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Clerk to Panel on Environmental Affairs
Legislative Council Building
8 Jackson Road
Central
Hong Kong
(Attention: Miss Becky YU)

11 May 2009

Dear Miss YU,

Panel on Environmental Affairs
Subcommittee on Improving Air Quality
Comments on the paper entitled "Air Pollution and Public Health" submitted by Professor Hedley to the meeting on 12 February 2009

The captioned paper has analyzed our air quality monitoring data to examine the trend of the air pollution levels of Hong Kong – the past and the future. Some of its analysis findings do not tally with the monitoring data and has hence led to invalid conclusions on the air quality trend. We would like to provide for Members' information the attached Annex, which sets out the relevant air quality data and our assessment of the air quality trend.

Yours sincerely,

(Dave Ho)
for Director of Environmental Protection

Annex

Response to the paper "Air Pollution and Public Health" Submitted by Professor Anthony J Hedley to the LegCo SubCommittee for Improvement Air Quality on 12 February 2009

Purpose

The paper entitled "Air Pollution and Public Health", which was submitted to the meeting of the LegCo SubCommittee for Improving Air Quality on 12 February 2009, examined, among other things, the air quality trend of Hong Kong, based on the air quality monitoring data of our air quality monitoring network. However, the following observations in the paper on the roadside respirable suspended particulate (RSP) trend do not tally with our monitoring data:

(a) section 9.1 of the paper suggested that the roadside RSP level during cool season rose by 84.5% from 1999 to 2008. The relevant air quality monitoring data over the same period showed that the roadside RSP level decreased by 16% ;

(b) the same section of the paper commented that the 2003-2008 roadside RSP level rose by 33%. The relevant air quality data showed that the RSP level decreased by 10%.

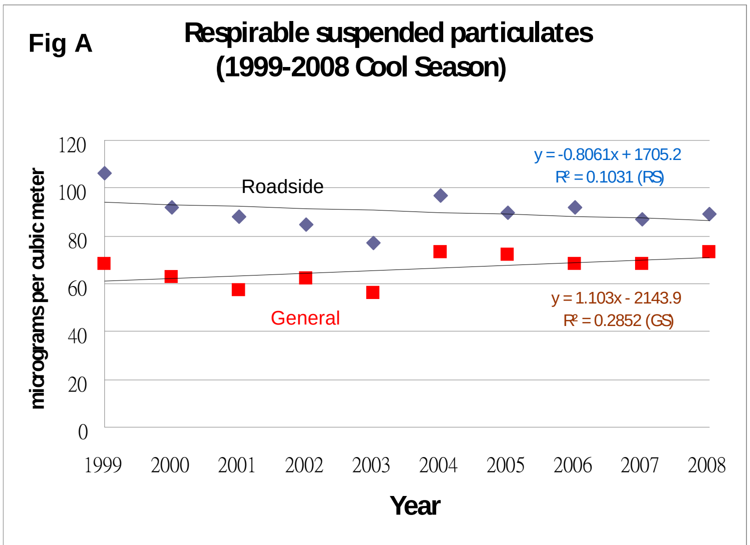
The above deviations made some of the conclusions in the paper invalid. The note sets out the relevant air quality monitoring data and our assessment of the trend.

2. Roadside RSP Levels

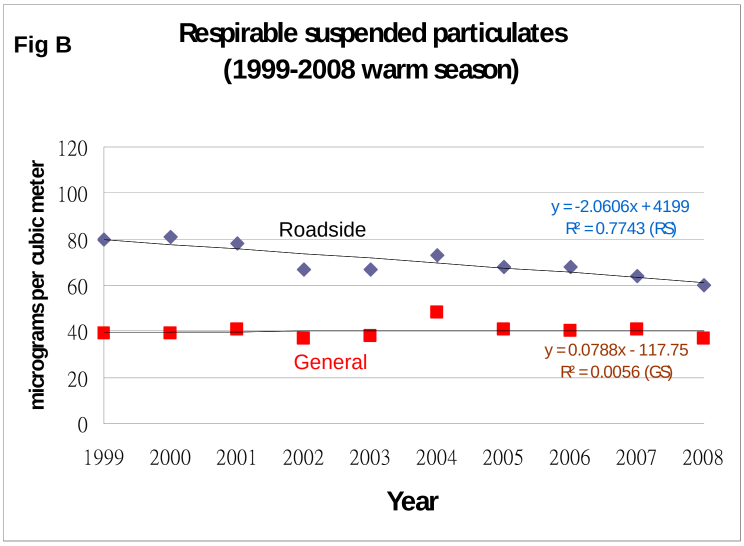
2.1 Section 9.1 of the paper rightly shows that the RSP level at roadside over the last 10 years has exhibited a clear downward trend. However, the second paragraph of Section 9.1 mentions that *"An examination of the 1997 -2008 cool season* (Oct to Mar according to Section 2.5 of the paper) *trends show an **<u>84.5% increase</u>** at **<u>roadside</u>** stations…………….(Figure 10)"* This observation does not tally with our air quality monitoring data, on which the observation had been made.

