Pearl River Delta
Regional Air Quality Monitoring Network

A Report of Monitoring Results
for the Period between January and June 2008

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Purpose of the Report

This report provides the monitoring results from the Pearl River Delta Regional Air Quality Monitoring Network measured between January and June 2008 and their statistical analysis.

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1. Introduction to the Pearl River Delta Regional Air Quality Monitoring Network

The Pearl River Delta (PRD) Regional Air Quality Monitoring Network (the Network) was jointly established by the Guangdong Provincial Environmental Monitoring Centre (GDEMC) and the Environmental Protection Department of the Hong Kong Special Administrative Region (HKEPD) from 2003 to 2005. It came into operation on 30 November 2005 and has been providing data for the reporting of Regional Air Quality Index (RAQI) to the public since then.

The Network comprises 16 automatic air quality monitoring stations (see Figure 1) across the PRD region. Ten of these stations are operated by the Environmental Monitoring Centres of the individual cities in Guangdong while the 3 stations located in Hong Kong are managed by the HKEPD. The remaining 3 regional stations in the Network are operated by the GDEMC. The objectives of the Network are to :

- provide accurate air quality data that can help the Guangdong Provincial and HKSAR governments to appraise the air quality situation and pollution problems in the PRD region for formulating appropriate control measures;
- evaluate the effectiveness of the air pollution control measures through long-term monitoring;
- provide the public with information on the air quality of various places in the region.

In order to ensure the air quality monitoring results attain a high degree of accuracy and reliability, the two governments had jointly developed a set of "Standard Operational Procedures on Quality Assurance and Quality Control of the PRD Air Quality Monitoring System for Hong Kong and Guangdong" (QA/QC Operating Procedures). The design and operation of the Network comply with the requirements set out in the QA/QC Operating Procedures.

All stations are installed with equipment to measure the ambient concentrations of respirable suspended particulate (PM_{10} or RSP), sulphur dioxide (SO_2), nitrogen dioxide (NO_2) and ozone (O_3).

Annexes A and B set out, respectively, the site information of the monitoring stations in the Network and the methods used for measuring air pollutant concentrations.

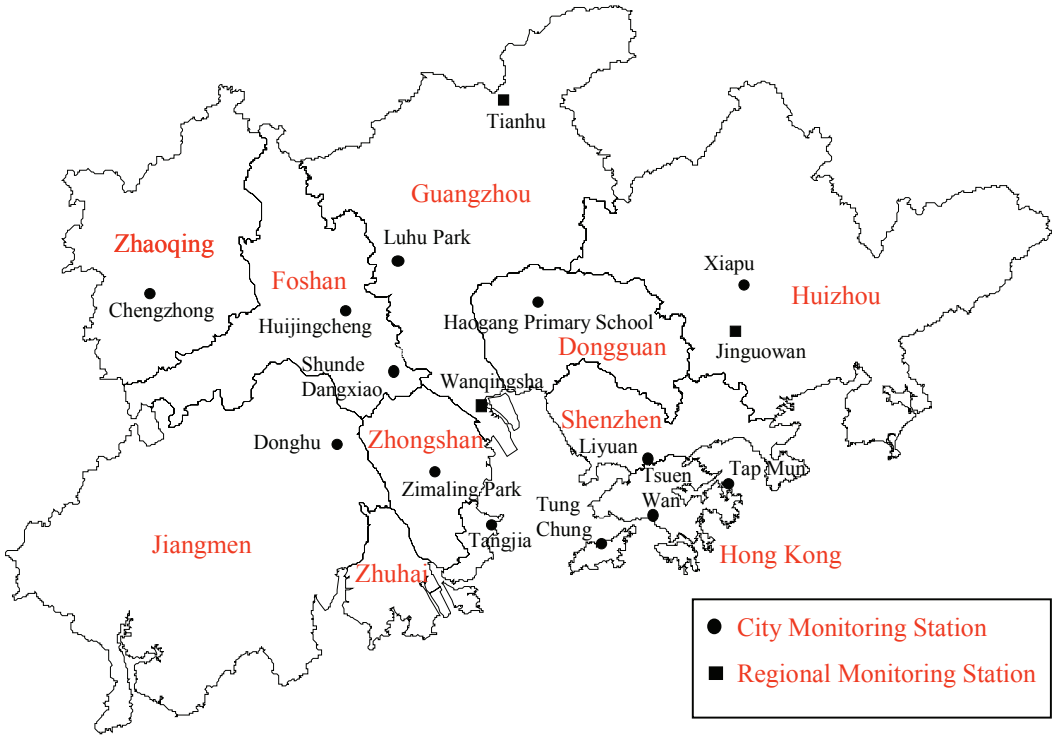

Figure 1：Spatial distribution of the PRD Regional Air Quality Monitoring Stations

2. Operation of the Network

The Network was generally in smooth operation during the period from January to June 2008. The data capture rates of all monitoring stations averaged 89%.

In order to provide the public in both Guangdong and HKSAR with daily air quality information in different parts of the PRD region, the GDEMC and HKEPD established a daily reporting system of the Regional Air Quality Index (RAQI). The two Governments have been issuing the RAQI to the public at 4pm every day through the Internet since 30 November 2005.

2.1 Quality Control (QC) and Quality Assurance (QA) Activities

The two governments have fully carried out the agreed QA/QC activities, which include zero/span checks, precision checks, dynamic calibration, etc., in accordance with the QA/QC Operating Procedures so as to ensure that the air quality data from the monitoring stations are accurate and reliable. To ensure the operation of the Network complies continuously with the QA/QC requirements, the GDEMC and HKEPD have jointly set up the Guangdong-Hong Kong Quality Management Committee for the PRD Regional Air Quality Monitoring Network (the Quality Management Committee, QMC) to review, on a quarterly basis, the set-up of the network, its performance in QA/QC and the operation status of its data transmission system. The QMC will also conduct system audit once a year to evaluate the effectiveness of the quality management system. The findings of the system audit will be reported. The deficiencies found and corrective measures suggested will be listed and followed up by the QMC.

The performance audit results of Network accuracy and precision for 2008 will be discussed in details in the annual report.

3. Statistical Analysis of Pollutant Concentrations

3.1 Sulphur Dioxide (SO_2)

SO_2 comes mainly from the combustion of sulphur-containing fossil fuel. Its major sources of emissions include power plants, fuel combustion plants, vehicles and vessels. Apart from its impact on human respiratory system, SO_2 contributes substantially to acid rain. It can also be oxidized in the air to form sulphate which has a significant impact on the levels of respirable suspended particulates (PM_{10}) and visibility in the region.

The overall averages of SO_2 at various monitoring stations in the Network ranged from 0.015 mg/m^3 to 0.080 mg/m^3 for the period from January to June 2008. Figure 2 shows that the average levels of SO_2 at the north-western part of PRD and the Pearl River Estuary region were in general higher than those of other areas, similar to the corresponding period in previous years. The overall averages of SO_2 at various monitoring stations are shown in Table 3.1c.

During the period, 8 monitoring stations in the Network had recorded exceedance of the national daily air quality standard# (0.15 mg/m^3) of SO_2 while the corresponding national hourly standard (0.50 mg/m^3) was exceeded at 6 monitoring stations. Details are shown in Figure 2 and Table 3.1a - 3.1b.

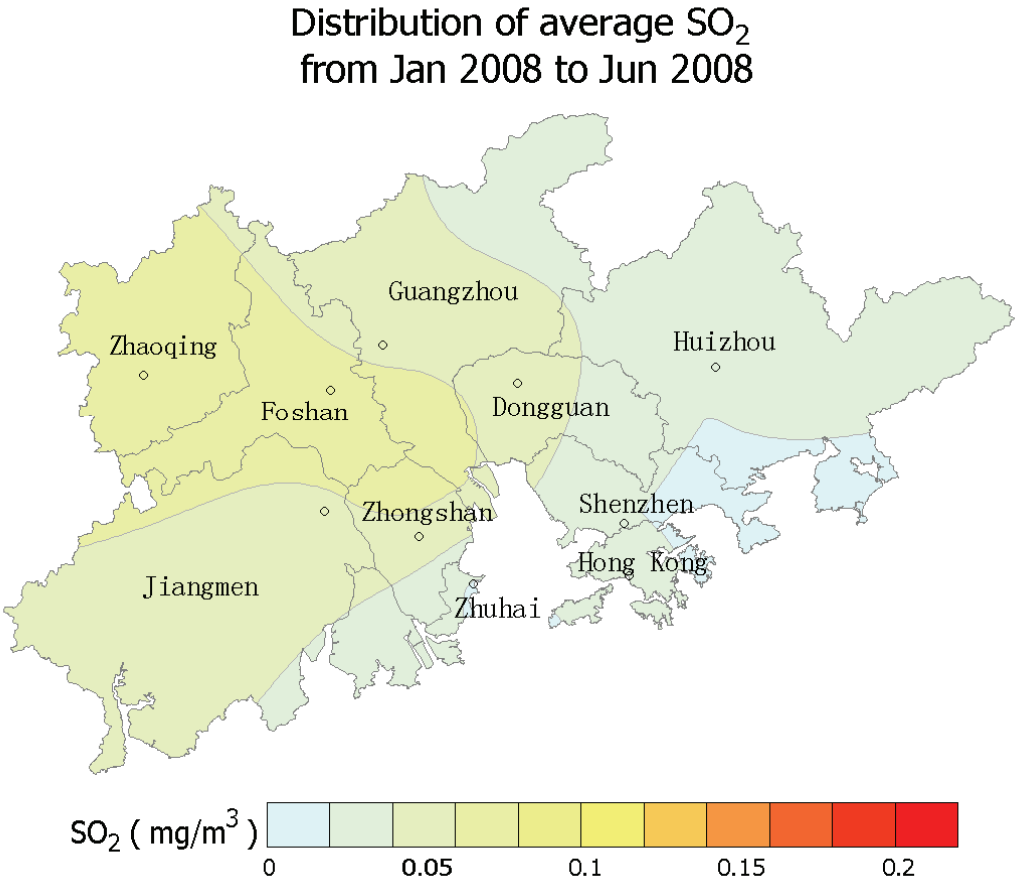

Figure 2：Spatial distribution of average concentrations of Sulphur Dioxide (SO_2) in the Network

National Standards refer to Class 2 of the "National Ambient Air Quality Standards (GB 3095 – 1996 – revised version)" [NAAQS], which are applicable to residential, mixed commercial/residential, cultural, industrial and village areas.

