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Chief Council Secretary (1)1
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Legislative Council Complex,
1 Legislative Council Road, Central
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(Attn: Ms. Angel Shek)

17 February 2017

Dear Ms. Shek,

Panel on Environmental Affairs
List of follow-up actions

When discussing "Proposal to tighten emission standards of newly registered vehicles" at the meeting on 19 December 2016, Members requested the Administration to provide supplementary information. Please find our response at **Annex.**

If you have any query, please contact the undersigned at 2594 6401.

Yours sincerely,

(Dave Ho)

for Director of Environmental Protection

Encl.

Annex

a) Information on recent studies and findings on the emission performance of diesel private cars, and the latest developments on the control of diesel vehicles in the member cities of the C40 Cities Climate Leadership Group

Diesel vehicles emit considerable nitrogen oxides (NOx) and particulates during operation. The advancement of diesel emission control technology has been able to keep their particulate emissions at a low level. However, controlling their NOx emissions remains a significant technological challenge. This is particularly so for diesel cars under real-world driving, which incurs transient increases in engine load (e.g. uphill driving, acceleration on a ramp or accelerations from a standstill) or regeneration of diesel exhaust after-treatment systems[1]. It is not easy to keep the associated increase in NOx emissions at bay.

In recent years, a number of reputable organisations have found that Euro 3 to Euro 6 diesel cars that could meet the respective prescribed emission certification standards in a test laboratory emit substantially above the regulated limit in real-world driving[2]. Below are some of the findings:

i. the Netherlands Organisation for Applied Scientific Research (TNO) sponsored by the Dutch Ministry of Infrastructure and the Environment[3] has found, after testing the on-road NOx emission of 16 Euro 6 diesel cars, that their emissions were on average five to six times higher than the regulated limit;

ii. the Department for Transport of United Kingdom[4], after testing the on-road NOx emission of 19 Euro 6 diesel cars, has found that their emissions were on average over six times higher than the regulated

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1 Vicente Franco, Francisco Posada Sanchez, John German, and Peter Mock. "Real-World Exhaust Emissions from Modern Diesel Cars" The International Council on Clean Transportation, October 2014, pp. ii

2 Jens Gieseke, Gerben-Jan Gerbrandy , "DRAFT REPORT on the inquiry into emission measurements in the automotive sector (2016/2215(INI))", 5 December 2016, Committee of Inquiry into Emission Measurements in the Automotive Sector of the European Parliament, pp. 4

3 Gerrit Kadijk, Pim van Mensch, and Jordy Spreen, "Detailed investigations and real-world emission performance of Euro 6 diesel passenger cars" The Netherlands Organisation for applied scientific research, 18 May 2015, pp. 50

4 The Department for Transport of United Kingdom. "Vehicle Emissions Testing Programme", April 2016, pp. 23

limit;

iii. the International Council on Clean Transportation[1], an independent non-profit organisation, whose efforts helped reveal the Volkswagen defeat device incident, has found that the average on-road NOx emission of Euro 6 diesel cars could even breach the emission limit of Euro 3[5].

Concerned about the air pollution caused by diesel cars, Mayors of Paris, Mexico City, Madrid and Athens[6] signed at the C40[7] Mayors Summit held in Mexico City in December 2016 an Air Quality Declaration, committing to removing all diesel vehicles from their cities by 2025 to tackle air pollution. C40 has also called for the support across the world to join their campaign to reduce urban air pollution by signing a global petition[8] , demanding among others vehicle manufacturers to stop producing diesel vehicles by 2025.

Since 2010, more diesel cars have been added to the local private car fleet merely on compliance with the respective standard of the European Union for petrol private cars but not with the statutory California LEV standards. The number of registered diesel private cars tripled in about seven years from 2 066 in December 2009 to 7 278 in November 2016, much faster than the 35% growth of petrol private cars. The growth of diesel private cars in Hong Kong is expected to continue quickly in the coming years, thereby posing a significant risk to our roadside air quality.