2.2 We have plotted our air quality monitoring data for the same cool season in the same period in Fig A below. Instead of rising by 84.5%, the roadside RSP level over the period from 1999 to 2008 decreased by 16% . In addition, we have plotted RSP level for the warm season, Fig B, in the same period. The same decreasing trend is also observed in Fig B for the warm season but to a larger extent. The greater decrease for the warm season is due to Hong Kong being exposed to a higher regional background RSP in winter. The higher RSP background level could offset some of the reduction in local vehicle emissions. The effectiveness of our local vehicle emission control measures in reducing RSP can be better reflected by the trend in the warm season when the regional background pollution is lower.

Fig A and Fig B prepared by EPD

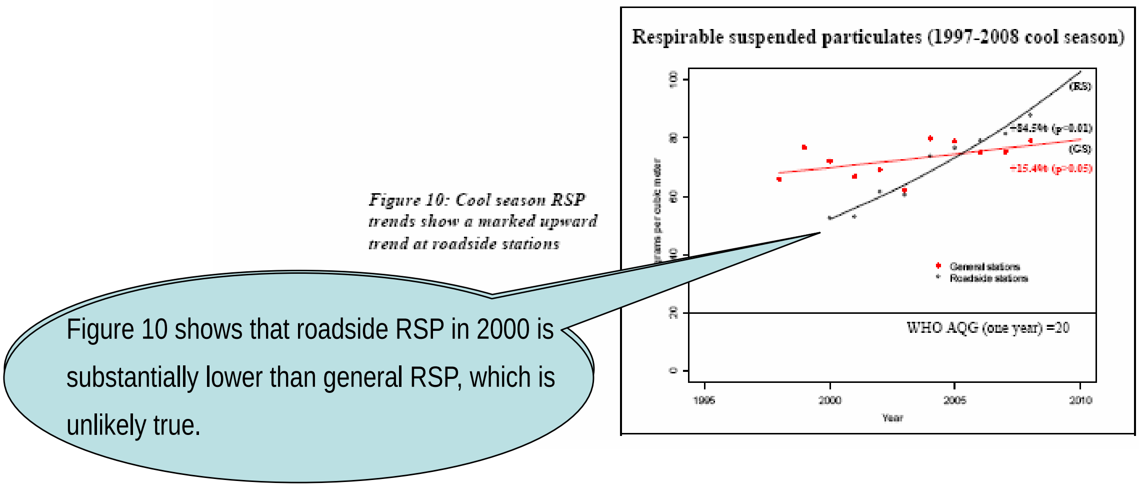


Note : The Mongkok roadside station was built in 2001 and data are not available for 1999 and 2000. As such, the roadside RSP concentrations are based on data from the remaining two roadside stations, namely the Causeway Bay and Central roadside stations.



Note : The Mongkok roadside station was built in 2001 and data are not available for 1999 and 2000. As such, the roadside RSP concentrations are based on data from the remaining two roadside stations, namely the Causeway Bay and Central roadside stations.

Fig 10 of Professor Hedley's paper



2.3 Fig 10 of the paper also has an inexplicable anomaly – the RSP levels at roadside in 2000 and 2001 were substantially lower than those at general air quality stations. This again contradicts the air quality data as shown in Fig A as well as our observation that, because of the proximity of roadside air quality monitoring stations to vehicles, a main source of RSP emissions, their monitored particulate levels are higher than those of general air quality stations.

2.4 The same section of the paper also mentions that "*the recent roadside quarterly means from 2003 to 2008 show a steep upward slope (33%)… (Figure 11).*" This observation also contradicts our monitored data, which are set out in Fig C and show a declining trend from 2003 to 2008. Moreover, Fig 11 again shows some general air quality readings higher than roadside readings for the period from 2003 to 2005, which we believe is anomalous.

