Pearl River Delta
Regional Air Quality Monitoring Network

A Report of Monitoring Results
for the Period between January and June 2010

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Report Prepared by	**:**	**Guangdong Provincial Environmental Monitoring Centre** **Environmental Protection Department, HKSAR**
Approved by	**:**	**Pearl River Delta Air Quality Management and Monitoring Special Panel**
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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 2010 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 have 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 particulates (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 2010. The data capture rates of all monitoring stations averaged 94%.

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 have established the Regional Air Quality Index (RAQI) reporting system. The two Governments have been reporting the RAQI to the public at 4pm everyday 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, the performance in the QA/QC activities and the operation of the data transmission system. The QMC also conducts system audit once a year to evaluate the effectiveness of the quality management system. The findings of the system audit will be documented and the deficiencies found and corrective measures suggested will be listed and followed up by the QMC.

The results of the performance audit on the accuracy and precision of the Network for 2010 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. The major emission sources of SO_2 include power plants, fuel combustion plants, vehicles and vessels. Apart from causing adverse health effects, SO_2 also 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 0.007 mg/m^3 to 0.058 mg/m^3 for the period from January to June 2010. Figure 2 shows that the average levels of SO_2 at the western part of PRD 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, the national daily air quality standard# (0.15 mg/m^3) of SO_2 was exceeded at 4 monitoring stations in the Network, wtih 1 station exceeded the national hourly standard (0.50 mg/m^3). Details are shown in Figure 2 and Table 3.1a - 3.1b.

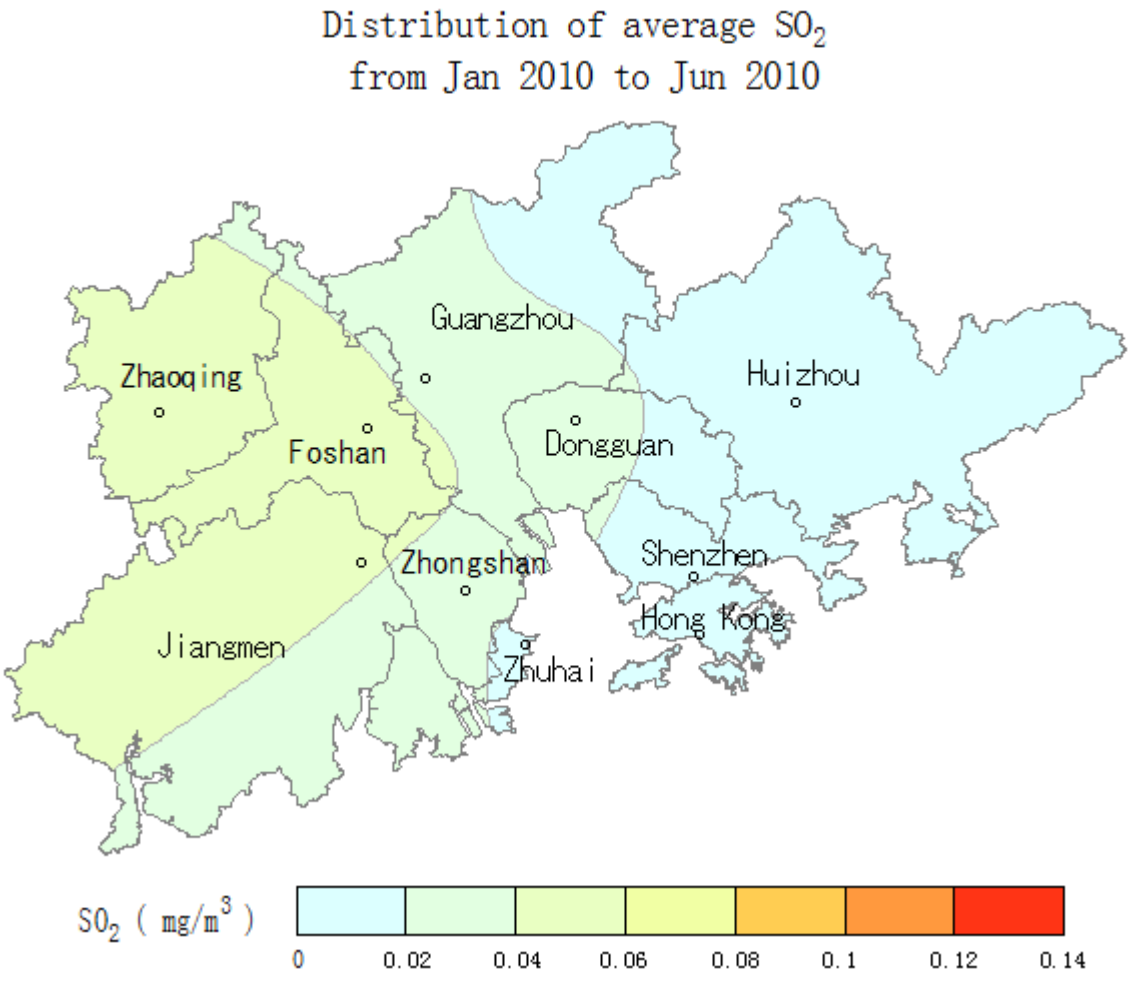

Figure 2：Spatial distribution of average concentrations of Sulphur Dioxide (SO_2) in the Network

