions**

**Purpose**

At the request of the Legislative Council Panels on Environmental Affairs and Transport at their joint meeting on 23 June 2000, this paper provides the following information:

- (a) updated estimate on annual medical expenses and loss of productivity resulting from air pollution;
- (b) the basis of the projected reduction of respirable suspended particulates (RSP) and nitrogen oxides (NO<sub>x</sub>) levels in 2005, and effectiveness of the comprehensive vehicle emission control programme;
- (c) the projected improvements in 2005 after the introduction of the air pollution control measures;
- (d) the costs of various consultancy studies on air pollution issues;
- (e) whether the Administration will consider imposing mandatory air quality objectives in the Air Pollution Control Ordinance;
- (f) timetable for consultation with the industry on extending LPG vehicles to public light buses and other vehicles;
- (g) findings of risk evaluation studies on LPG vehicles; and
- (h) progress of discussion with motor vehicle suppliers on the provision of vehicle maintenance information.

**Estimated medical expenses and loss of productivity resulting from air pollution**

2. Based on the 1999 measured levels of major air pollutants and the methodology adopted in the “Study of Economic Aspects of Ambient Air Pollution on Health Effects”, it is estimated that the annual medical expenses and loss of productivity resulting from air pollution could amount

to about \$4.1 billion.

**Basis of the projected reduction in air pollution levels and effectiveness of the comprehensive vehicle emission control programme**

3. The projected reduction of RSP and NO<sub>x</sub> levels by 2005 are based on a package of on-going and new measures being implemented to reduce emissions from all categories of vehicles. These include:

- (a) replacing all diesel taxis with LPG taxis;
- (b) replacing all diesel light buses with cleaner alternatives;
- (c) retrofitting pre-Euro light diesel vehicles with particulate traps;
- (d) retrofitting pre-Euro medium and heavy diesel vehicles with catalytic converters;
- (e) implementation of Euro III standards for new vehicles; and
- (f) introduction of ultra low sulphur diesel.

4. Upon full implementation of the above measures, it is estimated that RSP and NO<sub>x</sub> emissions from the existing motor vehicle fleet could be reduced by about 80% and 30% respectively by end 2005.

5. The implementation of the above measures will also improve the ambient levels of RSP and nitrogen dioxide. Assuming that there is no major change in the background air pollution in the region, it is estimated that the ambient levels of RSP and nitrogen dioxide could be reduced by about 35% and 20% respectively by end 2005.

**Projected improvements in 2005 after the introduction of the air pollution control measures**

6. As mentioned in paragraph 5 above, it is estimated that the ambient levels of RSP and nitrogen dioxide could reduce by 35% and 20% respectively, or a reduction of RSP and nitrogen dioxide concentrations by 19 and 12 microgrammes per cubic metre of air respectively as compared with 1997.

7. Based on the methodology derived by the medical experts of the University of Hong Kong and the World Health Organisation, such reduction in pollutant levels could bring about 550 fewer avoidable premature death and 2,670 fewer hospital admissions per year, as compared

with those projected in the “Study of Economic Aspects of Ambient Air Pollution on Health Effects” conducted in 1998.

### **Costs of various consultancy studies on air pollution issues**

8. A list of the consultancy studies on effects of air pollution on health and their corresponding costs are given in **Annex A**.

### **Mandatory air quality objectives**

9. The Air Quality Objectives (AQOs) for seven major air pollutants established under the Air Pollution Control Ordinance in 1987 are statutory standards. Under the Ordinance, the Authority, who is the Director of Environmental Protection, is obliged to achieve the AQOs as soon as reasonably practicable and thereafter to maintain the air quality so achieved.

### **Trade consultation on extending LPG vehicles to public light buses and other vehicles**

10. The trial of LPG and electric light buses is scheduled to complete by end of this year/ early next year. Subject to the results of the trial, we will consult the trade on a proposal to replace all diesel light buses with LPG or electric vehicles. For diesel vehicles other than taxis and light buses, the Task Force to Improve Air Quality will consider the feasibility of various options of replacing these vehicles with cleaner alternatives.

### **Findings of risk evaluation studies on LPG vehicles**

11. The Electrical and Mechanical Services Department commissioned a study in 1998 on the risk on LPG vehicles. **Annex B** sets out the key findings.

### **Provision of vehicle maintenance information**

12. As regards the provision of vehicle maintenance information,

the Administration has discussed with the Motor Traders Association and the Service Managers Association on the release of information on the emission system of Pre-Euro diesel vehicles. The requested information was passed to the Government in July 2000. The information would be kept and maintained by the Vocational Training Council for easy access by the vehicle maintenance trade. The Administration consulted the trade through the Working Group on Vehicle Maintenance Services in August 2000, and the trade considered the information provided to be adequate in meeting their needs and was satisfied with the arrangement.