Fig 11 of Professor Hedley's paper

Figure 11: Recent years show a clear upward trend for RSP at roadside stations

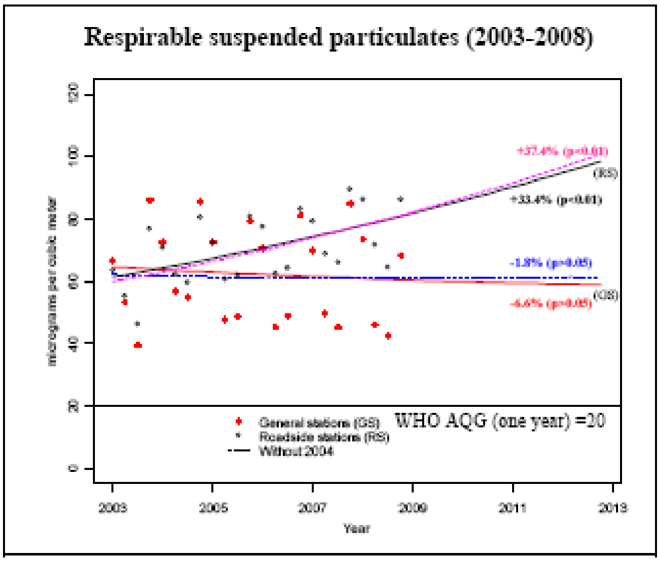
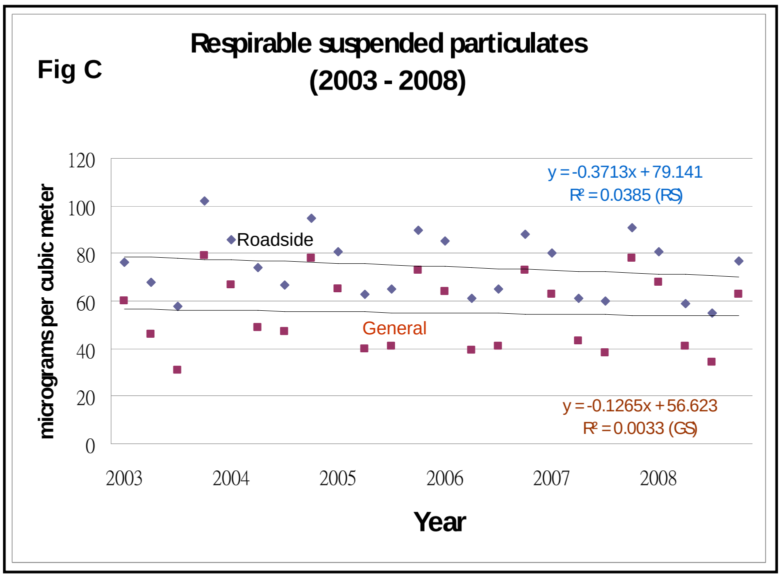


Fig C prepared by EPD



3. Air Quality Trend

3.1 Professor Hedley's paper predicts the future air quality by extrapolation of past air quality data (e.g., first paragraph of Section 9.1, third paragraph of Section 9.2). The underlying assumption of this prediction method is that time is the only factor that affects future air quality. Other relevant factors such as future changes in emission levels and introduction of new emission control initiatives are not taken into account. To provide a more realistic picture of future air quality, one has to make use of air quality modelling taking into account all relevant future developments as what the AQO review consultant has done.

3.2 Regarding the air quality trend of past years, the most common method adopted by the professionals is to examine the long-term variations of the annual average concentrations of pollutants. The annual averages of pollutants measured at the general and roadside stations over the last 10 years from 1999 and 2008 are at Appendix 1.

3.3 There are a number of reasons for choosing 1999 as the starting year for trend analysis. The government has implemented a host of measures to cut vehicular emissions after 1999, such as the LPG taxis incentive programme, the introduction of ultra low sulphur diesel (ULSD), the incentive programme to retrofit old diesel vehicles with particulate traps, the tightened smoky vehicle control programme and higher penalty for smoky vehicles, the Euro III standard, etc. As compared with 1999, these measures had reduced the emissions of RSP, NOx, SO2 and VOCs from motor vehicles by 24% to 81%. It is thus reasonable to assess the impact of such measures by comparing the roadside air quality changes from 1999, i.e., the year before such strong intervention. Moreover, the Central roadside station came into operation only in end 1998 so 1999 is the first year in which full year data for Central roadside station were available. Similarly, a number of general stations came into operation in 1999, including the important station at Tung Chung for tracking regional air pollution. 1999 is the first year in which all the 11 general stations were fully operational.