It is worth noting that the on-road NOx emissions of petrol vehicles are generally below the regulated limits[9]; and are not considered in the international community as much a concern as diesel private cars provided that they are in compliance with the emission requirements in an emission certification test.

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5 Dr. Peter Mock. "European Vehicle Market Statistics Pocketbook 2014" The International Council on Clean Transportation, 2014, pp. 74

6 Anne Hidalgo, Miguel Ángel Mancera, Manuela Carmena and Giorgos Kaminis. "C40 MAYORS AIR QUALITY COMMITMENT", 1 December 2016

7 C40 is a network of the world's megacities committed to addressing climate change.

8 https://www.change.org/p/car-companies-time-to-end-diesel

9 Marina Kousoulidou et.al., "Use of portable emissions measurement system (PEMS) for the development and validation of passenger car emission factors" Atmospheric Environment, September 2012

b) Implementation progress and effectiveness of the Pilot Green Transport Fund, including whether any models of electric and/or hybrid vehicles under trial have been found suitable for introduction into Hong Kong

To encourage the transport sector (including operators of taxis, mini-buses, coaches and ferries) to try out green innovative transport technologies, the Government set up in March 2011 the $300 million Pilot Green Transport Fund (the Fund). Recipients of the Fund will have to record the trial data for evaluating the performance of the transport technologies concerned and to share their trial experiences for promoting a wider use of successful technologies.

As at end December 2016, the Fund approved 87 trials with a total subsidy of about $81 million. Among the trials, 47 and 34 were on electric vehicles (EVs) and hybrid vehicles respectively involving a total of 68 commercial EVs (taxis, light buses, coaches and goods vehicles) and 57 hybrid commercial vehicles (goods vehicles and light buses). In the case of EVs, 25 trials were completed and 15 trials were in progress with the remaining seven in preparation. As for hybrid vehicles, 13 trials were completed and 13 trials were in progress with the remaining eight in preparation. On the website of Environmental Protection Department (EPD), five final reports and 14 interim reports on EV trials were uploaded while the corresponding figures for hybrid vehicle reports are two and nine respectively.

<u>Electric Vehicles</u>

High production cost, limited service life, long charging time and low energy density of EV batteries are the key constraints for EV to take up commercial transportation duties. The low energy density of EV batteries is of particular concern to the transport trades because of the resultant reduced payloads – goods and passengers. This might explain why the transport trades have not been making greater use of the Fund to test out EV despite that the Fund can subsidise the price premium between the EV and its conventional vehicle or 50% of the cost of the EV, whichever is higher, and our active promotion of the Fund. Only those commercial vehicle operators, whose operation requirements are less intense or whose fleets are large enough to take up the slack of a few EV, have so far participated in testing out EV under the Fund.

Owing to the above challenges, all the electric taxis that were once trialed

under the Fund have been re-registered as private cars because a taxi under normal operation cannot spare about four hours a day for its charging. Electric light buses and coaches also have experienced similar problems. The electric light bus models that were trialed under the Fund could only sustain a driving range of 180 km after a full charge, which takes about two hours. In the case of the electric coaches under trial, the driving range varies from 200 km to 280 km after a full charge, which takes about four hours.

Electric light goods vehicles (LGV) generally do not operate round the clock and they undertake duties of various intensities. For those used in the logistic/courier business, they might incur high mileage and heavy payload. However, those used by schools/universities and non-profit organisations might have much lower mileage on a daily basis and might not need to tackle a heavy payload. Furthermore, their relatively low use intensity could allow top-up charging as necessary. Hence, we have made electric LGV a key focus of our promotion for the Fund.

For those commercial vehicle operators whose operation schedules can be met by EVs, using EVs could help save 41% to 91% of their energy cost on an individual vehicle basis as compared with their conventional counterparts.

