Legislative Council
Panel on Environmental Affairs

Supplementary Information
on the Study of Air Quality in the Pearl River Delta Region

Purpose

This paper provides Members with further information on the proposed "Study of Air Quality in the Pearl River Delta Region" (the Study).

Background

2. At the Panel's meeting on 11 September 1998, Members were advised of the Administration's proposed joint study with Guangdong Province on the air quality in the Pearl River Delta Region (the Region). The Study aims to identify the air quality problems in the Region, project trends into the future, assess their impacts and propose the necessary preventive and control measures. Members noted our intention to apply to the Finance Committee for $15 million to conduct the Study.

3. During discussion of the proposed study, Members requested for additional information including the air quality in Hong Kong and Guangdong, air pollution control measures taken by both sides, the need for carrying out the Study, the detailed scope and budget of the Study, and the implications of the study findings on the air pollution control works in Hong Kong and Guangdong.

Air Quality in Hong Kong and Guangdong

4. The Environmental Protection Department (EPD) has long been monitoring the air quality of Hong Kong. Since the promulgation of the Air Quality Objectives in 1989, a series of air pollution control measures have been put in place, including the restriction of sulphur content in industrial fuels and the licensing control of major air polluters which led to an improvement in the air quality of Hong Kong. However, suspended particulates and nitrogen dioxide in the ambient air are still

found not to be in compliance with the Air Quality Objectives (Enclosure 1). We have also found that the photochemical smog problem is deteriorating. Ozone, being the major component of photochemical smog, reached the highest hourly average concentration of 314mg/m^3 in 1996 as compared with the Air Quality Objective of 240mg/m^3. The annual average concentration of ozone also increased from 18mg/m^3 in 1990 to 30mg/m^3 in 1997 (see Enclosure 2). Hong Kong's visibility also deteriorated significantly during the same period, possibly due to the photochemical smog problem (see Enclosure 3).

5. In Guangdong Province, their 1997 monitoring data revealed that the pollution problem of nitrogen oxides was becoming more significant in the Region. Six cities in the Province, namely, Guangzhou, Foshan, Zhuhai, Dongguan, Shenzhen and Jiangmen, the levels of nitrogen oxides were found not in compliance with the national standard. In Guangzhou, the level of total suspended particulates was also found not in compliance with the national standard. The levels of ozone and respirable suspended particulates (RSP) in the Guangdong Province are not available since they are not regularly monitored at present.

Air Pollution Preventive and Control Measures in Hong Kong and Guangdong

6. Apart from carrying out the existing pollution control measures to deal with the air pollution problems in Hong Kong, we have also implemented an integrated vehicle emission control strategy, including the use of clean alternatives to diesel vehicles, stringent vehicle emission and fuel standards, strengthening emission inspection, and enforcement against smoky vehicles, education and publicity.

7. For the Guangdong side, they have established the environmental objectives of implementing initial control of air pollutants released from vehicles by 2000, and effective control of air pollution problems caused by vehicle emissions by 2010. To achieve these objectives, all petrol vehicles in Guangzhou and Shenzhen are now using unleaded petrol, and vehicles using liquefied petroleum gas are now on trial. Leaded petrol will be banned from use in the Region in 1999, and the ban will be extended to the whole Province in 2000. In addition, the State will also devise a series of control measures, including more stringent emission standards for newly manufactured vehicles, promoting

the phasing out of out-dated manufacturing technologies and industries, legislation on controlling motor vehicle emissions, model type-approval system for newly registered vehicles, regular inspection and maintenance of the registered in-use vehicles, strengthening the control of vehicles which are not in compliance with the emission standards, and mandatory disposal of aged vehicles etc.

The Need for the Study

8. In order to comprehend the imperative need for the Study, it is necessary to understand the causes and characteristics of the major air pollutants in the Region.

9. For Hong Kong, our major concern is pollution problems caused directly or indirectly by the emissions of motor vehicles, including photochemical smog, nitrogen dioxide and RSP.

10. Photochemical smog is different from other air pollutants as it is not directly released into the atmosphere from pollution sources. It is formed under sunlight through a series of complicated chemical reactions among a mixture of gases emitted from different sources. The whole process takes some time to complete as it involves a mixture of different gases and depends on the intensity of sunlight. As the gases disperse during the formation period, the area affected by photochemical smog is usually much more extensive and is farther away from the pollution sources. Change in weather conditions would have significant impact on the formation and intensity of photochemical smog.