3.4 Over the years, the Government has also been implementing a wide range of measures to cut the emissions from other local sources. For example, we have tightened the sulphur content of industrial diesel progressively from around 2.5% before 1990 to 0.005% (ultra low sulphur diesel) in 2008. The sulphur content of the motor diesel being used in Hong Kong has been further reduced to 0.001%. We have been imposing stringent licensing control on power plants requiring them to adopt the Best Practicable Means to minimise emissions. We have required all new power generation units built after 1996 to be gas-fired and imposed emission caps on power plants since 2005. We have introduced regulations to cut the emissions of volatile organic compounds (VOCs) from various consumer products. As a result, between 1990 and 2007, the emissions of sulphur dioxide (SO2), nitrogen oxides (NOx), respirable suspended particulates (RSP) and VOCs in Hong Kong had reduced by 35% to 55%.

General (Ambient) air quality trend

3.5 From Appendix 1, there have been general rising trends in RSP, ozone (O3) and SO2 levels in the ambient air since 1999 due to the influence from regional air pollution but the worsening trends have leveled off or reversed over the last 5 years, thanks to the control measures taken by the Guangdong Provincial Government in recent years, such as the implementation of flue gas desulphurization programme for the power sector, the introduction of cleaner motor vehicle fuels and standards, etc..

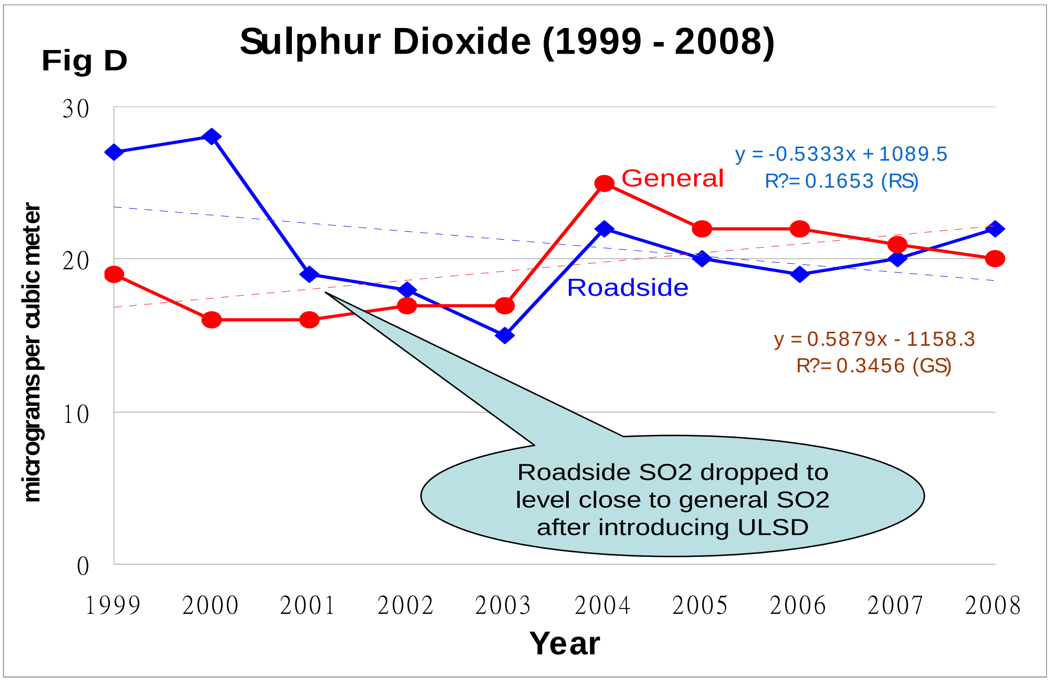
Roadside air quality trend

3.6 From Appendix 1, there have been discernible reductions of major air pollutants at the roadside, thanks to the vehicle emission control measures implemented after 1999. Between 1999 and 2008, the RSP, NOx and SO2 have reduced 22%, 23% and 19% respectively.

4. Further Evidence of Improvement in Roadside Air Quality

Reduction in Sulphur Dioxide Concentration at Roadside

4.1 The SO2 concentration at roadside was substantially higher than that in the ambient air a decade ago. With the introduction of the ultra low sulphur diesel (ULSD)[1] in 2000/2001, which reduced the sulphur content of motor vehicle diesel by 86%, the roadside SO2 concentrations have reduced to levels that are comparable with the ambient SO2 concentrations (Fig D). The subsequent trend of roadside SO2 has been mainly dominated by the ambient SO2 levels. Despite a subsequent rise in SO2 after 2003 due to the worsening of regional air quality and the use of more coal for power generation in Hong Kong, the roadside SO2 concentration is still some 20% lower than the level in 1999 before the intervention.