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 2010		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	0.253	0.001	0.149	0.000	0.190	0.000	0.163	0.001	0.139	0.000	0.118	0	0.00%
Wanqingsha(Guangzhou)	0.010	0.255	0.006	0.215	0.007	0.700	0.007	0.199	0.005	0.181	0.004	0.214	1	0.02%
Tianhu(Guangzhou)	0.000	0.099	0.001	0.083	0.000	0.181	0.003	0.084	0.005	0.113	0.001	0.110	0	0.00%
Liyuan(Shenzhen)	0.001	0.076	0.001	0.038	0.000	0.060	0.000	0.076	0.001	0.032	0.000	0.091	0	0.00%
Tangjia(Zhuhai)	0.004	0.194	0.001	0.161	0.000	0.264	0.000	0.178	0.000	0.087	0.000	0.106	0	0.00%
Jinjuzui(Foshan)	0.010	0.241	0.004	0.271	0.000	0.346	0.000	0.398	0.005	0.237	0.006	0.143	0	0.00%
Huijingcheng(Foshan)	0.023	0.324	0.012	0.159	0.015	0.346	0.018	0.201	0.007	0.241	0.007	0.128	0	0.00%
Donghu(Jiangmen)	0.009	0.238	0.003	0.149	0.007	0.361	0.005	0.339	0.005	0.162	0.000	0.183	0	0.00%
Chengzhong(Zhaoqing)	0.001	0.311	0.002	0.168	0.002	0.251	0.002	0.210	0.003	0.201	0.002	0.205	0	0.00%
Xiapu(Huizhou)	0.003	0.061	0.002	0.027	0.002	0.070	0.005	0.058	0.005	0.063	0.005	0.036	0	0.00%
Jinguowan(Huizhou)	0.011	0.050	0.003	0.050	0.002	0.051	0.000	0.028	0.001	0.043	0.000	0.039	0	0.00%
Haogang(Dongguan)	0.009	0.244	0.001	0.154	0.007	0.238	0.008	0.293	0.004	0.171	0.004	0.127	0	0.00%
Zimaling Park(Zhongshan)	0.004	0.196	0.002	0.174	0.001	0.305	0.002	0.134	0.000	0.066	0.001	0.164	0	0.00%
Tsuen Wan(HKSAR)	0.000	0.156	0.001	0.110	0.003	0.108	0.000	0.141	0.000	0.119	0.002	0.186	0	0.00%
Tap Mun(HKSAR)	0.003	0.062	0.003	0.038	0.003	0.054	0.005	0.026	0.005	0.035	0.006	0.030	0	0.00%
Tung Chung(HKSAR)	0.001	0.111	0.000	0.090	0.003	0.107	0.006	0.118	0.006	0.114	0.004	0.111	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 2010		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)	0.002	0.086	0.003	0.058	0.003	0.072	0.002	0.058	0.008	0.051	0.008	0.056	0	0.00%
Wanqingsha(Guangzhou)	0.021	0.152	0.007	0.090	0.011	0.117	0.010	0.071	0.005	0.067	0.006	0.087	1	0.60%
Tianhu(Guangzhou)	0.001	0.033	0.002	0.037	0.003	0.071	0.004	0.025	0.006	0.051	0.003	0.049	0	0.00%
Liyuan(Shenzhen)	0.005	0.029	0.001	0.012	0.002	0.032	0.002	0.016	0.002	0.015	0.002	0.016	0	0.00%
Tangjia(Zhuhai)	0.009	0.101	0.003	0.074	0.002	0.098	0.002	0.051	0.001	0.036	0.000	0.059	0	0.00%
Jinjuzui(Foshan)	0.021	0.129	0.011	0.077	0.014	0.126	0.013	0.091	0.018	0.092	0.019	0.072	0	0.00%
Huijingcheng(Foshan)	0.026	0.190	0.019	0.079	0.022	0.178	0.033	0.123	0.009	0.077	0.010	0.068	7	4.22%
Donghu(Jiangmen)	0.035	0.129	0.008	0.061	0.019	0.162	0.008	0.086	0.007	0.082	0.008	0.085	1	0.59%
Chengzhong(Zhaoqing)	0.011	0.137	0.004	0.064	0.006	0.153	0.010	0.131	0.022	0.090	0.005	0.081	1	0.57%
Xiapu(Huizhou)	0.005	0.031	0.002	0.012	0.006	0.033	0.008	0.026	0.008	0.020	0.007	0.018	0	0.00%
Jinguowan(Huizhou)	0.014	0.037	0.008	0.022	0.008	0.023	0.003	0.018	0.007	0.017	0.002	0.016	0	0.00%
Haogang(Dongguan)	0.021	0.096	0.007	0.064	0.010	0.080	0.012	0.098	0.011	0.051	0.007	0.047	0	0.00%
Zimaling Park(Zhongshan)	0.008	0.123	0.002	0.085	0.002	0.118	0.003	0.075	0.001	0.031	0.002	0.078	0	0.00%
Tsuen Wan(HKSAR)	0.004	0.057	0.004	0.042	0.005	0.054	0.003	0.046	0.003	0.039	0.004	0.056	0	0.00%
Tap Mun(HKSAR)	0.005	0.025	0.004	0.014	0.005	0.021	0.006	0.014	0.007	0.016	0.007	0.017	0	0.00%
Tung Chung(HKSAR)	0.004	0.050	0.002	0.040	0.004	0.058	0.007	0.028	0.007	0.033	0.005	0.041	0	0.00%

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

Month	Jan 2010	Feb	Mar	Apr	May	Jun	Overall Average
Luhu Park(Guangzhou)	0.039	0.022	0.036	0.028	0.027	0.023	0.029
Wanqingsha(Guangzhou)	0.063	0.026	0.038	0.029	0.019	0.020	0.033
Tianhu(Guangzhou)	0.010	0.010	0.021	0.011	0.017	0.019	0.015
Liyuan(Shenzhen)	0.012	0.005	0.008	0.006	0.005	0.005	0.007
Tangjia(Zhuhai)	0.037	0.013	0.019	0.016	0.007	0.007	0.017
Jinjuzui(Foshan)	0.068	0.034	0.058	0.041	0.040	0.038	0.046
Huijingcheng(Foshan)	0.089	0.044	0.072	0.065	0.042	0.033	0.058
Donghu(Jiangmen)	0.075	0.026	0.056	0.041	0.028	0.029	0.044
Chengzhong(Zhaoqing)	0.059	0.028	0.058	0.056	0.054	0.034	0.048
Xiapu(Huizhou)	0.014	0.007	0.017	0.013	0.012	0.012	0.013
Jinguowan(Huizhou)	0.020	0.013	0.015	0.010	0.010	0.010	0.013
Haogang(Dongguan)	0.041	0.019	0.031	0.028	0.022	0.021	0.027
Zimaling Park(Zhongshan)	0.052	0.014	0.028	0.021	0.007	0.015	0.023
Tsuen Wan(HKSAR)	0.015	0.015	0.022	0.015	0.015	0.018	0.017
Tap Mun(HKSAR)	0.012	0.007	0.010	0.010	0.010	0.009	0.010
Tung Chung(HKSAR)	0.014	0.008	0.014	0.013	0.012	0.010	0.012

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. The major emission sources of the pollutant include power plants, vehicles, industrial combustion plants, etc. Apart from causing adverse health effects, NO_2 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 0.014 mg/m^3 to 0.067 mg/m^3 for the period from January to June 2010. During the period, the national daily air quality standard (0.12 mg/m^3) was exceeded at 10 monitoring stations in the Network. The national hourly air quality standard (0.24 mg/m^3) of NO_2 was exceeded at 7 stations. Details are shown in Figure 3 and Table 3.2a - 3.2c.

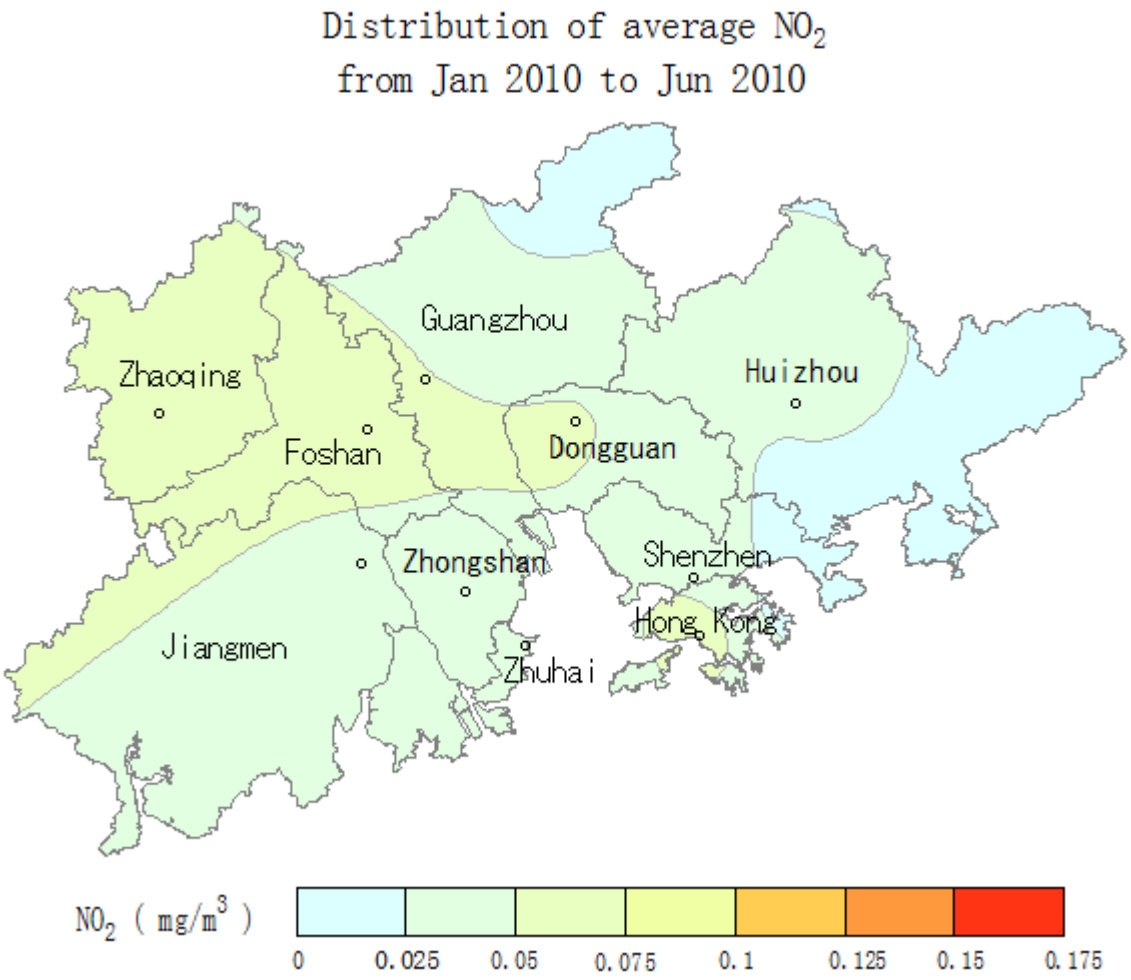

Figure 3：Spatial distribution of average concentrations of Nitrogen Dioxide (NO_2) in the Network