Table 3.1 a：The monthly maxima and minima of hourly averages of Sulphur Dioxide

[Class 2 NAAQS (Hourly) : 0.50 mg/m^3]

Month	Jan 2008		Feb		Mar		Apr		May		Jun		Exceed-ance Hours	Exceed-ance Rate
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max		
Luhu Park(Guangzhou)	0.002	0.285	0.002	0.401	0.003	0.476	0.002	0.316	0.001	0.199	0.002	0.189	0	0.00%
Wanqingsha(Guangzhou)	0.005	0.481	0.018	0.246	0.006	0.549	0.006	0.363	0.003	0.303	0.003	0.254	2	0.05%
Tianhu(Guangzhou)	0.006	0.311	0.006	0.150	0.007	0.244	0.006	0.349	0.007	0.273	0.007	0.257	0	0.00%
Liyuan(Shenzhen)	0.002	0.167	0.002	0.188	0.001	0.194	0.001	0.146	0.001	0.124	0.000	0.127	0	0.00%
Tangjia(Zhuhai)	0.003	0.081	0.004	0.070	0.005	0.097	0.004	0.079	0.003	0.055	0.003	0.044	0	0.00%
Shunde Dangxiao(Foshan)	0.012	0.425	0.008	0.506	0.022	0.385	0.012	0.348	0.006	0.348	0.000	0.292	1	0.03%
Huijingcheng(Foshan)	0.017	0.566	0.010	0.373	0.012	0.394	0.015	0.385	0.011	0.362	0.005	0.183	2	0.05%
Donghu(Jiangmen)	0.006	0.661	0.006	0.496	0.004	0.447	0.000	0.202	0.001	0.253	0.000	0.217	2	0.05%
Chengzhong(Zhaoqing)	0.014	0.528	0.010	0.302	0.012	0.358	0.011	0.410	0.005	0.457	0.002	0.223	1	0.03%
Xiapu(Huizhou)	0.006	0.103	0.006	0.059	0.008	0.160	0.007	0.086	0.008	0.102	0.002	0.147	0	0.00%
Jinguowan(Huizhou)	0.009	0.108	0.009	0.085	0.011	0.072	0.010	0.110	0.011	0.086	0.011	0.058	0	0.00%
Haogang(Dongguan)	0.005	0.383	0.004	0.313	0.014	0.540	0.011	0.343	0.008	0.517	0.005	0.350	2	0.05%
Zimaling Park(Zhongshan)	0.008	0.438	0.017	0.271	0.011	0.419	0.001	0.267	0.000	0.273	0.000	0.134	0	0.00%
Tsuen Wan(HKSAR)	0.008	0.150	0.011	0.133	0.010	0.161	0.009	0.163	0.012	0.260	0.014	0.283	0	0.00%
Tap Mun(HKSAR)	0.007	0.205	0.004	0.177	0.002	0.178	0.002	0.208	0.001	0.153	0.001	0.065	0	0.00%
Tung Chung(HKSAR)	0.000	0.159	0.003	0.170	0.001	0.172	0.000	0.131	0.003	0.064	0.000	0.061	0	0.00%

Table 3.1 b：The monthly maxima and minima of daily averages of Sulphur Dioxide

[Class 2 NAAQS (Daily) : 0.15 mg/m^3]

Month	Jan 2008		Feb		Mar		Apr		May		Jun		Exceed-ance Days	Exceed-ance Rate
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max		
Luhu Park(Guangzhou)	0.010	0.087	0.017	0.160	0.018	0.211	0.005	0.189	0.006	0.078	0.014	0.070	3	1.89%
Wanqingsha(Guangzhou)	0.034	0.167	0.054	0.126	0.017	0.175	0.015	0.202	0.004	0.104	0.011	0.076	4	2.52%
Tianhu(Guangzhou)	0.007	0.143	0.007	0.052	0.009	0.134	0.008	0.106	0.007	0.139	0.008	0.085	0	0.00%
Liyuan(Shenzhen)	0.007	0.073	0.008	0.068	0.008	0.058	0.002	0.066	0.004	0.035	0.004	0.028	0	0.00%
Tangjia(Zhuhai)	0.010	0.040	0.011	0.041	0.013	0.042	0.006	0.031	0.004	0.027	0.004	0.018	0	0.00%
Shunde Dangxiao(Foshan)	0.031	0.230	0.024	0.205	0.043	0.214	0.038	0.142	0.012	0.165	0.017	0.099	14	9.27%
Huijingcheng(Foshan)	0.027	0.224	0.021	0.141	0.026	0.175	0.030	0.253	0.026	0.153	0.011	0.068	10	6.29%
Donghu(Jiangmen)	0.025	0.194	0.010	0.161	0.019	0.163	0.001	0.108	0.002	0.106	0.003	0.110	8	5.13%
Chengzhong(Zhaoqing)	0.030	0.157	0.017	0.184	0.028	0.163	0.023	0.258	0.010	0.244	0.012	0.112	7	4.67%
Xiapu(Huizhou)	0.010	0.052	0.009	0.040	0.011	0.063	0.009	0.051	0.016	0.055	0.012	0.099	0	0.00%
Jinguowan(Huizhou)	0.010	0.040	0.010	0.038	0.023	0.040	0.011	0.038	0.011	0.042	0.011	0.025	0	0.00%
Haogang(Dongguan)	0.012	0.169	0.014	0.133	0.020	0.307	0.021	0.163	0.013	0.135	0.012	0.110	3	1.82%
Zimaling Park(Zhongshan)	0.020	0.196	0.044	0.155	0.019	0.172	0.013	0.144	0.004	0.098	0.002	0.051	4	2.60%
Tsuen Wan(HKSAR)	0.013	0.093	0.016	0.070	0.016	0.063	0.011	0.062	0.014	0.065	0.017	0.087	0	0.00%
Tap Mun(HKSAR)	0.009	0.040	0.009	0.033	0.005	0.031	0.004	0.036	0.004	0.032	0.002	0.018	0	0.00%
Tung Chung(HKSAR)	0.007	0.099	0.012	0.095	0.003	0.050	0.001	0.067	0.004	0.034	0.004	0.023	0	0.00%

Table 3.1 c：The monthly averages and overall averages of Sulphur Dioxide

Month	Jan 2008	Feb	Mar	Apr	May	Jun	Overall Average
Luhu Park(Guangzhou)	0.034	0.053	0.079	0.076	0.043	0.039	0.054
Wanqingsha(Guangzhou)	0.088	0.083	0.078	0.059	0.041	0.027	0.063
Tianhu(Guangzhou)	0.027	0.027	0.043	0.036	0.039	0.029	0.034
Liyuan(Shenzhen)	0.023	0.030	0.025	0.016	0.015	0.011	0.020
Tangjia(Zhuhai)	0.025	0.020	0.023	0.017	0.012	0.008	0.017
Shunde Dangxiao(Foshan)	0.097	0.086	0.103	0.079	0.062	0.046	0.080
Huijingcheng(Foshan)	0.102	0.064	0.070	0.091	0.056	0.025	0.066
Donghu(Jiangmen)	0.084	0.058	0.078	0.041	0.027	0.033	0.053
Chengzhong(Zhaoqing)	0.087	0.060	0.086	0.085	0.077	0.040	0.072
Xiapu(Huizhou)	0.031	0.026*	0.031	0.025	0.035	0.048	0.033
Jinguowan(Huizhou)	0.022	0.023	0.032*	0.019	0.019	0.015	0.020
Haogang(Dongguan)	0.057	0.046	0.068	0.052	0.048	0.036	0.051
Zimaling Park(Zhongshan)	0.091	0.088	0.070	0.042	0.028	0.011	0.054
Tsuen Wan(HKSAR)	0.030	0.033	0.035	0.026	0.033	0.042	0.033
Tap Mun(HKSAR)	0.025	0.021	0.017	0.012	0.011	0.005	0.015
Tung Chung(HKSAR)	0.032	0.033	0.025	0.016	0.014	0.009	0.022

Remark : 1. All concentration units are in milligrams per cubic metre.

2. "*" denotes that the data capture rate does not meet the minimum requirements for determining a representative value due to maintenance work on monitoring equipment.

3.2 Nitrogen Dioxide (NO_2)

Nitrogen Dioxide (NO_2) is mainly formed from oxidization of nitrogen monoxide (NO) emitted in the process of combustion. Its major emission sources include power plants, vehicles, industrial combustion plants, etc. Apart from the impact on human respiratory system, it can also be oxidized in the air to form nitrate, which has significant impact on the levels of particulates, acid rain and visibility in the region.

The overall averages of NO_2 at various monitoring stations in the Network ranged from 0.015 mg/m^3 to 0.075 mg/m^3 for the period from January to June 2008. During the period, 11 monitoring stations in the Network had recorded exceedance of both the national daily air quality standard (0.12 mg/m^3) and the national hourly air quality standard (0.24 mg/m^3) of NO_2. Details are shown in Figure 3 and Table 3.2a - 3.2c.