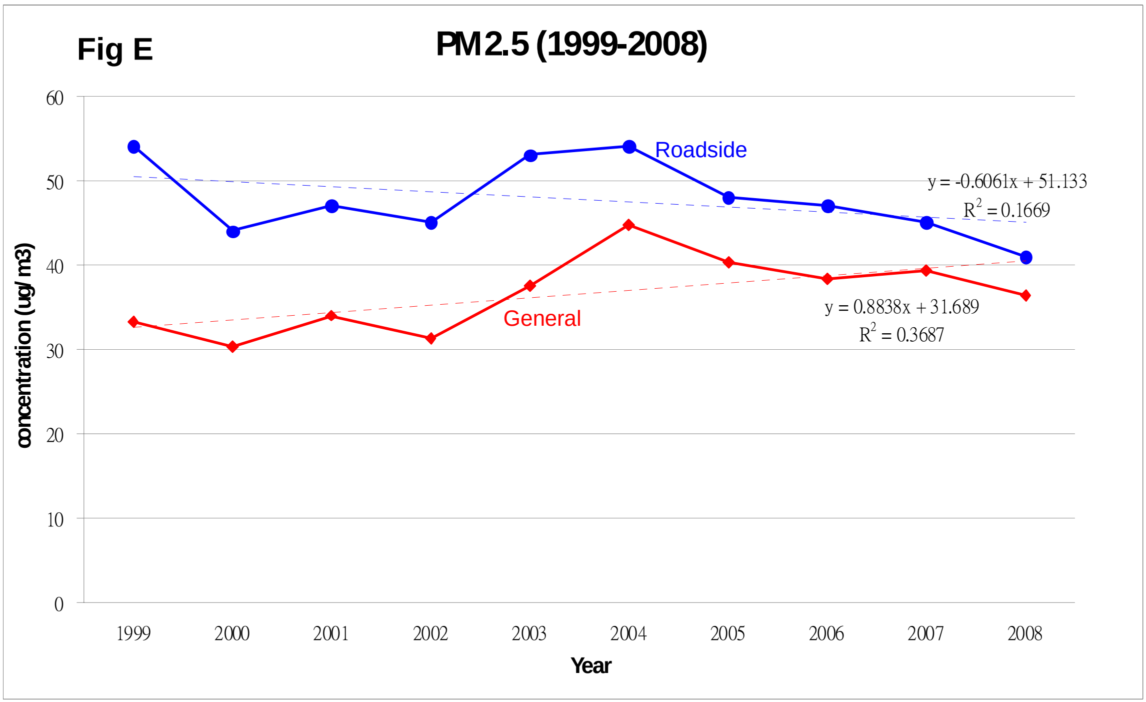


Reduction in PM2.5 concentration at roadside

4.2 Motor vehicle emissions are a major source of PM2.5. EPD has been measuring PM2.5 at three general stations and the Central roadside stations from 1999 to 2008. Figure E shows that the roadside PM2.5 concentration has dropped over the years and the level is now close to the ambient PM2.5

[1] The sulphur content of ULSD is capped at 0.005 %, about 1% of that of industrial diesel at the time.

concentration. This shows that the particulates emissions from vehicles have been substantially reduced by the measures implemented over the years.



Reduction in Carbon Particles at Roadside

4.3 Carbon particles (elemental and organic carbons) at the roadside mainly come from vehicle emissions. On a project basis, EPD launched two 12-month studies of PM2.5 in 2001 and 2005 at various sites, including the Mong Kok roadside station. The measurement shows that the carbon concentrations at the roadside site dropped by 30% between the 4-year period.

Environmental Protection Department
May 2009

Appendix 1

Annual Averages of Major Pollutants 1999 – 2008 (μg/m³)

		1999	2000	2001	2002	2003	2004	2005	2006	2007	**2008**
RSP	General	52	48	51	46	54	60	55	54	55	**51**
	Roadside	91	84	84	74	79	83	78	79	77	**71**
NOx	General	114	113	112	101	102	106	103	102	99	**99**
	Roadside	452	415	404	380	347	342	375	364	342	**349**
NO_2	General	57	52	55	50	53	58	52	52	53	**53**
	Roadside	99	96	100	92	94	99	97	96	95	**99**
SO_2	General	18	16	16	17	17	25	22	22	21	**20**
	Roadside	27	28	19	18	16	22	21	19	21	**22**
O_3	General	34	32	36	36	40	43	35	36	37	**39**