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 2010		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)	0.029	0.249	0.007	0.190	0.009	0.142	0.018	0.123	0.010	0.117	0.004	0.086	4	0.10%
Wanqingsha(Guangzhou)	0.016	0.193	0.005	0.130	0.005	0.181	0.002	0.183	0.003	0.126	0.001	0.155	0	0.00%
Tianhu(Guangzhou)	0.003	0.103	0.004	0.080	0.003	0.149	0.004	0.076	0.001	0.105	0.000	0.063	0	0.00%
Liyuan(Shenzhen)	0.015	0.305	0.007	0.136	0.000	0.162	0.007	0.231	0.001	0.114	0.004	0.111	5	0.12%
Tangjia(Zhuhai)	0.000	0.185	0.001	0.131	0.003	0.174	0.006	0.189	0.001	0.100	0.005	0.060	0	0.00%
Jinjuzui(Foshan)	0.025	0.241	0.006	0.144	0.011	0.189	0.012	0.174	0.008	0.181	0.000	0.142	1	0.02%
Huijingcheng(Foshan)	0.024	0.274	0.017	0.182	0.020	0.181	0.023	0.196	0.025	0.196	0.019	0.143	7	0.18%
Donghu(Jiangmen)	0.015	0.212	0.004	0.068	0.006	0.143	0.006	0.090	0.007	0.094	0.001	0.079	0	0.00%
Chengzhong(Zhaoqing)	0.028	0.299	0.013	0.141	0.017	0.159	0.017	0.141	0.019	0.186	0.015	0.122	3	0.08%
Xiapu(Huizhou)	0.016	0.136	0.006	0.096	0.009	0.134	0.012	0.179	0.005	0.085	0.007	0.079	0	0.00%
Jinguowan(Huizhou)	0.006	0.125	0.001	0.056	0.003	0.075	0.003	0.119	0.004	0.062	0.003	0.060	0	0.00%
Haogang(Dongguan)	0.024	0.204	0.010	0.150	0.014	0.178	0.012	0.191	0.012	0.169	0.014	0.131	0	0.00%
Zimaling Park(Zhongshan)	0.006	0.226	0.001	0.166	0.001	0.171	0.003	0.210	0.002	0.090	0.003	0.129	0	0.00%
Tsuen Wan(HKSAR)	0.016	0.301	0.013	0.157	0.012	0.210	0.016	0.195	0.013	0.154	0.015	0.183	6	0.14%
Tap Mun(HKSAR)	0.002	0.074	0.003	0.076	0.003	0.091	0.001	0.075	0.004	0.062	0.002	0.048	0	0.00%
Tung Chung(HKSAR)	0.011	0.251	0.000	0.205	0.000	0.200	0.001	0.199	0.003	0.158	0.000	0.198	3	0.07%

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 2010		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)	0.043	0.147	0.016	0.115	0.020	0.095	0.025	0.076	0.020	0.064	0.015	0.052	2	1.23%
Wanqingsha(Guangzhou)	0.043	0.128	0.012	0.095	0.013	0.117	0.013	0.108	0.010	0.062	0.012	0.079	1	0.60%
Tianhu(Guangzhou)	0.008	0.040	0.006	0.033	0.008	0.063	0.006	0.025	0.007	0.047	0.001	0.023	0	0.00%
Liyuan(Shenzhen)	0.041	0.130	0.023	0.082	0.010	0.120	0.025	0.117	0.017	0.067	0.015	0.066	2	1.24%
Tangjia(Zhuhai)	0.015	0.119	0.011	0.100	0.010	0.091	0.013	0.077	0.006	0.036	0.008	0.028	0	0.00%
Jinjuzui(Foshan)	0.041	0.144	0.016	0.092	0.020	0.128	0.026	0.082	0.023	0.075	0.004	0.085	4	2.45%
Huijingcheng(Foshan)	0.033	0.169	0.029	0.136	0.033	0.140	0.043	0.112	0.037	0.098	0.032	0.099	8	4.85%
Donghu(Jiangmen)	0.027	0.140	0.010	0.045	0.012	0.093	0.014	0.062	0.013	0.060	0.013	0.053	3	2.14%
Chengzhong(Zhaoqing)	0.042	0.165	0.021	0.100	0.027	0.130	0.034	0.106	0.032	0.095	0.032	0.079	8	5.00%
Xiapu(Huizhou)	0.028	0.067	0.013	0.058	0.017	0.072	0.026	0.071	0.023	0.038	0.020	0.043	0	0.00%
Jinguowan(Huizhou)	0.020	0.053	0.010	0.031	0.007	0.042	0.009	0.047	0.007	0.023	0.008	0.033	0	0.00%
Haogang(Dongguan)	0.041	0.119	0.016	0.082	0.024	0.100	0.026	0.116	0.017	0.090	0.028	0.072	0	0.00%
Zimaling Park(Zhongshan)	0.024	0.149	0.004	0.110	0.005	0.099	0.005	0.078	0.006	0.056	0.007	0.093	1	0.61%
Tsuen Wan(HKSAR)	0.048	0.155	0.030	0.099	0.040	0.141	0.052	0.114	0.045	0.094	0.037	0.126	3	1.70%
Tap Mun(HKSAR)	0.009	0.036	0.007	0.040	0.009	0.034	0.008	0.023	0.007	0.036	0.005	0.025	0	0.00%
Tung Chung(HKSAR)	0.028	0.152	0.003	0.110	0.004	0.138	0.006	0.129	0.010	0.088	0.011	0.094	3	1.70%

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

Month	Jan 2010	Feb	Mar	Apr	May	Jun	Overall Average
Luhu Park(Guangzhou)	0.079	0.056	0.051	0.044	0.042	0.030	0.051
Wanqingsha(Guangzhou)	0.071	0.040	0.047	0.053	0.037	0.033	0.048
Tianhu(Guangzhou)	0.017	0.019	0.024	0.014	0.015	0.013	0.017
Liyuan(Shenzhen)	0.059	0.042	0.043	0.043	0.036	0.034	0.043
Tangjia(Zhuhai)	0.049	0.032	0.036	0.039	0.018*	0.018*	0.034
Jinjuzui(Foshan)	0.074	0.044	0.058	0.051	0.044	0.035	0.051
Huijingcheng(Foshan)	0.081	0.058	0.072	0.071	0.063	0.056	0.067
Donghu(Jiangmen)	0.064	0.024	0.033	0.031	0.033*	0.024*	0.037
Chengzhong(Zhaoqing)	0.086	0.050	0.062	0.065	0.054	0.049	0.062
Xiapu(Huizhou)	0.042	0.030	0.039	0.038	0.030	0.030	0.035
Jinguowan(Huizhou)	0.033	0.017	0.020	0.019	0.013	0.015	0.020
Haogang(Dongguan)	0.068	0.044	0.055	0.054	0.046	0.048	0.053
Zimaling Park(Zhongshan)	0.064	0.028	0.041	0.041	0.020	0.025	0.037
Tsuen Wan(HKSAR)	0.072	0.062	0.072	0.069	0.067	0.060	0.067
Tap Mun(HKSAR)	0.017	0.013	0.016	0.013	0.013	0.012	0.014
Tung Chung(HKSAR)	0.061	0.037	0.052	0.045	0.040	0.036	0.045

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 eyes, 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, 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 those in the urban areas. The overall averages of O_3 recorded by the Network ranged from 0.020 mg/m^3 to 0.078 mg/m^3 for the period from January to June 2010, 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, 15 monitoring stations in the Network had recorded hourly concentrations exceeding 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.