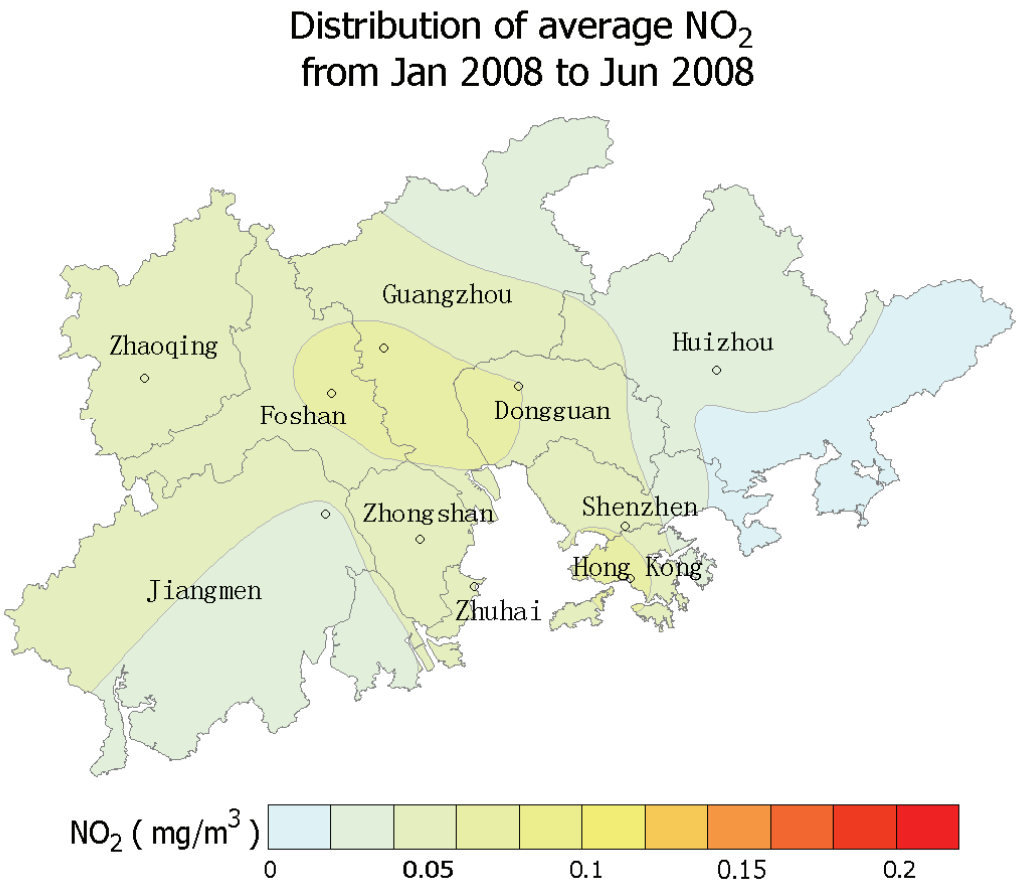

Figure 3：Spatial distribution of average concentrations of Nitrogen Dioxide (NO_2) in the Network

Table 3.2 a：The monthly maxima and minima of hourly averages of Nitrogen Dioxide

[Class 2 NAAQS (Hourly) : 0.24 mg/m^3]

Month	Jan 2008		Feb		Mar		Apr		May		Jun		Exceed-ance Hours	Exceed-ance Rate
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max		
Luhu Park(Guangzhou)	0.014	0.189	0.010	0.302	0.025	0.296	0.024	0.208	0.003	0.196	0.012	0.122	14	0.37%
Wanqingsha(Guangzhou)	0.013	0.290	0.013	0.296	0.001	0.258	0.000	0.206	0.004	0.085	0.000	0.051	7	0.21%
Tianhu(Guangzhou)	0.008	0.025	0.007	0.070	0.005	0.184	0.004	0.136	0.004	0.087	0.003	0.106	0	0.00%
Liyuan(Shenzhen)	0.011	0.251	0.008	0.251	0.010	0.286	0.006	0.204	0.008	0.180	0.005	0.104	8	0.20%
Tangjia(Zhuhai)	0.011	0.169	0.006	0.171	0.004	0.154	0.004	0.169	0.004	0.103	0.005	0.087	0	0.00%
Shunde Dangxiao(Foshan)	0.022	0.385	0.009	0.290	0.016	0.230	0.017	0.163	0.006	0.158	0.007	0.105	9	0.23%
Huijingcheng(Foshan)	0.022	0.362	0.014	0.246	0.016	0.248	0.010	0.199	0.004	0.167	0.007	0.124	31	0.82%
Donghu(Jiangmen)	0.012	0.392	0.010	0.268	0.008	0.210	0.006	0.080	0.006	0.138	0.004	0.106	12	0.31%
Chengzhong(Zhaoqing)	0.016	0.258	0.011	0.198	0.015	0.227	0.014	0.148	0.011	0.177	0.008	0.140	1	0.03%
Xiapu(Huizhou)	0.003	0.230	0.000	0.132	0.006	0.157	0.007	0.135	0.006	0.120	0.001	0.102	0	0.00%
Jinguowan(Huizhou)	0.001	0.110	0.002	0.095	0.006	0.025	0.000	0.095	0.000	0.089	0.000	0.056	0	0.00%
Haogang(Dongguan)	0.009	0.216	0.012	0.223	0.011	0.265	0.015	0.216	0.016	0.152	0.009	0.140	4	0.10%
Zimaling Park(Zhongshan)	0.020	0.310	0.014	0.196	0.010	0.187	0.005	0.188	0.002	0.150	0.001	0.069	5	0.13%
Tsuen Wan(HKSAR)	0.018	0.246	0.012	0.214	0.018	0.265	0.017	0.217	0.018	0.178	0.009	0.138	5	0.12%
Tap Mun(HKSAR)	0.006	0.104	0.005	0.075	0.004	0.115	0.001	0.113	0.002	0.102	0.001	0.052	0	0.00%
Tung Chung(HKSAR)	0.007	0.274	0.006	0.229	0.002	0.273	0.003	0.171	0.000	0.173	0.002	0.109	7	0.17%

Table 3.2 b：The monthly maxima and minima of daily averages of Nitrogen Dioxide

[Class 2 NAAQS (Daily) : 0.12 mg/m^3]

Month	Jan 2008		Feb		Mar		Apr		May		Jun		Exceed-ance Days	Exceed-ance Rate
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max		
Luhu Park(Guangzhou)	0.027	0.133	0.019	0.182	0.054	0.194	0.034	0.132	0.023	0.088	0.028	0.068	14	8.81%
Wanqingsha(Guangzhou)	0.035	0.158	0.036	0.168	0.007	0.164	0.004	0.123	0.025	0.046	0.002	0.021	12	8.70%
Tianhu(Guangzhou)	0.009	0.011	0.008	0.030	0.008	0.084	0.007	0.049	0.005	0.065	0.005	0.048	0	0.00%
Liyuan(Shenzhen)	0.043	0.122	0.024	0.122	0.030	0.128	0.028	0.111	0.027	0.097	0.025	0.065	5	3.07%
Tangjia(Zhuhai)	0.021	0.088	0.029	0.098	0.019	0.099	0.021	0.091	0.011	0.049	0.015	0.048	0	0.00%
Shunde Dangxiao(Foshan)	0.040	0.221	0.027	0.156	0.034	0.149	0.022	0.093	0.029	0.094	0.016	0.049	14	8.92%
Huijingcheng(Foshan)	0.039	0.230	0.029	0.153	0.037	0.151	0.022	0.147	0.027	0.074	0.017	0.057	12	7.79%
Donghu(Jiangmen)	0.024	0.192	0.015	0.127	0.013	0.121	0.007	0.033	0.008	0.050	0.008	0.042	5	3.14%
Chengzhong(Zhaoqing)	0.030	0.153	0.025	0.135	0.036	0.120	0.025	0.082	0.026	0.083	0.020	0.061	6	3.82%
Xiapu(Huizhou)	0.014	0.094	0.008	0.050	0.026	0.069	0.024	0.074	0.017	0.079	0.021	0.045	0	0.00%
Jinguowan(Huizhou)	0.006	0.033	0.009	0.035	0.006	0.007	0.005	0.036	0.006	0.045	0.001	0.015	0	0.00%
Haogang(Dongguan)	0.025	0.145	0.023	0.106	0.049	0.169	0.036	0.124	0.027	0.102	0.018	0.068	5	3.11%
Zimaling Park(Zhongshan)	0.041	0.189	0.025	0.120	0.034	0.101	0.011	0.115	0.009	0.083	0.005	0.044	3	2.00%
Tsuen Wan(HKSAR)	0.041	0.136	0.053	0.136	0.058	0.152	0.049	0.135	0.051	0.114	0.038	0.081	10	5.52%
Tap Mun(HKSAR)	0.010	0.041	0.009	0.036	0.007	0.030	0.005	0.035	0.005	0.053	0.004	0.024	0	0.00%
Tung Chung(HKSAR)	0.021	0.146	0.021	0.136	0.011	0.131	0.008	0.123	0.005	0.101	0.008	0.059	6	3.31%

Table 3.2 c：The monthly averages and overall averages of Nitrogen Dioxide

Month	Jan 2008	Feb	Mar	Apr	May	Jun	Overall Average
Luhu Park(Guangzhou)	0.055	0.071	0.104	0.076	0.050	0.042	0.065
Wanqingsha(Guangzhou)	0.081	0.085	0.081	0.040	0.033*	0.010	0.059
Tianhu(Guangzhou)	0.010*	0.015	0.032	0.027	0.021	0.019	0.022
Liyuan(Shenzhen)	0.068	0.066	0.067	0.051	0.049	0.044	0.057
Tangjia(Zhuhai)	0.055	0.057	0.046	0.041	0.034	0.026	0.043
Shunde Dangxiao(Foshan)	0.087	0.074	0.080	0.051	0.046	0.032	0.062
Huijingcheng(Foshan)	0.087	0.071	0.087	0.068	0.049	0.032	0.065
Donghu(Jiangmen)	0.057	0.054	0.047	0.015	0.019	0.022	0.036
Chengzhong(Zhaoqing)	0.063	0.058	0.070	0.047	0.043	0.034	0.051
Xiapu(Huizhou)	0.038	0.025*	0.042	0.036	0.034	0.029	0.035
Jinguowan(Huizhou)	0.021	0.019	0.006*	0.016	0.016	0.005	0.015
Haogang(Dongguan)	0.055	0.054	0.091	0.062	0.056	0.046	0.061
Zimaling Park(Zhongshan)	0.073	0.068	0.065	0.044	0.032	0.018	0.048
Tsuen Wan(HKSAR)	0.078	0.082	0.092	0.070	0.073	0.055	0.075
Tap Mun(HKSAR)	0.025	0.019	0.017	0.014	0.012	0.011	0.016
Tung Chung(HKSAR)	0.068	0.073	0.071	0.048	0.045	0.028	0.055

Remark : 1. All concentration units are in milligrams per cubic metre.