11. Numerous types of gases and their respective sources are involved in the formation of photochemical smog. Nitrogen oxides and volatile organic compounds are the two main classes of gases involved. Their respective sources are emissions from fuel-consuming industrial plants or vehicles and, for volatile organic compounds, facilities like petrochemical works, food industries, chemical plants and landfills. Natural woodland and vegetation are also sources of photochemical smog.

12. Nitrogen dioxide is formed by oxidation of the nitrogen oxides in air during the combustion of fuels. Emissions from vehicles and power plants are the major sources of nitrogen dioxide in the Region. As nitrogen dioxide is also involved in photochemical reactions, it is

necessary to understand the pollution problems of all nitrogen oxides (including nitrogen dioxide) in the study of photochemical smog.

13. RSP is formed directly from the combustion of fuels by vehicles and power plants. It can also be formed in the atmosphere by other physical and chemical means. Photochemical reaction is one such important mechanism in urban areas.

14. Although there is some preliminary evidence showing that photochemical smog problems exists in the Region, it is still necessary to carry out a comprehensive study to collect specific information in the Region, so as to assess the seriousness of the problem and the pollution sources, in order to formulate effective preventive and control measures. Given the characteristics of photochemical smog stated above, it is necessary to study the distribution of pollution sources, their emission levels and the effects of different gases in the photochemical reaction, in order to identify the targets and devise preventive and control measures. As photochemical reaction is a very complicated process, advanced prediction models are usually used for evaluating the future trend of the problem and the effectiveness of the measures identified. Similar studies have been carried out in many advanced countries for the formulation of specific and highly effective preventive and control measures.

15. As photochemical smog relates closely with nitrogen dioxide and suspended particulates, the proposed study will be conducted in such a way that the pollution problems caused by these pollutants are investigated in parallel for better utilization of resources.

Study Area

16. Geographically, the Study covers the Pearl River Delta Economic Zone and the Hong Kong Special Administrative Region. The Pearl River Delta Economic Zone, which includes Guangzhou, Shenzhen, Zhuhai, Dongguan, Zhongshan, Foshan, Jiangmen, and Huicheng, Huiyang, Huidong, Boluo of Huizhou, and Duanzhou, Dinghu, Gaoyao and Sihui of Zhaoqing, covers an area of 55,000 km^2 (approximately 30% of the Province) with a population of 21 million people (approximately 31.5% of the Province).

17. According to the 1993 statistics of Guangdong Province, the emissions from the Region constitute about 57% of the total emissions

from the Province. As the emissions outside the Region are comparatively low and more dispersed, the proposed study area will have covered the major sources of pollution problems in the Region caused by nitrogen dioxide, photochemical smog and suspended particulates. The pollution sources outside the Region have only minor effect on the air pollution problems in the Region.

Detailed Scope of the Study

18. We suggest to engage external services for the Study. The detailed scope of the Study includes:

(a) Collecting and Collating Baseline Information

This part of the Study is expected to take about 12 months to complete which will comprise the following tasks:

(i) collecting baseline air quality information such as the levels of nitrogen oxides, suspended particulates and ozone monitored in Hong Kong, and the levels of nitrogen oxides and suspended particulates monitored in Guangdong, in order to understand the state of air quality and the trend of pollution in the Region. Relevant meteorological information will also be collected from the relevant departments/authorities to study the effects of meteorological conditions on the formation of photochemical smog;

(ii) collecting information from relevant government departments/authorities as well as industrial and commercial establishments in public and private sectors in Hong Kong and Guangdong on the distribution of pollution sources, emission levels, production technologies and existing mitigation measures, etc. Information like the distribution of population and vegetation, land uses, transport networks as well as activities in the sectors of transport, industry, commerce and household in the Region will also be collected. The above information will be used in estimating the intensity of various emission sources. Besides desktop study on the archived data and

publications, surveying and statistical analysis will also be required;

(iii) collecting information from relevant government departments/authorities and research institutions about policy and legislation, management, and technical standards on pollution control and land uses, as well as projections on transport planning, social development, population growth and energy demand, etc. The information will be used in estimating the future emission levels of gases involved in the formation of photochemical smog in the Region; and

(iv) after collecting the above information, it is necessary to collate, quantify and digitise the data acquired. An emission inventory for the existing and future situations will be constructed for use in the prediction models.

(b) Monitoring and Analysis

This part of the Study is expected to take about 6 months to complete which include carrying out monitoring and sampling work in the Region to measure air quality and the relevant meteorological information at different times, locations and altitudes. This will provide information on those essential items which are currently not available, for example the distribution of ozone level, as well as the level and composition of volatile organic compounds in the Region.