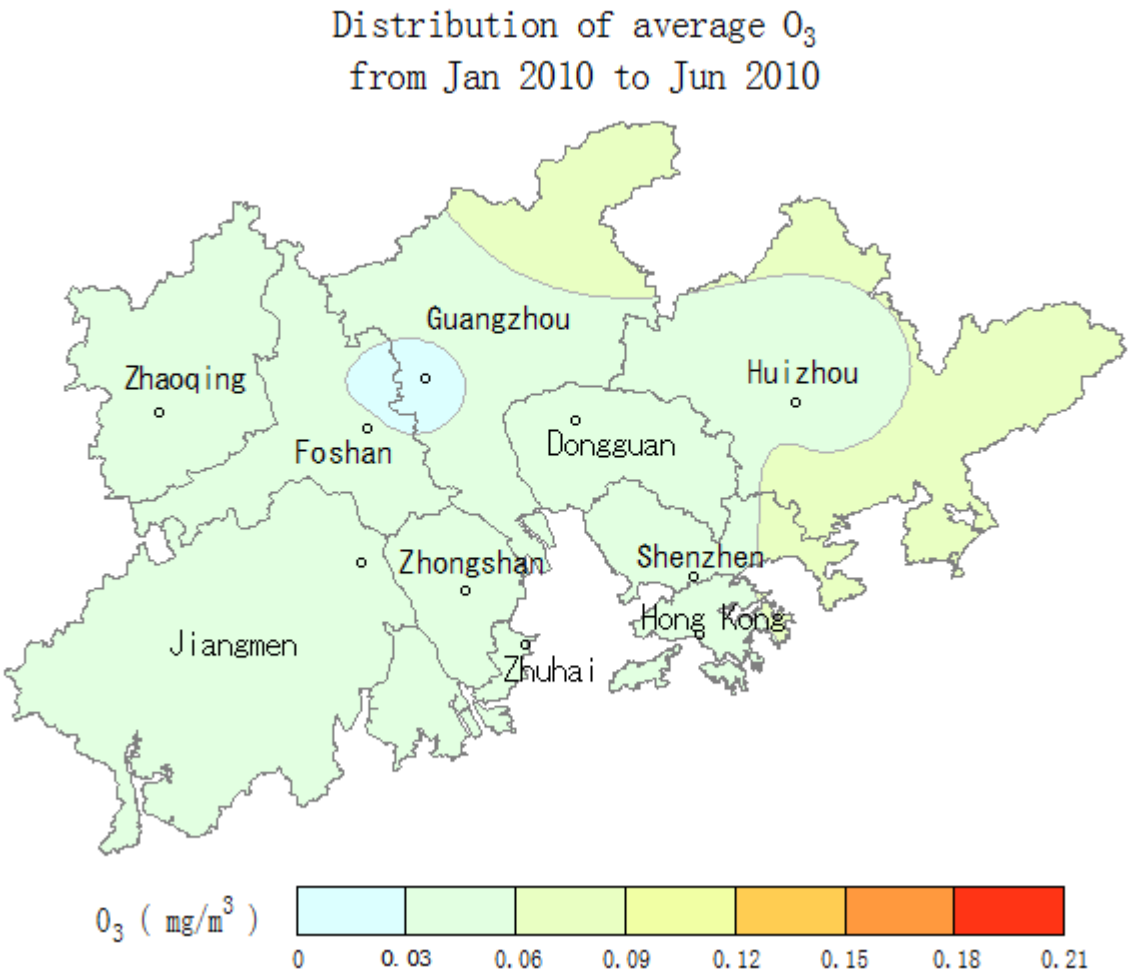

Figure 4：Spatial distribution of average concentrations of Ozone (O_3) in the Network

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 2010		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	0.171	0.001	0.100	0.000	0.181	0.000	0.168	0.001	0.249	0.000	0.214	11	0.28%
Wanqingsha(Guangzhou)	0.006	0.244	0.000	0.123	0.005	0.282	0.006	0.305	0.007	0.392	0.007	0.354	78	1.89%
Tianhu(Guangzhou)	0.000	0.274	0.009	0.211	0.005	0.277	0.006	0.188	0.003	0.251	0.005	0.284	60	1.48%
Liyuan(Shenzhen)	0.002	0.166	0.001	0.084	0.000	0.190	0.002	0.161	0.001	0.197	0.000	0.212	1	0.02%
Tangjia(Zhuhai)	0.000	0.270	0.001	0.120	0.000	0.318	0.000	0.225	0.000	0.430	0.001	0.402	80	1.97%
Jinjuzui(Foshan)	0.005	0.188	0.000	0.108	0.005	0.200	0.003	0.256	0.000	0.370	0.006	0.284	46	1.11%
Huijingcheng(Foshan)	0.014	0.153	0.007	0.148	0.007	0.319	0.008	0.128	0.004	0.331	0.000	0.297	38	0.94%
Donghu(Jiangmen)	0.002	0.172	0.002	0.111	0.001	0.266	0.001	0.164	0.000	0.298	0.002	0.215	28	0.68%
Chengzhong(Zhaoqing)	0.000	0.141	0.000	0.096	0.000	0.188	0.000	0.196	0.000	0.370	0.000	0.201	26	0.68%
Xiapu(Huizhou)	0.002	0.150	0.003	0.149	0.003	0.189	0.003	0.200	0.004	0.194	0.002	0.205	2	0.05%
Jinguowan(Huizhou)	0.002	0.177	0.000	0.166	0.000	0.193	0.008	0.200	0.010	0.246	0.005	0.171	1	0.02%
Haogang(Dongguan)	0.005	0.202	0.005	0.163	0.001	0.228	0.001	0.198	0.000	0.238	0.000	0.256	26	0.61%
Zimaling Park(Zhongshan)	0.000	0.174	0.001	0.114	0.000	0.193	0.000	0.187	0.000	0.325	0.000	0.268	26	0.62%
Tsuen Wan(HKSAR)	0.000	0.111	0.003	0.070	0.001	0.121	0.002	0.138	0.004	0.124	0.006	0.142	0	0.00%
Tap Mun(HKSAR)	0.003	0.163	0.003	0.145	0.003	0.222	0.004	0.205	0.004	0.180	0.008	0.176	3	0.07%
Tung Chung(HKSAR)	0.005	0.156	0.005	0.109	0.006	0.180	0.003	0.178	0.003	0.184	0.004	0.292	4	0.09%