2. "*" denotes that the data capture rate does not meet the minimum requirements for determining a representative value due to maintenance work on monitoring equipment.

3.3 Ozone (O_3)

Ozone (O_3) is not directly emitted from emission sources. It is formed by the photochemical reaction of oxygen, nitrogen oxides (NOx) and volatile organic compounds (VOCs) in the air under sunlight, and is the main component of photochemical smog. Ozone can cause irritation to the eye, nose and throat. At elevated levels, O_3 can increase a person's susceptibility to respiratory diseases and aggravate pre-existing respiratory diseases such as asthma.

The precursors (NOx and VOCs) of O_3 mainly originate from pollution sources in urban areas. However, as it usually takes several hours for O_3 to be formed and rise to its peak level, and O_3 and its precursors can be transported to rural areas downwind of their sources during this period, the concentrations of O_3 in rural areas are therefore often higher than in the urban areas. The overall averages of O_3 recorded by the Network ranged from 0.022 mg/m^3 to 0.082 mg/m^3 for the period from January to June 2008, with higher average values measured in rural areas such as Tianhu of Guangzhou, Tap Mun of Hong Kong and Jinguowan of Huizhou, similar to the corresponding period in previous years. During the period, 14 monitoring stations in the Network had recorded exceedance of the national hourly air quality standard (0.20 mg/m^3) of ozone. Details are shown in Figure 4 and Table 3.3a - 3.3c.

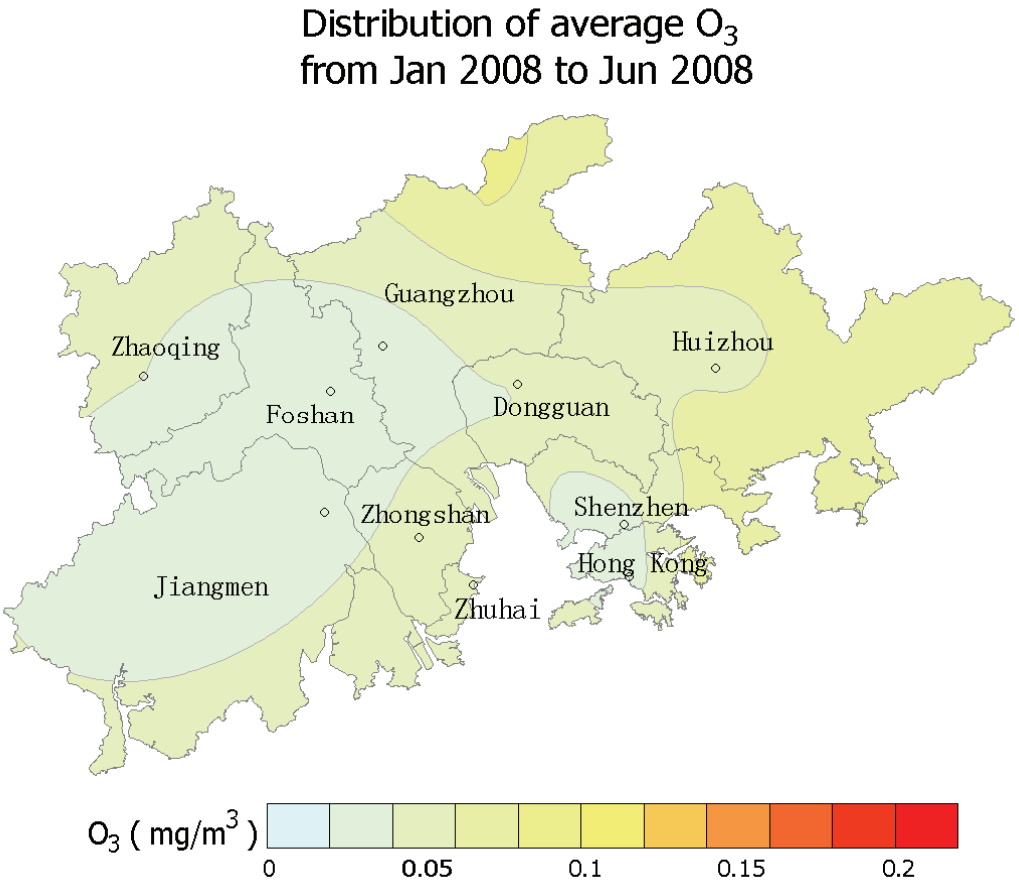

Figure 4：Spatial distribution of average concentrations of Ozone (O_3) in the Network

Table 3.3 a：The monthly maxima and minima of hourly averages of Ozone

[Class 2 NAAQS (Hourly) : 0.20 mg/m^3]

Month	Jan 2008		Feb		Mar		Apr		May		Jun		Exceed-ance Hours	Exceed-ance Rate
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max		
Luhu Park(Guangzhou)	0.000	0.170	0.000	0.210	0.000	0.198	0.000	0.168	0.002	0.275	0.003	0.301	22	0.58%
Wanqingsha(Guangzhou)	0.003	0.304	0.003	0.253	0.002	0.320	0.003	0.280	0.001	0.355	0.000	0.312	78	1.98%
Tianhu(Guangzhou)	0.007	0.222	0.011	0.171	0.007	0.281	0.007	0.226	0.007	0.298	0.007	0.283	56	1.57%
Liyuan(Shenzhen)	0.000	0.171	0.000	0.134	0.000	0.185	0.000	0.198	0.000	0.184	0.000	0.103	0	0.00%
Tangjia(Zhuhai)	0.000	0.330	0.000	0.192	0.000	0.352	0.000	0.269	0.003	0.378	0.004	0.336	70	1.81%
Shunde Dangxiao(Foshan)	0.000	0.173	0.000	0.132	0.003	0.226	0.003	0.284	0.003	0.292	0.001	0.340	48	1.24%
Huijingcheng(Foshan)	0.001	0.101	0.003	0.216	0.001	0.149	0.001	0.184	0.002	0.320	0.001	0.258	13	0.34%
Donghu(Jiangmen)	0.001	0.183	0.002	0.138	0.002	0.171	0.001	0.187	0.001	0.247	0.002	0.283	21	0.56%
Chengzhong(Zhaoqing)	0.002	0.248	0.001	0.224	0.002	0.205	0.002	0.184	0.002	0.206	0.001	0.285	18	0.48%
Xiapu(Huizhou)	0.002	0.173	0.007	0.135	0.007	0.201	0.006	0.216	0.005	0.252	0.004	0.254	26	0.66%
Jinguowan(Huizhou)	0.004	0.186	0.019	0.165	0.025	0.194	0.007	0.286	0.006	0.301	0.007	0.290	39	1.18%
Haogang(Dongguan)	0.002	0.182	0.003	0.184	0.003	0.245	0.002	0.317	0.001	0.362	0.003	0.364	31	0.79%
Zimaling Park(Zhongshan)	0.002	0.262	0.002	0.223	0.002	0.265	0.001	0.246	0.001	0.386	0.002	0.289	62	1.63%
Tsuen Wan(HKSAR)	0.002	0.102	0.001	0.109	0.004	0.149	0.005	0.121	0.006	0.161	0.008	0.089	0	0.00%
Tap Mun(HKSAR)	0.005	0.181	0.002	0.176	0.001	0.231	0.000	0.225	0.003	0.230	0.002	0.139	28	0.66%
Tung Chung(HKSAR)	0.002	0.165	0.003	0.154	0.001	0.271	0.004	0.157	0.004	0.305	0.002	0.113	10	0.24%