Hybrid Vehicles

Hybrid vehicles could operate without charging up their batteries by an external source. Their operation is thus similar to that of conventional vehicles. The transport trades have thus less reservation about trialing hybrid commercial vehicles under the Fund. However, the hybrid commercial vehicle models on the local market are limited, with only two light goods vehicle models, two medium goods vehicle models and one hybrid light bus model, all of which have already been trialed under the Fund.

Higher fuel economy is the major merit of hybrid vehicles over the conventional vehicles, thereby reducing operating cost and air pollutant emissions. The fuel economy of a hybrid vehicle depends on the operation routes. A route requiring frequent start-stop will harness better the hybrid drive-train. If a route is dominated by highway driving, a hybrid vehicle can hardly outperform its conventional counterpart in fuel economy.

The above is confirmed by the trials undertaken under the Fund. It has been found that the hybrid goods vehicles incurred fuel expense saving ranging

from negligible to 39% as compared with their conventional counterparts whilst the corresponding figure for the hybrid light buses was about 3%. The latter was also affected by inadequate cooling for their batteries, which led to poor fuel economy performance.

As hybrid vehicles are more likely to take up local commercial transportation duties, we have also stepped up our efforts to promote their trials under the Fund.

Trial Experience Sharing

Apart from uploading the trial reports to the website of EPD, we also organise experience sharing sessions to share with the relevant transport sectors the trial results under the Fund. As at end December 2016, we held five experience sharing sessions.

In the light of the trial findings that electric light goods vehicles are likely suitable for taking up commercial transportation duties that are less intensive and that hybrid vehicles are comparable with their conventional counterparts in driving performance, we will step up the promotion for these two types of vehicles by –

i. encouraging more proactively commercial vehicle manufacturers to put on the local market their electric light goods vehicles and hybrid vehicles;

ii. organising more experience sharing seminars dedicated for the transport sectors that could use these vehicles in their operations.

c) A statistical analysis on the effectiveness of the Government's measures, in particular the control of vehicle emissions, in improving roadside air quality and reducing premature deaths caused by air pollution

To reduce vehicle emissions, the Government has a standing policy to tighten the statutory standards for vehicle fuels and the emissions of newly registered vehicles whenever it is practicable to do so. Stepped-up actions have also been taken in recent years to reduce the levels of roadside particulates (including respirable suspended particulates (PM_{10}) and fine suspended

particulates ($PM_{2.5}$)) and nitrogen dioxide, which are key air pollution challenges.

The stepped-up actions include –

i. phasing out via an incentive-cum-regulatory scheme some 82 000 pre-Euro IV diesel commercial vehicles by the end of 2019. Up to the end of 2016, about 49 700 pre-Euro IV DCVs (i.e. 61 % of the eligible vehicles) were retired under the scheme;

ii. retrofitting Euro II and III franchised buses with selective catalytic reduction devices and setting up franchised bus low emission zones at busy corridors in Causeway Bay, Central and Mong Kok; and

iii. screening out via roadside remote sensing equipment gross emitters from petrol private cars and liquefied petroleum gas (LPG) vehicles for their owners to fix the excessive emission problem and using dynamometers to ascertain the effectiveness of the repair.

These actions have borne fruits. As compared with 2012, the roadside levels of nitrogen dioxide, PM_{10} and $PM_{2.5}$ in 2016 were reduced by 31%, 28% and 28% respectively. These improvements should help reducing the health risk to the public. As to the quantification of the health risk reduction, we have commissioned the Chinese University of Hong Kong to develop "a methodology suitable for evaluating and quantifying the adverse health outcomes of air pollution and their associated costs". The study is now being finalised and its findings will be used in the current Air Quality Objective (AQO) Review for analysing the health and associated economic impacts of air pollution. We will report to the Panel on the findings in due course alongside other findings of the AQO review.