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

Month	Jan 2010		Feb		Mar		Apr		May		Jun	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Luhu Park(Guangzhou)	0.000	0.050	0.003	0.055	0.003	0.067	0.004	0.060	0.005	0.093	0.002	0.103
Wanqingsha(Guangzhou)	0.007	0.077	0.008	0.078	0.008	0.114	0.012	0.131	0.034	0.158	0.019	0.150
Tianhu(Guangzhou)	0.028	0.176	0.039	0.108	0.038	0.147	0.035	0.128	0.029	0.145	0.040	0.146
Liyuan(Shenzhen)	0.006	0.077	0.013	0.058	0.006	0.080	0.021	0.114	0.013	0.119	0.013	0.095
Tangjia(Zhuhai)	0.002	0.088	0.004	0.085	0.001	0.112	0.010	0.133	0.030	0.159	0.031	0.126
Jinjuzui(Foshan)	0.006	0.052	0.005	0.052	0.007	0.099	0.012	0.098	0.011	0.147	0.021	0.095
Huijingcheng(Foshan)	0.015	0.056	0.009	0.051	0.011	0.093	0.011	0.049	0.013	0.147	0.005	0.103
Donghu(Jiangmen)	0.003	0.050	0.005	0.055	0.003	0.083	0.003	0.084	0.005	0.121	0.006	0.084
Chengzhong(Zhaoqing)	0.002	0.050	0.003	0.045	0.004	0.099	0.002	0.093	0.007	0.169	0.006	0.087
Xiapu(Huizhou)	0.007	0.082	0.015	0.067	0.010	0.103	0.013	0.135	0.016	0.127	0.016	0.119
Jinguowan(Huizhou)	0.009	0.110	0.002	0.091	0.020	0.118	0.038	0.142	0.031	0.121	0.027	0.125
Haogang(Dongguan)	0.011	0.074	0.016	0.072	0.009	0.092	0.012	0.117	0.014	0.126	0.006	0.093
Zimaling Park(Zhongshan)	0.006	0.068	0.004	0.072	0.003	0.084	0.004	0.105	0.005	0.130	0.017	0.109
Tsuen Wan(HKSAR)	0.010	0.057	0.006	0.041	0.006	0.085	0.006	0.102	0.006	0.081	0.008	0.079
Tap Mun(HKSAR)	0.011	0.110	0.022	0.088	0.017	0.134	0.041	0.151	0.029	0.137	0.026	0.134
Tung Chung(HKSAR)	0.007	0.073	0.011	0.088	0.008	0.117	0.017	0.126	0.019	0.100	0.009	0.089

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

Month	Jan 2010	Feb	Mar	Apr	May	Jun	Overall Average
Luhu Park(Guangzhou)	0.015	0.016	0.024	0.014	0.028	0.026	0.020
Wanqingsha(Guangzhou)	0.031	0.035	0.056	0.050	0.071	0.060	0.050
Tianhu(Guangzhou)	0.088	0.072	0.081	0.069	0.076	0.083	0.078
Liyuan(Shenzhen)	0.038	0.029	0.038	0.050	0.056	0.042	0.042
Tangjia(Zhuhai)	0.033	0.036	0.055	0.056	0.086	0.064	0.055
Jinjuzui(Foshan)	0.020	0.025	0.039	0.038	0.052	0.044	0.036
Huijingcheng(Foshan)	0.031	0.025	0.037	0.020	0.047	0.032	0.032
Donghu(Jiangmen)	0.020	0.026	0.039	0.024	0.046	0.034	0.031
Chengzhong(Zhaoqing)	0.019	0.025	0.047*	0.025	0.048	0.028	0.031
Xiapu(Huizhou)	0.036	0.037	0.052	0.049	0.068	0.052	0.048
Jinguowan(Huizhou)	0.055	0.050	0.066	0.068	0.081	0.059	0.063
Haogang(Dongguan)	0.032	0.042	0.046	0.040	0.054	0.039	0.042
Zimaling Park(Zhongshan)	0.024	0.033	0.049	0.041	0.051	0.046	0.040
Tsuen Wan(HKSAR)	0.031	0.019	0.027	0.035	0.034	0.024	0.028
Tap Mun(HKSAR)	0.069	0.056	0.072	0.082	0.087	0.056	0.070
Tung Chung(HKSAR)	0.039	0.039	0.047	0.055	0.051	0.042	0.045

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 0.044 mg/m^3 to 0.112 mg/m^3 for the period from January to June 2010. As shown in Figure 5, the average levels of PM_{10} in the central and north-western 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, 15 monitoring stations in the Network had recorded daily concentrations exceeding the national daily air quality standard (0.15mg/m^3) of PM_{10}. Details are shown in Tables 3.4a - 3.4c.

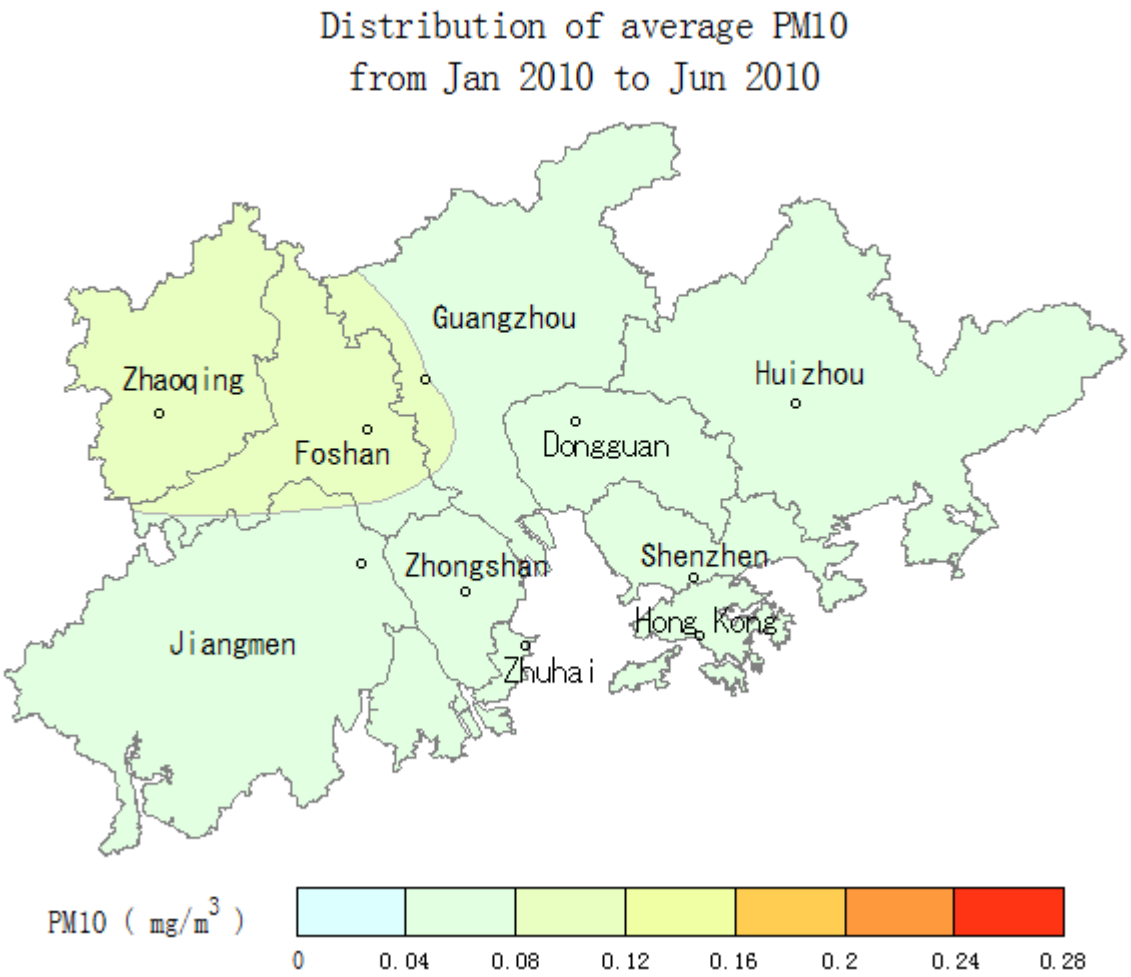

Figure 5：Spatial distribution of average concentrations of Respirable Suspended Particulates (PM_{10}) in the Network