Table 3.3 b：The monthly maxima and minima of daily averages of Ozone

Month	Jan 2008		Feb		Mar		Apr		May		Jun	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Luhu Park(Guangzhou)	0.002	0.056	0.002	0.099	0.005	0.076	0.002	0.049	0.007	0.120	0.008	0.105
Wanqingsha(Guangzhou)	0.004	0.102	0.008	0.082	0.006	0.117	0.008	0.085	0.011	0.151	0.016	0.091
Tianhu(Guangzhou)	0.038	0.143	0.034	0.126	0.041	0.153	0.018	0.120	0.050	0.195	0.025	0.155
Liyuan(Shenzhen)	0.001	0.043	0.003	0.064	0.010	0.085	0.002	0.071	0.002	0.113	0.000	0.041
Tangjia(Zhuhai)	0.001	0.114	0.005	0.093	0.018	0.144	0.004	0.096	0.033	0.190	0.029	0.077
Shunde Dangxiao(Foshan)	0.002	0.060	0.009	0.066	0.004	0.086	0.004	0.097	0.007	0.138	0.010	0.119
Huijingcheng(Foshan)	0.004	0.037	0.005	0.131	0.003	0.046	0.002	0.067	0.007	0.074	0.005	0.101
Donghu(Jiangmen)	0.002	0.055	0.004	0.078	0.003	0.074	0.002	0.062	0.008	0.111	0.013	0.101
Chengzhong(Zhaoqing)	0.009	0.061	0.012	0.091	0.012	0.078	0.004	0.085	0.009	0.094	0.007	0.136
Xiapu(Huizhou)	0.012	0.072	0.027	0.100	0.025	0.107	0.011	0.089	0.013	0.158	0.011	0.101
Jinguowan(Huizhou)	0.013	0.101	0.039	0.114	0.094	0.128	0.019	0.113	0.030	0.197	0.026	0.122
Haogang(Dongguan)	0.003	0.056	0.010	0.088	0.012	0.094	0.006	0.068	0.012	0.145	0.006	0.111
Zimaling Park(Zhongshan)	0.003	0.071	0.004	0.077	0.034	0.105	0.004	0.069	0.009	0.152	0.021	0.103
Tsuen Wan(HKSAR)	0.008	0.053	0.009	0.065	0.008	0.099	0.007	0.077	0.009	0.116	0.009	0.048
Tap Mun(HKSAR)	0.013	0.110	0.028	0.124	0.032	0.160	0.019	0.125	0.018	0.176	0.023	0.103
Tung Chung(HKSAR)	0.003	0.064	0.005	0.100	0.020	0.134	0.013	0.103	0.011	0.159	0.013	0.051

Table 3.3 c：The monthly averages and overall averages of Ozone

Month	Jan 2008	Feb	Mar	Apr	May	Jun	Overall Average
Luhu Park(Guangzhou)	0.019	0.044	0.032	0.019	0.034	0.028	0.029
Wanqingsha(Guangzhou)	0.031	0.041	0.062	0.044	0.057	0.037	0.045
Tianhu(Guangzhou)	0.071	0.097	0.103	0.070	0.097	0.059	0.082
Liyuan(Shenzhen)	0.020	0.036	0.051	0.032	0.037	0.009	0.031
Tangjia(Zhuhai)	0.044	0.052	0.082	0.050	0.076	0.043	0.060
Shunde Dangxiao(Foshan)	0.019	0.034	0.049	0.038	0.045	0.026	0.036
Huijingcheng(Foshan)	0.015	0.037	0.020	0.020	0.024	0.018	0.022
Donghu(Jiangmen)	0.020	0.034	0.040	0.020	0.035	0.034	0.030
Chengzhong(Zhaoqing)	0.035	0.058	0.046	0.033	0.038	0.034	0.040
Xiapu(Huizhou)	0.038	0.061*	0.069	0.046	0.067	0.035	0.052
Jinguowan(Huizhou)	0.052	0.079	0.110*	0.071	0.087	0.047	0.070
Haogang(Dongguan)	0.025	0.049	0.054	0.038	0.048	0.032	0.040
Zimaling Park(Zhongshan)	0.031	0.041	0.068	0.040	0.058	0.044	0.047
Tsuen Wan(HKSAR)	0.022	0.034	0.044	0.034	0.039	0.018	0.032
Tap Mun(HKSAR)	0.060	0.079	0.100	0.070	0.087	0.044	0.073
Tung Chung(HKSAR)	0.024	0.040	0.061	0.040	0.055	0.028	0.041

Remark : 1. All concentration units are in milligrams per cubic metre.

2. "*" denotes that the data capture rate does not meet the minimum requirements for determining a representative value due to maintenance work on monitoring equipment.

3.4 Respirable Suspended Particulates (PM_{10})

The respirable suspended particulates (PM_{10} or RSP) in the atmosphere come from a great variety of emission sources, such as power plants, vehicles, cement and pottery manufacturing, fugitive dust, etc, while some are products of oxidization of gaseous pollutants in the air (e.g., sulphate formed from oxidation of SO_2) or from photochemical reactions. PM_{10} can penetrate deeply into human lungs and cause impact on human respiratory system. Furthermore, finer particles in PM_{10} have significant effect on visibility.

The overall averages of PM_{10} at various monitoring stations in the Network ranged from 0.030 mg/m^3 to 0.125 mg/m^3 for the period from January to June 2008. As shown in Figure 5, the average levels of PM_{10} in the central and northern parts of PRD were generally higher than those in the coastal areas in the south, similar to the corresponding period in previous years. During the period, 14 monitoring stations had recorded exceedance of the national daily air quality standard (0.15mg/m^3) of PM_{10}. Details are shown in Tables 3.4a - 3.4c.

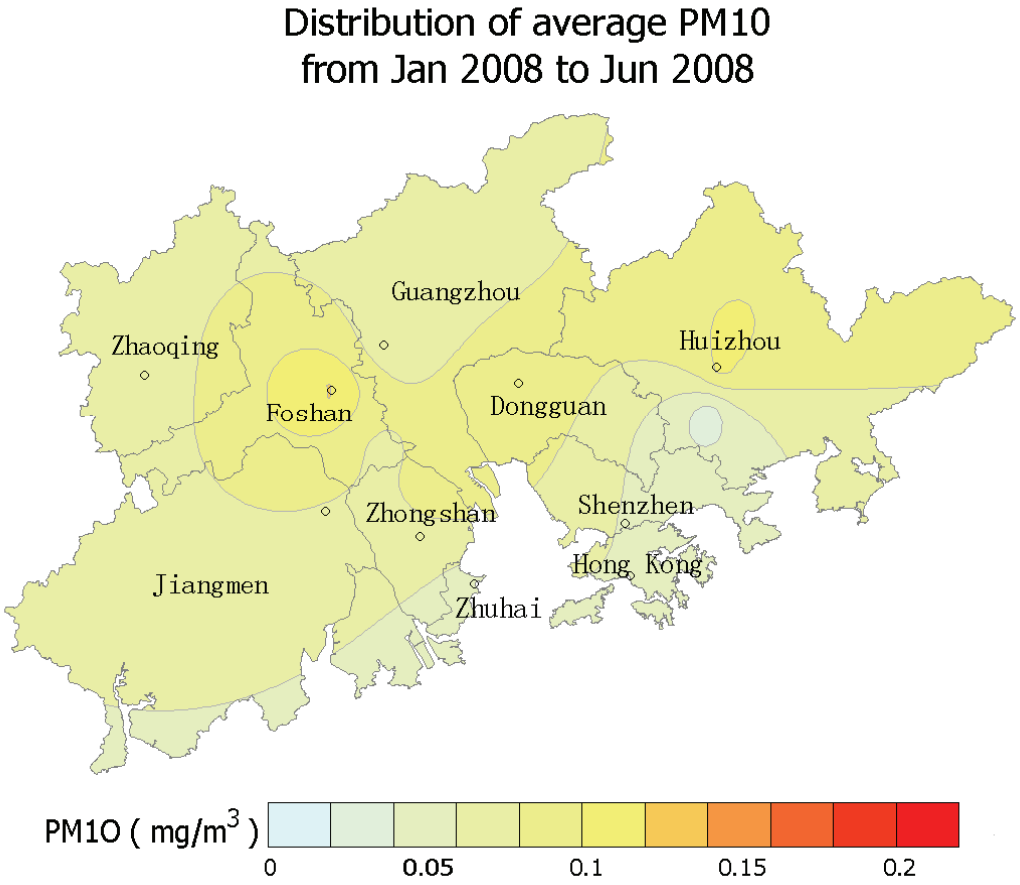

Figure 5：Spatial distribution of average concentrations of Respirable Suspended Particulates (PM_{10}) in the Network

Table 3.4 a：The monthly maxima and minima of hourly averages of Respirable Suspended Particulates

Month	Jan 2008		Feb		Mar		Apr		May		Jun	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Luhu Park(Guangzhou)	0.001	0.264	0.009	0.318	0.008	0.304	0.007	0.222	0.000	0.186	0.000	0.132
Wanqingsha(Guangzhou)	0.015	0.370	0.018	0.404	0.002	0.514	0.000	0.397	0.000	0.329	0.000	0.255
Tianhu(Guangzhou)	0.000	0.241	0.000	0.230	0.000	0.295	0.000	0.328	0.000	0.230	0.000	0.216
Liyuan(Shenzhen)	0.000	0.304	0.001	0.236	0.000	0.258	0.003	0.268	0.000	0.208	0.000	0.299
Tangjia(Zhuhai)	0.004	0.154	0.003	0.148	0.009	0.188	0.005	0.223	0.005	0.162	0.006	0.078
Shunde Dangxiao(Foshan)	0.000	0.532	0.000	0.433	0.000	0.345	0.000	0.294	0.000	0.311	0.000	0.180
Huijingcheng(Foshan)	0.007	0.965	0.007	0.641	0.016	0.708	0.007	0.425	0.007	0.334	0.007	0.298
Donghu(Jiangmen)	0.005	0.545	0.000	0.294	0.003	0.415	0.002	0.280	0.000	0.301	0.000	0.169
Chengzhong(Zhaoqing)	0.005	0.328	0.002	0.249	0.008	0.290	0.002	0.307	0.000	0.232	0.000	0.161
Xiapu(Huizhou)	0.020	0.465	0.019	0.324	0.027	0.379	0.000	0.331	0.000	0.488	0.000	0.222
Jinguowan(Huizhou)	0.000	0.139	0.000	0.073	0.009	0.144	0.000	0.125	0.000	0.136	0.000	0.102
Haogang(Dongguan)	0.000	0.534	0.000	0.245	0.000	0.751	0.005	0.388	0.006	0.247	0.000	0.253
Zimaling Park(Zhongshan)	0.004	0.424	0.004	0.304	0.010	0.340	0.011	0.291	0.006	0.262	0.001	0.184
Tsuen Wan(HKSAR)	0.006	0.205	0.011	0.188	0.007	0.212	0.006	0.148	0.016	0.146	0.010	0.170
Tap Mun(HKSAR)	0.006	0.198	0.006	0.143	0.005	0.227	0.008	0.226	0.005	0.240	0.005	0.383
Tung Chung(HKSAR)	0.008	0.251	0.010	0.204	0.006	0.246	0.008	0.256	0.005	0.182	0.004	0.176