13. On maintenance information of petrol and Euro diesel vehicles, our research indicates that third-party publications covering different aspects of almost all running models of vehicles, e.g. ignition systems, braking system, carburetor and fuel injection systems, electric and air conditioning systems, are readily available in Hong Kong. There is at least a publisher which offers full sets of vehicle maintenance data for all running models. Similar to practice overseas, the public or the vehicle maintenance trade in Hong Kong could purchase such information from the publishers' local office or through the internet.

**Environment and Food Bureau  
September 2000**

### Costs of Studies on Health Effects of Air Pollution

<b>Title of Study</b>	<b>Cost</b>	<b>Completion date</b>
1. "Short-term Effects of Ambient Air Pollution on Public Health", Department of Community & Family Medicine & Department of Statistics, CUHK	\$480,000	September 1997
2. "Short-term Effects of Ambient Air Pollution on Public Health in Hong Kong – a follow-up Study", Department of Community Medicine, HKU	\$171,428	February 1998
3. "Study of Economic Aspects of Ambient Air Pollution on Health Effects", EHS Consultants Ltd.	\$389,633	April 1998
4. "Short-term Effects of Ambient Air Pollution on Public Health in Hong Kong – an APHEA-2 Study", Department of Community Medicine, HKU	\$125,000	May 1999
5. "Study of Ambient Air Pollution Effects – Hospital Admission & Mortality", EHS Consultants Ltd.	\$180,000	February 2000
6. "Design of Statistical System for Logging Air Pollution Related Disease", Hong Kong Air Pollution and Health Joint Research Group	\$180,000	March 2000
7. "Short-term Effects of Air Pollution on Morbidity of the General Population and the Associated Cost-of-illness", Hong Kong Air Pollution and Health Joint Research Group	\$300,000	In progress
Total cost:	\$1,826,061	

**Assessment of Risk on LPG Vehicles  
Key Findings**

**1. Hazards of LPG**

The LPG used in Hong Kong is a mixture of butane and propane gas that is held in liquid form under pressure. As a vehicle fuel, LPG is similar to petrol in that it requires a spark ignition engine. Compared to engines using conventional diesel, LPG produces lower emissions of pollutants, particularly small particulates.

If a fuel leak occurs, LPG is more volatile than diesel and more readily ignited. It burns with a very intense flame, and may cause explosions in some circumstances. On the other hand, compared to diesel fires, LPG does not produce significant amounts of smoke. Overall, the hazards of LPG require more careful management than diesel.

**2. Safeguards**

The use of LPG was investigated in a trial of 30 taxis and 4 filling stations in Hong Kong. The designs of LPG vehicles, filling stations and road tankers selected for Hong Kong include many safeguards intended to prevent accidental release of LPG and to mitigate them if they do occur. These safeguards match the best standards that are used world-wide for LPG vehicles.

One key safeguard is that LPG vehicles in Hong Kong will be original manufactured vehicles. Most difficulties and incidents that have occurred with LPG vehicles elsewhere in the world involved converted vehicles, which will not be used in Hong Kong.

The LPG facility designs have been subjected to detailed scrutiny to evaluate whether the safeguards are adequate to minimise the hazards inherent with LPG.

**3. Risks from LPG Vehicles on the Open Road**

For LPG vehicles on the open road, as for other types of vehicles, the fuel system contributes only a very small proportion of the total risk, which is dominated by impacts in road traffic accidents. Based on calculations in this study, LPG vehicles have slightly higher risks than diesel vehicles, but similar risks to petrol vehicles.

#### **4. Risks from LPG Vehicles in Tunnels**

For LPG vehicles in tunnels, there is a risk of explosions that is not present for diesel vehicles. An explosion of LPG that damaged the structure of a tunnel in Hong Kong would result in major disruption to traffic and would be very expensive to repair. For this reason, it would not be appropriate to introduce large numbers of LPG vehicles in Hong Kong if they had the potential to cause this type of damage.

Available models indicate that vehicles with LPG fuel tank capacity less than 65 kg have no potential to cause explosion damage to tunnel structures. This indicates that cars and taxis could be allowed through tunnels. On this basis, many tunnels world-wide have started to allow LPG cars to pass through, and it is considered that this would be acceptable in Hong Kong too.

For vehicles with LPG fuel tank capacity above 65 kg, the risk assessment study is being conducted.

#### **5. Risks from LPG Vehicles on Bridges**

In general for LPG vehicles on bridges, there is no significant additional hazard, and the risks would be no higher than for other types of vehicles.

#### **6. Risks from LPG Vehicles in Car Parks**

For LPG vehicles in underground car parks, there is again a risk of explosions. This could be controlled by a system of forced ventilation and avoiding small, enclosed parking areas. For LPG vehicles in multi-storey above-ground car parks, a similar potential exists. However, natural ventilation reduces the probability of an explosion occurring.

#### **7. Risks from LPG Vehicle Workshops**

Maintenance work on LPG vehicles involves a particular hazard of LPG leaks, and possible escalation to affect other vehicles and nearby premises. However, the risks from LPG vehicle workshops could be considered acceptable, provided that they were no greater than the risks from similar workshops handling other types of vehicles. This could be achieved by using high standards of safety management.