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

Month	Jan 2010		Feb		Mar		Apr		May		Jun	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Luhu Park(Guangzhou)	0.003	0.396	0.016	0.210	0.003	0.281	0.005	0.212	0.005	0.178	0.005	0.349
Wanqingsha(Guangzhou)	0.002	0.445	0.002	0.208	0.000	0.499	0.000	0.405	0.001	0.261	0.000	0.483
Tianhu(Guangzhou)	0.000	0.236	0.001	0.129	0.000	0.366	0.000	0.175	0.001	0.186	0.000	0.195
Liyuan(Shenzhen)	0.001	0.353	0.001	0.149	0.000	0.652	0.002	0.259	0.001	0.224	0.000	0.171
Tangjia(Zhuhai)	0.000	0.331	0.001	0.245	0.002	0.656	0.000	0.427	0.000	0.171	0.000	0.306
Jinjuzui(Foshan)	0.009	0.435	0.000	0.591	0.000	0.356	0.000	0.387	0.000	0.186	0.003	0.296
Huijingcheng(Foshan)	0.035	0.513	0.029	0.341	0.024	0.361	0.031	0.348	0.020	0.198	0.017	0.212
Donghu(Jiangmen)	0.001	0.469	0.006	0.216	0.005	0.251	0.000	0.234	0.000	0.202	0.000	0.258
Chengzhong(Zhaoqing)	0.000	0.531	0.003	0.269	0.001	0.397	0.000	0.320	0.003	0.272	0.000	0.233
Xiapu(Huizhou)	0.006	0.358	0.003	0.231	0.003	0.567	0.002	0.247	0.004	0.111	0.005	0.140
Jinguowan(Huizhou)	0.005	0.398	0.003	0.156	0.003	0.763	0.001	0.213	0.001	0.213	0.000	0.112
Haogang(Dongguan)	0.003	0.386	0.001	0.258	0.000	0.415	0.000	0.354	0.000	0.243	0.000	0.252
Zimaling Park(Zhongshan)	0.003	0.362	0.001	0.283	0.002	0.617	0.000	0.316	0.000	0.228	0.000	0.264
Tsuen Wan(HKSAR)	0.005	0.368	0.004	0.177	0.000	0.798	0.003	0.158	0.003	0.109	0.006	0.182
Tap Mun(HKSAR)	0.003	0.120	0.004	0.083	0.004	0.780	0.002	0.140	0.004	0.139	0.002	0.083
Tung Chung(HKSAR)	0.002	0.337	0.003	0.220	0.004	0.699	0.001	0.136	0.002	0.133	0.002	0.169

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 2010		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)	0.034	0.252	0.027	0.126	0.024	0.218	0.024	0.151	0.046	0.128	0.041	0.126	8	4.76%
Wanqingsha(Guangzhou)	0.030	0.276	0.020	0.164	0.022	0.401	0.025	0.224	0.028	0.108	0.023	0.188	15	9.20%
Tianhu(Guangzhou)	0.007	0.114	0.005	0.080	0.003	0.149	0.007	0.126	0.012	0.101	0.007	0.111	0	0.00%
Liyuan(Shenzhen)	0.020	0.131	0.011	0.071	0.016	0.524	0.023	0.097	0.015	0.120	0.010	0.081	2	1.23%
Tangjia(Zhuhai)	0.032	0.205	0.018	0.178	0.022	0.547	0.022	0.175	0.005	0.086	0.015	0.143	6	3.92%
Jinjuzui(Foshan)	0.036	0.291	0.025	0.194	0.021	0.213	0.020	0.145	0.036	0.101	0.029	0.150	16	10.39%
Huijingcheng(Foshan)	0.058	0.327	0.049	0.287	0.044	0.272	0.053	0.199	0.056	0.125	0.046	0.146	32	20.00%
Donghu(Jiangmen)	0.028	0.217	0.018	0.117	0.021	0.165	0.015	0.152	0.017	0.119	0.015	0.120	6	3.53%
Chengzhong(Zhaoqing)	0.012	0.374	0.020	0.171	0.015	0.240	0.010	0.217	0.032	0.137	0.029	0.133	19	11.05%
Xiapu(Huizhou)	0.020	0.164	0.021	0.103	0.015	0.427	0.013	0.115	0.025	0.079	0.017	0.075	4	2.29%
Jinguowan(Huizhou)	0.031	0.136	0.017	0.077	0.018	0.457	0.020	0.107	0.025	0.085	0.016	0.063	3	1.81%
Haogang(Dongguan)	0.024	0.171	0.013	0.125	0.019	0.334	0.013	0.180	0.026	0.089	0.025	0.113	7	4.02%
Zimaling Park(Zhongshan)	0.024	0.264	0.015	0.181	0.029	0.464	0.019	0.118	0.023	0.078	0.010	0.123	12	6.98%
Tsuen Wan(HKSAR)	0.021	0.142	0.012	0.068	0.017	0.581	0.021	0.077	0.021	0.071	0.015	0.093	2	1.11%
Tap Mun(HKSAR)	0.018	0.098	0.012	0.050	0.013	0.664	0.017	0.072	0.014	0.079	0.009	0.052	3	1.69%
Tung Chung(HKSAR)	0.020	0.163	0.012	0.121	0.020	0.519	0.021	0.065	0.013	0.064	0.011	0.090	3	1.69%

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

Month	Jan 2010	Feb	Mar	Apr	May	Jun	Overall Average
Luhu Park(Guangzhou)	0.109	0.062	0.082	0.071	0.088	0.065	0.080
Wanqingsha(Guangzhou)	0.104	0.044	0.080	0.060	0.056	0.062	0.069
Tianhu(Guangzhou)	0.053	0.037	0.063	0.048	0.043	0.041	0.048
Liyuan(Shenzhen)	0.069	0.035	0.088	0.046	0.049	0.030	0.053
Tangjia(Zhuhai)	0.083	0.043	0.086	0.052	0.043	0.041*	0.060
Jinjuzui(Foshan)	0.122	0.073	0.078*	0.073	0.060	0.057	0.077
Huijingcheng(Foshan)	0.152	0.112	0.131	0.103	0.087*	0.075	0.112
Donghu(Jiangmen)	0.094	0.041	0.065	0.052	0.042	0.036	0.056
Chengzhong(Zhaoqing)	0.126	0.057	0.106	0.086	0.079	0.061	0.087
Xiapu(Huizhou)	0.084	0.051	0.091	0.054	0.044	0.039	0.061
Jinguowan(Huizhou)	0.075	0.040	0.079	0.052	0.046	0.035	0.055
Haogang(Dongguan)	0.096	0.050	0.084	0.065	0.055	0.044	0.066
Zimaling Park(Zhongshan)	0.093	0.045	0.103	0.060	0.043	0.044	0.065
Tsuen Wan(HKSAR)	0.059	0.036	0.084	0.043	0.039	0.031	0.049
Tap Mun(HKSAR)	0.054	0.028	0.089	0.039	0.034	0.019	0.044
Tung Chung(HKSAR)	0.063	0.033	0.077	0.038	0.034	0.028	0.046

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 2010. The overall concentrations of SO_2, NO_2 and PM_{10} were generally higher in the first quarter and lower in June as summer approached, similar to the corresponding period in previous years. The relatively low pollution level in June was due to more effective air dispersion under higher mixing heights as well as heavier rainfall and clean maritime air stream associated with the southern monsoon during summer.