Table 3.4 b：The monthly maxima and minima of daily averages of Respirable Suspended Particulates

[Class 2 NAAQS (Daily) : 0.15 mg/m^3]

Month	Jan 2008		Feb		Mar		Apr		May		Jun		Exceed-ance Days	Exceed-ance Rate
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max		
Luhu Park(Guangzhou)	0.015	0.208	0.032	0.189	0.050	0.214	0.017	0.125	0.017	0.112	0.011	0.069	5	3.11%
Wanqingsha(Guangzhou)	0.032	0.280	0.028	0.206	0.059	0.241	0.033	0.319	0.034	0.191	0.019	0.135	25	20.49%
Tianhu(Guangzhou)	0.005	0.144	0.004	0.112	0.023	0.170	0.017	0.146	0.013	0.181	0.009	0.133	5	3.21%
Liyuan(Shenzhen)	0.020	0.150	0.015	0.122	0.022	0.156	0.022	0.180	0.010	0.094	0.013	0.117	3	1.75%
Tangjia(Zhuhai)	0.037	0.092	0.027	0.109	0.032	0.101	0.023	0.136	0.020	0.078	0.020	0.051	0	0.00%
Shunde Dangxiao(Foshan)	0.024	0.310	0.020	0.158	0.043	0.161	0.033	0.172	0.031	0.196	0.016	0.095	8	5.26%
Huijingcheng(Foshan)	0.031	0.589	0.029	0.456	0.058	0.343	0.033	0.255	0.029	0.192	0.022	0.077	47	29.56%
Donghu(Jiangmen)	0.025	0.370	0.018	0.160	0.031	0.221	0.028	0.188	0.031	0.145	0.018	0.069	14	8.97%
Chengzhong(Zhaoqing)	0.014	0.229	0.014	0.193	0.021	0.169	0.017	0.142	0.023	0.152	0.003	0.084	9	5.81%
Xiapu(Huizhou)	0.045	0.264	0.042	0.209	0.081	0.223	0.033	0.200	0.011	0.237	0.002	0.100	37	24.18%
Jinguowan(Huizhou)	0.005	0.059	0.005	0.058	0.043	0.085	0.010	0.066	0.010	0.081	0.003	0.052	0	0.00%
Haogang(Dongguan)	0.026	0.308	0.039	0.186	0.044	0.391	0.033	0.245	0.034	0.134	0.032	0.129	24	14.72%
Zimaling Park(Zhongshan)	0.018	0.245	0.018	0.190	0.050	0.204	0.027	0.238	0.028	0.153	0.013	0.082	15	9.43%
Tsuen Wan(HKSAR)	0.023	0.156	0.021	0.145	0.031	0.143	0.026	0.103	0.020	0.081	0.023	0.070	1	0.56%
Tap Mun(HKSAR)	0.016	0.097	0.012	0.114	0.037	0.156	0.022	0.137	0.017	0.122	0.014	0.147	1	0.56%
Tung Chung(HKSAR)	0.027	0.159	0.026	0.157	0.027	0.157	0.017	0.158	0.010	0.116	0.010	0.050	4	2.22%

Table 3.4 c：The monthly averages and overall averages of Respirable Suspended Particulates

Month	Jan 2008	Feb	Mar	Apr	May	Jun	Overall Average
Luhu Park(Guangzhou)	0.067	0.079	0.104	0.061	0.056	0.032	0.065
Wanqingsha(Guangzhou)	0.098*	0.131	0.141	0.115*	0.085	0.037	0.100
Tianhu(Guangzhou)	0.053	0.069	0.097	0.068	0.071	0.037	0.065
Liyuan(Shenzhen)	0.074	0.073	0.079	0.055	0.047	0.029	0.059
Tangjia(Zhuhai)	0.058	0.060	0.061	0.047	0.040	0.029	0.049
Shunde Dangxiao(Foshan)	0.085	0.082	0.087	0.070	0.072	0.044	0.074
Huijingcheng(Foshan)	0.188	0.174	0.173	0.113	0.074	0.045	0.125
Donghu(Jiangmen)	0.110	0.096	0.087	0.069	0.068	0.035	0.078
Chengzhong(Zhaoqing)	0.081	0.084	0.088	0.068	0.061	0.032	0.067
Xiapu(Huizhou)	0.126	0.126*	0.164	0.106	0.070	0.031	0.104
Jinguowan(Huizhou)	0.029	0.038	0.056*	0.029	0.032	0.016	0.030
Haogang(Dongguan)	0.107	0.099	0.159	0.084	0.083	0.052	0.096
Zimaling Park(Zhongshan)	0.094	0.106	0.108	0.064	0.057	0.031	0.075
Tsuen Wan(HKSAR)	0.069	0.078	0.076	0.049	0.046	0.033	0.058
Tap Mun(HKSAR)	0.061	0.079	0.085	0.055	0.053	0.027	0.060
Tung Chung(HKSAR)	0.074	0.086	0.078	0.050	0.048	0.020	0.059

Remark : 1. All concentration units are in milligrams per cubic metre.

2. "*" denotes that the data capture rate does not meet the minimum requirements for determining a representative value due to maintenance work on monitoring equipment.

3.5 Monthly Variations of Pollutant Concentrations

Figure 6 shows the monthly variations of the major pollutants (SO_2, NO_2, O_3, and PM_{10}) recorded by the Network during the period from January to June 2008. The overall concentrations of SO_2, NO_2 and PM_{10} were generally higher in January to March and lower in June as summer approached. This was due to the heavier rainfall and higher mixing layer height in the summer months. Apart from heavier rainfall and higher mixing layer which favoured the dispersion of pollutants, the relatively clean maritime air stream prevailed in the PRD region under the influence of southern monsoon also accounts for a lower level of pollution in summer time. The overall concentrations of pollutants were fairly high in March, which could be attributed to the frequent occurrence of stagnant atmospheric conditions during the month. That notwithstanding, the monthly variations in concentrations of pollutants may change from year to year. Long-term monitoring is thus required before a general pattern can be established.

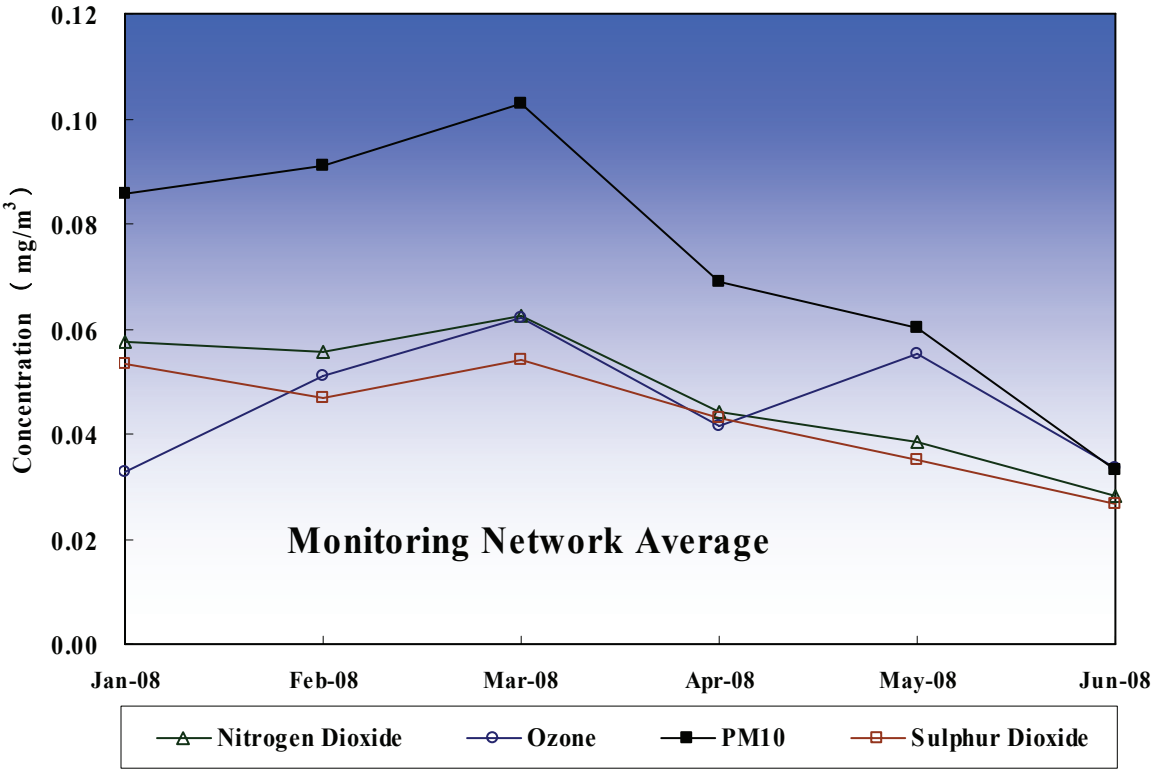

Figure 6：Monthly variations of average pollutant concentrations measured by the Network

4. Statistical Analysis of the Regional Air Quality Index (RAQI)

The two governments of Guangdong and HKSAR jointly started reporting the RAQI since 30 November 2005 to provide the public with information about the air quality in different parts of the PRD region.

