

**Panel on Environmental Affairs  
Follow-up Actions of the Meeting on 25 May 2013**

**Meeting to receive views on "Retirement of pre-Euro IV diesel commercial vehicles"**

*Item 3: to provide an information paper to explain the technical feasibility of retrofitting pre-Euro IV diesel commercial vehicles with emission reduction devices as an alternative to their phasing-out.*

**Reply**

This paper explains why retrofitting pre-Euro IV diesel commercial vehicles with emission reduction devices is generally not a practicable alternative to their phasing out for improving roadside air quality in protecting public health.

**Emission Performance**

2. Euro V standards are the prevailing emission standards for newly registered vehicles. Pre-Euro IV diesel commercial vehicles emit 5 to 34 times as much respirable suspended particulates (RSP) and 2.5 to 4.5 times as much nitrogen oxides (NO<sub>x</sub>) as their Euro V counterparts. The World Health Organisation (WHO) has declared diesel particulates carcinogenic and NO<sub>x</sub> is the main culprit causing the Air Pollution Index reaching very high level (i.e. exceeding 100). To upgrade the emission performance of pre-Euro IV diesel commercial vehicles to the Euro V level, their emissions of RSP will have to be reduced by 80% to 97% and NO<sub>x</sub> by 60% to 78%. Among these vehicles, a larger emission reduction is required for vehicles of more relaxed emission design standards. Details of their relative emission levels are at **Annex**.

**Emission Reduction Retrofit Technologies**

3. At present, there are no emission reduction retrofit devices that can be installed to a large number of pre-Euro III diesel commercial vehicles to upgrade their emission performance. As for Euro III diesel commercial vehicles, diesel particulate filters (DPFs) and selective catalytic reduction

devices (SCR)<sup>1</sup> could potentially upgrade their emission performance for RSP and NO<sub>x</sub> respectively. Local pre-Euro IV franchised buses have been retrofitted with DPFs while the installation of SCR has been carried out on selected bus models on a trial basis. However, these two devices together could be too large for retrofit onto Euro III diesel commercial vehicles. Even if space is not a constraint, these Euro III diesel commercial vehicles can hardly provide the conditions for these devices to function properly because of the constraints explained below. In the case of franchised buses, only some bus models can accommodate the installation of SCRs.

### Diesel Particulate Filters

4. To enable a DPF to function properly, the vehicle needs a high enough exhaust temperature (typically above 350°C) for the DPF to regenerate. Otherwise, it would be blocked, causing eventually pre-mature failure of the DPFs and in extreme cases, the vehicle engines. Many of the Euro III diesel commercial vehicles have been in operation for more than 10 years. As compared with franchised buses of the same age, these diesel commercial vehicles tend to have more severe engine wear and tear because their maintenance is more remedial than preventive. As such, their engine exhaust is unlikely to reach the very high temperature required for the proper functioning of a DPF.

### Selective Catalytic Reduction Devices

5. SCRs can perform properly only with the right amount of urea solution injected into the exhaust gas. An insufficient urea injection will compromise the operation of SCRs while an excessive injection of urea solution will risk blockage in the tailpipe leading to pre-mature failure of both SCR and the DPF upstream. In extreme cases, they will result in engine failures. The optimization of SCR injection will have to be conducted on a vehicle model basis, which is the reason why we need to conduct a 12 month trial of SCR retrofitting for suitable models of franchised buses before full implementation. The complications and challenges in ensuring effective installation and optimization of the SCR injection for some 650 Euro III

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<sup>1</sup> Provided with the right engine exhaust conditions, a DPF can reduce the particulate emissions of a diesel vehicle by typically 80% and an SCR can reduce the nitrogen oxides emissions of a diesel vehicle by typically 60%.

models of different design in the whole diesel commercial vehicle fleet are very substantial and may not be practical.

### **Conclusion**

6. In view of the above constraints, phasing-out of the pre-Euro IV diesel commercial vehicle fleet (excluding franchised buses which will be retrofitted with DPFs and SCR) is the only practicable way to bring quick relief to our air pollution for better protecting public health. The retrofit route is not viable for delivering clean air at our roadside.

**Environment Bureau/Environmental Protection Department  
September 2013**

**Comparison of Emission Performance of Diesel Commercial Vehicles  
of Different Vehicle Design Standards**

Vehicle Design Standards	Amount of Exhaust Emission Relative to that of Euro V Diesel Commercial Vehicles (Number of times)	
	RSP	NOx
Pre-Euro	34 (97%)	4.5 (78%)
Euro I	18 (94%)	4.0 (75%)
Euro II	7.5 (87%)	3.5 (71%)
Euro III	5 (80%)	2.5 (60%)
Euro IV	1	1.8
Euro V	1	1.0

Note: The figures in brackets are the emission reduction for achieving the Euro V level.