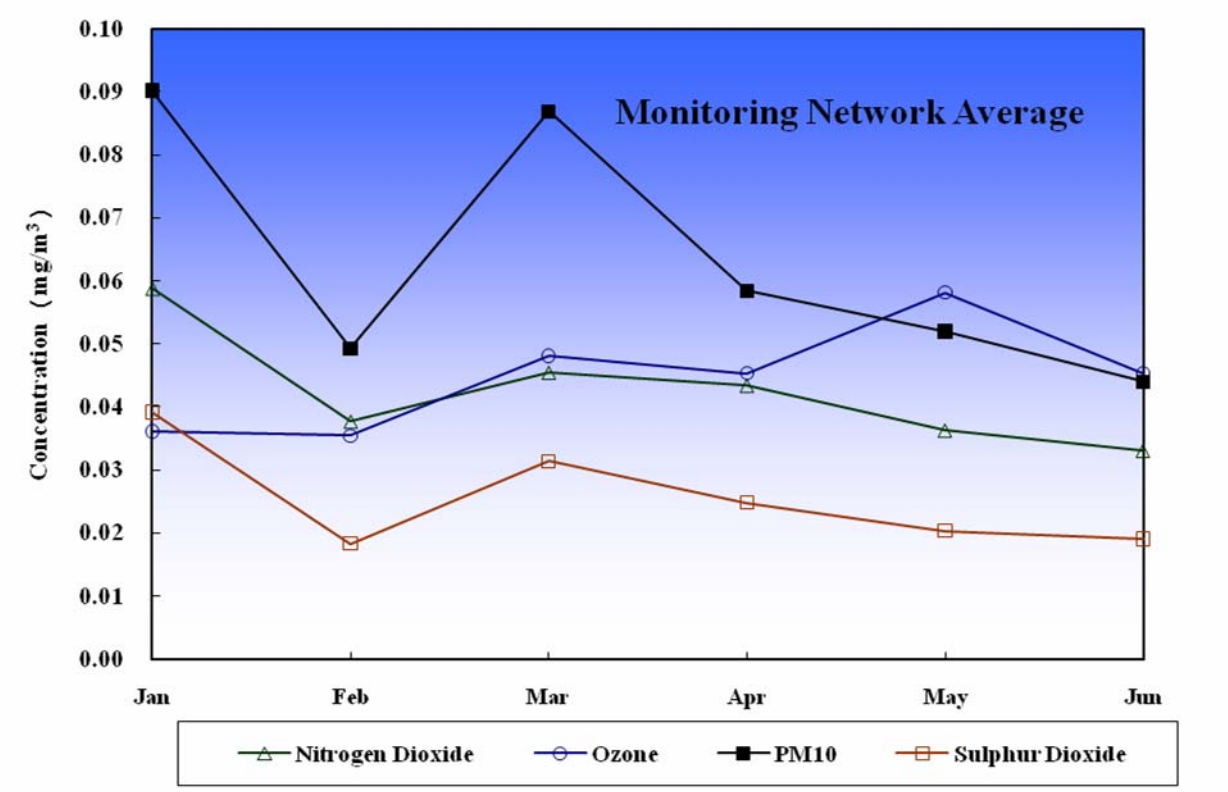

Figure 6：Monthly variations of average pollutant concentrations measured by the Network

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

The Guangdong and HKSAR Governments 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 2010. The percentages of days with valid RAQI at various monitoring stations averaged 92%.

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 2010)				
			Grade I	Grade II	Grade III	Grade IV	Grade V
Luhu Park	Guangzhou	164	26.83	49.39	21.95	1.83	0.00
Wanqingsha	Guangzhou	169	30.77	44.97	17.16	5.33	1.78
Tianhu	Guangzhou	157	49.04	43.95	7.01	0.00	0.00
Liyuan	Shenzhen	168	52.98	39.88	6.55	0.60	0.00
Tangjia	Zhuhai	166	40.36	44.58	12.05	1.81	1.20
Jinjuzui	Foshan	154	23.38	46.10	21.43	8.44	0.65
Huijingcheng	Foshan	167	5.39	54.49	23.95	11.38	4.79
Donghu	Jiangmen	167	49.10	33.53	14.37	2.99	0.00
Chengzhong	Zhaoqing	169	24.26	43.20	20.71	8.88	2.96
Xiapu	Huizhou	169	39.05	54.44	5.33	1.18	0.00
Jinguowan	Huizhou	159	49.06	47.17	3.14	0.63	0.00
Haogang	Dongguan	175	22.86	54.29	20.57	2.29	0.00
Zimaling Park	Zhongshan	165	47.27	33.33	16.36	2.42	0.61
Tsuen Wan	HKSAR	170	26.47	67.65	5.29	0.00	0.59
Tap Mun	HKSAR	172	57.56	41.28	0.00	0.58	0.58
Tung Chung	HKSAR	170	51.18	41.18	6.47	0.59	0.59

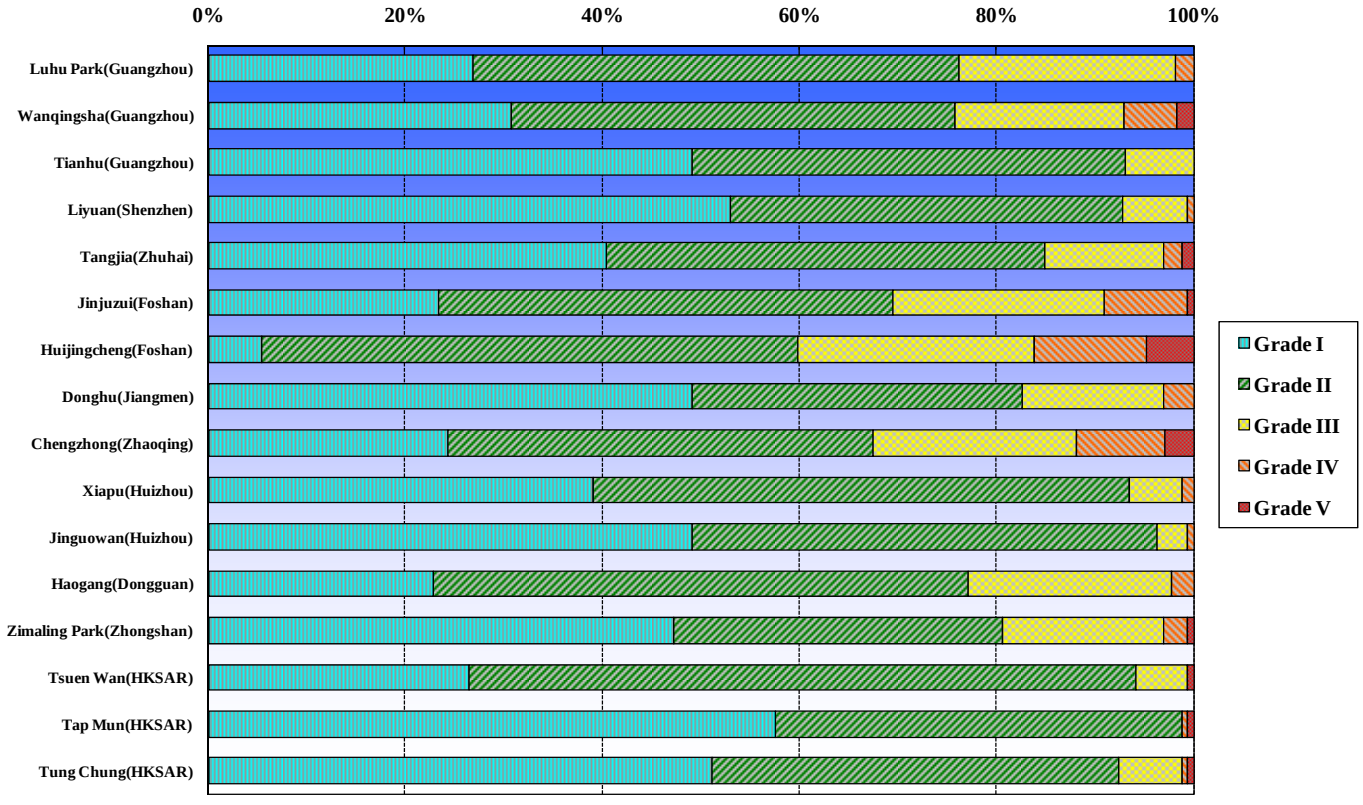

Figure 7：Stacked column chart of RAQI grades of individual monitoring stations

Figure 8 shows the overall distribution of different RAQI grades recorded by the Network during the period from January to June 2010. On the whole, 83.46% of the RAQI values are in Grade I or II, meaning the pollutant concentrations are within Class 2 NAAQS, followed by 12.63% in Grade III, 3.04% in Grade IV and 0.86% in Grade V.