The RAQI is a composite indicator of the aggregate level of the four major regional air pollutants, namely sulphur dioxide (SO_2), nitrogen dioxide (NO_2), ozone (O_3) and respirable suspended particulates (PM_{10}). The higher the index value, the higher the regional air pollution levels. The RAQI is divided into the following five grades :

Grade	Regional Air Quality Index (RAQI) value[#]	Air Quality Condition in the Monitored Area
I	0 – 1	Concentrations of all pollutants are well within Class 2 of the National Ambient Air Quality Standards (NAAQS)
II	1 – 2	Concentrations of all pollutants are generally within Class 2 NAAQS
III	2 – 3	Concentrations of individual pollutants may approach or exceed Class 2 NAAQS
IV	3 – 4	Class 2 NAAQS are generally exceeded
V	>4	Class 2 NAAQS are significantly exceeded

The formula for calculating the RAQI is as follows:

$$I_c = \sum_{i=1}^{4} \frac{C_i}{R_i}$$

where I_c stands for the RAQI, an indicator of the aggregate pollution level of four pollutants, namely, SO_2, NO_2, PM_{10} and O_3. For SO_2, NO_2 and PM_{10}, C_i is the daily average concentration while R_i represents the daily average concentration limits of the corresponding pollutants as specified in Class 2 NAAQS. For O_3, C_i is the highest hourly average of a day while R_i represents the hourly average concentration limit in Class 2 NAAQS (refer to "NAAQS (GB 3095 – 1996)" revised version).

[#] The upper limits of the value ranges for RAQI Grades I, II, III and IV are inclusive.

4.1 Statistics on RAQI Grades

Table 4.1a and Figure 7 summarise the statistics on the RAQI grades of all monitoring stations in the Network from January to June 2008. The percentages of days with valid RAQI at various monitoring stations averaged 83%.

Table 4.1 a：Statistics on RAQI grades of individual monitoring stations

Monitoring Stations	District	Days with valid RAQI	Distribution of RAQI grades (%) (January – June 2008)				
			Grade I	Grade II	Grade III	Grade IV	Grade V
Luhu Park	Guangzhou	148	19.59	45.95	24.32	7.43	2.70
Wanqingsha	Guangzhou	159	20.13	37.11	22.01	13.84	6.92
Tianhu	Guangzhou	147	29.93	48.98	14.97	6.12	0.00
Liyuan	Shenzhen	165	35.76	50.30	12.12	1.82	0.00
Tangjia	Zhuhai	143	26.57	49.65	19.58	4.20	0.00
Shunde Dangxiao	Foshan	151	14.57	46.36	21.85	12.58	4.64
Huijingcheng	Foshan	155	21.29	36.13	23.87	7.74	10.97
Donghu	Jiangmen	161	34.16	40.99	16.77	4.35	3.73
Chengzhong	Zhaoqing	148	18.92	47.30	23.65	6.08	4.05
Xiapu	Huizhou	155	18.06	52.90	23.87	5.16	0.00
Jinguowan	Huizhou	133	42.11	48.12	9.77	0.00	0.00
Haogang	Dongguan	155	12.26	45.16	21.94	15.48	5.16
Zimaling Park	Zhongshan	151	22.52	41.72	21.85	10.60	3.31
Tsuen Wan	HKSAR	149	14.77	61.74	23.49	0.00	0.00
Tap Mun	HKSAR	151	33.77	61.59	4.64	0.00	0.00
Tung Chung	HKSAR	148	33.78	41.22	21.62	3.38	0.00

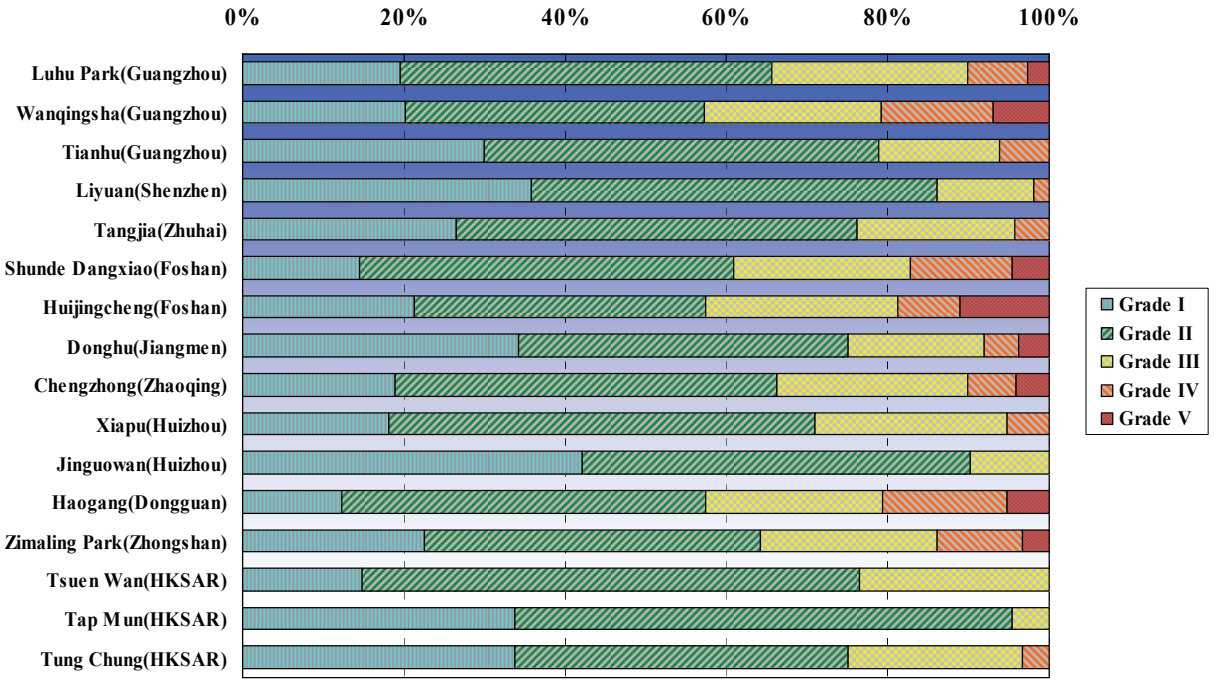

Figure 7：Stacked column chart of RAQI grades of individual monitoring stations

Figure 8 shows the overall distribution of different RAQI grades recorded by the Network during the period from January to June 2008. On the whole, 71.93% of the RAQI values are in Grade I or II, meaning the pollutant concentrations are within Class 2 NAAQS, followed by 19.18% in Grade III, 6.24% in Grade IV and 2.65% in Grade V.

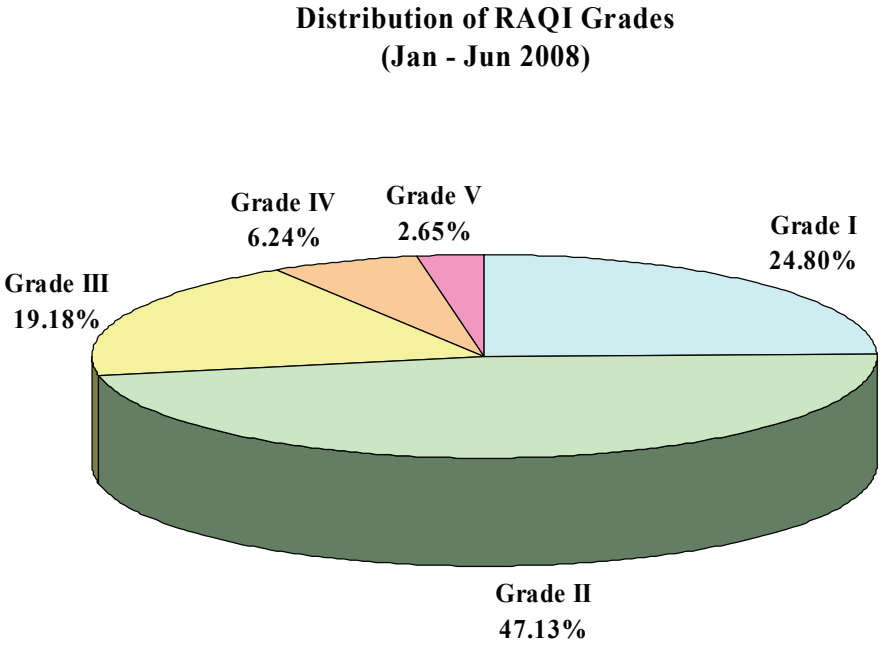

Figure 8：Distribution of RAQI grades in the Network

4.2 Spatial Distribution of Average RAQI Grades

Figure 9 shows the spatial distribution of RAQI overall average grades during the period from January to June 2008. It can be seen that average RAQI values measured in most parts of the PRD region were in Grade II while the average values in the middle part of the region were in Grade III, similar to the corresponding period in previous years. Average RAQI values measured at individual monitoring stations in the Network are shown in Figure 10.