(c) Evaluation and Future Projection

This part of the Study is expected to take 6 months to complete which include the use of prediction models with those baseline and additional information collected from the other two parts of work mentioned above to predict future air pollution situations up to 2010. Recommended pollution preventive and control options will also be devised based on the actual situations of Guangdong and Hong Kong, with reference to the local and overseas experiences. In addition, a comprehensive implementation plan will also be prepared for the optimised preventive and control strategy together

with an air quality monitoring plan for assessing the effectiveness of the strategy.

19. Certain parts of the Study will be carried out simultaneously in order to expedite the Study. Subject to the availability of fund, the Study will commence in April 1999. It will last for 18 months and be completed by the end of 2000.

Budget

20. The budget of the Study is HK$15 million. The breakdown of the estimates is in Enclosure 4.

Implications of the Study

21. Both Guangdong and Hong Kong have agreed to share the responsibilities, the work and the findings arising from the Study. The Guangdong side has provided valuable input when the outlines of the Study were drafted. They fully understood and consented to the scope and the purposes of the Study. During the study period, experts from Guangdong side will also provide information, assistance and advice in areas of methodology, data collection, model validation, and formulation of preventive and control strategy. The findings of this study, together with the findings of the acid rain study to be conducted by the Guangdong side, will be incorporated into a joint report to be submitted to the Hong Kong-Guangdong Environmental Protection Liaison Group for consideration and approval. The report will assist in the formulation of future control strategies to tackle air pollution in the Region.

Planning, Environment and Lands Bureau
October 1998

Enclosure 1

Compliance Status of Air Quality Objectives

Pollutants	Air Quality Objectives	89	90	91	92	93	94	95	96	97
Total Suspended Particulates	24 hours			✓		✓				✓
	Annual									
Respirable Suspended Particulates	24 hours		✓	✓	✓	✓	✓		✓	✓
	Annual									
Sulphur Dioxide	1 hour		✓	✓	✓	✓	✓	✓	✓	✓
	24 hours		✓	✓	✓	✓	✓	✓	✓	✓
	Annual		✓	✓	✓	✓	✓	✓	✓	✓
Nitrogen Dioxide	1 hour			✓	✓	✓	✓	✓	✓	
	24 hours									
	Annual	✓	✓	✓	✓	✓		✓	✓	
Carbon Monoxide	1 hour	✓	N/A	✓	✓	✓	✓	✓	✓	✓
	8 hours	✓	N/A	✓	✓	✓	✓	✓	✓	✓
Ozone	1 hours	✓	✓	✓	✓	✓	✓	✓		✓
Lead	3 months	✓	✓	✓	✓	✓	✓	✓	✓	✓

Note: ✓ **Compliance with Air Quality Objective**

Non-compliance with Air Quality Objective

N/A **Insufficient data**

Enclosure 4

DETAILS ABOUT STUDY FEES

Breakdown of estimates for study fees

Study team's staff costs		Estimated man months	Average MPS salary point	Multiplier factor	Estimated fee ($ million)
(a) Collection of baseline information					
(i) Collection of information	Professional	6	40	3.0	1.13
	Technical	18	16	3.0	1.14
(ii) Collation of information	Professional	12	40	3.0	2.26
	Technical	12	16	3.0	0.76
	Sub-total				5.29
(b) Monitoring and analysis					
(i) Field work	Professional	4	40	3.0	0.75
	Technical	32	16	3.0	2.02
(ii) Data analysis	Professional	8	40	3.0	1.51
	Technical	4	16	3.0	0.25
	Sub-total				4.53
(c) Evaluation and future projection					
(i) Conducting of mathematical modelling	Professional	4	40	3.0	0.75
	Technical	8	16	3.0	0.50
(ii) Evaluation of control measures	Professional	8	40	3.0	1.51
	Technical	4	16	3.0	0.25
	Sub-total				3.01
Total staff costs					12.83

Out-of-pocket expenses (for item (b) above)

(a)	Hiring of equipment	1.00
(b)	Travel and accommodation	0.30
(c)	Sampling and chemical analysis	0.50
	Total out-of-pocket expenses	1.80

Others

Miscellaneous expenses and contingencies	0.37
Total	15.00

Notes

1. A multiplier factor of 3 is applied to the average MPS point to arrive at the full staff costs including the study team's overheads and profit, as the staff will be employed in the consultant's offices. (At 1.4.98, MPS pt. 40 = $62,780 p.m. and MPS pt. 16 = $21,010 p.m.).

2. Out-of-pocket expenses are the actual costs incurred. The study team is not entitled to any additional payment for overheads or profit in respect of these items.

3. The figures given above are based on estimates prepared by the Director of Environmental Protection. We will only know the actual man months and actual fees when we have selected the study team through the usual competitive lump sum fee bid system.