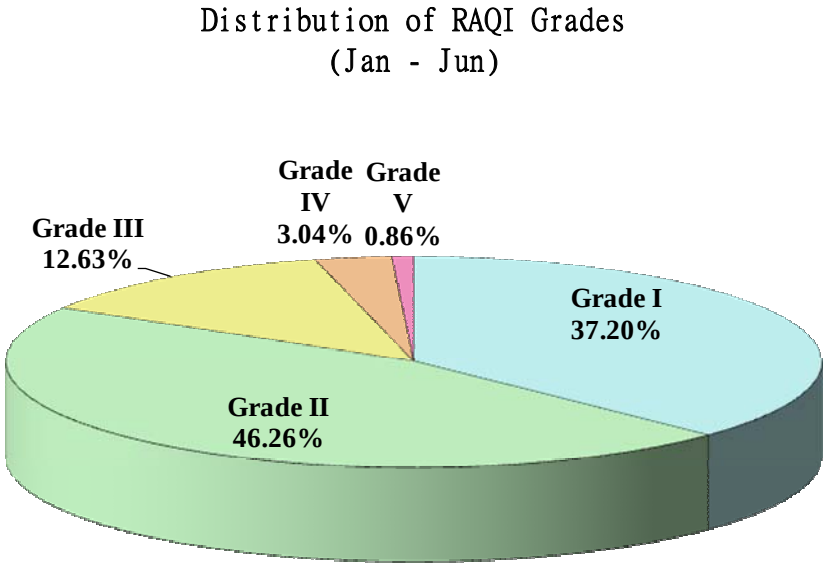

Figure 8：Distribution of RAQI grades in the Network

4.2 Spatial Distribution of Average RAQI Grades

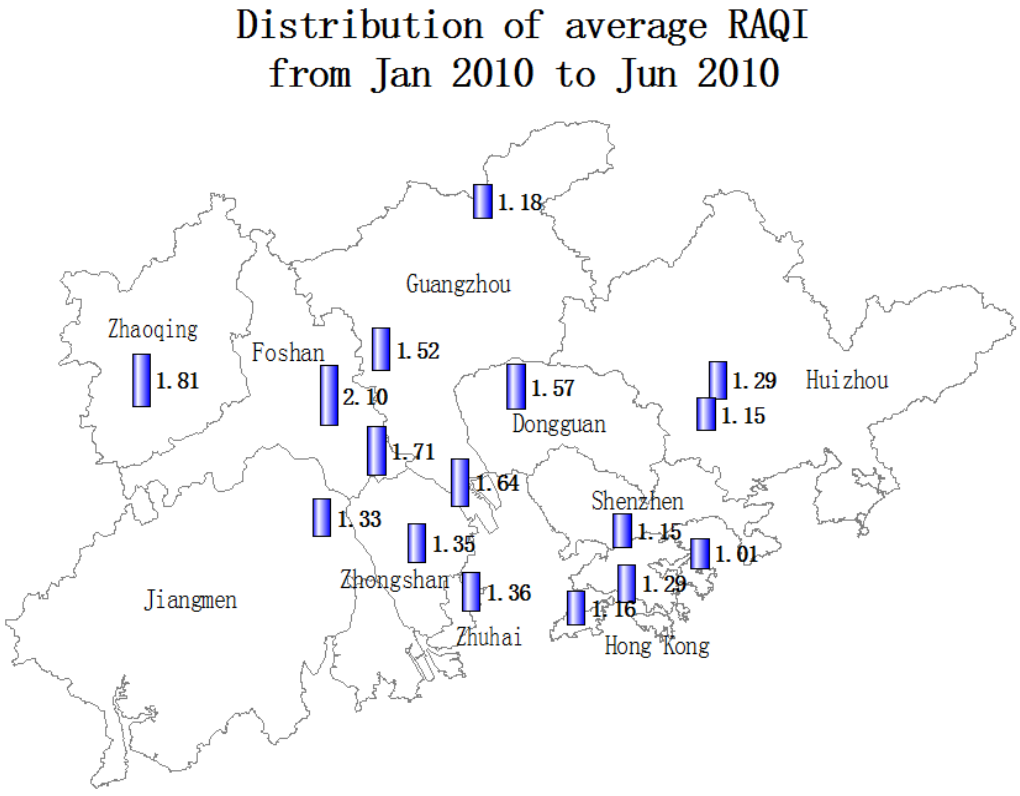

Figure 9：Spatial distribution of average RAQI at Monitoring Stations in the Network

Figure 9 shows the spatial distribution of half-yearly average RAQI during the period from January to June 2010. The half yearly average RAQI values measured in the PRD monitoring network are within Grade II and III.

4.3 Monthly Variations of Average RAQI

Figure 10 shows the monthly variations in the average RAQI values of the Network from January to June 2010. The average RAQI values in all six months were within the Grade II category.

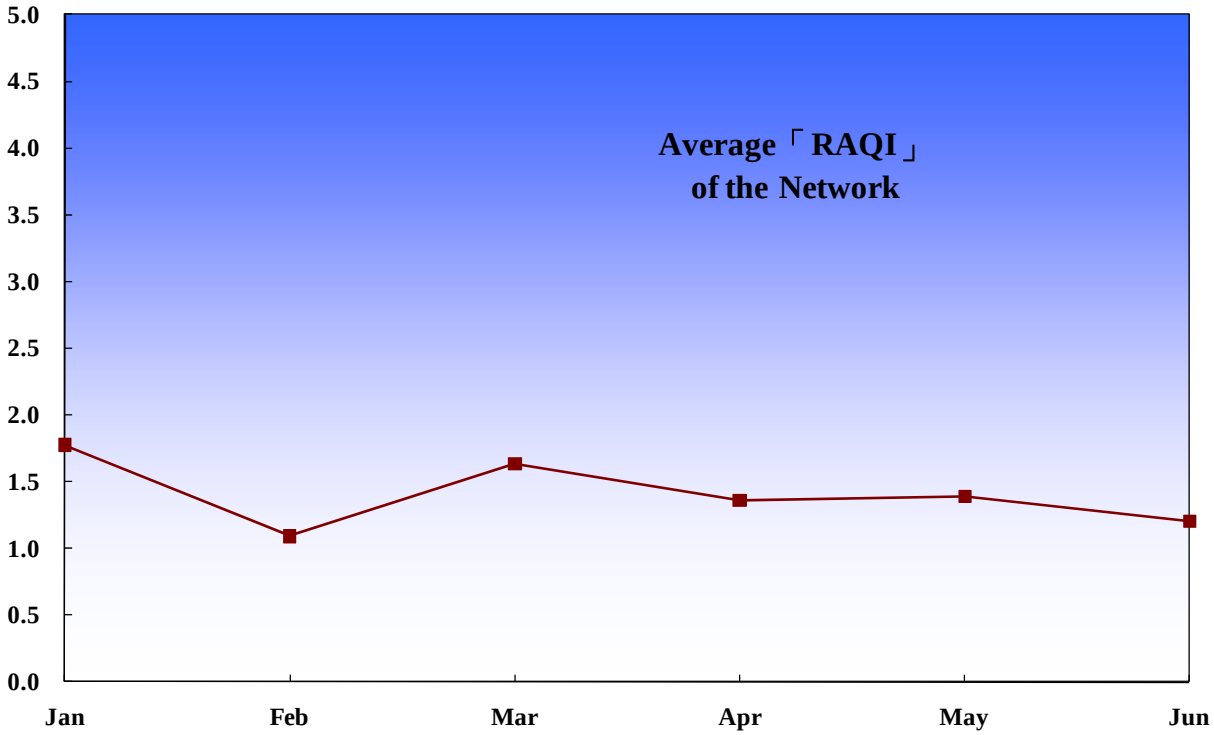

Figure 10：Monthly variations in average RAQI

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
Jinjuzui (Foshan)	Roof-top of Educational Building, Foshan City Communist Party Shunde Jinjuzui	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

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Annex B：Methods of Measuring Air Pollutant Concentrations

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