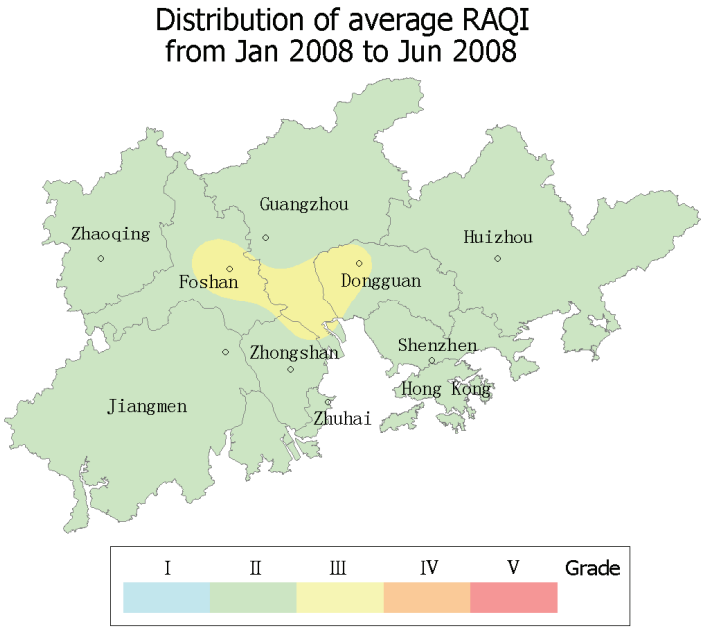

Figure 9：Spatial distribution of average RAQI grades in the Network

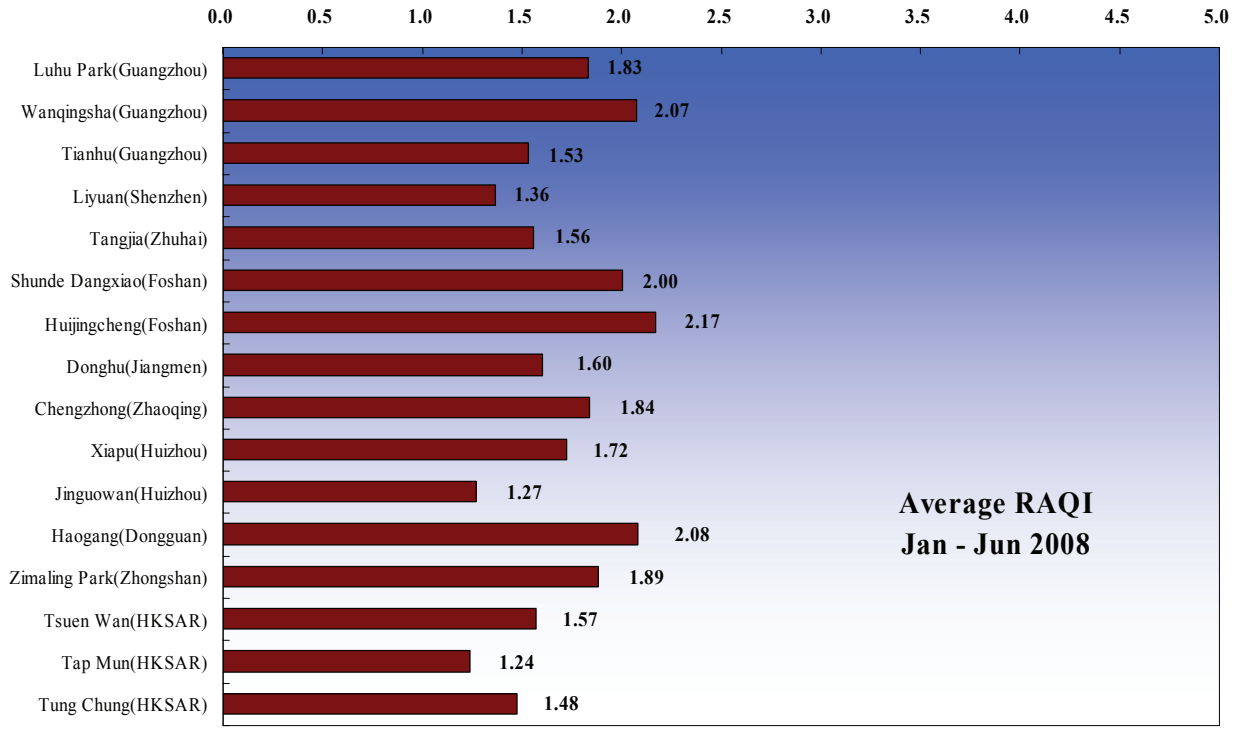

Figure 10：The average RAQI of individual monitoring stations

4.3 Monthly Variations of Average RAQI

Figure 11 shows the monthly variations in the average RAQI values of the Network from January to June 2008. Except for March where average RAQI value reached the Grade III level, the values in other months were within the Grade II category. The highest and lowest monthly averages of RAQI were recorded in March and June, respectively.

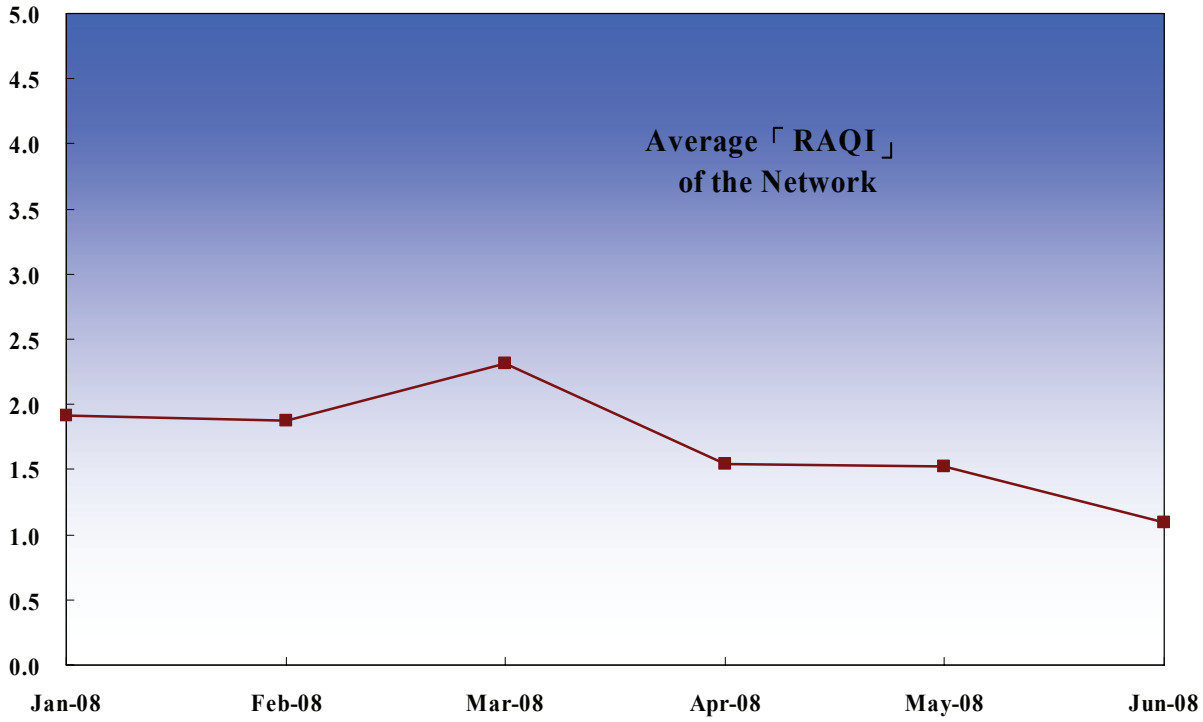

Figure 11：Monthly variations in average RAQI

Annex A：Site Information of Monitoring Stations

Monitoring Stations	Address	Area Type	Sampling Height (Above P.D.)	Above Ground	Date Commenced Operation
Luhu Park (Guangzhou)	Inside Jufong Garden of Luhu Park (Big yard, No. 11 Luhu Park)	City	30m	9m	1993
Wanqingsha (Guangzhou)	Wanqingsha Secondary School, Nansha	Mixed educational/commercial and residential/industrial	13m	12m	Oct 2004
Tianhu (Guangzhou)	Tianhu Park, Conghua City	Background : rural	251m	13m	Oct 2004
Liyuan (Shenzhen)	Shennan Zhong Road, Shenzhen City	City	38m	12m	Sep 1997
Tangjia (Zhuhai)	Building No. 1, Rong Yuan, Zhongshan University, Tangjia, Zhuhai City	Mixed educational/commercial and residential/industrial	24m	19m	Jan 2003
Shunde Dangxiao (Foshan)	Roof-top of Educational Building, Foshan City Communist Party Shunde	Tourist and cultural/educational	27m	17m	Oct 1999
Huijingcheng (Foshan)	No. 127, Fenjiang Nan Road, Chancheng Area	Urban: mixed residential/commercial/industrial	24m	14m	Feb 2000
Donghu (Jiangmen)	Inside Donghu Park, Jiangmen City	City	17.5m	5m	Nov 2001
Chengzhong (Zhaoqing)	No. 17, Qintian Road, Zhaoqing City	Urban: mixed residential/commercial	21m	16m	Jun 2001
Xiapu (Huizhou)	No. 4 Xiabuhengjiang Road No. 3, Huicheng Area	Urban: commercial	49m	20m	Dec 1999
Jinguowan (Huizhou)	Jinguowan Ecological Farm, Huizhou City	Residential	77m	8m	Oct 2004
Haogang (Dongguan)	Haogang Primary School, NanchengQu, Dongguan City	Mixed residential/commercial/industrial	18m	14m	1998
Zimaling Park (Zhongshan)	Zimaling Park, Zhongshan City	Mixed residential/commercial	45 m	7m	Aug 2002
Tsuen Wan (HKSAR)	60 Tai Ho Road, Tsuen Wan	Urban: mixed residential/commercial/industrial	21m	17m	Aug 1988
Tap Mun (HKSAR)	Tap Mun Police Station	Background: rural	26m	11m	Apr 1998
Tung Chung (HKSAR)	6 Fu Tung Street, Tung Chung	New Town: residential	34.5m	27.5m	Apr 1999

Annex B：Measurement Methods of Air Pollutant Concentration

Pollutants	**Measuring Principles**
Sulphur Dioxide	UV fluorescence / Differential Optical Absorption Spectroscopy
Nitrogen Dioxide	Chemiluminescence / Differential Optical Absorption Spectroscopy
Ozone	UV absorption / Differential Optical Absorption Spectroscopy
Respirable Suspended Particulates	Oscillating microbalance (TEOM) Beta particulate monitor