d) Detailed information on the support provided to the vehicle maintenance trade to complement the measure of tightening the vehicle emission standards to Euro VI, including the number of vehicle maintenance seminars held/planned to be held, the existing and projected numbers of vehicle maintenance shops and vehicle mechanics equipped with the required maintenance skills and knowledge before implementation of the Euro VI emission standards

To help the vehicle maintenance trade repair commercial vehicles equipped with advanced diesel engines, EPD, in conjunction with vehicle manufacturers, the Vocational Training Council and commercial vehicle repair associations representing medium and small vehicle repair workshops (including Hong Kong Vehicle Repair Merchants Association and Hong Kong Commercial Vehicle Maintenance Association) have been conducting technical seminars on advanced diesel engines. Suppliers of engine lubricants and diesel injection equipment, which are essential aspects of advanced diesel engines, have also given talks in the technical seminars,

EPD advertised the seminars on newspapers, direct mailing to vehicle repair workshops and through the afore-mentioned repair associations. Since 2015, about 1 200 vehicle mechanics have attended seven technical seminars. The repair trade found the seminars useful and has requested EPD to continue holding these seminars. As for 2017, EPD plans to hold six seminars. Details of these seminars are in Appendix. The seminar materials will be made available on EPD's web site for the mechanics and public.

Appendix

Information on the Seminars and Co-organising Companies/Organisations

Seminars

Date	Topic
30/4/2015	Technical Seminar: Proper Maintenance of Heavy Duty Commercial Vehicles of Euro IV and V Emission Standards (Shell, Scania, Hino)
21/5/2015	Technical Seminar: Proper Maintenance of Heavy Duty Commercial Vehicles of Euro IV and V Emission Standards (Shell, Scania, Hino)
27/11/2015	Technical Seminar on Emission Control System of Diesel Commercial Vehicles of Euro V and VI Emission Standards : Scania, Crown, IVECO, MAN
11/8/2016	Technical Seminar on Proper Maintenance of Common Rail Diesel Injection System for Vehicle Emission Reduction : Bosch
20/10/2016	Technical Seminar: Heavy Duty Vehicle Repair, Maintenance and Free Emission Test (EPD/IVE/HKVRMA/HKCVMA)
22/10/2016	Technical Seminar: Heavy Duty Vehicle Repair, Maintenance and Free Emission Test (EPD/IVE/HKVRMA/HKCVMA)
8/11/2016	Technical Seminar: Heavy Duty Vehicle Repair, Maintenance and Free Emission Test (EPD/IVE/HKVRMA/HKCVMA)
24/02/2017	Technical Seminar on Diesel Commercial Vehicles: Volkswagen
16/03/2017	Technical Seminar on Diesel Commercial Vehicles: Mercedes Benz
20/4/2017	Technical Seminar on Diesel Commercial Vehicles: Mitsubishi Fuso
May/2017	Technical Seminar on Diesel Commercial Vehicles: Hino
June/2017	Technical Seminar on Diesel Commercial Vehicles: MAN
Sept/2017	Technical Seminar on Diesel Commercial Vehicles: IVECO

Co-organising companies and organisations

Vehicle Manufacturers / Dealers	Crown, Hino, IVECO, MAN, Mercedes Benz, Mitsubishi Fuso, Scania, Volkswagen
Fuel/Lubricant Supplier	Shell
Injection Equipment Specialist	Bosch
Repair Trade Associations	Environmental Vehicle Repairers Association Limited (EVRA) Hong Kong Commercial Vehicle Maintenance Association Limited (HKCVMA) Hong Kong Vehicle Repair Merchants Association Limited (HKVRMA)
Professional Organisations	The Hong Kong Institution of Engineers (HKIE) The Institute of The Motor Industry Hong Kong (IMI HK) Society of Operation Engineers (Hong Kong Region) Limited (SOE HK) SAE International (Hong Kong) Limited (SAE-HK)
Training Institution	Vocation Training Council: -Jockey Club Heavy Vehicle Emissions Testing and Research Centre -Pro-Act Training and Development Centre (Automobile)